FUTURING SMART ENERGY

www.lsis.com




Susol
Super Solution

# Low voltage circuit breakers

LS IS

LSIS continues
the value and the prominence of LG

## New Name for LG Industrial Systems,
## New Take-off for LSIS

To advance to the next level,
LG Industrial Systems is reborn as LS Industrial Systems.
LSIS will continue to lead the future
of industrial electrics and automation by providing
Total Solution, a core essential
for competition in the 21st 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 LSIS

## 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 LSIS 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 LSIS will become a genuine global leader.



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



Cheongju Plant (Korea)



Busan Plant (Korea)

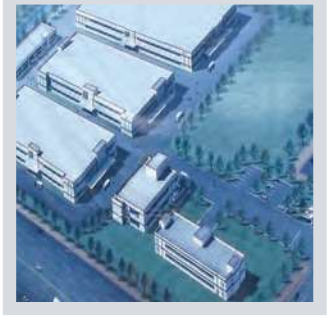
## Electric Power Industry |
### Electric Equipment & Systems

The electric equipment and systems of LSIS, 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.



Dalian Plant (China)



Wuxi Plant (China)



Hanoi Plant (Vietnam)



Chonan Plant (Korea)



Wuxi Plant (China)

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

LSIS, 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 Low voltage circuit breakers



Susol LV circuit breakers




## Super Solution

# Contents :


| | |
|---|---|
| Overview | A-1 |
| Main characteristics | A-2 |
| Accessories | A-3 |
| Mounting & connection | A-4 |
| Characteristics curves | A-5 |
| Dimensions | A-6 |
| Technical information | A-7 |


Susol
MCCB

GOOD DESIGN
Ministry of Commerce

product
design
award
2007

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

SuSol Series MCCB is available forworld 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 wining IF Design Award.

>>>

# Super Solution




## For power distribution

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

## For protection of motor & its control device

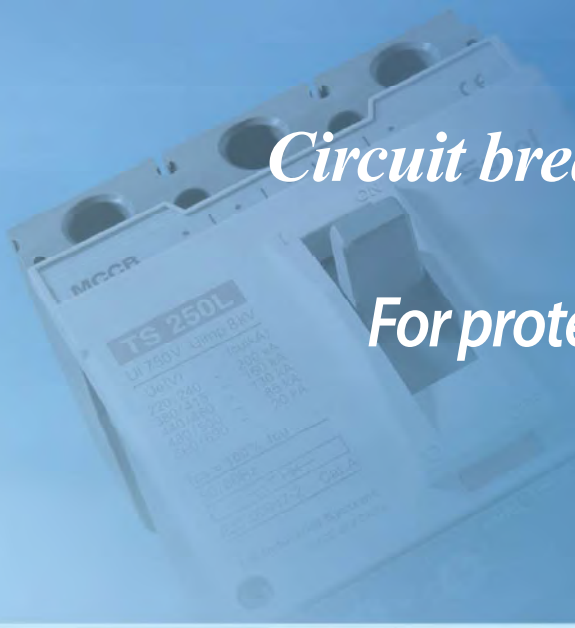
- Optimal overload protection
- Guaranteed type-2 coordination between circuit breaker and contactor, relay

## For controlling and disconnecting circuits

## For extensive applications

- Wide range of optimized auxiliaries and accessories

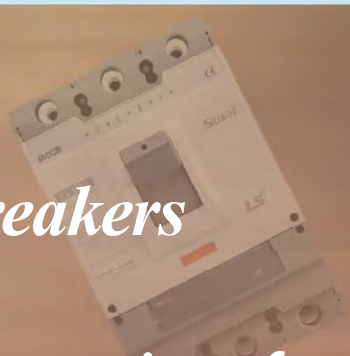
# Global Leading Products




## *Circuit breakers*

For protection of power distribution

A-21




## *Circuit breakers*

For protection of motor &
its control device

A-257




## *Disconnecting switches*

For controlling and
disconnecting circuits

A-261

# 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.

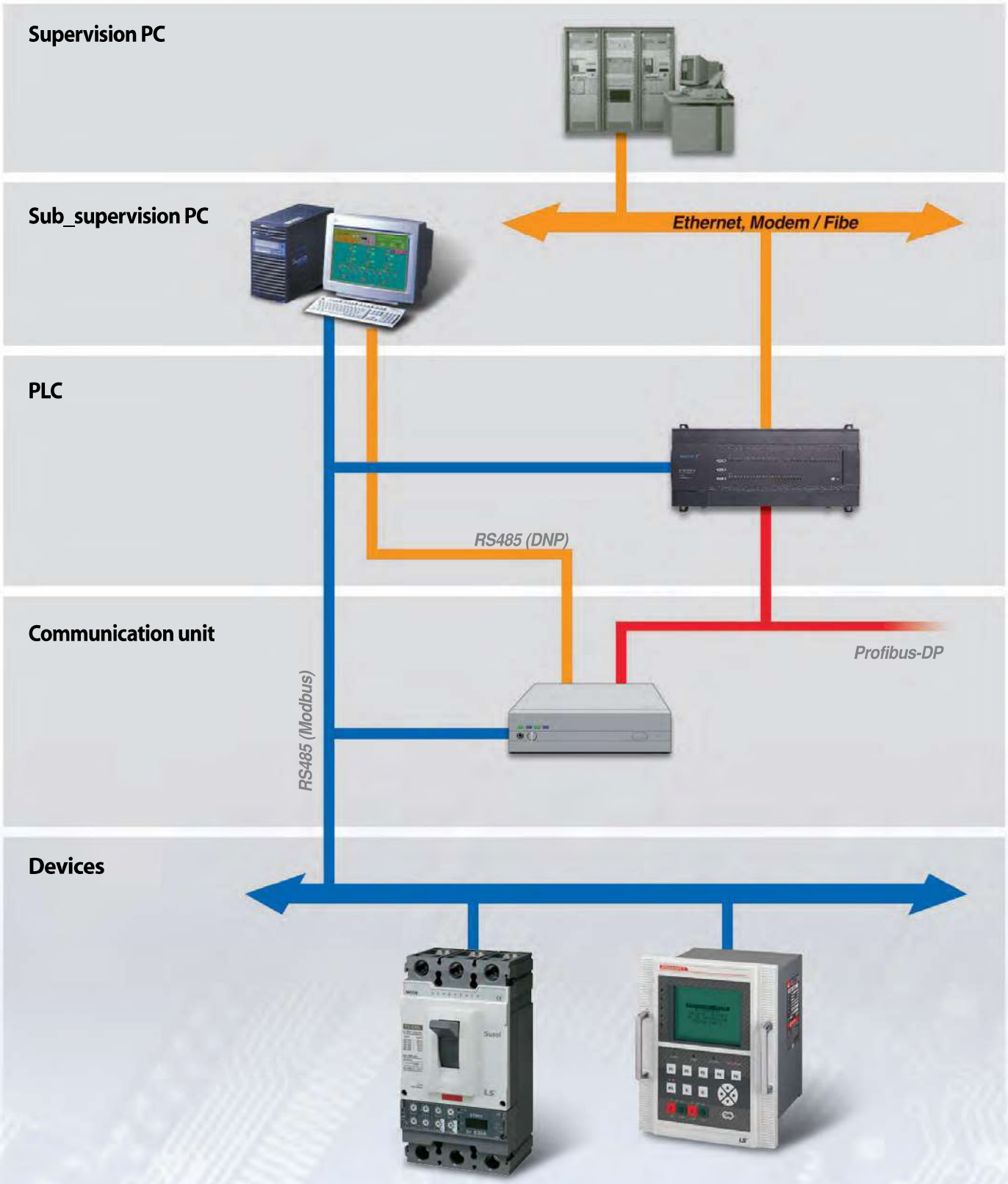
# Susol MCCB Communication






- **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**

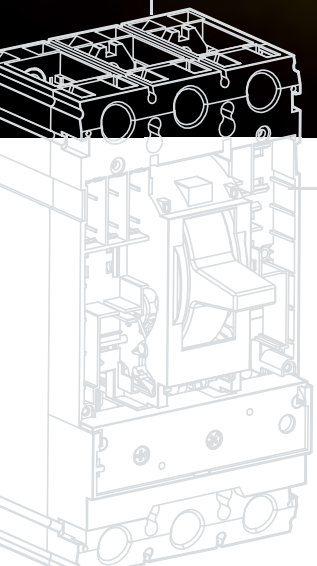
# Providing optimal solution




- 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
# RTU23, RTU33 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 | RTU33 | RTU43 |
|---|---|---|---|---|
| Number of poles | | 3* | 3* | 3* |
| Applicable circuit breaker | TS100 | ■ | | |
| | TS160 | ■ | | |
| | TS250 | ■ | | |
| | TS400 | | ■ | |
| | TS630 | | ■ | |
| | TS800 | | | ■ |
| Protection charicteristics | | | | |
| Sensitivity | I△n(A) | (adjustable) 0.03-0.3-1-3-10 | (adjustable) 0.03-0.3-1-3-10 | (adjustable) 0.03-0.3-1-3-10 |
| Time delay ** | Intentional time delay(ms) | (adjustable) 0-60-150-300-600 | (adjustable) 0-60-150-300-600 | (adjustable) 0-60-150-300-600 |
| | Max. breaking time(ms) | (adjustable) 40-140-240-450-880 | (adjustable) 40-140-240-450-880 | (adjustable) 40-140-240-450-880 |
| Rated voltage | AC 50/60 Hz | 220~460V / 460~690V | 220~460V / 460~690V | 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
- Quarantee safety of the installation
- Reducing the stress on components and damage
- Guarantee service continuity


MCCB
Susol
TS 1600H
1600A


MCCB
TS 630L
Susol
630A


MCCB
TS 250L
Susol
250A


MC-32
Susol




MCCB
TS 250L
Susol
250A


MC-63
Susol


MCCB
DIGITAL TRIP RELAY
Susol
TS 1600H
1600A
Ui 1000V Uimp 8kV
Ue(V) Icu(kA)
220/240 ~ 85kA
380/415 ~ 70kA
440/460 ~ 65kA
480/500 ~ 50kA
TS 630L
TS 250L
TD 160L
TS 160H
TS 250L
250A
40°C
3P
TRIP
ON
OFF
In 250A

# A-1. Overview

Range of LS low voltage circuit breakers ..... A-1-1
General ..... A-1-3
Standard & Approval ..... A-1-4
Structure ..... A-1-5
Marking and configuration ..... A-1-7
Overview of trip unit ..... A-1-9
Switching mechanism ..... A-1-11
Degree of protection ..... A-1-12
Ordering ..... A-1-13

# Range of LS low voltage circuit breakers

Susol

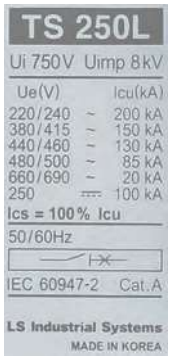
| | Main switchboard | |
|---|---|---|
| Type of circuit breaker | ACB | MCCB |
| Rated current, In | 630~6300A | 1000~1600A |
| Breaking capacity, Icu | 65~150kA | 50~150kA |
| Service breaking capacity (% Icu),Ics | 100% | 75~100% |
| Utilization category | B | A, B |
| Applied standard | IEC 60947-2 | IEC 60947-2 |
| Image of circuit breaker |  |  |
| Brand name | Susol/Metasol | Susol |
| Image of brand | Susol·Metasol | Susol |
| 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 | 1~125A |
| 37~150kA | 10~85kA | 6~10kA |
| 100% | 100% | 50~100% |
| A | A | A |
| IEC 60947-2, UL489 | IEC 60947-2 | IEC60898, 60947-2, UL1077 |
|  |  |  |
| Susol | Metasol | |
| Susol | Metasol | |
| TE, TD, TS | AB series | BK 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.







## 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
- Full type test report issued by KEMA
- Certificate of conformance test - CCC (China)
- Letter of origin

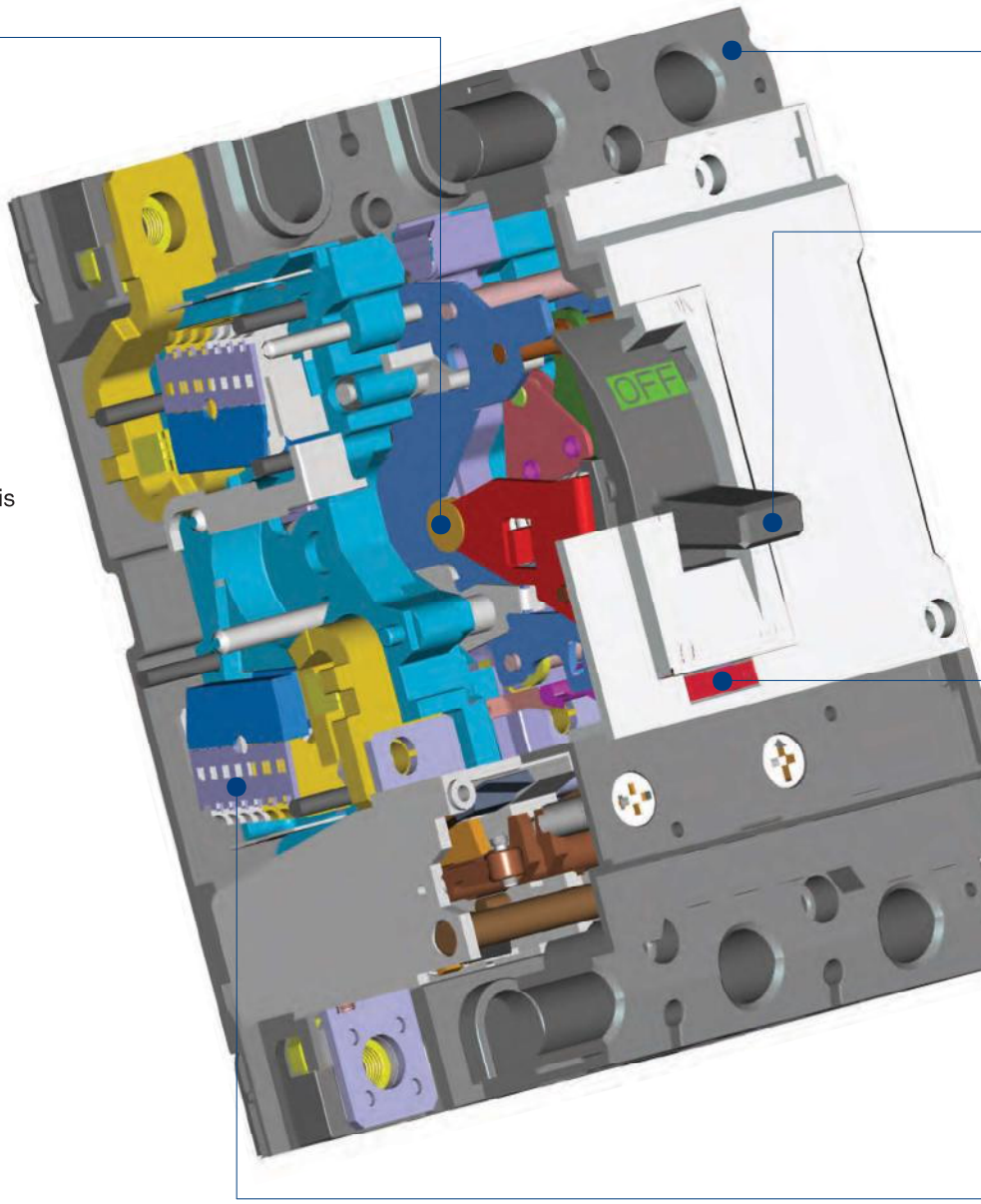
## CE conformity marking

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'.

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.

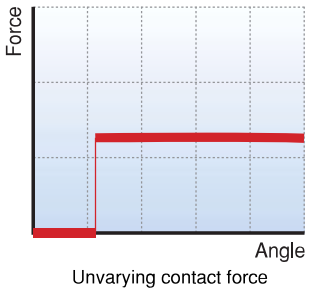



**Mechanism unit**

- 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




Unvarying contact force

# Structure

Susol

### Molded case

- UL94 V-0 flame retarded
- High strength

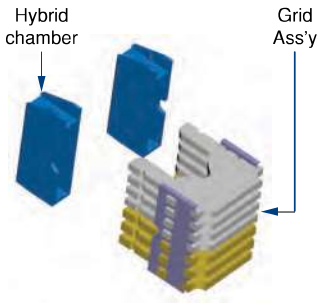
### Trip button (push to trip)

- 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 LSIS




### Handle

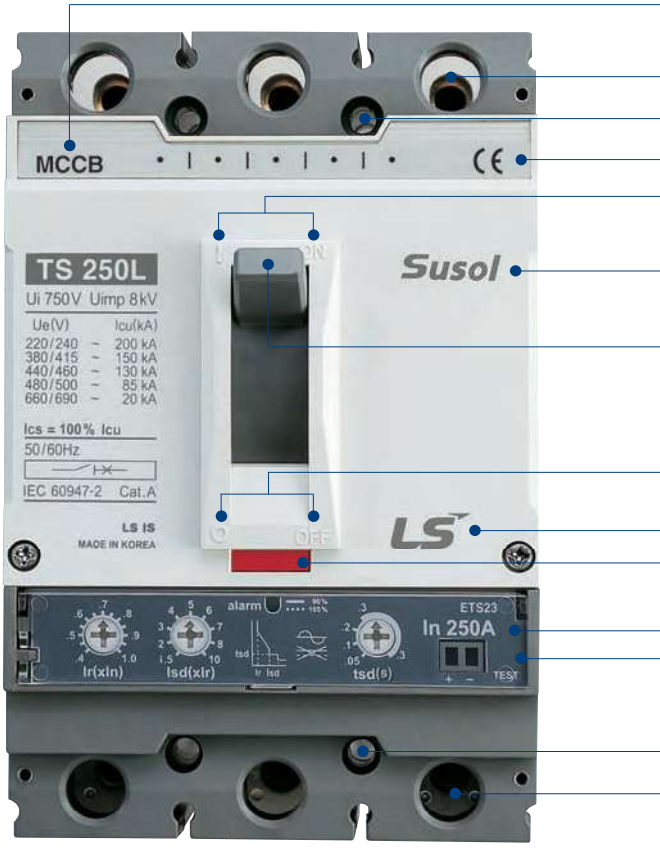
- Function of indications
  - "ON" "OFF" "TRIP"
- Resetting
  When the handle indicates "tripped" position it must first be reset by moving the handle to the "OFF" position and then closing is possible
- Trip-Free even if the handle is held at "ON", the breaker will trip if an over current flows
- Suitable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



# Marking and configuration





# 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



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

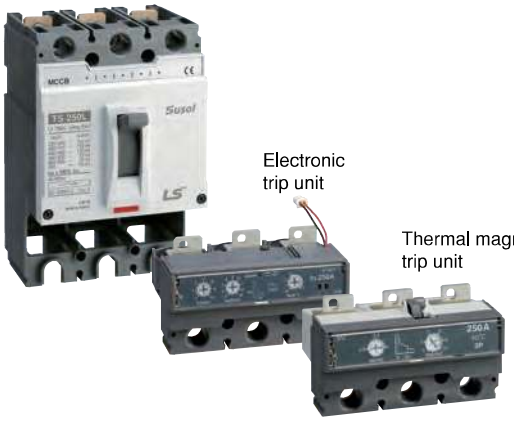
| MCCB frame type | | Rated current, In[A] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Type of trip unit | Thermal magnetic release | | | | Electronic release | | DSU |
| | | FTU | FMU | ATU | MTU | ETS | ETM | |
| TE100<br>TD100 | Built in unit | 16, 20, 25, 32, 40, 50, 63, 80, 100 | 16, 20, 25, 32, 40, 50, 63, 80, 100 | - | - | - | - | - |
| TE160<br>TD160 | Built in unit | 100, 125, 160 | 100, 125, 160 | - | - | - | - | 160 |
| TS100 | Inter changeable trip unit | 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 | Inter changeable trip unit | 100, 125, 160 | 100, 125, 160 | 125, 160 | 32, 50, 63, 100, 160 | 40, 80, 160 | - | 160 |
| TS250 | Inter changeable trip unit | 125, 160, 200, 250 | 125, 160, 200, 250 | 125, 160, 200, 250 | 100, 160, 220 | 40, 80, 160, 250 | - | 250 |
| TS400 | Inter changeable trip unit | 300, 400 | 300, 400 | 300, 400 | 320 | 160, 250, 400 | 160, 250, 400 | 400 |
| TS630 | Inter changeable trip unit | 500, 630 | 500, 630 | 500, 630 | 500 | 160, 250, 400, 630 | 160, 250, 400, 630 | 630 |
| TS800 | Inter changeable trip unit | 700, 800 | 800 | 800 | 630 | 630, 800 | 630, 800 | 800 |

### Types of trip units

| | |
|---|---|
| FTU | • Fixed thermal, Fixed magnetic |
| FMU | • Adjustable thermal, Fixed magnetic |
| ATU | • Adjustable thermal, Adjustable magnetic |
| MTU | • Magnetic only |
| ETS | • Electronic (LSI) |
| ETM | • Electronic (LSIG, Ammeter, Communication, Zone selective interlocking) |
| DSU | • Disconnecting switch |

# Overview of trip units

Susol




## Trip unit identification

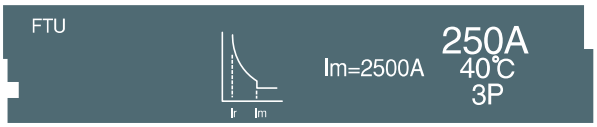
TS250 FMU

Trip unit function

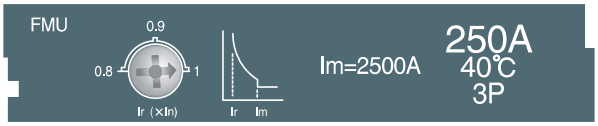
MCCB frame type



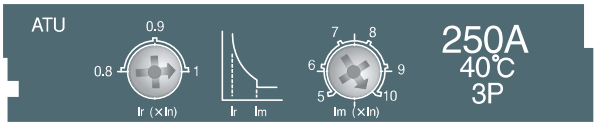

**FTU** **Fixed-thermal, fixed-magnetic**



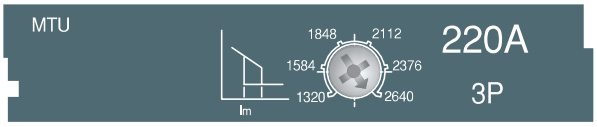

**FMU** **Adjustable-thermal, fixed-magnetic**




**ATU** **Adjustable-thermal, adjustable-magnetic**



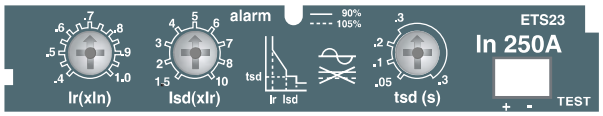

**MTU** **Magnetic only**



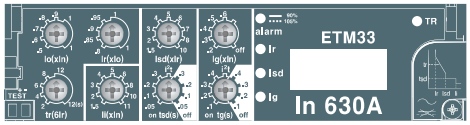

**DSU** **Disconnecting switch**




**ETS** **Electronic (LSI)**




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



# 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

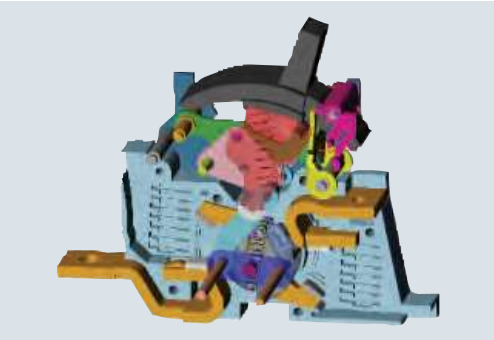


Fig. 4 “OFF“ position

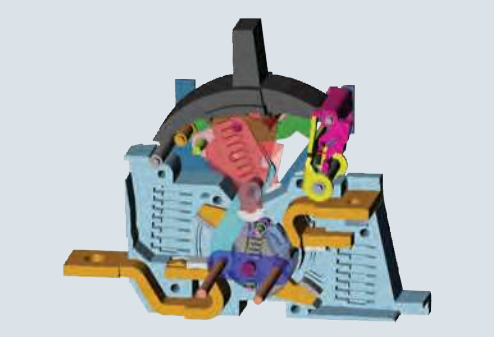
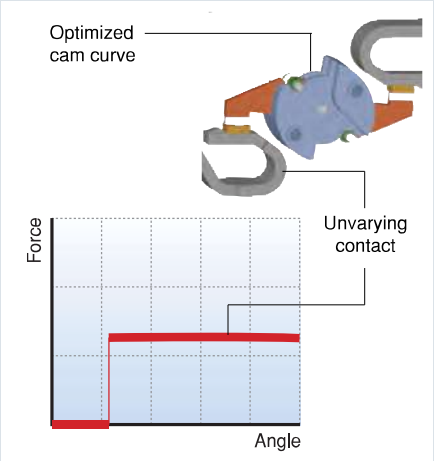


Fig. 5 “TRIP“ position

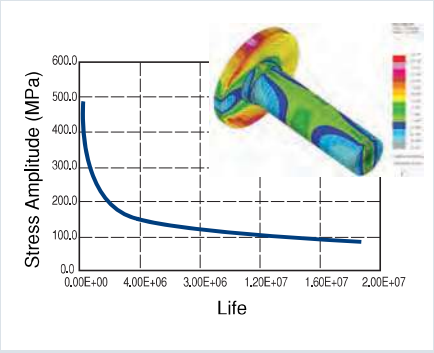
**ON position**

- 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



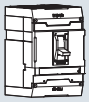
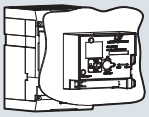
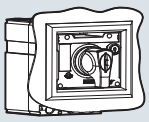
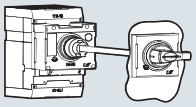

**TRIP position**

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

# Degree of protection



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. * When the circuit breaker is installed and the supplied covers are mounted. | 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 fromany direction | IP65 | Wire |

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

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

**TS250 N FTU 250 3 - AX**

| Ampere frame | |
|---|---|
| TE | 100 |
| | 160 |
| TD | 100 |
| | 160 |
| TS | 100 |
| | 160 |
| | 250 |
| | 400 |
| | 630 |
| | 800 |

| Type | |
|---|---|
| S | Standard |
| N | Normal |
| H | High |
| L | Current limit |

| Trip unit | | |
|---|---|---|
| Thermal magnetic trip unit | FTU | Fixed Trip Unit |
| | FMU | Fixed Magnetic Trip Unit |
| | ATU | Adjustable Trip Unit |
| Electronic trip units | ETS | Electronic Trip Unit Standard |
| | ETM | Electronic Trip Unit Multi Function |

Rated current

| Poles | |
|---|---|
| 2P | 2Pole |
| 3P | 3Pole |
| 4P* | 4Pole |

Note) 4Pole MCCB of TS100 to 800A have N-R-S-T and R-S-T-N both N phase way. Electric trip unit type is only available 3Pole

| | |
|---|---|
| - | Standard |
| P | Plug-in |

Note) Plug in type is only available 3Pole

Accessories

Note) Please refer to A-3

## Trip unit: MTU

**TS250 N MTU 220 3 - AX**

| Ampere frame | |
|---|---|
| TS | 100 |
| | 160 |
| | 250 |
| | 400 |
| | 630 |
| | 800 |

| Type | |
|---|---|
| N | Normal |
| H | High |
| L | Current limit |

Magnetic only trip unit

Rated current

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

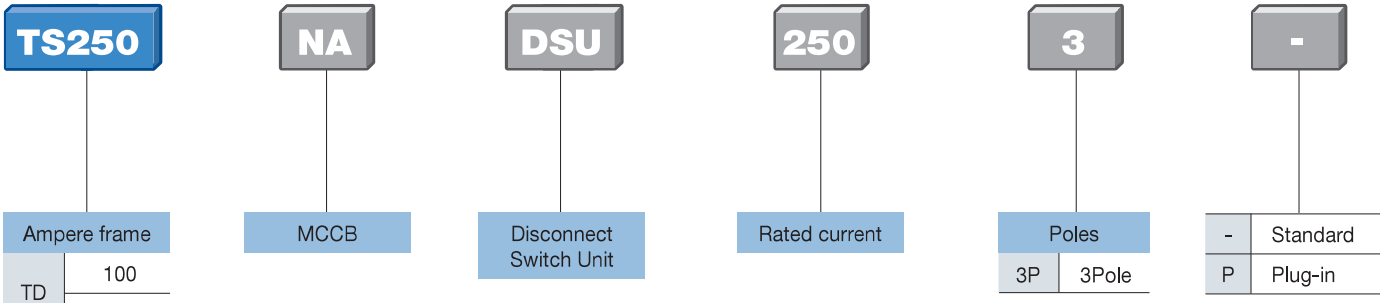
| | |
|---|---|
| - | Standard |
| P | Plug-in |

Accessories

Note) Please refer to A-3

| AF | Rated current |
|---|---|
| TS100 | 1.6, 3.2, 6.3, 12, 20, 32, 50, 63, 100 |
| TS160 | 32, 50, 63, 80, 100, 160 |
| TS250 | 100, 160, 220 |
| TS400 | 320 |
| TS630 | 500 |
| TS800 | 630 |

## Trip unit: DSU




| Ampere frame | |
|---|---|
| TD | 100 |
| | 160 |
| TS | 100 |
| | 160 |
| | 250 |
| | 400 |
| | 630 |
| | 800 |

MCCB

Disconnect Switch Unit

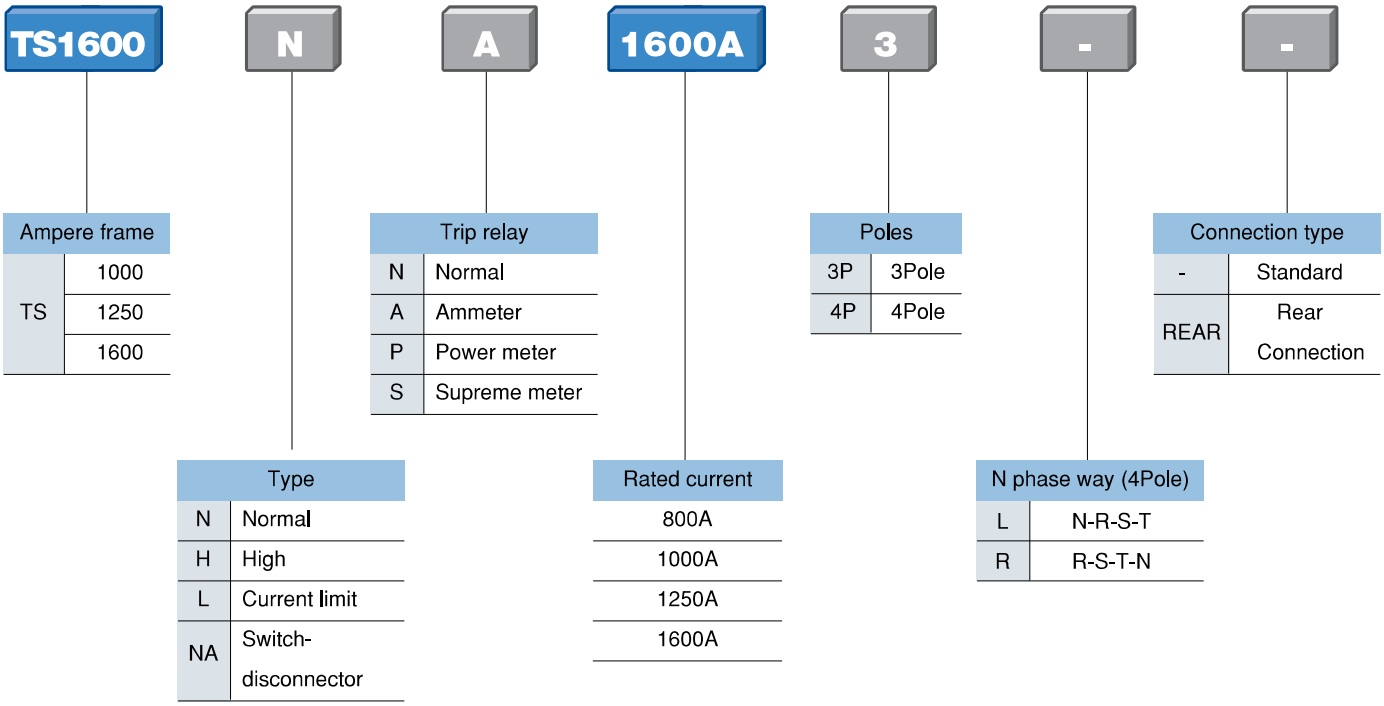
Rated current

| AF | Rated current |
|---|---|
| TD100 | 100 |
| TD160 | 160 |
| TS100 | 100 |
| TS160 | 160 |
| TS250 | 250 |
| TS400 | 400 |
| TS630 | 630 |
| TS800 | 800 |

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

| | |
|---|---|
| - | Standard |
| P | Plug-in |

## Susol TS 1600AF MCCB




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

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

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

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

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

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

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

# Trip relay









| N | G | O |
|---|---|---|
| Trip relay type | Communication & protection | Control voltage & frequency |
| 000 Without trip relay | | |

| N | G | O |
|---|---|---|
| N Normal | G Without comm. + L/S/I/G | 0 Self-Power, 60Hz |
| | | 5 Self-Power, 50Hz |

* L/S/I/G configuration as standard
  -with LED indicators
  -without output contacts
* Ground fault system by vector sum

| A | G | O |
|---|---|---|
| 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
* Ground fault system by vector sum(G,C)
* Earth leakage system
  - Z,K: External CT - LS ZCT applied(fault current 0.5~30A, 1600AF)
  - E,X: External CT - Private ZCT applied(fault current >30A)
* Comm. And output contacts DO NOT work under self-power condition.
  (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
* Ground fault system by vector sum
* Earth leakage system
  - K: External CT - LS ZCT applied(fault current 0.5~30A, 1600AF)
  - X: External CT - Private ZCT applied(fault current >30A)
* Applicable to generator protection purpose
* Comm. And output contacts DO NOT work under self-power condition.
  (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
* Ground fault system by vector sum
* Earth leakage system
  - K: External CT - LS ZCT applied(fault current 0.5~30A, 1600AF)
  - X: External CT - Private ZCT applied(fault current >30A)
* Applicable to generator protection purpose
* Comm. And output contacts DO NOT work under self-power condition.
  (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)


MCCB
TS 250L
Susol
250A
40°C
3P
250A
40°C
3P
250A
40°C
3P
In 250A

# A-2. Main characteristics

## MCCBs for power distribution up to 800A

**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-2-68

## MCCBs for power distribution up to 1600A

**Electrical characteristics** ..... A-2-69
**OCR(Over current relays) Trip unit**
Overview ..... A-2-70
N(Normal), NV type ..... A-2-71
A(Ammeter) type ..... A-2-73
P(Power meter) type ..... A-2-75
S(Supreme meter) type ..... A-2-77
Operation characteristic ..... A-2-79
Measurement function ..... A-2-81
ZSI -Zone Selective Interlocking (A, P, S type) ..... A-2-82
Remote reset and digital I/O (A, P, S type) ..... A-2-83
Communication ..... A-2-84
Event & fault recording (P, S type) ..... A-2-85
System information ..... A-2-85
System block diagram ..... A-2-86
Installation and Handling ..... A-2-87

## Electrical characteristics

| | | | | TE100 | | TE160 | | TD100 | | | TD160 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | | [AF] | 100 | | 160 | | 100 | | | 160 | | |
| Rated current, In * | | | [A] | 16~100 | | 100,125,160 | | 16, 20, 25, 32, 40, 50, 63, 80, 100 | | | 1P: 16, 20, 25, 32, 40, 50, 63, 80, 100,125, 160<br>2, 3P: 100, 125, 160 | | |
| No. of poles | | | | 3,4 | | 3,4 | | 2*, 3, 4 | | | 1, 2*, 3, 4 | | |
| Rated operational voltage, Ue | AC | | [V] | 690 | | 690 | | 690 | | | 240(1P), 690 | | |
| | DC | | [V] | 500 | | 500 | | 500 | | | 250(1P), 500 | | |
| Rated impulse withstand voltage, Uimp | | | [kV] | 8 | | 8 | | 8 | | | 8 | | |
| Rated insulation voltage, Ui | | | [V] | 750 | | 750 | | 750 | | | 750 | | |
| 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 | 30(1P) 85 | 50(1P) 100 | 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 |
| | | 660/690V | [kA] | 6 | 8 | 6 | 8 | 5 | 8 | 10 | 5 | 8 | 10 |
| | DC | 250V | [kA] | 37 | 50 | 37 | 50 | 42 | 65 | 100 | 16(1P) 42 | 25(1P) 65 | 100 |
| | | 500V(2poles in series) | [kA] | 37 | 50 | 37 | 50 | 42 | 65 | 100 | 42 | 65 | 100 |
| Rated service breaking capacity, Ics | | | [%Icu] | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Rated short-circuit making capacity Icm | | | | | | | | | | | | | |
| | AC 50/60Hz | 220/240V | [kA] | 105 | 187 | 105 | 187 | 187 | 220 | 440 | 105(1P) 187 | 105(1P) 220 | 440 |
| | | 380/415V | [kA] | 77.7 | 105 | 77.7 | 105 | 105 | 187 | 330 | 105 | 187 | 330 |
| | | 440/460V | [kA] | 52.5 | 77.7 | 52.5 | 77.7 | 105 | 154 | 286 | 105 | 154 | 286 |
| | | 480/500V | [kA] | 36 | 52.5 | 36 | 52.5 | 63 | 105 | 143 | 63 | 105 | 143 |
| | | 660/690V | [kA] | 9.2 | 13.6 | 9.2 | 13.6 | 8 | 14 | 17 | 8 | 14 | 17 |
| 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 | - | | - | | - | | | - | | |
| Electronic | | | | | | | | | | | | | |
| ●LSI | | | ETS | - | | - | | - | | | - | | |
| ●LSI | | | ETM | - | | - | | - | | | - | | |
| | 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 | | - | | - | | ● | | | ●** | | |
| Mechanical life | | | [operations] | 25000 | | 25000 | | 25000 | | | 25000 | | |
| Electrical life @ 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
** Not applicable to 1pole
* 2 pole MCCB in 3pole frame size

# 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 | | | 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 | | |
| | 750 | | | 750 | | | 750 | | | 750 | | | 750 | | | 750 | | |
| | 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 |
| | 10 | 15 | 20 | 10 | 15 | 20 | 10 | 15 | 20 | 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% |
| | | | | | | | | | | | | | | | | | | |
| | 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 |
| | 17 | 30 | 40 | 17 | 30 | 40 | 17 | 30 | 40 | 17 | 40 | 74 | 17 | 40 | 74 | 17 | 40 | 74 |
| | A | | | A | | | A | | | A | | | A | | | A | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | - | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | | | | | | | | | | | | | | | | | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | - | | | - | | | - | | | ● | | | ● | | | ● | | |
| | - | | | - | | | - | | | ● | | | ● | | | ● | | |
| | - | | | - | | | - | | | ● | | | ● | | | ● | | |
| | - | | | - | | | - | | | ● | | | ● | | | ● | | |
| | - | | | - | | | - | | | ● | | | ● | | | ● | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | ● | | | ● | | | ● | | | ● | | | ● | | | ● | | |
| | 25000 | | | 25000 | | | 25000 | | | 20000 | | | 20000 | | | 10000 | | |
| | 10000 | | | 10000 | | | 10000 | | | 6000 | | | 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

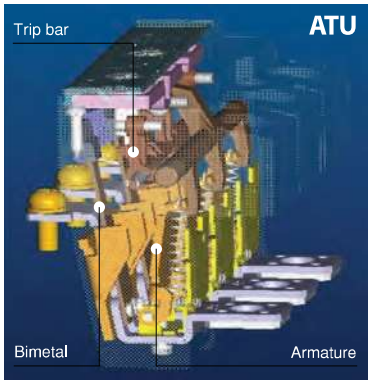
# Thermal magnetic trip units Overview

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 × In)
  4P4T type 100% (neutral protection at 1 × In)

## 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) at 40℃ In | Thermal magnetic trip units(FTU/FMU/ATU) TE100 to TS800 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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.

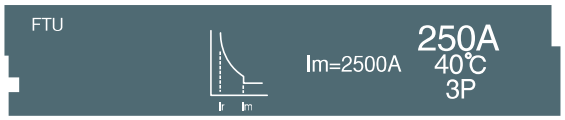
# Thermal magnetic trip units Overview

## Characteristics

### Fixed thermal, fixed magnetic trip units

**FTU**

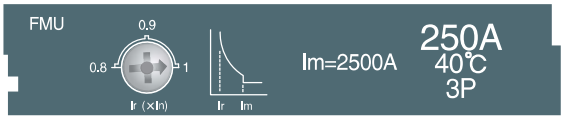
- Fixed thermal
  16A ... 800A rated currents
- Fixed magnetic
  400A ... 8000A tripping currents
- Applicable to TE100 ... TS800 frames




### Adjustable thermal, fixed magnetic trip units

**FMU**

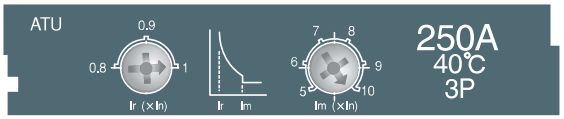
- Adjustable thermal
  16A ... 800A rated currents
  Adjustable : 0.8~1 × In
- Fixed magnetic
  400A ... 8000A tripping currents
- Applicable to TE100 ... TS800 frames




### Adjustable thermal, adjustable magnetic trip units

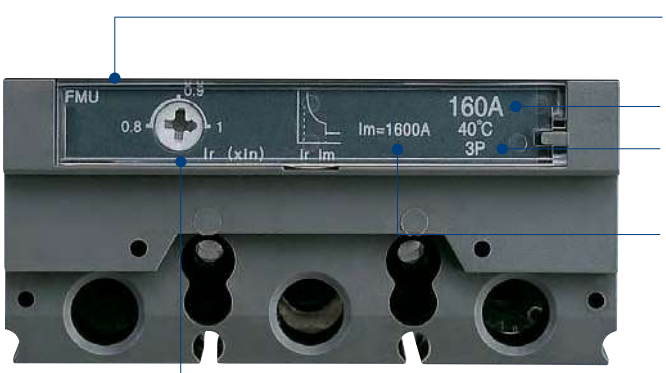
**ATU**

- Adjustable thermal
  100A ... 800A rated currents
  Adjustable : 0.8~1 × In
- Adjustable magnetic
  500A ... 8000A tripping currents
  Adjustable : 5~10 × In
- Applicable to TS160 ... TS800 frames



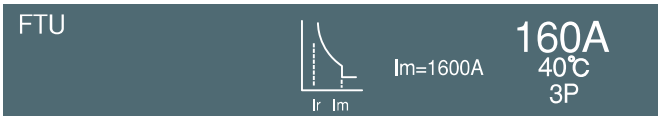
# Thermal magnetic trip units
# FTU, FMU for TE100, TD100, TE160, TD160

## Configuration



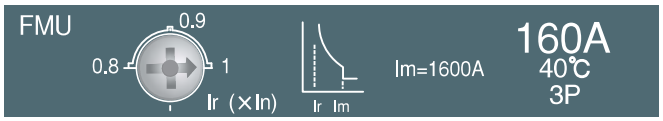

**TE100 FTU, TD100 FTU, TE160 FTU, TD160 FTU**

- Fixed thermal & magnetic trip unit

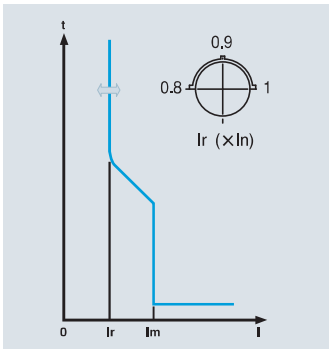



**TE100 FMU, TD100 FMU, TE160 FMU, TD160 FMU**

- 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

# 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) Im | | | |
| | 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

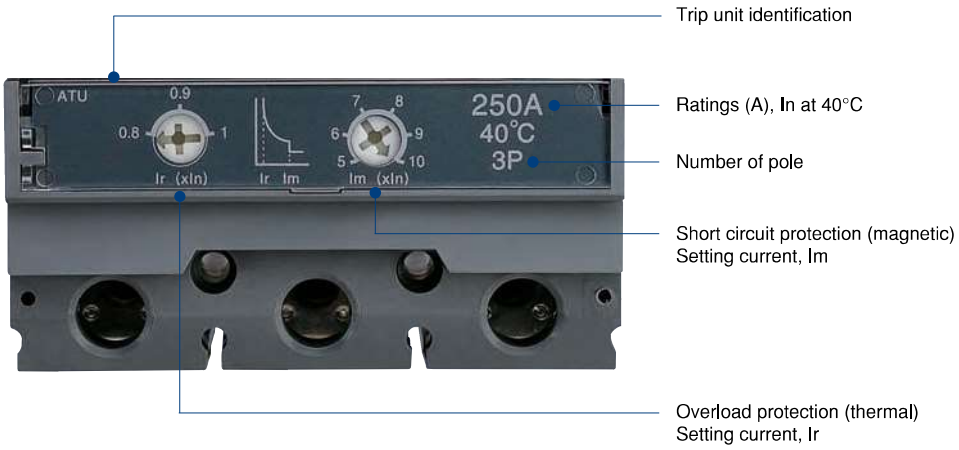
| Trip unit type | Setting Ir | Trip unit rating, In (A) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 80 | 100 | 125 | 160 |
| TE/TD100FTU | Fixed | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 80 | 100 | - | - |
| TE/TD100FMU | 0.8 | 12.8 | 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 | Fixed | - | - | - | - | - | - | - | - | 100 | 125 | 160 |
| TE/TD160FMU | 0.8 | - | - | - | - | - | - | - | - | 80 | 100 | 128 |
| | 0.9 | - | - | - | - | - | - | - | - | 90 | 112.5 | 144 |
| | 1 | - | - | - | - | - | - | - | - | 100 | 125 | 160 |

### Magnetic short-circuit protection

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

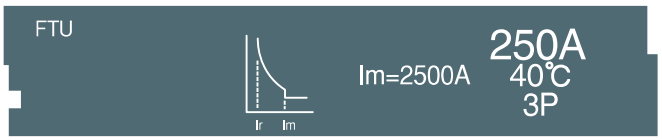
# Thermal magnetic trip units
# FTU, FMU for TS100, TS160, TS250
# ATU for TS160, TS250

## Configuration



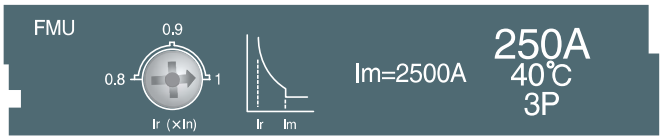

**TS100 FTU, TS160 FTU, TS250 FTU**

- Fixed thermal fixed magnetic trip unit



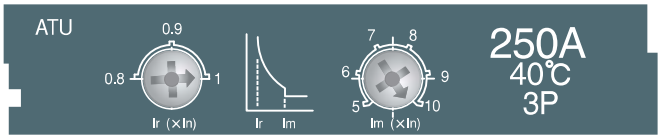

**TS100 FMU, TS160 FMU, TS250 FMU**

- Adjustable thermal fixed magnetic trip unit

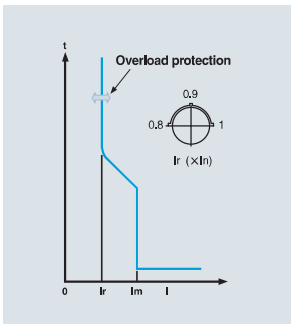



**TS160 ATU, TS250 ATU**

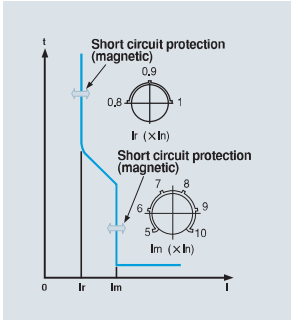
- Adjustable thermal adjustable magnetic trip unit




**TS100 FMU, TS160 FMU, TS250 FMU**




**TS160 ATU, TS250 ATU**



# 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℃ 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×In |
| | ATU | Adjustable 0.8 to×In |

| Short - circuit protection(magnetic) | | |
|---|---|---|
| Current setting(A) Im | | |
| | 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

