

# LS ELECTRIC

Derwent  
Top 100  
Global  
Innovator  
2020

**Susol** Super Solution

## MCCB

Low voltage circuit breakers



تهران - خیابان لاله زارنو - بالاتر از منوچهری - پاساژ البرزیه - طبقه اول - واحد ۲۳۵

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LS ELECTRIC continues  
the value and the prominence of LG



**New Name for LG Industrial Systems,  
New Take-off for LS ELECTRIC**



To advance to the next level,  
LG Industrial Systems is reborn as LS ELECTRIC Co., Ltd.

LS ELECTRIC will continue to lead the future  
of industrial electrics and automation by providing

Total Solution, a core essential  
for competition in the 21<sup>st</sup> century industrial era.



# Research & Development

## We provide differentiated values.

**The world-class Power Testing & Technology Institute guarantees certified products and global brands.**

The PT&TI is an accredited testing laboratory that provides a worldwide testing service with a 1500MVA-capacity High Power Laboratory, a High Voltage Laboratory, and a Reliability Testing Laboratory. Its testing has been fully acknowledged and recognized by overseas testing certification bodies, such as KEMA of Netherlands, UL of America, and CE of the EU for its low voltage testing.



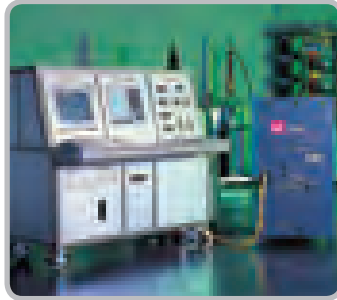
# Global technology and R&D are behind the best industrial Electric power and automation products from LS ELECTRIC



## Quality Test at PT&T



High Voltage Test / Impulse Test



Characteristics Test / VCB Characteristics Test



Short-Circuit Test / ACB Breaker Test



Environmental Test /  
Non-stop High Temperature Test

## Electro Technology R&D Center

The Electro Technology R&D Center focuses on overall research and development activities related to power supply systems such as low and high voltage equipment as well as integrated digital networks, automatic switchboards and integrated power protection.

The R&D Center maximizes energy efficiencies by integrating rapidly developing information & technology, communication, electronics and mechanical engineering, while concentrating its efforts in creating a safe and pleasant industrial environment.

### • Power Equipments

The R&D Center researches products and technologies related to low and high voltage circuit breakers and contactors as well as power transmission & distribution.

### • Electric Technology

The R&D Center analyzes and researches core technologies related to power equipment.

### • SCADA

The R&D Center carries out projects and technology research in the fields of SCADA and DAS.

### • Simulator

The R&D Center predicts probable electrocution hazards by conducting simulated analyses of power generation phenomena, and develops simulation technologies and products that can optimize the constituent facilities.



## Power Testing & Technology Institute

PT&T is a KOLAS-qualified (Korea Laboratory Accreditation Scheme) accredited testing laboratory and provides worldwide testing service with its 1500MVA-capacity High Power Laboratory, High Voltage Laboratory and Reliability Testing Laboratory. PT&T is also fully recognized by foreign testing and certification bodies of high reputation as CESI of Italy, KEMA of Netherlands, UL of America, etc. for its low voltage testings.

### • Available Tests

- Electro-Mechanical Tests
- Insulation Performance Tests
- Short-Circuit Tests
- Reliability Evaluation Tests
- Arc Tests
- Environmental Tests

### • Research & Development

Testing Technology, Measuring & Analyzing Technology, Power Equipment Monitoring & Diagnostic Techniques, Reliability Testing & Evaluation Technology.

# Solution provider

## You can count on us.

**New face & New resolution to become  
a global leader that gives top priority to customer values**

We promise you that LS will be reborn as a corporation that returns the best values to its customers.

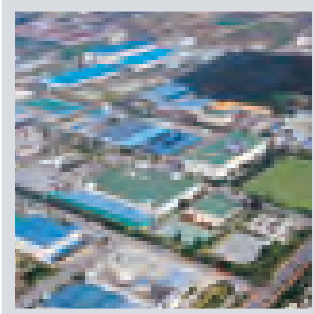
We are committed to global product development, driving future growth, and expanding the overseas market share, as well as consolidating existing business.

Join us in a future where LS will become a genuine global leader.





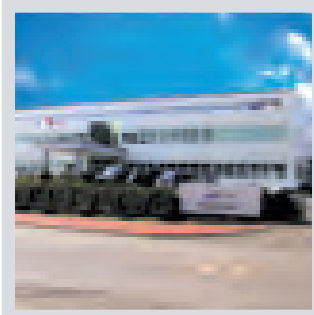
Customer satisfaction with world-class products and services:  
LS ELECTRIC is committed to excellence!



Cheongju Plant (Korea)



Busan Plant (Korea)



Dalian Plant (China)



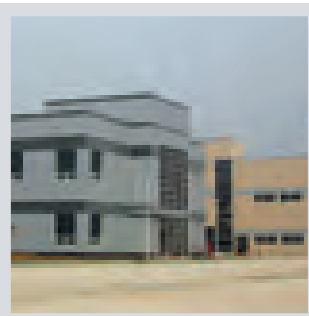
Wuxi Plant (China)



Hanoi Plant (Vietnam)



Chonan Plant (Korea)



Wuxi Plant (China)

## Electric Power Industry | Electric Equipment & Systems

The electric equipment and systems of LS ELECTRIC, ranging from low to high voltage products, have not only acquired ISO 9001 and 14001 certification for their efficient design and excellent quality, but many other certificates, including KEMA, TÜV, CESI, ASTA, and KERI. The outstanding quality of the products that we are manufacturing conforms to international standards such as IEC, UL, ANSI, CCC, JIS, and KS.

We also provide Total Solutions that encompass customized designs and more advanced technology, as well as efficient production and installation, and highly accurate testing and analysis of power equipment.

## Automation Industry | Automation Equipment, Industrial IT & RFID

LS ELECTRIC, a leading pioneer of the domestic automation business, developed the first ever PLC, Inverter (AC Drive), and DCS in Korean automation history. We now provide Total Solutions through the diverse application of our own products, ranging from controllers to control systems that are based on sophisticated technology and proven experience, to bring innovative change to distribution systems and logistics.

**Susol** *Super Solution*

# MCCB

Low voltage circuit breakers



GOOD DESIGN  
Ministry of Commerce



product  
design  
award

2007

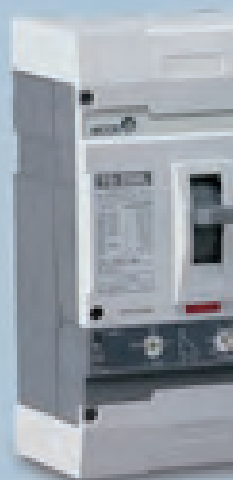
## ■ Design for technical strong point: The Susol MCCB

Susol series MCCB is available for world best breaking capacity up to 150kA, and MS is seal structure for hidden electricity arc.

Susol product represents simultaneously simple and complicated design for using cut diamond motive to emphasis on the hardness of industrial product.

And we applied the identity of product image by designing same concept MCCB and MS which is installed to cubicle.

Susol series acquire the competitive power through getting the picking up GD product and winning iF design award.



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## ***Super Solution***



### **For power distribution**

- ▶ The highest breaking capacity
- ▶ Optimum coordination technique (Cascading & discrimination)
- ▶ Powerful engineering tools

### **For protection of motor & its control device**

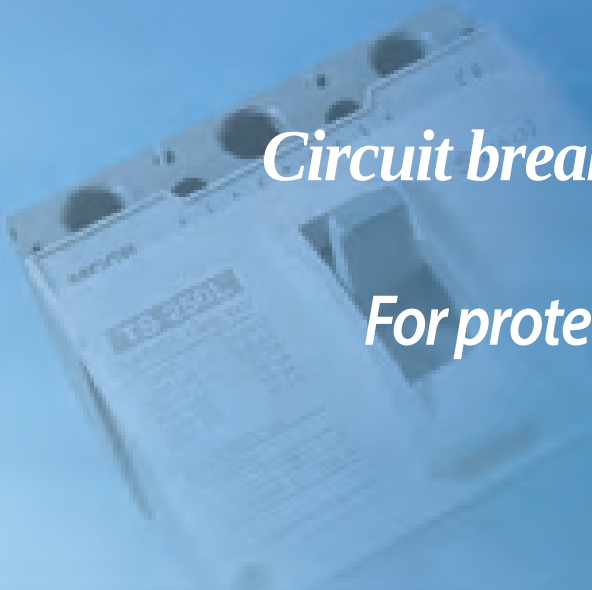
- ▶ Optimal overload protection
- ▶ Guaranteed type-2 coordination between circuit breaker and contactor, relay

### **For controlling and disconnecting circuits**

### **For extensive applications**

- ▶ Wide range of optimized auxiliaries and accessories

# ***Global Leading Products***



## ***Circuit breakers***

***For protection of power distribution***



## ***Circuit breakers***

***For protection of motor &  
its control device***



## ***Disconnecting switches***

***For controlling and  
disconnecting circuits***



# Susol

## Super solution



- **Super** Performance
- **Super** Breaking capacity
- **Super** Optimum coordination
- **Super** Extensive applications

# Susol TE, TD, TS series

## Circuit breakers and disconnecting switches



Susol circuit breakers provide superior performance in a compact package. They are used in cascade rated systems, allowing the use of lower interruption circuit breakers downstream, which lead to lower system cost.

While meeting IEC60947-2 service and interrupting ratings, these breakers provide unmatched flexibility by

employing a wide variety of trip units including fixed thermal & magnetic, adjustable thermal-fixed magnetic, adjustable thermal adjustable magnetic, and electronic options.

Susol TE and TD circuit breaker is available in one frame size in ratings from 16 to 160 amperes and TS circuit breakers are available in three frame sizes in

ratings from 40 to 1600 amperes and in interrupting capacities up to 150 kA at 415V AC.

Standard calibration is at 40°C with optional 55°C factory calibration available for applications where higher ambient temperatures are encountered.

# *Susol* MCCB Communication



## ■ Communication interface:RS485 (ModBUS)

### ■ Transmittable data :

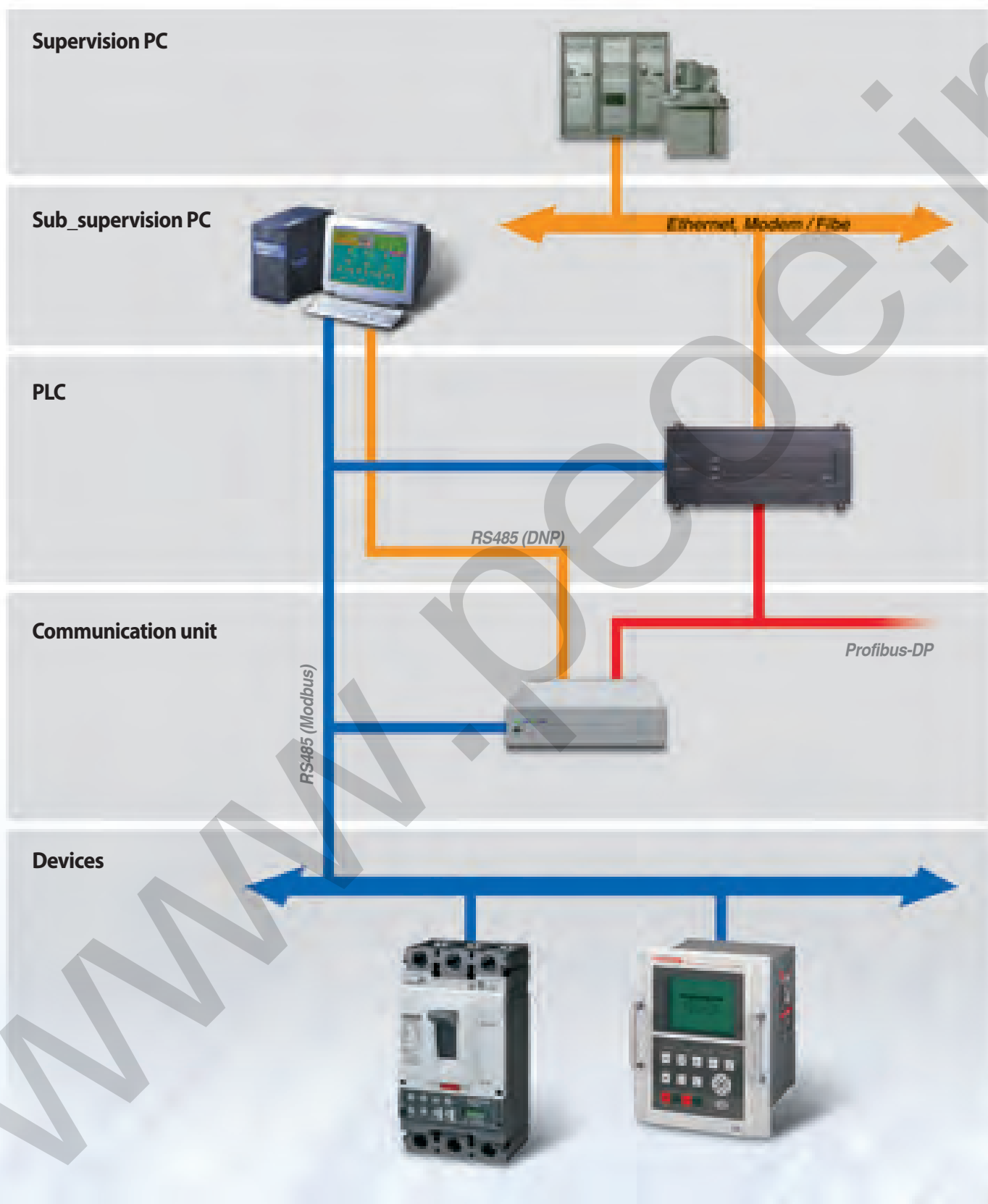
- Reading of protection settings
- The highest current of the three phases
- Measurement: R, S, T and N phase current (RMS)
- Fault reading: Type of fault, Fault phase

### ■ The setting of communication address By using TR button and LCD display (Ammeter)

### ■ ZSI Enable/Occurrence

### ■ Power source: DC24V Power is required

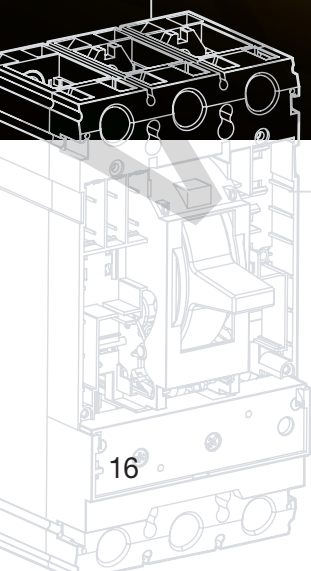
# Providing optimal solution



- MCCB(MODBUS) → CU → Profibus\_DP → PLC → EtherNET → Supervision PC
- MCCB(MODBUS) → PLC → EtherNET → Supervision PC
- MCCB(MODBUS) → CU → RS485(DNP) → SUB\_Supervision PC
- MCCB(MODBUS) → SUB\_Supervision PC

# Susol MCCB

Residual Current Devices



## ■ Protection against earth leakage currents

The Susol circuit breaker can offer protection against earth leakage currents by using an add-on residual current device (RCD). RCD unit interfaces directly below the circuit breaker trip unit area without the use of any secondary wiring or connections



# Residual Current Devices

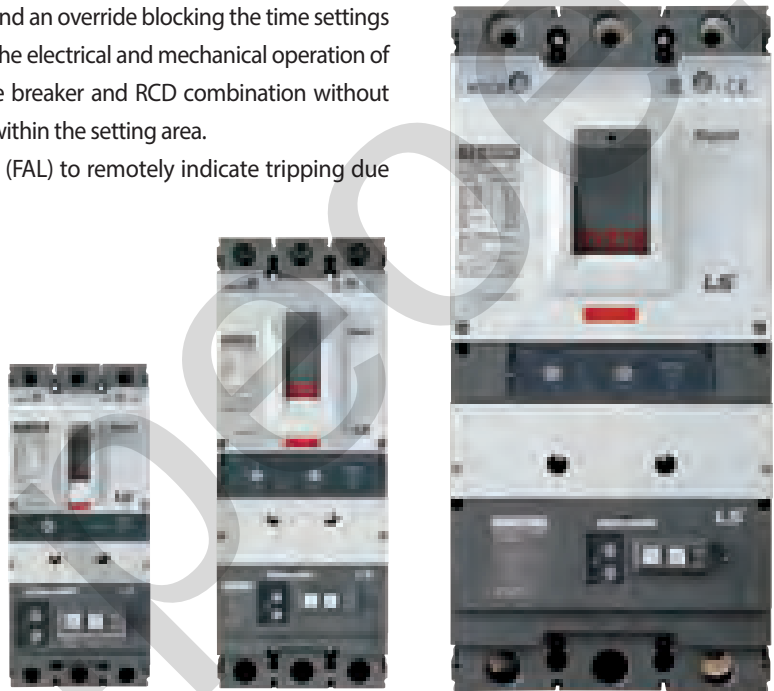
## Residual Current Devices

### RTU23/24, RTU33/34 and RTU43 for TS type MCCBs

Apart from the protection against overloads typical of automatic circuit breakers, the residual current circuit breaker derived from them also guarantee protection of people against earth leakage currents, thereby ensuring protection against direct contacts, indirect contacts and fire hazards. (ELCB)

The RCD unit has numerous current and time settings and an override blocking the time settings when set to 30mA. The earth leakage test button tests the electrical and mechanical operation of the device. In order to allow for a dielectric test of the breaker and RCD combination without damaging the electronics, the dielectric plug is placed within the setting area.

The RCD unit may be equipped with an alarm switch (FAL) to remotely indicate tripping due to an earth leakage current.



|                            |                             | RTU23                              | RTU24 | RTU33 | RTU34 | RTU43 |
|----------------------------|-----------------------------|------------------------------------|-------|-------|-------|-------|
| Number of poles            |                             | 3*                                 | 4     | 3*    | 4     | 3*    |
| Applicable circuit breaker | TS100                       | ■                                  | ■     |       |       |       |
|                            | TS160                       | ■                                  | ■     |       |       |       |
|                            | TS250                       | ■                                  | ■     |       |       |       |
|                            | TS400                       |                                    |       | ■     | ■     |       |
|                            | TS630                       |                                    |       | ■     | ■     |       |
|                            | TS800                       |                                    |       |       |       | ■     |
| Protection characteristics |                             |                                    |       |       |       |       |
| Sensitivity                | $I_{\Delta n}$ (A)          | (adjustable)<br>0.03-0.3-1-3-10    |       |       |       |       |
| Time delay **              | Intentional time delay (ms) | (adjustable)<br>0-60-150-300-600   |       |       |       |       |
|                            | Max. breaking time (ms)     | (adjustable)<br>40-150-300-600-990 |       |       |       |       |
| Rated voltage              | AC 50/60 Hz                 | 220-460V / 460-690V                |       |       |       |       |

\* 3P modules may also be used on 2P circuit breakers.

\*\* If the sensitivity is set to 30mA, the time delay setting is reduced to zero.

# **Susol MCCB** Main characteristics



## ■ **Susol series circuit breakers are suitable for**

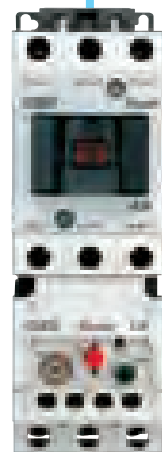
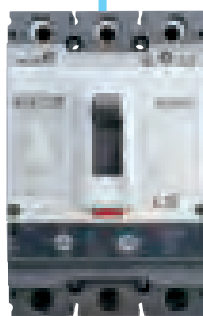
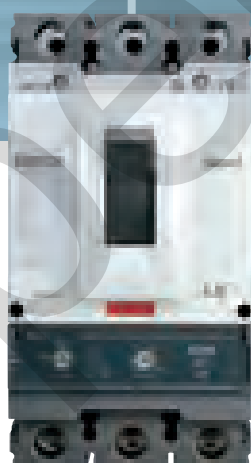
- Protection of power distribution
- Protection of motor & its control device
- Controlling and disconnecting circuits



## ■ **Optimum technical support for**

(Cascading, Discrimination, Type 2 coordination)

- Selecting economical protection system
- Guarantee safety of the installation
- Reducing the stress on components and damage
- Guarantee service continuity





# A-1. Overview

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# Range of LS low voltage circuit breakers

**Susol**

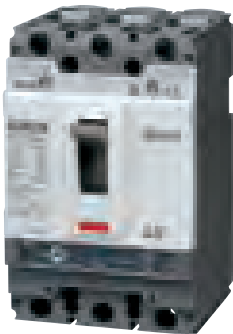
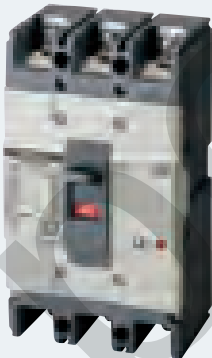
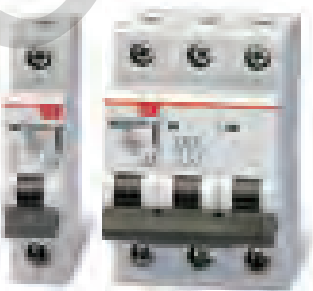
|                                        | Main switchboard                                                                   |                                                                                      |
|----------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Type of circuit breaker                | ACB                                                                                | MCCB                                                                                 |
| Rated current, In                      | 630~6300A                                                                          | 1000~1600A                                                                           |
| Breaking capacity, Icu                 | 65~150kA                                                                           | 50~150kA                                                                             |
| Service breaking capacity (% Icu), Ics | 100%                                                                               | 75~100%                                                                              |
| Utilization category                   | B                                                                                  | A, B                                                                                 |
| Applied standard                       | IEC 60947-2                                                                        | IEC 60947-2                                                                          |
| Image of circuit breaker               |  |  |
| Brand name                             | Susol/Metasol                                                                      | Susol                                                                                |
| Image of brand                         | <b>Susol · Metasol</b>                                                             | <b>Susol</b>                                                                         |
| Series                                 | AH, AS, AN                                                                         | TS                                                                                   |

\* 1pole MCCB



# Range of LS low voltage circuit breakers

**Susol**

| Main / Sub switchboard                                                             |                                                                                    | Final distribution                                                                   |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| MCCB                                                                               | MCCB                                                                               | MCB                                                                                  |
| 16~800A                                                                            | 3~1200A                                                                            | 1~63A                                                                                |
| 37~150kA                                                                           | 10~85kA                                                                            | 10kA                                                                                 |
| 100%                                                                               | 100%                                                                               | 75%                                                                                  |
| A                                                                                  | A                                                                                  | A                                                                                    |
| IEC 60947-2, UL489                                                                 | IEC 60947-2                                                                        | IEC60898, 60947-2, UL1077                                                            |
|  |  |  |
| Susol                                                                              | Metasol                                                                            |                                                                                      |
| <b>Susol</b>                                                                       | <b>Metasol</b>                                                                     |                                                                                      |
| TE, TD, TS                                                                         | AB series                                                                          | BK63H series                                                                         |



## Molded Case Circuit Breakers

The new series of Susol circuit-breakers is available in four frame sizes : 160, 250, 630, 800, 1600AF

The breakers are able to cover a range of service currents up to 1600A and are available in the fixed version and plug-in version.

The breaking capacities, at 380/415V, are classified by following letters:

- S: 37kA for 100 and 160AF
- N: 50kA for 160, 250 and 1600AF
- 65kA for 630 and 800AF
- H: 75kA for 1600AF
- 85kA for 160, 250 and 630AF
- 100kA for 800AF
- L: 150kA for 160, 250, 630, 800 and 1600AF

Susol circuit-breakers are climate-proof. The breakers are intended for use in rooms where there are no excessive operating conditions (e.g. dust, corrosive vapors, gases).

If the circuit-breakers are used in dusty or humid locations, suitable enclosures should be provided. Sufficient fresh air supply must be provided if there are harmful gases (e.g. hydrogen-sulfide vapor) in the ambient air.

All Susol circuit breakers offer positive contact indication and are suitable for isolation in compliance with standards IEC 60947-1 and 2.

Susol circuit-breakers are suitable for protection of

- Power distribution systems supplied by transformers or generators
- Motor and generator

A switch-disconnector of Susol circuit breakers is available for for circuit control and isolation.

# Standards & Approval

**Susol**



## Susol series circuit breakers and auxiliaries comply with the following international standard:

### IEC 60947-1

Low-voltage switchgear and controlgear  
- Part 1: General rules

### IEC 60947-2

Low-voltage switchgear and controlgear  
- Part 2: Circuit-breakers

### IEC 60947-3

Low-voltage switchgear and controlgear  
- Part 3: Switches, disconnectors, switchdisconnectors and fuse-combination units

### IEC 60947-4

Low-voltage switchgear and controlgear  
- Part 4-1: Contactors and motor-starters  
Electromechanical contactors and motor starters  
Switches, disconnectors, switchdisconnectors  
- Part 4-2: Contactors and motor-starters  
AC semiconductor motor controllers and starters  
- Part 4-3: Contactors and motor-starters  
AC semiconductor controllers and contactors for non-motor loads

The following certificates are available on a request.

- CE Declaration of conformity
- Certificate of conformance test (CB) - IEC 60947
- Certificate of conformance test - CCC (China)
- Letter of origin

## CE conformity marking

The CE conformity marking shall indicate conformity to all the obligations imposed on the manufacturer, as regards his products, by virtue of the European Community directives providing for the affixing of the CE marking.

When the CE marking is affixed on a product, it represents a declaration of the manufacturer or of his authorized representative that the product in question conforms to all the applicable provisions including the conformity assessment procedures. This prevents the Member States from limiting the marketing and putting into service of products bearing the CE marking, unless this measure is justified by the proved non-conformity of the product.

## IECEE CB SCHEME

The IECEE CB Scheme is the world's first truly international system for acceptance of test reports dealing with the safety of electrical and electronic products. It is a multilateral agreement among participating countries and certification organizations. A manufacturer utilizing a CB test report issued by one of these organizations can obtain national certification in all other member countries of the CB Scheme.

The Scheme is based on the use of international (IEC) Standards. If some members' national standards are not yet completely harmonized with IEC Standards, national differences are permitted if clearly declared to all other members. The CB Scheme utilizes CB Test Certificates to attest that product samples have successfully passed the appropriate tests and are in compliance with the requirements of the relevant IEC Standard and with the declared national differences of various member countries.

The main objective of the Scheme, is to facilitate trade by promoting harmonization of the national standards with international Standards and cooperation among product certifiers worldwide in order to bring product manufacturers a step closer to the ideal concept of "one product, one test, one mark, where applicable".

# Structure

Susol

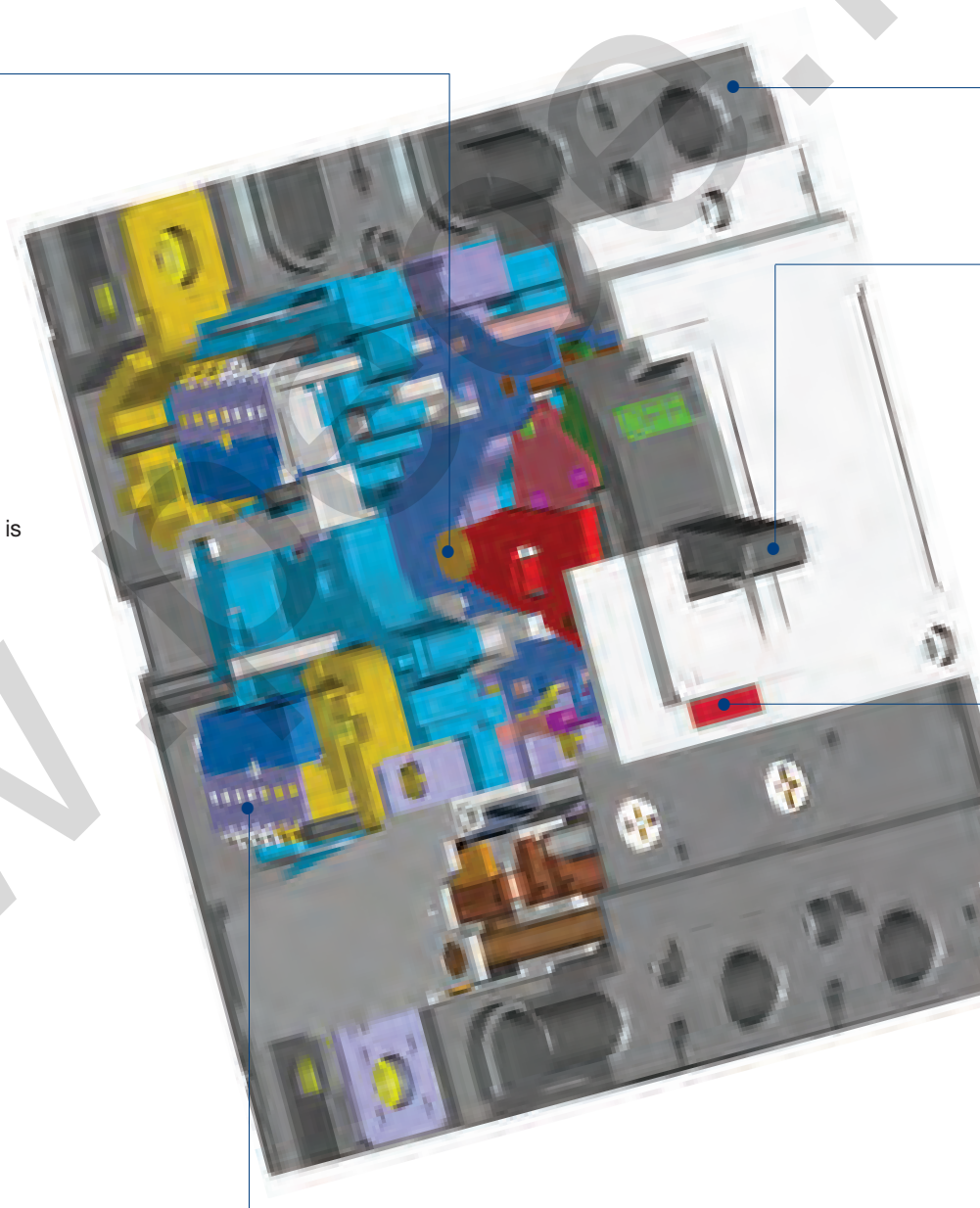
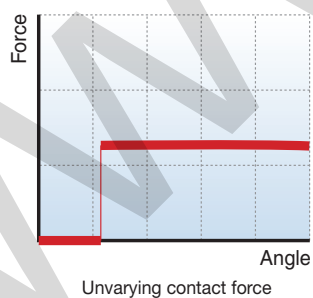
The primary components are: a switching mechanism, an automatic tripping device (and manual trip button), contacts, an arc-extinguishing device, terminals and a molded case.

## Mechanism unit

- Unvarying contact force regardless of over travel
- RTA (Rapid Toggle Area)  
Open speed of moving contact is rapid by **optimized cam curve** regardless of trip signal



Optimized cam curve



# Structure

**Susol**

## Molded case

- UL94 V-0 flame retarded
- High strength

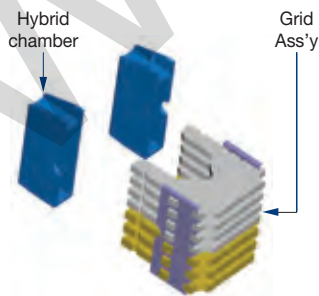
## Trip button (push to trip)

- Enables tripping mechanically from outside, for confirming the operation of the accessory switches and the manual resetting function.

Note) Fault Alarm Switch, FAL is not operated by trip button.  
FAL is applicable only to the breakers with electronic trip units.

## Arc-Extinguishing unit

- PASQ Type Quenching Chamber
- Very superior to increasing arc voltage during short time
- PASQ ;
  - Puffer Assisted Self-Quenching
  - Patented by LS



## Handle

- Function of indications
  - "ON" "OFF" "TRIP"
- Resetting
  - When the handle indicates "tripped" position it must first be reset by moving the handle to the "OFF" position and then closing is possible
- Trip-Free even if the handle is held at "ON", the breaker will trip if an over current flows
- Suitable for Verification of the main contact position under abnormal conditions because the handle doesn't indicate open position



# Marking and configuration

Susol

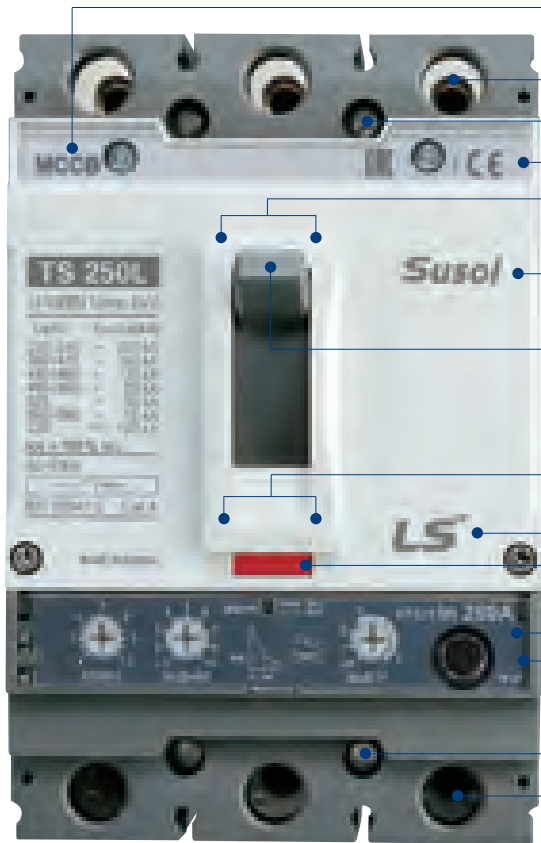


Rated frequency

Standard

Utilization category

Symbol indicating suitability for isolation as defined by IEC 947-2





# Marking and configuration

Susol

## Model (Rating and breaking capacity)

- TS: Series
- 250: Max. Ampere rating
- S: Standard
- N: Normal (Standard)
- H: High
- L: Current limiting

## Standardized characteristics:

- Ui: Rated insulation voltage
- Uimp: Impulse withstand voltage
- Ue: Rated operational voltage
- Icu: Ultimate breaking capacity
- Ics: Service breaking capacity

|   | 160AF                                | 250AF                           | 630AF                 | 800AF            | 1600AF                             |
|---|--------------------------------------|---------------------------------|-----------------------|------------------|------------------------------------|
| S | TE100S<br>TE160S                     | -                               | -                     | -                | -                                  |
| N | TE100N<br>TE160N<br>TD100N<br>TD160N | TS100N<br>TS160N<br>TS250N<br>- | TS400N<br>TS630N<br>- | TS800N<br>-<br>- | TS1000N<br>TS1250N<br>TS1600N<br>- |
| H | TD100H<br>TD160H<br>-                | TS100H<br>TS160H<br>TS250H      | TS400H<br>TS630H<br>- | TS800H<br>-<br>- | TS1000H<br>TS1250H<br>TS1600H      |
| L | TD100L<br>TD160L<br>-                | TS100L<br>TS160L<br>TS250L      | TS400L<br>TS630L<br>- | TS800L<br>-<br>- | TS1000L<br>-<br>-                  |

|   |       |       |       |       |       |
|---|-------|-------|-------|-------|-------|
| S | 37kA  | -     | -     | -     | -     |
| N | 50kA  | 50kA  | 65kA  | 65kA  | 50kA  |
| H | 85kA  | 85kA  | 85kA  | 100kA | 70kA  |
| L | 150kA | 150kA | 150kA | 150kA | 150kA |

Product: Molded Case Circuit Breaker

Upstream connections

Fixing hole

Certificate plate

Indication of closed (I/ON) position

Brand name

Operating handle

Indication of open (O/OFF) position

Company logo

"push to trip" button

Rating of trip unit

Trip unit

Fixing hole

Downstream connections

# Overview of trip units

Susol

On Susol circuit breakers, the thermal-magnetic and electronic trip units are interchangeable and may be rapidly fitted to the circuit breakers.  
It is therefore easy to change the protection of a given circuit following a modification in an installation.  
On TS400 and 630 circuit breakers, the electronic trip units are interchangeable plug-in modules.  
Trip unit ETM offers a large number of protection settings.

## Each Trip devices has different types of protection depending on the associated trip unit:

- Standard protection
- Protection of networks supplied by line distribution
- Protection of long cables
- Protection of DC networks
- Protection of motor-starters
- Service connection circuit breaker (for special subscriber contracts)

Susol TD100, TD160 circuit breakers may be equipped with either FTU or FMU.

The trip units are not interchangeable types and can be supplied only after fixed with circuit breakers.

## Ampere ratings

| MCCB frame type | Rated current, In[A]     |                     |                    |                                        |                    |                    |     |
|-----------------|--------------------------|---------------------|--------------------|----------------------------------------|--------------------|--------------------|-----|
|                 | Thermal magnetic release |                     |                    |                                        | Electronic release |                    | DSU |
|                 | FTU                      | FMU                 | ATU                | MTU                                    | ETS                | ETM                |     |
| TE100           | 16, 20, 25, 32, 40,      | 16, 20, 25, 32, 40, | -                  | -                                      | -                  | -                  | -   |
| TD100           | 50, 63, 80, 100          | 50, 63, 80, 100     |                    |                                        |                    |                    |     |
| TE160           | 100, 125, 160            | 100, 125, 160       | -                  | -                                      | -                  | -                  | 160 |
| TD160           |                          |                     |                    |                                        |                    |                    |     |
| TS100           | 40, 50, 63, 80, 100      | 40, 50, 63, 80, 100 | -                  | 1.6, 3.2, 6.3, 12, 20, 32, 50, 63, 100 | 40, 80             | -                  | 100 |
| TS160           | 100, 125, 160            | 100, 125, 160       | 125, 160           | 32, 50, 63, 100, 160                   | 40, 80, 160        | -                  | 160 |
| TS250           | 125, 160, 200, 250       | 125, 160, 200, 250  | 125, 160, 200, 250 | 100, 160, 220                          | 40, 80, 160, 250   | -                  | 250 |
| TS400           | 300, 400                 | 300, 400            | 300, 400           | 320                                    | 160, 250, 400      | 160, 250, 400      | 400 |
| TS630           | 500, 630                 | 500, 630            | 500, 630           | 500                                    | 160, 250, 400, 630 | 160, 250, 400, 630 | 630 |
| TS800           | 700, 800                 | 800                 | 800                | 630                                    | 630, 800           | 630, 800           | 800 |
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# Overview of trip units

Susol



## Trip unit identification

TS250 FMU

Trip unit function

MCCB frame type

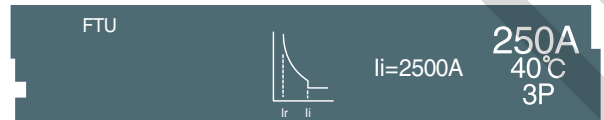


FTU

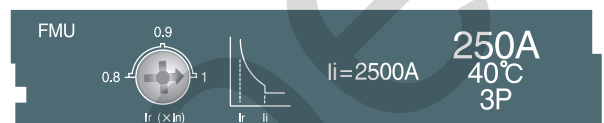
ATU

ETM

### FTU Fixed-thermal, fixed-magnetic



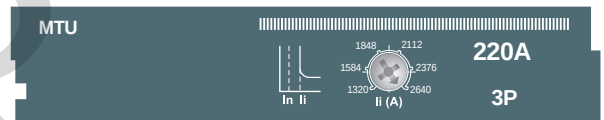
### FMU Adjustable-thermal, fixed-magnetic



### ATU Adjustable-thermal, adjustable-magnetic



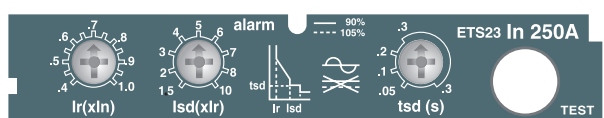
### MTU Magnetic only



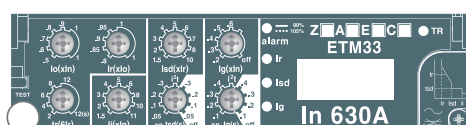
### DSU Disconnecting switch



### ETS Electronic (LSI)



### ETM Electronic (LSIG, multi-function unit)



# Switching mechanism

Susol

## Double contactor structure

### Optimize

#### Repulsion force

#### Shape of contactor

- Induce easily the arc mobility to grid direction
- Rapidly redeploy the arc from moving contactor
- Prevent contact tip from erosion

#### Open speed & contact force

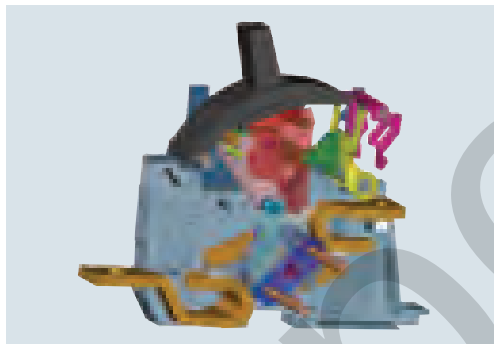


Fig. 3 "ON" position



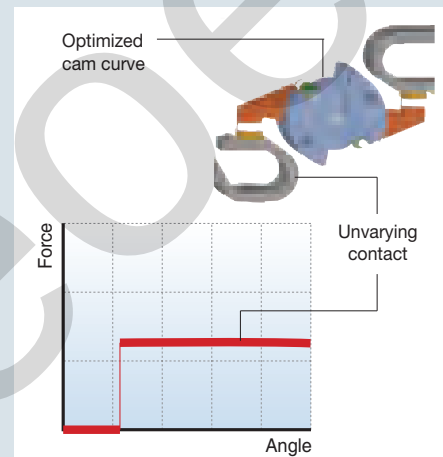
Fig. 4 "OFF" position



Fig. 5 "TRIP" position

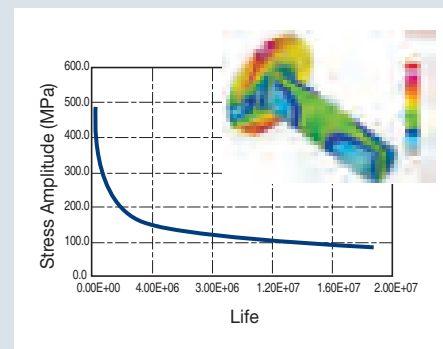
### ON position

- Unvarying contact force regardless of over travel
- Open speed of moving contact is rapid by optimized cam curve regardless of trip signal
- Function of trip free



### OFF position

- Push to trip in OFF position
  - \* Reset pin moment < Main spring moment
- Stability of endurance



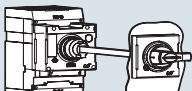
### TRIP position

- Enables tripping mechanically from outside, for confirming the operation of the accessory switches and the manual resetting function

# Degree of protection

**Susol**

The table indicates the degrees of protection guaranteed by Susol circuit-breakers according to several type of installation. Basically, the fixed parts are always preset with IP20 degree of protection. IP65 degree of protection can be obtained with the circuit-breaker installed in a switchboard fitted with an extended rotary handle operating mechanism transmitted on the compartment door.

| Type                                                                                                                                            | Degree of protection                                                                                                                                                                                                               | IP           | Protection of persons against access to hazardous parts with: |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------------------------------------------|
|  Circuit breaker                                               | Full penetration of 12.5mm diameter sphere not allowed. The jointed test finger shall have adequate clearance from hazardous parts                                                                                                 | IP20         | Wire                                                          |
|  Circuit breaker with terminal cover                           | The access probe of 2.5mm diameter shall not penetrate.                                                                                                                                                                            | IP30         | Wire                                                          |
|  Plug-in circuit breaker                                     | Full penetration of 12.5mm diameter sphere not allowed. The jointed test finger shall have adequate clearance from hazardous parts.<br><small>* When the circuit breaker is installed and the supplied covers are mounted.</small> | IP20 or IP30 | Wire                                                          |
|  Circuit breaker with cover frame for door cutout            | The access probe of 1.0mm shall not penetrate.                                                                                                                                                                                     | IP40         | Wire                                                          |
|  Circuit breaker with cover frame and motor operator         | The access probe of 1.0mm diameter shall not penetrate.                                                                                                                                                                            | IP40         | Wire                                                          |
|  Circuit breaker with cover frame and rotary direct handle   | The access probe of 1.0mm diameter shall not penetrate.                                                                                                                                                                            | IP40         | Wire                                                          |
|  Circuit breaker with cover frame and rotary extended handle | Totally protected against ingress of dust and water jets from any direction                                                                                                                                                        | IP65         | Wire                                                          |

# Ordering

Susol

## Susol TE, TD, TS up to 800AF MCCB

Trip unit: FTU, ATU, FMU, ETS, ETM

| TS250        |     | N                          |                                     | FTU           |  | 250                           |       | 3                                                                                                                                      |          | R                         |  | - |  | AX |  |
|--------------|-----|----------------------------|-------------------------------------|---------------|--|-------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------|--|---|--|----|--|
| Ampere frame |     | Type                       |                                     | Rated current |  | Poles                         |       | Standard                                                                                                                               |          | Accessories               |  |   |  |    |  |
| TE           | 100 | S                          | Standard                            |               |  | 2P                            | 2Pole | -                                                                                                                                      | Standard | Note) Please refer to A-3 |  |   |  |    |  |
|              | 160 | N                          | Normal                              |               |  | 3P                            | 3Pole | P                                                                                                                                      | Plug-in  |                           |  |   |  |    |  |
| TD           | 100 | H                          | High                                |               |  | 4P                            | 4Pole | Note) Plug in type is only available 3Pole                                                                                             |          |                           |  |   |  |    |  |
|              | 160 | L                          | Current limit                       |               |  |                               |       |                                                                                                                                        |          |                           |  |   |  |    |  |
| TS           | 100 | Trip unit                  |                                     |               |  |                               |       | N phase way(4Pole)                                                                                                                     |          |                           |  |   |  |    |  |
|              | 160 | Thermal magnetic trip unit | FTU                                 |               |  | Fixed Trip Unit               |       | L                                                                                                                                      | N-R-S-T  |                           |  |   |  |    |  |
|              | 250 |                            | FMU                                 |               |  | Fixed Magnetic Trip Unit      |       | R                                                                                                                                      | R-S-T-N  |                           |  |   |  |    |  |
|              | 400 |                            | ATU                                 |               |  | Adjustable Trip Unit          |       |                                                                                                                                        |          |                           |  |   |  |    |  |
|              | 630 | Electronic trip units      | ETS                                 |               |  | Electronic Trip Unit Standard |       | Note)<br>1. R type is not available for TE and TD types.<br>2. L: N phase is located on the left<br>R: N phase is located on the right |          |                           |  |   |  |    |  |
| 800          | ETM |                            | Electronic Trip Unit Multi Function |               |  |                               |       |                                                                                                                                        |          |                           |  |   |  |    |  |

Trip unit: MTU

|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|--------------|-----|------|---------------|-------------------------|--|---------------|--|-------|-------|------------|---------|---------------------------|--|
| TS250        |     | N    |               | MTU                     |  | 220           |  | 3     |       | -          |         | AX                        |  |
| Ampere frame |     | Type |               | Magnetic only trip unit |  | Rated current |  | Poles |       | - Standard |         | Accessories               |  |
| TS           | 100 | N    | Normal        |                         |  |               |  | 3P    | 3Pole | P          | Plug-in | Note) Please refer to A-3 |  |
|              | 160 | H    | High          |                         |  |               |  |       |       |            |         |                           |  |
|              | 250 | L    | Current limit |                         |  |               |  |       |       |            |         |                           |  |
|              | 400 |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              | 630 |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              | 800 |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |
|              |     |      |               |                         |  |               |  |       |       |            |         |                           |  |

## Trip unit: DSU

|              |     |      |                        |       |               |       |       |          |         |
|--------------|-----|------|------------------------|-------|---------------|-------|-------|----------|---------|
| TS250        |     | NA   | DSU                    | 250   | 3             | -     |       |          |         |
| Ampere frame |     | MCCB | Disconnect Switch Unit | AF    | Rated current | Poles | -     | Standard |         |
| TD           | 100 |      |                        | TD100 | 100           | 2P    | 2Pole | P        | Plug-in |
|              | 160 |      |                        | TD160 | 160           | 3P    | 3Pole |          |         |
| TS           | 100 |      |                        | TS100 | 100           | 4P    | 4Pole |          |         |
|              | 160 |      |                        | TS160 | 160           |       |       |          |         |
|              | 250 |      |                        | TS250 | 250           |       |       |          |         |
|              | 400 |      |                        | TS400 | 400           |       |       |          |         |
|              | 630 |      |                        | TS630 | 630           |       |       |          |         |
|              | 800 |      |                        | TS800 | 800           |       |       |          |         |

## Trip unit: RTU

| RTU   |     | 2  |       | 4    |    | AC220/460V    |  | TS250                      |                     |
|-------|-----|----|-------|------|----|---------------|--|----------------------------|---------------------|
| Model |     | AF |       | Pole |    | Rated voltage |  | Applicable circuit breaker |                     |
| RTU   | RCD | 2  | 250AF | 3    | 3P | AC220/460V    |  | 250AF                      | TS100/160,<br>TS250 |
|       |     | 3  | 630AF | 4    | 4P | AC460/690V    |  | 630AF                      | TS400<br>TS630      |
|       |     | 4  | 800AF |      |    |               |  | 800AF                      | TS800<br>(3p only)  |



# Ordering

Susol

## Susol TS 1600AF MCCB

TS1600

| Ampere frame |      |
|--------------|------|
| TS           | 1000 |
|              | 1250 |
|              | 1600 |

N

| Type |                     |
|------|---------------------|
| N    | Normal              |
| H    | High                |
| L    | Current limit       |
| NA   | Switch-disconnector |

A

| Trip relay |               |
|------------|---------------|
| N          | Normal        |
| A          | Ammeter       |
| P          | Power meter   |
| S          | Supreme meter |

1600A

| Rated current |  |
|---------------|--|
| 800A          |  |
| 1000A         |  |
| 1250A         |  |
| 1600A         |  |

3

| Poles |       |
|-------|-------|
| 3P    | 3Pole |
| 4P    | 4Pole |

-

| N phase way (4Pole) |         |
|---------------------|---------|
| L                   | N-R-S-T |
| R                   | R-S-T-N |

-

| Connection type |                 |
|-----------------|-----------------|
| -               | Standard        |
| REAR            | Rear Connection |

## Trip relay

| N                      | G                                                                                                                                                                                                                                                                                                                                                                                               | O                           |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Trip relay type        | Communication & protection                                                                                                                                                                                                                                                                                                                                                                      | Control voltage & frequency |
| 000 Without trip relay |                                                                                                                                                                                                                                                                                                                                                                                                 |                             |
| N                      | G                                                                                                                                                                                                                                                                                                                                                                                               | 0                           |
| N Normal               | G Without comm. + L/S/I/G                                                                                                                                                                                                                                                                                                                                                                       | 0 Self-Power, 60Hz          |
|                        |                                                                                                                                                                                                                                                                                                                                                                                                 | 5 Self-Power, 50Hz          |
|                        | * L/S/I/G configuration as standard<br>-with LED indicators<br>-without output contacts<br>* Ground fault system by vector sum                                                                                                                                                                                                                                                                  |                             |
| A                      | G                                                                                                                                                                                                                                                                                                                                                                                               | 0                           |
| A Ammeter              | G Without comm.                                                                                                                                                                                                                                                                                                                                                                                 | 0 Self-Power, 60Hz          |
|                        | Z Without comm. + Earth leakage                                                                                                                                                                                                                                                                                                                                                                 | 1 AC/DC 100V~250V, 60Hz     |
|                        | E Without comm. + Earth leakage                                                                                                                                                                                                                                                                                                                                                                 | 2 DC 24V~60V, 60Hz          |
|                        | C Comm.                                                                                                                                                                                                                                                                                                                                                                                         | 5 Self-Power, 50Hz          |
|                        | K Comm. + Earth leakage                                                                                                                                                                                                                                                                                                                                                                         | 6 AC/DC 100V~250V, 50Hz     |
|                        | X Comm. + Earth leakage                                                                                                                                                                                                                                                                                                                                                                         | 7 DC 24V~60V, 50Hz          |
|                        | * L/S/I/G configuration as standard<br>* Ground fault system by vector sum(G,C)<br>* Earth leakage system<br>- Z,K: External CT - LS ZCT applied(fault current 0.5~30A, 1600AF)<br>- E,X: External CT - Private ZCT applied(fault current > 30A)<br>* Comm. And output contacts DO NOT work under self-power condition.<br>(Only checking LED available)                                        |                             |
| P                      | C                                                                                                                                                                                                                                                                                                                                                                                               | 1                           |
| P Power meter          | C Comm.                                                                                                                                                                                                                                                                                                                                                                                         | 1 AC/DC 100V~250V, 60Hz     |
|                        | K Comm. + Earth leakage                                                                                                                                                                                                                                                                                                                                                                         | 2 DC 24V~60V, 60Hz          |
|                        | X Comm. + Earth leakage                                                                                                                                                                                                                                                                                                                                                                         | 6 AC/DC 100V~250V, 50Hz     |
|                        | A Comm. + Pre-trip alarm                                                                                                                                                                                                                                                                                                                                                                        | 7 DC 24V~60V, 50Hz          |
|                        | * L/S/I/G configuration as standard<br>* Ground fault system by vector sum<br>* Earth leakage system<br>- K: External CT - LS ZCT applied(fault current 0.5~30A, 1600AF)<br>- X: External CT - Private ZCT applied(fault current > 30A)<br>* Applicable to generator protection purpose<br>* Comm. And output contacts DO NOT work under self-power condition.<br>(Only checking LED available) |                             |
| S                      | C                                                                                                                                                                                                                                                                                                                                                                                               | 1                           |
| S Supreme meter        | C Comm.                                                                                                                                                                                                                                                                                                                                                                                         | 1 AC/DC 100V~250V, 60Hz     |
|                        | K Comm. + Earth leakage                                                                                                                                                                                                                                                                                                                                                                         | 2 DC 24V~60V, 60Hz          |
|                        | X Comm. + Earth leakage                                                                                                                                                                                                                                                                                                                                                                         | 6 AC/DC 100V~250V, 50Hz     |
|                        | A Comm. + Pre-trip alarm                                                                                                                                                                                                                                                                                                                                                                        | 7 DC 24V~60V, 50Hz          |
|                        | * L/S/I/G configuration as standard<br>* Ground fault system by vector sum<br>* Earth leakage system<br>- K: External CT - LS ZCT applied(fault current 0.5~30A, 1600AF)<br>- X: External CT - Private ZCT applied(fault current > 30A)<br>* Applicable to generator protection purpose<br>* Comm. And output contacts DO NOT work under self-power condition.<br>(Only checking LED available) |                             |

Note) 1. L/S/I/G configuration as standard

2. Ground fault, earth leakage and pre-trip alarm functions are alternative.

3. The functions like Metering, Communication, ZSI, Remote reset and Digital output are NOT available only under Self-power condition.

4. Voltage module should be required for P and S types(supplied separately)



## A-2. Main characteristics

### 100 to 800AF

#### MCCBs for power distribution

Electrical characteristics ..... A-2-1

#### Thermal magnetic trip unit

Overview ..... A-2-3

FTU, FMU for TE100, TE160, TD100, TD160 ..... A-2-5

FTU, FMU for TS100, TS160, TS250 ..... A-2-7

ATU for TS160, TS250

FTU, FMU, ATU for TS400, TS630 ..... A-2-11

FTU, FMU, ATU for TS800 ..... A-2-15

#### Electronic trip units (Standard)

Overview ..... A-2-17

ETS23 for TS100, TS160, TS250 ..... A-2-19

ETS33 for TS400, TS630 ..... A-2-25

ETS43 for TS800 ..... A-2-31

#### Electronic trip units (Multifunction)

Overview ..... A-2-37

ETM33 for TS400, TS630 ..... A-2-40

ETM43 for TS800 ..... A-2-49

#### MCCBs for motor protection

Electrical characteristics ..... A-2-57

Magnetic only trip unit ..... A-2-59

#### Switch-Disconnectors

Electrical characteristics ..... A-2-61

#### Susol MCCB for DC Application

A-2-63

#### 4 pole MCCB with electronic trip unit

A-2-70

### 1000 to 1600AF

Electrical characteristics ..... A-2-71

#### OCR(Over current relays) Trip unit

Overview ..... A-2-72

N(Normal), NV type ..... A-2-73

A(Ammeter) type ..... A-2-75

P(Power meter) type ..... A-2-77

S(Supreme meter) type ..... A-2-79

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Measurement function ..... A-2-83

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Remote reset and digital I/O (A, P, S type) ..... A-2-85

Communication ..... A-2-86

Event & fault recording (P, S type) ..... A-2-87

System information ..... A-2-87

System block diagram ..... A-2-88

Installation and Handling ..... A-2-89

#### Switch-Disconnectors

A-2-92

# MCCBs for power distribution

Susol

## Electrical characteristics

|                                                     |                                    |                  | TE100      |      | TE160         |      | TD100                               |      |      | TD160                     |              |      |
|-----------------------------------------------------|------------------------------------|------------------|------------|------|---------------|------|-------------------------------------|------|------|---------------------------|--------------|------|
| Frame size                                          |                                    |                  | 100        |      | 160           |      | 100                                 |      |      | 160                       |              |      |
| Rated current, In *                                 |                                    |                  | 16~100     |      | 100, 125, 160 |      | 16, 20, 25, 32, 40, 60, 63, 80, 100 |      |      | 100, 125, 160, 1P: 16~160 |              |      |
| No. of poles                                        |                                    |                  | 3,4        |      | 3,4           |      | 2*, 3, 4                            |      |      | 1, 2*, 3, 4               |              |      |
| Rated operational voltage, Ue                       |                                    | AC               | 690        |      | 690           |      | 690                                 |      |      | 690, 1P: 240              |              |      |
|                                                     |                                    | DC               | 500        |      | 500           |      | 500                                 |      |      | 500, 1P:250               |              |      |
| Rated impulse withstand voltage, Uimp               |                                    |                  | 8          |      | 8             |      | 8                                   |      |      | 8                         |              |      |
| Rated insulation voltage, Ui                        |                                    |                  | 750        |      | 750           |      | 1000                                |      |      | 1000                      |              |      |
| Rated ultimate short-circuit breaking capacity, Icu |                                    |                  | S          | N    | S             | N    | N                                   | H    | L    | N                         | H            | L    |
| AC 50/60Hz                                          | 220/240V                           | [kA]             | 50         | 85   | 50            | 85   | 85                                  | 100  | 200  | 85 (1P:30)                | 100 (1P:50)  | 200  |
|                                                     | 380/415V                           | [kA]             | 37         | 50   | 37            | 50   | 50                                  | 85   | 150  | 50                        | 85           | 150  |
|                                                     | 440/460V                           | [kA]             | 25         | 37   | 25            | 37   | 50                                  | 70   | 130  | 50                        | 70           | 130  |
|                                                     | 480/500V                           | [kA]             | 18         | 25   | 18            | 25   | 30                                  | 50   | 65   | 30                        | 50           | 65   |
|                                                     | 525V                               | [kA]             | -          | -    | -             | -    | 22                                  | 35   | 50   | 22                        | 35           | 50   |
|                                                     | 660/690V                           | [kA]             | 6          | 8    | 6             | 8    | 10                                  | 10   | 10   | 10                        | 10           | 10   |
| DC                                                  | 250V                               | [kA]             | 37         | 50   | 37            | 50   | 42                                  | 65   | 100  | 42 (1P:16)                | 65 (1P:25)   | 100  |
|                                                     | 500V(2poles in series)             | [kA]             | 37         | 50   | 37            | 50   | 42                                  | 65   | 100  | 42                        | 65           | 100  |
| Rated service breaking capacity, Ics                |                                    |                  | 100%       | 100% | 100%          | 100% | 100%                                | 100% | 100% | 100%                      | 100%         | 100% |
| AC 50/60Hz                                          | 220~525V                           | [%Icu]           | -          | -    | -             | -    | 5                                   | 5    | 5    | 5                         | 5            | 5    |
|                                                     | 660/690V                           | [kA]             | 100%       | 100% | 100%          | 100% | 100%                                | 100% | 100% | 100%                      | 100%         | 100% |
| DC                                                  |                                    |                  | 100%       | 100% | 100%          | 100% | 100%                                | 100% | 100% | 100%                      | 100%         | 100% |
| Rated short-circuit making capacity Icm             |                                    |                  | 105        | 187  | 105           | 187  | 187                                 | 220  | 440  | 187 (1P:105)              | 220 (1P:105) | 440  |
| AC 50/60Hz                                          | 220/240V                           | [kA]             | 77.7       | 105  | 77.7          | 105  | 105                                 | 187  | 330  | 105                       | 187          | 330  |
|                                                     | 380/415V                           | [kA]             | 52.5       | 77.7 | 52.5          | 77.7 | 105                                 | 154  | 286  | 105                       | 154          | 286  |
|                                                     | 440/460V                           | [kA]             | 36         | 52.5 | 36            | 52.5 | 63                                  | 105  | 143  | 63                        | 105          | 143  |
|                                                     | 480/500V                           | [kA]             | -          | -    | -             | -    | 46                                  | 74   | 105  | 46                        | 74           | 105  |
|                                                     | 525V                               | [kA]             | 9.2        | 13.6 | 9.2           | 13.6 | 17                                  | 17   | 17   | 17                        | 17           | 17   |
|                                                     | 660/690V                           | [kA]             |            |      |               |      |                                     |      |      |                           |              |      |
| Category of utilization                             |                                    |                  | A          |      | A             |      | A                                   |      |      | A                         |              |      |
| Isolation behavior                                  |                                    |                  | ●          |      | ●             |      | ●                                   |      |      | ●                         |              |      |
| Trip unit (release)                                 |                                    |                  |            |      |               |      |                                     |      |      |                           |              |      |
| Thermal-Magnetic                                    |                                    |                  |            |      |               |      |                                     |      |      |                           |              |      |
| ● fixed-thermal, fixed-magnetic                     |                                    | FTU              | ●          |      | ●             |      | ●                                   |      |      | ●                         |              |      |
| ● adjustable-thermal, fixed-magnetic                |                                    | FMU              | ●          |      | ●             |      | ●                                   |      |      | ●**                       |              |      |
| ● adjustable-thermal, adjustable-magnetic           |                                    | ATU              | -          |      | -             |      | -                                   |      |      | -                         |              |      |
| ● magnetic only                                     |                                    | MTU (3P)         | -          |      | -             |      | -                                   |      |      | -                         |              |      |
| Electronic                                          |                                    |                  |            |      |               |      |                                     |      |      |                           |              |      |
| ● LSI                                               |                                    | ETS (3P, 4P)     | -          |      | -             |      | -                                   |      |      | -                         |              |      |
| ● LSI                                               |                                    | ETM (3P, 4P)     | -          |      | -             |      | -                                   |      |      | -                         |              |      |
| Option                                              | Earth-fault protection, Ig         |                  | -          |      | -             |      | -                                   |      |      | -                         |              |      |
|                                                     | Zone selective interlocking, ZSI   |                  | -          |      | -             |      | -                                   |      |      | -                         |              |      |
|                                                     | Ammeter                            |                  | -          |      | -             |      | -                                   |      |      | -                         |              |      |
|                                                     | Communication                      |                  | -          |      | -             |      | -                                   |      |      | -                         |              |      |
|                                                     | Earth-leakage protection module    |                  | -          |      | -             |      | -                                   |      |      | -                         |              |      |
| Connection                                          | fixed                              | front-connection | ●          |      | ●             |      | ●                                   |      |      | ●                         |              |      |
|                                                     |                                    | rear-connection  | ●          |      | ●             |      | ●                                   |      |      | ●**                       |              |      |
|                                                     | plug-in                            | front-connection | -          |      | -             |      | ●                                   |      |      | ●**                       |              |      |
|                                                     |                                    | rear-connection  | -          |      | -             |      | ●                                   |      |      | ●**                       |              |      |
| Life cycle ***                                      | Mechanical [operations]            |                  | 25000      |      | 25000         |      | 25000                               |      |      | 25000                     |              |      |
|                                                     | Electrical @ 415 V AC [operations] |                  | 10000      |      | 10000         |      | 10000                               |      |      | 10000                     |              |      |
| Basic dimensions, W×H×D (front connection)          | 1-pole [mm]                        |                  | -          |      | -             |      | -                                   |      |      | 35×140×86                 |              |      |
|                                                     | 3-pole [mm]                        |                  | 76×130×82  |      | 76×130×82     |      | 90×140×86                           |      |      | 90×140×86                 |              |      |
|                                                     | 4-pole [mm]                        |                  | 101×130×82 |      | 101×130×82    |      | 120×140×86                          |      |      | 120×140×86                |              |      |
| Weight (front connection)                           | 1-pole [kg]                        |                  | -          |      | -             |      | -                                   |      |      | 0.57                      |              |      |
|                                                     | 3-pole [kg]                        |                  | 1.05       |      | 1.05          |      | 1.5                                 |      |      | 1.5                       |              |      |
|                                                     | 4-pole [kg]                        |                  | 1.35       |      | 1.35          |      | 1.8                                 |      |      | 1.8                       |              |      |
| Reference standard                                  |                                    |                  | IEC60947-2 |      | IEC60947-2    |      | IEC60947-2                          |      |      | IEC60947-2                |              |      |

※ Breaking capacity at 660/690V is for your reference. (not certified)

\* Applicable to MCCBs equipped with FTU, FMU, ATU

2 pole MCCB in 3pole frame size

\*\* Not applicable to 1pole

\*\*\* Life cycle means not guarantee but limitation

(Quality guarantee: On/Off frequency on the basis of IEC60947-2 within the term of guarantee.)

# MCCBs for power distribution

Susol

| TS100               |      |      | TS160            |      |      | TS250              |      |      | TS400         |      |      | TS630         |      |      | TS800       |      |      |
|---------------------|------|------|------------------|------|------|--------------------|------|------|---------------|------|------|---------------|------|------|-------------|------|------|
| 100                 |      |      | 160              |      |      | 250                |      |      | 400           |      |      | 630           |      |      | 800         |      |      |
| 40, 50, 63, 80, 100 |      |      | (100)*, 125, 160 |      |      | 125, 160, 200, 250 |      |      | 300, 400      |      |      | 500, 630      |      |      | 700**, 800  |      |      |
| 2*, 3, 4            |      |      | 2*, 3, 4         |      |      | 2*, 3, 4           |      |      | 2*, 3, 4      |      |      | 2*, 3, 4      |      |      | 2*, 3, 4    |      |      |
| 690                 |      |      | 690              |      |      | 690                |      |      | 690           |      |      | 690           |      |      | 690         |      |      |
| 500                 |      |      | 500              |      |      | 500                |      |      | 500           |      |      | 500           |      |      | 500         |      |      |
| 8                   |      |      | 8                |      |      | 8                  |      |      | 8             |      |      | 8             |      |      | 8           |      |      |
| 1000                |      |      | 1000             |      |      | 1000               |      |      | 1000          |      |      | 1000          |      |      | 1000        |      |      |
| N                   | H    | L    | N                | H    | L    | N                  | H    | L    | N             | H    | L    | N             | H    | L    | N           | H    | L    |
| 100                 | 120  | 200  | 100              | 120  | 200  | 100                | 120  | 200  | 100           | 120  | 200  | 100           | 120  | 200  | 100         | 120  | 200  |
| 50                  | 85   | 150  | 50               | 85   | 150  | 50                 | 85   | 150  | 65            | 85   | 150  | 65            | 85   | 150  | 65          | 100  | 150  |
| 50                  | 70   | 130  | 50               | 70   | 130  | 50                 | 70   | 130  | 65            | 85   | 130  | 65            | 85   | 130  | 65          | 100  | 130  |
| 42                  | 65   | 85   | 42               | 65   | 85   | 42                 | 65   | 85   | 42            | 65   | 85   | 42            | 65   | 85   | 42          | 85   | 100  |
| 22                  | 35   | 50   | 22               | 35   | 50   | 22                 | 35   | 50   | 22            | 35   | 50   | 22            | 35   | 50   | 22          | 35   | 50   |
| 10                  | 10   | 10   | 10               | 10   | 10   | 10                 | 10   | 10   | 10            | 20   | 35   | 10            | 20   | 35   | 10          | 20   | 35   |
| 50                  | 85   | 100  | 50               | 85   | 100  | 50                 | 85   | 100  | 50            | 85   | 100  | 50            | 85   | 100  | 50          | 85   | 100  |
| 50                  | 85   | 100  | 50               | 85   | 100  | 50                 | 85   | 100  | 50            | 85   | 100  | 50            | 85   | 100  | 50          | 85   | 100  |
| 100%                | 100% | 100% | 100%             | 100% | 100% | 100%               | 100% | 100% | 100%          | 100% | 100% | 100%          | 100% | 100% | 100%        | 100% | 100% |
| 5                   | 5    | 5    | 5                | 5    | 5    | 5                  | 5    | 5    | 10            | 12   | 12   | 10            | 12   | 12   | 10          | 20   | 20   |
| 100%                | 100% | 100% | 100%             | 100% | 100% | 100%               | 100% | 100% | 100%          | 100% | 100% | 100%          | 100% | 100% | 100%        | 100% | 100% |
| 220                 | 264  | 440  | 220              | 264  | 440  | 220                | 264  | 440  | 220           | 264  | 440  | 220           | 264  | 440  | 220         | 264  | 440  |
| 105                 | 187  | 330  | 105              | 187  | 330  | 105                | 187  | 330  | 143           | 187  | 330  | 143           | 187  | 330  | 143         | 220  | 330  |
| 105                 | 154  | 286  | 105              | 154  | 286  | 105                | 154  | 286  | 143           | 187  | 286  | 143           | 187  | 286  | 143         | 220  | 286  |
| 88                  | 143  | 187  | 88               | 143  | 187  | 88                 | 143  | 187  | 88            | 143  | 187  | 88            | 143  | 187  | 88          | 187  | 220  |
| 46                  | 74   | 105  | 46               | 74   | 105  | 46                 | 74   | 105  | 46            | 74   | 105  | 46            | 74   | 105  | 46          | 74   | 105  |
| 17                  | 17   | 17   | 17               | 17   | 17   | 17                 | 17   | 17   | 17            | 40   | 74   | 17            | 40   | 74   | 17          | 40   | 74   |
| A                   |      |      | A                |      |      | A                  |      |      | A             |      |      | A             |      |      | A           |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
|                     |      |      |                  |      |      |                    |      |      |               |      |      |               |      |      |             |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| -                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
|                     |      |      |                  |      |      |                    |      |      |               |      |      |               |      |      |             |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| -                   |      |      | -                |      |      | -                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| -                   |      |      | -                |      |      | -                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| -                   |      |      | -                |      |      | -                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| -                   |      |      | -                |      |      | -                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| -                   |      |      | -                |      |      | -                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| ●                   |      |      | ●                |      |      | ●                  |      |      | ●             |      |      | ●             |      |      | ●           |      |      |
| 25000               |      |      | 25000            |      |      | 25000              |      |      | 20000         |      |      | 20000         |      |      | 10000       |      |      |
| 10000               |      |      | 10000            |      |      | 10000              |      |      | 10000         |      |      | 6000          |      |      | 3000        |      |      |
| -                   |      |      | -                |      |      | -                  |      |      | -             |      |      | -             |      |      | -           |      |      |
| 105×160×86          |      |      | 105×160×86       |      |      | 105×160×86         |      |      | 140×260×110   |      |      | 140×260×110   |      |      | 210×320×135 |      |      |
| 140×160×86          |      |      | 140×160×86       |      |      | 140×160×86         |      |      | 186.5×260×110 |      |      | 186.5×260×110 |      |      | 280×320×135 |      |      |
| -                   |      |      | -                |      |      | -                  |      |      | -             |      |      | -             |      |      | -           |      |      |
| 2                   |      |      | 2                |      |      | 2                  |      |      | 5.4           |      |      | 5.4           |      |      | 15.1        |      |      |
| 2.6                 |      |      | 2.6              |      |      | 2.6                |      |      | 7.2           |      |      | 7.2           |      |      | 19.6        |      |      |
| IEC60947-2          |      |      | IEC60947-2       |      |      | IEC60947-2         |      |      | IEC60947-2    |      |      | IEC60947-2    |      |      | IEC60947-2  |      |      |

※ The trip unit ATU is available from 125A

※ ※ 700A is only available for TS800FTU

# MCCBs for power distribution

Susol

## Thermal magnetic trip units Overview

Susol series circuit breakers can be installed with thermal magnetic trip units. And, there are two kinds of trip units according to way of installation as follows.

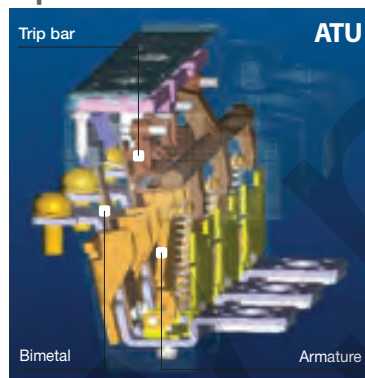
- Built-in trip units for TE and TD series upto 160A
- Interchangeable trip units for TS series upto 800A

### Function

Protection of power distribution

- Overload protection: Thermal protection with a fixed or adjustable threshold
- Short-circuit protection: Magnetic protection with a fixed or adjustable pick-up
- Protection of the fourth pole
  - 4P3T type (neutral unprotected)
  - 4P4T type 50% (neutral protection at  $0.5 \times I_n$ )
  - 4P4T type 100% (neutral protection at  $1 \times I_n$ )

### Operation



#### Thermal magnetic types

- Time-Delay operation  
An overcurrent heats and warps the bimetal to actuate the trip bar by the bimetal characteristic.
- Instantaneous operation  
If the overcurrent is excessive, the armature is attracted and the trip bar actuated by electromagnetic force.

### Ratings

| Ratings(A) |        |    | Thermal magnetic trip units(FTU/FMU/ATU) |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     | TE100 to TS800 |     |  |  |  |  |  |  |
|------------|--------|----|------------------------------------------|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|----------------|-----|--|--|--|--|--|--|
|            | at 40℃ | In | 16                                       | 20 | 25 | 32 | 40 | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 | 300 | 400 | 500 | 630            | 800 |  |  |  |  |  |  |
|            | TE100  |    | ●                                        | ●  | ●  | ●  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   | -   | -   | -              | -   |  |  |  |  |  |  |
|            | TD100  |    | ●                                        | ●  | ●  | ●  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   | -   | -   | -              | -   |  |  |  |  |  |  |
|            | TE160  |    | -                                        | -  | -  | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   | -   | -   | -              | -   |  |  |  |  |  |  |
|            | TD160  |    | -                                        | -  | -  | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   | -   | -   | -              | -   |  |  |  |  |  |  |
|            | TS100  |    | -                                        | -  | -  | -  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   | -   | -   | -              | -   |  |  |  |  |  |  |
|            | TS160  |    | -                                        | -  | -  | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   | -   | -   | -              | -   |  |  |  |  |  |  |
|            | TS250  |    | -                                        | -  | -  | -  | -  | -  | -  | -  | -   | ●   | ●   | ●   | ●   | -   | -   | -   | -              | -   |  |  |  |  |  |  |
|            | TS400  |    | -                                        | -  | -  | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | ●   | ●   | -   | -              | -   |  |  |  |  |  |  |
|            | TS630  |    | -                                        | -  | -  | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | -   | -   | ●   | ●              | -   |  |  |  |  |  |  |
|            | TS800  |    | -                                        | -  | -  | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | -   | -   | -   | -              | ●   |  |  |  |  |  |  |

Note) Rated current 700A is available for TS800FTU.



# MCCBs for power distribution

Susol

## Thermal magnetic trip units Overview

### Characteristics

#### Fixed thermal, fixed magnetic trip units

##### FTU

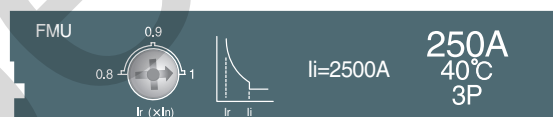
- Fixed thermal  
16A ... 800A rated currents
- Fixed magnetic  
400A ... 8000A tripping currents
- Applicable to TE100 ... TS800 frames



#### Adjustable thermal, fixed magnetic trip units

##### FMU

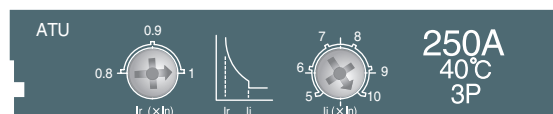
- Adjustable thermal  
16A ... 800A rated currents  
Adjustable :  $0.8 \sim 1 \times I_n$
- Fixed magnetic  
400A ... 8000A tripping currents
- Applicable to TE100 ... TS800 frames



#### Adjustable thermal, adjustable magnetic trip units

##### ATU

- Adjustable thermal  
100A ... 800A rated currents  
Adjustable :  $0.8 \sim 1 \times I_n$
- Adjustable magnetic  
500A ... 8000A tripping currents  
Adjustable :  $5 \sim 10 \times I_n$
- Applicable to TS160 ... TS800 frames

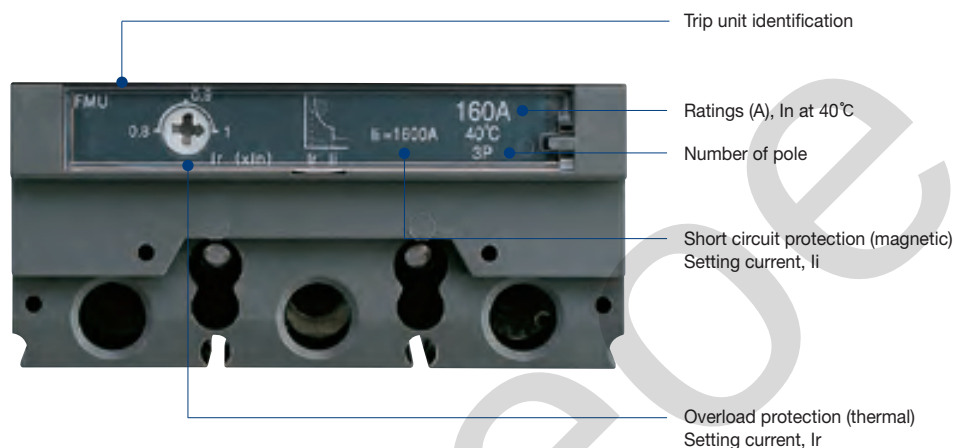


# MCCBs for power distribution

Susol

## Thermal magnetic trip units FTU, FMU for TE100, TD100, TE160, TD160

### Configuration



### TE100 FTU, TD100 FTU, TE160 FTU, TD160 FTU

- Fixed thermal & magnetic trip unit

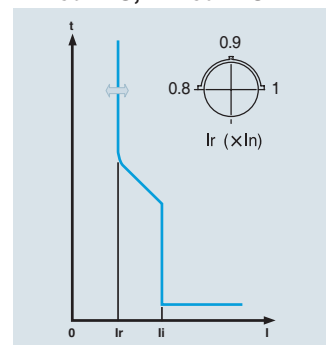


### TE100 FMU, TD100 FMU, TE160 FMU, TD160 FMU

- Adjustable thermal & fixed magnetic trip unit



### TE100 FTU, TD100 FTU, TE160 FTU, TD160 FTU



### Catalogue numbering system

**TD160 FMU**

#### Trip unit function

- FTU : Fixed thermal & magnetic unit
- FMU : Adjustable thermal, fixed magnetic unit

#### MCCB frame type

- TE100 : TE100N, TE100H, TE100L
- TD100 : TD100N, TD100H, TD100L
- TE160 : TE160N, TE160H, TE160L
- TD160 : TD160N, TD160H, TD160L

# MCCBs for power distribution

Susol

## Thermal magnetic trip units FTU, FMU for TE100, TD100, TE160, TD160

### Characteristics

| Thermal magnetic trip units(FTU/FMU) ... TE100, TD100, TE160, TD160 |           |                                          |    |    |    |    |             |    |    |     |     |     |
|---------------------------------------------------------------------|-----------|------------------------------------------|----|----|----|----|-------------|----|----|-----|-----|-----|
| Rating(A)                                                           | at 40℃ In | 16                                       | 20 | 25 | 32 | 40 | 50          | 63 | 80 | 100 | 125 | 160 |
|                                                                     | TE/TD100  | ●                                        | ●  | ●  | ●  | ●  | ●           | ●  | ●  | ●   | -   | -   |
|                                                                     | TE/TD160  | -                                        | -  | -  | -  | -  | -           | -  | -  | ●   | ●   | ●   |
| Overload protection(thermal)                                        |           |                                          |    |    |    |    |             |    |    |     |     |     |
| Current setting(A) Ir                                               |           |                                          |    |    |    |    |             |    |    |     |     |     |
|                                                                     | FTU       | Fixed                                    |    |    |    |    |             |    |    |     |     |     |
|                                                                     | FMU       | Adjustable 0.8, 0.9, 1 × In (3 settings) |    |    |    |    |             |    |    |     |     |     |
| Short - circuit protection(magnetic)                                |           |                                          |    |    |    |    |             |    |    |     |     |     |
| Current setting(A) Ii                                               |           |                                          |    |    |    |    |             |    |    |     |     |     |
|                                                                     | FTU       | Fixed 400A                               |    |    |    |    | Fixed 10×In |    |    |     |     |     |
|                                                                     | FMU       | Fixed 400A                               |    |    |    |    | Fixed 10×In |    |    |     |     |     |
| Protection of N pole                                                |           |                                          |    |    |    |    |             |    |    |     |     |     |
|                                                                     | 4P3T      | Neutral No protection                    |    |    |    |    |             |    |    |     |     |     |
|                                                                     | 4P4T      | Neutral protection (100% Ir)             |    |    |    |    |             |    |    |     |     |     |

### Setting details

#### Thermal overload protection

| Trip unit type |             | Setting | Trip unit rating, In (A) |    |      |      |    |    |      |    |     |       |     |
|----------------|-------------|---------|--------------------------|----|------|------|----|----|------|----|-----|-------|-----|
|                |             |         | 16                       | 20 | 25   | 32   | 40 | 50 | 63   | 80 | 100 | 125   | 160 |
| TE/TD100FTU    | TE/TD100FMU | Fixed   | 16                       | 20 | 25   | 32   | 40 | 50 | 63   | 80 | 100 | -     | -   |
|                |             | 0.8     | 12.8                     | 16 | 20   | 25.6 | 32 | 40 | 50.4 | 64 | 80  | -     | -   |
|                |             | 0.9     | 14.4                     | 18 | 22.5 | 28.8 | 36 | 45 | 56.7 | 72 | 90  | -     | -   |
|                |             | 1       | 16                       | 20 | 25   | 32   | 40 | 50 | 63   | 80 | 100 | -     | -   |
| TE/TD160FTU    | TE/TD160FMU | Fixed   | -                        | -  | -    | -    | -  | -  | -    | -  | 100 | 125   | 160 |
|                |             | 0.8     | -                        | -  | -    | -    | -  | -  | -    | -  | 80  | 100   | 128 |
|                |             | 0.9     | -                        | -  | -    | -    | -  | -  | -    | -  | 90  | 112.5 | 144 |
|                |             | 1       | -                        | -  | -    | -    | -  | -  | -    | -  | 100 | 125   | 160 |

#### Magnetic short-circuit protection

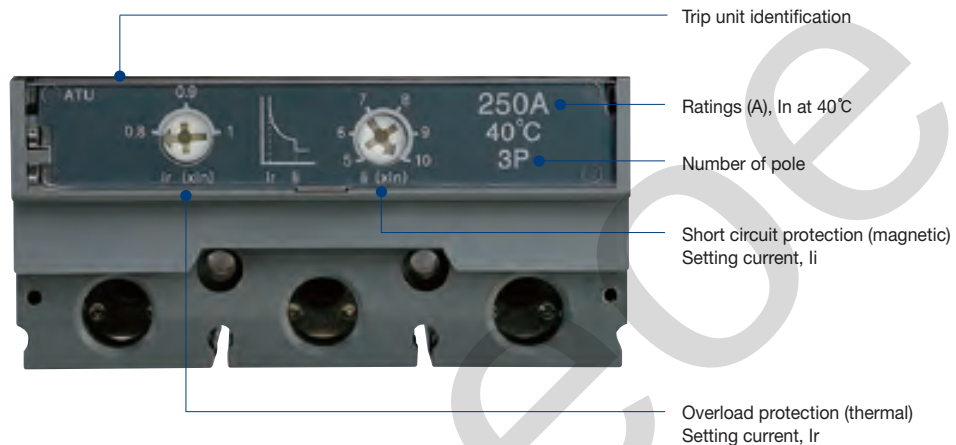
| Trip unit type |             | Setting<br>current, Ir | Setting<br>current, li | Trip unit rating, In (A) |     |     |     |     |     |     |     |     |      |      |      |
|----------------|-------------|------------------------|------------------------|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
|                |             |                        |                        | 16                       | 20  | 25  | 32  | 40  | 50  | 63  | 80  | 100 | 125  | 160  |      |
| TE/TD100FTU    | TE/TD100FMU |                        | Fixed                  | In×10                    | 400 | 400 | 400 | 400 | 400 | 500 | 630 | 800 | 1000 | -    | -    |
|                |             | 0.8×In                 | Fixed                  | In×10                    | 400 | 400 | 400 | 400 | 400 | 500 | 630 | 800 | 1000 | -    | -    |
|                |             | 0.9×In                 | Fixed                  | In×10                    | 400 | 400 | 400 | 400 | 400 | 500 | 630 | 800 | 1000 | -    | -    |
|                |             | 1.0×In                 | Fixed                  | In×10                    | 400 | 400 | 400 | 400 | 400 | 500 | 630 | 800 | 1000 | -    | -    |
| TE/TD160FTU    | TE/TD160FMU |                        | Fixed                  | In×10                    | -   | -   | -   | -   | -   | -   | -   | -   | 1000 | 1250 | 1600 |
|                |             | 0.8×In                 | Fixed                  | In×10                    | -   | -   | -   | -   | -   | -   | -   | -   | 1000 | 1250 | 1600 |
|                |             | 0.9×In                 | Fixed                  | In×10                    | -   | -   | -   | -   | -   | -   | -   | -   | 1000 | 1250 | 1600 |
|                |             | 1.0×In                 | Fixed                  | In×10                    | -   | -   | -   | -   | -   | -   | -   | -   | 1000 | 1250 | 1600 |

# MCCBs for power distribution

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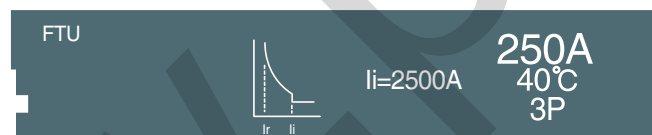
## Thermal magnetic trip units FTU, FMU for TS100, TS160, TS250 ATU for TS160, TS250

### Configuration

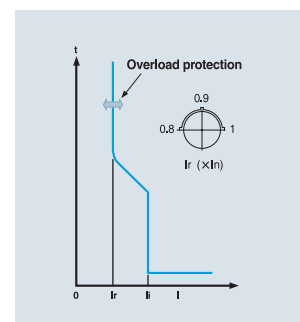


### TS100 FTU, TS160 FTU, TS250 FTU

- Fixed thermal fixed magnetic trip unit

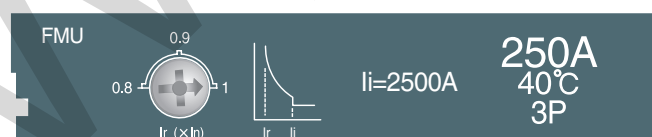


### TS100 FMU, TS160 FMU, TS250 FMU

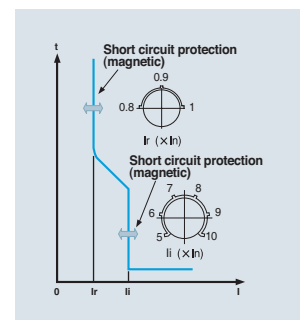


### TS100 FMU, TS160 FMU, TS250 FMU

- Adjustable thermal fixed magnetic trip unit



### TS160 ATU, TS250 ATU



### TS160 ATU, TS250 ATU

- Adjustable thermal adjustable magnetic trip unit



# MCCBs for power distribution

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## Thermal magnetic trip units FTU, FMU for TS100, TS160, TS250 ATU for TS160, TS250

### Characteristics

| Thermal Magnetic trip units(FTU/FMU/ATU) ... TS100 to TS250 |            |    |    |    |    |     |     |     |     |     |
|-------------------------------------------------------------|------------|----|----|----|----|-----|-----|-----|-----|-----|
| Rating(A)                                                   | at 40°C In | 40 | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 |
| TS100                                                       |            | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   |
| TS160                                                       |            | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   |
| TS250                                                       |            | -  | -  | -  | -  | -   | ●   | ●   | ●   | ●   |

| Overload protection(thermal) |                               |
|------------------------------|-------------------------------|
| Current setting(A)           | Ir                            |
| FTU                          | Fixed                         |
| FMU                          | Adjustable 0.8 to $\times$ In |
| ATU                          | Adjustable 0.8 to $\times$ In |

| Short - circuit protection(magnetic) |                                                       |
|--------------------------------------|-------------------------------------------------------|
| Current setting(A)                   | Ii                                                    |
| FTU                                  | Fixed $10 \times$ In                                  |
| FMU                                  | Fixed $10 \times$ In                                  |
| ATU                                  | Adjustable 5, 6, 7, 8, 9, $10 \times$ In (6 settings) |

| Protection of N pole |                              |
|----------------------|------------------------------|
| 4P3T                 | Neutral No protection        |
| 4P4T                 | Neutral protection (100% Ir) |

### Catalogue numbering system

**TS250 FTU**

#### Trip unit function

- FTU: Fixed thermal, fixed magnetic unit

#### MCCB frame type

- TS100: TS100N, TS100H, TS100L  
- TS160: TS160N, TS160H, TS160L  
- TS250: TS250N, TS250H, TS250L

**TS250 FMU**

#### Trip unit function

- FMU: Adjustable thermal, fixed magnetic unit

#### MCCB frame type

- TS100: TS100N, TS100H, TS100L  
- TS160: TS160N, TS160H, TS160L  
- TS250: TS250N, TS250H, TS250L

**TS250 ATU**

#### Trip unit function

- ATU: Adjustable thermal, adjustable magnetic unit

#### MCCB frame type

- TS160: TS160N, TS160H, TS160L  
- TS250: TS250N, TS250H, TS250L

The trip unit ATU is available from 125A

# MCCBs for power distribution

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## Thermal magnetic trip units FTU, FMU for TS100, TS160, TS250 ATU for TS160, TS250

### Setting details

#### Thermal overload protection

| Trip unit type |          | Setting<br>Ir | Trip unit rating, In (A) |    |    |    |     |     |     |     |     |
|----------------|----------|---------------|--------------------------|----|----|----|-----|-----|-----|-----|-----|
|                |          |               | 40                       | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 |
| TS100FTU       | TS100FMU | Fixed         | 40                       | 50 | 63 | 80 | 100 | -   | -   | -   | -   |
|                |          | 0.8×In        | 32                       | 40 | 50 | 64 | 80  | -   | -   | -   | -   |
|                |          | 0.9×In        | 36                       | 45 | 57 | 72 | 90  | -   | -   | -   | -   |
|                |          | 1.0×In        | 40                       | 50 | 63 | 80 | 100 | -   | -   | -   | -   |
| TS160FTU       | TS160FMU | Fixed         | -                        | -  | -  | -  | 100 | 125 | 160 | -   | -   |
|                |          | 0.8×In        | -                        | -  | -  | -  | 80  | 100 | 128 | -   | -   |
|                |          | 0.9×In        | -                        | -  | -  | -  | 90  | 113 | 144 | -   | -   |
|                |          | 1.0×In        | -                        | -  | -  | -  | 100 | 125 | 160 | -   | -   |
| TS160ATU       | TS250FTU | 0.8×In        | -                        | -  | -  | -  | -   | 100 | 128 | -   | -   |
|                |          | 0.9×In        | -                        | -  | -  | -  | -   | 113 | 144 | -   | -   |
|                |          | 1.0×In        | -                        | -  | -  | -  | -   | 125 | 160 | -   | -   |
|                |          | Fixed         | -                        | -  | -  | -  | -   | 125 | 160 | 200 | 250 |
| TS250FMU       | TS250ATU | 0.8×In        | -                        | -  | -  | -  | -   | 100 | 128 | 160 | 200 |
|                |          | 0.9×In        | -                        | -  | -  | -  | -   | 113 | 144 | 180 | 225 |
|                |          | 1.0×In        | -                        | -  | -  | -  | -   | 125 | 160 | 200 | 250 |
|                |          | 0.8×In        | -                        | -  | -  | -  | -   | 100 | 128 | 160 | 200 |
| TS250ATU       | TS250ATU | 0.9×In        | -                        | -  | -  | -  | -   | 113 | 144 | 180 | 225 |
|                |          | 1.0×In        | -                        | -  | -  | -  | -   | 125 | 160 | 200 | 250 |

# MCCBs for power distribution

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## Thermal magnetic trip units FTU, FMU for TS100, TS160, TS250 ATU for TS160, TS250

### Setting details

#### Magnetic short-circuit protection

| Trip unit type |          | Setting<br>current, Ir | Setting<br>current, Ii | Trip unit rating, In (A) |       |     |     |      |      |      |      |      |      |      |
|----------------|----------|------------------------|------------------------|--------------------------|-------|-----|-----|------|------|------|------|------|------|------|
|                |          |                        |                        | 40                       | 50    | 63  | 80  | 100  | 125  | 160  | 200  | 250  |      |      |
| TS100FTU       | TS100FMU | Fixed                  | In×10                  | 400                      | 500   | 630 | 800 | 1000 | -    | -    | -    | -    |      |      |
|                |          | 0.8×In                 | Fixed                  | In×10                    | 400   | 500 | 630 | 800  | 1000 | -    | -    | -    |      |      |
|                |          | 0.9×In                 | Fixed                  | In×10                    | 400   | 500 | 630 | 800  | 1000 | -    | -    | -    |      |      |
| TS160FTU       | TS160FMU | Fixed                  | In×10                  | 400                      | 500   | 630 | 800 | 1000 | -    | -    | -    | -    |      |      |
|                |          | 0.8×In                 | Fixed                  | In×10                    | 400   | 500 | 630 | 800  | 1000 | -    | -    | -    |      |      |
|                |          | 0.9×In                 | Fixed                  | In×10                    | 400   | 500 | 630 | 800  | 1000 | -    | -    | -    |      |      |
| TS160ATU       | 0.8×In   | Adjustable             | In×5                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×6                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×7                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×8                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×9                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×10                  | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                | 0.9×In   | Adjustable             | In×5                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×6                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×7                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×8                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×9                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×10                  | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                | 1.0×In   | Adjustable             | In×5                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×6                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×7                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×8                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×9                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                |          |                        | In×10                  | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | -    | -    |      |      |
|                | TS250FTU | TS250FMU               | Fixed                  | In×10                    | 400   | 500 | 630 | 800  | 1000 | 1250 | 1600 | 2000 | 2500 |      |
|                |          |                        | 0.8×In                 | Fixed                    | In×10 | 400 | 500 | 630  | 800  | 1000 | 1250 | 1600 | 2000 | 2500 |
|                |          |                        | 0.9×In                 | Fixed                    | In×10 | 400 | 500 | 630  | 800  | 1000 | 1250 | 1600 | 2000 | 2500 |
|                | TS250ATU | 0.8×In                 | Adjustable             | In×5                     | 400   | 500 | 630 | 800  | 1000 | 1250 | 1600 | 2000 | 2500 |      |
| In×6           |          |                        |                        | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
| In×7           |          |                        |                        | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
| In×8           |          |                        |                        | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
| In×9           |          |                        |                        | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
| In×10          |          |                        |                        | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
| 0.9×In         |          | Adjustable             | In×5                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×6                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×7                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×8                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×9                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×10                  | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
| 1.0×In         |          | Adjustable             | In×5                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×6                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×7                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×8                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×9                   | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |
|                |          |                        | In×10                  | 400                      | 500   | 630 | 800 | 1000 | 1250 | 1600 | 2000 | 2500 |      |      |

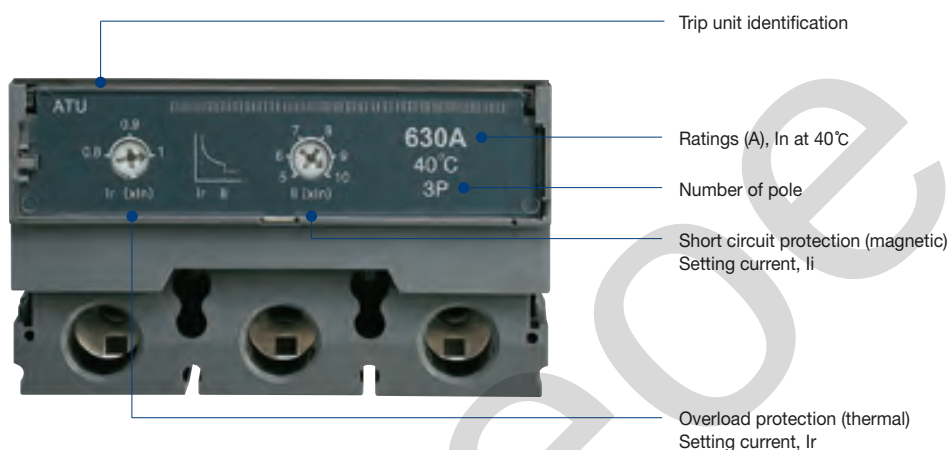


# MCCBs for power distribution

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## Thermal magnetic trip units FTU, FMU, ATU for TS400, TS630

### Configuration



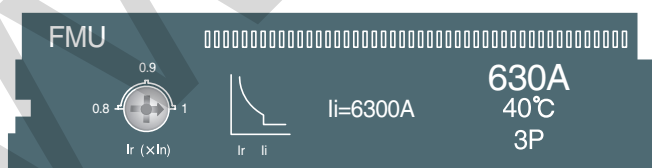
### TS400 FTU, TS630 FTU

- Fixed thermal fixed magnetic trip unit



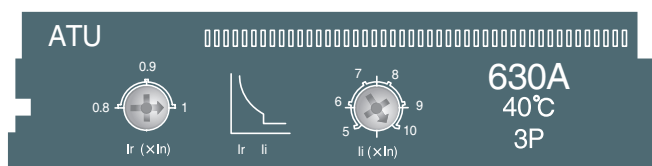
### TS400 FMU, TS630 FMU

- Adjustable thermal fixed magnetic trip unit

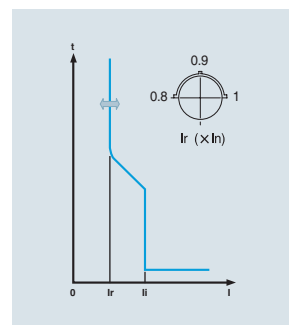


### TS400 ATU, TS630 ATU

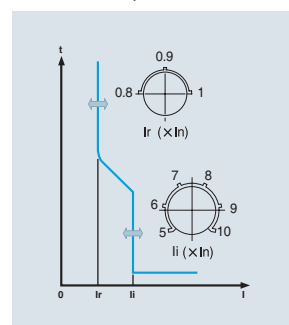
- Adjustable thermal adjustable magnetic trip unit



### TS400 FMU, TS630 FMU



### TS400 ATU, TS630 ATU



# MCCBs for power distribution

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## Thermal magnetic trip units FTU, FMU, ATU for TS400, TS630

### Characteristics

| Thermal Magnetic trip units(FTU/FMU/ATU) ... TS400 to TS630 |       |                                               |     |     |     |     |
|-------------------------------------------------------------|-------|-----------------------------------------------|-----|-----|-----|-----|
| Rating(A) at 40°C                                           |       | In                                            | 300 | 400 | 500 | 630 |
|                                                             | TS400 |                                               | ●   | ●   | -   | -   |
|                                                             | TS630 |                                               | -   | -   | ●   | ●   |
| Overload protection(thermal)                                |       |                                               |     |     |     |     |
| Current setting(A)                                          |       | Ir                                            |     |     |     |     |
|                                                             | FTU   | In=Ir (Fixed)                                 |     |     |     |     |
|                                                             | FMU   | Adjustable 0.8, 0.9, 1 × In (3 settings)      |     |     |     |     |
|                                                             | ATU   | Adjustable 0.8, 0.9, 1 × In (3 settings)      |     |     |     |     |
| Short - circuit protection(magnetic)                        |       |                                               |     |     |     |     |
| Current setting(A)                                          |       | Ii                                            |     |     |     |     |
|                                                             | FTU   | Fixed 10 × In                                 |     |     |     |     |
|                                                             | FMU   | Fixed 10 × In                                 |     |     |     |     |
|                                                             | ATU   | Adjustable 5, 6, 7, 8, 9, 10 × In(6 settings) |     |     |     |     |
| Protection of N pole                                        |       |                                               |     |     |     |     |
|                                                             | 4P3T  | Neutral No protection                         |     |     |     |     |
|                                                             | 4P4T  | Neutral protection (100% Ir)                  |     |     |     |     |

### Catalogue numbering system

**TS630 ATU**

#### Trip unit function

- FTU : Fixed thermal & magnetic unit
- FMU : Adjustable thermal & fixed magnetic unit
- ATU : Adjustable thermal & adjustable magnetic unit

#### MCCB frame type

- TS400 : TS400N, TS400H, TS400L
- TS630 : TS630N, TS630H, TS630L

# MCCBs for power distribution

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## Thermal magnetic trip units FTU, FMU, ATU for TS400, TS630

### Setting details

#### Thermal overload protection

| Trip unit type |       | Setting | Trip unit rating, In (A) |     |     |     |
|----------------|-------|---------|--------------------------|-----|-----|-----|
|                |       | Ir      | 300                      | 400 | 500 | 630 |
| TS400FTU       | Fixed | Fixed   | 300                      | 400 | -   | -   |
|                |       | 0.8     | 240                      | 320 | -   | -   |
|                |       | 0.9     | 270                      | 360 | -   | -   |
| TS400FMU       | 1     | 1       | 300                      | 400 | -   | -   |
|                |       | 0.8     | 240                      | 320 | -   | -   |
|                |       | 0.9     | 270                      | 360 | -   | -   |
| TS400ATU       | 1     | 1       | 300                      | 400 | -   | -   |
|                |       | 0.8     | 240                      | 320 | -   | -   |
|                |       | 0.9     | 270                      | 360 | -   | -   |
| TS630FTU       | Fixed | Fixed   | -                        | -   | 500 | 630 |
|                |       | 0.8     | -                        | -   | 400 | 504 |
|                |       | 0.9     | -                        | -   | 450 | 567 |
| TS630FMU       | 1     | 1       | -                        | -   | 500 | 630 |
|                |       | 0.8     | -                        | -   | 400 | 504 |
|                |       | 0.9     | -                        | -   | 450 | 567 |
| TS630ATU       | 1     | 1       | -                        | -   | 500 | 630 |
|                |       | 0.8     | -                        | -   | 400 | 504 |
|                |       | 0.9     | -                        | -   | 450 | 567 |

# MCCBs for power distribution

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## Thermal magnetic trip units FTU, FMU, ATU for TS400, TS630

### Setting details

#### Magnetic short-circuit protection

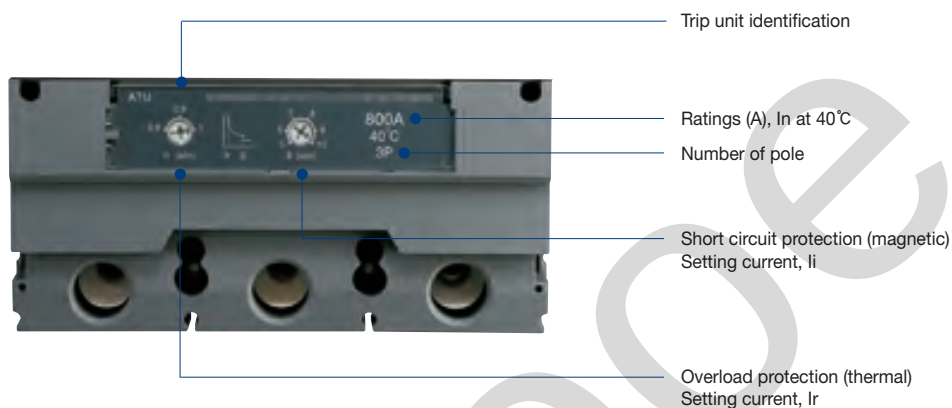
| Trip unit type | Setting current, I <sub>r</sub> | Setting current, I <sub>i</sub> |                     | Trip unit rating, I <sub>n</sub> (A) |      |      |      |
|----------------|---------------------------------|---------------------------------|---------------------|--------------------------------------|------|------|------|
|                |                                 |                                 |                     | 300                                  | 400  | 500  | 630  |
| TS400FTU       |                                 | Fixed                           | I <sub>n</sub> × 10 | 3000                                 | 4000 | -    | -    |
| TS400FMU       | 0.8 × I <sub>n</sub>            | Fixed                           | I <sub>n</sub> × 10 | 3000                                 | 4000 | -    | -    |
|                | 0.9 × I <sub>n</sub>            | Fixed                           | I <sub>n</sub> × 10 | 3000                                 | 4000 | -    | -    |
|                | 1.0 × I <sub>n</sub>            | Fixed                           | I <sub>n</sub> × 10 | 3000                                 | 4000 | -    | -    |
| TS400ATU       | 0.8 × I <sub>n</sub>            | Adjustable                      | I <sub>n</sub> × 5  | 1500                                 | 2000 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 6  | 1800                                 | 2400 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 7  | 2100                                 | 2800 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 8  | 2400                                 | 3200 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 9  | 2700                                 | 3600 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 10 | 3000                                 | 4000 | -    | -    |
|                | 0.9 × I <sub>n</sub>            | Adjustable                      | I <sub>n</sub> × 5  | 1500                                 | 2000 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 6  | 1800                                 | 2400 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 7  | 2100                                 | 2800 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 8  | 2400                                 | 3200 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 9  | 2700                                 | 3600 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 10 | 3000                                 | 4000 | -    | -    |
|                | 1.0 × I <sub>n</sub>            | Adjustable                      | I <sub>n</sub> × 5  | 1500                                 | 2000 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 6  | 1800                                 | 2400 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 7  | 2100                                 | 2800 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 8  | 2400                                 | 3200 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 9  | 2700                                 | 3600 | -    | -    |
|                |                                 |                                 | I <sub>n</sub> × 10 | 3000                                 | 4000 | -    | -    |
| TS630FTU       |                                 | Fixed                           | I <sub>n</sub> × 10 | -                                    | -    | 5000 | 6300 |
| TS630FMU       | 0.8 × I <sub>n</sub>            | Fixed                           | I <sub>n</sub> × 10 | -                                    | -    | 5000 | 6300 |
|                | 0.9 × I <sub>n</sub>            | Fixed                           | I <sub>n</sub> × 10 | -                                    | -    | 5000 | 6300 |
|                | 1.0 × I <sub>n</sub>            | Fixed                           | I <sub>n</sub> × 10 | -                                    | -    | 5000 | 6300 |
| TS630ATU       | 0.8 × I <sub>n</sub>            | Adjustable                      | I <sub>n</sub> × 5  | -                                    | -    | 2500 | 3150 |
|                |                                 |                                 | I <sub>n</sub> × 6  | -                                    | -    | 3000 | 3780 |
|                |                                 |                                 | I <sub>n</sub> × 7  | -                                    | -    | 3500 | 4410 |
|                |                                 |                                 | I <sub>n</sub> × 8  | -                                    | -    | 4000 | 5040 |
|                |                                 |                                 | I <sub>n</sub> × 9  | -                                    | -    | 4500 | 5670 |
|                |                                 |                                 | I <sub>n</sub> × 10 | -                                    | -    | 5000 | 6300 |
|                | 0.9 × I <sub>n</sub>            | Adjustable                      | I <sub>n</sub> × 5  | -                                    | -    | 2500 | 3150 |
|                |                                 |                                 | I <sub>n</sub> × 6  | -                                    | -    | 3000 | 3780 |
|                |                                 |                                 | I <sub>n</sub> × 7  | -                                    | -    | 3500 | 4410 |
|                |                                 |                                 | I <sub>n</sub> × 8  | -                                    | -    | 4000 | 5040 |
|                |                                 |                                 | I <sub>n</sub> × 9  | -                                    | -    | 4500 | 5670 |
|                |                                 |                                 | I <sub>n</sub> × 10 | -                                    | -    | 5000 | 6300 |
|                | 1.0 × I <sub>n</sub>            | Adjustable                      | I <sub>n</sub> × 5  | -                                    | -    | 2500 | 3150 |
|                |                                 |                                 | I <sub>n</sub> × 6  | -                                    | -    | 3000 | 3780 |
|                |                                 |                                 | I <sub>n</sub> × 7  | -                                    | -    | 3500 | 4410 |
|                |                                 |                                 | I <sub>n</sub> × 8  | -                                    | -    | 4000 | 5040 |
|                |                                 |                                 | I <sub>n</sub> × 9  | -                                    | -    | 4500 | 5670 |
|                |                                 |                                 | I <sub>n</sub> × 10 | -                                    | -    | 5000 | 6300 |

# MCCBs for power distribution

Susol

## Thermal magnetic trip units FTU, FMU, ATU for TS800

### Configuration

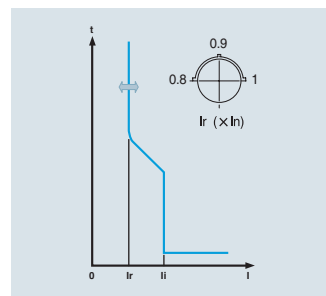


#### TS800 FTU

- Fixed thermal fixed magnetic trip unit

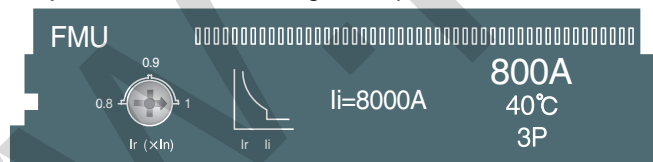


#### TS800 FMU

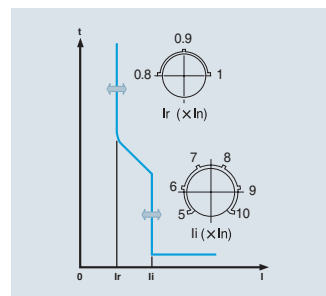


#### TS800 FMU

- Adjustable thermal fixed magnetic trip unit

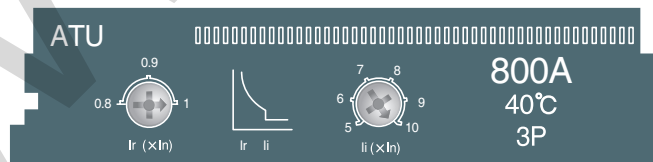


#### TS800 ATU



#### TS800 ATU

- Adjustable thermal adjustable magnetic trip unit



### Catalogue numbering system

**TS800** **ATU**

#### Trip unit function

- FTU : Fixed thermal & magnetic unit
- FMU : Adjustable thermal & fixed magnetic unit
- ATU : Adjustable thermal & adjustable magnetic unit

#### MCCB frame type

- TS800 : TS800N, TS800H, TS800L

# MCCBs for power distribution

Susol

## Thermal magnetic trip units FTU, FMU, ATU for TS800

### Characteristics

| Thermal Magnetic trip units(FTU/FMU/ATU) ... TS800 |       |     |
|----------------------------------------------------|-------|-----|
| Rating(A) at 40°C                                  | In    | 800 |
|                                                    | TS800 | ●   |

| Overload protection(thermal) |                |                                        |
|------------------------------|----------------|----------------------------------------|
| Current setting(A)           | I <sub>r</sub> |                                        |
|                              | FTU            | Fixed                                  |
|                              | FMU            | Adjustable 0.8, 0.9, 1×In (3 settings) |
|                              | ATU            | Adjustable 0.8, 0.9, 1×In (3 settings) |

| Short - circuit protection(magnetic) |                |                                              |
|--------------------------------------|----------------|----------------------------------------------|
| Current setting(A)                   | I <sub>i</sub> |                                              |
|                                      | FTU            | Fixed 10×In                                  |
|                                      | FMU            | Fixed 10×In                                  |
|                                      | ATU            | Adjustable 5, 6, 7, 8, 9, 10×In (6 settings) |

| Protection of N pole |      |                                           |
|----------------------|------|-------------------------------------------|
|                      | 4P3T | Neutral No protection                     |
|                      | 4P4T | Neutral protection (100% I <sub>r</sub> ) |

### Setting details

#### Thermal overload protection

| Trip unit type |          | Setting        | Trip unit rating, I <sub>n</sub> (A) |
|----------------|----------|----------------|--------------------------------------|
|                |          | I <sub>r</sub> |                                      |
|                | TS800FTU | Fixed          | 800                                  |
|                | TS800FMU | 0.8            | 640                                  |
|                |          | 0.9            | 720                                  |
|                |          | 1              | 800                                  |
|                | TS800ATU | 0.8            | 640                                  |
|                |          | 0.9            | 720                                  |
|                |          | 1              | 800                                  |

#### Magnetic short-circuit protection

| Trip unit type     | Setting<br>current, I <sub>r</sub> | Setting<br>current, I <sub>i</sub> |                     | Trip unit rating, I <sub>n</sub> (A) |
|--------------------|------------------------------------|------------------------------------|---------------------|--------------------------------------|
|                    |                                    |                                    |                     | 800                                  |
| TS800FTU           |                                    | Fixed                              | I <sub>n</sub> × 10 | 8000                                 |
| TS800FMU           | 0.8 × I <sub>n</sub>               | Fixed                              | I <sub>n</sub> × 10 | 8000                                 |
|                    | 0.9 × I <sub>n</sub>               | Fixed                              | I <sub>n</sub> × 10 | 8000                                 |
|                    | 1.0 × I <sub>n</sub>               | Fixed                              | I <sub>n</sub> × 10 | 8000                                 |
| TS800ATU           | 0.8 × I <sub>n</sub>               | Adjustable                         | I <sub>n</sub> × 5  | 4000                                 |
|                    |                                    |                                    | I <sub>n</sub> × 6  | 4800                                 |
|                    |                                    |                                    | I <sub>n</sub> × 7  | 5600                                 |
|                    |                                    |                                    | I <sub>n</sub> × 8  | 6400                                 |
|                    |                                    |                                    | I <sub>n</sub> × 9  | 7200                                 |
|                    |                                    |                                    | I <sub>n</sub> × 10 | 8000                                 |
|                    | 0.9 × I <sub>n</sub>               | Adjustable                         | I <sub>n</sub> × 5  | 4000                                 |
|                    |                                    |                                    | I <sub>n</sub> × 6  | 4800                                 |
|                    |                                    |                                    | I <sub>n</sub> × 7  | 5600                                 |
|                    |                                    |                                    | I <sub>n</sub> × 8  | 6400                                 |
|                    |                                    |                                    | I <sub>n</sub> × 9  | 7200                                 |
|                    |                                    |                                    | I <sub>n</sub> × 10 | 8000                                 |
|                    | 1.0 × I <sub>n</sub>               | Adjustable                         | I <sub>n</sub> × 5  | 4000                                 |
|                    |                                    |                                    | I <sub>n</sub> × 6  | 4800                                 |
|                    |                                    |                                    | I <sub>n</sub> × 7  | 5600                                 |
| I <sub>n</sub> × 8 |                                    |                                    | 6400                |                                      |
| I <sub>n</sub> × 9 |                                    |                                    | 7200                |                                      |
|                    |                                    |                                    | I <sub>n</sub> × 10 | 8000                                 |

# MCCBs for power distribution

Susol

## Overview of electronic trip units (Standard type)

Types: ETS23, ETS33, ETS43

3 frame size of circuit breaker: 250AF, 630AF, 800AF

The Trip units can be mounted on circuit breakers of N, H and L type from TS100 to TS800.

Test connector for trip unit (AC/DC 30mA ~ AC/DC 100mA)

### Protection

- Overload protection
- Short-circuit protection

### Ratings

|                          |     | Trip units  |             |             |             |             |             |
|--------------------------|-----|-------------|-------------|-------------|-------------|-------------|-------------|
|                          |     | ETS23       |             | ETS33       |             | ETS43       |             |
| Rated current, $I_n$ (A) | 40  | ●           | ●           | ●           | -           | -           | -           |
|                          | 80  | ●           | ●           | ●           | -           | -           | -           |
|                          | 160 | -           | ●           | ●           | ●           | -           | -           |
|                          | 250 | -           | -           | ●           | ●           | -           | -           |
|                          | 400 | -           | -           | -           | ●           | -           | -           |
|                          | 630 | -           | -           | -           | ●           | ●           | -           |
|                          | 800 | -           | -           | -           | -           | ●           | ●           |
| Applicable to            |     | TS100 N/H/L | TS160 N/H/L | TS250 N/H/L | TS400 N/H/L | TS630 N/H/L | TS800 N/H/L |

### Current setting, $I_r$ (A)

| ETS                  | 16 | 32 | 40 | 64 | 80 | 100 | 160 | 250 | 320 | 400 | 630 | 800 |
|----------------------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|
| ETS23 for TS100N/H/L |    |    |    |    |    |     |     |     |     |     |     |     |
| ETS23 for TS160N/H/L |    |    |    |    |    |     |     |     |     |     |     |     |
| ETS23 for TS250N/H/L |    |    |    |    |    |     |     |     |     |     |     |     |
| ETS33 for TS400N/H/L |    |    |    |    |    |     |     |     |     |     |     |     |
| ETS33 for TS630N/H/L |    |    |    |    |    |     |     |     |     |     |     |     |
| ETS43 for TS800N/H/L |    |    |    |    |    |     |     |     |     |     |     |     |

### Setting values

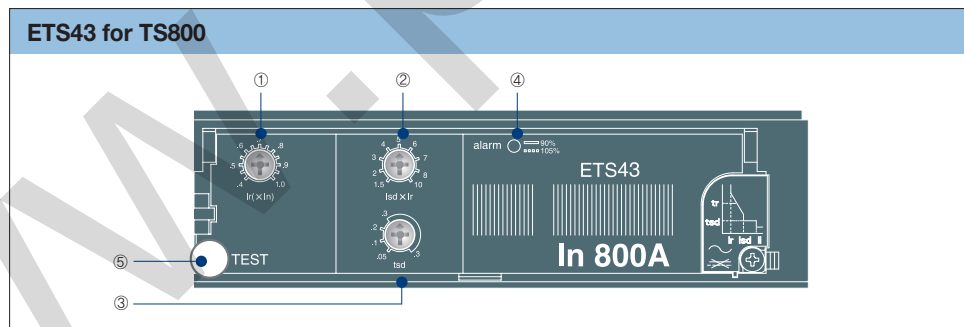
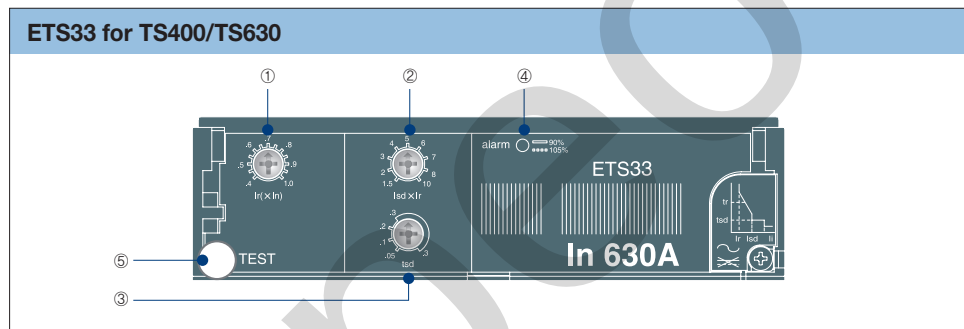
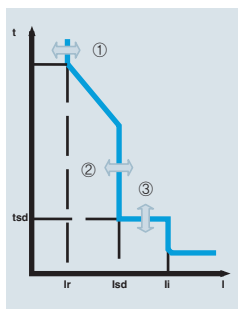
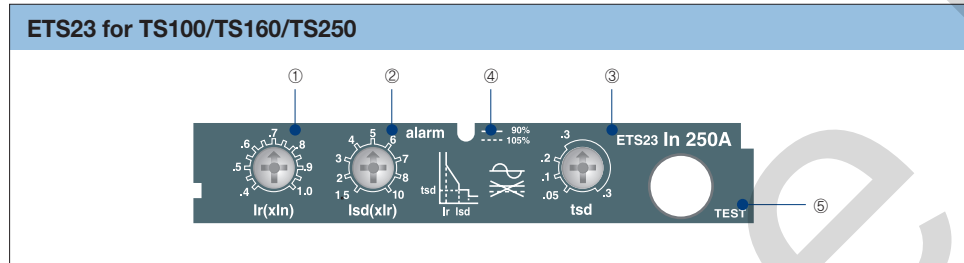
| Overload protection (long time)          |                                                                                                   |         |          |           |           |                                       |
|------------------------------------------|---------------------------------------------------------------------------------------------------|---------|----------|-----------|-----------|---------------------------------------|
| Setting current (A), I <sub>r</sub>      | 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0×I <sub>n</sub> , 13 setting |         |          |           |           |                                       |
| Tripping time (s)                        | Fixed at 6×I <sub>r</sub> , tolerance±20%                                                         |         |          |           |           |                                       |
| Short-circuit protection (short time)    |                                                                                                   |         |          |           |           |                                       |
| Tripping threshold (A), I <sub>sd</sub>  | adjustable 1.5, 2, 3, 4, 5, 6, 7, 8, 10×I <sub>r</sub> , 9 settings, tolerance ±15%               |         |          |           |           |                                       |
| Time delay (tsd)                         | setting time (ms)                                                                                 | 50      | 100      | 200       | 300       | 4 settings<br>I <sup>2</sup> t is off |
|                                          | operation time (ms)                                                                               | 30<t≤70 | 70<t≤140 | 140<t≤240 | 240<t≤350 |                                       |
| Short circuit protection (Instantaneous) |                                                                                                   |         |          |           |           |                                       |
| Tripping threshold (A), I <sub>i</sub>   | Fixed at 11×I <sub>n</sub>                                                                        |         |          |           |           |                                       |

# MCCBs for power distribution

**Susol**

## Overview of electronic trip units (Standard type)

- ① Adjustable rated current setting ( $I_r$ )
- ② Adjustable short time delay current setting ( $I_{sd}$ )
- ③ Adjustable time delay setting ( $t_{sd}$ )
- ④ Alarm LED  
90%  $I_r$ : ON,  
105%  $I_r$  or more: ON-OFF
- ⑤ Test connector





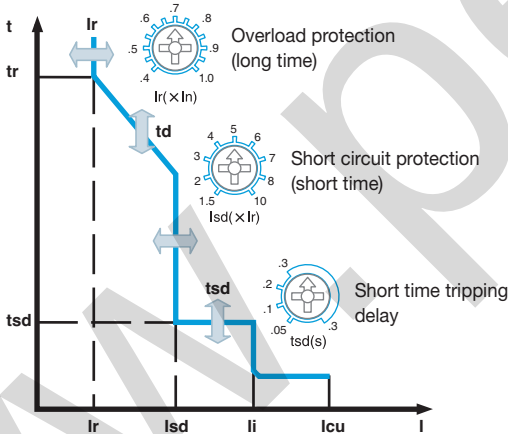
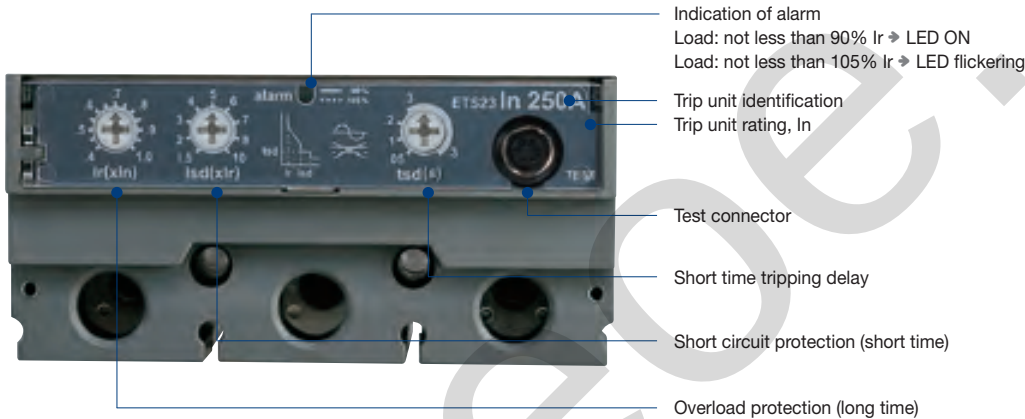
# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS23 for TS100, TS160, TS250

### Configuration

Electronic type, ETS23 for MCCBs TS100, TS160, TS250



| Overload protection (long time) |                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------|
| Setting current (A), $I_r$      | 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, $1.0 \times I_n$<br>13 settings |
| Tripping time (s)               | Fixed at $6 \times I_r$ , tolerance $\pm 20\%$                                                    |

| Short-circuit protection (short time)    |                                                                |         |          |           |           |            |
|------------------------------------------|----------------------------------------------------------------|---------|----------|-----------|-----------|------------|
| Tripping threshold (A), (Isd)            | 1.5, 2, 3, 4, 5, 6, 7, 8, 10×Ir<br>9 settings, tolerance ± 15% |         |          |           |           |            |
| Time delay (tsd)                         | setting time (ms)                                              | 50      | 100      | 200       | 300       | 4 settings |
|                                          | operation time (ms)                                            | 30<t≤70 | 70<t≤140 | 140<t≤240 | 240<t≤350 |            |
| Short circuit protection (Instantaneous) |                                                                |         |          |           |           |            |
| Tripping threshold (A), li               | Fixed at 11×In                                                 |         |          |           |           |            |

### Catalogue numbering system

|               |                                                                         |                                                                                  |
|---------------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| ETS 23 In250A | <b>Trip unit frame</b>                                                  | <b>Rated current, <math>I_n</math></b>                                           |
|               | - 23 for TS100, TS160, TS250<br>- 33 for TS400, TS630<br>- 43 for TS800 | - 40, 80A for TS100<br>- 40, 80, 160A for TS160<br>- 40, 80, 160, 250A for TS250 |
|               | <b>Trip unit function</b><br>- ETS: Standard electronic trip unit       |                                                                                  |

# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS23 for TS100, TS160, TS250

### Current setting, $I_r$ (A)

Standard electronic trip unit, ETS23

Trip unit

for TS100

for TS160

for TS250

| 16 | 32 | 40 | 64 | 80 | 100 | 160 | 250 | 320 | 400 | 630 | 800 |
|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|
|    |    |    |    |    |     |     |     |     |     |     |     |
|    |    |    |    |    |     |     |     |     |     |     |     |
|    |    |    |    |    |     |     |     |     |     |     |     |

### Setting details

Overload protection (long time)

| Circuit breakers            | TS100                                                                          |    | TS160 |    |     | TS250 |    |     |     |
|-----------------------------|--------------------------------------------------------------------------------|----|-------|----|-----|-------|----|-----|-----|
| Trip unit rating, $I_n$ (A) | 40                                                                             | 80 | 40    | 80 | 160 | 40    | 80 | 160 | 250 |
| Setting value               | Overload protection setting current $I_r$ = Setting value (0.4~1) $\times I_n$ |    |       |    |     |       |    |     |     |
| 0.4                         | 16                                                                             | 32 | 16    | 32 | 64  | 16    | 32 | 64  | 100 |
| 0.45                        | 18                                                                             | 36 | 18    | 36 | 72  | 18    | 36 | 72  | 113 |
| 0.5                         | 20                                                                             | 40 | 20    | 40 | 80  | 20    | 40 | 80  | 125 |
| 0.55                        | 22                                                                             | 44 | 22    | 44 | 88  | 22    | 44 | 88  | 138 |
| 0.6                         | 24                                                                             | 48 | 24    | 48 | 96  | 24    | 48 | 96  | 150 |
| 0.65                        | 26                                                                             | 52 | 26    | 52 | 104 | 26    | 52 | 104 | 163 |
| 0.7                         | 28                                                                             | 56 | 28    | 56 | 112 | 28    | 56 | 112 | 175 |
| 0.75                        | 30                                                                             | 60 | 30    | 60 | 120 | 30    | 60 | 120 | 188 |
| 0.8                         | 32                                                                             | 64 | 32    | 64 | 128 | 32    | 64 | 128 | 200 |
| 0.85                        | 34                                                                             | 68 | 34    | 68 | 136 | 34    | 68 | 136 | 213 |
| 0.9                         | 36                                                                             | 72 | 36    | 72 | 144 | 36    | 72 | 144 | 225 |
| 0.95                        | 38                                                                             | 76 | 38    | 76 | 152 | 38    | 76 | 152 | 238 |
| 1                           | 40                                                                             | 80 | 40    | 80 | 160 | 40    | 80 | 160 | 250 |

Long time tripping delay,  $t_d$  (sec)

Tripping time (s)

Fixed at  $6 \times I_r$   
tolerance  $\pm 20\%$

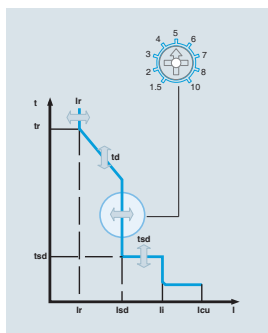
# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS23 for TS100, TS160, TS250

### Setting details

#### Short-circuit protection (short time)

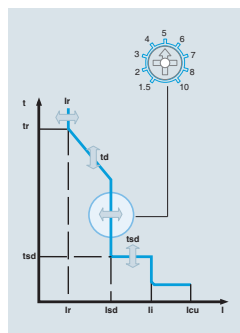


| Circuit breakers        |     | TS100                                                                                       |     | TS160 |     | TS250 |     |     |     |     |
|-------------------------|-----|---------------------------------------------------------------------------------------------|-----|-------|-----|-------|-----|-----|-----|-----|
| Trip unit rating, In(A) |     | 40                                                                                          | 80  | 40    | 80  | 160   | 40  | 80  | 160 | 250 |
| Setting value           |     | Short time pick-up current setting, I <sub>sd</sub> = Setting value (1.5~10)×I <sub>r</sub> |     |       |     |       |     |     |     |     |
| 0.4                     | 1.5 | 24                                                                                          | 48  | 24    | 48  | 96    | 24  | 48  | 96  | 150 |
| 0.45                    |     | 27                                                                                          | 54  | 27    | 54  | 108   | 27  | 54  | 108 | 169 |
| 0.5                     |     | 30                                                                                          | 60  | 30    | 60  | 120   | 30  | 60  | 120 | 188 |
| 0.55                    |     | 33                                                                                          | 66  | 33    | 66  | 132   | 33  | 66  | 132 | 206 |
| 0.6                     |     | 36                                                                                          | 72  | 36    | 72  | 144   | 36  | 72  | 144 | 225 |
| 0.65                    |     | 39                                                                                          | 78  | 39    | 78  | 156   | 39  | 78  | 156 | 244 |
| 0.7                     |     | 42                                                                                          | 84  | 42    | 84  | 168   | 42  | 84  | 168 | 263 |
| 0.75                    |     | 45                                                                                          | 90  | 45    | 90  | 180   | 45  | 90  | 180 | 281 |
| 0.8                     |     | 48                                                                                          | 96  | 48    | 96  | 192   | 48  | 96  | 192 | 300 |
| 0.85                    |     | 51                                                                                          | 102 | 51    | 102 | 204   | 51  | 102 | 204 | 319 |
| 0.9                     |     | 54                                                                                          | 108 | 54    | 108 | 216   | 54  | 108 | 216 | 338 |
| 0.95                    |     | 57                                                                                          | 114 | 57    | 114 | 228   | 57  | 114 | 228 | 356 |
| 1                       | 2   | 60                                                                                          | 120 | 60    | 120 | 240   | 60  | 120 | 240 | 375 |
| 0.4                     |     | 32                                                                                          | 64  | 32    | 64  | 128   | 32  | 64  | 128 | 200 |
| 0.45                    |     | 36                                                                                          | 72  | 36    | 72  | 144   | 36  | 72  | 144 | 225 |
| 0.5                     |     | 40                                                                                          | 80  | 40    | 80  | 160   | 40  | 80  | 160 | 250 |
| 0.55                    |     | 44                                                                                          | 88  | 44    | 88  | 176   | 44  | 88  | 176 | 275 |
| 0.6                     |     | 48                                                                                          | 96  | 48    | 96  | 192   | 48  | 96  | 192 | 300 |
| 0.65                    |     | 52                                                                                          | 104 | 52    | 104 | 208   | 52  | 104 | 208 | 325 |
| 0.7                     |     | 56                                                                                          | 112 | 56    | 112 | 224   | 56  | 112 | 224 | 350 |
| 0.75                    |     | 60                                                                                          | 120 | 60    | 120 | 240   | 60  | 120 | 240 | 375 |
| 0.8                     |     | 64                                                                                          | 128 | 64    | 128 | 256   | 64  | 128 | 256 | 400 |
| 0.85                    |     | 68                                                                                          | 136 | 68    | 136 | 272   | 68  | 136 | 272 | 425 |
| 0.9                     |     | 72                                                                                          | 144 | 72    | 144 | 288   | 72  | 144 | 288 | 450 |
| 0.95                    | 76  | 152                                                                                         | 76  | 152   | 304 | 76    | 152 | 304 | 475 |     |
| 1                       | 3   | 80                                                                                          | 160 | 80    | 160 | 320   | 80  | 160 | 320 | 500 |
| 0.4                     |     | 48                                                                                          | 96  | 48    | 96  | 192   | 48  | 96  | 192 | 300 |
| 0.45                    |     | 54                                                                                          | 108 | 54    | 108 | 216   | 54  | 108 | 216 | 338 |
| 0.5                     |     | 60                                                                                          | 120 | 60    | 120 | 240   | 60  | 120 | 240 | 375 |
| 0.55                    |     | 66                                                                                          | 132 | 66    | 132 | 264   | 66  | 132 | 264 | 413 |
| 0.6                     |     | 72                                                                                          | 144 | 72    | 144 | 288   | 72  | 144 | 288 | 450 |
| 0.65                    |     | 78                                                                                          | 156 | 78    | 156 | 312   | 78  | 156 | 312 | 488 |
| 0.7                     |     | 84                                                                                          | 168 | 84    | 168 | 336   | 84  | 168 | 336 | 525 |
| 0.75                    |     | 90                                                                                          | 180 | 90    | 180 | 360   | 90  | 180 | 360 | 563 |
| 0.8                     |     | 96                                                                                          | 192 | 96    | 192 | 384   | 96  | 192 | 384 | 600 |
| 0.85                    |     | 102                                                                                         | 204 | 102   | 204 | 408   | 102 | 204 | 408 | 638 |
| 0.9                     |     | 108                                                                                         | 216 | 108   | 216 | 432   | 108 | 216 | 432 | 675 |
| 0.95                    | 114 | 228                                                                                         | 114 | 228   | 456 | 114   | 228 | 456 | 713 |     |
| 1                       |     | 120                                                                                         | 240 | 120   | 240 | 480   | 120 | 240 | 480 | 750 |

# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS23 for TS100, TS160, TS250



| Circuit breakers        |   | TS100                                                                                       |     | TS160 |     |     | TS250 |     |     |      |
|-------------------------|---|---------------------------------------------------------------------------------------------|-----|-------|-----|-----|-------|-----|-----|------|
| Trip unit rating, In(A) |   | 40                                                                                          | 80  | 40    | 80  | 160 | 40    | 80  | 160 | 250  |
| Setting value           |   | Short time pick-up current setting, I <sub>sd</sub> = Setting value (1.5~10)×I <sub>r</sub> |     |       |     |     |       |     |     |      |
| 0.4                     | 4 | 64                                                                                          | 128 | 64    | 128 | 256 | 64    | 128 | 256 | 400  |
| 0.45                    |   | 72                                                                                          | 144 | 72    | 144 | 288 | 72    | 144 | 288 | 450  |
| 0.5                     |   | 80                                                                                          | 160 | 80    | 160 | 320 | 80    | 160 | 320 | 500  |
| 0.55                    |   | 88                                                                                          | 176 | 88    | 176 | 352 | 88    | 176 | 352 | 550  |
| 0.6                     |   | 96                                                                                          | 192 | 96    | 192 | 384 | 96    | 192 | 384 | 600  |
| 0.65                    |   | 104                                                                                         | 208 | 104   | 208 | 416 | 104   | 208 | 416 | 650  |
| 0.7                     |   | 112                                                                                         | 224 | 112   | 224 | 448 | 112   | 224 | 448 | 700  |
| 0.75                    |   | 120                                                                                         | 240 | 120   | 240 | 480 | 120   | 240 | 480 | 750  |
| 0.8                     |   | 128                                                                                         | 256 | 128   | 256 | 512 | 128   | 256 | 512 | 800  |
| 0.85                    |   | 136                                                                                         | 272 | 136   | 272 | 544 | 136   | 272 | 544 | 850  |
| 0.9                     |   | 144                                                                                         | 288 | 144   | 288 | 576 | 144   | 288 | 576 | 900  |
| 0.95                    |   | 152                                                                                         | 304 | 152   | 304 | 608 | 152   | 304 | 608 | 950  |
| 1                       | 5 | 160                                                                                         | 320 | 160   | 320 | 640 | 160   | 320 | 640 | 1000 |
| 0.4                     |   | 80                                                                                          | 160 | 80    | 160 | 320 | 80    | 160 | 320 | 500  |
| 0.45                    |   | 90                                                                                          | 180 | 90    | 180 | 360 | 90    | 180 | 360 | 563  |
| 0.5                     |   | 100                                                                                         | 200 | 100   | 200 | 400 | 100   | 200 | 400 | 625  |
| 0.55                    |   | 110                                                                                         | 220 | 110   | 220 | 440 | 110   | 220 | 440 | 688  |
| 0.6                     |   | 120                                                                                         | 240 | 120   | 240 | 480 | 120   | 240 | 480 | 750  |
| 0.65                    |   | 130                                                                                         | 260 | 130   | 260 | 520 | 130   | 260 | 520 | 813  |
| 0.7                     |   | 140                                                                                         | 280 | 140   | 280 | 560 | 140   | 280 | 560 | 875  |
| 0.75                    |   | 150                                                                                         | 300 | 150   | 300 | 600 | 150   | 300 | 600 | 938  |
| 0.8                     |   | 160                                                                                         | 320 | 160   | 320 | 640 | 160   | 320 | 640 | 1000 |
| 0.85                    |   | 170                                                                                         | 340 | 170   | 340 | 680 | 170   | 340 | 680 | 1063 |
| 0.9                     |   | 180                                                                                         | 360 | 180   | 360 | 720 | 180   | 360 | 720 | 1125 |
| 0.95                    | 6 | 190                                                                                         | 380 | 190   | 380 | 760 | 190   | 380 | 760 | 1188 |
| 1                       |   | 200                                                                                         | 400 | 200   | 400 | 800 | 200   | 400 | 800 | 1250 |
| 0.4                     |   | 96                                                                                          | 192 | 96    | 192 | 384 | 96    | 192 | 384 | 600  |
| 0.45                    |   | 108                                                                                         | 216 | 108   | 216 | 432 | 108   | 216 | 432 | 675  |
| 0.5                     |   | 120                                                                                         | 240 | 120   | 240 | 480 | 120   | 240 | 480 | 750  |
| 0.55                    |   | 132                                                                                         | 264 | 132   | 264 | 528 | 132   | 264 | 528 | 825  |
| 0.6                     |   | 144                                                                                         | 288 | 144   | 288 | 576 | 144   | 288 | 576 | 900  |
| 0.65                    |   | 156                                                                                         | 312 | 156   | 312 | 624 | 156   | 312 | 624 | 975  |
| 0.7                     |   | 168                                                                                         | 336 | 168   | 336 | 672 | 168   | 336 | 672 | 1050 |
| 0.75                    |   | 180                                                                                         | 360 | 180   | 360 | 720 | 180   | 360 | 720 | 1125 |
| 0.8                     |   | 192                                                                                         | 384 | 192   | 384 | 768 | 192   | 384 | 768 | 1200 |
| 0.85                    |   | 204                                                                                         | 408 | 204   | 408 | 816 | 204   | 408 | 816 | 1275 |
| 0.9                     |   | 216                                                                                         | 432 | 216   | 432 | 864 | 216   | 432 | 864 | 1350 |
| 0.95                    |   | 228                                                                                         | 456 | 228   | 456 | 912 | 228   | 456 | 912 | 1425 |
| 1                       |   | 240                                                                                         | 480 | 240   | 480 | 960 | 240   | 480 | 960 | 1500 |

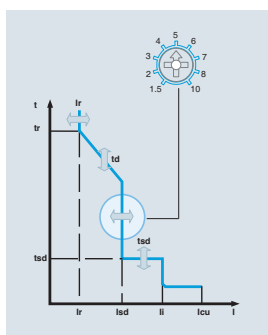
# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS23 for TS100, TS160, TS250

### Setting details

#### Short-circuit protection (short time)



| Circuit breakers        |     | TS100                                                                                         |     | TS160 |      |      | TS250 |      |      |      |
|-------------------------|-----|-----------------------------------------------------------------------------------------------|-----|-------|------|------|-------|------|------|------|
| Trip unit rating, In(A) |     | 40                                                                                            | 80  | 40    | 80   | 160  | 40    | 80   | 160  | 250  |
| Setting value           |     | Short time pick-up current setting, I <sub>sd</sub> = Setting value (1.5~10) × I <sub>r</sub> |     |       |      |      |       |      |      |      |
| 0.4                     | 7   | 112                                                                                           | 224 | 112   | 224  | 448  | 112   | 224  | 448  | 700  |
| 0.45                    |     | 126                                                                                           | 252 | 126   | 252  | 504  | 126   | 252  | 504  | 788  |
| 0.5                     |     | 140                                                                                           | 280 | 140   | 280  | 560  | 140   | 280  | 560  | 875  |
| 0.55                    |     | 154                                                                                           | 308 | 154   | 308  | 616  | 154   | 308  | 616  | 963  |
| 0.6                     |     | 168                                                                                           | 336 | 168   | 336  | 672  | 168   | 336  | 672  | 1050 |
| 0.65                    |     | 182                                                                                           | 364 | 182   | 364  | 728  | 182   | 364  | 728  | 1138 |
| 0.7                     |     | 196                                                                                           | 392 | 196   | 392  | 784  | 196   | 392  | 784  | 1225 |
| 0.75                    |     | 210                                                                                           | 420 | 210   | 420  | 840  | 210   | 420  | 840  | 1313 |
| 0.8                     |     | 224                                                                                           | 448 | 224   | 448  | 896  | 224   | 448  | 896  | 1400 |
| 0.85                    |     | 238                                                                                           | 476 | 238   | 476  | 952  | 238   | 476  | 952  | 1488 |
| 0.9                     |     | 252                                                                                           | 504 | 252   | 504  | 1008 | 252   | 504  | 1008 | 1575 |
| 0.95                    |     | 266                                                                                           | 532 | 266   | 532  | 1064 | 266   | 532  | 1064 | 1663 |
| 1                       | 280 | 560                                                                                           | 280 | 560   | 1120 | 280  | 560   | 1120 | 1750 |      |
| 0.4                     | 8   | 128                                                                                           | 256 | 128   | 256  | 512  | 128   | 256  | 512  | 800  |
| 0.45                    |     | 144                                                                                           | 288 | 144   | 288  | 576  | 144   | 288  | 576  | 900  |
| 0.5                     |     | 160                                                                                           | 320 | 160   | 320  | 640  | 160   | 320  | 640  | 1000 |
| 0.55                    |     | 176                                                                                           | 352 | 176   | 352  | 704  | 176   | 352  | 704  | 1100 |
| 0.6                     |     | 192                                                                                           | 384 | 192   | 384  | 768  | 192   | 384  | 768  | 1200 |
| 0.65                    |     | 208                                                                                           | 416 | 208   | 416  | 832  | 208   | 416  | 832  | 1300 |
| 0.7                     |     | 224                                                                                           | 448 | 224   | 448  | 896  | 224   | 448  | 896  | 1400 |
| 0.75                    |     | 240                                                                                           | 480 | 240   | 480  | 960  | 240   | 480  | 960  | 1500 |
| 0.8                     |     | 256                                                                                           | 512 | 256   | 512  | 1024 | 256   | 512  | 1024 | 1600 |
| 0.85                    |     | 272                                                                                           | 544 | 272   | 544  | 1088 | 272   | 544  | 1088 | 1700 |
| 0.9                     |     | 288                                                                                           | 576 | 288   | 576  | 1152 | 288   | 576  | 1152 | 1800 |
| 0.95                    |     | 304                                                                                           | 608 | 304   | 608  | 1216 | 304   | 608  | 1216 | 1900 |
| 1                       | 320 | 640                                                                                           | 320 | 640   | 1280 | 320  | 640   | 1280 | 2000 |      |
| 0.4                     | 10  | 160                                                                                           | 320 | 160   | 320  | 640  | 160   | 320  | 640  | 1000 |
| 0.45                    |     | 180                                                                                           | 360 | 180   | 360  | 720  | 180   | 360  | 720  | 1125 |
| 0.5                     |     | 200                                                                                           | 400 | 200   | 400  | 800  | 200   | 400  | 800  | 1250 |
| 0.55                    |     | 220                                                                                           | 440 | 220   | 440  | 880  | 220   | 440  | 880  | 1375 |
| 0.6                     |     | 240                                                                                           | 480 | 240   | 480  | 960  | 240   | 480  | 960  | 1500 |
| 0.65                    |     | 260                                                                                           | 520 | 260   | 520  | 1040 | 260   | 520  | 1040 | 1625 |
| 0.7                     |     | 280                                                                                           | 560 | 280   | 560  | 1120 | 280   | 560  | 1120 | 1750 |
| 0.75                    |     | 300                                                                                           | 600 | 300   | 600  | 1200 | 300   | 600  | 1200 | 1875 |
| 0.8                     |     | 320                                                                                           | 640 | 320   | 640  | 1280 | 320   | 640  | 1280 | 2000 |
| 0.85                    |     | 340                                                                                           | 680 | 340   | 680  | 1360 | 340   | 680  | 1360 | 2125 |
| 0.9                     |     | 360                                                                                           | 720 | 360   | 720  | 1440 | 360   | 720  | 1440 | 2250 |
| 0.95                    |     | 380                                                                                           | 760 | 380   | 760  | 1520 | 380   | 760  | 1520 | 2375 |
| 1                       | 400 | 800                                                                                           | 400 | 800   | 1600 | 400  | 800   | 1600 | 2500 |      |

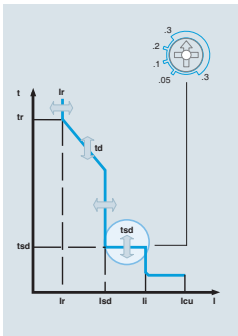
# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS23 for TS100, TS160, TS250

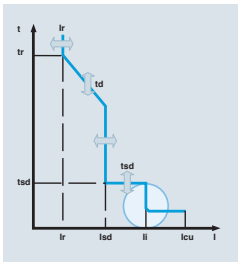
### Setting details

#### Short time tripping delay setting, t<sub>sd</sub> (ms)



|                                  |                     |         |          |           |           |            |
|----------------------------------|---------------------|---------|----------|-----------|-----------|------------|
| Time delay<br>(t <sub>sd</sub> ) | setting time (ms)   | 50      | 100      | 200       | 300       | 4 settings |
|                                  | operation time (ms) | 30<t≤70 | 70<t≤140 | 140<t≤240 | 240<t≤350 |            |

#### Short circuit protection (Instantaneous), I<sub>i</sub> (A)



|                                           |                            |
|-------------------------------------------|----------------------------|
| Tripping threshold (A),<br>I <sub>i</sub> | Fixed at 11×I <sub>n</sub> |
|-------------------------------------------|----------------------------|

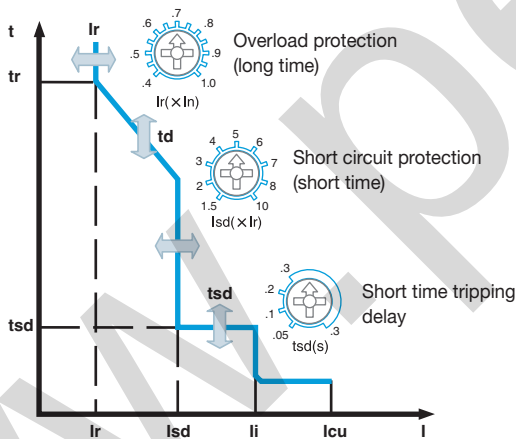
# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS33 for TS400, TS630

### Configuration

Electronic type, ETS33 for MCCBs TS400 & TS630



| Overload protection (long time) |                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------|
| Setting current (A), $I_r$      | 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, $1.0 \times I_n$<br>13 settings |
| Tripping time (s)               | Fixed at $6 \times I_r$ , tolerance $\pm 20\%$                                                    |

| Short-circuit protection (short time)         |                                                                           |         |          |           |           |            |
|-----------------------------------------------|---------------------------------------------------------------------------|---------|----------|-----------|-----------|------------|
| Tripping threshold (A),<br>(I <sub>sd</sub> ) | 1.5, 2, 3, 4, 5, 6, 7, 8, 10×I <sub>r</sub><br>9 settings, tolerance ±15% |         |          |           |           |            |
| Time delay<br>(t <sub>sd</sub> )              | setting time (ms)                                                         | 50      | 100      | 200       | 300       | 4 settings |
|                                               | operation time (ms)                                                       | 30<t≤70 | 70<t≤140 | 140<t≤240 | 240<t≤350 |            |
| Short circuit protection (Instantaneous)      |                                                                           |         |          |           |           |            |
| Tripping threshold (A), I <sub>i</sub>        | Fixed at 11×I <sub>n</sub>                                                |         |          |           |           |            |

### Catalogue numbering system

|               |                                                                         |  |                                                               |  |
|---------------|-------------------------------------------------------------------------|--|---------------------------------------------------------------|--|
| ETS 33 In630A | <b>Trip unit frame</b>                                                  |  | <b>Rated current, In</b>                                      |  |
|               | - 23 for TS100, TS160, TS250<br>- 33 for TS400, TS630<br>- 43 for TS800 |  | - 160, 250, 400A for TS400<br>- 160, 250, 400, 630A for TS630 |  |
|               | <b>Trip unit function</b><br>- ETS: Standard electronic trip unit       |  |                                                               |  |

# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS33 for TS400, TS630

### Current setting, Ir (A)

Standard electronic trip unit, ETS33

|           | 16 | 32 | 40 | 64 | 80 | 100 | 160 | 250 | 320 | 400 | 630 | 800 |
|-----------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|
| Trip unit |    |    |    |    |    |     |     |     |     |     |     |     |
| for TS400 |    |    |    |    |    |     |     |     |     |     |     |     |
| for TS630 |    |    |    |    |    |     |     |     |     |     |     |     |

### Setting details

Overload protection (long time)

| Circuit breakers        | TS400 |     |     | TS630 |     |     |     |
|-------------------------|-------|-----|-----|-------|-----|-----|-----|
| Trip unit rating, In(A) | 160   | 250 | 400 | 160   | 250 | 400 | 630 |

| Setting value | Overload protection setting current Ir = Setting value (0.4~1) × In |     |     |     |     |     |     |
|---------------|---------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|
| 0.4           | 64                                                                  | 100 | 160 | 64  | 100 | 160 | 252 |
| 0.45          | 72                                                                  | 113 | 180 | 72  | 113 | 180 | 284 |
| 0.5           | 80                                                                  | 125 | 200 | 80  | 125 | 200 | 315 |
| 0.55          | 88                                                                  | 138 | 220 | 88  | 138 | 220 | 347 |
| 0.6           | 96                                                                  | 150 | 240 | 96  | 150 | 240 | 378 |
| 0.65          | 104                                                                 | 163 | 260 | 104 | 163 | 260 | 410 |
| 0.7           | 112                                                                 | 175 | 280 | 112 | 175 | 280 | 441 |
| 0.75          | 120                                                                 | 188 | 300 | 120 | 188 | 300 | 473 |
| 0.8           | 128                                                                 | 200 | 320 | 128 | 200 | 320 | 504 |
| 0.85          | 136                                                                 | 213 | 340 | 136 | 213 | 340 | 536 |
| 0.9           | 144                                                                 | 225 | 360 | 144 | 225 | 360 | 567 |
| 0.95          | 152                                                                 | 238 | 380 | 152 | 238 | 380 | 599 |
| 1             | 160                                                                 | 250 | 400 | 160 | 250 | 400 | 630 |

Long time tripping delay, td (sec)

|                   |                                |
|-------------------|--------------------------------|
| Tripping time (s) | Fixed at 6×Ir<br>tolerance±20% |
|-------------------|--------------------------------|



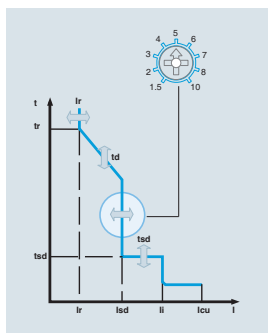
# MCCBs for power distribution

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## Electronic trip units (Standard) ETS33 for TS400, TS630

### Setting details

#### Short-circuit protection (short time)



| Circuit breakers        |     | TS400                                                                 |     |      | TS630 |     |      |      |
|-------------------------|-----|-----------------------------------------------------------------------|-----|------|-------|-----|------|------|
| Trip unit rating, In(A) |     | 160                                                                   | 250 | 400  | 160   | 250 | 400  | 630  |
| Setting value           |     | Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir |     |      |       |     |      |      |
| 0.4                     | 1.5 | 96                                                                    | 150 | 240  | 96    | 150 | 240  | 378  |
| 0.45                    |     | 108                                                                   | 169 | 270  | 108   | 169 | 270  | 425  |
| 0.5                     |     | 120                                                                   | 188 | 300  | 120   | 188 | 300  | 473  |
| 0.55                    |     | 132                                                                   | 206 | 330  | 132   | 206 | 330  | 520  |
| 0.6                     |     | 144                                                                   | 225 | 360  | 144   | 225 | 360  | 567  |
| 0.65                    |     | 156                                                                   | 244 | 390  | 156   | 244 | 390  | 614  |
| 0.7                     |     | 168                                                                   | 263 | 420  | 168   | 263 | 420  | 662  |
| 0.75                    |     | 180                                                                   | 281 | 450  | 180   | 281 | 450  | 709  |
| 0.8                     |     | 192                                                                   | 300 | 480  | 192   | 300 | 480  | 756  |
| 0.85                    |     | 204                                                                   | 319 | 510  | 204   | 319 | 510  | 803  |
| 0.9                     |     | 216                                                                   | 338 | 540  | 216   | 338 | 540  | 851  |
| 0.95                    |     | 228                                                                   | 356 | 570  | 228   | 356 | 570  | 898  |
| 1                       | 2   | 240                                                                   | 375 | 600  | 240   | 375 | 600  | 945  |
| 0.4                     |     | 128                                                                   | 200 | 320  | 128   | 200 | 320  | 504  |
| 0.45                    |     | 144                                                                   | 225 | 360  | 144   | 225 | 360  | 567  |
| 0.5                     |     | 160                                                                   | 250 | 400  | 160   | 250 | 400  | 630  |
| 0.55                    |     | 176                                                                   | 275 | 440  | 176   | 275 | 440  | 693  |
| 0.6                     |     | 192                                                                   | 300 | 480  | 192   | 300 | 480  | 756  |
| 0.65                    |     | 208                                                                   | 325 | 520  | 208   | 325 | 520  | 819  |
| 0.7                     |     | 224                                                                   | 350 | 560  | 224   | 350 | 560  | 882  |
| 0.75                    |     | 240                                                                   | 375 | 600  | 240   | 375 | 600  | 945  |
| 0.8                     |     | 256                                                                   | 400 | 640  | 256   | 400 | 640  | 1008 |
| 0.85                    |     | 272                                                                   | 425 | 680  | 272   | 425 | 680  | 1071 |
| 0.9                     |     | 288                                                                   | 450 | 720  | 288   | 450 | 720  | 1134 |
| 0.95                    | 3   | 304                                                                   | 475 | 760  | 304   | 475 | 760  | 1197 |
| 1                       |     | 320                                                                   | 500 | 800  | 320   | 500 | 800  | 1260 |
| 0.4                     |     | 192                                                                   | 300 | 480  | 192   | 300 | 480  | 756  |
| 0.45                    |     | 216                                                                   | 338 | 540  | 216   | 338 | 540  | 851  |
| 0.5                     |     | 240                                                                   | 375 | 600  | 240   | 375 | 600  | 945  |
| 0.55                    |     | 264                                                                   | 413 | 660  | 264   | 413 | 660  | 1040 |
| 0.6                     |     | 288                                                                   | 450 | 720  | 288   | 450 | 720  | 1134 |
| 0.65                    |     | 312                                                                   | 488 | 780  | 312   | 488 | 780  | 1229 |
| 0.7                     |     | 336                                                                   | 525 | 840  | 336   | 525 | 840  | 1323 |
| 0.75                    |     | 360                                                                   | 563 | 900  | 360   | 563 | 900  | 1418 |
| 0.8                     |     | 384                                                                   | 600 | 960  | 384   | 600 | 960  | 1512 |
| 0.85                    |     | 408                                                                   | 638 | 1020 | 408   | 638 | 1020 | 1607 |
| 0.9                     |     | 432                                                                   | 675 | 1080 | 432   | 675 | 1080 | 1701 |
| 0.95                    |     | 456                                                                   | 713 | 1140 | 456   | 713 | 1140 | 1795 |
| 1                       |     | 480                                                                   | 750 | 1200 | 480   | 750 | 1200 | 1890 |

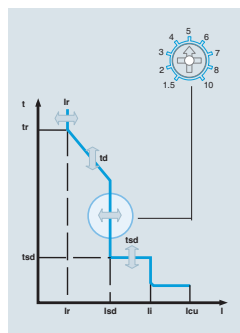
# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS33 for TS400, TS630

### Setting details

#### Short-circuit protection (short time)



| Circuit breakers        |   | TS400                                                                                         |       |      | TS630 |      |      |      |
|-------------------------|---|-----------------------------------------------------------------------------------------------|-------|------|-------|------|------|------|
| Trip unit rating, In(A) |   | 160                                                                                           | 250   | 400  | 160   | 250  | 400  | 630  |
| Setting value           |   | Short time pick-up current setting, I <sub>sd</sub> = Setting value (1.5-10) × I <sub>r</sub> |       |      |       |      |      |      |
| 0.4                     | 4 | 256                                                                                           | 400   | 640  | 256   | 400  | 640  | 1008 |
| 0.45                    |   | 288                                                                                           | 450   | 720  | 288   | 450  | 720  | 1134 |
| 0.5                     |   | 320                                                                                           | 500   | 800  | 320   | 500  | 800  | 1260 |
| 0.55                    |   | 352                                                                                           | 550   | 880  | 352   | 550  | 880  | 1386 |
| 0.6                     |   | 384                                                                                           | 600   | 960  | 384   | 600  | 960  | 1512 |
| 0.65                    |   | 416                                                                                           | 650   | 1040 | 416   | 650  | 1040 | 1638 |
| 0.7                     |   | 448                                                                                           | 700   | 1120 | 448   | 700  | 1120 | 1764 |
| 0.75                    |   | 480                                                                                           | 750   | 1200 | 480   | 750  | 1200 | 1890 |
| 0.8                     |   | 512                                                                                           | 800   | 1280 | 512   | 800  | 1280 | 2016 |
| 0.85                    |   | 544                                                                                           | 850   | 1360 | 544   | 850  | 1360 | 2142 |
| 0.9                     |   | 576                                                                                           | 900   | 1440 | 576   | 900  | 1440 | 2268 |
| 0.95                    |   | 608                                                                                           | 950   | 1520 | 608   | 950  | 1520 | 2394 |
| 1                       | 5 | 640                                                                                           | 1000  | 1600 | 640   | 1000 | 1600 | 2520 |
| 0.4                     |   | 320                                                                                           | 500   | 800  | 320   | 500  | 800  | 1260 |
| 0.45                    |   | 360                                                                                           | 563   | 900  | 360   | 563  | 900  | 1418 |
| 0.5                     |   | 400                                                                                           | 625   | 1000 | 400   | 625  | 1000 | 1575 |
| 0.55                    |   | 440                                                                                           | 687.5 | 1100 | 440   | 688  | 1100 | 1733 |
| 0.6                     |   | 480                                                                                           | 750   | 1200 | 480   | 750  | 1200 | 1890 |
| 0.65                    |   | 520                                                                                           | 813   | 1300 | 520   | 813  | 1300 | 2048 |
| 0.7                     |   | 560                                                                                           | 875   | 1400 | 560   | 875  | 1400 | 2205 |
| 0.75                    |   | 600                                                                                           | 938   | 1500 | 600   | 938  | 1500 | 2363 |
| 0.8                     |   | 640                                                                                           | 1000  | 1600 | 640   | 1000 | 1600 | 2520 |
| 0.85                    |   | 680                                                                                           | 1063  | 1700 | 680   | 1063 | 1700 | 2678 |
| 0.9                     |   | 720                                                                                           | 1125  | 1800 | 720   | 1125 | 1800 | 2835 |
| 0.95                    |   | 760                                                                                           | 1188  | 1900 | 760   | 1188 | 1900 | 2993 |
| 1                       | 6 | 800                                                                                           | 1250  | 2000 | 800   | 1250 | 2000 | 3150 |
| 0.4                     |   | 384                                                                                           | 600   | 960  | 384   | 600  | 960  | 1512 |
| 0.45                    |   | 432                                                                                           | 675   | 1080 | 432   | 675  | 1080 | 1701 |
| 0.5                     |   | 480                                                                                           | 750   | 1200 | 480   | 750  | 1200 | 1890 |
| 0.55                    |   | 528                                                                                           | 825   | 1320 | 528   | 825  | 1320 | 2079 |
| 0.6                     |   | 576                                                                                           | 900   | 1440 | 576   | 900  | 1440 | 2268 |
| 0.65                    |   | 624                                                                                           | 975   | 1560 | 624   | 975  | 1560 | 2457 |
| 0.7                     |   | 672                                                                                           | 1050  | 1680 | 672   | 1050 | 1680 | 2646 |
| 0.75                    |   | 720                                                                                           | 1125  | 1800 | 720   | 1125 | 1800 | 2835 |
| 0.8                     |   | 768                                                                                           | 1200  | 1920 | 768   | 1200 | 1920 | 3024 |
| 0.85                    |   | 816                                                                                           | 1275  | 2040 | 816   | 1275 | 2040 | 3213 |
| 0.9                     |   | 864                                                                                           | 1350  | 2160 | 864   | 1350 | 2160 | 3402 |
| 0.95                    |   | 912                                                                                           | 1425  | 2280 | 912   | 1425 | 2280 | 3591 |
| 1                       |   | 960                                                                                           | 1500  | 2400 | 960   | 1500 | 2400 | 3780 |

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## Setting details

A-2-29

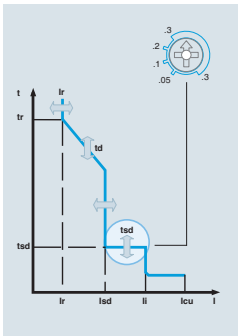
# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS33 for TS400, TS630

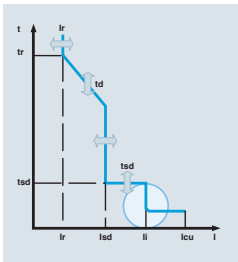
### Setting details

#### Short time tripping delay setting, t<sub>sd</sub> (ms)



|                     |                     |         |          |           |           |            |
|---------------------|---------------------|---------|----------|-----------|-----------|------------|
| Time delay<br>(tsd) | setting time (ms)   | 50      | 100      | 200       | 300       | 4 settings |
|                     | operation time (ms) | 30<t≤70 | 70<t≤140 | 140<t≤240 | 240<t≤350 |            |

#### Short circuit protection (Instantaneous), I<sub>i</sub> (A)



|                                           |                            |
|-------------------------------------------|----------------------------|
| Tripping threshold (A),<br>I <sub>i</sub> | Fixed at 11×I <sub>n</sub> |
|-------------------------------------------|----------------------------|

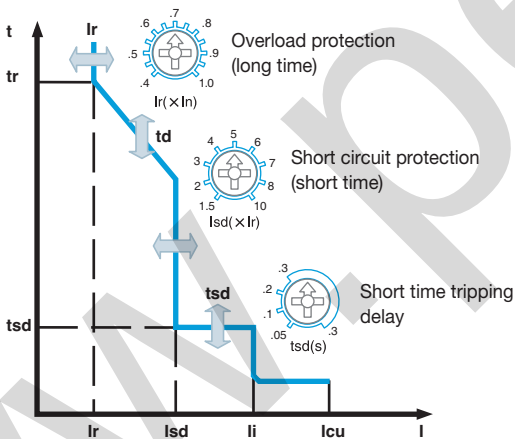
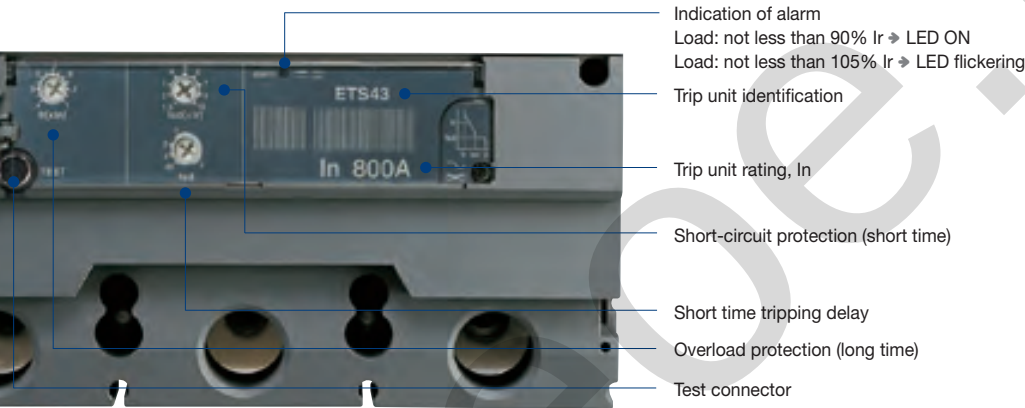
# MCCBs for power distribution

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## Electronic trip units (Standard) ETS43 for MCCBs TS800

### Configuration

Electronic type, ETS43 for MCCBs TS800



| Overload protection (long time) |                                                                                                   |
|---------------------------------|---------------------------------------------------------------------------------------------------|
| Setting current (A), $I_r$      | 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, $1.0 \times I_n$<br>13 settings |
| Tripping time (s)               | Fixed at $6 \times I_r$ , tolerance $\pm 20\%$                                                    |

| Short-circuit protection (short time)    |                                                                |         |          |           |           |            |
|------------------------------------------|----------------------------------------------------------------|---------|----------|-----------|-----------|------------|
| Tripping threshold (A),<br>(Isd)         | 1.5, 2, 3, 4, 5, 6, 7, 8, 10×Ir<br>9 settings, tolerance ± 15% |         |          |           |           |            |
| Time delay<br>(tsd)                      | setting time (ms)                                              | 50      | 100      | 200       | 300       | 4 settings |
|                                          | operation time (ms)                                            | 30<t≤70 | 70<t≤140 | 140<t≤240 | 240<t≤350 |            |
| Short circuit protection (Instantaneous) |                                                                |         |          |           |           |            |
| Tripping threshold (A), li               | Fixed at 11×In                                                 |         |          |           |           |            |

### Catalogue numbering system

ETS 43 In800A

**Trip unit frame**  
- 23 for TS100, TS160, TS250  
- 33 for TS400, TS630  
- 43 for TS800

**Rated current,  $I_n$**   
- 630, 800A for TS800

**Trip unit function**  
- ETS: Standard electronic trip unit

# MCCBs for power distribution

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## Electronic trip units (Standard) ETS43 for MCCBs TS800

### Current setting, Ir (A)

Standard electronic trip unit, ETS43

|    |    |    |    |    |     |     |     |     |     |     |     |
|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|
| 16 | 32 | 40 | 64 | 80 | 100 | 160 | 250 | 320 | 400 | 630 | 800 |
|    |    |    |    |    |     |     |     |     |     |     |     |

Trip unit  
for TS800

### Setting details

Overload protection (long time)

| Circuit breakers        | TS800                                                               |     |
|-------------------------|---------------------------------------------------------------------|-----|
| Trip unit rating, In(A) | 630                                                                 | 800 |
| Setting value           | Overload protection setting current Ir = Setting value (0.4~1) × In |     |
| 0.4                     | 252                                                                 | 320 |
| 0.45                    | 284                                                                 | 360 |
| 0.5                     | 315                                                                 | 400 |
| 0.55                    | 347                                                                 | 440 |
| 0.6                     | 378                                                                 | 480 |
| 0.65                    | 410                                                                 | 520 |
| 0.7                     | 441                                                                 | 560 |
| 0.75                    | 473                                                                 | 600 |
| 0.8                     | 504                                                                 | 640 |
| 0.85                    | 536                                                                 | 680 |
| 0.9                     | 567                                                                 | 720 |
| 0.95                    | 599                                                                 | 760 |
| 1                       | 630                                                                 | 800 |

Long time tripping delay, td (sec)

|                   |                                |
|-------------------|--------------------------------|
| Tripping time (s) | Fixed at 6×Ir<br>tolerance±20% |
|-------------------|--------------------------------|

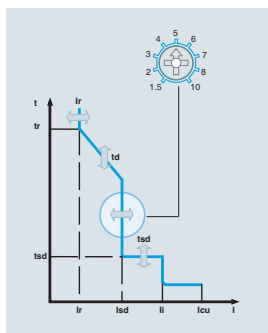
# MCCBs for power distribution

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## Electronic trip units (Standard) ETS43 for MCCBs TS800

### Setting details

#### Overload protection (long time)



| Circuit breakers        |     | TS800                                                                                         |      |
|-------------------------|-----|-----------------------------------------------------------------------------------------------|------|
| Trip unit rating, In(A) |     | 630                                                                                           | 800  |
| Setting value           |     | Short time pick-up current setting, I <sub>sd</sub> = Setting value (1.5~10) × I <sub>r</sub> |      |
| 0.4                     | 1.5 | 378                                                                                           | 480  |
| 0.45                    |     | 425                                                                                           | 540  |
| 0.5                     |     | 473                                                                                           | 600  |
| 0.55                    |     | 520                                                                                           | 660  |
| 0.6                     |     | 567                                                                                           | 720  |
| 0.65                    |     | 614                                                                                           | 780  |
| 0.7                     |     | 662                                                                                           | 840  |
| 0.75                    |     | 709                                                                                           | 900  |
| 0.8                     |     | 756                                                                                           | 960  |
| 0.85                    |     | 804                                                                                           | 1020 |
| 0.9                     | 2   | 850.5                                                                                         | 1080 |
| 0.95                    |     | 898                                                                                           | 1140 |
| 1                       |     | 945                                                                                           | 1200 |
| 0.4                     |     | 504                                                                                           | 640  |
| 0.45                    |     | 567                                                                                           | 720  |
| 0.5                     |     | 630                                                                                           | 800  |
| 0.55                    |     | 693                                                                                           | 880  |
| 0.6                     |     | 756                                                                                           | 960  |
| 0.65                    |     | 819                                                                                           | 1040 |
| 0.7                     |     | 882                                                                                           | 1120 |
| 0.75                    | 3   | 945                                                                                           | 1200 |
| 0.8                     |     | 1008                                                                                          | 1280 |
| 0.85                    |     | 1071                                                                                          | 1360 |
| 0.9                     |     | 1134                                                                                          | 1440 |
| 0.95                    |     | 1197                                                                                          | 1520 |
| 1                       |     | 1260                                                                                          | 1600 |
| 0.4                     |     | 756                                                                                           | 960  |
| 0.45                    |     | 851                                                                                           | 1080 |
| 0.5                     |     | 945                                                                                           | 1200 |
| 0.55                    |     | 1040                                                                                          | 1320 |
| 0.6                     |     | 1134                                                                                          | 1440 |
| 0.65                    |     | 1229                                                                                          | 1560 |
| 0.7                     |     | 1323                                                                                          | 1680 |
| 0.75                    |     | 1418                                                                                          | 1800 |
| 0.8                     |     | 1512                                                                                          | 1920 |
| 0.85                    |     | 1607                                                                                          | 2040 |
| 0.9                     |     | 1701                                                                                          | 2160 |
| 0.95                    |     | 1796                                                                                          | 2280 |
| 1                       |     | 1890                                                                                          | 2400 |

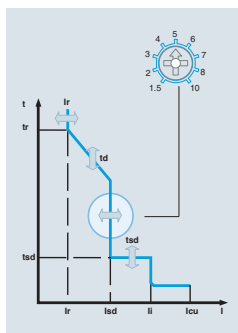
# MCCBs for power distribution

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## Electronic trip units (Standard) ETS43 for MCCBs TS800

### Setting details

#### Overload protection (long time)



| Circuit breakers        |   | TS800                                                                                         |      |
|-------------------------|---|-----------------------------------------------------------------------------------------------|------|
| Trip unit rating, In(A) |   | 630                                                                                           | 800  |
| Setting value           |   | Short time pick-up current setting, I <sub>sd</sub> = Setting value (1.5~10) × I <sub>r</sub> |      |
| 0.4                     | 4 | 1008                                                                                          | 1280 |
| 0.45                    |   | 1134                                                                                          | 1440 |
| 0.5                     |   | 1260                                                                                          | 1600 |
| 0.55                    |   | 1386                                                                                          | 1760 |
| 0.6                     |   | 1512                                                                                          | 1920 |
| 0.65                    |   | 1638                                                                                          | 2080 |
| 0.7                     |   | 1764                                                                                          | 2240 |
| 0.75                    |   | 1890                                                                                          | 2400 |
| 0.8                     |   | 2016                                                                                          | 2560 |
| 0.85                    |   | 2142                                                                                          | 2720 |
| 0.9                     |   | 2268                                                                                          | 2880 |
| 0.95                    |   | 2394                                                                                          | 3040 |
| 1                       | 5 | 2520                                                                                          | 3200 |
| 0.4                     |   | 1260                                                                                          | 1600 |
| 0.45                    |   | 1418                                                                                          | 1800 |
| 0.5                     |   | 1575                                                                                          | 2000 |
| 0.55                    |   | 1733                                                                                          | 2200 |
| 0.6                     |   | 1890                                                                                          | 2400 |
| 0.65                    |   | 2048                                                                                          | 2600 |
| 0.7                     |   | 2205                                                                                          | 2800 |
| 0.75                    |   | 2363                                                                                          | 3000 |
| 0.8                     |   | 2520                                                                                          | 3200 |
| 0.85                    |   | 2678                                                                                          | 3400 |
| 0.9                     |   | 2835                                                                                          | 3600 |
| 0.95                    | 6 | 2993                                                                                          | 3800 |
| 1                       |   | 3150                                                                                          | 4000 |
| 0.4                     |   | 1512                                                                                          | 1920 |
| 0.45                    |   | 1701                                                                                          | 2160 |
| 0.5                     |   | 1890                                                                                          | 2400 |
| 0.55                    |   | 2079                                                                                          | 2640 |
| 0.6                     |   | 2268                                                                                          | 2880 |
| 0.65                    |   | 2457                                                                                          | 3120 |
| 0.7                     |   | 2646                                                                                          | 3360 |
| 0.75                    |   | 2835                                                                                          | 3600 |
| 0.8                     |   | 3024                                                                                          | 3840 |
| 0.85                    |   | 3213                                                                                          | 4080 |
| 0.9                     |   | 3402                                                                                          | 4320 |
| 0.95                    |   | 3591                                                                                          | 4560 |
| 1                       |   | 3780                                                                                          | 4800 |



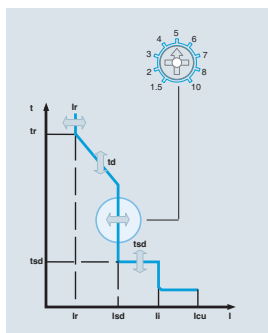
# MCCBs for power distribution

Susol

## Electronic trip units (Standard) ETS43 for MCCBs TS800

### Setting details

#### Short-circuit protection (short time)



| Circuit breakers        |    | TS800                                                                                         |      |
|-------------------------|----|-----------------------------------------------------------------------------------------------|------|
| Trip unit rating, In(A) |    | 630                                                                                           | 800  |
| Setting value           |    | Short time pick-up current setting, I <sub>sd</sub> = Setting value (1.5~10) × I <sub>r</sub> |      |
| 0.4                     | 7  | 1764                                                                                          | 2240 |
| 0.45                    |    | 1985                                                                                          | 2520 |
| 0.5                     |    | 2205                                                                                          | 2800 |
| 0.55                    |    | 2426                                                                                          | 3080 |
| 0.6                     |    | 2646                                                                                          | 3360 |
| 0.65                    |    | 2867                                                                                          | 3640 |
| 0.7                     |    | 3087                                                                                          | 3920 |
| 0.75                    |    | 3308                                                                                          | 4200 |
| 0.8                     |    | 3528                                                                                          | 4480 |
| 0.85                    |    | 3749                                                                                          | 4760 |
| 0.9                     | 8  | 3969                                                                                          | 5040 |
| 0.95                    |    | 4190                                                                                          | 5320 |
| 1                       |    | 4410                                                                                          | 5600 |
| 0.4                     |    | 2016                                                                                          | 2560 |
| 0.45                    |    | 2268                                                                                          | 2880 |
| 0.5                     |    | 2520                                                                                          | 3200 |
| 0.55                    |    | 2772                                                                                          | 3520 |
| 0.6                     |    | 3024                                                                                          | 3840 |
| 0.65                    |    | 3276                                                                                          | 4160 |
| 0.7                     |    | 3528                                                                                          | 4480 |
| 0.75                    | 10 | 3780                                                                                          | 4800 |
| 0.8                     |    | 4032                                                                                          | 5120 |
| 0.85                    |    | 4284                                                                                          | 5440 |
| 0.9                     |    | 4536                                                                                          | 5760 |
| 0.95                    |    | 4788                                                                                          | 6080 |
| 1                       |    | 5040                                                                                          | 6400 |
| 0.4                     |    | 2520                                                                                          | 3200 |
| 0.45                    |    | 2835                                                                                          | 3600 |
| 0.5                     |    | 3150                                                                                          | 4000 |
| 0.55                    |    | 3465                                                                                          | 4400 |
| 0.6                     |    | 3780                                                                                          | 4800 |
| 0.65                    |    | 4095                                                                                          | 5200 |
| 0.7                     |    | 4410                                                                                          | 5600 |
| 0.75                    |    | 4725                                                                                          | 6000 |
| 0.8                     |    | 5040                                                                                          | 6400 |
| 0.85                    |    | 5355                                                                                          | 6800 |
| 0.9                     |    | 5670                                                                                          | 7200 |
| 0.95                    |    | 5985                                                                                          | 7600 |
| 1                       |    | 6300                                                                                          | 8000 |

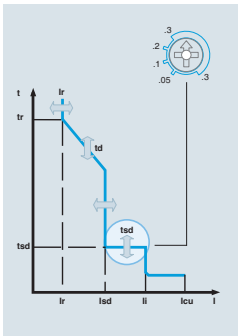
# MCCBs for power distribution

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## Electronic trip units (Standard) ETS43 for MCCBs TS800

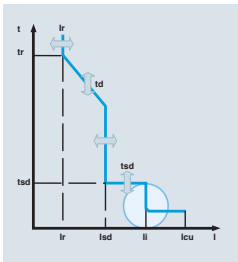
### Setting details

#### Short time tripping delay setting, t<sub>sd</sub> (ms)



|                     |                     |         |          |           |           |            |
|---------------------|---------------------|---------|----------|-----------|-----------|------------|
| Time delay<br>(tsd) | setting time (ms)   | 50      | 100      | 200       | 300       | 4 settings |
|                     | operation time (ms) | 30<t≤70 | 70<t≤140 | 140<t≤240 | 240<t≤350 |            |

#### Short circuit protection (Instantaneous), I<sub>i</sub> (A)



|                                           |                            |
|-------------------------------------------|----------------------------|
| Tripping threshold (A),<br>I <sub>i</sub> | Fixed at 11×I <sub>n</sub> |
|-------------------------------------------|----------------------------|

# MCCBs for power distribution

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## Electronic trip units (Multifunction) Overview

Types : ETM33, ETM43

Range of overload protection setting current (Ir): 64~630A (ETM33), 250~800A (ETM43)

Two frame size of circuit breakers: 630AF, 800AF

Trip units ETM33 and ETM43 can be mounted on circuit breakers of N, H and L type TS400 / TS630 / TS800

### Ratings

Rated current, In(A)

| Rated current<br>In (A) | Trip unit   |             |             |
|-------------------------|-------------|-------------|-------------|
|                         | ETM33       |             | ETM43       |
| 160                     | ●           | ●           | -           |
| 250                     | ●           | ●           | ●           |
| 400                     | ●           | ●           | ●           |
| 630                     | -           | ●           | ●           |
| 800                     | -           | -           | ●           |
| Circuit breakers        | TS400 N/H/L | TS630 N/H/L | TS800 N/H/L |

Current setting, Ir(A)

| Trip unit                                     |     | ETM33       | ETM33       | ETM43       |
|-----------------------------------------------|-----|-------------|-------------|-------------|
| Overload protection<br>setting current, Ir(A) | 64  | ●           | ●           | -           |
|                                               | 80  | ●           | ●           | -           |
|                                               | 100 | ●           | ●           | -           |
|                                               | 160 | ●           | ●           | -           |
|                                               | 250 | ●           | ●           | ●           |
|                                               | 400 | ●           | ●           | ●           |
|                                               | 630 | -           | ●           | ●           |
|                                               | 800 | -           | -           | ●           |
| Applicable circuit breakers                   |     | TS400 N/H/L | TS630 N/H/L | TS800 N/H/L |

# MCCBs for power distribution

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## Electronic trip units (Multifunction) Overview

### Setting values

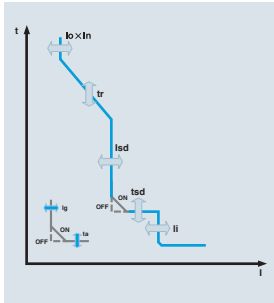
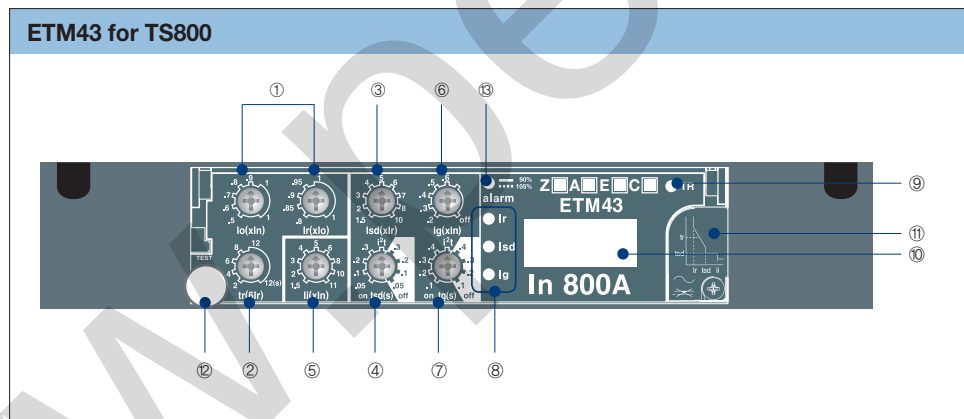
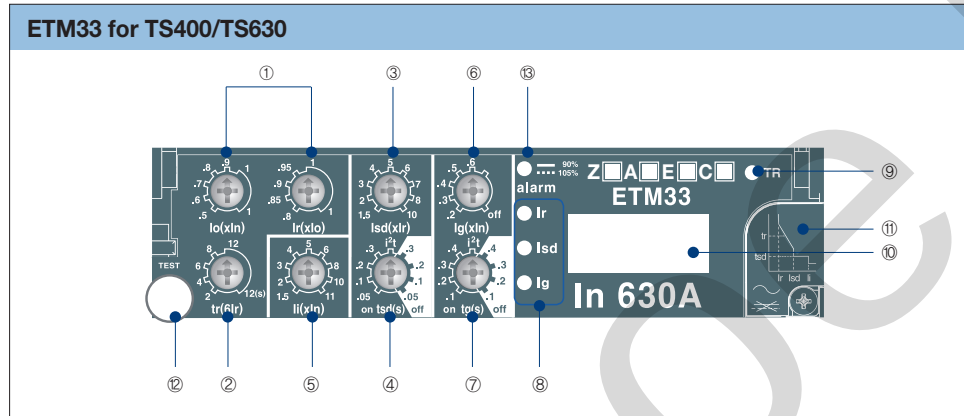
|                                          |                                                                                     |          |           |           |           |                         |
|------------------------------------------|-------------------------------------------------------------------------------------|----------|-----------|-----------|-----------|-------------------------|
| Overload protection (long time)          |                                                                                     |          |           |           |           |                         |
| Setting current (A), I <sub>r</sub>      | Adjustable 0.4 ~ 1.0×I <sub>n</sub> , 30 settings                                   |          |           |           |           |                         |
| Tripping time (s) at 6×I <sub>r</sub>    | Adjustable 2, 4, 6, 8, 12 5 settings, tolerance±20%                                 |          |           |           |           |                         |
| Short-circuit protection (short time)    |                                                                                     |          |           |           |           |                         |
| Tripping threshold (A), I <sub>sd</sub>  | Adjustable 1.5, 2, 3, 4, 5, 6, 7, 8, 10×I <sub>r</sub> , 9 settings, tolerance ±15% |          |           |           |           |                         |
| Time delay (tsd)                         | setting time (ms)                                                                   | 50       | 100       | 200       | 300       | 4 settings              |
|                                          | operation time (ms)                                                                 | 30<t≤70  | 70<t≤140  | 140<t≤240 | 240<t≤350 | I <sup>2</sup> t is off |
| Short-circuit protection (instantaneous) |                                                                                     |          |           |           |           |                         |
| Tripping threshold (A), I <sub>i</sub>   | Adjustable 1.5, 2, 4, 5, 6, 8, 10, 11×I <sub>n</sub> , 9 settings                   |          |           |           |           |                         |
| Indication of tripping reason            |                                                                                     |          |           |           |           |                         |
| LED indication                           | I <sub>r</sub> , I <sub>sd</sub> , I <sub>i</sub> , (I <sub>g</sub> )               |          |           |           |           |                         |
| Option for TS400ETM to TS800ETM          |                                                                                     |          |           |           |           |                         |
| Ammeter (A)                              | Maximum load phase current and R,S,T,N phase current                                |          |           |           |           |                         |
| Earth fault protection (E)               | Adjustable tripping threshold (A), 0.2~1×I <sub>n</sub> , 9 setting                 |          |           |           |           |                         |
|                                          | setting time (ms)                                                                   | 100      | 200       | 300       | 400       | 4 settings              |
|                                          | operation time (ms)                                                                 | 60<t≤140 | 140<t≤230 | 230<t≤350 | 350<t≤500 | I <sup>2</sup> t is off |
| Communication (C)                        | Setting, R, S, T, N phase current, tripping reason                                  |          |           |           |           |                         |
| ZSI (Z)                                  | ZSI input and output signal                                                         |          |           |           |           |                         |

# MCCBs for power distribution

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## Electronic trip units (Multifunction) Overview

- ① Adjustable rated current setting ( $I_r$ )
- ② Adjustable long time setting ( $t_r$ )
- ③ Adjustable short time current setting ( $I_{sd}$ )
- ④ Adjustable time delay setting ( $t_{sd}$ )
- ⑤ Adjustable instantaneous current setting ( $I_l$ )
- ⑥ Adjustable earth fault current setting ( $I_g$ )
- ⑦ Adjustable earth fault delay setting ( $t_g$ )
- ⑧ Indication LED
- ⑨ TR (trip reason) button
- ⑩ Display LCD (Ammeter)
- ⑪ Auxiliary power
- ⑫ Test connector
- ⑬ Alarm LED

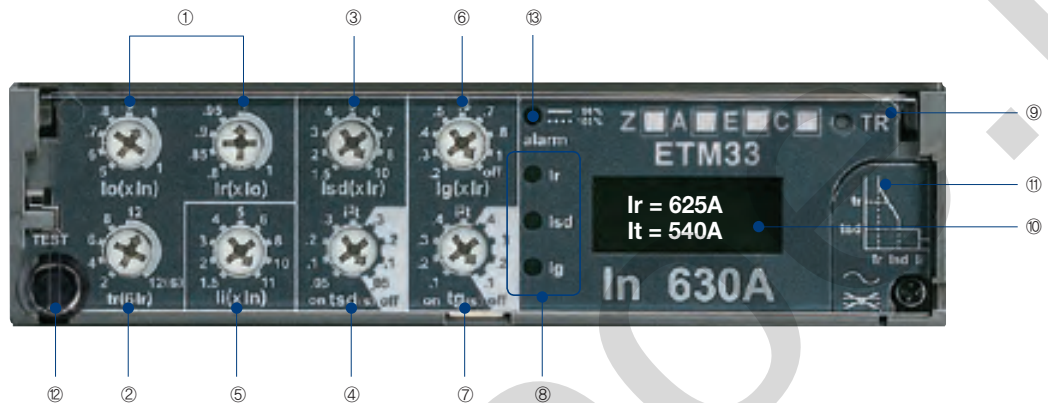


# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM33 for TS400, TS630

### Configuration



- |                                                 |                                                     |
|-------------------------------------------------|-----------------------------------------------------|
| ① Adjustable rated current setting (Ir)         | ⑧ Indication LED                                    |
| ② Adjustable long time setting (tr)             | ⑨ TR (trip reason) button                           |
| ③ Adjustable short time current setting (Isd)   | ⑩ Display LCD (Ammeter)                             |
| ④ Adjustable time delay setting (tsd)           | ⑪ Battery                                           |
| ⑤ Adjustable instantaneous current setting (li) | ⑫ Test connector                                    |
| ⑥ Adjustable earth fault current setting (Ig)   | ⑬ Alarm LED 90% Ir : ON,<br>105% Ir or more: ON-OFF |
| ⑦ Adjustable earth fault delay setting (tg)     |                                                     |

### Alarm indication

The LED lights and remains lit when the load exceeds 90 % of Ir.  
The LED blinks for an overload ( $\geq 105\%$  Ir), warning that the circuit breaker may trip.

### Fault indications

LEDs indicate the type of fault that caused tripping:

- Ir : overload
- Isd : short-circuit ( short time, instantaneous)
- Ig : earth fault

If push the TR button to indicate the tripping reason, the indication LED of tripping is ON.

The information is however stored in memory and the LED can be reilluminated by pressing the TR button.

The LED automatically goes off and the memory is cleared when the circuit breaker is reset.

In normal condition, if push TR button, all indication LED is ON for testing auxiliary power and LED.

○ — 90%  
○ - - - 105%  
alarm

○ Ir

○ Isd

○ Ig

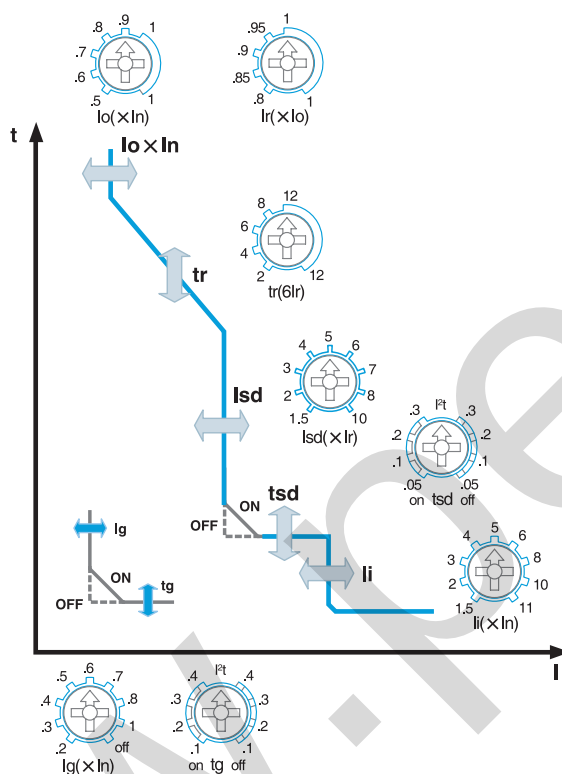
# MCCBs for power distribution

Susol

## Electronic trip units (Multifunction) ETM33 for TS400, TS630

### Tripping characteristics

Trip unit, ETM33



#### Long time protection against overloads

$I_o$  = Coarse adjustment (function of  $I_n$ )  
 $I_r$  = Fine adjustment  
 $t_r$  = Long time delay

#### Short circuit protection

$I_{sd}$  = Short circuit threshold,  
 $t_{sd}$  = Short circuit time delay  
 $I^2t$  curve in position ON or OFF

#### Instantaneous protection

$I_i$  = Instantaneous threshold

#### Earth fault protection

$I_g$  = Insulation fault threshold  
 $t_g$  = Earth fault time delay  
 $I^2t$  curve in position ON or OFF

### Catalogue numbering system

ETM 33 In600A

#### Trip unit frame

- 33 for TS400, TS630  
 - 43 for TS800

#### Rated current, $I_n$

- 160, 250, 400A for TS400  
 - 160, 250, 400, 630A for TS630

#### Trip unit function

- ETM : Multifunction electronic trip unit

# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM33 for TS400, TS630

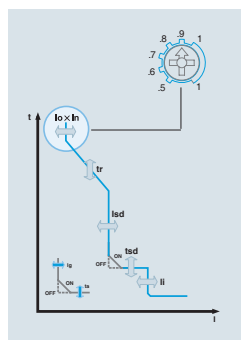
### Setting details

#### Overload protection setting current, Ir(A)

| Trip unit type |           | 16 | 32 | 40 | 64 | 80 | 100 | 160 | 250 | 320 | 400 | 630 | 800 |
|----------------|-----------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|
| ETM33          | for TS400 |    |    |    |    |    |     |     |     |     |     |     |     |
|                | for TS630 |    |    |    |    |    |     |     |     |     |     |     |     |

#### Overload protection (long time)

| Type of trip unit           |                           | TS400ETM                                                              |        |     |
|-----------------------------|---------------------------|-----------------------------------------------------------------------|--------|-----|
| Rated current, In(A)        |                           | 160                                                                   | 250    | 400 |
| Setting value<br>Coarse, Io | Setting value<br>Fine, Ir | Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir |        |     |
| 0.5                         | 0.8                       | 64                                                                    | 100    | 160 |
|                             | 0.85                      | 68                                                                    | 106.25 | 170 |
|                             | 0.9                       | 72                                                                    | 112.5  | 180 |
|                             | 0.95                      | 76                                                                    | 118.75 | 190 |
|                             | 1                         | 80                                                                    | 125    | 200 |
| 0.6                         | 0.8                       | 76.8                                                                  | 120    | 192 |
|                             | 0.85                      | 81.6                                                                  | 127.5  | 204 |
|                             | 0.9                       | 86.4                                                                  | 135    | 216 |
|                             | 0.95                      | 91.2                                                                  | 142.5  | 228 |
|                             | 1                         | 96                                                                    | 150    | 240 |
| 0.7                         | 0.8                       | 89.6                                                                  | 140    | 224 |
|                             | 0.85                      | 95.2                                                                  | 148.75 | 238 |
|                             | 0.9                       | 100.8                                                                 | 157.5  | 252 |
|                             | 0.95                      | 106.4                                                                 | 166.25 | 266 |
|                             | 1                         | 112                                                                   | 175    | 280 |
| 0.8                         | 0.8                       | 102.4                                                                 | 160    | 256 |
|                             | 0.85                      | 108.8                                                                 | 170    | 272 |
|                             | 0.9                       | 115.2                                                                 | 180    | 288 |
|                             | 0.95                      | 121.6                                                                 | 190    | 304 |
|                             | 1                         | 128                                                                   | 200    | 320 |
| 0.9                         | 0.8                       | 115.2                                                                 | 180    | 288 |
|                             | 0.85                      | 122.4                                                                 | 191.25 | 306 |
|                             | 0.9                       | 129.6                                                                 | 202.5  | 324 |
|                             | 0.95                      | 136.8                                                                 | 213.75 | 342 |
|                             | 1                         | 144                                                                   | 225    | 360 |
| 1                           | 0.8                       | 128                                                                   | 200    | 320 |
|                             | 0.85                      | 136                                                                   | 212.5  | 340 |
|                             | 0.9                       | 144                                                                   | 225    | 360 |
|                             | 0.95                      | 152                                                                   | 237.5  | 380 |
|                             | 1                         | 160                                                                   | 250    | 400 |





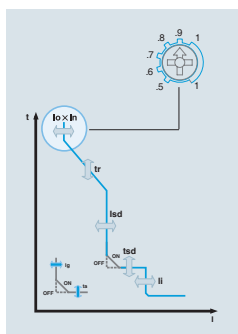
# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM33 for TS400, TS630

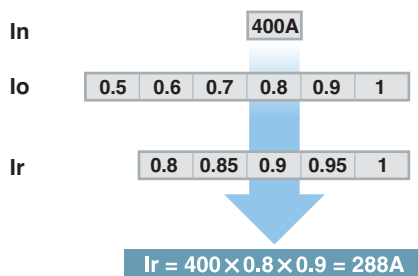
### Setting details

#### Overload protection (long time)



| Type of trip unit           |                           | TS630ETM                                    |        |     |        |
|-----------------------------|---------------------------|---------------------------------------------|--------|-----|--------|
| Rated current, In(A)        |                           | 160                                         | 250    | 400 | 630    |
| Setting value<br>Coarse, Io | Setting value<br>Fine, Ir | Overload protection setting current, Ir (A) |        |     |        |
| 0.5                         | 0.8                       | 64                                          | 100    | 160 | 252    |
|                             | 0.85                      | 68                                          | 106.25 | 170 | 267.75 |
|                             | 0.9                       | 72                                          | 112.5  | 180 | 283.5  |
|                             | 0.95                      | 76                                          | 118.75 | 190 | 299.25 |
|                             | 1                         | 80                                          | 125    | 200 | 315    |
| 0.6                         | 0.8                       | 76.8                                        | 120    | 192 | 302.4  |
|                             | 0.85                      | 81.6                                        | 127.5  | 204 | 321.3  |
|                             | 0.9                       | 86.4                                        | 135    | 216 | 340.2  |
|                             | 0.95                      | 91.2                                        | 142.5  | 228 | 359.1  |
|                             | 1                         | 96                                          | 150    | 240 | 378    |
| 0.7                         | 0.8                       | 89.6                                        | 140    | 224 | 352.8  |
|                             | 0.85                      | 95.2                                        | 148.75 | 238 | 374.85 |
|                             | 0.9                       | 100.8                                       | 157.5  | 252 | 396.9  |
|                             | 0.95                      | 106.4                                       | 166.25 | 266 | 418.95 |
|                             | 1                         | 112                                         | 175    | 280 | 441    |
| 0.8                         | 0.8                       | 102.4                                       | 160    | 256 | 403.2  |
|                             | 0.85                      | 108.8                                       | 170    | 272 | 428.4  |
|                             | 0.9                       | 115.2                                       | 180    | 288 | 453.6  |
|                             | 0.95                      | 121.6                                       | 190    | 304 | 478.8  |
|                             | 1                         | 128                                         | 200    | 320 | 504    |
| 0.9                         | 0.8                       | 115.2                                       | 180    | 288 | 453.6  |
|                             | 0.85                      | 122.4                                       | 191.25 | 306 | 481.95 |
|                             | 0.9                       | 129.6                                       | 202.5  | 324 | 510.3  |
|                             | 0.95                      | 136.8                                       | 213.75 | 342 | 538.65 |
|                             | 1                         | 144                                         | 225    | 360 | 567    |
| 1                           | 0.8                       | 128                                         | 200    | 320 | 504    |
|                             | 0.85                      | 136                                         | 212.5  | 340 | 535.5  |
|                             | 0.9                       | 144                                         | 225    | 360 | 567    |
|                             | 0.95                      | 152                                         | 237.5  | 380 | 598.5  |
|                             | 1                         | 160                                         | 250    | 400 | 630    |

#### Setting example :



# MCCBs for power distribution

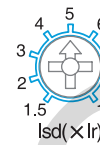
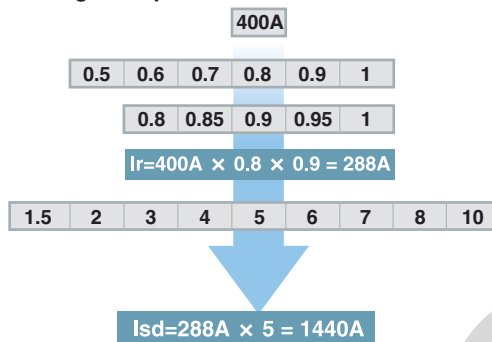
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## Electronic trip units (Multifunction) ETM33 for TS400, TS630

### Short circuit protection

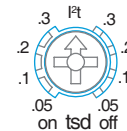
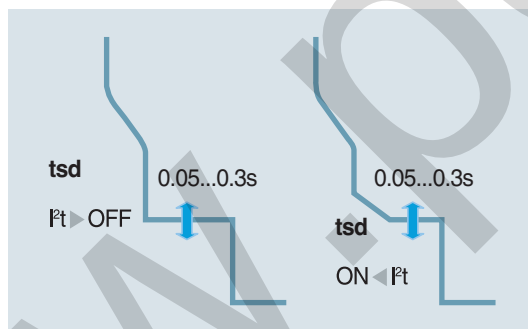
The short circuit threshold,  $I_{sd}$  is a multiple of the overload setting,  $I_r$ .

Setting example :



The breaker trips when the current exceeds 2880 A.

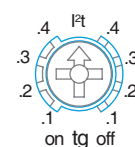
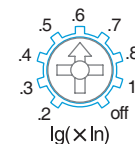
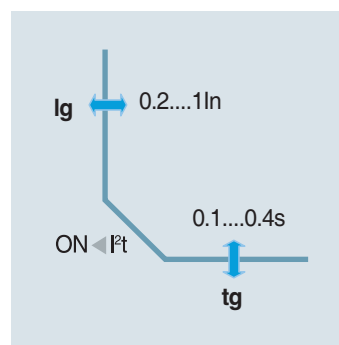
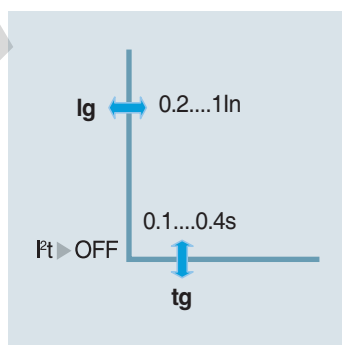
### Short circuit time delay



### Earth fault protection(E), optional

The ETM trip units measure the vectorial sum of the three phase current and, if present, that of the neutral conductor.

If the sum of these values exceeds the set current thresholds for a period of time greater than the time delay, the breaker is tripped.

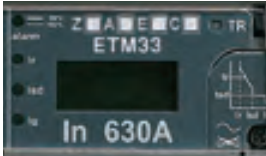


$I_g$  = insulation fault threshold  
t<sub>g</sub> = earth fault time delay

# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM33 for TS400, TS630



### Ammeter (A), optional

The Ammeter device has an accuracy of  $\pm 10\%$ .  
The highest phase current is displayed in upper line.  
In under line, R, S and T phase current is scrolled autom.

#### Ammeter display limits:

- minimum current  $\geq 0.3 \times I_n$  (one phase)
- maximum current  $\leq 10 \times I_n$

### Zone selective interlocking (ZSI), optional

Zone Selective Interlocking is mainly used in systems with high rated current and short circuit current values, with safety and service continuity requirements.  
This type of discrimination can be achieved with circuit breakers equipped with specially designed electronic trip units (ETM for TS circuit breakers).

#### Zone selective interlocking (ZSI) is a system designed

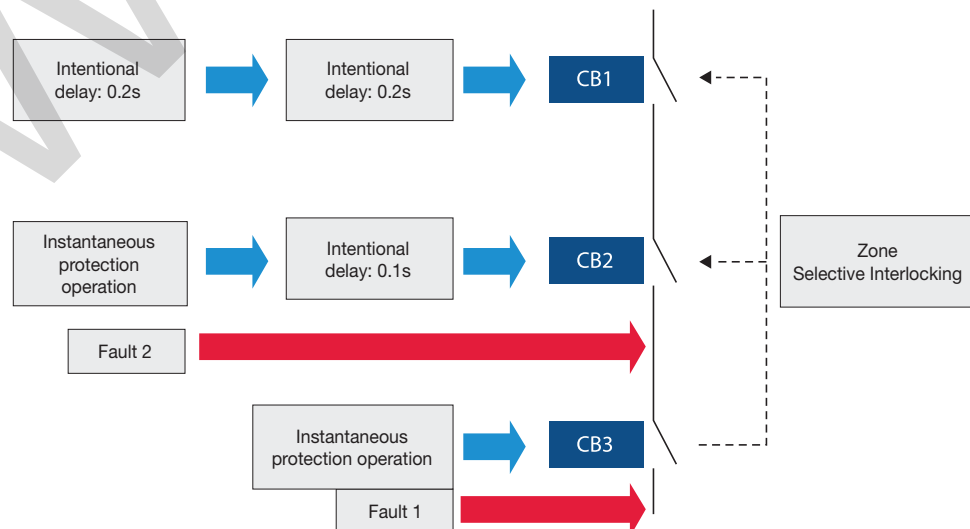
- to reduce the stress on electrical distribution components during short-circuit or earth fault conditions.
- to reduce the tripping times (Lower than hundred milliseconds).
- to reduce the damage caused by the fault and of interferences to the power supply system;

**A number of circuit breakers are interconnected one after another by a pilot-wire.**

**Power source: DC24V Power is required.**

#### Operation

- With ZSI, ETM trip unit detects the fault and then send the signal to upstream circuit breaker which applies the set time delay and ignore its present short-time and or/ earth fault delay and clear the fault with no intentional delay.
- Without ZSI, ETM trip unit detects the fault and then trips the circuit breaker with intentional delay



# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM33 for TS400, TS630

### Communication(C), optional

#### Communication interface: RS485 (Modbus-RTU)

The Modbus RS485 system is an open bus on which communicating Modbus devices are installed. All kinds of PLCs and computers can be connected to the bus.

#### Transmitted data :

- Protection setting values
- Highest current of the three phases
- Measurement: R, S, T and N phase current
- Fault reading: Type of fault (Overload, short-circuit, etc)

**The setting of communication address using TR button and LCD display (Ammeter).**

**Power source: DC24V Power is required.**

### Combination of options

- |                                                    |                                                         |
|----------------------------------------------------|---------------------------------------------------------|
| <input type="checkbox"/> A(Ammeter)                | <input type="checkbox"/> Z(Zone selective interlocking) |
| <input type="checkbox"/> E(Earth fault protection) | <input type="checkbox"/> Z+A                            |
| <input type="checkbox"/> A+E                       | <input type="checkbox"/> Z+E                            |
| <input type="checkbox"/> A+C(Communication)        | <input type="checkbox"/> Z+A+E                          |
| <input type="checkbox"/> A+E+C                     | <input type="checkbox"/> Z+A+C                          |
|                                                    | <input type="checkbox"/> Z+A+E+C                        |

# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM33 for TS400, TS630

### Menu structure of the electronic trip unit (ETM)

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| I | r | - | 1 | 2 | 6 | 0 | A |
| I | s | - |   |   | 6 | 5 | A |

→ Display current value (RMS) of phase which is carrying maximum in each phase

→ Display current value (RMS) of each phase at an interval of every 2 seconds.



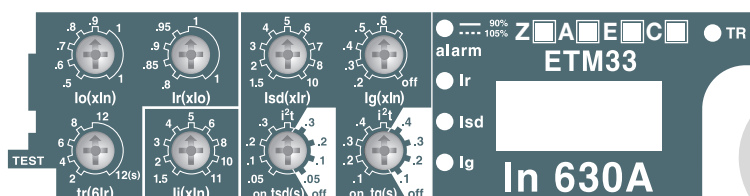
# MCCBs for power distribution

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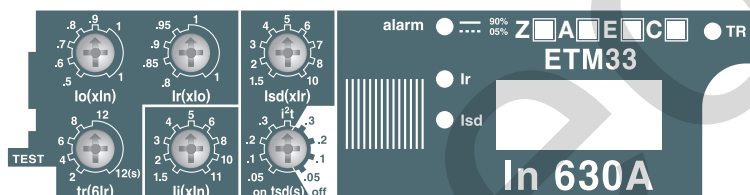
## Electronic trip units (Multifunction) ETM33 for TS400, TS630

Feature of trip unit according to option

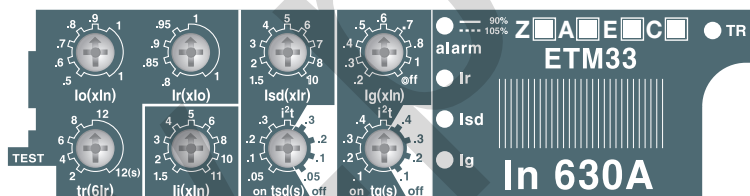
ETM33 A+E  
ETM33 A+E+C  
ETM33 Z+A+E  
ETM33 Z+A+E+C



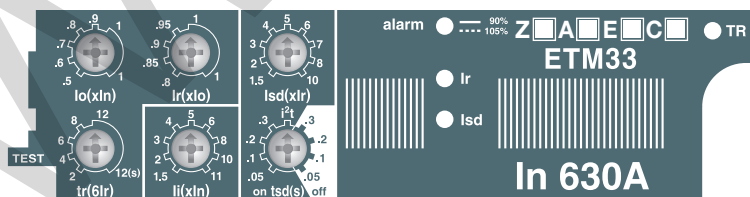
ETM33 A  
ETM33 A+C  
ETM33 Z+A  
ETM33 Z+A+C



ETM33 E  
ETM33 Z+E



ETM33  
ETM33 Z

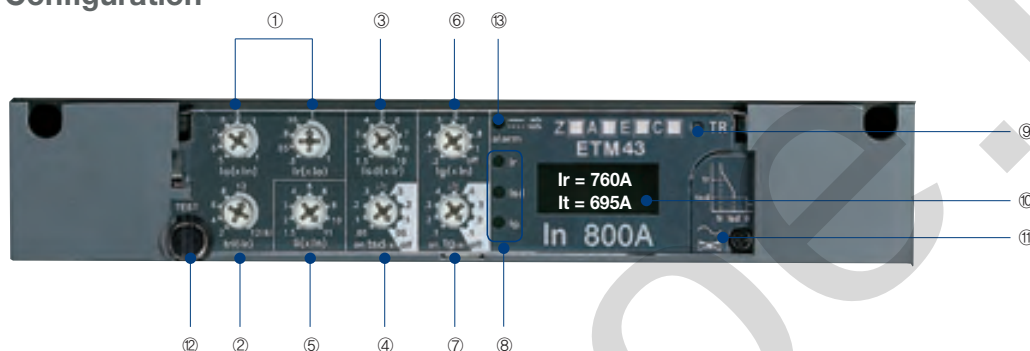


# MCCBs for power distribution

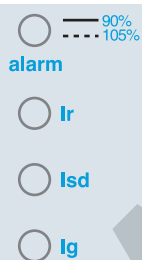
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## Electronic trip units (Multifunction) ETM43 for TS800

### Configuration



- ① Adjustable rated current setting ( $I_r$ )
- ② Adjustable long time setting ( $t_r$ )
- ③ Adjustable short time current setting ( $I_{sd}$ )
- ④ Adjustable time delay setting ( $t_{sd}$ )
- ⑤ Adjustable instantaneous current setting ( $I_i$ )
- ⑥ Adjustable earth fault current setting ( $I_g$ )
- ⑦ Adjustable earth fault delay setting ( $t_g$ )
- ⑧ Indication LED
- ⑨ TR (trip reason) button
- ⑩ Display LCD (Ammeter)
- ⑪ Battery
- ⑫ Test connector
- ⑬ Alarm LED 90%  $I_r$  : ON,  
105%  $I_r$  or more : ON-OFF



### Alarm indication

The LED lights and remains lit when the load exceeds 90 % of  $I_r$ .  
The LED blinks for an overload ( $\geq 105\% I_r$ ), warning that the circuit breaker may trip.

### Fault indications

LEDs indicate the type of fault that caused tripping:  
 $I_r$  : overload  
 $I_{sd}$  : short-circuit (short time, instantaneous)  
 $I_g$  : earth fault

The information is however stored in memory and the LED can be reilluminated by pressing the TR button.  
The LED automatically goes off and the memory is cleared when the circuit breaker is reset.  
In normal condition, if push TR button, all indication LED is ON for testing auxiliary power and LED.

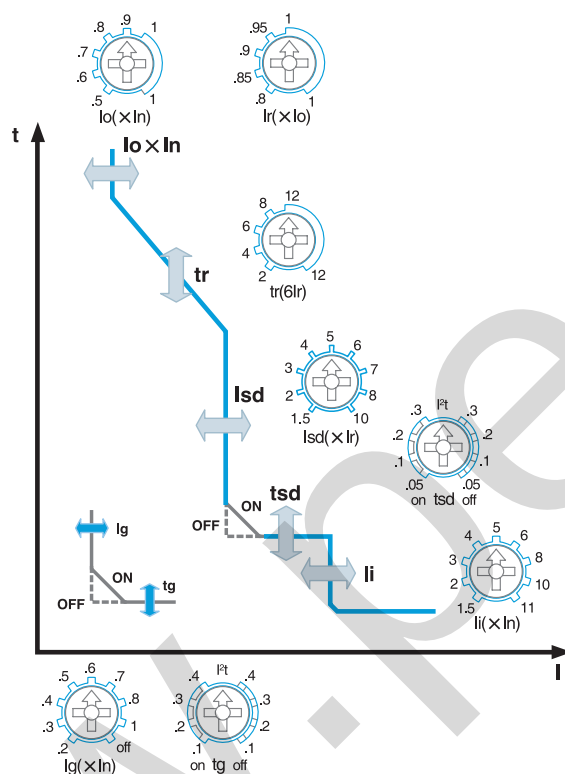
# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM43 for TS800

### Tripping characteristics

Trip unit for TS800 circuit breaker



#### Long time protection against overloads

$I_0$  = Coarse adjustment (function of  $I_n$ )  
 $I_r$  = Fine adjustment  
 $t_r$  = Long time delay

#### Short circuit protection

$I_{sd}$  = Short circuit threshold,  
 $t_{sd}$  = Short circuit time delay  
 $I^2t$  curve in position ON or OFF

#### Instantaneous protection

$I_i$  = Instantaneous threshold

#### Earth fault protection

$I_g$  = Insulation fault threshold  
 $t_g$  = Earth fault time delay  
 $I^2t$  curve in position ON or OFF

### Catalogue numbering system

**ETM 43 In800A**

#### Trip unit frame

- 33 for TS400, TS630  
 - 43 for TS800

#### Rated current, $I_n$

- 630, 800A for TS800

#### Trip unit function

- ETM: Multi function electronic trip unit



# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM43 for TS800

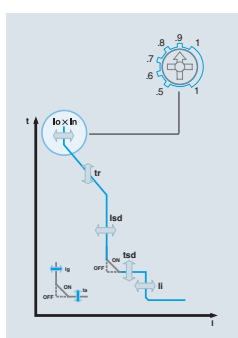
### Setting details

#### Trip unit rating, $I_n$

| Trip unit type  | 16 | 32 | 40 | 64 | 80 | 100 | 160 | 250 | 320 | 400 | 630 | 800 |
|-----------------|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|
| ETM43 for TS800 |    |    |    |    |    |     |     |     |     |     |     |     |

#### Overload protection (long time)

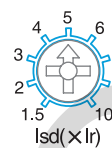
| Type of trip unit              |                              | TS800ETM                                       |     |
|--------------------------------|------------------------------|------------------------------------------------|-----|
| Rated current, $I_n$ (A)       |                              | 630                                            | 800 |
| Setting value<br>Coarse, $I_o$ | Setting value<br>Fine, $I_r$ | Overload protection setting current, $I_r$ (A) |     |
| 0.5                            | 0.8                          | 252                                            | 320 |
|                                | 0.85                         | 267.75                                         | 340 |
|                                | 0.9                          | 283.5                                          | 360 |
|                                | 0.95                         | 299.25                                         | 380 |
|                                | 1                            | 315                                            | 400 |
| 0.6                            | 0.8                          | 302.4                                          | 384 |
|                                | 0.85                         | 321.3                                          | 408 |
|                                | 0.9                          | 340.2                                          | 432 |
|                                | 0.95                         | 359.1                                          | 456 |
|                                | 1                            | 378                                            | 480 |
| 0.7                            | 0.8                          | 352.8                                          | 448 |
|                                | 0.85                         | 374.85                                         | 476 |
|                                | 0.9                          | 396.9                                          | 504 |
|                                | 0.95                         | 418.95                                         | 532 |
|                                | 1                            | 441                                            | 560 |
| 0.8                            | 0.8                          | 403.2                                          | 512 |
|                                | 0.85                         | 428.4                                          | 544 |
|                                | 0.9                          | 453.6                                          | 576 |
|                                | 0.95                         | 478.8                                          | 608 |
|                                | 1                            | 504                                            | 640 |
| 0.9                            | 0.8                          | 453.6                                          | 576 |
|                                | 0.85                         | 481.95                                         | 612 |
|                                | 0.9                          | 510.3                                          | 648 |
|                                | 0.95                         | 538.65                                         | 684 |
|                                | 1                            | 567                                            | 720 |
| 1                              | 0.8                          | 504                                            | 640 |
|                                | 0.85                         | 535.5                                          | 680 |
|                                | 0.9                          | 567                                            | 720 |
|                                | 0.95                         | 598.5                                          | 760 |
|                                | 1                            | 630                                            | 800 |



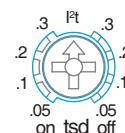
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## Short circuit protection

**Setting example :**

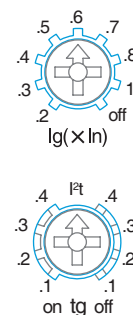
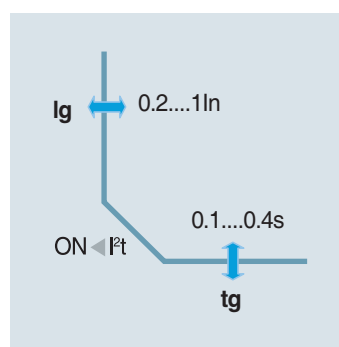
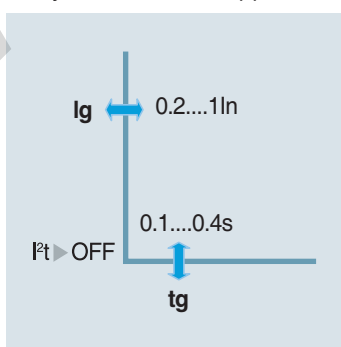


The breaker trips when the current exceeds 2880 A.



The ETM trip units measure the vectorial sum of the three phase current and, if present, that of the neutral conductor.

If the sum of these values exceeds the set current thresholds for a period of time greater than the time delay, the breaker is tripped.

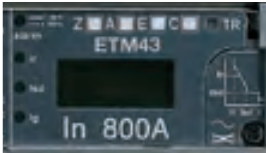


lg = insulation fault threshold  
tg = earth fault time delay

# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM43 for TS800



### Ammeter (A), optional

The Ammeter device has an accuracy of  $\pm 10\%$ .  
The highest phase current is displayed in upper line.  
In under line, R, S and T phase current is scrolled autom.

#### Ammeter display limits:

- minimum current  $\geq 0.3 \times I_n$  (one phase)
- maximum current  $\leq 10 \times I_n$

### Zone selective interlocking (ZSI), optional

Zone Selective Interlocking is mainly used in systems with high rated current and short circuit current values, with safety and service continuity requirements.  
This type of discrimination can be achieved with circuit breakers equipped with specially designed electronic trip units (ETM for TS circuit breakers).

#### Zone selective interlocking (ZSI) is a system designed

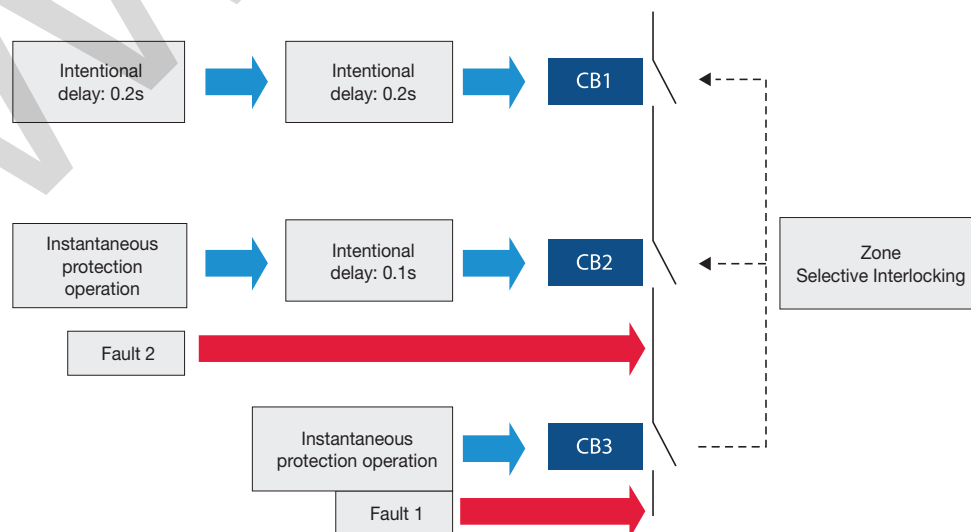
- to reduce the stress on electrical distribution components during short-circuit or earth fault conditions.
- to reduce the tripping times (Lower than hundred milliseconds).
- to reduce the damage caused by the fault and of interferences to the power supply system;

**A number of circuit breakers are interconnected one after another by a pilot-wire.**

**Power source: DC24V Power is required.**

#### Operation

- With ZSI, ETM trip unit detects the fault and then send the signal to upstream circuit breaker which applies the set time delay and ignore its present short-time and or/ earth fault delay and clear the fault with no intentional delay.
- Without ZSI, ETM trip unit detects the fault and then trips the circuit breaker with intentional delay



# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM43 for TS800

### Communication(C), optional

#### Communication interface: RS485 (Modbus-RTU)

The Modbus RS485 system is an open bus on which communicating Modbus devices are installed. All kinds of PLCs and computers can be connected to the bus.

#### Transmitted data :

- Protection setting values
- Highest current of the three phases
- Measurement: R, S, T and N phase current
- Fault reading: Type of fault (Overload, short-circuit, etc)

**The setting of communication address using TR button and LCD display (Ammeter).**

**Power source: DC24V Power is required.**

### Combination of options

- |                                                    |                                                         |
|----------------------------------------------------|---------------------------------------------------------|
| <input type="checkbox"/> A(Ammeter)                | <input type="checkbox"/> Z(Zone selective interlocking) |
| <input type="checkbox"/> E(Earth fault protection) | <input type="checkbox"/> Z+A                            |
| <input type="checkbox"/> A+E                       | <input type="checkbox"/> Z+E                            |
| <input type="checkbox"/> A+C(Communication)        | <input type="checkbox"/> Z+A+E                          |
| <input type="checkbox"/> A+E+C                     | <input type="checkbox"/> Z+A+C                          |
|                                                    | <input type="checkbox"/> Z+A+E+C                        |

# MCCBs for power distribution

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## Electronic trip units (Multifunction) ETM43 for TS800

### Menu structure of the electronic trip unit (ETM)

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| I | r | - | 1 | 2 | 6 | 0 | A |
| I | s | - |   |   | 6 | 5 | A |

→ Display current value (RMS) of phase which is carrying maximum in each phase

→ Display current value (RMS) of each phase at an interval of every 2 seconds.



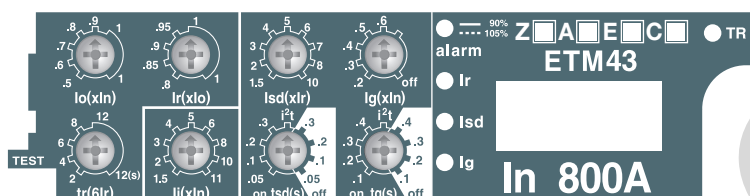
# MCCBs for power distribution

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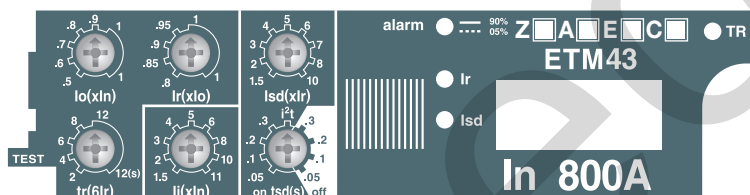
## Electronic trip units (Multifunction) ETM43 for TS800

Feature of trip unit according to option

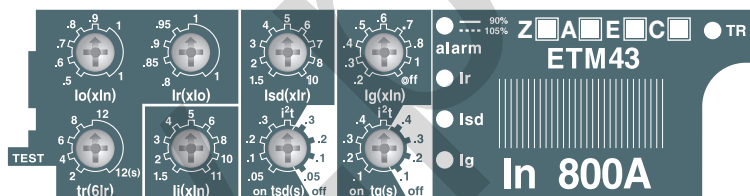
ETM43 A+E  
ETM43 A+E+C  
ETM43 Z+A+E  
ETM43 Z+A+E+C



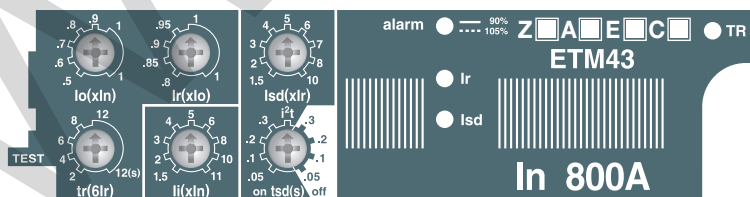
ETM43 A  
ETM43 A+C  
ETM43 Z+A  
ETM43 Z+A+C



ETM43 E  
ETM43 Z+E



ETM43  
ETM43 Z



# MCCBs for motor protection

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## Electrical characteristics



|                                                                 |                       |                     | TS100                                  |      |      | TS160                |      |      |
|-----------------------------------------------------------------|-----------------------|---------------------|----------------------------------------|------|------|----------------------|------|------|
| Frame size [AF]                                                 |                       |                     | 100                                    |      |      | 160                  |      |      |
| Rated current, I <sub>n</sub> *                                 |                       |                     | 1.6, 3.2, 6.3, 12, 20, 32, 50, 63, 100 |      |      | 32, 50, 63, 100, 160 |      |      |
| No. of poles                                                    |                       |                     | 3                                      |      |      | 3                    |      |      |
| Rated operational voltage, U <sub>e</sub>                       | AC                    | [V]                 | 690                                    |      |      | 690                  |      |      |
|                                                                 | DC                    | [V]                 | 500                                    |      |      | 500                  |      |      |
| Rated impulse withstand voltage, U <sub>imp</sub>               |                       |                     | 8                                      |      |      | 8                    |      |      |
| Rated insulation voltage, U <sub>i</sub>                        |                       |                     | 1000                                   |      |      | 1000                 |      |      |
| Rated ultimate short-circuit breaking capacity, I <sub>cu</sub> |                       |                     | N                                      | H    | L    | N                    | H    | L    |
| AC 50/60Hz                                                      | 220/240V              | [kA]                | 100                                    | 120  | 200  | 100                  | 120  | 200  |
|                                                                 | 380/415V              | [kA]                | 50                                     | 85   | 150  | 50                   | 85   | 150  |
|                                                                 | 440/460V              | [kA]                | 50                                     | 70   | 130  | 50                   | 70   | 130  |
|                                                                 | 480/500V              | [kA]                | 42                                     | 65   | 85   | 42                   | 65   | 85   |
|                                                                 | 525V                  | [kA]                | 22                                     | 35   | 50   | 22                   | 35   | 50   |
|                                                                 | 660/690V              | [kA]                | 10                                     | 10   | 10   | 10                   | 10   | 10   |
| Rated service breaking capacity, I <sub>cs</sub>                |                       |                     | 100%                                   | 100% | 100% | 100%                 | 100% | 100% |
| AC 50/60Hz                                                      | 220~525V              | [%I <sub>cu</sub> ] | 5                                      | 5    | 5    | 5                    | 5    | 5    |
|                                                                 | 660/690V              | [kA]                |                                        |      |      |                      |      |      |
| Rated short-circuit making capacity I <sub>cm</sub>             |                       |                     |                                        |      |      |                      |      |      |
| AC 50/60Hz                                                      | 220/240V              | [kA]                | 220                                    | 264  | 440  | 220                  | 264  | 440  |
|                                                                 | 380/415V              | [kA]                | 105                                    | 187  | 330  | 105                  | 187  | 330  |
|                                                                 | 440/460V              | [kA]                | 105                                    | 154  | 286  | 105                  | 154  | 286  |
|                                                                 | 480/500V              | [kA]                | 88                                     | 143  | 187  | 88                   | 143  | 187  |
|                                                                 | 525V                  | [kA]                | 46                                     | 74   | 105  | 46                   | 74   | 105  |
|                                                                 | 660/690V              | [kA]                | 17                                     | 17   | 17   | 17                   | 17   | 17   |
| Category of utilization                                         |                       |                     | A                                      |      |      | A                    |      |      |
| Isolation behavior                                              |                       |                     | ●                                      |      |      | ●                    |      |      |
| Trip unit (release)                                             |                       |                     |                                        |      |      |                      |      |      |
| ● magnetic only MTU                                             |                       |                     | ●                                      |      |      | ●                    |      |      |
| Connection                                                      | fixed                 | front-connection    | ●                                      |      |      | ●                    |      |      |
|                                                                 |                       | rear-connection     | ●                                      |      |      | ●                    |      |      |
|                                                                 | plug-in               | front-connection    | ●                                      |      |      | ●                    |      |      |
|                                                                 |                       | rear-connection     | ●                                      |      |      | ●                    |      |      |
| Life cycle ***                                                  | Mechanical            | [operations]        | 25000                                  |      |      | 25000                |      |      |
|                                                                 | Electrical @ 415 V AC | [operations]        | 10000                                  |      |      | 10000                |      |      |
| Basic dimensions, W×H×D (front connection)                      |                       | 3-pole [mm]         | 105×160×86                             |      |      | 105×160×86           |      |      |
| Weight (front connection)                                       |                       | 3-pole [kg]         | 2                                      |      |      | 2                    |      |      |
| Reference standard                                              |                       |                     | IEC60947-2                             |      |      | IEC60947-2           |      |      |

※ Breaking capacity at 660/690V is for your reference. (not certified)

\* Life cycle means not guarantee but limitation

(Quality guarantee: On/Off frequency on the basis of IEC60947-2 within the term of guarantee.)

# MCCBs for motor protection

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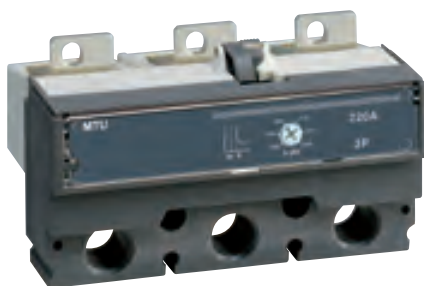
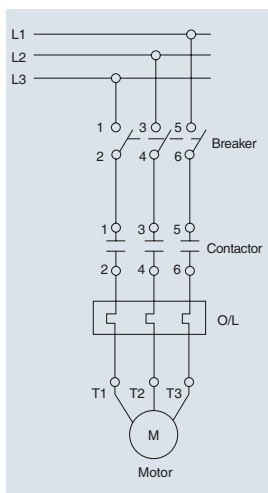
| TS250         |     |     | TS400       |     |     | TS630       |     |     | TS800       |     |     |
|---------------|-----|-----|-------------|-----|-----|-------------|-----|-----|-------------|-----|-----|
| 250           |     |     | 400         |     |     | 630         |     |     | 800         |     |     |
| 100, 160, 220 |     |     | 320         |     |     | 500         |     |     | 630         |     |     |
| 3             |     |     | 3           |     |     | 3           |     |     | 3           |     |     |
| 690           |     |     | 690         |     |     | 690         |     |     | 690         |     |     |
| 500           |     |     | 500         |     |     | 500         |     |     | 500         |     |     |
| 8             |     |     | 8           |     |     | 8           |     |     | 8           |     |     |
| 1000          |     |     | 1000        |     |     | 1000        |     |     | 1000        |     |     |
| N             | H   | L   | N           | H   | L   | N           | H   | L   | N           | H   | L   |
| 100           | 120 | 200 | 100         | 120 | 200 | 100         | 120 | 200 | 100         | 120 | 200 |
| 50            | 85  | 150 | 65          | 85  | 150 | 65          | 85  | 150 | 65          | 100 | 150 |
| 50            | 70  | 130 | 65          | 85  | 130 | 65          | 85  | 130 | 65          | 100 | 130 |
| 42            | 65  | 85  | 42          | 65  | 85  | 42          | 65  | 85  | 42          | 85  | 100 |
| 22            | 35  | 50  | 22          | 35  | 50  | 22          | 35  | 50  | 22          | 35  | 50  |
| 10            | 10  | 10  | 10          | 20  | 35  | 10          | 20  | 35  | 10          | 20  | 35  |
| 100%          |     |     | 100%        |     |     | 100%        |     |     | 100%        |     |     |
| 5             | 5   | 5   | 10          | 12  | 12  | 10          | 12  | 12  | 10          | 20  | 20  |
| 220           | 264 | 440 | 220         | 264 | 440 | 220         | 264 | 440 | 220         | 264 | 440 |
| 105           | 187 | 330 | 143         | 187 | 330 | 143         | 187 | 330 | 143         | 220 | 330 |
| 105           | 154 | 286 | 143         | 187 | 286 | 143         | 187 | 286 | 143         | 220 | 286 |
| 88            | 143 | 187 | 88          | 143 | 187 | 88          | 143 | 187 | 88          | 187 | 220 |
| 46            | 74  | 105 | 46          | 74  | 105 | 46          | 74  | 105 | 46          | 74  | 105 |
| 17            | 17  | 17  | 17          | 40  | 74  | 17          | 40  | 74  | 17          | 40  | 74  |
| A             |     |     | A           |     |     | A           |     |     | A           |     |     |
| ●             |     |     | ●           |     |     | ●           |     |     | ●           |     |     |
| ●             |     |     | ●           |     |     | ●           |     |     | ●           |     |     |
| ●             |     |     | ●           |     |     | ●           |     |     | ●           |     |     |
| ●             |     |     | ●           |     |     | ●           |     |     | ●           |     |     |
| ●             |     |     | ●           |     |     | ●           |     |     | ●           |     |     |
| ●             |     |     | ●           |     |     | ●           |     |     | ●           |     |     |
| 25000         |     |     | 20000       |     |     | 20000       |     |     | 10000       |     |     |
| 10000         |     |     | 10000       |     |     | 6000        |     |     | 3000        |     |     |
| 105×160×86    |     |     | 140×260×110 |     |     | 140×260×110 |     |     | 210×320×135 |     |     |
| 2             |     |     | 5.4         |     |     | 5.4         |     |     | 15.1        |     |     |
| IEC60947-2    |     |     | IEC60947-2  |     |     | IEC60947-2  |     |     | IEC60947-2  |     |     |



# MCCBs for motor protection

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## Magnetic only trip unit MTU for TS100, TS160, TS250, TS400, TS630, TS800



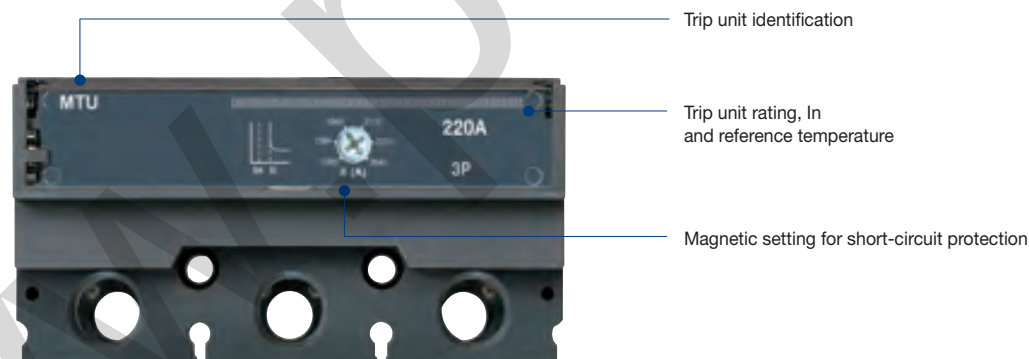
Magnetic only release

For the protection of motors from 1.6 to 250kW(400V), TS100 to TS800 circuit Breakers must be equipped with a special trip unit MTU adjustable thresholds.

This assembly ensures: Short-circuit protection (magnetic trip unit with adjustable thresholds); Suitability for isolation. For the TS100 to TS800 circuit breakers, trip unit MTU is interchangeable.

The circuit breakers presented here: Provide protection against short-circuits; Are suitable for isolation as defined by IEC60947-2 standard.

### Configuration



### Catalogue numbering system

**TS250** **MTU**

**Magnetic only release**

**MCCB frame type**

- TS100: TS100N, TS100H, TS100L
- TS160: TS160N, TS160H, TS160L
- TS250: TS250N, TS250H, TS250L
- TS400: TS400N, TS400H, TS400L
- TS630: TS630N, TS630H, TS630L
- TS800: TS800N, TS800H, TS800L

# MCCBs for motor protection

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## Magnetic only trip unit MTU for TS100, TS160, TS250, TS400, TS630, TS800

### Characteristics

#### Magnetic trip units(MTU)

| Rating(A) |       | In |
|-----------|-------|----|
| N / H / L | TS100 |    |
|           | TS160 |    |
|           | TS250 |    |
|           | TS400 |    |
|           | TS630 |    |
|           | TS800 |    |

| TS100 to TS800 |     |     |    |    |    |    |    |     |     |     |     |     |     |
|----------------|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| 1.6            | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| ●              | ●   | ●   | ●  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | ●  | ●  | ●  | ●   | ●   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | ●   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | ●   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | ●   |

| Pick - up | li |
|-----------|----|
|           |    |

#### Short - circuit protection(magnetic)

| setting            |
|--------------------|
| 6..12×In (6 Point) |

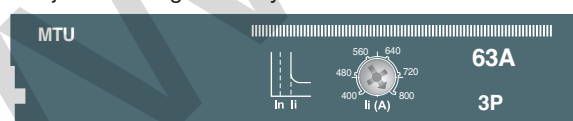
### Setting details

| MTU In | 6×In | ..  | ..  | ..  | ..  | 12×In |
|--------|------|-----|-----|-----|-----|-------|
| 1.6    | 10   | 12  | 14  | 16  | 18  | 20    |
| 3.2    | 20   | 24  | 28  | 32  | 36  | 40    |
| 6.3    | 40   | 48  | 56  | 64  | 72  | 80    |
| 12     | 70   | 84  | 98  | 112 | 126 | 140   |
| 20     | 120  | 144 | 168 | 192 | 216 | 240   |
| 32     | 190  | 228 | 266 | 304 | 342 | 380   |
| 50     | 300  | 360 | 420 | 480 | 540 | 600   |
| 63     | 400  | 480 | 560 | 640 | 720 | 800   |

| MTU In | 6×In | ..   | ..   | ..   | ..   | 12×In |
|--------|------|------|------|------|------|-------|
| 100    | 600  | 720  | 840  | 960  | 1080 | 1200  |
| 160    | 960  | 1152 | 1344 | 1536 | 1728 | 1920  |
| 220    | 1320 | 1584 | 1848 | 2112 | 2376 | 2640  |
| 320    | 1920 | 2304 | 2688 | 3072 | 3456 | 3840  |
| 500    | 3000 | 3600 | 4200 | 4800 | 5400 | 6000  |
| 630    | 3780 | 4536 | 5292 | 6048 | 6804 | 7560  |

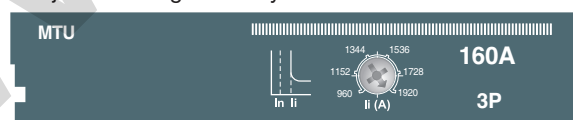
#### TS100 MTU

- Adjustable magnetic only unit



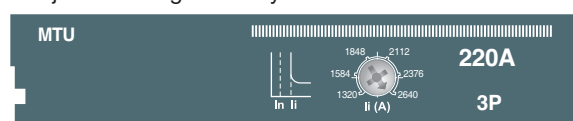
#### TS160 MTU

- Adjustable magnetic only unit



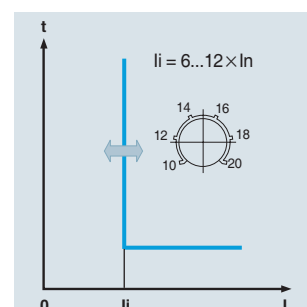
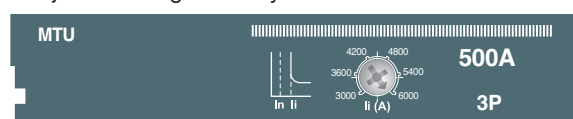
#### TS250 MTU

- Adjustable magnetic only unit



#### TS400 MTU, TS630 MTU, TS800 MTU

- Adjustable magnetic only unit



# Switch-Disconnectors

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The switch-disconnectors are different from the circuit-breakers in the absence of the conventional protection unit. They keep the overall dimensions, connection systems and accessories unchanged from the corresponding circuit-breakers.

|                                                      |                     |                  |              |      |
|------------------------------------------------------|---------------------|------------------|--------------|------|
| Frame size                                           |                     |                  |              | [AF] |
| Conventional thermal current, I <sub>th</sub>        |                     |                  |              | [A]  |
| No. of poles                                         |                     |                  |              |      |
| Rated operational voltage, U <sub>e</sub>            | AC                  | [V]              |              |      |
|                                                      | DC                  | [V]              |              |      |
| Rated operational current, I <sub>e</sub>            |                     |                  |              |      |
| Rated impulse withstand voltage, U <sub>imp</sub>    |                     |                  |              | [kV] |
| Rated insulation voltage, U <sub>i</sub>             | AC                  | [V]              |              |      |
|                                                      | DC                  | [V]              |              |      |
| Rated short-circuit making capacity, I <sub>cm</sub> | AC                  | [kA peak]        |              |      |
|                                                      | DC                  | [kA peak]        |              |      |
| Rated short-time withstand current, I <sub>cw</sub>  | AC                  | 1s               | [A rms]      |      |
|                                                      |                     | 3s               | [A rms]      |      |
|                                                      |                     | 20s              | [A rms]      |      |
|                                                      | DC                  | 1s               | [A rms]      |      |
| Isolation behavior                                   |                     |                  |              |      |
| Trip unit (Release)                                  |                     |                  |              |      |
|                                                      | ● Disconnector unit |                  |              | DSU  |
| Connection                                           | Fixed               | Front-connection |              |      |
|                                                      |                     | Rear-connection  |              |      |
|                                                      | Plug-in             | Front-connection |              |      |
|                                                      |                     | Rear-connection  |              |      |
| Life cycle <small>(Note 4)</small>                   | Mechanical          | [Operations]     |              |      |
|                                                      | Electrical          | AC               | [Operations] |      |
|                                                      |                     | DC               | [Operations] |      |
| Basic dimensions, W×H×D<br>(Front connection)        | 3-pole              | [mm]             |              |      |
|                                                      | 4-pole              | [mm]             |              |      |
| Weight<br>(Front connection)                         | 3-pole              | [kg]             |              |      |
|                                                      | 4-pole              | [kg]             |              |      |
| Reference standard                                   |                     |                  |              |      |

Note)

1. Rating of TD160NA is 100, 160A

2. Rating of TS250NA is 200, 250A

3. DC Rating of TS630NA is 500A

4. Life cycle means not guarantee but limitation

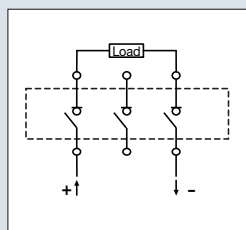
(Quality guarantee: On/Off frequency on the basis of IEC60947-2 within the term of guarantee.)

## TD series

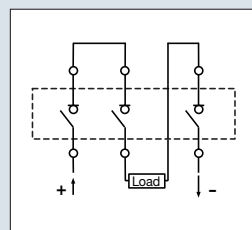


| TD100NA    | TD160NA        |                | TS100NA    |
|------------|----------------|----------------|------------|
| 100        | 160            | 160            | 100        |
| 100        | 100            | 160            | 100        |
| 2, 3, 4    | 2, 3, 4        | 2, 3, 4        | 2, 3, 4    |
| 690        | -              | 690            | 690        |
| 500        | 500, 750, 1100 | 500, 750, 1100 | 500        |
| 100        | -              | 160            | 100        |
| 8          | 8              | 8              | 8          |
| 750        | -              | 750            | 750        |
| -          | 1100           | 1100           | -          |
| 3.1        | -              | 3.1            | 2.8        |
| -          | 1.92           | 1.92           | -          |
| 2200       | -              | 2200           | 2000       |
| 2200       | -              | 2200           | 2000       |
| 960        | -              | 960            | 690        |
| -          | 1920           | 1920           | -          |
| ●          | ●              | ●              | ●          |
| ●          | ●              | ●              | ●          |
| ●          | ●              | ●              | ●          |
| ●          | ●              | ●              | ●          |
| ●          | ●              | ●              | ●          |
| 25000      | -              | 25000          | 25000      |
| 10000      | -              | 10000          | 10000      |
| -          | 1500           | 1000           | -          |
| 90×140×86  | 90×140×86      |                | 105×160×86 |
| 120×140×86 | 120×140×86     |                | 140×160×86 |
| 1.5        | 1.5            |                | 2          |
| 1.8        | 1.8            |                | 2.6        |
| IEC60947-3 | IEC60947-3     |                | IEC60947-3 |

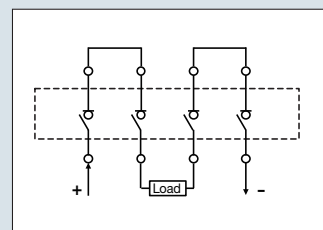
## DC Exemplary circuit diagrams



DC500V (2P)



DC750V (3P)

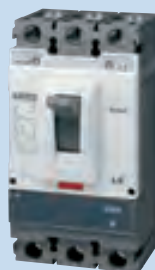


DC1100V (4P)

# Switch-Disconnectors

**Susol**

## TS series



| TS160NA    | TS250NA        |                | TS400NA        | TS630NA                      | TS800NA        |
|------------|----------------|----------------|----------------|------------------------------|----------------|
| 160        | 250            | 250            | 400            | 630                          | 800            |
| 160        | 200            | 250            | 400            | 630 (500) <sup>Note 3)</sup> | 800            |
| 2, 3, 4    | 2, 3, 4        | 2, 3, 4        | 2, 3, 4        | 2, 3, 4                      | 2, 3, 4        |
| 690        | -              | 690            | 690            | 690                          | 690            |
| 500        | 500, 750, 1100 | 500, 750, 1100 | 500, 750, 1100 | 500, 750, 1100               | 500, 750, 1100 |
| 160        | -              | 250            | 400            | 630                          | 800            |
| 8          | 8              | 8              | 8              | 8                            | 8              |
| 750        | -              | 750            | 750            | 750                          | 750            |
| -          | 1100           | 1100           | 1100           | 1100                         | 1100           |
| 3.6        | -              | 4.9            | 7.1            | 8.5                          | 12             |
| -          | 3.0            | 3.0            | 6.0            | 6.0                          | 9.6            |
| 2500       | -              | 3500           | 5000           | 6300                         | 8000           |
| 2500       | -              | 3500           | 5000           | 6300                         | 8000           |
| 960        | -              | 1350           | 1930           | 2320                         | 2560           |
| -          | 3000           | 3000           | 6000           | 6000                         | 9600           |
| ●          | ●              | ●              | ●              | ●                            | ●              |
| ●          | ●              | ●              | ●              | ●                            | ●              |
| ●          | ●              | ●              | ●              | ●                            | ●              |
| ●          | ●              | ●              | ●              | ●                            | ●              |
| ●          | ●              | ●              | ●              | ●                            | ●              |
| ●          | ●              | ●              | ●              | ●                            | ●              |
| 25000      | -              | 25000          | 20000          | 20000                        | 10000          |
| 10000      | 10000          | 10000          | 6000           | 6000                         | 3000           |
| -          | 1000           | 1000           | 1000           | 1000                         | 500            |
| 105×160×86 | 105×160×86     |                | 140×260×110    | 140×260×110                  | 210×320×135    |
| 140×160×86 | 140×160×86     |                | 186.5×260×110  | 186.5×260×110                | 280×320×135    |
| 2          | 2              |                | 5.4            | 5.4                          | 15.1           |
| 2.6        | 2.6            |                | 7.2            | 7.2                          | 19.6           |
| IEC60947-3 | IEC60947-3     |                | IEC60947-3     | IEC60947-3                   | IEC60947-3     |

Trip unit identification



# Susol MCCB for DC application

**Susol**

- Susol MCCB is suitable for DC application such as photovoltaic circuit breaker, UPS and datacenter
- Certificate of conformance test(CB) by DEKRA
- Higher nominal voltage range up to 1000 VDC
- Rated current: 16A~800A
- No. of poles: 2/3/4pole



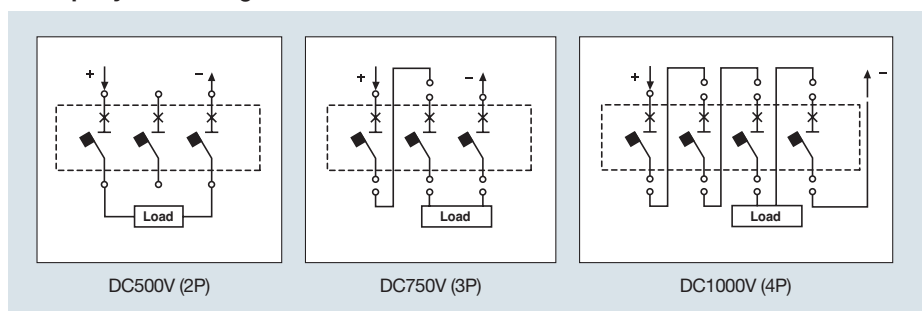
## Susol MCCB DC spec for CB certification

| Model                                                    |              | TD100                               | TD160         | TS100               | TS160         | TS250              | TS400    | TS630    | TS800                        |
|----------------------------------------------------------|--------------|-------------------------------------|---------------|---------------------|---------------|--------------------|----------|----------|------------------------------|
| Frame size (AF)                                          |              | 100                                 | 160           | 100                 | 160           | 250                | 400      | 630      | 800                          |
| Rated current, In (A)                                    |              | 16, 20, 25, 32, 40, 50, 63, 80, 100 | 100, 125, 160 | 40, 50, 63, 80, 100 | 100, 125, 160 | 125, 160, 200, 250 | 300, 400 | 500, 550 | 700 <sup>Note 5)</sup> , 800 |
| No. of poles (Pole)                                      |              | 2, 3, 4                             | 2, 3, 4       | 2, 3, 4             | 2, 3, 4       | 2, 3, 4            | 2, 3, 4  | 2, 3, 4  | 2, 3, 4                      |
| Rated operational voltage, Ue (VDC)                      | 2Pole        | 500                                 | 500           | 500                 | 500           | 500                | 500      | 500      | 500                          |
|                                                          | 3Pole        | 750                                 | 750           | 750                 | 750           | 750                | 750      | 750      | 750                          |
|                                                          | 4Pole        | 1000                                | 1000          | 1000                | 1000          | 1000               | 1000     | 1000     | 1000                         |
| Rated insulation voltage, Ui (V)                         | 2Pole        | 800                                 | 800           | 800                 | 800           | 800                | 800      | 800      | 800                          |
|                                                          | 3Pole        | 800                                 | 800           | 800                 | 800           | 800                | 800      | 800      | 800                          |
|                                                          | 4Pole        | 1000                                | 1000          | 1000                | 1000          | 1000               | 1000     | 1000     | 1000                         |
| Rated impulse withstand voltage Uimp (kV)                |              | 8                                   | 8             | 8                   | 8             | 8                  | 8        | 8        | 8                            |
| Rated ultimate short-circuit breaking capacity, Icu (kA) | Type         | H                                   | H             | H                   | H             | H                  | H        | H        | H                            |
| Rated service breaking capacity, Ics [%Icu]              | 500VDC (2P)  | 40                                  | 40            | 40                  | 40            | 40                 | 40       | 40       | 40                           |
|                                                          | 750VDC (3P)  | 40                                  | 40            | 40                  | 40            | 40                 | 40       | 40       | 40                           |
|                                                          | 1000VDC (4P) | 40                                  | 40            | 40                  | 40            | 40                 | 40       | 40       | 40                           |
| Rated service breaking capacity, Ics [%Icu]              |              | 100%                                | 100%          | 100%                | 100%          | 100%               | 100%     | 100%     | 100%                         |
| Trip Unit <sup>Note 4)</sup> Function                    | FTU          | ●                                   | ●             | ●                   | ●             | ●                  | ●        | ●        | ●                            |
|                                                          | FMU          | ●                                   | ●             | ●                   | ●             | ●                  | ●        | ●        | ●                            |
|                                                          | ATU          | -                                   | -             | -                   | ●             | ●                  | ●        | ●        | ●                            |

Note)

1. TD100/TD160 is the same construction frame.
2. TS100/TS160/TS250 is the same construction frame.
3. TS400/TS630 is the same construction frame.
4. Trip unit function have 3 types (FTU/FMU/ATU)
  - FTU : Fixed thermal, fixed magnetic unit
  - FMU : Adjustable thermal, fixed magnetic unit
  - ATU : Adjustable thermal, adjustable magnetic unit (Not applicable to TS160 100A ATU)
5. 700A is only available for TS800FTU
6. 4Pole type MCCB is 4P4T.

## Exemplary circuit diagrams



# Susol MCCB for DC application

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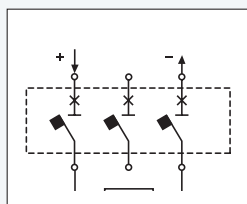
## Susol MCCB DC up to 800A

The following warning must be kept when using  
Susol MCCB for PV applications  
When violated, it can cause serious damages on  
relevant products or incur injuries.

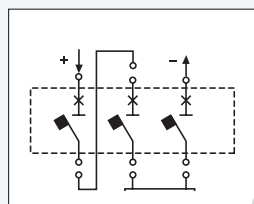


### Warning

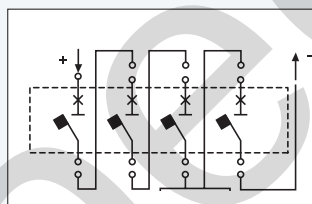
1. Please use wiring in accordance with the diagrams shown below.  
Otherwise, usable voltage may be different from the stated requirement.



DC500V (2P)



DC750V (3P)



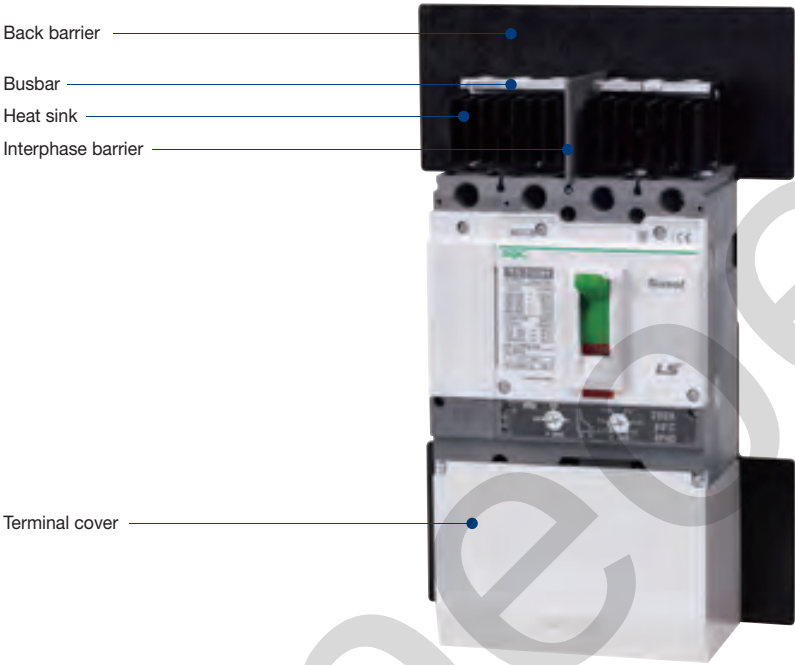
DC1000V (4P)

2. Wire length should be at least 60cm. Shorter wires can cause increase in temperature.
3. De-rated use is highly recommended when designing circuit by using busbar in a manner shown in Figure 1 on the right. If not, it can cause increase in temperature, erroneous trip, damage or fire due to the shortage of heat release (Please refer to the De-rating table.)
4. Please use thickness and length of busbar in compliance with the specification drawing.  
When used differently, additional de-rating may be required to release the heat.
5. Use of tin-plated busbar is recommended.
6. Inside of the low voltage panel should not exceed 40°C specified in KS/IEC Standard. Install sun screens or ventilation system if necessary. If violated, it can cause increase in temperature, erroneous trip, damage or fire. Also, additional de-rating is required when the temperature exceeds 40°C.
7. If you have additional questions regarding the application method, please consult with us before the use.

# Susol MCCB for DC application

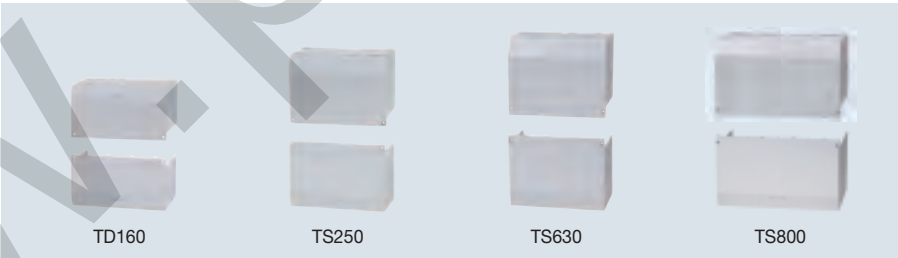
Susol

## Susol MCCB DC up to 800A

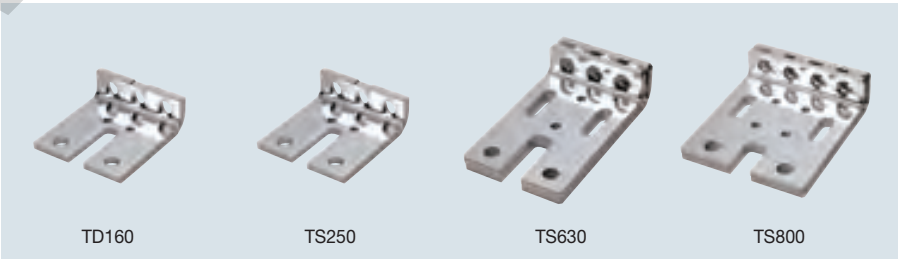


### Accessories

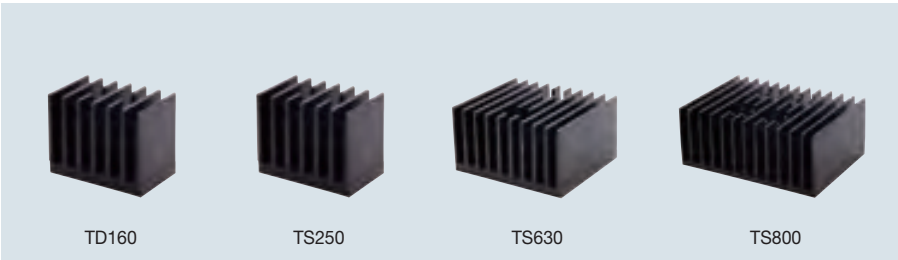
#### Terminal cover



#### Busbar



#### Heatsink



# Susol MCCB for DC application

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## Susol MCCB DC up to 800A

1. Basically, heat sink and busbar are optional accessories.
2. A set of busbar parts is mounted on terminals of the chassis.
3. If busbar parts are mounted only, it is available to refer to derating table and if heat sink parts are mounted additionally, please refer to rated current table

### Derating table for AF

The following tables are based on the following assumptions;

- Maximum permissible temperature of busbars are 100°C
- T : Temperature around the circuit breaker and its connections

Note) 1. The values presented in the tables are the result of trials and theoretical calculations on the basis of the assumption mentioned above.  
2. These tables are intended as an aid in designing connection, however, the actual values must be confirmed by tests on the installation.

| Type  | Rated current (A) | Derating current (A) | Terminal connection condition              |
|-------|-------------------|----------------------|--------------------------------------------|
| TD100 | 16                | 16                   | TD160<br>Busbar 5t                         |
|       | 20                | 20                   |                                            |
|       | 25                | 25                   |                                            |
|       | 32                | 32                   |                                            |
|       | 40                | 40                   |                                            |
|       | 50                | 50                   |                                            |
|       | 63                | 63                   |                                            |
|       | 80                | 80                   |                                            |
| TD160 | 100               | 100                  | TD160<br>Busbar 5t + Heat Sink             |
|       | 125               | 113                  |                                            |
|       | 160               | 144                  |                                            |
|       | 125               | 125                  |                                            |
| TS100 | 160               | 160                  | TS250<br>Busbar 5t                         |
|       | 40                | 40                   |                                            |
|       | 50                | 50                   |                                            |
|       | 63                | 63                   |                                            |
| TS160 | 80                | 80                   |                                            |
|       | 100               | 100                  |                                            |
|       | 100               | 100                  |                                            |
|       | 125               | 125                  |                                            |
| TS250 | 160               | 160                  | TS250<br>Busbar 5t + Heat Sink             |
|       | 125               | 125                  |                                            |
|       | 160               | 160                  |                                            |
|       | 200               | 180                  |                                            |
| TS400 | 250               | 200                  | TS630 Busbar<br>Lower & Upper 6t           |
|       | 200               | 200                  |                                            |
|       | 250               | 250                  |                                            |
|       | 300               | 300                  |                                            |
| TS630 | 400               | 360                  | TS630 Busbar Lower & Upper 6t+Heat Sink    |
|       | 400               | 400                  |                                            |
|       | 500               | 400                  |                                            |
|       | 550               | 440                  |                                            |
| TS800 | 500               | 500                  | TS800 Busbar<br>Lower & Upper 6t           |
|       | 550               | 550                  |                                            |
|       | 700 *             | 630                  |                                            |
|       | 800               | 640                  |                                            |
|       | 700 *             | 700                  | TS800 Busbar<br>Lower & Upper 6t+Heat Sink |
|       | 800               | 800                  |                                            |

Note) 1. \* Only available for TS800 FTU  
2. Dimension on the connection & busbar.



# Susol MCCB for DC application

Susol

## Susol MCCB DC up to 800A

### Temperature derating

| Type  | Rated current (A) | Derating current (A) | Compensated rated current in accordance with ambient temperature (A) |     |      |     |      |     |      |     |      |     |      |     |     |     |     |     | Terminal connection condition |                                         |
|-------|-------------------|----------------------|----------------------------------------------------------------------|-----|------|-----|------|-----|------|-----|------|-----|------|-----|-----|-----|-----|-----|-------------------------------|-----------------------------------------|
|       |                   |                      | 10℃                                                                  |     | 20℃  |     | 30℃  |     | 40℃  |     | 45℃  |     | 50℃  |     | 60℃ |     | 70℃ |     |                               |                                         |
| TD100 | 16                | 16                   | 100%                                                                 | 16  | 100% | 16  | 100% | 16  | 100% | 16  | 100% | 16  | 100% | 15  | 94% | 14  | 88% | 13  | 81%                           | TD160 Busbar 5t                         |
|       | 20                | 20                   | 100%                                                                 | 20  | 100% | 20  | 100% | 20  | 100% | 20  | 100% | 19  | 95%  | 19  | 95% | 18  | 90% | 18  | 90%                           |                                         |
|       | 25                | 25                   | 100%                                                                 | 25  | 100% | 25  | 100% | 25  | 100% | 25  | 100% | 24  | 96%  | 23  | 92% | 22  | 88% | 21  | 84%                           |                                         |
|       | 32                | 32                   | 100%                                                                 | 32  | 100% | 32  | 100% | 32  | 100% | 32  | 100% | 31  | 97%  | 30  | 94% | 29  | 91% | 27  | 84%                           |                                         |
|       | 40                | 40                   | 100%                                                                 | 40  | 100% | 40  | 100% | 40  | 100% | 40  | 100% | 39  | 98%  | 38  | 95% | 35  | 88% | 33  | 83%                           |                                         |
|       | 50                | 50                   | 100%                                                                 | 50  | 100% | 50  | 100% | 50  | 100% | 50  | 100% | 49  | 98%  | 47  | 94% | 44  | 88% | 41  | 82%                           |                                         |
|       | 63                | 63                   | 100%                                                                 | 63  | 100% | 63  | 100% | 63  | 100% | 63  | 100% | 62  | 98%  | 60  | 95% | 56  | 89% | 52  | 83%                           |                                         |
|       | 80                | 80                   | 100%                                                                 | 80  | 100% | 80  | 100% | 80  | 100% | 80  | 100% | 78  | 98%  | 76  | 95% | 71  | 89% | 66  | 83%                           |                                         |
|       | 100               | 100                  | 100%                                                                 | 100 | 100% | 100 | 100% | 100 | 100% | 100 | 100% | 98  | 98%  | 95  | 95% | 89  | 89% | 83  | 83%                           |                                         |
| TD160 | 100               | 100                  | 100%                                                                 | 100 | 100% | 100 | 100% | 100 | 100% | 100 | 100% | 98  | 98%  | 95  | 95% | 89  | 89% | 83  | 83%                           | TD160 Busbar 5t + Heat Sink             |
|       | 125               | 113                  | 90%                                                                  | 113 | 90%  | 113 | 90%  | 113 | 90%  | 113 | 90%  | 109 | 87%  | 105 | 84% | 99  | 79% | 92  | 74%                           |                                         |
|       | 160               | 144                  | 90%                                                                  | 144 | 90%  | 144 | 90%  | 144 | 90%  | 144 | 90%  | 139 | 87%  | 135 | 84% | 127 | 79% | 119 | 74%                           |                                         |
|       | 125               | 125                  | 100%                                                                 | 125 | 100% | 125 | 100% | 125 | 100% | 125 | 100% | 122 | 98%  | 119 | 95% | 111 | 89% | 104 | 83%                           |                                         |
| TS100 | 160               | 160                  | 100%                                                                 | 160 | 100% | 160 | 100% | 160 | 100% | 160 | 100% | 155 | 97%  | 150 | 94% | 141 | 88% | 131 | 82%                           | TS250 Busbar 5t                         |
|       | 40                | 40                   | 100%                                                                 | 40  | 100% | 40  | 100% | 40  | 100% | 40  | 100% | 39  | 98%  | 38  | 95% | 35  | 88% | 33  | 83%                           |                                         |
|       | 50                | 50                   | 100%                                                                 | 50  | 100% | 50  | 100% | 50  | 100% | 50  | 100% | 49  | 98%  | 47  | 94% | 44  | 88% | 41  | 82%                           |                                         |
|       | 63                | 63                   | 100%                                                                 | 63  | 100% | 63  | 100% | 63  | 100% | 63  | 100% | 62  | 98%  | 60  | 95% | 56  | 89% | 52  | 83%                           |                                         |
|       | 80                | 80                   | 100%                                                                 | 80  | 100% | 80  | 100% | 80  | 100% | 80  | 100% | 78  | 98%  | 76  | 95% | 71  | 89% | 66  | 83%                           |                                         |
| TS160 | 100               | 100                  | 100%                                                                 | 100 | 100% | 100 | 100% | 100 | 100% | 100 | 100% | 98  | 98%  | 95  | 95% | 89  | 89% | 83  | 83%                           |                                         |
|       | 100               | 100                  | 100%                                                                 | 100 | 100% | 100 | 100% | 100 | 100% | 100 | 100% | 98  | 98%  | 95  | 95% | 89  | 89% | 83  | 83%                           |                                         |
|       | 125               | 125                  | 100%                                                                 | 125 | 100% | 125 | 100% | 125 | 100% | 125 | 100% | 122 | 98%  | 119 | 95% | 111 | 89% | 104 | 83%                           |                                         |
| TS250 | 160               | 160                  | 100%                                                                 | 160 | 100% | 160 | 100% | 160 | 100% | 160 | 100% | 155 | 97%  | 150 | 94% | 141 | 88% | 131 | 82%                           |                                         |
|       | 125               | 125                  | 100%                                                                 | 125 | 100% | 125 | 100% | 125 | 100% | 125 | 100% | 122 | 98%  | 119 | 95% | 111 | 89% | 104 | 83%                           |                                         |
|       | 160               | 160                  | 100%                                                                 | 160 | 100% | 160 | 100% | 160 | 100% | 160 | 100% | 155 | 97%  | 150 | 94% | 141 | 88% | 131 | 82%                           |                                         |
|       | 200               | 180                  | 90%                                                                  | 180 | 90%  | 180 | 90%  | 180 | 90%  | 180 | 90%  | 174 | 87%  | 168 | 84% | 157 | 79% | 147 | 74%                           |                                         |
|       | 250               | 200                  | 80%                                                                  | 200 | 80%  | 200 | 80%  | 200 | 80%  | 200 | 80%  | 192 | 77%  | 185 | 74% | 172 | 69% | 160 | 64%                           |                                         |
| TS400 | 200               | 200                  | 100%                                                                 | 200 | 100% | 200 | 100% | 200 | 100% | 200 | 100% | 196 | 98%  | 189 | 95% | 178 | 89% | 166 | 83%                           | TS250 Busbar 5t + Heat Sink             |
|       | 250               | 250                  | 100%                                                                 | 250 | 100% | 250 | 100% | 250 | 100% | 250 | 100% | 243 | 97%  | 236 | 94% | 221 | 88% | 206 | 82%                           |                                         |
|       | 300               | 300                  | 100%                                                                 | 300 | 100% | 300 | 100% | 300 | 100% | 300 | 100% | 291 | 97%  | 281 | 94% | 264 | 88% | 246 | 82%                           | TS630 Busbar Lower & Upper 6t           |
|       | 400               | 360                  | 90%                                                                  | 360 | 90%  | 360 | 90%  | 360 | 90%  | 360 | 90%  | 348 | 87%  | 337 | 84% | 318 | 80% | 305 | 76%                           |                                         |
| TS630 | 400               | 400                  | 100%                                                                 | 400 | 100% | 400 | 100% | 400 | 100% | 400 | 100% | 390 | 98%  | 378 | 95% | 357 | 89% | 333 | 83%                           | TS630 Busbar Lower & Upper 6t+Heat Sink |
|       | 500               | 400                  | 80%                                                                  | 400 | 80%  | 400 | 80%  | 400 | 80%  | 400 | 80%  | 387 | 77%  | 372 | 74% | 347 | 69% | 322 | 64%                           |                                         |
|       | 550               | 440                  | 80%                                                                  | 440 | 80%  | 440 | 80%  | 440 | 80%  | 440 | 80%  | 426 | 77%  | 409 | 74% | 382 | 69% | 354 | 64%                           | TS630 Busbar Lower & Upper 6t+Heat Sink |
|       | 500               | 500                  | 100%                                                                 | 500 | 100% | 500 | 100% | 500 | 100% | 500 | 100% | 488 | 98%  | 476 | 95% | 446 | 89% | 416 | 83%                           |                                         |
| TS800 | 550               | 550                  | 100%                                                                 | 550 | 100% | 550 | 100% | 550 | 100% | 550 | 100% | 532 | 97%  | 515 | 94% | 486 | 88% | 453 | 82%                           | TS800 Busbar Lower & Upper 6t           |
|       | 700 *             | 630                  | 90%                                                                  | 630 | 90%  | 630 | 90%  | 630 | 90%  | 630 | 90%  | 619 | 88%  | 605 | 86% | 584 | 83% | 563 | 80%                           |                                         |
|       | 800               | 640                  | 80%                                                                  | 640 | 80%  | 640 | 80%  | 640 | 80%  | 640 | 80%  | 619 | 77%  | 605 | 76% | 584 | 73% | 563 | 70%                           | TS800 Busbar Lower & Upper 6t+Heat Sink |
|       | 700 *             | 700                  | 100%                                                                 | 700 | 100% | 700 | 100% | 700 | 100% | 700 | 100% | 684 | 98%  | 665 | 95% | 626 | 89% | 584 | 83%                           |                                         |
|       | 800               | 800                  | 100%                                                                 | 800 | 100% | 800 | 100% | 800 | 100% | 800 | 100% | 772 | 97%  | 748 | 94% | 700 | 88% | 652 | 82%                           |                                         |

Note) \* Only available for TS800 FTU

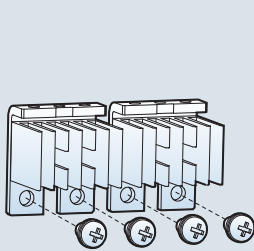
# Susol MCCB for DC application

Susol

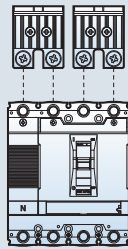
## The Installation of the BUSBAR Kit

1. Install the BUSBAR Kit to the circuit breaker as shown in the fig.
2. Conductors should be tightened with the torque specified to prevent fire accident.
3. Fit the barriers to the circuit breaker after installing the BUSBAR Kit.

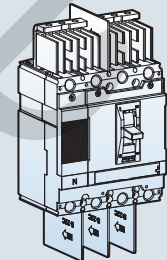
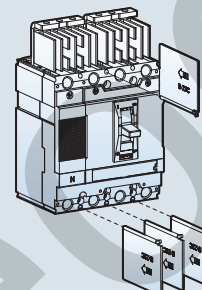
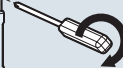
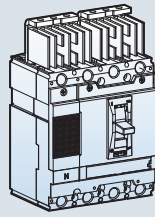
### TD100, TD160



Above bolts are included in spare part of MCCB, so do not offer.

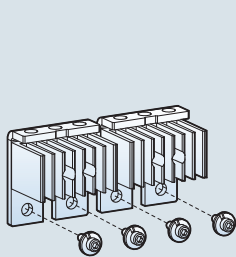


Tightening torque  
M8×20 Max.8N.m/Max.80kgf.cm

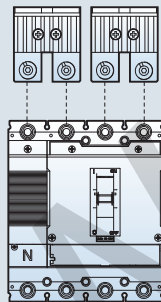


\* N-R Line & S-T Line common condition

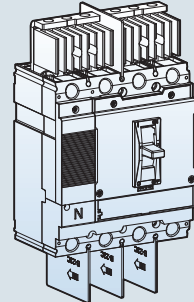
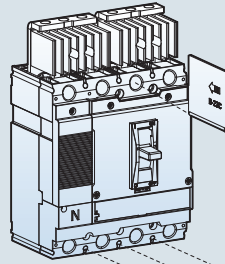
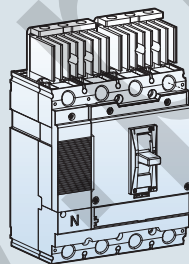
### TS100, TS160, TS250



Above bolts are included in spare part of MCCB, so do not offer.