**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

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

## Setting details

**Thermal overload protection**

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

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

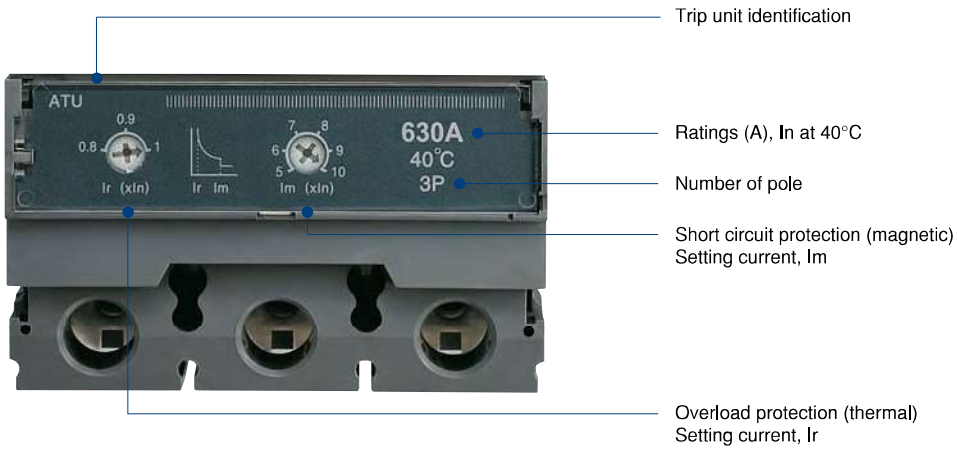
## Setting details

**Magnetic short-circuit protection**

| Trip unit type | Setting current, Ir | Setting current, Im | | Trip unit rating, In (A) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 40 | 50 | 63 | 80 | 100 | 125 | 160 | 200 | 250 |
| TS100FTU | | Fixed | In×10 | 400 | 500 | 630 | 800 | 1000 | - | - | - | - |
| TS100FMU | 0.8×In | Fixed | In×10 | 400 | 500 | 630 | 800 | 1000 | - | - | - | - |
| | 0.9×In | Fixed | In×10 | 400 | 500 | 630 | 800 | 1000 | - | - | - | - |
| | 1.0×In | Fixed | In×10 | 400 | 500 | 630 | 800 | 1000 | - | - | - | - |
| TS160FTU | | Fixed | In×10 | - | - | - | - | 1000 | 1250 | 1600 | | |
| TS160FMU | 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 | - | - |
| TS160ATU | 0.8×In | Adjustable | In×5 | - | - | - | - | - | 625 | 800 | - | - |
| | | | In×6 | - | - | - | - | - | 750 | 960 | - | - |
| | | | In×7 | - | - | - | - | - | 875 | 1120 | - | - |
| | | | In×8 | - | - | - | - | - | 1000 | 1280 | - | - |
| | | | In×9 | - | - | - | - | - | 1125 | 1440 | - | - |
| | | | In×10 | - | - | - | - | - | 1250 | 1600 | - | - |
| | 0.9×In | Adjustable | In×5 | - | - | - | - | - | 625 | 800 | - | - |
| | | | In×6 | - | - | - | - | - | 750 | 960 | - | - |
| | | | In×7 | - | - | - | - | - | 875 | 1120 | - | - |
| | | | In×8 | - | - | - | - | - | 1000 | 1280 | - | - |
| | | | In×9 | - | - | - | - | - | 1125 | 1440 | - | - |
| | | | In×10 | - | - | - | - | - | 1250 | 1600 | - | - |
| | 1.0×In | Adjustable | In×5 | - | - | - | - | - | 625 | 800 | - | - |
| | | | In×6 | - | - | - | - | - | 750 | 960 | - | - |
| | | | In×7 | - | - | - | - | - | 875 | 1120 | - | - |
| | | | In×8 | - | - | - | - | - | 1000 | 1280 | - | - |
| | | | In×9 | - | - | - | - | - | 1125 | 1440 | - | - |
| | | | In×10 | - | - | - | - | - | 1250 | 1600 | - | - |
| TS250FTU | | Fixed | In×10 | - | - | - | - | - | 1250 | 1600 | 2000 | 2500 |
| TS250FMU | 0.8×In | Fixed | In×10 | - | - | - | - | - | 1250 | 1600 | 2000 | 2500 |
| | 0.9×In | Fixed | In×10 | - | - | - | - | - | 1250 | 1600 | 2000 | 2500 |
| | 1.0×In | Fixed | In×10 | - | - | - | - | - | 1250 | 1600 | 2000 | 2500 |
| TS250ATU | 0.8×In | Adjustable | In×5 | - | - | - | - | - | 625 | 800 | 1000 | 1250 |
| | | | In×6 | - | - | - | - | - | 750 | 960 | 1200 | 1500 |
| | | | In×7 | - | - | - | - | - | 875 | 1120 | 1400 | 1750 |
| | | | In×8 | - | - | - | - | - | 1000 | 1280 | 1600 | 2000 |
| | | | In×9 | - | - | - | - | - | 1125 | 1440 | 1800 | 2250 |
| | | | In×10 | - | - | - | - | - | 1250 | 1600 | 2000 | 2500 |
| | 0.9×In | Adjustable | In×5 | - | - | - | - | - | 625 | 800 | 1000 | 1250 |
| | | | In×6 | - | - | - | - | - | 750 | 960 | 1200 | 1500 |
| | | | In×7 | - | - | - | - | - | 875 | 1120 | 1400 | 1750 |
| | | | In×8 | - | - | - | - | - | 1000 | 1280 | 1600 | 2000 |
| | | | In×9 | - | - | - | - | - | 1125 | 1440 | 1800 | 2250 |
| | | | In×10 | - | - | - | - | - | 1250 | 1600 | 2000 | 2500 |
| | 1.0×In | Adjustable | In×5 | - | - | - | - | - | 625 | 800 | 1000 | 1250 |
| | | | In×6 | - | - | - | - | - | 750 | 960 | 1200 | 1500 |
| | | | In×7 | - | - | - | - | - | 875 | 1120 | 1400 | 1750 |
| | | | In×8 | - | - | - | - | - | 1000 | 1280 | 1600 | 2000 |
| | | | In×9 | - | - | - | - | - | 1125 | 1440 | 1800 | 2250 |
| | | | In×10 | - | - | - | - | - | 1250 | 1600 | 2000 | 2500 |

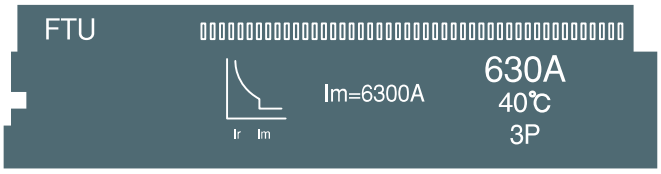
# Thermal magnetic trip units
# FTU, FMU, ATU for TS400, TS630

## Configuration



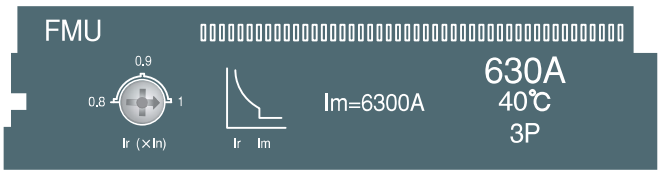

**TS400 FTU, TS630 FTU**

- Fixed thermal fixed magnetic trip unit



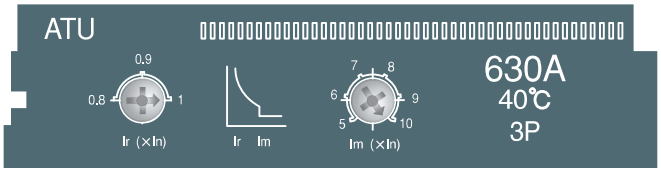

**TS400 FMU, TS630 FMU**

- Adjustable thermal fixed magnetic trip unit

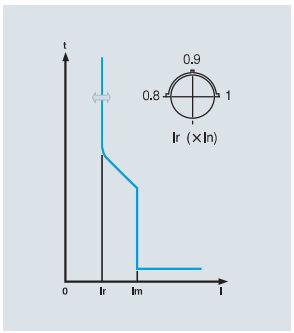



**TS400 ATU, TS630 ATU**

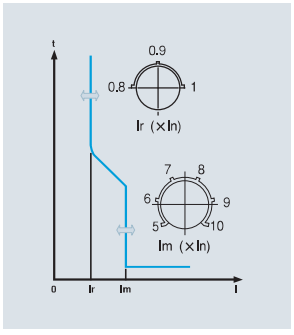
- Adjustable thermal adjustable magnetic trip unit




**TS400 FMU, TS630 FMU**



**TS400 ATU, TS630 ATU**



# 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℃ 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) Im | | | | | |
| | 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

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

## Setting details

**Thermal overload protection**

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

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

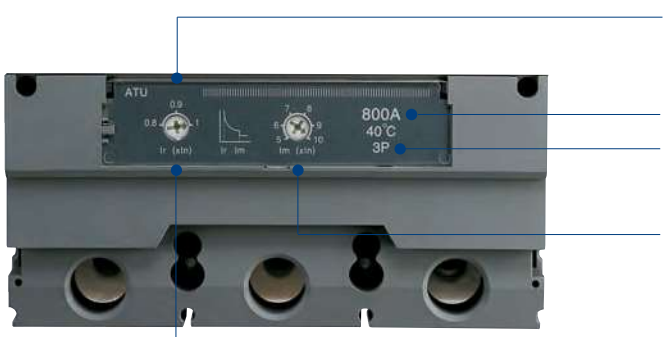
## Setting details

**Magnetic short-circuit protection**

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

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

## Configuration




Trip unit identification

Ratings (A), In at 40°C

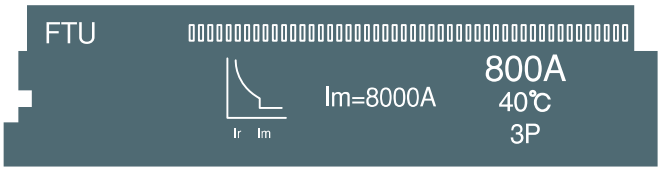
Number of pole

Short circuit protection (magnetic)
Setting current, Im

Overload protection (thermal)
Setting current, Ir

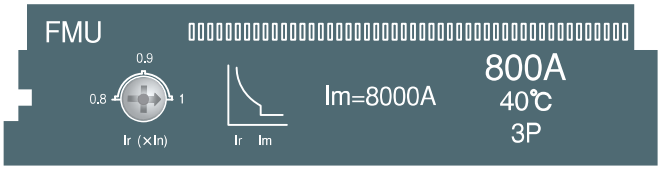
**TS800 FTU**

- Fixed thermal fixed magnetic trip unit



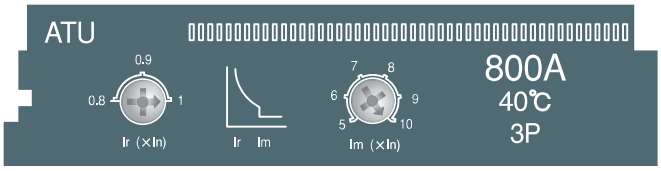

**TS800 FMU**

- Adjustable thermal fixed magnetic trip unit

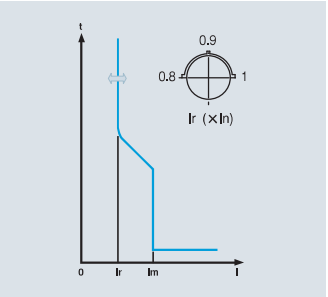



**TS800 ATU**

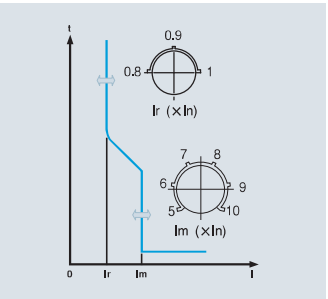
- Adjustable thermal adjustable magnetic trip unit




**TS800 FMU**




**TS800 ATU**




## 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

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

## Characteristics

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

| Overload protection(thermal) | | |
|---|---|---|
| Current setting(A) Ir | | |
| | 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) Im | | |
| | 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) |

## Setting details

**Thermal overload protection**

| Trip unit type | | Setting Ir | Trip unit rating, In (A) 800 |
|---|---|---|---|
| | 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 current, Ir | Setting current, Im | | Trip unit rating, In (A) 800 |
|---|---|---|---|---|---|
| | TS800FTU | | Fixed | In×10 | 8000 |
| | TS800FMU | 0.8×In | Fixed | In×10 | 8000 |
| | | 0.9×In | Fixed | In×10 | 8000 |
| | | 1.0×In | Fixed | In×10 | 8000 |
| | TS800ATU | 0.8×In | Adjustable | In×5 | 4000 |
| | | | | In×6 | 4800 |
| | | | | In×7 | 5600 |
| | | | | In×8 | 6400 |
| | | | | In×9 | 7200 |
| | | | | In×10 | 8000 |
| | | 0.9×In | Adjustable | In×5 | 4000 |
| | | | | In×6 | 4800 |
| | | | | In×7 | 5600 |
| | | | | In×8 | 6400 |
| | | | | In×9 | 7200 |
| | | | | In×10 | 8000 |
| | | 1.0×In | Adjustable | In×5 | 4000 |
| | | | | In×6 | 4800 |
| | | | | In×7 | 5600 |
| | | | | In×8 | 6400 |
| | | | | In×9 | 7200 |
| | | | | In×10 | 8000 |

# Overview of electronic trip units (Standard type)

**Types: ETS23, ETS33, ETS43**

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

**Only three(3) pole circuit breakers are available.**

**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, In (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, Ir(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

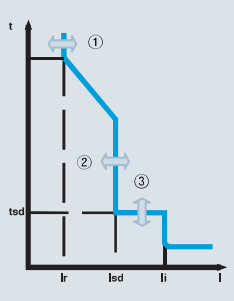
| Overload protection (long time) | |
|---|---|
| Setting current (A), Ir | 0.4, 0.45, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8, 0.85, 0.9, 0.95, 1.0×In, 13 setting |
| Tripping time (s) | Fixed at 6×Ir , tolerance±20% |

| Short-circuit protection (short time) | |
|---|---|
| Tripping threshold (A), Isd | adjustable 1.5, 2, 3, 4, 5, 6, 7, 8, 10×Ir, 9 setting, tolerance ±15% |
| Time delay (ms) | adjustable 50, 100, 200, 300, 4 setting, tolerance ±20% |

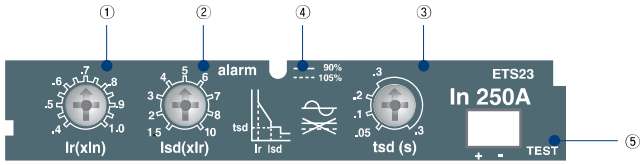
| Short circuit protection (Instantaneous) | |
|---|---|
| Tripping threshold (A), Ii | Fixed at 11×In |

# Overview of electronic trip units (Standard type)

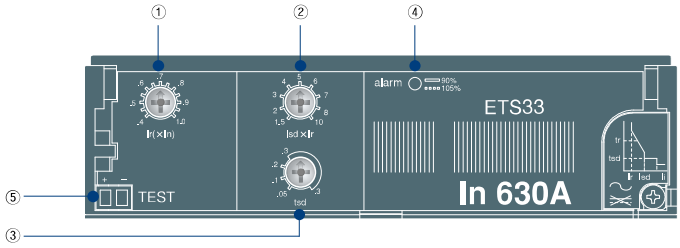
① Adjustable rated current setting (Ir)
② Adjustable short time delay current setting (Isd)
③ Adjustable time delay setting (tsd)
④ Alarm LED
90% Ir: ON,
105% Ir or more: ON-OFF
⑤ Test connector



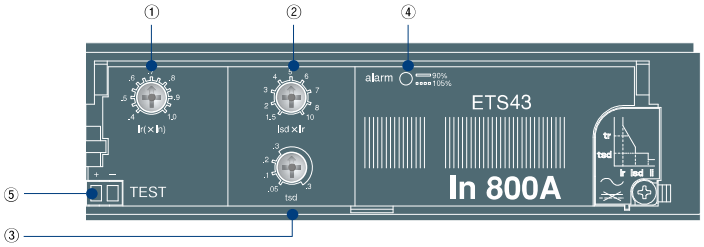

## ETS23 for TS100/TS160/TS250




## ETS33 for TS400/TS630



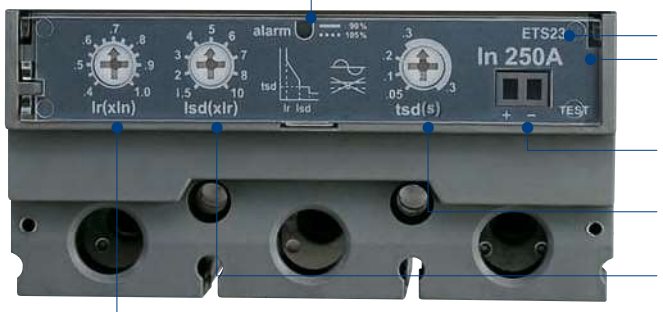

## ETS43 for TS800



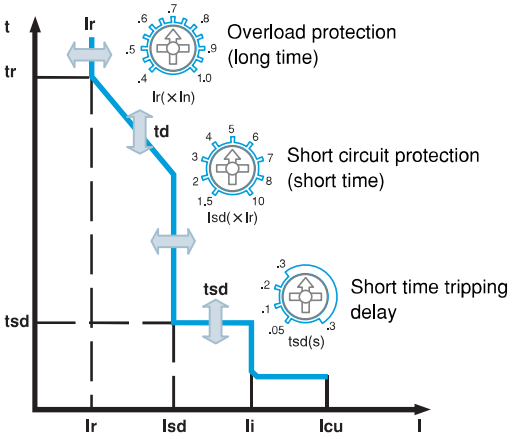
# Electronic trip units (Standard)
# ETS23 for TS100, TS160, TS250

## Configuration

**Electronic type, ETS23 for MCCBs TS100, TS160, TS250**




Indication of alarm
Load: not less than 90% Ir → LED ON
Load: not less than 105% Ir → LED flickering
Trip unit identification
Trip unit rating, In
Test connector
Short time tripping delay
Short circuit protection (short time)
Overload protection (long time)




Overload protection (long time)
Short circuit protection (short time)
Short time tripping delay

| Overload protection (long time) | |
|---|---|
| Setting current (A), Ir | 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×In<br>13 settings |
| Tripping time (s) | Fixed at 6×Ir , tolerance±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), Ii | Fixed at 11×In |

## Catalogue numbering system

ETS 23 In250A

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

**Rated current, In**
- 40, 80A for TS100
- 40, 80, 160A for TS160
- 40, 80, 160, 250A for TS250

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

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

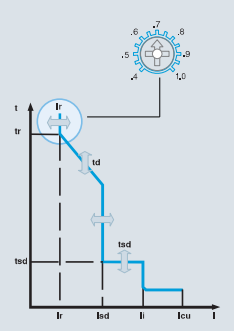
## Current setting, Ir (A)

**Standard electronic trip unit, ETS23**

| Trip unit | 16 | 32 | 40 | 64 | 80 | 100 | 160 | 250 | 320 | 400 | 630 | 800 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| for TS100 | | | | | | | | | | | | |
| for TS160 | | | | | | | | | | | | |
| for TS250 | | | | | | | | | | | | |

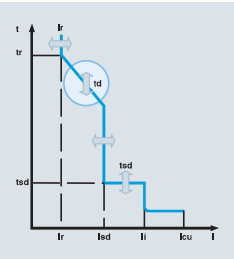
## Setting details

**Overload protection (long time)**




| Circuit breakers | TS100 | | TS160 | | | TS250 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Trip unit rating, In(A) | 40 | 80 | 40 | 80 | 160 | 40 | 80 | 160 | 250 |
| **Setting value** | **Overload protection setting current Ir = Setting value (0.4~1) × In** | | | | | | | | |
| 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, td (sec)**

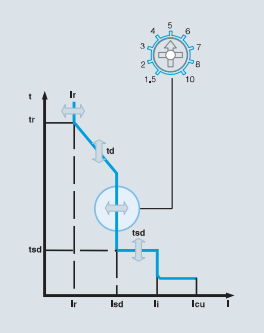



| | |
|---|---|
| Tripping time (s) | Fixed at 6×Ir<br>tolerance±20% |

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

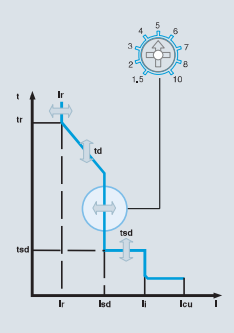
## Setting details

**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, Isd = Setting value (1.5~10) × Ir | | | | | | | | |
| 0.4 | | 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 | 1.5 | 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 | | 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 | 2 | 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 | | 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 | 3 | 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 |

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

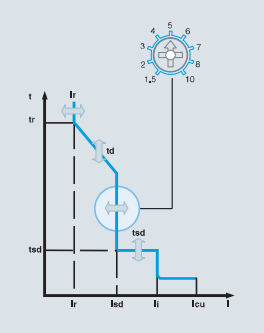



| Circuit breakers | | TS100 | | TS160 | | | TS250 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Trip unit rating, In(A) | | 40 | 80 | 40 | 80 | 160 | 40 | 80 | 160 | 250 |
| Setting value | | Short time pick-up current setting, Isd = Setting value (1.5~10)×Ir | | | | | | | | |
| 0.4 | | 64 | 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 | 4 | 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 | | 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 | 5 | 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 | | 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 | 6 | 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 |

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

## Setting details

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

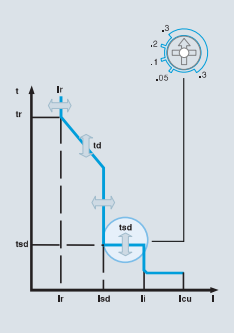



| Circuit breakers | | TS100 | | TS160 | | | TS250 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Trip unit rating, In(A) | | 40 | 80 | 40 | 80 | 160 | 40 | 80 | 160 | 250 |
| Setting value | | Short time pick-up current setting, Isd = Setting value (1.5~10)×Ir | | | | | | | | |
| 0.4 | | 112 | 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 | 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 | | 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 | 8 | 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 | | 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 | 10 | 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 |

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

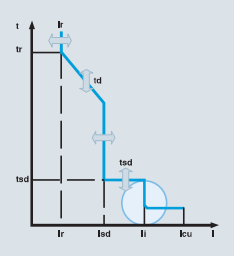
## Setting details

**Short time tripping delay setting, tsd (ms)**




| | | | | | | |
|---|---|---|---|---|---|---|
| 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), Ii (A)**




| | |
|---|---|
| Tripping threshold (A), Ii | Fixed at 11×In |

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

## Configuration

**Electronic type, ETS33 for MCCBs TS400 & TS630**




Indication of alarm
Load: not less than 90% Ir → LED ON
Load: not less than 105% Ir → LED flickering

Trip unit identification

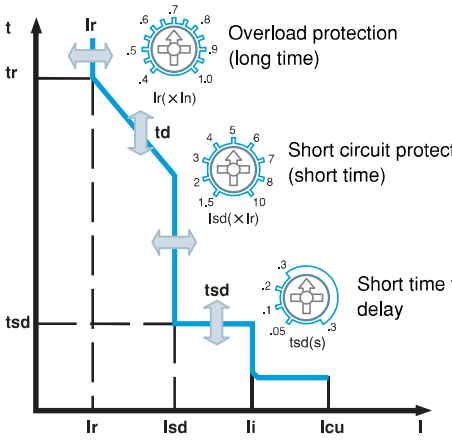
Trip unit rating, In

Short-circuit protection (short time)

Short time tripping delay

Overload protection (long time)

Test connector




Overload protection (long time)

Short circuit protection (short time)

Short time tripping delay

| Overload protection (long time) | |
|---|---|
| Setting current (A), Ir | 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×In<br>13 settings |
| Tripping time (s) | Fixed at 6×Ir , tolerance±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), Ii | Fixed at 11×In |

## Catalogue numbering system

ETS 33 In630A

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

**Rated current, In**
- 160, 250, 400A for TS400
- 160, 250, 400, 630A for TS630

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

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

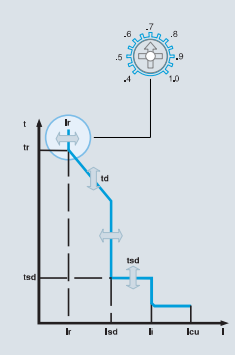
## Current setting, Ir (A)

**Standard electronic trip unit, ETS33**

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

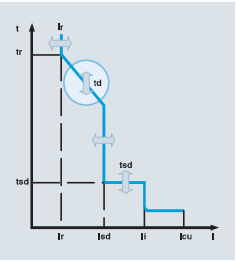
## Setting details

**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)**

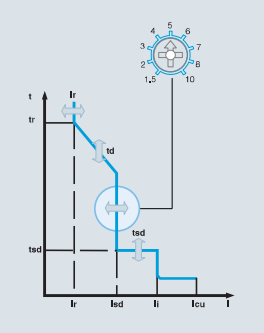



| | |
|---|---|
| Tripping time (s) | Fixed at 6×Ir<br>tolerance±20% |

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

## Setting details

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

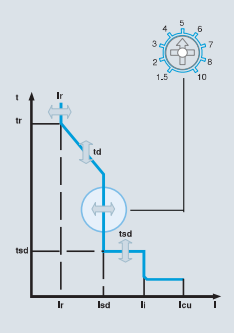



| Circuit breakers | | TS400 | | | TS630 | | | |
|---|---|---|---|---|---|---|---|---|
| Trip unit rating, In(A) | | 160 | 250 | 400 | 160 | 250 | 400 | 630 |
| Setting value | | Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir | | | | | | |
| 0.4 | 1.5 | 96 | 150 | 240 | 96 | 150 | 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 | | 240 | 375 | 600 | 240 | 375 | 600 | 945 |
| 0.4 | 2 | 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 | | 304 | 475 | 760 | 304 | 475 | 760 | 1197 |
| 1 | | 320 | 500 | 800 | 320 | 500 | 800 | 1260 |
| 0.4 | 3 | 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 |

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

## Setting details

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

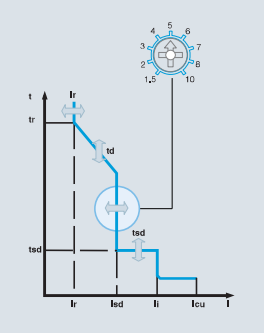



| Circuit breakers | | TS400 | | | TS630 | | | |
|---|---|---|---|---|---|---|---|---|
| Trip unit rating, In(A) | | 160 | 250 | 400 | 160 | 250 | 400 | 630 |
| Setting value | | Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir | | | | | | |
| 0.4 | | 256 | 400 | 640 | 256 | 400 | 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 | 4 | 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 | | 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 | 5 | 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 | | 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 | 6 | 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 |

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

## Setting details

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

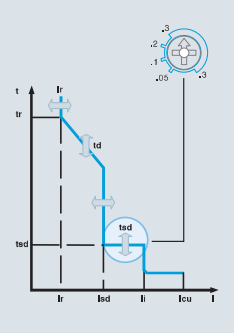



| Circuit breakers | | TS400 | | | TS630 | | | |
|---|---|---|---|---|---|---|---|---|
| Trip unit rating, In(A) | | 160 | 250 | 400 | 160 | 250 | 400 | 630 |
| Setting value | | Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir | | | | | | |
| 0.4 | | 448 | 700 | 1120 | 448 | 700 | 1120 | 1764 |
| 0.45 | | 504 | 788 | 1260 | 504 | 788 | 1260 | 1984 |
| 0.5 | | 560 | 875 | 1400 | 560 | 875 | 1400 | 2205 |
| 0.55 | | 616 | 963 | 1540 | 616 | 963 | 1540 | 2425 |
| 0.6 | | 672 | 1050 | 1680 | 672 | 1050 | 1680 | 2646 |
| 0.65 | | 728 | 1138 | 1820 | 728 | 1138 | 1820 | 2867 |
| 0.7 | 7 | 784 | 1225 | 1960 | 784 | 1225 | 1960 | 3087 |
| 0.75 | | 840 | 1313 | 2100 | 840 | 1313 | 2100 | 3308 |
| 0.8 | | 896 | 1400 | 2240 | 896 | 1400 | 2240 | 3528 |
| 0.85 | | 952 | 1488 | 2380 | 952 | 1488 | 2380 | 3749 |
| 0.9 | | 1008 | 1575 | 2520 | 1008 | 1575 | 2520 | 3969 |
| 0.95 | | 1064 | 1663 | 2660 | 1064 | 1663 | 2660 | 4190 |
| 1 | | 1120 | 1750 | 2800 | 1120 | 1750 | 2800 | 4410 |
| 0.4 | | 512 | 800 | 1280 | 512 | 800 | 1280 | 2016 |
| 0.45 | | 576 | 900 | 1440 | 576 | 900 | 1440 | 2268 |
| 0.5 | | 640 | 1000 | 1600 | 640 | 1000 | 1600 | 2520 |
| 0.55 | | 704 | 1100 | 1760 | 704 | 1100 | 1760 | 2772 |
| 0.6 | | 768 | 1200 | 1920 | 768 | 1200 | 1920 | 3024 |
| 0.65 | | 832 | 1300 | 2080 | 832 | 1300 | 2080 | 3276 |
| 0.7 | 8 | 896 | 1400 | 2240 | 896 | 1400 | 2240 | 3528 |
| 0.75 | | 960 | 1500 | 2400 | 960 | 1500 | 2400 | 3780 |
| 0.8 | | 1024 | 1600 | 2560 | 1024 | 1600 | 2560 | 4032 |
| 0.85 | | 1088 | 1700 | 2720 | 1088 | 1700 | 2720 | 4284 |
| 0.9 | | 1152 | 1800 | 2880 | 1152 | 1800 | 2880 | 4536 |
| 0.95 | | 1216 | 1900 | 3040 | 1216 | 1900 | 3040 | 4788 |
| 1 | | 1280 | 2000 | 3200 | 1280 | 2000 | 3200 | 5040 |
| 0.4 | | 640 | 1000 | 1600 | 640 | 1000 | 1600 | 2520 |
| 0.45 | | 720 | 1125 | 1800 | 720 | 1125 | 1800 | 2835 |
| 0.5 | | 800 | 1250 | 2000 | 800 | 1250 | 2000 | 3150 |
| 0.55 | | 880 | 1375 | 2200 | 880 | 1375 | 2200 | 3465 |
| 0.6 | | 960 | 1500 | 2400 | 960 | 1500 | 2400 | 3780 |
| 0.65 | | 1040 | 1625 | 2600 | 1040 | 1625 | 2600 | 4095 |
| 0.7 | 10 | 1120 | 1750 | 2800 | 1120 | 1750 | 2800 | 4410 |
| 0.75 | | 1200 | 1875 | 3000 | 1200 | 1875 | 3000 | 4725 |
| 0.8 | | 1280 | 2000 | 3200 | 1280 | 2000 | 3200 | 5040 |
| 0.85 | | 1360 | 2125 | 3400 | 1360 | 2125 | 3400 | 5355 |
| 0.9 | | 1440 | 2250 | 3600 | 1440 | 2250 | 3600 | 5670 |
| 0.95 | | 1520 | 2375 | 3800 | 1520 | 2375 | 3800 | 5985 |
| 1 | | 1600 | 2500 | 4000 | 1600 | 2500 | 4000 | 6300 |

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

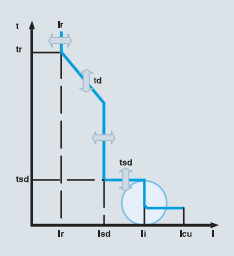
## Setting details

**Short time tripping delay setting, tsd (ms)**




| | | | | | | |
|---|---|---|---|---|---|---|
| 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), Ii (A)**

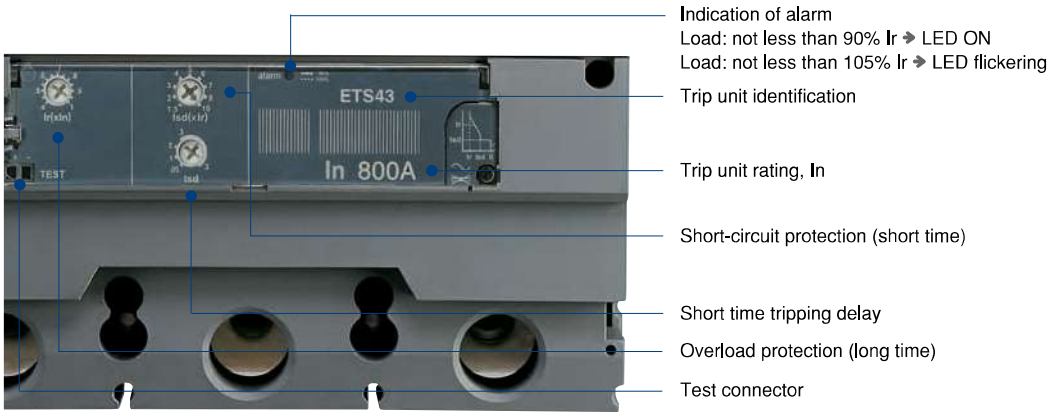


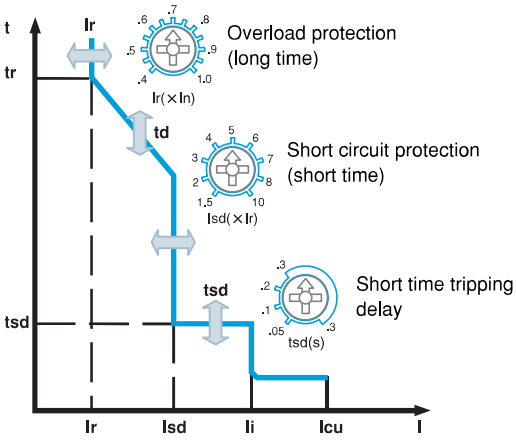

| | |
|---|---|
| Tripping threshold (A), Ii | Fixed at 11×In |

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

## Configuration

**Electronic type, ETS43 for MCCBs TS800**




| Overload protection (long time) | |
|---|---|
| Setting current (A), Ir | 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×In<br>13 settings |
| Tripping time (s) | Fixed at 6×Ir , tolerance±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), Ii | 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, In**
- 630, 800A for TS800

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

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

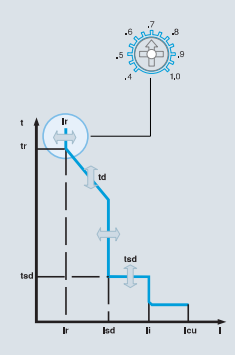
## Current setting, Ir (A)

**Standard electronic trip unit, ETS43**

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

## Setting details

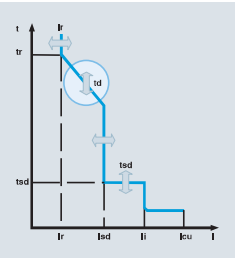
**Overload protection (long time)**




| 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)**

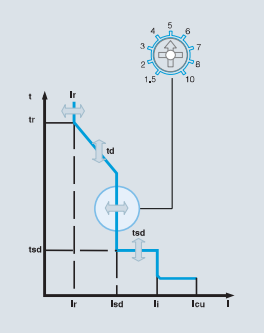



| | |
|---|---|
| Tripping time (s) | Fixed at 6×Ir<br>tolerance±20% |

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

## Setting details

**Overload protection (long time)**

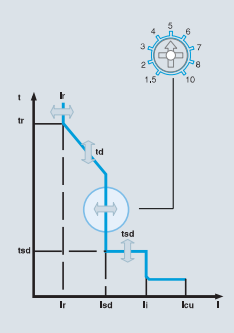



| Circuit breakers | | TS800 | |
|---|---|---|---|
| Trip unit rating, In(A) | | 630 | 800 |
| Setting value | | Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir | |
| 0.4 | 1.5 | 378 | 480 |
| 0.45 | | 425 | 540 |
| 0.5 | | 473 | 600 |
| 0.55 | | 520 | 660 |
| 0.6 | | 567 | 720 |
| 0.65 | | 614 | 780 |
| 0.7 | | 662 | 840 |
| 0.75 | | 709 | 900 |
| 0.8 | | 756 | 960 |
| 0.85 | | 804 | 1020 |
| 0.9 | | 850.5 | 1080 |
| 0.95 | | 898 | 1140 |
| 1 | | 945 | 1200 |
| 0.4 | 2 | 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 | | 945 | 1200 |
| 0.8 | | 1008 | 1280 |
| 0.85 | | 1071 | 1360 |
| 0.9 | | 1134 | 1440 |
| 0.95 | | 1197 | 1520 |
| 1 | | 1260 | 1600 |
| 0.4 | 3 | 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 |

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

## Setting details

**Overload protection (long time)**

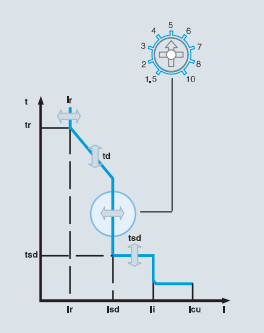



| Circuit breakers | | TS800 | |
|---|---|---|---|
| Trip unit rating, In(A) | | 630 | 800 |
| Setting value | | Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir | |
| 0.4 | | 1008 | 1280 |
| 0.45 | | 1134 | 1440 |
| 0.5 | | 1260 | 1600 |
| 0.55 | | 1386 | 1760 |
| 0.6 | | 1512 | 1920 |
| 0.65 | | 1638 | 2080 |
| 0.7 | 4 | 1764 | 2240 |
| 0.75 | | 1890 | 2400 |
| 0.8 | | 2016 | 2560 |
| 0.85 | | 2142 | 2720 |
| 0.9 | | 2268 | 2880 |
| 0.95 | | 2394 | 3040 |
| 1 | | 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 | 5 | 2205 | 2800 |
| 0.75 | | 2363 | 3000 |
| 0.8 | | 2520 | 3200 |
| 0.85 | | 2678 | 3400 |
| 0.9 | | 2835 | 3600 |
| 0.95 | | 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 | 6 | 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 |

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

## Setting details

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

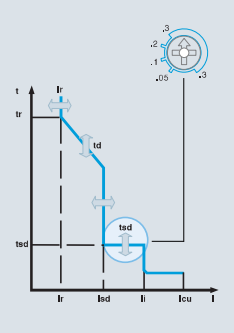



| Circuit breakers | | TS800 | |
|---|---|---|---|
| Trip unit rating, In(A) | | 630 | 800 |
| Setting value | | Short time pick-up current setting, Isd = Setting value (1.5~10) × Ir | |
| 0.4 | | 1764 | 2240 |
| 0.45 | | 1985 | 2520 |
| 0.5 | | 2205 | 2800 |
| 0.55 | | 2426 | 3080 |
| 0.6 | | 2646 | 3360 |
| 0.65 | | 2867 | 3640 |
| 0.7 | 7 | 3087 | 3920 |
| 0.75 | | 3308 | 4200 |
| 0.8 | | 3528 | 4480 |
| 0.85 | | 3749 | 4760 |
| 0.9 | | 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 | 8 | 3528 | 4480 |
| 0.75 | | 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 | 10 | 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 |

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

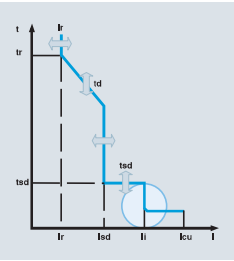
## Setting details

**Short time tripping delay setting, tsd (ms)**




| | | | | | | |
|---|---|---|---|---|---|---|
| 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), Ii (A)**




| | |
|---|---|
| Tripping threshold (A), Ii | Fixed at 11×In |

# 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**
**Only three(3) pole circuit breakers are available.**

## Ratings

**Rated current, In(A)**

| Rated current 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 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 |

# Electronic trip units (Multifunction)
# Overview

## Setting values

| Overload protection (long time) | | | | | | |
|---|---|---|---|---|---|---|
| Setting current (A), Ir | Adjustable 0.4 ~ 1.0×In, 30 settings | | | | | |
| Tripping time (s) at 6×Ir | Adjustable 2, 4, 6, 8,12 5 settings, tolerance ±20% | | | | | |

| Short-circuit protection (short time) | | | | | | |
|---|---|---|---|---|---|---|
| Tripping threshold (A), Isd | Adjustable 1.5, 2, 3, 4, 5, 6, 7, 8, 10×Ir, 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 | $I^2t$ is off |

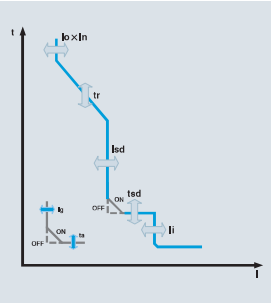
| Short-circuit protection (instantaneous) | |
|---|---|
| Tripping threshold (A), Ii | Adjustable 1.5, 2, 4, 5, 6, 8, 10, 11×In, 9 settings |

| Indication of tripping reason | |
|---|---|
| LED indication | Ir, Isd, Ii, (Ig) |

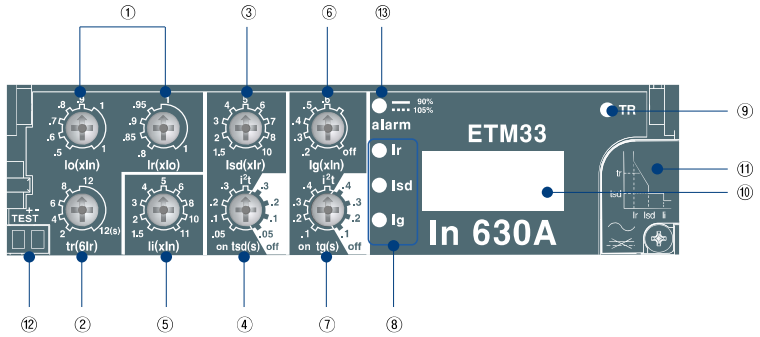
| Option for TS400ETM to TS800ETM | | | | | | |
|---|---|---|---|---|---|---|
| Ammeter (A) | Maximum load phase current and R,S,T,N phase current | | | | | |
| Earth fault protection (E) | Adjustable tripping threshold (A), 0.2~1×In, 9 setting | | | | | |
| | setting time (ms) | 100 | 200 | 300 | 400 | 4 settings |
| | operation time (ms) | 60<t≤140 | 140<t≤230 | 230<t≤350 | 350<t≤500 | $I^2t$ is off |
| Communication (C) | Setting, R, S, T, N phase current, tripping reason | | | | | |
| ZSI (Z) | ZSI input and output signal | | | | | |

# Electronic trip units (Multifunction)
# Overview

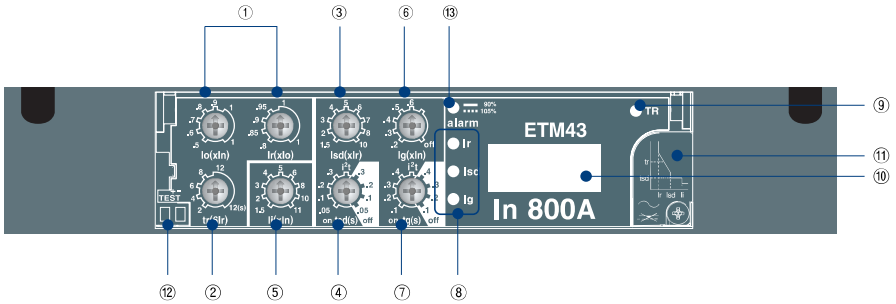
① Adjustable rated current setting (Ir)
② Adjustable long time setting (tr)
③ Adjustable short time current setting (Isd)
④ Adjustable time delay setting (tsd)
⑤ Adjustable instantaneous current setting (Ii)
⑥ Adjustable earth fault current setting (Ig)
⑦ Adjustable earth fault delay setting (tg)
⑧ Indication LED
⑨ TR (trip reason) button
⑩ Display LCD (Ammeter)
⑪ Auxiliary power
⑫ Test connector
⑬ Alarm LED




## ETM33 for TS400/TS630

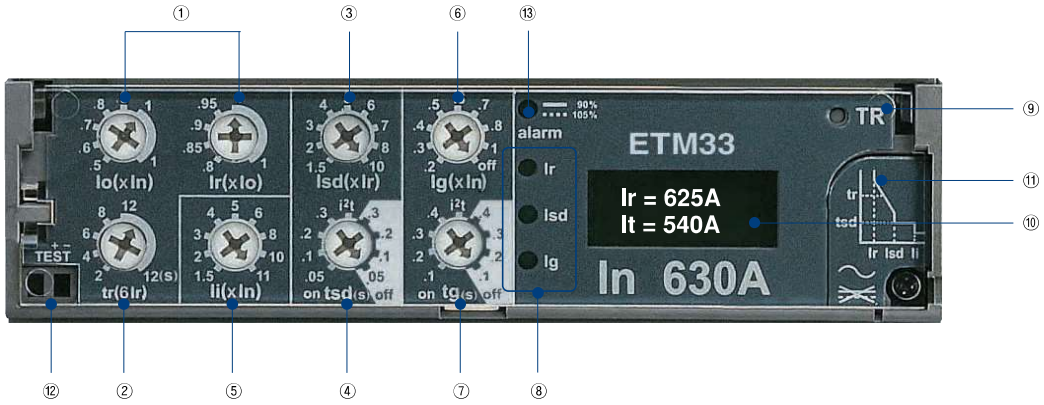



## ETM43 for TS800

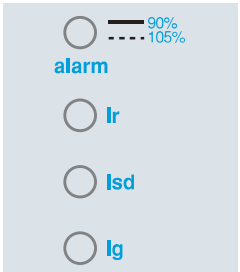


# Electronic trip units (Multifunction)
# ETM33 for TS400, TS630

## Configuration




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




### Alarm indication

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

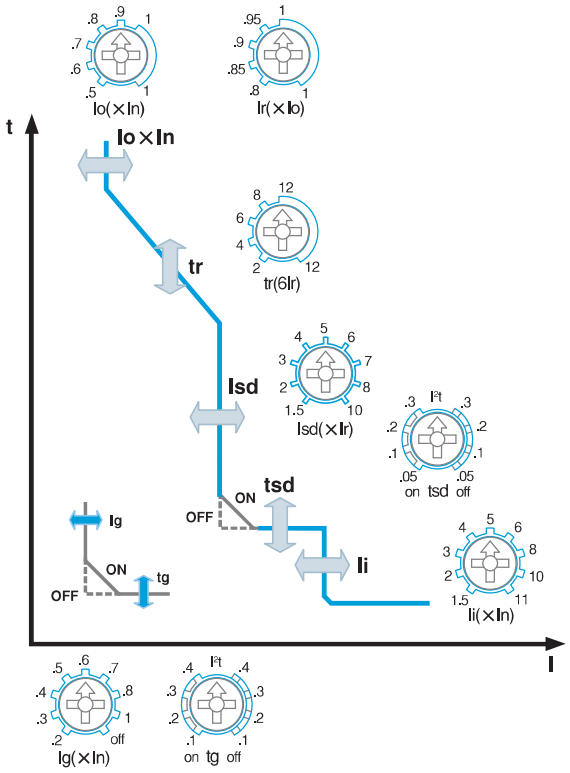
### Fault indications

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.

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

## Tripping characteristics

**Trip unit, ETM33**




**Long time protection against overloads**

Io = Coarse adjustment (function of In)
Ir = Fine adjustment
tr = Long time delay

**Short circuit protection**

Isd = Short circuit threshold,
tsd = Short circuit time delay
$I^2t$ curve in position ON or OFF

**Instantaneous protection**

Ii = Instantaneous threshold

**Earth fault protection**

Ig = Insulation fault threshold
tg = 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, In**
- 160, 250, 400A for TS400
- 160, 250, 400, 630A for TS630

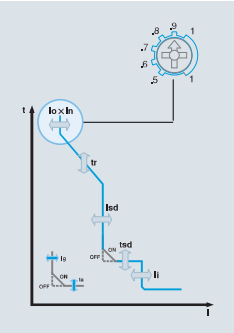
**Trip unit function**
- ETM : Multifunction electronic trip unit

# 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 | | | | | | | | | | | | |



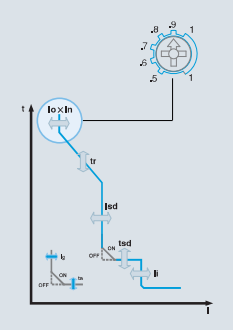

### Overload protection (long time)

| Type of trip unit | | TS400ETM | | |
|---|---|---|---|---|
| Rated current, In(A) | | 160 | 250 | 400 |
| Setting value Coarse, Io | Setting value 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 |

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

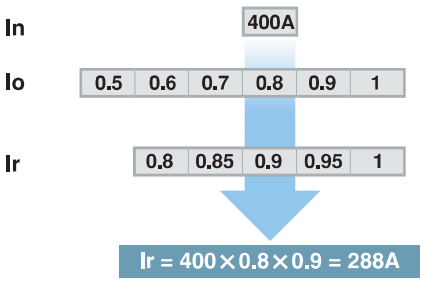
## Setting details

**Overload protection (long time)**




| Type of trip unit | | TS630ETM | | | |
|---|---|---|---|---|---|
| Rated current, In(A) | | 160 | 250 | 400 | 630 |
| Setting value Coarse, Io | Setting value 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 :**

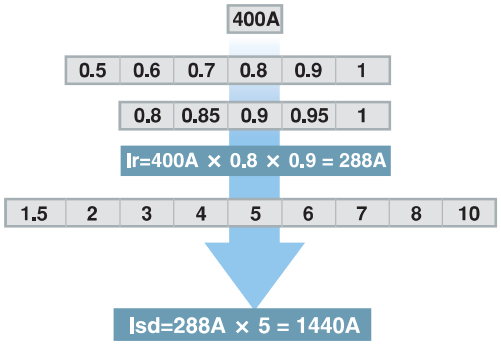


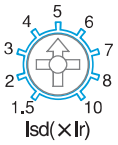
# Electronic trip units (Multifunction)
# ETM33 for TS400, TS630

## Short circuit protection

The short circuit threshold, Isd is a multiple of the overload setting, Ir.

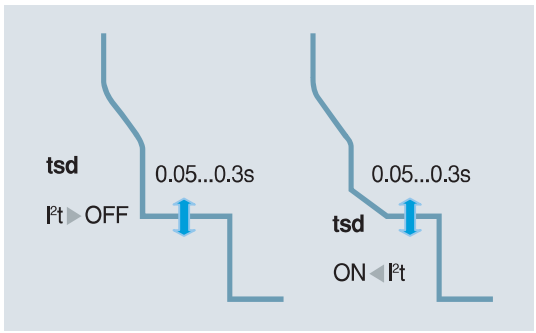
**Setting example :**

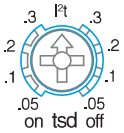



The breaker trips when the current exceeds 2880 A.

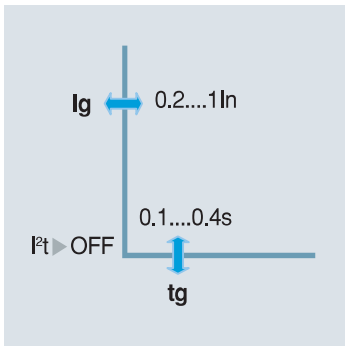
## Short circuit time delay

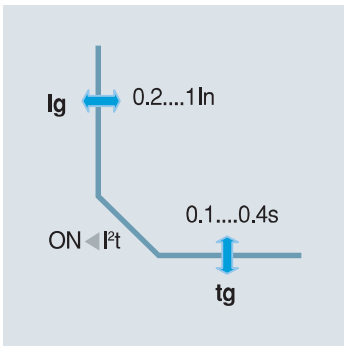


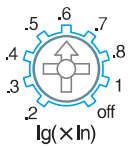



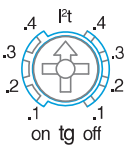

## Earth fault protection(E), optional

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.




Ig = insulation fault threshold
tg = earth fault time delay

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




## Ammeter (A), optional

The Ammeter device has an accuracy of ±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 ≥ 0.3×In (one phase)
- maximum current ≤ 10×In

## 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**

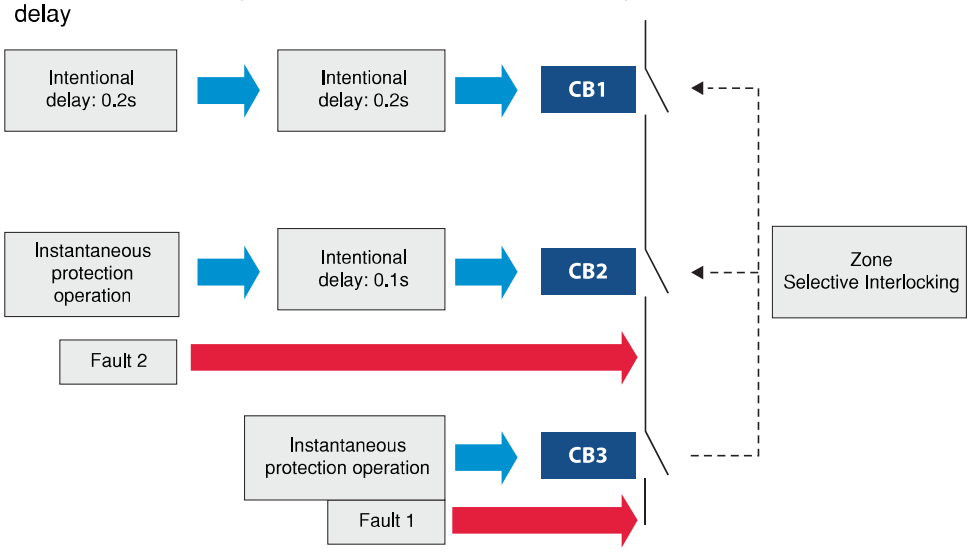
- to reduce the stress on electrical distribution components during short-circuit or earth fault conditions.
- to reduce the tripping times (Lower than hundred milliseconds).
- to reduce the damage caused by the fault and of interferences to the power supply system;

**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



# 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

- ☐ A(Ammeter)
- ☐ E(Earth fault protection)
- ☐ A+E
- ☐ A +C(Communication)
- ☐ A+E+C
- ☐ Z(Zone selective interlocking)
- ☐ Z+A
- ☐ Z+E
- ☐ Z+A+E
- ☐ Z+A +C
- ☐ Z+A+E+C

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

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

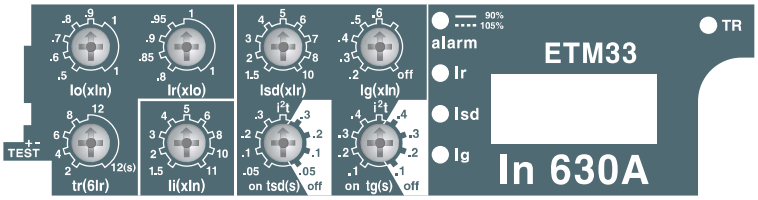
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| I | r | - | 1 | 2 | 6 | 0 | A | → Display current value (RMS) of phase which is carrying maximum in each phase |
| I | s | - | | | 6 | 5 | A | → Display current value (RMS) of each phase at an interval of every 2 seconds. |



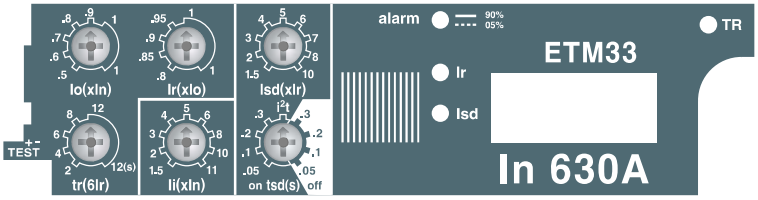
# Electronic trip units (Multifunction)
# ETM33 for TS400, TS630

## Feature of trip unit according to option

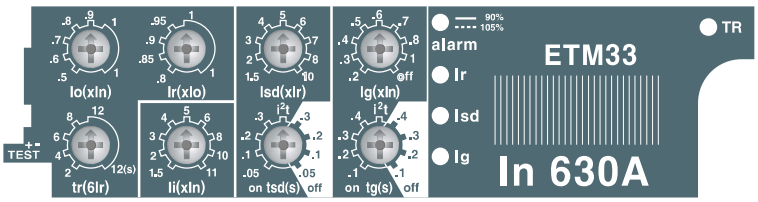
**ETM33 A+E**
**ETM33 A+E+C**
**ETM33 Z+A+E**
**ETM33 Z+A+E+C**



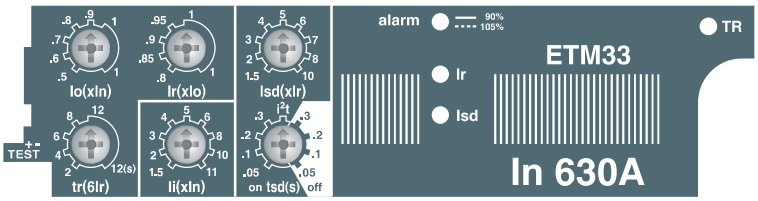

**ETM33 A**
**ETM33 A+C**
**ETM33 Z+A**
**ETM33 Z+A+C**




**ETM33 E**
**ETM33 Z+E**

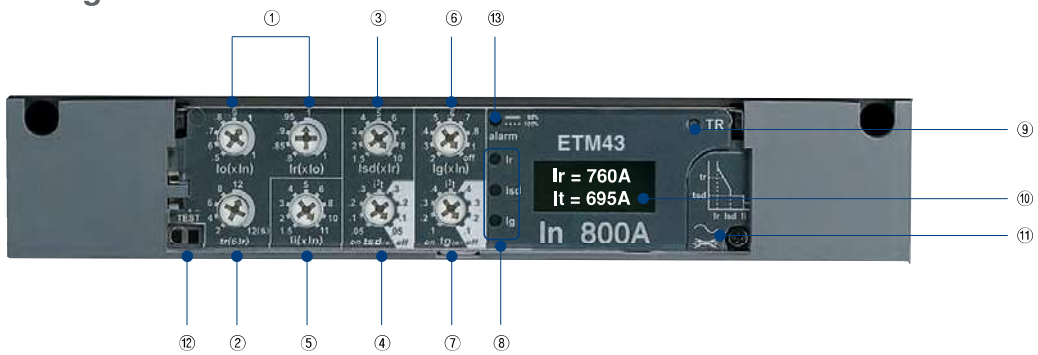



**ETM33**
**ETM33 Z**

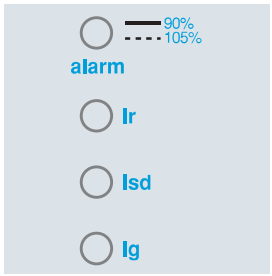


# Electronic trip units (Multifunction)
# ETM43 for TS800

## Configuration




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




### Alarm indication

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

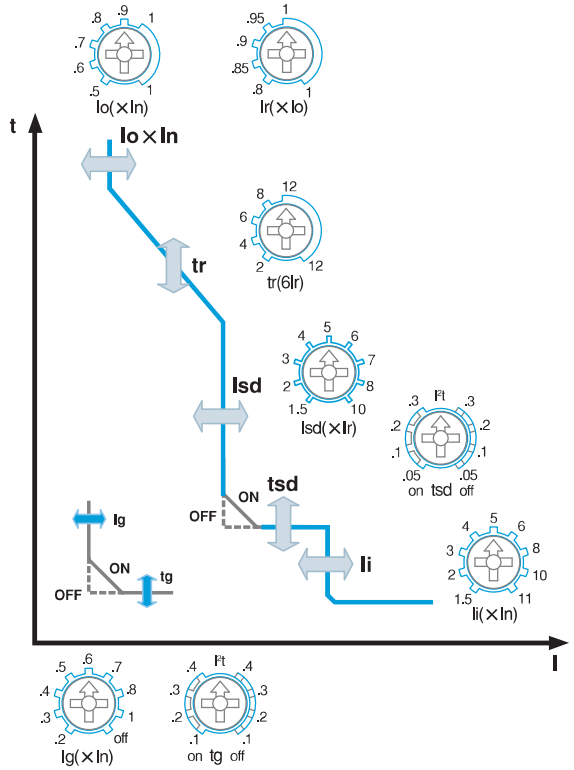
### Fault indications

LEDs indicate the type of fault that caused tripping:
Ir : overload
Isd : short-circuit (short time, instantaneous)
Ig : earth fault
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.

# Electronic trip units (Multifunction)
# ETM43 for TS800

## Tripping characteristics

**Trip unit for TS800 circuit breaker**




**Long time protection against overloads**

Io = Coarse adjustment (function of In)
Ir = Fine adjustment
tr = Long time delay

**Short circuit protection**

Isd = Short circuit threshold,
tsd = Short circuit time delay
I²t curve in position ON or OFF

**Instantaneous protection**

Ii = Instantaneous threshold

**Earth fault protection**

Ig = Insulation fault threshold
tg = Earth fault time delay
I²t curve in position ON or OFF

## Catalogue numbering system

ETM 43 In800A

**Trip unit frame**
- 33 for TS400, TS630
- 43 for TS800

**Rated current, In**
- 630, 800A for TS630

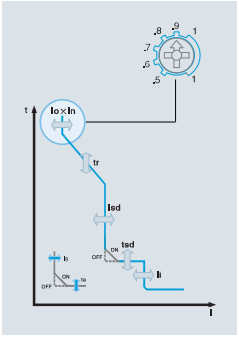
**Trip unit function**
- ETM: Multi function electronic trip unit

# Electronic trip units (Multifunction)
# ETM43 for TS800

## Setting details

**Trip unit rating, In**

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




**Overload protection (long time)**

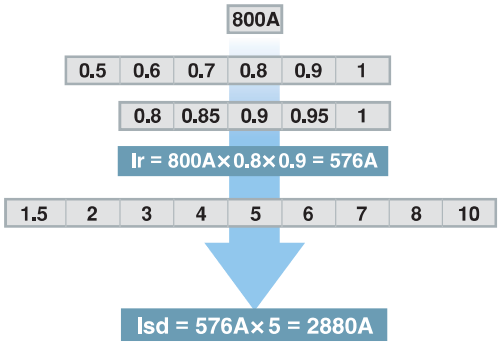
| Type of trip unit | | TS800ETM | |
|---|---|---|---|
| Rated current, In(A) | | 630 | 800 |
| Setting value Coarse, Io | Setting value Fine, Ir | Overload protection setting current, Ir (A) | |
| 0.5 | 0.8 | 252 | 320 |
| | 0.85 | 267.75 | 340 |
| | 0.9 | 283.5 | 360 |
| | 0.95 | 299.25 | 380 |
| | 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 |

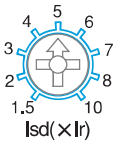
# Electronic trip units (Multifunction)
# ETM43 for TS800

## Short circuit protection

The short circuit threshold, Isd is a multiple of the overload setting, Ir.

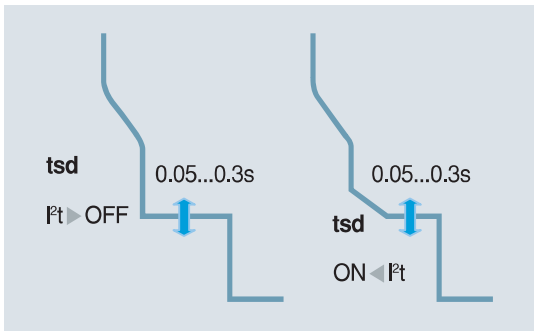
**Setting example :**

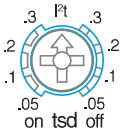



The breaker trips when the current exceeds 2880 A.

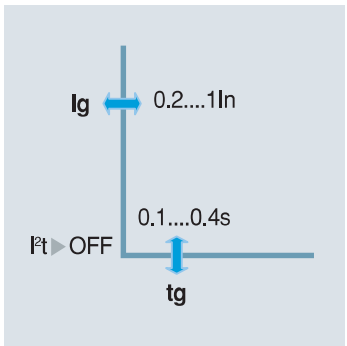
## Short circuit time delay

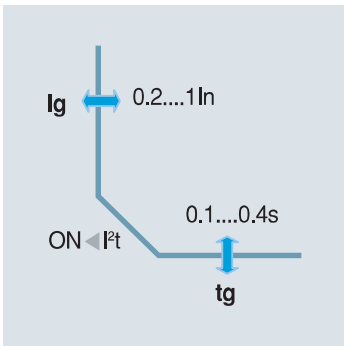


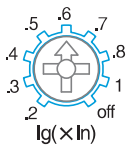



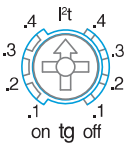

## Earth fault protection(E), optional

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.




Ig = insulation fault threshold
tg = earth fault time delay

# Electronic trip units (Multifunction)
# ETM43 for TS800




## Ammeter (A), optional

The Ammeter device has an accuracy of ±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 ≥ 0.3×In (one phase)
- maximum current ≤ 10×In

## 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**

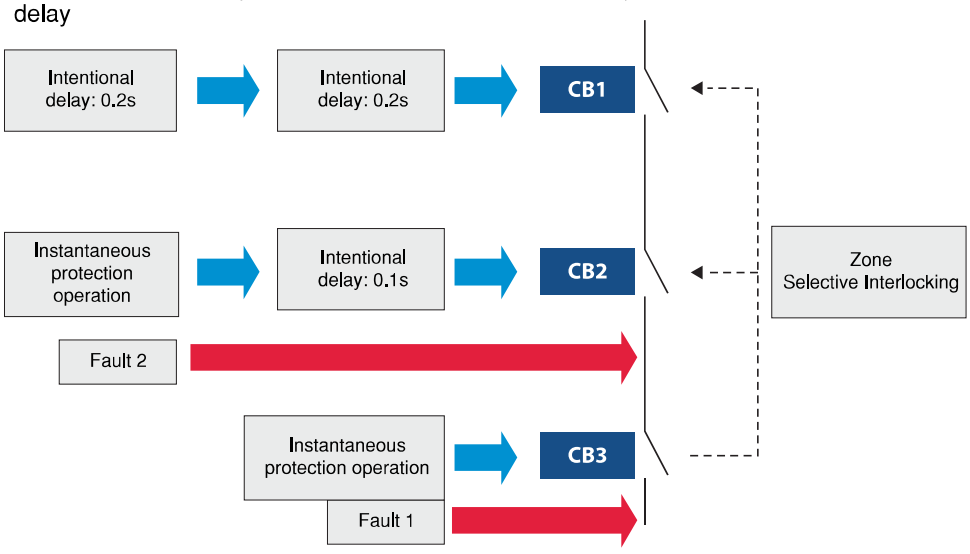
- to reduce the stress on electrical distribution components during short-circuit or earth fault conditions.
- to reduce the tripping times (Lower than hundred milliseconds).
- to reduce the damage caused by the fault and of interferences to the power supply system;

**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



# 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

- ☐ A(Ammeter)
- ☐ E(Earth fault protection)
- ☐ A+E
- ☐ A +C(Communication)
- ☐ A+E+C
- ☐ Z(Zone selective interlocking)
- ☐ Z+A
- ☐ Z+E
- ☐ Z+A+E
- ☐ Z+A +C
- ☐ Z+A+E+C

# Electronic trip units (Multifunction)
# ETM43 for TS800

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

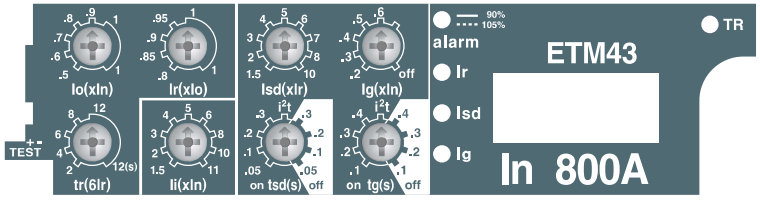
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| I | r | - | 1 | 2 | 6 | 0 | A | → Display current value (RMS) of phase which is carrying maximum in each phase |
| I | s | - | | | 6 | 5 | A | → Display current value (RMS) of each phase at an interval of every 2 seconds. |



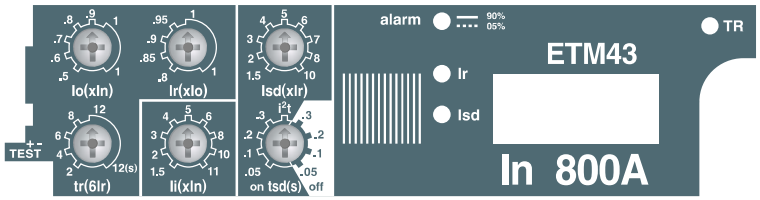
# Electronic trip units (Multifunction)
# ETM43 for TS800

## Feature of trip unit according to option

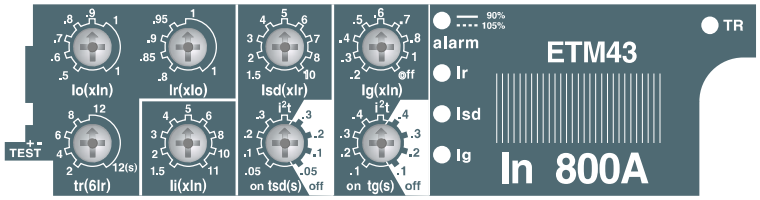
**ETM43 A+E**
**ETM43 A+E+C**
**ETM43 Z+A+E**
**ETM43 Z+A+E+C**



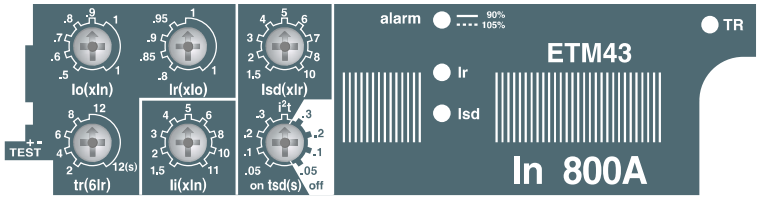

**ETM43 A**
**ETM43 A+C**
**ETM43 Z+A**
**ETM43 Z+A+C**




**ETM43 E**
**ETM43 Z+E**




**ETM43**
**ETM43 Z**



## Electrical characteristics





| | | | | TS100 | | | TS160 | | | TS250 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Frame size | | | [AF] | 100 | | | 160 | | | 250 | | |
| Rated current, In | | | [A] | 1.6, 3.2, 6.3, 12, 20, 32, 50, 63, 100 | | | 32, 50, 63, 100, 160 | | | 100, 160, 220 | | |
| No. of poles | | | | 3 | | | 3 | | | 3 | | |
| Rated operational voltage, Ue | AC | | [V] | 690 | | | 690 | | | 690 | | |
| | DC | | [V] | 500 | | | 500 | | | 500 | | |
| Rated impulse withstand voltage, Uimp | | | [kV] | 8 | | | 8 | | | 8 | | |
| Rated insulation voltage, Ui | | | [V] | 750 | | | 750 | | | 750 | | |
| Rated ultimate 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 | 50 | 85 | 150 | 50 | 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 |
| | 660/690V | | [kA] | 10 | 15 | 20 | 10 | 15 | 20 | 10 | 15 | 20 |
| Rated service breaking capacity, Ics [%Icu] | | | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Rated short-circuit making capacity, Icm | | | | | | | | | | | | |
| AC 50/60Hz | 220/240V | | [kA] | 220 | 264 | 440 | 220 | 264 | 440 | 220 | 264 | 440 |
| | 380/415V | | [kA] | 105 | 187 | 330 | 105 | 187 | 330 | 105 | 187 | 330 |
| | 440/460V | | [kA] | 105 | 154 | 286 | 105 | 154 | 286 | 105 | 154 | 286 |
| | 480/500V | | [kA] | 88 | 143 | 187 | 88 | 143 | 187 | 88 | 143 | 187 |
| | 660/690V | | [kA] | 17 | 30 | 40 | 17 | 30 | 40 | 17 | 30 | 40 |
| Category of utilization | | | | A | | | A | | | A | | |
| Isolation behavior | | | | ● | | | ● | | | ● | | |
| Trip unit (release) | | | | | | | | | | | | |
| ●magnetic only | | | MTU | ● | | | ● | | | ● | | |
| Connection | fixed | front-connection | | ● | | | ● | | | ● | | |
| | | rear-connection | | ● | | | ● | | | ● | | |
| | plug-in | front-connection | | ● | | | ● | | | ● | | |
| | | rear-connection | | ● | | | ● | | | ● | | |
| Mechanical life | | | [operations] | 25000 | | | 25000 | | | 25000 | | |
| Electrical life @415 V AC | | | [operations] | 10000 | | | 10000 | | | 10000 | | |
| Basic dimensions, W×H×D (front connection) | 3-pole | | [mm] | 105×160×86 | | | 105×160×86 | | | 105×160×86 | | |
| Weight (front connection) | 3-pole | | [kg] | 2 | | | 2 | | | 2 | | |
| Reference standard | | | | IEC60947-2 | | | IEC60947-2 | | | IEC60947-2 | | |

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

# MCCBs for motor protection

**Susol**

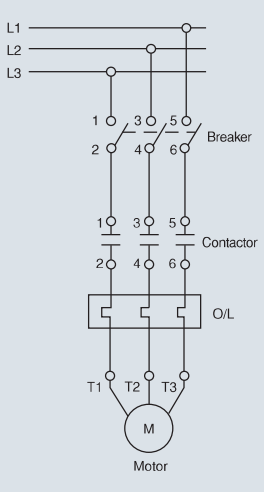






| | TS400 | | | TS630 | | | TS800 | | |
|---|---|---|---|---|---|---|---|---|---|
| | 400 | | | 630 | | | 800 | | |
| | 320 | | | 500 | | | 630 | | |
| | 3 | | | 3 | | | 3 | | |
| | 690 | | | 690 | | | 690 | | |
| | 500 | | | 500 | | | 500 | | |
| | 8 | | | 8 | | | 8 | | |
| | 750 | | | 750 | | | 750 | | |
| | N | H | L | N | H | L | N | H | L |
| | 100 | 120 | 200 | 100 | 120 | 200 | 100 | 120 | 200 |
| | 65 | 85 | 150 | 65 | 85 | 150 | 65 | 100 | 150 |
| | 65 | 85 | 130 | 65 | 85 | 130 | 65 | 100 | 130 |
| | 42 | 65 | 85 | 42 | 65 | 85 | 42 | 85 | 100 |
| | 10 | 20 | 35 | 10 | 20 | 35 | 10 | 20 | 35 |
| | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| | | | | | | | | | |
| | 220 | 264 | 440 | 220 | 264 | 440 | 220 | 264 | 440 |
| | 143 | 187 | 330 | 143 | 187 | 330 | 143 | 220 | 330 |
| | 143 | 187 | 286 | 143 | 187 | 286 | 143 | 220 | 286 |
| | 88 | 143 | 187 | 88 | 143 | 187 | 88 | 187 | 220 |
| | 17 | 40 | 74 | 17 | 40 | 74 | 17 | 40 | 74 |
| | | A | | | A | | | A | |
| | | ● | | | ● | | | ● | |
| | | | | | | | | | |
| | | ● | | | ● | | | ● | |
| | | ● | | | ● | | | ● | |
| | | ● | | | ● | | | ● | |
| | | ● | | | ● | | | ● | |
| | | ● | | | ● | | | ● | |
| | | 20000 | | | 20000 | | | 10000 | |
| | | 6000 | | | 6000 | | | 3000 | |
| | | 140×260×110 | | | 140×260×110 | | | 210×320×135 | |
| | | 5.4 | | | 5.4 | | | 15.1 | |
| | | IEC60947-2 | | | IEC60947-2 | | | IEC60947-2 | |

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







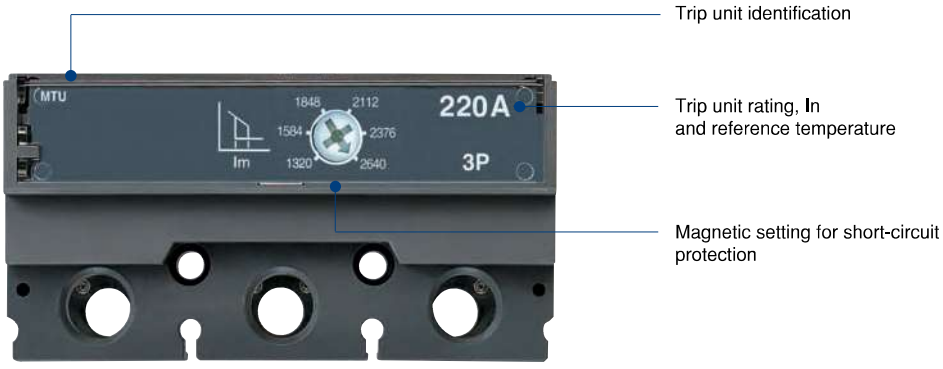
Magnetic only release

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

# 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 |
| ● | ● | ● | ● | ● | ● | ● | ● | ● | - | - | - | - | - |
| - | - | - | - | - | ● | ● | ● | ● | ● | - | - | - | - |
| - | - | - | - | - | - | - | - | ● | ● | ● | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | ● | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | ● | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - | ● |

**Short - circuit protection(magnetic)**

| Pick - up | Im |
|---|---|
| | |

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

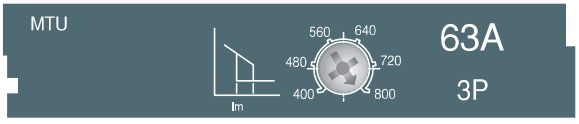
## Setting details

| 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 |

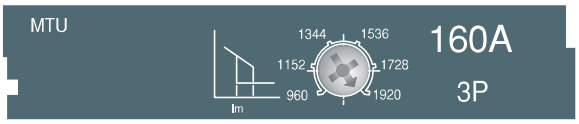
**TS100 MTU**

- Adjustable magnetic only unit



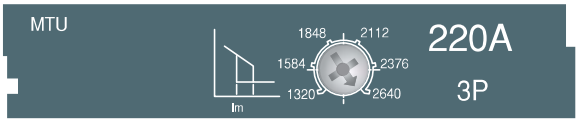

**TS160 MTU**

- Adjustable magnetic only unit



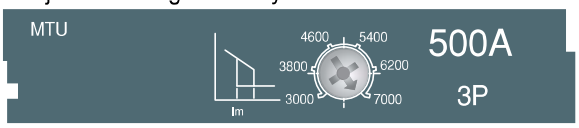

**TS250 MTU**

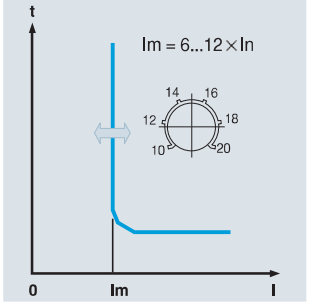
- Adjustable magnetic only unit




**TS400 MTU, TS630 MTU, TS800 MTU**

- Adjustable magnetic only unit



# Switch-Disconnectors

*Susol*

| | | | | TD series | | |
|---|---|---|---|---|---|---|
| | | | |  |  |  |
| | | | | TD100NA | TD160NA | TS100NA |
| Frame size | | | [AF] | 100 | 160 | 100 |
| Conventional thermal current, Ith | | | [A] | 100 | 160 | 100 |
| No. of poles | | | | 2, 3, 4 | 2, 3, 4 | 2, 3, 4 |
| Rated operational voltage, Ue | | AC | [V] | 690 | 690 | 690 |
| | | DC | [V] | 500 | 500 | 500 |
| Rated operational current, Ie | | | | 100 | 160 | 100 |
| Rated impulse withstand voltage,Uimp | | | [kV] | 8 | 8 | 8 |
| Rated insulation voltage, Ui | | | [V] | 750 | 750 | 750 |
| Rated short-circuit making capacity, Icm | | | [kA peak] | 3.1 | 3.1 | 2.8 |
| Rated short-time withstand current, Icw | | 1s | [A rms] | 2200 | 2200 | 2000 |
| | | 3s | [A rms] | 2200 | 2200 | 2000 |
| | | 20s | [A rms] | 960 | 960 | 690 |
| Isolation behavior | | | | ● | ● | ● |
| Trip unit (release) | | | | | | |
| ●disconnector unit | | | DSU | ● | ● | ● |
| Connection | fixed | front-connection | | ● | ● | ● |
| | | rear-connection | | ● | ● | ● |
| | plug-in | front-connection | | ● | ● | ● |
| | | rear-connection | | ● | ● | ● |
| Mechanical life | | | [operations] | 25000 | 25000 | 25000 |
| Electrical life @415 V AC | | | [operations] | 10000 | 10000 | 10000 |
| Basic dimensions, W×H×D (front connection) | | 3-pole | [mm] | 90×140×86 | 90×140×86 | 105×160×86 |
| | | 4-pole | [mm] | 120×140×86 | 120×140×86 | 140×160×86 |
| Weight (front connection) | | 3-pole | [kg] | 1.5 | 1.5 | 2 |
| | | 4-pole | [kg] | 1.8 | 1.8 | 2.6 |
| Reference standard | | | | IEC60947-3 | IEC60947-3 | IEC60947-3 |

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. Installation standards require upstream protection. However, thanks to their high-set magnetic release, TD160 ... TS800 DSU are self protected.

## TS series







| | TS160NA | TS250NA | TS400NA | TS630NA | TS800NA |
|---|---|---|---|---|---|
| | 160 | 250 | 400 | 630 | 800 |
| | 160 | 250 | 400 | 630 | 800 |
| | 2, 3, 4 | 2, 3, 4 | 2, 3, 4 | 2, 3, 4 | 2, 3, 4 |
| | 690 | 690 | 690 | 690 | 690 |
| | 500 | 500 | 500 | 500 | 500 |
| | 160 | 250 | 400 | 630 | 800 |
| | 8 | 8 | 8 | 8 | 8 |
| | 750 | 750 | 750 | 750 | 750 |
| | 3.6 | 4.9 | 7.1 | 8.5 | 12 |
| | 2500 | 3500 | 5000 | 6300 | 8000 |
| | 2500 | 3500 | 5000 | 6300 | 8000 |
| | 960 | 1350 | 1930 | 2320 | 2560 |
| | ● | ● | ● | ● | ● |
| | | | | | |
| | ● | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● |
| | ● | ● | ● | ● | ● |
| | 25000 | 25000 | 20000 | 20000 | 10000 |
| | 10000 | 10000 | 6000 | 6000 | 3000 |
| | 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

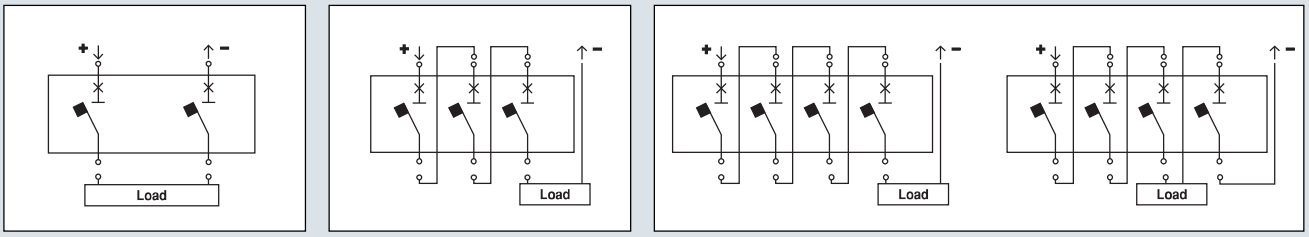
*Susol*

- Susol MCCB is sutable for DC application such as Photovoltaic Circuit Breaker, UPS and datacenter
- DC short circuit test tested by VDE
- Higher nominal voltage range up to 1000 VDC
- Rated Current : 16A~800A
- No of Pole: 2/3/4Pole
- Available for AC/DC application



| | | 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, 630 | | | 700, 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 | | |
| Rating (DC) | 1000V | 4P | | | 4P | | | 4P | | | 4P | | | 4P | | | 4P | | | 4P | | | 4P | | |
| | 750V | 3P | | | 3P | | | 3P | | | 3P | | | 3P | | | 3P | | | 3P | | | 3P | | |
| | 500V | 2P | | | 2P | | | 2P | | | 2P | | | 2P | | | 2P | | | 2P | | | 2P | | |
| Rated service breaking (DC) | Type | N | H | L | N | H | L | N | H | L | N | H | L | N | H | L | N | H | L | N | H | L | N | H | L |
| | 1000V (4P) | 42 | 65 | 100 | 42 | 65 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 |
| | 750V (3P) | 42 | 65 | 100 | 42 | 65 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 |
| | 500V (2P) | 42 | 65 | 100 | 42 | 65 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 | 50 | 85 | 100 |
| Trip unit | | | | | | | | | | | | | | | | | | | | | | | | | |
| FTU (fixed-thermal, fixed-magnetic) | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| FMU (adjustable-thermal, fixed-magnetic) | | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| ATU (adjustable-thermal, adjustable-magnetic) | | - | - | - | - | - | - | - | - | - | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

**Exemplary circuit diagrams**




DC500V (2P) DC750V (3P) DC1000V (4P)

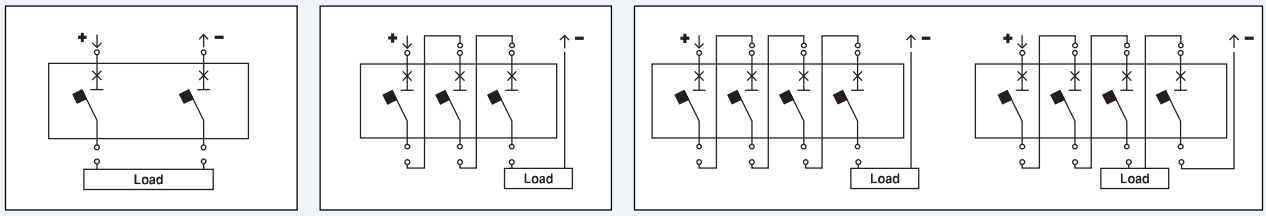
## Susol MCCB PV up to 800A

### Warnings when using Susol MCCB on PV system

**The following warning must be kept when using Susol MCCB on PV system**
**If not, it can result damages on any related products or injuries.**

## Warning

1. Please, follow the wiring as shown below.
   When wired differently, usable voltage can be limited.




DC500V (2P) DC750V (3P) DC1000V (4P)

2. Use minimum of 60cm wire when wiring. Shot wires can result increasing temperature.



3. When designing circuit by using busbar as picture on right, de-rated use is recommended.
   It can cause temperature increase, wrongly trip, damage or fire due to shortage of heat release(Refer to De-rating table)

4. Please, maintain given thickness and length of busbar on the specification drawing.
   Additional de-rating is required in order to release the heat when busbar specification is different than instructed.

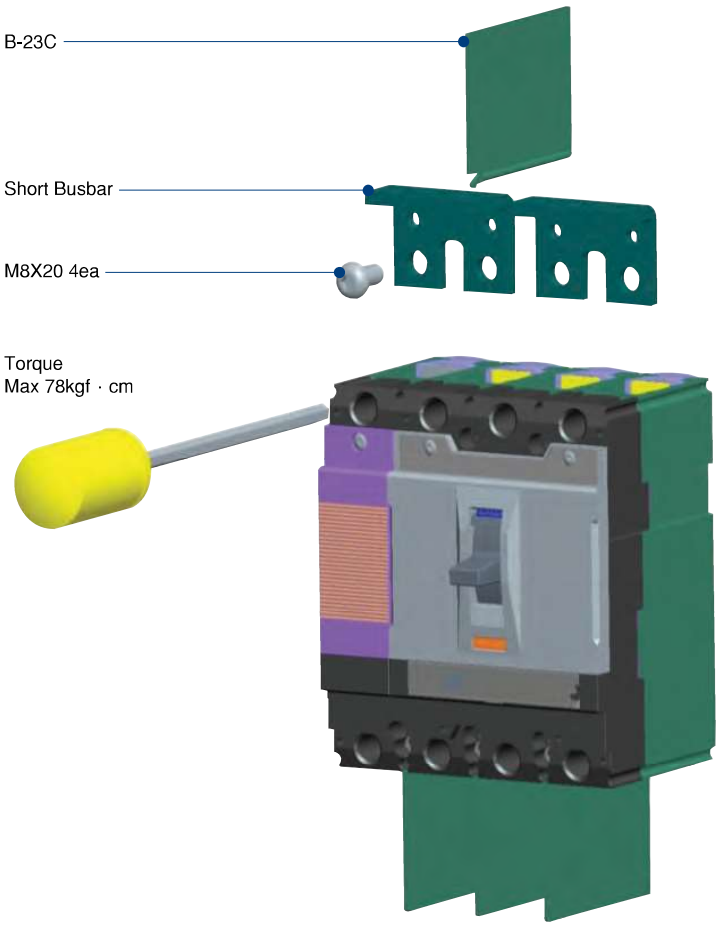
5. It is recommended to use tin or silver plated busbar.

6. Install sun screens or fans to maintain KS or IEC standard 40℃ inside of connection and low voltage panels.
   When inside temperature of panel exceeds 40℃, it can cause temperature increase, wrongly trip, damage or fire.
   Additional de-rating is required when panel temperature exceeds 40℃.

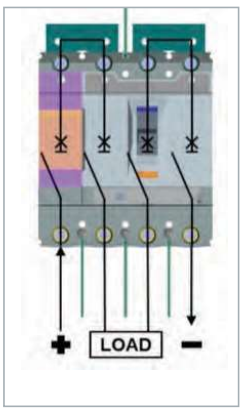
7. Please, ask any other further questions before applying.

## Susol MCCB PV up to 800A

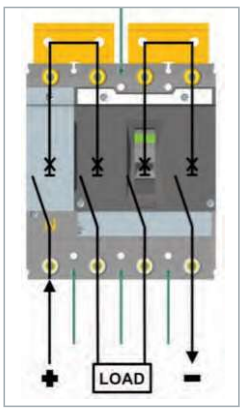
### Short Busbar Installation




### Configuration and Series Connection



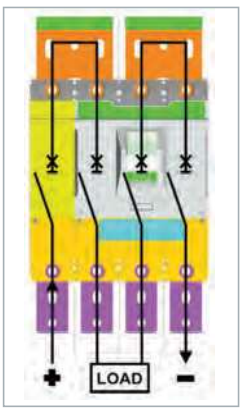

TD160




TS250




TS630




TS800

# Susol MCCB PV up to 800A

## Derating Table for AF

**The following tables are based on the following assumptions;**

- Maximum permissible temperature of busbars are 100℃
- 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.

| AF | Rated current(A) | Derating(A) | Short Busbar |
|---|---|---|---|
| TD100 | 16 | 16 | TD160 3t Short Busbar |
| | 20 | 20 | |
| | 25 | 25 | |
| | 32 | 32 | |
| | 40 | 40 | |
| | 50 | 50 | |
| | 63 | 63 | TD160 4t Short Busbar |
| | 80 | 80 | |
| | 100 | 100 | |
| TD160 | 100 | 100 | |
| | 125 | 125 | |
| | 160 | 135 | TD160 5t Short Busbar |
| TS100 | 40 | 40 | TS250 4t Short Busbar |
| | 50 | 50 | |
| | 63 | 63 | |
| | 80 | 80 | |
| | 100 | 100 | |
| TS160 | 100 | 100 | |
| | 125 | 125 | |
| | 160 | 135 | |
| TS250 | 125 | 125 | |
| | 160 | 160 | TS250 5t Short Busbar |
| | 200 | 180 | |
| | 250 | 180 | |
| TS400 | 300 | 300 | TS630 Lower & Upper Short Busbar |
| | 400 | 400 | |
| TS630 | 500 | 500 | |
| | 630 | 500 | |
| TS800 | 700 * | 700 | TS800 Lower & Upper Short Busbar |
| | 800 | 700 | |

Note) 1. * Only available for TS800FTU
2. Dimension on the short busbar refer to A-6-47~52.
3. Short busbar for PV application is not provided by LSIS.

# Susol MCCB PV up to 800A

## Temperature Derating

| Item | Rated current | Derating Current | Compensated rated current in accordance with ambient temperature (A) | | | | | | | | Short Busbar |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10°C | 20°C | 30°C | 40°C | 45°C | 50°C | 60°C | 70°C | |
| TD100 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 15 | 14 | 13 | TD160 3t Short Busbar |
| | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 19 | 18 | 18 | |
| | 25 | 25 | 25 | 25 | 25 | 25 | 24 | 23 | 22 | 21 | |
| | 32 | 32 | 32 | 32 | 32 | 32 | 31 | 30 | 28 | 26 | |
| | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 35 | 33 | |
| | 50 | 50 | 50 | 50 | 50 | 50 | 48 | 47 | 44 | 41 | |
| | 63 | 63 | 63 | 63 | 63 | 63 | 61 | 59 | 56 | 52 | |
| | 80 | 80 | 80 | 80 | 80 | 80 | 78 | 75 | 71 | 66 | |
| | 100 | 100 | 100 | 100 | 100 | 100 | 97 | 94 | 88 | 82 | TD160 4t Short Busbar |
| TD160 | 100 | 100 | 100 | 100 | 100 | 100 | 97 | 94 | 88 | 82 | |
| | 125 | 125 | 125 | 125 | 125 | 125 | 121 | 117 | 110 | 103 | |
| | 160 | 135 | 135 | 135 | 135 | 135 | 130 | 125 | 117 | 108 | TD160 5t Short Busbar |
| TS100 | 40 | 40 | 40 | 40 | 40 | 40 | 39 | 38 | 35 | 33 | TS250 4t Short Busbar |
| | 50 | 50 | 50 | 50 | 50 | 50 | 48 | 47 | 44 | 41 | |
| | 63 | 63 | 63 | 63 | 63 | 63 | 61 | 59 | 56 | 52 | |
| | 80 | 80 | 80 | 80 | 80 | 80 | 78 | 75 | 71 | 66 | |
| | 100 | 100 | 100 | 100 | 100 | 100 | 97 | 94 | 88 | 82 | |
| TS160 | 100 | 100 | 100 | 100 | 100 | 100 | 97 | 94 | 88 | 82 | |
| | 125 | 125 | 125 | 125 | 125 | 125 | 121 | 117 | 110 | 103 | |
| | 160 | 160 | 160 | 160 | 160 | 160 | 155 | 150 | 141 | 131 | |
| TS250 | 125 | 125 | 125 | 125 | 125 | 125 | 121 | 117 | 110 | 103 | |
| | 160 | 160 | 160 | 160 | 160 | 160 | 155 | 150 | 141 | 131 | TS250 5t Short Busbar |
| | 200 | 180 | 180 | 180 | 180 | 180 | 174 | 168 | 157 | 146 | |
| | 250 | 180 | 180 | 180 | 180 | 180 | 174 | 168 | 157 | 146 | |
| TS400 | 300 | 300 | 300 | 300 | 300 | 300 | 291 | 281 | 264 | 246 | TS630 Lower & Upper Short Busbar |
| | 400 | 400 | 400 | 400 | 400 | 400 | 388 | 375 | 353 | 323 | |
| TS630 | 500 | 500 | 500 | 500 | 500 | 500 | 484 | 468 | 439 | 408 | |
| | 630 | 500 | 500 | 500 | 500 | 500 | 484 | 468 | 439 | 408 | |
| TS800 | 700 * | 700 | 700 | 700 | 700 | 700 | 678 | 656 | 616 | 573 | TS800 Lower & Upper Short Busbar |
| | 800 | 700 | 700 | 700 | 700 | 700 | 678 | 656 | 616 | 573 | |

Note) * Only available for TS800FTU

# 4 pole MCCB with electronic trip unit

Susol

## 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 | | AC750V | | | AC750V | | | AC750V | | |
| 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 | 100 | 120 | 200 | 100 | 120 | 200 | 100 | 120 | 200 |
| | 380/415V | 50 | 85 | 150 | 65 | 85 | 150 | 65 | 85 | 150 |
| | 440/460V | 50 | 70 | 130 | 50 | 70 | 130 | 50 | 70 | 130 |
| | 480/500V | 42 | 65 | 85 | 42 | 65 | 85 | 42 | 65 | 85 |
| | 660/690V | 10 | 15 | 20 | 10 | 15 | 20 | 10 | 15 | 20 |
| Ics | | 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 | Io, Ir | ETS: Ir = 0.4~1.0 ×In (13settings) | | | ETS: Ir = 0.4~1.0 ×In (13settings) | | | ETS: Ir = 0.4~1.0 ×In (13settings) | | |
| | | | | | ETM: Io = 0.5~1.0 ×In (6settings) | | | ETM: Io = 0.5~1.0 ×In (6settings) | | |
| | | | | | Ir = 0.8~1.0 ×Io (5settings) | | | Ir = 0.8~1.0 ×Io (5settings) | | |
| | tr (6Ir) | ETS: 6sec at 6Ir (fixed) | | | ETS: 6sec at 6Ir (fixed) | | | ETS: 6sec at 6Ir (fixed) | | |
| | | | | | ETM: 12sec at 6Ir (5settings) | | | ETM: 12sec at 6Ir (5settings) | | |
| Instant. | Im | ETS: 1.5~10 ×Ir (9settings) | | | ETS, ETM: 1.5~10 ×Ir (9settings) | | | ETS,ETM: 1.5~10 ×Ir (9settings) | | |
| | It | 12 ×In | | | 12 ×In | | | 12 ×In | | |
| Neutral protection | 4P3d | No protection | | | No protection | | | No protection | | |
| | 4P3d+N/2 | 0.5 ×Ir | | | 0.5 ×Ir | | | 0.5 ×Ir | | |
| | 4P4d | 1.0 ×Ir | | | 1.0 ×Ir | | | 1.0 ×Ir | | |
| Cable | Min | 10mm² or 8 AWG(40A) | | | 70mm²(160A) | | | 185mm² ×2 / 350 kcmil ×2(630A) | | |
| | Max | 120mm² or 250kcmil(250A) | | | 185mm² ×2 / 350 kcmil ×2(630A) | | | 240mm² ×2(800A) | | |
| Tighetning 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)

## Electrical characteristics



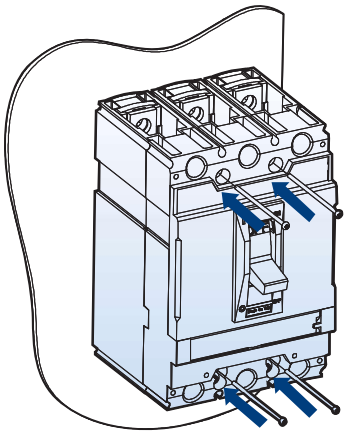
| | | | | TS1000 | | | TS1250 | | TS1600 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Type | | | | TS1000 | | | TS1250 | | TS1600 | |
| Ampere frame | | | | 1000 | | | 1250 | | 1600 | |
| Pole | | | | 3, 4 | | | 3, 4 | | 3, 4 | |
| Rated current,(A) | | In | -5~40℃ | 800, 1000 | | | 1250 | | 1600 | |
| | | | 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 AC50/60Hz (sym) | Rated ultimate short-circuit 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 breaking capacity (Ics) | %Icu | | 100% | 75% | 100% | 100% | 75% | 100% | 75% |
| | Rated short-circuit making capacity (kA) (Icw) | AC50/60Hz | 1s | 25 | | 12 | 25 | | 25 | |
| | | | 3s | - | | | - | | - | |
| Overriding instantaneous protection | | | kA peak | 50 | | 30 | 50 | | 50 | |
| Isolation | | | | ○ | | | ○ | | ○ | |
| Category | | | | B | | A | B | | B | |
| (Life cycle) | Mechanical life (operations) | | | 10000 | | 4000 | 10000 | | 10000 | |
| | Electrical life (operations) | 440V | In/2 | 6000 | | 4000 | 5000 | | 5000 | |
| | | | In | 5000 | | 3000 | 4000 | | 2000 | |
| | | 690V | In/2 | 4000 | | 3000 | 3000 | | 2000 | |
| | | | In | 2000 | | 2000 | 2000 | | 1000 | |
| Pollution degree | | | | 3 | | | 3 | | 3 | |
| Dimension (mm) (W×H×D) | | | 3-pole | 210×327×152.5 | | | | | | |
| | | | 4-pole | 280×327×152.5 | | | | | | |
| Weight (kg) | | | 3-pole | 13 | | | | | | |
| | | | 4-pole | 16.8 | | | | | | |

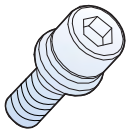
# A-4. Mounting & Connection

Fixed mounting ..... A-4-1
Connecting terminal & conductor ..... A-4-2
Safety clearance ..... A-4-3
Example of installation ..... A-4-6
Connections for 1600AF ..... A-4-7
Size of busbar for 1600AF ..... A-4-8

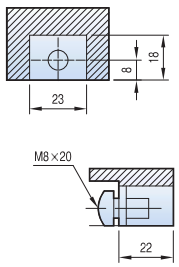
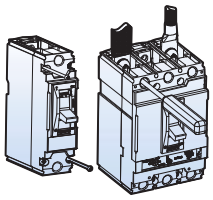
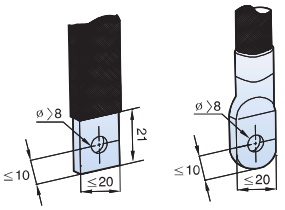
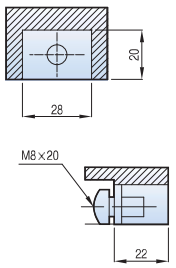
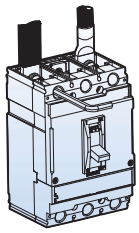
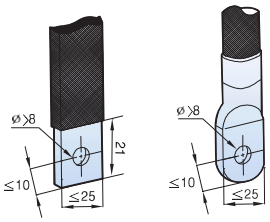
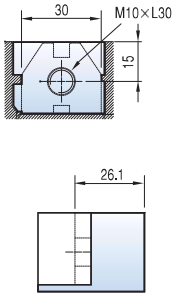
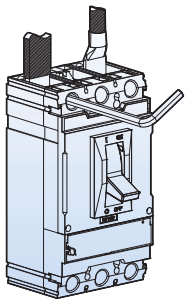
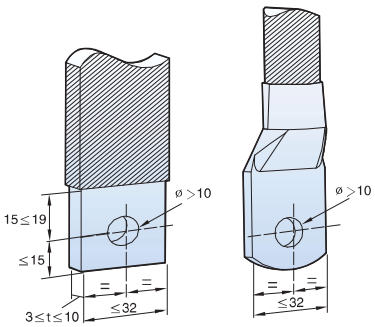
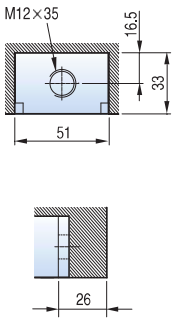
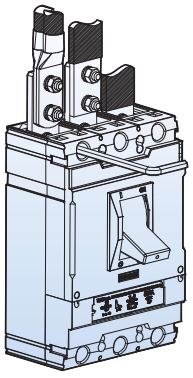
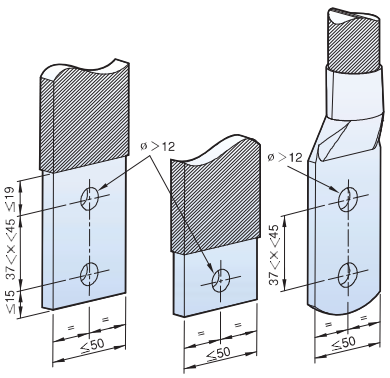
## Fixed mounting

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, 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><br><br><br> | -<br><br><br><br> | <br><br>3Pole:4EA<br>4Pole:4EA | <br><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>3Pole:6EA(M8×20)<br>4Pole:8EA(M8×20) | <br>3Pole:6EA(M10×30)<br>4Pole:8EA(M10×30) | <br>3Pole:6EA(M12×35)<br>4Pole:8EA(M12×35) |
| | Torque:<br>Max 78kgf · cm | Torque:<br>Max 147kgf · cm | Torque:<br>Max 490kgf · cm | Torque:<br>Max 630kgf · cm |

## 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 |  |

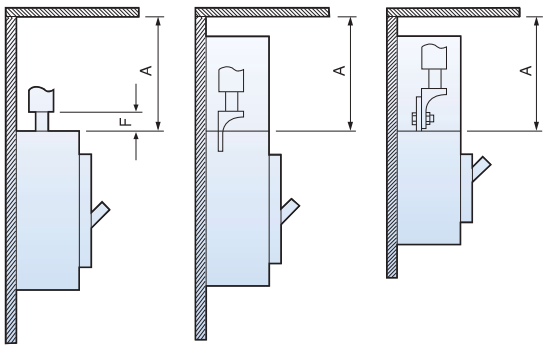
## Safety clearance

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.