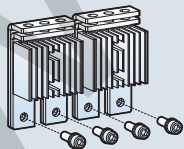


Tightening torque  
M8×20 Max.15N.m/Max.150kgf.cm

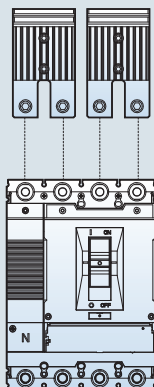


\* N-R Line & S-T Line common condition

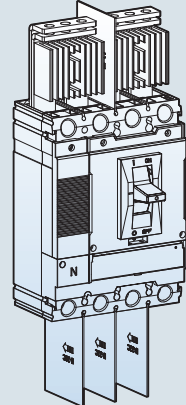
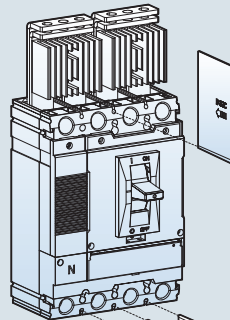
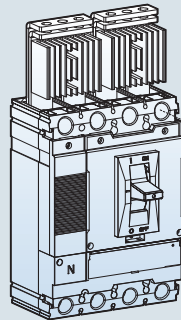
### TS400, TS630



Above bolts are included in spare part of MCCB, so do not offer.



Tightening torque  
M10×30 Max.50N.m/Max.500kgf.cm



\* N-R Line & S-T Line common condition

# Susol MCCB for DC application

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## TS800

Above bolts are included in spare part of MCCB, so do not offer.

Tightening torque  
M12×35 Max.62N.m/Max.630kgf.cm

\* N-R Line & S-T Line common condition

## The Installation of terminal cover & Barrier for DC insulation

Above bolts are included in spare part of MCCB, so do not offer.

Tightening torque  
M12×35 Max.62N.m/Max.630kgf.cm

\* N-R Line & S-T Line common condition

| AF    | SCREW         |
|-------|---------------|
| TD160 | M4 * 75, 4EA  |
| TS250 | M5 * 85, 4EA  |
| TS630 | M6 * 100, 4EA |

| AF    | SCREW          |
|-------|----------------|
| TD160 | CH.M3×L10, 4EA |
| TS250 | PH.M3×L10, 4EA |
| TS630 |                |
| TS800 |                |

# 4 pole MCCB with electronic trip unit

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## Products application & Function

- N-R-S-T and R-S-T-N Type for consideration of application field
- Full line up with 100~800AF
- 4P4D for N phase protection type
- Max. breaking capacity 150kA@415V
- KEMA type test and CE certification



| Designation                          |                                 |      | TS100, TS160, TS250                                       |          |          | TS400, TS630                                                                                                    |          |          | TS800                                                                                                           |          |          |
|--------------------------------------|---------------------------------|------|-----------------------------------------------------------|----------|----------|-----------------------------------------------------------------------------------------------------------------|----------|----------|-----------------------------------------------------------------------------------------------------------------|----------|----------|
| Type                                 |                                 |      | N / H / L                                                 |          |          | N / H / L                                                                                                       |          |          | N / H / L                                                                                                       |          |          |
| Rated current                        |                                 |      | 40, 80, 160, 250A                                         |          |          | 160, 250, 400, 630A                                                                                             |          |          | 630, 800A                                                                                                       |          |          |
| Poles                                |                                 |      | 4 (N-R-S-T, R-S-T-N)                                      |          |          | 4 (N-R-S-T, R-S-T-N)                                                                                            |          |          | 4 (N-R-S-T, R-S-T-N)                                                                                            |          |          |
| Insulation voltage, Ui               |                                 |      | AC1000V                                                   |          |          | AC1000V                                                                                                         |          |          | AC1000V                                                                                                         |          |          |
| Impulse withstand voltage, Uimp      |                                 |      | 8kV                                                       |          |          | 8kV                                                                                                             |          |          | 8kV                                                                                                             |          |          |
| Short-circuit breaking capacity, Icu |                                 |      | N                                                         | H        | L        | N                                                                                                               | H        | L        | N                                                                                                               | H        | L        |
| AC 50/60Hz                           | 220/240V                        | [kA] | 100                                                       | 120      | 200      | 100                                                                                                             | 120      | 200      | 100                                                                                                             | 120      | 200      |
|                                      | 380/415V                        | [kA] | 50                                                        | 85       | 150      | 65                                                                                                              | 85       | 150      | 65                                                                                                              | 85       | 150      |
|                                      | 440/460V                        | [kA] | 50                                                        | 70       | 130      | 50                                                                                                              | 70       | 130      | 50                                                                                                              | 70       | 130      |
|                                      | 480/500V                        | [kA] | 42                                                        | 65       | 85       | 42                                                                                                              | 65       | 85       | 42                                                                                                              | 65       | 85       |
|                                      | 525V                            | [kA] | 22                                                        | 35       | 50       | 22                                                                                                              | 35       | 50       | 22                                                                                                              | 35       | 50       |
| Ics                                  | 660/690V                        | [kA] | 10                                                        | 10       | 10       | 10                                                                                                              | 20       | 35       | 10                                                                                                              | 20       | 35       |
|                                      | 220~525V                        |      | 100% Icu                                                  | 100% Icu | 100% Icu | 100% Icu                                                                                                        | 100% Icu | 100% Icu | 100% Icu                                                                                                        | 100% Icu | 100% Icu |
| Utilization category                 |                                 |      | A                                                         |          |          | A                                                                                                               |          |          | A                                                                                                               |          |          |
| Reverse connection (Line/Load)       |                                 |      | Available                                                 |          |          | Available                                                                                                       |          |          | Available                                                                                                       |          |          |
| Tripping device                      |                                 |      | Electronics                                               |          |          | Electronics                                                                                                     |          |          | Electronics                                                                                                     |          |          |
|                                      |                                 |      | ETS                                                       |          |          | ETS & ETM                                                                                                       |          |          | ETS & ETM                                                                                                       |          |          |
| Thermal                              | I <sub>o</sub> , I <sub>r</sub> |      | ETS: I <sub>r</sub> = 0.4~1.0×I <sub>n</sub> (13settings) |          |          | ETS: I <sub>r</sub> = 0.4~1.0×I <sub>n</sub> (13settings)                                                       |          |          | ETS: I <sub>r</sub> = 0.4~1.0×I <sub>n</sub> (13settings)                                                       |          |          |
|                                      |                                 |      |                                                           |          |          | ETM: I <sub>o</sub> = 0.5~1.0×I <sub>n</sub> (6settings)<br>I <sub>r</sub> = 0.8~1.0×I <sub>o</sub> (5settings) |          |          | ETM: I <sub>o</sub> = 0.5~1.0×I <sub>n</sub> (6settings)<br>I <sub>r</sub> = 0.8~1.0×I <sub>o</sub> (5settings) |          |          |
|                                      | tr (6I <sub>r</sub> )           |      | ETS: 6sec at 6I <sub>r</sub> (fixed)                      |          |          | ETS: 6sec at 6I <sub>r</sub> (fixed)<br>ETM: 12sec at 6I <sub>r</sub> (5settings)                               |          |          | ETS: 6sec at 6I <sub>r</sub> (fixed)<br>ETM: 12sec at 6I <sub>r</sub> (5settings)                               |          |          |
| Instant.                             | I <sub>i</sub>                  |      | ETS: 1.5~10×I <sub>r</sub> (9settings)                    |          |          | ETS, ETM: 1.5~10×I <sub>r</sub> (9settings)                                                                     |          |          | ETS, ETM: 1.5~10×I <sub>r</sub> (9settings)                                                                     |          |          |
|                                      | I <sub>t</sub>                  |      | 12×I <sub>n</sub>                                         |          |          | 12×I <sub>n</sub>                                                                                               |          |          | 12×I <sub>n</sub>                                                                                               |          |          |
| Neutral protection                   | 4P3d                            |      | No protection                                             |          |          | No protection                                                                                                   |          |          | No protection                                                                                                   |          |          |
|                                      | 4P3d+N/2                        |      | 0.5×I <sub>r</sub>                                        |          |          | 0.5×I <sub>r</sub>                                                                                              |          |          | 0.5×I <sub>r</sub>                                                                                              |          |          |
|                                      | 4P4d                            |      | 1.0×I <sub>r</sub>                                        |          |          | 1.0×I <sub>r</sub>                                                                                              |          |          | 1.0×I <sub>r</sub>                                                                                              |          |          |
| Cable                                | Min.                            |      | 10mm <sup>2</sup> or 8 AWG (40A)                          |          |          | 70mm <sup>2</sup> (160A)                                                                                        |          |          | 185mm <sup>2</sup> ×2 / 350 kcmil×2 (630A)                                                                      |          |          |
|                                      | Max.                            |      | 120mm <sup>2</sup> or 250kcmil (250A)                     |          |          | 185mm <sup>2</sup> ×2 / 350 kcmil×2 (630A)                                                                      |          |          | 240mm <sup>2</sup> ×2 (800A)                                                                                    |          |          |
| Tightening Torque                    |                                 |      | Hex.Socket bolt (M8): 6N·m                                |          |          | Hex.Socket bolt (M10): 10N·m                                                                                    |          |          | Hex. Socket bolt (M12): 14N·m                                                                                   |          |          |
| MCCB (W×H×D)                         |                                 |      | 140×160×86                                                |          |          | 186.5×260×110                                                                                                   |          |          | 280×320×135                                                                                                     |          |          |

※ Breaking capacity at 660/690V is for your reference. (not certified)

# MCCBs for power distribution 1600A

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## Electrical characteristics



|                                                  |                                                               |           |                         | TS1000        |      |      | TS1250 |      | TS1600 |      |      |
|--------------------------------------------------|---------------------------------------------------------------|-----------|-------------------------|---------------|------|------|--------|------|--------|------|------|
| Type                                             |                                                               |           |                         | TS1000        |      |      | TS1250 |      | TS1600 |      |      |
| Ampere frame                                     |                                                               |           |                         | 1000          |      |      | 1250   |      | 1600   |      |      |
| Pole                                             |                                                               |           |                         | 3, 4          |      |      | 3, 4   |      | 3, 4   |      |      |
| Rated current,(A)                                |                                                               | In        | -5~40℃                  | 800, 1000     |      |      | 1250   |      | 1600   |      |      |
|                                                  |                                                               |           | 50℃                     | 800, 1000     |      |      | 1250   |      | 1560   |      |      |
|                                                  |                                                               |           | 65℃                     | 800, 1000     |      |      | 1240   |      | 1420   |      |      |
| Rated insulation voltage, (V)                    |                                                               | Ui        | 1000                    |               |      | 1000 |        | 1000 |        |      |      |
| Rated impulse withstand voltage, (kV)            |                                                               | Uimp      | 8                       |               |      | 8    |        | 8    |        |      |      |
| Rated operational voltage, (V)                   |                                                               | Ue        | AC50/60Hz               | 690           |      |      | 690    |      | 690    |      |      |
|                                                  |                                                               |           | DC                      | -             |      |      | -      |      | -      |      |      |
| Rated short-circuit breaking capacity            |                                                               |           |                         | N             | H    | L    | N      | H    | N      | H    |      |
| IEC60947-2<br>AC50/60Hz<br>(sym)                 | Rated ultimate short-circuit<br>breaking capacity, (kA) (Icu) |           | 220/240V                | 55            | 75   | 200  | 55     | 75   | 55     | 75   |      |
|                                                  |                                                               |           | 380/415V                | 50            | 70   | 150  | 50     | 70   | 50     | 70   |      |
|                                                  |                                                               |           | 440/460V                | 50            | 65   | 130  | 50     | 65   | 50     | 65   |      |
|                                                  |                                                               |           | 480/500V                | 40            | 50   | 100  | 40     | 50   | 40     | 50   |      |
|                                                  |                                                               |           | 660/690V                | 35            | 45   | -    | 35     | 45   | 35     | 45   |      |
|                                                  | DC                                                            |           | 250V 2P                 | -             | -    | -    | -      | -    | -      | -    |      |
|                                                  |                                                               |           | 500V 2P                 | -             | -    | -    | -      | -    | -      | -    |      |
|                                                  |                                                               |           | 750V 3P                 | -             | -    | -    | -      | -    | -      | -    |      |
|                                                  |                                                               |           | Rated service %Icu      |               | 100% | 75%  | 100%   | 100% | 75%    | 100% | 75%  |
|                                                  |                                                               |           | breaking capacity (Ics) |               |      |      |        |      |        |      |      |
| Rated short-time<br>withstand current (kA) (Icw) |                                                               | AC50/60Hz | 1s                      | 25            |      | 12   |        | 25   |        | 25   |      |
|                                                  |                                                               | 3s        | -                       |               | -    |      | -      |      | -      |      |      |
| Overriding instantaneous protection              |                                                               |           | kA peak                 | 50            |      | 30   |        | 50   |        | 50   |      |
| Isolation                                        |                                                               |           |                         | ○             |      |      | ○      |      | ○      |      |      |
| Category                                         |                                                               |           |                         | B             |      |      | A      |      | B      |      |      |
| Life cycle <small>Note 1)</small>                | Mechanical (operations)                                       |           |                         | 10000         |      |      | 4000   |      | 10000  |      |      |
|                                                  | Electrical (operations)                                       |           | 440V                    | In/2          | 6000 |      | 4000   |      | 5000   |      |      |
|                                                  |                                                               |           |                         | In            | 5000 |      | 3000   |      | 4000   |      |      |
|                                                  |                                                               |           | 690V                    | In/2          | 4000 |      | 3000   |      | 3000   |      | 2000 |
| In                                               | 2000                                                          |           |                         | 2000          |      | 2000 |        | 1000 |        |      |      |
| Pollution degree                                 |                                                               |           |                         | 3             |      |      | 3      |      | 3      |      |      |
| Dimension (mm)                                   |                                                               |           | 3-pole                  | 210×327×152.5 |      |      |        |      |        |      |      |
| (W×H×D)                                          |                                                               |           | 4-pole                  | 280×327×152.5 |      |      |        |      |        |      |      |
| Weight (kg)                                      |                                                               |           | 3-pole                  | 13            |      |      |        |      |        |      |      |
|                                                  |                                                               |           | 4-pole                  | 16.8          |      |      |        |      |        |      |      |

Note) 1. Life cycle means not guarantee but limitation  
(Quality guarantee: On/Off frequency on the basis of IEC60947-2 within the term of guarantee.)



# MCCBs for power distribution 1600A

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## Overview

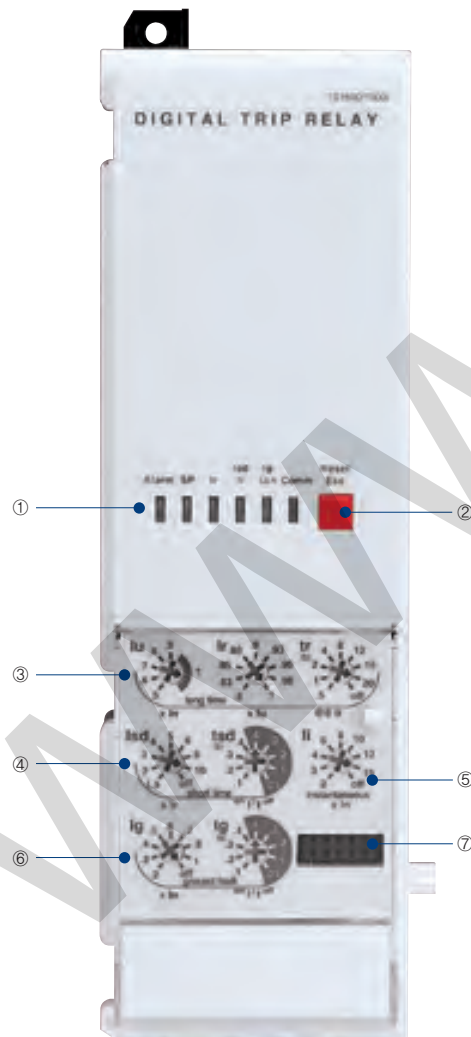
| Classification       | N type                                                                            | A type                                                                                                                                                        | P type                                                                                                                       | S type                                                                                                                                                                                                               |
|----------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Externals            |  |                                                                              |                                            |                                                                                                                                   |
| Current protection   | • L / S / I / G / Thermal                                                         | • L / S / I / G / Thermal<br>• ZSI(Protective coordination)                                                                                                   | • L / S / I / G / Thermal(Continuous)<br>• ZSI(Protective coordination)                                                      | • P type                                                                                                                                                                                                             |
| Other protection     | -                                                                                 | • Earth leakage (Option)                                                                                                                                      | • Earth leakage(Option)<br>• Over/Under current<br>• Over/Under frequency<br>• Unbalance(Voltage/Current)<br>• Reverse power | • P type                                                                                                                                                                                                             |
| Measurement function | -                                                                                 | • Current (R / S / T / N)                                                                                                                                     | • 3 Phase Voltage/Current RMS/Vector<br>• Power(P, Q, S), PF(3-Phase)<br>• Energy(Positive/Negative)<br>• Frequency, Demand  | • 3 Phase Voltage/Current RMS/Vector<br>• Power(P, Q, S), PF(3-Phase)<br>• Energy(Positive/Negative)<br>• Frequency, Demand<br>• Voltage/Current harmonics (1st~63th)<br>• 3 Phase Waveforms<br>• THD, TDD, K-Factor |
| Fine adjustment      | -                                                                                 | -                                                                                                                                                             | • Fine adjustment for long/short time delay/instantaneous/ ground                                                            | • P type                                                                                                                                                                                                             |
| Pre Trip Alarm       | -                                                                                 | -                                                                                                                                                             | • Overload protection relays : DO (Alarm)<br>(Ground fault is not available when using Pre trip alarm)                       | • P type                                                                                                                                                                                                             |
| Digital Output       | -                                                                                 | • 3DO (Fixed)<br>• L, S/I, G Alarm                                                                                                                            | • 3DO (Programmable)<br>• Trip, Alarm, General                                                                               | • P type                                                                                                                                                                                                             |
| IDMTL setting        | -                                                                                 | -                                                                                                                                                             | • Compliance with IEC60255-3 SIT, VIT, EIT, DT                                                                               | • P type                                                                                                                                                                                                             |
| Communication        | -                                                                                 | • Modbus/RS-485<br>• Profibus-DP                                                                                                                              | • Modbus / RS-485<br>• Profibus-DP                                                                                           | • Modbus / RS-485<br>• Profibus-DP                                                                                                                                                                                   |
| Power supply         | • Self Power<br>-Power source works over 25% of current of In (one pole)          | • Self Power<br>- Power source works over 25% of current of In (one pole)<br>- External power source is required for comm.<br>• AC/DC 100~250V<br>• DC 24~60V | Basic protection function(L / S / I / G) is still under normal operation without control power.                              |                                                                                                                                                                                                                      |
| RTC timer            | • Available                                                                       | • Available                                                                                                                                                   | • Available                                                                                                                  | • Available                                                                                                                                                                                                          |
| LED for trip info.   | • Long time delay<br>• Short time delay/Instantaneous<br>• Ground fault           | • N type                                                                                                                                                      | • N type                                                                                                                     | • N type                                                                                                                                                                                                             |
| Fault recording      | -                                                                                 | • 10 records (No fault records when using self power)<br>(Fault/Current/Date and Time)                                                                        | • 256 records<br>(Fault/Current/Date and Time)                                                                               | • 256 records<br>• Last fault wave recording (3 Phase)                                                                                                                                                               |
| Event recording      | -                                                                                 | -                                                                                                                                                             | • 256 records(Content, Status, Date)                                                                                         | • P type                                                                                                                                                                                                             |
| Operating button     | • Reset button                                                                    | • Reset, Menu<br>Up/Down, Left/Right, Enter                                                                                                                   | • A type                                                                                                                     | • A type                                                                                                                                                                                                             |

# MCCBs for power distribution 1600A

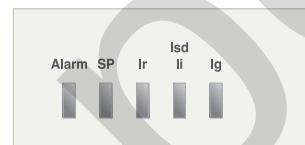
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## N type: 'Normal' type

- Optimized protection function
- OCR, OCGR function according IEC60947-2
- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground fault protection
  - I<sup>2</sup>t On/Off optional
- Self-Power



① LED: Indication of trip info. and overload state



- Ig: LED indicating ground-fault
- I<sup>2</sup>d/I<sup>2</sup>i: LED indicating short-time or instantaneous tripping
- Ir: LED indicating long-time delay
- SP: Self-protection and battery test LED
- Alarm: LED indicating an overload  
(Turn on above 90%, Blink above 105%)

② Reset Key: Fault reset or battery check

③ I<sub>u</sub>, I<sub>r</sub>: Long-time current setting, t<sub>r</sub>: Long-time tripping delay setting

④ I<sub>sd</sub>: Short-time current setting, t<sub>sd</sub>: Short-time tripping delay setting

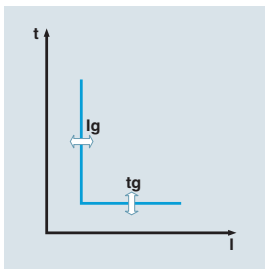
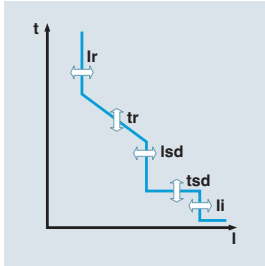
⑤ I<sub>i</sub>: Instantaneous current setting

⑥ I<sub>g</sub>: Ground fault current setting, t<sub>g</sub>: Ground fault tripping delay setting

⑦ Test terminal: OCR test terminal (Connected with OCR tester)

# MCCBs for power distribution 1600A

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## Protection

| Long time                                                             |                             |                        |      |      |      |     |      |      |      |     |
|-----------------------------------------------------------------------|-----------------------------|------------------------|------|------|------|-----|------|------|------|-----|
| Current setting (A)                                                   | $I_u = I_n \times \dots$    | 0.5                    | 0.6  | 0.7  | 0.8  | 0.9 | 1.0  |      |      |     |
|                                                                       | $I_r = I_u \times \dots$    | 0.8                    | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |
| Time delay (s)                                                        | $t_r @ (1.5 \times I_r)$    | 12.5                   | 25   | 50   | 100  | 200 | 300  | 400  | 500  | Off |
| Accuracy: $\pm 15\%$ or below                                         | $t_r @ (6.0 \times I_r)$    | 0.5                    | 1    | 2    | 4    | 8   | 12   | 16   | 20   | Off |
| 100ms                                                                 | $t_r @ (7.2 \times I_r)$    | 0.34                   | 0.69 | 1.38 | 2.7  | 5.5 | 8.3  | 11   | 13.8 | Off |
| Short time                                                            |                             |                        |      |      |      |     |      |      |      |     |
| Current setting (A)                                                   | $I_{sd} = I_r \times \dots$ | 1.5                    | 2    | 3    | 4    | 5   | 6    | 8    | 10   | Off |
| Accuracy: $\pm 10\%$                                                  |                             |                        |      |      |      |     |      |      |      |     |
| Time delay (s)                                                        | $t_{sd}$                    | $I^2t$ Off             | 0.05 | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |
| @ $10 \times I_r$                                                     |                             | $I^2t$ On              |      | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |
|                                                                       | $(I^2t \text{ Off})$        | Min. Trip Time(ms)     | 20   | 80   | 160  | 260 | 360  |      |      |     |
|                                                                       |                             | Max. Trip Time(ms)     | 80   | 140  | 240  | 340 | 440  |      |      |     |
| Instantaneous                                                         |                             |                        |      |      |      |     |      |      |      |     |
| Current setting (A)                                                   | $I_i = I_n \times \dots$    | 2                      | 3    | 4    | 6    | 8   | 10   | 12   | 15   | Off |
| Tripping time                                                         |                             | $50 (\pm 10\text{ms})$ |      |      |      |     |      |      |      |     |
| Ground fault                                                          |                             |                        |      |      |      |     |      |      |      |     |
| Pick-up (A)                                                           |                             |                        |      |      |      |     |      |      |      |     |
| Accuracy: $\pm 10\% (I_g > 0.4 I_n)$<br>$\pm 20\% (I_g \leq 0.4 I_n)$ | $I_g = I_n \times \dots$    | 0.2                    | 0.3  | 0.4  | 0.5  | 0.6 | 0.7  | 0.8  | 1.0  | Off |
|                                                                       | $t_g$                       | $I^2t$ Off             | 0.05 | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |
|                                                                       |                             | $I^2t$ On              |      | 0.1  | 0.2  | 0.3 | 0.4  |      |      |     |
| Time delay (s)                                                        | $(I^2t \text{ Off})$        | Min. Trip Time(ms)     | 20   | 80   | 160  | 260 | 360  |      |      |     |
| @ $1 \times I_n$                                                      |                             | Max. Trip Time(ms)     | 80   | 140  | 240  | 340 | 440  |      |      |     |

## NV type (For ship only)

## Protection

| Long time                     |                             |                  |      |      |      |      |      |      |      |      |
|-------------------------------|-----------------------------|------------------|------|------|------|------|------|------|------|------|
| Current setting (A)           | $I_r = I_n \times \dots$    | 0.8              | 0.9  | 1.0  | 1.05 | 1.1  | 1.15 | 1.2  | 1.25 | Off  |
| Time delay (s)                | $tr @ (1.2 \times I_r)$     | 10               | 15   | 20   | 25   | 30   | 40   | 50   | 60   | 100  |
| Accuracy: $\pm 15\%$ or below | $tr @ (3 \times I_r)$       | 0.99             | 1.49 | 1.99 | 2.48 | 2.98 | 3.97 | 4.97 | 5.96 | 9.93 |
| 100ms                         | $tr @ (6 \times I_r)$       | 0.24             | 0.36 | 0.48 | 0.59 | 0.71 | 0.95 | 1.19 | 1.43 | 2.38 |
| Short time                    |                             |                  |      |      |      |      |      |      |      |      |
| Current setting (A)           | $I_{sd} = I_n \times \dots$ | 2                | 2.5  | 2.7  | 3    | 3.5  | 4    | 4.5  | 5    | Off  |
| Accuracy: $\pm 10\%$          |                             |                  |      |      |      |      |      |      |      |      |
| Time delay (s)                | $I^2t$ Off                  | 0.05             | 0.1  | 0.2  | 0.3  | 0.4  |      |      |      |      |
| @ $10 \times I_r$             | $I^2t$ On                   |                  | 0.1  | 0.2  | 0.3  | 0.4  |      |      |      |      |
|                               | Min. Trip Time(ms)          | 20               | 80   | 160  | 260  | 360  |      |      |      |      |
|                               | Max. Trip Time(ms)          | 80               | 140  | 240  | 340  | 440  |      |      |      |      |
| Instantaneous                 |                             |                  |      |      |      |      |      |      |      |      |
| Current setting (A)           | $I_i = I_n \times \dots$    | 2                | 4    | 6    | 8    | 10   | 12   | 14   | 16   | Off  |
| Tripping time                 |                             | 50( $\pm 10$ ms) |      |      |      |      |      |      |      |      |

■ The fine-adjustable setting of the rated current [ $I_n$ ]

- $I_n = I_{ct} \times [0.4 \sim 1.0]$
- Setting range: 40~100% of  $I_{ct}$  (unit: 0.5%)

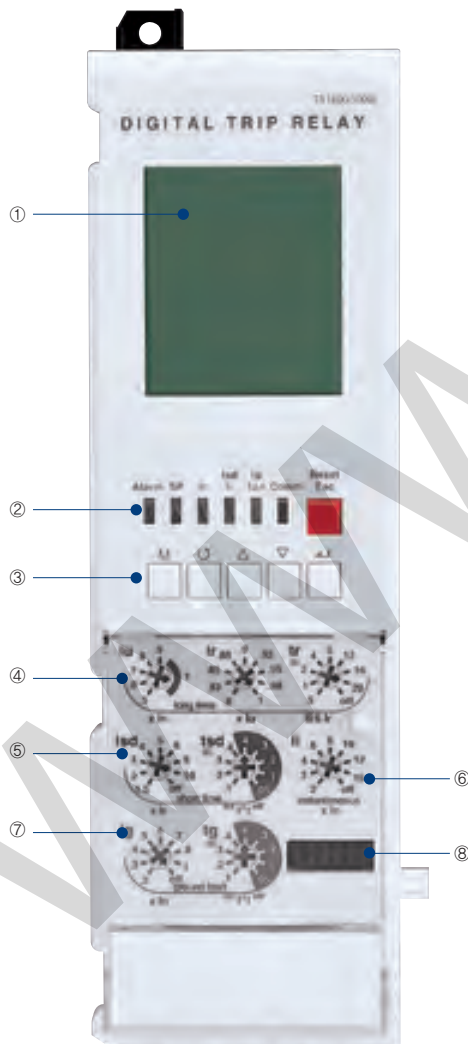


# MCCBs for power distribution 1600A

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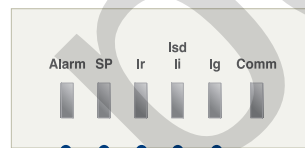
## A type: 'Ammeter' type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - $I^2t$  On/Off optional (for short-time delay)
- Ground fault protection
  - $I^2t$  On/Off optional
- Realization of protective coordination by ZSI (Zone Selective Interlocking)
- High-performance and high-speed MCU built-in
  - Accurate measurement with tolerance of 1.0%
- Fault recording
  - Records Max. up to 10 fault information about fault type, fault phase, fault data, occurrence time of fault
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- 3 DO(Digital Output)
  - Fixed
- Communication
  - Modbus/RS485
  - Profibus-DP



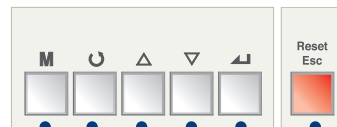
① LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



Ig: LED indicating ground-fault  
Isd/Ii: LED indicating short-time or instantaneous tripping  
Ir: LED indicating long-time delay  
SP: Self-protection and battery test LED  
Alarm: LED indicating an overload  
(Turn on above 90%, Blink above 105%)

③ Key: Move to menu or reset



Reset/ESC: Fault reset or ESC from menu  
Enter: Enter into secondary menu or setting input  
Up/Down: Move the cursor up/down on screen or increase/decrease a setting value  
Right/Left: Move the cursor or setting right/left on screen (Rotation)  
Menu: Menu display ↔ Measurement display

④ Iu, Ir: Long-time current setting, tr: Long-time tripping delay setting

⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑥ Ii: Instantaneous current setting

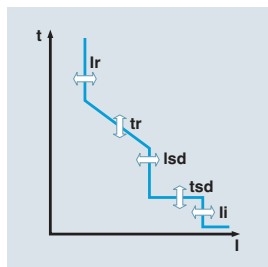
⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

⑧ Test terminal: OCR test terminal (Connected with OCR tester)

# MCCBs for power distribution 1600A

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## Protection



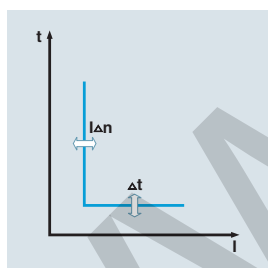
| Long time                           |                          |      |      |      |      |     |      |      |      |     |  |
|-------------------------------------|--------------------------|------|------|------|------|-----|------|------|------|-----|--|
| Current setting (A)                 | $I_u = I_n \times \dots$ | 0.5  | 0.6  | 0.7  | 0.8  | 0.9 | 1.0  |      |      |     |  |
|                                     | $I_r = I_u \times \dots$ | 0.8  | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |  |
| Time delay (s)                      | $t_r @ (1.5 \times I_r)$ | 12.5 | 25   | 50   | 100  | 200 | 300  | 400  | 500  | Off |  |
| Accuracy: $\pm 15\%$ or below 100ms | $t_r @ (6.0 \times I_r)$ | 0.5  | 1    | 2    | 4    | 8   | 12   | 16   | 20   | Off |  |
|                                     | $t_r @ (7.2 \times I_r)$ | 0.34 | 0.69 | 1.38 | 2.7  | 5.5 | 8.3  | 11   | 13.8 | Off |  |

| Short time                  |                        |                      |      |     |     |     |     |   |    |     |
|-----------------------------|------------------------|----------------------|------|-----|-----|-----|-----|---|----|-----|
| Current setting (A)         | Isd = Ir × ...         | 1.5                  | 2    | 3   | 4   | 5   | 6   | 8 | 10 | Off |
| Accuracy: ±10%              |                        |                      |      |     |     |     |     |   |    |     |
| Time delay (s)<br>@ 10 × Ir | tsd                    | I <sup>2</sup> t Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 |   |    |     |
|                             |                        | I <sup>2</sup> t On  |      | 0.1 | 0.2 | 0.3 | 0.4 |   |    |     |
|                             | (I <sup>2</sup> t Off) | Min. Trip Time(ms)   | 20   | 80  | 160 | 260 | 360 |   |    |     |
|                             |                        | Max. Trip Time(ms)   | 80   | 140 | 240 | 340 | 440 |   |    |     |

| Instantaneous       |                          |                  |   |   |   |   |    |    |    |     |  |
|---------------------|--------------------------|------------------|---|---|---|---|----|----|----|-----|--|
| Current setting (A) | $I_i = I_n \times \dots$ | 2                | 3 | 4 | 6 | 8 | 10 | 12 | 15 | Off |  |
| Tripping time       |                          | 50( $\pm 10$ ms) |   |   |   |   |    |    |    |     |  |



| Ground fault                          |                          |      |     |     |     |     |     |     |     |     |  |
|---------------------------------------|--------------------------|------|-----|-----|-----|-----|-----|-----|-----|-----|--|
| Pick-up (A)                           |                          |      |     |     |     |     |     |     |     |     |  |
| Accuracy: $\pm 10\%$ ( $I_g>0.4I_n$ ) | $I_g = I_n \times \dots$ | 0.2  | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | Off |  |
| $\pm 20\%$ ( $I_g\leq 0.4I_n$ )       |                          |      |     |     |     |     |     |     |     |     |  |
|                                       | $I^2t$ Off               | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 |     |     |     |     |  |
|                                       | $I^2t$ On                |      | 0.1 | 0.2 | 0.3 | 0.4 |     |     |     |     |  |
| Time delay (s)                        |                          |      |     |     |     |     |     |     |     |     |  |
| @ $1 \times I_n$                      | ( $I^2t$ Off)            |      |     |     |     |     |     |     |     |     |  |
|                                       | Min. Trip Time(ms)       | 20   | 80  | 160 | 260 | 360 |     |     |     |     |  |
|                                       | Max. Trip Time(ms)       | 80   | 140 | 240 | 340 | 440 |     |     |     |     |  |



| Earth leakage (Option) |                |          |     |     |     |     |     |    |    |    |     |
|------------------------|----------------|----------|-----|-----|-----|-----|-----|----|----|----|-----|
| Current setting (A)    | $I_{\Delta n}$ |          | 0.5 | 1   | 2   | 3   | 5   | 10 | 20 | 30 | Off |
| Time delay (ms)        | $\Delta t$     | Alarm    |     |     |     |     |     |    |    |    |     |
| Accuracy: $\pm 15\%$   |                | Time(ms) | 140 | 230 | 350 | 800 | 950 |    |    |    |     |
|                        |                | Trip     |     |     |     |     |     |    |    |    |     |
|                        |                | Time(ms) | 140 | 230 | 350 | 800 |     |    |    |    |     |

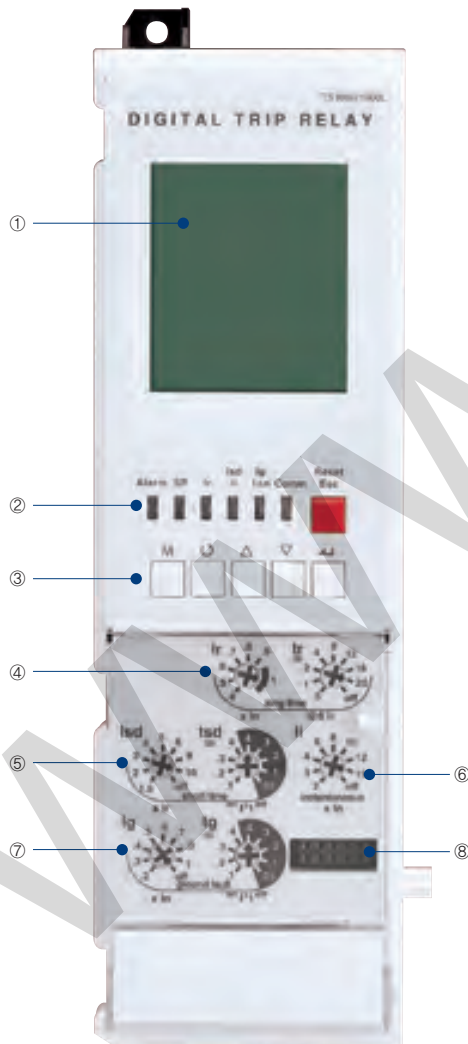
Note) Earth leakage function is available with ZCT or external CT

# MCCBs for power distribution 1600A

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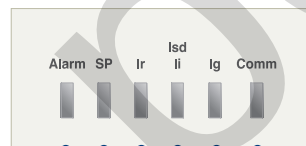
## P type: 'Power meter' type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground fault protection
  - I<sup>2</sup>t On/Off optional
- Protection for Over voltage/Under voltage/Over frequency/Under frequency/Unbalance/Reverse power
- Realization of protective coordination by ZSI (Zone Selective Interlocking)
- The fine-adjustable setting by knob and Key
- IDMTL setting (SIT, VIT, EIT, DT curve)
  - Basic setting : "None". Thermal curve.
- Measurement and Display Function
  - High detailed measurement for 3 phase current/Voltage/Power/Energy/Phase angle/Frequency/PF/Demand
  - 128 x 128 Graphic LCD
  - Indicates current/voltage Vector Diagram and Waveform
- Fault recording
  - Records Max. up to 256 fault information about fault type, fault phase, fault value, occurrence time of fault
- Event recording
  - Records events of device related to setting change, operation and state change. (Max. up to 256)
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- 3 DO(Digital output)
  - Programmable for alarm, trip and general DO
- Communication
  - Modbus/RS485
  - Profibus-DP



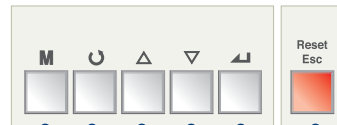
① Graphic LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



- Comm: LED indicating comm. state (Blink when running)
- Ig: LED indicating ground-fault
- Isd/Ii: LED indicating short-time or instantaneous tripping
- Ir: LED indicating long-time delay
- SP: Self-protection and battery test LED
- Alarm: LED indicating an overload (Turn on above 90%, Blink above 105%)

③ Key: Move to menu or reset



- Reset/ESC: Fault reset or ESC from menu
- Enter: Enter into secondary menu or setting input
- Up/Down: Move the cursor up/down on screen or increase/decrease a setting value
- Right/Left: Move the cursor or setting right/left on screen (Rotation)
- Menu: Menu display ↔ Measurement display

④ Ir: Long-time current setting, tr: Long-time tripping delay setting

⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑥ Ii: Instantaneous current setting

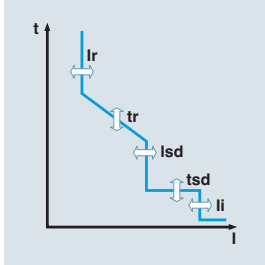
⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

⑧ Test terminal: OCR test terminal (Connected with OCR tester)

# MCCBs for power distribution 1600A

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## Protection

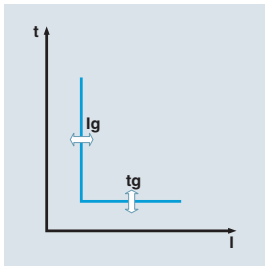


| Long time                     |                          |      |      |      |     |     |     |     |      |     |
|-------------------------------|--------------------------|------|------|------|-----|-----|-----|-----|------|-----|
| Current setting (A)           | $I_r = I_n \times \dots$ | 0.4  | 0.5  | 0.6  | 0.7 | 0.8 | 0.9 | 1.0 |      |     |
| Time delay (s)                | $t_r @ (1.5 \times I_r)$ | 12.5 | 25   | 50   | 100 | 200 | 300 | 400 | 500  | Off |
| Accuracy: $\pm 15\%$ or below | $t_r @ (6.0 \times I_r)$ | 0.5  | 1    | 2    | 4   | 8   | 12  | 16  | 20   | Off |
| 100ms                         | $t_r @ (7.2 \times I_r)$ | 0.34 | 0.69 | 1.38 | 2.7 | 5.5 | 8.3 | 11  | 13.8 | Off |

| Short time           |                             |                    |      |     |     |     |     |   |    |     |
|----------------------|-----------------------------|--------------------|------|-----|-----|-----|-----|---|----|-----|
| Current setting (A)  | $I_{sd} = I_r \times \dots$ | 1.5                | 2    | 3   | 4   | 5   | 6   | 8 | 10 | Off |
| Accuracy: $\pm 10\%$ |                             |                    |      |     |     |     |     |   |    |     |
| Time delay (s)       | $t_{sd}$                    | $I^2 t$ Off        | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 |   |    |     |
| @ $10 \times I_r$    |                             | $I^2 t$ On         |      | 0.1 | 0.2 | 0.3 | 0.4 |   |    |     |
|                      |                             | Min. Trip Time(ms) | 20   | 80  | 160 | 260 | 360 |   |    |     |
|                      |                             | Max. Trip Time(ms) | 80   | 140 | 240 | 340 | 440 |   |    |     |

| Instantaneous       |                          |                  |   |   |   |   |    |    |    |     |
|---------------------|--------------------------|------------------|---|---|---|---|----|----|----|-----|
| Current setting (A) | $I_i = I_n \times \dots$ | 2                | 3 | 4 | 6 | 8 | 10 | 12 | 15 | Off |
| Tripping time       |                          | 50( $\pm 10$ ms) |   |   |   |   |    |    |    |     |

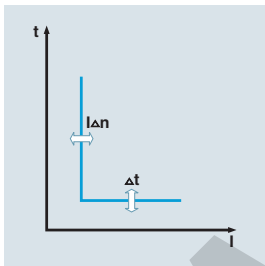
| Ground fault                             |                          |                    |      |     |     |     |     |     |     |     |
|------------------------------------------|--------------------------|--------------------|------|-----|-----|-----|-----|-----|-----|-----|
| Pick-up (A)                              |                          |                    |      |     |     |     |     |     |     |     |
| Accuracy: $\pm 10\%$ ( $I_g > 0.4 I_n$ ) | $I_g = I_n \times \dots$ | 0.2                | 0.3  | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | Off |
| $\pm 20\%$ ( $I_g \leq 0.4 I_n$ )        |                          |                    |      |     |     |     |     |     |     |     |
|                                          |                          | $I^2 t$ Off        | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 |     |     |     |
|                                          |                          | $I^2 t$ On         |      | 0.1 | 0.2 | 0.3 | 0.4 |     |     |     |
| Time delay (s)                           |                          | Min. Trip Time(ms) | 20   | 80  | 160 | 260 | 360 |     |     |     |
| @ $1 \times I_n$                         |                          | Max. Trip Time(ms) | 80   | 140 | 240 | 340 | 440 |     |     |     |



| Earth leakage (Option) |                |                |     |     |     |     |     |    |    |     |
|------------------------|----------------|----------------|-----|-----|-----|-----|-----|----|----|-----|
| Current setting (A)    | $I_{\Delta n}$ | 0.5            | 1   | 2   | 3   | 5   | 10  | 20 | 30 | Off |
| Time delay (ms)        |                |                |     |     |     |     |     |    |    |     |
| Accuracy: $\pm 15\%$   | $\Delta t$     | Alarm Time(ms) | 140 | 230 | 350 | 800 | 950 |    |    |     |
|                        |                | Trip Time(ms)  | 140 | 230 | 350 | 800 |     |    |    |     |

Note) Earth leakage function is available with ZCT or external CT

| PTA(Pre Trip Alarm)  |                          |     |      |     |      |     |      |     |      |     |
|----------------------|--------------------------|-----|------|-----|------|-----|------|-----|------|-----|
| Current setting (A)  | $I_p = I_r \times \dots$ | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1   |
| Time delay (s)       | $t_p @ (1.2 \times I_p)$ | 1   | 5    | 10  | 15   | 20  | 25   | 30  | 35   | Off |
| Accuracy: $\pm 15\%$ |                          |     |      |     |      |     |      |     |      |     |



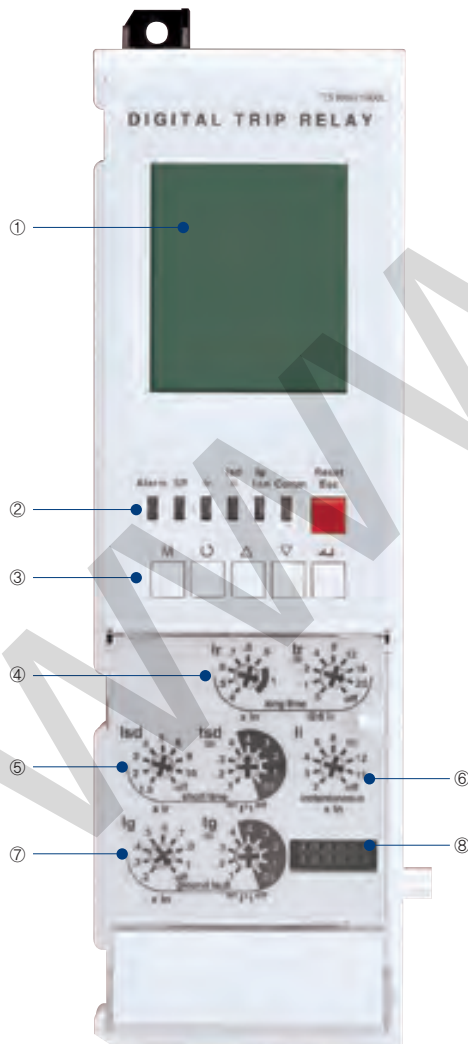
| Other protection  |      | Pick-up           |      |                               | Time delay(s) |        |               |
|-------------------|------|-------------------|------|-------------------------------|---------------|--------|---------------|
|                   |      | Setting range     | Step | Accuracy                      | Setting range | Step   | Accuracy      |
| Under voltage     |      | 80V ~ 0V_Pick-up  | 1V   | $\pm 5\%$                     | 1.2~40sec     | 0.1sec | $\pm 0.1$ sec |
| Over voltage      |      | UV_Pick-up ~ 980V | 1V   | $\pm 5\%$                     |               |        |               |
| Voltage unbalance |      | 6% ~ 99%          | 1%   | $\pm 2.5\%$ or ( $\pm 10\%$ ) |               |        |               |
| Reverse power     |      | 10~500 kW         | 1kW  | $\pm 10\%$                    |               |        |               |
| Over power        |      | 500~5000 kW       | 1kW  | $\pm 10\%$                    | 0.2~40sec     | 0.1sec | $\pm 0.1$ sec |
| Current unbalance |      | 6% ~ 99%          | 1%   | $\pm 2.5\%$ or ( $\pm 10\%$ ) |               |        |               |
| Over frequency    | 60Hz | UF_Pick-up ~ 65   | 1Hz  | $\pm 0.1$ Hz                  | 1.2~40sec     | 0.1sec | $\pm 0.1$ sec |
| Under frequency   | 50Hz | UF_Pick-up ~ 55   | 1Hz  | $\pm 0.1$ Hz                  |               |        |               |
| Over frequency    | 60Hz | 55Hz ~ OF_Pick-up | 1Hz  | $\pm 0.1$ Hz                  |               |        |               |
| Under frequency   | 50Hz | 45Hz ~ OF_Pick-up | 1Hz  | $\pm 0.1$ Hz                  |               |        |               |

# MCCBs for power distribution 1600A

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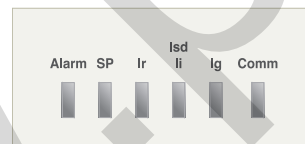
## S type: 'Supreme meter' type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - I't On/Off optional (for short-time delay)
- Ground fault protection
  - I't On/Off optional
- Protection for Over voltage/Under voltage/Over frequency/Under frequency/Unbalance/Reverse power
- Realization of protective coordination by ZSI (Zone Selective Interlocking)
- The fine-adjustable setting by knob and Key
- IDMTL setting (SIT, VIT, EIT, DT curve)
  - Basic setting : "None". Thermal curve.
- Measurement and Display Function
  - High detailed measurement for 3 phase current/Voltage/Power/Energy/Phase angle/Frequency/PF/Demand
  - 128 x 128 Graphic LCD
  - Indicates current/voltage Vector Diagram and Waveform
- Fault recording
  - Records Max. up to 256 fault information about fault type, fault phase, fault value, occurrence time of fault
  - Fault wave recording: records the latest fault wave
- Event recording
  - Records events of device related to setting change, operation and state change. (Max. up to 256)
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- Power quality analysis
  - Measurement for 1st~63th harmonics
  - THD, TDD, k-Factor
  - Voltage/current waveform capture
- 3 DO(Digital output)
  - Programmable for alarm, trip and general DO
- Communication
  - Modbus/RS485
  - Profibus-DP



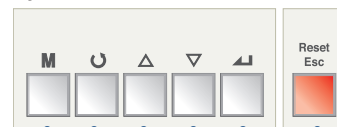
① Graphic LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



- Comm: LED indicating comm. state (Blink when running)
- Ig: LED indicating ground-fault
- Isd/li: LED indicating short-time or instantaneous tripping
- Ir: LED indicating long-time delay
- SP: Self-protection LED and battery test LED
- Alarm: LED indicating an overload (Turn on above 90%, Blink above 105%)

③ Key: Move to menu or reset



- Reset/ESC: Fault reset or ESC from menu
- Enter: Enter into secondary menu or setting input
- Up/Down: Move the cursor up/down on screen or increase/decrease a setting value
- Right/Left: Move the cursor or setting right/left on screen (Rotation)
- Menu: Menu display ↔ Measurement display

④ Ir: Long-time current setting, tr: Long-time tripping delay setting

⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑥ li: Instantaneous current setting

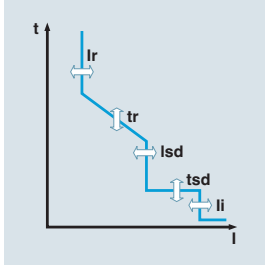
⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

⑧ Test terminal: OCR test terminal (Connected with OCR tester)

# MCCBs for power distribution 1600A

Susol

## Protection

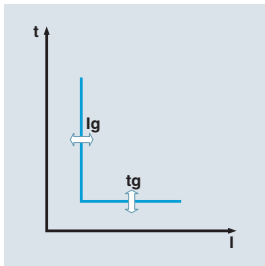


| Long time                     |                          |      |      |      |     |     |     |     |      |     |
|-------------------------------|--------------------------|------|------|------|-----|-----|-----|-----|------|-----|
| Current setting (A)           | $I_u = I_n \times \dots$ | 0.4  | 0.5  | 0.6  | 0.7 | 0.8 | 0.9 | 1.0 |      |     |
| Time delay (s)                | $t_r @ (1.5 \times I_r)$ | 12.5 | 25   | 50   | 100 | 200 | 300 | 400 | 500  | Off |
| Accuracy: $\pm 15\%$ or below | $t_r @ (6.0 \times I_r)$ | 0.5  | 1    | 2    | 4   | 6   | 12  | 16  | 20   | Off |
| 100ms                         | $t_r @ (7.2 \times I_r)$ | 0.34 | 0.69 | 1.38 | 2.7 | 5.5 | 8.3 | 11  | 13.8 | Off |

| Short time           |                             |                    |      |     |     |     |     |   |    |     |
|----------------------|-----------------------------|--------------------|------|-----|-----|-----|-----|---|----|-----|
| Current setting (A)  | $I_{sd} = I_r \times \dots$ | 1.5                | 2    | 3   | 4   | 5   | 6   | 8 | 10 | Off |
| Accuracy: $\pm 10\%$ |                             |                    |      |     |     |     |     |   |    |     |
| Time delay (s)       | $t_{sd}$                    | $I^2 t$ Off        | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 |   |    |     |
| @ $10 \times I_r$    |                             | $I^2 t$ On         |      | 0.1 | 0.2 | 0.3 | 0.4 |   |    |     |
|                      |                             | Min. Trip Time(ms) | 20   | 80  | 160 | 260 | 360 |   |    |     |
|                      |                             | Max. Trip Time(ms) | 80   | 140 | 240 | 340 | 440 |   |    |     |

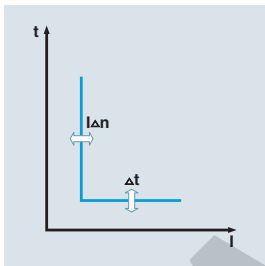
| Instantaneous       |                          |                  |   |   |   |   |    |    |    |     |
|---------------------|--------------------------|------------------|---|---|---|---|----|----|----|-----|
| Current setting (A) | $I_i = I_n \times \dots$ | 2                | 3 | 4 | 6 | 8 | 10 | 12 | 15 | Off |
| Tripping time       |                          | 50( $\pm 10$ ms) |   |   |   |   |    |    |    |     |

| Ground fault                             |                          |                    |      |     |     |     |     |     |     |     |
|------------------------------------------|--------------------------|--------------------|------|-----|-----|-----|-----|-----|-----|-----|
| Pick-up (A)                              |                          |                    |      |     |     |     |     |     |     |     |
| Accuracy: $\pm 10\%$ ( $I_g > 0.4 I_n$ ) | $I_g = I_n \times \dots$ | 0.2                | 0.3  | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | Off |
| $\pm 20\%$ ( $I_g \leq 0.4 I_n$ )        |                          |                    |      |     |     |     |     |     |     |     |
|                                          |                          | $I^2 t$ Off        | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 |     |     |     |
|                                          |                          | $I^2 t$ On         |      | 0.1 | 0.2 | 0.3 | 0.4 |     |     |     |
| Time delay (s)                           |                          | Min. Trip Time(ms) | 20   | 80  | 160 | 260 | 360 |     |     |     |
| @ $1 \times I_n$                         |                          | Max. Trip Time(ms) | 80   | 140 | 240 | 340 | 440 |     |     |     |



| Earth leakage (Option) |                |                |     |     |     |     |     |    |    |     |
|------------------------|----------------|----------------|-----|-----|-----|-----|-----|----|----|-----|
| Current setting (A)    | $I_{\Delta n}$ | 0.5            | 1   | 2   | 3   | 5   | 10  | 20 | 30 | Off |
| Time delay (ms)        |                |                |     |     |     |     |     |    |    |     |
| Accuracy: $\pm 15\%$   | $\Delta t$     | Alarm Time(ms) | 140 | 230 | 350 | 800 | 950 |    |    |     |
|                        |                | Trip Time(ms)  | 140 | 230 | 350 | 800 |     |    |    |     |

Note) Earth leakage function is available with ZCT or external CT



| PTA(Pre Trip Alarm)  |                          |     |      |     |      |     |      |     |      |     |
|----------------------|--------------------------|-----|------|-----|------|-----|------|-----|------|-----|
| Current setting (A)  | $I_p = I_r \times \dots$ | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1   |
| Time delay (s)       | $t_p @ (1.2 \times I_p)$ | 1   | 5    | 10  | 15   | 20  | 25   | 30  | 35   | Off |
| Accuracy: $\pm 15\%$ |                          |     |      |     |      |     |      |     |      |     |

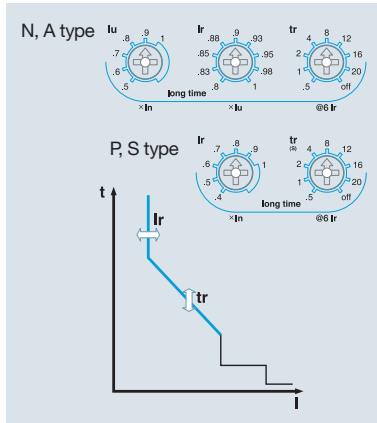
| Other protection  |      | Pick-up           |      |                  | Time delay(s) |        |          |
|-------------------|------|-------------------|------|------------------|---------------|--------|----------|
|                   |      | Setting range     | Step | Accuracy         | Setting range | Step   | Accuracy |
| Under voltage     |      | 80V ~ 0V_Pick-up  | 1V   | ±5%              | 1.2~40sec     | 0.1sec | ±0.1sec  |
| Over voltage      |      | UV_Pick-up ~ 980V | 1V   | ±5%              |               |        |          |
| Voltage unbalance |      | 6% ~ 99%          | 1%   | ±2.5% or (*±10%) |               |        |          |
| Reverse power     |      | 10~500 kW         | 1kW  | ± 10%            | 0.2~40sec     |        |          |
| Over power        |      | 500~5000 kW       | 1kW  | ± 10%            |               |        |          |
| Current unbalance |      | 6% ~ 99%          | 1%   | ±2.5% or (*±10%) | 1.2~40sec     |        |          |
| Over frequency    | 60Hz | UF_Pick-up ~ 65   | 1Hz  | ±0.1Hz           |               |        |          |
|                   | 50Hz | UF_Pick-up ~ 55   | 1Hz  | ±0.1Hz           |               |        |          |
| Under frequency   | 60Hz | 55Hz ~ OF_Pick-up | 1Hz  | ±0.1Hz           |               |        |          |
|                   | 50Hz | 45Hz ~ OF_Pick-up | 1Hz  | ±0.1Hz           |               |        |          |

# MCCBs for power distribution 1600A

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## Operation characteristic

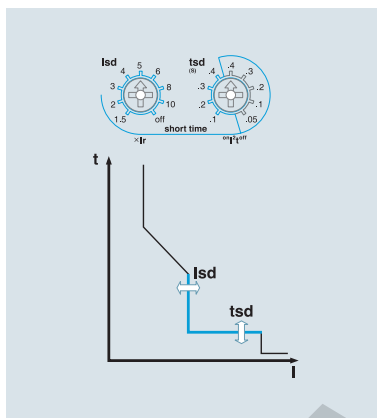
### Long-time delay (L)



The function for overload protection which has time delayed characteristic in inverse ratio to fault current.

- Standard current setting knob:  $I_r$ 
  - Setting range in P type and S type:  $(0.4-0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
  - Setting range in N type and A type:  $(0.4 \sim 1.0) \times I_n$ 
    - $I_u$ :  $(0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
    - $I_r$ :  $(0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0) \times I_u$
- Time delay setting knob:  $t_r$ 
  - Standard operating time is based on the time of  $6 \times I_r$
  - Setting range: 0.5-1-2-4-8-12-16-20-Off sec (9 modes)
- Relay pick-up current
  - When current over  $(1.15) \times I_r$  flows in, relay is picked up.
- Relay operates basing on the largest load current among R/S/T/N phase.

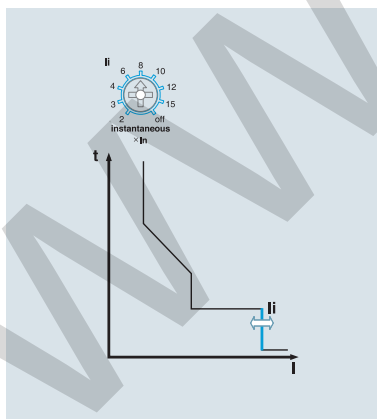
### Short-time delay (S)



The function for fault current (over current) protection which has definite time characteristic and time delayed in inverse ratio to fault current.

- Standard current setting knob:  $I_{sd}$ 
  - Setting range:  $(1.5-2-3-4-5-6-8-10-Off) \times I_r$
- Time delay setting knob:  $t_{sd}$ 
  - Standard operating time is based on the time of  $10 \times I_r$ .
  - Inverse time ( $I^2 t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2 t$  Off): 0.05-0.1-0.2-0.3-0.4 sec
- Relay operates basing on the largest load current among R/S/T/N phase.
- When ZSI function was set, the protection operation will take place instantaneously with input absence by downstream devices. It is advised to disable its ZSI function on the last downstream device.

### Instantaneous (I)



The function for breaking fault current above the setting value within the shortest time to protect the circuit from short-circuit.

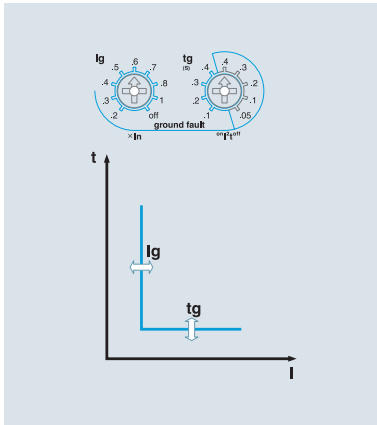
- Standard current setting knob:  $I_i$ 
  - Setting range:  $(2-3-4-6-8-10-12-15-Off) \times I_n$
- Relay operates basing on the largest load current among R/S/T/N phase.
- Total breaking time is below 50 ( $\pm 10$ )ms.



# MCCBs for power distribution 1600A

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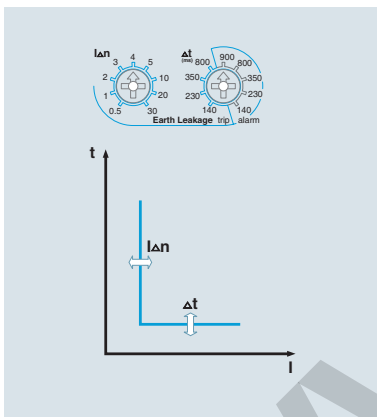
## Ground Fault (G)



**The function for breaking ground fault current above setting value after time-delay to protect the circuit from ground fault.**

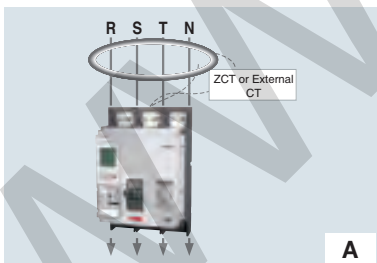
1. Standard setting current knob:  $I_g$ 
  - Setting range:  $(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-\text{Off}) \times I_n$
2. Time delay setting knob:  $t_g$ 
  - Inverse time ( $I^2t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2t$  Off): 0.05-0.1-0.2-0.3-0.4 sec
3. Ground fault current is vector sum of each phase current. Therefore, 3Pole products may operate under its phase-unbalance including ground fault situations. (R+S+T+(N) Phase)
4. When ZSI function was set, the protection operation will take place instantaneously with input absence by downstream devices. It is advised to disable its ZSI function on the last downstream device.
5. Ground-fault functions are basically provided with products equipped with a trip relay through its internal CT that is embedded in each phase. (But, it can't be used with earth-leakage protection function at the same time)

## Earth Leakage (G) - Option

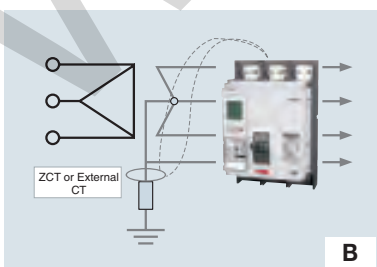


**The function for breaking earth leakage current above setting value after time delay to protect the circuit from earth leakage. (A, P, S type)**

1. Standard setting current knob:  $I_{\Delta n}$ 
  - Setting range: 0.5-1-2-3-4-5-10-20-30-Off (A)
2. Time delay setting knob:  $\Delta t$ 
  - Trip time: 140-230-350-800 ms
  - Alarm time: 140-230-350-800-950 ms
3. Settings within its alarm range will prevent its breaker from tripping but activating its alarm.
4. This function is enabled and can be used only with standard ZCT provided by LS or private external CT (secondary output 5A) selected by customers.
5. When ZSI function was set, the protection operation will take place instantaneously with input absence by downstream devices. It is advised to disable its ZSI function on the last downstream device.



A



B

### ※ Use cautions with earth-leakage current settings

- When using a standard ZCT provided by LS, the setting range is from 0.5 to 30A which is based on its primary current. But MCCB installed like A type (displayed on the left side) should only be cable-connected and its rated current should be less than 1600A.
- When using other CT selected by customers, the setting range is from 0.5 to 5A based on its secondary current. (Secondary output rating : 5A)  
Hence, under 100:5A CT, if trip relay is set to 0.5A, earth-leakage exceeding 10A will activate its operation ( $0.5A \times 20 = 10A$ )

### ※ Guideline for the external CT usage

- Earth-leakage protection characteristics using the standard CT which is installed inside of MCCB can protect currents from 20 to 100% range on its rated current.
- As rated currents on MCCB increases, current that is covered by its standard CT increase as well. This can not protect against small leakage currents.  
ex) 400A MCCB Min. Earth-leakage current  $400A \times 20\% = 80A$   
4000A MCCB Min. Earth-leakage current  $4000A \times 20\% = 800A$
- Therefore, customers are advised to install an external CT in accordance with its rated currents within its systems. And choose trip relay (E, X type) which is required with external CT usage in order to provide earth-leakage functions.



# MCCBs for power distribution 1600A

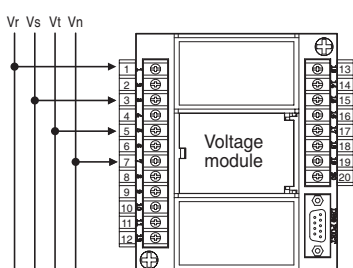
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## Measurement function

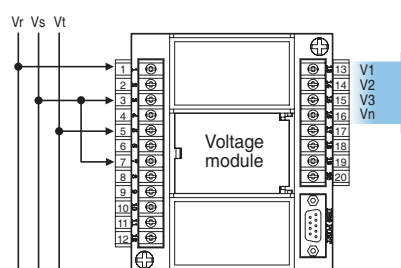
| Class.       | Measurement element   | Detailed element                             | Unit           | Display range       | Accuracy |
|--------------|-----------------------|----------------------------------------------|----------------|---------------------|----------|
| Current      | Line current          | Ia, Ib, Ic                                   | A              | 80A~65,535A         | ±3%      |
|              | Normal current        | I <sub>1</sub>                               |                |                     |          |
|              | Reverse current       | I <sub>2</sub>                               |                |                     |          |
| Voltage      | Line voltage          | Vab, Vbc, Vca                                | V              | 60~690V             | ±1%      |
|              | Phase voltage         | Va, Vb, Vc                                   |                |                     | ±1%      |
|              | Normal voltage        | V <sub>1</sub>                               |                |                     |          |
|              | Reverse voltage       | V <sub>2</sub>                               |                |                     |          |
| Angle        | Line-to-line          | ∠VabIa, ∠Vabl, ∠Vablc,                       | °              | 0~360°              | ±1°      |
|              | Line-to-current       | ∠VabVbc, ∠VabVca                             |                |                     | ±1°      |
|              | Phase-to-phase        | ∠VaVb, ∠VaVc                                 |                |                     | ±1°      |
|              | Phase-to-current      | ∠Vala, ∠Vblb, ∠Vclc                          |                |                     | ±1°      |
| Power        | Active power          | Pa(ab), Pb(bc), Pc(ca), P                    | kW             | 1kW~99,999kW        | ±3%      |
|              | Reactive power        | Qa(ab), Qb(bc), Qc(ca), Q                    | kVar           | 1kVar~99,999kVar    | ±3%      |
|              | Apparent power        | Sa(ab), Sb(bc), Sc(ca), S                    | kVA            | 1kVA~99,999kVA      | ±3%      |
| Energy       | Active energy         | WHa(ab), WHb(bc), WHc(ca), WH                | kWh<br>MWh     | 1kWh~9999.99MWh     | ±3%      |
|              | Reactive energy       | VARHa(ab), VARHb(bc), VARHc(ca), VARH        | kVarh<br>Mvarh | 1kVarh~9999.99MVarh | ±3%      |
|              | Reverse active energy | rWHa(ab), rWHb(bc), rWHc(ca), rWH            | kWh<br>MWh     | 1kWh~9999.99MWh     | ±3%      |
| Freq.        | Frequency             | F                                            | Hz             | 45~65Hz             |          |
| Power factor | Power factor(PF)      | PFa(ab), PFb(bc), PFc(ca), PF                |                | + : Lead, - : Lag   |          |
| Unbalance    | Unbalance rate        | Iunbalance, Vunbalance                       | %              | 0.0~100.0           |          |
| Demand       | Active power demand   | Peak demand                                  | kW             | 1kW~99999kW         |          |
|              | Current demand        | Peak demand                                  | A              | 80A~65,535A         |          |
| Harmonics    | Voltage harmonics     | 1st~63th harmonics of Va(ab), Vb(bc), Vc(ca) | V              | 60~690V             |          |
|              | Current harmonics     | 1st~63th harmonics of Ia, Ib, Ic             | A              | 80A~65,535A         |          |
|              | THD, TDD              |                                              | %              | 0.0~100.0           |          |
|              | K-Factor              |                                              | -              | 0.0~100.0           |          |

### Voltage module

For P and S type Trip relay, separate voltage module is necessary to measure other element besides current (Separate purchase is needed)  
- Voltage input range: AC 60~690V



3P4W wiring



3P3W wiring

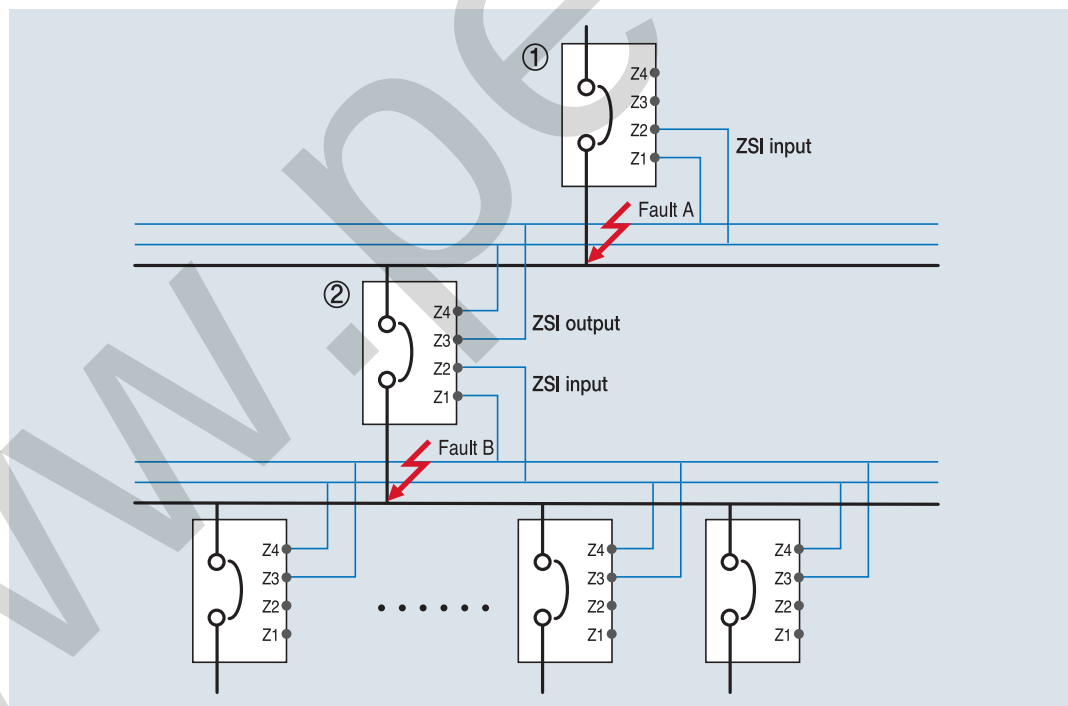
# MCCBs for power distribution 1600A

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## ZSI - Zone Selective Interlocking (A, P, S type)

**Zone-selective interlocking drops delay time that eliminates faults for breakers. It minimizes the shock that all kinds of electric machineries get under fault conditions.**

1. In case of that short time-delay or ground fault accident occurs at ZSI built in system, the breaker at accident site sends ZSI signal to halt upstream breaker's operation.
2. To eliminate a breakdown, trip relay of MCCB at accident site activates trip operation without time delay.
3. The upstream breaker that received ZSI signal adhere to pre-set short time-delay or ground fault time-delay for protective coordination in the system. However upstream breaker that did not receive its signal will trip instantaneously.
4. For ordinary ZSI operation, it should arrange operation time accordingly so that downstream circuit breakers will react before upstream ones under overcurrent/short time delay/ground fault situations.
5. ZSI connecting line needs to be Max. 3m.



- 1) Occurrence of fault A
  - Only breaker ① performs instantaneous trip operation.
- 2) Occurrence of fault B
  - Breaker ② performs instantaneous trip operation, breaker ① performs trip operation after prearranged delay time
  - But if breaker ② did not break the fault normally, breaker ① performs instantaneous trip operation to protect system.

# MCCBs for power distribution 1600A

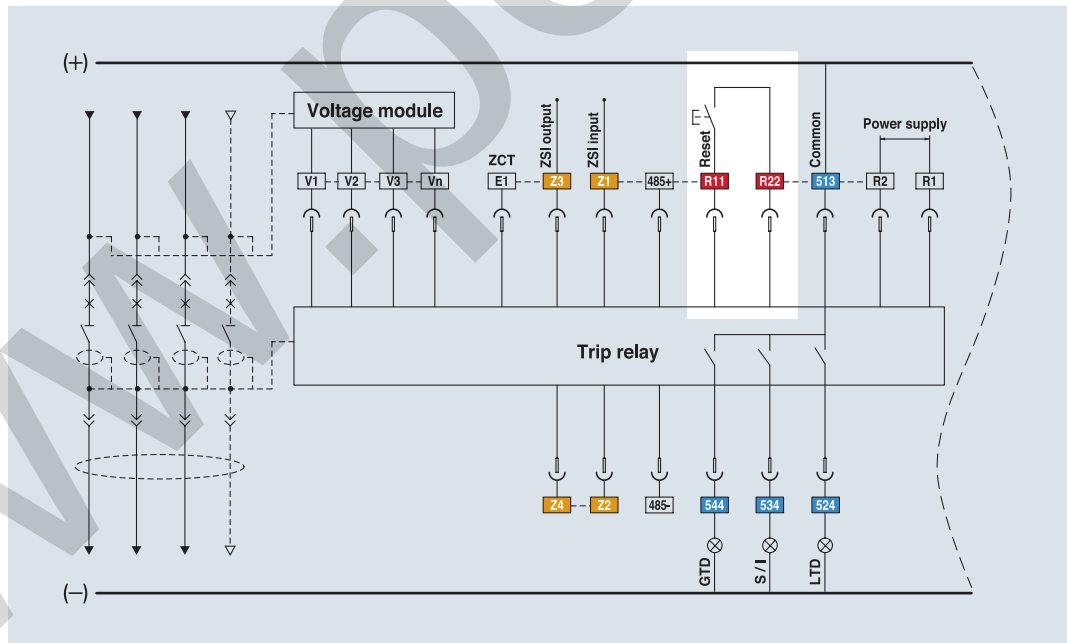
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## Remote reset and digital I/O (A, P, S type)

In case of that MCCB operates due to accidents or over current, Trip relay indicates the information of the accident through the LED and LCD. Trip relay A, P and S type is possible to perform the remote reset by digital input, and have 3 DO(Digital output).

1. Methods to reset Trip relay is to push the Reset button on the frontal side and to use the remote reset.
2. Digital input
  - [R11-R22] input: Remote reset
  - [Z1-Z2] Input: ZSI input
  - [E1-E2] Input: ZCT for earth leakage detection or external CT input

※All DI are dry contact that has 3.3V of recognition voltage. When inputting close by SSR(Solid State Relay) or open-collector, connect collector(Drain) to R11.
3. Digital output 3a(524, 534, 544-513)
  - Fault output: Long/Short time delay, Instantaneous, Ground fault, UVR, OVR, UFR, OFR, rPower, Vunbal, Iunbal (Maintains state as Latch form until user pushes reset.)
  - General DO: when setting L/R as remote, it is available to control close/open remotely by using communication.



| Trip Relay | Digital Output | Long time | Short time | Instantaneous | Ground | Overload Alarm | OVr | UVr | rPower | Vunbal | Iunbal | OFR | UFR | OPR | Note         |
|------------|----------------|-----------|------------|---------------|--------|----------------|-----|-----|--------|--------|--------|-----|-----|-----|--------------|
| P, S type  | DO1(524)       | ●         | ○          | ○             | ○      | ○              | ○   | ○   | ○      | ○      | ○      | ○   | ○   | ○   | Programmable |
|            | DO2(534)       | ○         | ●          | ●             | ○      | ○              | ○   | ○   | ○      | ○      | ○      | ○   | ○   | ○   |              |
|            | DO3(544)       | ○         | ○          | ○             | ●      | ○              | ○   | ○   | ○      | ○      | ○      | ○   | ○   | ○   |              |
| A type     | DO1(524)       | ●         | ×          | ×             | ×      | Not available  |     |     |        |        |        |     |     |     | Fixed        |
|            | DO2(534)       | ×         | ●          | ●             | ×      |                |     |     |        |        |        |     |     |     |              |
|            | DO3(544)       | ×         | ×          | ×             | ●      |                |     |     |        |        |        |     |     |     |              |

# MCCBs for power distribution 1600A

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## Communication

### Modbus/RS-485

- Operation mode: Differential
- Distance: Max. 1.2km
- Cable :  
General RS-485 shielded twist 2-pair cable
- Baud rate :  
9600bps, 19200bps, 38400bps
- Transmission method: Half-Duplex
- Termination: 150Ω

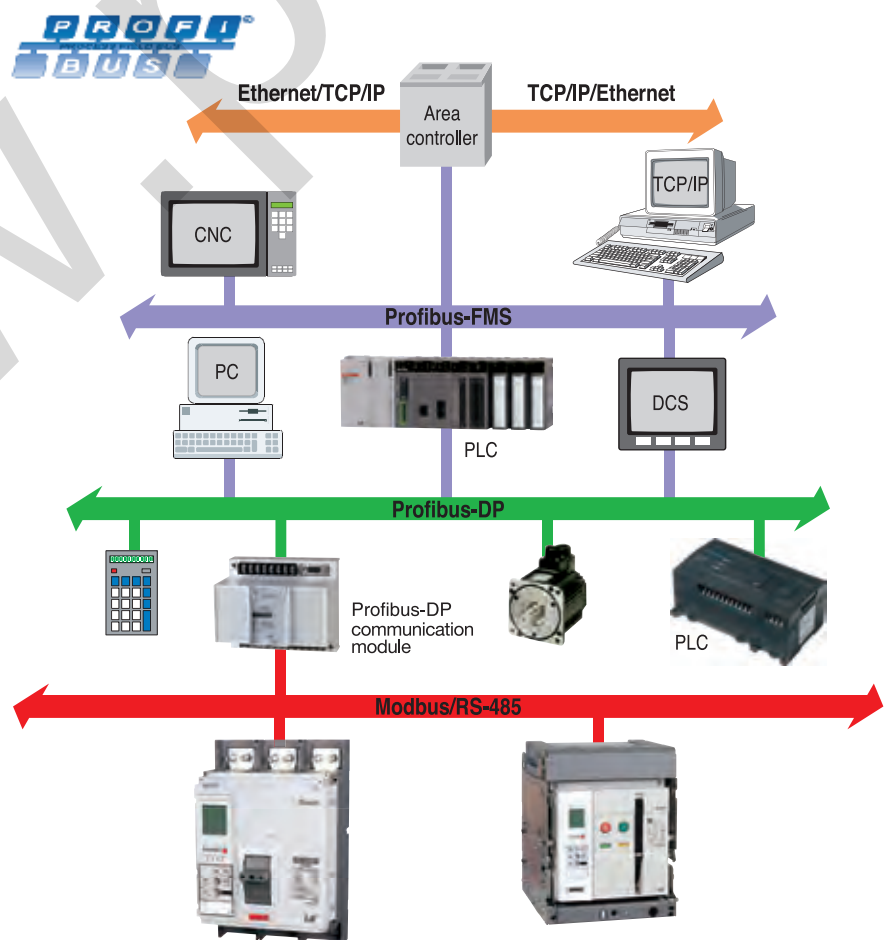


### Profibus-DP

- Profibus-DP module is installed separately (Option)
- Operation mode: Differential
- Distance: Max. 1.2km
- Cable :  
Profibus-DP shielded twist 2-pair cable
- Baud rate: 9600bps~12Mbps
- Transmission method: Half-Duplex
- Termination: 150Ω
- Standard: EN 50170 / DIN 19245



Profibus-DP communication module (Option)



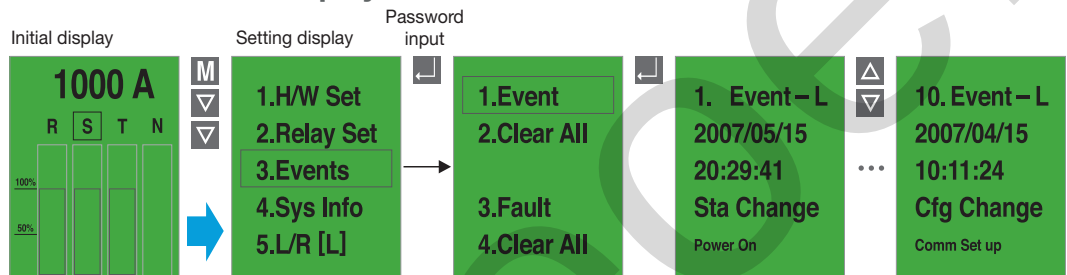
# MCCBs for power distribution 1600A

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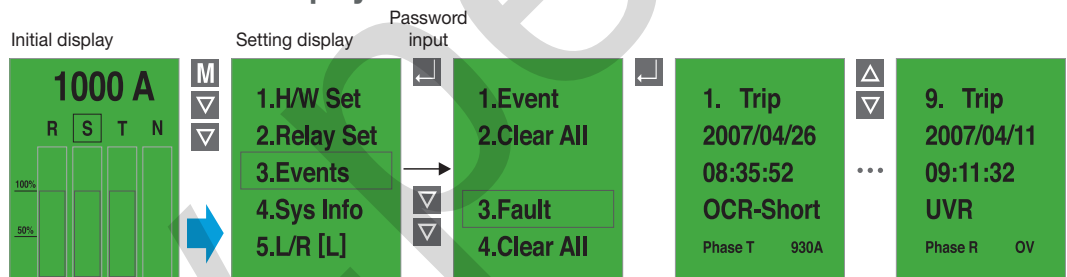
## Event & fault recording (P, S type)

When there are events such as setting change, Info. change, error of self-diagnose, state change, P and S type record Max. up to 256 information of the events in accordance with time(ms). In addition, they can record Max. up to 256(up to 10 for A type) information of the faults such as fault cause, fault phase, fault value and so on in accordance with time(ms).

### Event information display



### Fault information display

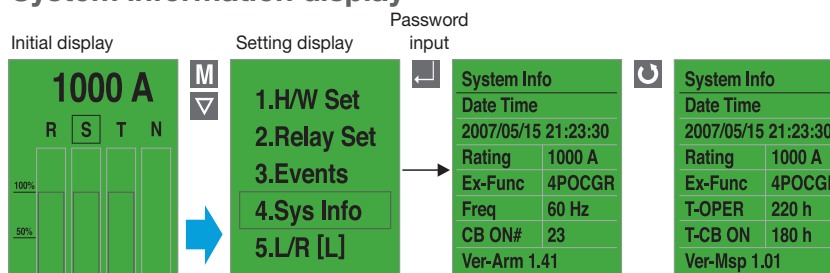


## System information

P and S type can indicate information as followings with the information of the MCCB.

- Present time: year/month/date/hour/minute/ms
- MCCB current ratings
- N-phase current ratings: 100%
- Frequency information: 60Hz / 50Hz
- Closing numbers of breaker: CB ON numbers
- Trip relay operating time: OCR ON time
- ON time of breaker: CB ON time
- S/W ver. information

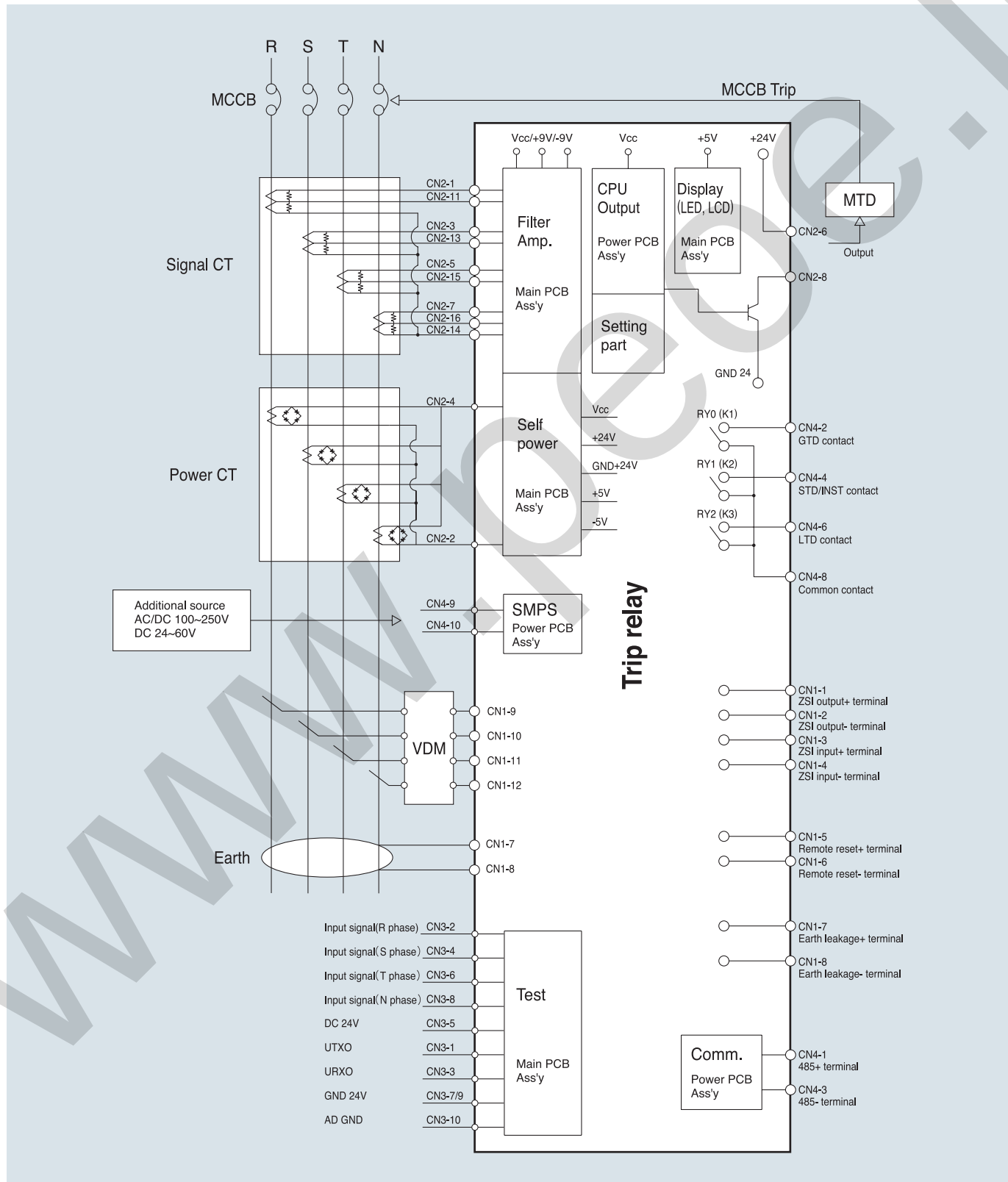
### System information display



# MCCBs for power distribution 1600A

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## System block diagram



# MCCBs for power distribution 1600A

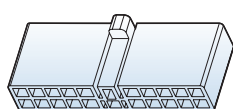
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## Installation and Handling

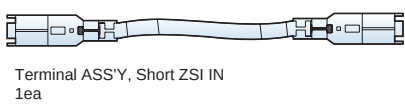
### Withdrawal Wiring for Trip Relay

#### Caution

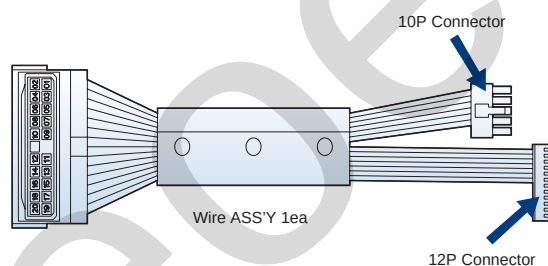
1. In case of disassembling and assembling the main cover, screw should be tightened in specific torque of 1.5N.m (15.3kgf.cm)
2. In case of disassembling and assembling the main cover by over tightening torque, the parts of MCCB can be damaged.



CONN.,172501-1, AMP  
1ea



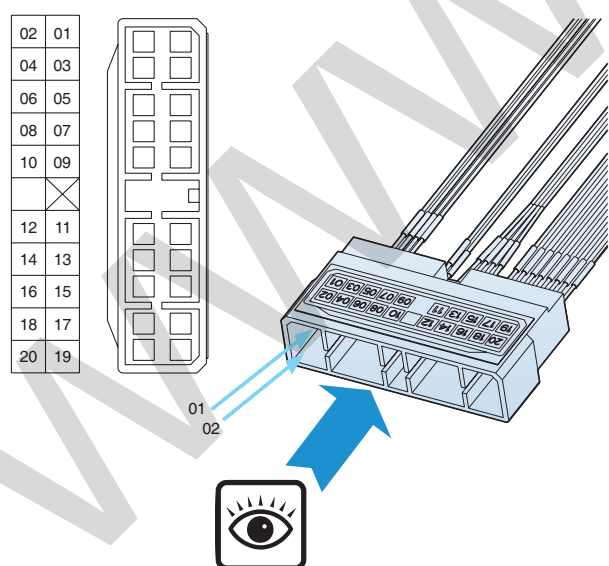
Terminal ASS'Y, Short ZSI IN  
1ea  
Terminal,172773-1, AMP  
25ea



### WIRE ASS'Y OCR types

| No. | Drawing No. | Part Name                  | Functions                                                                             | OCR       |
|-----|-------------|----------------------------|---------------------------------------------------------------------------------------|-----------|
| 1   | 76671176262 | WIRE ASS'Y AG AC OCR       | Communication, Digital Output, ZSI, Remote Reset                                      | A Type    |
| 2   | 76671176263 | WIRE ASS'Y A ZK PS CKA OCR | Communication, Digital Output, ZSI, Remote Reset, Earth Leakage(<30A), Voltage Module | P, S Type |
| 3   | 76671176264 | WIRE ASS'Y AE AX PX SX OCR | Communication, Digital Output, ZSI, Remote Reset, Earth Leakage(>30A), Voltage Module | P, S Type |

### Components of wire ass'y OCR and types



### Terminal number and Description

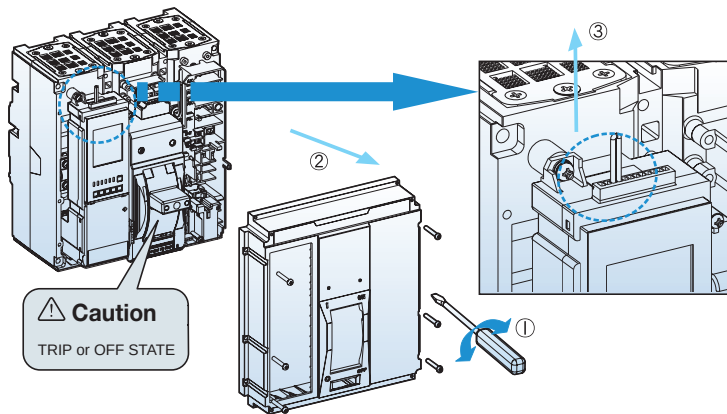
| Number | Marking  | Description                             |
|--------|----------|-----------------------------------------|
| 01     | 485+     | Comm. +                                 |
| 02     | 485-     | Comm. -                                 |
| 03     | R1       | Power +                                 |
| 04     | R2       | Power -                                 |
| 05     | 524      | Relay Output (Long time)                |
| 06     | 534      | Relay Output (Short time/Instantaneous) |
| 07     | 544      | Relay Output (Ground fault/PAL)         |
| 08     | 513      | Relay Output Common                     |
| 09     | Z3       | ZSI Out +                               |
| 10     | Z4       | ZSI Out -                               |
| 11     | Z1       | ZSI In +                                |
| 12     | Z2       | ZSI In -                                |
| 13     | R11      | Remote Reset +                          |
| 14     | R22      | Remote Reset -                          |
| 15     | E1 or B1 | Earth Leakage +                         |
| 16     | E2 or B2 | Earth Leakage -                         |
| 17     | V1       | VR Input                                |
| 18     | V2       | VS Input                                |
| 19     | V3       | VT Input                                |
| 20     | VN       | V Input Common                          |



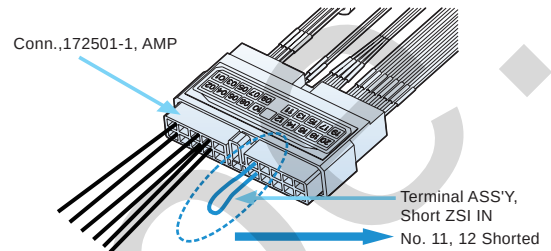
# MCCBs for power distribution 1600A

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## 1. Disassembling cover and short connector

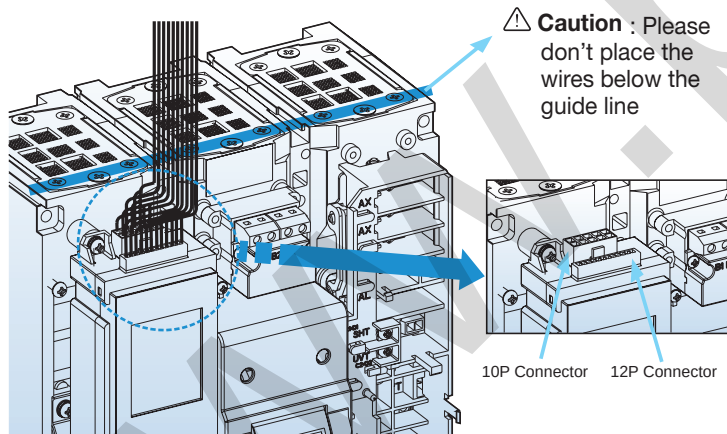


### In case of not using ZSI function



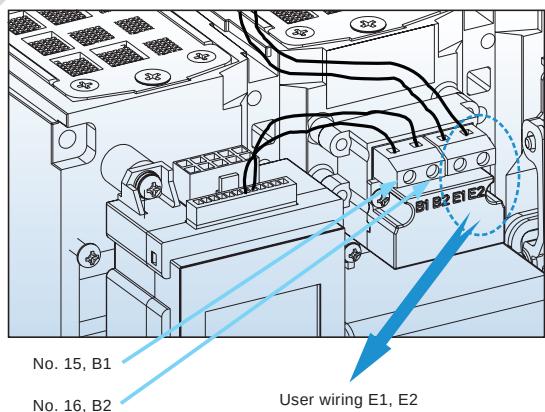
**Caution** : If not using ZSI function of Trip Relay (OCR), please short ZSI INPUT of terminal No.11,12 (ZSI IN +, ZSI IN-) by using the "TERMINAL ASS'Y, SHORT ZSI IN"

## 2. Assembly of wire ass'y and withdrawal of wire



### In case of the wiring of Earth Leakage $\geq 30A$

| Drawing No. | Part Name                  |
|-------------|----------------------------|
| 76671176264 | WIRE ASS'Y AE AX PX SX OCR |





# MCCBs for power distribution 1600A

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## Installation of withdrawal wiring for Trip Relay

### Trip Relay (OCR) type and applied wire ass'y

| No | Type | WIRE ASS'Y, [     ],OCR,TS1600 |                              |                              | No | Type | WIRE ASS'Y, [     ],OCR,TS1600 |                              |                              |
|----|------|--------------------------------|------------------------------|------------------------------|----|------|--------------------------------|------------------------------|------------------------------|
|    |      | [AG AC]<br>76671176262         | [A ZK PS CKA]<br>76671176263 | [AE AX PX SX]<br>76671176264 |    |      | [AG AC]<br>76671176262         | [A ZK PS CKA]<br>76671176263 | [AE AX PX SX]<br>76671176264 |
| 1  | NG0  |                                |                              |                              | 33 | PC1  |                                | ■                            |                              |
| 2  | NG5  |                                |                              |                              | 34 | PC2  |                                | ■                            |                              |
| 3  | AG0  |                                |                              |                              | 35 | PC6  |                                | ■                            |                              |
| 4  | AG1  | ■                              |                              |                              | 36 | PC7  |                                | ■                            |                              |
| 5  | AG2  | ■                              |                              |                              | 37 | PK1  |                                | ■                            |                              |
| 6  | AG5  |                                |                              |                              | 38 | PK2  |                                | ■                            |                              |
| 7  | AG6  | ■                              |                              |                              | 39 | PK6  |                                | ■                            |                              |
| 8  | AG7  | ■                              |                              |                              | 40 | PK7  |                                | ■                            |                              |
| 9  | AZ0  |                                |                              |                              | 41 | PX1  |                                |                              | ■                            |
| 10 | AZ1  |                                | ■                            |                              | 42 | PX2  |                                |                              | ■                            |
| 11 | AZ2  |                                | ■                            |                              | 43 | PX6  |                                |                              | ■                            |
| 12 | AZ5  |                                |                              |                              | 44 | PX7  |                                |                              | ■                            |
| 13 | AZ6  |                                | ■                            |                              | 45 | PA1  |                                | ■                            |                              |
| 14 | AZ7  |                                | ■                            |                              | 46 | PA2  |                                | ■                            |                              |
| 15 | AE0  |                                |                              |                              | 47 | PA6  |                                | ■                            |                              |
| 16 | AE1  |                                |                              | ■                            | 48 | PA7  |                                | ■                            |                              |
| 17 | AE2  |                                |                              | ■                            | 49 | SC1  |                                | ■                            |                              |
| 18 | AE5  |                                |                              |                              | 50 | SC2  |                                | ■                            |                              |
| 19 | AE6  |                                |                              | ■                            | 51 | SC6  |                                | ■                            |                              |
| 20 | AE7  |                                |                              | ■                            | 52 | SC7  |                                | ■                            |                              |
| 21 | AC1  | ■                              |                              |                              | 53 | SK1  |                                | ■                            |                              |
| 22 | AC2  | ■                              |                              |                              | 54 | SK2  |                                | ■                            |                              |
| 23 | AC6  | ■                              |                              |                              | 55 | SK6  |                                | ■                            |                              |
| 24 | AC7  | ■                              |                              |                              | 56 | SK7  |                                | ■                            |                              |
| 25 | AK1  |                                | ■                            |                              | 57 | SX1  |                                |                              | ■                            |
| 26 | AK2  |                                | ■                            |                              | 58 | SX2  |                                |                              | ■                            |
| 27 | AK6  |                                | ■                            |                              | 59 | SX6  |                                |                              | ■                            |
| 28 | AK7  |                                | ■                            |                              | 60 | SX7  |                                |                              | ■                            |
| 29 | AX1  |                                |                              | ■                            | 61 | SA1  |                                | ■                            |                              |
| 30 | AX2  |                                |                              | ■                            | 62 | SA2  |                                | ■                            |                              |
| 31 | AX6  |                                |                              | ■                            | 63 | SA6  |                                | ■                            |                              |
| 32 | AX7  |                                |                              | ■                            | 64 | SA7  |                                | ■                            |                              |
|    |      |                                |                              |                              | 65 | NV1  | ■                              |                              |                              |
|    |      |                                |                              |                              | 66 | NV6  | ■                              |                              |                              |

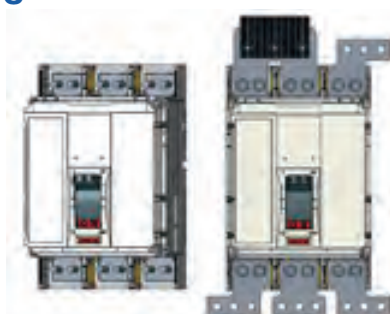
# Disconnectors Switch (1600AF)

Susol

## 1600AF Switch Disconnectors

### Products application & Function

- 4Pole: DC1150V/AC690V Switch disconnectors
- 3Pole: DC900V/AC690V Switch disconnectors
- 1000/1250/1600A DC/AC
- Uimp = 8kV
- IEC60947-3



(TS1250NA 3P)



(TS1600NA 4P)

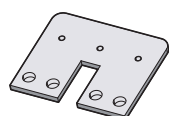
| Type                                                     |                       |                        | TS1000NA      | TS1250NA      | TS1600NA      |
|----------------------------------------------------------|-----------------------|------------------------|---------------|---------------|---------------|
| Frame size                                               | [AF]                  |                        | 1000          | 1250          | 1600          |
| Conventional thermal current, Ith                        | [A]                   |                        | 1000          | 1250          | 1600          |
| Rated operational current, Ie                            | [A]                   |                        | 1000          | 1250          | 1600          |
| No. of poles                                             | [Pole]                |                        | 3/4           | 3/4           | 3/4           |
| Rated operational voltage, Ue                            | DC/AC                 | 3pole [V]              | 900/690       | 900/690       | 900/690       |
|                                                          | DC/AC                 | 4pole [V]              | 1150/690      | 1150/690      | 1150/690      |
| Rated insulation voltage, Ui                             | DC                    | [V]                    | 1150          | 1150          | 1150          |
|                                                          | AC                    | [V]                    | 1000          | 1000          | 1000          |
| Rated impulse withstand voltage, Uimp                    | [kV]                  |                        | 8             | 8             | 8             |
| Rated short-circuit making capacity, Icm                 | DC                    | [kA peak]              | 25            | 25            | 25            |
|                                                          | AC                    | [kA peak]              | 52.5          | 52.5          | 52.5          |
| Rated short-time withstand current, Icw                  | 1sec                  | [kA rms]               | 25            | 25            | 25            |
| Utilization category                                     |                       |                        | DC22B/AC23B   | DC22B/AC23B   | DC22B/AC23B   |
| Isolation behavior                                       |                       |                        | ●             | ●             | ●             |
| Trip unit (Release)                                      | Disconnecter unit DSU |                        | ●             | ●             | ●             |
| Connection                                               | Fixed                 | Front-connection       | ●             | ●             | ●             |
|                                                          |                       | Rear-connection        | ●             | ●             | ●             |
| Life cycle <small>Note 1)</small>                        | Mechanical            | [Operations]           | 10,000        | 10,000        | 10,000        |
|                                                          | Electrical            | @ V DC [Operations]    | 500           | 500           | 500           |
|                                                          |                       | @ 690V AC [Operations] | 2,000         | 2,000         | 2,000         |
| Dimensions without accessories, W×H×D (Front connection) | 3pole                 | [mm]                   | 210×327×152.5 | 210×327×152.5 | 210×327×152.5 |
|                                                          | 4pole                 | [mm]                   | 280×327×152.5 | 280×327×152.5 | 280×327×152.5 |
| Weight without accessories (Front connection)            | 3pole                 | [kg]                   | 12            | 12            | 12            |
|                                                          | 4pole                 | [kg]                   | 17.8          | 17.8          | 17.8          |
| Reference standard                                       |                       |                        | IEC60947-3    | IEC60947-3    | IEC60947-3    |

Note) 1. Life cycle means not guarantee but limitation

(Quality guarantee: On/Off frequency on the basis of IEC60947-2 within the term of guarantee.)

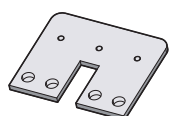
### Accessories

1) For TS1000NA DC



<Busbar>

2) For TS1250NA DC



<Busbar>

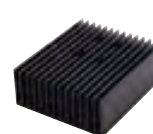


<Heatsink>

3) For TS1600NA DC



<Busbar>

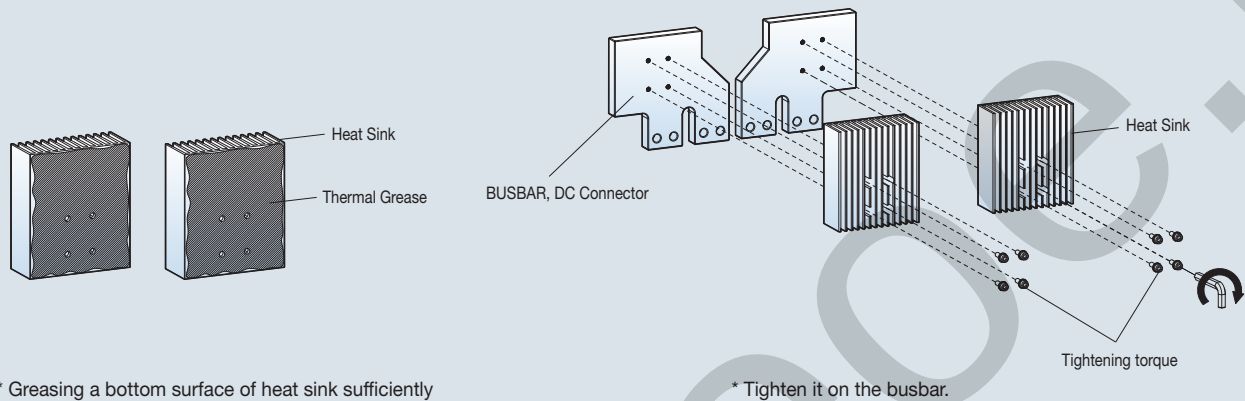


<Heatsink>

# Disconnectors Switch (1600AF)

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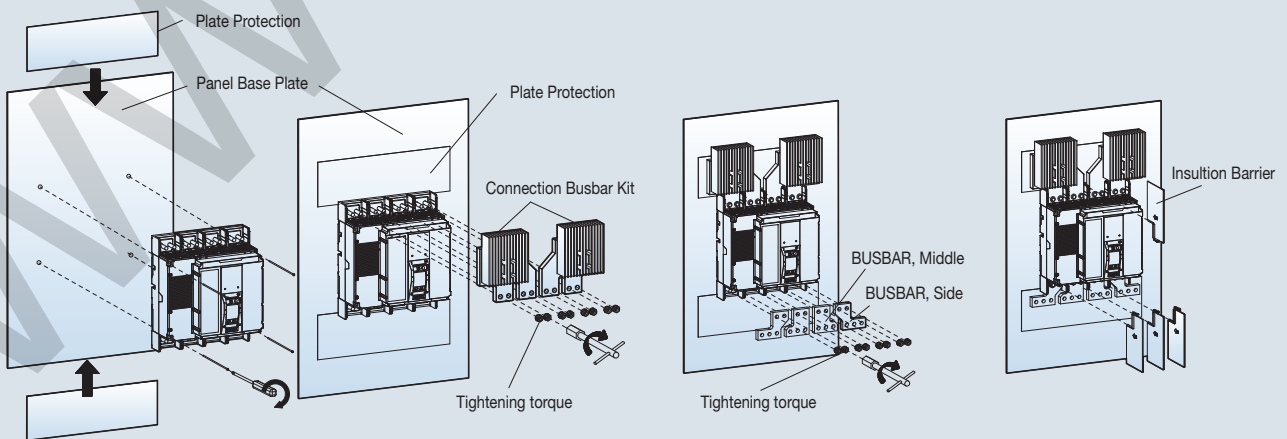
## Assembling Procedures



Note) 1. After greasing a bottom surface of heat sink sufficiently, tighten it on the busbar. (Thermal grease is not offered)  
2. Please attach Thermal grease to prevent overheating  
3. A Thermal grease Specification: YG6111, Silicone heat sink compound

## The Installation of the BUSBAR

1. Insert the plate protection between the panel base plate and MCCB after mounting MCCB on the panel base plate.
2. Install the BUSBAR to the circuit breaker as shown fig. below.  
(Conductors should be tightened with the torque specified to prevent fire accident.)
3. Fit the barriers to the circuit breaker after installing the BUSBAR.



\* Above bolts and washers are included in Spare Part of MCCB, so do not offer  
\* N-R Line side & S-T Line side Common Condition

## A-3. Accessories

### Accessories for TE series

|                              |       |
|------------------------------|-------|
| Overview .....               | A-3-1 |
| Electrical auxiliaries ..... | A-3-2 |
| Rotary handles .....         | A-3-5 |
| Terminals .....              | A-3-6 |
| Insulation .....             | A-3-7 |
| Interlock .....              | A-3-8 |
| Remote operation .....       | A-3-9 |

### Accessories for TD, TS up to 800A

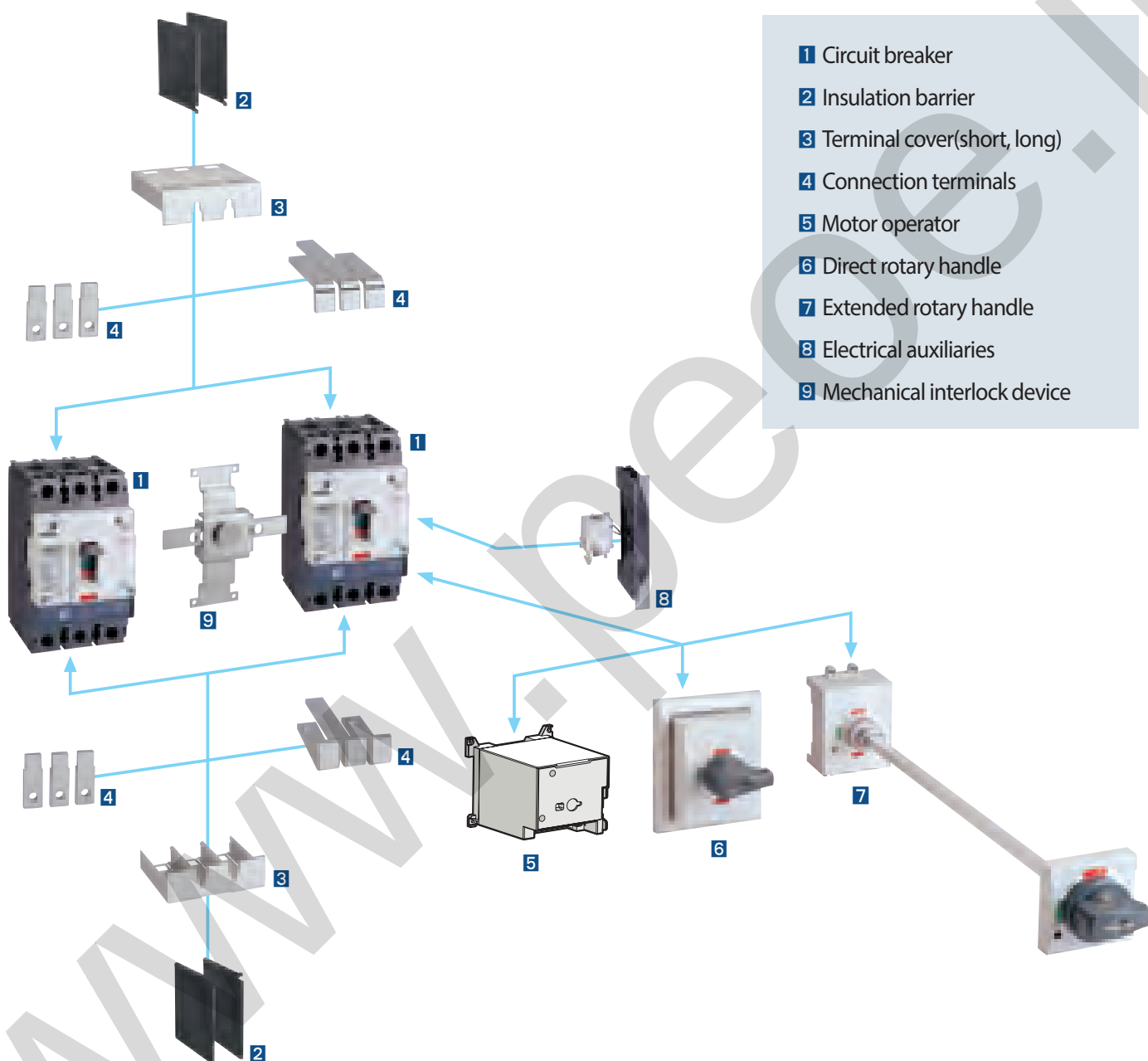
|                                      |        |
|--------------------------------------|--------|
| Overview .....                       | A-3-10 |
| Electrical auxiliaries .....         | A-3-11 |
| Rotary handles .....                 | A-3-15 |
| Locking devices .....                | A-3-17 |
| Terminals .....                      | A-3-20 |
| Insulation .....                     | A-3-25 |
| External Neutral CT (NCT) .....      | A-3-26 |
| Mechanical interlocking device ..... | A-3-27 |
| Plug-in device .....                 | A-3-28 |
| Connector KIT .....                  | A-3-33 |
| Remote operation .....               | A-3-35 |
| Electronic MCCB Tester .....         | A-3-38 |
| Residual Current Devices (RCD) ..... | A-3-40 |
| Standard accessories .....           | A-3-44 |

### Accessories for TS 1600A

|                                       |        |
|---------------------------------------|--------|
| Overview .....                        | A-3-45 |
| Electrical auxiliaries .....          | A-3-46 |
| OCR Tester (OT) .....                 | A-3-50 |
| UVT Time Delay Controller (UDC) ..... | A-3-51 |
| Rotary handles .....                  | A-3-52 |
| Locking devices .....                 | A-3-56 |
| Terminals .....                       | A-3-58 |
| Insulation .....                      | A-3-61 |
| Standard accessories .....            | A-3-62 |

# Accessories for TE series

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# Accessories for TE series

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## Auxiliary and Alarm switch



### Auxiliary switch (AX)

Auxiliary switch is for applications requiring remote “ON” and “OFF” indication. Each switch contains two contacts having a common connection. One is open and the other closed when the circuit breaker is open, and viceversa.



### Alarm switch (AL)

Alarm switches offer provisions for immediate audio or visual indication of a tripped breaker due to overload, short circuit, shunt trip, or undervoltage release conditions. They are particularly useful in automated plants where operators must be signaled about changes in the electrical distribution system. This switch features a closed contact when the circuit breaker is tripped automatically. In other words, this switch does not function when the breaker is operated manually. Its contact is open when the circuit breaker is reset.

### Combination switch (AX+AL)

It consists of one auxiliary switch (AX) and one alarm switch (AL) in a body to connect into the same position of the breaker.

### Contact

| MCCB | ON | OFF | TRIP |
|------|----|-----|------|
| AX   |    |     |      |
| AL   |    |     |      |

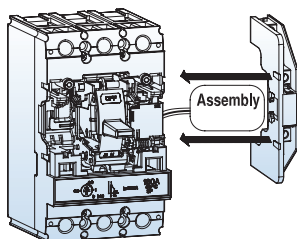
### Rating

|                                                                   |         |             |            |                         |                |
|-------------------------------------------------------------------|---------|-------------|------------|-------------------------|----------------|
| Conventional thermal current Ith                                  | 5A      |             |            |                         | TE100<br>TE160 |
| Rated operational current Ie<br>with rated operational voltage Ue | Voltage | Current, Ie |            | Minimum load<br>current |                |
|                                                                   |         | Resistance  | Inductance |                         |                |
| - Alternating current 50/60Hz AC                                  | 125V    | 5           | 3          | 5V DC 160mA             |                |
|                                                                   | 250V    | 3           | 2          |                         |                |
|                                                                   | 500V    | -           | -          |                         |                |
| - Direct current DC                                               | 30V     | 4           | 3          | 30V DC 30mA             |                |
|                                                                   | 125V    | 0.4         | 0.4        |                         |                |
|                                                                   | 250V    | 0.2         | 0.2        |                         |                |

# Accessories for TE series

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## Shunt trip, SHT



The shunt trip opens the mechanism in response to an externally applied voltage signal. The releases include coil clearing contacts that automatically clear the signal circuit when the mechanism has tripped. The shunt release can be installed in the right accessory compartment of the MCCBs.

- Range of operational voltage  
AC: 0.7~1.1Vn, DC: 0.8~1.1Vn
- Frequency(Only AC): 45Hz ~ 65Hz

## Rating (Terminal Block Type)



Terminal block type (TBT)

| Control voltage, Ue                 |                | Power consumption |        |     |
|-------------------------------------|----------------|-------------------|--------|-----|
|                                     |                | AC (VA)           | DC (W) | mA  |
| Voltage                             | AC/DC 12V      | 0.35              | 0.36   | 30  |
|                                     | AC/DC 24V      | 0.64              | 0.65   | 27  |
|                                     | AC/DC 48V      | 1.09              | 1.1    | 23  |
|                                     | AC/DC 60V      | 1.2               | 1.22   | 20  |
|                                     | AC/DC 100~130V | 0.73              | 0.75   | 5.8 |
|                                     | AC/DC 200~250V | 1.21              | 1.35   | 5.4 |
|                                     | AC 380~450V    | 1.67              | -      | 3.8 |
|                                     | AC 440~500V    | 1.68              | -      | 3.5 |
| Max.opening time                    |                | 50ms (max.)       |        |     |
| Tightening torque of terminal screw |                | 8.2 kgf · cm      |        |     |

## Rating (Lead Wire Type)



Lead wire type (LWT)

| Control voltage, Ue                 |                | Power consumption |        |
|-------------------------------------|----------------|-------------------|--------|
|                                     |                | AC (VA)           | DC (W) |
| Voltage                             | DC 12V         | -                 | 1.5    |
|                                     | AC/DC 24~30V   | 1.5               | 1.5    |
|                                     | AC/DC 48~60V   | 1.5               | 1.5    |
|                                     | AC/DC 100~130V | 1.5               | 1.5    |
|                                     | AC/DC 200~250V | 1.5               | 1.5    |
|                                     | AC 380~440V    | 1.5               | -      |
|                                     | AC 440~500V    | 1.5               | -      |
| Max.opening time                    |                | 50ms (max.)       |        |
| Tightening torque of terminal screw |                | 8.2 kgf·cm        |        |

# Accessories for TE series

Susol

## Undervoltage release, UVT

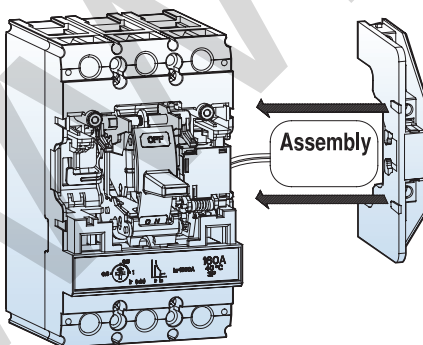


The undervoltage release automatically opens a circuit breaker when voltage drops to a value ranging between 20% to 70% of the line voltage. The operation is instantaneous, and after tripping, the circuit breaker cannot be re-closed again until the voltage returns to 85% of line voltage. Continuously energized, the undervoltage release must be operating before the circuit breaker can be closed. The undervoltage release can be easily installed in the right accessory compartment of the MCCBs.

- Range of tripping voltage: 0.2 ~ 0.7Vn
- MCCB making possible voltage: 0.85Vn (Exceed)
- Frequency (Only AC): 45Hz ~ 65Hz

### Rating

| Control voltage, Ue                 |                | Power consumption |        |     |
|-------------------------------------|----------------|-------------------|--------|-----|
|                                     |                | AC (VA)           | DC (W) | mA  |
| Voltage                             | AC/DC 24V      | 0.64              | 0.65   | 27  |
|                                     | AC/DC 48V      | 1.09              | 1.1    | 23  |
|                                     | AC/DC 100~110V | 0.73              | 0.75   | 5.8 |
|                                     | AC/DC 200~220V | 1.21              | 1.35   | 5.4 |
|                                     | AC 380~440V    | 1.67              | -      | 3.8 |
|                                     | AC 440~480V    | 1.68              | -      | 3.5 |
| Max.opening time                    |                | 50ms (max.)       |        |     |
| Tightening torque of terminal screw |                | 8.2 kgf · cm      |        |     |
| Operating voltage range             | Trip           | 20~70% Vn         |        |     |
|                                     | Reset/Closing  | ≥ 0.85Vn          |        |     |



### Maximum possibilities

| Position        | Type    | TE160 |
|-----------------|---------|-------|
|                 |         | 3/4P  |
| Left-hand seat  | AX      | 1     |
|                 | AL      | 1     |
| Right-hand seat | AX      | 1     |
|                 | AL      | 1     |
|                 | SHT/UVT | 1     |

Note) Right-hand seat can be installed only one Electrical Accessory



# Accessories for TE series

Susol

## Rotary handles



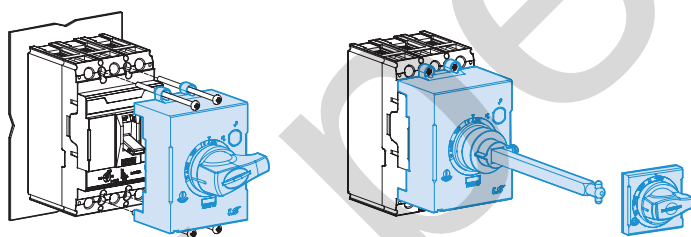
The rotary handle operating mechanism is available in either the direct version or in the extended version on the compartment door. It is always fitted with a compartment door lock and on a request it can be supplied with a key lock in the open position.

### Direct rotary handles

| MCCB      | Rotary handle |
|-----------|---------------|
| TE100/160 | DH1E          |

### Extended rotary handles

| MCCB      | Rotary handle |
|-----------|---------------|
| TE100/160 | EH1E          |



### Degree of protections

| Type | Degree of protection                                                        |
|------|-----------------------------------------------------------------------------|
| DH1E | The access probe of 1.0mm diameter shall not penetrate                      |
| EH1E | Totally protected against ingress of dust and water jets from any direction |

# Accessories for TE series

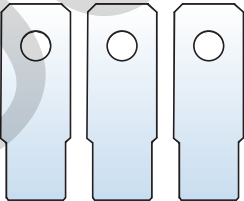
Susol

## Terminals

### Front connection

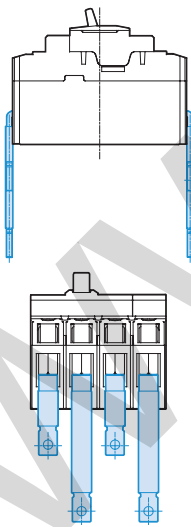
#### Extended terminal

- As an optional part of circuit breaker
- Can increase the pitch of the terminals

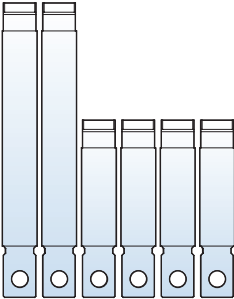
| MCCB      | Pole | Type  | Feature                                                                             |
|-----------|------|-------|-------------------------------------------------------------------------------------|
| TE100/160 | 3P   | ET13E |  |
|           | 4P   | ET14E |                                                                                     |

### Rear connection

Rear connection terminals are used to adapt Susol TE circuit breakers to switchboards or other application that require rear connection.  
These can be connected directly to circuit breakers without any modification.



#### Flat terminals

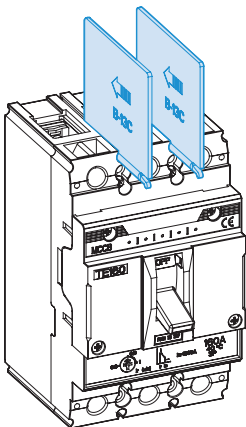
| MCCB      | Pole | Type  | Feature                                                                               |
|-----------|------|-------|---------------------------------------------------------------------------------------|
| TE100/160 | 3P   | RTF13 |  |
|           | 4P   | RTF14 |                                                                                       |

# Accessories for TE series

Susol

## Insulation

### Insulation by barrier



These allow the insulation characteristics between the phases at the connections to be increased. They are mounted from the front, even with the circuit-breaker already installed, inserting them into the corresponding slots. They are incompatible with both the insulating terminal covers. It is possible to mount the phase separating partitions between two circuit-breakers side by side.

| Type | Applied MCCB | Set quantity |      |
|------|--------------|--------------|------|
| B13C | TE100, TE160 | 3P           | 4P   |
|      |              | 4pcs         | 6pcs |

### Insulation by terminal cover

#### Insulation terminal cover

The terminal covers are applied to the circuit-breaker to prevent accidental contact with live parts and thereby guarantee protection against direct contacts.

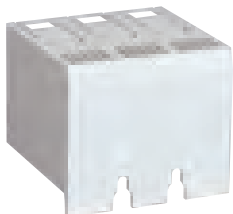
#### Two types by length are available:

Short type covers, ITS  
- IP40 degree of protection  
- For fixed circuit-breakers with rear terminals and for moving parts of plug-in

Long type covers, ITL  
- IP40 degree of protection  
- For fixed circuit-breakers with front, front extended, front for cables terminals.



Short type covers



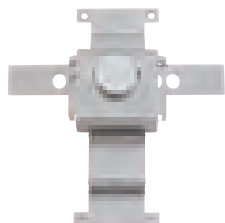
Long type covers

| Type         |      | Terminal cover |            |
|--------------|------|----------------|------------|
| Frame type   | pole | Long type      | Short type |
| TE100, TE160 | 3P   | ITL13E         | ITS13E     |
|              | 4P   | ITL14E         | ITS14E     |

# Accessories for TE series

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## Interlock



Mechanical Interlock  
(Padlocks are not supplied)

### Mechanical interlocking device

The mechanical interlock (MIT) can be applied on the front of two breakers mounted side by side, in either the 3-pole or 4-pole version and prevents simultaneous closing of the two breakers.

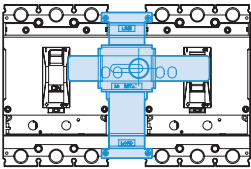
Fixing is carried out directly on the cover of the breakers.

The front interlocking plate allows installation of a padlock in order to fix the position. (possibility of locking in the O-O position as well)

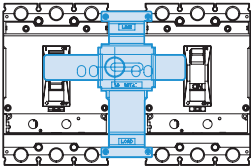
This mechanical interlocking device is very useful and simple for consisting of manual source-changeover system.

| MCCB         |      | Interlock |
|--------------|------|-----------|
| Frame type   | pole |           |
| TE100, TE160 | 3P   | MIT13E    |
|              | 4P   | MIT14E    |

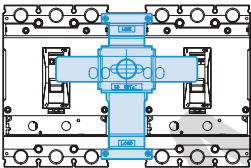
### Operation



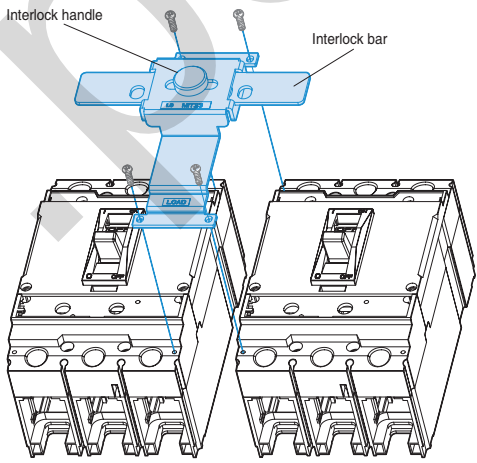
Left MCCB: ON/OFF is possible  
Right MCCB: Off lock



Left MCCB: Off lock  
Right MCCB: ON/OFF is possible



Both MCCBs are of locked



Note) Terminal covers do not use with the interlock.

# Accessories for TE series

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## Remote operation

### Motor operator

Motor operators can also be operated by manual. The motor drives a mechanism which switches TE toggle handle to the "ON" and "OFF/RESET" positions.

- The manual actuator handle is located on the front of the cover.
- Manual or Automatic operation can be selected.
- Applicable to 3 and 4-pole breakers.

The motor operator is an essential device for constructing a remote operated automatic source-changeover system to ensure a continuous supply of electrical power at following certain installations:

- Commercial sector: Hospital, Tall building, Bank, Insurance companies, Shopping centers
- Industry: Ships, Assembly lines at plant, Military sites, Port and Railway installation



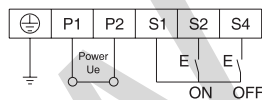
TE160 + MOP-M7

| MCCB                 | Type   | Control voltage                                                | Actuation current (A)         | Response time (ms) |         | Consumption (W) | Mechanical service life (operations) | No. of operations per hour |
|----------------------|--------|----------------------------------------------------------------|-------------------------------|--------------------|---------|-----------------|--------------------------------------|----------------------------|
|                      |        |                                                                |                               | Closing            | Opening |                 |                                      |                            |
| TE100, TE160 (3P/4P) | MOP-M7 | ① DC 24V<br>② AC 100~110V/<br>DC 110V<br>③ AC 230V/<br>DC 220V | ≤3A<br>(DC 24V)<br>≤0.5A (AC) | 700                | 700     | 14              | 10,000                               | 120                        |

### Wiring connection

#### Standard connection

Circuit breaker On and Off controlled by remote operation and manual operation



#### Connection with alarm switch (AL)

- 1) The below connection diagram is the method of using a alarm switch (AL) without shunt or undervoltage trip.
- 2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.

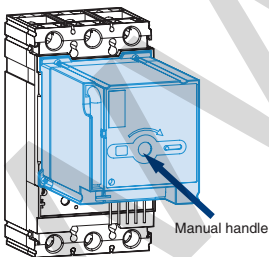
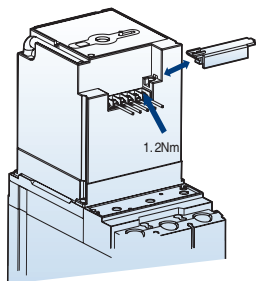
### Manual operation

- 1) Insert the manual handle into the slot of Motor Operator surface and rotate it clockwise.
- 2) It must be rotated just 180° clockwise for safe operation of micro switch in the motor operator.
- 3) Return the manual handle after the manual operation
- 4) Turn the slide switch back to the position of AUTO.

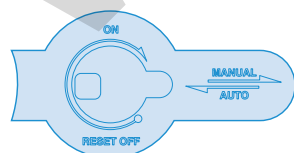
CAUTION: When the circuit breaker is tripped by trip button in the OFF status, it is impossible to operate motor operator automatically It must be reset by manual operation.

### Automatic operation

- 1) Set the slide switch to AUTO, then internal power is closed automatically.
- 2) Operating frequency should be less than these below regulated values.  
TE100N/S, TE160N/S:180 operations per hour
- 3) Use the ON/OFF switch in the range of regulated values.
- 4) It may interfere near communication equipments because of internal switching power supply.  
It's recommended that a noise filter be installed to power supply.
- 5) Please do not input ON/OFF signals at the same time during the automatic operation.
- 6) If the circuit breaker has a UVT attached inside, charge a UVT on the rated voltage before performing MOTOR OPERATOR.



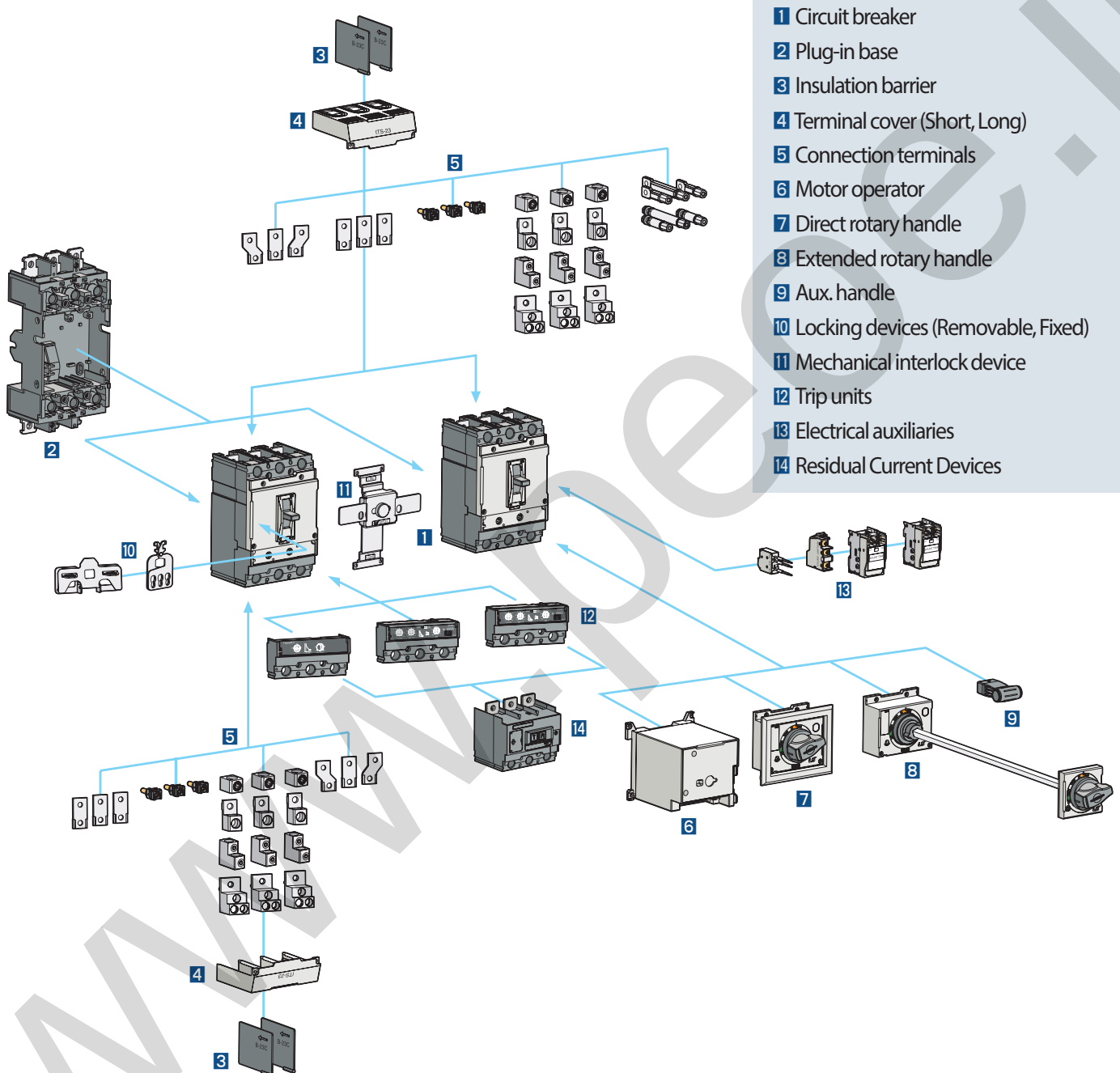
Manual handle



[TE100, TE160]

# Accessories for TD/TS series up to 800A

Susol



# Accessories for TD/TS series up to 800A

Susol

## Electrical auxiliaries

The following devices are installed into all TD & TS circuit breakers regardless of frame size. And, the electrical auxiliaries can be easily installed in the accessory compartment of the circuit breakers which is cassette type.



UVT

### Undervoltage release, UVT

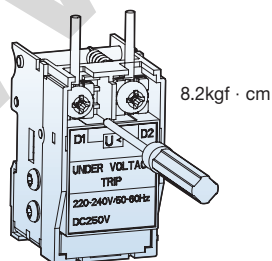
The undervoltage release automatically opens a circuit breaker when voltage drops to a value ranging between 35% to 70% of the line voltage. The operation is instantaneous, and after tripping, the circuit breaker cannot be re-closed again until the voltage returns to 85% of line voltage.

Continuously energized, the undervoltage release must be operating before the circuit breaker can be closed. The undervoltage release can be easily installed in the left accessory compartment of the Susol TD and TS circuit-breakers.

- Range of tripping voltage: 0.35 ~ 0.7Vn
- MCCB making is possible voltage: 0.85Vn (exceed)
- Frequency (only AC): 45Hz ~ 65Hz

### Technical data

| Power consumption                           | Control voltage (V) | Consumption           |        |     | Applicable MCCBs                                                |
|---------------------------------------------|---------------------|-----------------------|--------|-----|-----------------------------------------------------------------|
|                                             |                     | AC (VA)               | DC (W) | mA  |                                                                 |
|                                             | AC/DC 24V           | 0.64                  | 0.65   | 27  | TD100, TD160,<br>TS100, TS160,<br>TS250, TS400,<br>TS630, TS800 |
|                                             | AC/DC 48V           | 1.09                  | 1.10   | 23  |                                                                 |
|                                             | AC/DC 110~130V      | 0.73                  | 0.75   | 5.8 |                                                                 |
|                                             | AC 200~240V/DC 250V | 1.21                  | 1.35   | 5.4 |                                                                 |
|                                             | AC 380~440V         | 1.67                  | -      | 3.8 |                                                                 |
| AC 440~480V                                 | 1.68                | -                     | 3.5    |     |                                                                 |
| Max.opening time (ms)                       |                     | 50                    |        |     |                                                                 |
| Tightening torque of terminal screw         |                     | 8.2kgf · cm           |        |     |                                                                 |
| Transformer operating voltage (V)           |                     | 0.7~1.35Vn<br>~0.85Vn |        |     |                                                                 |
| - Drop (Circuit breaker trips)              |                     |                       |        |     |                                                                 |
| - Rise (Circuit breaker can be switched on) |                     |                       |        |     |                                                                 |



# Accessories for TD/TS series up to 800A

Susol

## Electrical auxiliaries



SHT

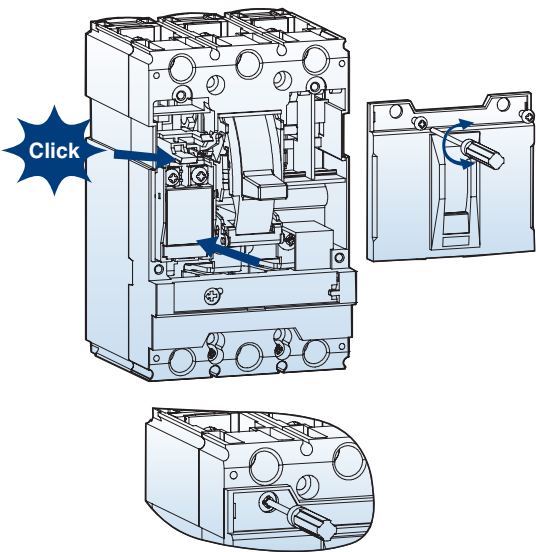
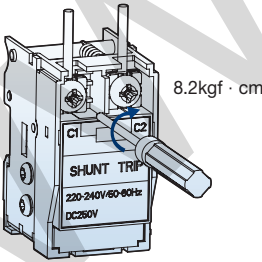
### Shunt release, SHT

The shunt release opens the mechanism in response to an externally applied voltage signal. The releases include coil clearing contacts that automatically clear the signal circuit when the mechanism has tripped. The shunt release can be installed in the left accessory compartment of the Susol TD & TS circuit-breakers.

- Range of operational voltage: 0.7 ~ 1.1Vn
- Frequency (only AC): 45Hz ~ 65Hz

### Technical data

| Power consumption                   | Control voltage (V) | Consumption |        |      | Applicable MCCBs                                                |
|-------------------------------------|---------------------|-------------|--------|------|-----------------------------------------------------------------|
|                                     |                     | AC (VA)     | DC (W) | mA   |                                                                 |
|                                     | DC 12V              | -           | 0.36   | 30   |                                                                 |
|                                     | AC/DC 24V           | 0.58        | 0.58   | 24   |                                                                 |
|                                     | AC/DC 48V           | 1.22        | 1.23   | 25   |                                                                 |
|                                     | AC/DC 110~130V      | 1.36        | 1.37   | 10.5 |                                                                 |
|                                     | AC 220~240V/DC250V  | 1.80        | 1.88   | 7.5  |                                                                 |
|                                     | AC 380~500V         | 1.15        | -      | 2.3  | TD100, TD160,<br>TS100, TS160,<br>TS250, TS400,<br>TS630, TS800 |
| Max.opening time (ms)               |                     | 50          |        |      |                                                                 |
| Tightening torque of terminal screw |                     | 8.2kgf · cm |        |      |                                                                 |





# Accessories for TD/TS series up to 800A

Susol

## Electrical auxiliaries

### Auxiliary switch (AX), Alarm switch (AL) and Fault alarm switch (FAL)

#### Auxiliary switch (AX)

Auxiliary switch is for applications requiring remote “ON” and “OFF” indication. Each switch contains two contacts having a common connection. One is open and the other closed when the circuit breaker is open, and vice-versa.

#### Alarm switch (AL)

Alarm switches offer provisions for immediate audio or visual indication of a tripped breaker due to overload, short circuit, shunt trip, or undervoltage release conditions. They are particularly useful in automated plants where operators must be signaled about changes in the electrical distribution system. This switch features a closed contact when the circuit breaker is tripped automatically. In other words, this switch does not function when the breaker is operated manually. Its contact is open when the circuit breaker is reset.

#### Fault alarm switch (FAL)

FAL Indicates that the breaker has tripped due to overload or short circuit. And, it can be applied to only circuit breakers with electronic trip units.

#### Contact operation

| MCCB                | ON | OFF | TRIP |
|---------------------|----|-----|------|
| Position of AX      |    |     |      |
| Position of AL, FAL |    |     |      |

#### Technical data

|                                                                                           |         |                         |            |                         |       |
|-------------------------------------------------------------------------------------------|---------|-------------------------|------------|-------------------------|-------|
| Conventional thermal current I <sub>th</sub>                                              | 5A      |                         |            |                         | TD100 |
| Rated operational current I <sub>e</sub><br>with rated operational voltage U <sub>e</sub> | Voltage | Current, I <sub>e</sub> |            | Minimum load<br>current |       |
|                                                                                           |         | Resistance              | Inductance |                         |       |
| - Alternating current 50/60Hz AC                                                          | 125V    | 5                       | 3          | 5V DC 160mA             | TS100 |
|                                                                                           | 250V    | 3                       | 2          |                         | TS160 |
|                                                                                           | 500V    | -                       | -          |                         | TS250 |
| - Direct current DC                                                                       | 30V     | 4                       | 3          | 30V DC 30mA             | TS400 |
|                                                                                           | 125V    | 0.4                     | 0.4        |                         | TS630 |
|                                                                                           | 250V    | 0.2                     | 0.2        |                         | TS800 |

# Accessories for TD/TS series up to 800A

Susol

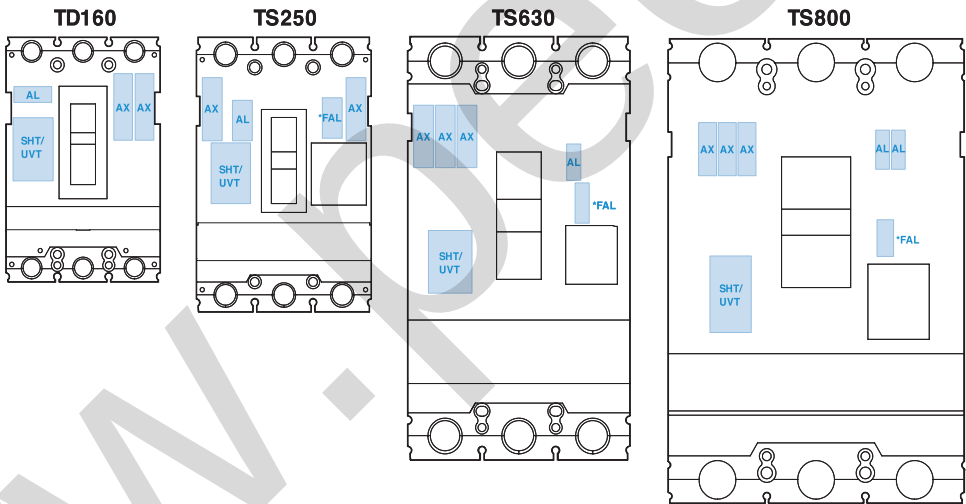
## Electrical auxiliaries

### Possible configuration of electrical auxiliaries

#### Maximum possibilities

| Phase     | Accessory  | TD160 | TS250 | TS630 | TS800 |
|-----------|------------|-------|-------|-------|-------|
| R (Left)  | AX         | -     | 1     | 3     | 3     |
|           | AL         | 1     | 1     | -     | -     |
|           | SHT or UVT | 1     | 1     | 1     | 1     |
| T (Right) | AX         | 2     | 1     | -     | -     |
|           | AL         | -     | -     | 1     | 2     |
|           | FAL        | -     | 1     | 1     | 1     |

Note) FAL can be applied to only MCCB with electronic trip release.



# Accessories for TD/TS series up to 800A

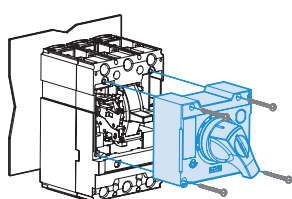
Susol

## Rotary handles

### Rotary handles

The rotary handle operating mechanism is available in either the direct version or in the extended version on the compartment door.

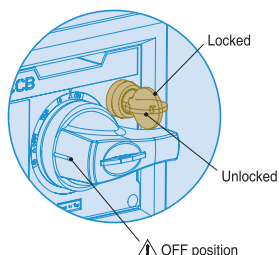
It is always fitted with a compartment door lock and on a request it can be supplied with a key lock in the open position.



Direct rotary handles

#### Direct rotary handles

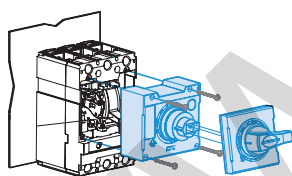
| MCCB              | Rotary handle |
|-------------------|---------------|
| TD100,TD160       | DH1           |
| TS100,TS160,TS250 | DH2           |
| TS400,TS630       | DH3           |
| TS800             | DH4           |



Direct rotary handle with a key lock

#### Direct rotary handles with a key lock

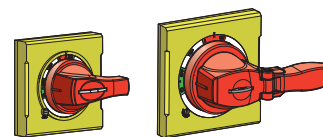
| MCCB                | Padlockable device | Lock function              |
|---------------------|--------------------|----------------------------|
| TD100, TD160        | DHK1               | Lock in On or Off position |
| TS100, TS160, TS250 | DHK2               |                            |
| TS400, TS630        | DHK3               |                            |
| TS800               | DHK4               |                            |



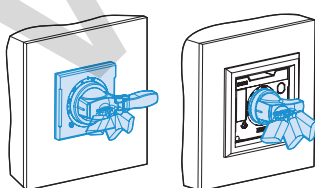
Extended rotary handles

#### Extended rotary handles

| MCCB              | Padlockable device |
|-------------------|--------------------|
| TD100,TD160       | EH1                |
| TS100,TS160,TS250 | EH2                |
| TS400,TS630       | EH3                |
| TS800             | EH4                |



Red/Yellow color handle available



Padlocks for direct or extended handle

Padlocks can be used to lock the breaker in the ON or OFF position.

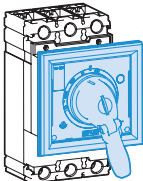
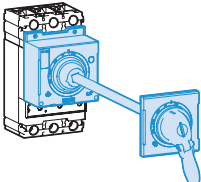
# Accessories for TD/TS series up to 800A

Susol

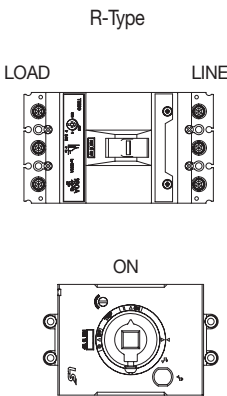
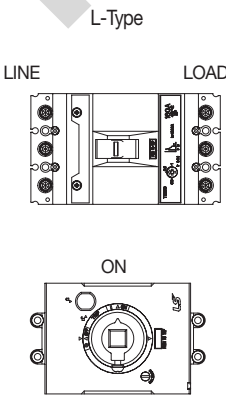
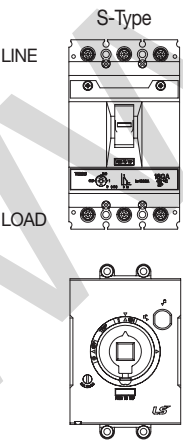
## Rotary handles

### Rotary handles

#### Degree of protections

| Type                                                                                                                                              | Degree of protection                                                        | IP   |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|------|
| <br>Circuit breaker with cover frame and rotary direct handle    | The access probe of 1.0mm diameter shall not penetrate.                     | IP40 |
| <br>Circuit breaker with cover frame and rotary extended handle | Totally protected against ingress of dust and water jets from any direction | IP65 |

#### Type suffix according to the mounting position



# Accessories for TD/TS series up to 800A

Susol

## Locking devices

### Removable locking device

Removable locking device is available for all TD & TS circuit-breakers. The locking device is designed to be easily attached to the circuit-breaker.

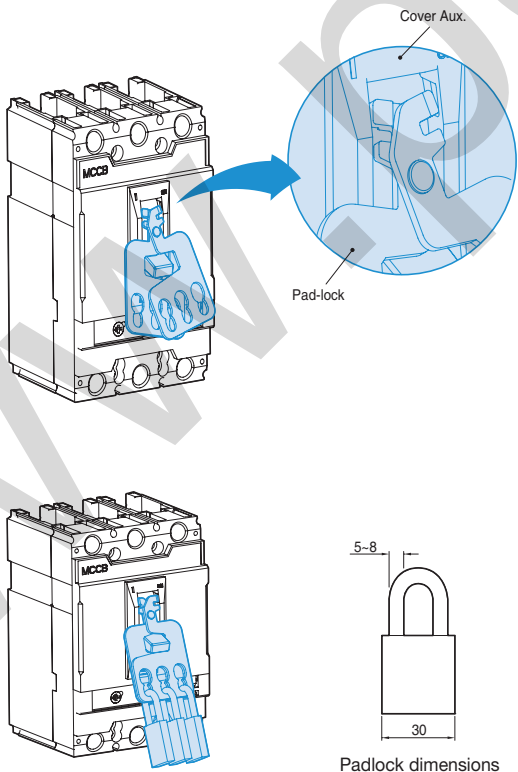
This device allows the handle to be locked in the “OFF” position. Locking in the OFF position guarantee isolation according to IEC 60947-2.

The locking device for the toggle handle can be installed in 3-pole and 4-pole circuit-breakers. Maximum three (3) padlocks with shackle diameters ranging from 5 to 8mm may be used. (Padlocks are not supplied)



### Removable locking device

| MCCB              | Padlockable device | Function       |
|-------------------|--------------------|----------------|
| TD100,TD160       | PL1                | “OFF” position |
| TS100,TS160,TS250 | PL2                |                |
| TS400,TS630       | PL3                |                |
| TS800             | PL4                |                |



# Accessories for TD/TS series up to 800A

Susol

## Locking devices

### Fixed locking device

Fixed locking device is available for all TD & TS circuit breakers. This device allows the handle to be locked in the "ON" and "OFF" position. Locking in the OFF position guarantee isolation according to IEC 60947-2.

The locking device for the toggle handle can be installed in 3-pole and 4-pole circuit-breakers. Maximum three (3) padlocks with shackle diameters ranging from 5 to 8mm may be used. (Padlocks are not supplied)



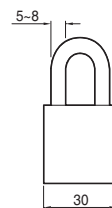
Fixed locking device

| MCCB              | Padlockable device | Function                   |
|-------------------|--------------------|----------------------------|
| TD100,TD160       | PHL1               | Lock in Off or On position |
| TS100,TS160,TS250 | PHL2               |                            |
| TS400,TS630       | PHL3               |                            |
| TS800             | PHL4               |                            |

### How to use

The locking device for the toggle handle is designed to be easily attached to the front of circuit-breaker.

- ① Please set the toggle handle in the position of "On" or "Off".
- ② Install the lock device onto the front of auxiliary cover of circuit breaker.
- ③ Folding the wings of lock device as shown in picture 3.
- ④ The padlock to be used shall be that which is commercially available with the nominal dimension. (30mm nominal dimension, 5~8mm diameter)



Padlock dimensions

|               |   |  |   |  |
|---------------|---|--|---|--|
| TD100, 160    | ① |  | ② |  |
|               | ③ |  | ④ |  |
| TS100 ~ TS800 | ① |  | ② |  |
|               | ③ |  | ④ |  |

# Accessories for TD/TS series up to 800A

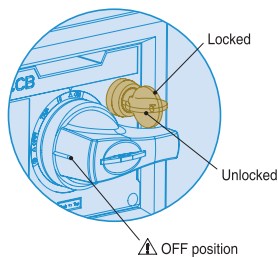
Susol

## Locking devices



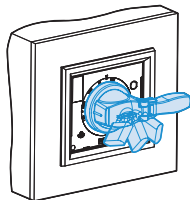
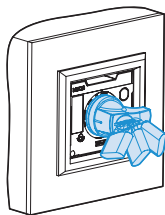
### Locking by rotary handle with a key lock

A locking can be done by using the rotary handle which has key lock device. The lock is used to lock the circuit-breaker in the OFF position.



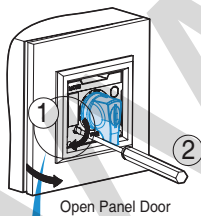
### Locking by rotary handle with a key lock

| MCCB              | Padlockable device | Function             |
|-------------------|--------------------|----------------------|
| TD100,TD160       | DHK1               | Lock in Off position |
| TS100,TS160,TS250 | DHK2               |                      |
| TS400,TS630       | DHK3               |                      |
| TS800             | DHK4               |                      |



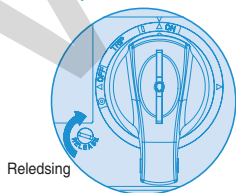
### Padlocking by rotary handle

A padlocking can be also done by using the rotary handle. The lock is used to lock the circuit-breaker in the ON and OFF position. Maximum three (3) padlocks with shackle diameters ranging from 5 to 8mm may be used. (Padlocks are not supplied)



### Releasing panel door lock at ON position

The panel door can be locked at ON and TRIP position of rotary handle. To open the panel door at ON position, just rotate release screw clockwise.



# Accessories for TD/TS series up to 800A

Susol

## Terminals

### Front connection

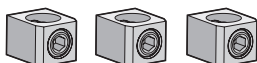
#### Terminal mounter



- It is supplied with Susol MCCBs as an standard part of circuit breaker.
- Connecting part with terminal for bus bar, cable with lug

| MCCB              | Type |
|-------------------|------|
| TD100,TD160       | TM1  |
| TS100,TS160,TS250 | TM2  |
| TS400,TS630       | -    |
| TS800             | -    |

#### Inner box terminal



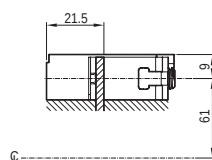
- Bare cable connectors for Susol TD and TS series circuit breakers
- Can be used for both aluminum and copper cables



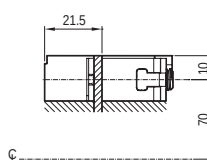
| Applicable to   | Type                    | Pole | Set quantity | Cable connection possibilities | Conductor size                       |
|-----------------|-------------------------|------|--------------|--------------------------------|--------------------------------------|
| TD100, 160      | SBT13                   | 3    | 1 Set (3EA)  | 1                              | L(mm) 21                             |
|                 | SBT14                   | 4    | 1 Set (4EA)  |                                | S(mm <sup>2</sup> )Cu/Al 2.5~95      |
|                 |                         |      |              |                                | Tightening torque (kgf · cm) 120~147 |
| TS100, 160, 250 | SBT23                   | 3    | 1 Set (3EA)  | 1                              | L(mm) 21                             |
|                 | SBT24                   | 4    | 1 Set (4EA)  |                                | S(mm <sup>2</sup> )Cu/Al 10~150      |
|                 |                         |      |              |                                | Tightening torque (kgf · cm) 120~147 |
| TS400, 630      | IBT33 <sup>Note1)</sup> | 3    | 1 Set (3EA)  | 1                              | L(mm) 30                             |
|                 | IBT34                   | 4    | 1 Set (4EA)  |                                | S(mm <sup>2</sup> )Cu/Al 70~300      |
|                 |                         |      |              |                                | Tightening torque (kgf · cm) 367~428 |
| PB12, 13        | IBT13 <sup>Note2)</sup> | 3    | 1 Set (3EA)  | 1                              | L(mm) 18                             |
|                 |                         |      |              |                                | S(mm <sup>2</sup> )Cu/Al 2.5~95      |
|                 |                         |      |              |                                | Tightening torque (kgf · cm) 306     |
| PB22, 23        | IBT23 <sup>Note2)</sup> | 3    | 1 Set (3EA)  | 1                              | L(mm) 21                             |
|                 |                         |      |              |                                | S(mm <sup>2</sup> )Cu/Al 10~150      |
|                 |                         |      |              |                                | Tightening torque (kgf · cm) 306     |

Note) 1. IBT3 for TS630 can be applied in case that rate current is upto 400A.  
2. IBT13, 23 are for Plug-in base.

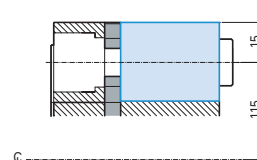
SBT13, 14



SBT23, 24



IBT33, 34(TS400)





# Accessories for TD/TS series up to 800A

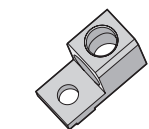
Susol

## Terminals

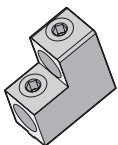
### Front connection

#### Extended box terminals (Copper cables/bars and aluminum cables)

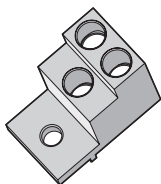
- The extended box terminals for TD and TS circuit breakers can be used for copper cables/bars and aluminum cables. There are four (4) kinds of terminals.
- For TD100, TD160: 1-cable connector (EBT13, EBT14)
- For TS100, TS160, TS250: 1-cable connector (EBT23, EBT24)
- For TS400, TS630: 2-cable connector (EBT33, EBT34)
- For TS800: 3-cable connector (EBT43, EBT44)



1-cable connector



2-cable connector

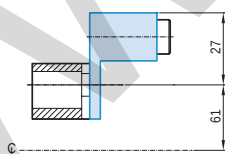


3-cable connector

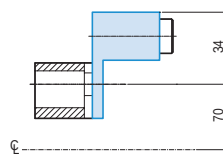


| Applicable to   | Type  | Pole | Set quantity | Cable connection possibilities | Conductor size             |               |
|-----------------|-------|------|--------------|--------------------------------|----------------------------|---------------|
| TD100, 160      | EBT13 | 3    | 1 Set (3EA)  | 1                              | L(mm)                      | 20            |
|                 | EBT14 | 4    | 1 Set (4EA)  |                                | S(mm <sup>2</sup> )Cu/Al   | 2.5~95        |
|                 |       |      |              |                                | Tightening torque (kgf-cm) | 306           |
| TS100, 160, 250 | EBT23 | 3    | 1 Set (3EA)  | 1                              | L(mm)                      | 24            |
|                 | EBT24 | 4    | 1 Set (4EA)  |                                | S(mm <sup>2</sup> )Cu/Al   | 10~150        |
|                 |       |      |              |                                | Tightening torque (kgf-cm) | 306           |
| TS400, 630      | EBT33 | 3    | 1 Set (3EA)  | 2                              | L(mm)                      | 33 or 62      |
|                 | EBT34 | 4    | 1 Set (4EA)  |                                | S(mm <sup>2</sup> )Cu/Al   | 2×85 to 2×240 |
|                 |       |      |              |                                | Tightening torque (kgf-cm) | 367~428       |
| TS800           | EBT43 | 3    | 1 Set (3EA)  | 3                              | L(mm)                      | 25~48         |
|                 | EBT44 | 4    | 1 Set (4EA)  |                                | S(mm <sup>2</sup> )Cu/Al   | 3×85 to 3×240 |
|                 |       |      |              |                                | Tightening torque (kgf-cm) | 367~428       |

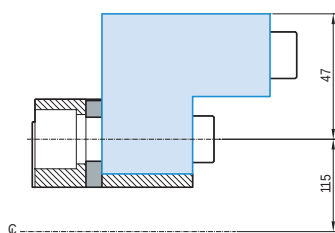
EBT13, 14



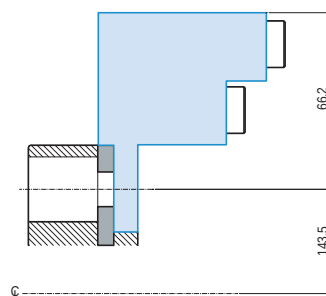
EBT23, 24



EBT33, 34



EBT43, 44



# Accessories for TD/TS series up to 800A

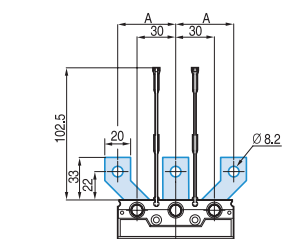
Susol

## Terminals

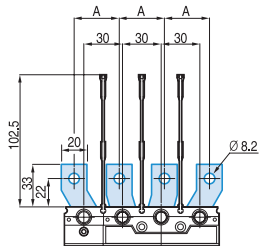
### Front connection

#### Spreaders

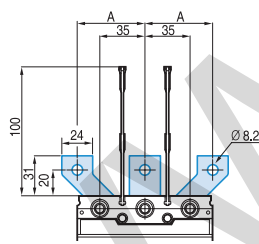
- As an optional part of circuit breaker
- Can increase the pitch of the terminals



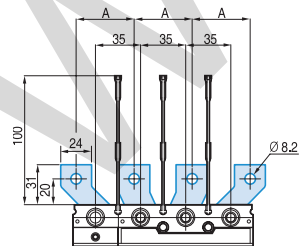
TD100, 160 3P



TD100, 160 4P



TS100, 160, 250 3P



TS100, 160, 250 4P

| MCCB                | Pole | Type  | Size A (mm) | Feature |
|---------------------|------|-------|-------------|---------|
| TD100, TD160        | 2P   | SP12a | 35          |         |
|                     | 3P   | SP13a |             |         |
|                     | 4P   | SP14a |             |         |
|                     | 2P   | SP12b | 45          |         |
|                     | 3P   | SP13b |             |         |
|                     | 4P   | SP14b |             |         |
| TS100, TS160, TS250 | 2P   | SP22a | 45          |         |
|                     | 3P   | SP23a |             |         |
|                     | 4P   | SP24a |             |         |
|                     | 2P   | SP22b | 52.5        |         |
|                     | 3P   | SP23b |             |         |
|                     | 4P   | SP24b |             |         |

# Accessories for TD/TS series up to 800A

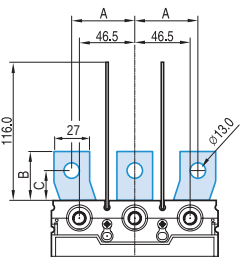
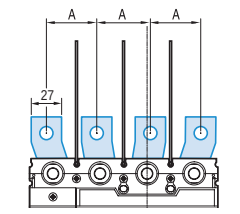
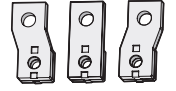
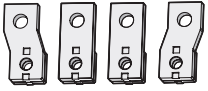
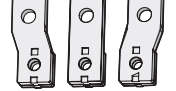
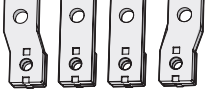
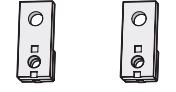
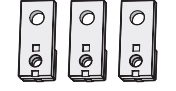
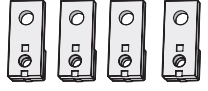
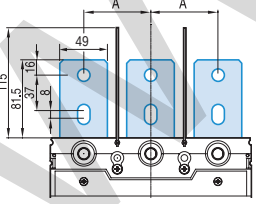
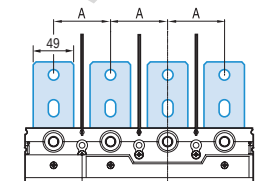
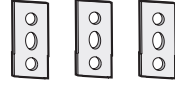
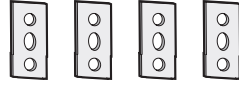
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## Terminals

### Front connection

#### Spreaders

- As an optional part of circuit breaker
- Can increase the pitch of the terminals

| MCCB                                                                                                                                                                                                             | Pole | Type  | Size(mm) |      |    | Feature                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|----------|------|----|---------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                  |      |       | A        | B    | C  |                                                                                       |
|  <p>TS400, 630 3P</p>  <p>TS400, 630 4P</p> | 2P   | SP32a | 52.5     | 41   | 25 |    |
|                                                                                                                                                                                                                  | 3P   | SP33a |          |      |    |    |
|                                                                                                                                                                                                                  | 4P   | SP34a |          |      |    |   |
|                                                                                                                                                                                                                  | 2P   | SP32b | 70       | 54   | 38 |  |
|                                                                                                                                                                                                                  | 3P   | SP33b |          |      |    |  |
|                                                                                                                                                                                                                  | 4P   | SP34b |          |      |    |  |
|                                                                                                                                                                                                                  | 2P   | SPS32 | 46.5     | 41   | 25 |  |
|                                                                                                                                                                                                                  | 3P   | SPS33 |          |      |    |  |
|                                                                                                                                                                                                                  | 4P   | SPS34 |          |      |    |  |
|  <p>TS800 3P</p>  <p>TS800 4P</p>          | 2P   | SPS42 | 70       | 81.5 |    |  |
|                                                                                                                                                                                                                  | 3P   | SPS43 |          |      |    |  |
|                                                                                                                                                                                                                  | 4P   | SPS44 |          |      |    |  |

# Accessories for TD/TS series up to 800A

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## Terminals

### Rear connection

Rear connection terminals are used to adapt Susol TD and TS circuit breakers to switchboards or other applications that require rear connection.

These can be connected directly to circuit breakers without any modification

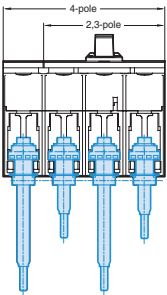
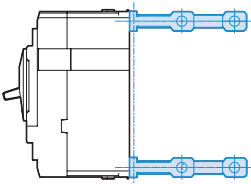
There are two kinds of rear connection terminals.

- Flat type
- Round type

### Flat type

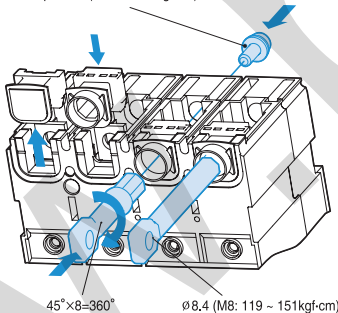
Flat vertical terminals

| MCCB              | 2-pole | 3-pole | 4-pole |
|-------------------|--------|--------|--------|
| TD100,TD160       | RTB12  | RTB13  | RTB14  |
| TS100,TS160,TS250 | RTB22  | RTB23  | RTB24  |
| TS400,TS630       | RTB32  | RTB33  | RTB34  |
| TS800             | RTB42  | RTB43  | RTB44  |



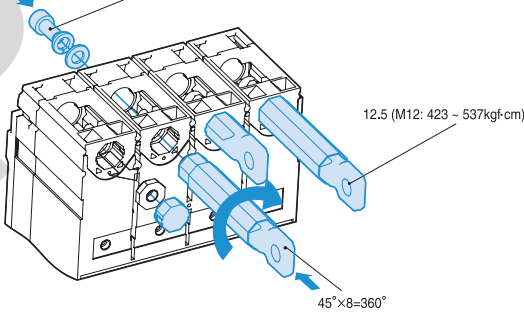
Flat type

**TD160,TS250**  
BOLT, HEX, SOCKET, P.S/W, M6, L15  
Torque: M6 (51.1 ~ 64.9kgf-cm)



**TS630**  
BOLT, HEX, SOCKET, P.S/W, M8, L20  
WASHER SPRONG LOCK D10  
WASHER PLAIN D10  
Torque: M8 (119 ~ 151kgf-cm)

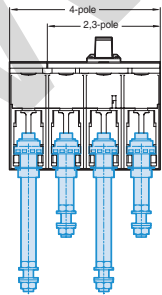
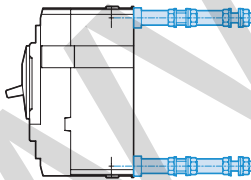
**TS800**  
BOLT, HEX, SOCKET, P.S/W, M12, L35  
Torque: M12 (423 ~ 537kgf-cm)



### Round type

Round threaded terminals

| MCCB              | 2-pole | 3-pole | 4-pole |
|-------------------|--------|--------|--------|
| TD100,TD160       | RTR12  | RTR13  | RTR14  |
| TS100,TS160,TS250 | RTR22  | RTR23  | RTR24  |
| TS400,TS630       | -      | -      | -      |
| TS800             | -      | -      | -      |



Round type

# Accessories for TD/TS series up to 800A

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## Insulation

### Insulation by terminal cover

#### Insulation terminal cover

The terminal covers are applied to the circuit-breaker to prevent accidental contact with live parts and thereby guarantee protection against direct contacts.

#### Two types by length are available:

Short type covers, ITS  
- IP40 degree of protection  
- For fixed circuit-breakers with rear terminals and for moving parts of plug-in

Long type covers, ITL  
- IP40 degree of protection  
- For fixed circuit-breakers with front, front extended, front for cables terminals.



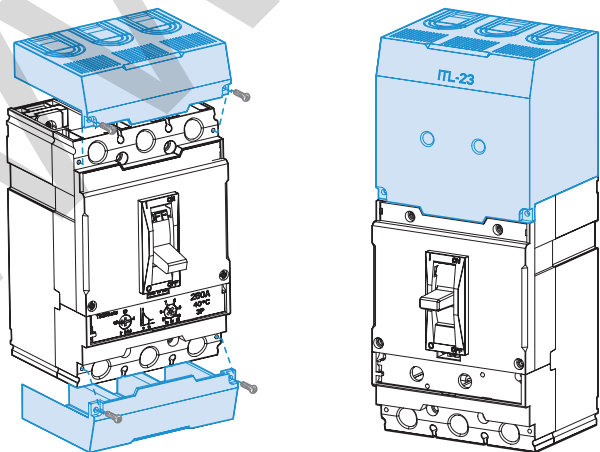
Short type covers



Long type covers

| MCCB              |                            | Terminal cover |            |
|-------------------|----------------------------|----------------|------------|
| Frame type        | Pole                       | Long type      | Short type |
| TD100,TD160       | 2P <sup>(1)</sup> , 3-pole | ITL13          | ITS13      |
|                   | 4-pole                     | ITL14          | ITS14      |
| TS100,TS160,TS250 | 2P <sup>(1)</sup> , 3-pole | ITL23          | ITS23      |
|                   | 4-pole                     | ITL24          | ITS24      |
| TS400,TS630       | 2P <sup>(1)</sup> , 3-pole | ITL33          | ITS33      |
|                   | 4-pole                     | ITL34          | ITS34      |
| TS800             | 2P <sup>(1)</sup> , 3-pole | ITL43          | ITS43      |
|                   | 4-pole                     | ITL44          | ITS44      |

Note) (1) 2P in 3pole mold case



# Accessories for TD/TS series up to 800A

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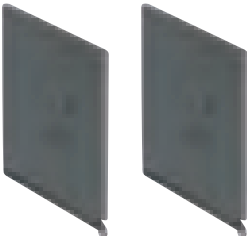
## Insulation

### Insulation by barrier

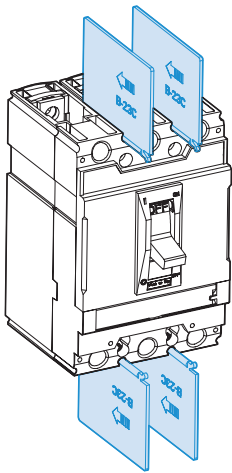
These allow the insulation characteristics between the phases at the connections to be increased. They are mounted from the front, even with the circuit-breaker already installed, inserting them into the corresponding slots.

They are incompatible with both the insulating terminal covers.

It is possible to mount the phase separating partitions between two circuit-breakers side by side.



Insulation barriers

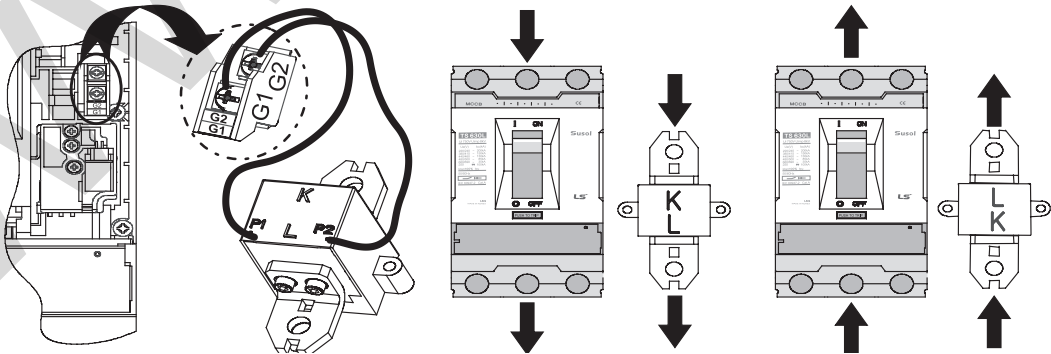


| Type  | Applied MCCB        | Set quantity |
|-------|---------------------|--------------|
| B-23C | TD100, TD160        | 4pcs         |
|       | TS100, TS160, TS250 | 4pcs         |
| B-33C | TS400, TS630        | 4pcs         |
| B-43C | TS800               | 4pcs         |

## External Neutral CT(NCT)

### ETM33, ETM43 with External Neutral CT(NCT)

Neutral CT is required for earth fault protection, when 3 pole breaker is used for 3 phase 4 wire system.

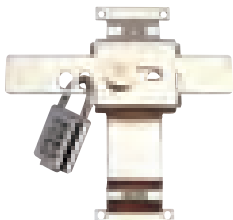


| Applied MCCB |       | Rated current NCT      |
|--------------|-------|------------------------|
| Frame type   | Pole  |                        |
| TS400, 630   | 3pole | 160A, 250A, 400A, 630A |
| TS800        | 3pole | 630A, 800A             |

# Accessories for TD/TS series up to 800A

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## Interlock



Mechanical Interlock  
(Padlocks are not supplied)

### Mechanical interlocking device

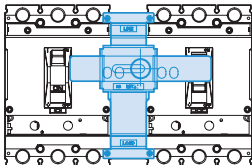
The mechanical interlock (MIT) can be applied on the front of two breakers mounted side by side, in either the 3-pole or 4-pole version and prevents simultaneous closing of the two breakers.

Fixing is carried out directly on the cover of the breakers.

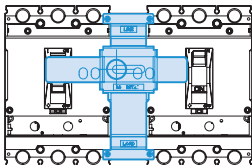
The front interlocking plate allows installation of a padlock in order to fix the position. (possibility of locking in the O-O position as well)

This mechanical interlocking device is very useful and simple for consisting of manual source-changeover system.

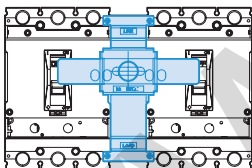
### Operation



Left MCCB: ON/OFF is possible  
Right MCCB: Off lock

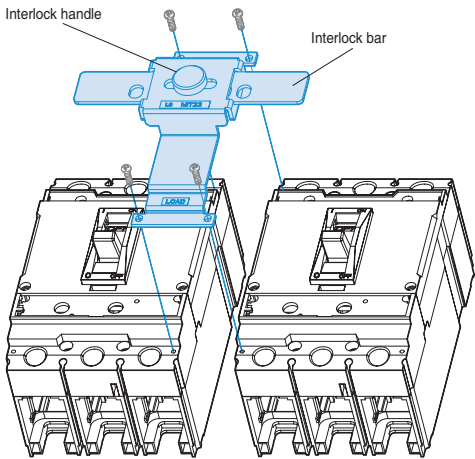


Left MCCB: Off lock  
Right MCCB: ON/OFF is possible



Both MCCBs are of locked

| MCCB              |        | Interlock |
|-------------------|--------|-----------|
| Frame type        | Pole   |           |
| TD100,TD160       | 3-pole | MIT13     |
|                   | 4-pole | MIT14     |
| TS100,TS160,TS250 | 3-pole | MIT23     |
|                   | 4-pole | MIT24     |
| TS400,TS630       | 3-pole | MIT33     |
|                   | 4-pole | MIT34     |
| TS800             | 3-pole | MIT43     |
|                   | 4-pole | MIT44     |



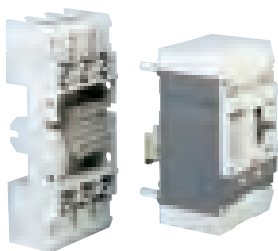
# Accessories for TD/TS series up to 800A

Susol

## Plug-in device

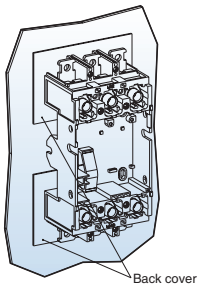
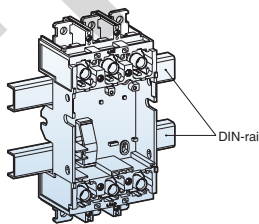
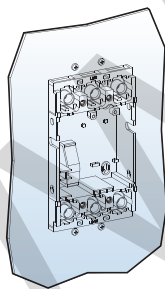
### Plug-in device

The plug-in base is the fixed part of the plug-in version of the circuit-breaker. It will be installed directly on the back plate of panel. The circuit-breaker is racked out by unscrewing the top and bottom fixing screws. Plug-in base makes it possible to extract and/or rapidly replace the circuit breaker without having to touch connections for ship and important installations.

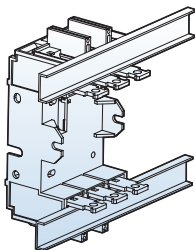
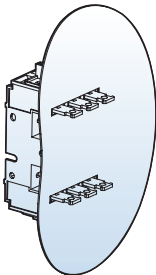


| MCCB                | Pole | Arrangement | Type   | Means                  |
|---------------------|------|-------------|--------|------------------------|
| TD100, TD160        | 2    | Single line | PB12   |                        |
|                     | 3    | Single line | PB13   |                        |
|                     | 4    | Single line | PB14   |                        |
|                     | 2    | Double line | PB12D2 | For distribution board |
|                     | 3    | Double line | PB13D2 | For distribution board |
| TS100, TS160, TS250 | 2    | Single line | PB22   |                        |
|                     | 3    | Single line | PB23   |                        |
| TS400, TS630        | 2    | Single line | PB32   |                        |
|                     | 3    | Single line | PB33   |                        |
| TS800               | 2    | Single line | PB42   |                        |
|                     | 3    | Single line | PB43   |                        |

### Front connection



### Rear connection

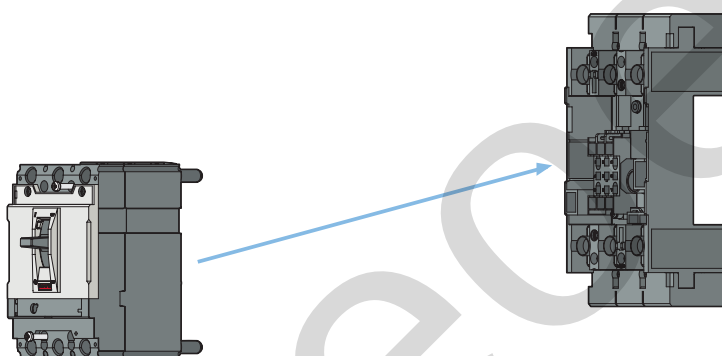




## Plug-in system

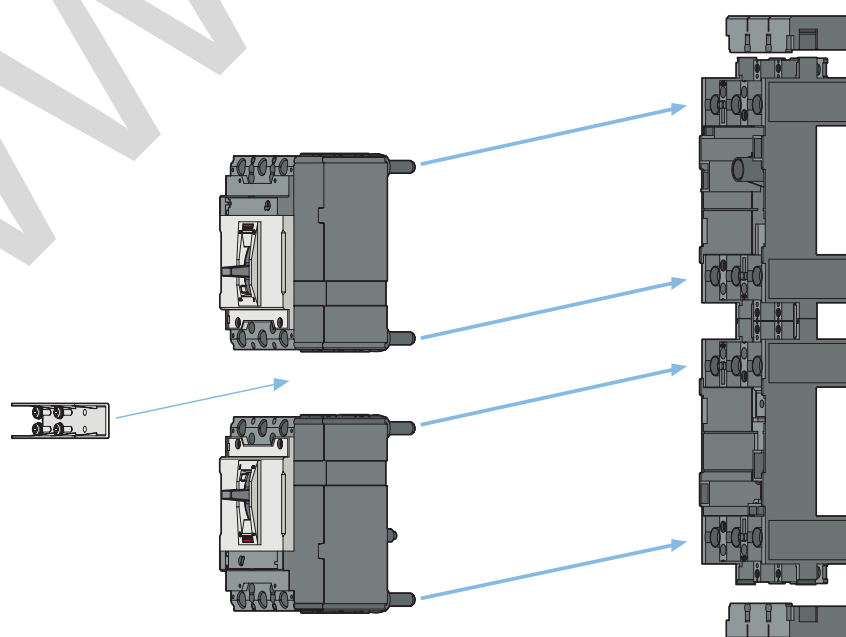
### Normal type Plug-in MCCB: PB□ type

- MCCB rating: TD100~TS800
- generally used in switchgears



### Double-row type Plug-in MCCB: PB□D2 type

- MCCB rating: TD100, 160
- generally used in branch circuits



# Accessories for TD/TS series up to 800A

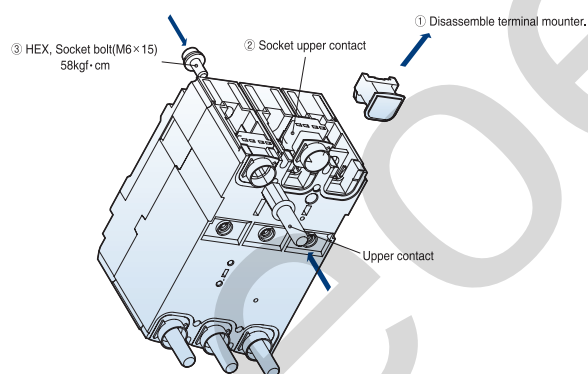
Susol

## Plug-in device

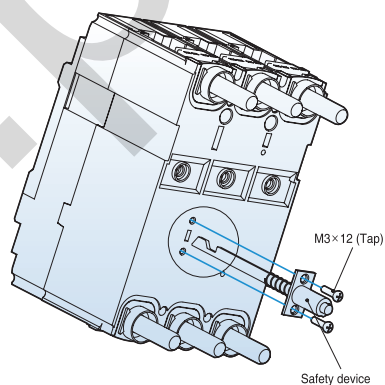
### Assembling procedure

TD100, TD160

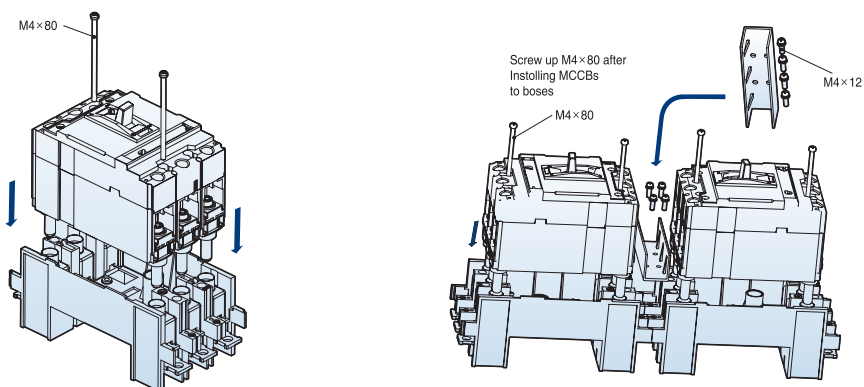
#### 1. Conversion to Plug-in MCCB



#### 2. Assembling safety device



#### 3. Assembling MCCB and plug-in device



# Accessories for TD/TS series up to 800A

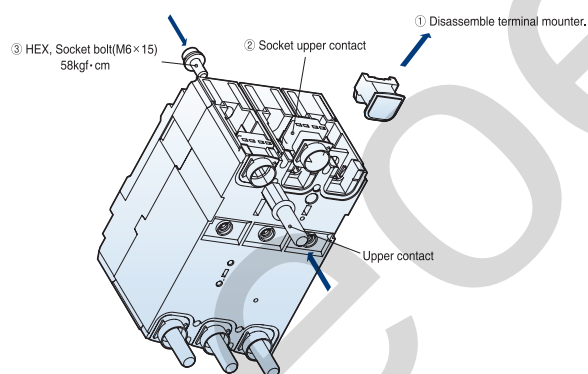
Susol

## Plug-in device

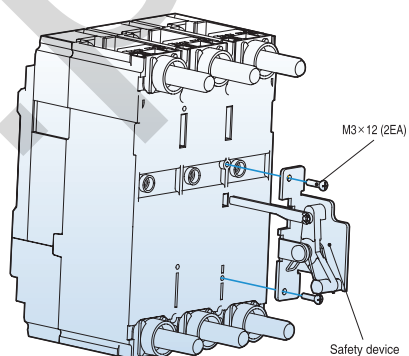
### Assembling procedure

TS100, TS160, TS250

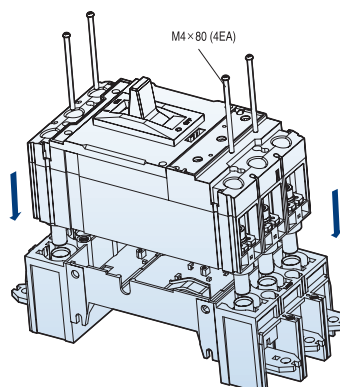
#### 1. Conversion to Plug-in MCCB



#### 2. Assembling safety device



#### 3. Assembling MCCB and plug-in device



# Accessories for TD/TS series up to 800A

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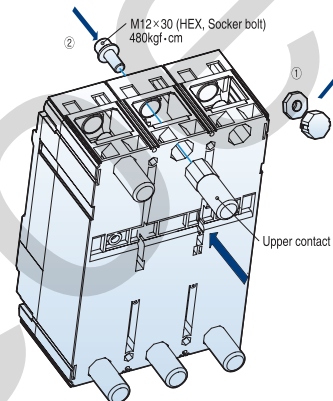
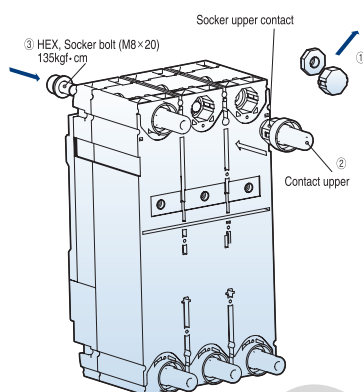
## Plug-in device

### Assembling procedure

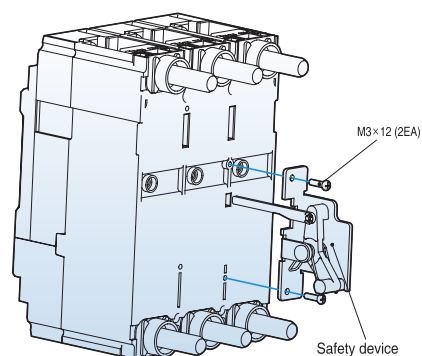
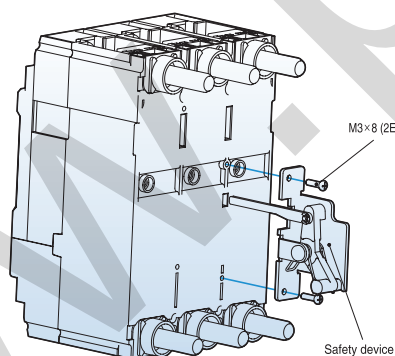
TS400, TS630

TS800

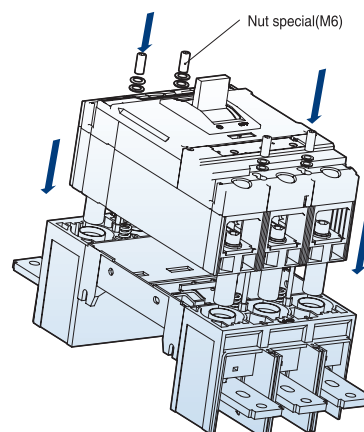
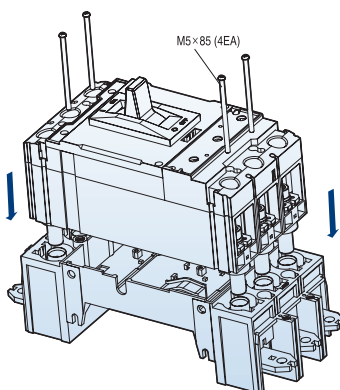
#### 1. Conversion to Plug-in MCCB



#### 2. Assembling safety device



#### 3. Assembling MCCB and plug-in device



# Accessories for TD/TS series up to 800A

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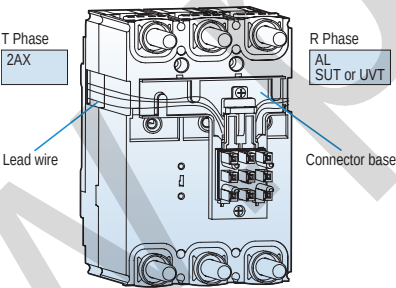
## Connector KIT

Electric auxilialy circuit(AX, AL, SHT, UVT) from Breaker via one to three connector KIT(nine wires each). These are made of moving part on Breaker and fixed part on plug-in base up to 800AF.

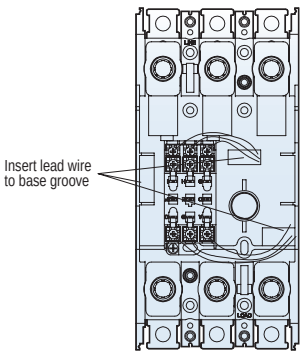
| Breaker Max. | Fixed part          |                                         | Moving part |                                           |
|--------------|---------------------|-----------------------------------------|-------------|-------------------------------------------|
|              | Max. Installed Q'TY | Description                             | Q'TY        | Description                               |
| TD160        | 1                   | SPARE PART ASS'Y,<br>CONNECOR KIT,TD160 | 1           | SPARE PART ASS'Y,<br>BASE CONNECTOR,TD160 |
| TS250        | 2                   |                                         | 1           | SPARE PART ASS'Y,<br>BASE CONNECTOR,TS250 |
| TS400/630    | 3                   |                                         | 1           | SPARE PART ASS'Y,<br>BASE CONNECTOR,TS630 |
| TS800        | 3                   |                                         | 1           | SPARE PART ASS'Y,<br>BASE CONNECTOR,TS800 |

### TD160

Moving part

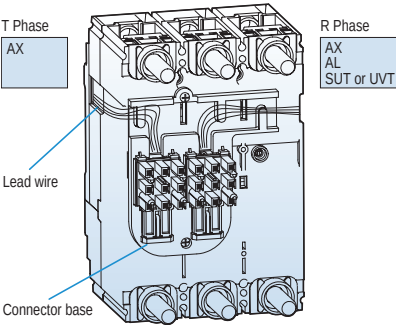


Fixed part

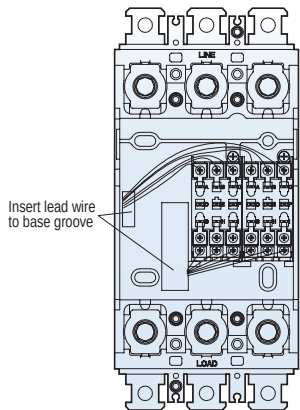


### TS250

Moving part



Fixed part



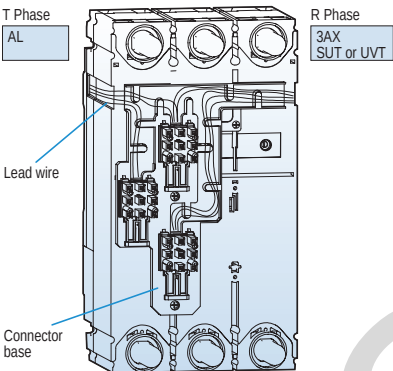
# Accessories for TD/TS series up to 800A

Susol

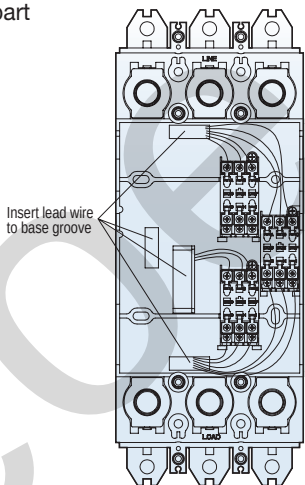
## Connector KIT

### TS400/630

Moving part

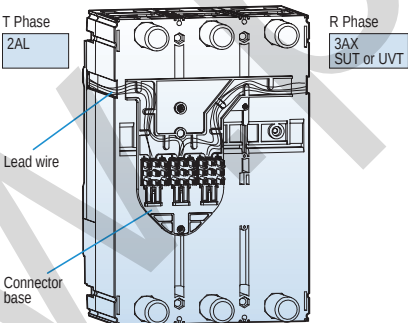


Fixed part

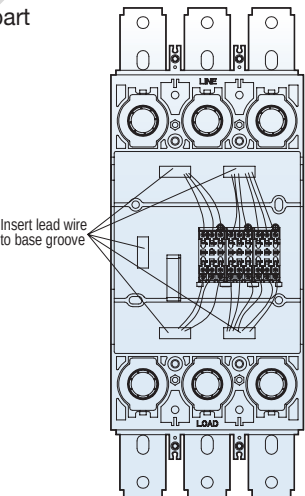


### TS800

Moving part

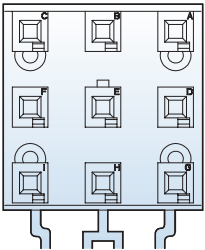


Fixed part

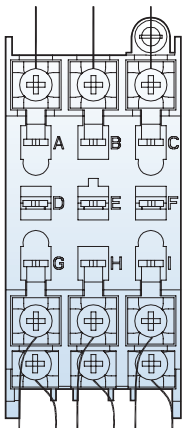


### Read wire color

Moving part



Fixed part



### Lead wire color

|         |           |          |
|---------|-----------|----------|
| A: Red  | B: White  | C: Black |
| D: Blue | E: Yellow | F: Green |
| G: Gray | H: Orange | I: Brown |

Note) Useless lead wires should be ended for Preventing an electric accident.  
- To connent AL and FAL solder the wire and insulates the wire



### Lead wire color

|         |           |          |
|---------|-----------|----------|
| A: Red  | B: White  | C: Black |
| D: Blue | E: Yellow | F: Green |
| G: Gray | H: Orange | I: Brown |

Note) Useless lead wires should be ended for Preventing an electric accident.

# Accessories for TD/TS series up to 800A

Susol

## Remote operation

### Motor operator

Motor operators can also be operated by manual. The motor drives a mechanism which switches TD & TS toggle handle to the "ON" and "OFF/RESET" positions.

- The manual actuator handle is located on the front of the cover.
- Manual or Automatic operation can be selected.
- Applicable to 2, 3 and 4-pole breakers.



TS250 + MOP2

The motor operator is an essential device for constructing a remote operated automatic source-changeover system to ensure a continuous supply of electrical power at following certain installations:

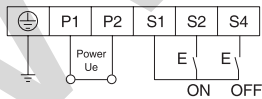
- Commercial sector: Hospital, Tall building, Bank, Insurance companies, Shopping centers
- Industry: Ships, Assembly lines at plant, Military sites, Port and Railway installation

| MCCB                   | Type | Control voltage               | Actuation current (A)                      | Response time (ms) |         | Consumption (W) | Mechanical service life (operations) | No. of operations per hour |
|------------------------|------|-------------------------------|--------------------------------------------|--------------------|---------|-----------------|--------------------------------------|----------------------------|
|                        |      |                               |                                            | Closing            | Opening |                 |                                      |                            |
| TD100, TD160           | MOP1 | ① DC 24V                      | $\leq 2.5A$                                | 310                | 200     | 14              | 25,000                               | 120                        |
|                        |      | ② AC 100~240V/<br>DC 100~220V | (DC 24V)<br>$\leq 0.5A$ (AC)               |                    |         |                 |                                      |                            |
| TS100, TS160,<br>TS250 | MOP2 | ① DC 24V                      | $\leq 5A$<br>(DC 24V)<br>$\leq 2A$<br>(AC) | 350                | 230     | 14              | 25,000                               | 120                        |
|                        |      | ② AC 100~110V/<br>DC 110V     |                                            |                    |         |                 |                                      |                            |
| TS400, TS630           | MOP3 | ③ AC 230/<br>DC 220V          |                                            | 500                | 350     | 35              | 20,000                               | 60                         |
| TS800                  | MOP4 |                               |                                            | 700                | 420     | 35              | 10,000                               | 20                         |

### Wiring connection

#### Standard connection

Circuit breaker On and Off controlled by remote operation and manual operation

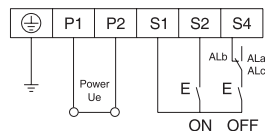


#### Connection with alarm switch (AL)

- 1) The below connection diagram is the method of using a alarm switch (AL) without shunt or undervoltage trip.
- 2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.

#### Connection with FAL (only for the breakers with electronic trip unit ETS or ETM)

- 1) The below connection diagram is the method of using a FAL for circuit breakers with electronic trip unit.
- 2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.

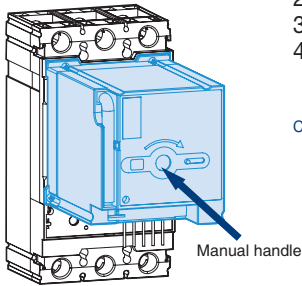


# Accessories for TD/TS series up to 800A

Susol

## Remote operation

### Manual operation

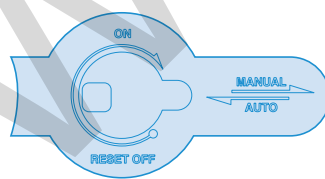


- 1) Insert the manual handle into the slot of Motor Operator surface and rotate it clockwise.
- 2) It must be rotated just 180° clockwise for safe operation of micro switch in the motor operator.
- 3) Return the manual handle after the manual operation
- 4) Turn the slide switch back to the position of AUTO.

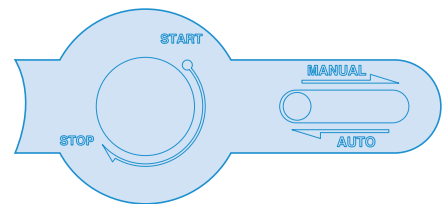
CAUTION: When the circuit breaker is tripped by trip button in the OFF status, it is impossible to operate motor operator automatically It must be reset by manual operation.

### Automatic operation

- 1) Set the slide switch to AUTO, then internal power is closed automatically.
- 2) Operating frequency should be less than these below regulated values.  
TD160N/H/L, TS250N/H/L:180 operations per hour
- 3) Use the ON/OFF switch in the range of regulated values.
- 4) It may interfere near communication equipments because of internal switching power supply.  
It's recommended that a noise filter be installed to power supply.
- 5) Please do not input ON/OFF signals at the same time during the automatic operation.
- 6) If the circuit breaker has a UVT attached inside, charge a UVT on the rated voltage before performing MOTOR OPERATOR.



[TD100, 160, TS100, 160, 250]



[TS400, 630, 800]



# Accessories for TD/TS series up to 800A

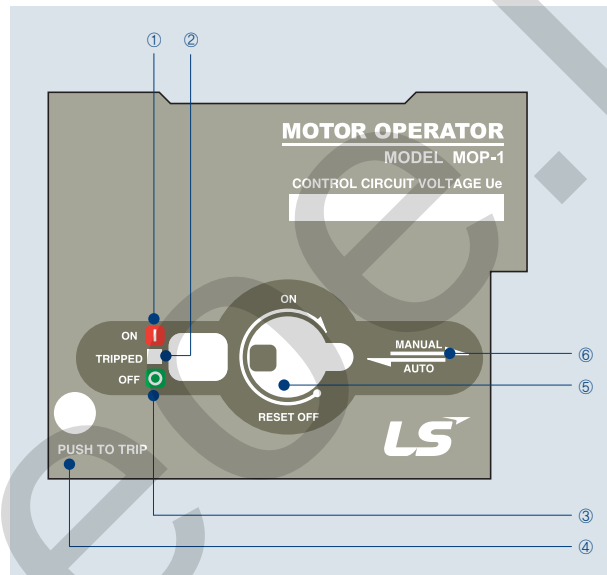
Susol

## Remote operation

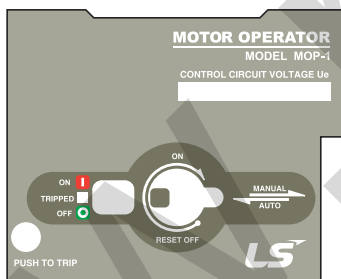
### Motor operator

#### Feature

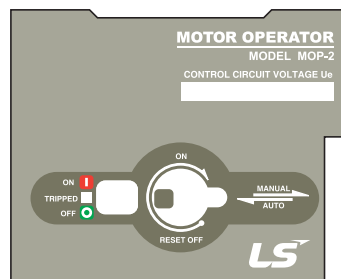
- ① On position indication (Red color)
- ② Trip position indication (White color)
- ③ Off position indication (Green color)
- ④ Button for push to trip
- ⑤ On/Off/Reset selection lever
- ⑥ Manual/Auto selection lever



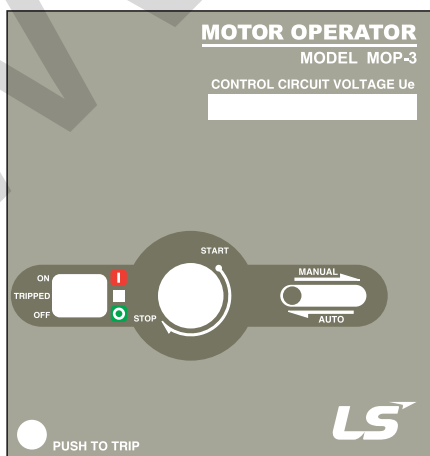
TD160 .... MOP-1



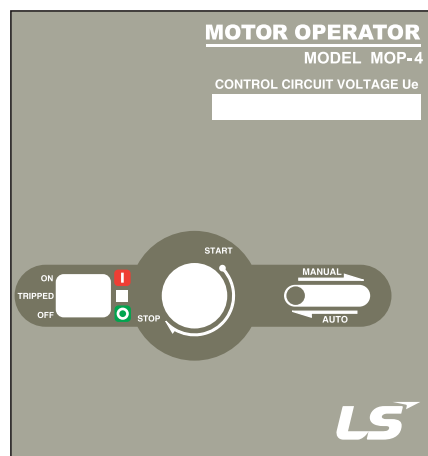
TS250 .... MOP-2



TS630.... MOP-3



TS800 .... MOP-4



# Accessories for TD/TS series up to 800A

**Susol**

## Electronic MCCB Tester



### It offers operating-test functions including:

- Checking on Long time pickup current
- Checking on Short time pickup current
- Checking on Instantaneous pickup current

### Applicable electronic trip units :

- ETS23 (250AF)
- ETS33/ETM33 (630AF)
- ETS43/ETM43 (800AF)

# Accessories for TD/TS series up to 800A

Susol

## Electronic MCCB Tester

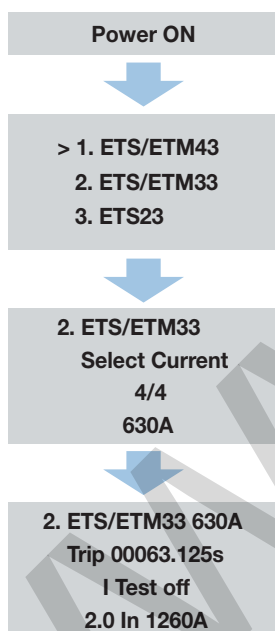


### Features

1. Maximum 12 times rated current can be inputted.
2. It is possible to enter the current value and phase on each of R/T
3. It is available to test for long time delay/short time delay/instantaneous
  - Ground fault test not possible.
4. There could be an error range of about 10% of the current value.
5. To protect the product, the test current application time stops after 1,500seconds.
  - Test Current size and time are inversely proportional
6. Operational Voltage: AC100~240V
7. Frequency: 50 / 60 Hz
8. Applicable Electronic MCCB trip units
  - ETS23 (250AF), ETS33/ETM33 (630AF), ETS43/ETM43 (800AF)

### How to operation

1. Power ON
2. Trip Unit selection  
Move the cursor(>) to the desired Trip Unit Type by pressing UP or DOWN button  
Then press ENTER to move to the next step
3. Rated Current selection  
Move the cursor(>) to the desired Rated Current by pressing UP or DOWN button  
Then press ENTER to move to the next step or press ESC to return to previous menu
4. Test current setting and testing  
Set the desired test current by pressing UP or DOWN button
  - Use ENTER/ESC buttons to set decimal digits
  - Press START to start the test
  - Press ESC to interrupt the test current



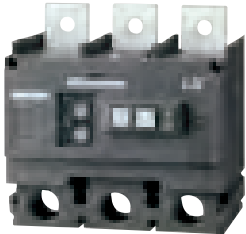
### Button Function

| Button | Descriptions                              |
|--------|-------------------------------------------|
| ESC    | Cancel / Move to previous step            |
| ▲      | Current Up                                |
| ▼      | Current Down                              |
| ENTER  | Save setting values and move to next step |
| START  | Test Start                                |
| STOP   | Test Stop                                 |
| Hz     | Frequency Change(50/60Hz)                 |

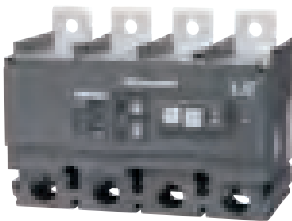
# Accessories for TD/TS series up to 800A

**Susol**

## Residual Current Devices (RCD)



3P



4P



The Susol circuit breaker can offer protection against earth leakage currents by using an add-on residual current device (RCD). In particular, the TS100, TS160 and TS250 circuit breakers can be combined with the RTU23/24 of residual current device, the TS400 and TS600 circuit breakers can be combined with the RTU33/34 of residual current device and the TS800 circuit breaker can be combined with the RTU43 of residual current device. In all cases the RCD unit interfaces directly below the circuit breaker trip unit area without the use of any secondary wiring or connections.

The Susol circuit breaker and an RCD unit combination can be connected like any stand-alone breaker and are available as fixed or plug-in devices. The main connection interface of the RCD is an exact replacement of the breaker connection area, thus allowing the use of all standard breaker terminals.

### Overview

Apart from the protection against overloads typical of automatic circuit breakers, the residual current circuit breaker derived from them also guarantee protection of people against earth leakage currents, thereby ensuring protection against direct contacts, indirect contacts and fire hazards.-(ELCB)

The RCD unit has numerous current and time settings and an override blocking the time settings when set to 30mA. The earth leakage test button tests the electrical and mechanical operation of the device. In order to allow for a dielectric test of the breaker and RCD combination without damaging the electronics, the dielectric plug is placed within the setting area. The RCD unit may be equipped with an alarm switch (FAL) to remotely indicate tripping due to an earth leakage current.

### Compliance with standards :

- IEC 60947-2 (industrial), Appendix B
- IEC 61009 (residential)
- IEC 60755, class A, immunity to DC components up to 6mA
- VDE664, operation down to -25°C

### Remote indications :

RCD unit may be equipped with an alarm contact (FAL-fault alarm switch) to remotely indicate tripping due to an earth leakage current.

### Power supply :

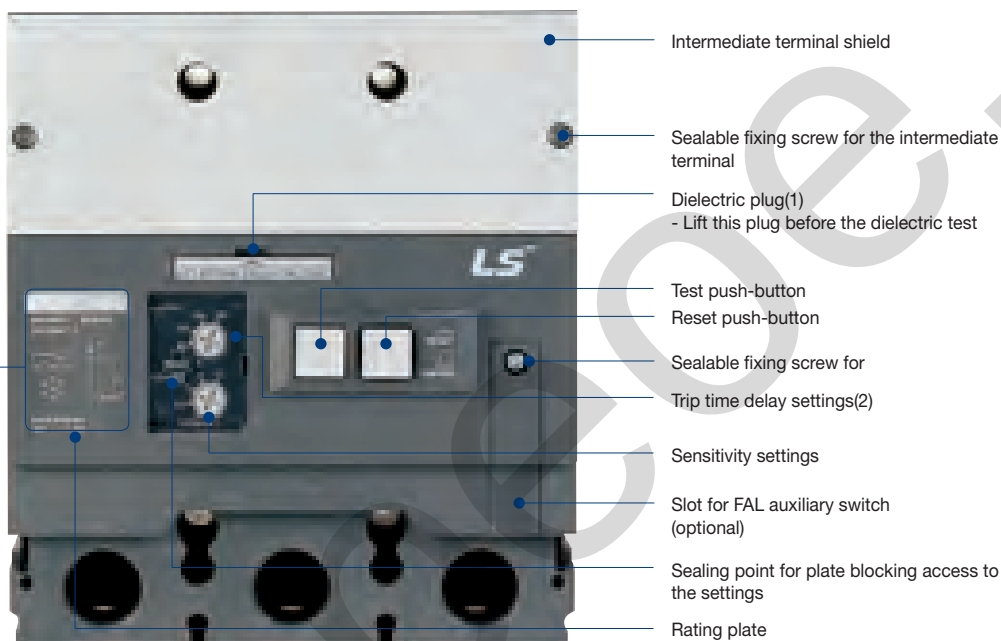
RCD unit are self-supplied internally by the distribution-system voltage and therefore do not require any external source. They continue to function even when supplied by only two phases.

# Accessories for TD/TS series up to 800A

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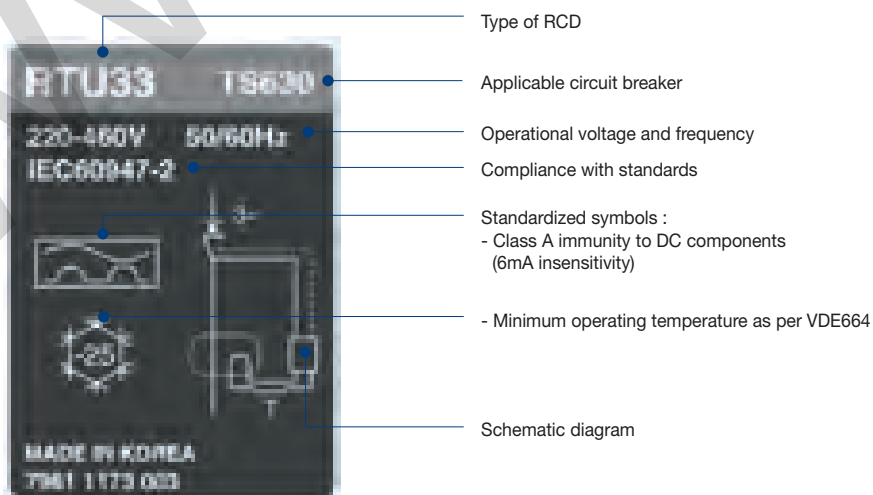
## Residual Current Devices (RCD)

### Configuration



- If the sensitivity is set to 30 mA, there is no time delay. Whatever the time-delay setting.

### Detail of Rating plate



# Accessories for TD/TS series up to 800A

**Susol**

## Residual Current Devices (RCD)

### Ratings and Selection



|                            |                             | RTU23                              | RTU24 | RTU33 | RTU34 | RTU43 |
|----------------------------|-----------------------------|------------------------------------|-------|-------|-------|-------|
| Number of poles            |                             | 3*                                 | 4     | 3*    | 4     | 3*    |
| Applicable circuit breaker | TS100                       | ■                                  | ■     |       |       |       |
|                            | TS160                       | ■                                  | ■     |       |       |       |
|                            | TS250                       | ■                                  | ■     |       |       |       |
|                            | TS400                       |                                    |       | ■     | ■     |       |
|                            | TS630                       |                                    |       | ■     | ■     |       |
|                            | TS800                       |                                    |       |       |       | ■     |
| Protection characteristics |                             |                                    |       |       |       |       |
| Sensitivity                | $I_{\Delta n}$ (A)          | (adjustable)<br>0.03-0.3-1-3-10    |       |       |       |       |
| Time delay **              | Intentional time delay (ms) | (adjustable)<br>0-60-150-300-600   |       |       |       |       |
|                            | Max. breaking time (ms)     | (adjustable)<br>40-150-300-600-990 |       |       |       |       |
| Rated voltage              | AC 50/60 Hz                 | 220-460V / 460-690V                |       |       |       |       |

Note 1) RTU can not be applied to 63A or less MTU type MCCB.

2) RTU can not be applied to MCCB (Electronic trip unit) + D/E-Handle

3) RTU24, RTU34: Only combination of N-R-S-T type MCCB is possible

4) RTU24 can be only combined with thermal-magnetic unit, which is produced after July.18, and electronic unit, which is produced after March. 2019.

5) RTU34 can be only combined with thermal-magnetic unit and electronic unit, which are produced after September. 2019.

\* 3P modules may also be used on 2P circuit breakers.

\*\* If the sensitivity is set to 30mA, the time delay setting is reduced to zero.

Trip time delay settings  
0-60-150-300-600ms

Sensitivity settings,  $I_{\Delta n}$   
0.03-0.3-1-3-10A



# Accessories for TD/TS series up to 800A

Susol

## Residual Current Devices (RCD)

### Combination

The addition of the RCD unit does not affect circuit breaker characteristics.

- Conformity with standards
- Protection degrees, class II insulation front face
- Suitability for isolation as defined by IEC 60947-2
- Electrical characteristics
- Trip unit characteristics
- Installation and connection methods
- Indication, measurement and control accessories
- Installation and connection accessories

|           |                          | RTU23      | RTU24      | RTU33       | RTU34         | RTU43       |
|-----------|--------------------------|------------|------------|-------------|---------------|-------------|
| MCCB      | L×H×D (mm)               | 105×160×86 | 140×160×86 | 140×260×110 | 186.5×260×110 | 210×320×135 |
| MCCB+RCD  |                          | 105×240×86 | 140×240×86 | 140×370×110 | 186.5×370×110 | 210×450×135 |
| RCD       |                          | 105×80×86  | 140×80×86  | 140×110×110 | 186.5×110×110 | 210×130×135 |
| MCCB+RCD  | Weight (kg)              | 2.7        | 1.1        | 8.1         | 3.9           | 16.3        |
| RCD       |                          | 1.0        | 3.7        | 2.6         | 11.1          | 4.6         |
| Type      | Bottom                   |            |            |             |               |             |
| Accessory | FAL (fault alarm switch) |            |            |             |               |             |



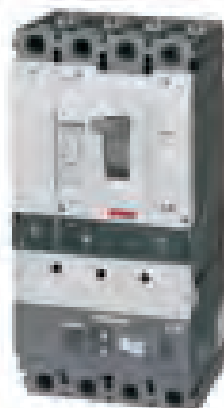
RTU23



RTU24



RTU33



RTU34



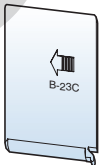
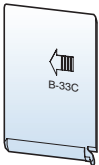
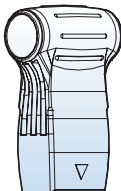
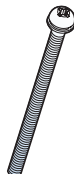
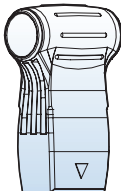
RTU43

# Accessories for TD/TS series up to 800A

**Susol**

## Standard accessories

The following accessories for mounting, connection, insulation, handle operation are standard items and are packed with Susol TD & TS series circuit breakers.

|                                        |                                                                                     |                                                                                     |                                                                                       |                                                                                       |                                                                                       |
|----------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| TD100N/H/L<br>TD160N/H/L               |    |    |    |                                                                                       |                                                                                       |
|                                        | M8×20<br>1P: 2pcs<br>3P: 6pcs<br>4P: 8pcs                                           | M3×75(1P)<br>M4×75<br>1P: 2pcs<br>3P: 2pcs<br>4P: 4pcs                              | 3P: 4pcs<br>4P: 6pcs                                                                  |                                                                                       |                                                                                       |
| TS100N/H/L<br>TS160N/H/L<br>TS250N/H/L |   |   |   |                                                                                       |                                                                                       |
|                                        | M8×20<br>3P: 6pcs<br>4P: 8pcs                                                       | M4×75<br>3P: 2pcs<br>4P: 4pcs                                                       | 3P: 4pcs<br>4P: 6pcs                                                                  |                                                                                       |                                                                                       |
| TS400N/H/L<br>TS630N/H/L               |  |  |  |  |  |
|                                        | M10×30<br>3P: 6pcs<br>4P: 8pcs                                                      | M5×85<br>3P: 4pcs<br>4P: 4pcs                                                       | M5<br>3P: 4pcs<br>4P: 4pcs                                                            | 3P: 4pcs<br>4P: 6pcs                                                                  | “1pc”                                                                                 |
| TS800N/H/L                             |  |  |  |  |  |
|                                        | M12×35<br>3P: 6pcs<br>4P: 8pcs                                                      | M6×100<br>3P: 4pcs<br>4P: 4pcs                                                      | M6<br>3P: 4pcs<br>4P: 4pcs                                                            | 3P: 4pcs<br>4P: 6pcs                                                                  | “1pc”                                                                                 |

\* Auxiliary operating handel : TS400, TS630, TS800N/H/L Only

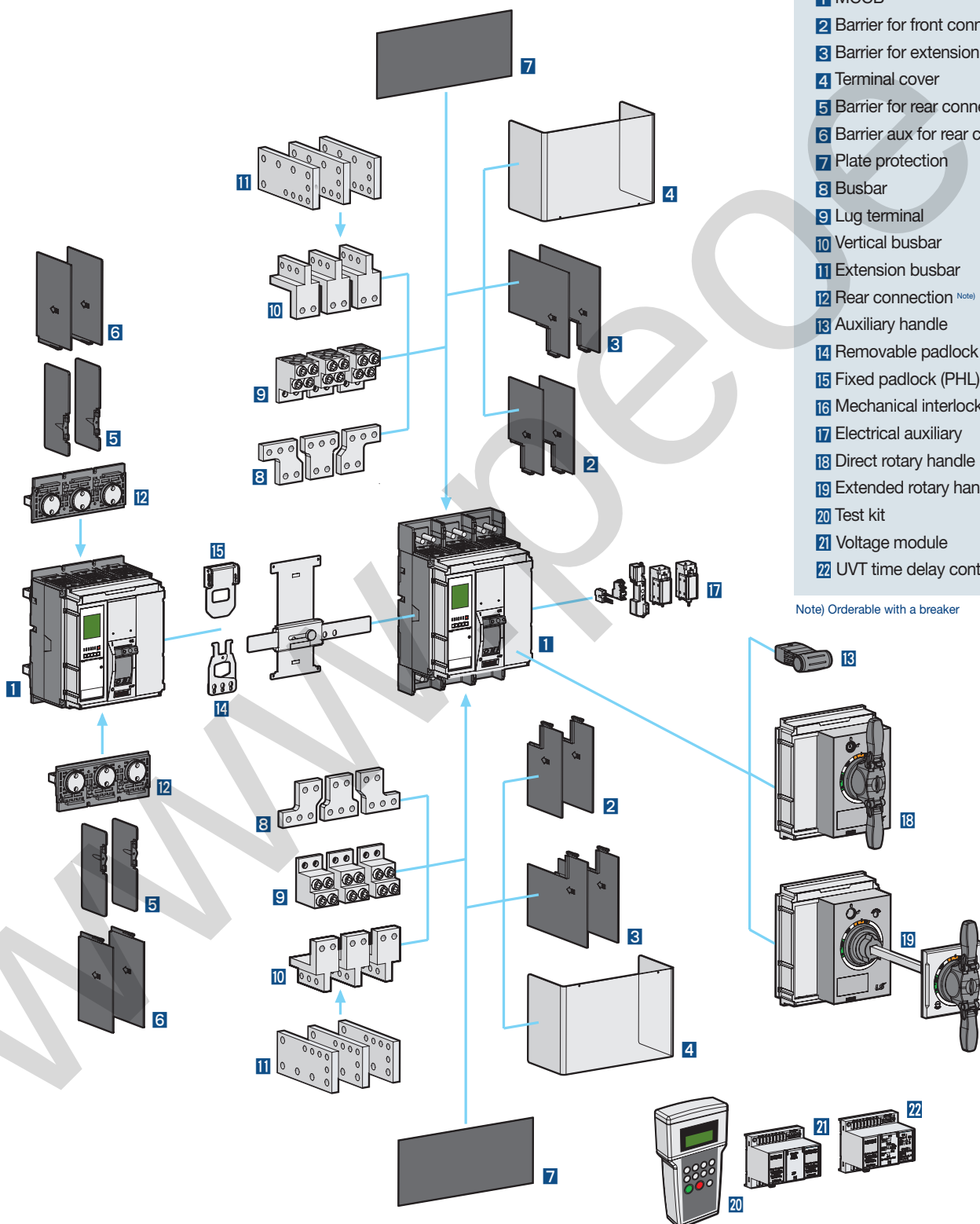


# Accessories for TS series 1600A

Susol

- 1 MCCB
- 2 Barrier for front connection
- 3 Barrier for extension terminal
- 4 Terminal cover
- 5 Barrier for rear connection
- 6 Barrier aux for rear connection
- 7 Plate protection
- 8 Busbar
- 9 Lug terminal
- 10 Vertical busbar
- 11 Extension busbar
- 12 Rear connection (Note)
- 13 Auxiliary handle
- 14 Removable padlock (PL)
- 15 Fixed padlock (PHL)
- 16 Mechanical interlock (MIT)
- 17 Electrical auxiliary
- 18 Direct rotary handle
- 19 Extended rotary handle
- 20 Test kit
- 21 Voltage module
- 22 UVT time delay controller (UDC)

Note) Orderable with a breaker

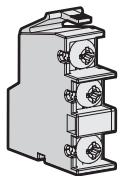
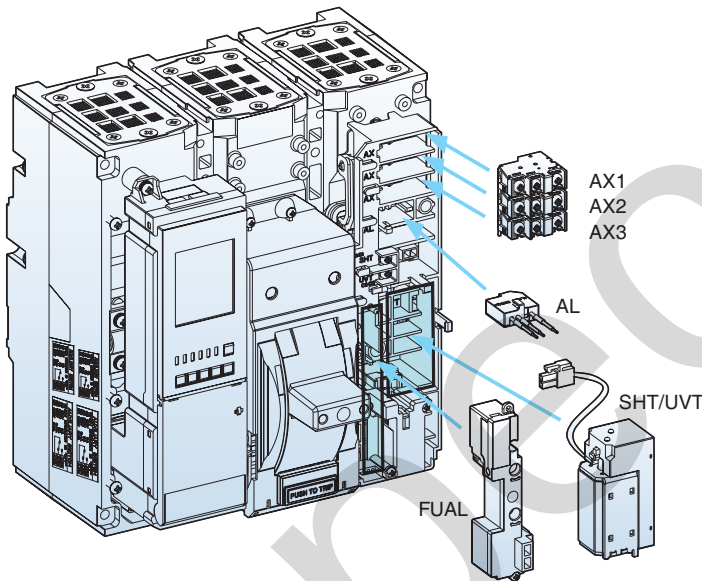


# Accessories for TS series 1600A

Susol

## Electrical auxiliaries

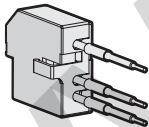
The following devices are installed into TS1000 to 1600AF circuit breakers regardless of frame size. And, the electrical auxiliaries can be easily installed in the accessory compartment of the circuit breakers which is cassette type.



AX

### Auxiliary switch (AX)

Auxiliary switch is for applications requiring remote “ON” and “OFF” indication. Each switch contains two contacts having a common connection. One is open and the other closed when the circuit breaker is open, and vice-versa.



AL

### Alarm switch (AL)

Alarm switches indicate that the circuit breaker has tripped due to overload, short circuit, shunt trip, or undervoltage release conditions. They are particularly useful in automated plants where operators must be signaled about changes in the electrical distribution system. This switch features a closed contact when the circuit breaker is tripped automatically. In other words, this switch does not function when the breaker is operated manually. Its contact is open when the circuit breaker is reset.

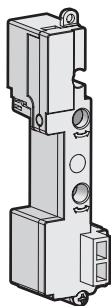
### Contact operation

| MCCB           | ON | OFF | TRIP |
|----------------|----|-----|------|
| Position of AX |    |     |      |
| Position of AL |    |     |      |

# Accessories for TS series 1600A

Susol

## Electrical auxiliaries



FUAL

### Indication switch FUAL

FUAL Indicates that the breaker has tripped due to FAL(overload, short circuit) and UAL(UVT, SHT) separately

|                                            |                                            |
|--------------------------------------------|--------------------------------------------|
| Normal position<br>CB no trip              | <p>FAL Normal Open / UAL Normal Open</p>   |
| FAL operation<br>CB trip due to OCR        | <p>FAL Normal Close / UAL Normal Open</p>  |
| UAL operation<br>CB trip due to UVT or SHT | <p>FAL Normal Close / UAL Normal Close</p> |

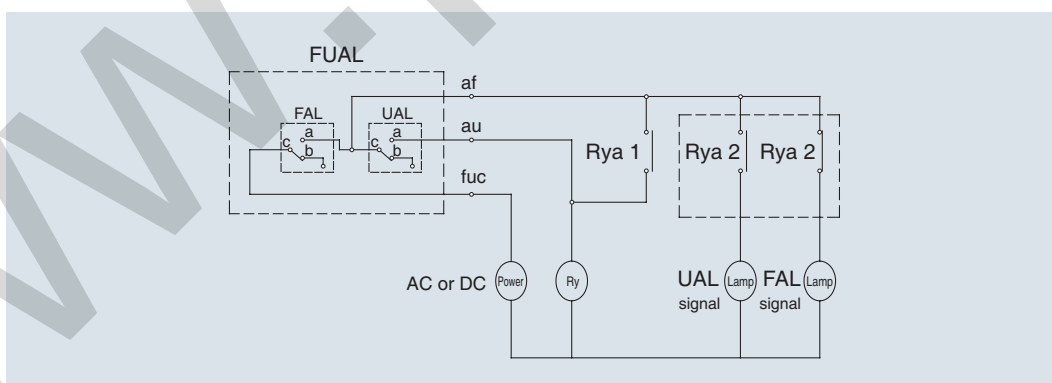


Figure. Example of Lock up Circuit for FUAL

**⚠ Caution:** Please use “Lock up Circuit” following under figure “Example of lock up circuit for FUAL”

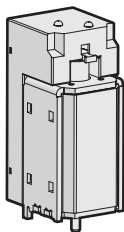
**⚠ Caution:** When MCCB is tripped by SHT or UVT, the FAL signal appears for 20ms that is time of being transferred from “b”contact to “a” contact of control relay

**⚠ Caution:** When MCCB is tripped by SHT or UVT, the transfer time of Relay signal(Ryb2 off → Rya2 on) is 20ms. if FAL signal is connected with other sequence circuit such as Latch circuit or other look up circuit it may cause to be miss operation. So, please do not use latch circuit or look up circuit with FAL signal.

# Accessories for TS series 1600A

Susol

## Electrical auxiliaries



### SHT Shunt trip device

SHT is a control device which trips a circuit breaker from remote place, when applying voltage continuously or instantaneously over 200ms to coil terminals(C1, C2).  
When UVT coil is installed, its location is changed.

### 1. Rated voltage and characteristics of Trip coil

| Rated voltage [Vn] |         | Operating voltage range [V] | Power consumption (VA or W) |              | Trip time [ms] |
|--------------------|---------|-----------------------------|-----------------------------|--------------|----------------|
| DC [V]             | AC [V]  |                             | Inrush                      | Steady-state |                |
| 24~30              | -       | 0.6~1.1 Vn                  | 200                         | 5            | Less than 40ms |
| 48~60              | 48      | 0.6~1.1 Vn                  |                             |              |                |
| 100~130            | 100~130 | 0.56~1.1 Vn                 |                             |              |                |
| 200~250            | 200~250 | 0.56~1.1 Vn                 |                             |              |                |
| -                  | 380~480 | 0.56~1.1 Vn                 |                             |              |                |

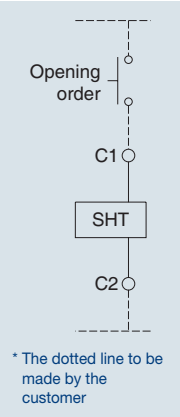
Note) Operating voltage range is the min. rated voltage standard for each rated voltage(Vn).

### 2. Specification of the wire

- Refer to the below table regarding the length and specification of wire when using trip coil with DC 24~30[V] or DC/AC 48~60[V] of rated voltage.

The maximum wire length

|                      |      | Rated voltage [Vn]   |                      |                      |                      |
|----------------------|------|----------------------|----------------------|----------------------|----------------------|
|                      |      | DC 24~30 [V]         |                      | DC/AC 48 [V]         |                      |
| Wire type            |      | #14 AWG<br>(2.08mm²) | #16 AWG<br>(1.31mm²) | #14 AWG<br>(2.08mm²) | #16 AWG<br>(1.31mm²) |
| Operating<br>voltage | 100% | 95.7m                | 61m                  | 457.8m               | 287.7m               |
|                      | 85%  | 62.5m                | 38.4m                | 291.7m               | 183.2m               |

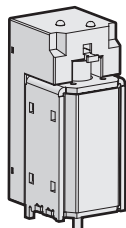


Wiring Diagram

# Accessories for TS series 1600A

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## Electrical auxiliaries



### UVT Under Voltage Trip device

- If the voltage of the main or the control power is under voltage, UVT which is installed inside of the breaker breaks the circuit automatically. Please connect with UVT time-delay device in order to present the time delay function because UVT is technically instantaneous type.
- The closing of a circuit breaker is impossible mechanically or electrically if control power not supplied to UVT. To close the circuit breaker, 65~85% of rated voltage should be applied to both terminals of UVT coil (D1, D2).
- When using UVT coil, the double trip coil can not be used, and the location of trip coil is changed.

### 1. Rated voltage and characteristics of UVT coil

| Rated voltage [Vn] |         | Operating voltage range [V] |             | Power consumption (VA or W) |              | Trip time [ms] |
|--------------------|---------|-----------------------------|-------------|-----------------------------|--------------|----------------|
| DC [V]             | AC [V]  | Pick up                     | Drop out    | Inrush                      | Steady-state |                |
| 24~30              | -       | 0.65~0.85 Vn                | 0.44~0.6 Vn | 200                         | 5            | Less than 50ms |
| 48~60              | 48      |                             |             |                             |              |                |
| 100~130            | 100~130 |                             |             |                             |              |                |
| 200~250            | 200~250 |                             |             |                             |              |                |
| -                  | 380~480 |                             |             |                             |              |                |

Note) Operating voltage range is the min. rated standard for each rated voltage (Vh).

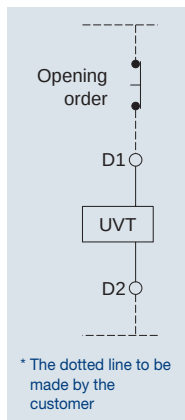
### 2. Specification of the wire

- Refer to the below table regarding the length and specification of wire when using trip coil with DC 24~30[V] or DC/AC 48~60[V] of rated voltage.

The maximum wire length

|                   |      | Rated voltage [Vn]                |                                   |                                   |                                   |
|-------------------|------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|                   |      | DC 24~30 [V]                      |                                   | DC/AC 48 [V]                      |                                   |
|                   |      | #14 AWG<br>(2.08mm <sup>2</sup> ) | #16 AWG<br>(1.31mm <sup>2</sup> ) | #14 AWG<br>(2.08mm <sup>2</sup> ) | #16 AWG<br>(1.31mm <sup>2</sup> ) |
| Operating voltage | 100% | 48.5m                             | 30.5m                             | 233.2m                            | 143.9m                            |
|                   | 85%  | 13.4m                             | 8.8m                              | 62.5m                             | 39.3m                             |

Note) In case of using UVT coil, the location of TC coil is changed.

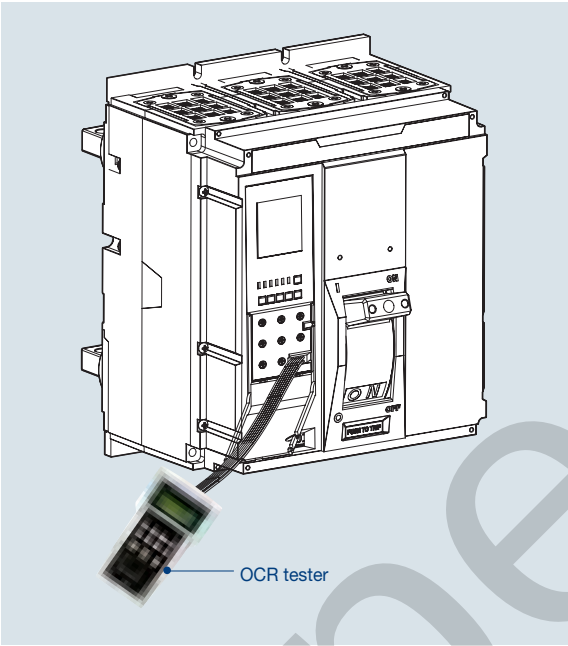
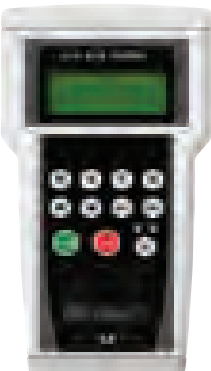


Wiring Diagram

# Accessories for TS series 1600A

Susol

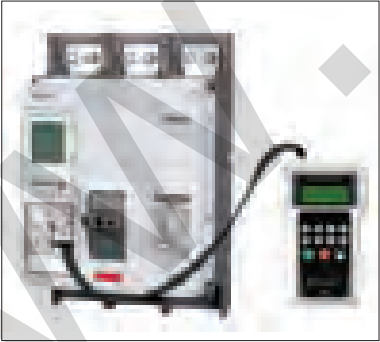
## OCR Tester [OT]



- It is a device which can test for the operation of Trip Relay under no power condition.

- 1. Maximum 17 times rated current can be inputted.
- 2. It is possible to enter the current value and phase on each of R/S/T/N
- 3. Frequency is adjustable.
- 4. It is available to test for long time delay/short time delay/instantaneous/ground fault.

### Configuration

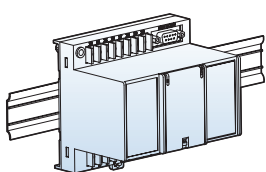


|                 |                                |
|-----------------|--------------------------------|
| R S T N         | R, S, T, N phase signal input  |
| ↶ ↷             | Increase/Decrease signal input |
| ENT. ESC        | Signal setting/Delete          |
| START STOP      | Waveform generation/Stop       |
| 50Hz 60Hz<br>Hz | Select frequency               |

# Accessories for TS series 1600A

Susol

## UVT Time Delay Controller [UDC]



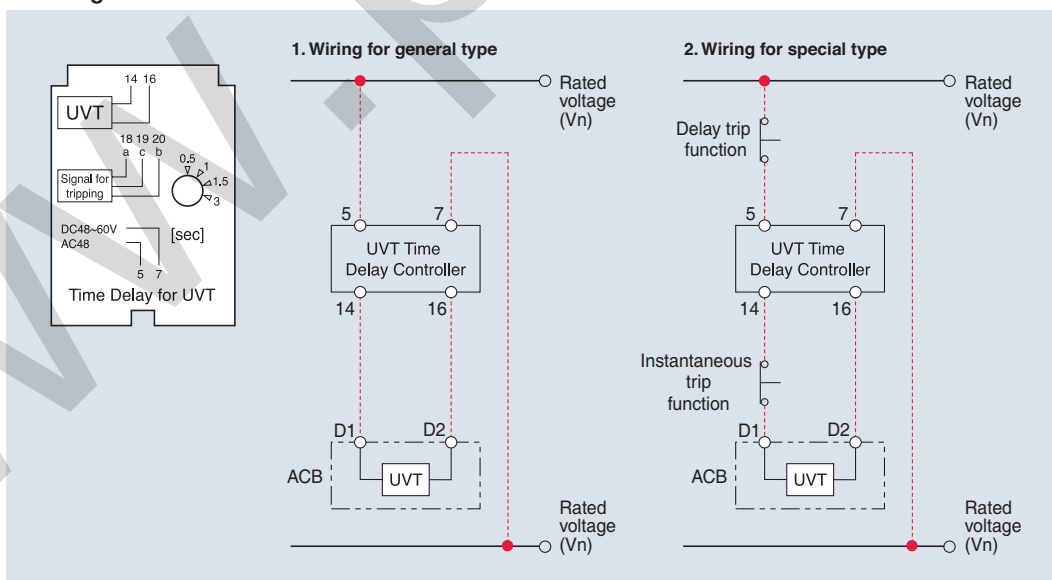
- UVT is a device which makes ACB tripped automatically to prevent the accident on load side due to under voltage or power breakdown.  
There are two types, Instantaneous type and time delay type.
- It can be installed on the rail or to the cradle.
- Instantaneous type: only available with UVT coil.
- Time delay type: available by connecting UVT coil and UVT time delay controller.
- Common use for the all types.

### 1. The rated voltage and characteristic of UVT time delay controller

| Rated voltage [Vn] |         | Operating voltage range [V] |             | Power consumption (VA or W) |              | Trip time[s]   |
|--------------------|---------|-----------------------------|-------------|-----------------------------|--------------|----------------|
| DC [V]             | AC [V]  | Pick up                     | Drop out    | Inrush                      | Steady-state |                |
| 48~60              | 48      | 0.65~0.85 Vn                | 0.44~0.65Vn | 200                         | 5            | 0.5, 1, 1.5, 3 |
| 100~130            | 100~130 |                             |             |                             |              |                |
| 200~250            | 200~250 |                             |             |                             |              |                |
| -                  | 380~480 |                             |             |                             |              |                |

Note) Operating voltage range is the min. rated standard for each rated voltage (Vh).

### 2. Wiring



\* The wiring presented with red color should be set by users.

# Accessories for TS series 1600A

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## Rotary handle

The rotary handle operating mechanism is available in either the direct version or in the extended version on the compartment door.

It is always fitted with a compartment door lock and on a request it can be supplied with a key lock in the open position. There are direct rotary handle two and extended rotary handle.

### Direct rotary handle

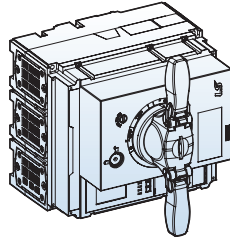
#### Degree of protection IP40

There are three types of direct rotary handle according to line load direction.

Indication of the three positions O(OFF), I(ON) and tripped. Circuit breaker locking capability in the OFF position by one to three padlocks, shackle diameter 5 to 6 mm (not supplied).

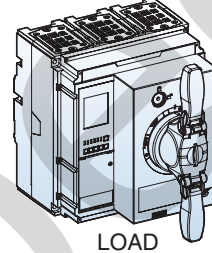
#### L Type

LINE LOAD



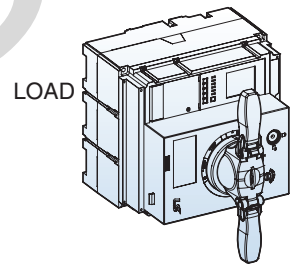
#### S Type

LINE



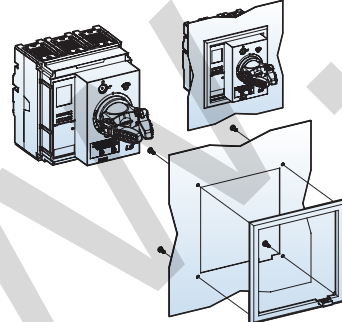
#### R Type

LOAD LINE

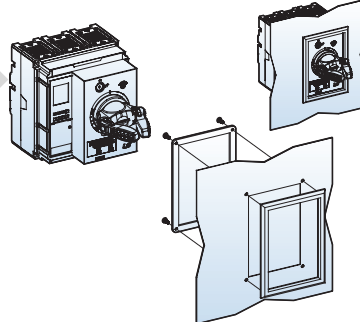


### Door cut type for Direct rotary handle

#### A Type

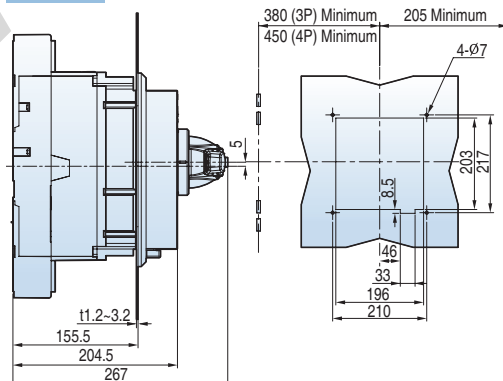


#### B Type

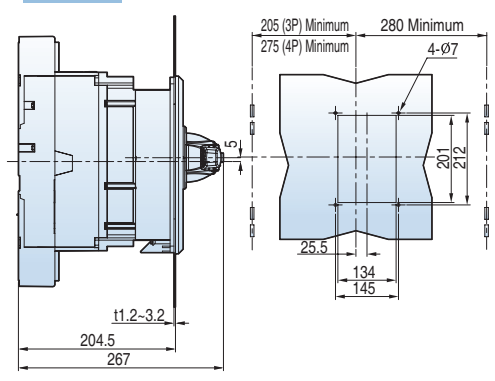


### Dimension of door cut

#### A Type



#### B Type



Note) 1. In case of disassembling and assembling the main cover, screw should be tightened in specific torque of 1.5N.m (15.3kgf.cm)  
2. In case of disassembling and assembling the main cover by over tightening torque, the parts of MCCB can be damaged.



# Accessories for TS series 1600A

Susol

## Rotary handle

### Extended rotary handle

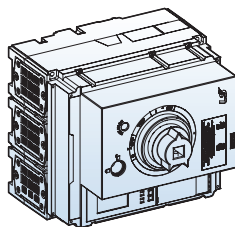
#### Degree of protections IP55

There are three types of extended rotary handle according to line & load direction  
With Extended rotary handles, can be operate MCCB at the back of switchboards, from the switchboard front.

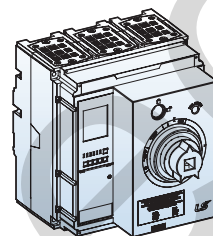
Indication of the three positions O(OFF), I(ON) and tripped circuit breaker locking capability in the OFF position by one to three padlocks, shackle diameter 5 to 6mm (not supplied).

When MCCB is on position, panel door is can't be open.

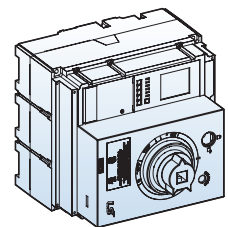
L Type



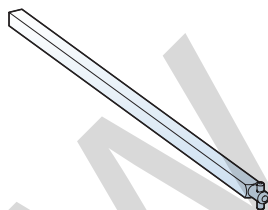
S Type



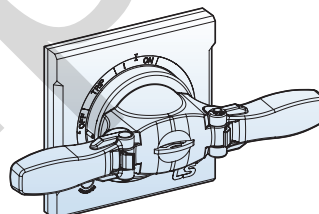
R Type



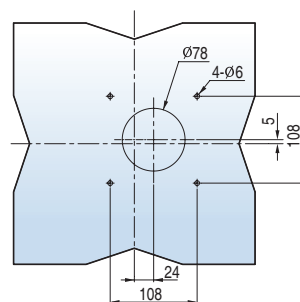
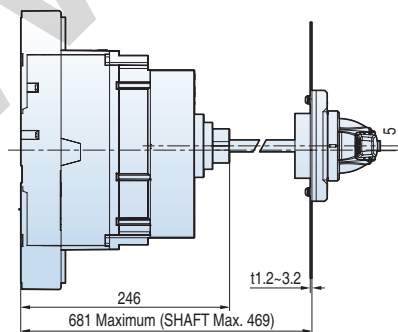
Shaft



Handle



#### Dimension of door cut



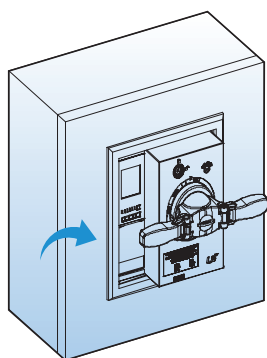
# Accessories for TS series 1600A

Susol

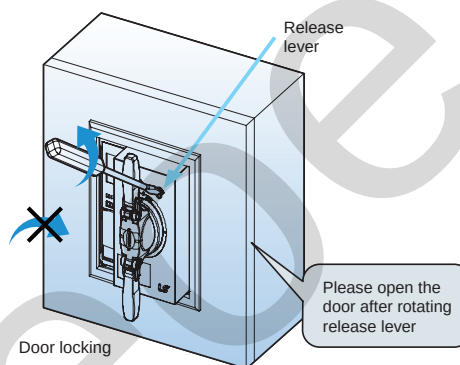
## Rotary handle

### Locking system(Door lock)

The panel door can be locked at ON and TRIP position of rotary handle.  
To open the panel door at ON position, just rotate release screw counterclockwise.  
When MCCB is on position, panel door is can't be open.



OFF State



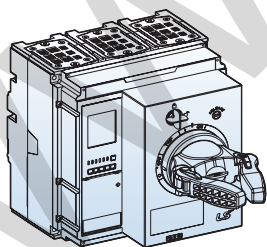
ON State

### ⚠ Caution

- If the door is opened with much pressure when the position of handle is ON or TRIP, the handle lock lever will be damaged

### Key lock

After locking handle, be sure that the key removed.

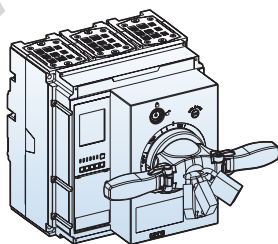


Key lock: locking OFF position

Locking by rotary handle with a key lock

A locking can be done by using the rotary handle which has key lock device.

The lock is used to lock the circuit-breaker in the OFF position.



Locking at ON or OFF position

Padlocking by rotary handle

A padlocking can be also done by using the rotary handle.

The lock is used to lock the circuit-breaker in the ON and OFF position.

Maximum three (3) padlocks with shackle diameters ranging from 5 to 6mm may be used. (Padlocks are not supplied)

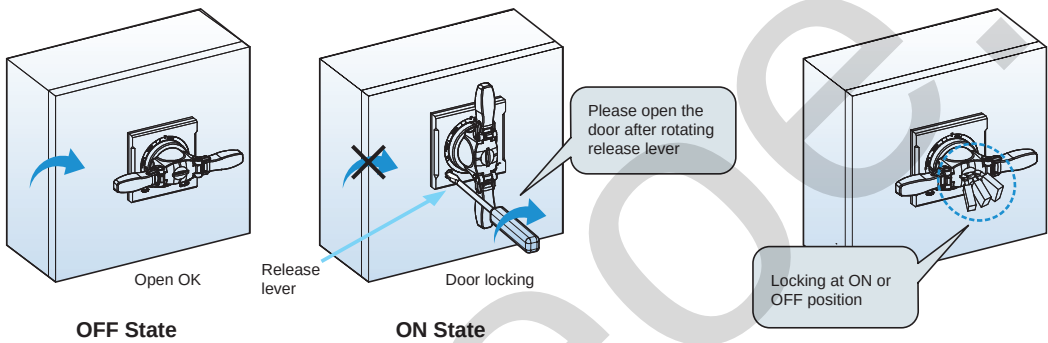
# Accessories for TS series 1600A

Susol

## Rotary handle

### Locking system(Door lock)

The panel door can be locked at ON and TRIP position of rotary handle.  
To open the panel door at ON position, just rotate release screw clockwise.  
When MCCB is on position, panel door is can't be open

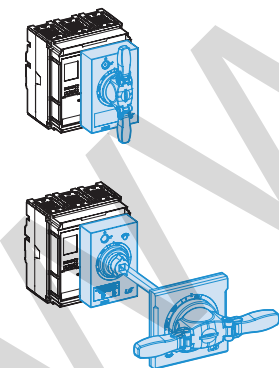


### ⚠ Caution

- If the door is opened with much pressure when the position of handle is ON or TRIP, the handle lock lever will be damaged

### Degree of protections

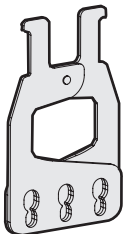
| Type                                                        | Degree of protection                                                        | IP   |
|-------------------------------------------------------------|-----------------------------------------------------------------------------|------|
| Circuit breaker with cover frame and rotary direct handle   | The access probe of 1.0mm diameter shall not penetrate.                     | IP40 |
| Circuit breaker with cover frame and rotary extended handle | Totally protected against ingress of dust and water jets from any direction | IP65 |



# Accessories for TS series 1600A

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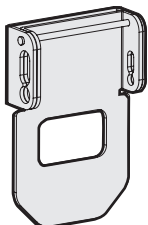
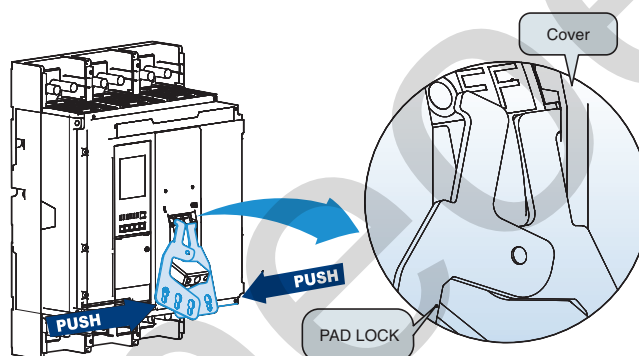
## Locking devices



### Removable padlock(PL)

This device allows the handle to be locked in the “OFF” position. Locking in the OFF position guarantee isolation according to IEC 60947-2.

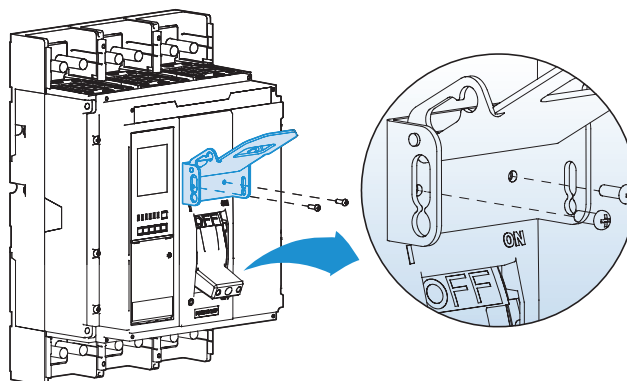
The locking device for the toggle handle can be installed in 3-pole and 4-pole circuit-breakers. Maximum three (3) padlocks with shackle diameters ranging from 5 to 8mm may be used. (Padlocks are not supplied)



### Fixed padlock (PHL)

This device allows the handle to be locked in the “ON” and “OFF” position. Locking in the OFF position guarantee isolation according to IEC 60947-2.

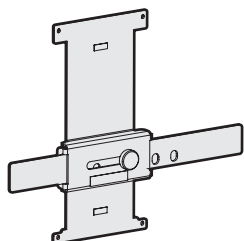
The locking device for the toggle handle can be installed in 3-pole and 4-pole circuitbreakers. Maximum three (3) padlocks with shackle diameters ranging from 5 to 8mm may be used. (Padlocks are not supplied)



# Accessories for TS series 1600A

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## Locking devices



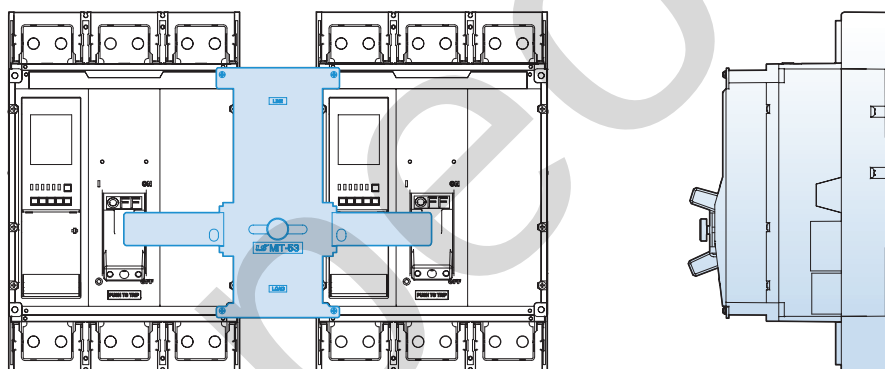
### Mechanical interlock (MIT)

The mechanical interlock (MIT) can be applied on the front of two breakers mounted side by side, in either the 3-pole or 4-pole version and prevents simultaneous closing of the two breakers.

Fixing is carried out directly on the cover of the breakers.

The front interlocking plate allows installation of a padlock in order to fix the position.  
(possibility of locking in the O-O position as well)

This mechanical interlocking device is very useful and simple for consisting of manual source changeover system



# Accessories for TS series 1600A

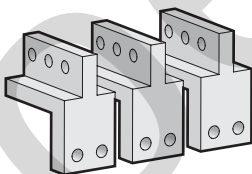
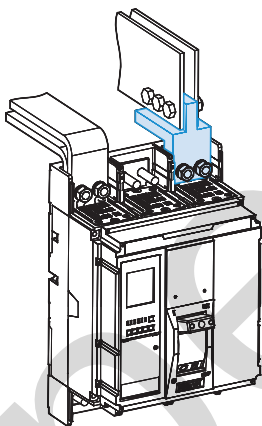
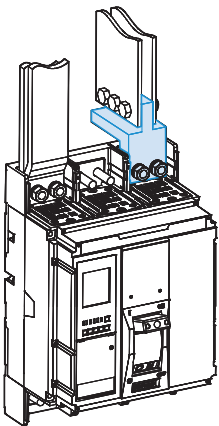
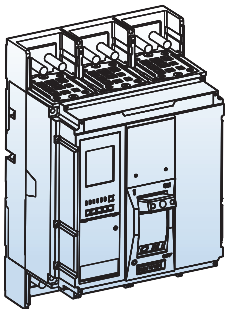
Susol

## Terminal

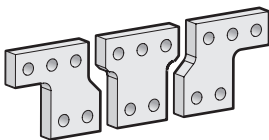
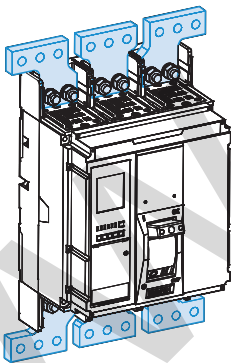
### Front connection of Fixed devices

#### Bars

Fixed, front-connection Susol TS1600AF devices are equipped with terminals comprising captive screws for direct connection of bars. Other connection possibilities for bars include vertical-connection adapters for edgewise bars and spreaders to increase the pole pitch to 95 mm.



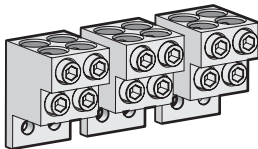
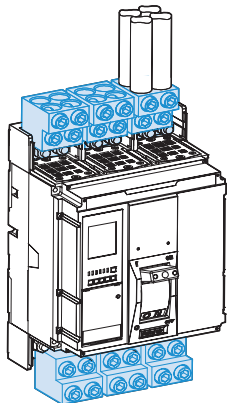
Vertical busbar



Busbars

#### Bare cables

Lug terminals may be used to connect four 85 up to 240mm<sup>2</sup> copper or aluminum cables for each phases. Bare cable connection is possible for rating up to and including 1250A



Lug terminal

|                           |               |
|---------------------------|---------------|
| L(mm)                     | 25~55         |
| S(mm <sup>2</sup> ) Cu/Al | 4×85 to 4×240 |
| Torque(kgf · cm)          | 564           |

# Accessories for TS series 1600A

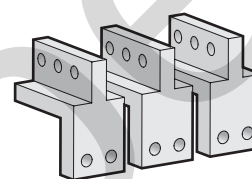
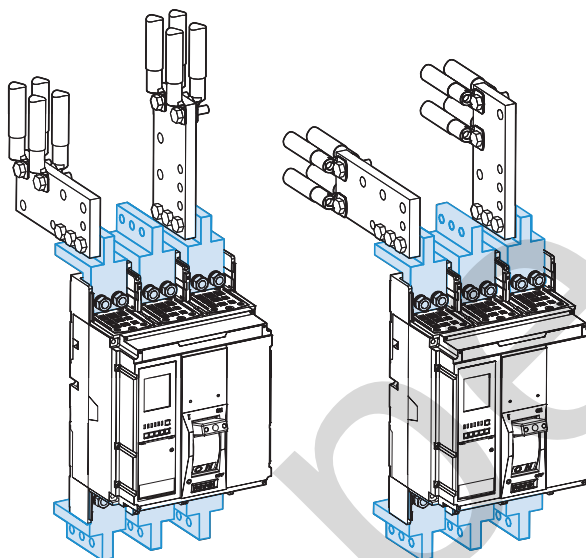
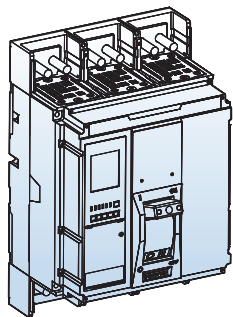
Susol

## Terminal

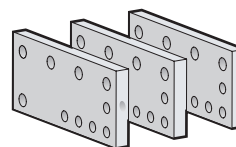
### Crimped Terminals

Crimped terminals are combined with the vertical and extension busbars. One to four cables with crimped terminals ( $\pm 300\text{mm}^2$ ) may be connected.

To ensure stability, connectors must be fixed and insulated between the terminal extensions.



Vertical busbar

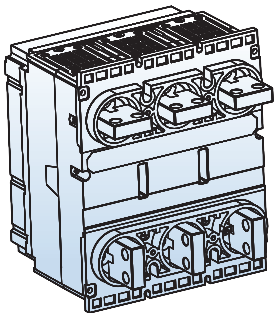


Extension busbars

# Accessories for TS series 1600A

Susol

## Terminal



### Rear connection of Fixed devices

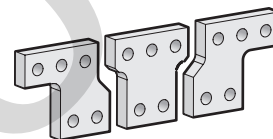
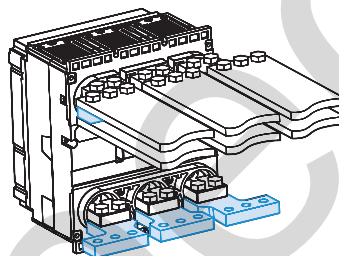
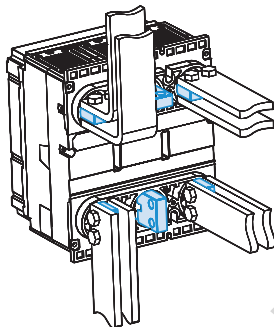
(Orderable with a breaker)

#### Bars

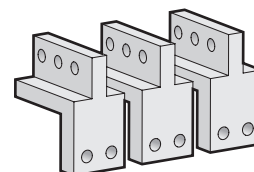
Rear connection devices equipped with horizontal or vertical connectors may be directly connected to flat or edgewise busbars, depending on the position of the connectors. Busbars are available to increase the pole pitch to 95mm

The standard type of rear connection type is horizontal type.

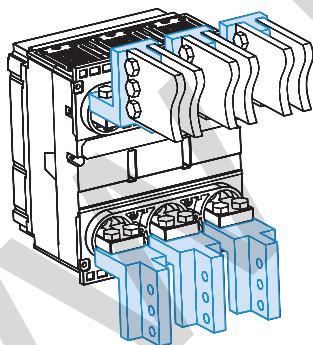
If customer want to connect busbars with vertical or combination(horizontal and vertical) please order separately.



Busbars

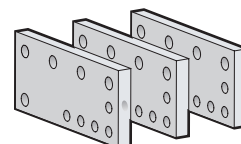
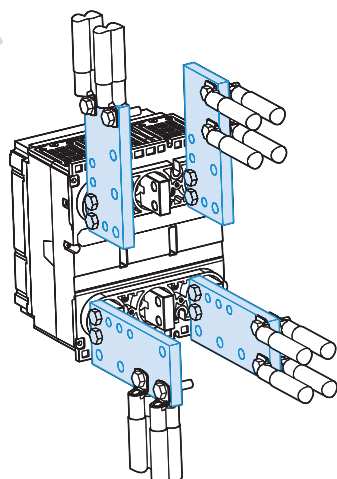


Vertical busbar



#### Crimped Terminals

Crimped terminals enable connection of one to four cables with crimped terminals( $\pm 300\text{mm}^2$ ) To ensure stability, connectors must be fixed and insulated between the terminal extensions



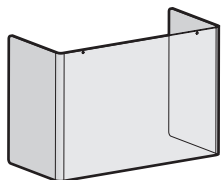
Extension busbars



# Accessories for TS series 1600A

Susol

## Insulation

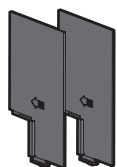


### Terminal cover

Mounted on fixed, front-connection devices, it insulates power-connection points.

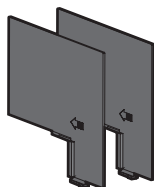
### Barrier

These barriers are insulated between the phases for increase insulation level. It also can be easily mounted, even the circuit-breaker already installed, inserting them in the corresponding slots. They are incompatible with both the insulating terminal covers. It is possible to mount the phase separating partitions between two circuit-breakers side



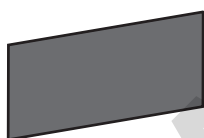
### Barrier for front connection

paking unit: 2ea/3Pole, 3EA/4Pole



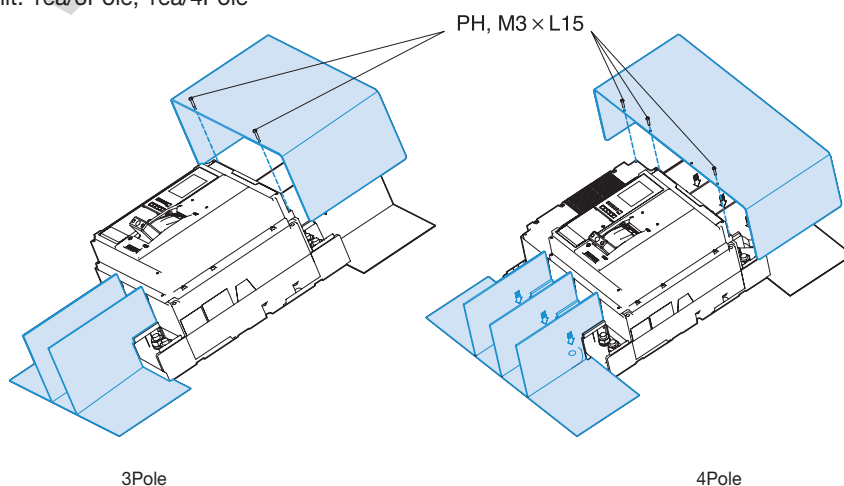
### Barrier for extension terminal

paking unit: 2ea/3Pole, 3EA/4Pole



### Plate protection

paking unit: 1ea/3Pole, 1ea/4Pole

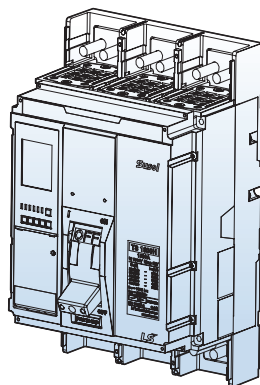


# Accessories for TS series 1600A

**Susol**

## Standard accessories

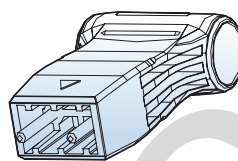
The following accessories for mounting, connection, insulation, handle operation are standard items and are packed with Susol TD & TS series circuit breakers.



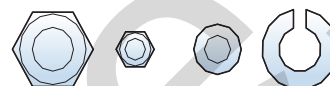
Circuit breaker: 1ea



Barrier Interphase  
3P: 2ea, 4P: 3ea



Handle Aux: 1ea



Nut(M5): 4ea  
Nut(M10), S/W, P/W  
3P: 12, 4P: 16

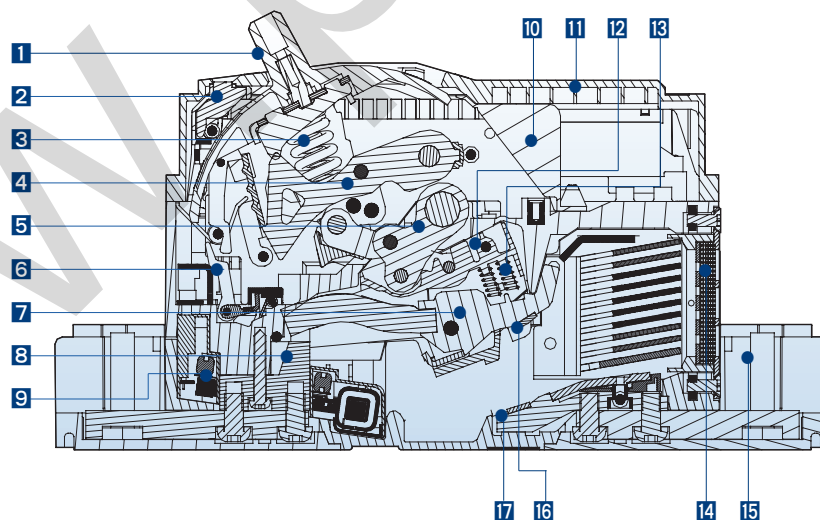


Screw (M5 x 110): 4ea



Plate protection: 1ea

## Components



- 1 Handle
- 2 Test Button
- 3 Main Spring
- 4 Link Ass'y
- 5 Main Shaft Ass'y
- 6 Hard Trip Device

- 7 Moving Contactor
- 8 Load Terminal
- 9 Power CT
- 10 Handle Cover
- 11 Main Cover
- 12 Wall Holder Contactor

- 13 Contact Spring
- 14 Arc Chute
- 15 Terminal Bolt
- 16 Moving Tip
- 17 Fixed Tip



## A-4. Mounting & Connection

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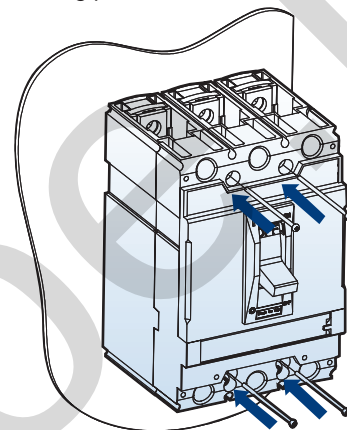
|                                                  |       |
|--------------------------------------------------|-------|
| <b>Fixed mounting</b> .....                      | A-4-1 |
| <b>Connecting terminal &amp; conductor</b> ..... | A-4-2 |
| <b>Safety clearance</b> .....                    | A-4-3 |
| <b>Example of installation</b> .....             | A-4-6 |
| <b>Connections for 1600AF</b> .....              | A-4-7 |
| <b>Size of busbar for 1600AF</b> .....           | A-4-8 |

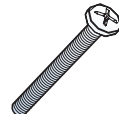
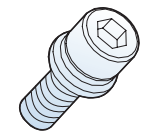
# Mounting & Connection

Susol

## Fixed mounting

Susol TD and TS circuit-breakers can be directly connected to the mounting plate. If busbars or terminals are used to connect the circuit breaker on the back of the mounting plate, the appropriate safety clearances must be observed.

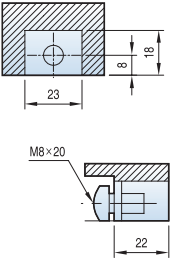
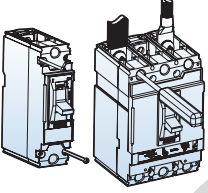
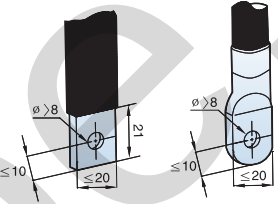
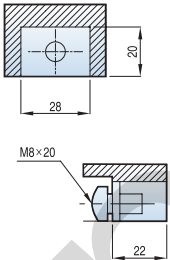
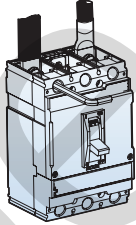
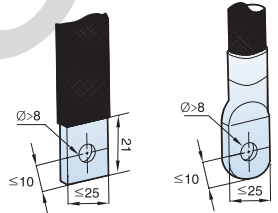
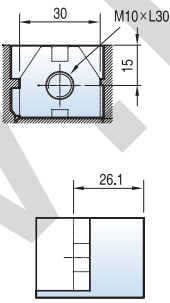
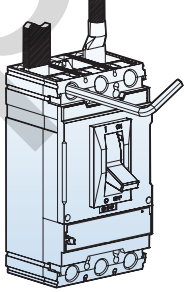
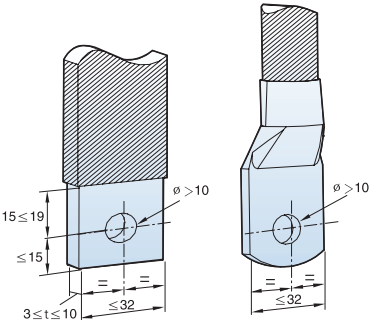
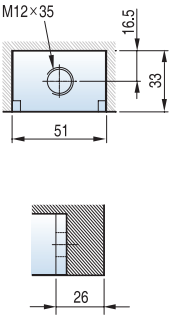
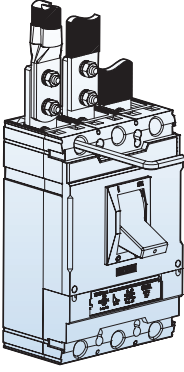
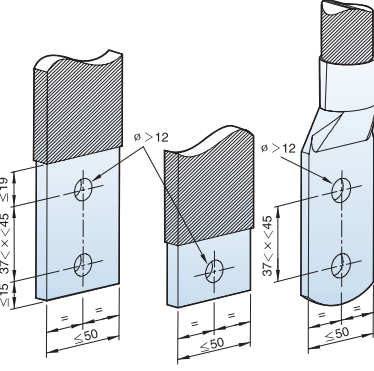


|                                             | TD100, TD160                                                                                                                                                                 | TS100, TS160,<br>TS250                                                                                                                                    | TS400, TS630                                                                                                                                                  | TS800                                                                                                                                                         |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Screw for mounting                          | <br>1Pole:2EA(M3×75)<br>3Pole:2EA(M4×75)<br>4Pole:4EA(M4×75)                              | <br>3Pole:2EA(M4×75)<br>4Pole:4EA(M4×75)                               | <br>3Pole:4EA(M5×85)<br>4Pole:4EA(M5×85)                                 | <br>3Pole:4EA(M6×100)<br>4Pole:4EA(M6×100)                               |
| Nut for mounting                            | -                                                                                                                                                                            | -                                                                                                                                                         | <br>3Pole:4EA<br>4Pole:4EA                                               | <br>3Pole:4EA<br>4Pole:4EA                                               |
| Screw for connection of terminals, Spreader | <br>1Pole:2EA(M8×20)<br>3Pole:6EA(M8×20)<br>4Pole:8EA(M8×20)<br>Torque:<br>Max 78kgf · cm | <br>3Pole:6EA(M8×20)<br>4Pole:8EA(M8×20)<br>Torque:<br>Max 147kgf · cm | <br>3Pole:6EA(M10×30)<br>4Pole:8EA(M10×30)<br>Torque:<br>Max 490kgf · cm | <br>3Pole:6EA(M12×35)<br>4Pole:8EA(M12×35)<br>Torque:<br>Max 630kgf · cm |

# Mounting & Connection

Susol

## Connecting terminal & conductor

|                         |                                                                                     | Terminal (mm)                                                                                           | Conductor (mm)                                                                        |
|-------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| TD100<br>TD160          |    | <br>Max 78kgf · cm    |    |
| TS100<br>TS160<br>TS250 |   | <br>Max 147kgf · cm  |   |
| TS400<br>TS630          |  | <br>Max 490kgf · cm |  |
| TS800                   |  | <br>Max 630kgf · cm |  |

# Mounting & Connection

Susol

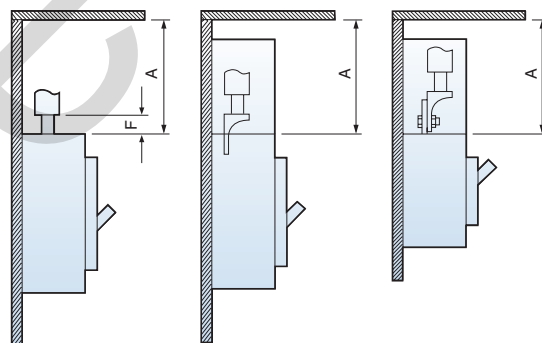
## Safety clearance

When installing a circuit breaker, safety clearances must be kept between the breaker and panels, bars and other protection devices installed nearby. These safety clearances are depend on the ultimate breaking capacity and are defined by tests carried out in accordance with standard IEC 60947-2.

When a short circuit interruption occur, high temperatures pressures are present in and above the arc chambers of the circuit-breaker. In order to allow the pressure to be distributed and to prevent fire and arcing or short-circuit currents, safety clearances are required.

### A: Insulation distance to ceiling for installation in metallic cubicle

|                        | A(mm) |      |
|------------------------|-------|------|
|                        | 415V  | 240V |
| TD100N, TD160N         | 35    | 30   |
| TD100H, TD160H         | 35    | 30   |
| TD100L, TD160L         | 35    | 30   |
| TS100N, TS160N, TS250N | 35    | 30   |
| TS100H, TS160H, TS250H | 35    | 30   |
| TS100L, TS160L, TS250L | 35    | 30   |
| TS400N, TS630N         | 60    | 50   |
| TS400H, TS630H         | 60    | 50   |
| TS400L, TS630L         | 60    | 50   |
| TS800N                 | 100   | 80   |
| TS800H                 | 100   | 80   |
| TS800L                 | 100   | 80   |



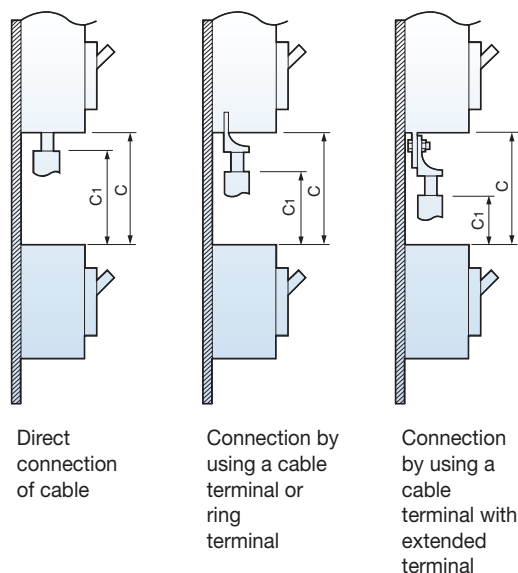
### C1: Minimum distance for superimposed circuit breakers

(from lower circuit breaker to uninsulated part of terminal of upper circuit breaker)

C: C1+ the dimension of exposed conducting part (The dimension of exposed conduct)

|                         | C1(mm) |      | C(mm) |
|-------------------------|--------|------|-------|
|                         | 415V   | 240V |       |
| TD100N, TD160N          | 35     | 30   |       |
| TD100H, TD160H          | 35     | 30   |       |
| TD100L, TD160L          | 35     | 30   |       |
| TS 100N, TS160N, TS250N | 35     | 30   |       |
| TS100H, TS160H, TS250H  | 35     | 30   |       |
| TS100L, TS160L, TS250L  | 35     | 30   |       |
| TS400N, TS630N          | 60     | 50   |       |
| TS400H, TS630H          | 60     | 50   |       |
| TS400L, TS630L          | 60     | 50   |       |
| TS800N                  | 100    | 80   |       |
| TS800H                  | 100    | 80   |       |
| TS800L                  | 100    | 80   |       |

The dimension of exposed conduct



# Mounting & Connection

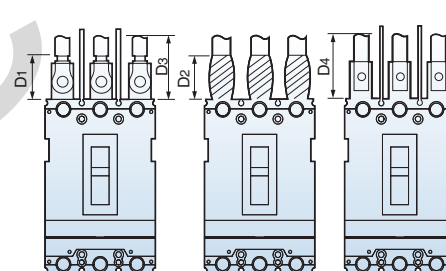
Susol

## Safety clearance

### D: Insulated length of main terminal of circuit breaker

- D1: Connection by ring terminal after taping  
(Larger than the dimension of exposed conducting part)
- D2: Connection by bar after taping
- D3: Connection by ring terminal using insulation barrier  
(Larger than the dimension of exposed conduct)
- D4: Connection by bar using insulation barrier

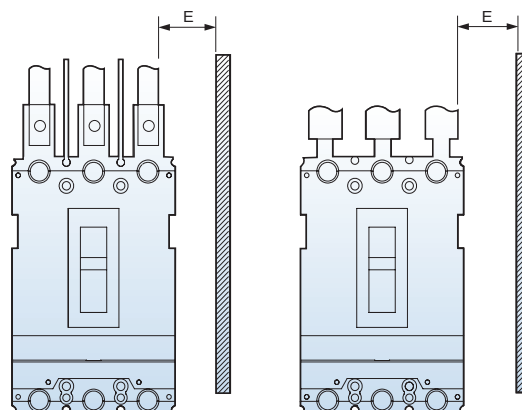
|                        | D1<br>(mm)                            | D2<br>(mm) | D3<br>(mm)                            | D4<br>(mm) |
|------------------------|---------------------------------------|------------|---------------------------------------|------------|
| TD100N, TD160N         | The dimension of exposed conduct + 20 | 50         | The dimension of exposed conduct + 20 | 50         |
| TD100H, TD160H         |                                       | 50         |                                       | 50         |
| TD100L, TD160L         |                                       | 50         |                                       | 50         |
| TS100N, TS160N, TS250N |                                       | 100        |                                       | 100        |
| TS100H, TS160H, TS250H |                                       | 100        |                                       | 100        |
| TS100L, TS160L, TS250L | The dimension of exposed conduct + 20 | 100        | The dimension of exposed conduct + 20 | 100        |
| TS400N, TS630N         |                                       | 200        |                                       | 200        |
| TS400H, TS630H         |                                       | 200        |                                       | 200        |
| TS400L, TS630L         |                                       | 200        |                                       | 200        |
| TS800N                 |                                       | 200        |                                       | 200        |
| TS800H                 | The dimension of exposed conduct + 20 | 200        | The dimension of exposed conduct + 20 | 200        |
| TS800L                 |                                       | 200        |                                       | 200        |



Note) If uninsulated conductors are used for connection, please insulate by taping to the point where the conductors overlap with the insulation barrier or to the root of the circuit breaker.