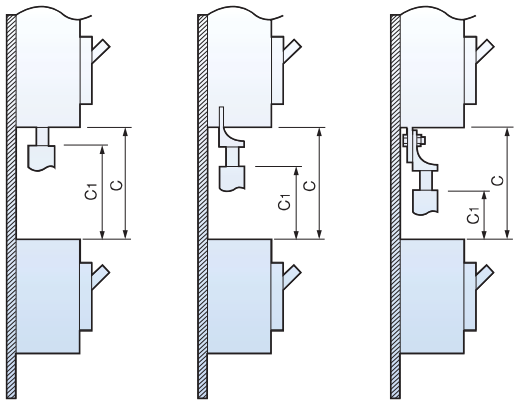
**A: Insulation distance to ceiling for installation in metallic cubicle**

| | 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 | The dimension of exposed conduct |
| 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 | |




Direct connection of cable

Connection by using a cable terminal or ring terminal

Connection by using a cable terminal with extended terminal

## Safety clearance

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

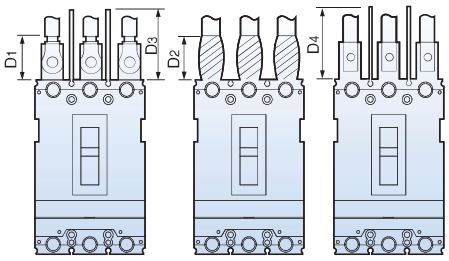
D1: Connection by ring terminal after taping
(Larger than the dimension of exposed conducting part)

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

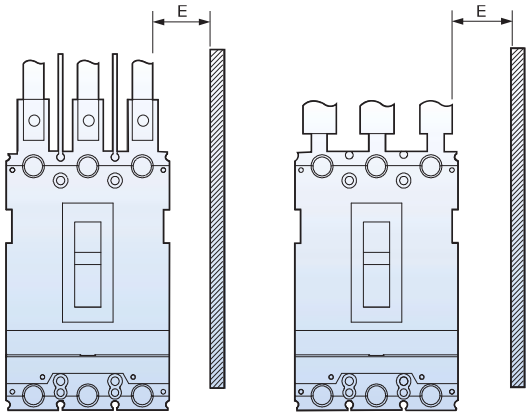
| | D1 (mm) | D2 (mm) | D3 (mm) | D4 (mm) |
|---|---|---|---|---|
| TD100N, TD160N | The dimension of exposed conduct + 20 | 50 | The dimension of exposed conduct + 20 | 50 |
| TD100H, TD160H | | 50 | | 50 |
| TD100L, TD160L | | 50 | | 50 |
| TS100N, TS160N, TS250N | | 100 | | 100 |
| TS100H, TS160H,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

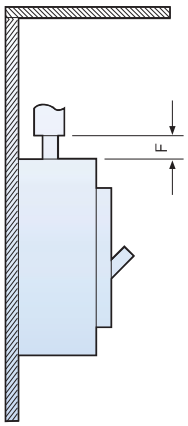
| | E(mm) | |
|---|---|---|
| | 415V | 240V |
| TD100N, TD160N | 25 | 15 |
| TD100H, TD160H | 25 | 15 |
| TD100L, TD160L | 25 | 15 |
| TS100N, TS160N, TS250N | 25 | 15 |
| TS100H, TS160H, TS250H | 25 | 15 |
| TS100L, TS160L, TS250L | 25 | 15 |
| TS400N, TS630N | 20 | 15 |
| TS400H, TS630H | 20 | 15 |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



## Safety clearance

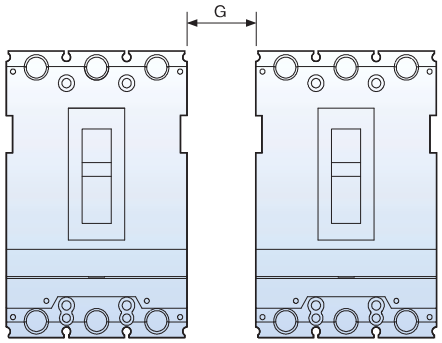
F: The dimension of exposed conducting part

| | F (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

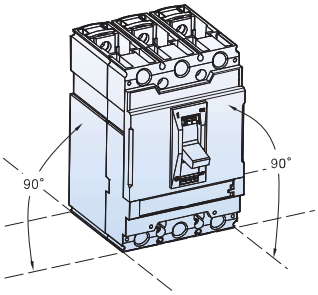
| | G (mm) |
|---|---|
| TD100N, TD160N | 0 |
| TD100H, TD160H | 0 |
| TD100L, TD160L | 0 |
| TS100N, TS160N, TS250N | 0 |
| TS100H, TS160H, TS250H | 0 |
| TS100L, TS160L, TS250L | 0 |
| TS400N, TS630N | 0 |
| TS400H, TS630H | 0 |
| TS400L, TS630L | 0 |
| TS800N | 0 |
| TS800H | 0 |
| TS800L | 0 |

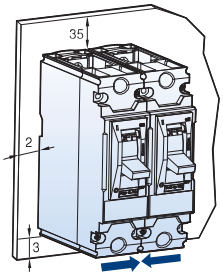


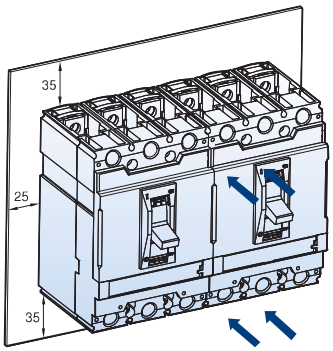

Note) In case of using long or short terminal covers.

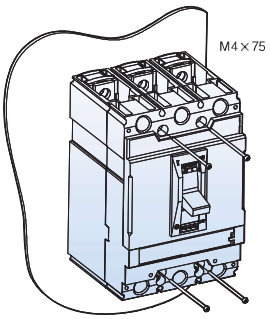
## Example of installation

TD100/160
TS100/160/250

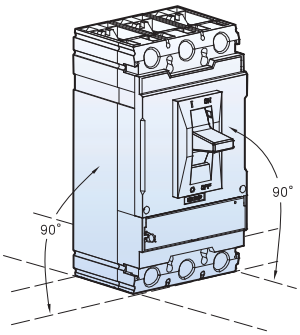


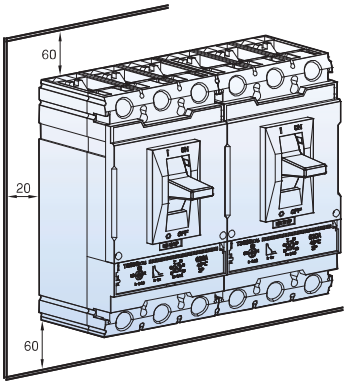



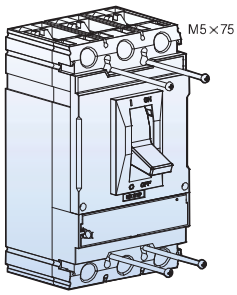



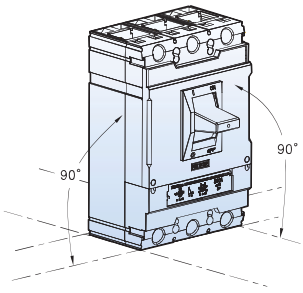

TS400/630

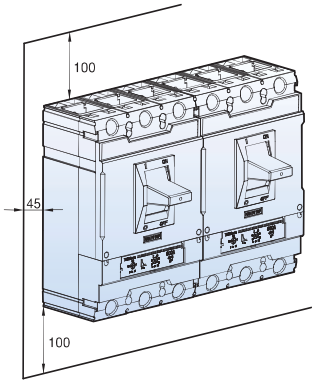


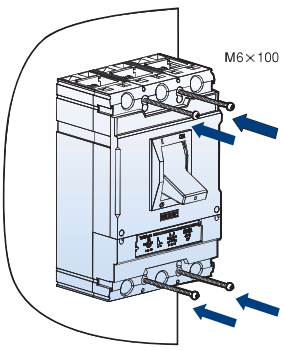




TS800




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

# Connections for 1600AF

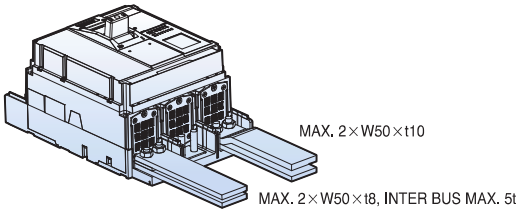
The quality of busbar connections depends, among other things, on the tightening torques used for nuts and bolts. Over-tightening may have the same consequences as under-tightening.
The correct tightening torques for the connection of busbars to the circuit breaker terminals are indicated in the table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

## Examples of busbar connections

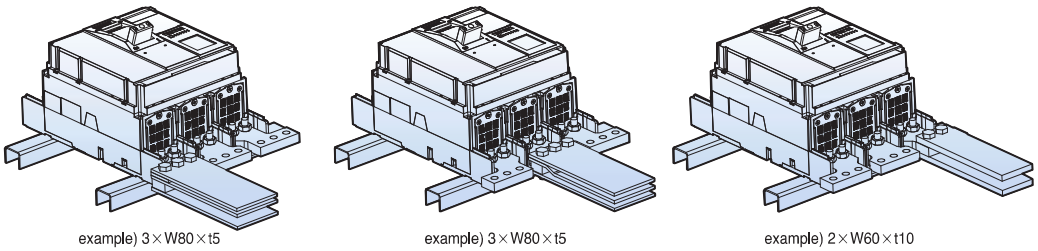
Susol TS1600 MCCB may be installed vertically, horizontally or flat on their back.

### Front type

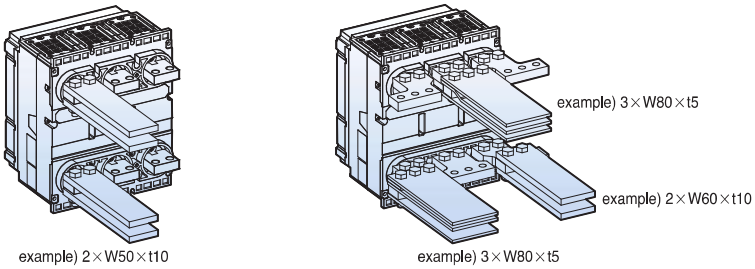
Front type with bars (on backplate or rail)




Front type with basbar (only on rail)

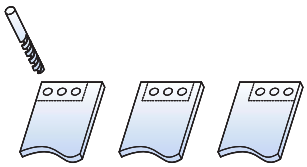



Rear type with bars (only on backplate)




### Insulation distance

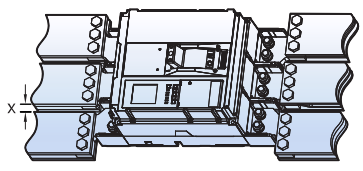
Examples



Tightening torques for busbar

| Bolt | Drilling diameter (mm) | Tightening torque (kgf · cm) |
|---|---|---|
| M10 | 11 | 240~500 |

### Insulation distance



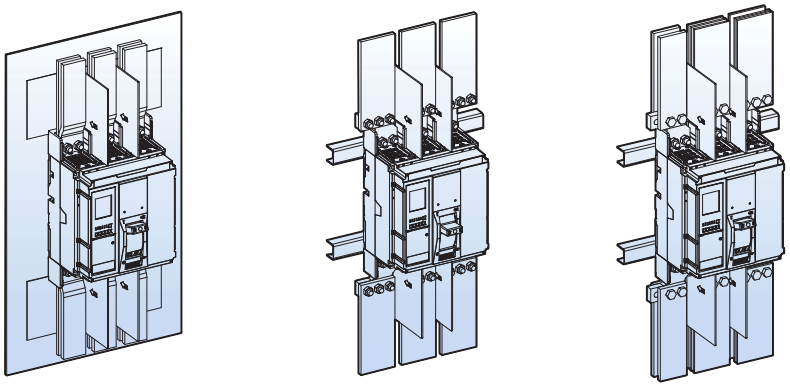

Dimension(mm)

| Utillsation voltage | X minimum |
|---|---|
| Ui≤600V | 8mm |
| Ui≤1000V | 14mm |

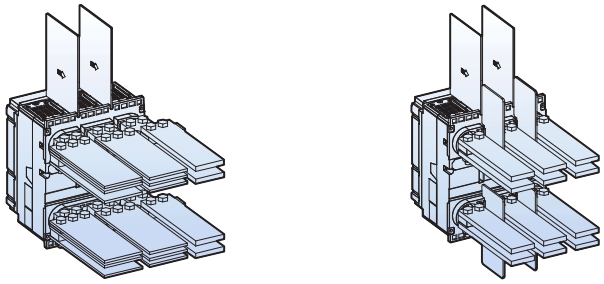
## Size of busbar for 1600AF

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 oder separately.



Front and horizontal rear connection

| Model | Maximum current | T:40°C Number of busbars | | T:50°C Number of busbars | | T:60°C 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 Number of busbars | | T:50°C Number of busbars | | T:60°C 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 |


MCCB
Susol
TS 1600H
1600A
TS 630L
TS 250L
TS 200L
TD 100L
ON
TRIP

# 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-5-21

## Susol MCCB 1600AF

Long-time delay (L) ..... A-5-23
Short-time delay (S) ..... A-5-24
Instantaneous (I), Ground fault (G) ..... A-5-25
IDMTL ..... A-5-26
Pre Trip Alarm ..... A-5-27

## Specific let-through energy curves ..... A-5-28

## Current-limiting curves ..... A-5-31

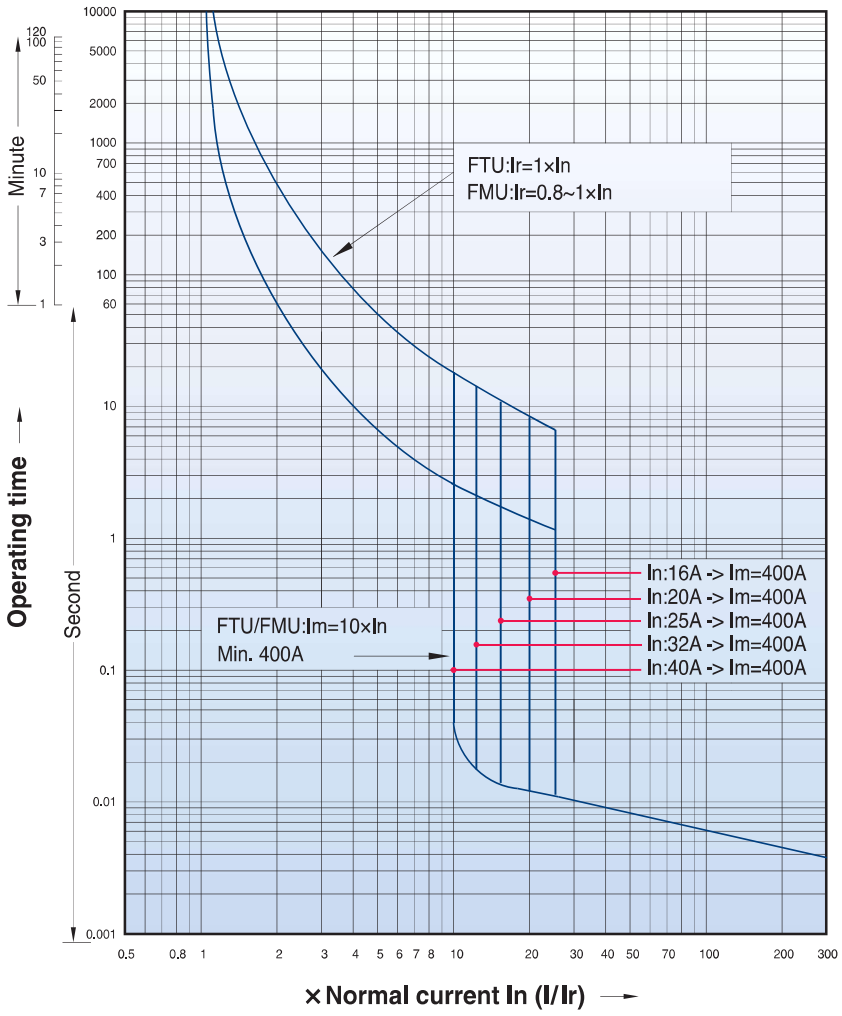
## Circuit breakers with thermal-magnetic trip units

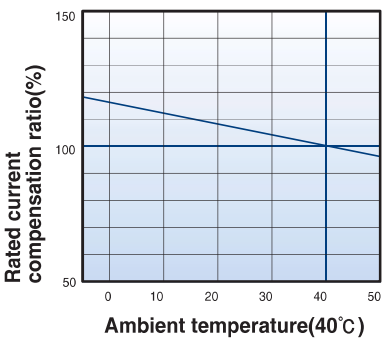
**TE100**

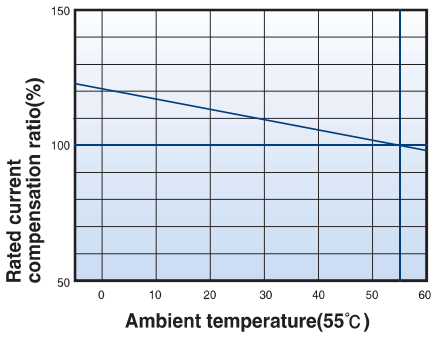
**FTU**

**FMU**

**16~100A**



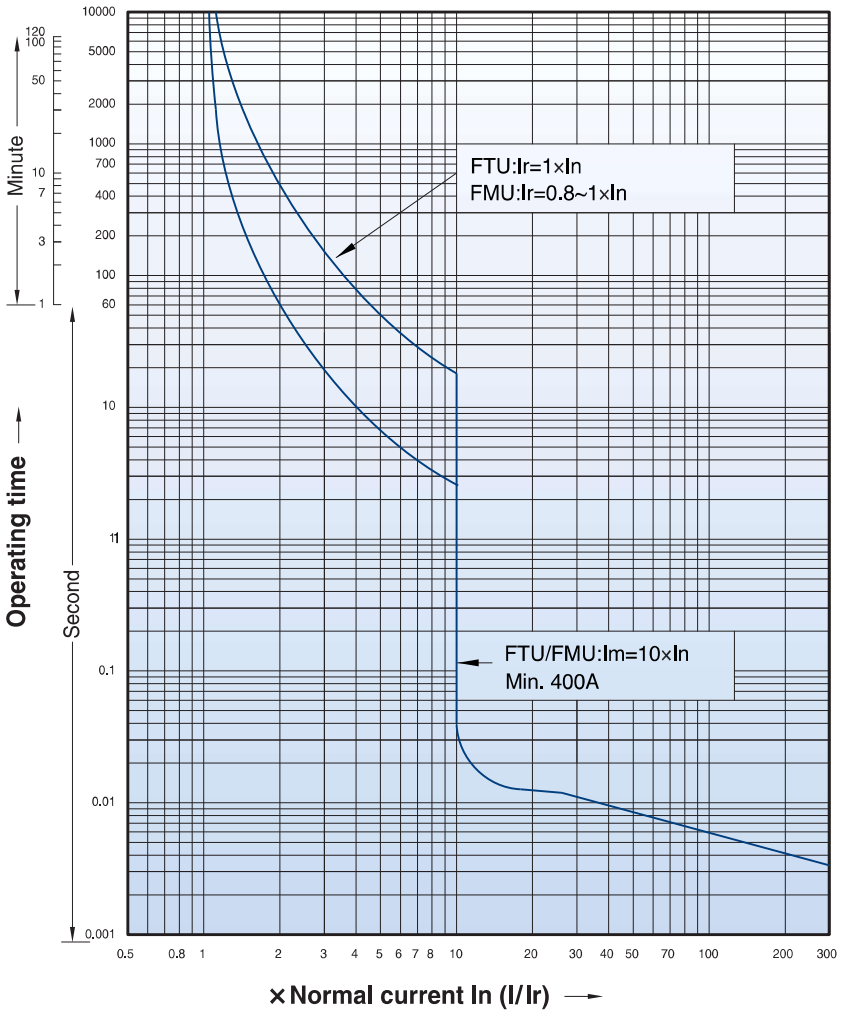
## Circuit breakers with thermal-magnetic trip units

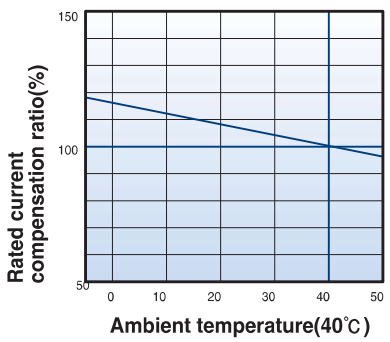
**TE160**

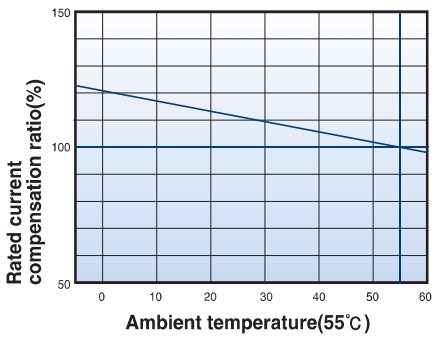
**FTU**

**FMU**

**100~160A**



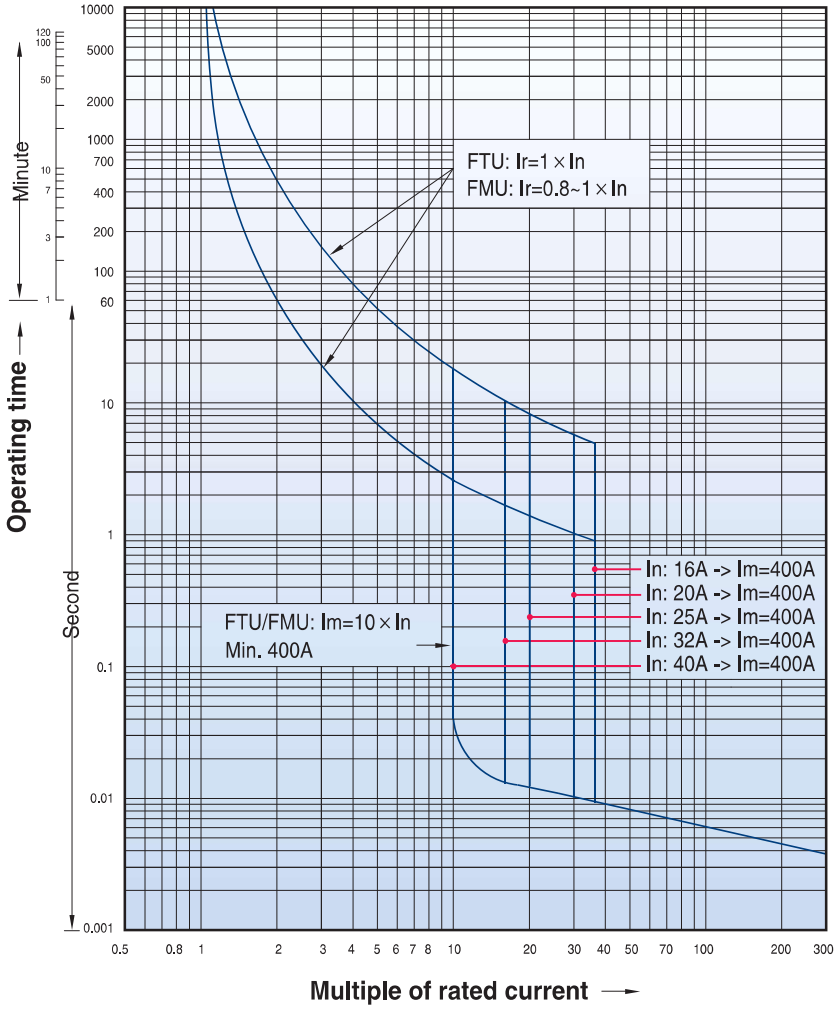
## Circuit breakers with thermal-magnetic trip units

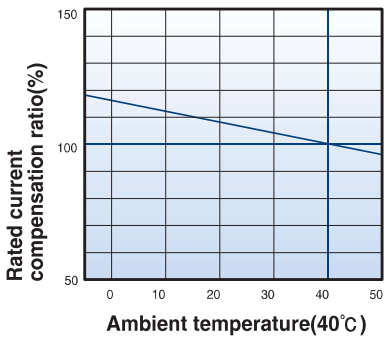
**TD100**

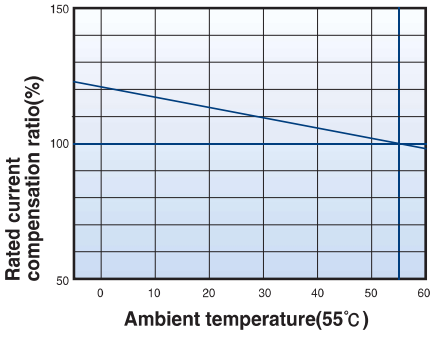
**FTU**

**FMU**

**16~100A**



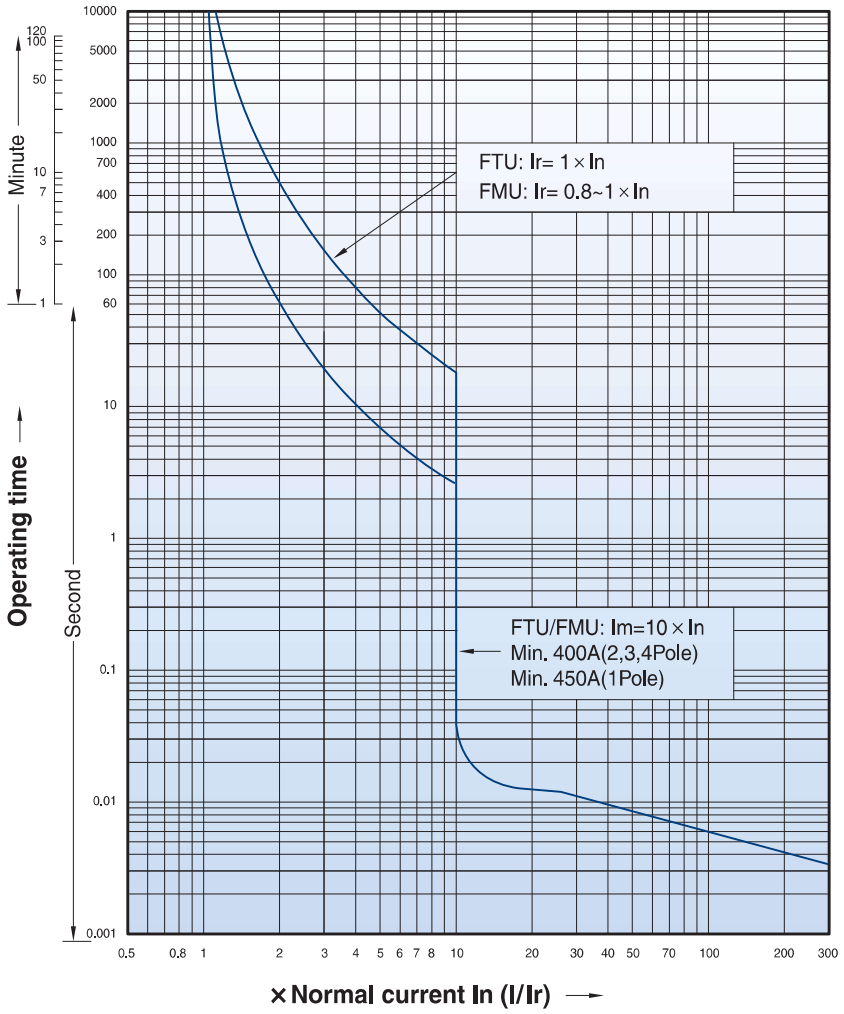
## Circuit breakers with thermal-magnetic trip units

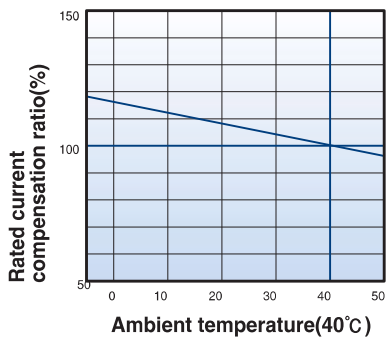
**TD160**

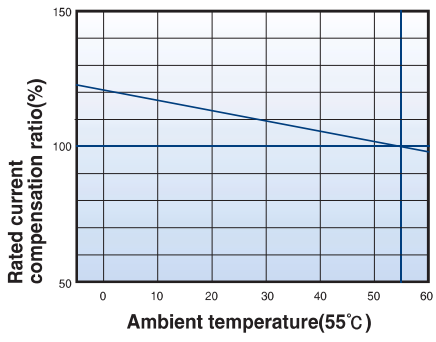
**FTU**

**FMU**

**100~160A**



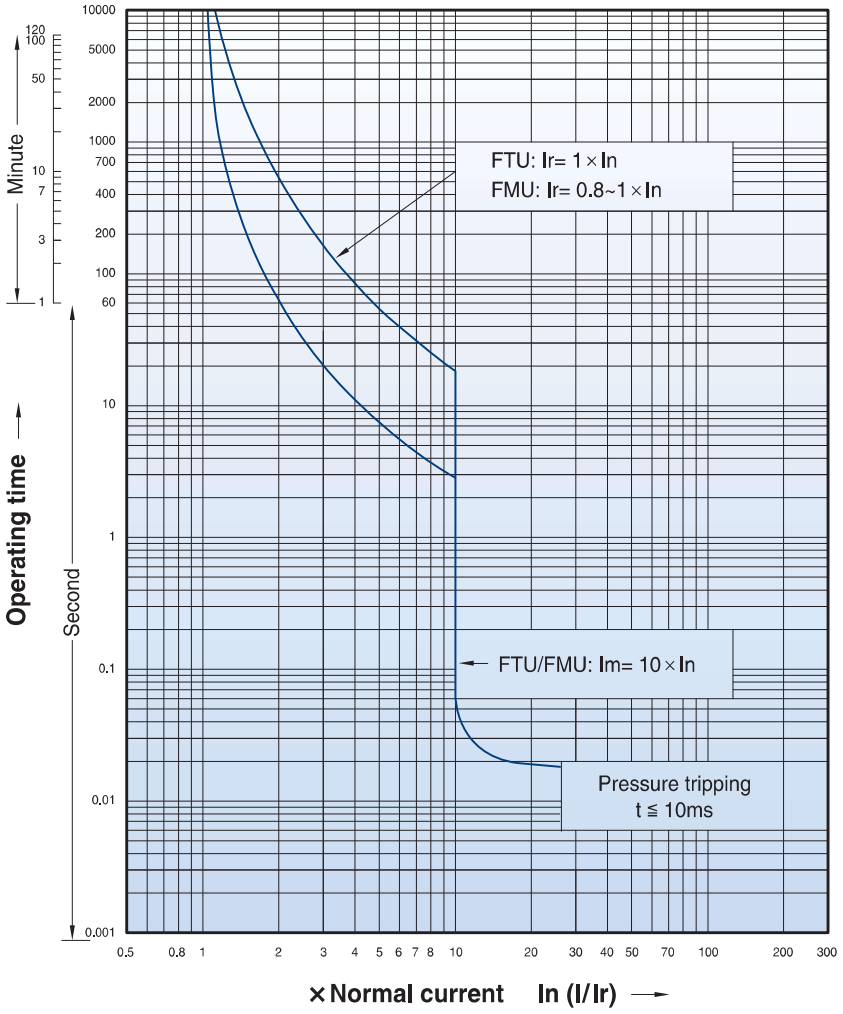
## Circuit breakers with thermal-magnetic trip units

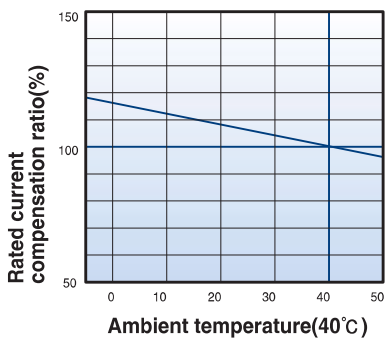
**TS100**

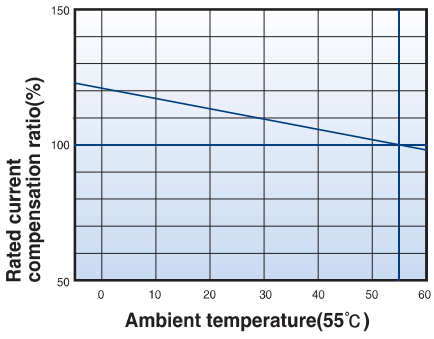
**FTU**

**FMU**

**40~100A**



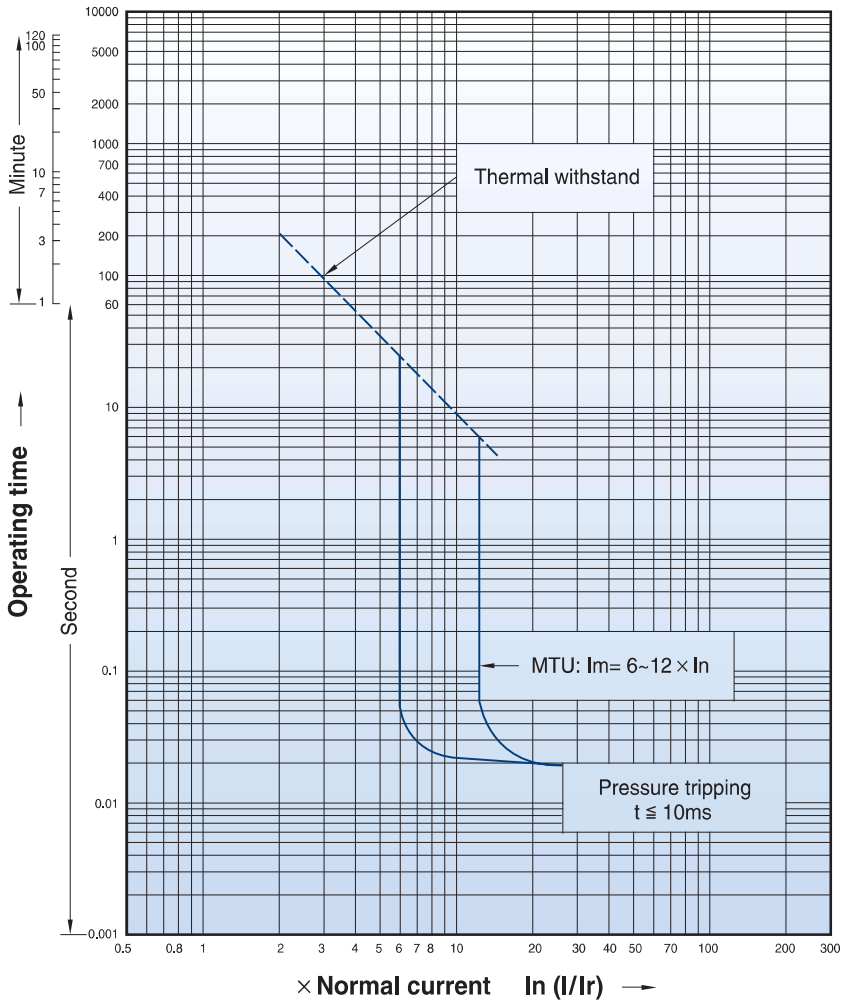
## Circuit breakers with magnetic only trip units

### TS100

**Magnetic only**
**MTU**
**1.6~100A**

### TS160

**Magnetic only**
**MTU**
**32~160A**




**Magnetic trip units(MTU)**

| Rating(A) | | In | TS100 to TS800 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1.6 | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| | N / H / L | TS100 | ● | ● | ● | ● | ● | ● | ● | ● | ● | - | - | - | - | - |
| | | TS160 | - | - | - | - | - | ● | ● | ● | ● | ● | - | - | - | - |
| | | TS250 | - | - | - | - | - | - | - | - | ● | ● | ● | - | - | - |
| | | TS400 | - | - | - | - | - | - | - | - | - | - | - | ● | - | - |
| | | TS630 | - | - | - | - | - | - | - | - | - | - | - | - | ● | - |
| | | TS800 | - | - | - | - | - | - | - | - | - | - | - | - | - | ● |

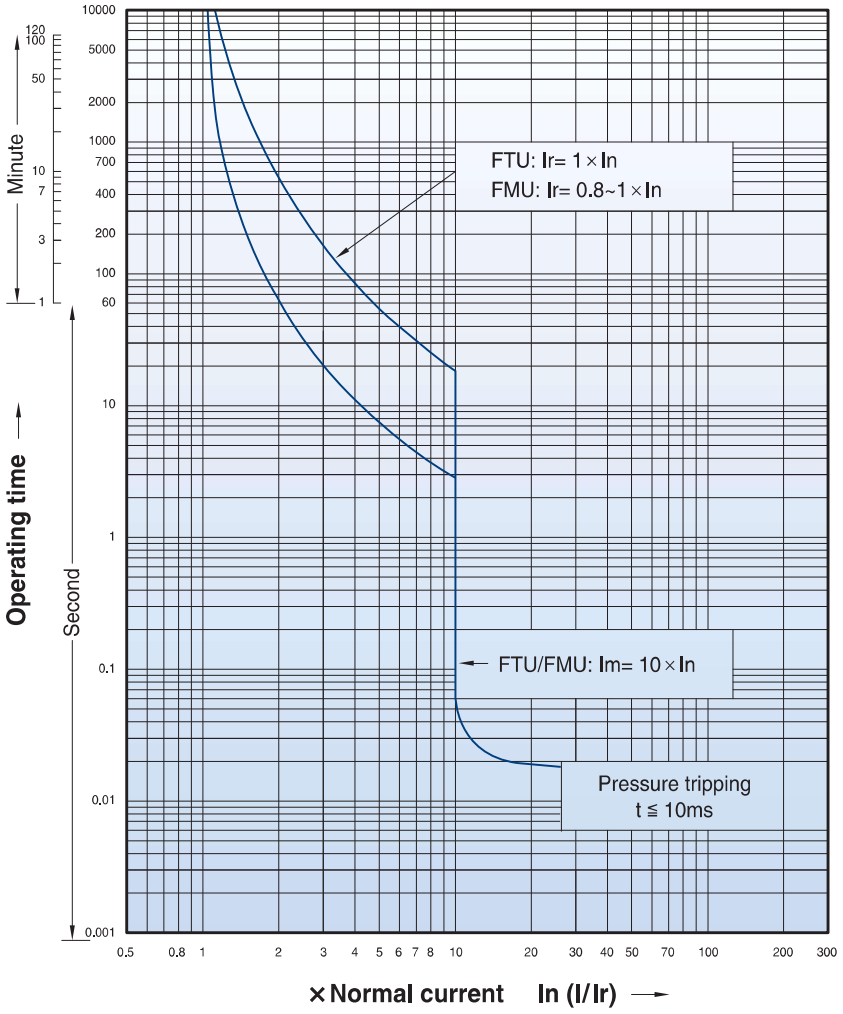
**Short - circuit protection(magnetic)**

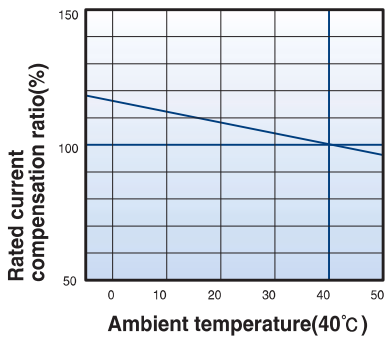
| Pick - up | Im | Setting |
|---|---|---|
| | | 6..12 × In (6 Point) |

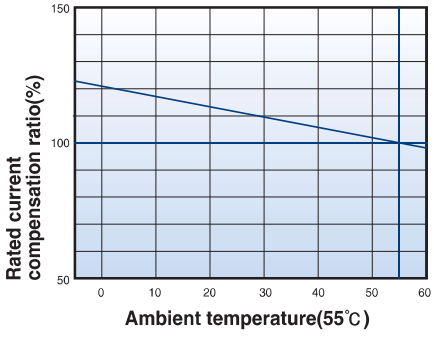
## Circuit breakers with thermal-magnetic trip units

### TS160

**FTU**
**FMU**
**100, 125, 160A**



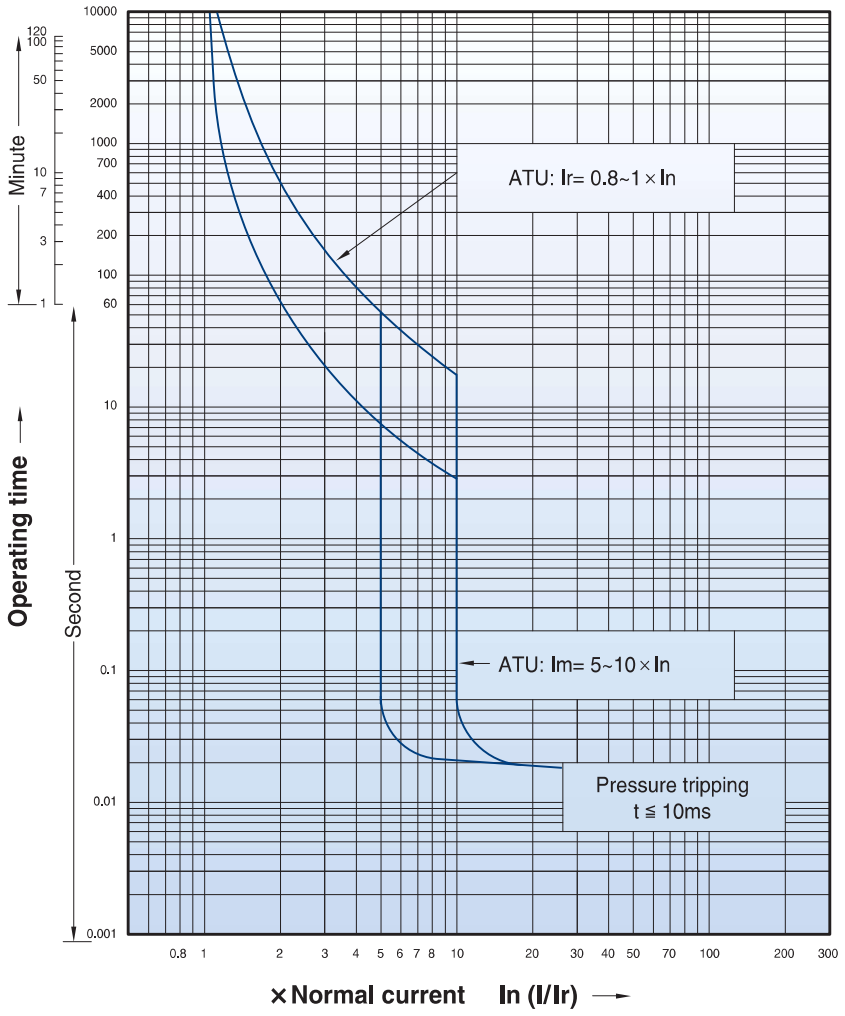



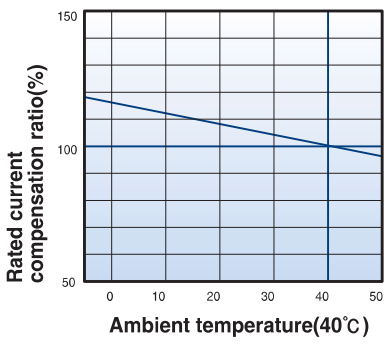
## Circuit breakers with thermal-magnetic trip units

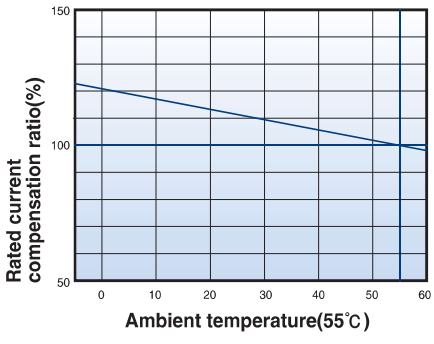
### TS160

**ATU**

**100, 125, 160A**



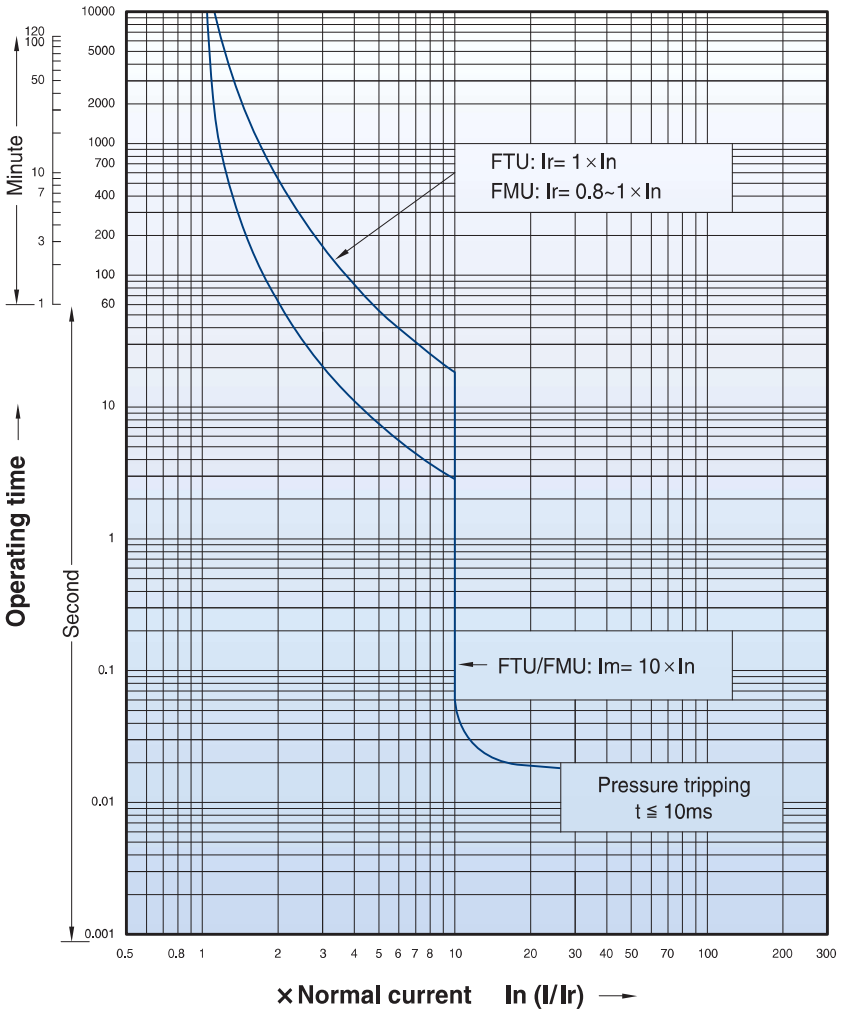



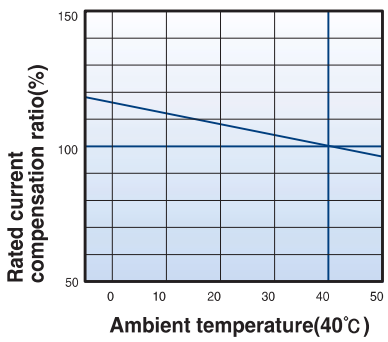



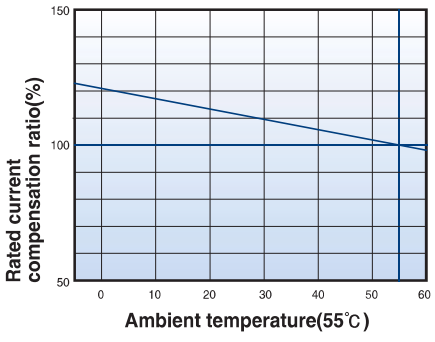
## Circuit breakers with thermal-magnetic trip units