### E: Distance from a side of breaker to side plate

|                        | E(mm) |      |
|------------------------|-------|------|
|                        | 415V  | 240V |
| TD100N, TD160N         | 25    | 15   |
| TD100H, TD160H         | 25    | 15   |
| TD100L, TD160L         | 25    | 15   |
| TS100N, TS160N, TS250N | 25    | 15   |
| TS100H, TS160H, TS250H | 25    | 15   |
| TS100L, TS160L, TS250L | 25    | 15   |
| TS400N, TS630N         | 20    | 15   |
| TS400H, TS630H         | 20    | 15   |
| TS400L, TS630L         | 20    | 15   |
| TS800N                 | 45    | 20   |
| TS800H                 | 45    | 20   |
| TS800L                 | 45    | 20   |





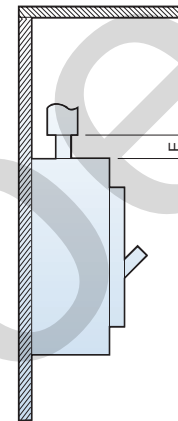
# Mounting & Connection

Susol

## Safety clearance

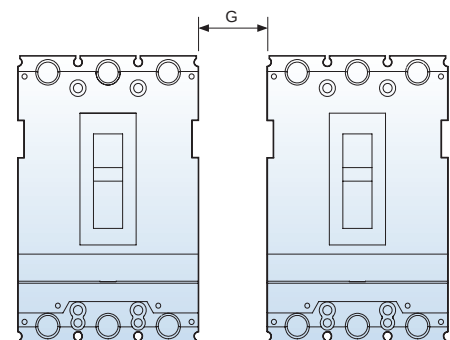
F: The dimension of exposed conducting part

|                        | F<br>(mm) |
|------------------------|-----------|
| TD100N, TD160N         | 20        |
| TD100H, TD160H         | 20        |
| TD100L, TD160L         | 20        |
| TS100N, TS160N, TS250N | 10        |
| TS100H, TS160H, TS250H | 10        |
| TS100L, TS160L, TS250L | 10        |
| TS400N, TS630N         | 10        |
| TS400H, TS630H         | 10        |
| TS400L, TS630L         | 10        |
| TS800N                 | 10        |
| TS800H                 | 10        |
| TS800L                 | 10        |



G: Minimum center distance for two horizontally installed circuit-breakers

|                        | G<br>(mm) |
|------------------------|-----------|
| TD100N, TD160N         | 0         |
| TD100H, TD160H         | 0         |
| TD100L, TD160L         | 0         |
| TS100N, TS160N, TS250N | 0         |
| TS100H, TS160H, TS250H | 0         |
| TS100L, TS160L, TS250L | 0         |
| TS400N, TS630N         | 0         |
| TS400H, TS630H         | 0         |
| TS400L, TS630L         | 0         |
| TS800N                 | 0         |
| TS800H                 | 0         |
| TS800L                 | 0         |



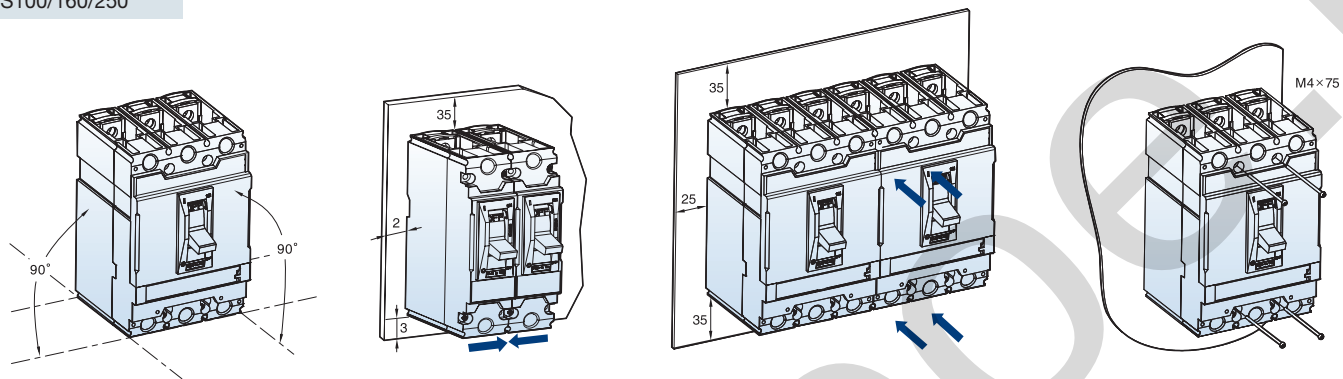
Note) In case of using long or short terminal covers.

# Mounting & Connection

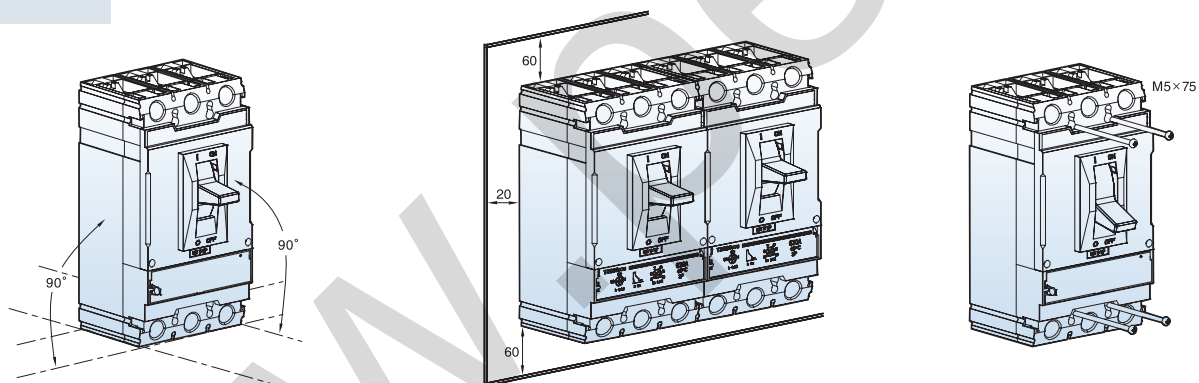
**Susol**

## Example of installation

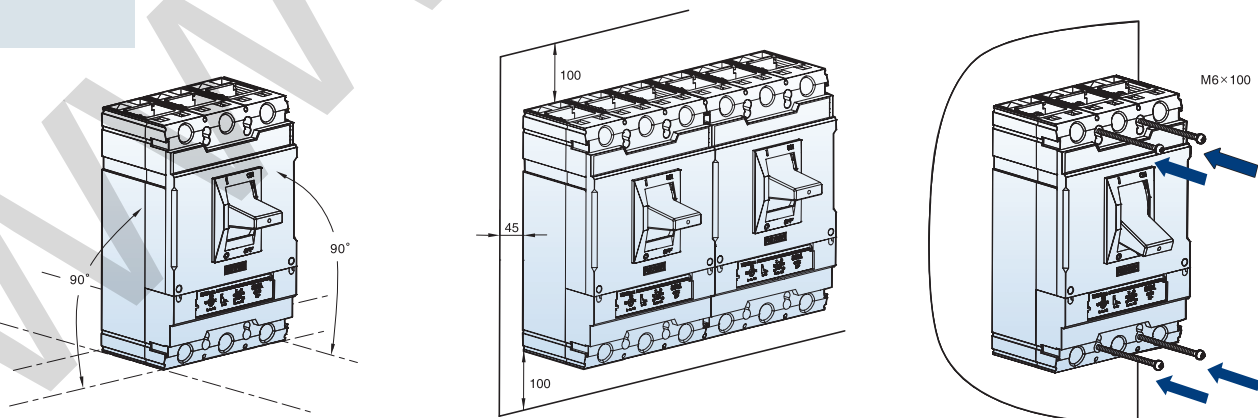
TD100/160  
TS100/160/250



TS400/630



TS800



Note) In case of using long or short terminal covers,  
no need to consider on minimum center distance for two horizontally installed circuit-breakers

# Mounting & Connection

Susol

## Connections for 1600AF

The quality of busbar connections depends, among other things, on the tightening torques used for nuts and bolts. Over-tightening may have the same consequences as under-tightening. The correct tightening torques for the connection of busbars to the circuit breaker terminals are indicated in the table below.

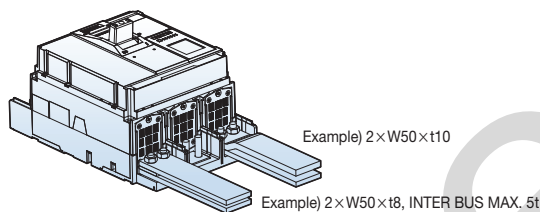
### Examples of busbar connections

Susol TS1600 MCCB may be installed vertically, horizontally or flat on their back.

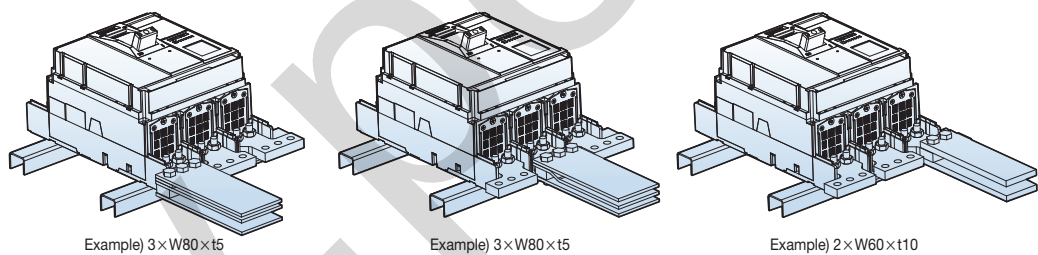
*Note)* Applicable only to rated current 1500A or less when directly connected to breaker terminals.

#### Front type

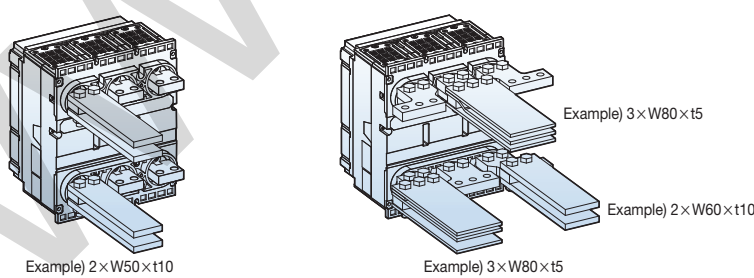
Front type with bars (on backplate or rail)



Front type with basbar (only on rail)

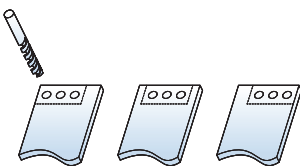


Rear type with bars (only on backplate)

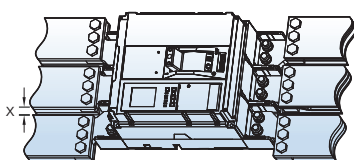


#### Insulation distance

Examples



#### Insulation distance



#### Tightening torques for busbar

| Bolt | Drilling diameter<br>(mm) | Tightening torque<br>(kgf · cm) |
|------|---------------------------|---------------------------------|
| M10  | 11                        | 240~500                         |

#### Dimension(mm)

| Utilisation voltage | X minimum |
|---------------------|-----------|
| $U_i \leq 600V$     | 8mm       |
| $U_i \leq 1000V$    | 14mm      |

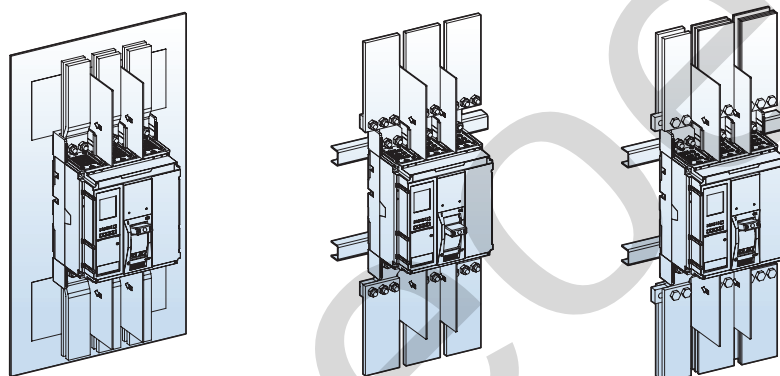
# Mounting & Connection

**Susol**

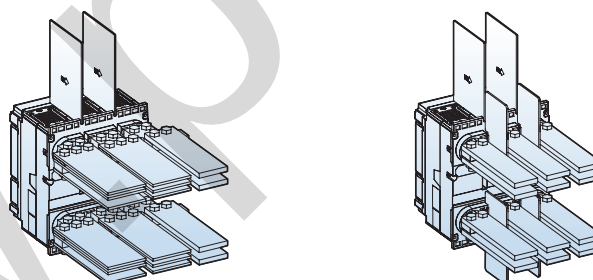
## Size of busbar for 1600AF

The following tables are based on the following assumptions;  
 - Maximum permissible temperature of busbars are 100°C  
 - T : Temperature around the circuit breaker and its connections

Note) 1. The values presented in the tables are the result of trials and theoretical calculations on the basis of the assumption mentioned above.  
 2. These tables are intended as an aid in designing connection, however, the actual values must be confirmed by tests on the installation.



Insulation barrier and plate protection on line side is standard.  
 If customer want to using insulation accessories on load side, please order separately.



Front and horizontal rear connection

| Model  | Maximum current | T:40°C            |           | T:50°C            |           | T:60°C            |           |
|--------|-----------------|-------------------|-----------|-------------------|-----------|-------------------|-----------|
|        |                 | Number of busbars |           | Number of busbars |           | Number of busbars |           |
|        |                 | t=5mm             | t=10mm    | t=5mm             | t=10mm    | t=5mm             | t=10mm    |
| TS1000 | 800             | 2b.5t×50          | 1b.10t×50 | 2b.5t×50          | 1b.10t×50 | 2b.5t×50          | 1b.10t×60 |
|        | 1000            | 3b.5t×50          | 1b.10t×60 | 3b.5t×50          | 2b.10t×50 | 3b.5t×60          | 2b.10t×50 |
| TS1250 | 1250            | 3b.5t×50          | 2b.10t×40 | 3b.5t×50          | 2b.10t×50 | 3b.5t×60          | 2b.10t×50 |
|        |                 | 2b.5t×80          | 2b.10t×40 | 2b.5t×80          |           |                   |           |
| TS1600 | 1400            | 2b.5t×80          | 2b.10t×40 | 2b.5t×80          | 2b.10t×50 | 3b.5t×80          | 2b.10t×60 |
|        | 1600            | 3b.5t×80          | 2b.10t×60 | 3b.5t×80          | 2b.10t×60 | 3b.5t×80          | 3b.10t×50 |

Vertical rear connection

| Model  | Maximum current | T:40°C            |           | T:50°C            |           | T:60°C            |           |
|--------|-----------------|-------------------|-----------|-------------------|-----------|-------------------|-----------|
|        |                 | Number of busbars |           | Number of busbars |           | Number of busbars |           |
|        |                 | t=5mm             | t=10mm    | t=5mm             | t=10mm    | t=5mm             | t=10mm    |
| TS1000 | 800             | 2b.5t×50          | 1b.10t×50 | 2b.5t×50          | 1b.10t×50 | 2b.5t×50          | 1b.10t×50 |
|        | 1000            | 2b.5t×50          | 1b.10t×50 | 2b.5t×50          | 1b.10t×50 | 2b.5t×60          | 1b.10t×60 |
| TS1250 | 1250            | 2b.5t×60          | 1b.10t×60 | 3b.5t×50          | 2b.10t×40 | 3b.5t×50          | 2b.10t×40 |
| TS1600 | 1400            | 2b.5t×80          | 1b.10t×80 | 2b.5t×80          | 2b.10t×50 | 3b.5t×60          | 2b.10t×50 |
|        | 1600            | 3b.5t×60          | 2b.10t×50 | 3b.5t×60          | 2b.10t×50 | 3b.5t×80          | 2b.10t×60 |



## A-5. Characteristics curves

### Susol MCCB up to 800AF

|                                                   |        |
|---------------------------------------------------|--------|
| Thermal-magnetic trip units (TE100, TE160)        | A-5-1  |
| Thermal-magnetic trip units (TD100, TD160, TS100) | A-5-3  |
| Magnetic only trip units (TS100, TS160)           | A-5-6  |
| Thermal-magnetic trip units (TS160, TS250)        | A-5-7  |
| Magnetic only trip units (TS250)                  | A-5-11 |
| Thermal-magnetic trip units (TS400)               | A-5-12 |
| Magnetic only trip units (TS400)                  | A-5-14 |
| Thermal-magnetic trip units (TS630)               | A-5-15 |
| Magnetic only trip units (TS630)                  | A-5-17 |
| Thermal-magnetic trip units (TS800)               | A-5-18 |
| Magnetic only trip units (TS800)                  | A-5-20 |
| Electronic trip unit (ETS)                        | A-5-21 |
| Electronic trip unit (ETM)                        | A-5-22 |
| Ground fault (G), ETM                             | A-5-23 |

### Susol MCCB 1600AF

|                                     |        |
|-------------------------------------|--------|
| Long-time delay (L)                 | A-5-24 |
| Short-time delay (S)                | A-5-25 |
| Instantaneous (I), Ground fault (G) | A-5-26 |
| IDMTL                               | A-5-27 |
| Pre Trip Alarm                      | A-5-28 |

|                                    |        |
|------------------------------------|--------|
| Specific let-through energy curves | A-5-29 |
|------------------------------------|--------|

|                         |        |
|-------------------------|--------|
| Current-limiting curves | A-5-32 |
|-------------------------|--------|

|                         |        |
|-------------------------|--------|
| Time delay curves (RCD) | A-5-35 |
|-------------------------|--------|

# Characteristics curves

Susol

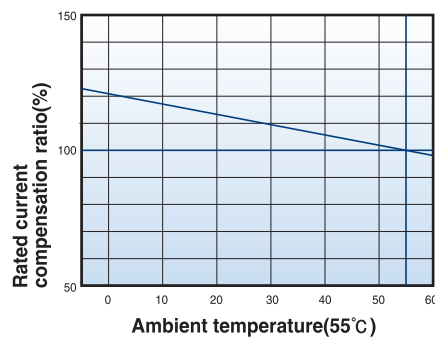
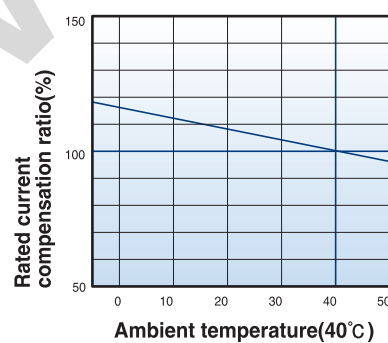
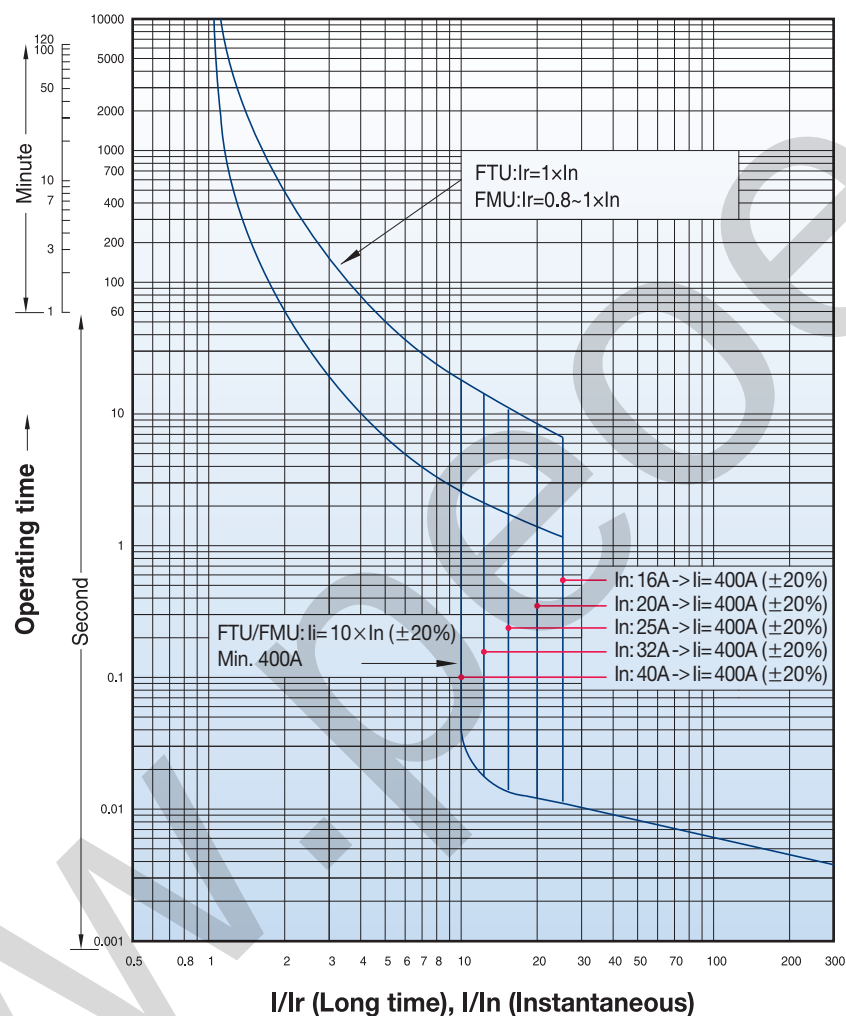
## Circuit breakers with thermal-magnetic trip units

**TE100**

**FTU**

**FMU**

**16~100A**

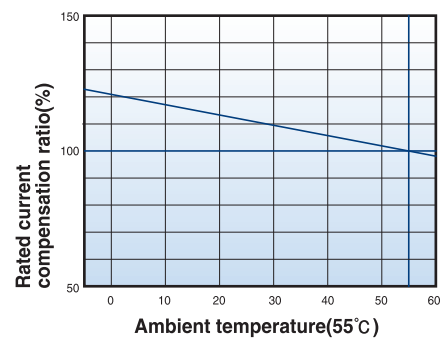
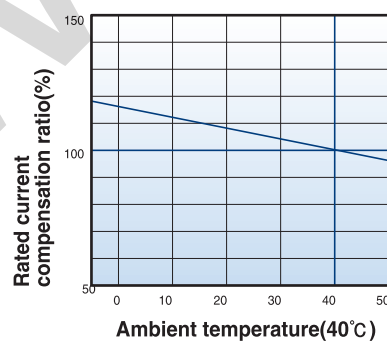
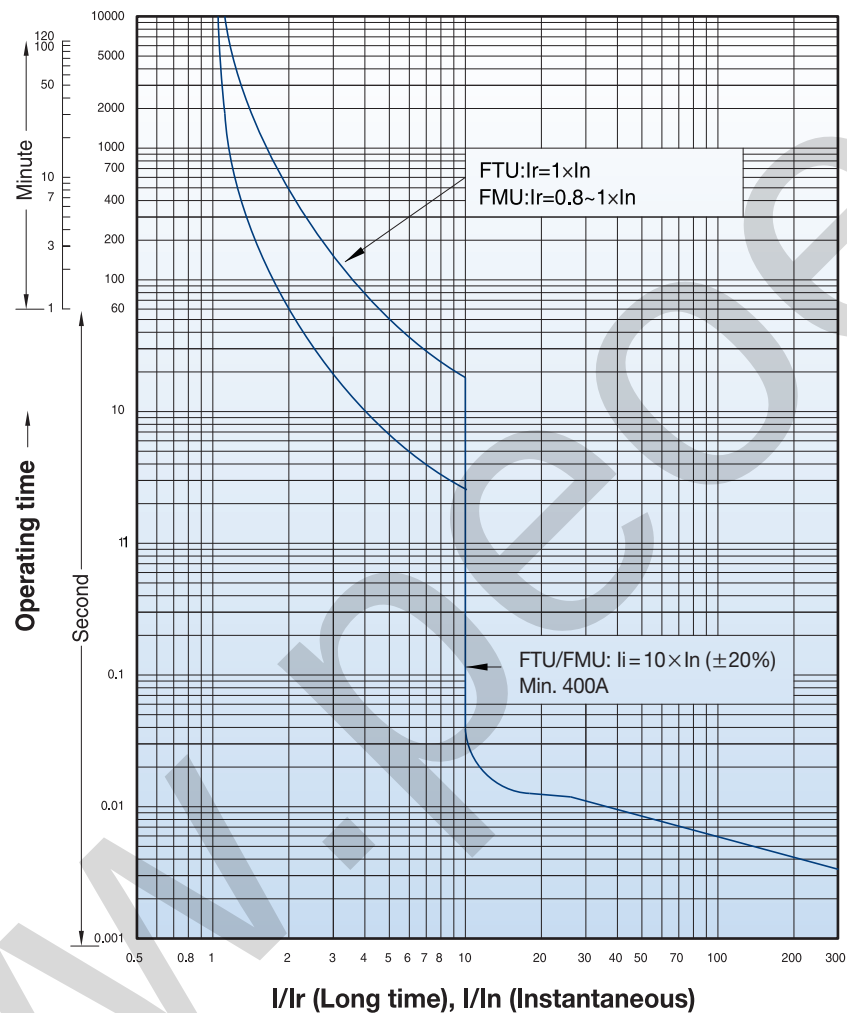


# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TE160**  
**FTU**  
**FMU**  
**100~160A**





# Characteristics curves

Susol

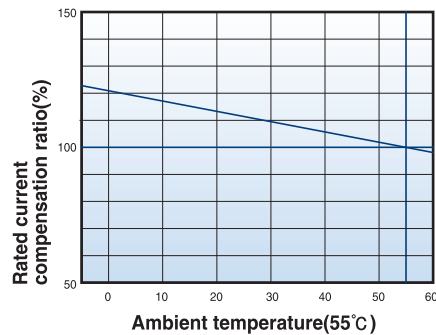
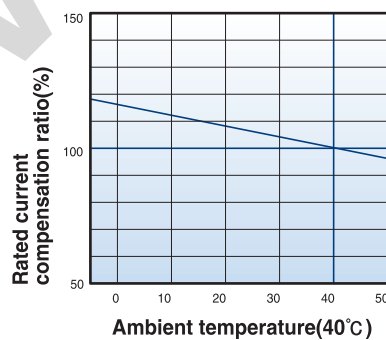
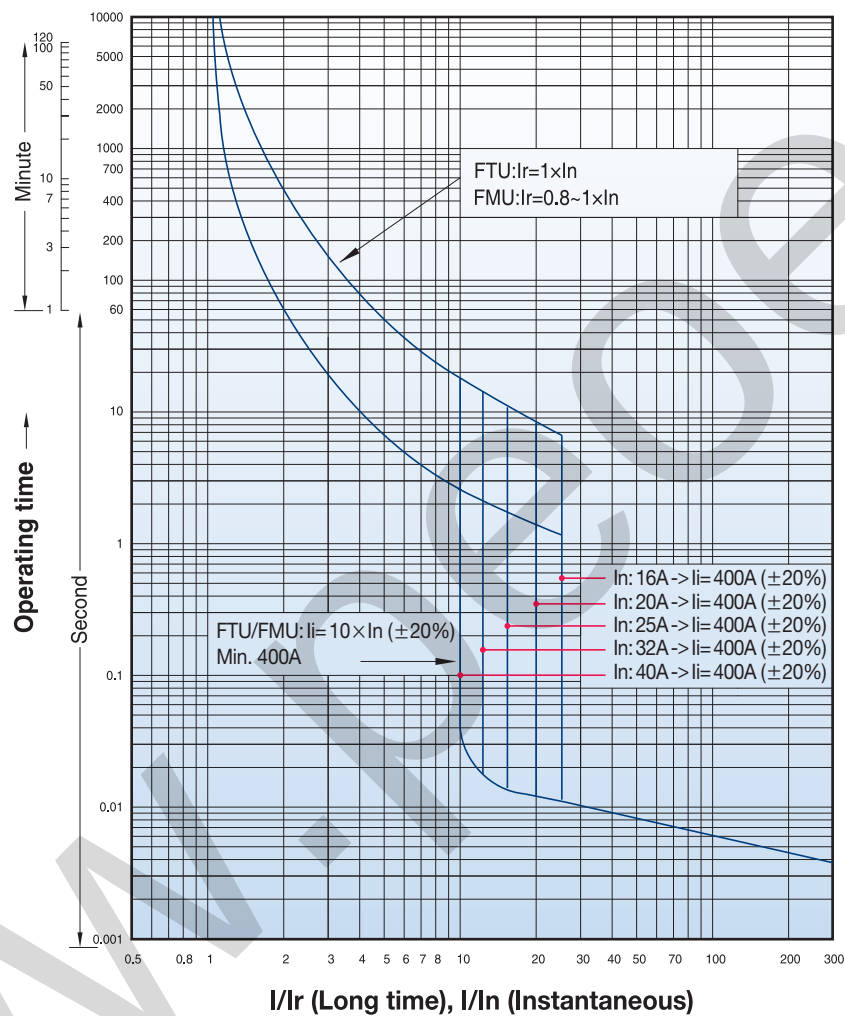
## Circuit breakers with thermal-magnetic trip units

**TD100**

**FTU**

**FMU**

**16~100A**

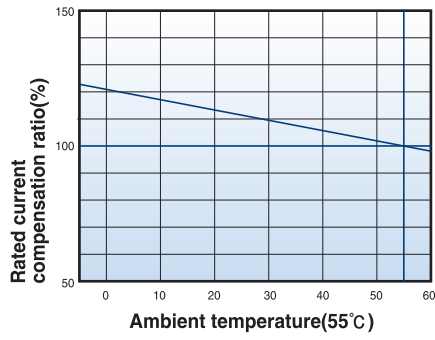
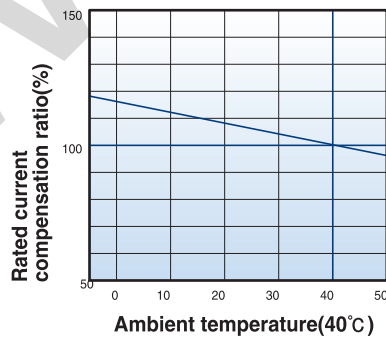
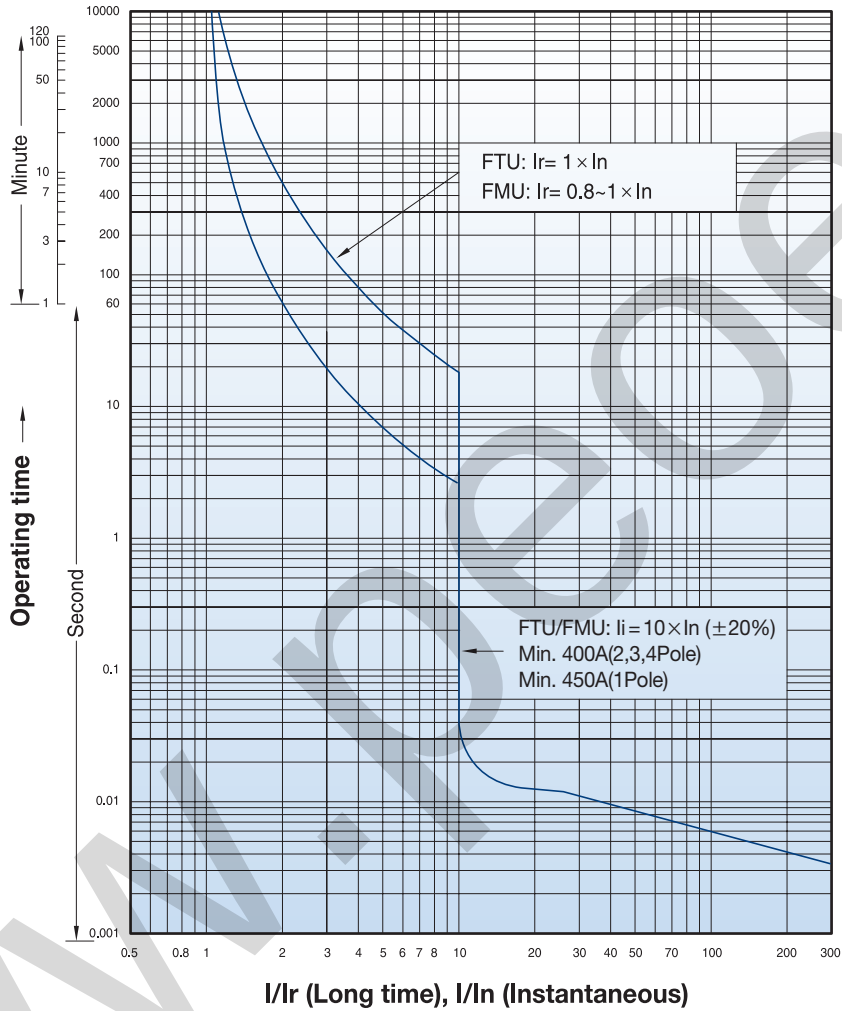


# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TD160**  
**FTU**  
**FMU**  
**100~160A**



# Characteristics curves

Susol

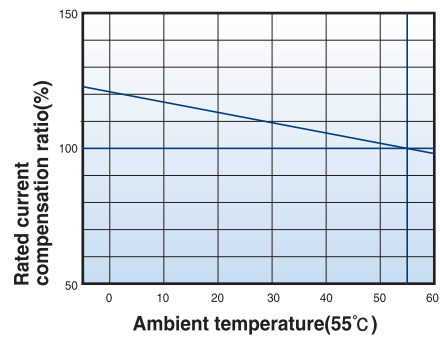
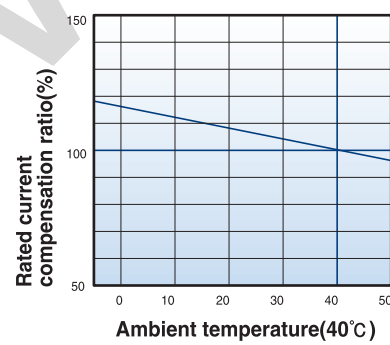
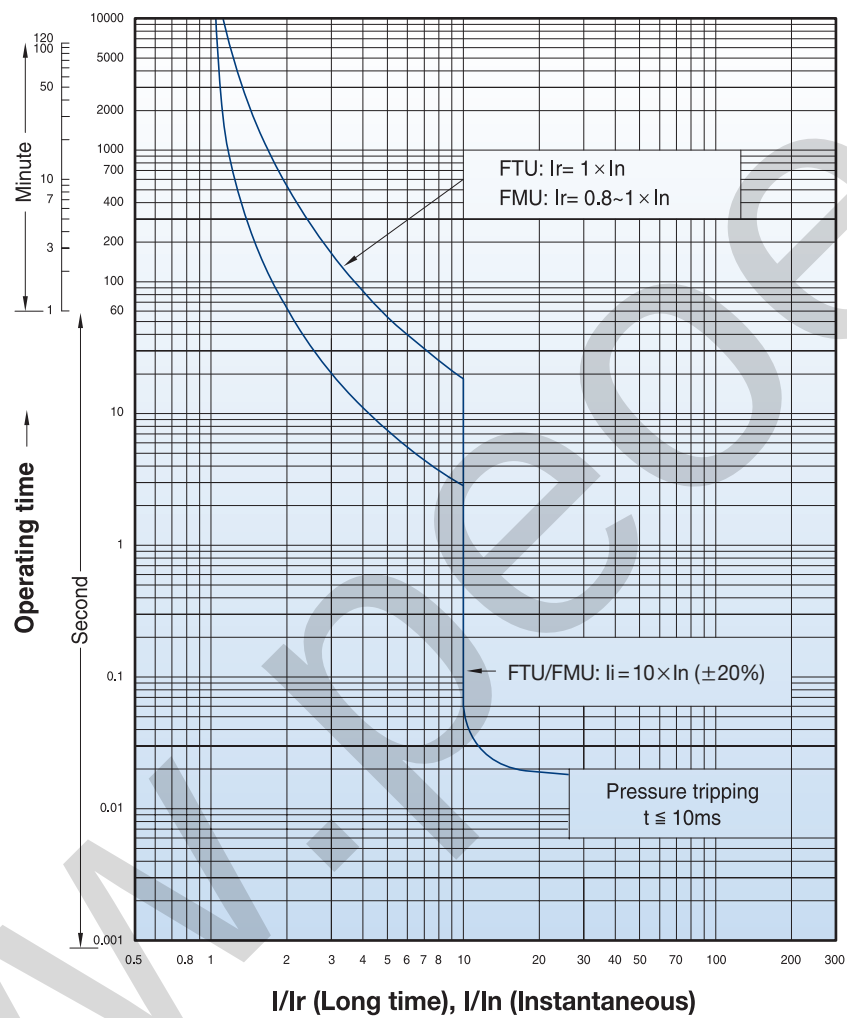
## Circuit breakers with thermal-magnetic trip units

**TS100**

**FTU**

**FMU**

**40~100A**



# Characteristics curves

Susol

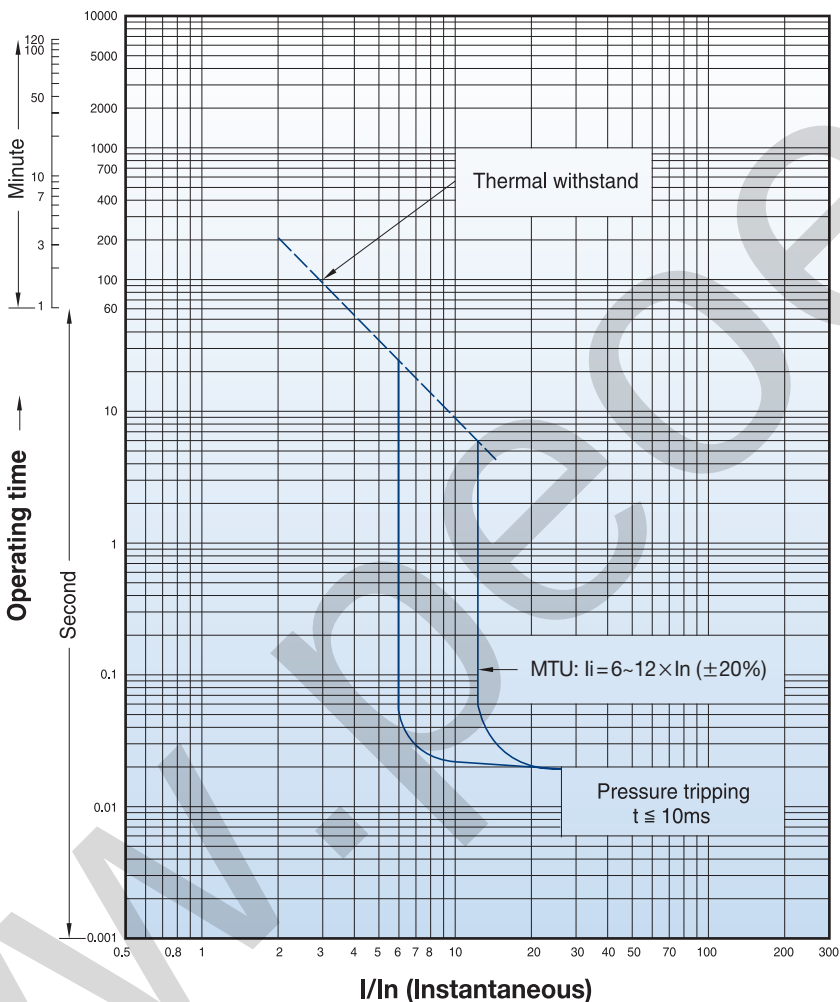
## Circuit breakers with magnetic only trip units

### TS100

Magnetic only  
MTU  
1.6~100A

### TS160

Magnetic only  
MTU  
32~160A



### Magnetic trip units(MTU)

| Rating(A) |       | $I_n$ |
|-----------|-------|-------|
| N / H / L | TS100 |       |
|           | TS160 |       |
|           | TS250 |       |
|           | TS400 |       |
|           | TS630 |       |
|           | TS800 |       |

| TS100 to TS800 |     |     |    |    |    |    |    |     |     |     |     |     |     |
|----------------|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| 1.6            | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| ●              | ●   | ●   | ●  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | ●  | ●  | ●  | ●   | ●   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | ●   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | ●   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | ●   |

### Short - circuit protection(magnetic)

|           |      |
|-----------|------|
| Pick - up | $li$ |
|-----------|------|

|                              |
|------------------------------|
| Setting                      |
| $6..12 \times I_n$ (6 Point) |

# Characteristics curves

Susol

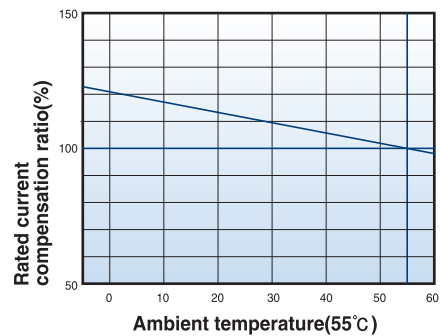
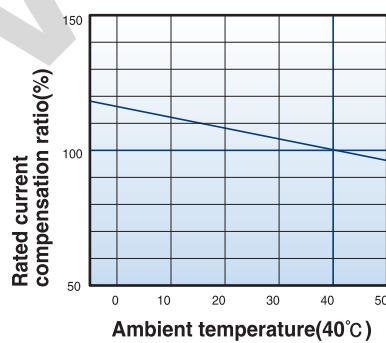
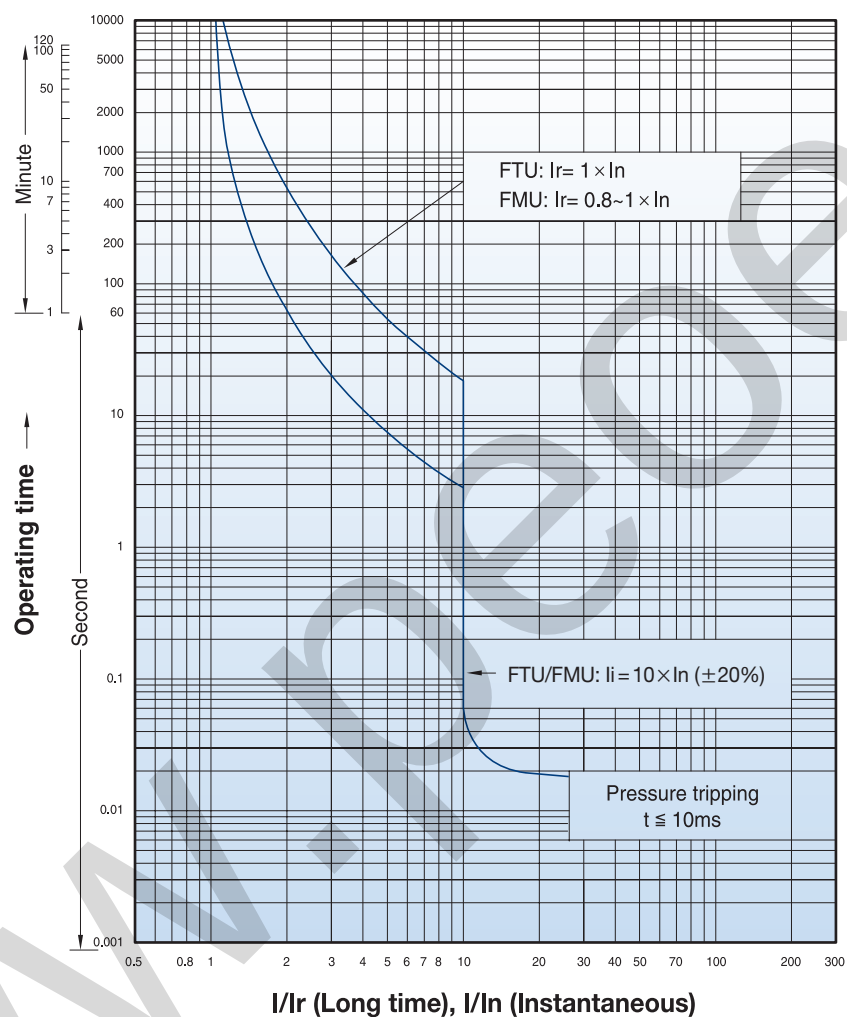
## Circuit breakers with thermal-magnetic trip units

**TS160**

**FTU**

**FMU**

**100, 125, 160A**

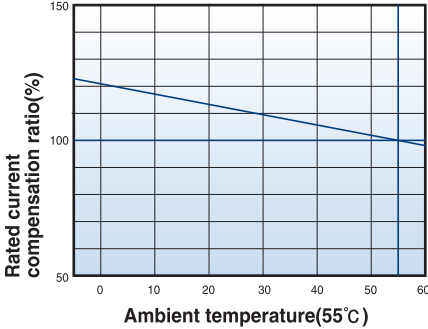
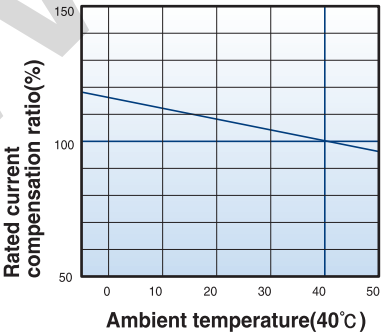
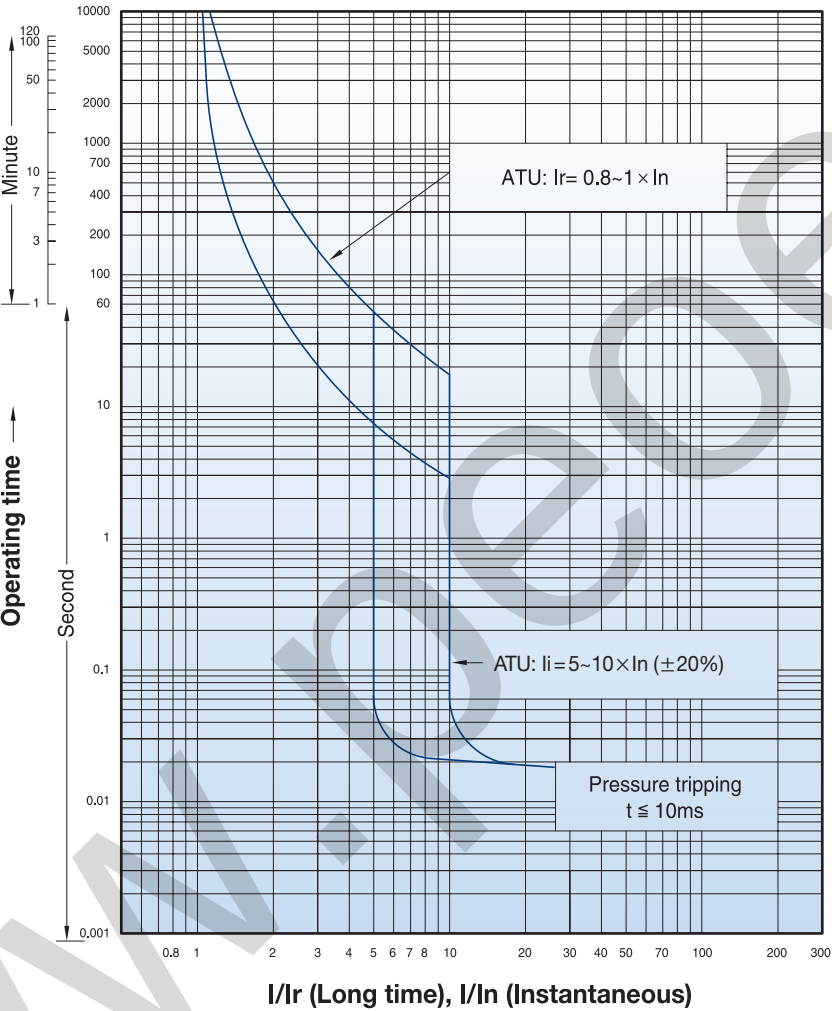


# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TS160**  
**ATU**  
100, 125, 160A

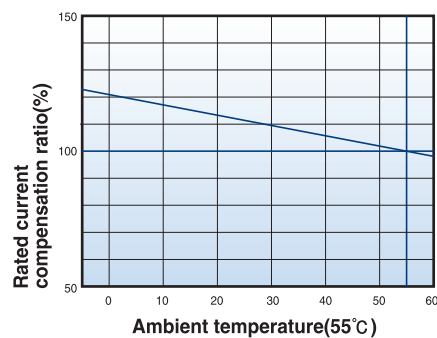
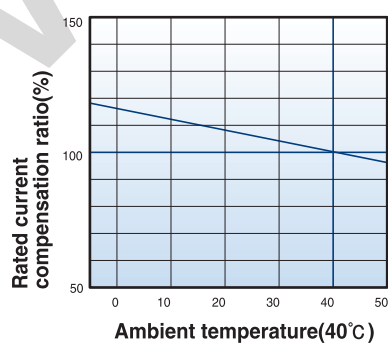
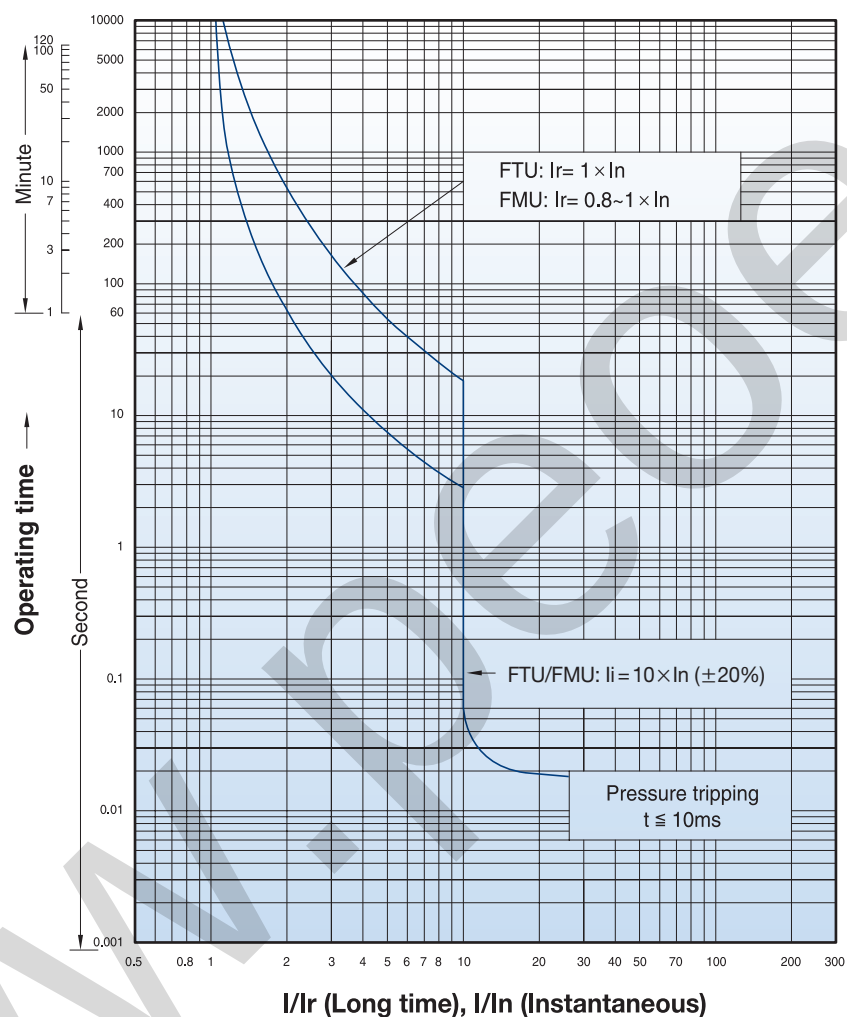


# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TS250**  
**FTU**  
**FMU**  
**125~250A**

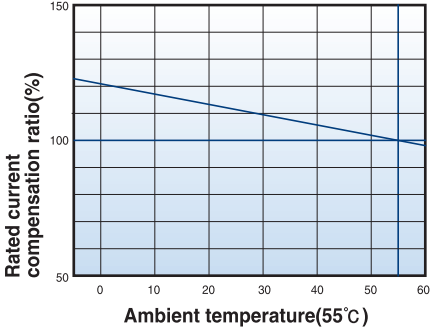
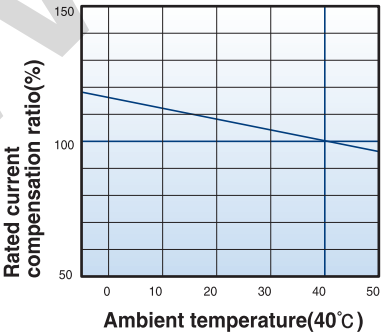
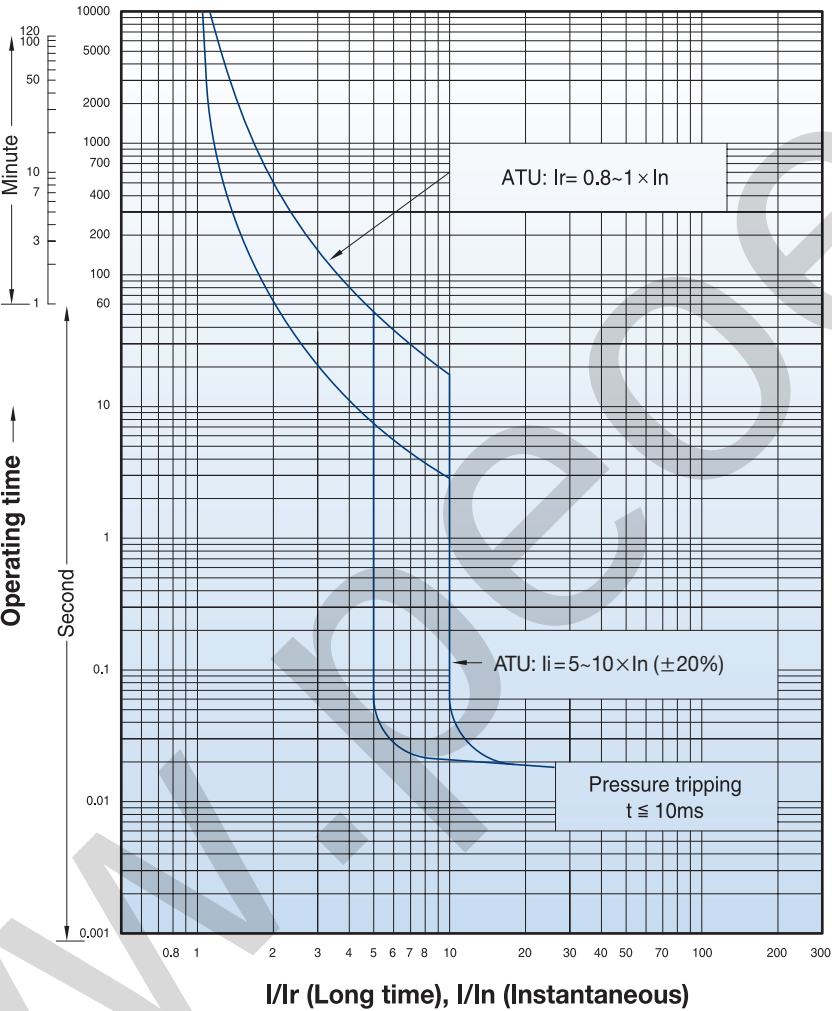


# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TS250**  
**ATU**  
**125~250A**



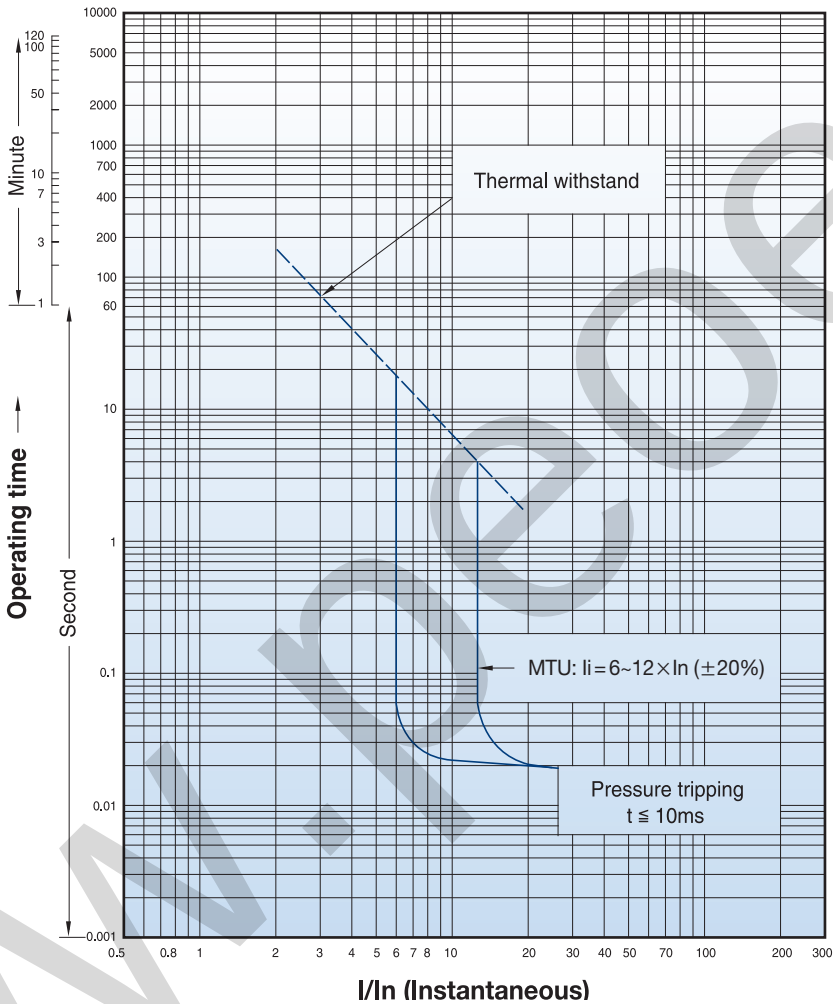


# Characteristics curves

Susol

## Circuit breakers with magnetic only trip units

**TS250**  
**Magnetic only**  
**MTU**  
**100, 160, 220A**



Magnetic trip units(MTU)

| Rating(A) |       | $I_n$ |
|-----------|-------|-------|
| N / H / L | TS100 |       |
|           | TS160 |       |
|           | TS250 |       |
|           | TS400 |       |
|           | TS630 |       |
|           | TS800 |       |

| TS100 to TS800 |     |     |    |    |    |    |    |     |     |     |     |     |     |
|----------------|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| 1.6            | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| ●              | ●   | ●   | ●  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | ●  | ●  | ●  | ●   | ●   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | ●   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | ●   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | ●   |

Short - circuit protection(magnetic)

|           |      |
|-----------|------|
| Pick - up | $li$ |
|-----------|------|

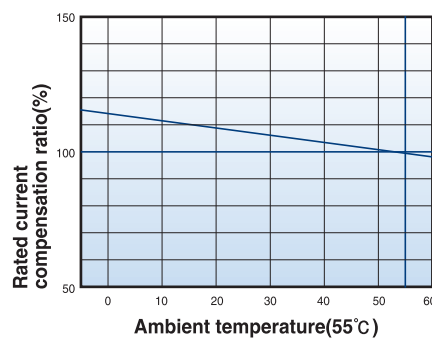
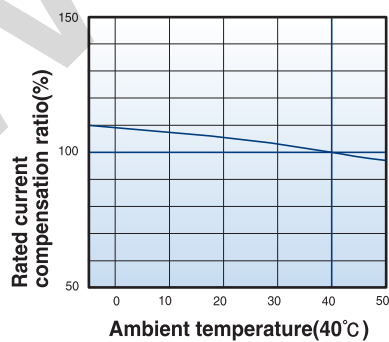
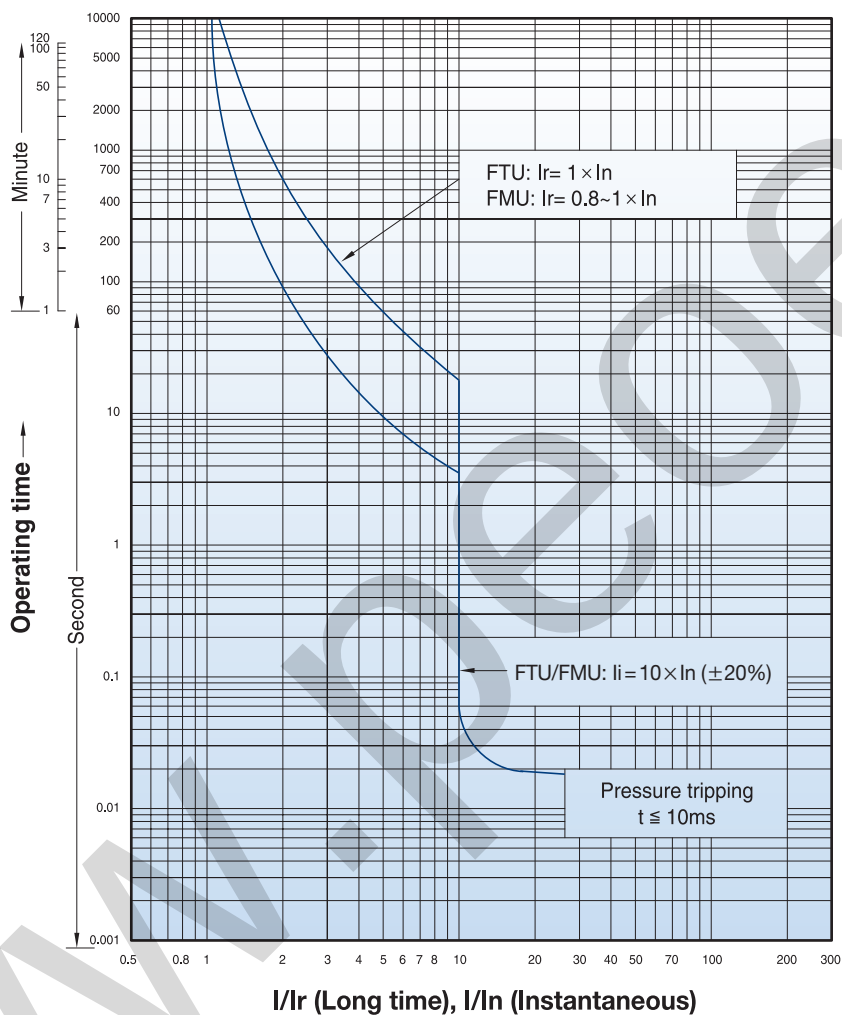
|                              |
|------------------------------|
| Setting                      |
| $6..12 \times I_n$ (6 Point) |

# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TS400**  
**FTU**  
**FMU**  
**300, 400A**

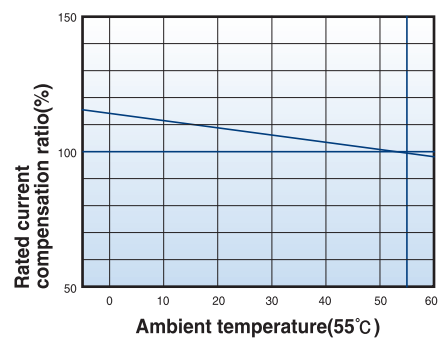
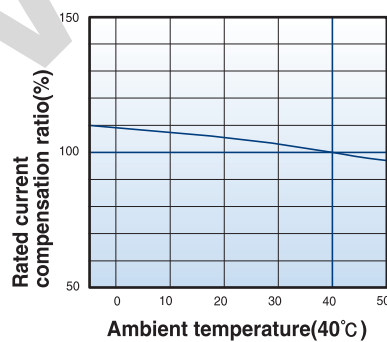
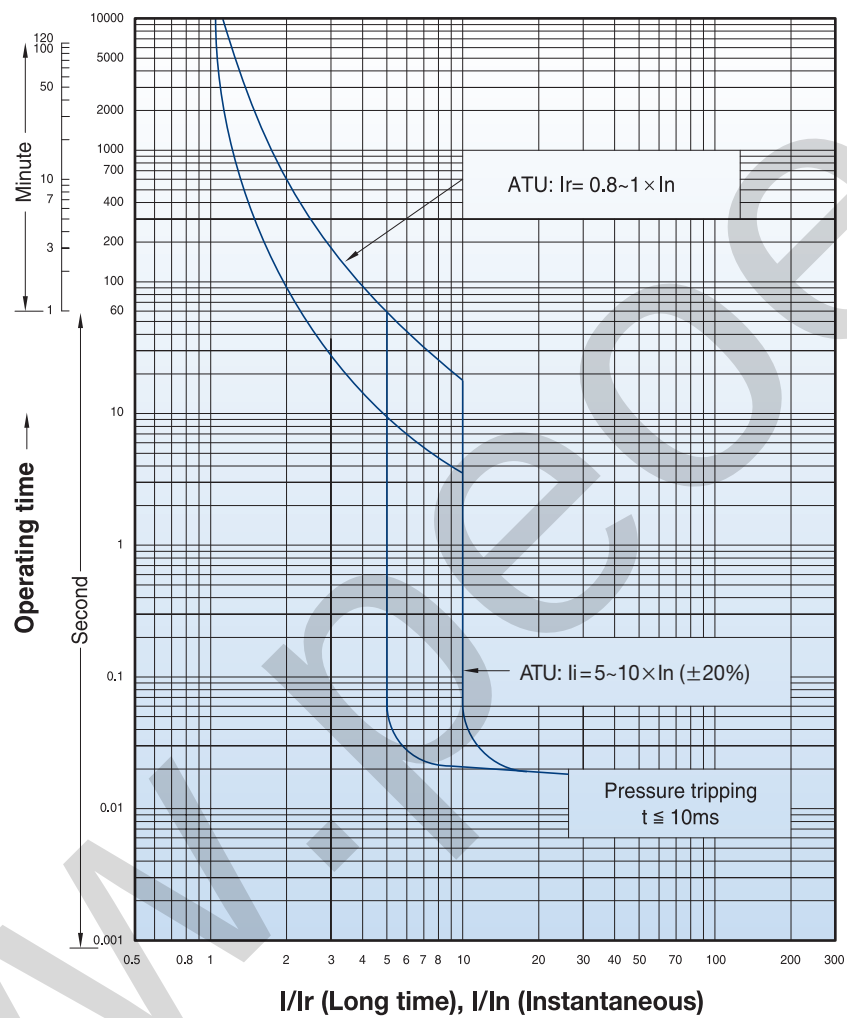


# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TS400**  
**ATU**  
**300, 400A**



# Characteristics curves

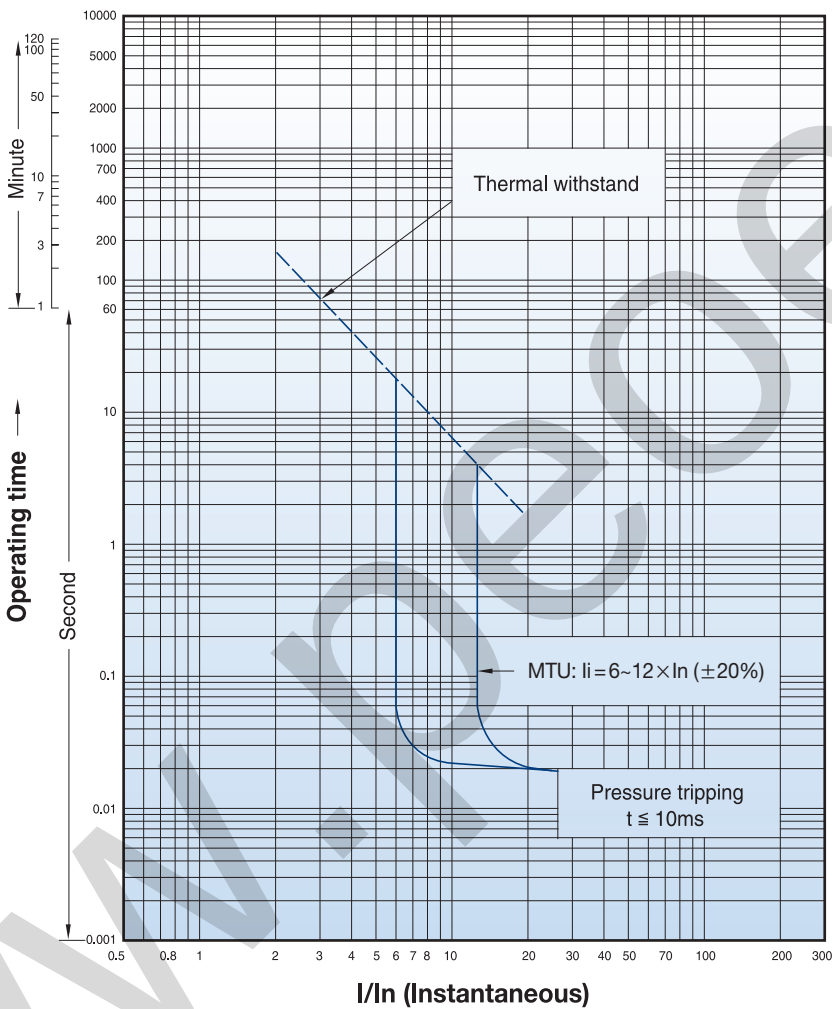
Susol

## Circuit breakers with magnetic only trip units

TS400

MTU

320A



### Magnetic trip units(MTU)

| Rating(A) |       | $I_n$ |
|-----------|-------|-------|
| N / H / L | TS100 |       |
|           | TS160 |       |
|           | TS250 |       |
|           | TS400 |       |
|           | TS630 |       |
|           | TS800 |       |

| TS100 to TS800 |     |     |    |    |    |    |    |     |     |     |     |     |     |
|----------------|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| 1.6            | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| ●              | ●   | ●   | ●  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | ●  | ●  | ●  | ●   | ●   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | ●   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | ●   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | ●   |

### Short - circuit protection(magnetic)

| Pick - up | $I_i$ |
|-----------|-------|
|-----------|-------|

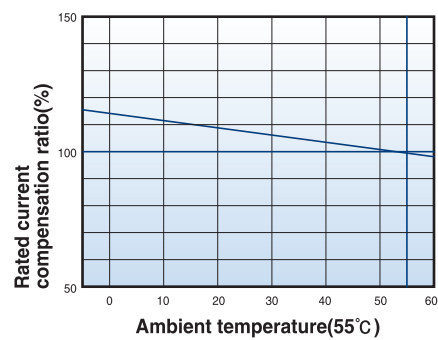
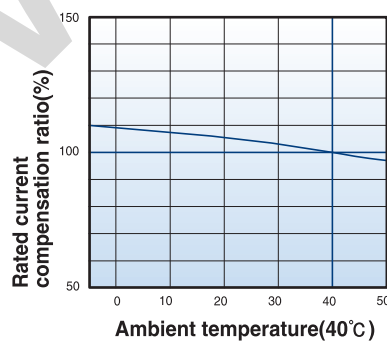
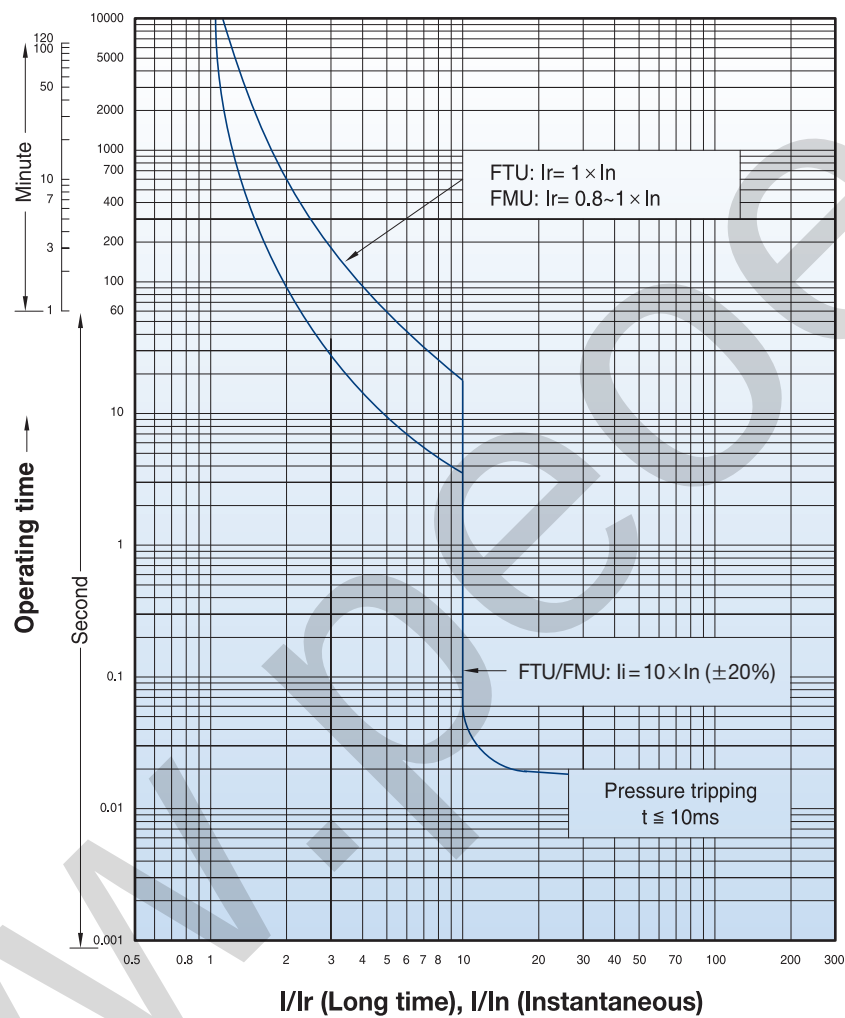
| Setting                      |
|------------------------------|
| $6..12 \times I_n$ (6 Point) |

# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TS630**  
**FTU**  
**FMU**  
**500, 630A**

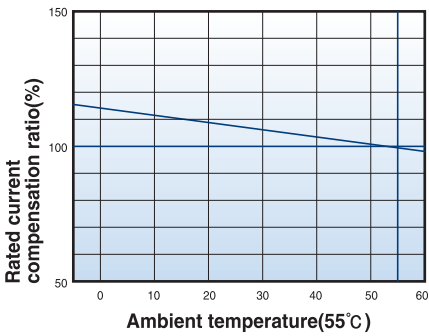
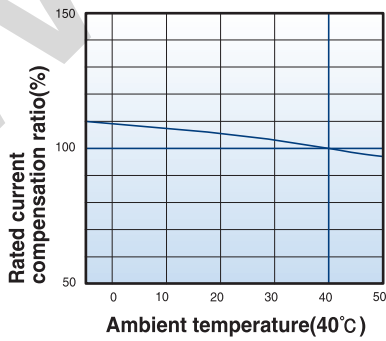
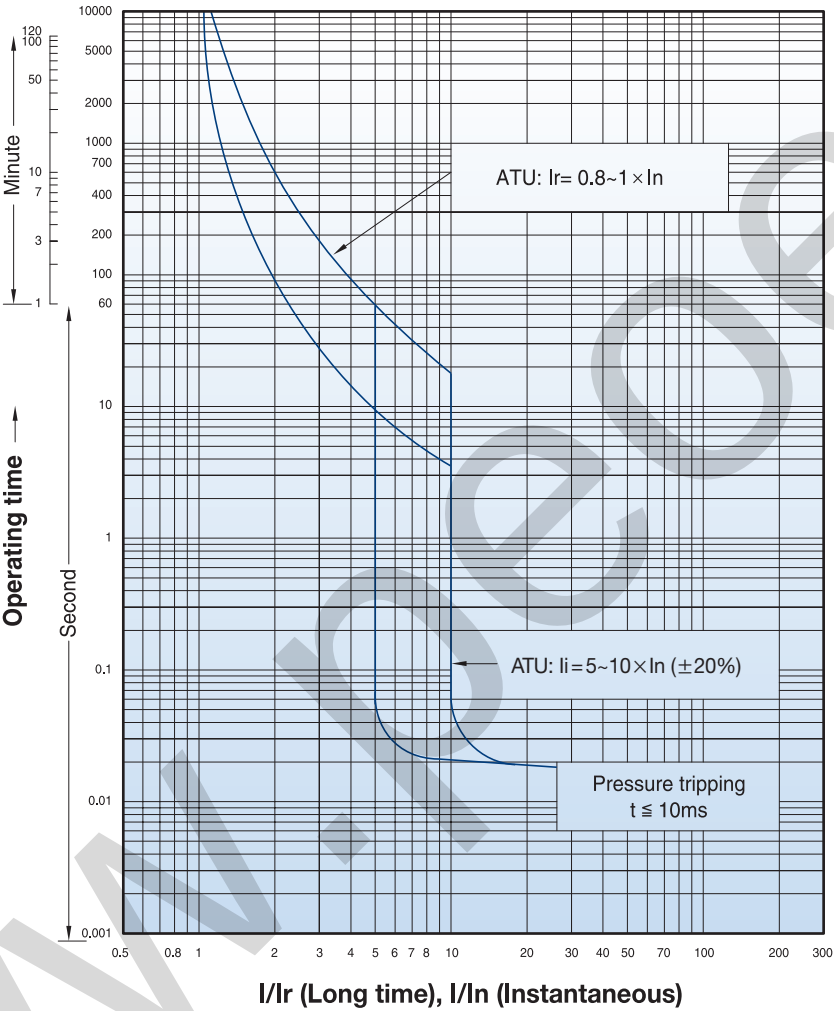


# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TS630**  
**ATU**  
**500, 630A**

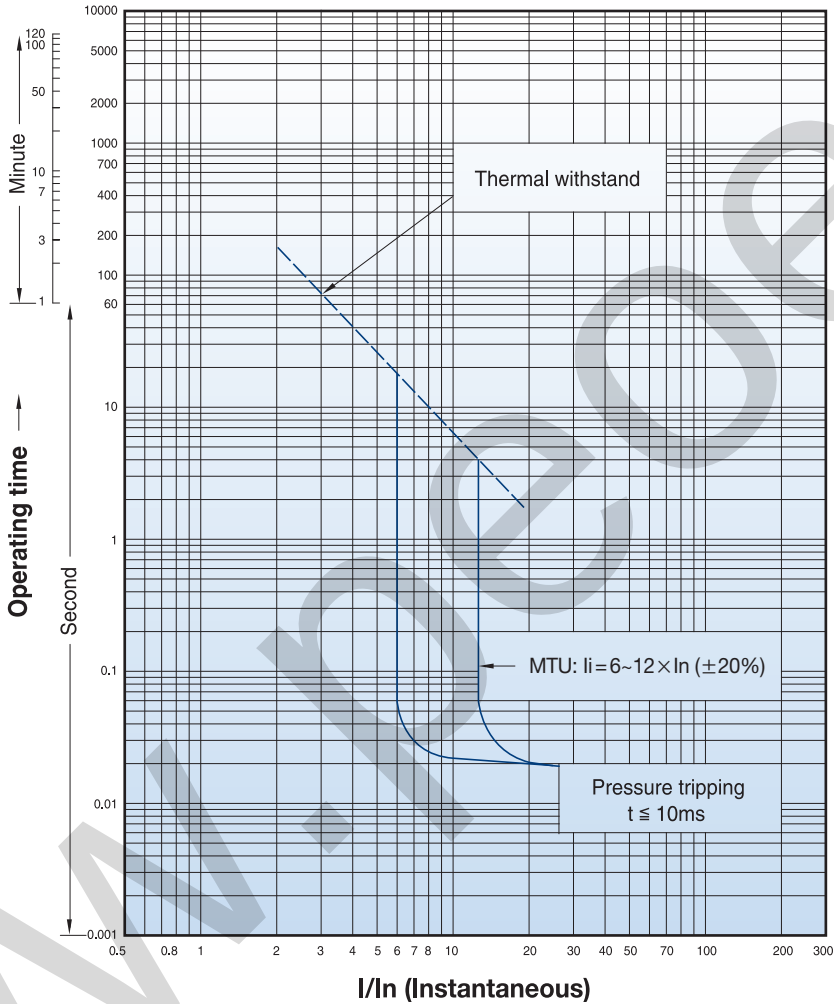


# Characteristics curves

Susol

## Circuit breakers with magnetic only trip units

TS630  
MTU  
500A



Magnetic trip units(MTU)

| Rating(A) |       | $I_n$ |
|-----------|-------|-------|
| N / H / L | TS100 |       |
|           | TS160 |       |
|           | TS250 |       |
|           | TS400 |       |
|           | TS630 |       |
|           | TS800 |       |

| TS100 to TS800 |     |     |    |    |    |    |    |     |     |     |     |     |     |
|----------------|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| 1.6            | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| ●              | ●   | ●   | ●  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | ●  | ●  | ●  | ●   | ●   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | ●   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | ●   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | ●   |

Short - circuit protection(magnetic)

|           |       |
|-----------|-------|
| Pick - up | $I_i$ |
|-----------|-------|

|                             |
|-----------------------------|
| Setting                     |
| $6..12\times I_n$ (6 Point) |

# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

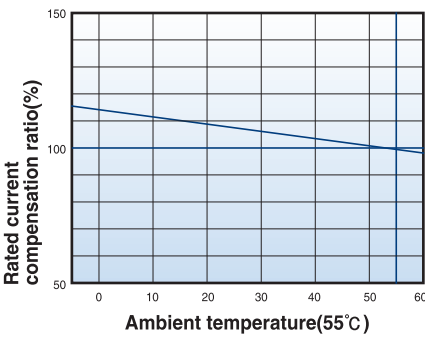
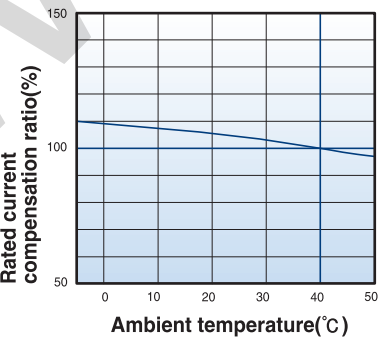
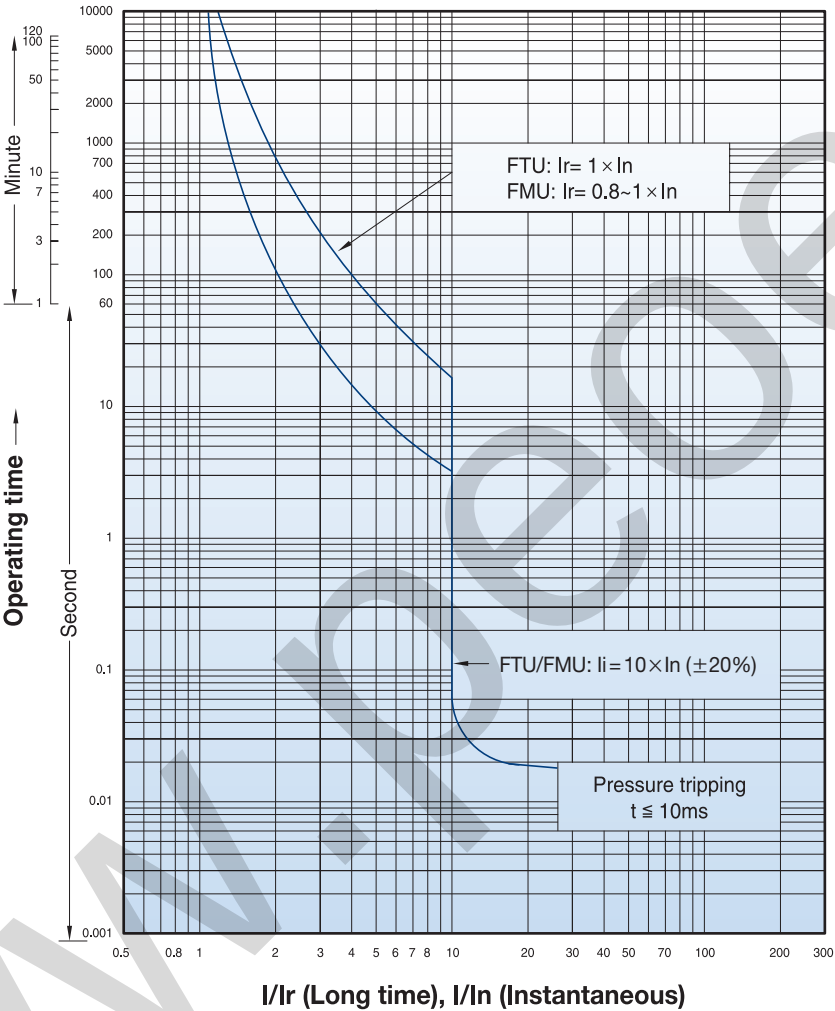
**TS800**

**FTU**

**700, 800A**

**FMU**

**800A**



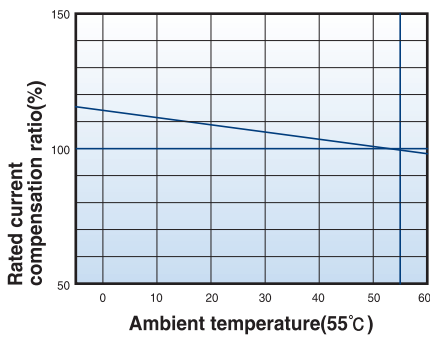
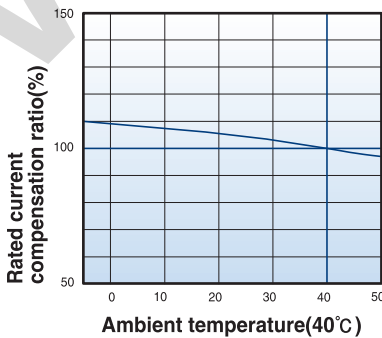
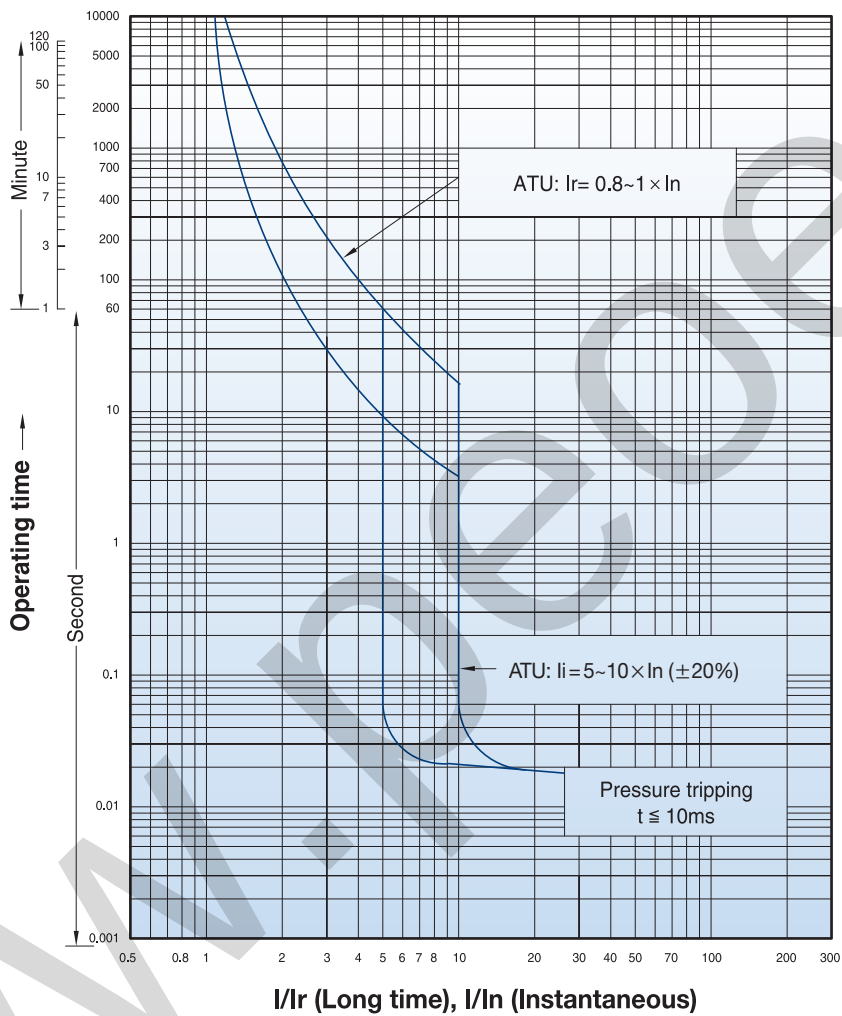


# Characteristics curves

Susol

## Circuit breakers with thermal-magnetic trip units

**TS800**  
**ATU**  
**800A**

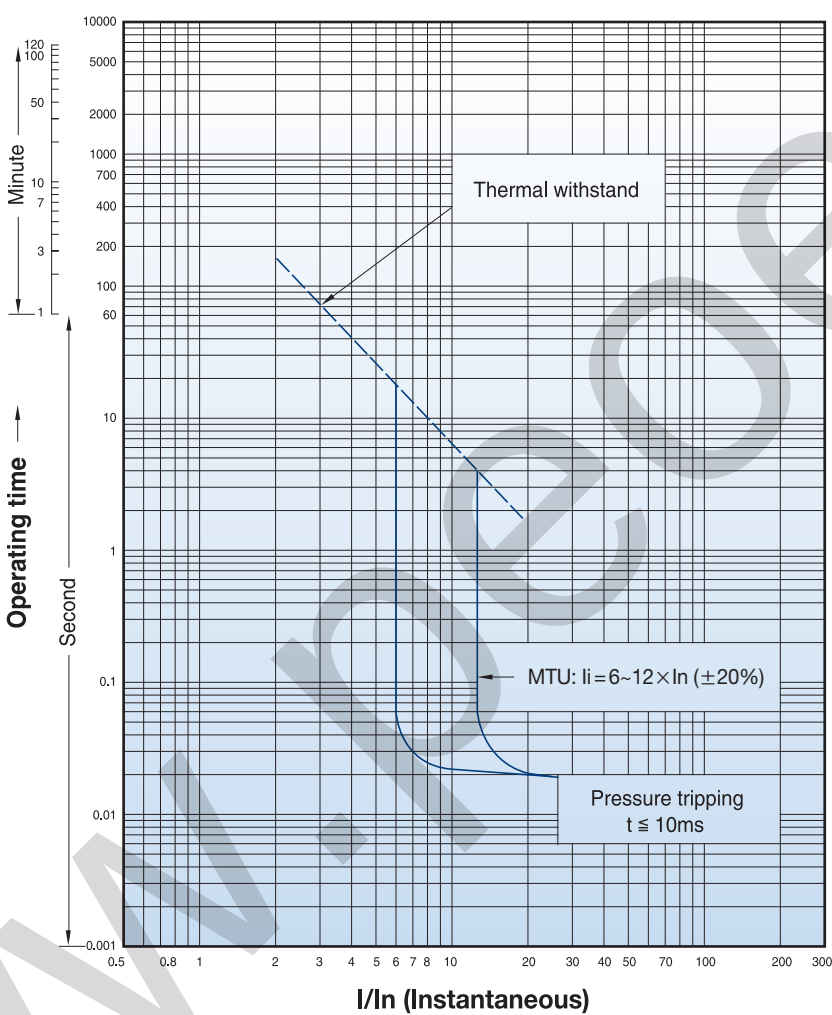


# Characteristics curves

Susol

## Circuit breakers with magnetic only trip units

TS800  
MTU  
630A



Magnetic trip units(MTU)

| Rating(A) |       | $I_n$ |
|-----------|-------|-------|
| N / H / L | TS100 |       |
|           | TS160 |       |
|           | TS250 |       |
|           | TS400 |       |
|           | TS630 |       |
|           | TS800 |       |

| TS100 to TS800 |     |     |    |    |    |    |    |     |     |     |     |     |     |
|----------------|-----|-----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| 1.6            | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| ●              | ●   | ●   | ●  | ●  | ●  | ●  | ●  | ●   | -   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | ●  | ●  | ●  | ●   | ●   | -   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | ●   | ●   | ●   | -   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | ●   | -   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | ●   | -   |
| -              | -   | -   | -  | -  | -  | -  | -  | -   | -   | -   | -   | -   | ●   |

Short - circuit protection(magnetic)

|           |      |
|-----------|------|
| Pick - up | $li$ |
|-----------|------|

|                              |
|------------------------------|
| Setting                      |
| $6..12 \times I_n$ (6 Point) |

# Characteristics curves

Susol

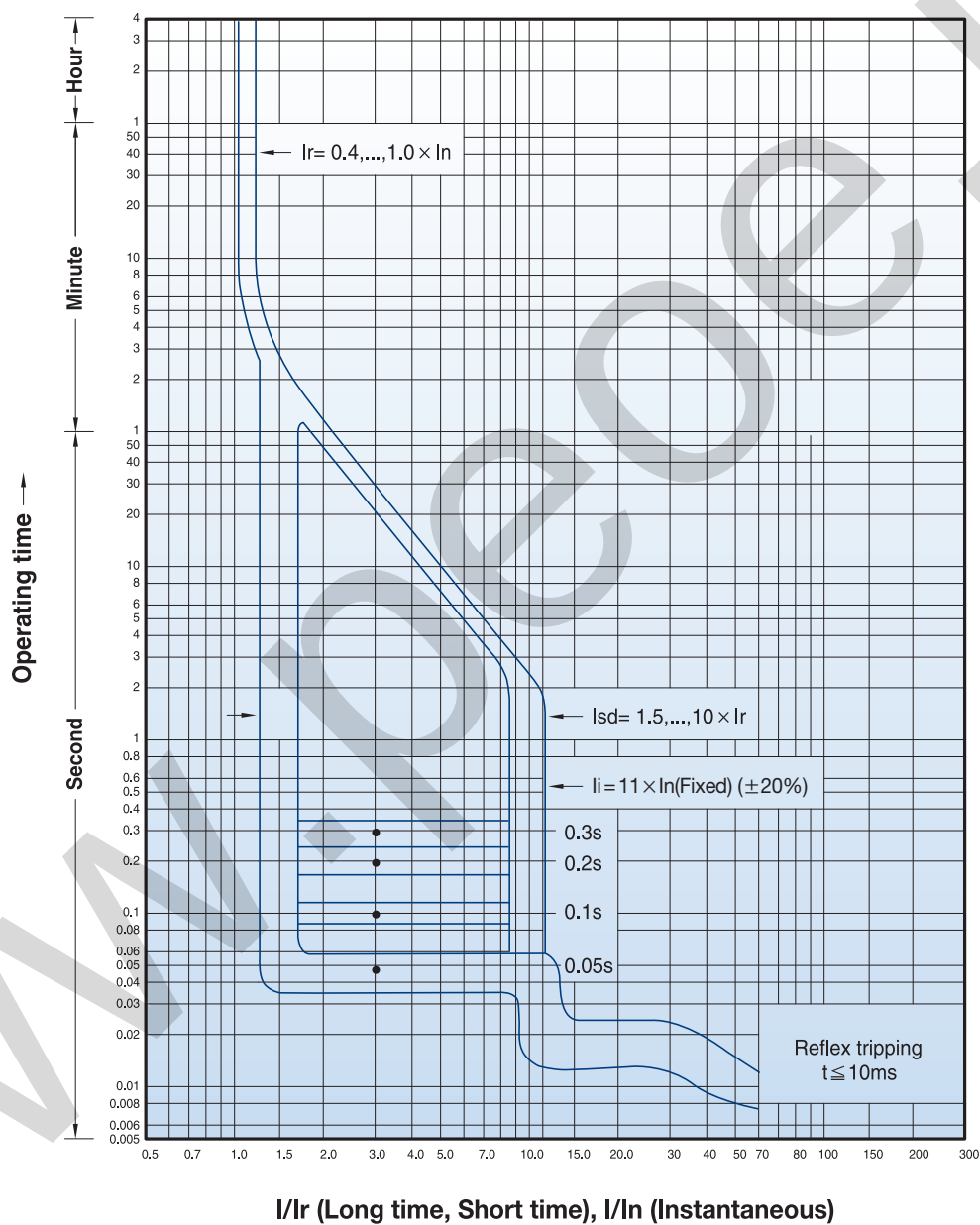
## Circuit breakers with electronic trip unit (ETS)

**TS100 to TS800**

ETS23

ETS33

ETS43



# Characteristics curves

Susol

## Circuit breakers with electronic trip unit (ETM)

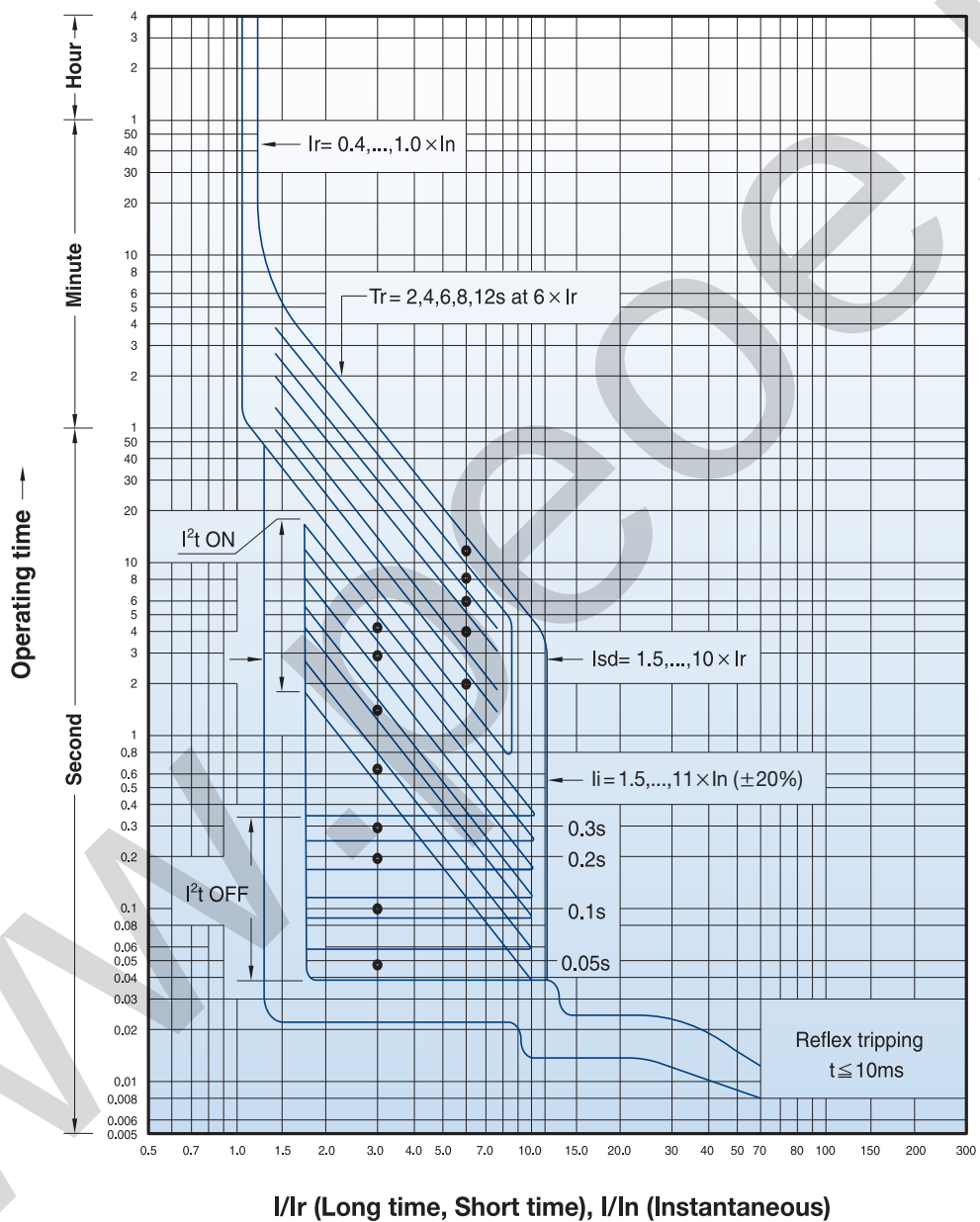
TS400

TS630

TS800

ETM33

ETM43

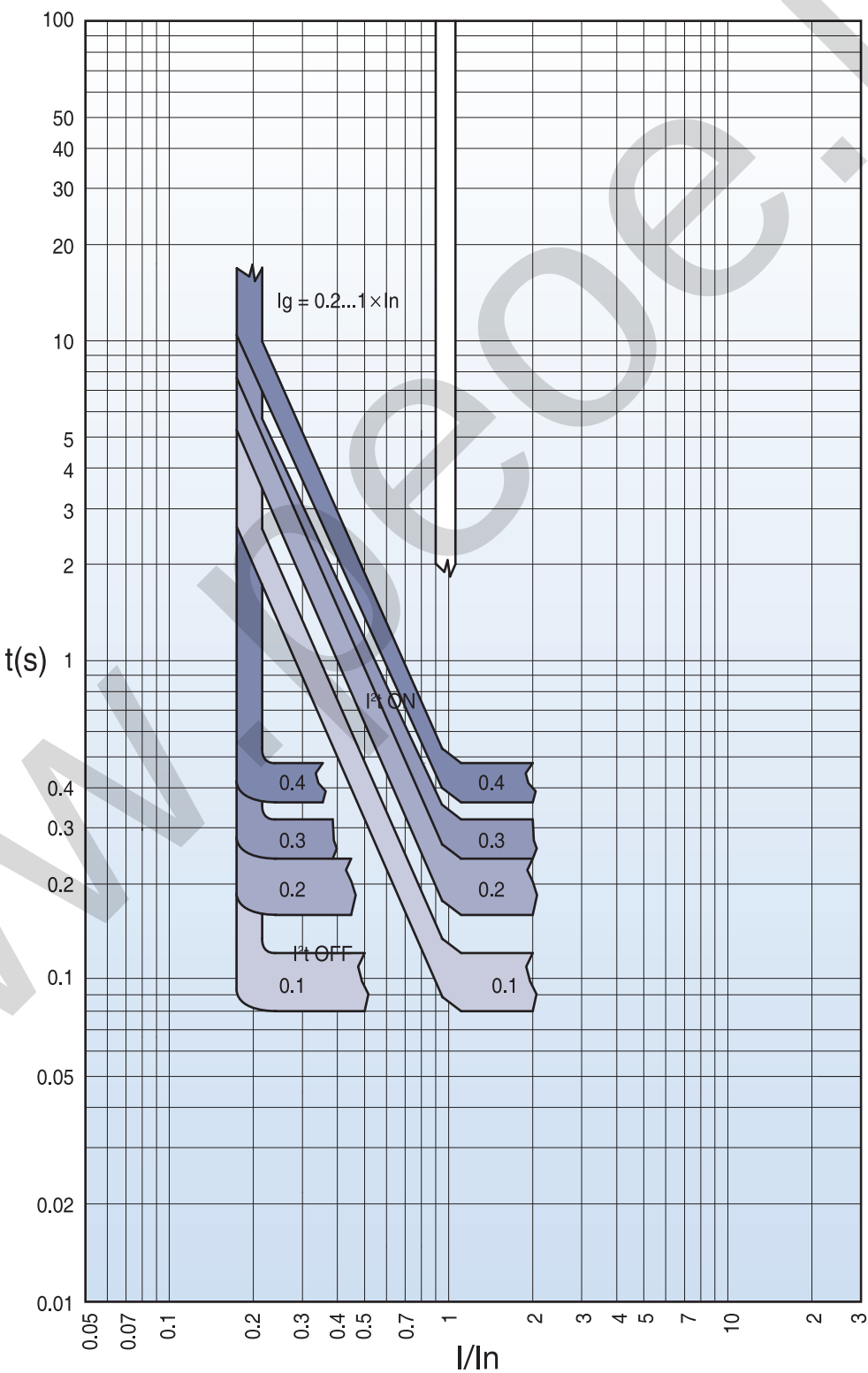


# Characteristics curves

Susol

## ETM Ground fault (G)

TS400  
TS630  
TS800  
ETM33  
ETM43

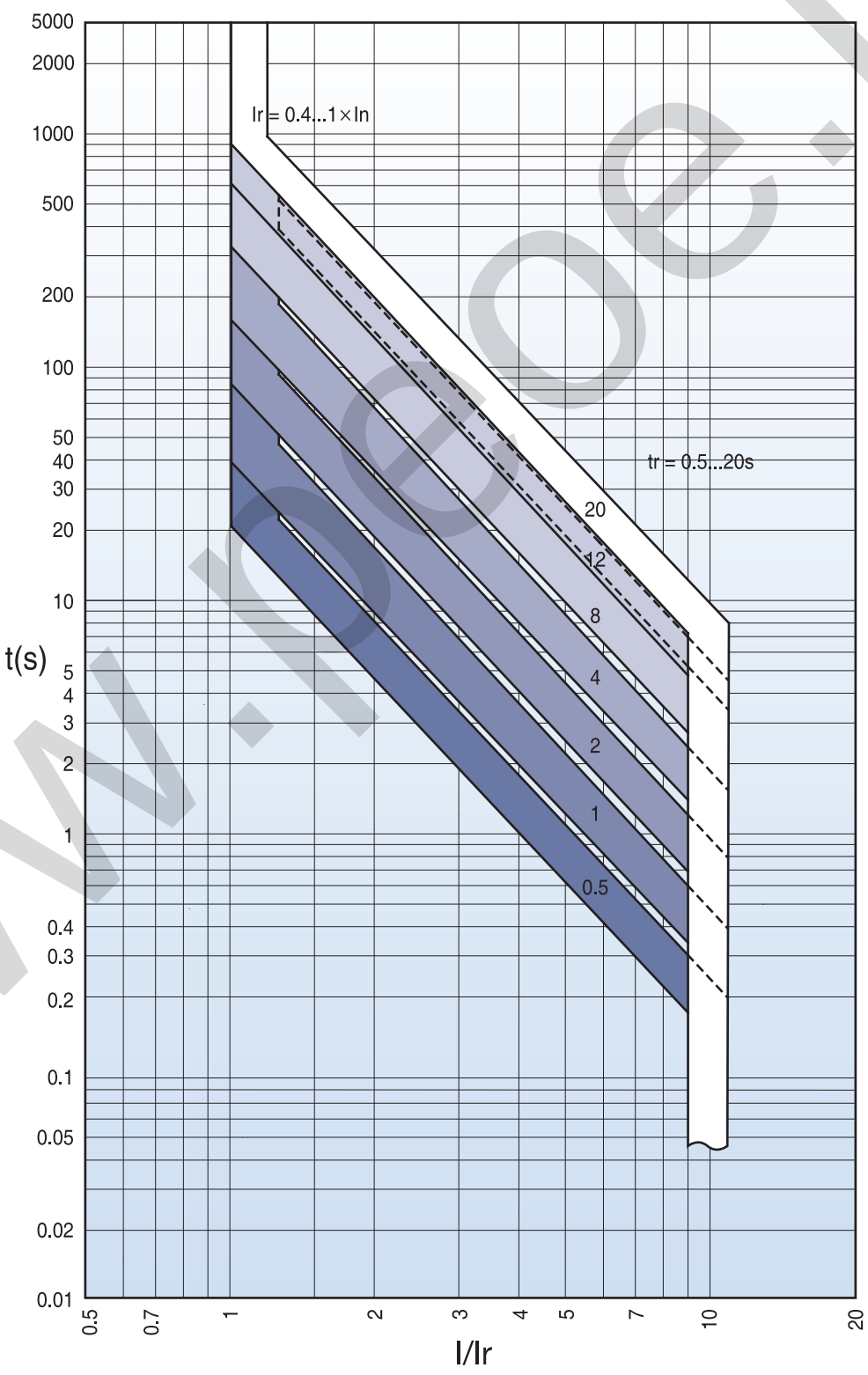


# Characteristics curves

Susol

## Long-time delay (L)

TS1600

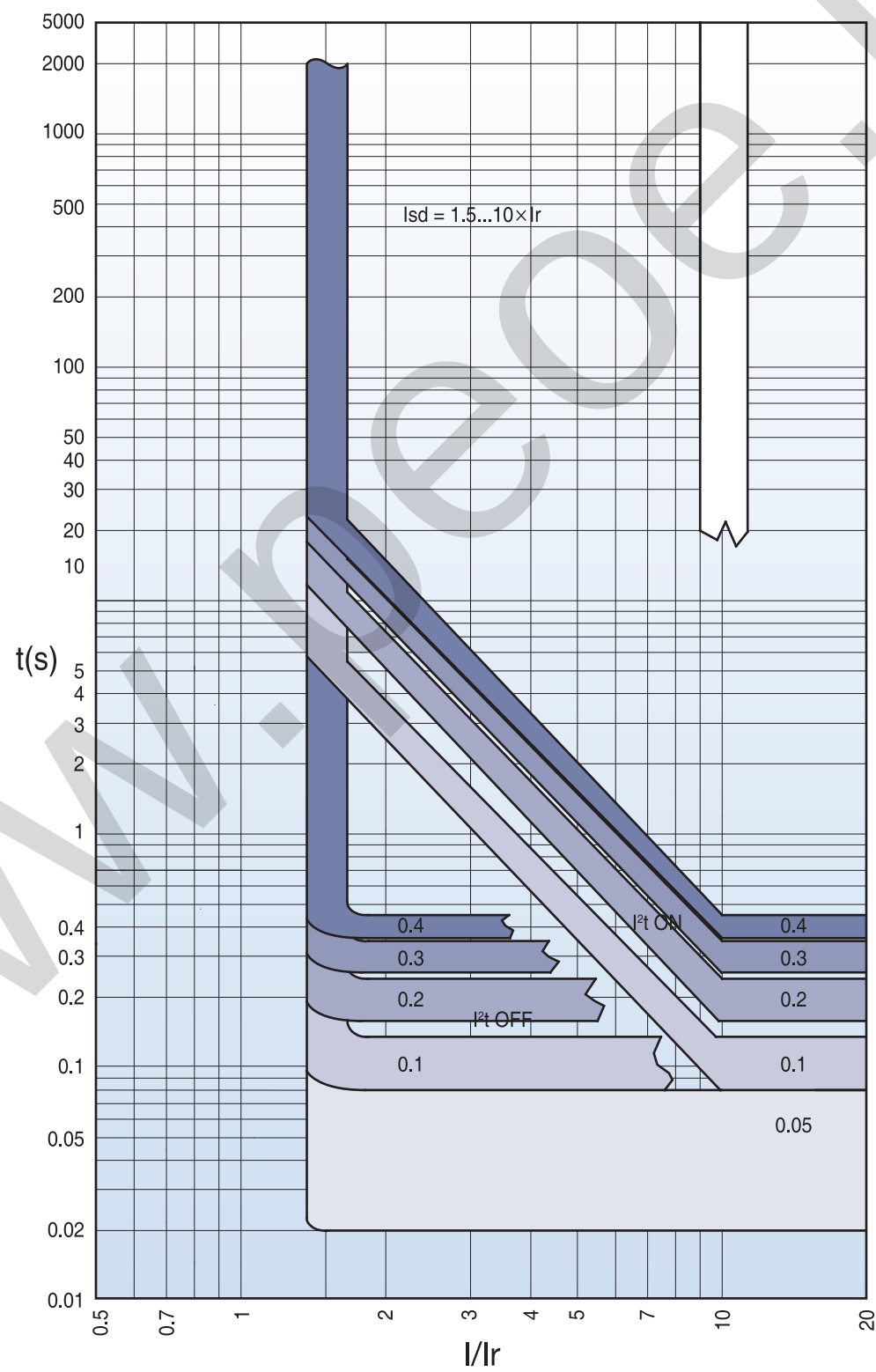


# Characteristics curves

Susol

## Short-time delay (S)

TS1600

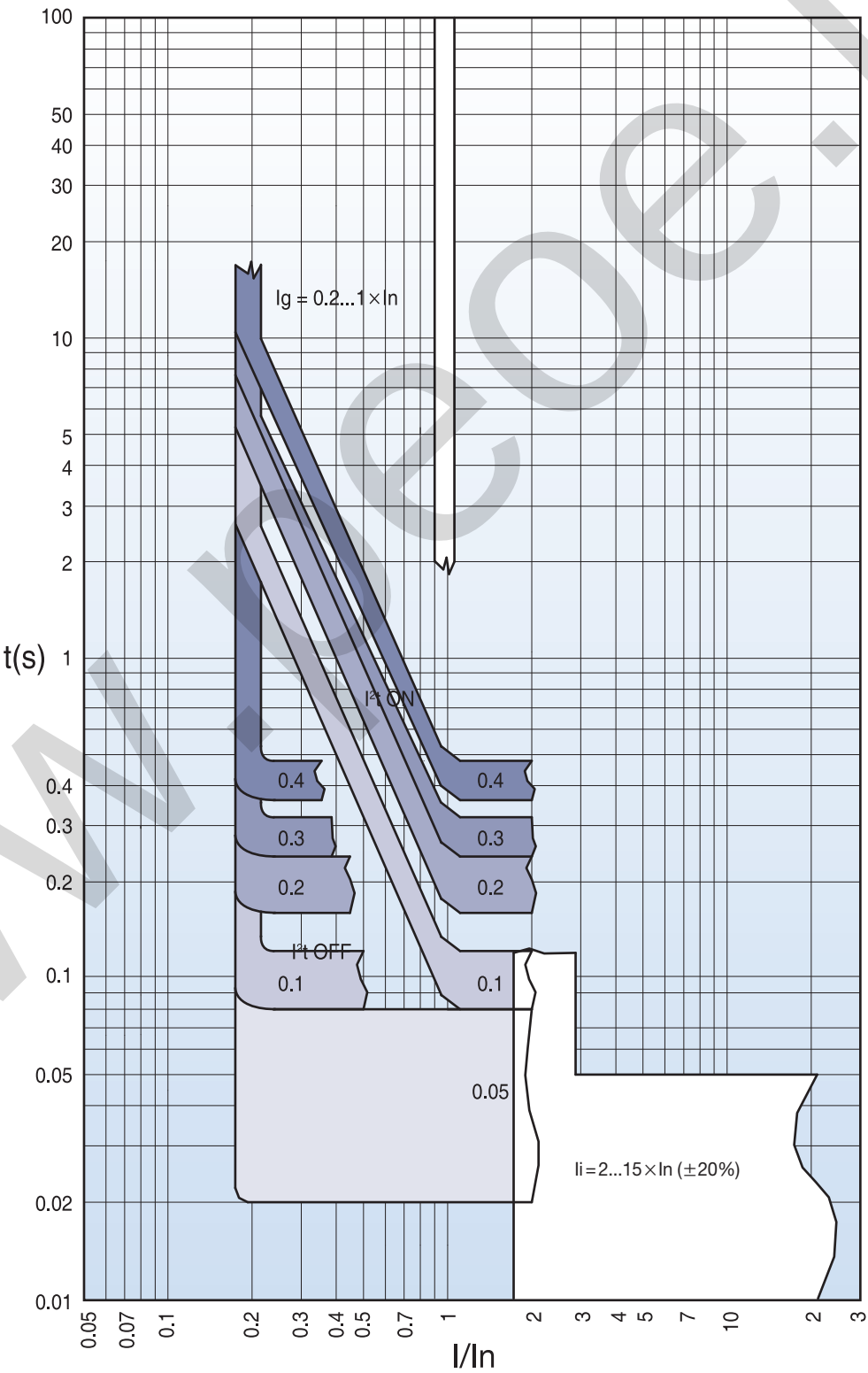


# Characteristics curves

Susol

Instantaneous (I)  
Ground fault (G)

TS1600



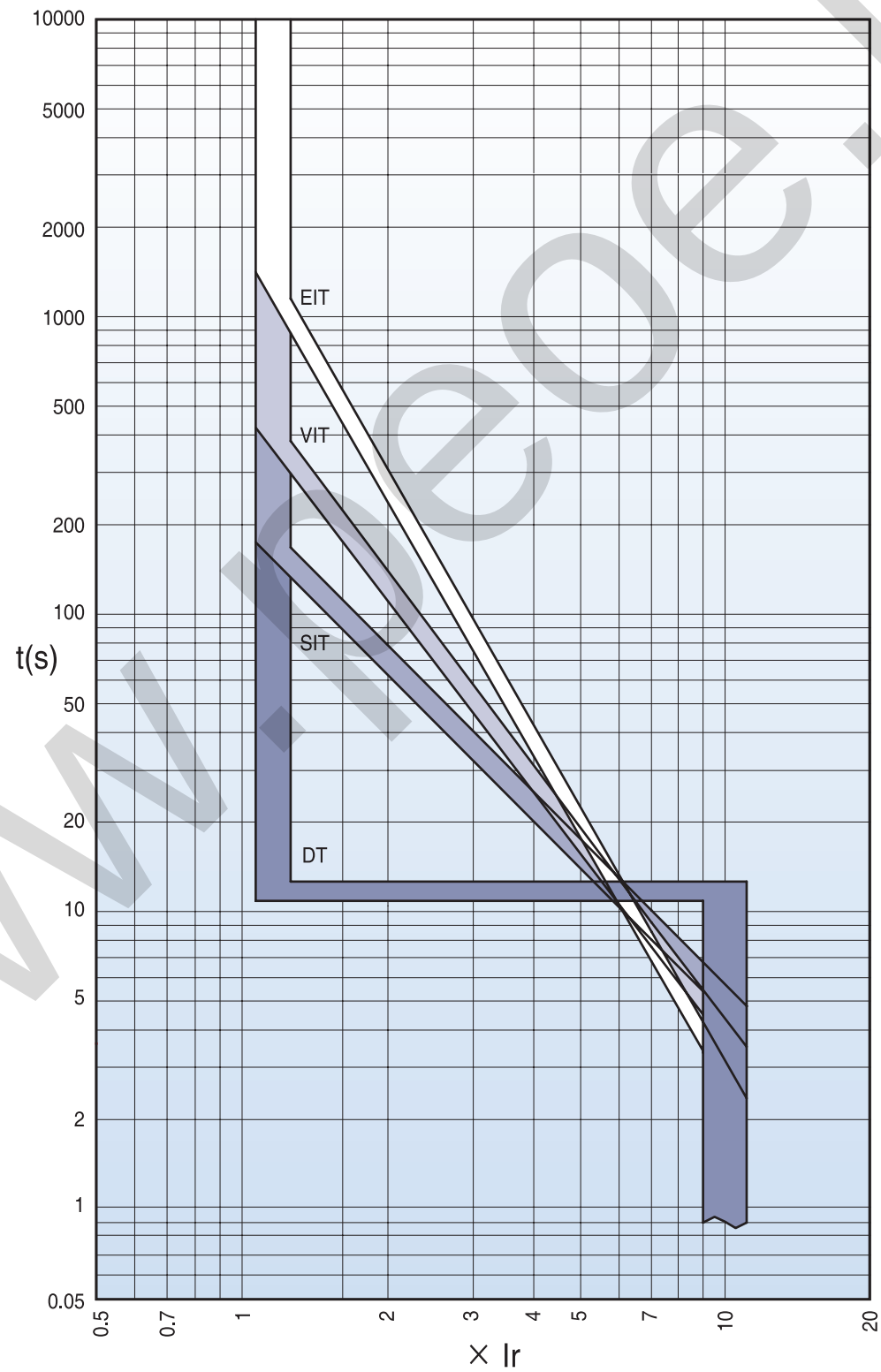


# Characteristics curves

Susol

## IDMTL

TS1600

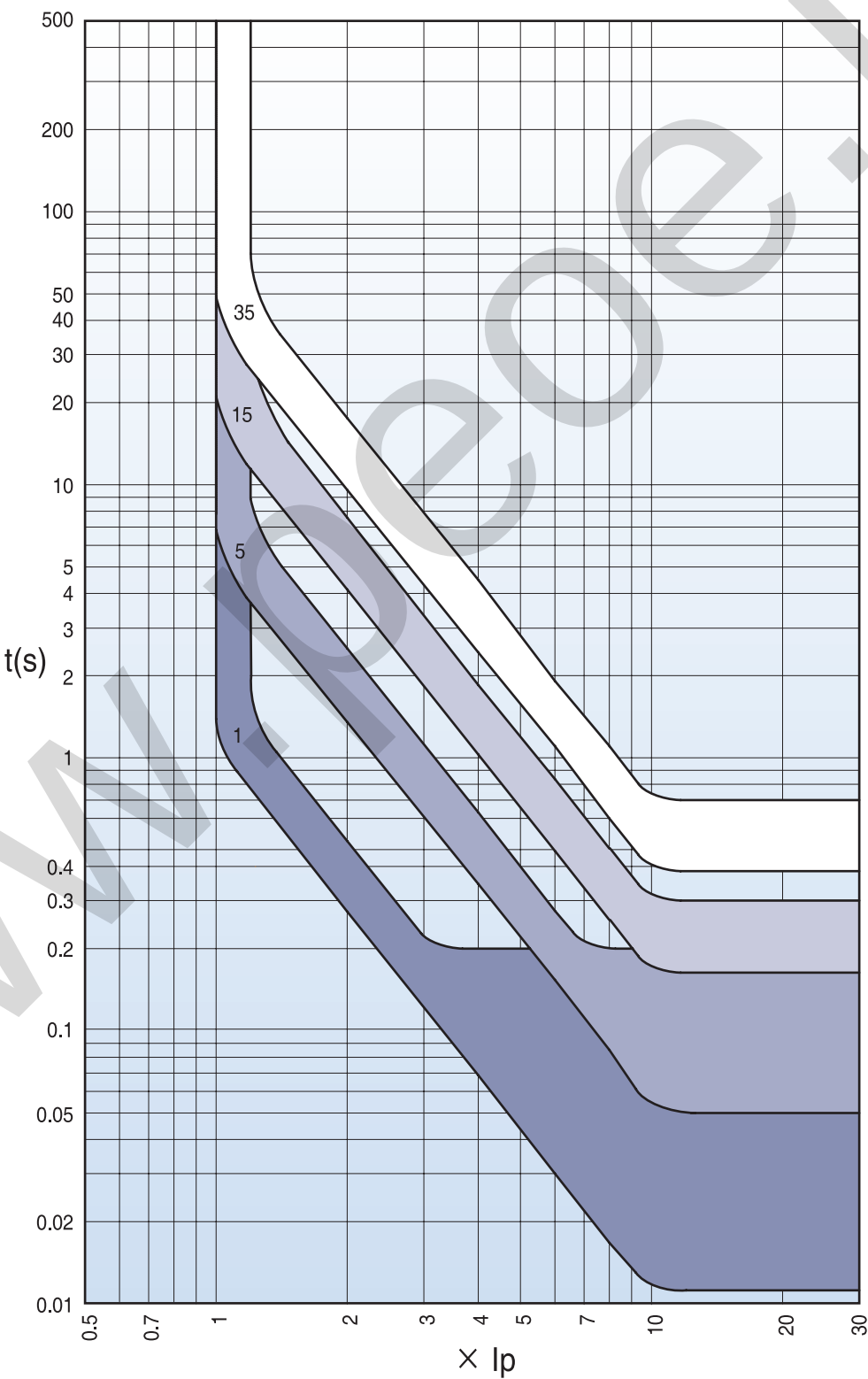


# Characteristics curves

Susol

## Pre Trip Alarm

TS1600

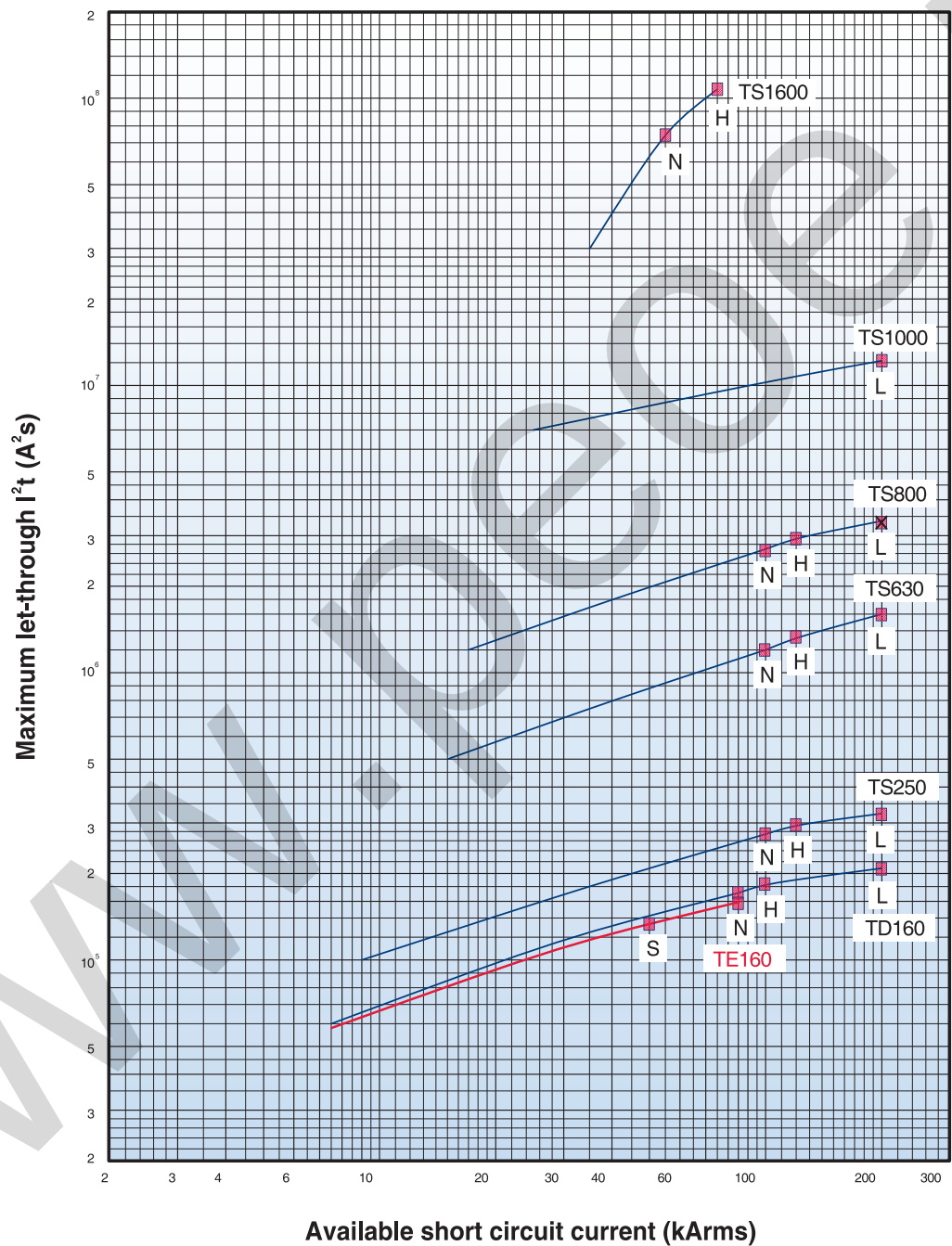


# Characteristics curves

Susol

## Specific let-through energy curves

220/240V  
Thermal stress

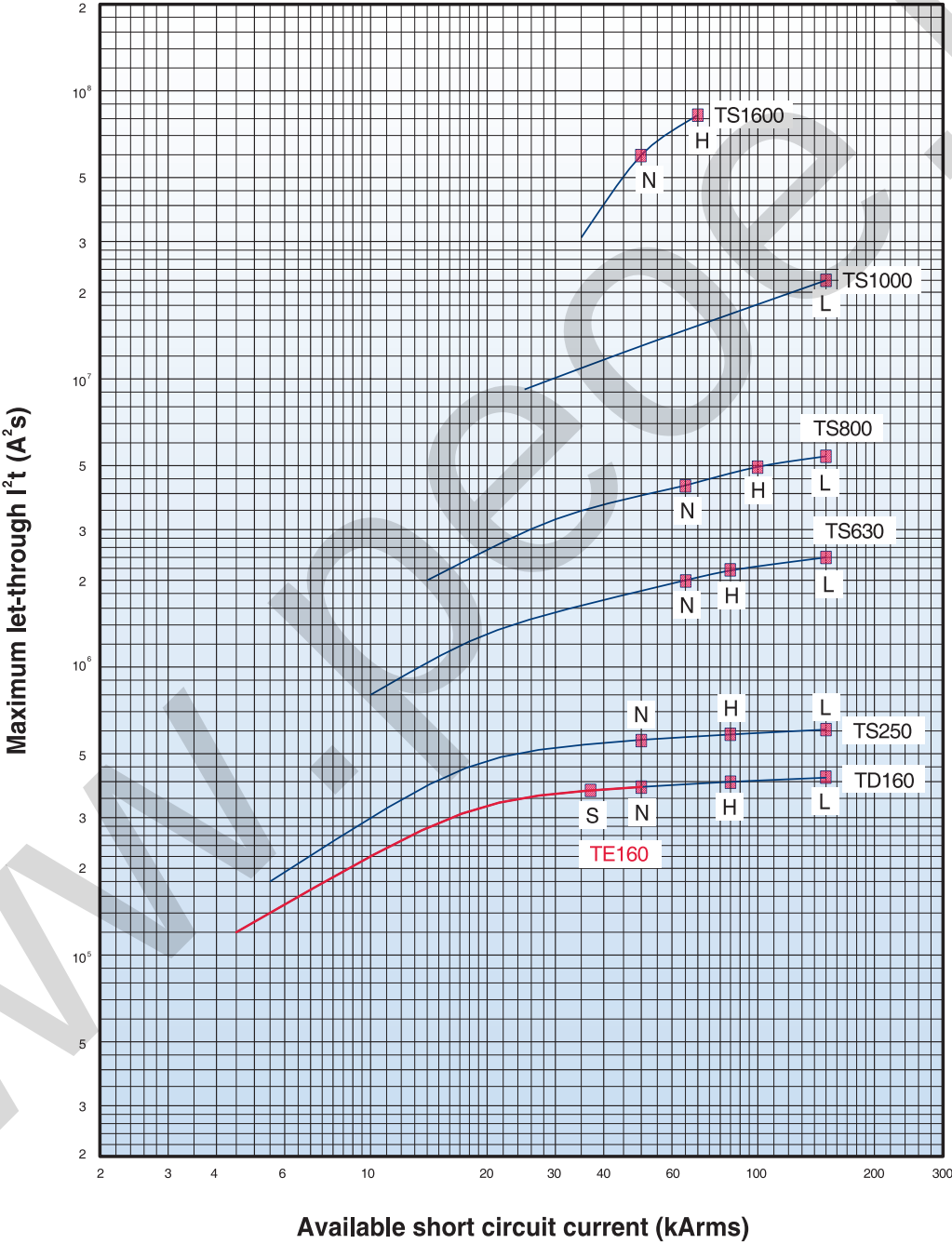


# Characteristics curves

Susol

## Specific let-through energy curves

380/415V  
Thermal stress

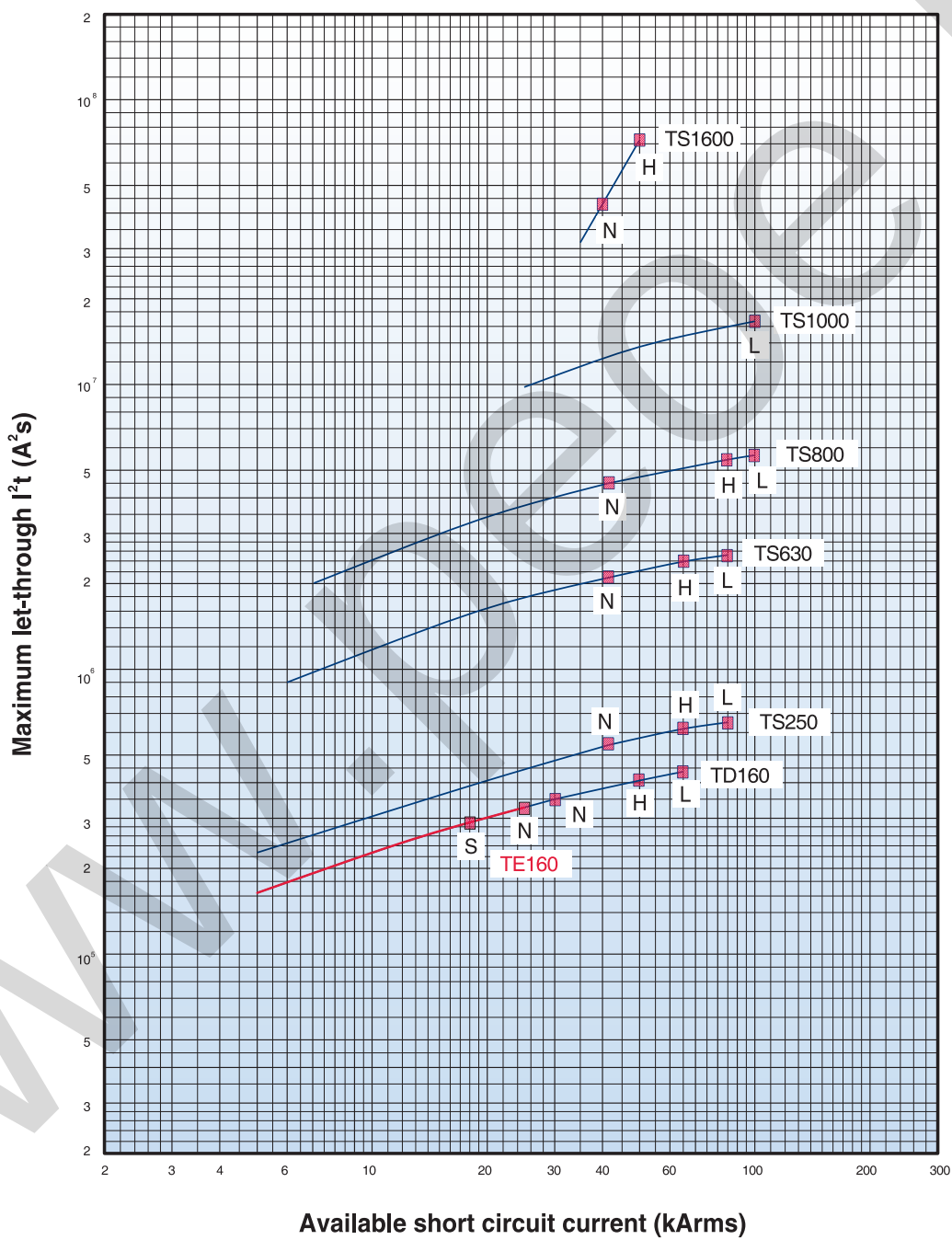


# Characteristics curves

Susol

## Specific let-through energy curves

480/500V  
Thermal stress



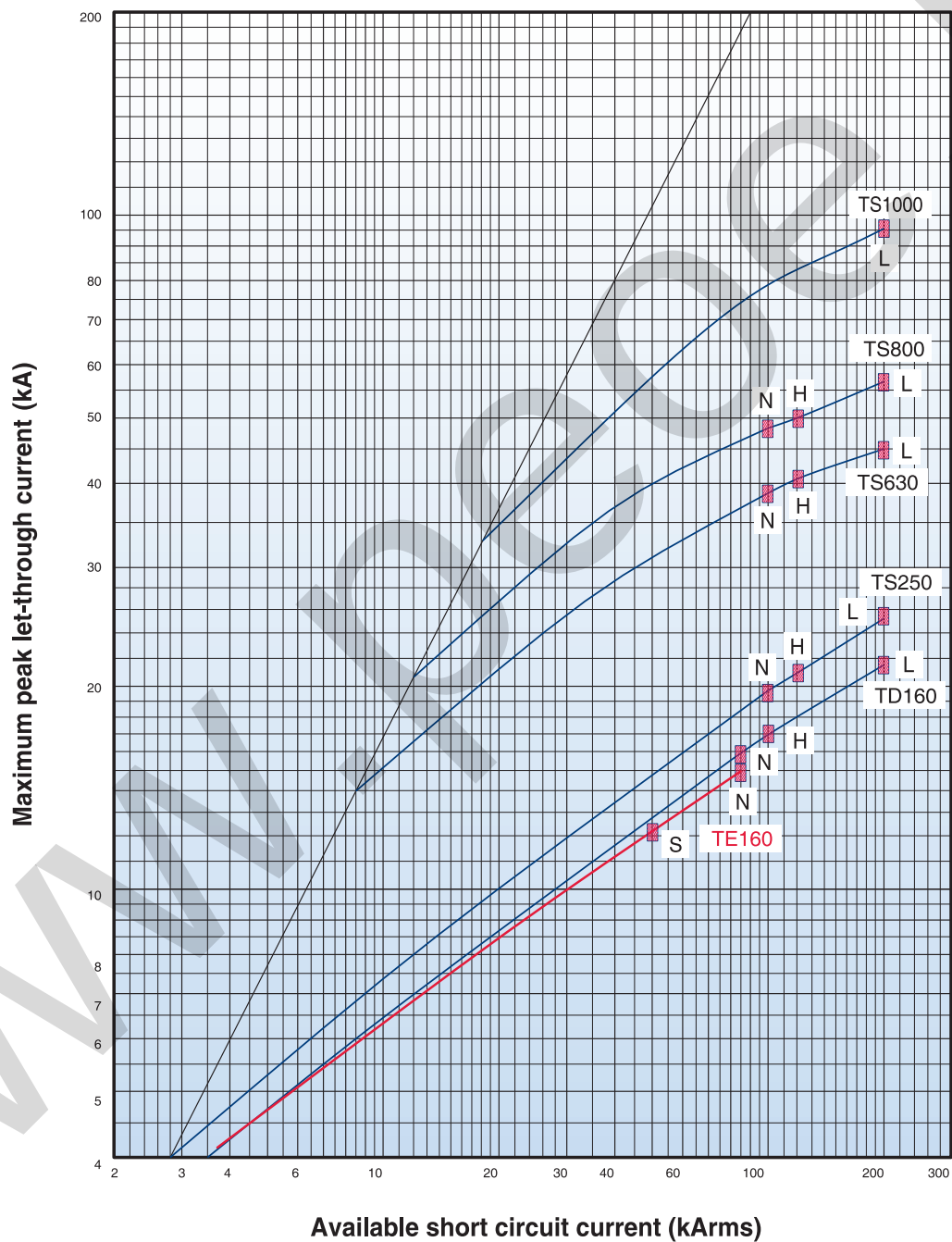
# Characteristics curves

Susol

## Current-limiting curves

220/240V

Peak current

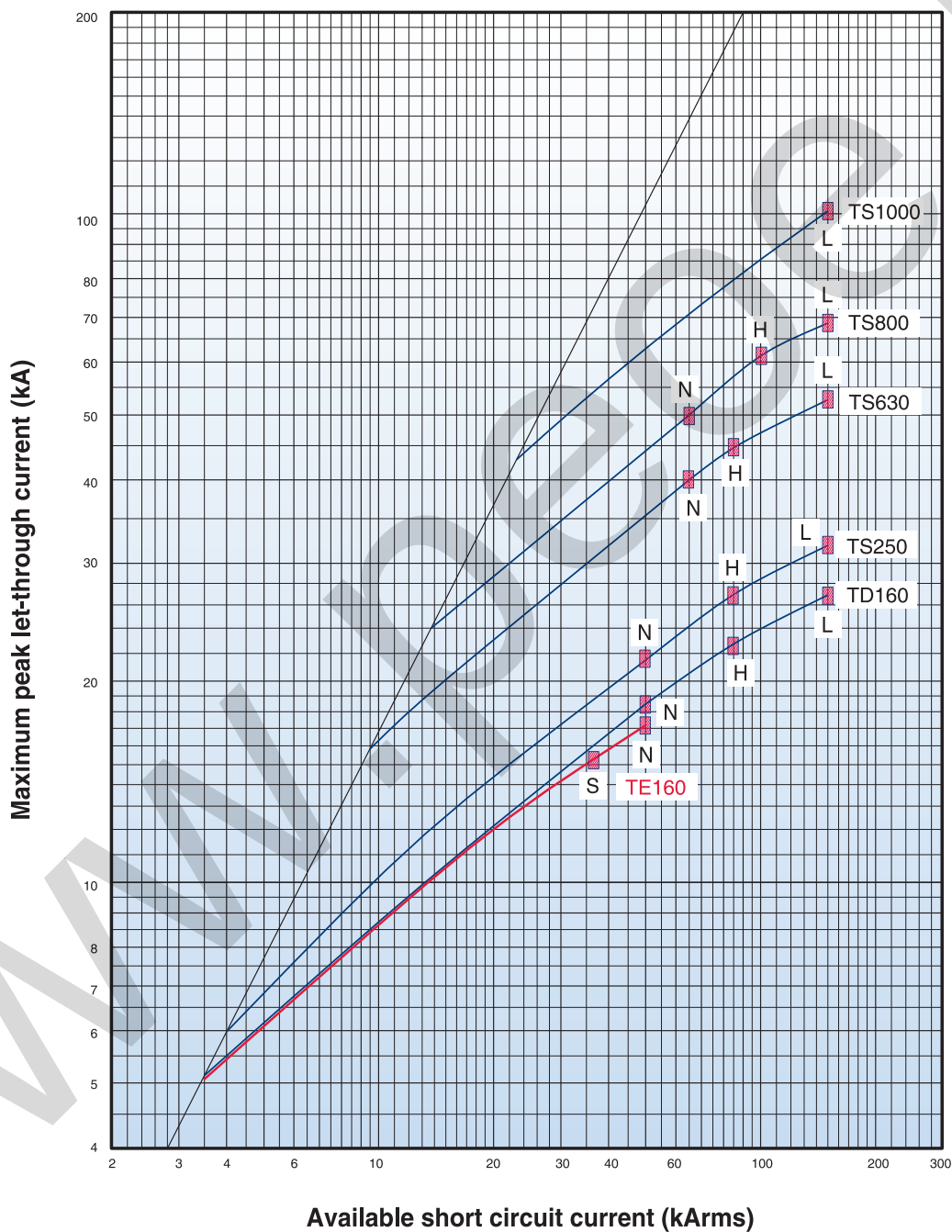


# Characteristics curves

Susol

## Current-limiting curves

380/415V  
Peak current

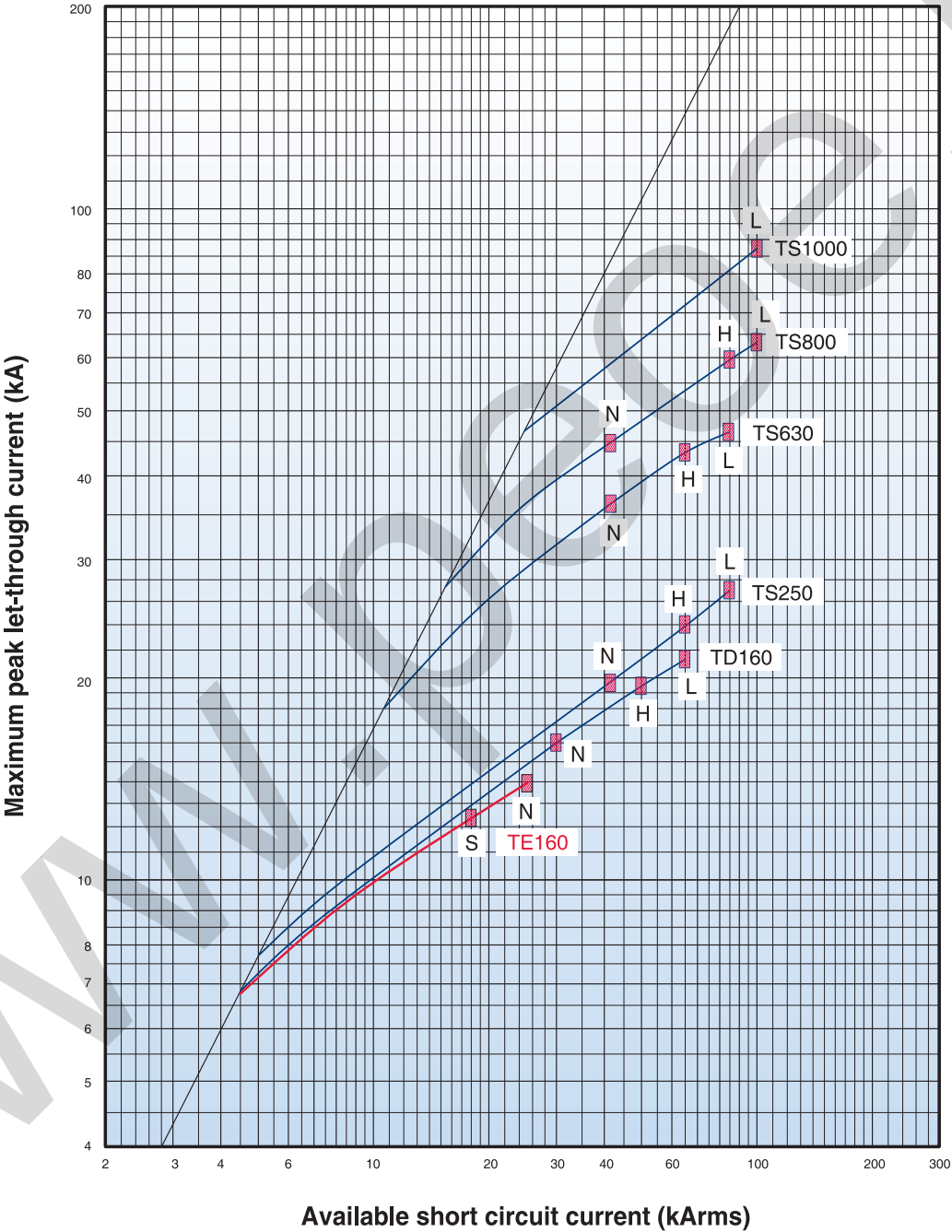


# Characteristics curves

Susol

## Current-limiting curves

480/500V  
Peak current



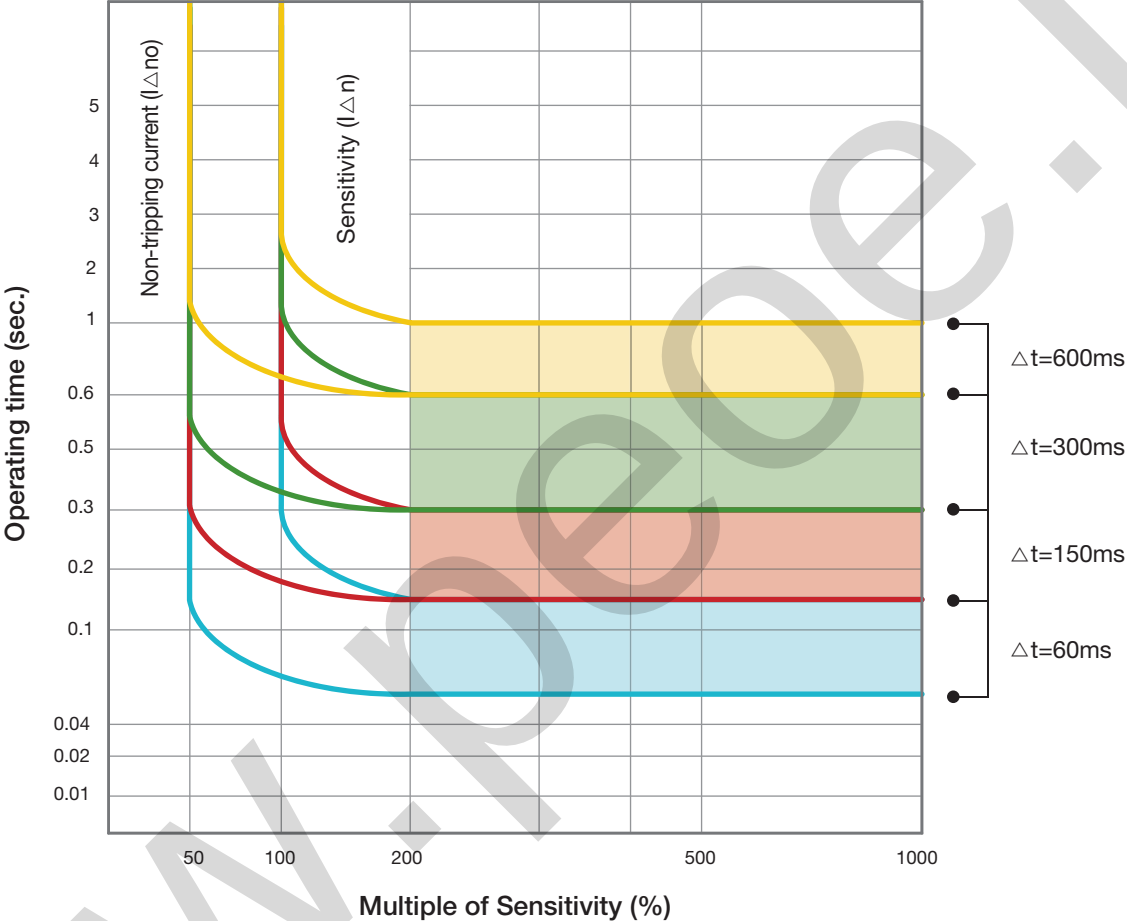


# Characteristics curves

Susol

## Time delay curves (RCD)

- RTU23
- RTU24
- RTU33
- RTU34
- RTU43



## A-6. Dimensions

### Susol MCCB TE100, 160 series

|            |       |
|------------|-------|
| TE100, 160 | A-6-1 |
|------------|-------|

### Susol MCCB TD, TS series up to 800A

|                 |       |
|-----------------|-------|
| TD160           | A-6-2 |
| TD100, 160      | A-6-3 |
| TS100, 160, 250 | A-6-4 |
| TS400, 630      | A-6-5 |
| TS800           | A-6-6 |

### Accessories for TD/TS series up to 800A

|                                                 |        |
|-------------------------------------------------|--------|
| Direct rotary handles up to 800AF               | A-6-7  |
| Extended rotary handles up to 800AF             | A-6-13 |
| Mechanical interlocking device up to 800AF      | A-6-19 |
| Plug-in device up to 800AF                      | A-6-22 |
| Terminal cover up to 800AF                      | A-6-28 |
| Rear terminals up to 800AF                      | A-6-30 |
| Extended terminal up to 800AF                   | A-6-30 |
| Rear terminals up to 800AF                      | A-6-31 |
| Circuit breaker with motor operator up to 800AF | A-6-37 |
| Wiring connection(motor operator)               | A-6-38 |
| Wiring diagram(State of operation)              | A-6-39 |

### Susol MCCB TS series up to 1600A

|                                       |        |
|---------------------------------------|--------|
| TS1000, 1250, 1600A front type        | A-6-40 |
| TS1000, 1250, 1600A front type busbar | A-6-41 |
| TS1000, 1250, 1600A rear type         | A-6-42 |
| Rotary handles for TS 1600AF          | A-6-43 |
| Locking devices for TS 1600AF         | A-6-44 |
| Terminals for TS1600AF                | A-6-45 |

### Susol MCCB DC PV series up to 1600A

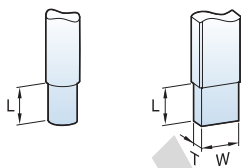
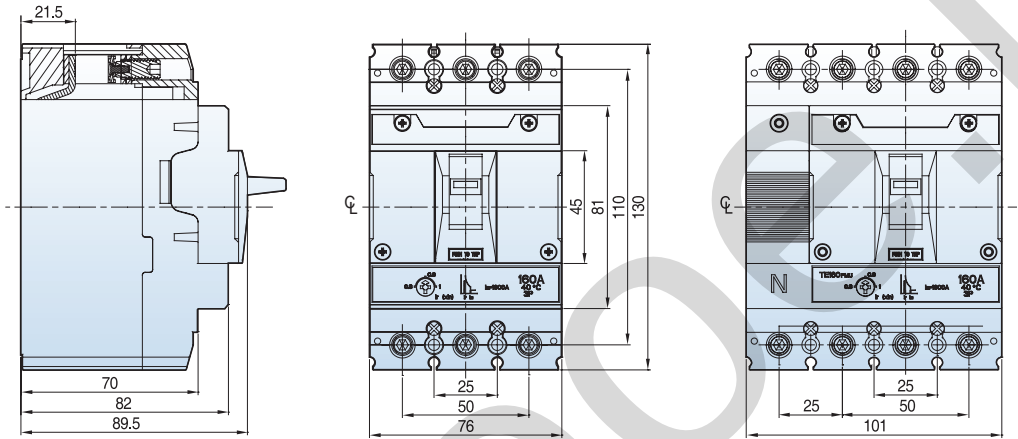
|                                   |        |
|-----------------------------------|--------|
| TD100, TD160, TS100, TS160, TS250 | A-6-47 |
| TS400, TS630, TS800               | A-6-48 |
| Short BUSBAR                      | A-6-51 |
| TS1600NA                          | A-6-54 |
| Short BUSBAR                      | A-6-57 |

# Overall dimensions

Susol

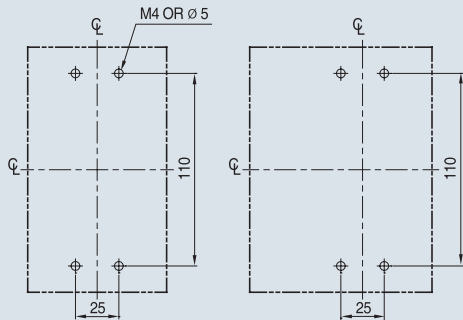
## TE100/160

[mm]

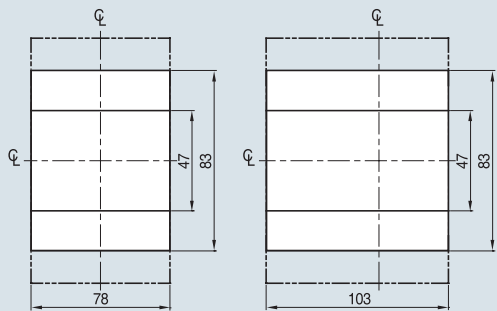


|           |      |                    |
|-----------|------|--------------------|
| Wire size | Min  | 2.5mm <sup>2</sup> |
|           | Max. | 70mm <sup>2</sup>  |
| L(mm)     |      | 17.5               |
| W(mm)     |      | ≤ 13.5             |
| T(mm)     |      | ≤ 6                |
| Torque    |      | 80kgf.cm           |

### Panel drilling



### Front panel cutting



**Susol**

## [mm]



Technical drawings of two rectangular components, 1P and 2P, showing dimensions and center marks.