**TS250**

**FTU**
**FMU**
**125~250A**



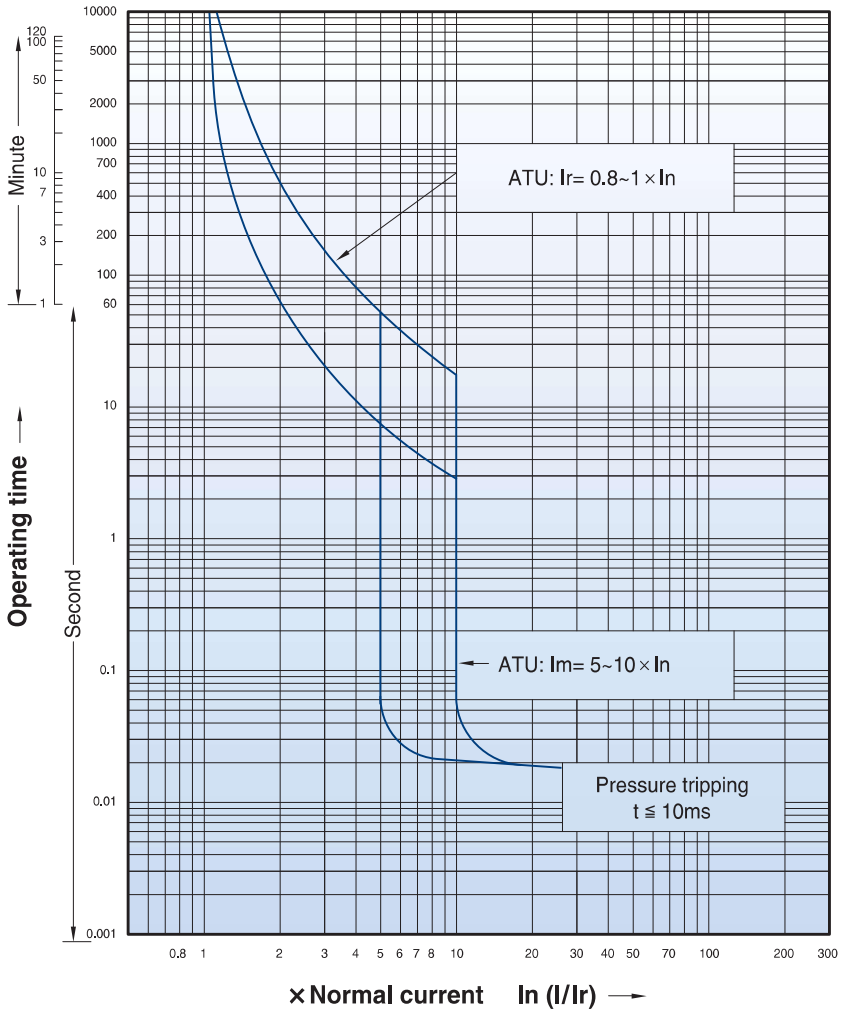



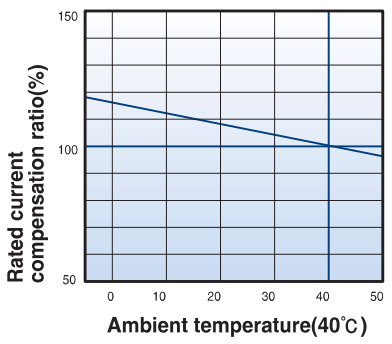
## Circuit breakers with thermal-magnetic trip units

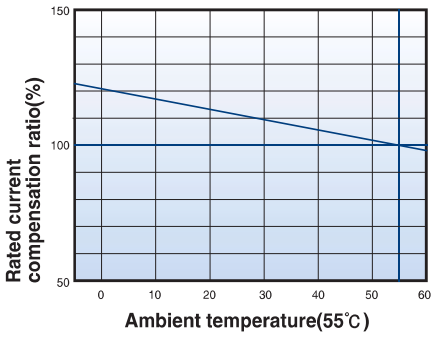
**TS250**

**ATU**

**125~250A**



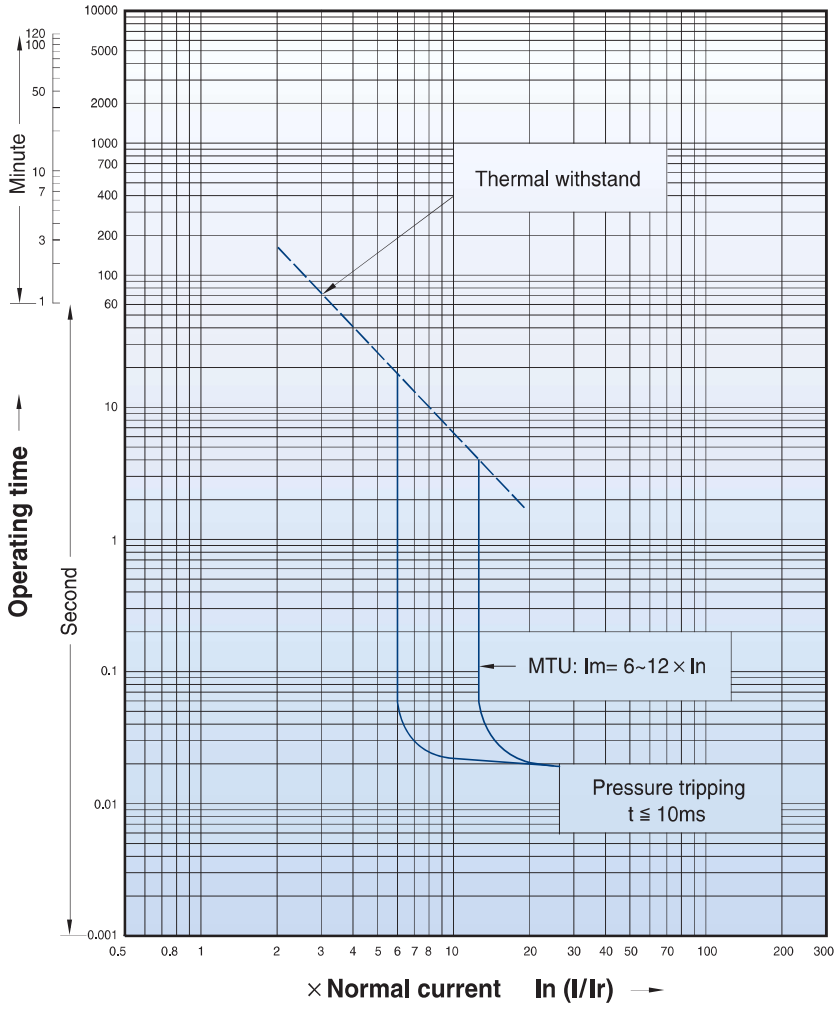



## Circuit breakers with magnetic only trip units

### TS250

**Magnetic only**
**MTU**
**100, 160, 220A**




**Magnetic trip units(MTU)**

| Rating(A) | In | TS100 to TS800 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1.6 | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| N / H / L | TS100 | ● | ● | ● | ● | ● | ● | ● | ● | ● | - | - | - | - | - |
| | TS160 | - | - | - | - | - | ● | ● | ● | ● | ● | - | - | - | - |
| | TS250 | - | - | - | - | - | - | - | - | ● | ● | ● | - | - | - |
| | TS400 | - | - | - | - | - | - | - | - | - | - | - | ● | - | - |
| | TS630 | - | - | - | - | - | - | - | - | - | - | - | - | ● | - |
| | TS800 | - | - | - | - | - | - | - | - | - | - | - | - | - | ● |

**Short - circuit protection(magnetic)**

| Pick - up | Im | Setting |
|---|---|---|
| | | 6..12 × In (6 Point) |

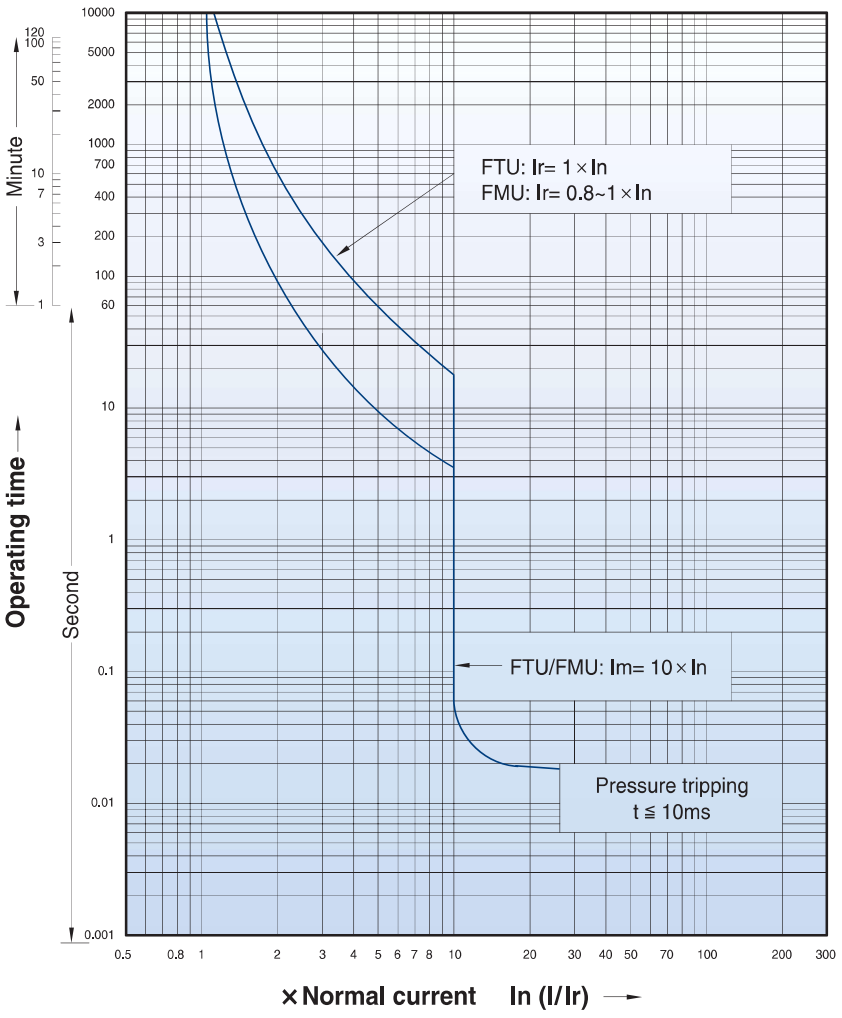
## Circuit breakers with thermal-magnetic trip units

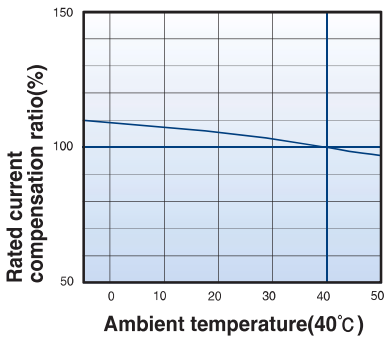
**TS400**

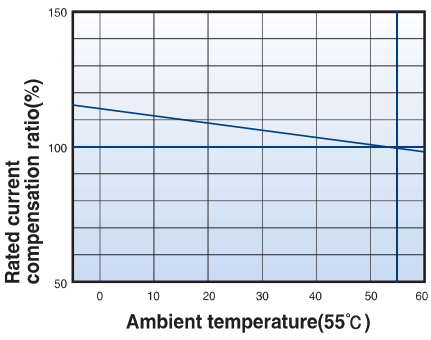
**FTU**

**FMU**

**300, 400A**



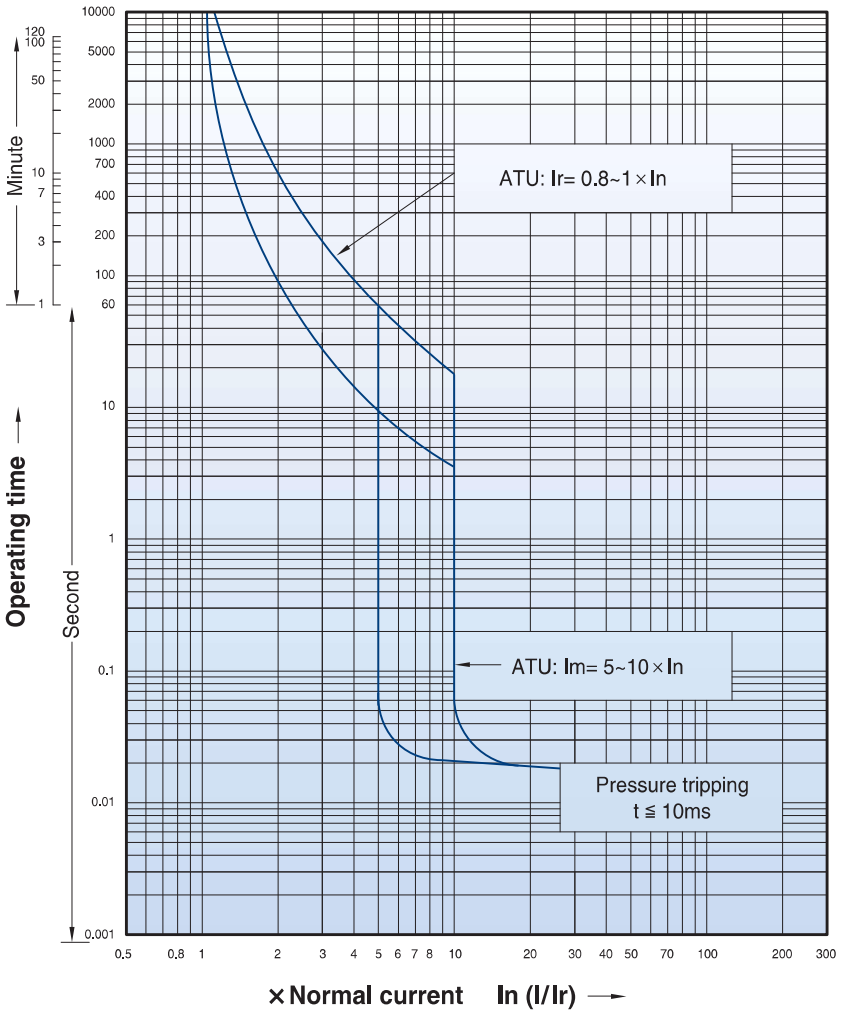



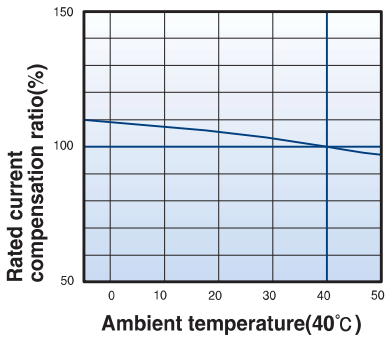
## Circuit breakers with thermal-magnetic trip units

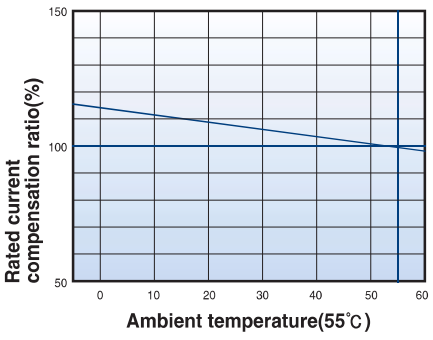
**TS400**

**ATU**

**300, 400A**



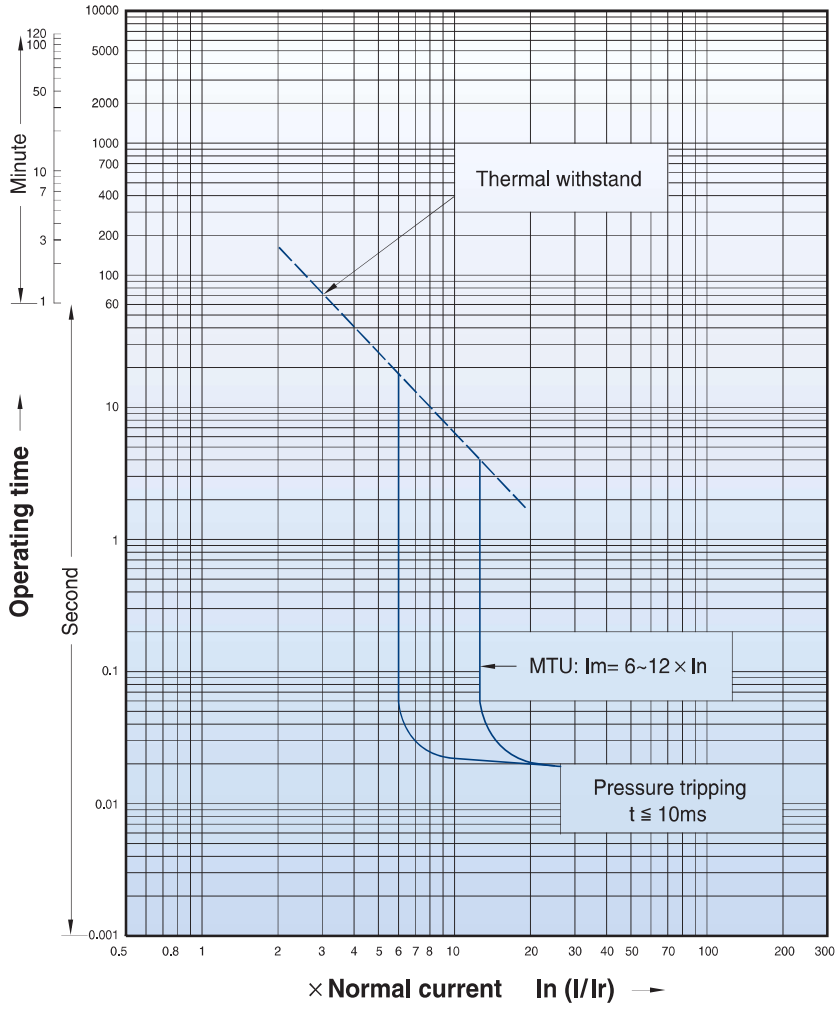



## Circuit breakers with magnetic only trip units

**TS400**

**MTU**

**320A**




**Magnetic trip units(MTU)**

| Rating(A) | | In | TS100 to TS800 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1.6 | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| | N / H / L | TS100 | ● | ● | ● | ● | ● | ● | ● | ● | ● | - | - | - | - | - |
| | | TS160 | - | - | - | - | - | ● | ● | ● | ● | ● | - | - | - | - |
| | | TS250 | - | - | - | - | - | - | - | - | ● | ● | ● | - | - | - |
| | | TS400 | - | - | - | - | - | - | - | - | - | - | - | ● | - | - |
| | | TS630 | - | - | - | - | - | - | - | - | - | - | - | - | ● | - |
| | | TS800 | - | - | - | - | - | - | - | - | - | - | - | - | - | ● |

**Short - circuit protection(magnetic)**

| Pick - up | Im | Setting |
|---|---|---|
| | | 6..12 × In (6 Point) |

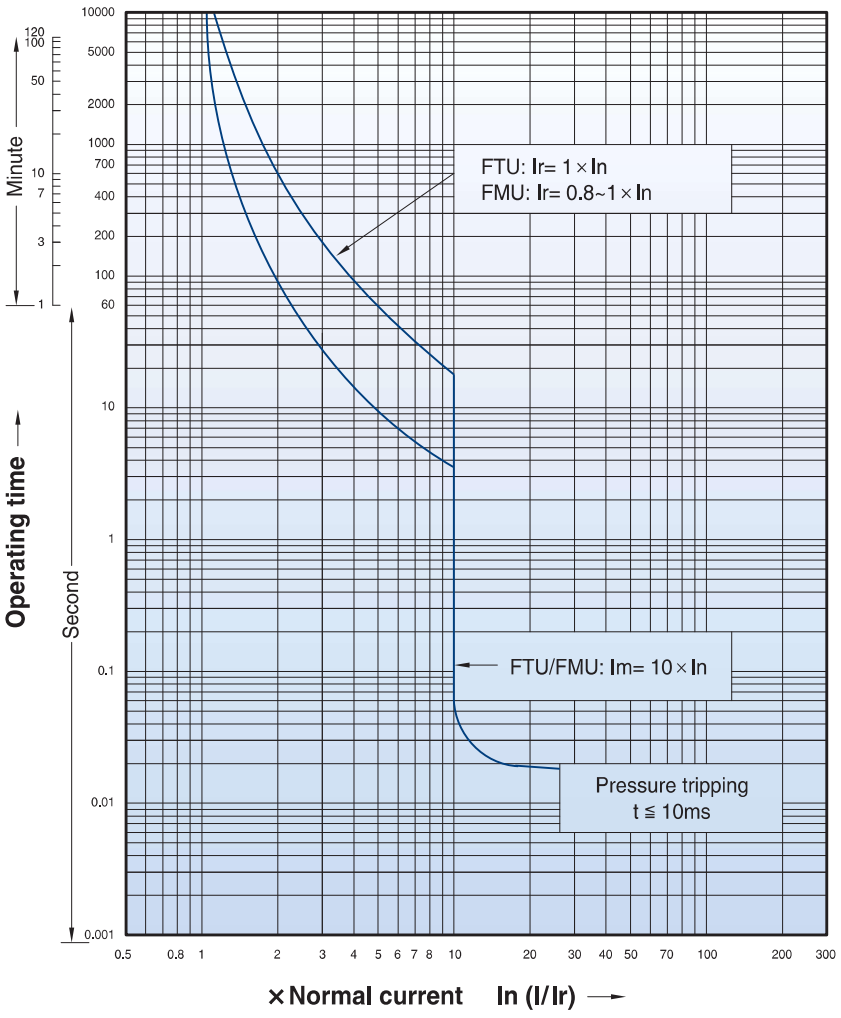
## Circuit breakers with thermal-magnetic trip units

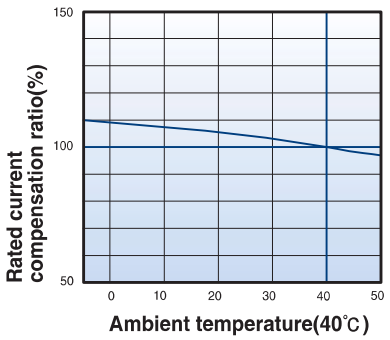
**TS630**

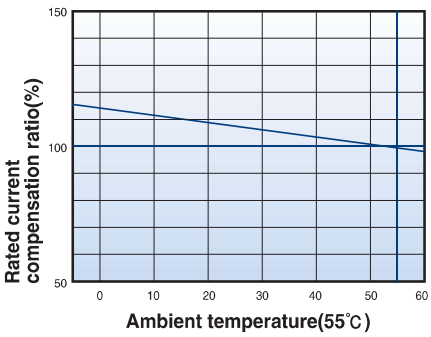
**FTU**

**FMU**

**500, 630A**



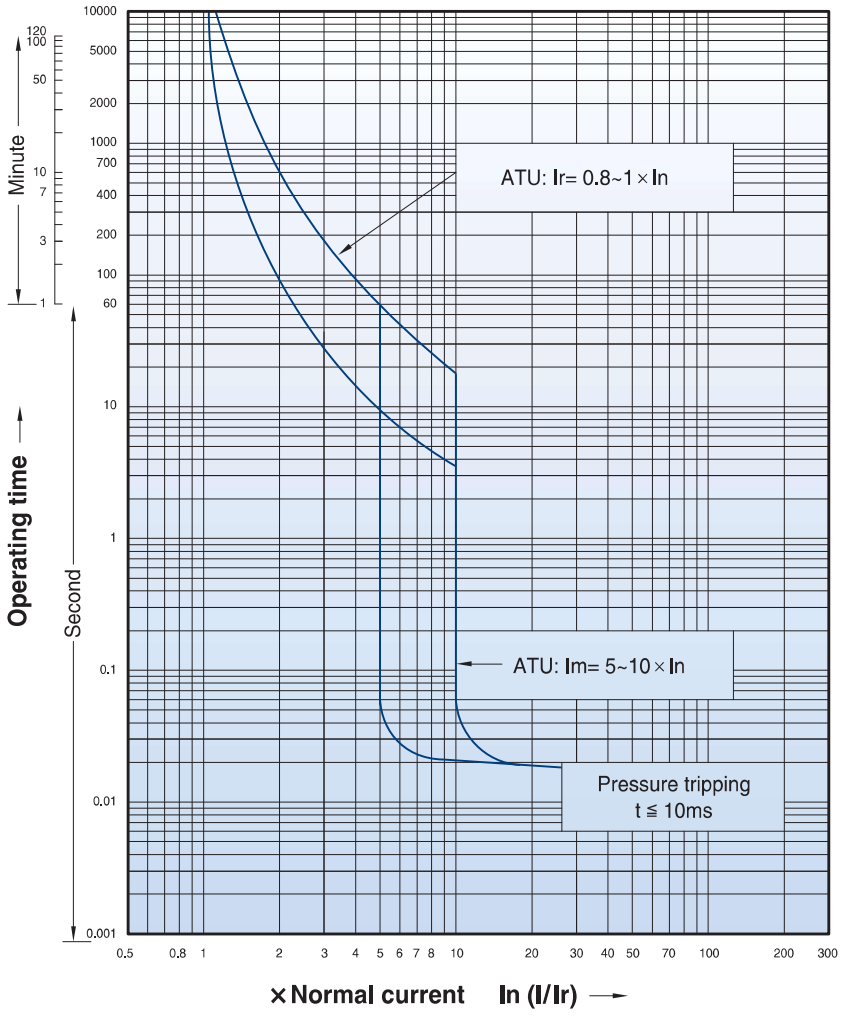



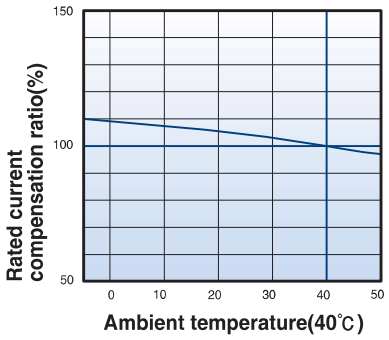
## Circuit breakers with thermal-magnetic trip units

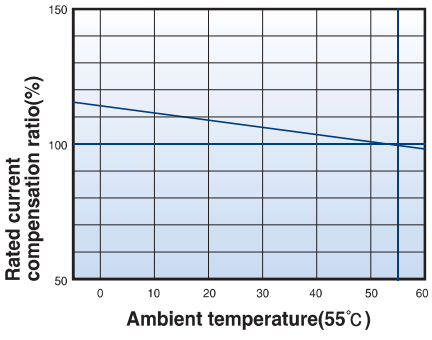
**TS630**

**ATU**

**500, 630A**

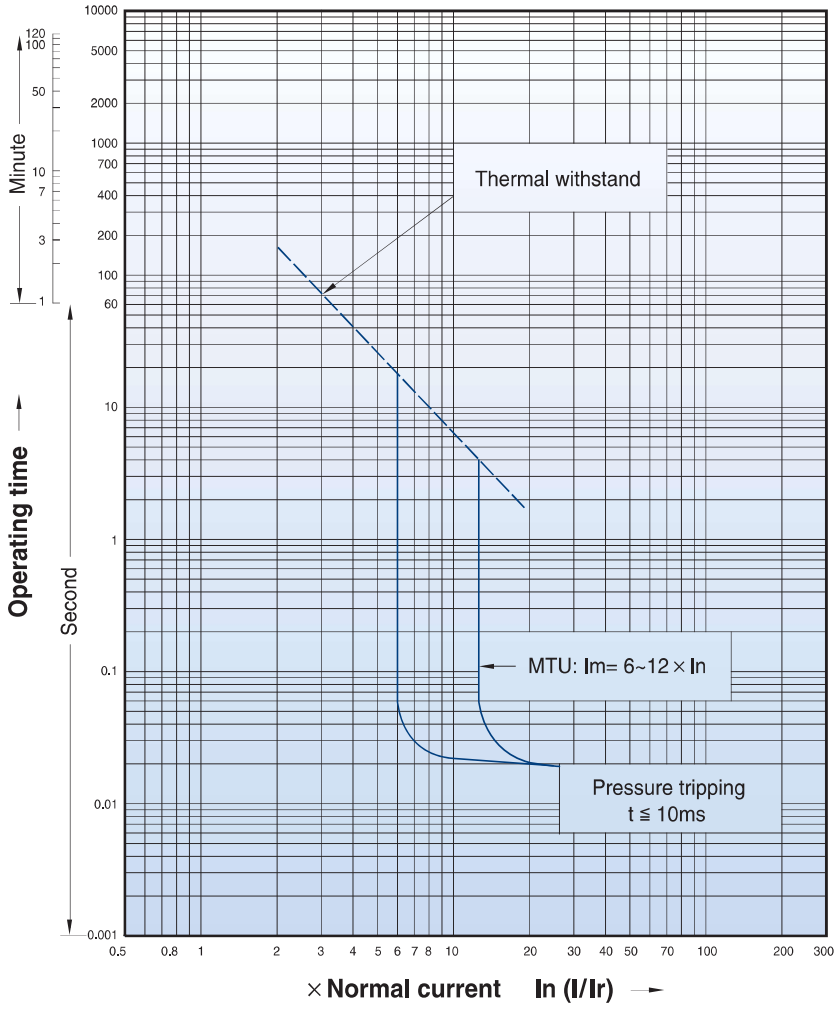


## Circuit breakers with magnetic only trip units

**TS630**
**MTU**
**500A**




**Magnetic trip units(MTU)**

| Rating(A) | In | TS100 to TS800 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1.6 | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| N / H / L | TS100 | ● | ● | ● | ● | ● | ● | ● | ● | ● | - | - | - | - | - |
| | TS160 | - | - | - | - | - | ● | ● | ● | ● | ● | - | - | - | - |
| | TS250 | - | - | - | - | - | - | - | - | ● | ● | ● | - | - | - |
| | TS400 | - | - | - | - | - | - | - | - | - | - | - | ● | - | - |
| | TS630 | - | - | - | - | - | - | - | - | - | - | - | - | ● | - |
| | TS800 | - | - | - | - | - | - | - | - | - | - | - | - | - | ● |

**Short - circuit protection(magnetic)**

| Pick - up | Im | Setting |
|---|---|---|
| | | 6..12 × In (6 Point) |

## Circuit breakers with thermal-magnetic trip units

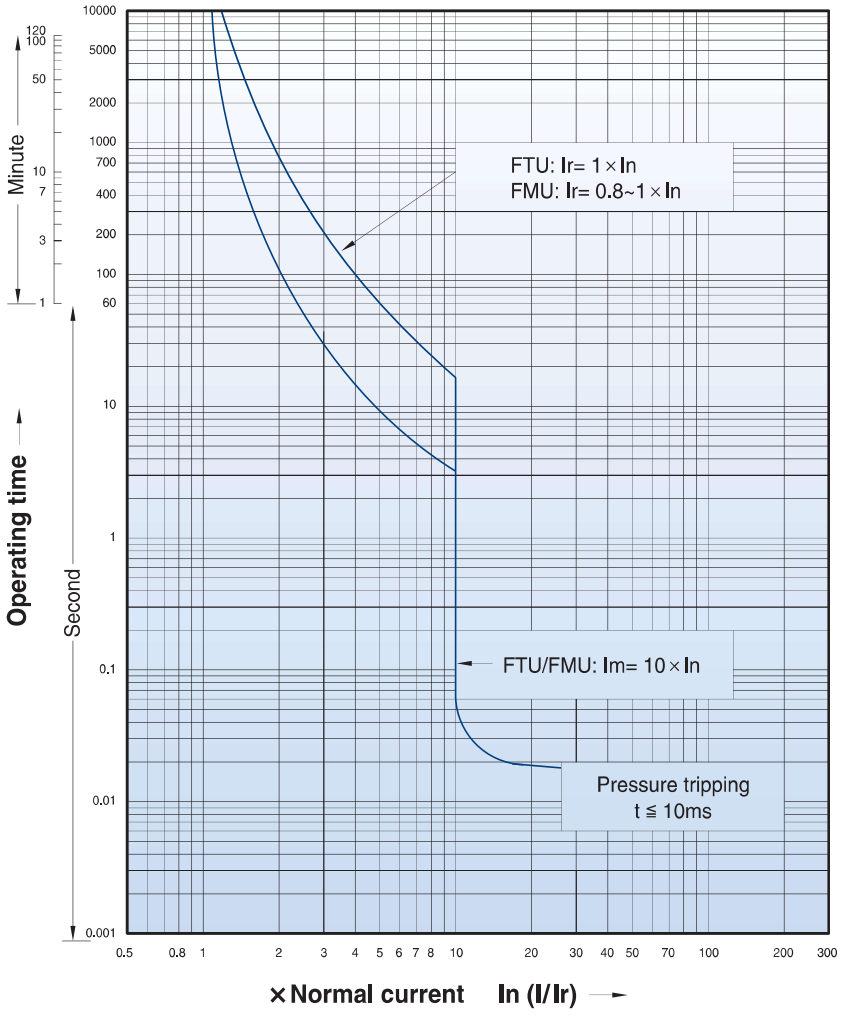
**TS800**

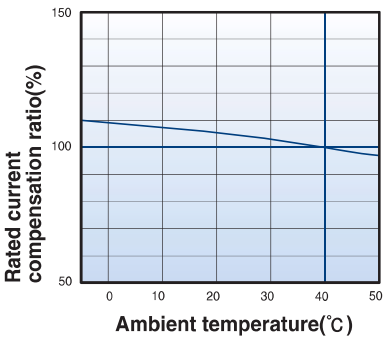
**FTU**

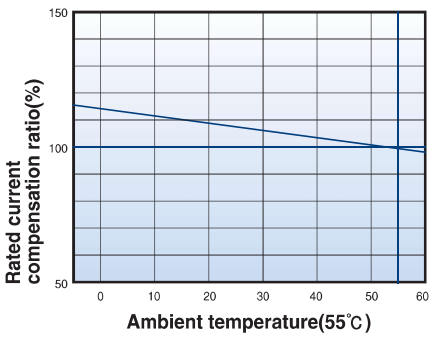
**700, 800A**

**FMU**

**800A**



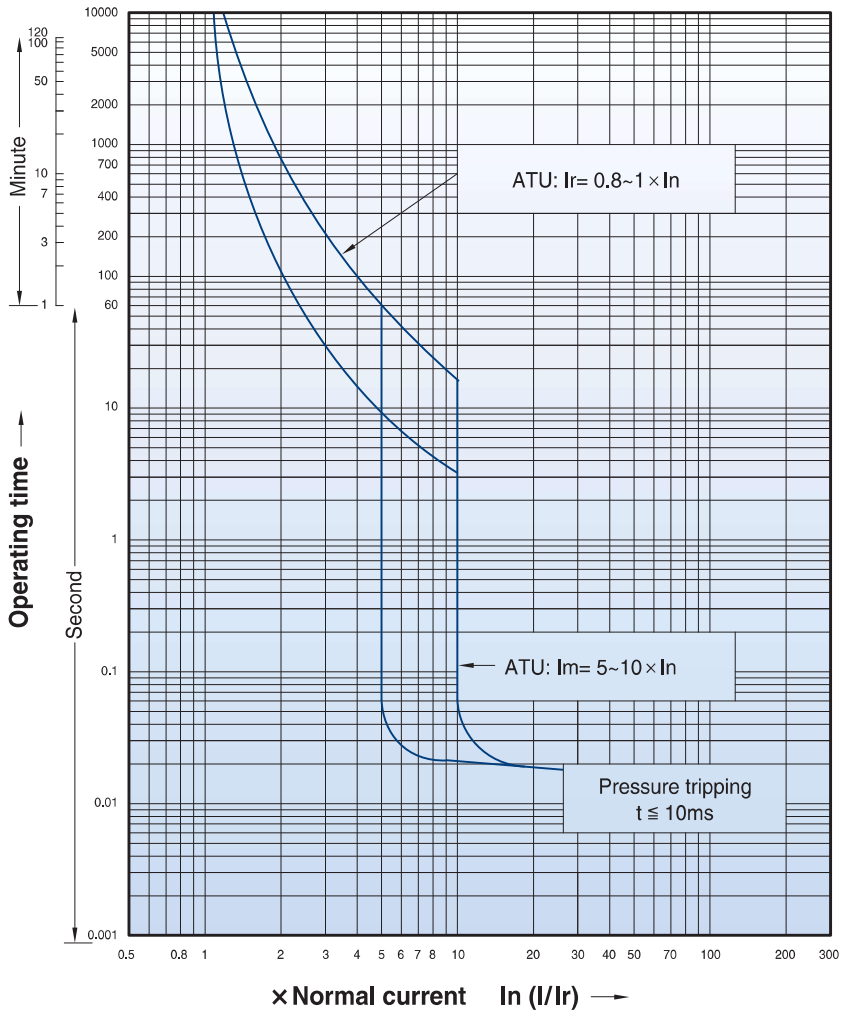



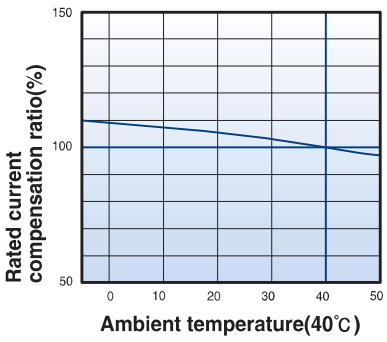
## Circuit breakers with thermal-magnetic trip units

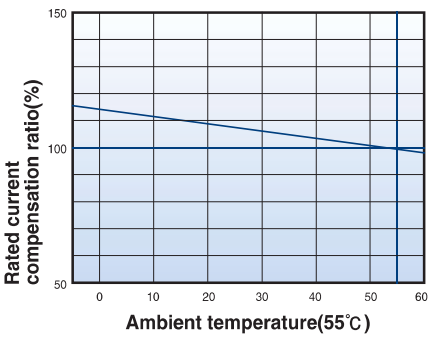
**TS800**

**ATU**

**800A**



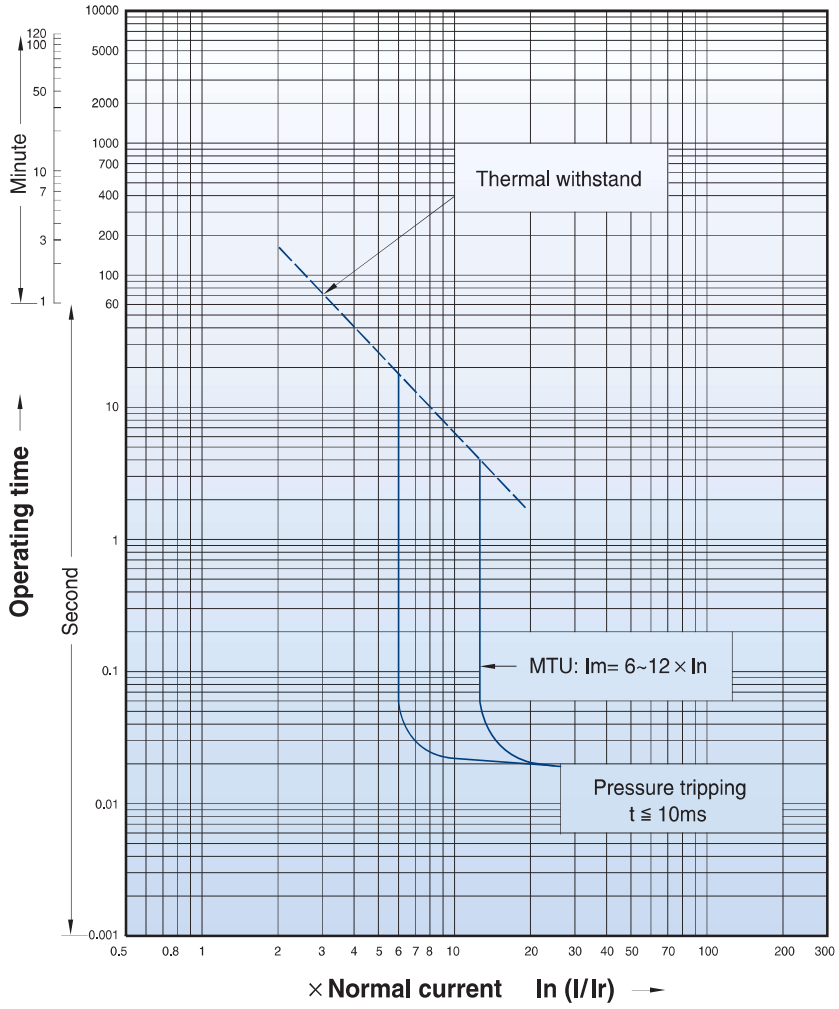



## Circuit breakers with magnetic only trip units

**TS800**

**MTU**

**630A**




**Magnetic trip units(MTU)**

| Rating(A) | | In | TS100 to TS800 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1.6 | 3.2 | 6.3 | 12 | 20 | 32 | 50 | 63 | 100 | 160 | 220 | 320 | 500 | 630 |
| | N / H / L | TS100 | ● | ● | ● | ● | ● | ● | ● | ● | ● | - | - | - | - | - |
| | | TS160 | - | - | - | - | - | ● | ● | ● | ● | ● | - | - | - | - |
| | | TS250 | - | - | - | - | - | - | - | - | ● | ● | ● | - | - | - |
| | | TS400 | - | - | - | - | - | - | - | - | - | - | - | ● | - | - |
| | | TS630 | - | - | - | - | - | - | - | - | - | - | - | - | ● | - |
| | | TS800 | - | - | - | - | - | - | - | - | - | - | - | - | - | ● |

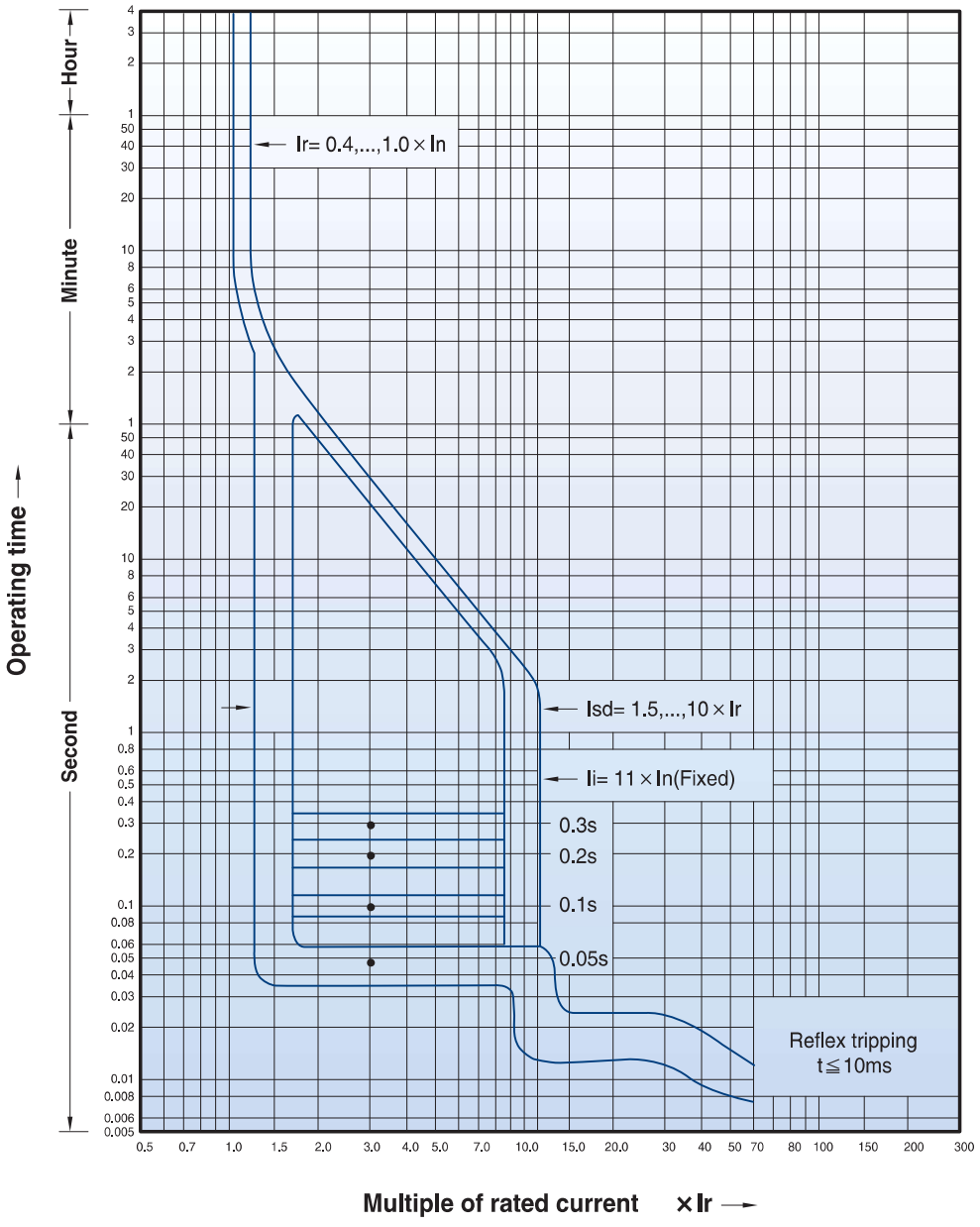
**Short - circuit protection(magnetic)**

| Pick - up | Im | Setting |
|---|---|---|
| | | 6..12 × In (6 Point) |

## Circuit breakers with electronic trip unit (ETS)

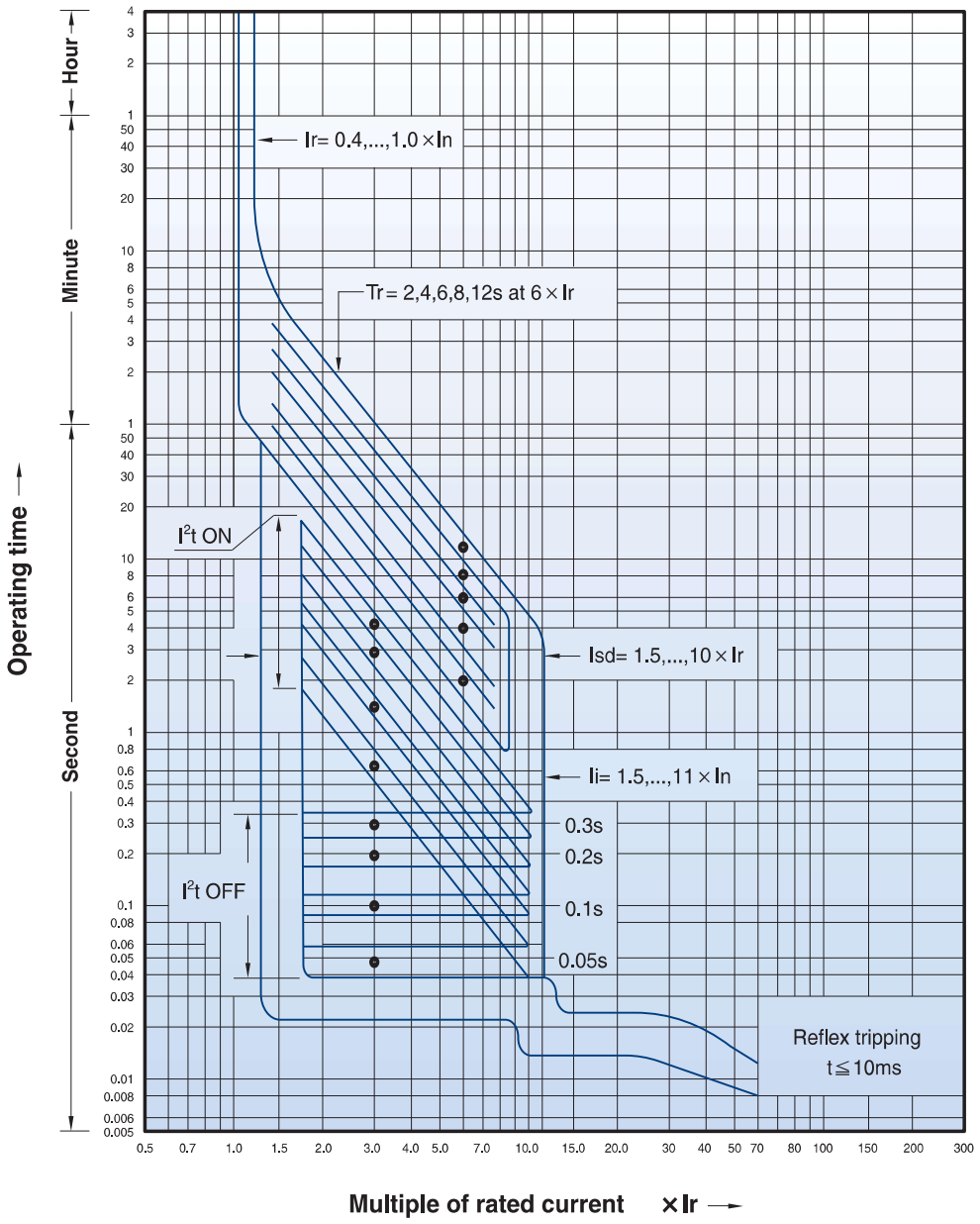
**TS100 to TS800**

**ETS23**
**ETS33**
**ETS43**



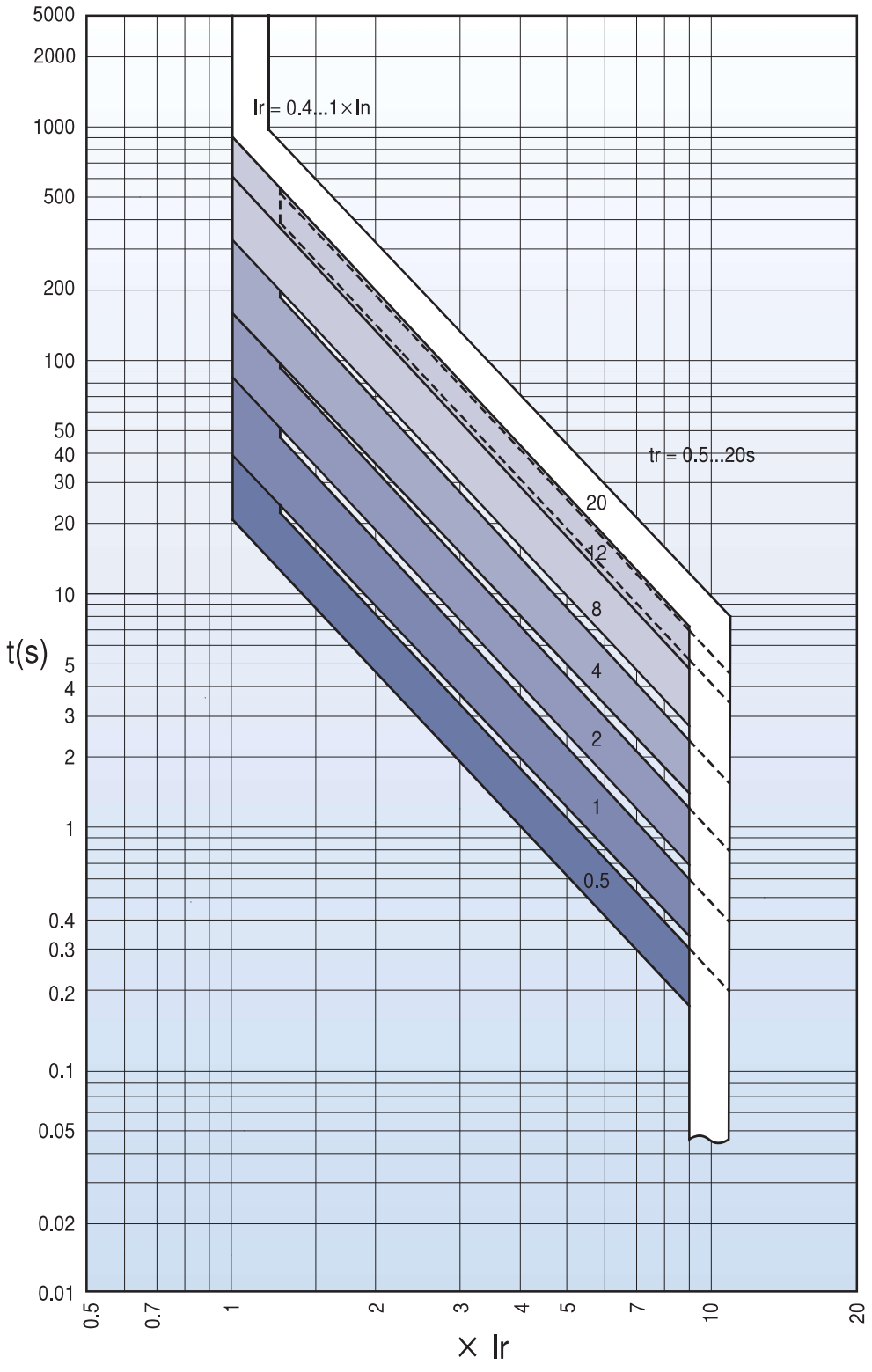
## Circuit breakers with electronic trip unit (ETM)

**TS400**
**TS630**
**TS800**
**ETM33**
**ETM43**



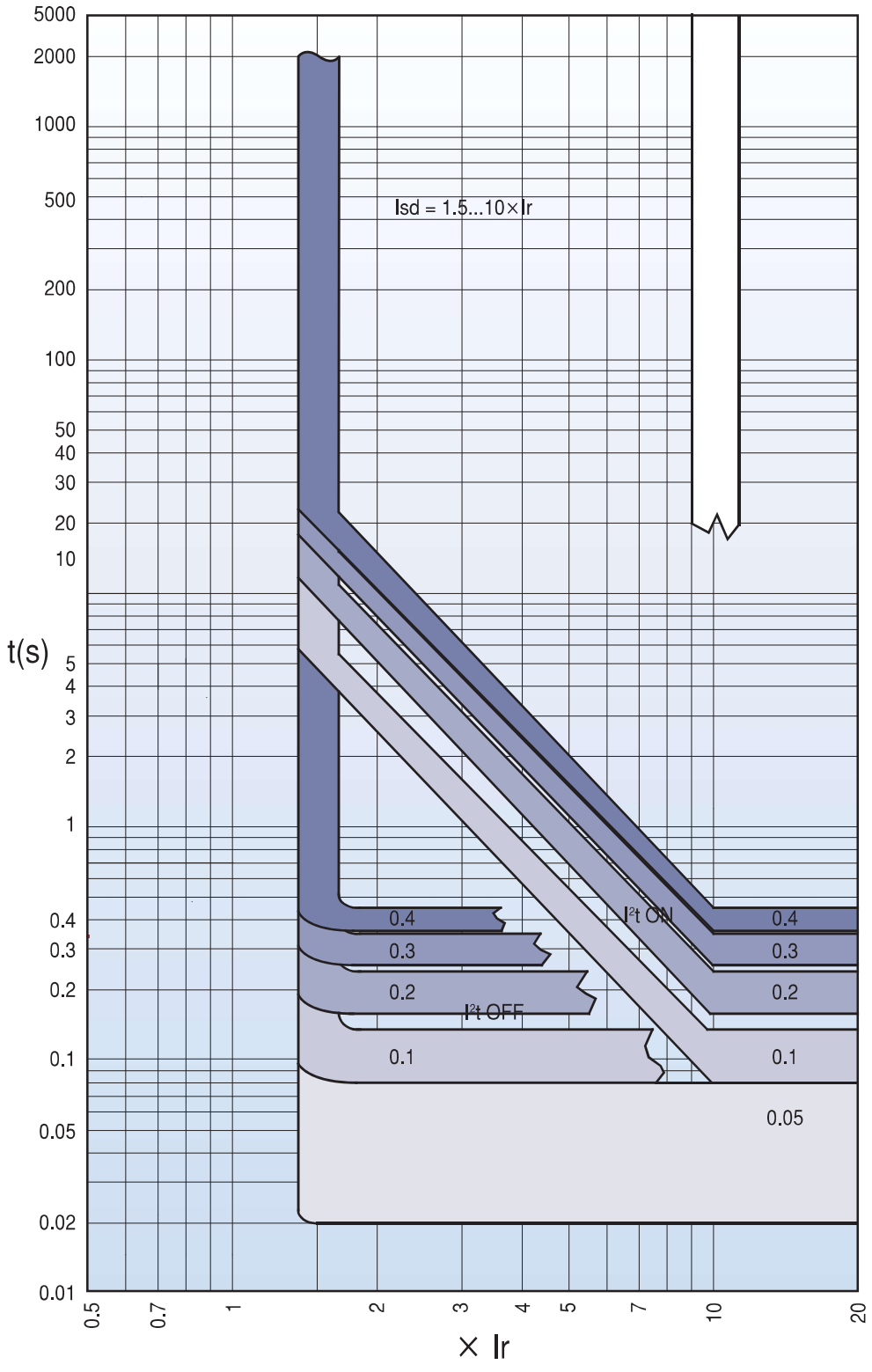
## Long-time delay (L)

**TS1600**



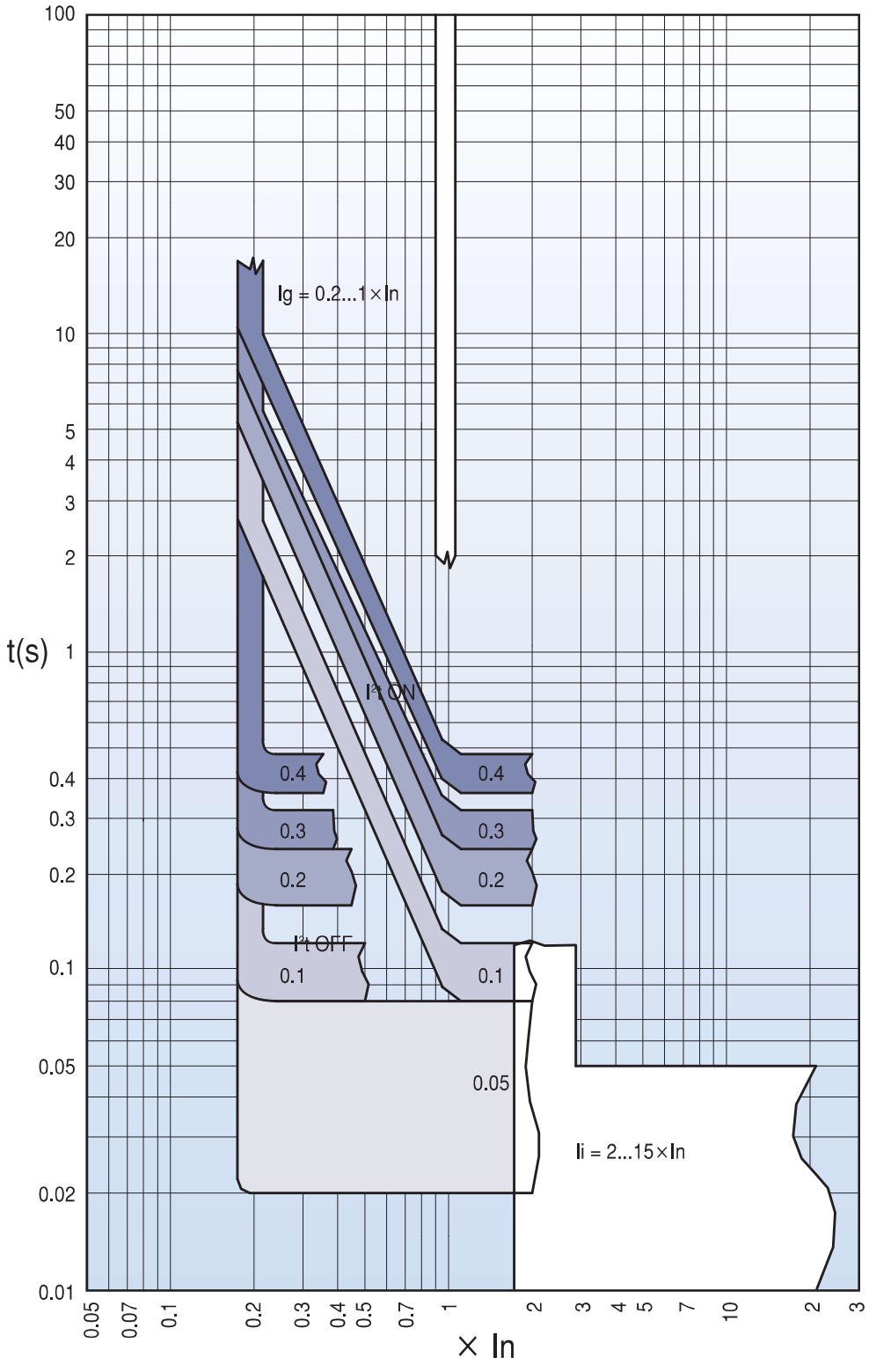
## Short-time delay (S)

TS1600



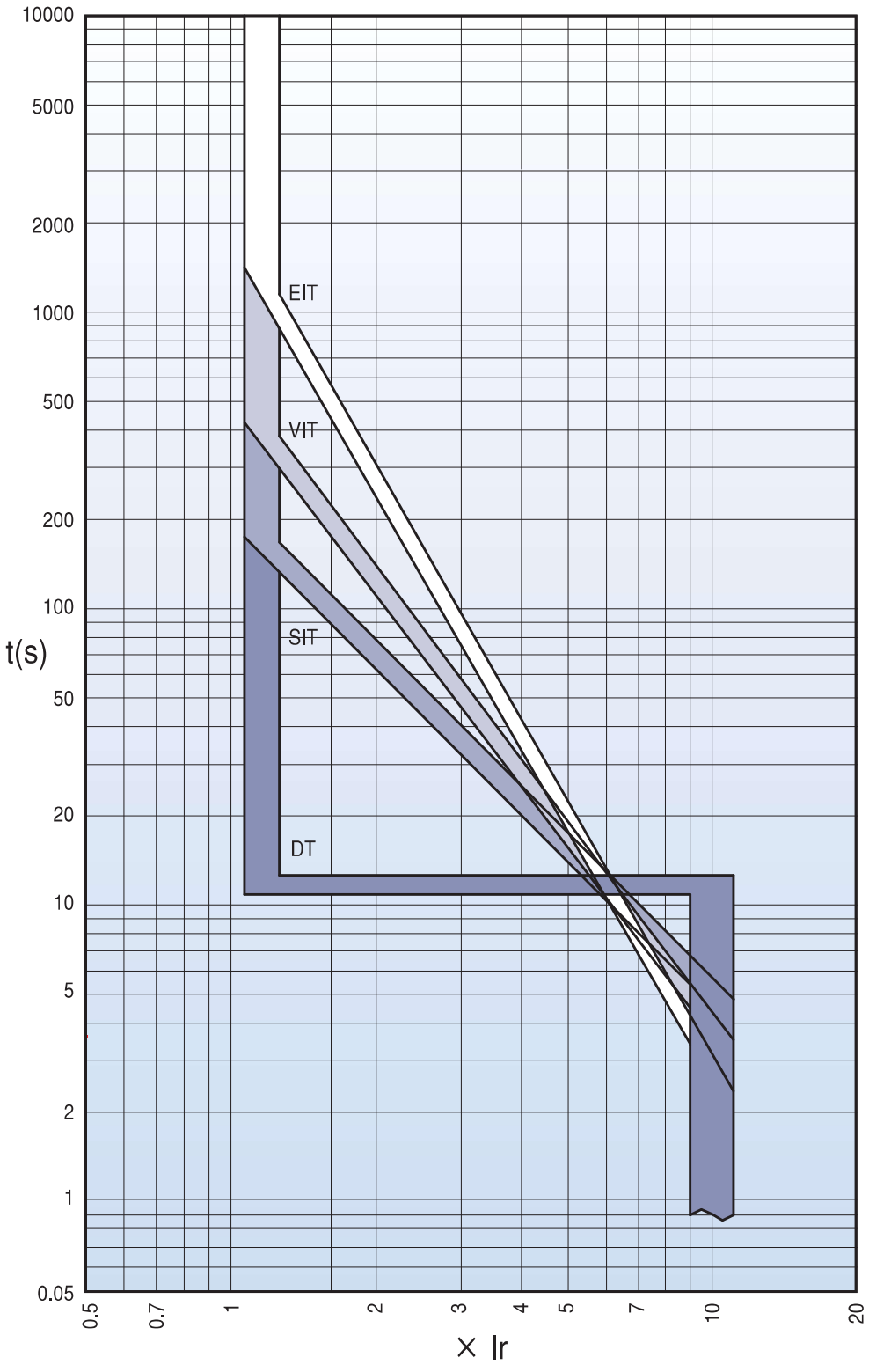
## Instantaneous (I)
## Ground fault (G)

TS1600



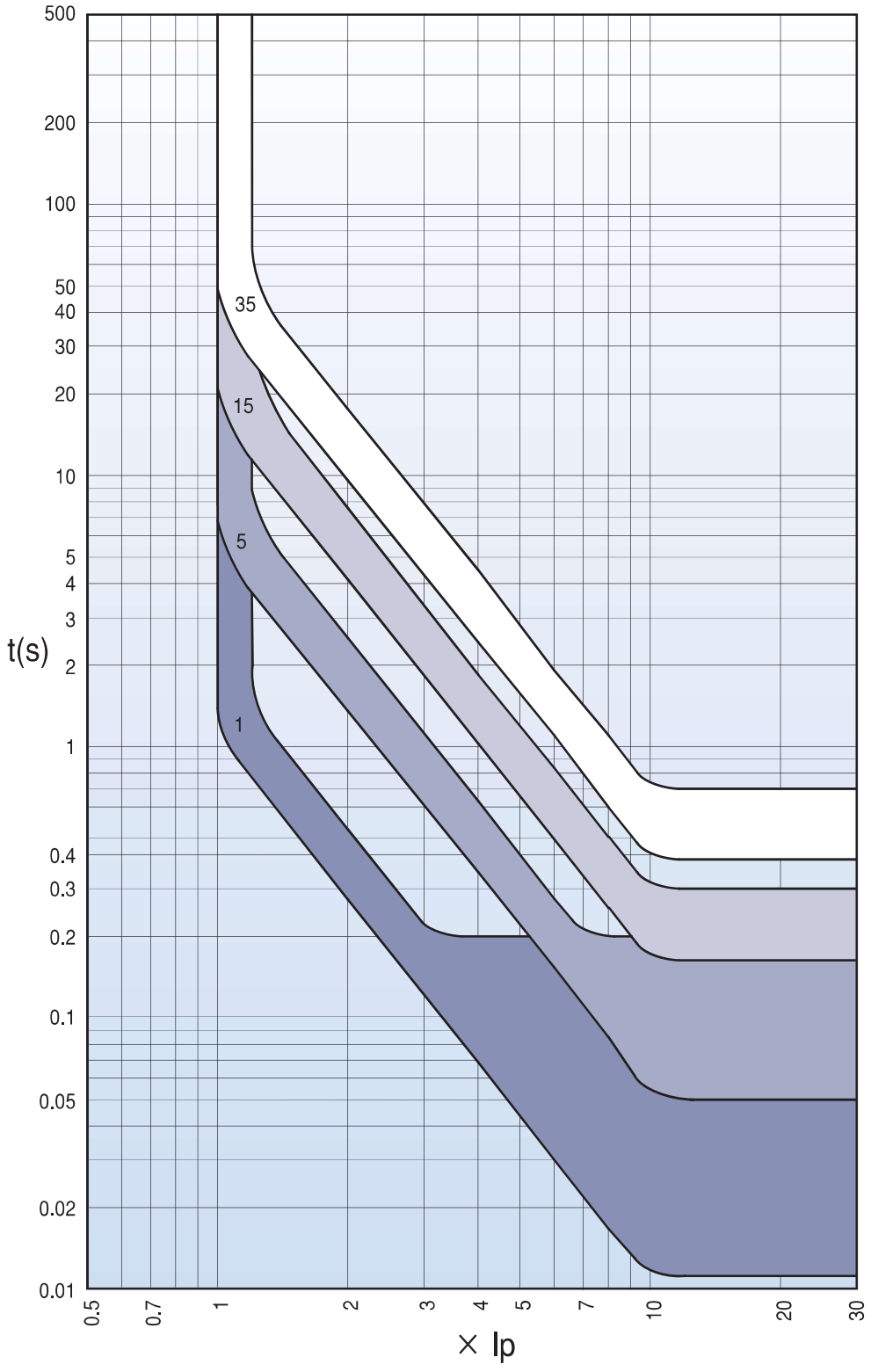
## IDMTL

### TS1600



## Pre Trip Alarm

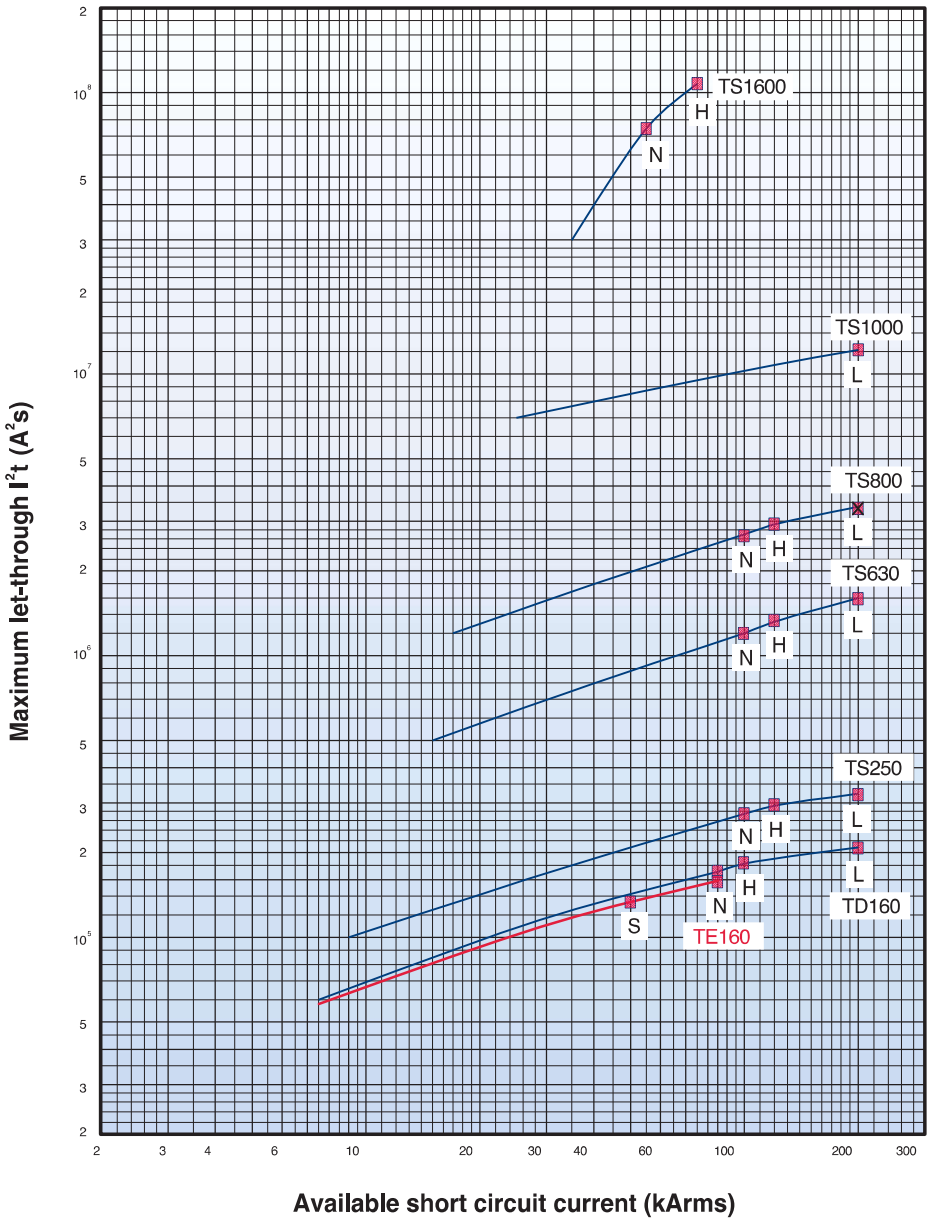
### TS1600



## Specific let-through energy curves

### 220/240V

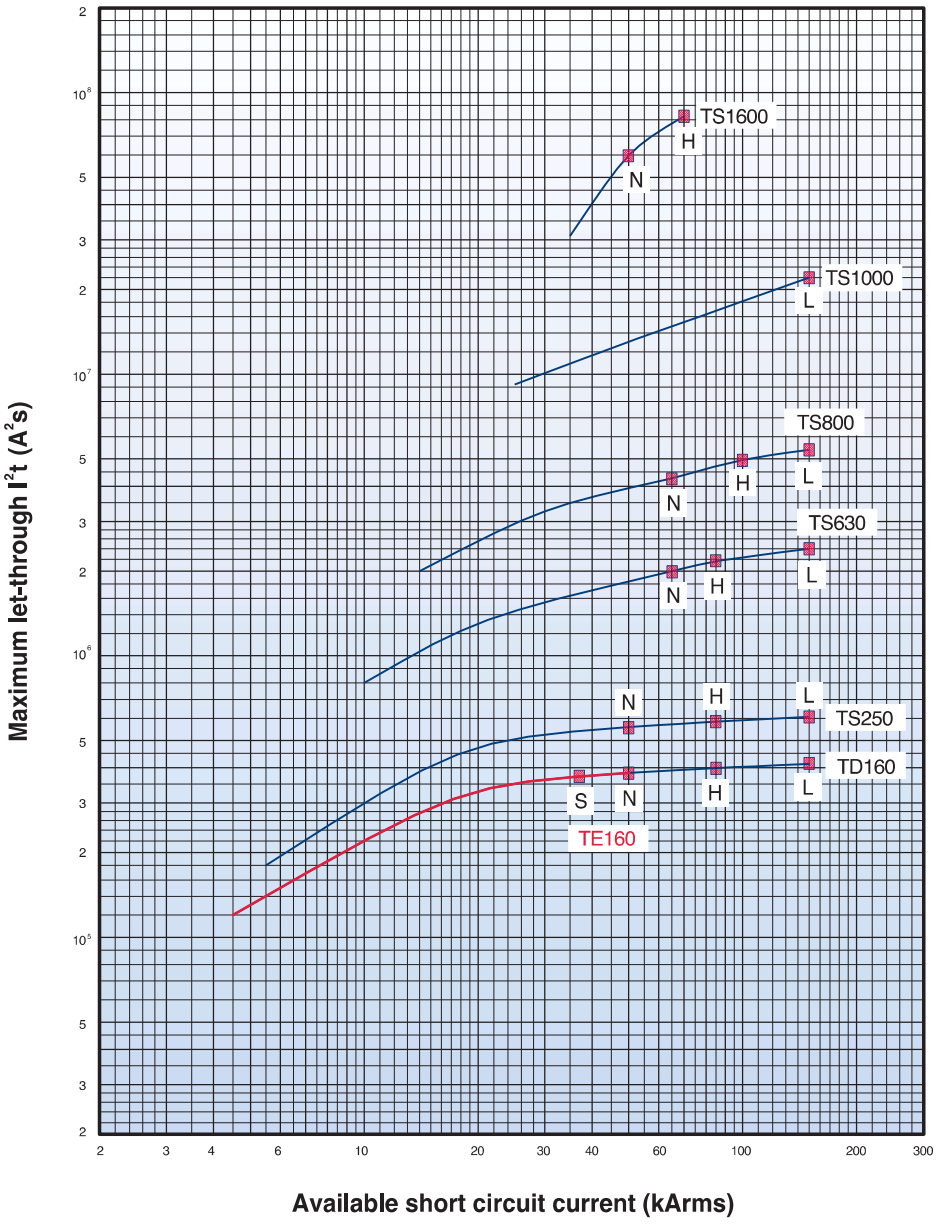
**Thermal stress**



## Specific let-through energy curves

### 380/415V

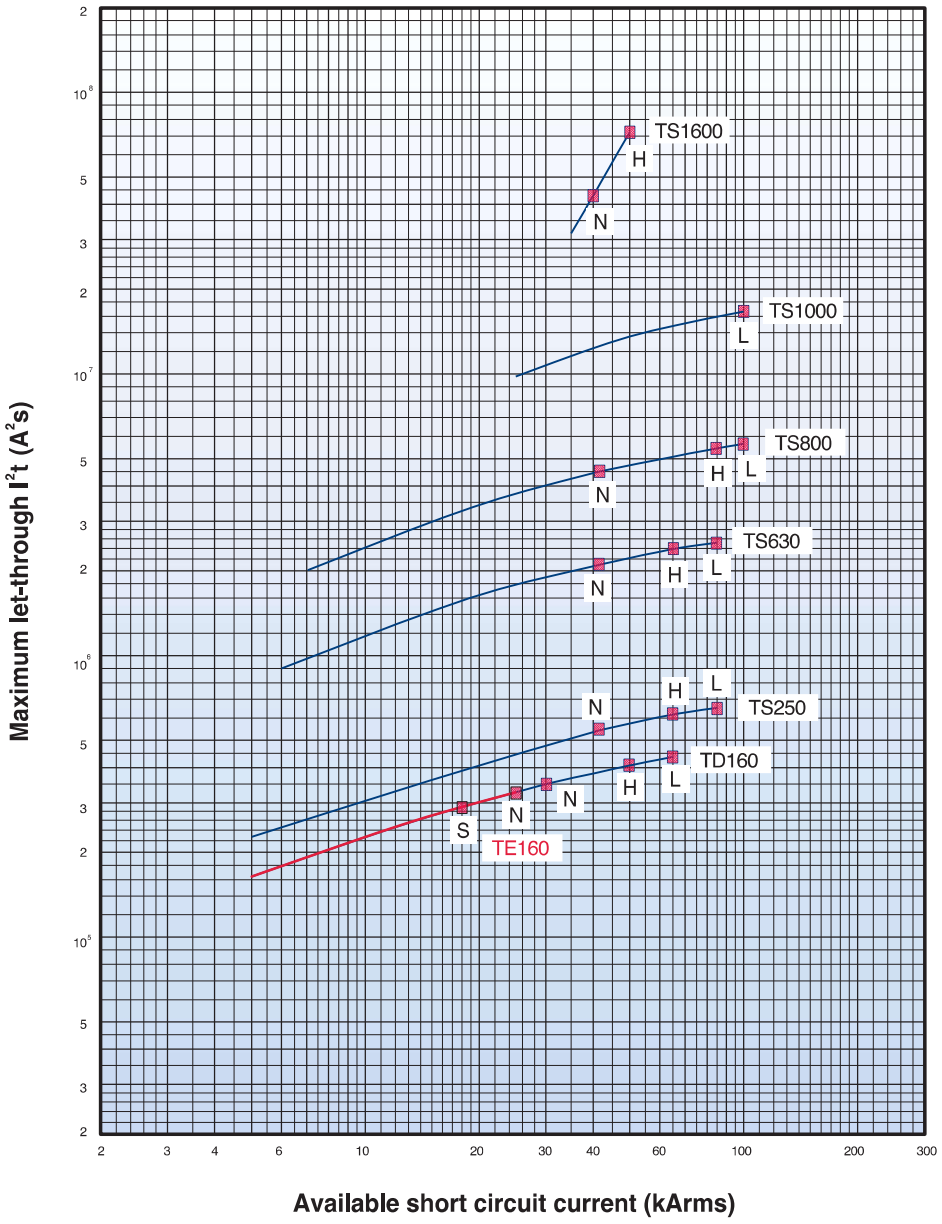
**Thermal stress**



## Specific let-through energy curves

### 480/500V

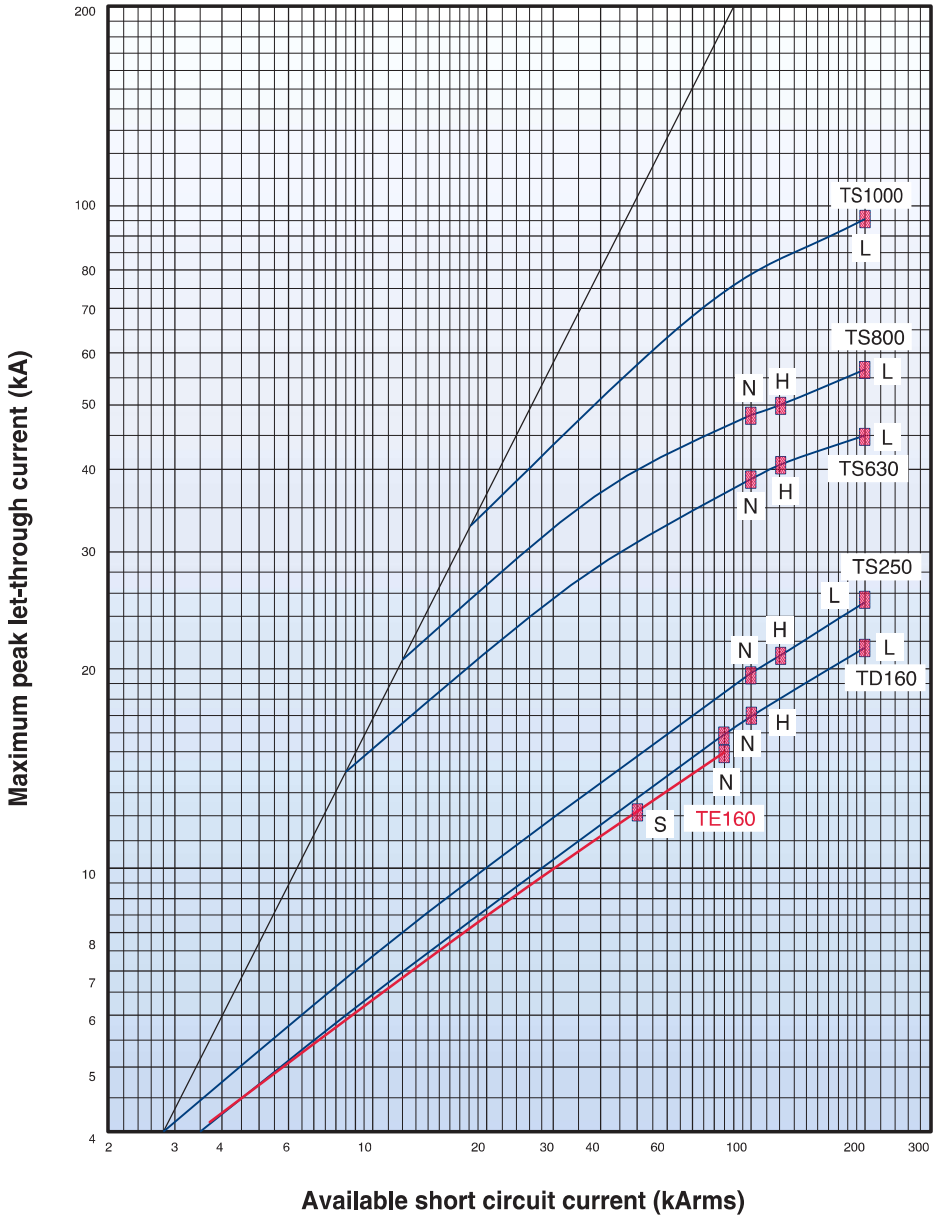
**Thermal stress**



## Current-limiting curves

### 220/240V

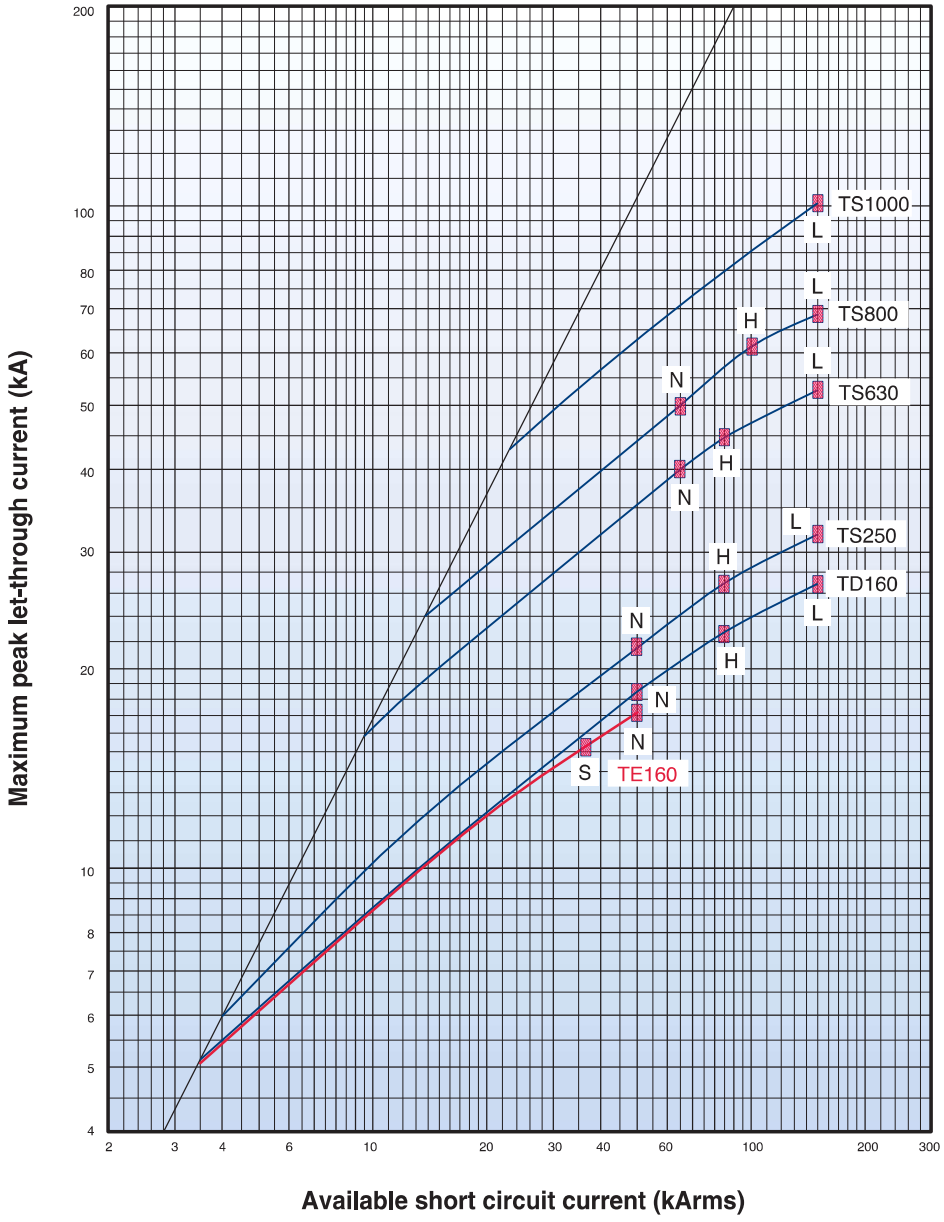
**Peak current**



## Current-limiting curves

### 380/415V

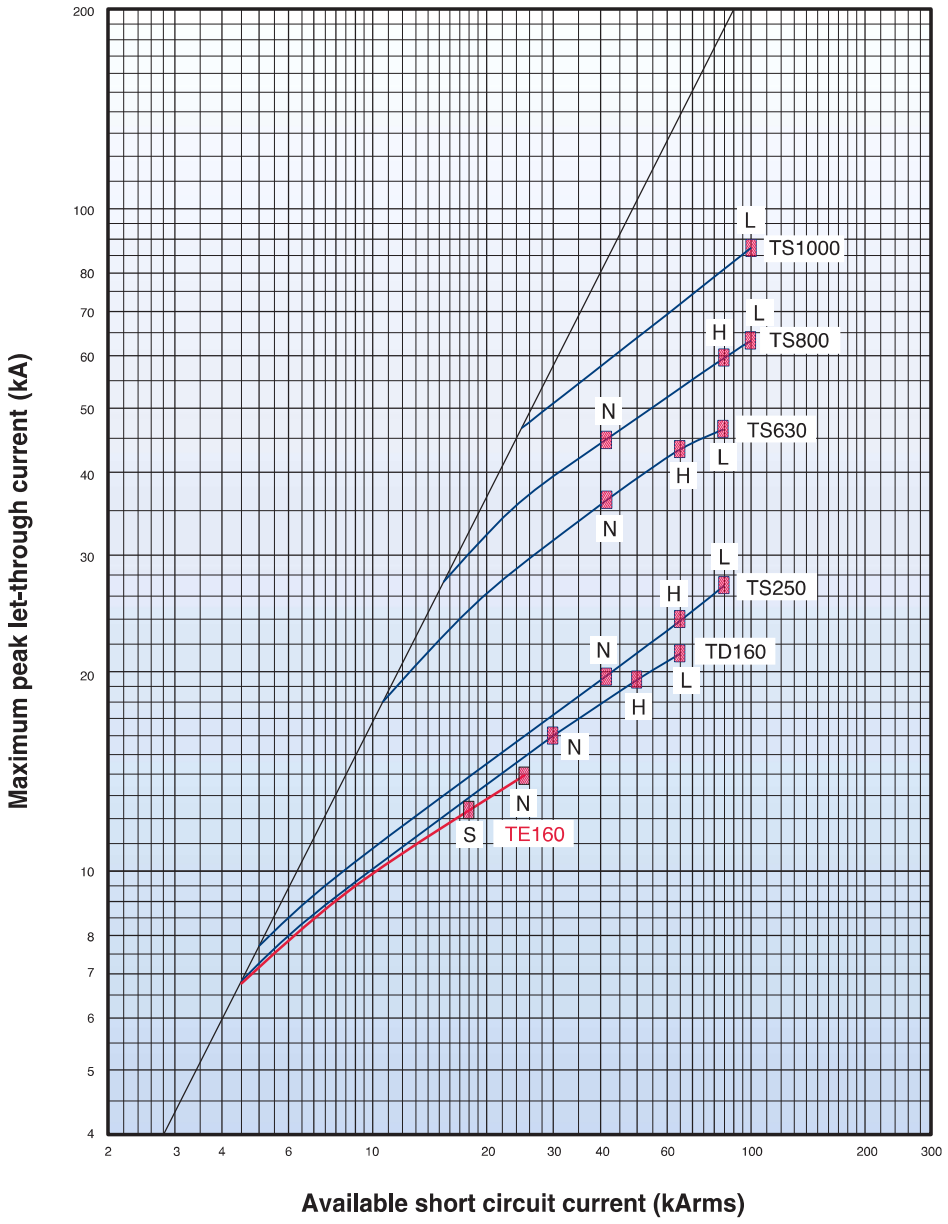
**Peak current**



## Current-limiting curves

### 480/500V

**Peak current**



# 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 800A

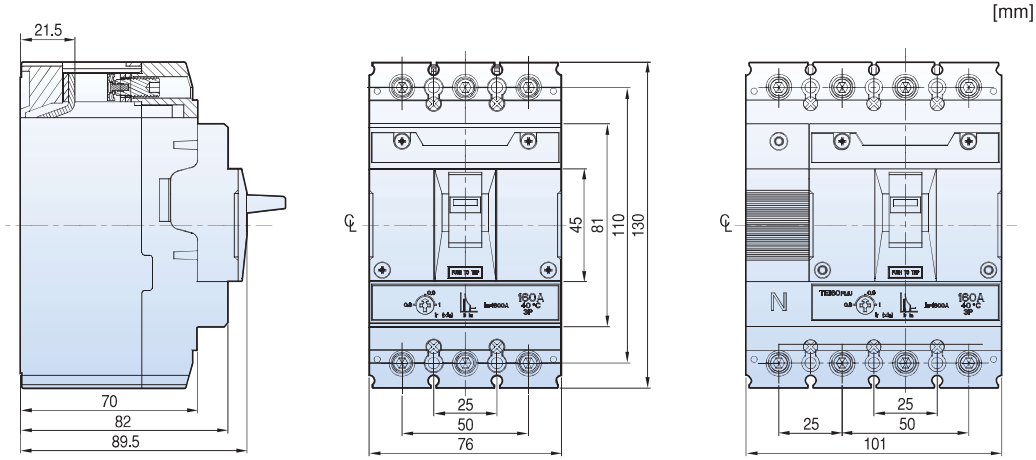
TD160, TS250 ..... A-6-47
TS630, TS800 ..... A-6-48
Short BUSBAR ..... A-6-49

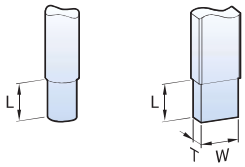
# Overall dimensions

Susol

## TE100/160

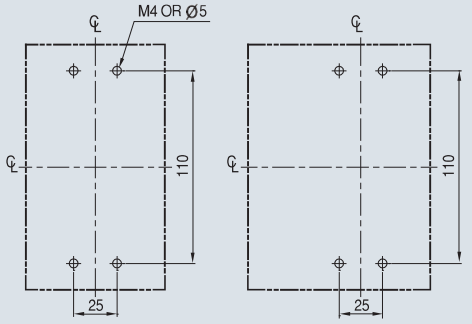
[mm]



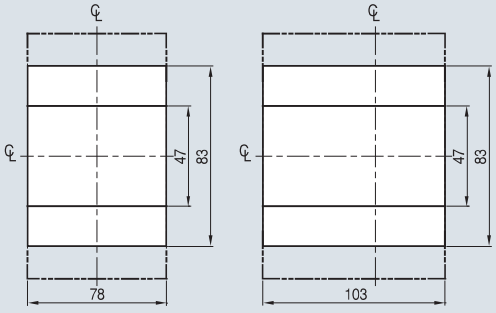




| | | |
|---|---|---|
| Wire size | Min | 2.5mm² |
| | Max. | 70mm² |
| L(mm) | | 17.5 |
| W(mm) | | ≤13.5 |
| T(mm) | | ≤6 |
| Torque | | ≤80kgf·cm |

### Panel drilling




### Front panel cutting

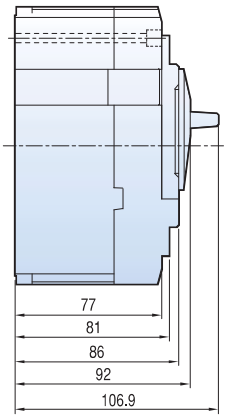


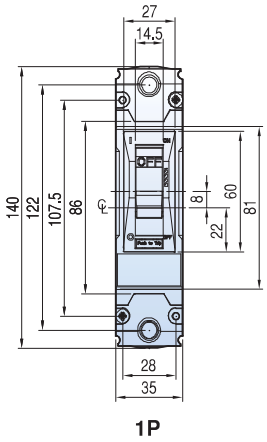
# Overall dimensions

Susol

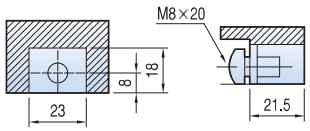
## TD160

[mm]

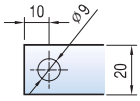


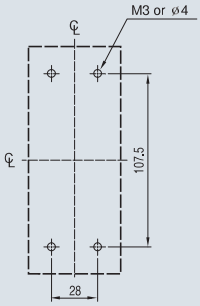

**Terminal section**



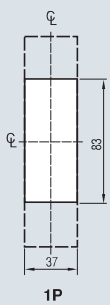

**Conductor**

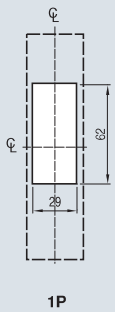



**Panel drilling**



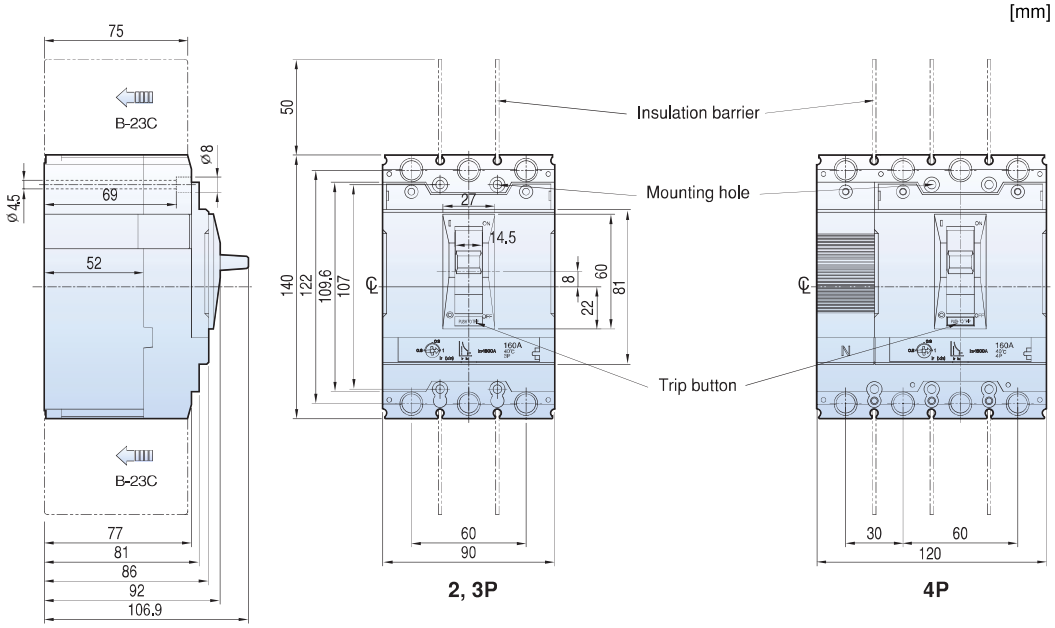

**Front panel cutting**



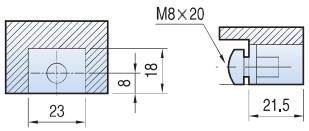



## TD100/160

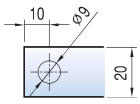
[mm]



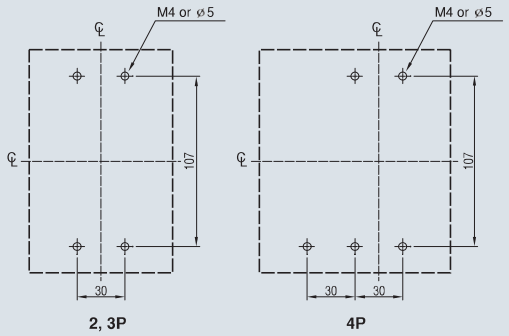

### Terminal section



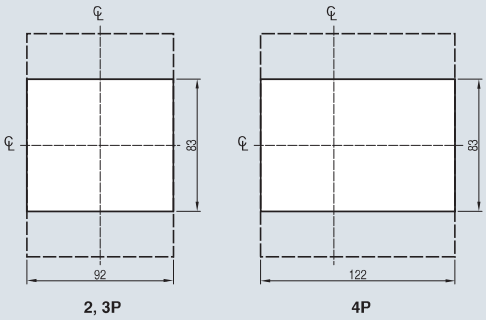

### Conductor




### Panel drilling




### Front panel cutting

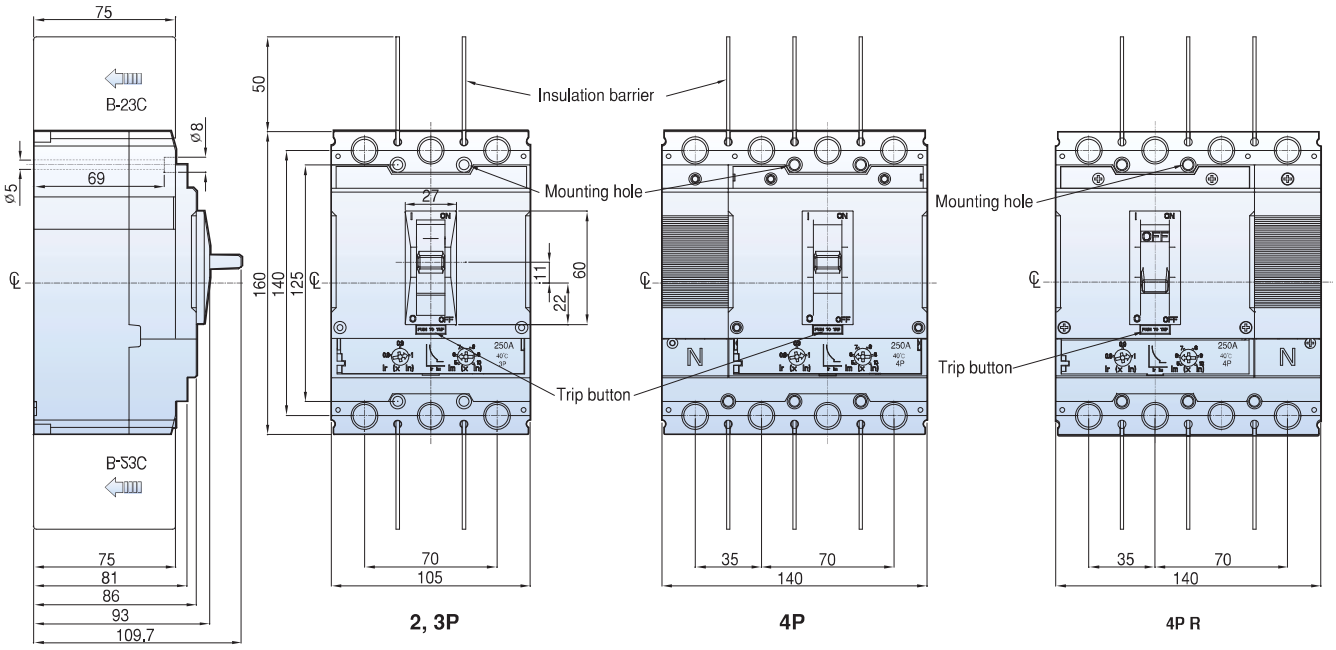


# Overall dimensions

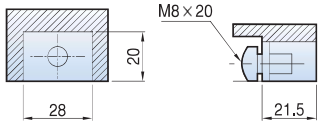
Susol

## TS100/160/250

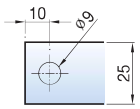
[mm]