**Component 1P:** A rectangle with a width of 37 and a height of 83. It has center marks on all four sides, indicated by dashed lines and small circles.

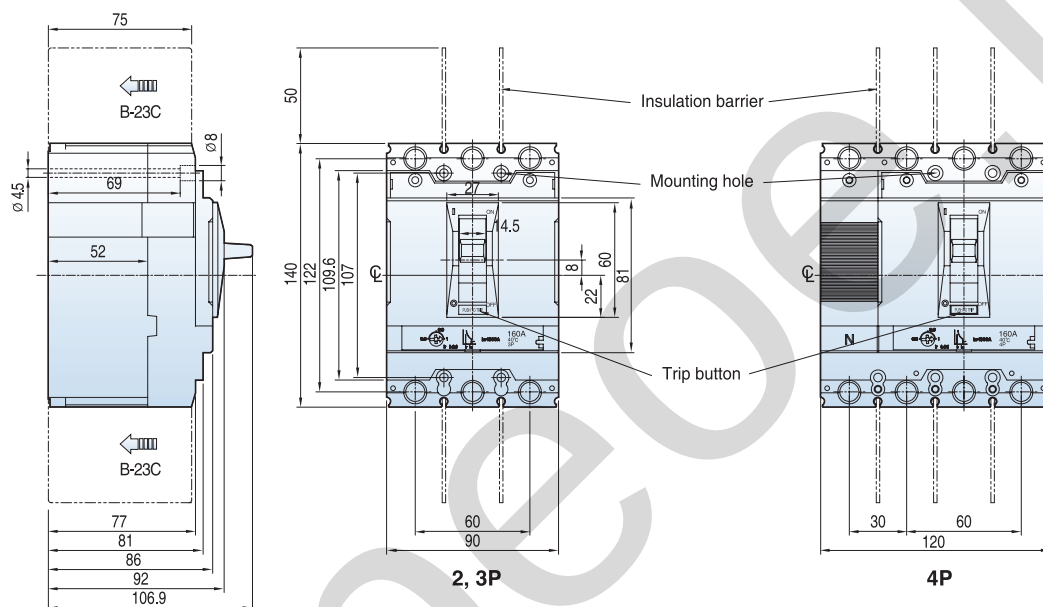
**Component 2P:** A rectangle with a width of 29 and a height of 62. It has center marks on all four sides, indicated by dashed lines and small circles.

# Overall dimensions

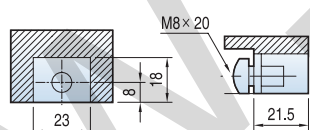
Susol

## TD100/160

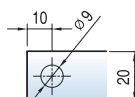
[mm]



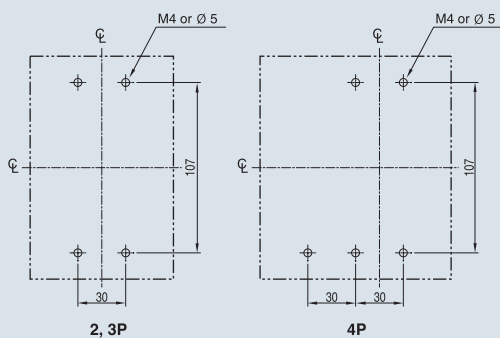
Terminal section



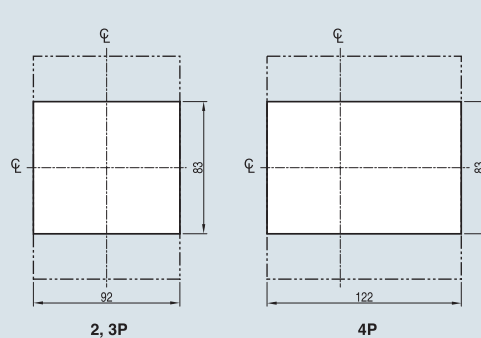
Conductor



Panel drilling



Front panel cutting

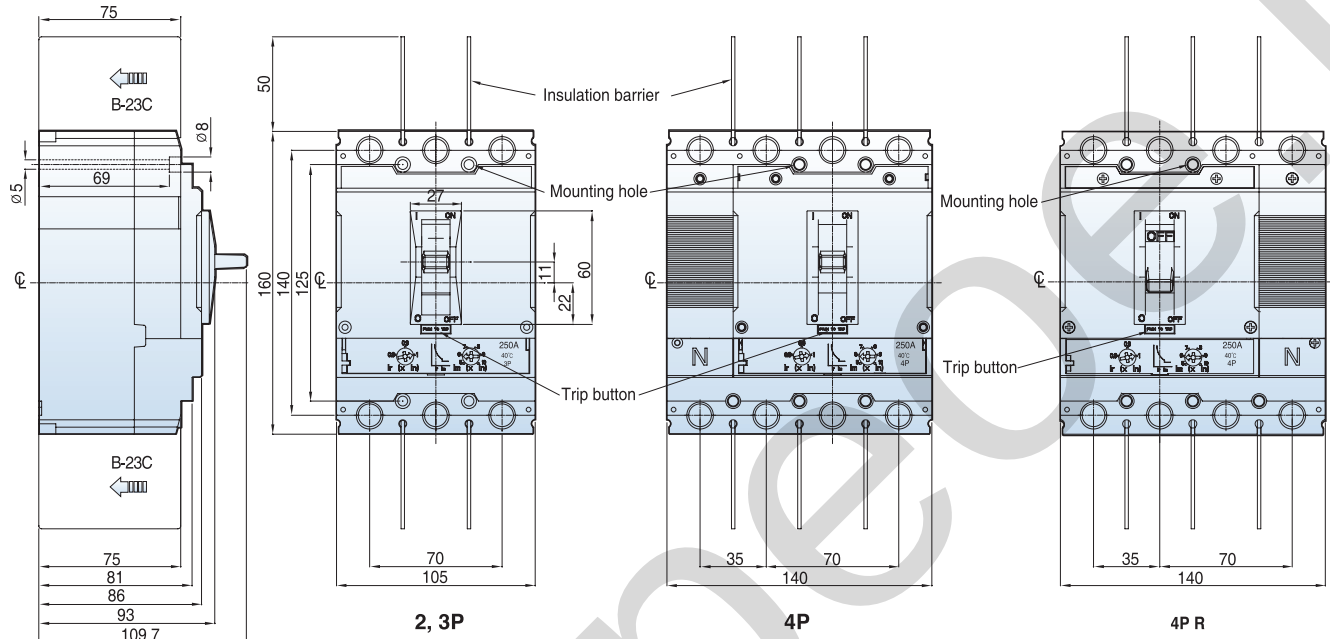


# Overall dimensions

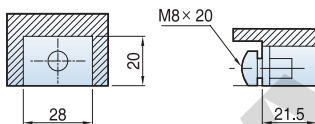
**Susol**

**TS100/160/250**

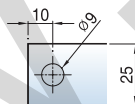
[mm]



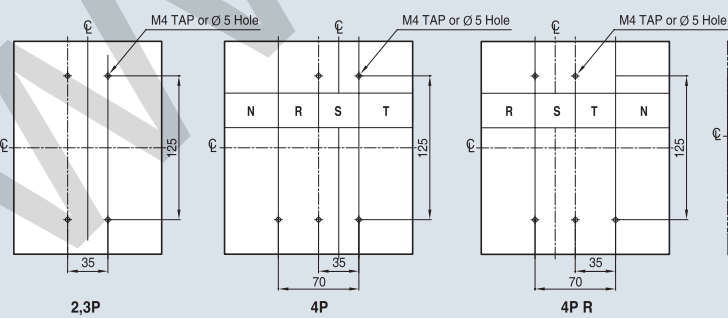
## Terminal section



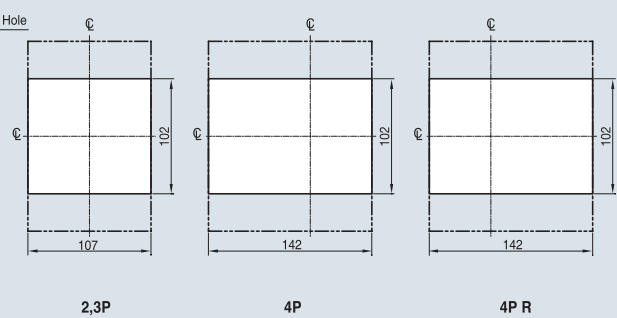
## Conductor



## Panel drilling



## Front panel cutting

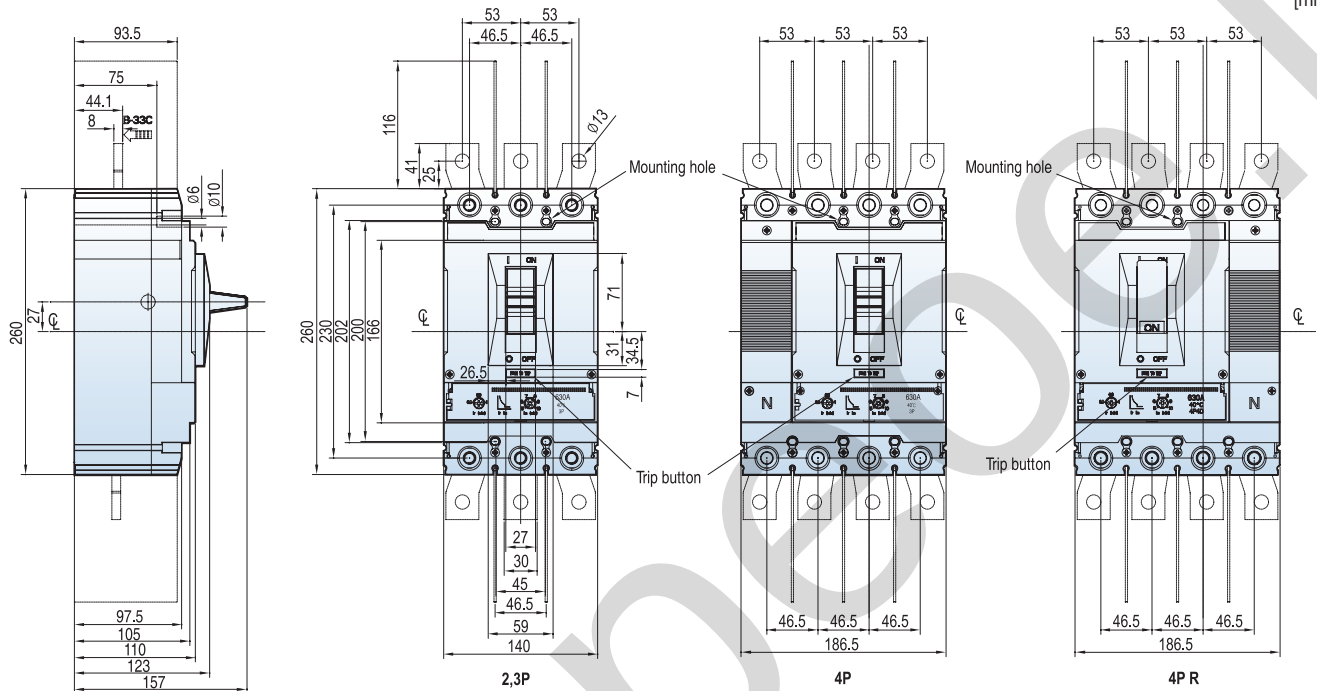


# Overall dimensions

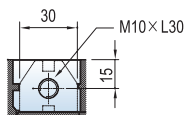
Susol

## TS400/630

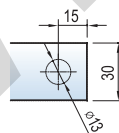
[mm]



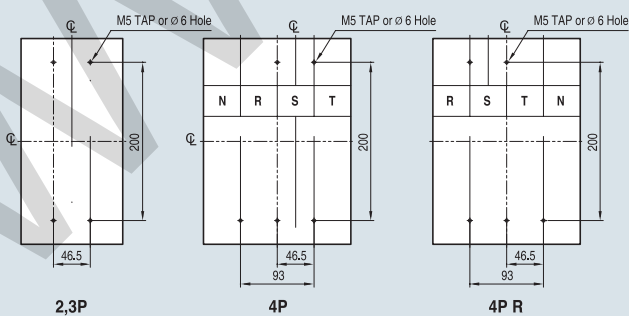
### Terminal section



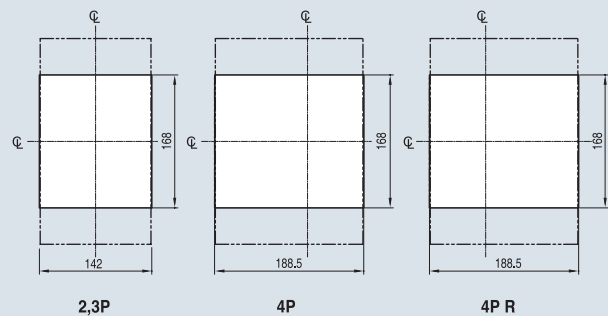
### Conductor



### Panel drilling



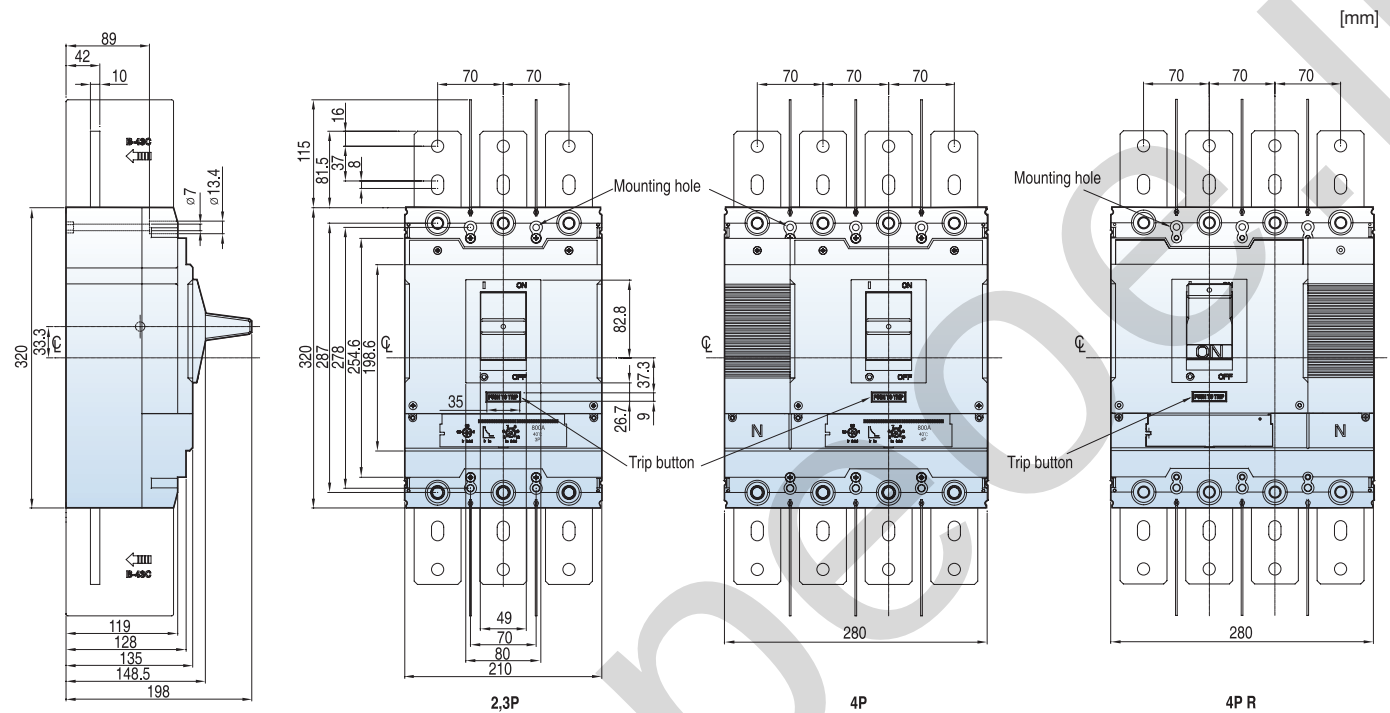
### Front panel cutting



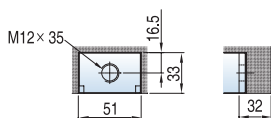
# Overall dimensions

Susol

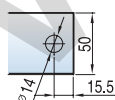
TS800



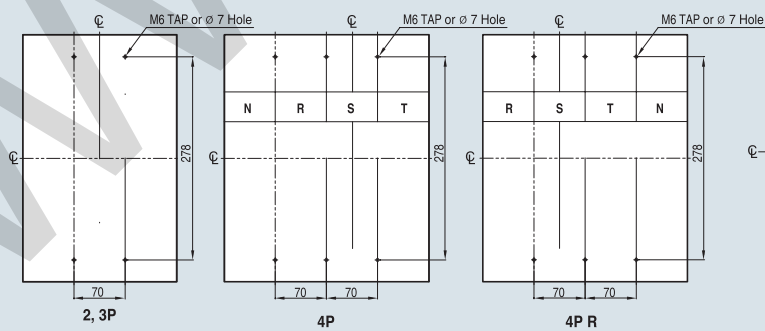
Terminal section



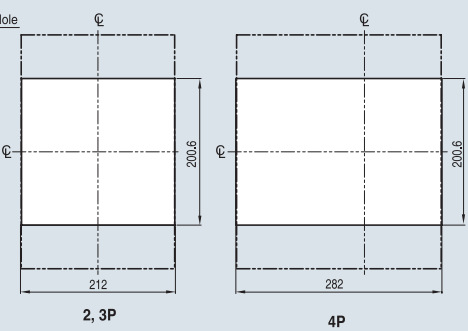
Conductor



Panel drilling



Front panel cutting





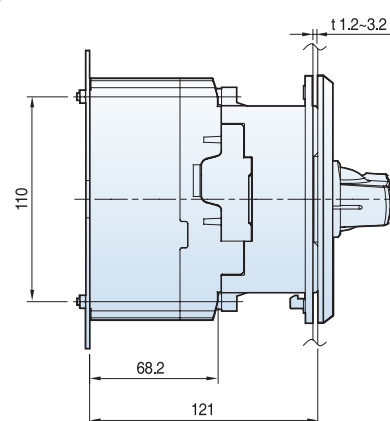
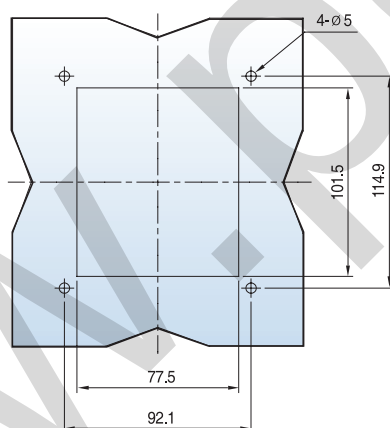
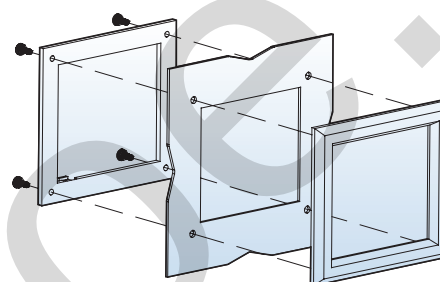
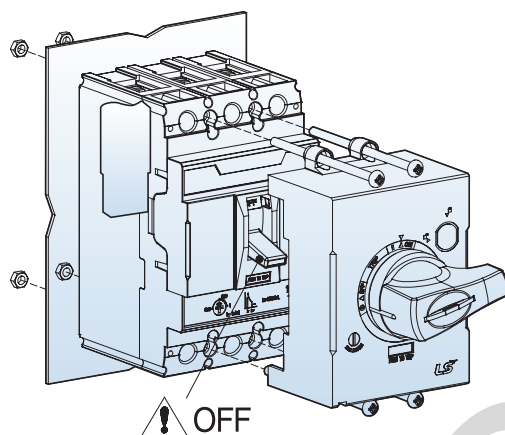
# Overall dimensions

Susol

## Direct rotary handles

DH1E for TE100/160

[mm]

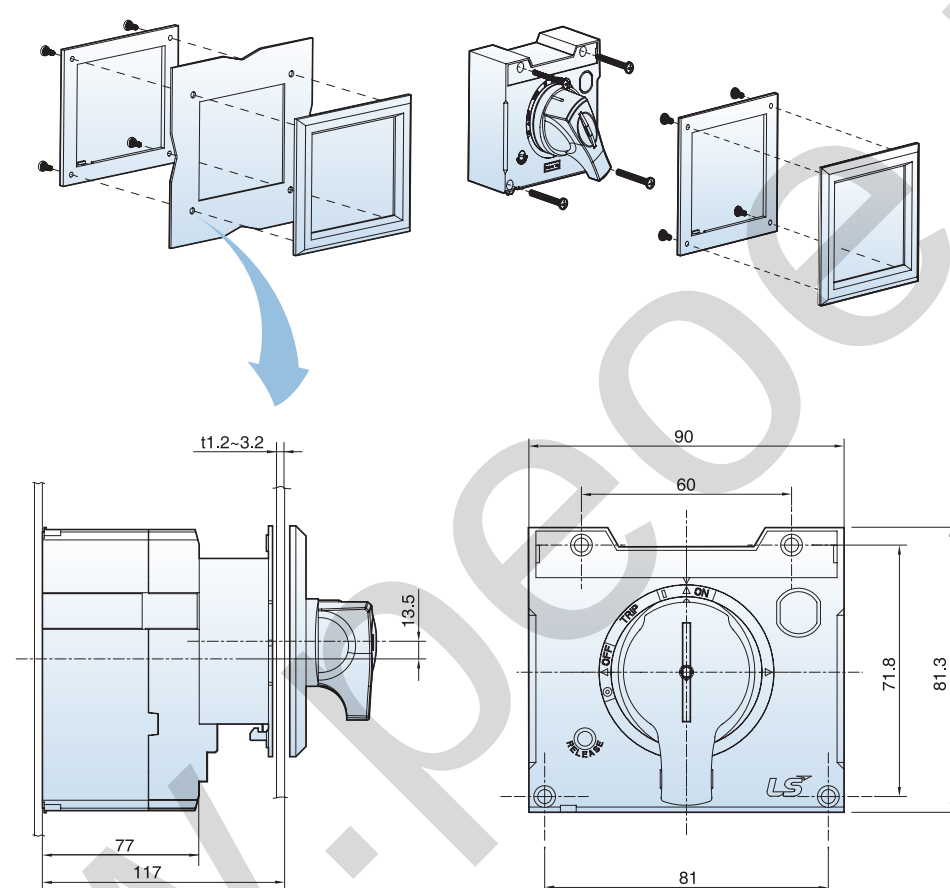


# Overall dimensions

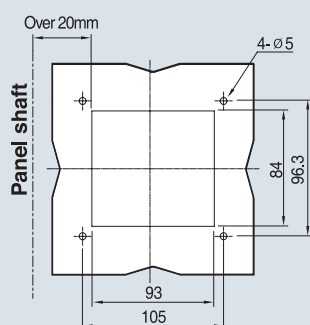
**Susol**

## Direct rotary handles

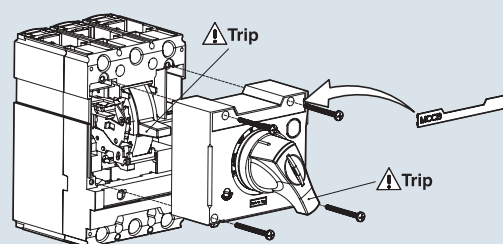
DH1 & DHK1 for TD100/160



### Panel drilling



### Way of installation

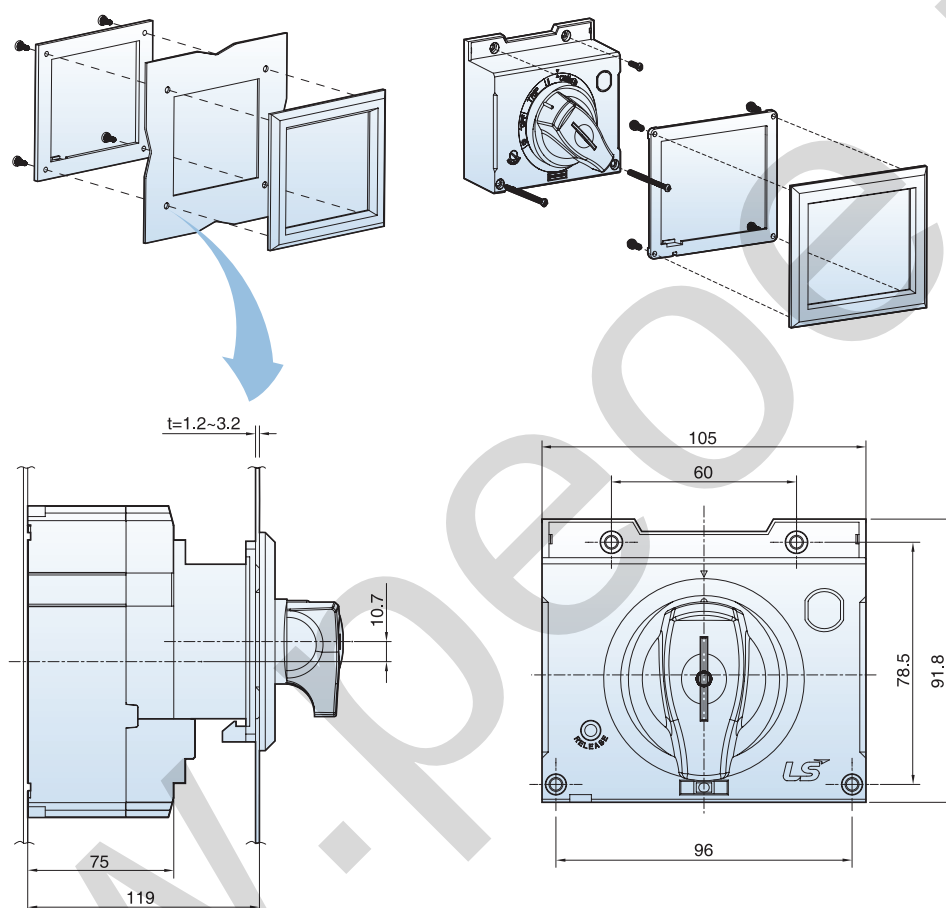


# Overall dimensions

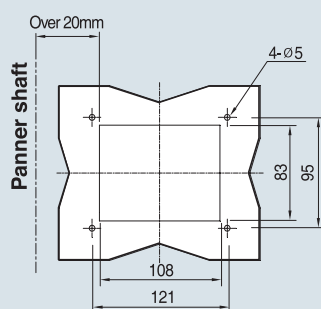
Susol

## Direct rotary handles

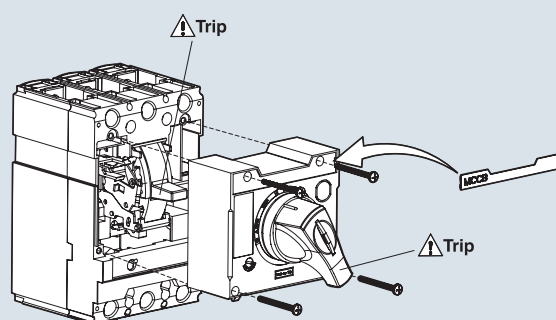
DH2 & DHK2 for TS100/160/250



### Panel drilling



### Way of installation

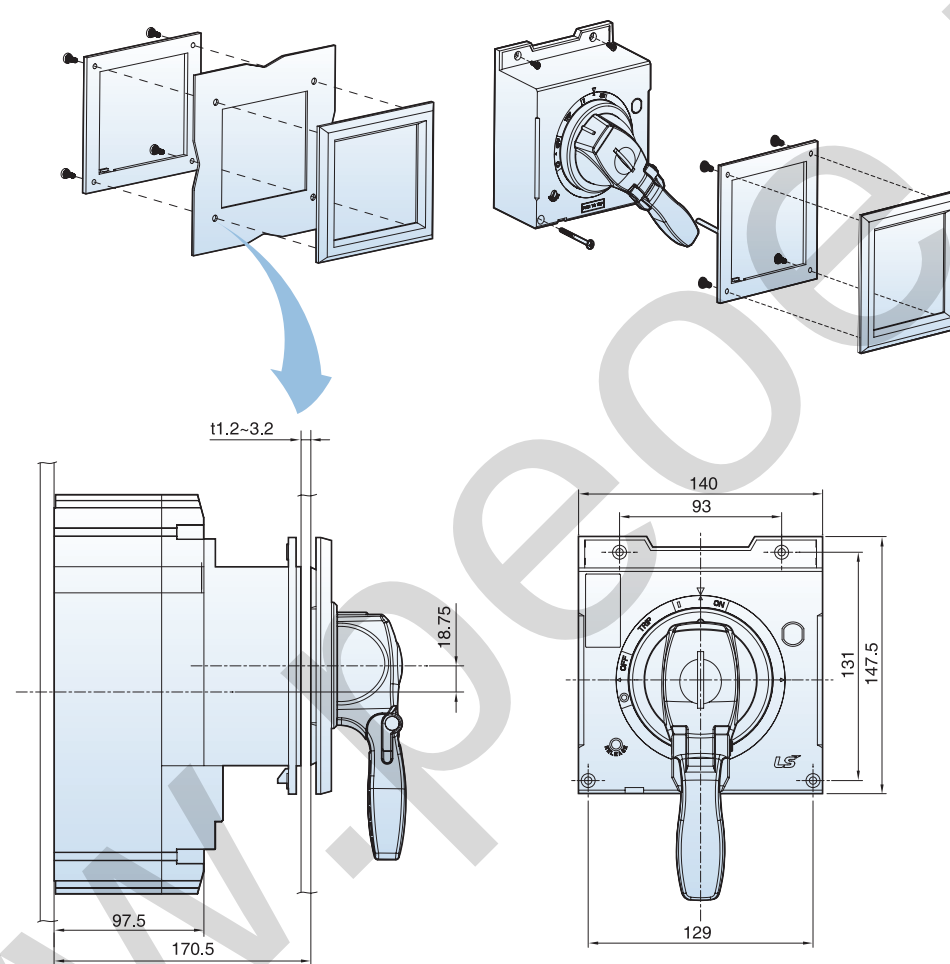


# Overall dimensions

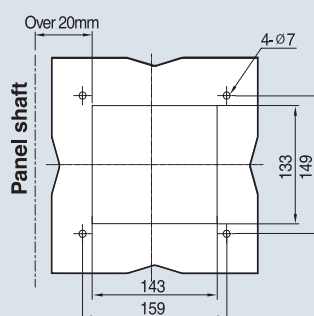
**Susol**

## Direct rotary handles

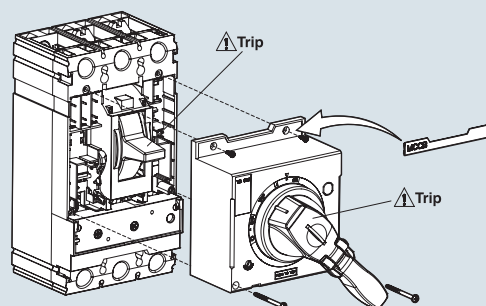
DH3 & DHK3 for TS400/630



### Panel drilling

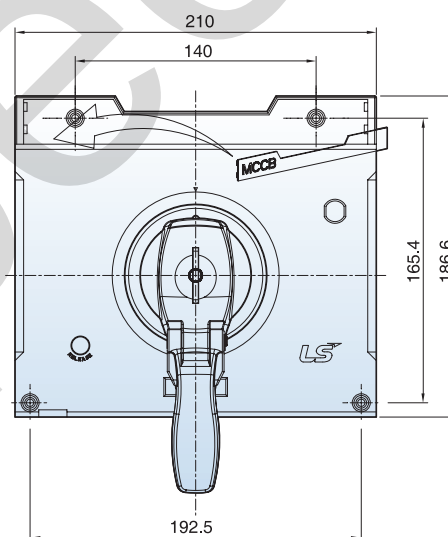
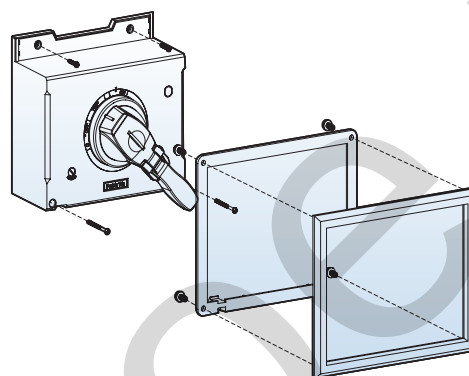


### Way of installation

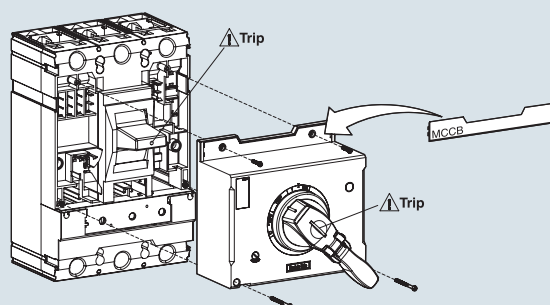


**Susol**

## DH4 & DHK4 for TS800



### Way of installation

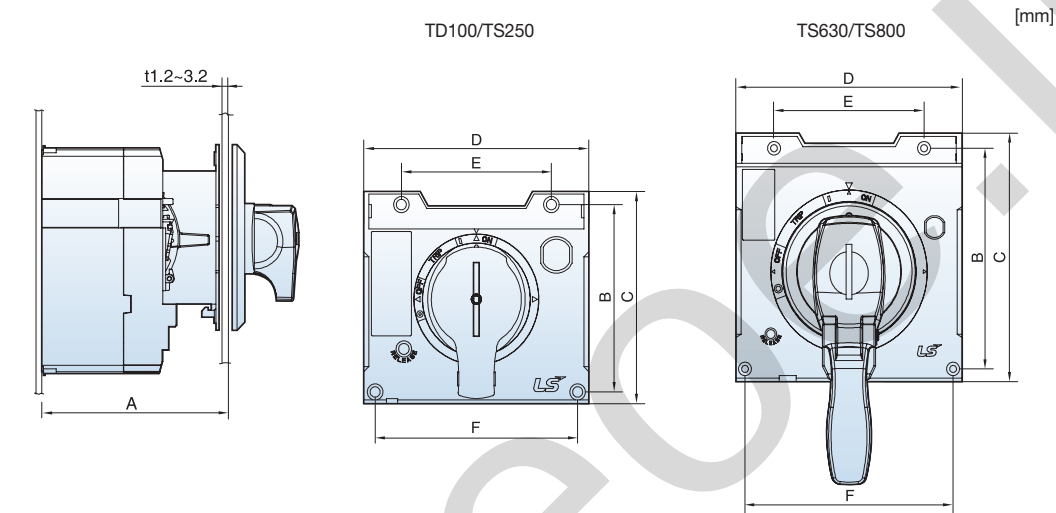


# Overall dimensions

Susol

## Direct rotary handles

Dimension table for D-handles



| Applicable to | TD160 | TS250 | TS630 | TS800 |
|---------------|-------|-------|-------|-------|
| A (mm)        | 117   | 119   | 170.5 | 211   |
| B (mm)        | 71.8  | 78.5  | 131   | 165.4 |
| C (mm)        | 81.3  | 91.8  | 147.5 | 186.6 |
| D (mm)        | 90    | 105   | 140   | 210   |
| E (mm)        | 60    | 60    | 93    | 140   |
| F (mm)        | 81    | 96    | 129   | 192.5 |

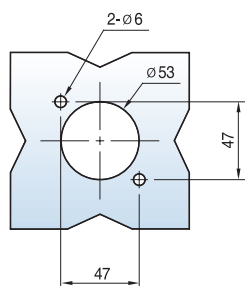
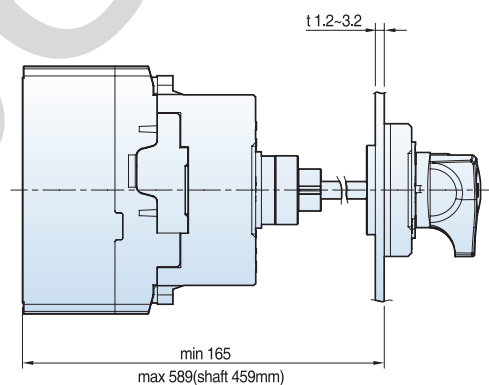
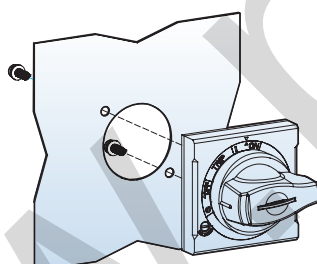
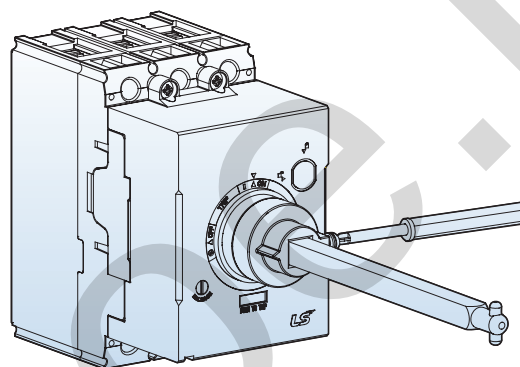
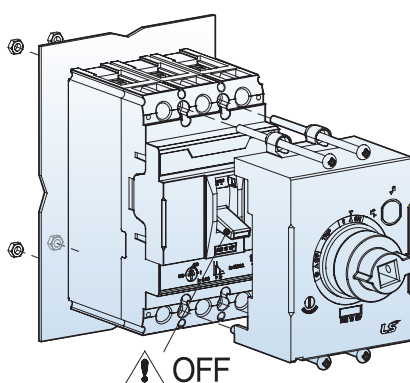
# Overall dimensions

Susol

## Extended rotary handles

EH1E for TE100/160

[mm]



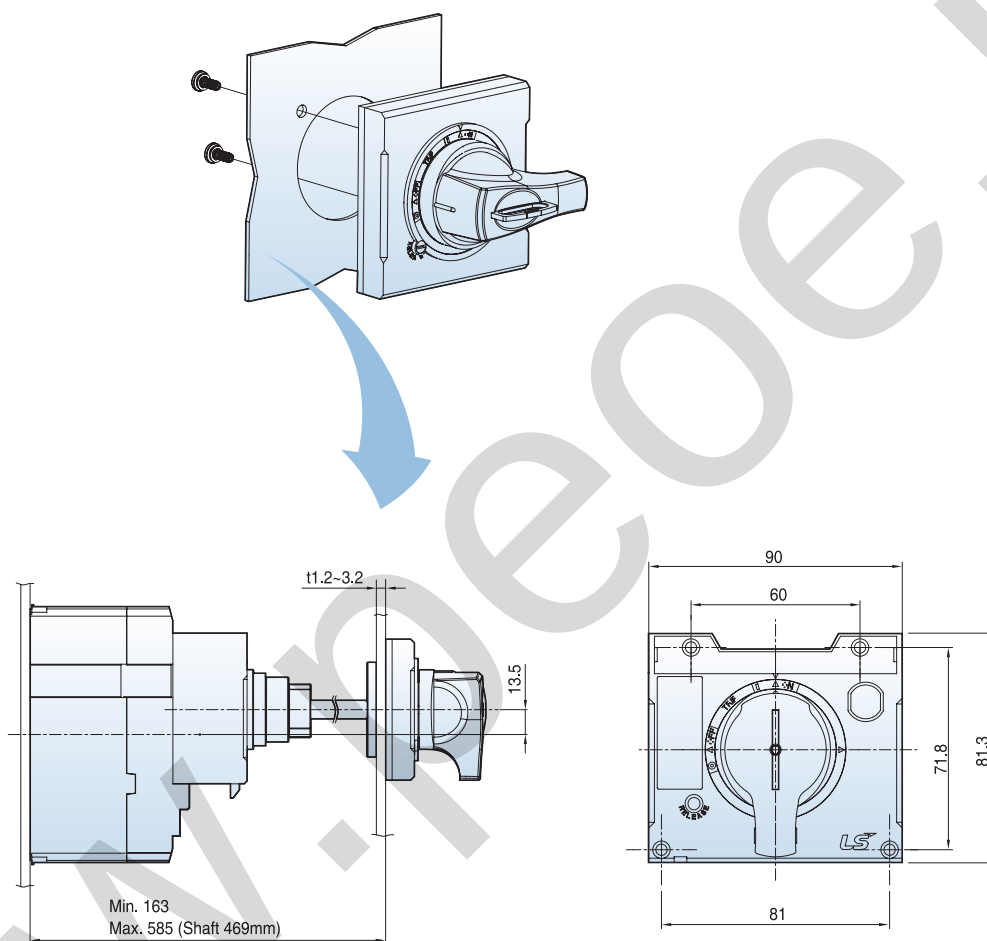
# Overall dimensions

Susol

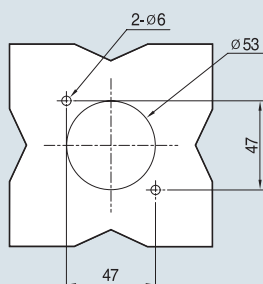
## Extended rotary handles

EH1 for TD100/160

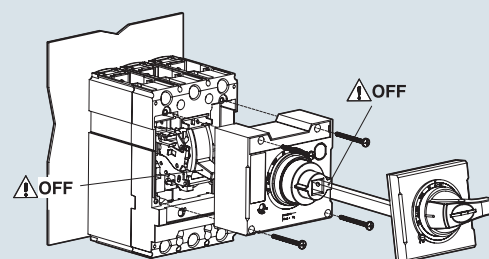
[mm]



### Panel drilling



### Way of installation



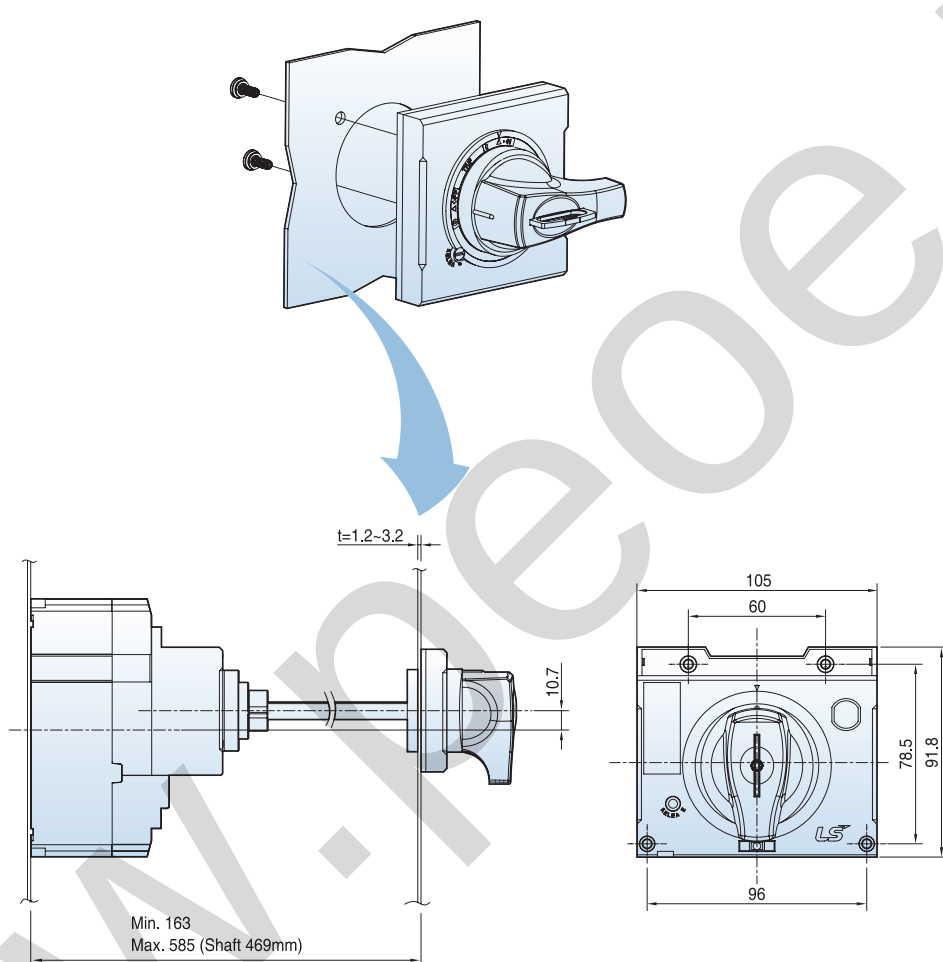


# Overall dimensions

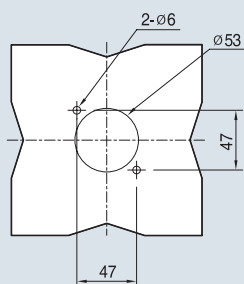
Susol

## Extended rotary handles

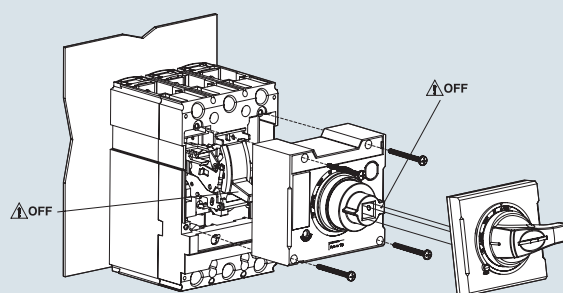
EH2 for TS100/160/250



### Panel drilling



### Way of installation



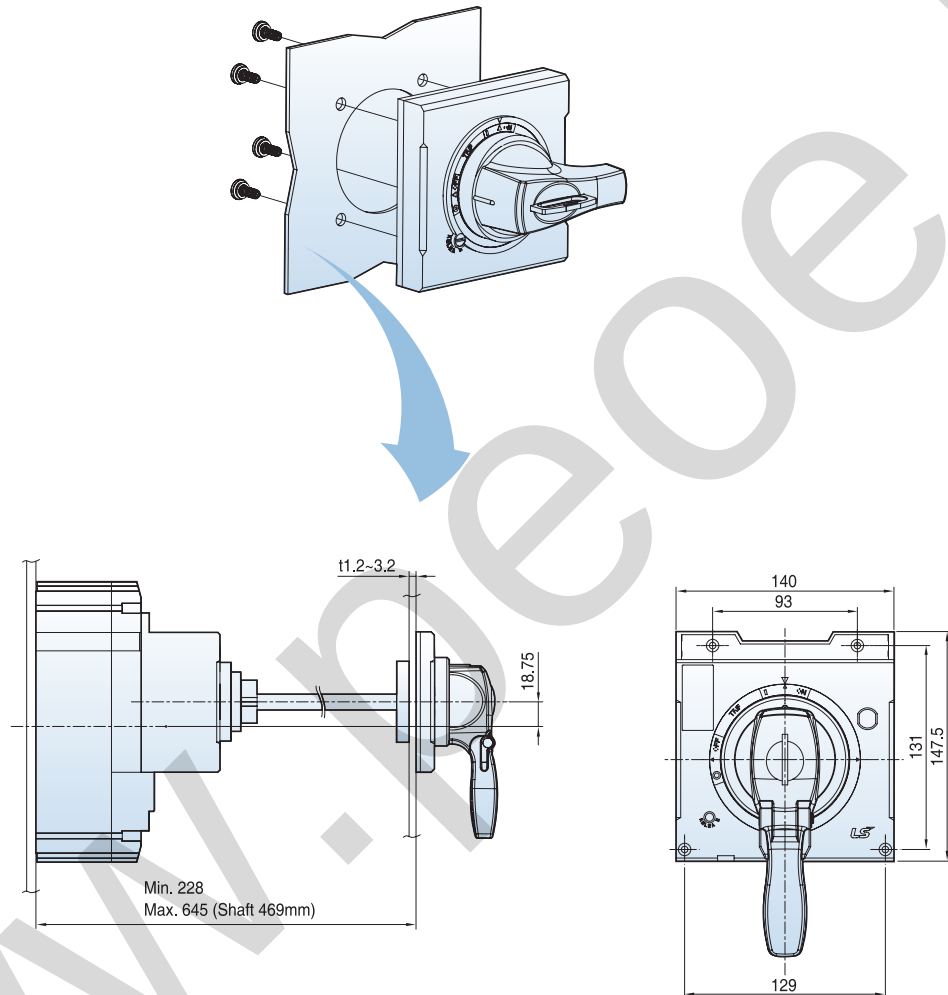
# Overall dimensions

Susol

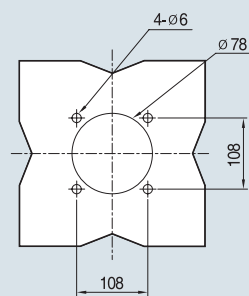
## Extended rotary handles

EH3 for TS400/630

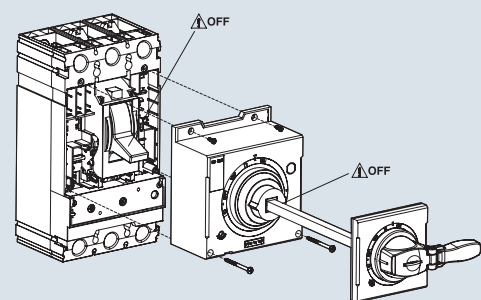
[mm]



### Panel drilling



### Way of installation

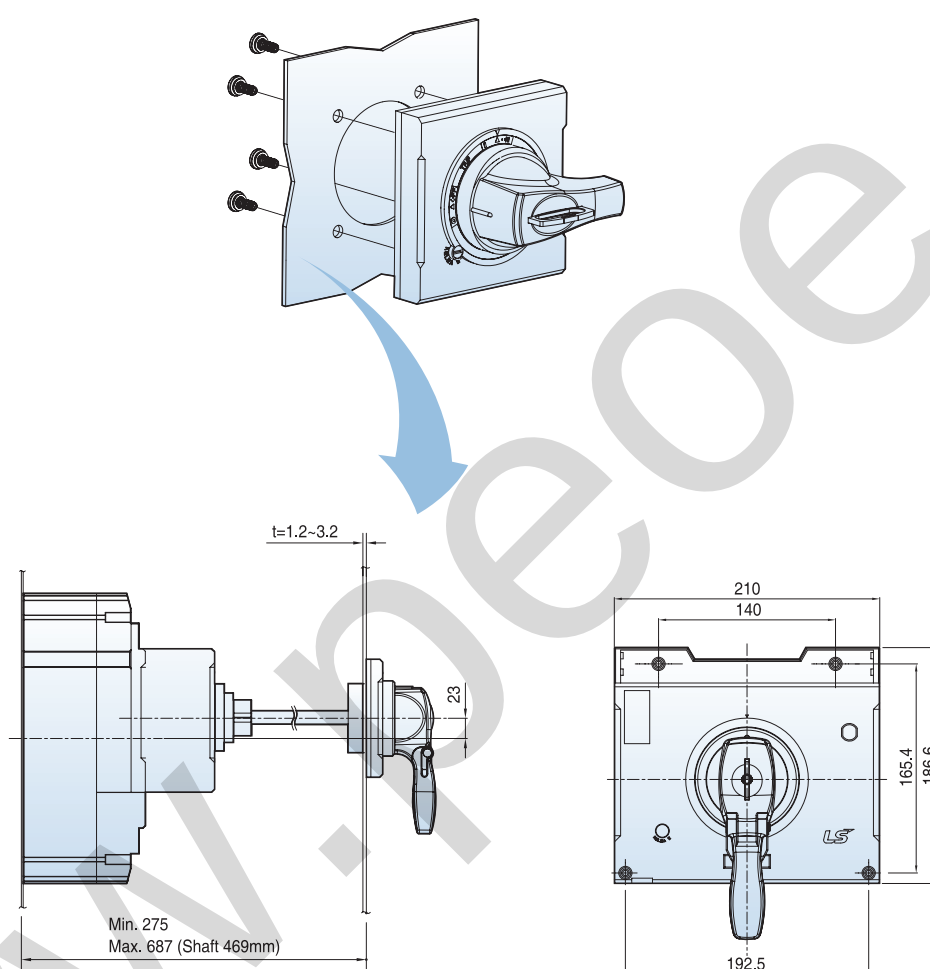


# Overall dimensions

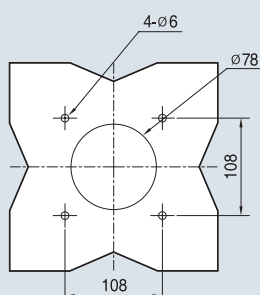
Susol

## Extended rotary handles

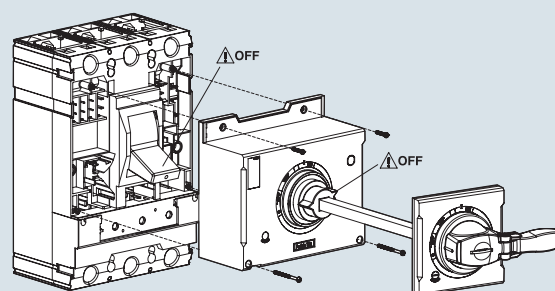
EH4 for TS800



### Panel drilling



### Way of installation

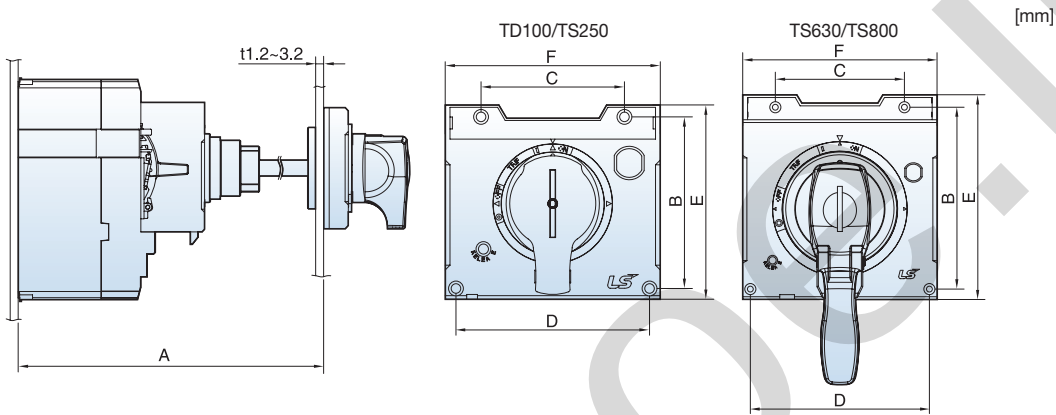


# Overall dimensions

Susol

## Extended rotary handles

Dimension table for E-handles



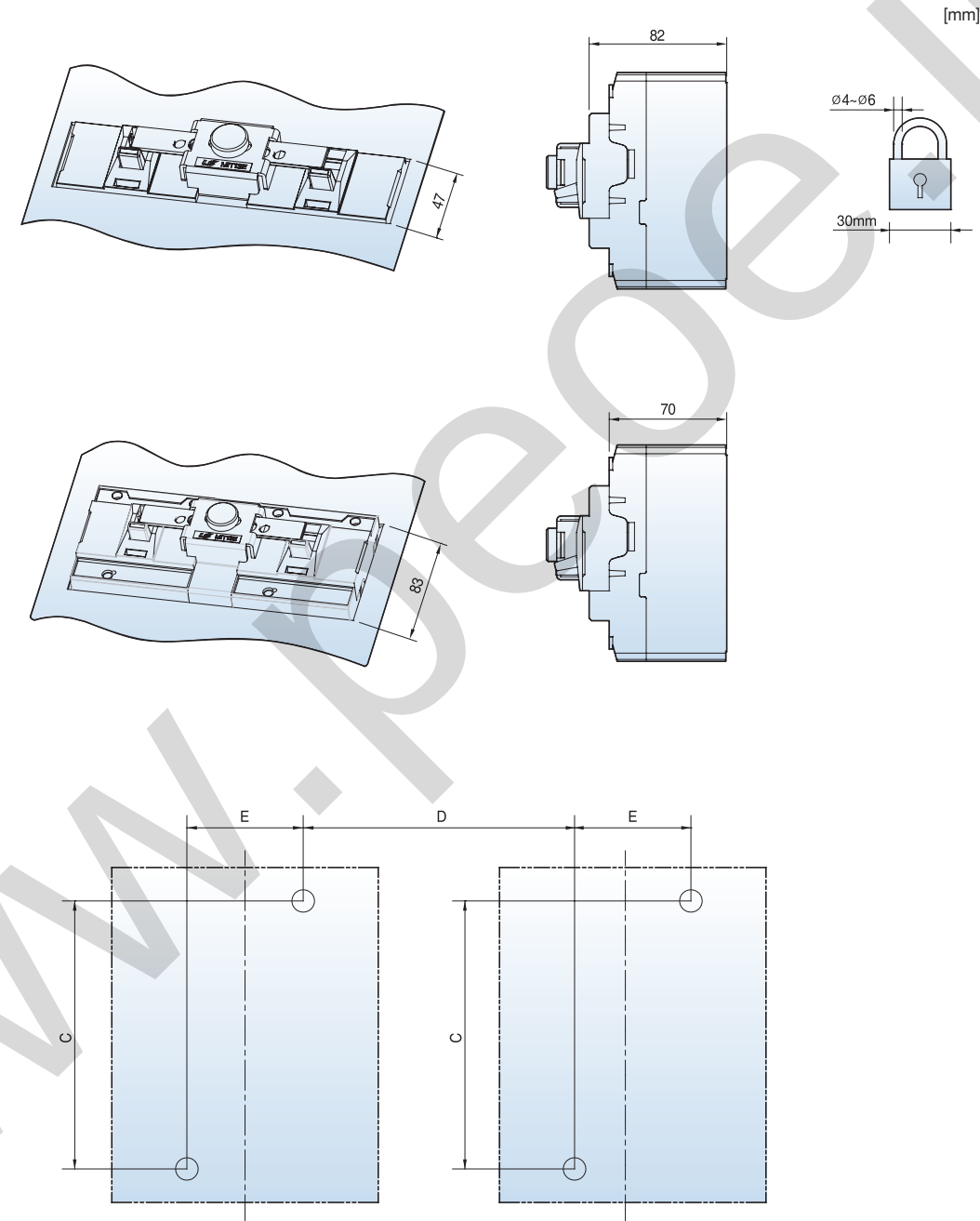
| Model         | EH1      | EH2      | EH3      | EH4      |
|---------------|----------|----------|----------|----------|
| Applicable to | TD160    | TS250    | TS630    | TS800    |
| A (mm)        | Min. 163 | Min. 163 | Min. 228 | Min. 275 |
|               | Max. 585 | Max. 585 | Max. 645 | Max. 687 |
| B (mm)        | 71.8     | 78.5     | 131      | 165.4    |
| C (mm)        | 60       | 60       | 93       | 140      |
| D (mm)        | 81       | 96       | 129      | 192.5    |
| E (mm)        | 81.3     | 91.8     | 147.5    | 186.6    |
| F (mm)        | 90       | 105      | 140      | 210      |
| Shaft (mm)    | 469      | 469      | 469      | 469      |

# Overall dimensions

Susol

## Mechanical interlocking device

MIT13E, MIT14E for TE100/160



| 3Pole MCCBs | C(mm) | D(mm) | E(mm) |
|-------------|-------|-------|-------|
| TE160       | 110   | 79    | 25    |

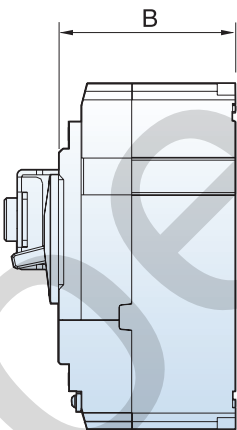
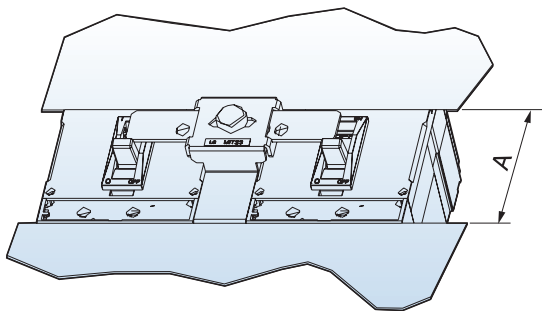
| 4Pole MCCBs | C(mm) | D(mm) | E(mm) |
|-------------|-------|-------|-------|
| TE160       | 110   | 79    | 50    |

# Overall dimensions

Susol

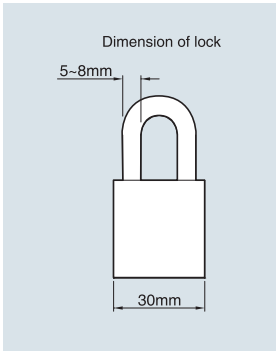
## Mechanical interlocking device

MIT13, MIT23, MIT33, MIT43



[mm]

|       | A (mm) | B (mm) |
|-------|--------|--------|
| TD160 | 83     | 86     |
| TS250 | 102    | 86     |
| TS630 | 168    | 110    |
| TS800 | 201    | 135    |

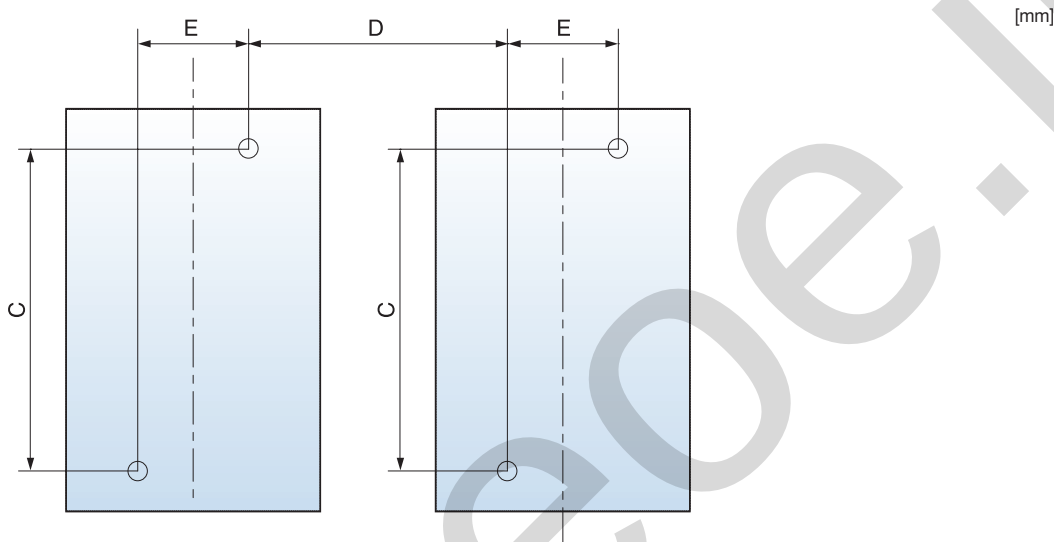


# Overall dimensions

Susol

## Mechanical interlocking device

Mounting dimension for MIT



| 2, 3Pole MCCBs | C(mm) | D(mm) | E(mm) |
|----------------|-------|-------|-------|
| TD100/160      | 107   | 90    | 30    |
| TS100/160/250  | 125   | 105   | 35    |
| TS400/630      | 200   | 139.5 | 46.5  |
| TS800          | 278   | 210   | 70    |

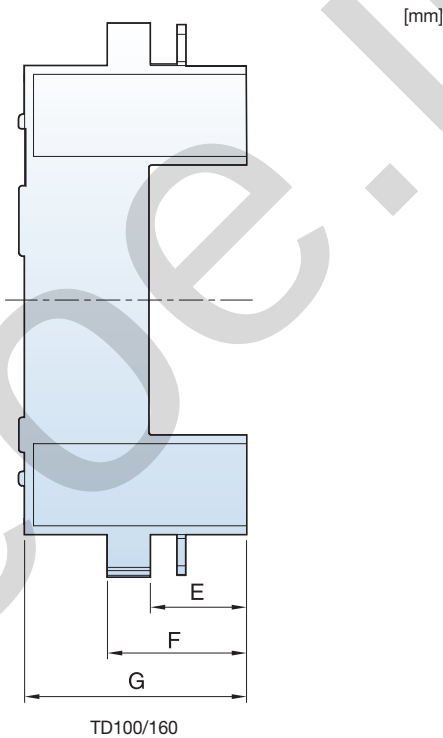
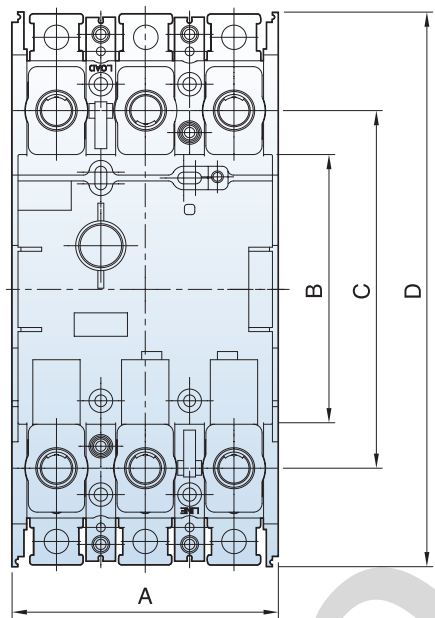
| 4Pole MCCBs   | C(mm) | D(mm) | E(mm) |
|---------------|-------|-------|-------|
| TD100/160     | 107   | 90    | 60    |
| TS100/160/250 | 125   | 105   | 70    |
| TS400/630     | 200   | 139.5 | 93    |
| TS800         | 278   | 210   | 140   |

# Overall dimensions

Susol

## Plug-in device

Plug-in devices for TD100/160



|       | TD100/160      |
|-------|----------------|
| A(mm) | 90 (120*)      |
| B(mm) | 92             |
| C(mm) | 122            |
| D(mm) | 189.2 (185.6*) |
| E(mm) | 32.5           |
| F(mm) | 47             |
| G(mm) | 75             |

\* 4P Plug-in (TD100/160 only)

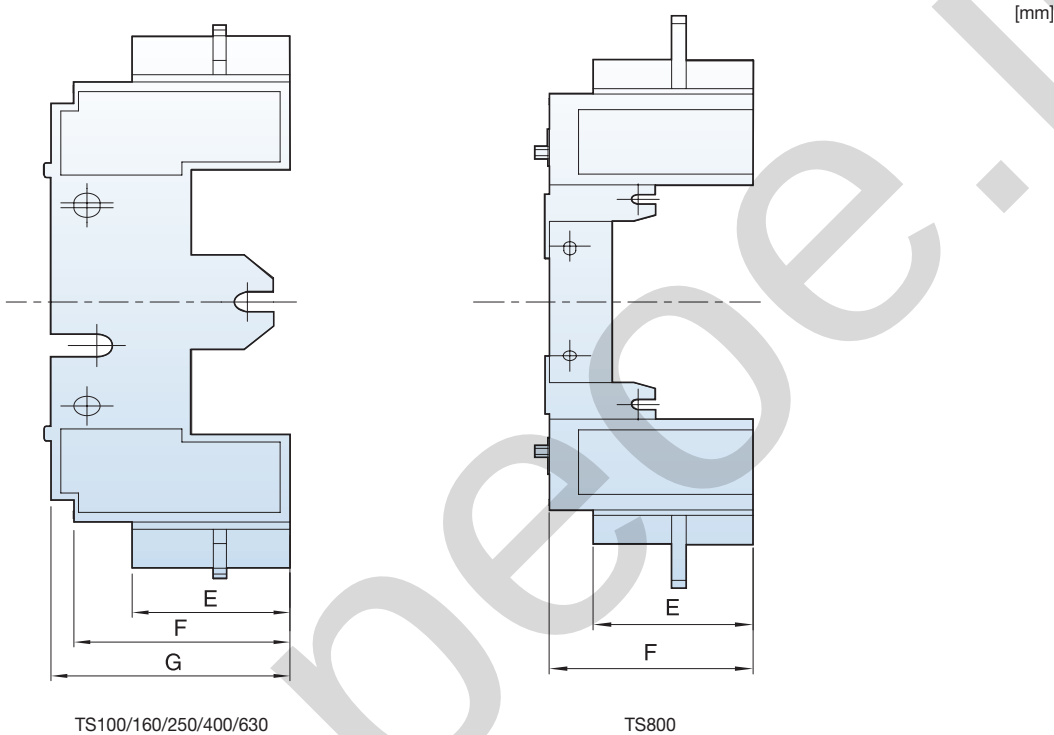


# Overall dimensions

Susol

## Plug-in device

Plug-in devices for TS100/160/250/400/630/800



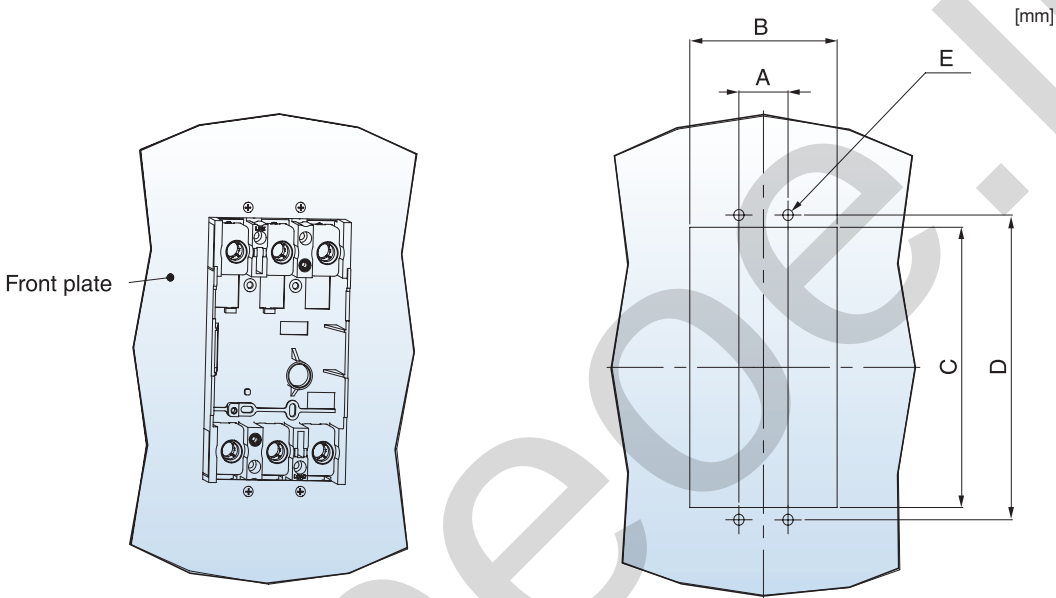
|       | TS100/160/250 | TS400/630 | TS800 |
|-------|---------------|-----------|-------|
| A(mm) | 105           | 140       | 210   |
| B(mm) | 103.5         | 186.4     | 220   |
| C(mm) | 140           | 230       | 287   |
| D(mm) | 220           | 335.2     | 451   |
| E(mm) | 48.2          | 73        | 110   |
| F(mm) | 66            | 94.2      | 140   |
| G(mm) | 73            | 102       | -     |

# Overall dimensions

Susol

## Plug-in device

Mounting to front plate



| Applicable to | TD100/160 | TS100/160/250 | TS400/630 | TS800     |
|---------------|-----------|---------------|-----------|-----------|
| A (mm)        | 30 (60*)  | 35            | 46.5      | 70        |
| B (mm)        | 90 (120*) | 105           | 140       | 210       |
| C (mm)        | 160       | 182           | 290       | 387       |
| D (mm)        | 174       | 202           | 314       | 422       |
| E (mm)        | M4 or ø 5 | M4 or ø 5     | M5 or ø 6 | M6 or ø 7 |

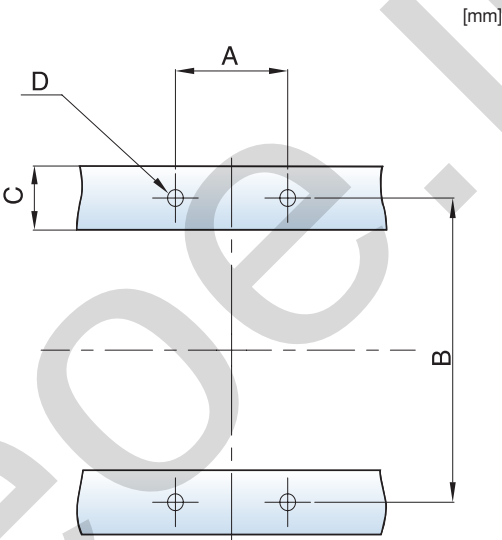
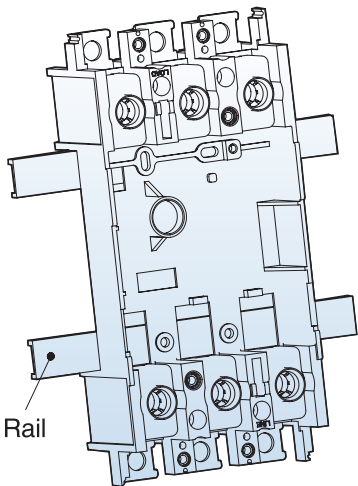
\* 4P Plug-in (TD100/160 only)

# Overall dimensions

Susol

## Plug-in device

### Rail mounting



| Applicable to | TD100/160             | TS100/160/250         | TS400/630             | TS800                 |
|---------------|-----------------------|-----------------------|-----------------------|-----------------------|
| A (mm)        | 30 (60*)              | 70                    | 100                   | 156                   |
| B (mm)        | 76                    | 77.8                  | 101.6                 | 104.2                 |
| C (mm)        | 14                    | 28                    | 32                    | 43                    |
| D (mm)        | M4 or $\varnothing 5$ | M6 or $\varnothing 7$ | M6 or $\varnothing 7$ | M8 or $\varnothing 9$ |

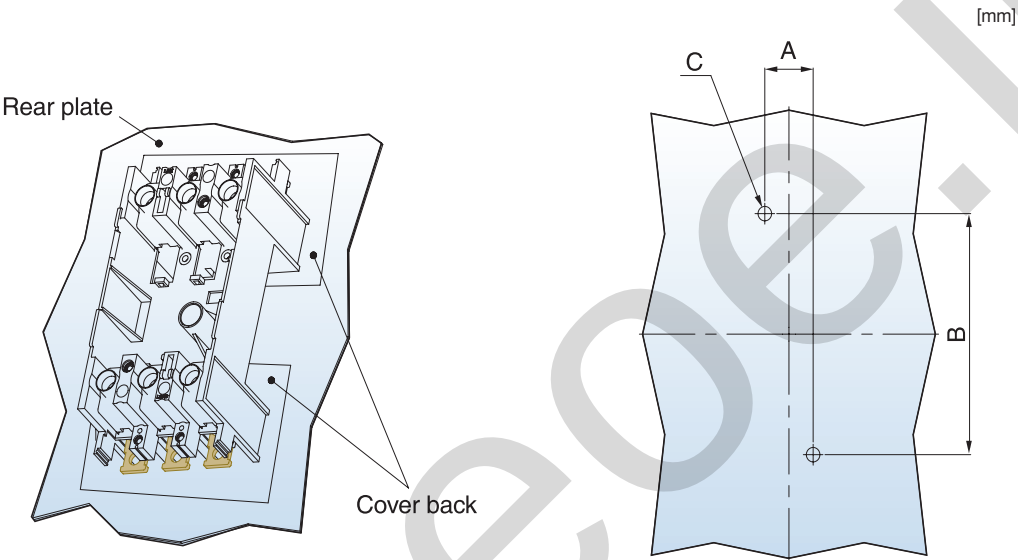
\* 4P Plug-in (TD100/160 only)

# Overall dimensions

Susol

## Plug-in device

Mounting to rear plate with cover back



| Applicable to | TD100/160             | TS100/160/250         | TS400/630             | TS800                 |
|---------------|-----------------------|-----------------------|-----------------------|-----------------------|
| A (mm)        | 30 (60*)              | 35                    | 46.5                  | 70                    |
| B (mm)        | 140                   | 154                   | 262                   | 343                   |
| C (mm)        | M4 or $\varnothing 5$ | M4 or $\varnothing 5$ | M5 or $\varnothing 6$ | M6 or $\varnothing 7$ |

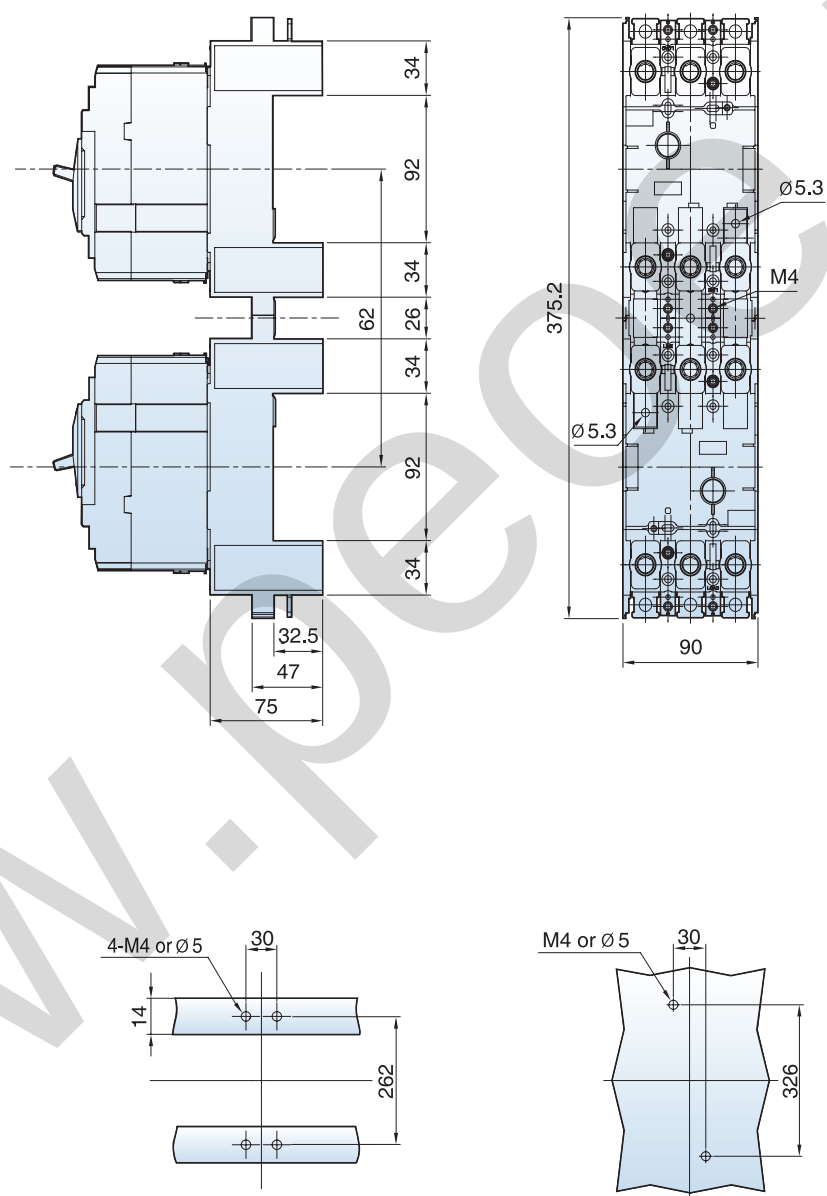
\* 4P Plug-in (TD100/160 only)

# Overall dimensions

Susol

## Plug-in device

Mounting for TD100/160

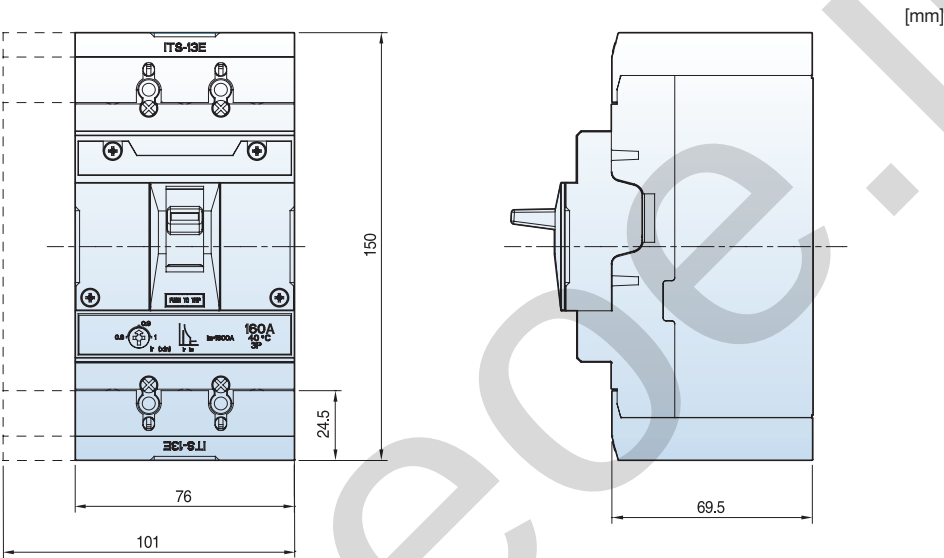


# Overall dimensions

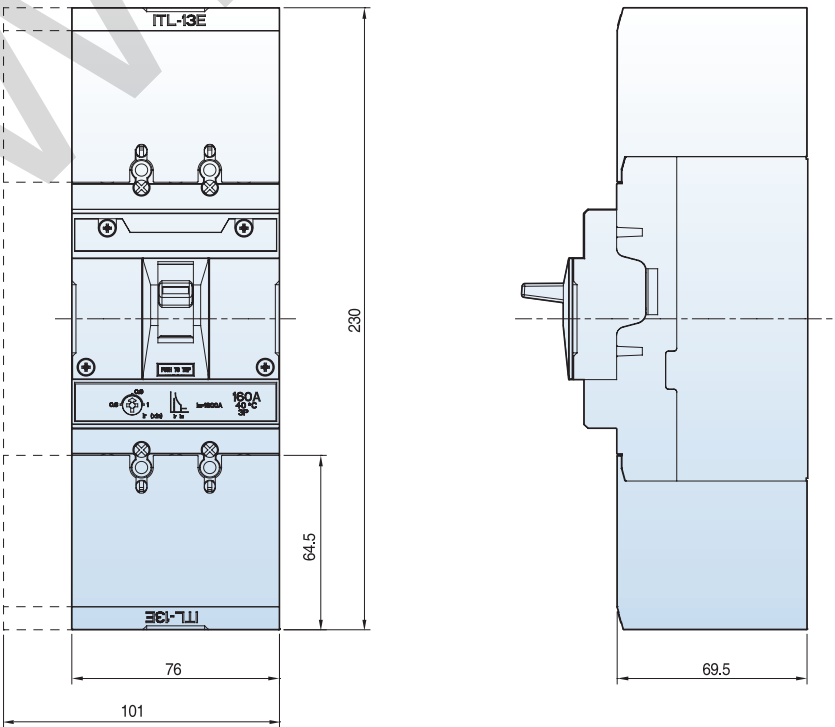
Susol

## Terminal cover

ITS13E, ITS14E for TE100/160



ITL13E, ITL14E for TE100/160

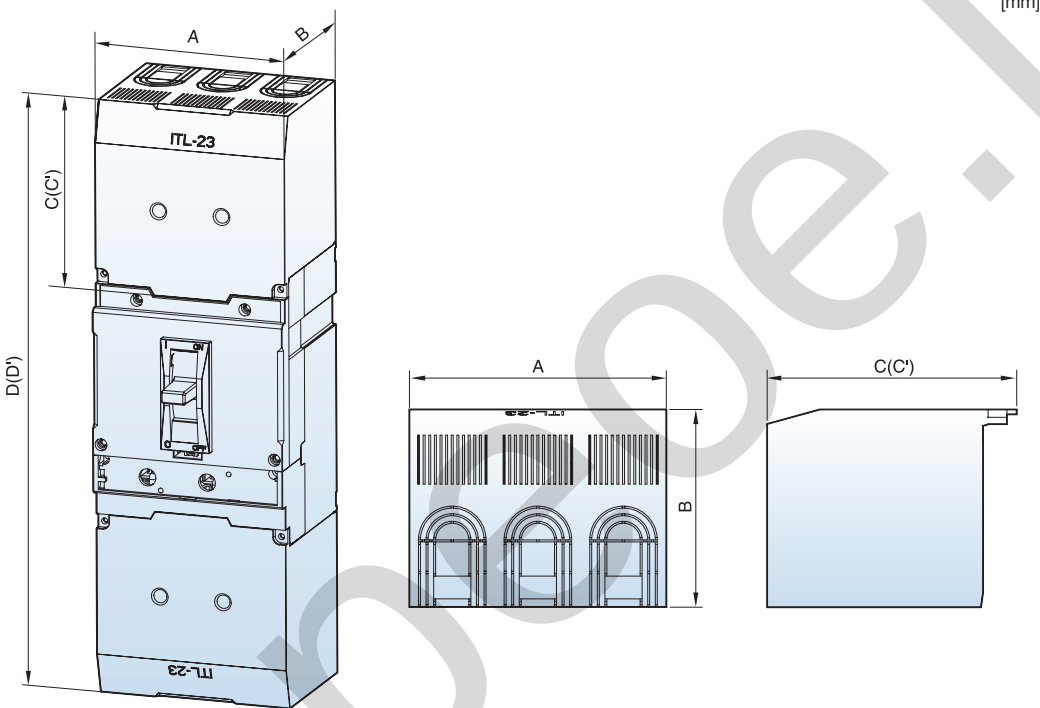


# Overall dimensions

Susol

## Terminal cover

ITS and ITL for TD100/160, TS100/160/250/400/630/800



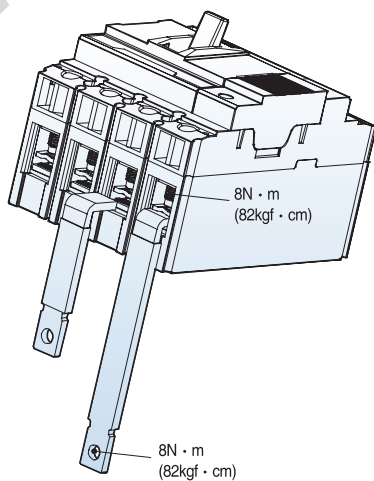
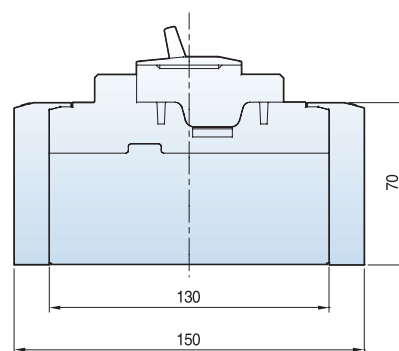
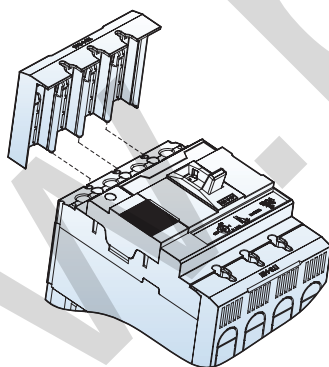
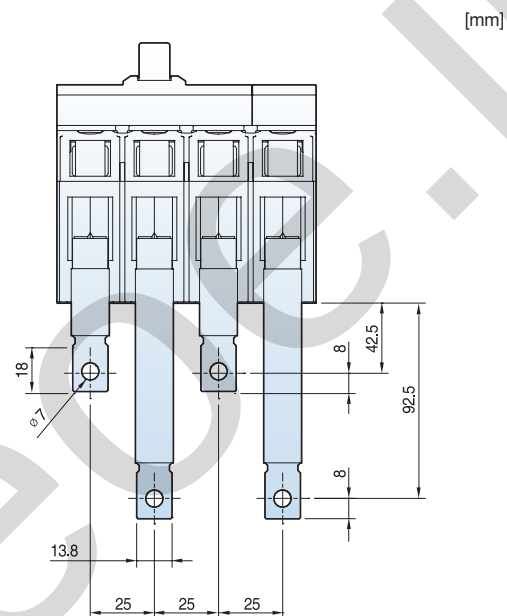
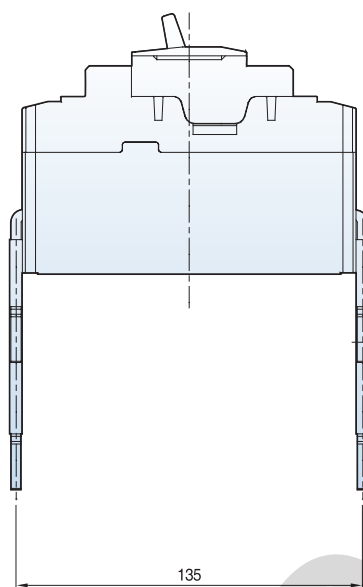
| Applicable to       | Type   |           |            | Dimension(mm) |       |                  |                    |                  |                    |
|---------------------|--------|-----------|------------|---------------|-------|------------------|--------------------|------------------|--------------------|
| Frame type          | Pole   | Long type | Short type | A             | B     | C<br>(Long type) | C'<br>(Short type) | D<br>(Long type) | D'<br>(Short type) |
| TD100, TD160        | 2P, 3P | ITL13     | ITS13      | 90            | 80.8  | 48.5             | 30.5               | 196              | 160                |
|                     | 4P     | ITL14     | ITS14      | 120           | 80.8  | 32               | 25                 |                  |                    |
| TS100, TS160, TS250 | 2P, 3P | ITL23     | ITS23      | 105           | 80.8  | 102              | 36.3               | 321.4            | 190                |
|                     | 4P     | ITL24     | ITS24      | 140           | 80.8  | 98               | 32.3               |                  |                    |
| TS400, TS630        | 2P, 3P | ITL33     | ITS33      | 140           | 105   | 144.5            | 54.8               | 479.4            | 300                |
|                     | 4P     | ITL34     | ITS34      | 186           | 105   | 138.5            | 48.8               |                  |                    |
| TS800               | 2P, 3P | ITL43     | ITS43      | 210           | 127.8 | 181.5            | 61.5               | 600              | 360                |
|                     | 4P     | ITL44     | ITS44      | 280           | 127.8 | 172.5            | 52.5               |                  |                    |

# Overall dimensions

Susol

## Rear connection

RTF13, RTF14 for TE100/160



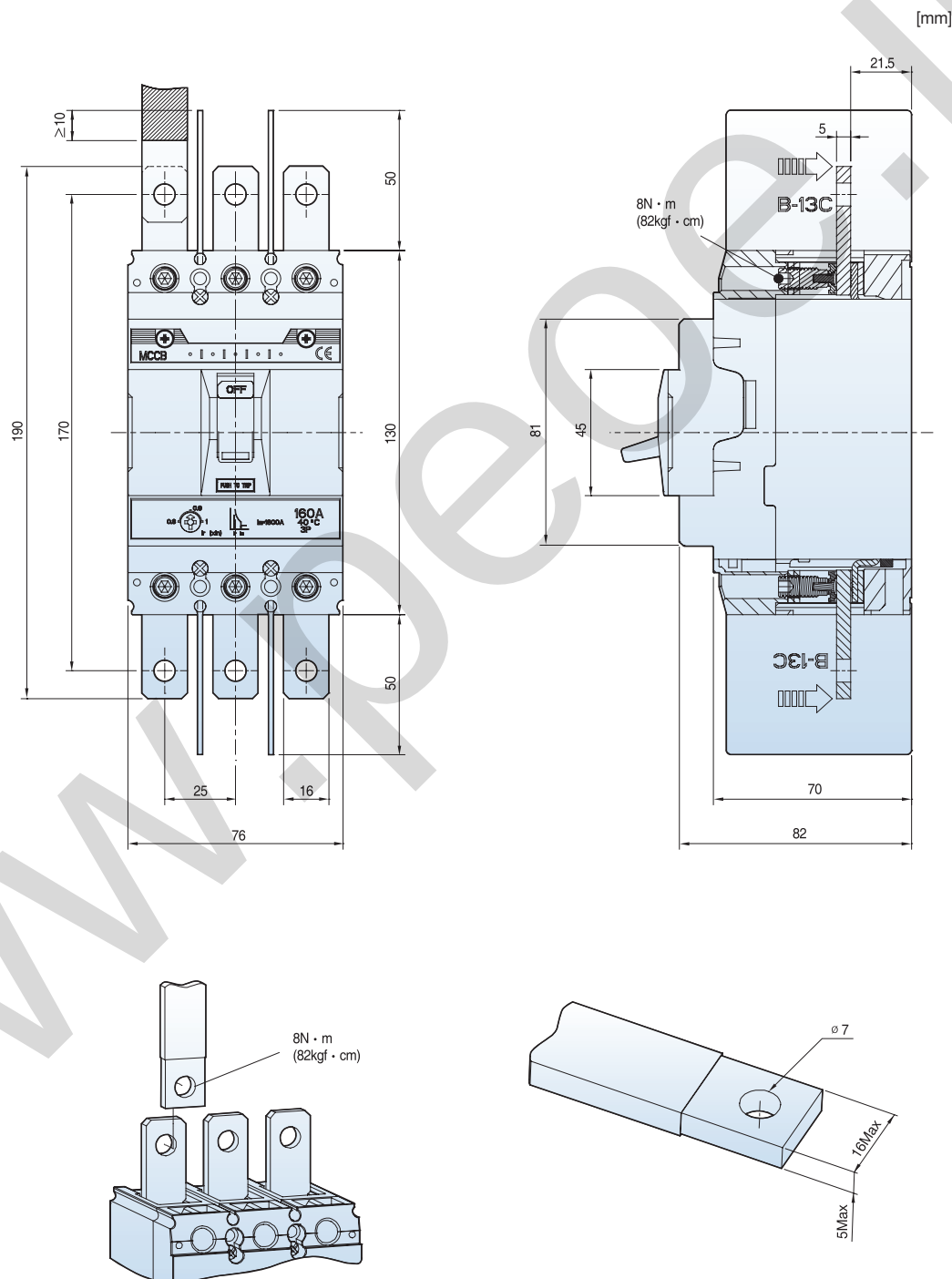


# Overall dimensions

Susol

## Extended terminal

ET13E, ET14E for TE100/160



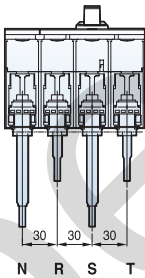
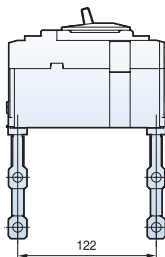
# Overall dimensions

Susol

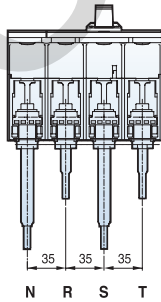
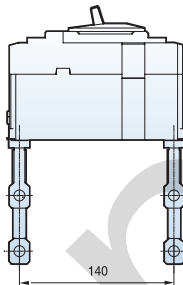
## Rear terminals

[mm]

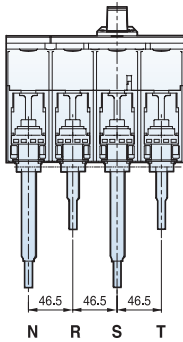
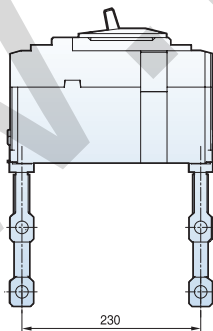
TD100  
TD160



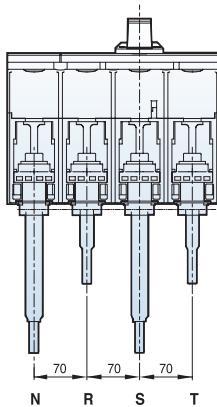
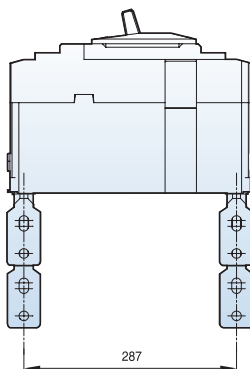
TS100  
TS160  
TS250



TS400  
TS630



TS800



# Overall dimensions

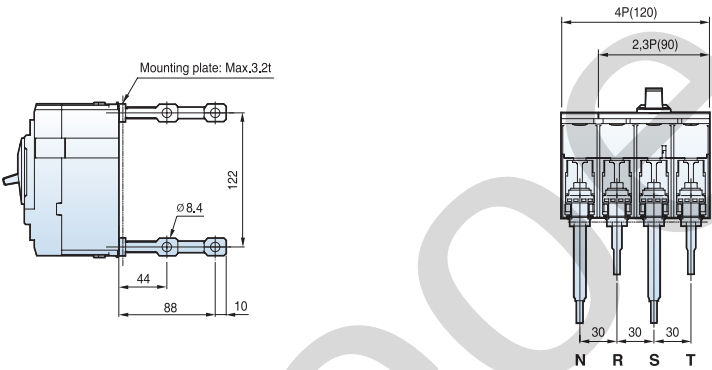
Susol

## Rear terminals

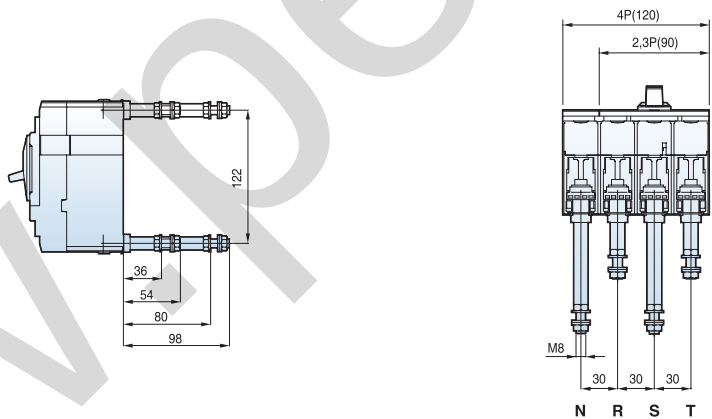
TD100 / TD160

[mm]

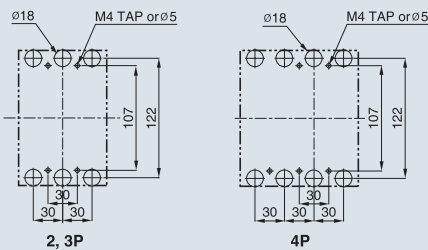
### Bar type



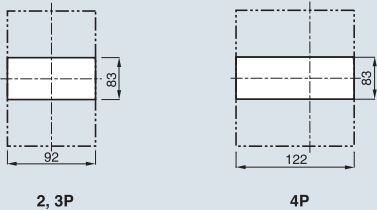
### Round type



### Panel drilling



### Front panel cutting



# Overall dimensions

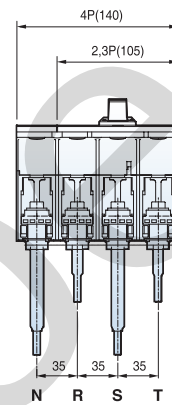
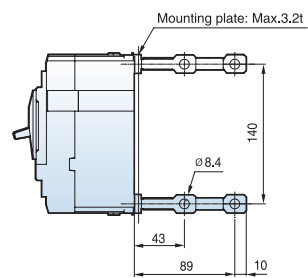
**Susol**

## Rear terminals

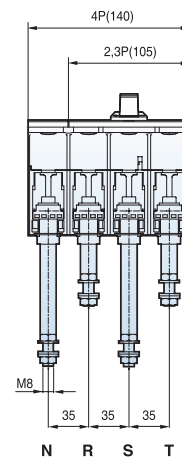
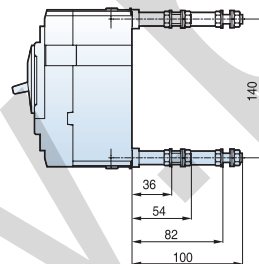
TS100 / TS160 / TS250

[mm]

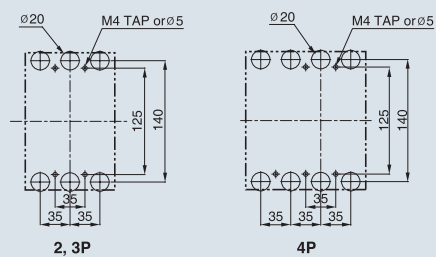
### Bar type



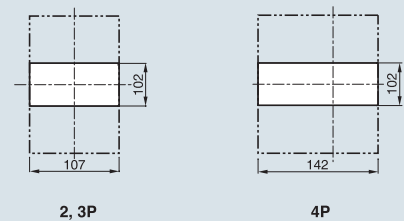
### Round type



### Panel drilling



### Front panel cutting



# Overall dimensions

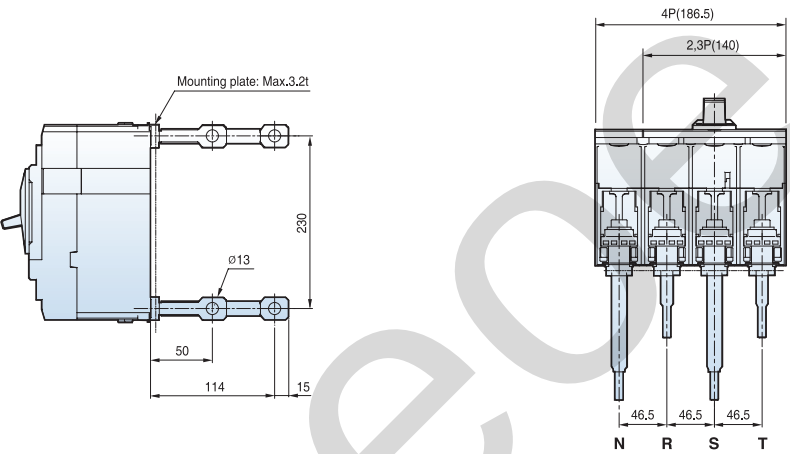
Susol

## Rear terminals

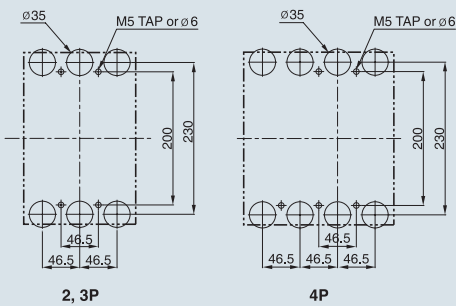
TS400 / TS630

[mm]

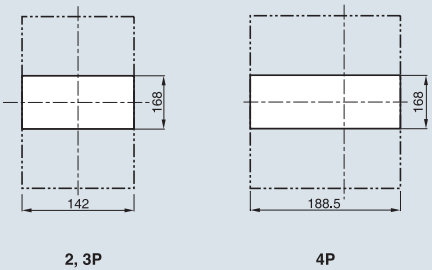
### Bar type



### Panel drilling



### Front panel cutting



# Overall dimensions

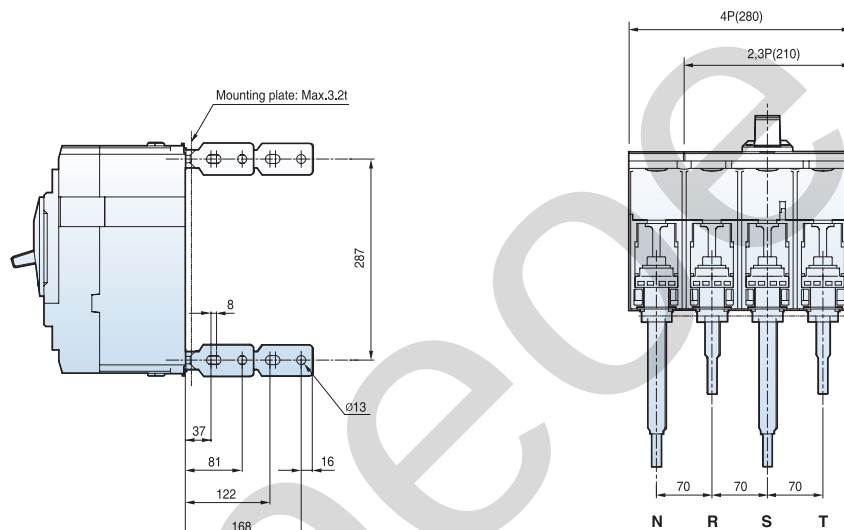
**Susol**

## Rear terminals

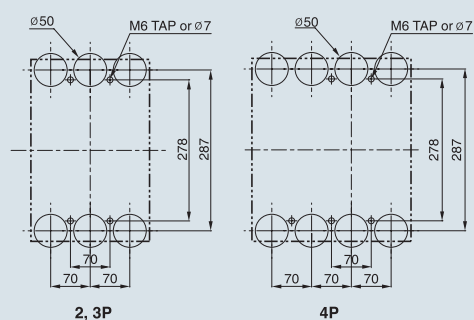
TS800

[mm]

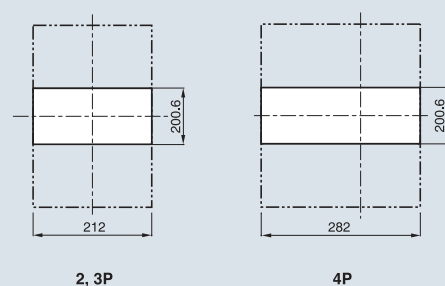
### Bar type



### Panel drilling



### Front panel cutting



# Overall dimensions

**Susol**

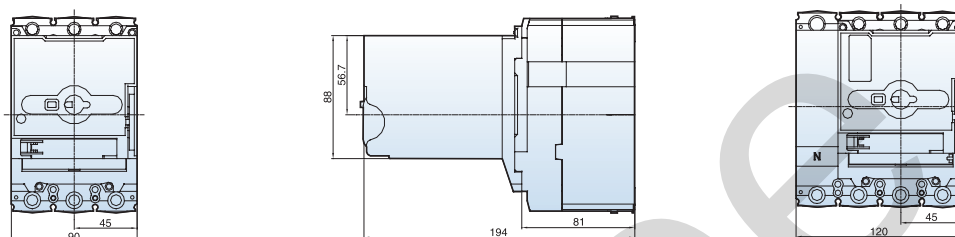
## Circuit breaker with motor operator

MOP1, MOP2, MOP3, MOP4

TD100N/H/L  
TD160N/H/L

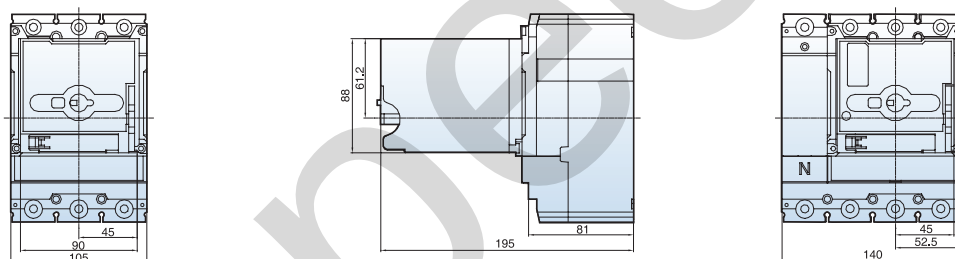
### Circuit breaker with MOP1

[mm]



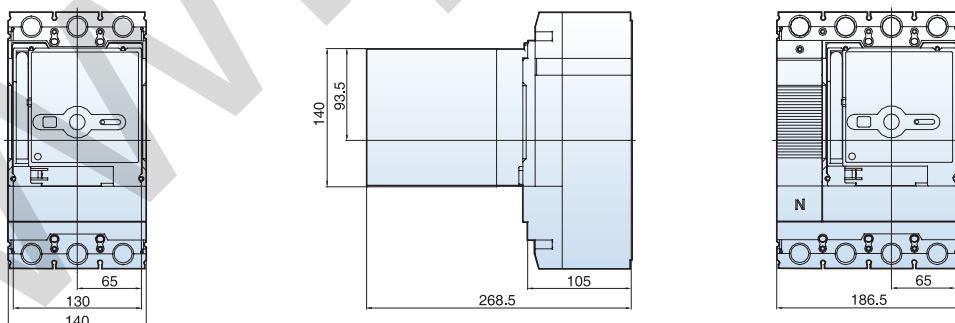
TS100N/H/L  
TS160N/H/L  
TS250N/H/L

### Circuit breaker with MOP2



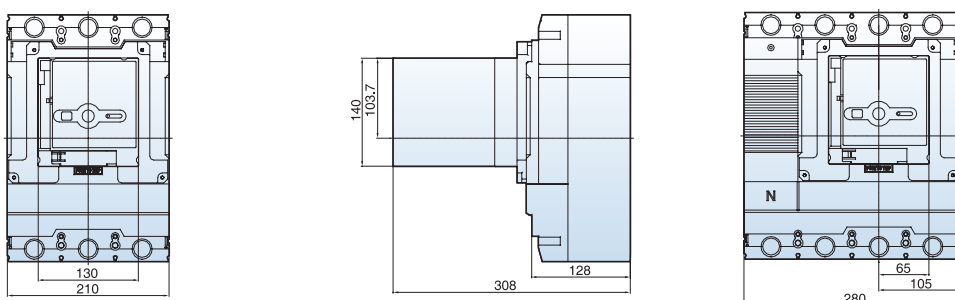
TS400N/H/L  
TS630N/H/L

### Circuit breaker with MOP3



TS800N/H/L

### Circuit breaker with MOP4

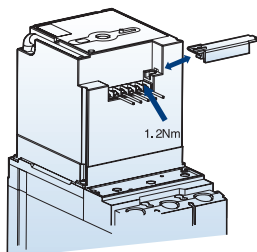


# Overall dimensions

Susol

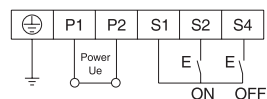
## Wiring connection

### Motor operator



#### Standard connection

Circuit breaker On and Off controlled by remote operation and manual operation

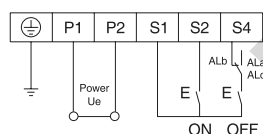


#### Connection with alarm switch (AL)

- 1) The below connection diagram is the method of using a alarm switch (AL) without shunt or undervoltage trip.
- 2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.

#### Connection with FAL (only for the breakers with electronic trip unit ETS or ETM)

- 1) The below connection diagram is the method of using a FAL for circuit breakers with electronic trip unit.
- 2) After clearing the fault surely, manual reset is mandatory in case of tripping due to an electrical fault.