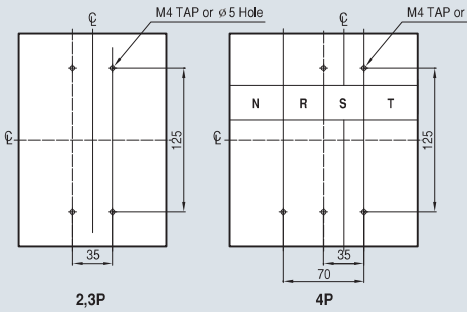

### Terminal section



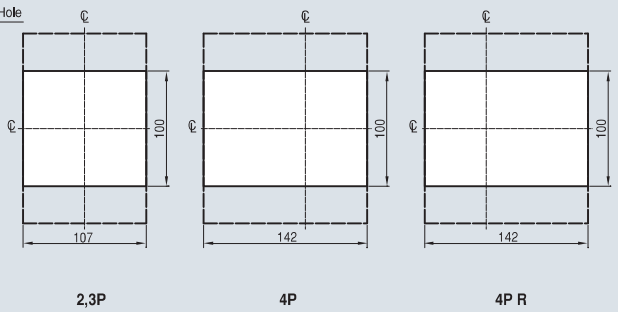

### Conductor




### Panel drilling




### Front panel cutting

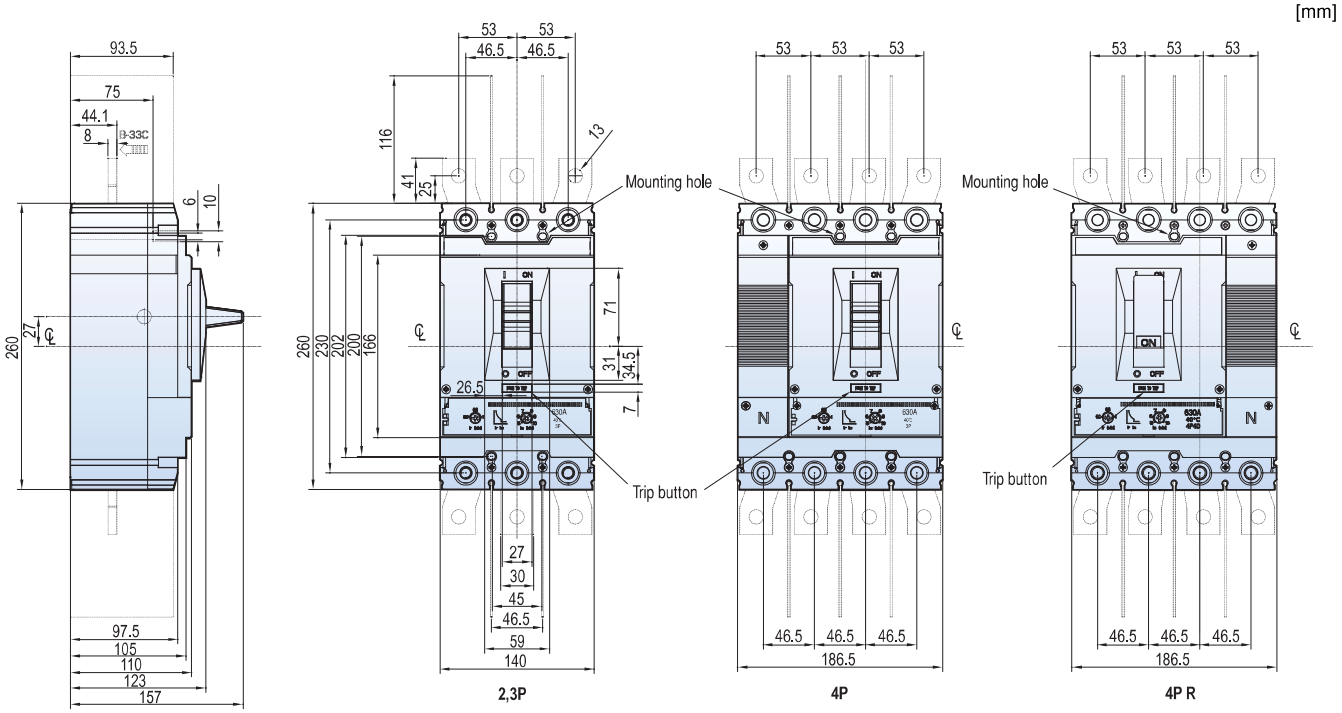


# Overall dimensions

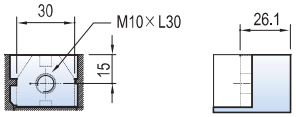
Susol

## TS400/630

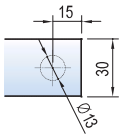
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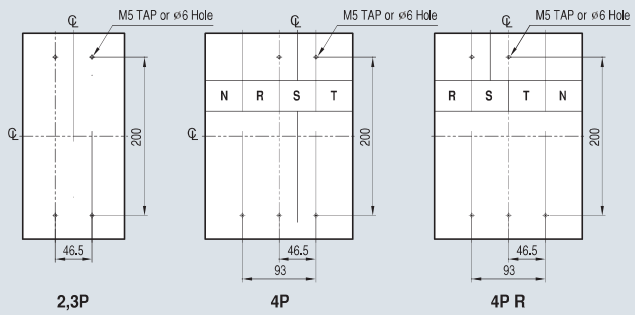

### Terminal section



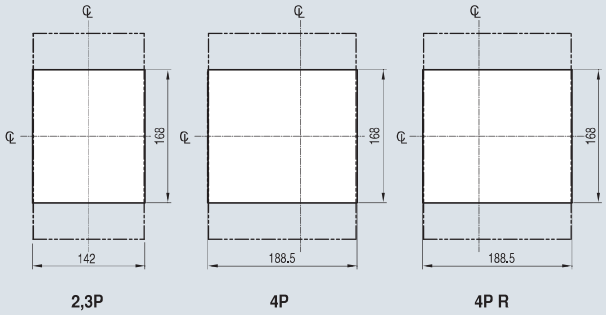

### Conductor




### Panel drilling




### Front panel cutting

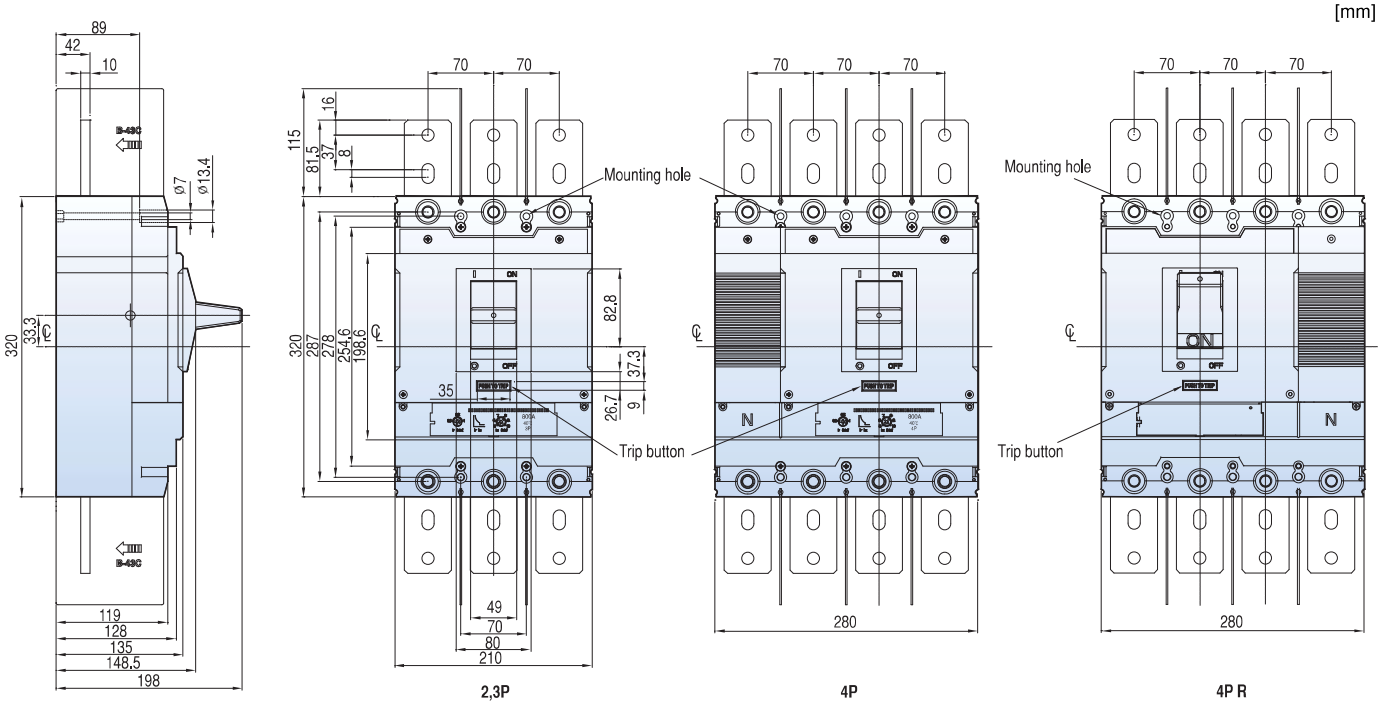


# Overall dimensions

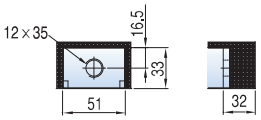
Susol

## TS800

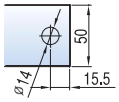
[mm]



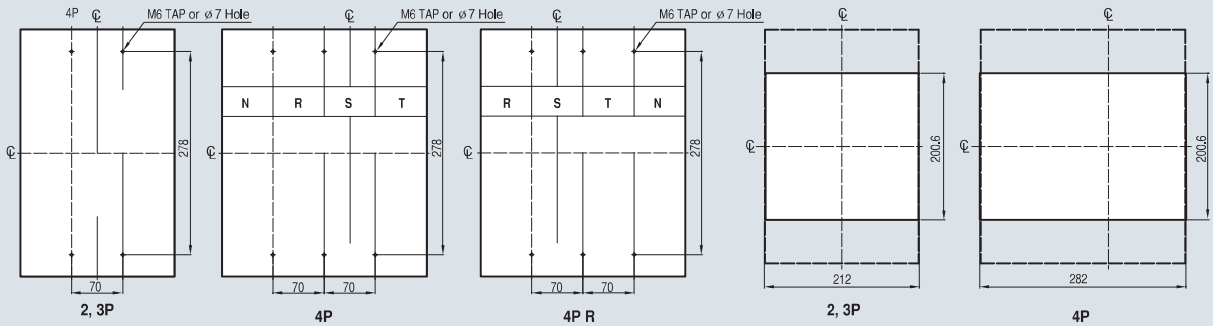

### Terminal section




### Conductor




### Panel drilling

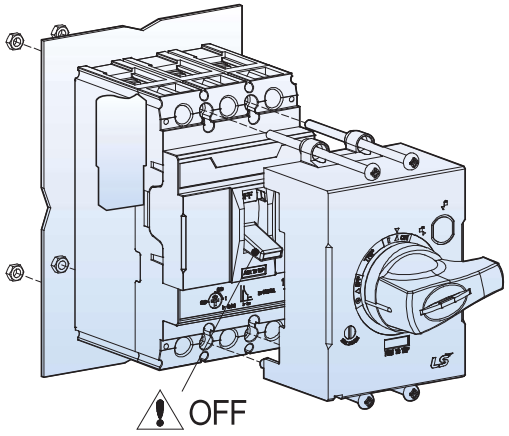


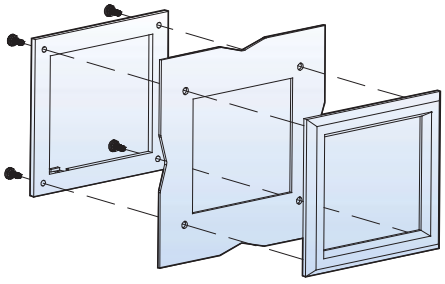

### Front panel cutting

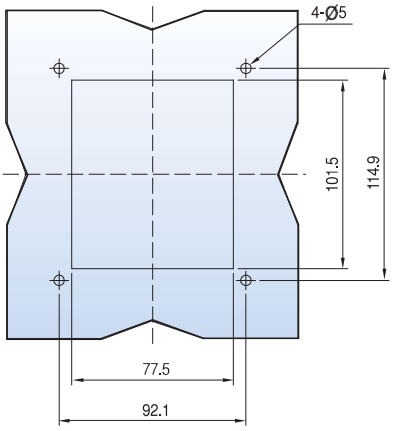
## Direct rotary handles

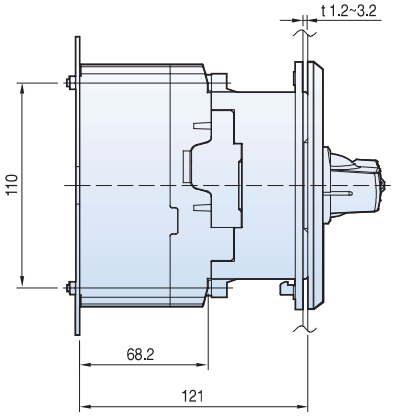
### DH1E for TE100/160

[mm]



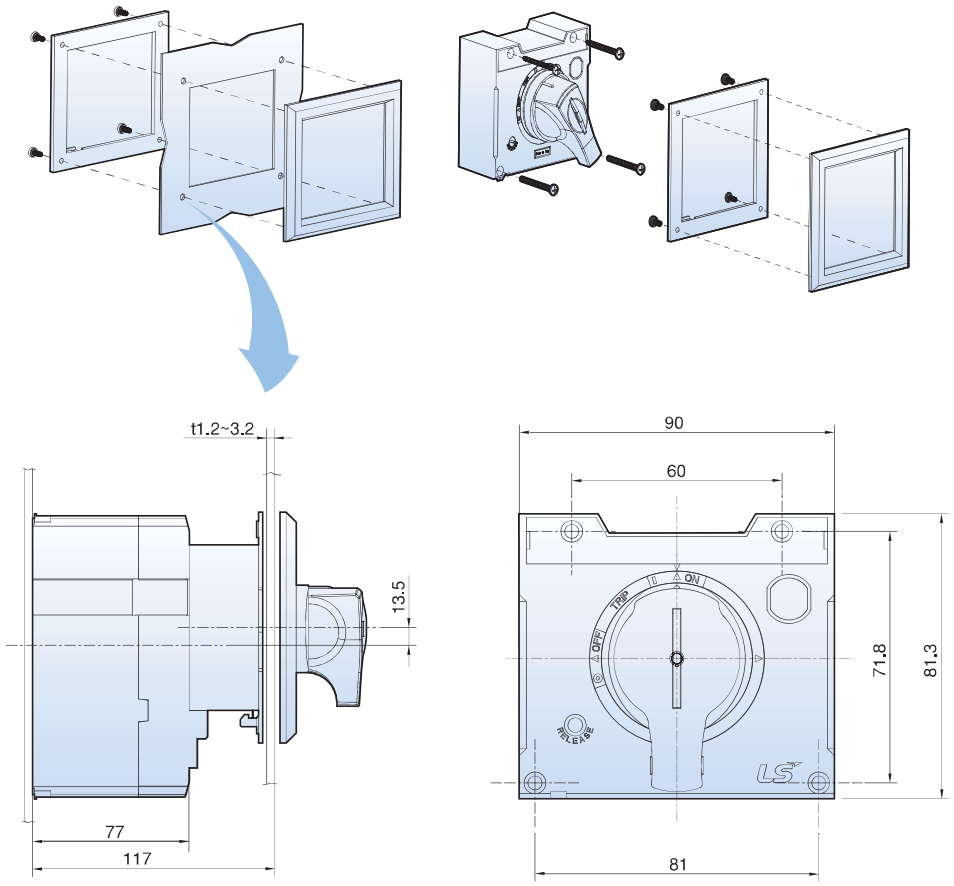


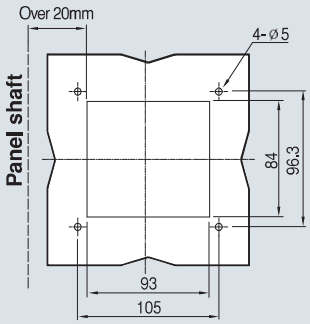
## Direct rotary handles

### DH1 & DHK1 for TD100/160

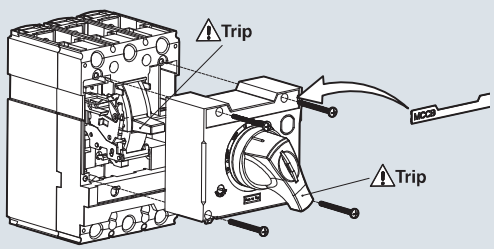
[mm]




**Panel drilling**



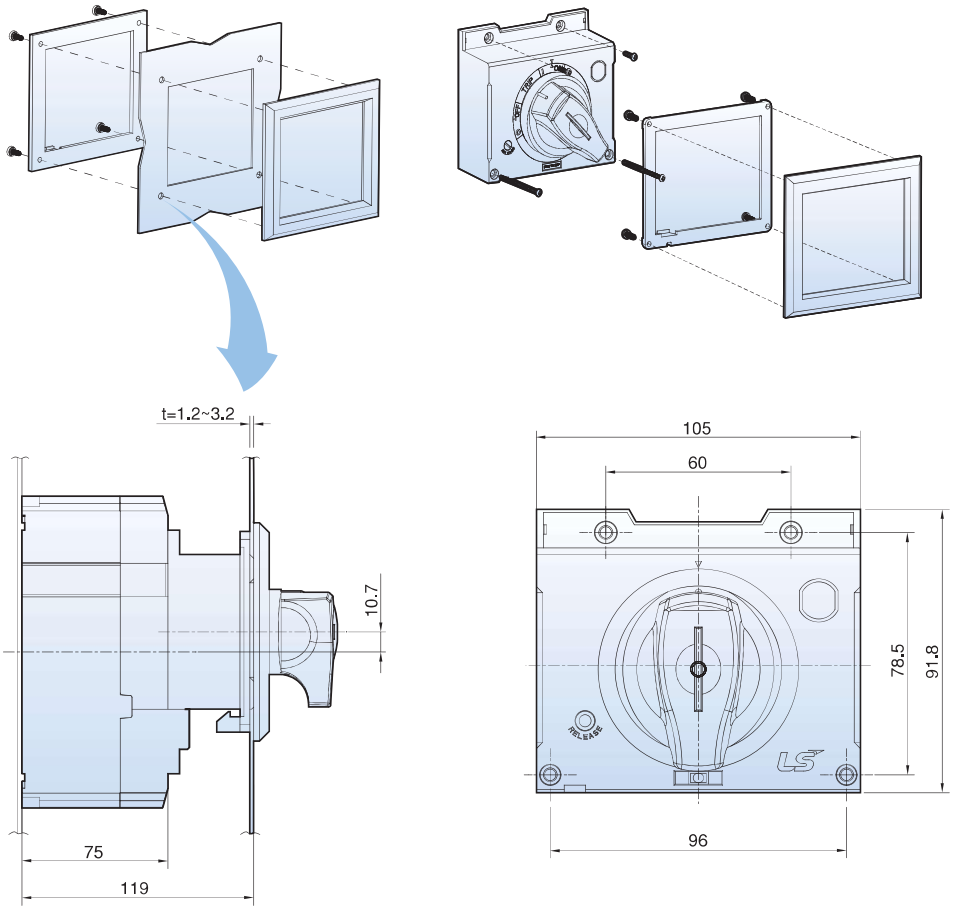

**Way of installation**



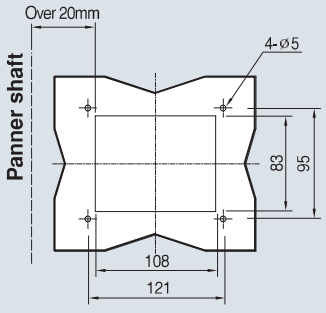
## Direct rotary handles

### DH2 & DHK2 for TS100/160/250

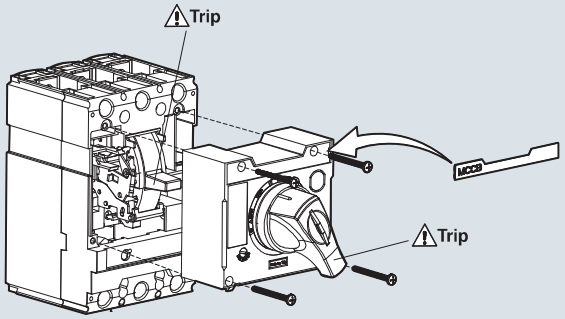
[mm]




**Panel drilling**



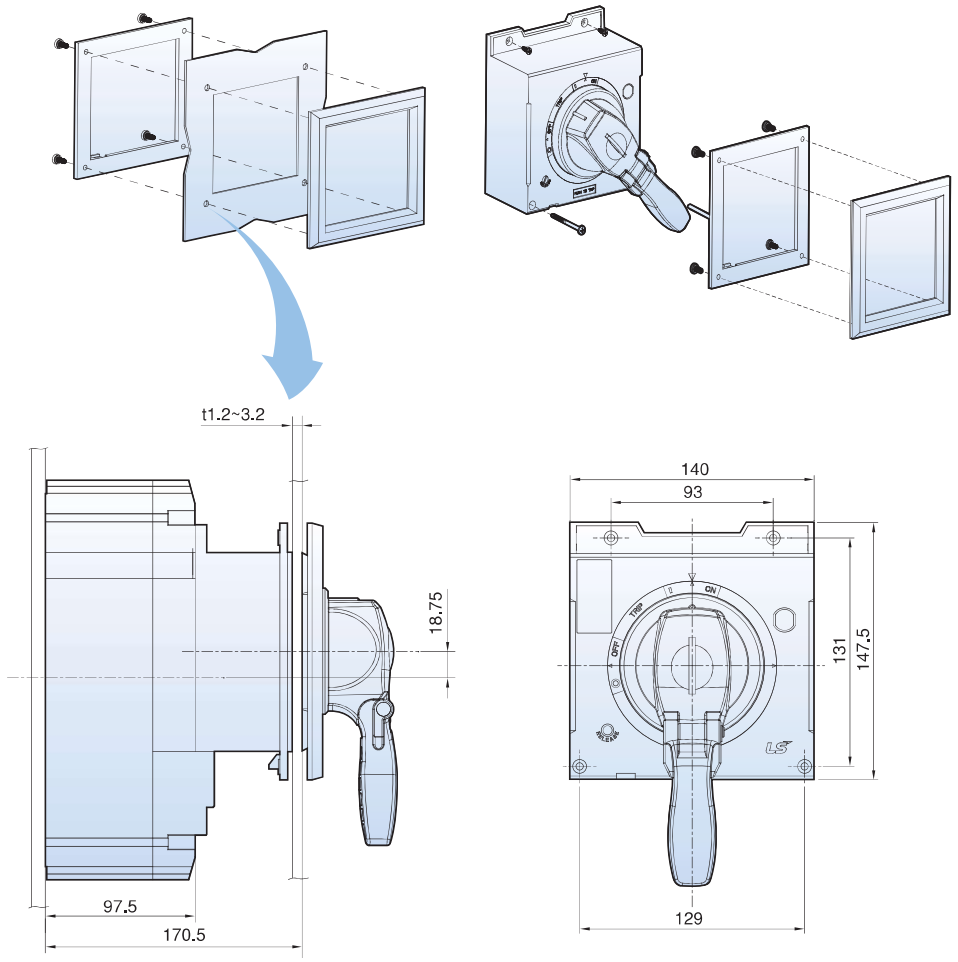

**Way of installation**



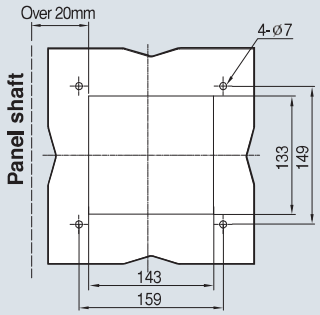
## Direct rotary handles

### DH3 & DHK3 for TS400/630

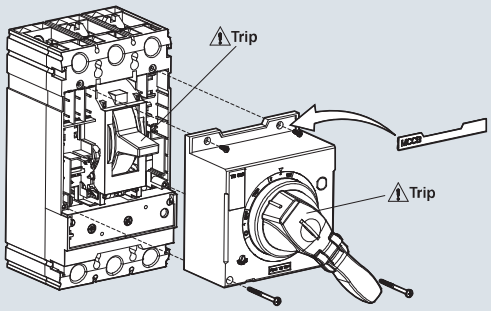
[mm]




**Panel drilling**



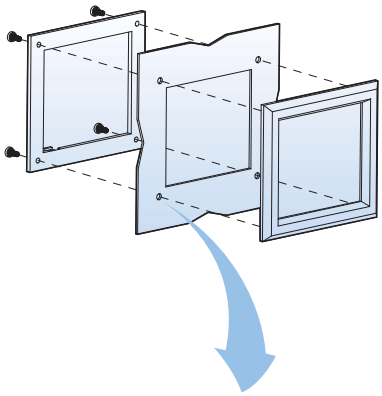

**Way of installation**

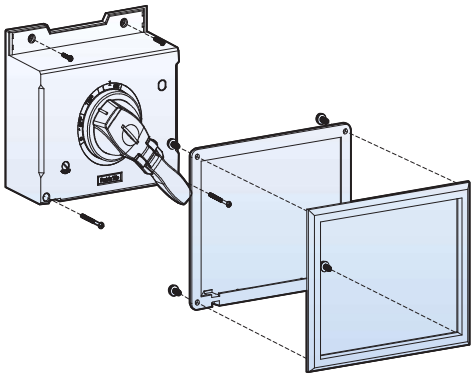


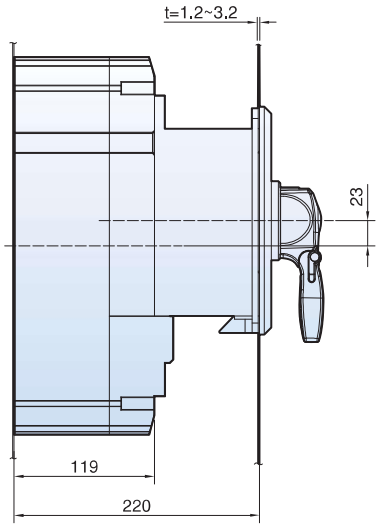
## Direct rotary handles

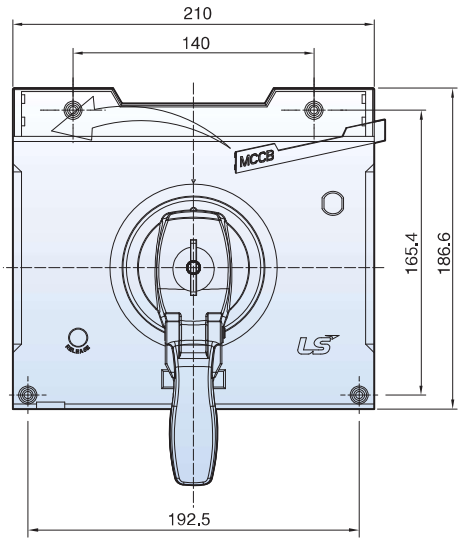
### DH4 & DHK4 for TS800

[mm]

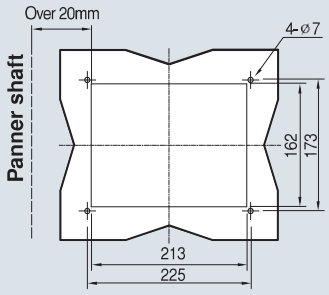




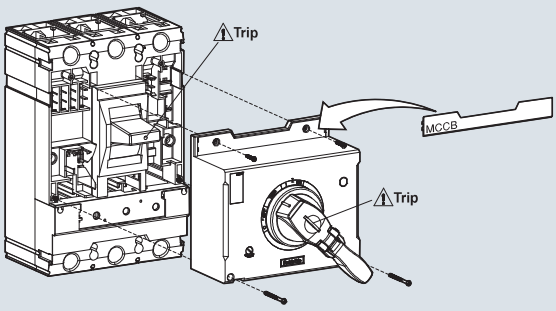



**Panel drilling**




**Way of installation**



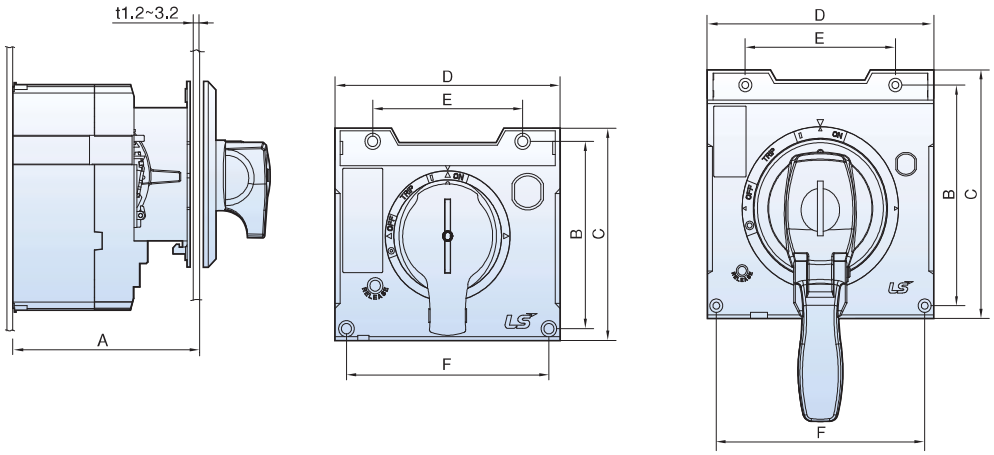
## Direct rotary handles

### Dimension table for D-handles

[mm]

TD100/TS250

TS630/TS800

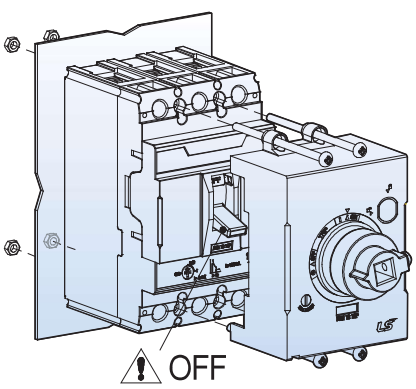


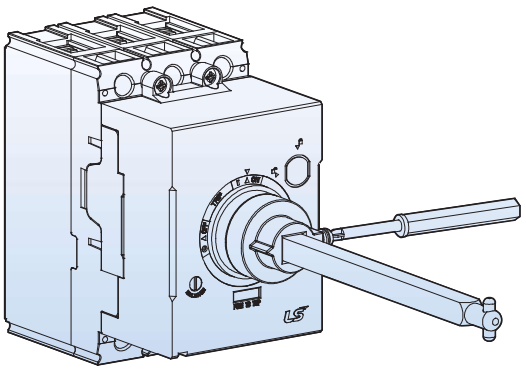

| Applicable to | TD160 | TS250 | TS630 | TS800 |
|---|---|---|---|---|
| A (mm) | 117 | 119 | 170.5 | 211 |
| B (mm) | 71.8 | 78.5 | 131 | 165.4 |
| C (mm) | 81.3 | 91.8 | 147.5 | 186.6 |
| D (mm) | 90 | 105 | 140 | 210 |
| E (mm) | 60 | 60 | 93 | 140 |
| F (mm) | 81 | 96 | 129 | 192.5 |

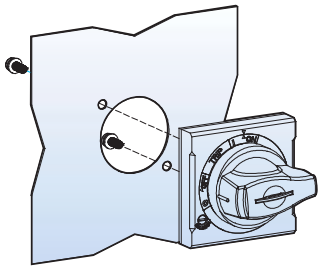
## Extended rotary handles

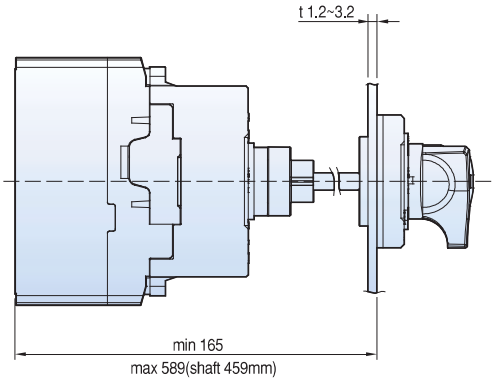
### EH1E for TE100/160

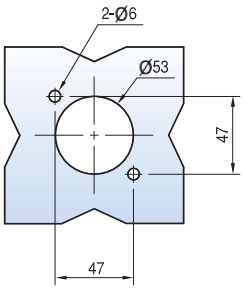
[mm]





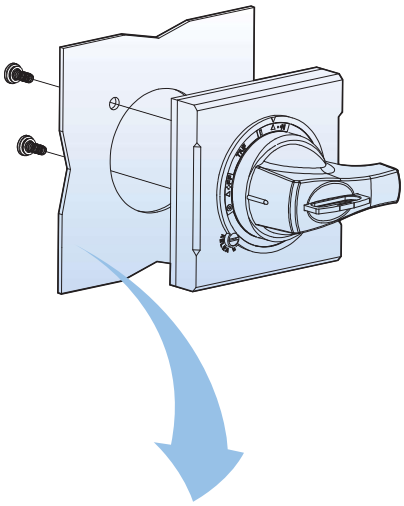


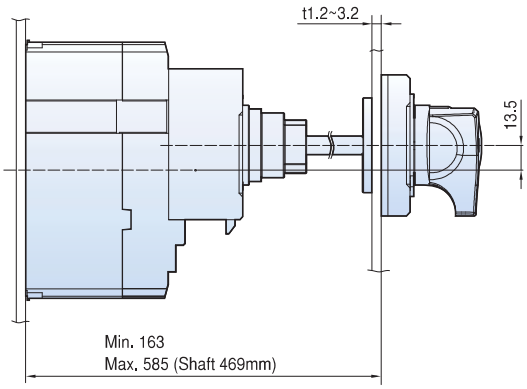



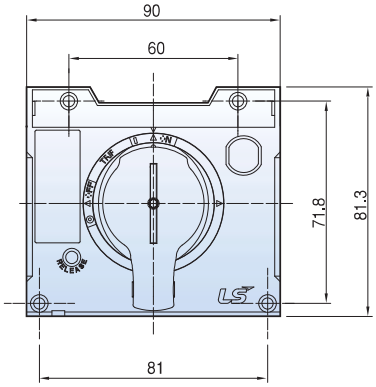
## Extended rotary handles

### EH1 for TD100/160

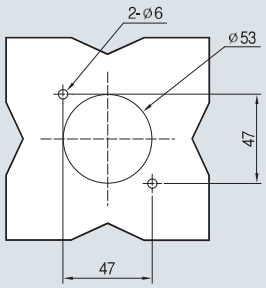
[mm]



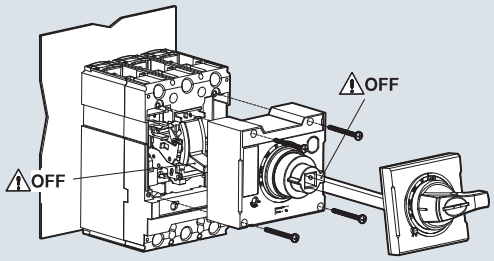



**Panel drilling**



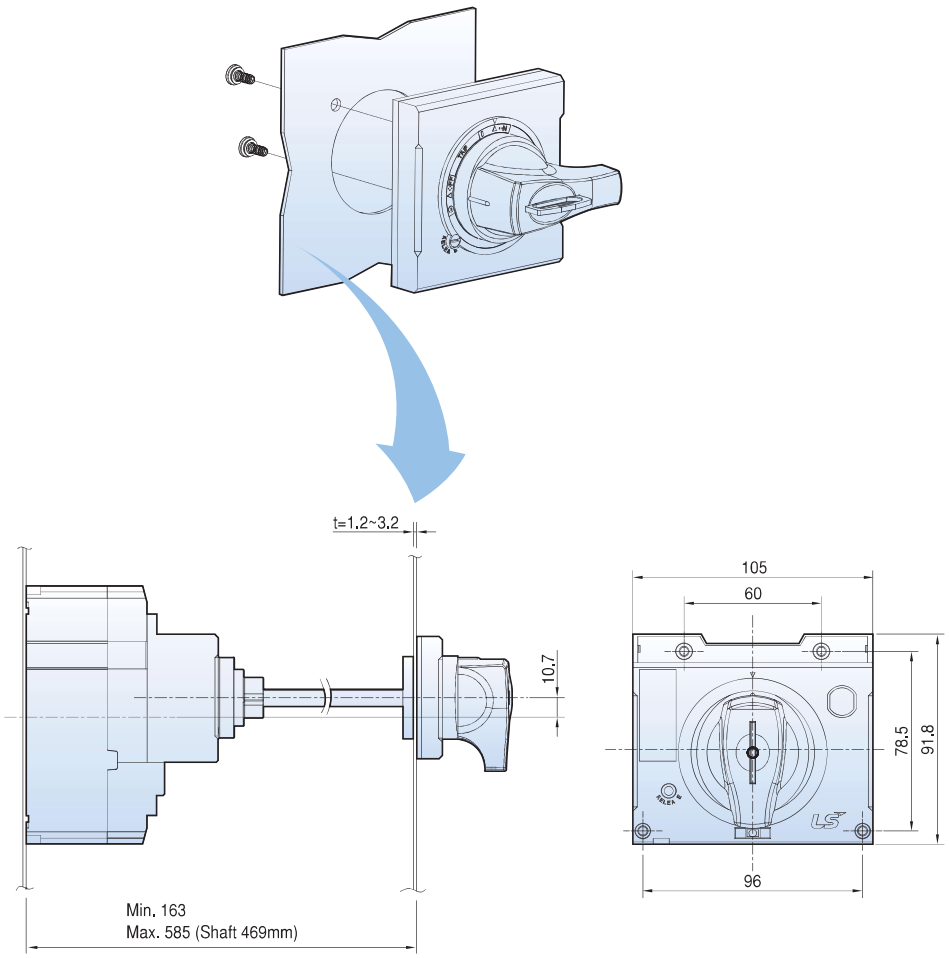

**Way of installation**



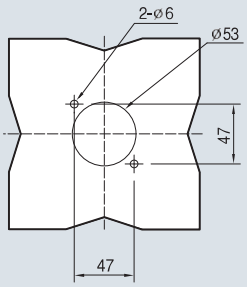
## Extended rotary handles

### EH2 for TS100/160/250

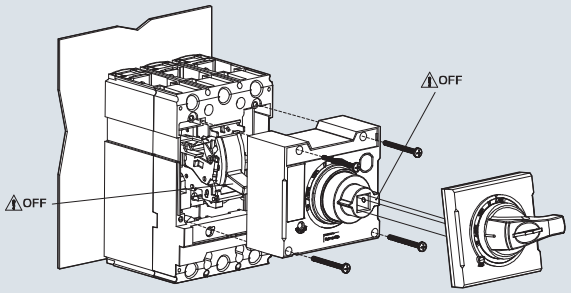
[mm]




**Panel drilling**



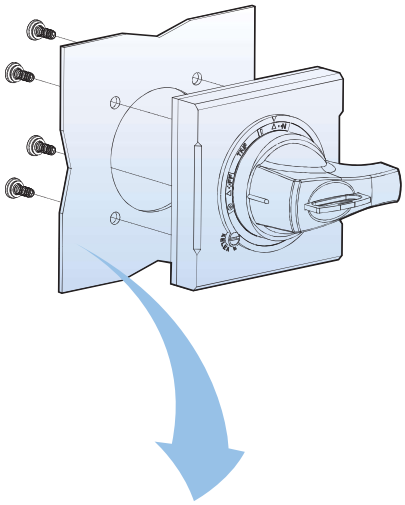

**Way of installation**

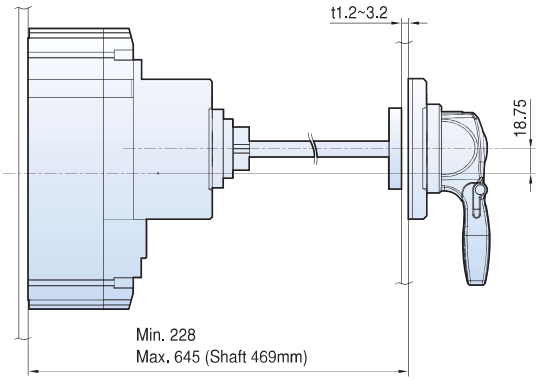


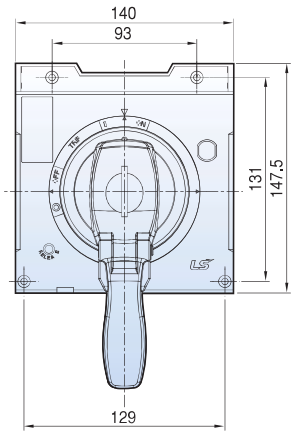
## Extended rotary handles

### EH3 for TS400/630

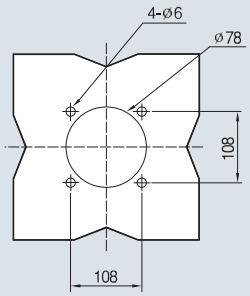
[mm]



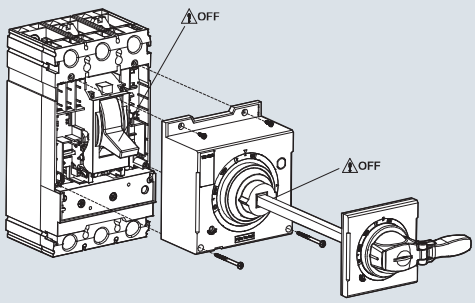



**Panel drilling**



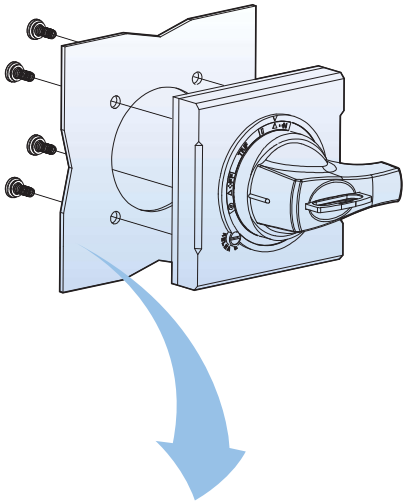

**Way of installation**

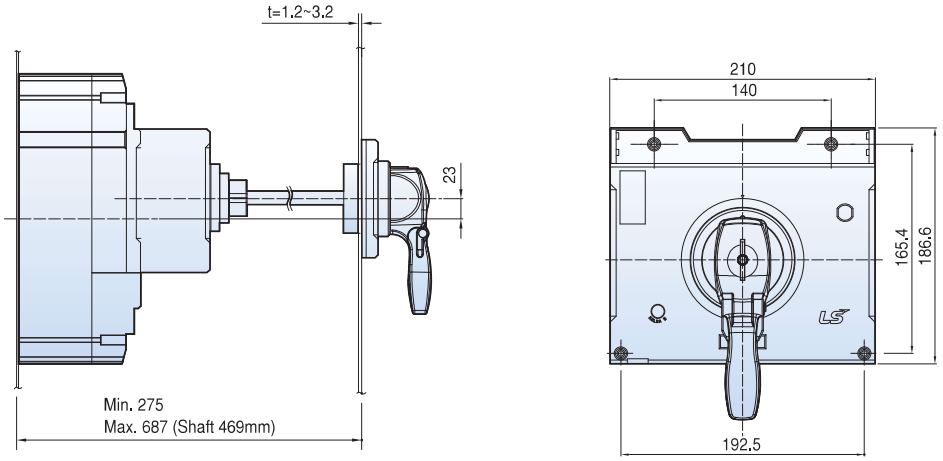


## Extended rotary handles

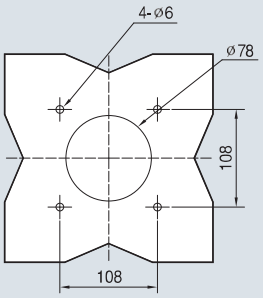
### EH4 for TS800

[mm]

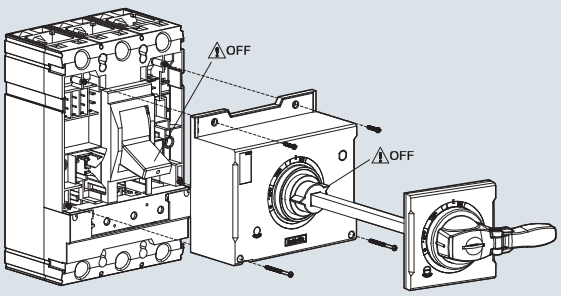





**Panel drilling**



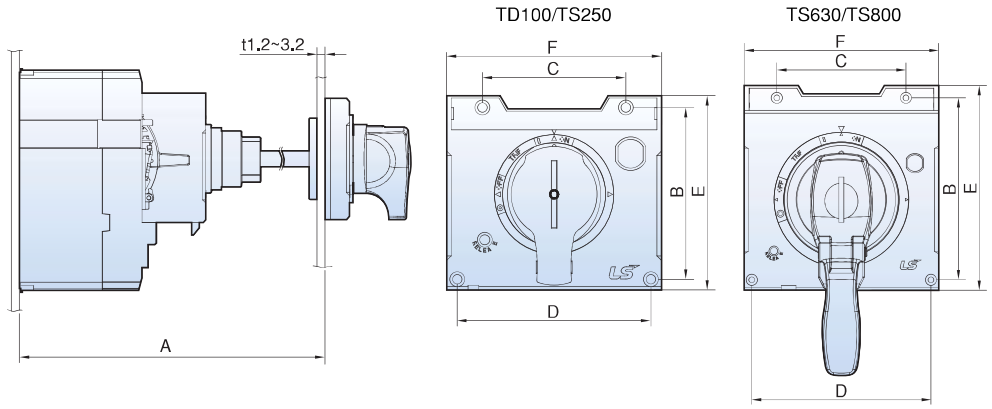

**Way of installation**



## Extended rotary handles

### Dimension table for E-handles

[mm]

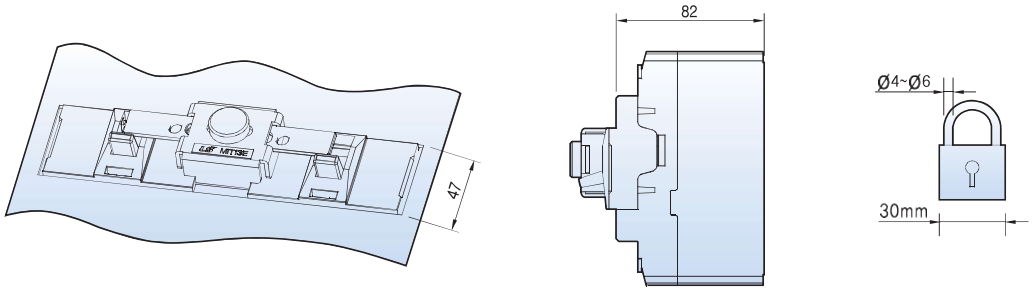


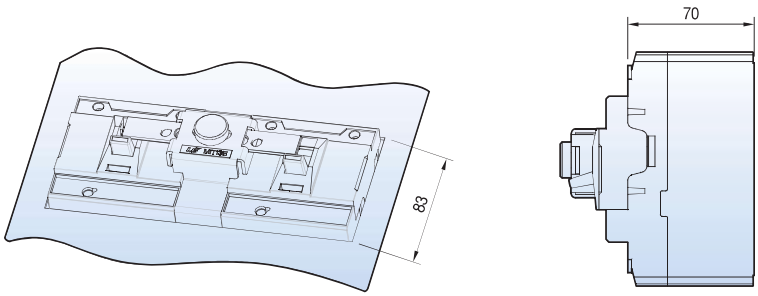

| Model | EH1 | EH2 | EH3 | EH4 |
|---|---|---|---|---|
| Applicable to | TD160 | TS250 | TS630 | TS800 |
| A (mm) | Min. 163 | Min. 163 | Min. 228 | Min. 275 |
| | Max. 585 | Max. 585 | Max. 645 | Max. 687 |
| B (mm) | 71.8 | 78.5 | 131 | 165.4 |
| C (mm) | 60 | 60 | 93 | 140 |
| D (mm) | 81 | 96 | 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 |

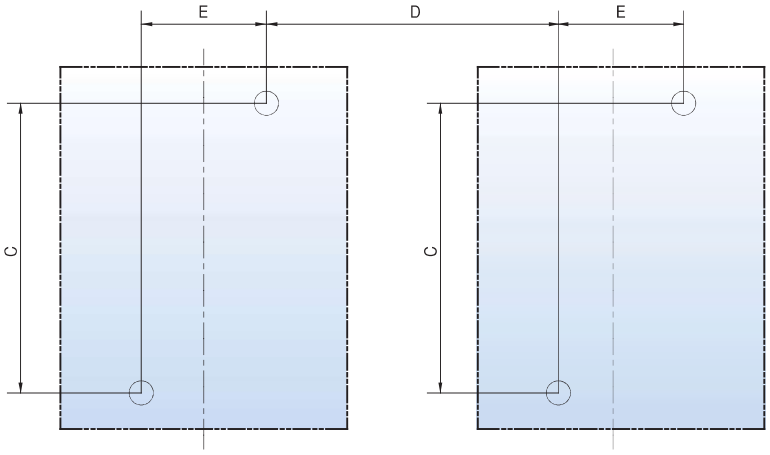
## Mechanical interlocking device

### MIT13E, MIT14E for TE100/160

[mm]