# Overall dimensions

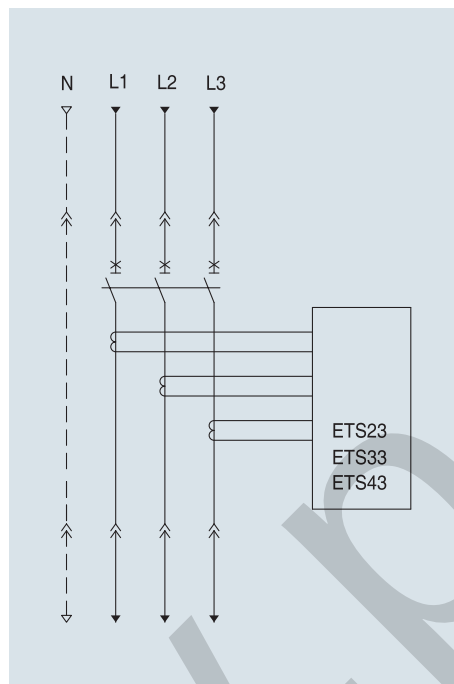
Susol

## Wiring diagram(State of operation)

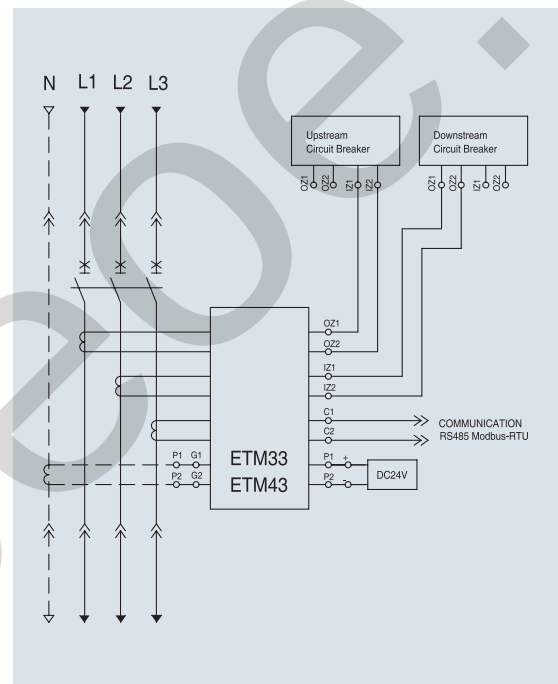
### ETS23/ETS33/ETS43

The diagram is shown in the following conditions:

- Fixed version circuit-breaker (depending on type of circuit-breaker)
- Circuit breakers open.
- Releases not tripped



Three-pole circuit-breaker with  
ETS23/ETS33/ETS43 electronic release

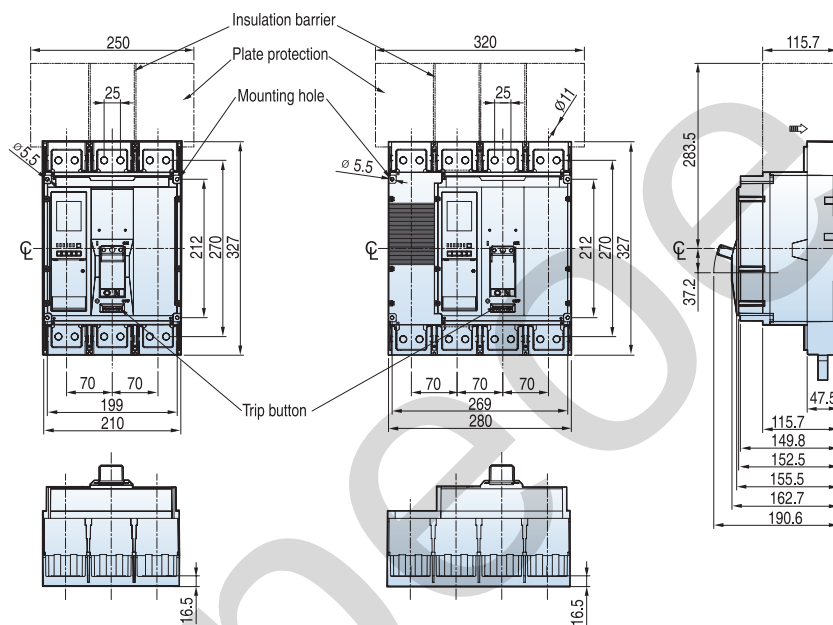


Three-pole circuit-breaker with  
ETM33/ETM43 electronic release  
(External natural current transformer)

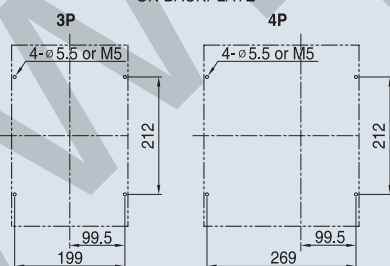
**Susol**

## Front Type

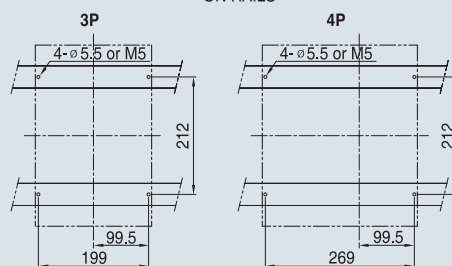
[mm]



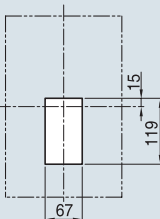
## ON BACKPLATE



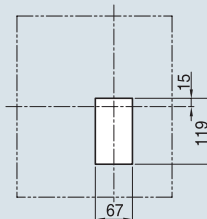
## ON RAILS



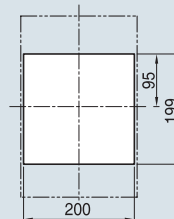
3P



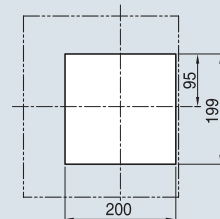
## 4P



## 3P



## 4P



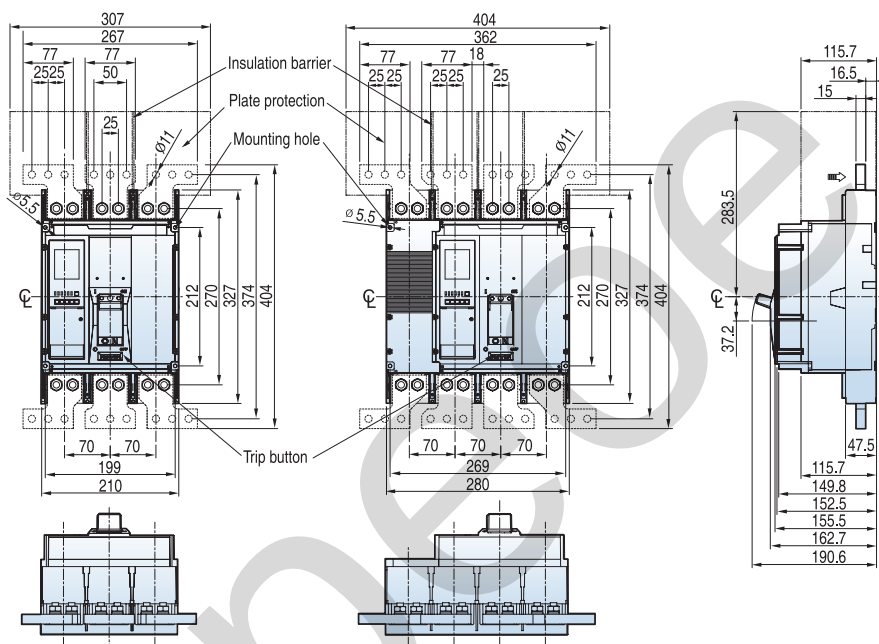
# Overall dimensions

Susol

## TS 1000, 1250, 1600A

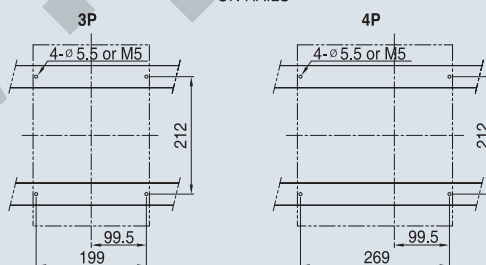
### Front Type Busbar

[mm]

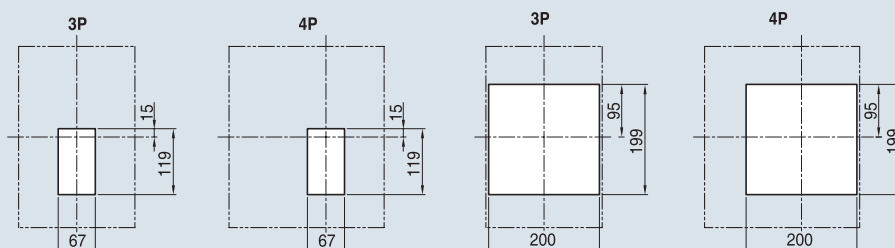


#### Panel drilling

ON RAILS



#### Front panel cutting

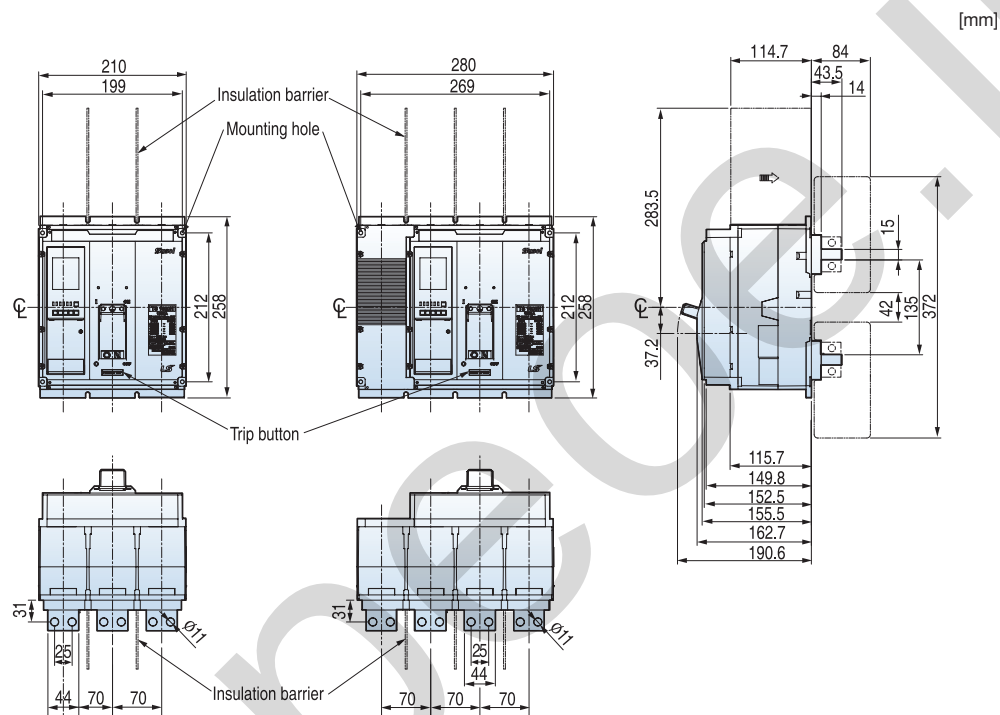


# Overall dimensions

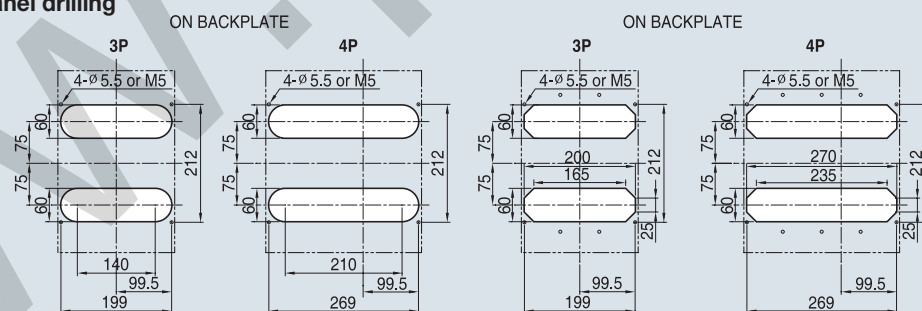
Susol

## TS 1000, 1250, 1600A

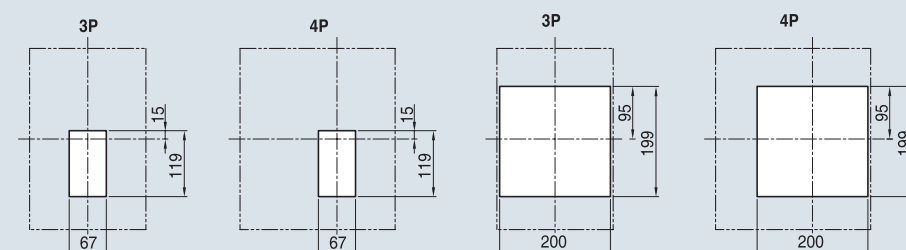
### Rear Type



### Panel drilling



### Front panel cutting



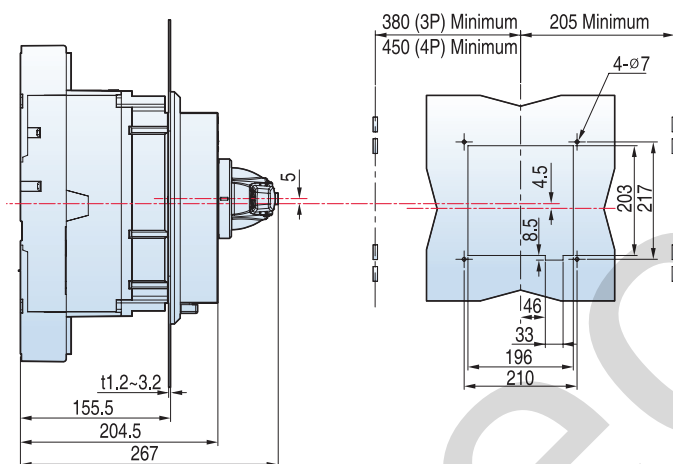
# Overall dimensions

Susol

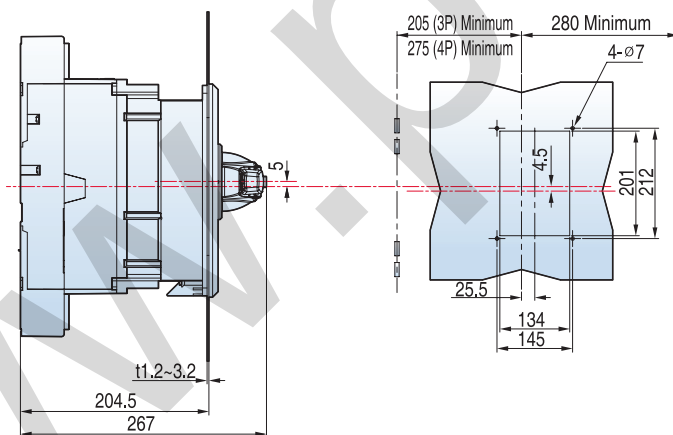
## Rotary handles

### Direct rotary handles for TS 1600AF

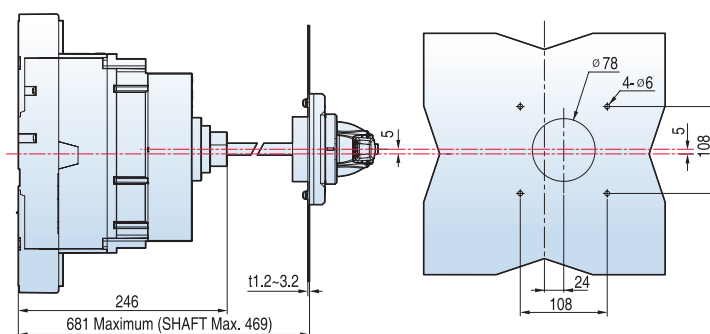
#### A Type



#### B Type



### Extended rotary handle for TS 1600AF

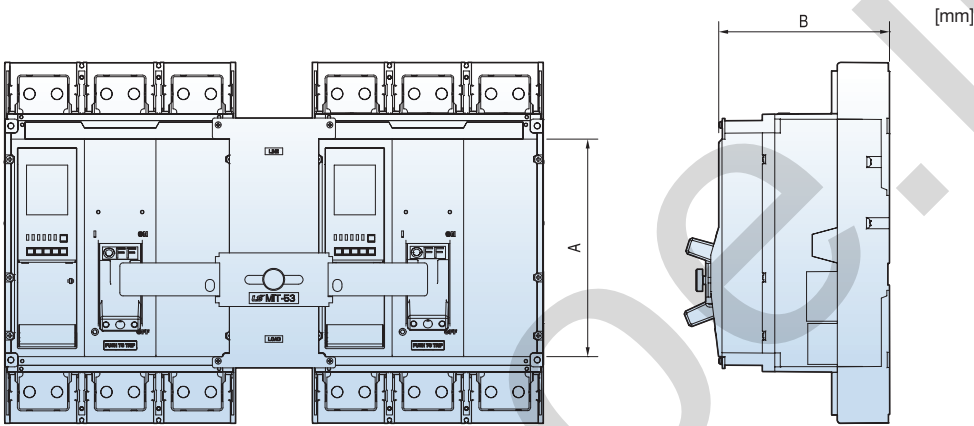


# Overall dimensions

Susol

## Locking devices

Mechanical interlock for TS 1600AF



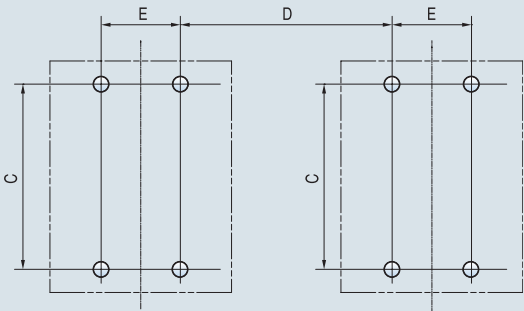
The cutting of Panel

| 3P     | C   | D  | E   |
|--------|-----|----|-----|
| TS1600 | 212 | 81 | 199 |

| 4P     | D  | E   |
|--------|----|-----|
| TS1600 | 11 | 269 |

The dimension of installation holes



The cutting of Panel

| 3P     | C   | D  | E   |
|--------|-----|----|-----|
| TS1600 | 212 | 81 | 199 |

| 4P     | D  | E   |
|--------|----|-----|
| TS1600 | 11 | 269 |

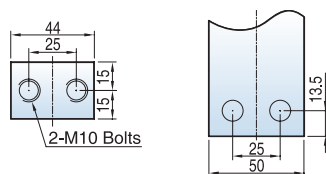
# Overall dimensions

Susol

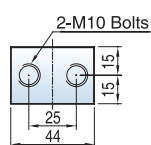
## Terminals

### Front connection with bars for TS1600

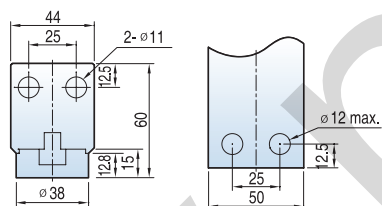
#### Top terminal



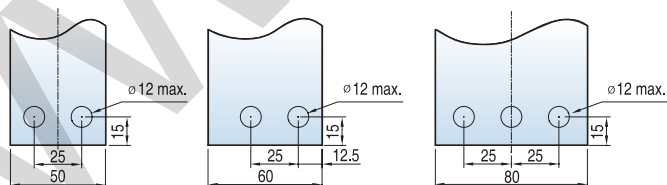
#### Bottom terminal



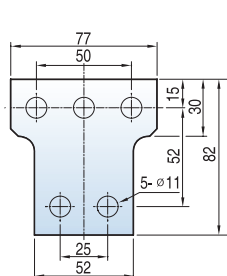
### Rear connection with bars



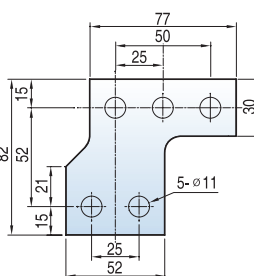
### Connection with Busbar



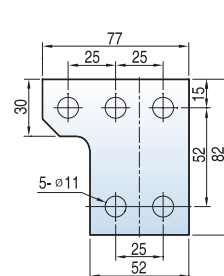
#### Middle busbar for 3P



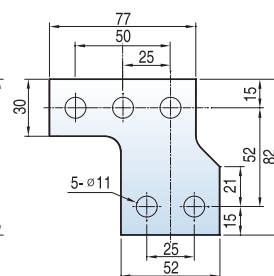
#### Left or right busbar for 3P



#### Middle left or middle right busbar for 4P



#### Left or right busbar for 4P

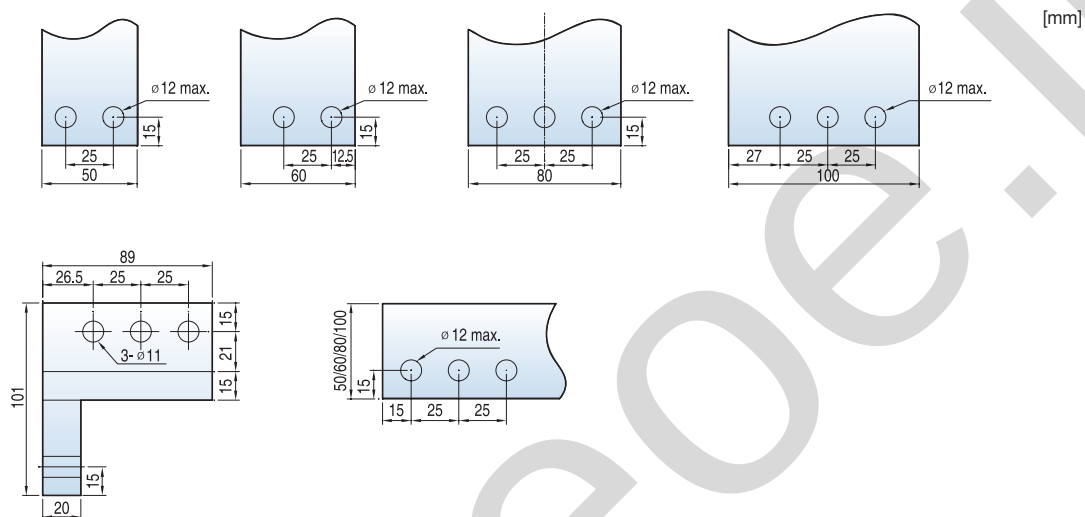


# Overall dimensions

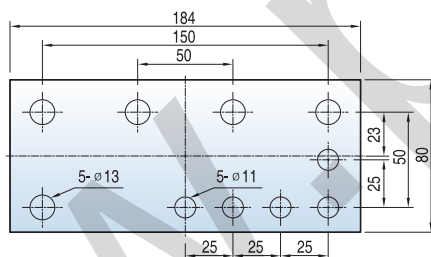
Susol

## Terminals

### Front or Rear connection with vertical busbar for TS1600



### Extension Busbar





# Overall dimensions

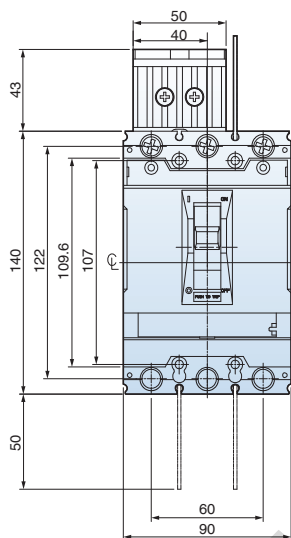
Susol

## DC1000V PV MCCB

### TD100, TD160

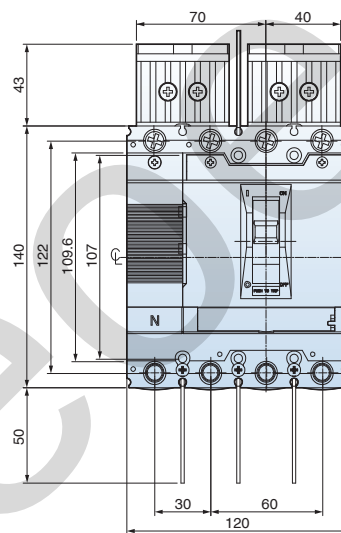
Dimension of MCCB with short BUSBAR

[mm]



3P

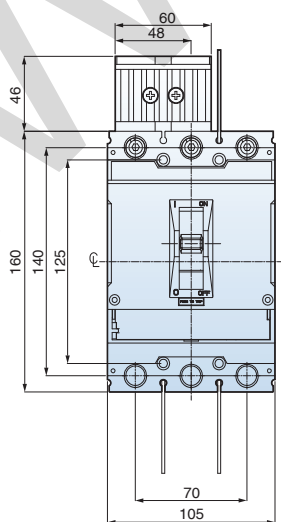
※ R, S Line Common conditions



4P (L-type)

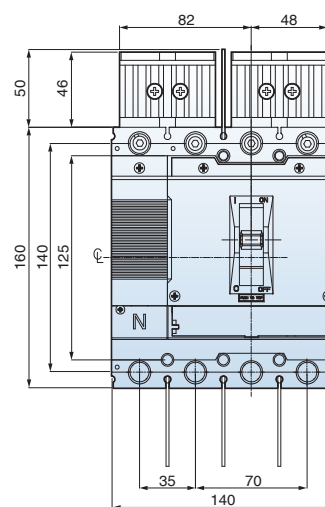
### TS100, TS160, TS250

Dimension of MCCB with short BUSBAR



3P

※ R, S Line Common conditions



4P (L-type)

※ L- Type and R-Type is symmetric

# Overall dimensions

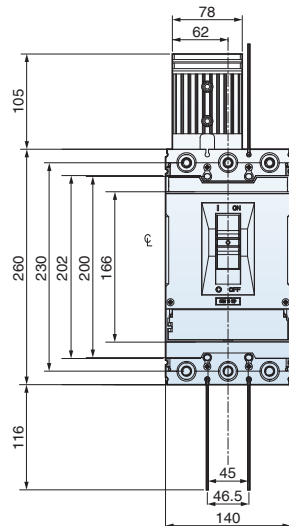
Susol

## DC1000V PV MCCB

### TS400, TS630

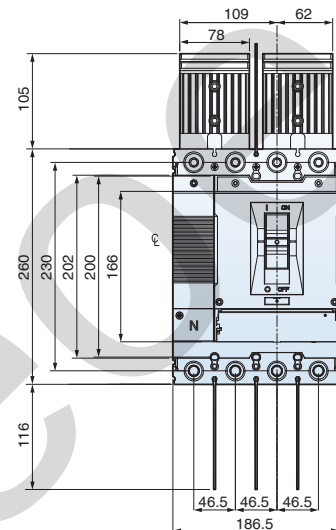
Dimension of MCCB with short BUSBAR

[mm]



3P

※ R, S Line Common conditions

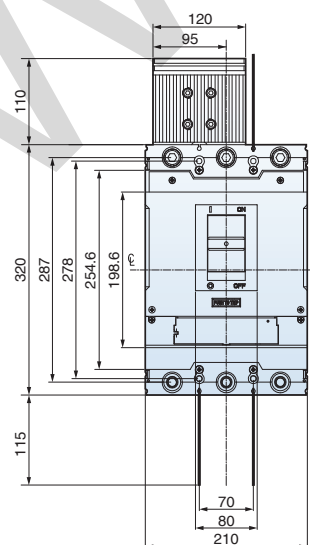


4P (L-type)

※ L- Type and R-Type is symmetric

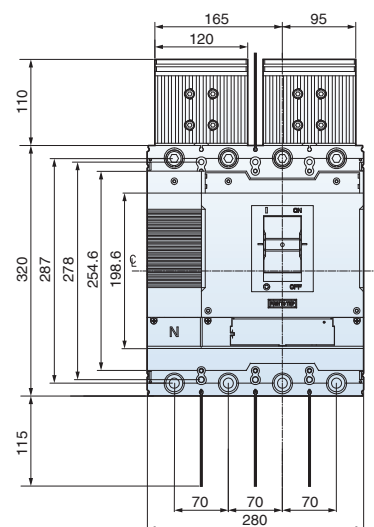
### TS800

Dimension of MCCB with short BUSBAR



3P

※ R, S Line Common conditions



4P (L-type)

※ L- Type and R-Type is symmetric

# Overall dimensions

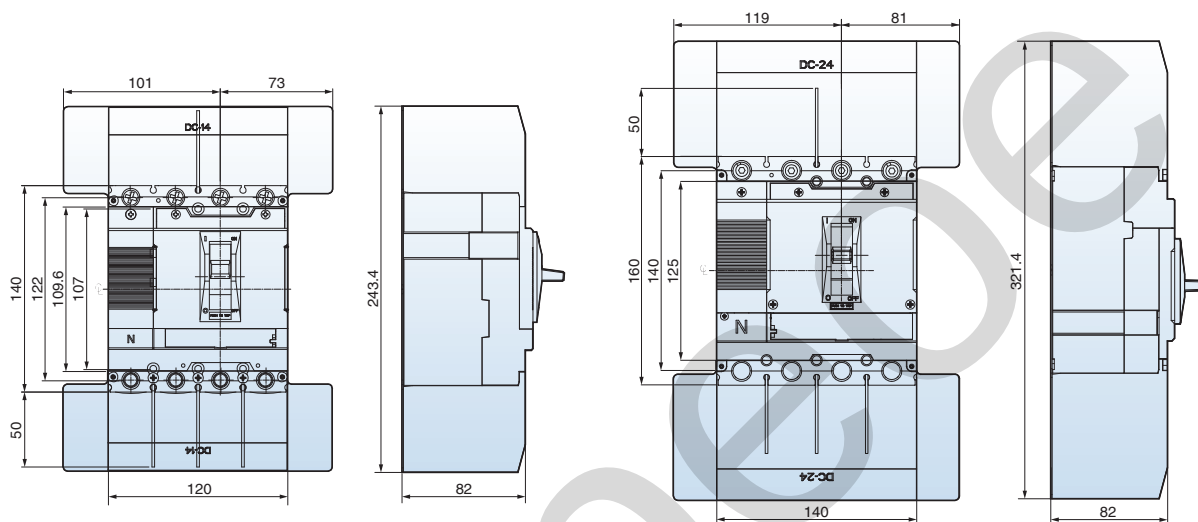
Susol

## DC1000V PV MCCB

### TD160, TS250

Dimension of MCCB with terminal cover & Barrier

[mm]



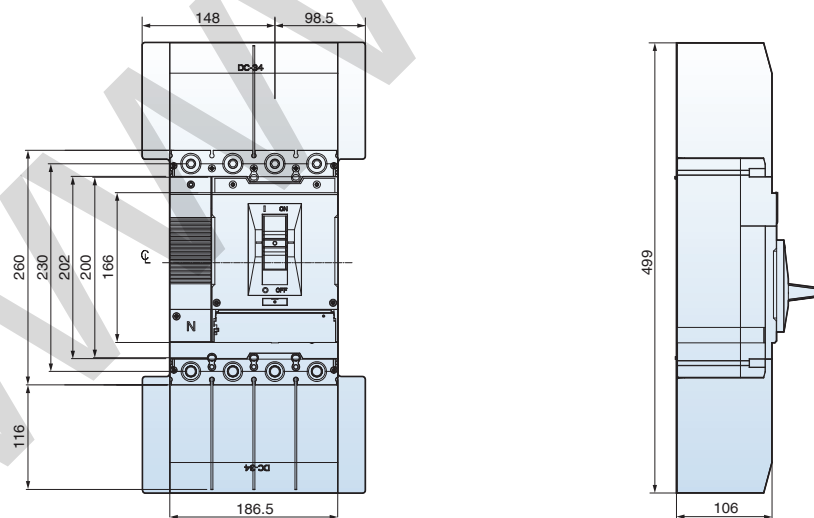
4P (L-type)

4P (L-type)

※ L-Type and R-Type is symmetric

### TS400, TS630

Dimension of MCCB with terminal cover & Barrier



4P (L-type)

※ L-Type and R-Type is symmetric

# Overall dimensions

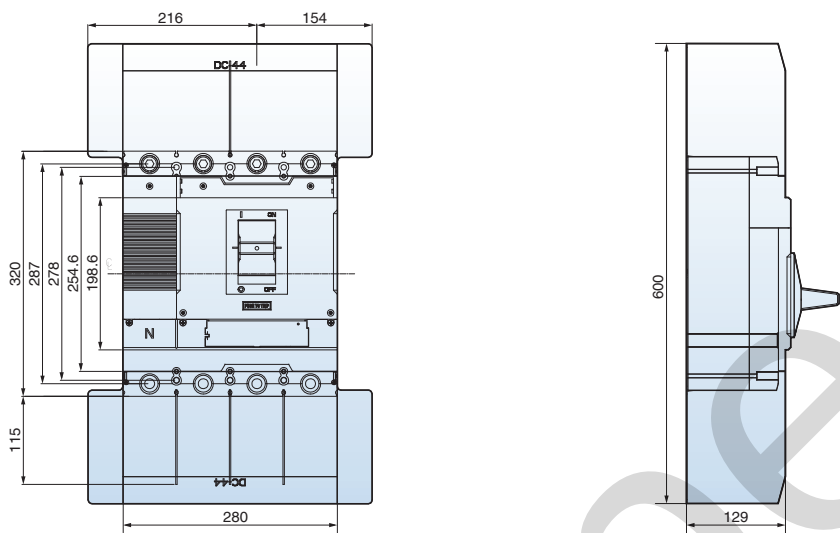
Susol

## DC1000V PV MCCB

### TS800

Dimension of MCCB with terminal cover & Barrier

[mm]



4P (L-type)

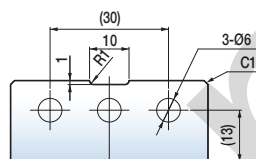
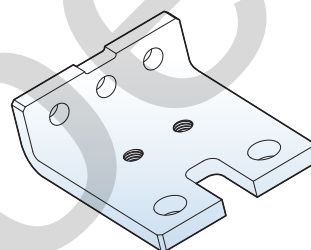
※ L- Type and R-Type is symmetric

**Susol**

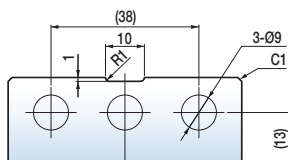
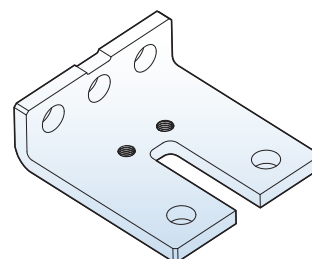
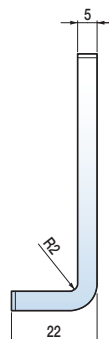
**TD160**

## TD160 5t Short Busbar

[mm]



## TS250 4t Short Busbar

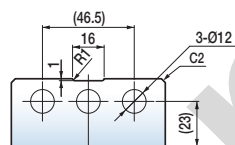
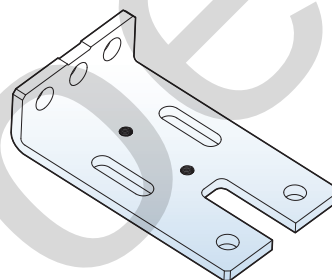
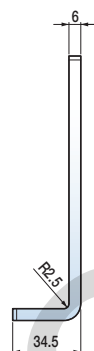


**Susol**

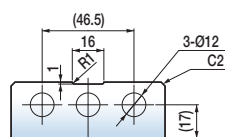
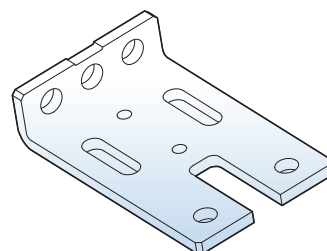
## TS630

### TS630 Lower Short Busbar

[mm]



**TS630 Upper Short Busbar**



# Overall dimensions

Susol

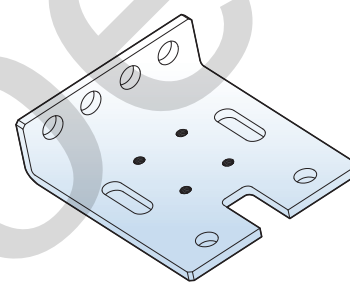
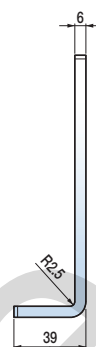
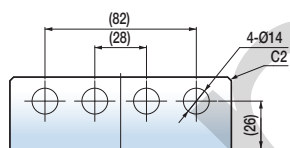
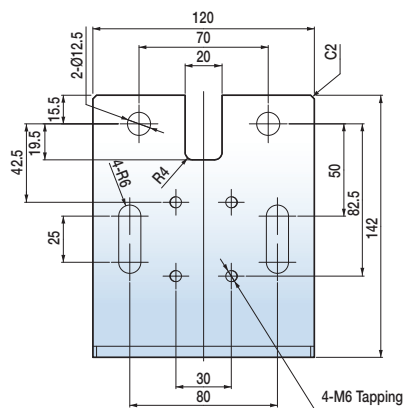
## DC1000V PV MCCB

### TS800

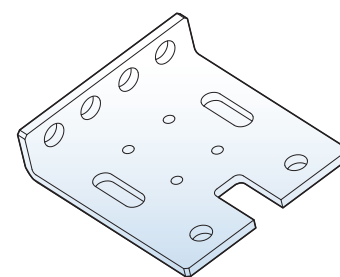
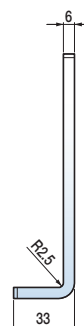
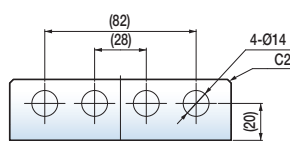
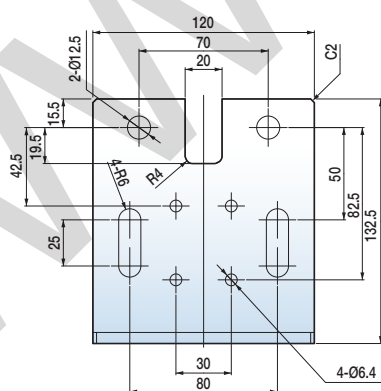
#### Short BUSBAR dimension

##### TS800 Lower Short Busbar

[mm]



##### TS800 Upper Short Busbar



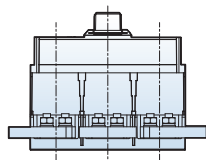
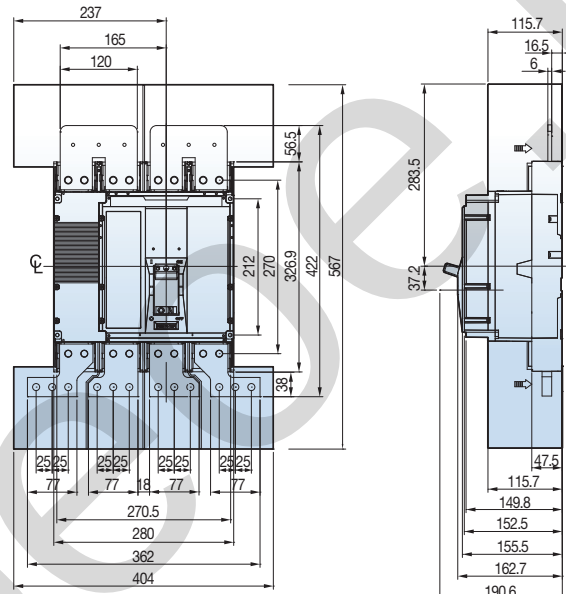
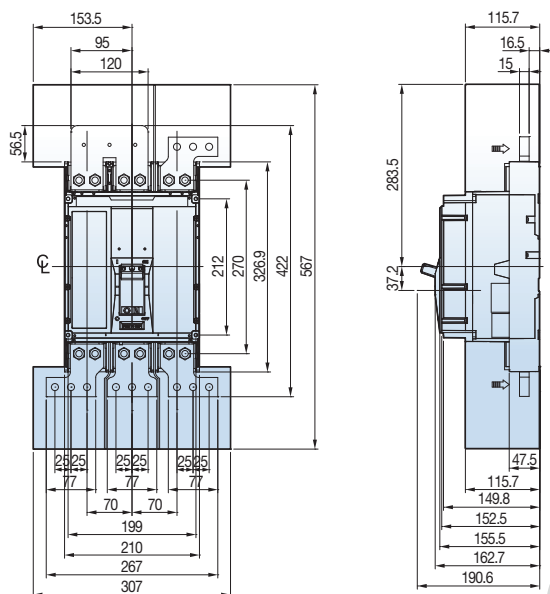
# Overall dimensions

Susol

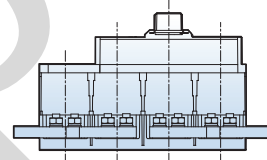
## Disconnectors Switch (1600AF)

### TS1600NA

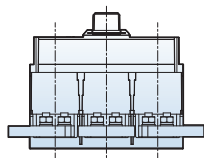
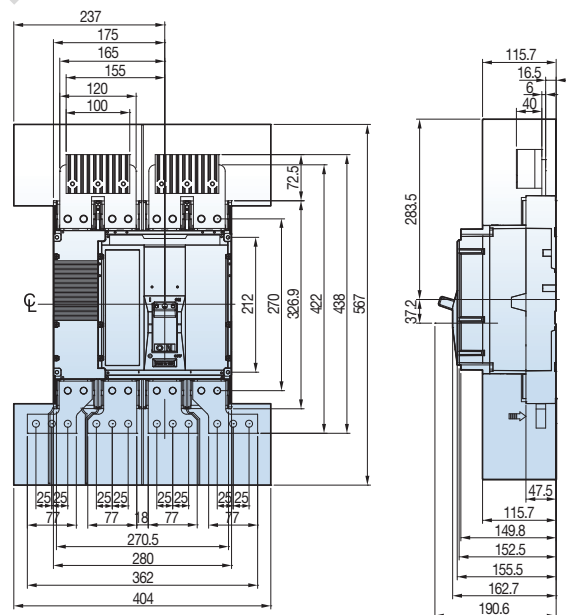
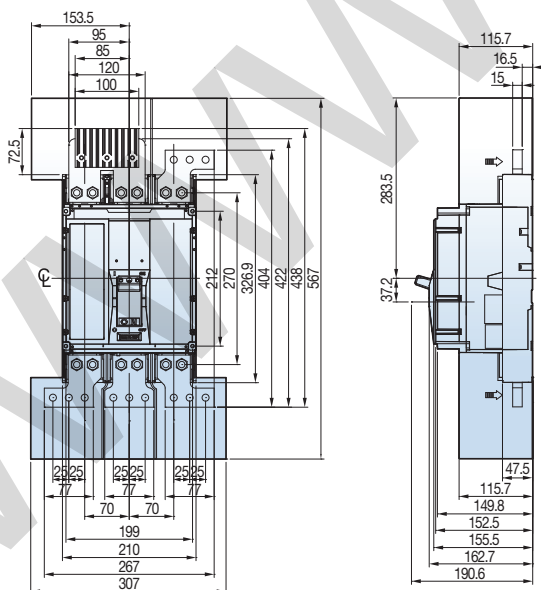
Dimension of MCCB with DC BUSBAR



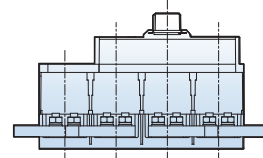
<TS1000NA 3P>



<TS1000NA 4P>



<TS1250NA 3P>



<TS1250NA 4P>



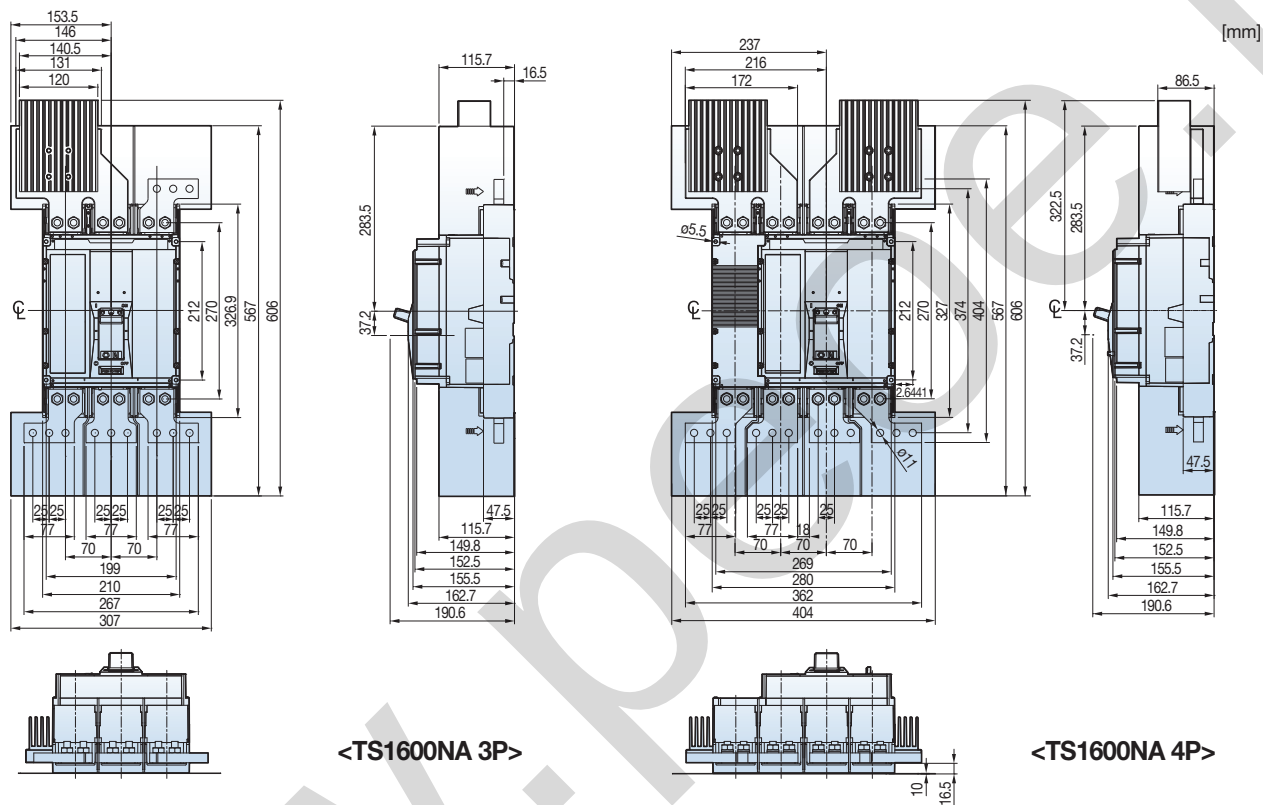
# Overall dimensions

Susol

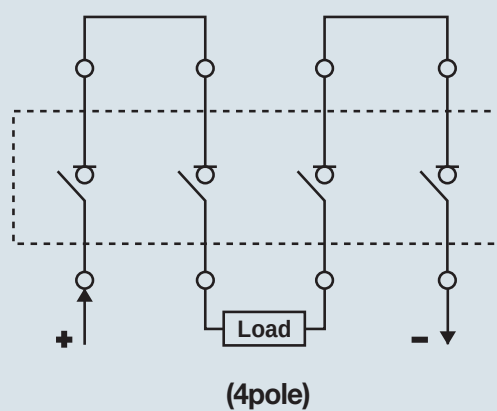
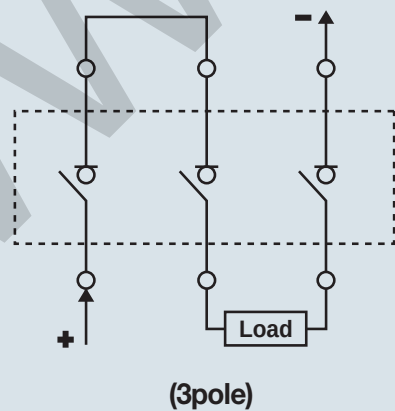
## Disconnectors Switch (1600AF)

### TS1600NA

Dimension of MCCB with DC BUSBAR



## Connection diagrams

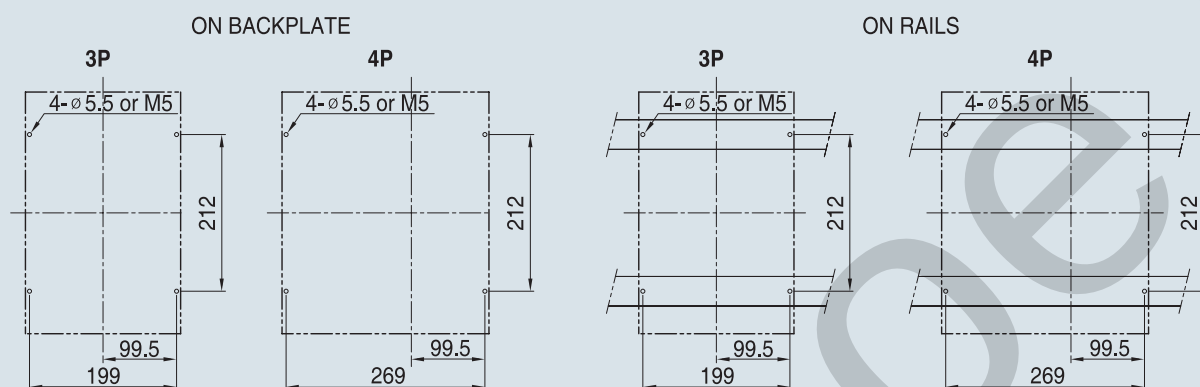


# Overall dimensions

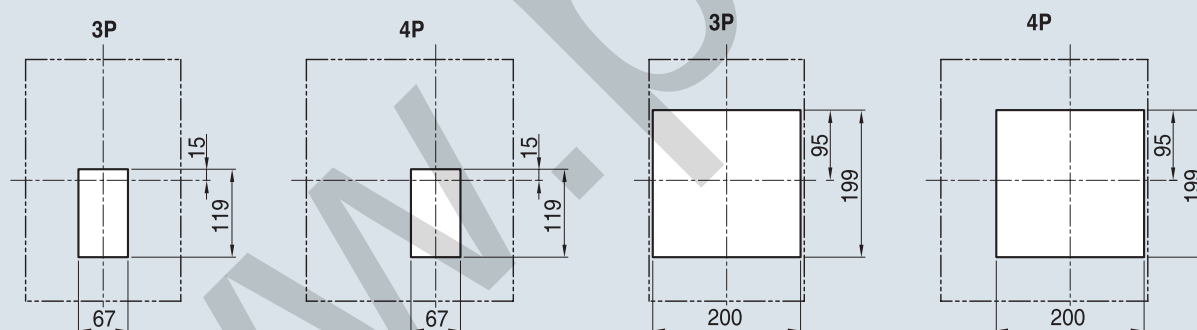
Susol

## Disconnectors Switch (1600AF)

### Panel drilling



### Front panel cutting



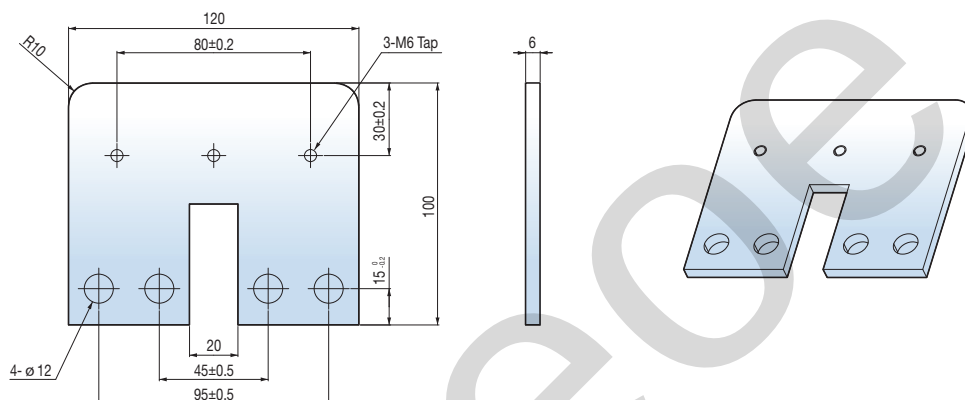
# Overall dimensions

Susol

## Disconnectors Switch (1600AF)

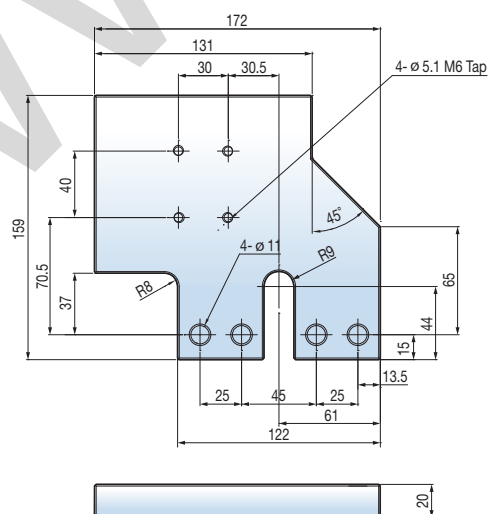
### TS1000NA/TS1250NA

#### Short BUSBAR dimension



### TS1600NA

#### Short BUSBAR dimension



## A-7. Technical information

### Temperature derating

|                           |       |
|---------------------------|-------|
| TD, TS series up to 1600A | A-7-1 |
|---------------------------|-------|

### Power dissipation /Resistance

|                           |       |
|---------------------------|-------|
| TD, TS series up to 1600A | A-7-7 |
|---------------------------|-------|

### Application

|                                             |        |
|---------------------------------------------|--------|
| Primary use of transformer                  | A-7-8  |
| Protection of lighting & heating circuits   | A-7-10 |
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## Temperature derating

A derating of the rated operational current of the Susol TD and TS molded case circuit breaker is necessary if the ambient temperature is greater than 40°C. Namely, when the ambient temperature is greater than 40°C, overload-protection characteristics are slightly modified.

Electronic trip units are not affected by variations in temperature.

But, the maximum permissible current in the circuit breaker depends on the ambient temperature.

### Derating chart

- Connection type: Standard

- Trip unit: FTU, FMU, ATU

| MCCB           | Rating<br>(A) | Fixed MCCB (c/w Thermal-magnetic trip unit) |      |      |      |      |      |      |      |
|----------------|---------------|---------------------------------------------|------|------|------|------|------|------|------|
|                |               | 10°C                                        | 20°C | 30°C | 40°C | 45°C | 50°C | 60°C | 70°C |
| TD100<br>TD160 | 16            | 16                                          | 16   | 16   | 16   | 16   | 15   | 14   | 13   |
|                | 20            | 20                                          | 20   | 20   | 20   | 19   | 19   | 18   | 16   |
|                | 25            | 25                                          | 25   | 25   | 25   | 24   | 23   | 22   | 21   |
|                | 32            | 32                                          | 32   | 32   | 32   | 31   | 30   | 28   | 26   |
|                | 40            | 40                                          | 40   | 40   | 40   | 39   | 38   | 35   | 33   |
|                | 50            | 50                                          | 50   | 50   | 50   | 48   | 47   | 44   | 41   |
|                | 63            | 63                                          | 63   | 63   | 63   | 61   | 59   | 56   | 52   |
|                | 80            | 80                                          | 80   | 80   | 80   | 78   | 75   | 71   | 66   |
|                | 100           | 100                                         | 100  | 100  | 100  | 97   | 94   | 88   | 82   |
|                | 125           | 125                                         | 125  | 125  | 125  | 121  | 117  | 110  | 103  |
|                | 160           | 160                                         | 160  | 160  | 160  | 155  | 150  | 141  | 131  |
| TS100<br>TS160 | 40            | 40                                          | 40   | 40   | 40   | 39   | 38   | 35   | 33   |
|                | 50            | 50                                          | 50   | 50   | 50   | 48   | 47   | 44   | 41   |
|                | 63            | 63                                          | 63   | 63   | 63   | 61   | 59   | 56   | 52   |
|                | 80            | 80                                          | 80   | 80   | 80   | 78   | 75   | 71   | 66   |
|                | 100           | 100                                         | 100  | 100  | 100  | 97   | 94   | 88   | 82   |
|                | 125           | 125                                         | 125  | 125  | 125  | 121  | 117  | 110  | 103  |
|                | 160           | 160                                         | 160  | 160  | 160  | 155  | 150  | 141  | 131  |
| TS250          | 200           | 200                                         | 200  | 200  | 200  | 194  | 188  | 176  | 164  |
|                | 250           | 250                                         | 250  | 250  | 250  | 242  | 234  | 220  | 205  |
| TS400          | 300           | 300                                         | 300  | 300  | 300  | 291  | 281  | 264  | 246  |
|                | 400           | 400                                         | 400  | 400  | 400  | 388  | 375  | 353  | 328  |
| TS630          | 500           | 500                                         | 500  | 500  | 500  | 484  | 469  | 441  | 410  |
|                | 630           | 630                                         | 630  | 630  | 630  | 610  | 591  | 555  | 517  |
| TS800          | 800           | 800                                         | 800  | 800  | 800  | 775  | 750  | 705  | 656  |

Note) TD160 1pole MCCB is not applied to temperature derating.

# Technical information

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## Temperature derating

### Derating chart

- Connection type: Plug-in
- Trip unit: FTU, FMU, ATU

| MCCB           | Rating<br>(A) | Fixed MCCB (c/w Thermal-magnetic trip unit) |      |      |      |      |      |      |      |
|----------------|---------------|---------------------------------------------|------|------|------|------|------|------|------|
|                |               | 10°C                                        | 20°C | 30°C | 40°C | 45°C | 50°C | 60°C | 70°C |
| TD100<br>TD160 | 16            | 16                                          | 16   | 16   | 16   | 16   | 15   | 14   | 13   |
|                | 20            | 20                                          | 20   | 20   | 20   | 19   | 19   | 18   | 16   |
|                | 25            | 25                                          | 25   | 25   | 25   | 24   | 23   | 22   | 21   |
|                | 32            | 32                                          | 32   | 32   | 32   | 31   | 30   | 28   | 26   |
|                | 40            | 40                                          | 40   | 40   | 40   | 39   | 38   | 35   | 33   |
|                | 50            | 50                                          | 50   | 50   | 50   | 48   | 47   | 44   | 41   |
|                | 63            | 63                                          | 63   | 63   | 63   | 61   | 59   | 56   | 52   |
|                | 80            | 80                                          | 80   | 80   | 80   | 78   | 75   | 71   | 66   |
|                | 100           | 100                                         | 100  | 100  | 100  | 97   | 94   | 88   | 82   |
|                | 125           | 125                                         | 125  | 125  | 125  | 121  | 117  | 110  | 103  |
|                | 160           | 144                                         | 144  | 144  | 144  | 140  | 135  | 127  | 118  |
| TS100<br>TS160 | 40            | 40                                          | 40   | 40   | 40   | 39   | 38   | 35   | 33   |
|                | 50            | 50                                          | 50   | 50   | 50   | 48   | 47   | 44   | 41   |
|                | 63            | 63                                          | 63   | 63   | 63   | 61   | 59   | 56   | 52   |
|                | 80            | 80                                          | 80   | 80   | 80   | 78   | 75   | 71   | 66   |
|                | 100           | 100                                         | 100  | 100  | 100  | 97   | 94   | 88   | 82   |
|                | 125           | 125                                         | 125  | 125  | 125  | 121  | 117  | 110  | 103  |
|                | 160           | 160                                         | 160  | 160  | 160  | 155  | 150  | 141  | 131  |
| TS250          | 200           | 200                                         | 200  | 200  | 200  | 194  | 188  | 176  | 164  |
|                | 250           | 235                                         | 235  | 235  | 235  | 228  | 220  | 207  | 193  |
| TS400          | 300           | 300                                         | 300  | 300  | 300  | 291  | 281  | 264  | 246  |
|                | 400           | 400                                         | 400  | 400  | 400  | 388  | 375  | 353  | 328  |
| TS630          | 500           | 500                                         | 500  | 500  | 500  | 484  | 469  | 441  | 410  |
|                | 630           | 540                                         | 540  | 540  | 540  | 523  | 506  | 476  | 443  |
| TS800          | 800           | 740                                         | 740  | 740  | 740  | 717  | 694  | 652  | 607  |

## Size of busbar

### Temperature derating

The table below indicates the maximum rated current value for each type of connection, depending on the ambient temperature.

| Connection | Front or horizontal rear |      |      |      |      |      |      |
|------------|--------------------------|------|------|------|------|------|------|
| T          | 40                       | 45   | 50   | 55   | 60   | 65   | 70   |
| TS1000     | 800                      | 800  | 800  | 800  | 800  | 800  | 800  |
|            | 1000                     | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| TS1250     | 1250                     | 1250 | 1250 | 1250 | 1250 | 1240 | 1090 |
| TS1600     | 1600                     | 1600 | 1560 | 1510 | 1470 | 1420 | 1360 |

| Connection | Vertical rear |      |      |      |      |      |      |
|------------|---------------|------|------|------|------|------|------|
| T          | 40            | 45   | 50   | 55   | 60   | 65   | 70   |
| TS1000     | 800           | 800  | 800  | 800  | 800  | 800  | 800  |
|            | 1000          | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 |
| TS1250     | 1250          | 1250 | 1250 | 1250 | 1250 | 1250 | 1180 |
| TS1600     | 1600          | 1600 | 1600 | 1600 | 1600 | 1510 | 1460 |

# Technical information

Susol

## Derating table

The following tables are based on the following assumptions;  
- T : Temperature around the circuit breaker and its connections

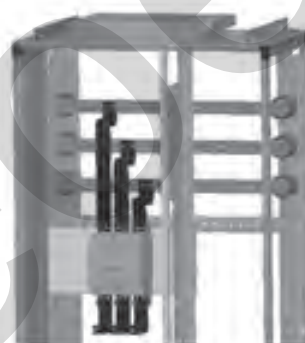
Note) 1. The values presented in the tables are the result of trials and theoretical calculations on the basis of the assumption mentioned above.  
2. These tables are intended as an aid in designing connection, however, the actual values must be confirmed by tests on the installation.

TS1000 to TS1600 mounted

Using bar connection

- Cross section of bar: 1000 mm<sup>2</sup>

- Limit of temperature rising at terminal connection: 70k



Using the data below, it is possible to determine the maximum permissible currents when making the connections to busbars for a Vertical, TS1000/TS1600, taking into account the ambient temperature around the switchboard and the IP value. Connection to be made according to the busbar drawings supplied.

Permissible current at switchboard condition using above external terminal connections

| Model        | T: 25°C | T: 30°C | T: 35°C | T: 40°C | T: 45°C | T: 50°C |
|--------------|---------|---------|---------|---------|---------|---------|
|              | IP40    | IP40    | IP40    | IP40    | IP40    | IP40    |
| TS1000 N/H/L | 1000    | 1000    | 1000    | 1000    | 1000    | 1000    |
| TS1250 N/H   | 1250    | 1250    | 1250    | 1250    | 1250    | 1250    |
| TS1600 N/H   | 1350    | 1350    | 1300    | 1250    | 1200    | 1150    |

TS1000 to TS1600 mounted

Using busbar connecting

- Cross section of bar: 1000 mm<sup>2</sup>

- Limit of temperature rising at terminal connection: 70k



Permissible current at switchboard condition using above external terminal connections

| Model        | T: 25°C | T: 30°C | T: 35°C | T: 40°C | T: 45°C | T: 50°C |
|--------------|---------|---------|---------|---------|---------|---------|
|              | IP40    | IP40    | IP40    | IP40    | IP40    | IP40    |
| TS1000 N/H/L | 1000    | 1000    | 1000    | 1000    | 1000    | 1000    |
| TS1250 N/H   | 1250    | 1250    | 1250    | 1250    | 1250    | 1200    |
| TS1600 N/H   | 1450    | 1400    | 1350    | 1300    | 1250    | 1200    |



## Derating table

The following tables are based on the following assumptions;  
 - T : Temperature around the circuit breaker and its connections

Note) 1. The values presented in the tables are the result of trials and theoretical calculations on the basis of the assumption mentioned above.  
 2. These tables are intended as an aid in designing connection, however, the actual values must be confirmed by tests on the installation.

TS1000 to TS1600 mounted  
 using special external connections  
 - Cross section of bar: 1000 mm<sup>2</sup>  
 - Limit of temperature rising at terminal connection: 70k



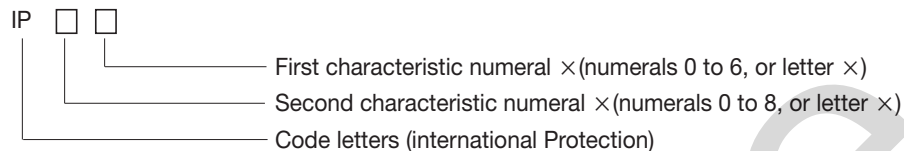
Using the data below, it is possible to determine the permissible current for a specified connection between TS1000/TS1600, fixed and busbars depending on the ambient temperature around the switchboard and the IP value.

Permissible current at switchboard condition using above external terminal connections

| Model        | T: 25°C | T: 30°C | T: 35°C | T: 40°C | T: 45°C | T: 50°C |
|--------------|---------|---------|---------|---------|---------|---------|
|              | IP40    | IP40    | IP40    | IP40    | IP40    | IP40    |
| TS1000 N/H/L | 1000    | 1000    | 1000    | 1000    | 1000    | 1000    |
| TS1250 N/H   | 1250    | 1250    | 1250    | 1250    | 1250    | 1250    |
| TS1600 N/H   | 1600    | 1600    | 1600    | 1550    | 1500    | 1450    |

## Installation recommendation

### Protection degree provided by enclosures (IP Code) IEC 60529



#### First characteristic numeral

|   | Degree of protection                                            |                                                                                                                                                                    |
|---|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | Brief description                                               | Definition                                                                                                                                                         |
| 0 | Non-protected                                                   | -                                                                                                                                                                  |
| 1 | Protected against solid foreign objects of 50mm ø and greater   | The object probe sphere of 50mm ø , shall not fully penetrate                                                                                                      |
| 2 | Protected against solid foreign objects of 12.5mm ø and greater | The object probe sphere of 12.5mm ø , shall not fully penetrate                                                                                                    |
| 3 | Protected against solid foreign objects of 2.5mm ø and greater  | The object probe sphere of 2.5mm ø , shall not penetrate at all                                                                                                    |
| 4 | Protected against solid foreign objects of 1.0mm ø and greater  | The object probe of 1.0mm ø , shall not penetrate at all                                                                                                           |
| 5 | Dust-protected                                                  | Ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus or to impair safety |
| 6 | Dust-tight                                                      | No ingress of dust                                                                                                                                                 |

#### Second characteristic numeral

|   | Degree of protection                                                             |                                                                                                                                                                                                                                                     |
|---|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | Brief description                                                                | Definition                                                                                                                                                                                                                                          |
| 0 | Non-protected                                                                    | -                                                                                                                                                                                                                                                   |
| 1 | Protected against vertically falling water drops                                 | Vertically falling drops shall have no harmful effects                                                                                                                                                                                              |
| 2 | Protected against vertically falling water drops when enclosure tilted up to 15° | Vertically falling drops shall have no harmful effects when the enclosure is tilted at any angle up to 15° on either side of the vertical                                                                                                           |
| 3 | Protected against spraying water                                                 | Water sprayed at an angle up to 60° on wither side of the vertical shall have no harmful effects                                                                                                                                                    |
| 4 | Protected against spraying water                                                 | Water splashed against the enclosure from and direction shall have no harmful effects                                                                                                                                                               |
| 5 | Protected against spraying jets                                                  | Water projected in powerful jets against the enclosure from and direction shall have no harmful effects                                                                                                                                             |
| 6 | Protected against powerful water jets                                            | Water projected in powerful jets against the enclosure from any direction shall have no harmful effects                                                                                                                                             |
| 7 | Protected against the effects of temporary immersion in water                    | Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time                                                                 |
| 8 | Protected against the effects of continuous immersion in water                   | Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and used but which are more severs than for numeral 7 |

## Power dissipation / Resistance

### Susol TD & TS series up to 1600A

|              | AF               | TD100 (3P & 4P) |      |      |       |      |       |       |       |       |
|--------------|------------------|-----------------|------|------|-------|------|-------|-------|-------|-------|
|              | Rating (A)       | 16              | 20   | 25   | 32    | 40   | 50    | 63    | 80    | 100   |
| Fixed MCCB   | R (mΩ)           | 5.60            | 5.60 | 3.80 | 3.80  | 1.84 | 1.34  | 1.10  | 0.91  | 0.70  |
|              | Watt single pole | 1.43            | 2.24 | 2.38 | 3.89  | 2.94 | 3.35  | 4.37  | 5.82  | 7.00  |
|              | Watt three poles | 4.30            | 6.72 | 7.13 | 11.67 | 8.83 | 10.05 | 13.10 | 17.47 | 21.00 |
| Plug-in MCCB | R (mΩ)           | 5.68            | 5.68 | 3.88 | 3.88  | 1.92 | 1.42  | 1.18  | 0.99  | 0.78  |
|              | Watt single pole | 1.45            | 2.27 | 2.43 | 3.97  | 3.07 | 3.55  | 4.68  | 6.34  | 7.80  |
|              | Watt three poles | 4.36            | 6.82 | 7.28 | 11.92 | 9.22 | 10.65 | 14.05 | 19.01 | 23.40 |

|              | AF               | TD160 (3P & 4P) |       |       |
|--------------|------------------|-----------------|-------|-------|
|              | Rating (A)       | 100             | 125   | 160   |
| Fixed MCCB   | R (mΩ)           | 0.70            | 0.61  | 0.50  |
|              | Watt single pole | 7.00            | 9.53  | 12.80 |
|              | Watt three poles | 21.00           | 28.59 | 38.40 |
| Plug-in MCCB | R (mΩ)           | 0.78            | 0.69  | 0.58  |
|              | Watt single pole | 7.80            | 10.78 | 14.85 |
|              | Watt three poles | 23.40           | 32.34 | 44.54 |

|              | AF               | TS100, TS160, TS250 (3P & 4P) |       |       |       |       |       |       |       |       |
|--------------|------------------|-------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
|              | Rating (A)       | 40                            | 50    | 63    | 80    | 100   | 125   | 160   | 200   | 250   |
| Fixed MCCB   | R (mΩ)           | 3.37                          | 2.86  | 2.86  | 1.36  | 0.96  | 0.76  | 0.62  | 0.52  | 0.25  |
|              | Watt single pole | 5.39                          | 7.15  | 11.35 | 8.70  | 9.60  | 11.88 | 15.87 | 20.80 | 15.79 |
|              | Watt three poles | 16.18                         | 21.45 | 34.05 | 26.11 | 28.80 | 35.63 | 47.62 | 62.40 | 47.38 |
| Plug-in MCCB | R (mΩ)           | 3.43                          | 2.92  | 2.92  | 1.42  | 1.02  | 0.82  | 0.68  | 0.58  | 0.31  |
|              | Watt single pole | 5.49                          | 7.30  | 11.59 | 9.09  | 10.20 | 12.81 | 17.41 | 23.20 | 19.54 |
|              | Watt three poles | 16.46                         | 21.90 | 34.77 | 27.26 | 30.60 | 38.44 | 52.22 | 69.60 | 58.63 |

|              | AF               | TS400, TS630 (3P, 4P) |        |        |        | TS800 (3P, 4P) |        |
|--------------|------------------|-----------------------|--------|--------|--------|----------------|--------|
|              | Rating (A)       | 300                   | 400    | 500    | 630    | 700            | 800    |
| Fixed MCCB   | R (mΩ)           | 0.30                  | 0.30   | 0.26   | 0.21   | 0.12           | 0.12   |
|              | Watt single pole | 26.82                 | 47.68  | 65.25  | 83.35  | 73.81          | 73.81  |
|              | Watt three poles | 80.46                 | 143.04 | 195.75 | 250.05 | 221.44         | 221.44 |
| Plug-in MCCB | R (mΩ)           | 0.34                  | 0.34   | 0.30   | 0.25   | 0.14           | 0.14   |
|              | Watt single pole | 30.42                 | 54.08  | 75.25  | 99.23  | 86.61          | 86.61  |
|              | Watt three poles | 91.26                 | 162.24 | 225.75 | 297.68 | 259.84         | 259.84 |

|            | AF               | TS1000N/H, TS1250N/H, TS1600N/H |       |       |       |       | TS1000L |       |       |
|------------|------------------|---------------------------------|-------|-------|-------|-------|---------|-------|-------|
|            | Rating (A)       | 630                             | 800   | 1000  | 1250  | 1600  | 630     | 800   | 1000  |
| Fixed MCCB | R (mΩ)           | 0.027                           | 0.027 | 0.027 | 0.027 | 0.027 | 0.046   | 0.046 | 0.046 |
|            | Watt single pole | 10.7                            | 17.3  | 27.8  | 45.1  | 76.0  | 18.3    | 30.0  | 48.3  |
|            | Watt three poles | 32.1                            | 51.8  | 83.4  | 135.4 | 228.1 | 54.8    | 90.1  | 144.9 |

- Power dissipated per pole (P/pole): Watts (W).
- Resistance per pole (R/pole): Milliohms (mΩ) (measured cold).
- Total power dissipation is the value measured at In, 50/60 Hz, for a 3 pole or 4 pole circuit breaker (Power= 3I²R)

# Technical information

Susol

## Application Primary use of transformer

### Application for transformer protection

Transformer excitation surge current may possibly exceed 10 times rated current, with a danger of nuisance tripping of the MCCB. The excitation surge current will vary depending upon the supply phase angle at the time of switching, and also on the level of core residual magnetism.

So, it's recommended to select proper circuit breakers according to the continuous current carrying capacity of transformer. It requires to consider separately whether transformer is single phase or three phase. The below table indicates the proper molded case circuit breaker suitable for each transformer.

#### AC220V

| Capacity of 3 phase transformer (kVA)      |     | Below 1500 | Below 1500       | Below 2000 | Below 3000       |     |
|--------------------------------------------|-----|------------|------------------|------------|------------------|-----|
| Capacity of single phase transformer (kVA) |     | Below 300  | -                |            |                  |     |
| Breaking capacity (kA) (sym)               |     | 42         | 85               | 100        | 120              | 200 |
| Frame (A)                                  | 100 | TD100N     | TD100H<br>TS100N | TS100H     | TD100L<br>TS100L |     |
|                                            | 160 | TD160N     | TD160H<br>TS160N | TS160H     | TD160L<br>TS160L |     |
|                                            | 250 | TS250N     |                  | TS250H     | TS250L           |     |
|                                            | 400 | TS400N     |                  | TS400H     | TS400L           |     |
|                                            | 630 | TS630N     |                  | TS630H     | TS630L           |     |
|                                            | 800 | TS800N     |                  | TS800H     | TS800L           |     |

#### AC460V

| Capacity of 3 phase transformer (kVA) |     | Below 2000       |                  | Below 3000 |                  | Below 4000 |
|---------------------------------------|-----|------------------|------------------|------------|------------------|------------|
| Breaking capacity (kA) (sym)          |     | 50               | 65               | 70         | 85               | 100 130    |
| Frame (A)                             | 100 | TD100N<br>TS100N | TD100H<br>TS100H |            | TD100L<br>TS100L |            |
|                                       | 160 | TD160N<br>TS160N | TD160H<br>TS160H |            | TD160L<br>TS160L |            |
|                                       | 250 | TS250N           | TS250H           |            | TS250L           |            |
|                                       | 400 | TS400N           |                  | TS400H     | TS400L           |            |
|                                       | 630 | TS630N           |                  | TS630H     | TS630L           |            |
|                                       | 800 | TS800N           |                  | TS800H     |                  | TS800L     |

## Application

### Primary use of transformer

#### Application for transformer protection (MCCBs for Transformer-Primary Use)

Transformers are used to change in the supply voltage, for both medium and low voltage supplies. The choice of the protection devices should be considered transient insertion phenomena, during which the current may reach values higher than the rated full load current; the phenomenon decays in a few seconds.

The peak value of the first half cycle may reach values of 15 to 25 times the effective rated current. For a protective device capable of protecting these units this must be taken into account. Manufacturers data and tests have indicated that a protective device feeding a transformer must be capable of carrying the following current values without tripping.

#### TD100/160, TS100~800 equipped with Thermal magnetic trip units

| Transformer ratings (kVA) |                              |              | MCCB rated current (A) | Trip unit         |
|---------------------------|------------------------------|--------------|------------------------|-------------------|
| 1 phase 230V              | 3 phase 230V<br>1 phase 400V | 3 phase 400V |                        |                   |
| 3 to 4                    | 5 to 6                       | 9 to 11      | 16                     | FTU<br>FMU<br>ATU |
| 4 to 5                    | 6 to 8                       | 11 to 14     | 20                     |                   |
| 5 to 6                    | 8 to 10                      | 14 to 17     | 25                     |                   |
| 6 to 7                    | 10 to 13                     | 18 to 22     | 32                     |                   |
| 7 to 9                    | 13 to 16                     | 22 to 28     | 40                     |                   |
| 9 to 12                   | 16 to 20                     | 28 to 35     | 50                     |                   |
| 12 to 14                  | 20 to 25                     | 35 to 44     | 63                     |                   |
| 15 to 18                  | 26 to 32                     | 44 to 55     | 80                     |                   |
| 18 to 23                  | 32 to 40                     | 55 to 69     | 100                    |                   |
| 23 to 29                  | 40 to 50                     | 69 to 87     | 125                    |                   |
| 29 to 37                  | 51 to 64                     | 89 to 111    | 160                    |                   |
| 37 to 47                  | 64 to 80                     | 111 to 138   | 200                    |                   |
| 46 to 58                  | 80 to 100                    | 138 to 173   | 250                    |                   |
| 55 to 69                  | 96 to 120                    | 166 to 208   | 300                    |                   |
| 74 to 92                  | 128 to 160                   | 221 to 277   | 400                    |                   |
| 92 to 115                 | 160 to 200                   | 277 to 346   | 500                    |                   |
| 116 to 145                | 202 to 252                   | 349 to 436   | 630                    |                   |
| 129 to 161                | 224 to 280                   | 388 to 484   | 700                    |                   |
| 147 to 184                | 256 to 320                   | 443 to 554   | 800                    |                   |

#### TS100~800 equipped with electronic trip units

| Transformer ratings (kVA) |                              |              | MCCB rated current (A) | Trip unit  | Ir max setting |
|---------------------------|------------------------------|--------------|------------------------|------------|----------------|
| 1 phase 230V              | 3 phase 230V<br>1 phase 400V | 3 phase 400V |                        |            |                |
| 4 to 7                    | 6 to 13                      | 11 to 22     | 40                     | ETS<br>ETM | 0.8            |
| 9 to 19                   | 16 to 32                     | 27 to 56     | 100                    |            | 0.8            |
| 15 to 30                  | 25 to 52                     | 44 to 90     | 160                    |            | 0.8            |
| 23 to 46                  | 40 to 80                     | 70 to 139    | 250                    |            | 0.8            |
| 37 to 74                  | 64 to 128                    | 111 to 222   | 400                    |            | 0.8            |
| 58 to 115                 | 100 to 200                   | 175 to 346   | 630                    |            | 0.8            |
| 74 to 184                 | 127 to 319                   | 222 to 554   | 800                    |            | 1              |

# Technical information

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## Application Protection of lighting & heating circuits

In the lighting & heating circuits, switching-surge magnitudes and times are normally not sufficient to cause serious tripping problems. But, in some cases, such as incandescent lamps, mercury arc lamps, metal halide and sodium vapour, or other large starting-current equipment, the proper selection should be considered.

Upon supply of a lighting installation, for a brief period an initial current exceeding the rated current (corresponding to the power of the lamps) circulates on the network. This possible peak has a value of approximately  $15 \div 20$  times the rated current, and is present for a few milliseconds; there may also be an inrush current with a value of approximately  $1.5 \div 3$  times the rated current, lasting up to some minutes. The correct dimensioning of the switching and protection devices must take these problems into account. Generally, it is recommended to make the maximum operating current not to exceed 80% of the related current.

### AC220V

| The maximum<br>operating<br>current (A) | The rated<br>current of<br>MCCB (A) | Breaking capacity (kA) |                  |                  |                  |     |
|-----------------------------------------|-------------------------------------|------------------------|------------------|------------------|------------------|-----|
|                                         |                                     | sym                    | 85               | 100              | 120              | 200 |
| 12                                      | 16                                  | TD100N                 | TD100H           | TD100L           |                  |     |
| 16                                      | 20                                  |                        |                  |                  |                  |     |
| 20                                      | 25                                  |                        |                  |                  |                  |     |
| 25                                      | 32                                  |                        |                  |                  |                  |     |
| 32                                      | 40                                  |                        | TD100H<br>TS100N | TD100L<br>TS100H | TD100L<br>TS100L |     |
| 40                                      | 50                                  |                        |                  |                  |                  |     |
| 50                                      | 63                                  |                        |                  |                  |                  |     |
| 64                                      | 80                                  |                        |                  |                  |                  |     |
| 80                                      | 100                                 | TD160N                 | TD160H<br>TS160N | TS160H           | TD160L<br>TS160L |     |
| 100                                     | 125                                 |                        |                  |                  |                  |     |
| 128                                     | 160                                 |                        |                  |                  |                  |     |
| 160                                     | 200                                 |                        |                  |                  |                  |     |
| 200                                     | 250                                 | TS250N                 |                  | TS250H           | TS250L           |     |
| 240                                     | 300                                 | TS400N                 |                  | TS400H           | TS400L           |     |
| 320                                     | 400                                 | TS630N                 |                  | TS630H           | TS630L           |     |
| 400                                     | 500                                 | TS800N                 |                  | TS800H           | TS800L           |     |
| 504                                     | 630                                 |                        |                  |                  |                  |     |
| 560                                     | 700                                 |                        |                  |                  |                  |     |
| 640                                     | 800                                 |                        |                  |                  |                  |     |

### AC460V

| The maximum<br>operating<br>current (A) | The rated<br>current of<br>MCCB (A) | Breaking capacity (kA) |                  |                  |    |        |        |
|-----------------------------------------|-------------------------------------|------------------------|------------------|------------------|----|--------|--------|
|                                         |                                     | sym                    | 50               | 65               | 70 | 85     | 100    |
| 12                                      | 16                                  | TD100N<br>TS100N       | TD100H<br>TS100H | TD100L<br>TS100L |    |        |        |
| 16                                      | 20                                  |                        |                  |                  |    |        |        |
| 20                                      | 25                                  |                        |                  |                  |    |        |        |
| 25                                      | 32                                  |                        |                  |                  |    |        |        |
| 32                                      | 40                                  |                        |                  |                  |    |        |        |
| 40                                      | 50                                  |                        |                  |                  |    |        |        |
| 50                                      | 63                                  |                        |                  |                  |    |        |        |
| 64                                      | 80                                  |                        |                  |                  |    |        |        |
| 80                                      | 100                                 | TD160N<br>TS160N       | TD160H<br>TS160H | TD160L<br>TS160L |    |        |        |
| 100                                     | 125                                 |                        |                  |                  |    |        |        |
| 128                                     | 160                                 |                        |                  |                  |    |        |        |
| 160                                     | 200                                 |                        |                  |                  |    |        |        |
| 200                                     | 250                                 | TS250N                 |                  | TS250H           |    | TS250L |        |
| 240                                     | 300                                 | TS400N                 |                  | TS400H           |    | TS400L |        |
| 320                                     | 400                                 | TS630N                 |                  | TS630H           |    | TS630L |        |
| 400                                     | 500                                 | TS800N                 |                  | TS800H           |    |        | TS800L |
| 504                                     | 630                                 |                        |                  |                  |    |        |        |
| 560                                     | 700                                 |                        |                  |                  |    |        |        |
| 640                                     | 800                                 |                        |                  |                  |    |        |        |

## Application Protection of resistance welding circuits

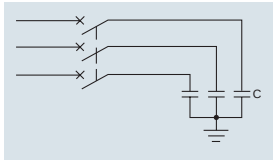
Short circuit protection for resistance welding devices can be obtained by applying molded case circuit breaker properly. These breakers permit normally high welding currents, but trip instantaneously if a short circuit develops.

It's recommended to select proper circuit breaker according to the characteristics of welding devices as the follow table.

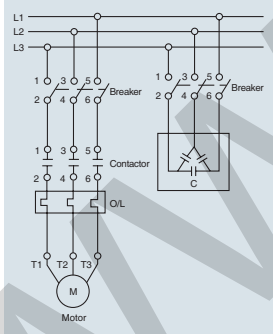
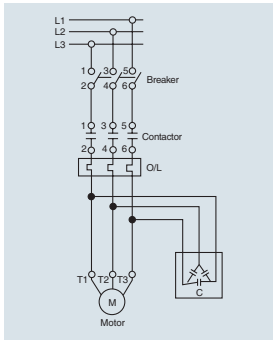
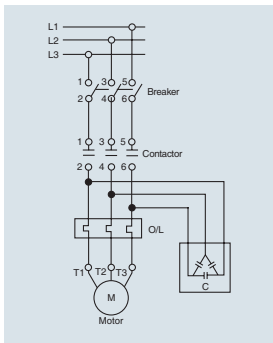
| Characteristics of welding device |                     | Applied circuit breaker (MCCB 2P) |                                                                          |
|-----------------------------------|---------------------|-----------------------------------|--------------------------------------------------------------------------|
| Capacity (kVA)                    | Maximum input (kVA) | 220V (Single phase)               | 400V (Single phase)                                                      |
| 15                                | 35                  | TD100N/H/L 100A                   | TD100N/H/L 50A<br>TS100N/H/L 50A                                         |
|                                   |                     | TS100N/H/L 100A                   |                                                                          |
|                                   |                     | TD160N/H/L 100A                   |                                                                          |
|                                   |                     | TS160N/H/L 100A                   |                                                                          |
| 30                                | 65                  | TD160N/H/L 125A                   | TD100N/H/L 100A<br>TS100N/H/L 100A<br>TD160N/H/L 100A<br>TS160N/H/L 100A |
|                                   |                     | TS160N/H/L 125A                   |                                                                          |
|                                   |                     | TS250N/H/L 125A                   |                                                                          |
|                                   |                     |                                   |                                                                          |
| 55                                | 140                 | TS250N/H/L 250A                   | TD160N/H/L 125A<br>TS160N/H/L 125A<br>TS250N/H/L 125A                    |
|                                   |                     |                                   |                                                                          |
|                                   |                     |                                   |                                                                          |
|                                   |                     |                                   |                                                                          |

## Application

### Use of circuit-breakers for capacitor banks



Capacitor circuit



Usual connection diagram

#### Application for protection of capacitor circuit

In order to reduce system losses (less than 0.5W/kvar in low voltage) and voltage drops in the power distribution system, reactive power compensation or power factor correction is generally undertaken. As a result, the power fed into the system is used as active power and costs will be saved through a reduction in the capacitive and inductive power factors. The compensation can be carried out by the fixed capacitors and automatic capacitor banks. However, the disadvantages of installing capacitors are sensitivity to over-voltages and to the presence of nonlinear loads.

Examples of equipment which consume reactive energy are all those receivers which require magnetic fields or arcs in order to operate, such as:

- Asynchronous motors: An asynchronous motor is a large consumer of inductive reactive energy. The amount of reactive power consumed is between 20% and 25% of the rated power of the motor (depending on its speed).
- Power Transformers: Power transformers are normally always connected. This means that reactive energy is always consumed. Also, as a consequence of its inductive nature, the reactive energy increases when the transformer is loaded.
- Discharge lamps, Resistance-type soldering machines, Dielectric type heating ovens, Induction heating ovens, Welding equipments, Arc furnaces

At the instant of closing a switch to energize a capacitor, the current is limited only by the impedance of the network upstream of the capacitor, so that high peak values of current will occur for a brief period, rapidly falling to normal operating values.

According to the relevant standards IEC 60831-1/IEC 70, capacitors must function under normal operating conditions with the current having a RMS value up to 1.3 times the rated current of the capacitor. Additionally, a further tolerance of up to 15% of the real value of the power must be taken into consideration. The maximum current with which the selected circuit-breaker can be constantly loaded, and which it must also be able to switch, is calculated as follows:

$$\text{Maximum expected rated current} = \text{Rated current of the capacitor bank} \times 1.5 \text{ (RMS value)}$$



## Application

### Use of circuit-breakers for capacitor banks

#### 220V, 50/60Hz Circuit

| Capacitor rating<br>kVAR | Single-phase circuit           |                           | Three-phase circuit            |                           |
|--------------------------|--------------------------------|---------------------------|--------------------------------|---------------------------|
|                          | Capacitor rated<br>current (A) | MCCB rated<br>current (A) | Capacitor rated<br>current (A) | MCCB rated<br>current (A) |
| 5                        | 22.7                           | 40                        | 13.1                           | 20                        |
| 10                       | 45.5                           | 80                        | 26.2                           | 40                        |
| 15                       | 68.2                           | 125                       | 39.4                           | 63                        |
| 20                       | 90.9                           | 160                       | 52.5                           | 80                        |
| 25                       | 113.6                          | 200                       | 65.6                           | 100                       |
| 30                       | 136.4                          | 225                       | 78.7                           | 125                       |
| 40                       | 181.8                          | 300                       | 105.0                          | 160                       |
| 50                       | 227.3                          | 400                       | 131.2                          | 200                       |
| 75                       | 340.9                          | 630                       | 196.8                          | 300                       |
| 100                      | 454.5                          | 700                       | 262.4                          | 400                       |
| 150                      | 681.8                          | -                         | 393.7                          | 630                       |
| 200                      | 909.1                          | -                         | 524.9                          | 800                       |
| 300                      | 1363.6                         | -                         | 787.3                          | -                         |
| 400                      | 1818.2                         | -                         | 1049.8                         | -                         |

Notes) 1. The MCCB rated current should be approx. 150% of the capacitor rated current.  
2. The MCCB short-circuit capacity should be adequate for the circuit short-circuit capacity.

# Technical information

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## Application Use of circuit-breakers for capacitor banks

### 440V, 50/60Hz Circuit

| Capacitor rating<br>kVAR | Single-phase circuit           |                           | Three-phase circuit            |                           |
|--------------------------|--------------------------------|---------------------------|--------------------------------|---------------------------|
|                          | Capacitor rated<br>current (A) | MCCB rated<br>current (A) | Capacitor rated<br>current (A) | MCCB rated<br>current (A) |
| 5                        | 11.4                           | 20                        | 6.6                            | 16                        |
| 10                       | 22.7                           | 40                        | 13.1                           | 20                        |
| 15                       | 34.1                           | 63                        | 19.7                           | 32                        |
| 20                       | 45.5                           | 80                        | 26.2                           | 40                        |
| 25                       | 56.8                           | 100                       | 32.8                           | 50                        |
| 30                       | 68.2                           | 125                       | 39.4                           | 63                        |
| 40                       | 90.9                           | 160                       | 52.5                           | 80                        |
| 50                       | 113.6                          | 200                       | 65.6                           | 100                       |
| 75                       | 170.5                          | 300                       | 98.4                           | 160                       |
| 100                      | 227.3                          | 400                       | 131.2                          | 200                       |
| 150                      | 340.9                          | 500                       | 196.8                          | 300                       |
| 200                      | 454.5                          | 700                       | 262.4                          | 400                       |
| 300                      | 681.8                          | -                         | 393.7                          | 630                       |
| 400                      | 909.1                          | -                         | 524.9                          | 800                       |

Notes) 1. The MCCB rated current should be approx. 150% of the capacitor rated current.  
2. The MCCB short-circuit capacity should be adequate for the circuit short-circuit capacity.

## Application

### Using circuit-breakers in DC networks

Susol circuit-breakers for protection of power distribution with thermal overload and magnetic short-circuit trip units are suitable for usage in DC networks.  
The circuit-breakers with electronic overcurrent releases are not suitable for DC networks.

#### Circuit-breaker selection criteria

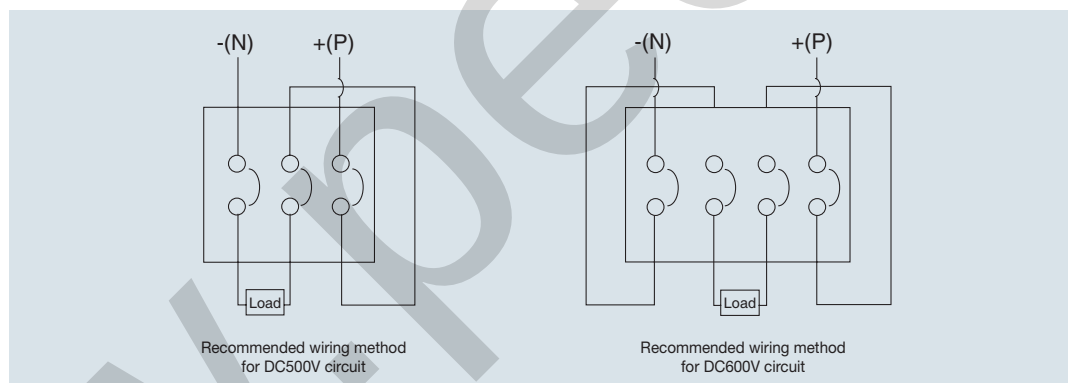
The followings are the most important criteria for selection of suitable circuit breaker for DC networks.

- The rated current determines the rating and size of the circuit-breaker (Equipment)
- The rated voltage determines the number of poles in series necessary for breaking
- The maximum short-circuit current at the connection point determines the breaking capacity

#### Setting range of the trip values

- Thermal overload protection: Same setpoints as in 50/60Hz circuits
- Instantaneous short-circuit protection: The response threshold increases by maximum 40%.

The following wiring diagrams are recommended since the current must flow through all current paths in order to conform to the thermal tripping characteristic curve.



|                        | Model                  | Trip unit         | Applicable to DC circuits        | Breaking capacity (kA) |
|------------------------|------------------------|-------------------|----------------------------------|------------------------|
| Thermal<br>magnetic    | TD100N,TD160N          | FTU<br>FMU<br>ATU | ○                                | 42                     |
|                        | TS100N,TS160N, TS250N  |                   | ○                                | 50                     |
|                        | TS400N, TS630N         |                   |                                  |                        |
|                        | TS800N                 |                   | ○                                | 65                     |
|                        | TD100H, TD160H         |                   |                                  |                        |
|                        | TS100H, TS160H, TS250H |                   | ○                                | 85                     |
|                        | TS400H, TS630H         |                   |                                  |                        |
|                        | TS800H                 |                   | ○                                | 100                    |
| TD100L, TD160L         |                        |                   |                                  |                        |
| TS100L, TS160L, TS250L |                        |                   |                                  |                        |
| TS400L, TS630L         |                        |                   |                                  |                        |
|                        | TS800L                 |                   |                                  |                        |
| Electronic             | TS250, TS630, TS800    | ETS, ETM          | Impossible to use to DC circuits |                        |

# Technical information

Susol

## Application Circuit breakers for 400Hz networks

When circuit breakers are used at high frequencies, the breakers in many cases require to be derated as the increased resistance of the copper sections resulting from the skin effect produced by eddy currents at 400Hz.

- Standard production breakers can be used with alternating currents with frequencies other than 50/60 Hz (the frequencies to which the rated performance of the device refer, with alternating current) as appropriate derating coefficients are applied.

### Thermal magnetic trip units

#### Thermal trip

As can be seen from the data shown in below, the tripping threshold of the thermal element (In) decreases as the frequency increases because of the reduced conductivity of the materials and the increase of the associated thermal phenomena.

Rated current (A) at 400Hz= K1 × rated current (A) at 50/60Hz

#### Instantaneous trip

The magnetic threshold increases with the increase in frequency.

Instantaneous current (A) at 400Hz= K2 × Instantaneous current (A) at 50/60Hz

### Thermal magnetic trip units

#### TD and TS series performance table at 400Hz

| Rated current<br>(A)<br>in 400 Hz | Applied circuit breaker<br>(MCCB)                                                                    | Trip unit         | Multiplier factors (K1, K2) |                             |
|-----------------------------------|------------------------------------------------------------------------------------------------------|-------------------|-----------------------------|-----------------------------|
|                                   |                                                                                                      |                   | K1<br>(Thermal trip units)  | K2<br>(Magnetic trip units) |
| 16                                | TD100N, TD100H, TD100L<br>TS100N, TS100H, TS100L<br>TD160N, TD160H, TD160L<br>TS160N, TS160H, TS160L | FTU<br>FMU<br>ATU | 0.8                         | 2                           |
| 20                                |                                                                                                      |                   | 0.8                         | 2                           |
| 25                                |                                                                                                      |                   | 0.8                         | 2                           |
| 32                                |                                                                                                      |                   | 0.8                         | 2                           |
| 40                                |                                                                                                      |                   | 0.8                         | 2                           |
| 50                                |                                                                                                      |                   | 0.8                         | 2                           |
| 63                                |                                                                                                      |                   | 0.8                         | 2                           |
| 80                                |                                                                                                      |                   | 0.8                         | 2                           |
| 100                               |                                                                                                      |                   | 0.8                         | 2                           |
| 125                               |                                                                                                      |                   | 0.8                         | 2                           |
| 160                               | TS250N, TS250H, TS250L                                                                               | FTU<br>FMU<br>ATU | 0.8                         | 2                           |
| 200                               |                                                                                                      |                   | 0.8                         | 2                           |
| 250                               | TS400N, TS400H, TS400L<br>TS630N, TS630H, TS630L                                                     |                   | 0.8                         | 2                           |
| 300                               |                                                                                                      |                   | 0.8                         | 2                           |
| 400                               |                                                                                                      |                   | 0.8                         | 2                           |
| 500                               | TS800N, TS800H, TS800L                                                                               |                   | 0.8                         | 2                           |
| 630                               |                                                                                                      |                   | 0.8                         | 2                           |
| 700                               |                                                                                                      |                   | 0.8                         | 2                           |

Note) K1 × Multiplier factor of rated current (In)

K2-Multiplier factor of instantaneous current due to the induced magnetic fields

FTU-Fixed Thermal and magnetic trip unit

FMU×Adjustable thermal and fixed magnetic trip unit

ATU×Adjustable thermal and magnetic trip unit

## Application

### Circuit breakers for 400Hz networks

#### Electronic trip units

The use of electronics offers the advantage of greater operating stability when the frequency is varied. However, the devices are still subjected to frequency related temperature effects which may sometimes pose restrictions on their use. Column K1 of the table below gives the maximum permissible current to be used for the current setting (knob position).

| Rated current<br>(A)<br>in 400 Hz | Applied circuit breaker<br>(MCCB)                                                                                                                        | Trip unit  | Multiplier factors (K1, K2) |                             |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------------|-----------------------------|
|                                   |                                                                                                                                                          |            | K1<br>(Thermal trip units)  | K2<br>(Magnetic trip units) |
| 40                                | TS100N, TS100H, TS100L<br>TS160N, TS160H, TS160L<br>TS250N, TS250H, TS250L<br>TS400N, TS400H, TS400L<br>TS630N, TS630H, TS630L<br>TS800N, TS800H, TS800L | ETS<br>ETM | 0.4 to 1                    | 1                           |
| 80                                |                                                                                                                                                          |            | 0.4 to 1                    | 1                           |
| 160                               |                                                                                                                                                          |            | 0.4 to 0.9                  | 1                           |
| 250                               |                                                                                                                                                          |            | 0.4 to 0.9                  | 1                           |
| 400                               |                                                                                                                                                          |            | 0.4 to 0.8                  | 1                           |
| 630                               |                                                                                                                                                          |            | 0.4 to 0.8                  | 1                           |
| 800                               |                                                                                                                                                          |            | 0.4 to 0.75                 | 0.97                        |

Note) ATU×Adjustable thermal and magnetic trip unit  
 K1×Multiplier factor of rated current (In)  
 K2×Multiplier factor of instantaneous current due to the induced magnetic fields  
 ETS×Electronic trip unit (Standard)  
 ETM×Electronic trip unit (Multi-function)

# Technical information

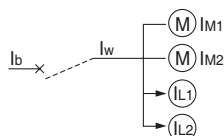
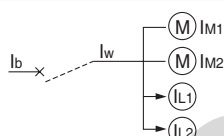
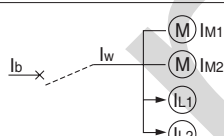
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## Application Protection of several kinds of loads

### Application for protection of several kinds of loads

It requires to select proper circuit breakers according to the characteristics of loads when they are installed to protect several kinds of loads. It's needed to consider the maximum operating current and the capacity of loads in total so as to select the rated current of breakers.

#### Selection of circuit breaker protecting the several loads simultaneously

| The kind of loads<br>( $I_M$ : motors, $I_L$ : others)                                                                                           | Permissible current<br>in cable or wire: $I_w$ | The rated current<br>of circuit breaker: $I_b$                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| In case of,<br>$\sum I_M \leq \sum I_L$                         | $I_w \geq \sum I_M + \sum I_L$                 | Choose the low value among<br>two formulas:                                                                                      |
| In case of,<br>$\sum I_M > \sum I_L$ ,<br>$\sum I_M \leq 50A$  | $I_w \geq 1.25 \sum I_M + \sum I_L$            | $I_b \geq 3 \sum I_M + \sum I_L$ and<br>$I_b \leq 2.5 I_w$                                                                       |
| In case of,<br>$\sum I_M > \sum I_L$ ,<br>$\sum I_M > 50A$    | $I_w \geq 1.1 \sum I_M + \sum I_L$             | It's permitted to select the above value<br>only if $I_w$ (above 100A) isn't subject to<br>the rated current of circuit breaker. |

#### The rated current of breakers as the main circuit of 3 phase inductive loads (AC 220V)

| Capacity of<br>loads in total<br>(below kW) | The maximum<br>operating current<br>(below A) | Capacity of the highest motor (kW / A) |          |             |             |           |           |          |          |            |          |           |           |           |           |           |           |  |  |
|---------------------------------------------|-----------------------------------------------|----------------------------------------|----------|-------------|-------------|-----------|-----------|----------|----------|------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|--|--|
|                                             |                                               | 0.75<br>4.8                            | 1.5<br>8 | 2.2<br>11.1 | 3.7<br>17.4 | 5.5<br>26 | 7.5<br>34 | 11<br>48 | 15<br>65 | 18.5<br>79 | 22<br>93 | 30<br>125 | 37<br>160 | 45<br>190 | 55<br>230 | 75<br>310 | 90<br>360 |  |  |
| 3                                           | 15                                            | 20                                     | 32       | 32          |             |           |           |          |          |            |          |           |           |           |           |           |           |  |  |
| 4.5                                         | 20                                            | 32                                     | 32       | 32          | 50          |           |           |          |          |            |          |           |           |           |           |           |           |  |  |
| 6.3                                         | 30                                            | 40                                     | 40       | 40          | 50          | 63        |           |          |          |            |          |           |           |           |           |           |           |  |  |
| 8.2                                         | 40                                            | 50                                     | 50       | 50          | 50          | 80        | 100       |          |          |            |          |           |           |           |           |           |           |  |  |
| 12                                          | 50                                            | 63                                     | 63       | 63          | 63          | 80        | 100       |          |          |            |          |           |           |           |           |           |           |  |  |
| 15.7                                        | 75                                            | 100                                    | 100      | 100         | 100         | 100       | 100       | 125      | 160      |            |          |           |           |           |           |           |           |  |  |
| 19.5                                        | 90                                            | 100                                    | 100      | 100         | 100         | 100       | 100       | 125      | 160      | 200        |          |           |           |           |           |           |           |  |  |
| 23.2                                        | 100                                           | 125                                    | 125      | 125         | 125         | 125       | 125       | 125      | 160      | 200        | 200      |           |           |           |           |           |           |  |  |
| 30                                          | 125                                           | 160                                    | 160      | 160         | 160         | 160       | 160       | 160      | 160      | 200        | 250      |           |           |           |           |           |           |  |  |
| 37.5                                        | 150                                           | 200                                    | 200      | 200         | 200         | 200       | 200       | 200      | 200      | 200        | 250      | 300       |           |           |           |           |           |  |  |
| 45                                          | 175                                           | 200                                    | 200      | 200         | 200         | 200       | 200       | 200      | 200      | 200        | 250      | 300       | 400       |           |           |           |           |  |  |
| 52.5                                        | 200                                           | 250                                    | 250      | 250         | 250         | 250       | 250       | 250      | 250      | 250        | 250      | 300       | 400       | 500       |           |           |           |  |  |
| 63.7                                        | 250                                           | 300                                    | 300      | 300         | 300         | 300       | 300       | 300      | 300      | 300        | 300      | 300       | 400       | 500       | 500       |           |           |  |  |
| 75                                          | 300                                           | 400                                    | 400      | 400         | 400         | 400       | 400       | 400      | 400      | 400        | 400      | 400       | 400       | 500       | 500       |           |           |  |  |
| 86.2                                        | 350                                           | 400                                    | 400      | 400         | 400         | 400       | 400       | 400      | 400      | 400        | 400      | 400       | 400       | 500       | 500       | 630       |           |  |  |
| 97.5                                        | 400                                           | 500                                    | 500      | 500         | 500         | 500       | 500       | 500      | 500      | 500        | 500      | 500       | 500       | 500       | 500       | 630       | 700       |  |  |
| 112.5                                       | 450                                           | 500                                    | 500      | 500         | 500         | 500       | 500       | 500      | 500      | 500        | 500      | 500       | 500       | 500       | 500       | 700       | 700       |  |  |
| 125                                         | 500                                           | 630                                    | 630      | 630         | 630         | 630       | 630       | 630      | 630      | 630        | 630      | 630       | 630       | 630       | 630       | 700       | 700       |  |  |
| 150                                         | 600                                           | 700                                    | 700      | 700         | 700         | 700       | 700       | 700      | 700      | 700        | 700      | 700       | 700       | 700       | 700       | 700       | 800       |  |  |
| 175                                         | 700                                           | 800                                    | 800      | 800         | 800         | 800       | 800       | 800      | 800      | 800        | 800      | 800       | 800       | 800       | 800       | 800       | 800       |  |  |

## Application Protection of several kinds of loads

The rated current of breakers as the main circuit of 3 phase inductive loads (AC 440V)

| Capacity of loads<br>In total<br>(below kW) | The maximum<br>operating<br>current<br>(below A) | Capacity of the highest motor (kW / A) |     |      |      |     |     |     |     |      |     |     |     |     |     |     |     |     |     |
|---------------------------------------------|--------------------------------------------------|----------------------------------------|-----|------|------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                                             |                                                  | 0.75                                   | 1.5 | 2.2  | 3.7  | 5.5 | 7.5 | 11  | 15  | 18.5 | 22  | 30  | 37  | 45  | 55  | 75  | 90  | 110 | 132 |
|                                             |                                                  | 4.8                                    | 8   | 11.1 | 17.4 | 26  | 34  | 48  | 65  | 79   | 93  | 125 | 160 | 190 | 230 | 310 | 360 | 220 | 250 |
| 3                                           | 7.5                                              | 16                                     | 16  | 16   |      |     |     |     |     |      |     |     |     |     |     |     |     |     |     |
| 4.5                                         | 10                                               | 16                                     | 16  | 16   | 32   |     |     |     |     |      |     |     |     |     |     |     |     |     |     |
| 6.3                                         | 15                                               | 20                                     | 20  | 20   | 32   | 40  |     |     |     |      |     |     |     |     |     |     |     |     |     |
| 8.2                                         | 20                                               | 32                                     | 32  | 32   | 32   | 40  | 50  |     |     |      |     |     |     |     |     |     |     |     |     |
| 12                                          | 25                                               | 32                                     | 32  | 32   | 32   | 40  | 50  |     |     |      |     |     |     |     |     |     |     |     |     |
| 15.7                                        | 38                                               | 50                                     | 50  | 50   | 50   | 50  | 50  | 63  | 80  |      |     |     |     |     |     |     |     |     |     |
| 19.5                                        | 45                                               | 50                                     | 50  | 50   | 50   | 50  | 50  | 63  | 80  | 100  |     |     |     |     |     |     |     |     |     |
| 23.2                                        | 50                                               | 63                                     | 63  | 63   | 63   | 63  | 63  | 63  | 80  | 100  | 125 |     |     |     |     |     |     |     |     |
| 30                                          | 63                                               | 80                                     | 80  | 80   | 80   | 80  | 80  | 80  | 100 | 100  | 125 |     |     |     |     |     |     |     |     |
| 37.5                                        | 75                                               | 100                                    | 100 | 100  | 100  | 100 | 100 | 100 | 100 | 100  | 125 | 160 |     |     |     |     |     |     |     |
| 45                                          | 88                                               | 100                                    | 100 | 100  | 100  | 100 | 100 | 100 | 100 | 100  | 125 | 160 | 200 |     |     |     |     |     |     |
| 52.5                                        | 100                                              | 125                                    | 125 | 125  | 125  | 125 | 125 | 125 | 125 | 125  | 125 | 160 | 200 | 250 |     |     |     |     |     |
| 63.7                                        | 125                                              | 160                                    | 160 | 160  | 160  | 160 | 160 | 160 | 160 | 160  | 160 | 160 | 200 | 250 | 250 |     |     |     |     |
| 75                                          | 150                                              | 200                                    | 200 | 200  | 200  | 200 | 200 | 200 | 200 | 200  | 200 | 200 | 200 | 250 | 250 |     |     |     |     |
| 86.2                                        | 175                                              | 200                                    | 200 | 200  | 200  | 200 | 200 | 200 | 200 | 200  | 200 | 200 | 200 | 250 | 300 | 400 |     |     |     |
| 97.5                                        | 200                                              | 250                                    | 250 | 250  | 250  | 250 | 250 | 250 | 250 | 250  | 250 | 250 | 250 | 250 | 300 | 400 | 400 | 500 |     |
| 112.5                                       | 225                                              | 250                                    | 250 | 250  | 250  | 250 | 250 | 250 | 250 | 250  | 250 | 250 | 250 | 250 | 300 | 400 | 400 | 500 | 500 |
| 125                                         | 250                                              | 300                                    | 300 | 300  | 300  | 300 | 300 | 300 | 300 | 300  | 300 | 300 | 300 | 300 | 300 | 400 | 400 | 500 | 500 |
| 150                                         | 300                                              | 400                                    | 400 | 400  | 400  | 400 | 400 | 400 | 400 | 400  | 400 | 400 | 400 | 400 | 400 | 400 | 400 | 500 | 500 |
| 175                                         | 350                                              | 400                                    | 400 | 400  | 400  | 400 | 400 | 400 | 400 | 400  | 400 | 400 | 400 | 400 | 400 | 400 | 500 | 630 | 630 |
| 200                                         | 400                                              | 500                                    | 500 | 500  | 500  | 500 | 500 | 500 | 500 | 500  | 500 | 500 | 500 | 500 | 500 | 500 | 500 | 700 | 700 |
| 250                                         | 500                                              | 630                                    | 630 | 630  | 630  | 630 | 630 | 630 | 630 | 630  | 630 | 630 | 630 | 630 | 630 | 630 | 630 | 800 | 800 |
| 300                                         | 600                                              | 700                                    | 700 | 700  | 700  | 700 | 700 | 700 | 700 | 700  | 700 | 700 | 700 | 700 | 700 | 700 | 700 | 800 | 800 |
| 350                                         | 700                                              | 800                                    | 800 | 800  | 800  | 800 | 800 | 800 | 800 | 800  | 800 | 800 | 800 | 800 | 800 | 800 | 800 | -   | -   |
| 400                                         | 700                                              | 800                                    | 800 | 800  | 800  | 800 | 800 | 800 | 800 | 800  | 800 | 800 | 800 | 800 | 800 | 800 | 800 | -   | -   |

Notes) The above mentioned technical data is defined under the usage conditions as follows ;

1. The circuit breaker is tripped within 10seconds in 600% of the current of the fully operating loads.
2. The start-up input current is set within 1700% of the current of the fully operating loads.
3. The capacity of highest motor is also applied when several loads starts up simultaneously.

# Technical information

Susol

## Protective coordination Discrimination & Cascading

The primary purpose of a circuit protection system is to prevent damage to series connected equipment and to minimize the area and duration of power loss. The first consideration is whether an air circuit breaker or molded case circuit breaker is the most suitable. The next is the type of system to be used. The two major types are: Discrimination and cascading.

### Discrimination

According to IEC60947-2, the discrimination can be defined as follows.

#### Total discrimination (total selectivity)

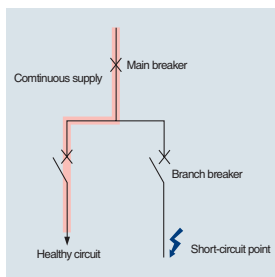
Over-current discrimination where, in the presence of two over-current protective devices in series, the protective device on the load side effects the protection without causing the other protective device to operate.

#### Partial discrimination (partial selectivity)

Over-current discrimination where, in the presence of two over-current protective devices in series, the protective device on the load side effects the protection up to a given level of over-current, without causing the other protective device to operate.

#### No discrimination

In case of a fault, main and branch circuit breakers open.



<Discrimination>

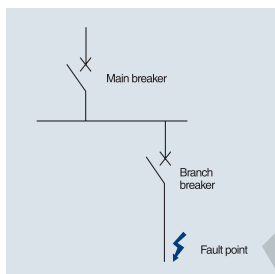
### Cascading

This is an economical approach to the use of circuit breakers, whereby only the main (upstream) breaker has adequate interrupting capacity for the maximum available fault current.

The MCCBs downstream cannot handle this maximum fault current and rely on the opening of the upstream breaker for protection.

The advantage of the cascade back-up approach is that it facilitates the use of low cost, low fault level breakers downstream, thereby offering savings in both the cost and size of equipment.

As Susol TD & TS circuit breakers have a very considerable current limiting effect, they can be used to provide this 'cascade back-up' protection for downstream circuit breakers.



<Cascading>



# Technical information

Susol

## Protective coordination Cascading, network 220/240V

### Complementary technical information

Main: Susol TD/TS series

Branch: Metasol AB and Susol MCCB

| Branch breaker         | Main breaker | Rated breaking capacity (kArms) | TD100N | TD100H | TD100L | TD160N | TD160H | TD160L | TS100N | TS100H | TS100L |
|------------------------|--------------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        |              |                                 | 85     | 100    | 200    | 85     | 100    | 200    | 100    | 120    | 200    |
| AB                     | ABS33c       | 30                              | 50     | 50     | 65     | 50     | 50     | 65     | 65     | 65     | 85     |
|                        | ABN53c       | 30                              | 50     | 50     | 65     | 50     | 50     | 65     | 85     | 100    | 100    |
|                        | ABS53c       | 35                              | 65     | 65     | 85     | 65     | 65     | 85     | 100    | 120    | 120    |
|                        | ABH53c       | 100                             |        |        | 120    |        |        | 120    |        |        |        |
|                        | ABN63c       | 30                              | 50     | 65     | 85     | 65     | 65     | 85     | 65     | 65     | 85     |
|                        | ABS63c       | 35                              | 65     | 85     | 100    | 85     | 85     | 100    | 85     | 100    | 100    |
|                        | ABN103c      | 35                              | 85     | 100    | 120    | 85     | 100    | 120    | 100    | 120    | 120    |
|                        | ABS125c      | 85                              |        |        |        |        |        |        |        |        |        |
|                        | ABH125c      | 100                             |        |        |        |        |        |        |        |        |        |
|                        | ABN203c      | 65                              |        |        |        |        |        |        |        |        |        |
|                        | ABS203c      | 85                              |        |        |        |        |        |        |        |        |        |
|                        | ABH203c      | 100                             |        |        |        |        |        |        |        |        |        |
|                        | ABN403c      | 50                              |        |        |        |        |        |        |        |        |        |
|                        | ABS403c      | 75                              |        |        |        |        |        |        |        |        |        |
|                        | ABH403c      | 85                              |        |        |        |        |        |        |        |        |        |
|                        | ABL403c      | 125                             |        |        |        |        |        |        |        |        |        |
|                        | ABN803c      | 50                              |        |        |        |        |        |        |        |        |        |
|                        | ABS803c      | 85                              |        |        |        |        |        |        |        |        |        |
|                        | ABL803c      | 125                             |        |        |        |        |        |        |        |        |        |
| Susol<br>TD<br>&<br>TS | TD100N       | 85                              |        | 100    | 200    |        | 100    | 200    | 100    | 120    | 200    |
|                        | TD100H       | 100                             |        |        | 200    |        |        | 200    |        | 120    | 200    |
|                        | TD160N       | 85                              |        |        |        |        | 100    | 200    |        |        |        |
|                        | TD160H       | 100                             |        |        |        |        |        | 200    |        |        |        |
|                        | TS100N       | 100                             |        |        |        |        |        |        |        | 120    | 200    |
|                        | TS100H       | 120                             |        |        |        |        |        |        |        |        | 200    |
|                        | TS160N       | 100                             |        |        |        |        |        |        |        |        |        |
|                        | TS160H       | 120                             |        |        |        |        |        |        |        |        |        |
|                        | TS250N       | 100                             |        |        |        |        |        |        |        |        |        |
|                        | TS250H       | 120                             |        |        |        |        |        |        |        |        |        |
|                        | TS400N       | 100                             |        |        |        |        |        |        |        |        |        |
|                        | TS400H       | 120                             |        |        |        |        |        |        |        |        |        |
|                        | TS630N       | 100                             |        |        |        |        |        |        |        |        |        |
|                        | TS630H       | 120                             |        |        |        |        |        |        |        |        |        |
|                        | TS800N       | 100                             |        |        |        |        |        |        |        |        |        |
|                        | TS800H       | 120                             |        |        |        |        |        |        |        |        |        |
|                        | TS1000N      | 55                              |        |        |        |        |        |        |        |        |        |
|                        | TS1000H      | 75                              |        |        |        |        |        |        |        |        |        |
|                        | TS1250N      | 55                              |        |        |        |        |        |        |        |        |        |
|                        | TS1250H      | 75                              |        |        |        |        |        |        |        |        |        |

# Technical information

Susol

## Protective coordination Cascading, network 220/240V

### Complementary technical information

Main: Susol TS series Branch: Metasol AB and Susol MCCB

| Branch breaker         |         | Main breaker                    | TS160N | TS160H | TS160L | TS250N | TS250H | TS250L | TS400N | TS400H | TS400L |
|------------------------|---------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        |         | Rated breaking capacity (kArms) | 100    | 120    | 200    | 100    | 120    | 200    | 100    | 120    | 200    |
| AB                     | ABS33c  | 30                              | 65     | 65     | 85     | 50     | 50     | 65     |        |        |        |
|                        | ABN53c  | 30                              | 85     | 100    | 100    | 50     | 50     | 65     |        |        |        |
|                        | ABS53c  | 35                              | 100    | 120    | 120    | 65     | 65     | 85     |        |        |        |
|                        | ABH53c  | 100                             |        |        |        |        | 120    | 120    |        |        |        |
|                        | ABN63c  | 30                              | 65     | 65     | 85     | 65     | 65     | 85     |        |        |        |
|                        | ABS63c  | 35                              | 85     | 100    | 100    | 85     | 85     | 100    |        |        |        |
|                        | ABN103c | 35                              | 100    | 120    | 120    | 85     | 100    | 120    |        |        |        |
|                        | ABS125c | 85                              |        |        |        | 100    | 100    | 120    | 100    | 120    | 150    |
|                        | ABH125c | 100                             |        |        |        |        | 120    | 150    | 100    | 120    | 150    |
|                        | ABN203c | 65                              |        |        |        | 85     | 85     | 100    | 85     | 85     | 100    |
|                        | ABS203c | 85                              |        |        |        | 100    | 100    | 120    | 100    | 120    | 150    |
|                        | ABH203c | 100                             |        |        |        |        | 120    | 150    | 100    | 120    | 150    |
|                        | ABN403c | 50                              |        |        |        |        |        |        | 85     | 100    | 100    |
|                        | ABS403c | 75                              |        |        |        |        |        |        | 100    | 120    | 120    |
|                        | ABH403c | 85                              |        |        |        |        |        |        | 100    | 120    | 150    |
|                        | ABL403c | 125                             |        |        |        |        |        |        |        |        | 200    |
|                        | ABN803c | 50                              |        |        |        |        |        |        |        |        |        |
|                        | ABS803c | 85                              |        |        |        |        |        |        |        |        |        |
|                        | ABL803c | 125                             |        |        |        |        |        |        |        |        |        |
| Susol<br>TD<br>&<br>TS | TD100N  | 85                              | 100    | 120    | 200    | 100    | 120    | 200    | 100    | 120    | 200    |
|                        | TD100H  | 100                             |        | 120    | 200    |        | 120    | 200    |        | 120    | 200    |
|                        | TD160N  | 85                              | 100    | 120    | 200    | 100    | 120    | 200    | 100    | 120    | 200    |
|                        | TD160H  | 100                             |        | 120    | 200    |        | 120    | 200    |        | 120    | 200    |
|                        | TS100N  | 100                             |        | 120    | 200    |        | 120    | 200    |        | 120    | 200    |
|                        | TS100H  | 120                             |        |        | 200    |        |        | 200    |        |        | 200    |
|                        | TS160N  | 100                             |        | 120    | 200    |        | 120    | 200    |        | 120    | 200    |
|                        | TS160H  | 120                             |        |        | 200    |        |        | 200    |        |        | 200    |
|                        | TS250N  | 100                             |        |        |        |        | 120    | 200    |        | 120    | 200    |
|                        | TS250H  | 120                             |        |        |        |        |        | 200    |        |        | 200    |
|                        | TS400N  | 100                             |        |        |        |        |        |        |        | 120    | 200    |
|                        | TS400H  | 120                             |        |        |        |        |        |        |        |        | 200    |
|                        | TS630N  | 100                             |        |        |        |        |        |        |        |        |        |
|                        | TS630H  | 120                             |        |        |        |        |        |        |        |        |        |
|                        | TS800N  | 100                             |        |        |        |        |        |        |        |        |        |
|                        | TS800H  | 120                             |        |        |        |        |        |        |        |        |        |
|                        | TS1000N | 55                              |        |        |        |        |        |        |        |        |        |
|                        | TS1000H | 75                              |        |        |        |        |        |        |        |        |        |
|                        | TS1250N | 55                              |        |        |        |        |        |        |        |        |        |
|                        | TS1250H | 75                              |        |        |        |        |        |        |        |        |        |

# Technical information

Susol

## Protective coordination Cascading, network 220/240V

### Complementary technical information

Main: Susol TS series

Branch: Metasol AB and Susol MCCB

| Branch breaker         |         | Main breaker                    | TS630N | TS630H | TS630L | TS800N | TS800H | TS800L |
|------------------------|---------|---------------------------------|--------|--------|--------|--------|--------|--------|
|                        |         | Rated breaking capacity (kArms) | 100    | 120    | 200    | 100    | 120    | 200    |
| AB                     | ABS33c  | 30                              |        |        |        |        |        |        |
|                        | ABN53c  | 30                              |        |        |        |        |        |        |
|                        | ABS53c  | 35                              |        |        |        |        |        |        |
|                        | ABH53c  | 100                             |        |        |        |        |        |        |
|                        | ABN63c  | 30                              |        |        |        |        |        |        |
|                        | ABS63c  | 35                              |        |        |        |        |        |        |
|                        | ABN103c | 35                              |        |        |        |        |        |        |
|                        | ABS125c | 85                              | 100    | 120    | 150    |        |        |        |
|                        | ABH125c | 100                             | 100    | 120    | 150    |        |        |        |
|                        | ABN203c | 65                              | 85     | 85     | 100    |        |        |        |
|                        | ABS203c | 85                              | 100    | 120    | 150    |        |        |        |
|                        | ABH203c | 100                             | 100    | 120    | 150    |        |        |        |
|                        | ABN403c | 50                              | 85     | 100    | 100    | 85     | 100    | 100    |
|                        | ABS403c | 75                              | 100    | 120    | 120    | 100    | 120    | 120    |
|                        | ABH403c | 85                              | 100    | 120    | 150    | 100    | 120    | 150    |
|                        | ABL403c | 125                             |        |        | 200    |        |        | 200    |
|                        | ABN803c | 50                              |        |        |        | 100    | 120    | 120    |
|                        | ABS803c | 85                              |        |        |        |        | 120    | 150    |
|                        | ABL803c | 125                             |        |        |        |        |        | 200    |
| Susol<br>TD<br>&<br>TS | TD100N  | 85                              | 100    | 120    | 200    | 100    | 120    | 200    |
|                        | TD100H  | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TD160N  | 85                              | 100    | 120    | 200    | 100    | 120    | 200    |
|                        | TD160H  | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS100N  | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS100H  | 120                             |        |        | 200    |        |        | 200    |
|                        | TS160N  | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS160H  | 120                             |        |        | 200    |        |        | 200    |
|                        | TS250N  | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS250H  | 120                             |        |        | 200    |        |        | 200    |
|                        | TS400N  | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS400H  | 120                             |        |        | 200    |        |        | 200    |
|                        | TS630N  | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS630H  | 120                             |        |        | 200    |        |        | 200    |
|                        | TS800N  | 100                             |        |        |        |        | 120    | 200    |
|                        | TS800H  | 120                             |        |        |        |        |        | 200    |
|                        | TS1000N | 55                              |        |        |        |        |        |        |
|                        | TS1000H | 75                              |        |        |        |        |        |        |
|                        | TS1250N | 55                              |        |        |        |        |        |        |
|                        | TS1250H | 75                              |        |        |        |        |        |        |

# Technical information

Susol

## Protective coordination Cascading, network 220/240V

### Complementary technical information

Main: Susol TS series

Branch: Metasol AB and Susol MCCB

| Branch breaker         |         | Main breaker                    | TS1000N | TS1000H | TS1000L | TS1250N | TS1250H | TS1600N | TS1600H |
|------------------------|---------|---------------------------------|---------|---------|---------|---------|---------|---------|---------|
|                        |         | Rated breaking capacity (kArms) | 55      | 75      | 200     | 55      | 75      | 55      | 75      |
| AB                     | ABS33c  | 30                              |         |         |         |         |         |         |         |
|                        | ABN53c  | 30                              |         |         |         |         |         |         |         |
|                        | ABS53c  | 35                              |         |         |         |         |         |         |         |
|                        | ABH53c  | 100                             |         |         |         |         |         |         |         |
|                        | ABN63c  | 30                              |         |         |         |         |         |         |         |
|                        | ABS63c  | 35                              |         |         |         |         |         |         |         |
|                        | ABN103c | 35                              |         |         |         |         |         |         |         |
|                        | ABS125c | 85                              |         |         |         |         |         |         |         |
|                        | ABH125c | 100                             |         |         |         |         |         |         |         |
|                        | ABN203c | 65                              |         |         |         |         |         |         |         |
|                        | ABS203c | 85                              |         |         |         |         |         |         |         |
|                        | ABH203c | 100                             |         |         |         |         |         |         |         |
|                        | ABN403c | 50                              | 55      | 75      | 200     | 55      | 75      | 55      | 75      |
|                        | ABS403c | 75                              |         |         | 200     |         |         |         |         |
|                        | ABH403c | 85                              |         |         | 200     |         |         |         |         |
|                        | ABL403c | 125                             |         |         | 200     |         |         |         |         |
|                        | ABN803c | 50                              | 55      | 75      | 200     | 55      | 75      | 55      | 75      |
|                        | ABS803c | 85                              |         |         | 200     |         |         |         |         |
|                        | ABL803c | 125                             |         |         | 200     |         |         |         |         |
| Susol<br>TD<br>&<br>TS | TD100N  | 85                              |         |         | 200     |         |         |         |         |
|                        | TD100H  | 100                             |         |         | 200     |         |         |         |         |
|                        | TD160N  | 85                              |         |         | 200     |         |         |         |         |
|                        | TD160H  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS100N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS100H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS160N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS160H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS250N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS250H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS400N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS400H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS630N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS630H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS800N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS800H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS1000N | 55                              |         |         | 200     |         | 75      |         | 75      |
|                        | TS1000H | 75                              |         |         | 200     |         |         |         |         |
|                        | TS1250N | 55                              |         |         | 200     |         | 75      |         | 75      |
|                        | TS1250H | 75                              |         |         | 200     |         |         |         |         |

# Technical information

Susol

## Protective coordination Cascading, network 380/415V

### Complementary technical information

Main: Susol TD/TS series

Branch: Metasol AB and Susol MCCB

| Branch breaker         |         | Main breaker                    | TD100N | TD100H | TD100L | TD160N | TD160H | TD160L | TS100N | TS100H | TS100L |
|------------------------|---------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        |         | Rated breaking capacity (kArms) | 50     | 85     | 150    | 50     | 85     | 150    | 50     | 85     | 150    |
| AB                     | ABS33c  | 14                              | 25     | 30     | 30     | 25     | 30     | 30     | 30     | 40     | 40     |
|                        | ABN53c  | 14                              | 35     | 50     | 50     | 35     | 50     | 50     | 35     | 65     | 65     |
|                        | ABS53c  | 18                              | 50     | 65     | 65     | 50     | 65     | 65     | 50     | 70     | 70     |
|                        | ABH53c  | 50                              |        |        |        |        |        |        |        |        |        |
|                        | ABN63c  | 14                              | 25     | 30     | 30     | 25     | 30     | 30     | 30     | 40     | 40     |
|                        | ABS63c  | 18                              | 35     | 50     | 50     | 35     | 50     | 50     | 35     | 65     | 65     |
|                        | ABN103c | 18                              | 50     | 65     | 65     | 50     | 65     | 65     | 50     | 70     | 70     |
|                        | ABS125c | 37                              | 50     | 65     | 65     | 50     | 65     | 65     | 50     | 70     | 70     |
|                        | ABH125c | 50                              |        |        |        |        |        |        |        |        |        |
|                        | ABN203c | 26                              |        |        |        |        |        |        |        |        |        |
|                        | ABS203c | 37                              |        |        |        |        |        |        |        |        |        |
|                        | ABH203c | 50                              |        |        |        |        |        |        |        |        |        |
|                        | ABN403c | 37                              |        |        |        |        |        |        |        |        |        |
|                        | ABS403c | 50                              |        |        |        |        |        |        |        |        |        |
|                        | ABH403c | 65                              |        |        |        |        |        |        |        |        |        |
|                        | ABL403c | 85                              |        |        |        |        |        |        |        |        |        |
|                        | ABN803c | 37                              |        |        |        |        |        |        |        |        |        |
|                        | ABS803c | 65                              |        |        |        |        |        |        |        |        |        |
|                        | ABL803b | 85                              |        |        |        |        |        |        |        |        |        |
| Susol<br>TD<br>&<br>TS | TD100N  | 50                              |        | 85     | 150    |        | 85     | 150    |        | 85     | 150    |
|                        | TD100H  | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TD160N  | 50                              |        |        |        |        | 85     | 150    |        |        |        |
|                        | TD160H  | 85                              |        |        |        |        |        | 150    |        |        |        |
|                        | TS100N  | 50                              |        |        |        |        |        |        |        | 85     | 150    |
|                        | TS100H  | 85                              |        |        |        |        |        |        |        |        | 150    |
|                        | TS160N  | 50                              |        |        |        |        |        |        |        |        |        |
|                        | TS160H  | 85                              |        |        |        |        |        |        |        |        |        |
|                        | TS250N  | 50                              |        |        |        |        |        |        |        |        |        |
|                        | TS250H  | 85                              |        |        |        |        |        |        |        |        |        |
|                        | TS400N  | 65                              |        |        |        |        |        |        |        |        |        |
|                        | TS400H  | 85                              |        |        |        |        |        |        |        |        |        |
|                        | TS630N  | 65                              |        |        |        |        |        |        |        |        |        |
|                        | TS630H  | 85                              |        |        |        |        |        |        |        |        |        |
|                        | TS800N  | 65                              |        |        |        |        |        |        |        |        |        |
|                        | TS800H  | 85                              |        |        |        |        |        |        |        |        |        |
|                        | TS1000N | 50                              |        |        |        |        |        |        |        |        |        |
|                        | TS1000H | 70                              |        |        |        |        |        |        |        |        |        |
|                        | TS1250N | 50                              |        |        |        |        |        |        |        |        |        |
|                        | TS1250H | 70                              |        |        |        |        |        |        |        |        |        |

# Technical information

Susol

## Protective coordination Cascading, network 380/415V

### Complementary technical information

Main: Susol TS series

Branch: Metasol AB and Susol MCCB

| Branch breaker         |         | Main breaker                    | TS160N | TS160H | TS160L | TS250N | TS250H | TS250L | TS400N | TS400H | TS400L |
|------------------------|---------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        |         | Rated breaking capacity (kArms) | 50     | 85     | 150    | 50     | 85     | 150    | 65     | 85     | 150    |
| AB                     | ABS33c  | 14                              | 30     | 40     | 40     | 30     | 40     | 40     |        |        |        |
|                        | ABN53c  | 14                              | 35     | 65     | 65     | 35     | 65     | 65     |        |        |        |
|                        | ABS53c  | 18                              | 50     | 70     | 70     | 50     | 70     | 70     |        |        |        |
|                        | ABH53c  | 50                              |        |        |        |        | 65     | 70     |        |        |        |
|                        | ABN63c  | 14                              | 30     | 40     | 40     | 30     | 40     | 40     |        |        |        |
|                        | ABS63c  | 18                              | 35     | 65     | 65     | 35     | 65     | 65     |        |        |        |
|                        | ABN103c | 18                              | 50     | 70     | 70     | 50     | 70     | 70     |        |        |        |
|                        | ABS125c | 37                              | 50     | 70     | 70     | 40     | 65     | 70     | 50     | 70     | 85     |
|                        | ABH125c | 50                              |        | 70     | 70     |        | 70     | 85     |        | 85     | 100    |
|                        | ABN203c | 26                              |        |        |        | 35     | 50     | 50     | 40     | 50     | 70     |
|                        | ABS203c | 37                              |        |        |        | 40     | 65     | 70     | 50     | 70     | 85     |
|                        | ABH203c | 50                              |        |        |        |        | 70     | 85     |        | 85     | 100    |
|                        | ABN403c | 37                              |        |        |        |        |        |        | 50     | 70     | 85     |
|                        | ABS403c | 50                              |        |        |        |        |        |        |        | 85     | 100    |
|                        | ABH403c | 65                              |        |        |        |        |        |        |        | 85     | 120    |
|                        | ABL403c | 85                              |        |        |        |        |        |        |        |        | 150    |
|                        | ABN803c | 37                              |        |        |        |        |        |        |        |        |        |
|                        | ABS803c | 65                              |        |        |        |        |        |        |        |        |        |
|                        | ABL803b | 85                              |        |        |        |        |        |        |        |        |        |
| Susol<br>TD<br>&<br>TS | TD100N  | 50                              |        | 85     | 150    |        | 85     | 150    | 65     | 85     | 150    |
|                        | TD100H  | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TD160N  | 50                              |        | 85     | 150    |        | 85     | 150    | 65     | 85     | 150    |
|                        | TD160H  | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TS100N  | 50                              |        | 85     | 150    |        | 85     | 150    | 65     | 85     | 150    |
|                        | TS100H  | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TS160N  | 50                              |        | 85     | 150    |        | 85     | 150    | 65     | 85     | 150    |
|                        | TS160H  | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TS250N  | 50                              |        |        |        |        | 85     | 150    | 65     | 85     | 150    |
|                        | TS250H  | 85                              |        |        |        |        |        | 150    |        |        | 150    |
|                        | TS400N  | 65                              |        |        |        |        |        |        |        | 85     | 150    |
|                        | TS400H  | 85                              |        |        |        |        |        |        |        |        | 150    |
|                        | TS630N  | 65                              |        |        |        |        |        |        |        |        |        |
|                        | TS630H  | 85                              |        |        |        |        |        |        |        |        |        |
|                        | TS800N  | 65                              |        |        |        |        |        |        |        |        |        |
|                        | TS800H  | 85                              |        |        |        |        |        |        |        |        |        |
|                        | TS1000N | 50                              |        |        |        |        |        |        |        |        |        |
|                        | TS1000H | 70                              |        |        |        |        |        |        |        |        |        |
|                        | TS1250N | 50                              |        |        |        |        |        |        |        |        |        |
|                        | TS1250H | 70                              |        |        |        |        |        |        |        |        |        |

# Technical information

Susol

## Protective coordination Cascading, network 380/415V

### Complementary technical information

Main: Susol TS series

Branch: Metasol AB and Susol MCCB

| Branch breaker         |         | Main breaker                    | TS630N | TS630H | TS630L | TS800N | TS800H | TS800L |
|------------------------|---------|---------------------------------|--------|--------|--------|--------|--------|--------|
|                        |         | Rated breaking capacity (kArms) | 65     | 85     | 150    | 65     | 100    | 150    |
| AB                     | ABS33c  | 14                              |        |        |        |        |        |        |
|                        | ABN53c  | 14                              |        |        |        |        |        |        |
|                        | ABS53c  | 18                              |        |        |        |        |        |        |
|                        | ABH53c  | 50                              |        |        |        |        |        |        |
|                        | ABN63c  | 14                              |        |        |        |        |        |        |
|                        | ABS63c  | 18                              |        |        |        |        |        |        |
|                        | ABN103c | 18                              |        |        |        |        |        |        |
|                        | ABS125c | 37                              | 50     | 70     | 85     |        |        |        |
|                        | ABH125c | 50                              |        | 85     | 100    |        |        |        |
|                        | ABN203c | 26                              | 40     | 50     | 70     |        |        |        |
|                        | ABS203c | 37                              | 50     | 70     | 85     |        |        |        |
|                        | ABH203c | 50                              |        | 85     | 100    |        |        |        |
|                        | ABN403c | 37                              | 50     | 70     | 85     | 50     | 70     | 85     |
|                        | ABS403c | 50                              |        | 85     | 100    |        | 85     | 100    |
|                        | ABH403c | 65                              |        | 85     | 120    | 65     | 100    | 120    |
|                        | ABL403c | 85                              |        |        | 150    |        | 100    | 150    |
|                        | ABN803c | 37                              |        |        |        | 65     | 85     | 100    |
|                        | ABS803c | 65                              |        |        |        | 65     | 100    | 120    |
|                        | ABL803b | 85                              |        |        |        |        | 100    | 150    |
| Susol<br>TD<br>&<br>TS | TD100N  | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TD100H  | 85                              |        |        | 150    |        |        | 150    |
|                        | TD160N  | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TD160H  | 85                              |        |        | 150    |        |        | 150    |
|                        | TS100N  | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TS100H  | 85                              |        |        | 150    |        |        | 150    |
|                        | TS160N  | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TS160H  | 85                              |        |        | 150    |        |        | 150    |
|                        | TS250N  | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TS250H  | 85                              |        |        | 150    |        |        | 150    |
|                        | TS400N  | 65                              |        | 85     | 150    |        | 100    | 150    |
|                        | TS400H  | 85                              |        |        | 150    |        |        | 150    |
|                        | TS630N  | 65                              |        | 85     | 150    |        | 100    | 150    |
|                        | TS630H  | 85                              |        |        | 150    |        |        | 150    |
|                        | TS800N  | 65                              |        |        |        |        | 100    | 150    |
|                        | TS800H  | 85                              |        |        |        |        |        |        |
|                        | TS1000N | 50                              |        |        |        |        |        |        |
|                        | TS1000H | 70                              |        |        |        |        |        |        |
|                        | TS1250N | 50                              |        |        |        |        |        |        |
|                        | TS1250H | 70                              |        |        |        |        |        |        |

# Technical information

Susol

## Protective coordination Cascading, network 380/415V

### Complementary technical information

Main: Susol TS series

Branch: Metasol AB and Susol MCCB

| Branch breaker         |         | Main breaker                    | TS1000N | TS1000H | TS1000L | TS1250N | TS1250H | TS1600N | TS1600H |
|------------------------|---------|---------------------------------|---------|---------|---------|---------|---------|---------|---------|
|                        |         | Rated breaking capacity (kArms) | 50      | 70      | 150     | 50      | 70      | 50      | 70      |
| AB                     | ABS33c  | 14                              |         |         |         |         |         |         |         |
|                        | ABN53c  | 14                              |         |         |         |         |         |         |         |
|                        | ABS53c  | 18                              |         |         |         |         |         |         |         |
|                        | ABH53c  | 50                              |         |         |         |         |         |         |         |
|                        | ABN63c  | 14                              |         |         |         |         |         |         |         |
|                        | ABS63c  | 18                              |         |         |         |         |         |         |         |
|                        | ABN103c | 18                              |         |         |         |         |         |         |         |
|                        | ABS125c | 37                              |         |         |         |         |         |         |         |
|                        | ABH125c | 50                              |         |         |         |         |         |         |         |
|                        | ABN203c | 26                              |         |         |         |         |         |         |         |
|                        | ABS203c | 37                              |         |         |         |         |         |         |         |
|                        | ABH203c | 50                              |         |         |         |         |         |         |         |
|                        | ABN403c | 37                              | 50      | 70      | 150     | 50      | 70      | 50      | 70      |
|                        | ABS403c | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | ABH403c | 65                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | ABL403c | 85                              |         |         | 150     |         |         |         |         |
|                        | ABN803c | 37                              | 50      | 70      | 150     | 50      | 70      | 50      | 70      |
|                        | ABS803c | 65                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | ABL803b | 85                              |         |         | 150     |         |         |         |         |
| Susol<br>TD<br>&<br>TS | TD100N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TD100H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TD160N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TD160H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS100N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS100H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS160N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS160H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS250N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS250H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS400N  | 65                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS400H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS630N  | 65                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS630H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS800N  | 65                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS800H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS1000N | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS1000H | 70                              |         |         | 150     |         |         |         |         |
|                        | TS1250N | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS1250H | 70                              |         |         | 150     |         |         |         |         |



## Protective coordination Motor protection cascading, network 220/240V

Main: Susol TD/TS series

Branch: Susol MCCB

| Branch breaker         |        | Main breaker                    | TD100N | TD100H | TD100L | TD160N | TD160H | TD160L | TS100N | TS100H | TS100L |
|------------------------|--------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        |        | Rated breaking capacity (kArms) | 85     | 100    | 200    | 85     | 100    | 200    | 100    | 120    | 200    |
| Susol<br>TD<br>&<br>TS | TD100N | 85                              |        | 100    | 200    |        | 100    | 200    | 100    | 120    | 200    |
|                        | TD100H | 100                             |        |        | 200    |        |        | 200    |        | 120    | 200    |
|                        | TD160N | 85                              |        |        |        |        | 100    | 200    |        |        |        |
|                        | TD160H | 100                             |        |        |        |        |        | 200    |        |        |        |
|                        | TS100N | 100                             |        |        |        |        |        |        |        | 120    | 200    |
|                        | TS100H | 120                             |        |        |        |        |        |        |        |        | 200    |
|                        | TS160N | 100                             |        |        |        |        |        |        |        |        |        |
|                        | TS160H | 120                             |        |        |        |        |        |        |        |        |        |

| Branch breaker         |        | Main breaker                    | TS160N | TS160H | TS160L | TS250N | TS250H | TS250L | TS400N | TS400H | TS400L |
|------------------------|--------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        |        | Rated breaking capacity (kArms) | 100    | 120    | 200    | 100    | 120    | 200    | 100    | 120    | 200    |
| Susol<br>TD<br>&<br>TS | TD100N | 85                              | 100    | 120    | 200    | 100    | 120    | 200    | 100    | 120    | 200    |
|                        | TD100H | 100                             |        | 120    | 200    |        | 120    | 200    |        | 120    | 200    |
|                        | TD160N | 85                              | 100    | 120    | 200    | 100    | 120    | 200    | 100    | 120    | 200    |
|                        | TD160H | 100                             |        | 120    | 200    |        | 120    | 200    |        | 120    | 200    |
|                        | TS100N | 100                             |        | 120    | 200    |        | 120    | 200    |        | 120    | 200    |
|                        | TS100H | 120                             |        |        | 200    |        |        | 200    |        |        | 200    |
|                        | TS160N | 100                             |        | 120    | 200    |        | 120    | 200    |        | 120    | 200    |
|                        | TS160H | 120                             |        |        | 200    |        |        | 200    |        |        | 200    |
|                        | TS250N | 100                             |        |        |        |        | 120    | 200    |        | 120    | 200    |
|                        | TS250H | 120                             |        |        |        |        |        | 200    |        |        | 200    |

| Branch breaker         |        | Main breaker                    | TS630N | TS630H | TS630L | TS800N | TS800H | TS800L |
|------------------------|--------|---------------------------------|--------|--------|--------|--------|--------|--------|
|                        |        | Rated breaking capacity (kArms) | 100    | 120    | 200    | 100    | 120    | 200    |
| Susol<br>TD<br>&<br>TS | TD100N | 85                              | 100    | 120    | 200    | 100    | 120    | 200    |
|                        | TD100H | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TD160N | 85                              | 100    | 120    | 200    | 100    | 120    | 200    |
|                        | TD160H | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS100N | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS100H | 120                             |        |        | 200    |        |        | 200    |
|                        | TS160N | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS160H | 120                             |        |        | 200    |        |        | 200    |
|                        | TS250N | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS250H | 120                             |        |        | 200    |        |        | 200    |
|                        | TS400N | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS400H | 120                             |        |        | 200    |        |        | 200    |
|                        | TS630N | 100                             |        | 120    | 200    |        | 120    | 200    |
|                        | TS630H | 120                             |        |        | 200    |        |        | 200    |
|                        | TS800N | 100                             |        |        |        |        | 120    | 200    |
|                        | TS800H | 120                             |        |        |        |        |        | 200    |

# Technical information

**Susol**

**Main: Susol TS series**

**Branch: Susol MCCB**

| Branch breaker         |         | Main breaker                    | TS1000N | TS1000H | TS1000L | TS1250N | TS1250H | TS1600N | TS1600H |
|------------------------|---------|---------------------------------|---------|---------|---------|---------|---------|---------|---------|
|                        |         | Rated breaking capacity (kArms) | 55      | 75      | 200     | 55      | 75      | 55      | 75      |
| Susol<br>TD<br>&<br>TS | TD100N  | 85                              |         |         | 200     |         |         |         |         |
|                        | TD100H  | 100                             |         |         | 200     |         |         |         |         |
|                        | TD160N  | 85                              |         |         | 200     |         |         |         |         |
|                        | TD160H  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS100N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS100H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS160N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS160H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS250N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS250H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS400N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS400H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS630N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS630H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS800N  | 100                             |         |         | 200     |         |         |         |         |
|                        | TS800H  | 120                             |         |         | 200     |         |         |         |         |
|                        | TS1000N | 55                              |         |         | 200     |         | 75      |         | 75      |
|                        | TS1000H | 75                              |         |         | 200     |         |         |         |         |
|                        | TS1250N | 55                              |         |         | 200     |         | 75      |         | 75      |
|                        | TS1250H | 75                              |         |         | 200     |         |         |         |         |

# Technical information

Susol

## Protective coordination Motor protection cascading, network 380/415V

Main: Susol TD/TS series

Branch: Susol MCCB

| Branch breaker         |        | Main breaker                    | TD100N | TD100H | TD100L | TD160N | TD160H | TD160L | TS100N | TS100H | TS100L |
|------------------------|--------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        |        | Rated breaking capacity (kArms) | 85     | 100    | 200    | 85     | 100    | 200    | 100    | 120    | 200    |
| Susol<br>TD<br>&<br>TS | TD100N | 50                              |        | 85     | 150    |        | 85     | 150    |        | 85     | 150    |
|                        | TD100H | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TD160N | 50                              |        |        |        |        | 85     | 150    |        |        |        |
|                        | TD160H | 85                              |        |        |        |        |        | 150    |        |        |        |
|                        | TS100N | 50                              |        |        |        |        |        |        |        | 85     | 150    |
|                        | TS100H | 85                              |        |        |        |        |        |        |        |        | 150    |
|                        | TS160N | 50                              |        |        |        |        |        |        |        |        |        |
|                        | TS160H | 85                              |        |        |        |        |        |        |        |        |        |

| Branch breaker         |        | Main breaker                    | TS160N | TS160H | TS160L | TS250N | TS250H | TS250L | TS400N | TS400H | TS400L |
|------------------------|--------|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|                        |        | Rated breaking capacity (kArms) | 100    | 120    | 200    | 100    | 120    | 200    | 100    | 120    | 200    |
| Susol<br>TD<br>&<br>TS | TD100N | 50                              |        | 85     | 150    |        | 85     | 150    | 65     | 85     | 150    |
|                        | TD100H | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TD160N | 50                              |        | 85     | 150    |        | 85     | 150    | 65     | 85     | 150    |
|                        | TD160H | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TS100N | 50                              |        | 85     | 150    |        | 85     | 150    | 65     | 85     | 150    |
|                        | TS100H | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TS160N | 50                              |        | 85     | 150    |        | 85     | 150    | 65     | 85     | 150    |
|                        | TS160H | 85                              |        |        | 150    |        |        | 150    |        |        | 150    |
|                        | TS250N | 50                              |        |        |        |        | 85     | 150    | 65     | 85     | 150    |
|                        | TS250H | 85                              |        |        |        |        |        | 150    |        |        | 150    |

| Branch breaker         |        | Main breaker                    | TS630N | TS630H | TS630L | TS800N | TS800H | TS800L |
|------------------------|--------|---------------------------------|--------|--------|--------|--------|--------|--------|
|                        |        | Rated breaking capacity (kArms) | 100    | 120    | 200    | 100    | 120    | 200    |
| Susol<br>TD<br>&<br>TS | TD100N | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TD100H | 85                              |        |        | 150    |        |        | 150    |
|                        | TD160N | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TD160H | 85                              |        |        | 150    |        |        | 150    |
|                        | TS100N | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TS100H | 85                              |        |        | 150    |        |        | 150    |
|                        | TS160N | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TS160H | 85                              |        |        | 150    |        |        | 150    |
|                        | TS250N | 50                              | 65     | 85     | 150    | 65     | 100    | 150    |
|                        | TS250H | 85                              |        |        | 150    |        |        | 150    |
|                        | TS400N | 65                              |        | 85     | 150    |        | 100    | 150    |
|                        | TS400H | 85                              |        |        | 150    |        |        | 150    |
|                        | TS630N | 65                              |        | 85     | 150    |        | 100    | 150    |
|                        | TS630H | 85                              |        |        | 150    |        |        | 150    |
|                        | TS800N | 65                              |        |        |        |        | 100    | 150    |
|                        | TS800H | 85                              |        |        |        |        |        |        |

# Technical information

**Susol**

**Main: Susol TS series**

**Branch: Susol MCCB**

| Branch breaker         |         | Main breaker                    | TS1000N | TS1000H | TS1000L | TS1250N | TS1250H | TS1600N | TS1600H |
|------------------------|---------|---------------------------------|---------|---------|---------|---------|---------|---------|---------|
|                        |         | Rated breaking capacity (kArms) | 55      | 75      | 200     | 55      | 75      | 55      | 75      |
| Susol<br>TD<br>&<br>TS | TD100N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TD100H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TD160N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TD160H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS100N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS100H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS160N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS160H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS250N  | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS250H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS400N  | 65                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS400H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS630N  | 65                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS630H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS800N  | 65                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS800H  | 85                              |         |         | 150     |         |         |         |         |
|                        | TS1000N | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS1000H | 70                              |         |         | 150     |         |         |         |         |
|                        | TS1250N | 50                              |         | 70      | 150     |         | 70      |         | 70      |
|                        | TS1250H | 70                              |         |         | 150     |         |         |         |         |

# Technical information

Susol

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol MCCB 100~800AF

Branch: AB type MCCB

| Branch breaker |         | Main breaker                       |     | TD100N/H/L                  |      |      |      |       |       |       |      | TD160N/H/L |      |      |     |
|----------------|---------|------------------------------------|-----|-----------------------------|------|------|------|-------|-------|-------|------|------------|------|------|-----|
|                |         |                                    |     | Trip units-Thermal magnetic |      |      |      |       |       |       |      |            |      |      |     |
|                |         | Rating (A)                         |     | 16                          | 20   | 25   | 32   | 40    | 50    | 63    | 80   | 100        | 100  | 125  | 160 |
| AB100          | N       |                                    | ~10 | 0.48                        | 0.48 | 0.48 | 0.48 | 0.48  | 0.6   | 0.756 | 0.96 | 1.2        | 1.2  | 1.50 | 2.0 |
|                |         |                                    | 15  |                             |      |      |      |       | 0.6   | 0.756 | 0.96 | 1.2        | 1.2  | 1.50 | 2.0 |
|                |         |                                    | 20  |                             |      |      |      |       | 0.6   | 0.756 | 0.96 | 1.2        | 1.2  | 1.50 | 2.0 |
|                |         |                                    | 30  |                             |      |      |      |       | 0.6   | 0.756 | 0.96 | 1.2        | 1.2  | 1.50 | 2.0 |
|                |         |                                    | 40  |                             |      |      |      |       |       | 0.756 | 0.96 | 1.2        | 1.2  | 1.50 | 2.0 |
|                |         |                                    | 50  |                             |      |      |      |       |       | 0.756 | 0.96 | 1.2        | 1.2  | 1.50 | 2.0 |
|                |         |                                    | 60  |                             |      |      |      |       |       |       | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 75  |                             |      |      |      |       |       |       | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 100 |                             |      |      |      |       |       |       |      |            | 1.50 | 2.0  |     |
| AB125          | S       | Trip units-<br>Thermal<br>magnetic | 15  |                             |      |      |      | 0.6   | 0.756 | 0.96  | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 20  |                             |      |      | 0.96 | 0.6   | 0.756 | 0.96  | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 30  |                             |      |      |      | 0.6   | 0.756 | 0.96  | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 40  |                             |      |      |      |       | 0.756 | 0.96  | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 50  |                             |      |      |      |       | 0.756 | 0.96  | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 60  |                             |      |      |      |       |       | 0.96  | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 75  |                             |      |      |      |       |       |       | 1.2  | 1.2        | 1.50 | 2.0  |     |
|                |         |                                    | 100 |                             |      |      |      |       |       |       |      |            | 1.50 | 2.0  |     |
|                |         |                                    | 125 |                             |      |      |      |       |       |       |      |            |      | 2.0  |     |
|                | H       | 15                                 |     |                             |      |      | 0.6  | 0.756 | 0.96  | 1.2   | 1.2  | 1.50       | 2.0  |      |     |
|                |         | 20                                 |     |                             |      |      | 0.6  | 0.756 | 0.96  | 1.2   | 1.2  | 1.50       | 2.0  |      |     |
|                |         | 30                                 |     |                             |      |      | 0.6  | 0.756 | 0.96  | 1.2   | 1.2  | 1.50       | 2.0  |      |     |
|                |         | 40                                 |     |                             |      |      |      | 0.756 | 0.96  | 1.2   | 1.2  | 1.50       | 2.0  |      |     |
|                |         | 50                                 |     |                             |      |      |      | 0.756 | 0.96  | 1.2   | 1.2  | 1.50       | 2.0  |      |     |
|                |         | 60                                 |     |                             |      |      |      |       | 0.96  | 1.2   | 1.2  | 1.50       | 2.0  |      |     |
|                |         | 75                                 |     |                             |      |      |      |       |       | 1.2   | 1.2  | 1.50       | 2.0  |      |     |
|                |         | 100                                |     |                             |      |      |      |       |       |       |      | 1.50       | 2.0  |      |     |
|                |         | 125                                |     |                             |      |      |      |       |       |       |      |            | 2.0  |      |     |
| AB203          | N       | Trip units-<br>Thermal<br>magnetic | 100 |                             |      |      |      |       |       |       |      |            | 1.50 | 2.0  |     |
|                |         |                                    | 125 |                             |      |      |      |       |       |       |      |            |      | 2.0  |     |
|                |         |                                    | 150 |                             |      |      |      |       |       |       |      |            |      | 2.0  |     |
|                |         |                                    | 175 |                             |      |      |      |       |       |       |      |            |      |      |     |
|                |         |                                    | 200 |                             |      |      |      |       |       |       |      |            |      |      |     |
|                |         |                                    | 225 |                             |      |      |      |       |       |       |      |            |      |      |     |
|                | S/<br>H | 250                                |     |                             |      |      |      |       |       |       |      |            |      |      |     |
|                |         | 100                                |     |                             |      |      |      |       |       |       |      |            | 1.50 | 2.0  |     |
|                |         | 125                                |     |                             |      |      |      |       |       |       |      |            |      | 2.0  |     |
|                |         | 150                                |     |                             |      |      |      |       |       |       |      |            |      | 2.0  |     |
|                |         | 175                                |     |                             |      |      |      |       |       |       |      |            |      |      |     |
|                |         | 200                                |     |                             |      |      |      |       |       |       |      |            |      |      |     |
|                |         | 225                                |     |                             |      |      |      |       |       |       |      |            |      |      |     |
|                |         | 250                                |     |                             |      |      |      |       |       |       |      |            |      |      |     |
|                |         |                                    |     |                             |      |      |      |       |       |       |      |            |      |      |     |

# Technical information

Susol

|  | TS100N/H/L                  |     |       |      |     | TS160N/H/L |      |     |      | TS250N/H/L |     |     |     | TS400N/H/L |     | TS630N/H/L |     | TS800N/H/L |
|--|-----------------------------|-----|-------|------|-----|------------|------|-----|------|------------|-----|-----|-----|------------|-----|------------|-----|------------|
|  | Trip units-Thermal magnetic |     |       |      |     |            |      |     |      |            |     |     |     |            |     |            |     |            |
|  | 40                          | 50  | 63    | 80   | 100 | 100        | 125  | 160 | 125  | 160        | 200 | 250 | 300 | 400        | 500 | 630        | 800 |            |
|  | 0.48                        | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | T          | T   | T          | T   |            |
|  |                             | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       |      | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       |      |     |            | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  | 0.4                         | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       |      | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       |      |     |            | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      | 2.0 |      | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  | 0.4                         | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             | 0.6 | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     | 0.756 | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       | 0.96 | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       |      | 1.2 | 1.2        | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | T   |            |
|  |                             |     |       |      |     |            | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      | 2.0 |      | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      | 2.0 |      | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      | 2.0 |      | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      |     |      |            | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      |     |      |            |     | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      |     |      |            |     |     | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      |     |      |            |     |     | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            | 1.50 | 2.0 | 1.50 | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      | 2.0 |      | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      | 2.0 |      | 2.0        | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      |     |      |            | 2.4 | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      |     |      |            |     | 3.0 | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      |     |      |            |     |     | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |
|  |                             |     |       |      |     |            |      |     |      |            |     |     | 3.6 | 4.8        | 6   | 7.6        | 9.6 |            |

# Technical information

Susol

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol MCCB 100~800AF(Electronic)

Branch: AB type MCCB

| Branch breaker |         | Main breaker                       |     | TS100N/H/L            |     | TS160N/H/L |     |     | TS250N/H/L |     |     |     |
|----------------|---------|------------------------------------|-----|-----------------------|-----|------------|-----|-----|------------|-----|-----|-----|
|                |         | Rating (A)                         |     | Trip units-Electronic |     |            |     |     |            |     |     |     |
|                |         |                                    |     | 40                    | 80  | 40         | 80  | 160 | 40         | 80  | 160 | 250 |
| AB100          | N       | Trip units-<br>Thermal<br>magnetic | ~10 | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 15  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 20  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 30  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 40  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 50  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 60  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 75  |                       |     |            |     | 2.1 |            |     | 2.1 | 3.3 |
|                |         |                                    | 100 |                       |     |            |     | 2.1 |            |     | 2.1 | 3.3 |
| AB125          | S       | Trip units-<br>Thermal<br>magnetic | 15  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 20  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 30  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 40  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 50  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 60  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 75  |                       |     |            |     | 2.1 |            |     | 2.1 | 3.3 |
|                |         |                                    | 100 |                       |     |            |     | 2.1 |            |     | 2.1 | 3.3 |
|                |         |                                    | 125 |                       |     |            |     |     |            |     |     | 3.3 |
|                | H       |                                    | 15  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 20  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 30  | 0.5                   | 1.0 | 0.5        | 1.0 | 2.1 | 0.5        | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 40  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 50  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
| AB203          | N       | Trip units-<br>Thermal<br>magnetic | 60  |                       | 1.0 |            | 1.0 | 2.1 |            | 1.0 | 2.1 | 3.3 |
|                |         |                                    | 75  |                       |     |            |     | 2.1 |            |     | 2.1 | 3.3 |
|                |         |                                    | 100 |                       |     |            |     | 2.1 |            |     | 2.1 | 3.3 |
|                |         |                                    | 125 |                       |     |            |     | 2.1 |            |     | 2.1 | 3.3 |
|                |         |                                    | 100 |                       |     |            |     |     |            |     |     | 3.3 |
|                |         |                                    | 125 |                       |     |            |     |     |            |     |     | 3.3 |
|                |         |                                    | 150 |                       |     |            |     |     |            |     |     | 3.3 |
|                |         |                                    | 175 |                       |     |            |     |     |            |     |     | 3.3 |
|                |         |                                    | 200 |                       |     |            |     |     |            |     |     |     |
|                | S/<br>H |                                    | 225 |                       |     |            |     |     |            |     |     |     |
|                |         |                                    | 250 |                       |     |            |     |     |            |     |     |     |
|                |         |                                    | 100 |                       |     |            |     |     |            |     |     | 3.3 |
|                |         |                                    | 125 |                       |     |            |     |     |            |     |     | 3.3 |
|                |         |                                    | 150 |                       |     |            |     |     |            |     |     | 3.3 |
|                |         |                                    | 175 |                       |     |            |     |     |            |     |     | 3.3 |
|                |         |                                    | 200 |                       |     |            |     |     |            |     |     |     |
|                |         |                                    | 225 |                       |     |            |     |     |            |     |     |     |
| 250            |         |                                    |     |                       |     |            |     |     |            |     |     |     |

**Susol**

LS ELECTRIC A-7-36



# Technical information

Susol

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol TD 100/160

Branch: Susol TD 100/160

| Branch breaker |   | Main breaker                       |     | TD100N/H/L                             |    |     |     |     |     |      | TD160N/H/L |     |      |      |     |
|----------------|---|------------------------------------|-----|----------------------------------------|----|-----|-----|-----|-----|------|------------|-----|------|------|-----|
|                |   | Rating (A)                         |     | Trip units-Thermal magnetic/Electronic |    |     |     |     |     |      |            |     |      |      |     |
|                |   |                                    |     | 16                                     | 20 | 25  | 32  | 40  | 50  | 63   | 80         | 100 | 100  | 125  | 160 |
| TD100          | N | Trip units-<br>Thermal<br>magnetic | 16  |                                        |    | 0.4 | 0.5 | 0.5 | 0.5 | 0.63 | 0.8        | 2   | 2    | 2    |     |
|                |   |                                    | 20  |                                        |    |     |     | 0.5 | 0.5 | 0.63 | 0.8        | 2   | 2    | 2    |     |
|                |   |                                    | 25  |                                        |    |     |     |     | 0.5 | 0.5  | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 32  |                                        |    |     |     |     |     | 0.5  | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 40  |                                        |    |     |     |     |     |      | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 50  |                                        |    |     |     |     |     |      | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 63  |                                        |    |     |     |     |     |      |            | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 80  |                                        |    |     |     |     |     |      |            |     |      | 1.25 | 2   |
|                |   |                                    | 100 |                                        |    |     |     |     |     |      |            |     |      |      | 1.6 |
|                | H |                                    | 16  |                                        |    |     | 0.5 | 0.5 | 0.5 | 0.63 | 0.8        | 2   | 2    | 2    | 2   |
|                |   |                                    | 20  |                                        |    |     |     |     | 0.5 | 0.5  | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 25  |                                        |    |     |     |     | 0.5 | 0.5  | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 32  |                                        |    |     |     |     |     | 0.5  | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 40  |                                        |    |     |     |     |     |      | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 50  |                                        |    |     |     |     |     |      | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 63  |                                        |    |     |     |     |     |      |            | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 80  |                                        |    |     |     |     |     |      |            |     |      | 1.25 | 2   |
|                |   |                                    | 100 |                                        |    |     |     |     |     |      |            |     |      | 1    | 1.6 |
|                | L |                                    | 16  |                                        |    |     | 0.5 | 0.5 | 0.5 | 0.63 | 0.8        | 2   | 2    | 2    | 2   |
|                |   |                                    | 20  |                                        |    |     |     |     | 0.5 | 0.5  | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 25  |                                        |    |     |     |     | 0.5 | 0.5  | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 32  |                                        |    |     |     |     |     | 0.5  | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 40  |                                        |    |     |     |     |     |      | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 50  |                                        |    |     |     |     |     |      | 0.63       | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 63  |                                        |    |     |     |     |     |      |            | 0.8 | 2    | 2    | 2   |
|                |   |                                    | 80  |                                        |    |     |     |     |     |      |            |     |      | 1.25 | 2   |
|                |   |                                    | 100 |                                        |    |     |     |     |     |      |            |     |      | 1    | 1.6 |
|                |   |                                    | 100 |                                        |    |     |     |     |     |      |            |     |      | 1    | 1.6 |
| TD160          | N | 125                                |     |                                        |    |     |     |     |     |      |            |     | 1.25 |      |     |
|                |   | 160                                |     |                                        |    |     |     |     |     |      |            |     |      |      |     |
|                |   | 100                                |     |                                        |    |     |     |     |     |      |            |     | 1.6  |      |     |
|                | H | 125                                |     |                                        |    |     |     |     |     |      |            |     | 1.25 |      |     |
|                |   | 160                                |     |                                        |    |     |     |     |     |      |            |     |      |      |     |
|                |   | 100                                |     |                                        |    |     |     |     |     |      |            |     | 1.6  |      |     |
|                | L | 125                                |     |                                        |    |     |     |     |     |      |            |     | 1.25 |      |     |
| 160            |   |                                    |     |                                        |    |     |     |     |     |      |            |     |      |      |     |

# Technical information

Susol

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol TS 100/160/250(Electronic)

Branch: Susol TD 100/160

| Branch breaker |   | Main breaker                       |     | TS100N/H/L                             |     |     |      |     | TS160N/H/L |      |     |      | TS250N/H/L |     |     |  |
|----------------|---|------------------------------------|-----|----------------------------------------|-----|-----|------|-----|------------|------|-----|------|------------|-----|-----|--|
|                |   | Rating (A)                         |     | Trip units-Thermal magnetic/Electronic |     |     |      |     |            |      |     |      |            |     |     |  |
|                |   |                                    |     | 40                                     | 50  | 63  | 80   | 100 | 100        | 125  | 160 | 125  | 160        | 200 | 250 |  |
| TD100          | N | Trip units-<br>Thermal<br>magnetic | 16  | 0.5                                    | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 20  | 0.5                                    | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 25  | 0.5                                    | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 32  |                                        |     | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 40  |                                        |     |     | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 50  |                                        |     |     | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 63  |                                        |     |     |      | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 80  |                                        |     |     |      | 0.8 | 1          | 1.25 | 2   | 1.25 | 36         | 36  | 36  |  |
|                |   |                                    | 100 |                                        |     |     |      |     |            | 1    | 1.6 | 1    | 36         | 36  | 36  |  |
|                | H |                                    | 16  | 0.5                                    | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 20  |                                        | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 25  |                                        | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 32  |                                        |     | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 40  |                                        |     |     | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 50  |                                        |     |     | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 63  |                                        |     |     |      | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 80  |                                        |     |     |      | 0.8 | 1          | 1.25 | 2   | 1.25 | 36         | 36  | 36  |  |
|                |   |                                    | 100 |                                        |     |     |      |     |            | 1    | 1.6 | 1    | 36         | 36  | 36  |  |
|                | L |                                    | 16  | 0.5                                    | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 20  |                                        | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 25  |                                        | 0.5 | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 32  |                                        |     | 0.5 | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 40  |                                        |     |     | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 50  |                                        |     |     | 0.63 | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 63  |                                        |     |     |      | 0.8 | 2          | 2    | 2   | 2    | 36         | 36  | 36  |  |
|                |   |                                    | 80  |                                        |     |     |      | 0.8 | 1          | 1.25 | 2   | 1.25 | 36         | 36  | 36  |  |
|                |   |                                    | 100 |                                        |     |     |      |     |            | 1    | 1.6 | 1    | 36         | 36  | 36  |  |
|                |   |                                    | 100 |                                        |     |     |      |     |            | 1    | 1.6 | 1    | 2.6        | 4   | 5   |  |
| TD160          | N | 125                                |     |                                        |     |     |      |     |            | 1.25 |     | 1.25 | 4          | 5   |     |  |
|                |   | 160                                |     |                                        |     |     |      |     |            |      |     |      |            | 5   |     |  |
|                |   | 100                                |     |                                        |     |     |      |     | 1          | 1.6  | 1   | 2.6  | 4          | 5   |     |  |
|                | H | 125                                |     |                                        |     |     |      |     |            | 1.25 |     | 1.25 | 4          | 5   |     |  |
|                |   | 160                                |     |                                        |     |     |      |     |            |      |     |      |            | 5   |     |  |
|                |   | 100                                |     |                                        |     |     |      |     | 1          | 1.6  | 1   | 2.6  | 4          | 5   |     |  |
|                | L | 125                                |     |                                        |     |     |      |     |            | 1.25 |     | 1.25 | 4          | 5   |     |  |
| 160            |   |                                    |     |                                        |     |     |      |     |            |      |     |      | 5          |     |     |  |

# Technical information

Susol

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol TS 400/630/800(Electronic)

Branch: Susol TS 100/160

| Branch<br>breaker |   | Main breaker                       |     | TS400N/H/L                             |     | TS630N/H/L |     | TS800N/H/L |  |
|-------------------|---|------------------------------------|-----|----------------------------------------|-----|------------|-----|------------|--|
|                   |   | Rating (A)                         |     | Trip units-Thermal magnetic/Electronic |     |            |     |            |  |
|                   |   |                                    |     | 300                                    | 400 | 500        | 630 | 800        |  |
| TD100             | N | Trip units-<br>Thermal<br>magnetic | 16  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 20  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 25  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 32  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 40  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 50  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 63  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 80  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 100 | T                                      | T   | T          | T   | T          |  |
|                   | H |                                    | 16  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 20  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 25  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 32  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 40  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 50  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 63  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 80  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 100 | T                                      | T   | T          | T   | T          |  |
|                   | L |                                    | 16  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 20  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 25  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 32  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 40  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 50  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 63  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 80  | T                                      | T   | T          | T   | T          |  |
|                   |   |                                    | 100 | T                                      | T   | T          | T   | T          |  |
| TD160             | N | 100                                | T   | T                                      | T   | T          | T   |            |  |
|                   |   | 125                                | T   | T                                      | T   | T          | T   |            |  |
|                   |   | 160                                | T   | T                                      | T   | T          | T   |            |  |
|                   | H | 100                                | T   | T                                      | T   | T          | T   |            |  |
|                   |   | 125                                | T   | T                                      | T   | T          | T   |            |  |
|                   |   | 160                                | T   | T                                      | T   | T          | T   |            |  |
|                   | L | 100                                | T   | T                                      | T   | T          | T   |            |  |
|                   |   | 125                                | T   | T                                      | T   | T          | T   |            |  |
|                   |   | 160                                | T   | T                                      | T   | T          | T   |            |  |

# Technical information

**Susol**

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol 1000/1250/1600

Branch: Susol TS 100/160

| Branch breaker |     | Main breaker                       |     | TS1000L                            |      | TS1000N/H |      | TS1250N/H | TS1600N/H |
|----------------|-----|------------------------------------|-----|------------------------------------|------|-----------|------|-----------|-----------|
|                |     | Rating (A)                         |     | Trip units-Electronic(Instant OFF) |      |           |      |           |           |
|                |     |                                    |     | 800                                | 1000 | 800       | 1000 | 1250      | 1600      |
| TD100          | N   | Trip units-<br>Thermal<br>magnetic | 16  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 20  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 25  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 32  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 40  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 50  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 63  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 80  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 100 | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | H   | 16                                 | T    | T         | T    | T         | T         |
|                | 20  |                                    |     | T                                  | T    | T         | T    | T         | T         |
|                | 25  |                                    |     | T                                  | T    | T         | T    | T         | T         |
|                | 32  |                                    |     | T                                  | T    | T         | T    | T         | T         |
|                | 40  |                                    |     | T                                  | T    | T         | T    | T         | T         |
|                | 50  |                                    |     | T                                  | T    | T         | T    | T         | T         |
|                | 63  |                                    |     | T                                  | T    | T         | T    | T         | T         |
|                | 80  |                                    |     | T                                  | T    | T         | T    | T         | T         |
|                | 100 |                                    |     | T                                  | T    | T         | T    | T         | T         |
|                | L   |                                    |     | 16                                 | T    | T         | T    | T         | T         |
|                |     |                                    | 20  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 25  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 32  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 40  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 50  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 63  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 80  | T                                  | T    | T         | T    | T         | T         |
|                |     |                                    | 100 | T                                  | T    | T         | T    | T         | T         |
| TD160          |     | N                                  | 100 | T                                  | T    | T         | T    | T         | T         |
|                | 125 |                                    | T   | T                                  | T    | T         | T    | T         |           |
|                | 160 |                                    | T   | T                                  | T    | T         | T    | T         |           |
|                | H   | 100                                | T   | T                                  | T    | T         | T    | T         |           |
|                |     | 125                                | T   | T                                  | T    | T         | T    | T         |           |
|                |     | 160                                | T   | T                                  | T    | T         | T    | T         |           |
|                | L   | 100                                | T   | T                                  | T    | T         | T    | T         |           |
|                |     | 125                                | T   | T                                  | T    | T         | T    | T         |           |
|                |     | 160                                | T   | T                                  | T    | T         | T    | T         |           |

# Technical information

Susol

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol TS 100/160/250(Electronic)

Branch: Susol TS 100/160/250

| Branch breaker |   | Main breaker                       |     | TS100N/H/L                             |    |    |      |     | TS160N/H/L |      |     | TS250N/H/L |      |     |     |
|----------------|---|------------------------------------|-----|----------------------------------------|----|----|------|-----|------------|------|-----|------------|------|-----|-----|
|                |   | Rating (A)                         |     | Trip units-Thermal magnetic/Electronic |    |    |      |     |            |      |     |            |      |     |     |
|                |   |                                    |     | 40                                     | 50 | 63 | 80   | 100 | 100        | 125  | 160 | 125        | 160  | 200 | 250 |
| TS100          | N | Trip units-<br>Thermal<br>magnetic | 40  |                                        |    |    | 0.63 | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 50  |                                        |    |    | 0.63 | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 63  |                                        |    |    |      | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 80  |                                        |    |    |      |     |            | 1.25 | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 100 |                                        |    |    |      |     |            | 1    | 1.6 | 1          | 2.6  | 4   | 5   |
|                | H |                                    | 40  |                                        |    |    | 0.63 | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 50  |                                        |    |    | 0.63 | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 63  |                                        |    |    |      | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 80  |                                        |    |    |      |     |            | 1.25 | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 100 |                                        |    |    |      |     |            | 1    | 1.6 | 1          | 2.6  | 4   | 5   |
|                | L |                                    | 40  |                                        |    |    | 0.63 | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 50  |                                        |    |    | 0.63 | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 63  |                                        |    |    |      | 0.8 | 2          | 2    | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 80  |                                        |    |    |      |     |            | 1.25 | 2   | 2          | 2.6  | 4   | 5   |
|                |   |                                    | 100 |                                        |    |    |      |     |            | 1    | 1.6 | 1          | 2.6  | 4   | 5   |
| TS160          | N | 100                                |     |                                        |    |    |      |     |            | 1.6  | 1   | 2.6        | 4    | 5   |     |
|                |   | 125                                |     |                                        |    |    |      |     |            | 1.25 |     | 1.25       | 4    | 5   |     |
|                |   | 160                                |     |                                        |    |    |      |     |            |      |     |            |      | 5   |     |
|                | H | 100                                |     |                                        |    |    |      |     |            | 1.6  | 1   | 2.6        | 4    | 5   |     |
|                |   | 125                                |     |                                        |    |    |      |     |            | 1.25 |     | 1.25       | 4    | 5   |     |
|                |   | 160                                |     |                                        |    |    |      |     |            |      |     |            |      | 5   |     |
|                | L | 100                                |     |                                        |    |    |      |     |            | 1.6  | 1   | 2.6        | 4    | 5   |     |
|                |   | 125                                |     |                                        |    |    |      |     |            | 1.25 |     | 1.25       | 4    | 5   |     |
|                |   | 160                                |     |                                        |    |    |      |     |            |      |     |            |      | 5   |     |
| TS250          | N | 125                                |     |                                        |    |    |      |     |            |      |     |            | 1.25 | 2.5 |     |
|                |   | 160                                |     |                                        |    |    |      |     |            |      |     |            |      | 2.5 |     |
|                |   | 200                                |     |                                        |    |    |      |     |            |      |     |            |      |     |     |
|                | H | 250                                |     |                                        |    |    |      |     |            |      |     |            | 1.25 | 2.5 |     |
|                |   | 160                                |     |                                        |    |    |      |     |            |      |     |            |      | 2.5 |     |
|                |   | 200                                |     |                                        |    |    |      |     |            |      |     |            |      |     |     |
|                | L | 250                                |     |                                        |    |    |      |     |            |      |     |            |      |     |     |
|                |   | 125                                |     |                                        |    |    |      |     |            |      |     |            | 1.25 | 2.5 |     |
|                |   | 160                                |     |                                        |    |    |      |     |            |      |     |            |      | 2.5 |     |
|                |   | 200                                |     |                                        |    |    |      |     |            |      |     |            |      |     |     |
|                |   | 250                                |     |                                        |    |    |      |     |            |      |     |            |      |     |     |

# Technical information

**Susol**

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol TS 400/630/800(Electronic) Branch: Susol TS 100/160/250

| Branch breaker |   | Main breaker                       |     | TS400N/H/L                             |     | TS630N/H/L |     | TS800N/H/L |  |
|----------------|---|------------------------------------|-----|----------------------------------------|-----|------------|-----|------------|--|
|                |   | Rating (A)                         |     | Trip units-Thermal magnetic/Electronic |     |            |     |            |  |
|                |   |                                    |     | 300                                    | 400 | 500        | 630 | 800        |  |
| TS100          | N | Trip units-<br>Thermal<br>magnetic | 40  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 50  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 63  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 80  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 100 | T                                      | T   | T          | T   | T          |  |
|                | H |                                    | 40  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 50  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 63  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 80  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 100 | T                                      | T   | T          | T   | T          |  |
|                | L |                                    | 40  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 50  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 63  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 80  | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 100 | T                                      | T   | T          | T   | T          |  |
| TS160          | N |                                    | 100 | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 125 | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 160 | T                                      | T   | T          | T   | T          |  |
|                | H |                                    | 100 | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 125 | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 160 | T                                      | T   | T          | T   | T          |  |
|                | L |                                    | 100 | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 125 | T                                      | T   | T          | T   | T          |  |
|                |   |                                    | 160 |                                        | T   | T          | T   | T          |  |
| TS250          | N |                                    | 125 | 5                                      | 5   | T          | T   | T          |  |
|                |   |                                    | 160 |                                        | 5   | T          | T   | T          |  |
|                |   |                                    | 200 |                                        |     | T          | T   | T          |  |
|                |   |                                    | 250 |                                        |     |            | T   | T          |  |
|                | H |                                    | 125 | 5                                      | 5   | T          | T   | T          |  |
|                |   |                                    | 160 |                                        | 5   | T          | T   | T          |  |
|                |   |                                    | 200 |                                        |     | T          | T   | T          |  |
|                |   |                                    | 250 |                                        |     |            | T   | T          |  |
|                | L |                                    | 125 | 5                                      | 5   | T          | T   | T          |  |
|                |   |                                    | 160 |                                        | 5   | T          | T   | T          |  |
|                |   |                                    | 200 |                                        |     | T          | T   | T          |  |
|                |   |                                    | 250 |                                        |     |            | T   | T          |  |

# Technical information

Susol

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: TS1000/1250/1600

Branch: TS100/160/250

| Branch breaker |   | Main breaker                       |     | TS1000L                            |      | TS1000N/H |      | TS1250N/H | TS1600N/H |
|----------------|---|------------------------------------|-----|------------------------------------|------|-----------|------|-----------|-----------|
|                |   | Rating (A)                         |     | Trip units-Electronic(Instant OFF) |      |           |      |           |           |
|                |   |                                    |     | 800                                | 1000 | 800       | 1000 | 1250      | 1600      |
| TS100          | N | Trip units-<br>Thermal<br>magnetic | 40  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 50  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 63  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 80  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 100 | T                                  | T    | T         | T    | T         | T         |
|                | H |                                    | 40  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 50  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 63  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 80  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 100 | T                                  | T    | T         | T    | T         | T         |
|                | L |                                    | 40  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 50  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 63  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 80  | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 100 | T                                  | T    | T         | T    | T         | T         |
| TS160          | N |                                    | 100 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 125 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 160 | T                                  | T    | T         | T    | T         | T         |
|                | H |                                    | 100 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 125 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 160 | T                                  | T    | T         | T    | T         | T         |
|                | L |                                    | 100 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 125 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 160 | T                                  | T    | T         | T    | T         | T         |
| TS250          | N |                                    | 125 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 160 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 200 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 250 | T                                  | T    | T         | T    | T         | T         |
|                | H |                                    | 125 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 160 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 200 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 250 | T                                  | T    | T         | T    | T         | T         |
|                | L |                                    | 125 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 160 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 200 | T                                  | T    | T         | T    | T         | T         |
|                |   |                                    | 250 | T                                  | T    | T         | T    | T         | T         |

# Technical information

**Susol**

## Protective coordination Protection discrimination table, Discrimination

### Complementary technical information

Main: Susol TS 400/630/800(Electronic)

Branch: Susol TS 400/630/800

| Branch<br>breaker |   | Main breaker                       |     | TS400N/H/L                             |     | TS630N/H/L |     | TS800N/H/L |  |
|-------------------|---|------------------------------------|-----|----------------------------------------|-----|------------|-----|------------|--|
|                   |   | Rating (A)                         |     | Trip units-Thermal magnetic/Electronic |     |            |     |            |  |
|                   |   |                                    |     | 300                                    | 400 | 500        | 630 | 800        |  |
| TS400             | N | Trip units-<br>Thermal<br>magnetic | 300 |                                        | 8   | 8          | T   |            |  |
|                   |   |                                    | 400 |                                        |     | 8          | 10  |            |  |
|                   | H |                                    | 300 |                                        | 8   | 8          | T   |            |  |
|                   |   |                                    | 400 |                                        |     | 8          | 10  |            |  |
|                   | L |                                    | 300 |                                        | 8   | 8          | T   |            |  |
|                   |   |                                    | 400 |                                        |     | 8          | 10  |            |  |
| TS630             | N |                                    | 500 |                                        |     | 8          | 10  |            |  |
|                   |   |                                    | 630 |                                        |     |            | 10  |            |  |
|                   | H |                                    | 500 |                                        |     | 8          | 10  |            |  |
|                   |   |                                    | 630 |                                        |     |            | 10  |            |  |
|                   | L |                                    | 500 |                                        |     | 8          | 10  |            |  |
|                   |   |                                    | 630 |                                        |     |            | 10  |            |  |
| TS800             | N | 800                                |     |                                        |     |            |     |            |  |
|                   | H | 800                                |     |                                        |     |            |     |            |  |
|                   | L | 800                                |     |                                        |     |            |     |            |  |

### Complementary technical information

Main: Susol TS 1000/1250/1600

Branch: Susol TS 400/630/800/1000/630/800(Electronic)

| Branch<br>breaker |   | Main breaker                               |      | TS1000L                            |      | TS1000N/H |      | TS1250N/H | TS1600N/H |
|-------------------|---|--------------------------------------------|------|------------------------------------|------|-----------|------|-----------|-----------|
|                   |   |                                            |      | Trip units-Electronic(Instant OFF) |      |           |      |           |           |
|                   |   | 800                                        | 1000 | 800                                | 1000 | 1250      | 1600 |           |           |
| TS400             | N | Trip units-<br>Thermal<br>magnetic<br>(TM) | 300  | 18                                 | 18   | T         | T    | T         | T         |
|                   |   |                                            | 400  | 18                                 | 18   | T         | T    | T         | T         |
|                   | H |                                            | 300  | 18                                 | 18   | T         | T    | T         | T         |
|                   |   |                                            | 400  | 18                                 | 18   | T         | T    | T         | T         |
|                   | L |                                            | 300  | 30                                 | 30   | T         | T    | T         | T         |
|                   |   |                                            | 400  | 30                                 | 30   | T         | T    | T         | T         |
| TS630             | N |                                            | 500  | 12                                 | 12   | T         | T    | T         | T         |
|                   |   |                                            | 630  |                                    | 12   |           | T    | T         | T         |
|                   | H |                                            | 500  | 12                                 | 12   | T         | T    | T         | T         |
|                   |   |                                            | 630  |                                    | 12   |           | T    | T         | T         |
|                   | L |                                            | 500  | 12                                 | 12   | T         | T    | T         | T         |
|                   |   |                                            | 630  |                                    | 12   |           | T    | T         | T         |
| TS800             | N |                                            | 800  |                                    |      |           |      | T         | T         |
|                   | H |                                            | 800  |                                    |      |           |      | T         | T         |
|                   | L |                                            | 800  |                                    |      |           |      | T         | T         |
| TS1000            | N | Trip units-<br>Electronic                  | 800  |                                    |      |           |      | 25        | 25        |
|                   |   |                                            | 1000 |                                    |      |           |      |           | 25        |
|                   | H |                                            | 800  |                                    |      |           |      | 25        | 25        |
|                   |   |                                            | 1000 |                                    |      |           |      |           | 25        |
|                   | L |                                            | 800  |                                    |      |           |      | 50        | 50        |
|                   |   |                                            | 1000 |                                    |      |           |      |           | 50        |



# Technical information

Susol

## Protective coordination Motor protection discrimination table

### Complementary technical information

Main: Susol MCCB

Branch: Susol MCCB

| Branch breaker | Main breaker |     | TD100N/H/L                  |    |    |    |    |    |    |     |     |
|----------------|--------------|-----|-----------------------------|----|----|----|----|----|----|-----|-----|
|                | Trip unit    |     | Trip units-Thermal magnetic |    |    |    |    |    |    |     |     |
|                | Rating (A)   |     | 16                          | 20 | 25 | 32 | 40 | 50 | 63 | 80  | 100 |
| TD100N/H/L     | FMU          | 16  |                             |    |    |    |    |    | 5  | 6.4 | 8   |
|                |              | 20  |                             |    |    |    |    |    |    | 6.4 | 8   |
|                |              | 25  |                             |    |    |    |    |    |    | 6.4 | 8   |
|                |              | 32  |                             |    |    |    |    |    |    |     | 8   |
|                |              | 40  |                             |    |    |    |    |    |    |     |     |
|                |              | 50  |                             |    |    |    |    |    |    |     |     |
|                |              | 63  |                             |    |    |    |    |    |    |     |     |
|                |              | 80  |                             |    |    |    |    |    |    |     |     |
|                |              | 100 |                             |    |    |    |    |    |    |     |     |
| TD160N/H/L     | FMU          | 100 |                             |    |    |    |    |    |    |     |     |
|                |              | 125 |                             |    |    |    |    |    |    |     |     |
|                |              | 160 |                             |    |    |    |    |    |    |     |     |
| TS100N/H/L     | MTU          | 100 |                             |    |    |    |    |    |    |     |     |
| TS160N/H/L     | MTU          | 150 |                             |    |    |    |    |    |    |     |     |
| TS250N/H/L     | MTU          | 220 |                             |    |    |    |    |    |    |     |     |
| TS400N/H/L     | MTU          | 320 |                             |    |    |    |    |    |    |     |     |
| TS630N/H/L     | MTU          | 500 |                             |    |    |    |    |    |    |     |     |
| TS100N/H/L     | ETS          | 40  |                             |    |    |    |    |    |    |     |     |
|                |              | 80  |                             |    |    |    |    |    |    |     |     |
|                |              | 100 |                             |    |    |    |    |    |    |     |     |
| TS160N/H/L     | ETS          | 150 |                             |    |    |    |    |    |    |     |     |
| TS250N/H/L     | ETS          | 220 |                             |    |    |    |    |    |    |     |     |
| TS400N/H/L     | ETS          | 320 |                             |    |    |    |    |    |    |     |     |

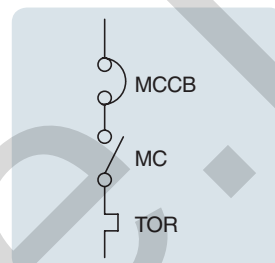
# Technical information

Susol

|  | TD160N/H/L |      |      | TS250N/H/L |     | TS100N/H/L |    | TS160N/H/L<br>TS250N/H/L |      |     | TS400N/H/L<br>TS630N/H/L |     | TS800N/H/L |     |
|--|------------|------|------|------------|-----|------------|----|--------------------------|------|-----|--------------------------|-----|------------|-----|
|  | FMU        |      |      | ATU        |     | ETS        |    | ETS                      |      |     | ETS/ETM                  |     | ETS/ETM    |     |
|  | 100        | 125  | 160  | 200        | 250 | 40         | 80 | 80                       | 160  | 250 | 400                      | 630 | 630        | 800 |
|  | 12.5       | 12.5 | 12.5 | 20         | 25  |            | 1  | 0.9                      | 1.75 | 36  | T                        | T   | T          | T   |
|  | 12.5       | 12.5 | 12.5 | 20         | 25  |            | 1  | 0.9                      | 1.75 | 36  | T                        | T   | T          | T   |
|  | 12.5       | 12.5 | 12.5 | 20         | 25  |            | 1  | 0.9                      | 1.75 | 36  | T                        | T   | T          | T   |
|  | 12.5       | 12.5 | 12.5 | 20         | 25  |            |    |                          | 1.75 | 36  | T                        | T   | T          | T   |
|  |            | 12.5 | 12.5 | 20         | 25  |            |    |                          | 1.75 | 36  | T                        | T   | T          | T   |
|  |            |      | 12.5 | 20         | 25  |            |    |                          | 1.75 | 36  | T                        | T   | T          | T   |
|  |            |      |      | 20         | 25  |            |    |                          |      | 36  | T                        | T   | T          | T   |
|  |            |      |      |            | 25  |            |    |                          |      | 36  | T                        | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     | T                        | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     | T                        | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     |                          | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     | T                        | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     |                          | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     |                          |     |            |     |
|  |            | 12.5 | 12.5 | 36         | 36  |            |    |                          | 1.75 | 3.6 | T                        | T   | T          | T   |
|  |            |      |      |            | 36  |            |    |                          |      | 3.6 | T                        | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     | T                        | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     |                          | T   | T          | T   |
|  |            |      |      |            |     |            |    |                          |      |     |                          |     |            |     |

## Protective coordination Type 2 Coordination according to IEC60947-4-1

| Performance: Ue=200/240V |       |       |       |
|--------------------------|-------|-------|-------|
| MCCB                     | N     | H     | L     |
| TD100                    | 85kA  | 100kA | 200kA |
| TS100                    | 100kA | 120kA | 200kA |



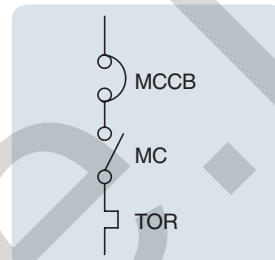
| Motor |      | MCCB           |               | Contactor | Thermal overload relay |                   |
|-------|------|----------------|---------------|-----------|------------------------|-------------------|
| kW    | A    | Type           | Rating Ir (A) | Type      | Type                   | Setting range (A) |
| 0.37  | 1.8  | TD100          | 16            | MC-9      | MT-32                  | 1.6-2.5           |
| 0.55  | 2.75 | TD100          | 16            | MC-32     | MT-32                  | 2.5-4             |
| 0.75  | 3.5  | TD100          | 16            | MC-32     | MT-32                  | 2.5-4             |
| 1.1   | 4.4  | TD100          | 16            | MC-40     | MT-63                  | 4-6               |
| 1.5   | 6.1  | TD100          | 16            | MC-40     | MT-63                  | 5-8               |
| 2.2   | 8.7  | TD100          | 16            | MC-40     | MT-63                  | 9-13              |
| 3     | 11.5 | TD100          | 16            | MC-40     | MT-63                  | 9-13              |
| 3.7   | 13.5 | TD100          | 16            | MC-40     | MT-63                  | 12-18             |
| 4     | 14.5 | TD100          | 16            | MC-40     | MT-63                  | 12-18             |
| 5.5   | 20   | TD100          | 20            | MC-40     | MT-63                  | 16-22             |
| 7.5   | 27   | TD100          | 32            | MC-40     | MT-63                  | 24-36             |
| 9     | 32   | TD100          | 32            | MC-85     | MT-95                  | 28-40             |
| 10    | 35   | TD100          | 40            | MC-85     | MT-95                  | 28-40             |
| 11    | 39   | TD100          | 40            | MC-85     | MT-95                  | 34-50             |
| 15    | 52   | TD100          | 63            | MC-85     | MT-95                  | 45-65             |
| 18.5  | 64   | TD100<br>TS100 | 80            | MC-85     | MT-95                  | 54-75             |
| 22    | 75   | TD100<br>TS100 | 80            | MC-85     | MT-95                  | 63-85             |
| 25    | 85   | TD100<br>TS100 | 100           | MC-85     | MT-95                  | 70-95             |

# Technical information

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## Protective coordination Type 2 Coordination according to IEC60947-4-1

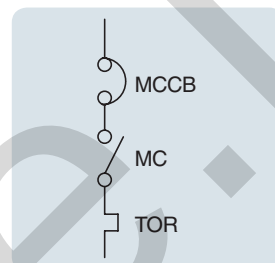
| Performance: Ue=380/415V |      |      |       |
|--------------------------|------|------|-------|
| MCCB                     | N    | H    | L     |
| TD100                    | 50kA | 85kA | 150kA |
| TS100                    | 50kA | 85kA | 150kA |



| Motor |      | MCCB           |                           | Contactor | Thermal overload relay |                   |
|-------|------|----------------|---------------------------|-----------|------------------------|-------------------|
| kW    | A    | Type           | Rating I <sub>r</sub> (A) | Type      | Type                   | Setting range (A) |
| 0.37  | 1.03 | TD100          | 16                        | MC-9      | MT-32                  | 1-1.6             |
| 0.55  | 1.6  | TD100          | 16                        | MC-9      | MT-32                  | 1-1.6             |
| 0.75  | 2    | TD100          | 16                        | MC-9      | MT-32                  | 1.6-2.5           |
| 1.1   | 2.6  | TD100          | 16                        | MC-32     | MT-32                  | 2.5-4             |
| 1.5   | 3.5  | TD100          | 16                        | MC-32     | MT-32                  | 2.5-4             |
| 2.2   | 5    | TD100          | 16                        | MC-40     | MT-63                  | 4-6               |
| 3     | 6.6  | TD100          | 16                        | MC-40     | MT-63                  | 5-8               |
| 3.7   | 7.7  | TD100          | 16                        | MC-40     | MT-63                  | 6-9               |
| 4     | 8.5  | TD100          | 16                        | MC-40     | MT-63                  | 7-10              |
| 5.5   | 11.5 | TD100          | 16                        | MC-40     | MT-63                  | 9-13              |
| 7.5   | 15.5 | TD100          | 16                        | MC-40     | MT-63                  | 12-18             |
| 9     | 18.5 | TD100          | 20                        | MC-40     | MT-63                  | 16-22             |
| 10    | 20   | TD100          | 20                        | MC-40     | MT-63                  | 16-22             |
| 11    | 22   | TD100          | 25                        | MC-40     | MT-63                  | 16-22             |
| 15    | 30   | TD100          | 32                        | MC-85     | MT-95                  | 24-36             |
| 18.5  | 37   | TD100<br>TS100 | 40                        | MC-85     | MT-95                  | 28-40             |
| 22    | 44   | TD100<br>TS100 | 50                        | MC-85     | MT-95                  | 34-50             |
| 25    | 52   | TD100<br>TS100 | 63                        | MC-85     | MT-95                  | 45-65             |
| 30    | 60   | TD100<br>TS100 | 63                        | MC-85     | MT-95                  | 45-65             |
| 33    | 68   | TD100<br>TS100 | 80                        | MC-85     | MT-95                  | 54-75             |
| 37    | 72   | TD100<br>TS100 | 80                        | MC-85     | MT-95                  | 63-85             |
| 40    | 79   | TD100<br>TS100 | 80                        | MC-85     | MT-95                  | 63-85             |
| 45    | 85   | TD100<br>TS100 | 100                       | MC-85     | MT-95                  | 70-95             |

## Protective coordination Type 2 Coordination according to IEC60947-4-1

| Performance: Ue=440V |      |      |       |
|----------------------|------|------|-------|
| MCCB                 | N    | H    | L     |
| TD100                | 42kA | 72kA | 130kA |
| TS100                | 42kA | 72kA | 130kA |



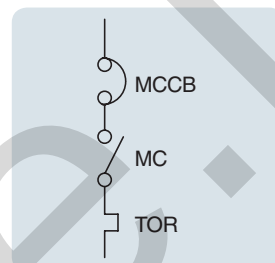
| Motor |      | MCCB           |                           | Contactor | Thermal overload relay |                   |
|-------|------|----------------|---------------------------|-----------|------------------------|-------------------|
| kW    | A    | Type           | Rating I <sub>r</sub> (A) | Type      | Type                   | Setting range (A) |
| 0.37  | 0.99 | TD100          | 16                        | MC-9      | MT-32                  | 0.63-1            |
| 0.55  | 1.36 | TD100          | 16                        | MC-9      | MT-32                  | 1-1.6             |
| 0.75  | 1.68 | TD100          | 16                        | MC-9      | MT-32                  | 1.6-2.5           |
| 1.1   | 2.37 | TD100          | 16                        | MC-9      | MT-32                  | 1.6-2.5           |
| 1.5   | 3.06 | TD100          | 16                        | MC-18     | MT-32                  | 2.5-4             |
| 2.2   | 4.42 | TD100          | 16                        | MC-25     | MT-32                  | 4-6               |
| 3     | 5.57 | TD100          | 16                        | MC-25     | MT-32                  | 4-6               |
| 3.7   | 7.1  | TD100          | 16                        | MC-32     | MT-32                  | 5-8               |
| 4     | 7.9  | TD100          | 16                        | MC-32     | MT-32                  | 6-9               |
| 5.5   | 10.4 | TD100          | 20                        | MC-32     | MT-32                  | 9-13              |
| 7.5   | 13.7 | TD100          | 20                        | MC-32     | MT-32                  | 12-18             |
| 9     | 16.9 | TD100          | 20                        | MC-40     | MT-63                  | 12-18             |
| 11    | 20.1 | TD100          | 25                        | MC-40     | MT-63                  | 16-22             |
| 15    | 26.5 | TD100          | 32                        | MC-40     | MT-63                  | 24-36             |
| 18.5  | 32.8 | TD100<br>TS100 | 40                        | MC-50     | MT-63                  | 28-40             |
| 22    | 39   | TD100<br>TS100 | 40                        | MC-50     | MT-63                  | 34-50             |
| 25    | 45.3 | TD100<br>TS100 | 50                        | MC-50     | MT-63                  | 34-50             |
| 30    | 51.5 | TD100<br>TS100 | 63                        | MC-65     | MT-95                  | 45-65             |
| 33    | 58   | TD100<br>TS100 | 63                        | MC-65     | MT-95                  | 45-65             |
| 37    | 64   | TD100<br>TS100 | 80                        | MC-65     | MT-95                  | 54-75             |
| 40    | 67   | TD100<br>TS100 | 80                        | MC-85     | MT-95                  | 54-75             |
| 45    | 76   | TD100<br>TS100 | 100                       | MC-85     | MT-95                  | 63-85             |

# Technical information

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## Protective coordination Type 2 Coordination according to IEC60947-4-1

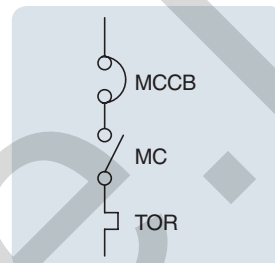
| Performance: Ue=480/500V |      |      |      |
|--------------------------|------|------|------|
| MCCB                     | N    | H    | L    |
| TD100                    | 30kA | 50kA | 65kA |
| TS100                    | 42kA | 65kA | 85kA |



| Motor |      | MCCB           |                           | Contactor | Thermal overload relay |                   |
|-------|------|----------------|---------------------------|-----------|------------------------|-------------------|
| kW    | A    | Type           | Rating I <sub>r</sub> (A) | Type      | Type                   | Setting range (A) |
| 0.37  | 1    | TD100          | 16                        | MC-9      | MT-32                  | 0.63-1            |
| 0.55  | 1.21 | TD100          | 16                        | MC-9      | MT-32                  | 1-1.6             |
| 0.75  | 1.5  | TD100          | 16                        | MC-9      | MT-32                  | 1-1.6             |
| 1.1   | 2    | TD100          | 16                        | MC-9      | MT-32                  | 1.6-2.5           |
| 1.5   | 2.6  | TD100          | 16                        | MC-32     | MT-32                  | 2.5-4             |
| 2.2   | 3.8  | TD100          | 16                        | MC-32     | MT-32                  | 2.5-4             |
| 3     | 5    | TD100          | 16                        | MC-40     | MT-63                  | 4-6               |
| 3.7   | 5.9  | TD100          | 16                        | MC-40     | MT-63                  | 5-8               |
| 4     | 6.5  | TD100          | 16                        | MC-40     | MT-63                  | 5-8               |
| 5.5   | 9    | TD100          | 16                        | MC-40     | MT-63                  | 7-10              |
| 7.5   | 12   | TD100          | 16                        | MC-40     | MT-63                  | 9-13              |
| 9     | 13.9 | TD100          | 16                        | MC-40     | MT-63                  | 12-18             |
| 11    | 15   | TD100          | 16                        | MC-85     | MT-95                  | 12-18             |
| 15    | 18.4 | TD100          | 20                        | MC-85     | MT-95                  | 16-22             |
| 18.5  | 23   | TD100          | 25                        | MC-85     | MT-95                  | 18-25             |
| 22    | 28.5 | TD100          | 32                        | MC-85     | MT-95                  | 24-36             |
| 25    | 33   | TD100<br>TS100 | 40                        | MC-85     | MT-95                  | 28-40             |
| 30    | 39.4 | TD100<br>TS100 | 40                        | MC-85     | MT-95                  | 34-50             |
| 33    | 45   | TD100<br>TS100 | 50                        | MC-85     | MT-95                  | 34-50             |
| 37    | 50   | TD100<br>TS100 | 50                        | MC-85     | MT-95                  | 45-65             |
| 40    | 55   | TD100<br>TS100 | 63                        | MC-85     | MT-95                  | 45-65             |
| 45    | 60   | TD100<br>TS100 | 63                        | MC-85     | MT-95                  | 54-75             |

## Protective coordination Type 2 Coordination according to IEC60947-4-1

| Performance: Ue=660/690V |      |      |      |
|--------------------------|------|------|------|
| MCCB                     | N    | H    | L    |
| TD100                    | 5kA  | 8kA  | 10kA |
| TS100                    | 10kA | 15kA | 20kA |



| Motor |      | MCCB           |                           | Contactor | Thermal overload relay |                   |
|-------|------|----------------|---------------------------|-----------|------------------------|-------------------|
| kW    | A    | Type           | Rating I <sub>r</sub> (A) | Type      | Type                   | Setting range (A) |
| 0.37  | 0.6  | TD100          | 16                        | MC-9      | MT-32                  | 0.4~0.63          |
| 0.55  | 0.9  | TD100          | 16                        | MC-9      | MT-32                  | 0.63-1            |
| 0.75  | 1.1  | TD100          | 16                        | MC-9      | MT-32                  | 1-1.6             |
| 1.1   | 1.5  | TD100          | 16                        | MC-9      | MT-32                  | 1-1.6             |
| 1.5   | 2    | TD100          | 16                        | MC-32     | MT-32                  | 1.6-2.5           |
| 2.2   | 2.8  | TD100          | 16                        | MC-32     | MT-32                  | 2.5-4             |
| 3     | 3.8  | TD100          | 16                        | MC-32     | MT-32                  | 2.5-4             |
| 3.7   | 4.4  | TD100          | 16                        | MC-40     | MT-63                  | 4-6               |
| 4     | 4.9  | TD100          | 16                        | MC-40     | MT-63                  | 4-6               |
| 5.5   | 6.6  | TD100          | 16                        | MC-40     | MT-63                  | 5-8               |
| 7.5   | 8.9  | TD100          | 16                        | MC-40     | MT-63                  | 7-10              |
| 9     | 10.6 | TD100          | 16                        | MC-85     | MT-95                  | 9-13              |
| 11    | 11.5 | TD100          | 16                        | MC-85     | MT-95                  | 9-13              |
| 15    | 14   | TD100          | 16                        | MC-85     | MT-95                  | 12-18             |
| 18.5  | 17.3 | TD100          | 20                        | MC-85     | MT-95                  | 16-22             |
| 22    | 21.3 | TD100          | 25                        | MC-85     | MT-95                  | 18-25             |
| 25    | 25.4 | TD100          | 32                        | MC-85     | MT-95                  | 24-36             |
| 30    | 30.3 | TD100          | 32                        | MC-85     | MT-95                  | 24-36             |
| 33    | 34.6 | TD100<br>TS100 | 40                        | MC-85     | MT-95                  | 28-40             |
| 37    | 39   | TD100<br>TS100 | 40                        | MC-85     | MT-95                  | 34-50             |
| 40    | 42   | TD100<br>TS100 | 50                        | MC-85     | MT-95                  | 34-50             |
| 45    | 44   | TD100<br>TS100 | 50                        | MC-85     | MT-95                  | 34-50             |

# Technical information

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## Protective coordination Type 2 Coordination according to IEC60947-4-1]

440V - N type

| Rated operational power |                    | MCCB   |               | Contactor | Thermal overload relays |                      | Short circuit       |                     |
|-------------------------|--------------------|--------|---------------|-----------|-------------------------|----------------------|---------------------|---------------------|
| kW                      | Current[A]<br>440V | Type   | Rating<br>[A] | Type      | Type                    | Setting<br>range [A] | breaking capacity   |                     |
|                         |                    |        |               |           |                         |                      | I <sub>r</sub> [kA] | I <sub>q</sub> [kA] |
| 1.1                     | 2.37               | TD100N | 16            | MC-12b    | MT-32                   | 2.5~4                | 1                   | 50                  |
| 1.5                     | 3.06               | TD100N | 16            | MC-18b    | MT-32                   | 2.5~4                | 1                   | 50                  |
| 2.2                     | 4.42               | TD100N | 16            | MC-22b    | MT-32                   | 4~6                  | 1                   | 50                  |
| 3                       | 5.77               | TD100N | 16            | MC-22b    | MT-32                   | 5~8                  | 1                   | 50                  |
| 4                       | 7.90               | TD100N | 16            | MC-32a    | MT-32                   | 6~9                  | 1                   | 50                  |
| 5.5                     | 10.40              | TD100N | 16            | MC-32a    | MT-32                   | 9~13                 | 3                   | 50                  |
| 7.5                     | 13.70              | TD100N | 20            | MC-32a    | MT-32                   | 12~18                | 3                   | 50                  |
| 11                      | 20.10              | TD100N | 32            | MC-40a    | MT-32                   | 18~25                | 3                   | 50                  |
| 15                      | 26.50              | TD100N | 40            | MC-40a    | MT-32                   | 22~32                | 3                   | 50                  |
| 18.5                    | 32.80              | TS100N | 40            | MC-50a    | MT-63                   | 28~40                | 3                   | 50                  |
| 22                      | 39.00              | TS100N | 50            | MC-50a    | MT-63                   | 34~50                | 3                   | 50                  |
| 30                      | 51.50              | TS100N | 63            | MC-65a    | MT-63                   | 45~65                | 3                   | 50                  |
| 37                      | 64.00              | TS100N | 80            | MC-75a    | MT-95                   | 54~75                | 5                   | 50                  |
| 45                      | 76.00              | TS100N | 100           | MC-85a    | MT-95                   | 63~85                | 5                   | 50                  |
| 55                      | 90.00              | TS100N | 100           | MC-100a   | MT-95                   | 70~95                | 5                   | 50                  |
| 59                      | 97.00              | TS160N | 100           | MC-130a   | MT-150                  | 80~105               | 5                   | 50                  |
| 75                      | 125                | TS160N | 160           | MC-150a   | MT-150                  | 110~150              | 10                  | 50                  |
| 90                      | 146                | TS160N | 160           | MC-185a   | MT-225                  | 120~185              | 10                  | 50                  |
| 110                     | 178                | TS250N | 200           | MC-185a   | MT-225                  | 160~240              | 10                  | 50                  |
| 132                     | 215                | TS250N | 250           | MC-225a   | MT-225                  | 160~240              | 10                  | 65                  |
| 160                     | 256                | TS400N | 300           | MC-400a   | MT-400                  | 200~330              | 18                  | 65                  |
| 200                     | 330                | TS400N | 400           | MC-400a   | MT-400                  | 260~400              | 18                  | 65                  |
| 220                     | 353                | TS400N | 400           | MC-400a   | MT-400                  | 260~400              | 18                  | 65                  |
| 250                     | 401                | TS630N | 500           | MC-630a   | MT-800                  | 260~400              | 18                  | 65                  |
| 300                     | 481                | TS630N | 500           | MC-630a   | MT-800                  | 400~630              | 18                  | 65                  |



## Protective coordination Type 2 Coordination according to IEC60947-4-1]

### 440V - H type

| Rated operational power |                    | MCCB   |               | Contactor | Thermal overload relays |                      | Short circuit breaking capacity |                     |
|-------------------------|--------------------|--------|---------------|-----------|-------------------------|----------------------|---------------------------------|---------------------|
| kW                      | Current[A]<br>440V | Type   | Rating<br>[A] | Type      | Type                    | Setting<br>range [A] | I <sub>r</sub> [kA]             | I <sub>q</sub> [kA] |
| 1.1                     | 2.37               | TD100H | 16            | MC-12b    | MT-32                   | 2.5~4                | 1                               | 50                  |
| 1.5                     | 3.06               | TD100H | 16            | MC-18b    | MT-32                   | 2.5~4                | 1                               | 50                  |
| 2.2                     | 4.42               | TD100H | 16            | MC-22b    | MT-32                   | 4~6                  | 1                               | 50                  |
| 3                       | 5.77               | TD100H | 16            | MC-22b    | MT-32                   | 5~8                  | 1                               | 50                  |
| 4                       | 7.90               | TD100H | 16            | MC-32a    | MT-32                   | 6~9                  | 1                               | 50                  |
| 5.5                     | 10.40              | TD100H | 16            | MC-32a    | MT-32                   | 9~13                 | 3                               | 50                  |
| 7.5                     | 13.70              | TD100H | 20            | MC-32a    | MT-32                   | 12~18                | 3                               | 70                  |
| 11                      | 20.10              | TD100H | 32            | MC-40a    | MT-32                   | 18~25                | 3                               | 70                  |
| 15                      | 26.50              | TD100H | 40            | MC-40a    | MT-32                   | 22~32                | 3                               | 70                  |
| 18.5                    | 32.80              | TS100H | 40            | MC-50a    | MT-63                   | 28~40                | 3                               | 70                  |
| 22                      | 39.00              | TS100H | 50            | MC-50a    | MT-63                   | 34~50                | 3                               | 70                  |
| 30                      | 51.50              | TS100H | 63            | MC-65a    | MT-63                   | 45~65                | 3                               | 70                  |
| 37                      | 64.00              | TS100H | 80            | MC-75a    | MT-95                   | 54~75                | 5                               | 70                  |
| 45                      | 76.00              | TS100H | 100           | MC-85a    | MT-95                   | 63~85                | 5                               | 70                  |
| 55                      | 90.00              | TS100H | 100           | MC-100a   | MT-95                   | 70~95                | 5                               | 70                  |
| 59                      | 97.00              | TS160H | 100           | MC-130a   | MT-150                  | 80~105               | 5                               | 70                  |
| 75                      | 125                | TS160H | 160           | MC-150a   | MT-150                  | 110~150              | 10                              | 70                  |
| 90                      | 146                | TS160H | 160           | MC-185a   | MT-225                  | 120~185              | 10                              | 70                  |
| 110                     | 178                | TS250H | 200           | MC-185a   | MT-225                  | 160~240              | 10                              | 70                  |
| 132                     | 215                | TS250H | 250           | MC-225a   | MT-225                  | 160~240              | 10                              | 70                  |
| 160                     | 256                | TS400H | 300           | MC-400a   | MT-400                  | 200~330              | 18                              | 85                  |
| 200                     | 330                | TS400H | 400           | MC-400a   | MT-400                  | 260~400              | 18                              | 85                  |
| 220                     | 353                | TS400H | 400           | MC-400a   | MT-400                  | 260~400              | 18                              | 85                  |
| 250                     | 401                | TS630H | 500           | MC-630a   | MT-800                  | 260~400              | 18                              | 85                  |
| 300                     | 481                | TS630H | 500           | MC-630a   | MT-800                  | 400~630              | 18                              | 100                 |

# Technical information

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## Protective coordination Type 2 Coordination according to IEC60947-4-1]

### 440V - L type

| Rated operational power |                    | MCCB   |               | Contactor | Thermal overload relays |                      | Short circuit breaking capacity |                     |
|-------------------------|--------------------|--------|---------------|-----------|-------------------------|----------------------|---------------------------------|---------------------|
| kW                      | Current[A]<br>440V | Type   | Rating<br>[A] | Type      | Type                    | Setting<br>range [A] | I <sub>r</sub> [kA]             | I <sub>q</sub> [kA] |
| 1.1                     | 2.37               | TD100L | 16            | MC-12b    | MT-32                   | 2.5~4                | 1                               | 50                  |
| 1.5                     | 3.06               | TD100L | 16            | MC-18b    | MT-32                   | 2.5~4                | 1                               | 50                  |
| 2.2                     | 4.42               | TD100L | 16            | MC-22b    | MT-32                   | 4~6                  | 1                               | 50                  |
| 3                       | 5.77               | TD100L | 16            | MC-22b    | MT-32                   | 5~8                  | 1                               | 50                  |
| 4                       | 7.90               | TD100L | 16            | MC-32a    | MT-32                   | 6~9                  | 1                               | 50                  |
| 5.5                     | 10.40              | TD100L | 16            | MC-32a    | MT-32                   | 9~13                 | 3                               | 50                  |
| 7.5                     | 13.70              | TD100L | 20            | MC-32a    | MT-32                   | 12~18                | 3                               | 100                 |
| 11                      | 20.10              | TD100L | 32            | MC-40a    | MT-32                   | 18~25                | 3                               | 100                 |
| 15                      | 26.50              | TD100L | 40            | MC-40a    | MT-32                   | 22~32                | 3                               | 100                 |
| 18.5                    | 32.80              | TS100L | 40            | MC-50a    | MT-63                   | 28~40                | 3                               | 130                 |
| 22                      | 39.00              | TS100L | 50            | MC-50a    | MT-63                   | 34~50                | 3                               | 130                 |
| 30                      | 51.50              | TS100L | 63            | MC-65a    | MT-63                   | 45~65                | 3                               | 130                 |
| 37                      | 64.00              | TS100L | 80            | MC-75a    | MT-95                   | 54~75                | 5                               | 130                 |
| 45                      | 76.00              | TS100L | 100           | MC-85a    | MT-95                   | 63~85                | 5                               | 130                 |
| 55                      | 90.00              | TS100L | 100           | MC-100a   | MT-95                   | 70~95                | 5                               | 130                 |
| 59                      | 97.00              | TS160L | 100           | MC-130a   | MT-150                  | 80~105               | 5                               | 130                 |
| 75                      | 125                | TS160L | 160           | MC-150a   | MT-150                  | 110~150              | 10                              | 130                 |
| 90                      | 146                | TS160L | 160           | MC-185a   | MT-225                  | 120~185              | 10                              | 130                 |
| 110                     | 178                | TS250L | 200           | MC-185a   | MT-225                  | 160~240              | 10                              | 130                 |
| 132                     | 215                | TS250L | 250           | MC-225a   | MT-225                  | 160~240              | 10                              | 130                 |
| 160                     | 256                | TS400L | 300           | MC-400a   | MT-400                  | 200~330              | 18                              | 130                 |
| 200                     | 330                | TS400L | 400           | MC-400a   | MT-400                  | 260~400              | 18                              | 130                 |
| 220                     | 353                | TS400L | 400           | MC-400a   | MT-400                  | 260~400              | 18                              | 130                 |
| 250                     | 401                | TS630L | 500           | MC-630a   | MT-800                  | 260~400              | 18                              | 130                 |
| 300                     | 481                | TS630L | 500           | MC-630a   | MT-800                  | 400~630              | 18                              | 130                 |

## How to calculate short-circuit current value Various short-circuit

The purpose of calculating short circuit values

- Selection of circuit breakers, fuse.
- Adjusting metering devices
- Consideration for mechanical resistance
- Consideration for thermal resistance

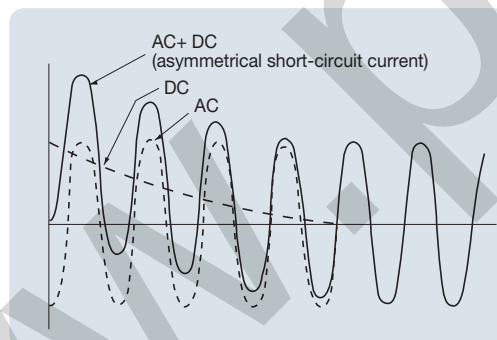
Various value of short-circuit current should be applied to the tests for upper factors.

Symmetrical current for AC and asymmetrical current for DC are used for classifying short circuit current.

Their differences should be essentially considered in the basic step of making network plan.

### Symmetrical short-circuit current real value

Short-circuit current is composed of AC and DC as it shows on <Fig.1>. The short-circuit which indicates the real value of AC is called as symmetrical short-current real value,  $I (rms)_{sym}$ . This current is the essential factor of selecting MCCB, ACB, fuse.



<Fig.1> Composition of short-circuit current

### Maximum asymmetrical short-circuit current real value: $I (rms)_{asym}$

The short-circuit which indicates the real value of DC is called as asymmetrical short-circuit current real value.

And this current value is changeable upon the short-circuit closing phase.

This current value is treated for checking the thermal resistant strength of wirings, CT and etc. With symmetrical short-circuit current real value and short-circuit power factor, we can achieve the value,  $\alpha$  from <Fig.5>.

and maximum asymmetrical short-circuit current real value is calculated with this formula.

$$I (rms)_{asym} = \alpha I (rms)_{sym}$$

### 3-phases average asymmetrical short-circuit current real value: $I (rms)_{ave}$

Each phase is different in its input current value in 3 phases circuit. So that AC rate for 3 phases is different. This value is the average of asymmetrical short-circuit current of 3 phases.

And with symmetrical short-circuit current real value and short-circuit power factor, we can achieve the value,  $\beta$ , and 3-phases average asymmetrical short circuit current real value is calculated with this formula.

$$I (rms)_{ave} = \beta I (rms)_{sym}$$

### Maximum asymmetrical short-circuit current instantaneous value: $I_{max}$

Each phase has different instantaneous current value. And when asymmetrical short-circuit current shows its maximum instantaneous value, the current value is called as maximum asymmetrical short-circuit current instantaneous value. This current is to test the mechanical strength of serial equipments.

And with symmetrical short-circuit current real value and short-circuit power factor, we can achieve the value,  $\gamma$  and maximum asymmetrical short-circuit current instantaneous value is calculated with this formula.

$$I_{max} = \gamma I (rms)_{sym}$$

### Network impedance for calculating short-circuit current value

Belows should be considered for the calculation as the impedance components affecting circuit to trouble spot from short-circuit power.

- Primary part impedance of incoming transformer It's calculated from the short-circuit current data which is provided by power supplier. Calculated value can be regarded as reactance.
- Impedance of incoming transformer Its amount is upon the capacity of transformer and primary voltage. Generally this impedance can be regarded as reactance and refer to <Table.4>, <Table.5>.

## How to calculate short-circuit current value Various short-circuit

### c. Reactance of motor

Motor works as generator and supply short circuit current in the condition of an accident circuit such as <Fig.2>.

Generation factor of firm motor should be considered in a low voltage circuit where a circuit breaker operates quickly and in a high voltage circuit for the selection of fuse. Reactance of motor can be regarded in the range of 25% normally.

### d. Distribution impedance

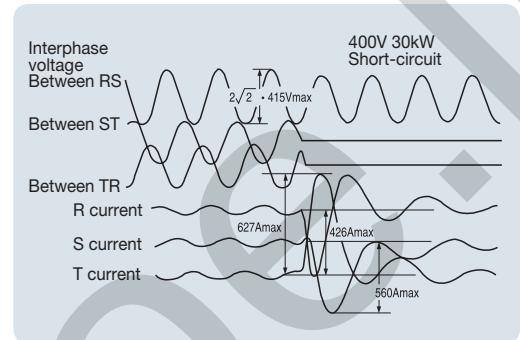
Impedance of cable and busduct do control short-circuit remarkably in low voltage network. Refer to <Table.5>, <Table.6>.

### e. Others

MCCB, ACB CT are equipments for the network of low voltage.

The impedance of these equipment which is calculated from short-circuit current value should be considered.

Generally, the impedance of those equipment is that of rated current (normal condition), if operators apply that impedance value, bigger reactance value may be applied to calculated short-circuit current value.



<Fig.2> Short-circuit of motor

## How to calculate short-circuit current value With percent impedance

Ohm formula ( $\Omega$ ), percent impedance formula (%), unit formula (per unit) can be applied to calculate short-circuit current value.

### Ohm formula [ $\Omega$ ]

Short-circuit current value is calculated by converting into ohm value [ $\Omega$ ]

### Percent impedance formula (%) Each impedance is converted into the impedance of base value and base voltage.

And the required amount for electric demand should be shown as percent unit.  
And apply that value in ohm formula.

### Unit formula

The base value equals 1.0. and all value of network shows in the way of decimal system. Applying any of upper calculation formulas to achieve short-circuit current value, it shows equal value. To select a certain formula for doing it, operator can select one of those formula which is proper to oneself. Below is percent impedance formula.

### Finding base value

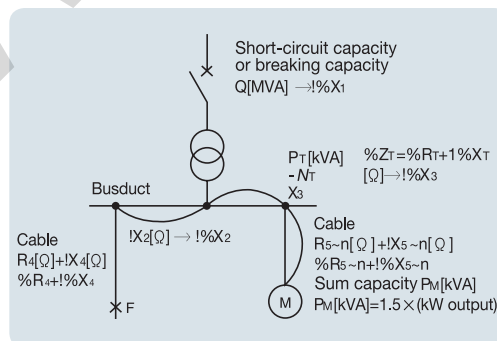
The rated current of transformer shall be the base value.

Base capacity  $P_b = P_T$  [kVA]

Base voltage  $V_b = V_T$  [V]

Base current  $I_b = I_T = \frac{P_T}{\sqrt{3}V_T} \times 10^3$  [A]

Base impedance  $Z_b = \frac{V_b^2}{P_b \times 10^3} = \frac{V_T^2}{P_T \times 10^3}$  [ $\Omega$ ]



<Fig.3> Base value

### Converting impedance into base value

a. Primary part impedance of transformer:  $\%X_1$

$$\%X_1 = \frac{P_b}{Q \times 10^3} \times 100 [\%]$$

Q: Primary part short-circuit capacity

b. Impedance of transformer:  $\%Z_T$

It generally indicates as percent impedance. If base capacity is equal to transformer capacity,  $\%Z_T$  can be used as it is. When base capacity is not equal to transformer capacity, convert values by this formula.

$$\frac{P_T}{\%Z_T} = \frac{P_b}{\%Z_b}$$

%: value converted by base value

1phase transformer should converted into the value of 3 phase transformer, And the percent impedance is equal to  $\frac{\sqrt{3}}{2} \times$  calculated urgent value.

c. Reactance of motor:  $\%X_m$

Transformer capacity shows the value in kW, so it is converted into unit, kVA.

(kVA value)  $\approx 1.5 \times$  (Output of motor, kW)

$\%X_m = 25\%$  Converting it from base capacity

$$\frac{P_m}{\%X_m} = \frac{P_b}{\%X_m}$$

(Converting formula for different capacity)

d. Impedance of busduct, cable

Cable: Area of cross-section & length

Busduct: Rated current

In <Fig.5>, <Fig.6>

$Z_c = (\Omega \text{ per each unit length}) \times (\text{length}) [\Omega]$

Convert this value into % value.

$$\%Z_c = \frac{Z_c}{Z_b}$$

(% converting formula)

2cables in same dimension, it's recommendable to divide the length by 2.

# Technical information

Susol

## How to calculate short-circuit current value

### Preparing a impedance map

Prepare impedance map according to the impedance value from (2). Various electricity suppliers like source, motor have same electric potential in impedance map.

As you find it on <Fig.4> (a), extend it from the unlimited bus to fault point, draw impedance map.

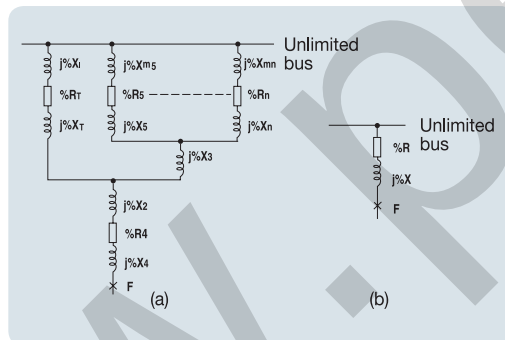
### Calculating impedance

Calculate impedance as <Fig.4 (b)> in impedance map < Fig.4 (a)>

$$\%Z = \%R + j \%X$$

$$\%Z = \sqrt{(\%R)^2 + (\%X)^2}$$

### Calculating symmetrical short-circuit current real value



<Fig.4> Base value

### Calculating various short-circuit current value

$$I_F(3\phi) = I_F(\text{rms})_{\text{sym}}(3\phi)$$

$$= \frac{P_B \times 10^3}{\sqrt{3} V_B \cdot \%Z} \times 100$$

$$= \frac{I_B}{\%Z} \times 100 [\text{A}]$$

Calculate various short-circuit current value with  $\alpha$ ,  $\beta$ ,  $\gamma$  values from <Fig.5> like

$$\text{short-circuit power factor } \cos \phi = \frac{\%R}{\%Z}$$

3 phases average asymmetrical real value

$$I_F(\text{rms})_{\text{ave}} = \beta I_F(\text{rms})_{\text{sym}}$$

Maximum average asymmetrical real value

$$I_F(\text{rms})_{\text{asym}} = \alpha I_F(\text{rms})_{\text{sym}}$$

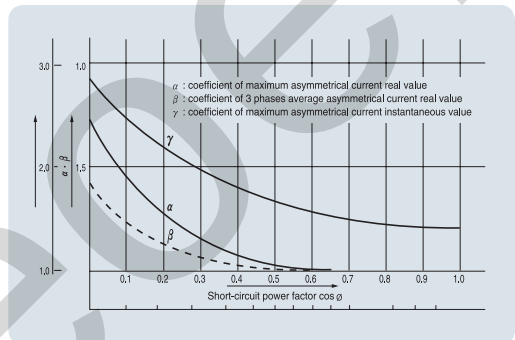
Maximum asymmetrical instantaneous value

$$I_F \text{max} = \gamma I_F(\text{rms})_{\text{sym}}$$

### In case of 1 phase short-circuit

Current value from (5) multiplied by  $\frac{\sqrt{3}}{2}$

Each short-circuit current value (1  $\phi$ ) =  $\frac{\sqrt{3}}{2}$  (3phases short-circuit current)  $\times \alpha$  (or  $\gamma$ )<sup>2</sup>



<Fig.5>

## How to calculate short-circuit current value With a simple formula

For its special cases, calculating exact value should be needed, in the other hand, for the practical use, we recommend simple formula.

### Finding a base value

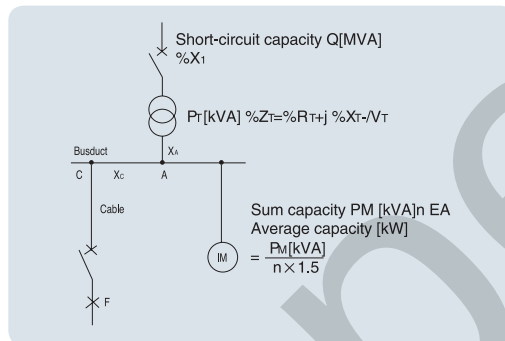
It shall be the rated current of transformer.

$$P_B = PT \text{ [kVA]}$$

$$V_B = VT \text{ [V]}$$

$$I_B = IT \text{ [A]}$$

$$Z_B = \frac{VT_B [\Omega]}{PT \times 103}$$



<Fig.6> Base value

### Short-circuit current from incoming circuit

Disregard the impedance value of primary part of transformer. Calculate short-circuit current value according to <Fig.7>.

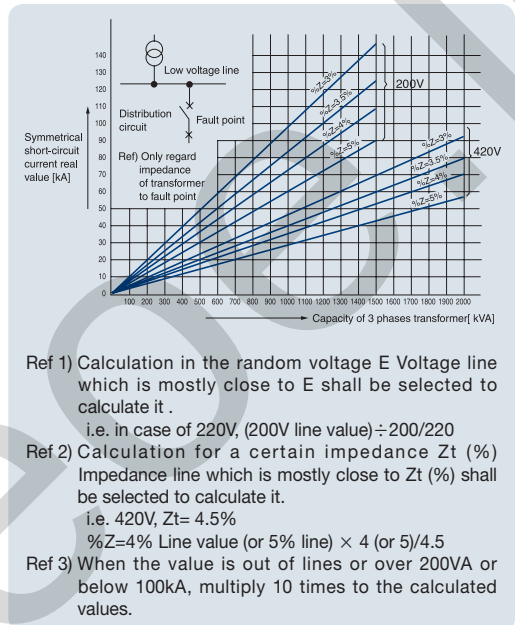
(If the impedance value of primary part of transformer is considered, calculate the current value as below formula)

$$I_A (R) = \frac{I_B}{\sqrt{(\%R_t)^2 + (\%X_t + \%X_1)^2}} \times 100 \text{ [A]}$$

$$\%X_1 = \frac{P_B}{Q \times 10^3} \times 100 \text{ [%]}$$

If the value of %R<sub>t</sub> is not clear, %Z<sub>t</sub> ÷ %X<sub>t</sub>

$$I_A (R) = \frac{I_B}{\%X_t + \%X_1} \times 100 \text{ [A]}$$



- Ref 1) Calculation in the random voltage E Voltage line which is mostly close to E shall be selected to calculate it.  
i.e. in case of 220V, (200V line value) ÷ 200/220
- Ref 2) Calculation for a certain impedance Z<sub>t</sub> (%) Impedance line which is mostly close to Z<sub>t</sub> (%) shall be selected to calculate it.  
i.e. 420V, Z<sub>t</sub> = 4.5%  
%Z = 4% Line value (or 5% line) × 4 (or 5)/4.5
- Ref 3) When the value is out of lines or over 200VA or below 100kA, multiply 10 times to the calculated values.

<Fig.7> Transformer capacity and short-circuit current

### Short-circuit current to motor

$$I_A (M) = 4 \times I_r \text{ (Rated current of motor)}$$

### Symmetrical short-circuit current at point A

$$I_A = I_A (R) + I_A (M)$$

### Decreasing coefficient caused by busduct

$$\text{Obtaining the value of } \frac{\ell \cdot I_A}{10VT}$$

Calculate decreasing coefficient from <Fig.10>

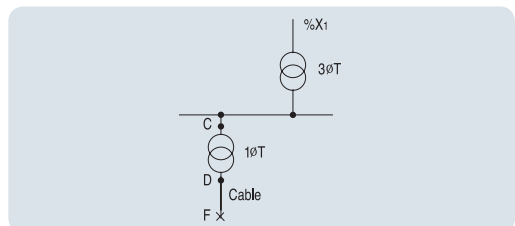
### Decreasing short-circuit current by reactance

When there's 1phase transformer in a certain circuit, calculate it in the base of reactance.

Regarding the reactance as pre-impedance at source part at point of <Fig.8>,

$$X_c = \frac{E_B}{\sqrt{3} I_c}$$

Reactance C~D: X<sub>D</sub> [Ω] (impedance of 1 Ø T)





## How to calculate short-circuit current value With a simple formula

Calculating the value of  $X_0/X_c$  and decreasing coefficient  $d$  from the reactance of <Fig.9>.

Current at point D  $I_0 = d \cdot I_c$

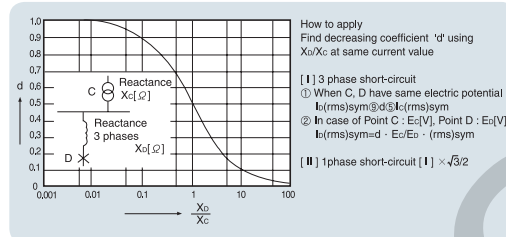
Impedance of 1 phase transformer  $X_0 = X (1 \phi) \cdot \frac{1}{2}$

a. Short-circuit current at  $E_c$  voltage base

$$I_0 (\text{rms})_{\text{sym}} \cdot 3 \phi = d \cdot I_c (\text{rms})_{\text{sym}} \cdot 3 \phi$$

b. Short-circuit current at  $E_0$  voltage base

$$I_0 (\text{rms})_{\text{sym}} \cdot 3 \phi = d \cdot I_c (\text{rms})_{\text{sym}} \cdot 3 \phi \times E_c/E_0$$



<Fig.9> Decreasing coefficient of short-circuit current by reactance: d

### Coefficient d for cables

Calculating the value of  $\frac{l \cdot I_0}{10V_r}$

Decreasing coefficient  $b$  value is calculated from <Fig.13>. For insulator drawn wrings, we can find the value directly from <Fig.13>.

### Calculating symmetrical short-circuit current real value

$$I_r (\text{rms})_{\text{sym}} = b \times I_0 [D]$$

### Various short-circuit current

In case of having short-circuit current power factor, find  $\alpha$ ,  $\beta$ ,  $\gamma$  from <Fig.5>. If not find 3 values from <Table.1>

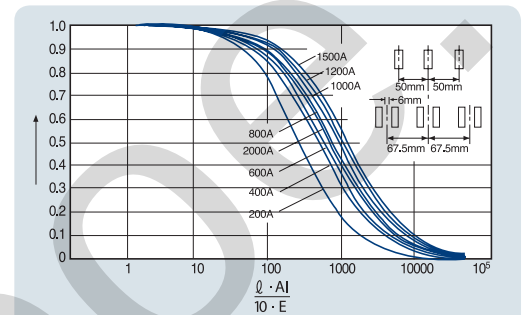
- 3 phases short-circuit asymmetrical current average value  
 $I_r (\text{rms})_{\text{ave}} = \beta I_r (\text{rms})_{\text{sym}}$
- Maximum asymmetrical real value  
 $I_r (\text{rms})_{\text{ave}} = \alpha I_r (\text{rms})_{\text{sym}}$
- Maximum asymmetrical instantaneous value  
 $I_r (\text{rms})_{\text{ave}} = \gamma I_r (\text{rms})_{\text{sym}}$

<Table.2>  $\alpha$ ,  $\beta$ ,  $\gamma$  values when short circuit power factor value is not definite.

| Symmetrical short-circuit real value (A) | Variables                       |                                                           |                                          |
|------------------------------------------|---------------------------------|-----------------------------------------------------------|------------------------------------------|
|                                          | Maximum asymmetrical real value | 3 phases short-circuit asymmetrical current average value | Maximum asymmetrical instantaneous value |
| 2500                                     | 1.0                             | 1.0                                                       | 1.48                                     |
| 2501~5000                                | 1.03                            | 1.02                                                      | 1.64                                     |
| 5001~1000                                | 1.13                            | 1.07                                                      | 1.94                                     |
| 1001~15000                               | 1.18                            | 1.09                                                      | 2.05                                     |
| 15001~25000                              | 1.25                            | 1.13                                                      | 2.17                                     |
| 25000                                    | 1.33                            | 1.17                                                      | 2.29                                     |

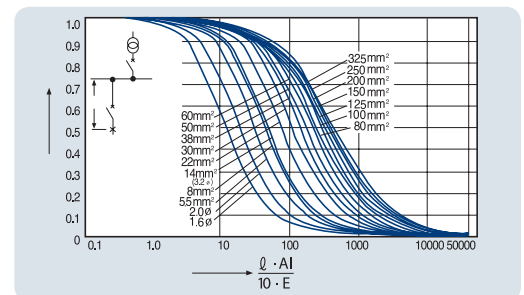
### 1 phase short-circuit

$$(\text{Each current}) = \frac{\sqrt{3}}{2} \times 3 \text{ phases short-circuit current} \times \gamma (\text{or } \alpha)$$

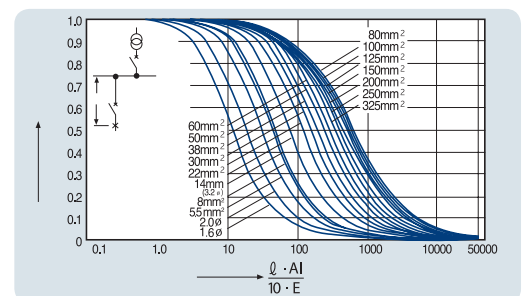


| Busduct Ratings<br>(A)<br>Material |      | General busduct    |                          |                         |                         |
|------------------------------------|------|--------------------|--------------------------|-------------------------|-------------------------|
|                                    |      | Size [mm]<br>[Ω/m] | Resistance<br>R<br>[Ω/m] | Reactance<br>X<br>[Ω/m] | Impedance<br>Z<br>[Ω/m] |
| Cu                                 | 200  | 3×25               | 2.41×10 <sup>-4</sup>    | 1.312×10 <sup>-4</sup>  | 2.74×10 <sup>-4</sup>   |
|                                    | 400  | 6×40               | 0.751×10 <sup>-4</sup>   | 1.02×10 <sup>-4</sup>   | 1.267×10 <sup>-4</sup>  |
|                                    | 600  | 6×50               | 0.607×10 <sup>-4</sup>   | 0.91×10 <sup>-4</sup>   | 1.094×10 <sup>-4</sup>  |
|                                    | 800  | 6×75               | 0.412×10 <sup>-4</sup>   | 0.72×10 <sup>-4</sup>   | 0.830×10 <sup>-4</sup>  |
|                                    | 1000 | 6×100              | 0.315×10 <sup>-4</sup>   | 0.60×10 <sup>-4</sup>   | 0.678×10 <sup>-4</sup>  |
|                                    | 1200 | 6×125              | 0.261×10 <sup>-4</sup>   | 0.516×10 <sup>-4</sup>  | 0.578×10 <sup>-4</sup>  |
|                                    | 1500 | 6×150              | 0.221×10 <sup>-4</sup>   | 0.449×10 <sup>-4</sup>  | 0.500×10 <sup>-4</sup>  |
|                                    | 2000 | 6×125×2            | 0.129×10 <sup>-4</sup>   | 0.79×10 <sup>-4</sup>   | 0.800×10 <sup>-4</sup>  |

<Fig.10> Decreasing coefficient of general busduct (Cu)



<Fig.11> Decreasing coefficient b in cable (600V IV)

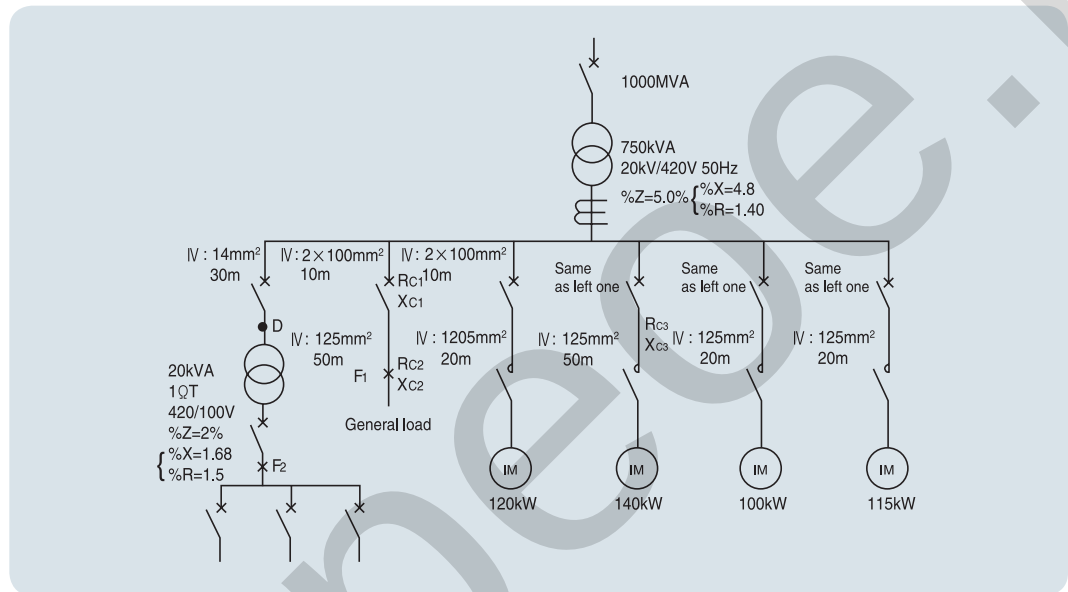


<Fig.12> Decreasing coefficient b in cable (600V IV)



## How to calculate short-circuit current value Calculation example

Calculation1) Short-circuit current value will be achieved by simple formula and percent impedance formula for <Fig.13>



<Fig.13>

### Percent impedance formula

(1) Base value

$$P_B = 750\text{kVA} \quad V_B = 420\text{V} \\ I_B = 1031\text{A} \quad Z_B = 0.237 \Omega$$

(2) Each impedance

a. Reactance at primary part of transformer

$$\%X_1 = \frac{750}{1000 \times 10^3} \times 100 = 0.075 [\%]$$

b. Impedance of transformer

$$\%R_1 = 1.4\% \\ \%X_1 = 4.8\%$$

c. 1  $\phi$  Tr impedance

$$\%R_{T1} = \frac{1.15 \times 750}{20} \times \frac{1}{2} = 21.6 [\%]$$

$$\%X_{T1} = \frac{1.68 \times 750}{20} \times \frac{1}{2} = 31.5 [\%]$$

d. Reactance of transformer

$$\%X_{m1} = \frac{750}{120 \times 1.5} \times 25 = 104 [\%]$$

$$\%X_{m2} = \frac{750}{140 \times 1.5} \times 25 = 89 [\%]$$

$$\%X_{m3} = \frac{750}{100 \times 1.5} \times 25 = 125 [\%]$$

$$\%X_{m4} = \frac{750}{115 \times 1.5} \times 25 = 108.7 [\%]$$

e. Impedance of cable

Converting impedance of whole metal tube  
[2x100mm² 10m]

$$\%R_{c1} = \frac{0.00018 \times 10}{0.237} \times \frac{1}{2} \times 100 = 0.38 [\%]$$

$$\%X_{c1} = \frac{0.00013 \times 10}{0.237} \times \frac{1}{2} \times 100 = 0.27 [\%]$$

[125mm² 20m]

$$\%R_{c2} = \frac{0.00014 \times 20}{0.237} \times 100 = 1.18 [\%]$$

$$\%X_{c2} = \frac{0.00013 \times 20}{0.237} \times 100 = 1.09 [\%]$$

[250mm² 50m]

$$\%R_{c3} = \frac{0.00007 \times 50}{0.237} \times 100 = 1.47 [\%]$$

$$\%X_{c3} = \frac{0.00013 \times 50}{0.237} \times 100 = 2.74 [\%]$$

[14mm² 30m]

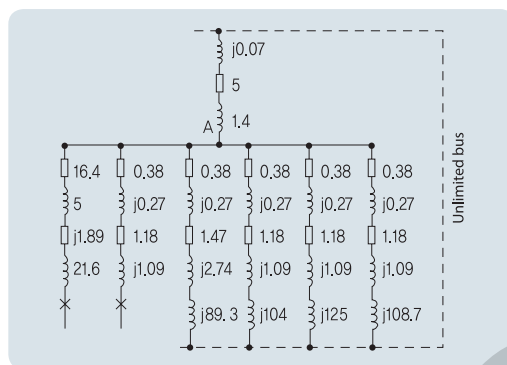
$$\%R_{c4} = \frac{0.00013 \times 30}{0.237} \times 100 = 16.45 [\%]$$

$$\%X_{c4} = \frac{0.00015 \times 30}{0.237} \times 100 = 1.88 [\%]$$

## How to calculate short-circuit current value

### Calculation example

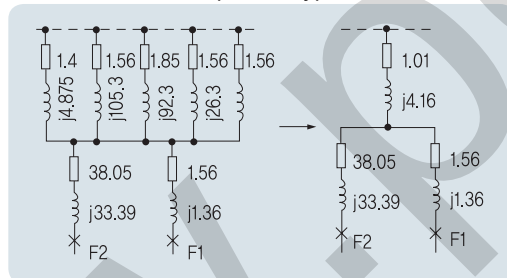
- (3) Preparing a impedance map  
Connect short-circuit supplier to the unlimited bus.



<Fig.14>

### Calculating impedance

Calculate it in serial/parallel type formula



<Fig.15>

- a. Fault point  $F_1$       b. Fault point  $F_2$



$$\begin{aligned}\%Z_1 &= \sqrt{(2.57)^2 + (5.53)^2} & \%Z_2 &= \sqrt{(39.06)^2 + (37.55)^2} \\ &= 6.1[\%] & &= 54.2[\%]\end{aligned}$$

- (5) Calculation of asymmetrical short-circuit current

- a. Fault point  $F_1$

$$\begin{aligned} I_{F1}(\text{rms})_{\text{sym}} &= \frac{1031}{6.1} \times 100 = 16900 \text{ [A]} \\ \cos \phi_1 &= \frac{2.57}{6.1} = 0.422 \end{aligned}$$

- b. Fault point  $F_2$  (1 phase circuit)

$$\begin{aligned} \text{IF}_2(\text{rms})\text{sym} &= \frac{1031}{54.2} \times 100 = 1902 \text{ [A]} \dots (\text{at } 100\text{V}) \\ &= \frac{1031}{54.2} \times 100 \times \frac{420}{100} = 7989 \text{ [A]} \dots (\text{at } 420\text{V}) \end{aligned}$$

$IF_2$  (rms) sym is short-circuit current.

Therefore, convert it into 1 phase short-circuit current.

$$I_{F_2}(\text{rms})_{1\Omega \text{ sym}} = 7989 \times \frac{\sqrt{3}}{2} = 6919 \text{ [A]}$$

$$\cos \phi_2 = \frac{39.06}{54.2} = 0.72$$

- (6) Various short-circuit current  
Calculate  $\alpha, \beta, \gamma$  from <Fig.5>.

- a. Fault point  $F_1$

$$\cos \theta_1 = 0,422$$

$\alpha = 1.05 \quad \beta = 1.3 \quad \gamma = 1.74$

$$I_{F1}(\text{rms})_{\text{ave}} = 1.03 \times 16900 = 17407 \text{ [A]}$$

$$I_{F1}(\text{rms})_{\text{asym}} = 1.05 \times 16900 = 17745 \text{ [A]}$$

$$I_{F1\max} = 1.74 \times 16900 = 29406 \text{ [A]}$$

- b. Fault point  $F_2$

$$\cos \theta_2 = 0.72$$

$\alpha = 1.0 \quad \beta = 1.48$

$$I_{F21} \varnothing \text{ (rms)asym} = 1.0 \times 6919 \text{ [A]}$$

$$I_{F21} \varnothing \max = 1.48 \times 6919 = 10240 \text{ [A]}$$

### Simple calculation formula

- (1) Base value

$$P_B = 750 \text{ kVA} \quad V_B = 420 \text{ V}$$

$$I_B = 1031 \text{ A} \quad Z_B = 0.237 \Omega$$

- (2) Short-circuit current of incoming circuit  
Disregard the impedance of primary part of transformer

In <Fig.7>  $I_{A(R)} = 20500 \text{ A}$

- (3) Short-circuit current of motor

Sum of motor capacity=

$$(120+140+100+115) \times 1.5 = 713 \text{ [kVA]}$$

$$I_{A(M)} = \frac{713}{\sqrt{3} \times 420} \times 4 = 3920 \text{ [A]}$$

- (4) Symmetrical short-circuit current at point A

$$I_A = 20500 + 3920 = 24420 \text{ [A]}$$

## How to calculate short-circuit current value Calculation example

(5) Decreasing short-circuit current for cable

a. At point F<sub>1</sub>

- 2×100mm<sup>2</sup> 10m  
2×100mm<sup>2</sup> 10m= 100mm<sup>2</sup> 5m

$$\frac{l}{10E} = \frac{20 \times 24420}{10 \times 420} = 29.1$$

Coefficient b= 0.935

Short-circuit current value at point C  
I<sub>C</sub> (rms) sym= 0.935×24420= 22850 [A]

- 125mm<sup>2</sup> 20m

$$\frac{l}{10E} = \frac{20 \times 22850}{10 \times 420} = 108.9$$

$$I_{F1} \text{ (rms) sym} = 0.785 \times 244850 = 17940 \text{ [A]}$$

b. At point F<sub>1</sub>

- 14mm<sup>2</sup> 30m

$$\frac{l}{10E} = \frac{30 \times 24420}{10 \times 420} = 174.4$$

Coefficient b= 0.249

$$I_b \text{ (rms) } 3 \phi \text{ sym} = 0.24 \times 24420 = 6080 \text{ [A]}$$

- Decreasing by the reactance (1 φ Tr)dp

Convert the value of '%X of 1 φ Tr' to base capacity

$$X_b = 750 \times 2/20 = 75\%$$

Impedance of primary part at 1 φ Tr

$$XA = \frac{I_b}{I_0} \times 100 = \frac{1031}{6080} \times 100 \text{ [%]}$$

Convert X<sub>b</sub> to equivalent 3 phases, and

$$\frac{X_b/2}{X_A} = \frac{750 \times 2 \times 6080}{20 \times 2 \times 1031 \times 100} = 2.21$$

Coefficient d of <Fig.9> d = 0.32

$$\begin{aligned} I_{F2} \text{ (rms) } 3 \phi \text{ sym} &= 0.32 \times 6080 = 1945 \text{ [A] (400V)} \\ &= 0.32 \times 6080 \times 420/100 \\ &= 817 \text{ [A] (100V)} \end{aligned}$$

$$\therefore I_{F2} \text{ (rms) } 1 \phi \text{ sym} = 817 \times \frac{\sqrt{3}}{2} = 7076 \text{ [A]}$$

(6) Various short-circuit current

Find α, β, γ from <Table.1>

a. At point F<sub>1</sub>

$$\alpha = 1.25 \quad \beta = 1.13 \quad \gamma = 2.17$$

$$IF1 \text{ (rms) ave} = 1.13 \times 17940 = 20272 \text{ [A]}$$

$$IF1 \text{ (rms) asym} = 1.25 \times 17940 = 22425 \text{ [A]}$$

$$IF1 \text{ max} = 2.17 \times 17940 = 38930 \text{ [A]}$$

b. At point F<sub>2</sub>

$$\alpha = 1.13 \quad \gamma = 1.94$$

$$IF21 \phi \text{ (rms) asym} = 1.13 \times 7076 = 7945 \text{ [A]}$$

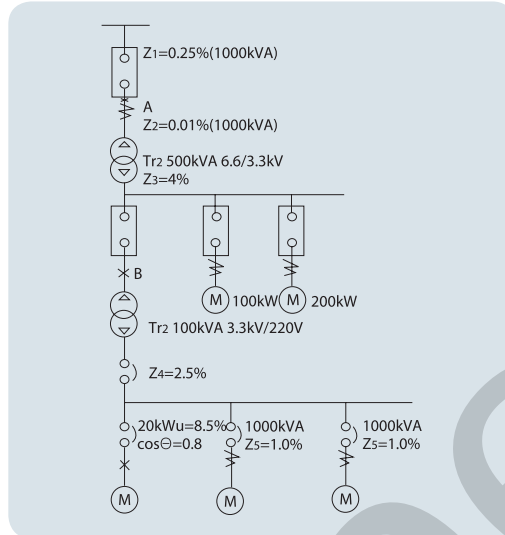
$$IF21 \phi \text{ max} = 1.94 \times 7076 = 13727 \text{ [A]}$$

<Table.2> Comparison of short-circuit

| Fault point                                      |                                     | F <sub>1</sub> | F <sub>2</sub> |
|--------------------------------------------------|-------------------------------------|----------------|----------------|
| Symmetrical short-circuit current real value     | Percent impedance calculation value | 16900A         | 6919A          |
|                                                  | Simple formula calculation value    | 17940A         | 7076A          |
| 3 phases average asymmetrical current real value | Percent impedance calculation value | 17407A         | -              |
|                                                  | Simple formula calculation value    | 20272A         | -              |
|                                                  |                                     | 116%           | -              |
| Maximum asymmetrical current real value          | Percent impedance calculation value | 17745A         | 6919A          |
|                                                  | Simple formula calculation value    | 22425A         | 7995A          |
|                                                  |                                     | 126%           | 115%           |

## How to calculate short-circuit current value Calculation example

Short-circuit current value will be achieved by simple formula for <Fig.16>



<Fig.16>

(1) Calculate rated current at each point

① Rated current  $I_{NA}$  at point A

$$I_{NA} = \frac{500[\text{kVA}] \times 1000}{\sqrt{3} \times 6.6[\text{kV}] \times 1000} = 43.7[\text{A}]$$

② Rated current  $I_{NB}$  at point B

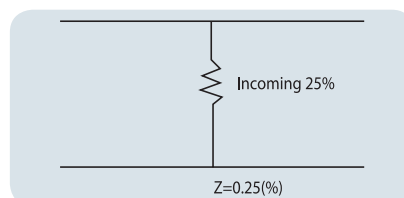
$$I_{NB} = \frac{100[\text{kVA}] \times 1000}{\sqrt{3} \times 3.3[\text{kV}] \times 1000} = 17.5[\text{A}]$$

$$I_{NC} = \frac{20[\text{kW}] \times 1000}{\sqrt{3} \times 220[\text{V}] \times 0.85 \times 0.8} = 77.2[\text{A}]$$

(2) Put 1000k VA for base capacity and calculate short-circuit current at each point.

① Short-circuit current  $I_{SA}$  at point A

a) Impedance Map



b) Short-circuit  $I_{SA}$

$$I_{SA} = \frac{1000 \text{ kVA} \times 1000 \times 100}{\sqrt{3} \times 6.6 \text{ kV} \times 1000 \times 0.25\%} = 34990[\text{A}]$$

\* Breaking capacity of breaker [MVA]

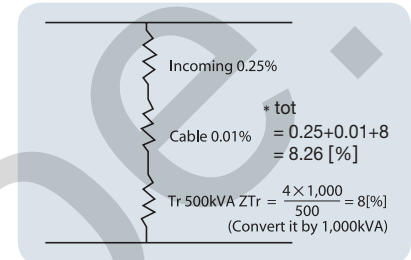
$$\text{MVA} = 3 \text{ short-circuit current}[\text{kA}] \text{ line to line voltage}[\text{kV}]$$

② Short-circuit current at point B:  $I_{SB}$

a) Impedance Map

\* Serial sum of impedance

$$Z_{tot} = 0.25 + 0.01 + 8 = 8.26 [\%]$$



b) Short-circuit current  $I_{SC}$

$$I_{SB} = \frac{1000[\text{kVA}] \times 1000 \times 100}{\sqrt{3} \times 3.3[\text{kV}] \times 1000 \times 8.26} = 2118 [\text{A}]$$

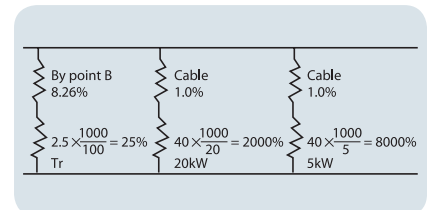
\* Breaking capacity of breaker [MVA]

$$\text{MVA} = \sqrt{3} \text{ short-circuit current}[\text{kA}]$$

$$\text{line to line voltage}[\text{kV}]$$

③ Short-circuit current at point C:  $I_{SC}$

a) Impedance Map



\* Parallel sum of impedance

$$Z = \frac{1}{\frac{1}{33.26} + \frac{1}{2001} + \frac{1}{8001}} = 32.58 [\%]$$

b) Short-circuit current  $I_{SC}$

$$I_{SC} = \frac{1000 [\text{kVA}] \times 1000 \times 100}{\sqrt{3} \times 220 [\text{V}] \times 32.58 [\%]} = 8055 [\text{A}]$$

### Calculation formula

$$\text{Rated current } I_N = \frac{\text{Transformer capacity}}{\sqrt{3} \times \text{Rated voltage}}$$

$$\text{Short-circuit current } I_S = \frac{\text{Transformer capacity} \times 100}{\sqrt{3} \times \text{Rated voltage} \times \%Z}$$

## How to calculate short-circuit current value Combination of transformer and impedance

<Table. 3> Combination of transformer and impedance

| Transformer<br>Impedance  | 3 phases transformer |       |       |                     |       |       |                    |       |       |                   |       |       |
|---------------------------|----------------------|-------|-------|---------------------|-------|-------|--------------------|-------|-------|-------------------|-------|-------|
|                           | 6.3kV/210V Oil Tr.   |       |       | 6.3kV/210V Mold Tr. |       |       | 20kV/420V Mold Tr. |       |       | 20kV/420V Oil Tr. |       |       |
| Transformer capacity (VA) | ZT[%]                | RT[%] | XT[%] | ZT[%]               | RT[%] | XT[%] | ZT[%]              | RT[%] | XT[%] | ZT[%]             | RT[%] | XT[%] |
| 20                        | 2.19                 | 1.94  | 1.03  |                     |       |       |                    |       |       |                   |       |       |
| 30                        | 2.45                 | 1.92  | 1.53  | 4.7                 | 2.27  | 4.12  |                    |       |       |                   |       |       |
| 50                        | 2.47                 | 1.59  | 1.89  | 4.7                 | 1.94  | 4.28  |                    |       |       |                   |       |       |
| 75                        | 2.35                 | 1.67  | 1.66  | 4.4                 | 1.56  | 4.11  |                    |       |       |                   |       |       |
| 100                       | 2.54                 | 1.65  | 1.96  | 4.6                 | 1.5   | 4.24  |                    |       |       |                   |       |       |
| 150                       | 2.64                 | 1.64  | 2.07  | 4.2                 | 1.29  | 4.0   |                    |       |       |                   |       |       |
| 200                       | 2.8                  | 1.59  | 2.31  | 4.5                 | 1.17  | 4.35  |                    |       |       |                   |       |       |
| 300                       | 3.26                 | 1.46  | 2.92  | 4.5                 | 1.2   | 4.33  |                    |       |       |                   |       |       |
| 500                       | 3.61                 | 1.33  | 3.36  | 4.7                 | 0.08  | 4.69  | 5.0                | 1.56  | 4.76  | 6.0               | 1.0   | 5.92  |
| 750                       | 4.2                  | 1.55  | 3.9   | 6.0                 | 0.8   | 5.95  | 5.0                | 1.40  | 4.80  | 6.0               | 0.9   | 5.93  |
| 1000                      | 5.0                  | 1.35  | 4.82  | 7.0                 | 0.7   | 6.96  | 5.0                | 1.26  | 4.84  | 6.0               | 0.8   | 5.95  |
| 1500                      | 5.1                  | 1.22  | 4.95  | 7.0                 | 0.6   | 6.97  | 5.5                | 1.2   | 5.37  | 7.0               | 0.75  | 6.96  |
| 2000                      | 5.0                  | 1.2   | 4.85  | 7.5                 | 0.65  | 7.47  | 5.5                | 1.1   | 5.39  | 7.0               | 0.7   | 6.96  |

<Table. 4> Example of transformer impedance

| Transformer<br>Impedance  | 1 phase transformer |       |       |                     |       |       |
|---------------------------|---------------------|-------|-------|---------------------|-------|-------|
|                           | 6.3kV/210V Oil Tr.  |       |       | 6.3kV/210V Mold Tr. |       |       |
| Transformer capacity (VA) | ZT[%]               | RT[%] | XT[%] | ZT[%]               | RT[%] | XT[%] |
| 10                        |                     |       |       | 14.9                | 14.9  | 0.268 |
| 20                        |                     |       |       | 14.0                | 14.0  | 0.503 |
| 30                        |                     |       |       | 14.8                | 14.8  | 0.523 |
| 50                        |                     |       |       | 13.6                | 13.6  | 0.494 |
| 75                        |                     |       |       | 11.0                | 11.0  | 0.558 |
| 100                       |                     |       |       | 8.87                | 8.85  | 0.562 |
| 200                       |                     |       |       | 7.70                | 7.68  | 0.571 |
| 300                       |                     |       |       | 5.75                | 5.69  | 0.619 |
| 500                       |                     |       |       | 5.08                | 4.97  | 1.05  |
| 750                       |                     |       |       | 5.05                | 4.92  | 1.16  |
| 1000                      |                     |       |       | 4.03                | 3.93  | 0.904 |
| 2000                      |                     |       |       | 4.55                | 4.50  | 0.637 |
| 3000                      |                     |       |       | 4.29                | 4.22  | 0.768 |
| 5000                      |                     |       |       | 3.26                | 3.18  | 0.725 |
| 7500                      |                     |       |       | 2.72                | 2.81  | 0.775 |
| 10000                     | 2.5                 | 2.07  | 1.40  | 2.33                | 2.18  | 0.823 |
| 15000                     | 2.37                | 1.84  | 1.49  | 2.04                | 1.82  | 0.937 |
| 20000                     | 2.57                | 1.76  | 1.87  | 1.90                | 1.60  | 1.02  |
| 30000                     | 2.18                | 1.58  | 1.50  |                     |       |       |
| 50000                     | 2.05                | 1.47  | 1.42  |                     |       |       |
| 75000                     | 2.27                | 1.46  | 1.74  |                     |       |       |
| 100000                    | 2.48                | 1.49  | 1.98  |                     |       |       |
| 150000                    | 3.39                | 1.31  | 3.13  |                     |       |       |
| 200000                    | 3.15                | 1.31  | 2.87  |                     |       |       |
| 300000                    | 2.23                | 1.28  | 2.96  |                     |       |       |
| 500000                    | 4.19                | 1.09  | 4.03  |                     |       |       |

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<Table. 5> Example of cable impedance (600 vinyl cable)

| Cable dimension                                                                                                                                                                                 | Impedance of cable 1m (Ω)                                  |                                                   |                              |                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------|------------------------------|------------------------------|
|                                                                                                                                                                                                 | Internal insulation wiring or cable of steel tube and duct | Internal vinyl tube wiring of steel tube and duct | Insulator wiring in building | Resistance(Ω) / cable 1meter |
| ø 1.6mm<br>ø 2mm<br>ø 3.2mm<br>5.5mm <sup>2</sup><br>8mm <sup>2</sup>                                                                                                                           | 0.00020                                                    | 0.00012                                           | 0.00031                      | 0.0089                       |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.0056                       |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.0022                       |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.0033                       |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.0023                       |
| 14mm <sup>2</sup><br>22mm <sup>2</sup><br>30mm <sup>2</sup><br>38mm <sup>2</sup>                                                                                                                | 0.00015                                                    | 0.00010                                           | 0.00026                      | 0.0013                       |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00082                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00062                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00048                      |
| 50mm <sup>2</sup><br>60mm <sup>2</sup><br>80mm <sup>2</sup><br>100mm <sup>2</sup><br>125mm <sup>2</sup><br>150mm <sup>2</sup><br>200mm <sup>2</sup><br>250mm <sup>2</sup><br>325mm <sup>2</sup> | 0.00013                                                    | 0.00009                                           | 0.00022                      | 0.00037                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00030                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00023                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00018                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00014                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00012                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00009                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00007                      |
|                                                                                                                                                                                                 |                                                            |                                                   |                              | 0.00005                      |

<Remark1> At 60Hz, the reactance multiply 2 times itself, so 1/2 reactance of primary part can achieve IB.

<Remark2> When the cable is parallelly 2 or 3ea, reactance and resistance can be calculated in the condition of 1/3 and 1/3 length cable.

## How to calculate short-circuit current value Various short-circuit

<Table.6> Impedance sample of bus and busduct (50Hz)

[ $\times 10^{-4} \Omega/m$ ]

| Ampere rating (A) | 50Hz  |       |       | 60Hz  |       |       |
|-------------------|-------|-------|-------|-------|-------|-------|
|                   | R     | X     | Z     | R     | X     | Z     |
| 600               | 1.257 | 0.323 | 1.297 | 1.385 | 0.387 | 1.438 |
| 800               | 0.848 | 0.235 | 0.879 | 0.851 | 0.282 | 0.896 |
| 1000              | 0.641 | 0.185 | 0.667 | 0.645 | 0.222 | 0.682 |
| 1200              | 0.518 | 0.152 | 0.540 | 0.523 | 0.183 | 0.554 |
| 1350              | 0.436 | 0.129 | 0.454 | 0.443 | 0.155 | 0.469 |
| 1500              | 0.378 | 0.113 | 0.394 | 0.386 | 0.135 | 0.409 |
| 1600              | 0.360 | 0.107 | 0.375 | 0.367 | 0.128 | 0.389 |
| 2000              | 0.286 | 0.084 | 0.298 | 0.293 | 0.101 | 0.310 |
| 2500              | 0.218 | 0.065 | 0.228 | 0.221 | 0.078 | 0.235 |
| 3000              | 0.180 | 0.054 | 0.188 | 0.184 | 0.064 | 0.195 |
| 3500              | 0.143 | 0.042 | 0.149 | 0.146 | 0.051 | 0.155 |
| 4000              | 0.126 | 0.038 | 0.131 | 0.129 | 0.045 | 0.136 |
| 4500              | 0.120 | 0.036 | 0.125 | 0.122 | 0.043 | 0.130 |
| 5000              | 0.095 | 0.028 | 0.099 | 0.098 | 0.034 | 0.103 |

<Table.6> Impedance sample of Bus and busduct (50Hz)

[ $\times 10^{-4} \Omega/m$ ]

| Ampere rating (A) | 50Hz  |       |       | 60Hz  |       |       |
|-------------------|-------|-------|-------|-------|-------|-------|
|                   | R     | X     | Z     | R     | X     | Z     |
| 600               | 0.974 | 0.380 | 1.045 | 0.977 | 0.456 | 1.078 |
| 800               | 0.784 | 0.323 | 0.848 | 0.789 | 0.387 | 0.879 |
| 1000              | 0.530 | 0.235 | 0.580 | 0.536 | 0.282 | 0.606 |
| 1200              | 0.405 | 0.185 | 0.445 | 0.412 | 0.222 | 0.468 |
| 1350              | 0.331 | 0.152 | 0.364 | 0.338 | 0.183 | 0.384 |
| 1500              | 0.331 | 0.152 | 0.364 | 0.338 | 0.183 | 0.384 |
| 1600              | 0.282 | 0.129 | 0.311 | 0.289 | 0.155 | 0.328 |
| 2000              | 0.235 | 0.107 | 0.259 | 0.241 | 0.128 | 0.273 |
| 2500              | 0.166 | 0.076 | 0.182 | 0.169 | 0.091 | 0.192 |
| 3000              | 0.141 | 0.065 | 0.155 | 0.144 | 0.078 | 0.164 |
| 3500              | 0.122 | 0.056 | 0.135 | 0.127 | 0.068 | 0.143 |
| 4000              | 0.110 | 0.051 | 0.121 | 0.113 | 0.061 | 0.126 |
| 4500              | 0.094 | 0.043 | 0.104 | 0.096 | 0.052 | 0.109 |
| 5000              | 0.082 | 0.038 | 0.091 | 0.084 | 0.045 | 0.096 |
| 5500              | 0.078 | 0.035 | 0.086 | 0.080 | 0.043 | 0.091 |
| 6500              | 0.068 | 0.028 | 0.074 | 0.071 | 0.031 | 0.077 |

## How to calculate short-circuit current value Calculation example

Using a certain graph, you can find and calculate the short-circuit current value which is at one position of network. No matter the condition of network is different, you can do the calculation through adjusting variables.

### Graph note

P coordinates – Transformer capacity (kVA)

Is<sub>1</sub> coordinates – Short-circuit current value (kA)

Is<sub>2</sub> coordinates – Short-circuit current value affected cable condition (kA)

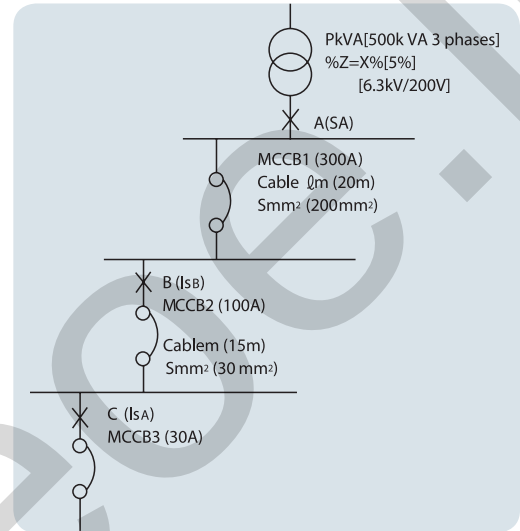
Ⓐ Line - % impedance of transformer (%)

Ⓑ Line - Length of cable (m)

Ⓒ Line - Square mm of cable (mm<sup>2</sup>)

Ⓓ Line - Is<sub>2</sub> (kA)

Remark) Ⓒ line shows the length of hard vinyl cable (600V IV)



### How to calculate short-circuit current value

#### (1) 3 phases transformer

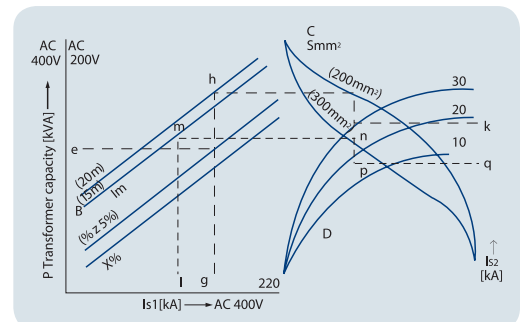
- ① Short-circuit current value at (A) where it is just below transformer. At P coordinates, find the coordinates value (g) of the cross point (f) which is from transformer capacity (e) and A line. Disregard primary part impedance of transformer.
- ② Find the short-circuit current value at Point B, C which are considered cable impedance.
  - At short-circuit current g (kA) of Is<sub>1</sub> coordinates, find the value (h) of B line
  - Move (h) to parallel direction of Is<sub>1</sub>, and find the cross point (i) to C line.
  - Move (i) to parallel direction of Is<sub>2</sub>, and find the cross point value (j) to D line (g), finally find (k) of Is<sub>2</sub>

#### (2) 1 phase transformer

- ① Short-circuit current value where it is just below transformer. Find the value as same as that of 3 phase transformer and multiply it 3 times. (g'kA)
- ② Find the short-circuit current value where it is considered cable impedance.
  - Multiply 2/3 times to g' of Is coordinates
  - Find the Is<sub>2</sub> value as same as that of 3 phase transformer and multiply it 3/2 times.

### Remark

1. It's not considered the transformer contribution. Multiply 4 times the rated current of transformer in cases.
2. The real short-circuit current value is littler lower that its calculated value by the way we suggest because we take the rated voltage as AC200V, 400V. So the current value should be calculated in the consideration of stability
3. The calculated value is symmetrical real value.





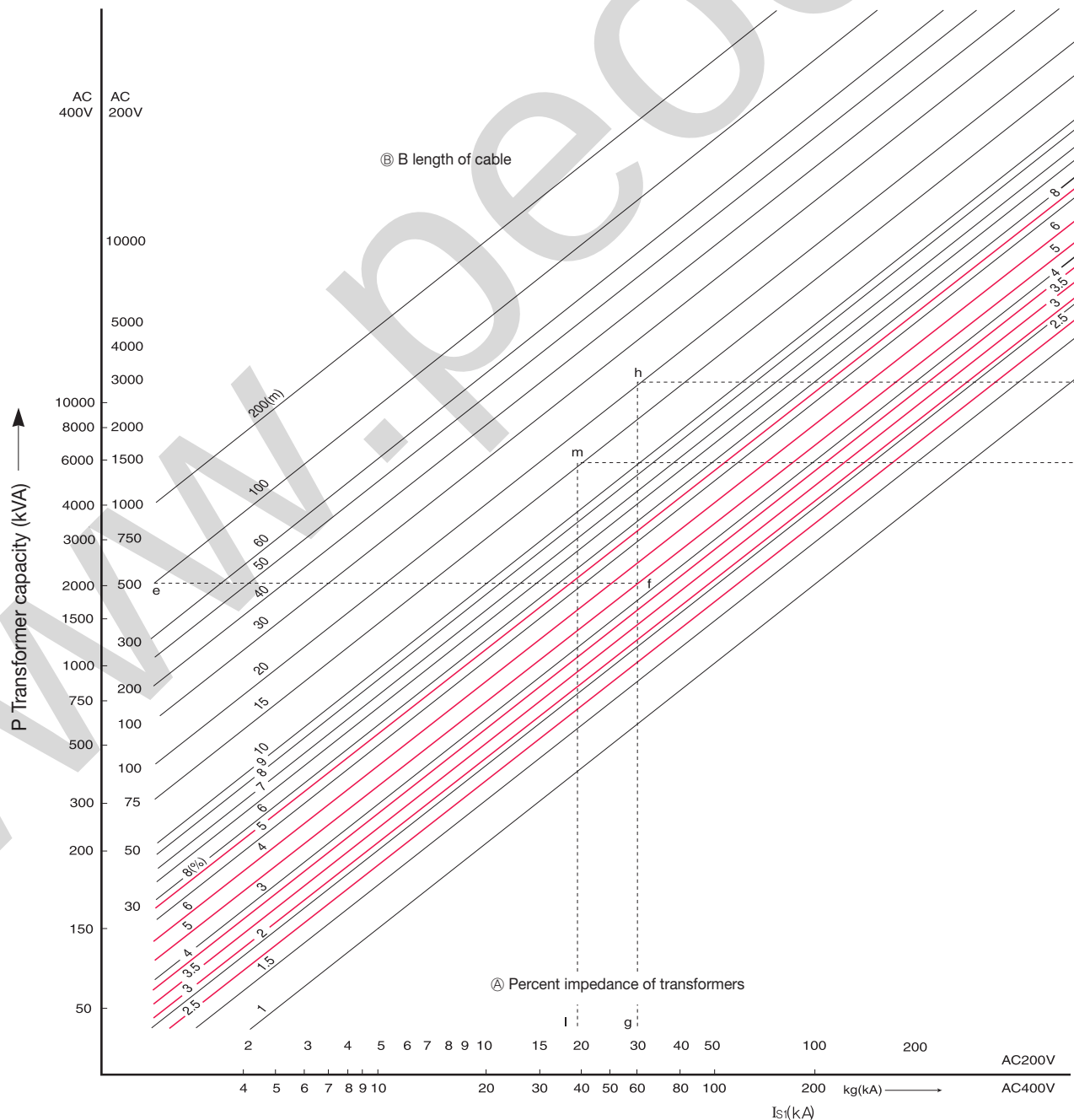
## How to calculate short-circuit current value Calculation graph

### (1) Short-circuit current value at point A ( $I_{SA}$ )

- At P coordinates, find (f) which is the point which is to match transformer capacity 500kVA and A line. Then move (f) to  $I_{S1}$  direction and finally find (g).
- $I_{SA} = 29\text{kVA}$  (g)

### (2) Short-circuit current value at point B ( $I_{SB}$ )

- Find value h of B line (20mm) at g (= 29kA) of  $I_{S1}$  coordinates
- Move h parallelly to the direction of  $I_{S1}$ , and find value l at the cross point with C line (200mm)
- Move l parallelly to the direction of  $I_{S2}$ , and find value j at the cross point with D line (g= 29kA)
- $I_{SB} = 19\text{kA}$  (k)



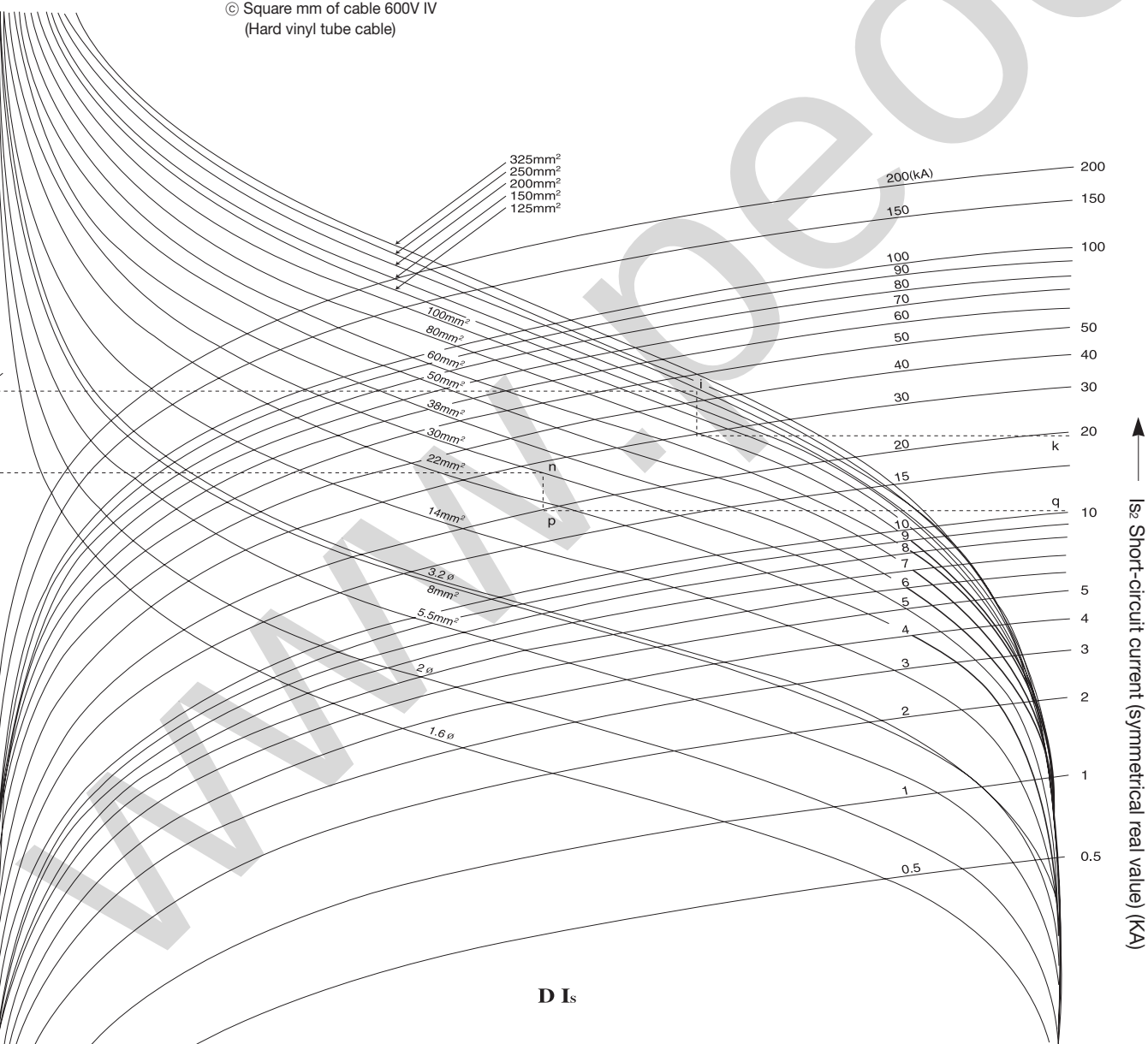
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## (3) Short-circuit current value at point C ( $I_{sc}$ )

- Find  $I_{s1}$  coordinates value (19kA) of short-circuit current value  $k$  (= 19kA) at Point B. and find cross point m between 19kA and B line.
- Move m parallelly to the direction of  $I_{s1}$  coordinates, and find the cross point n at C line (30mm).
- Move n parallelly to the direction of  $I_{s1}$  and find the cross point p of  $I_{s2}$  with D line.
- $I_{sc}$  = 10kA (g)

© Square mm of cable 600V IV  
(Hard vinyl tube cable)



# Certifications

Susol

| Type             |           | Approvals                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     | Certificates                                                                        |
|------------------|-----------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Certificate      |           | Safety certi                                                                      | IEC                                                                               | UL                                                                                | cUL                                                                               | GB                                                                                  | TRCU                                                                                | KEMA                                                                                |
| Mark and name    |           |  |  |  |  |  |  |  |
| Type             |           | Korea                                                                             | Europe                                                                            | U.S.A                                                                             | U.S.A                                                                             | China                                                                               | Russia                                                                              | Netherlands                                                                         |
| MCCB<br>Susol    | TE100S    |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|                  | TE100N    |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|                  | TE160S    |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|                  | TE160N    |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|                  | TD100N    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TD100H    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TD100L    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TD160N    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TD160H    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TD160L    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS100N    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS100H    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS100L    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS160N    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS160H    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS160L    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS250N    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS250H    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS250L    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS400N    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS400H    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS400L    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS630N    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS630H    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS630L    | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS800N    |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS800H    |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS800L    |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS100 ETS | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS160 ETS | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS250 ETS | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS400 ETS | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS400 ETM | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS630 ETS | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS630 ETM | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS800 ETS |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS800 ETM |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS1000N   |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS1250N   |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS1600N   |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS1000H   |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS1250H   |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS1600H   |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|                  | TS1000L   |                                                                                   | ●                                                                                 |                                                                                   |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
| MCCB<br>Susol UL | TD125NU   |                                                                                   |                                                                                   | ●                                                                                 | ●                                                                                 |                                                                                     |                                                                                     |                                                                                     |
|                  | TD125HU   |                                                                                   |                                                                                   | ●                                                                                 | ●                                                                                 |                                                                                     |                                                                                     |                                                                                     |
|                  | TS250NU   |                                                                                   |                                                                                   | ●                                                                                 | ●                                                                                 |                                                                                     |                                                                                     |                                                                                     |
|                  | TS250HU   |                                                                                   |                                                                                   | ●                                                                                 | ●                                                                                 |                                                                                     |                                                                                     |                                                                                     |
|                  | TS400NU   |                                                                                   |                                                                                   | ●                                                                                 | ●                                                                                 |                                                                                     |                                                                                     |                                                                                     |
|                  | TS400HU   |                                                                                   |                                                                                   | ●                                                                                 | ●                                                                                 |                                                                                     |                                                                                     |                                                                                     |
|                  | TS800NU   |                                                                                   |                                                                                   | ●                                                                                 | ●                                                                                 |                                                                                     |                                                                                     |                                                                                     |
|                  | TS800HU   |                                                                                   |                                                                                   | ●                                                                                 | ●                                                                                 |                                                                                     |                                                                                     |                                                                                     |

Note) ●: Completion

# Marine certifications

Susol

| Type          |            | Approvals                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |                                                                                     |
|---------------|------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Mark and name |            |  |  |  |  |  |  |  |
| Type          |            | KR<br>Korea                                                                       | LR<br>U.K                                                                         | BV<br>France                                                                      | ABS<br>U.S.A                                                                      | GL<br>Germany                                                                       | DNV<br>Norway                                                                       | RINA<br>Italy                                                                       |
| TD 100AF      | TD100E     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TD100S     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TD100P     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TD100N FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD100N FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD100H FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD100H FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD100L FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD100L FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
| TD 160AF      | TD160E     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TD160S     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TD160P     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TD160N FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD160N FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD160H FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD160H FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TD160L FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
| TS 100AF      | TS100E     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS100E ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS100S     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS100S ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS100P     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS100P ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS100N FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS100N FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS100N ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS100H FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS100H FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS100H ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS100L FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS100L FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS100L ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
| TS 160AF      | TS160E     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS160E ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS160S     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS160S ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS160P     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS160P ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS160N FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160N FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160N ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160N ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160H FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160H FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160H ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160H ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160L FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160L FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160L ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS160L ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |

Note) ●: Completion

# Marine certifications

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| Type          |            | Approvals                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |                                                                                     |
|---------------|------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Mark and name |            |  |  |  |  |  |  |  |
| Type          |            | KR<br>Korea                                                                       | LR<br>U.K                                                                         | BV<br>France                                                                      | ABS<br>U.S.A                                                                      | GL<br>Germany                                                                       | DNV<br>Norway                                                                       | RINA<br>Italy                                                                       |
| TS<br>250AF   | TS250E     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS250E ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS250S     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS250S ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS250P     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS250P ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS250N FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250N FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250N ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250N ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250H FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250H FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250H ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250H ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250L FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250L FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250L ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS250L ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
| TS<br>400AF   | TS400E     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400E ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400E ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400S     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400S ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400S ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400P     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400P ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400P ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS400N FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400N FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400N ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400N ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400N ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400H FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400H FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400H ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400H ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400H ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400L FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400L FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400L ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400L ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS400L ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
| TS<br>630AF   | TS630E     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS630E ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS630E ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS630S     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS630S ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS630S ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS630P     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS630P ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS630P ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |

Note) ●: Completion

# Marine certifications

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| Type          |            | Approvals                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     |                                                                                     |
|---------------|------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Mark and name |            |  |  |  |  |  |  |  |
| Type          |            | KR<br>Korea                                                                       | LR<br>U.K                                                                         | BV<br>France                                                                      | ABS<br>U.S.A                                                                      | GL<br>Germany                                                                       | DNV<br>Norway                                                                       | RINA<br>Italy                                                                       |
| TS<br>630AF   | TS630N FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630N FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630N ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630N ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630N ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630H FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630H FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630H ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630H ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630H ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630L FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630L FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630L ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630L ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS630L ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
| TS<br>800AF   | TS800E     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800E ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800E ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800S     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800S ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800S ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800P     | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800P ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800P ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 |                                                                                   |                                                                                     | ●                                                                                   | ●                                                                                   |
|               | TS800N FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800N FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800N ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800N ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800N ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800H FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800H FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800H ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800H ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800H ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800L FTU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800L FMU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800L ATU | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800L ETS | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
|               | TS800L ETM | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                 | ●                                                                                   | ●                                                                                   | ●                                                                                   |
| TS<br>1600AF  | TS1000N    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     | ●                                                                                   |
|               | TS1000H    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     | ●                                                                                   |
|               | TS1250N    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     | ●                                                                                   |
|               | TS1250H    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     | ●                                                                                   |
|               | TS1600N    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     | ●                                                                                   |
|               | TS1600H    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     | ●                                                                                   |
|               | TS1000L    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                     |                                                                                     | ●                                                                                   |

Note) ●: Completion



#### Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact qualified service technician when you need maintenance.  
Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.



- According to The WEEE Directive, please do not discard the device with your household waste.



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#### Technical Question or After-sales Service

Customer Center-Quick Responsive  
Service, Excellent technical support

**82-1644-5481**