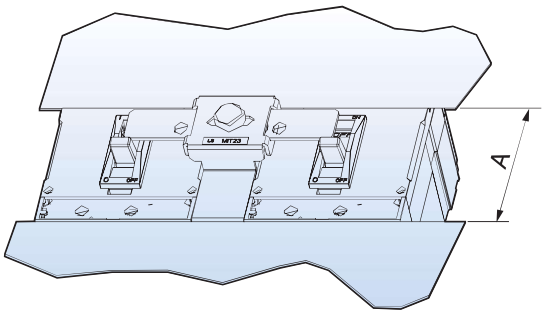

| 3Pole MCCBs | C(mm) | D(mm) | E(mm) |
|---|---|---|---|
| TE160 | 110 | 79 | 25 |

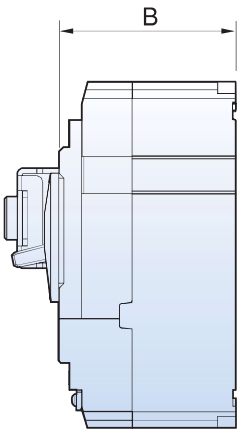
| 4Pole MCCBs | C(mm) | D(mm) | E(mm) |
|---|---|---|---|
| TE160 | 110 | 79 | 50 |

## Mechanical interlocking device

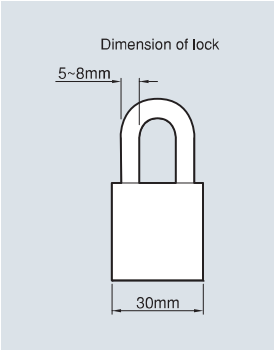
### MIT13, MIT23, MIT33, MIT43

[mm]



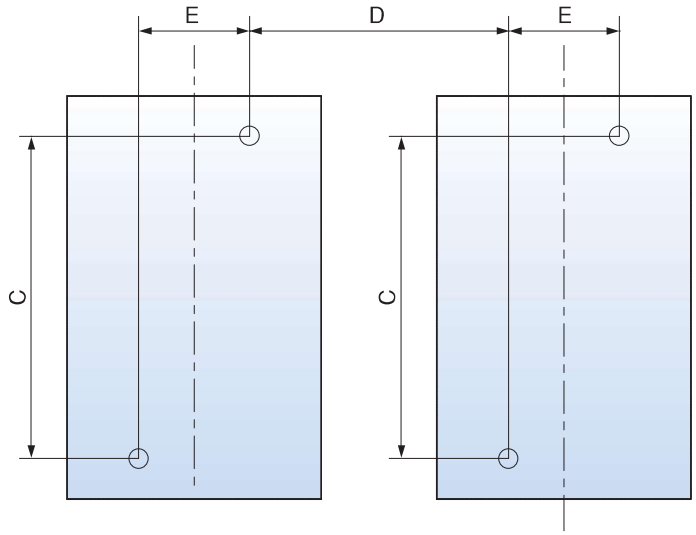

| | A (mm) | B (mm) |
|---|---|---|
| TD160 | 83 | 86 |
| TS250 | 102 | 86 |
| TS630 | 168 | 110 |
| TS800 | 201 | 135 |



## Mechanical interlocking device

### Mounting dimension for MIT

[mm]



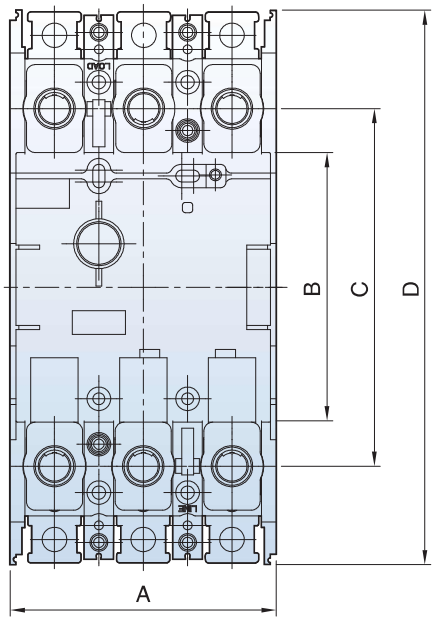

| 2, 3Pole MCCBs | C(mm) | D(mm) | E(mm) |
|---|---|---|---|
| TD100/160 | 107 | 90 | 30 |
| TS100/160/250 | 125 | 105 | 35 |
| TS400/630 | 200 | 139.5 | 46.5 |
| TS800 | 278 | 210 | 70 |

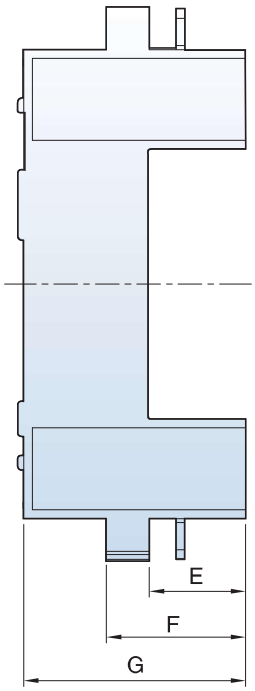
| 4Pole MCCBs | C(mm) | D(mm) | E(mm) |
|---|---|---|---|
| TD100/160 | 107 | 90 | 60 |
| TS100/160/250 | 125 | 105 | 70 |
| TS400/630 | 200 | 139.5 | 93 |
| TS800 | 278 | 210 | 140 |

## Plug-in device

### Plug-in devices for TD100/160

[mm]




TD100/160

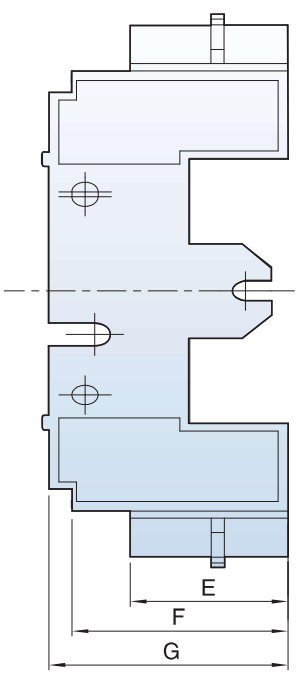
| | TD100/160 |
|---|---|
| A(mm) | 90 (120*) |
| B(mm) | 92 |
| C(mm) | 122 |
| D(mm) | 189.2 (185.6*) |
| E(mm) | 32.5 |
| F(mm) | 47 |
| G(mm) | 75 |

* 4P Plug-in (TD100/160 only)

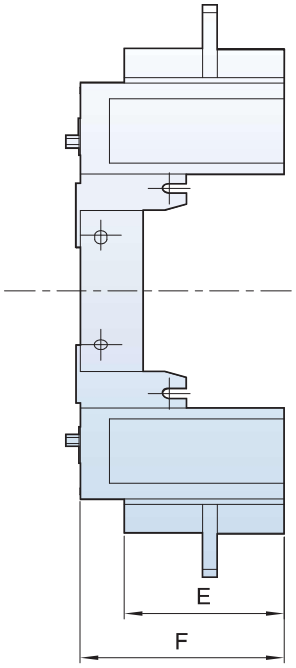
## Plug-in device

### Plug-in devices for TS100/160/250/400/630/800

[mm]




TS100/160/250/400/630



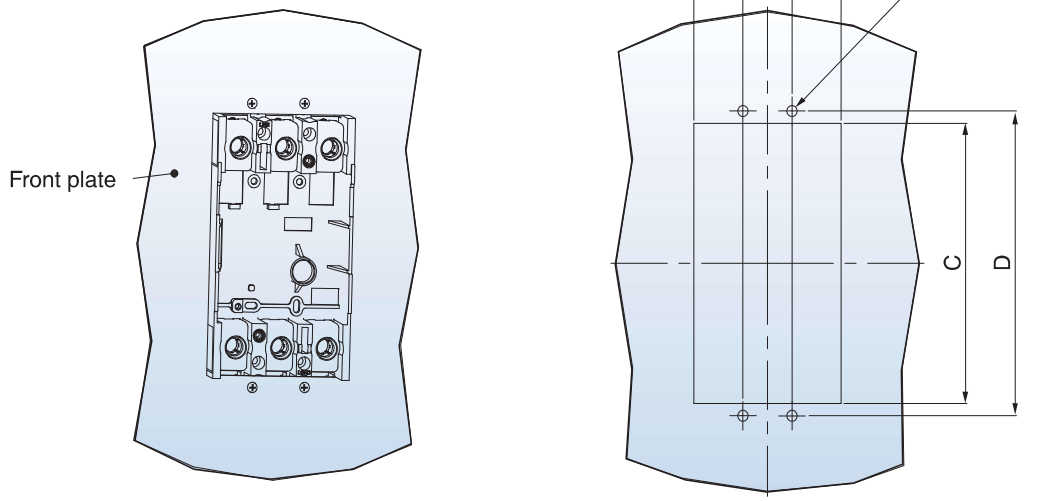

TS800

| | 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 | - |

## Plug-in device

### Mounting to front plate

[mm]



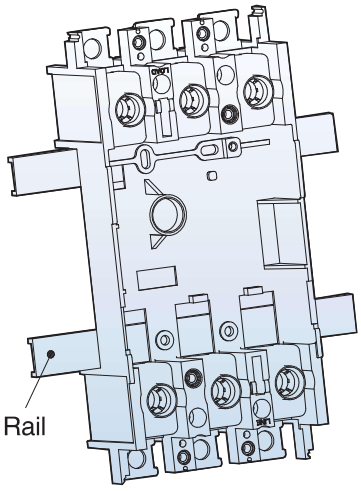

| Applicable to | TD100/160 | TS100/160/250 | TS400/630 | TS800 |
|---|---|---|---|---|
| A (mm) | 30 (60*) | 35 | 46.5 | 70 |
| B (mm) | 90 (120*) | 105 | 140 | 210 |
| C (mm) | 160 | 182 | 290 | 387 |
| D (mm) | 174 | 202 | 314 | 422 |
| E (mm) | M4 or ø5 | M4 or ø5 | M5 or ø6 | M6 or ø7 |

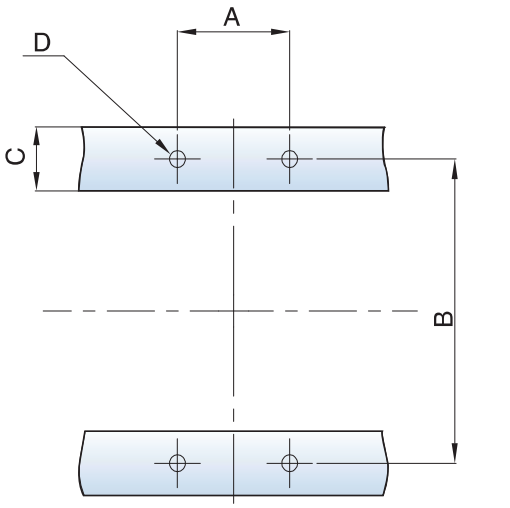
* 4P Plug-in (TD100/160 only)

## Plug-in device

### Rail mounting

[mm]



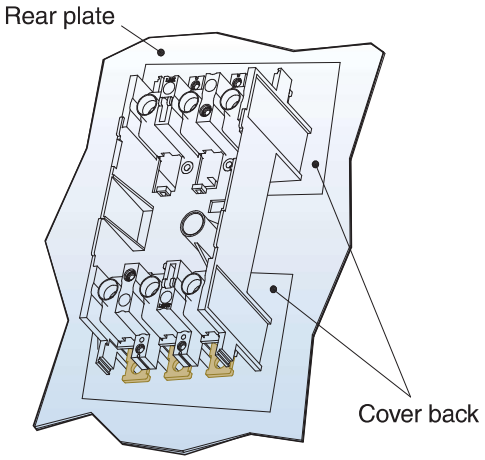

| Applicable to | TD100/160 | TS100/160/250 | TS400/630 | TS800 |
|---|---|---|---|---|
| A (mm) | 30 (60*) | 70 | 100 | 156 |
| B (mm) | 76 | 77.8 | 101.6 | 104.2 |
| C (mm) | 14 | 28 | 32 | 43 |
| D (mm) | M4 or ø5 | M6 or ø7 | M6 or ø7 | M8 or ø9 |

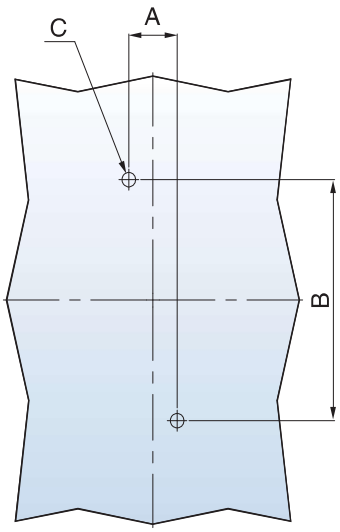
* 4P Plug-in (TD100/160 only)

## Plug-in device

### Mounting to rear plate with cover back

[mm]



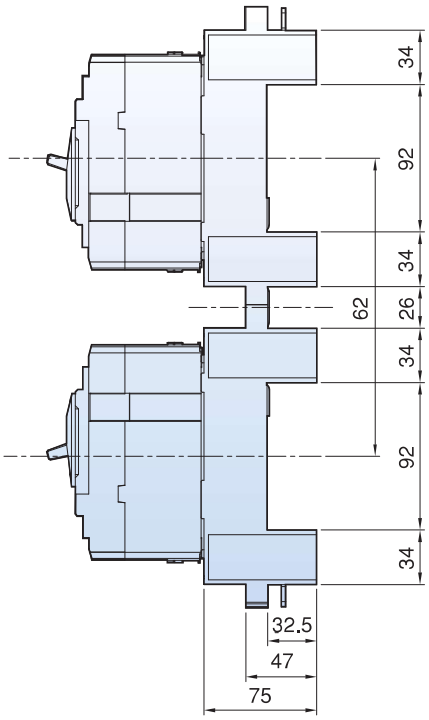

| Applicable to | TD100/160 | TS100/160/250 | TS400/630 | TS800 |
|---|---|---|---|---|
| A (mm) | 30 (60*) | 35 | 46.5 | 70 |
| B (mm) | 140 | 154 | 262 | 343 |
| C (mm) | M4 or ø5 | M4 or ø5 | M5 or ø6 | M6 or ø7 |

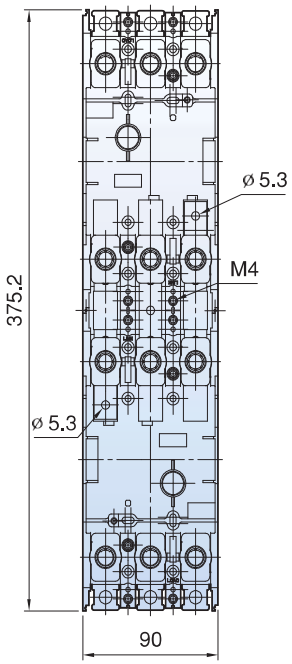
* 4P Plug-in (TD100/160 only)

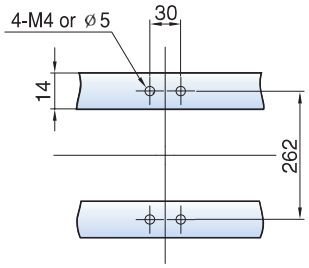
## Plug-in device

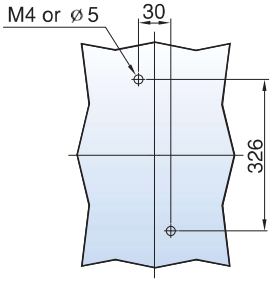
### Mounting for TD100/160

[mm]



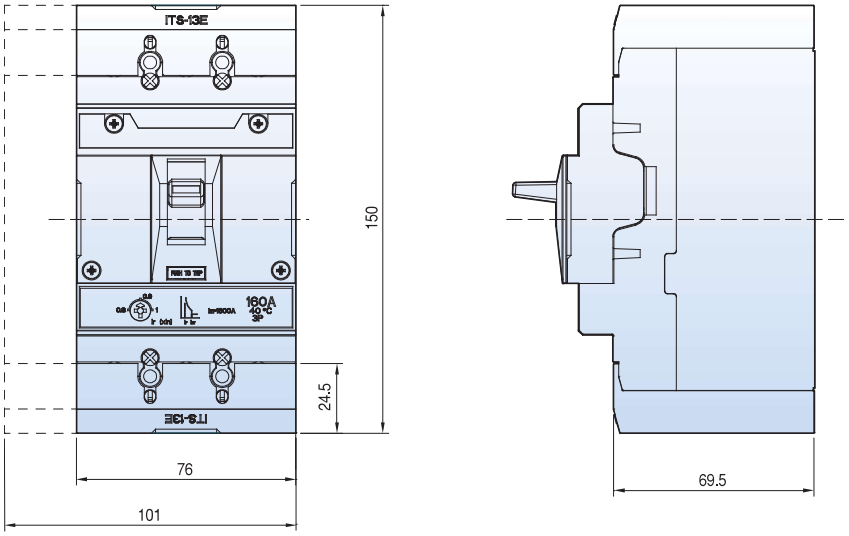



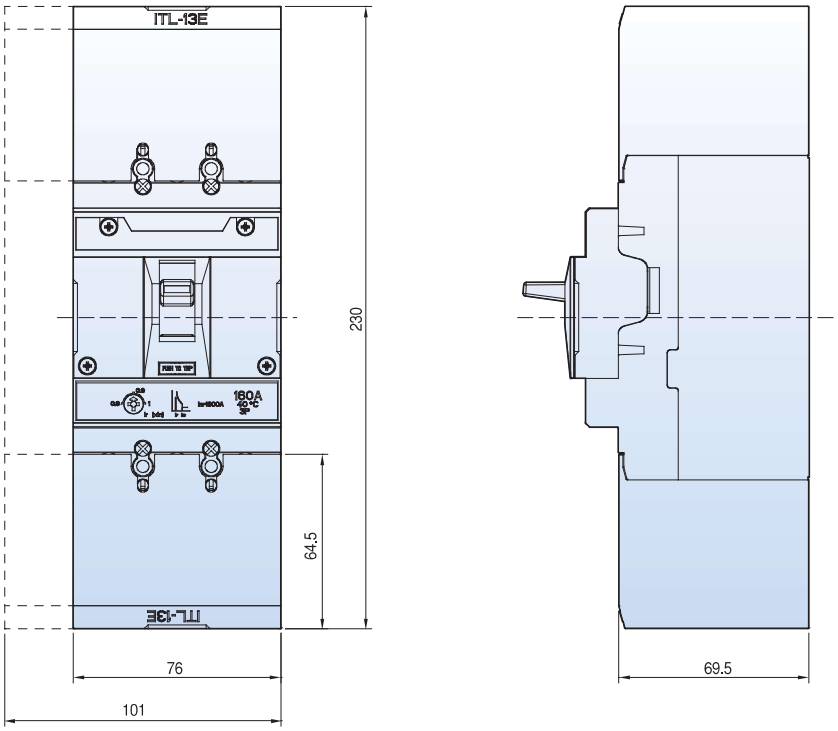
## Terminal cover

### ITS13E, ITS14E for TE100/160

[mm]



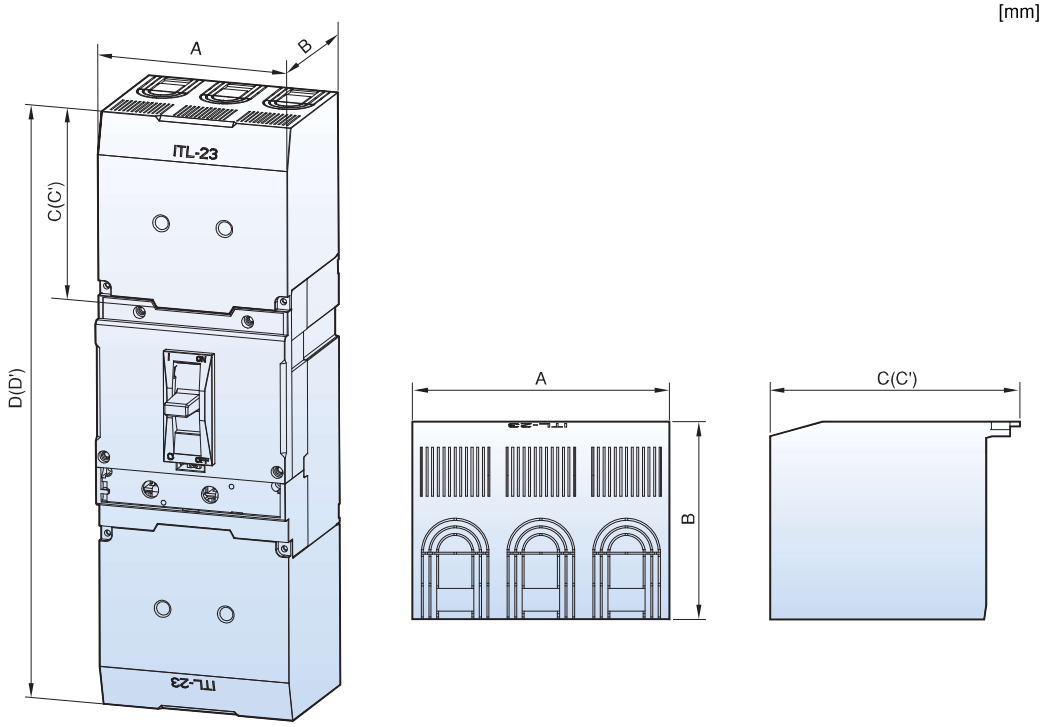

### ITL13E, ITL14E for TE100/160



## Terminal cover

### ITS and ITL for TD100/160, TS100/160/250/400/630/800

[mm]

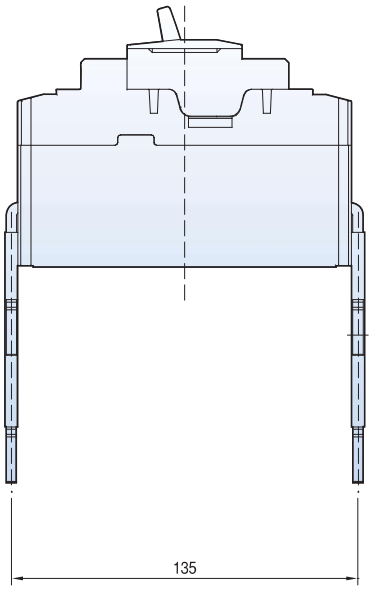


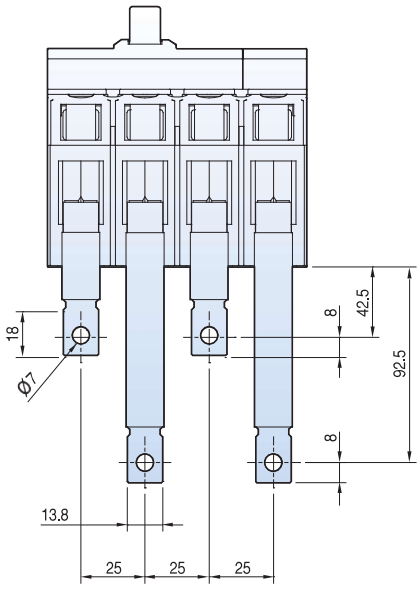

| Applicable to | Type | | | Dimension(mm) | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Frame type | Pole | Long type | Short type | A | B | C (Long type) | C′ (Short type) | D (Long type) | D′ (Short type) |
| TD100, TD160 | 2P, 3P | ITL13 | ITS13 | 90 | 80.8 | 48.5 | 30.5 | 196 | 160 |
| | 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 | | |

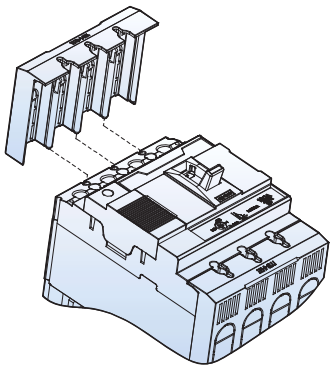
## Rear connection

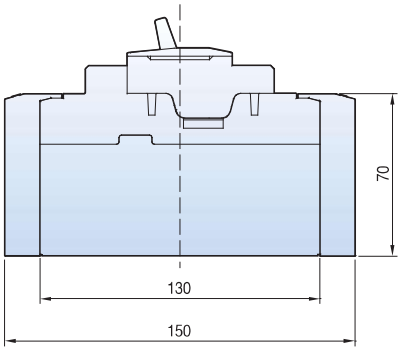
### RTF13, RTF14 for TE100/160

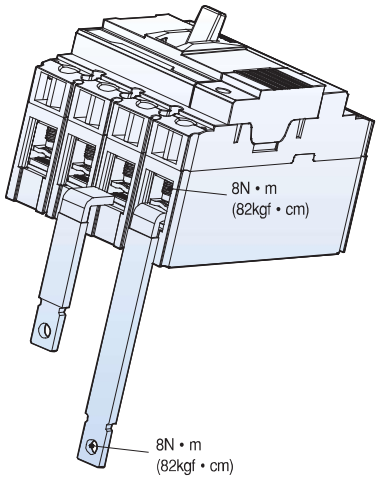
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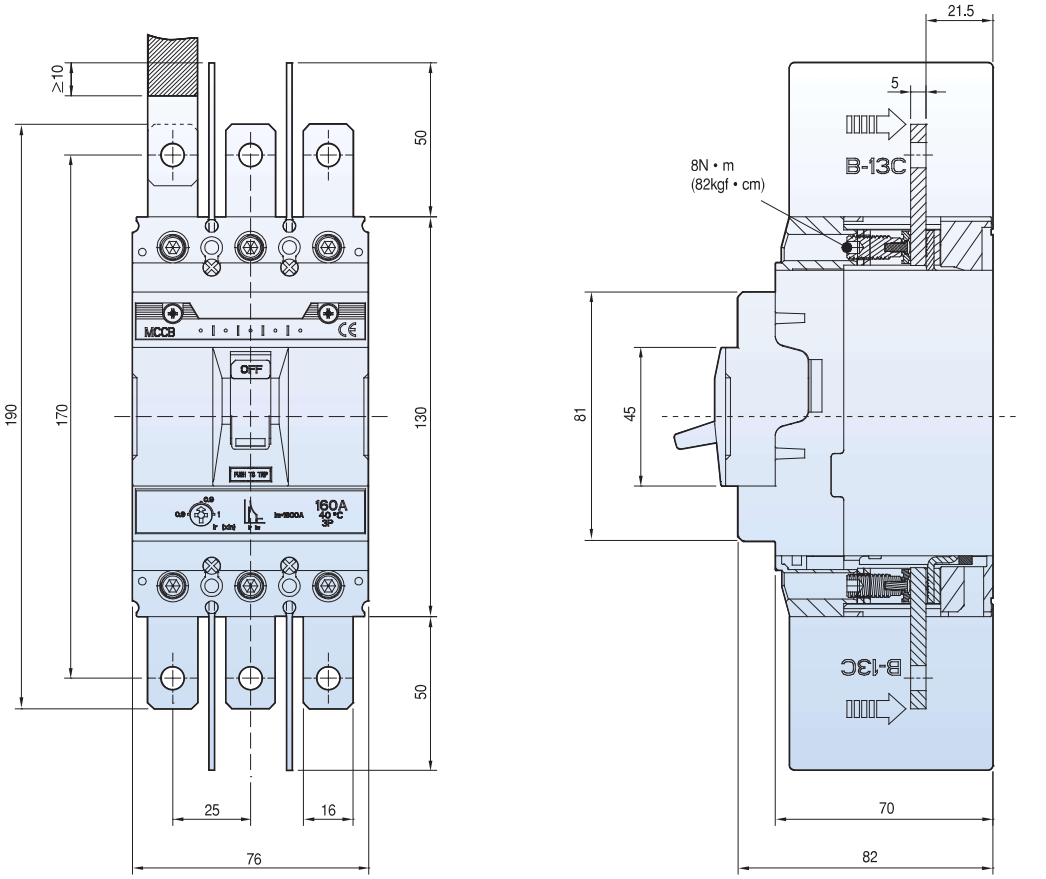


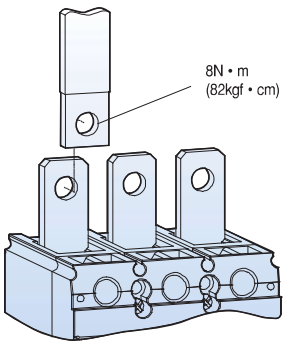



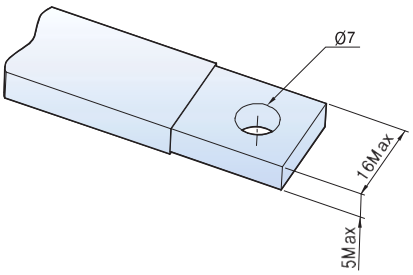
## Extended terminal

### ET13E, ET14E for TE100/160

[mm]



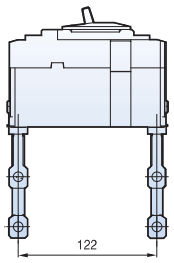



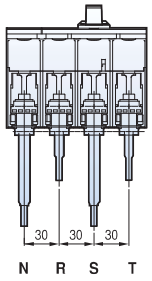



## Rear terminals

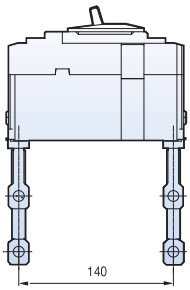
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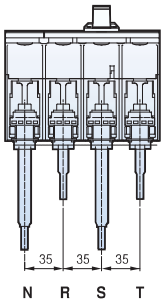
**TD100**
**TD160**



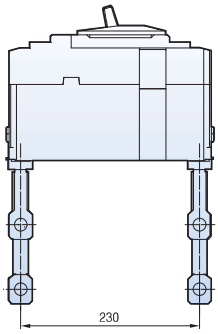



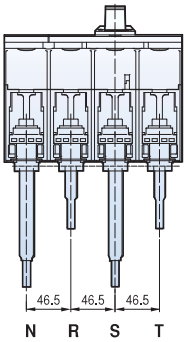

**TS100**
**TS160**
**TS250**



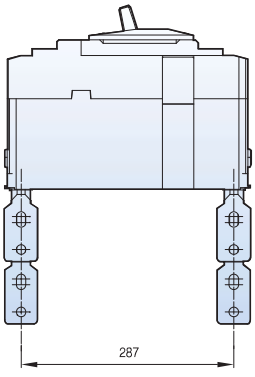



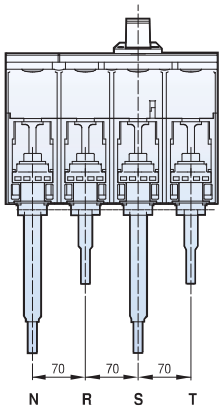

**TS400**
**TS630**




**TS800**



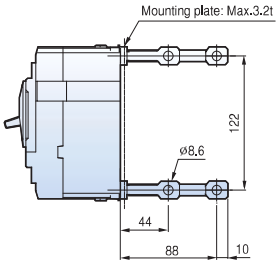



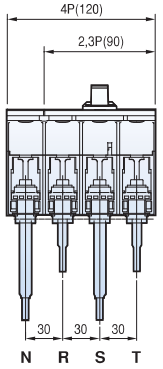
# Rear terminals

## TD100 / TD160

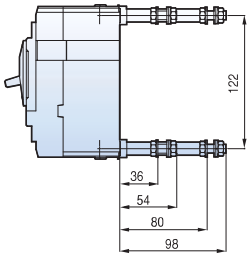
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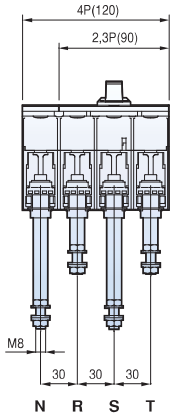
### Bar type



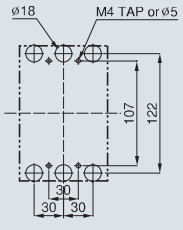




### Round type

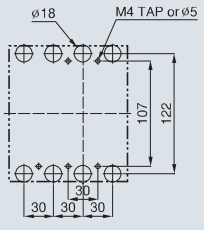



### Panel drilling

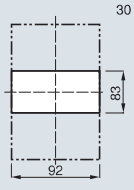



2, 3P

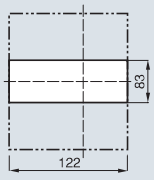



4P

### Front panel cutting




2, 3P



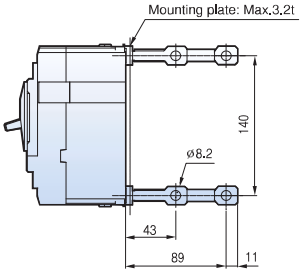

4P

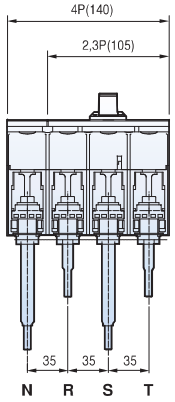
# Rear terminals

## TS100 / TS160 / TS250

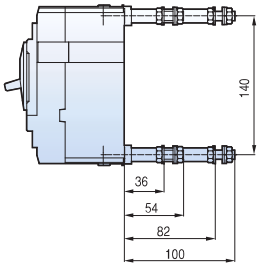
[mm]

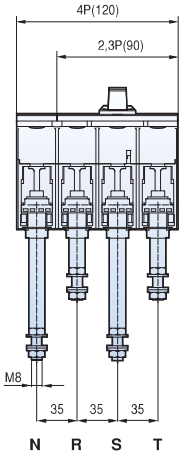
### Bar type



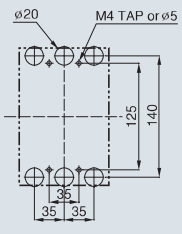




### Round type

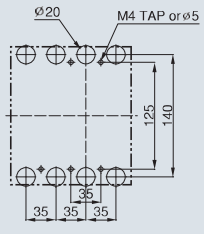



**Panel drilling**

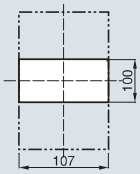



2, 3P

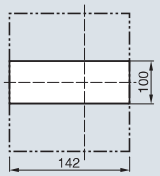



4P

**Front panel cutting**




2, 3P



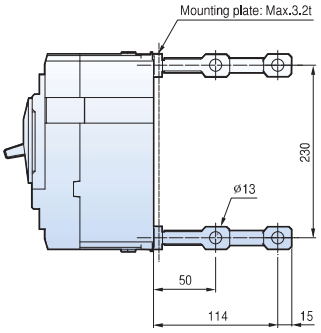

4P

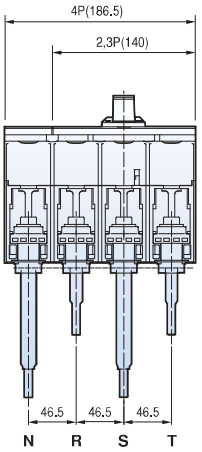
# Rear terminals

## TS400 / TS630

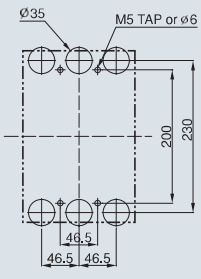
[mm]

### Bar type

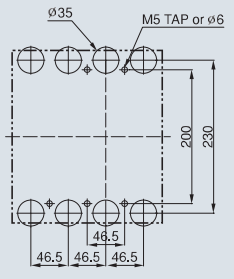



### Panel drilling

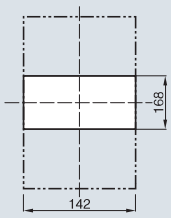



2, 3P

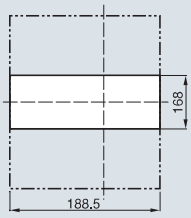



4P

### Front panel cutting




2, 3P



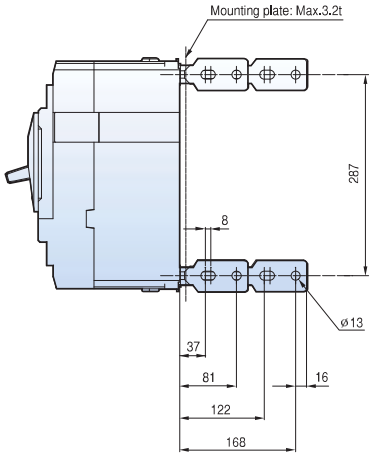

4P

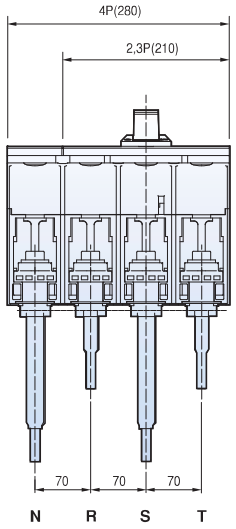
# Rear terminals

## TS800

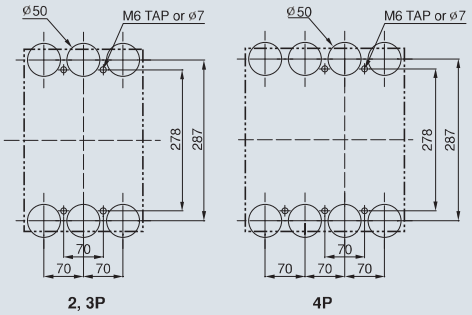
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### Bar type

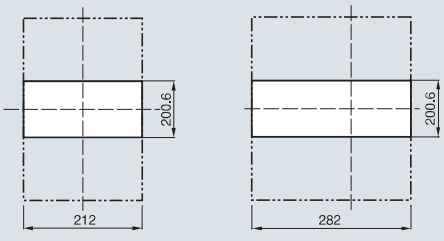



**Panel drilling**




**Front panel cutting**



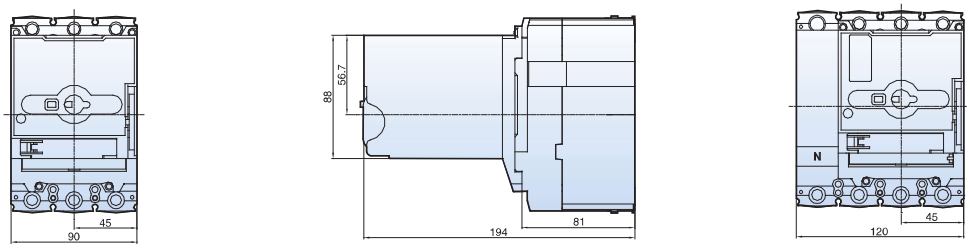
# Circuit breaker with motor operator

## MOP1, MOP2, MOP3, MOP4

[mm]

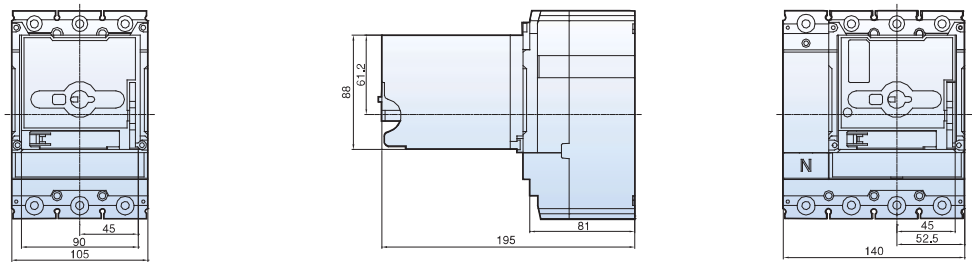
**TD100N/H/L**
**TD160N/H/L**

### Circuit breaker with MOP1



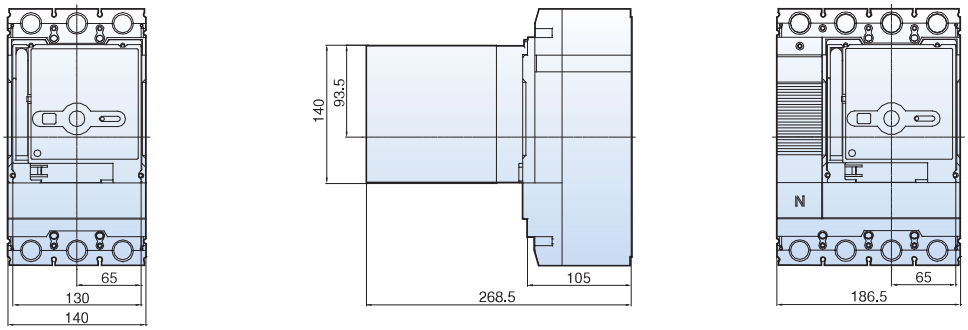

**TS100N/H/L**
**TS160N/H/L**
**TS250N/H/L**

### Circuit breaker with MOP2



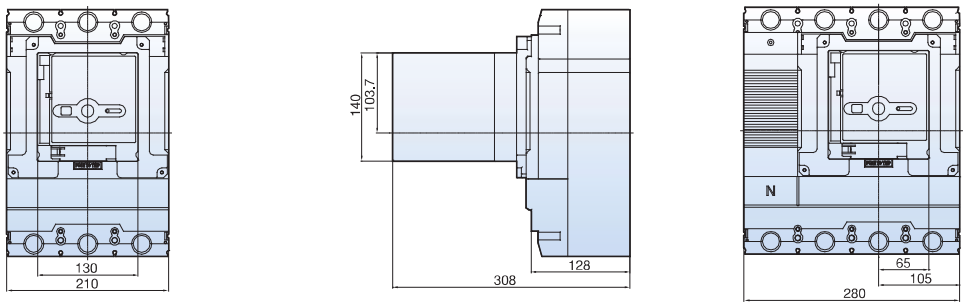

**TS400N/H/L**
**TS630N/H/L**

### Circuit breaker with MOP3



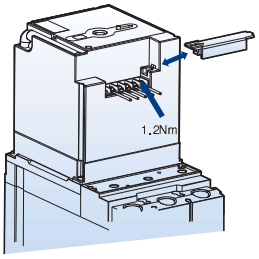

**TS800N/H/L**

### Circuit breaker with MOP4



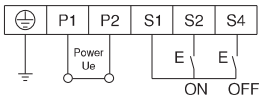
## Wiring connection

### Motor operator




**Standard connection**

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

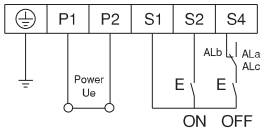



**Connection with alarm switch (AL)**

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.

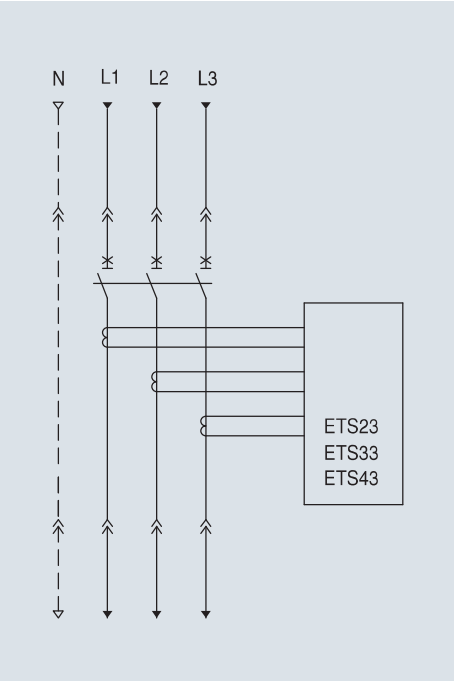


## Wiring diagram(State of operation)

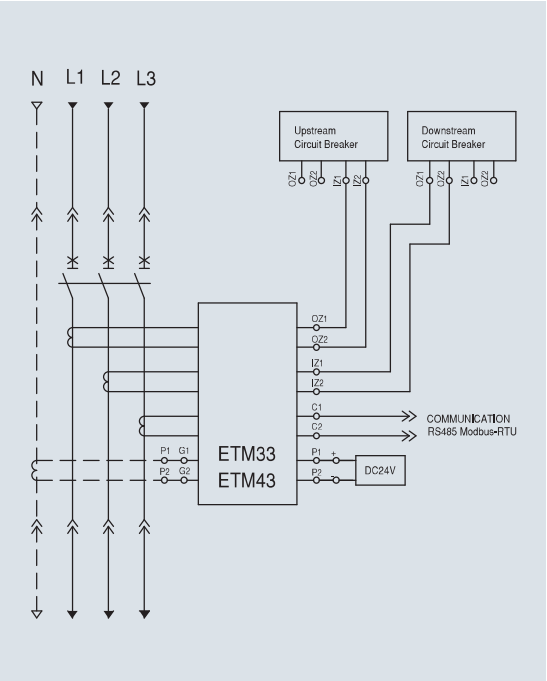
### ETS23/ETS33/ETS43

**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

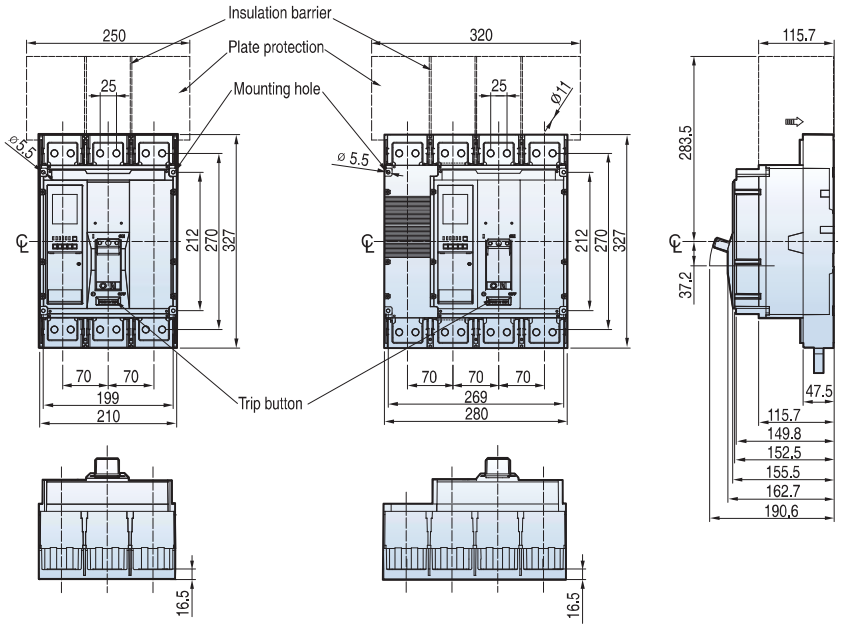



Three-pole circuit-breaker with
ETM33/ETM43 electronic release
(External natural current transformer)

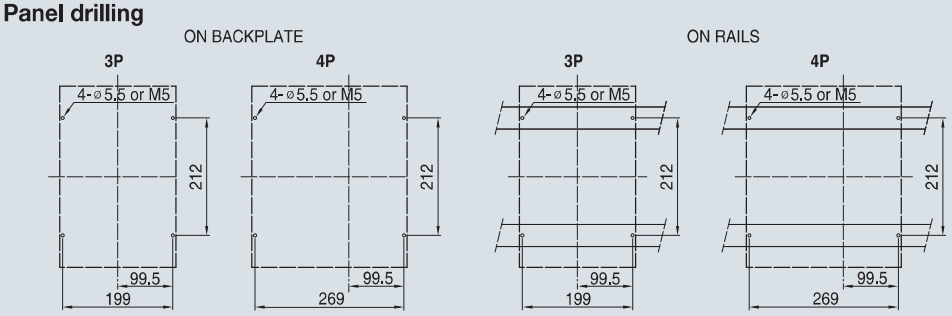
## TS 1000, 1250, 1600A

### Front Type

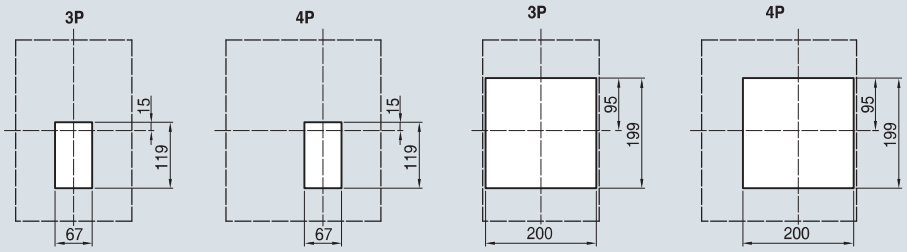
[mm]




### Panel drilling



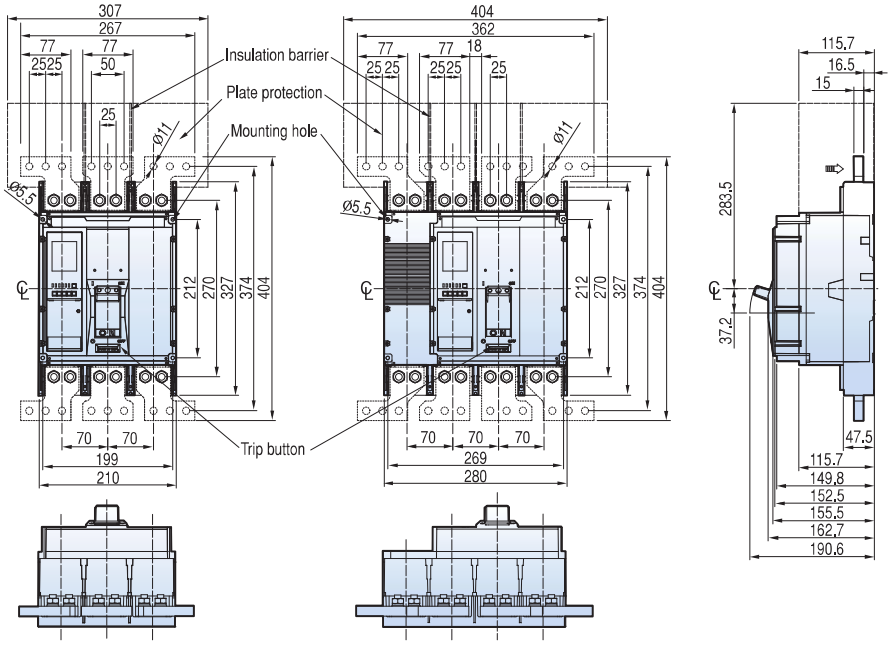

### Front panel cutting



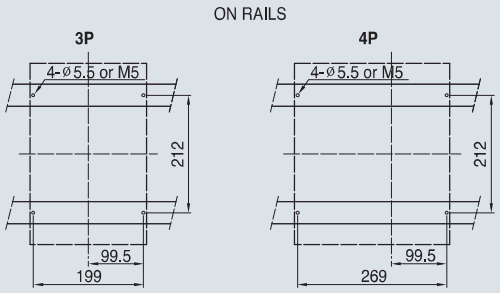
## TS 1000, 1250, 1600A

### Front Type Busbar

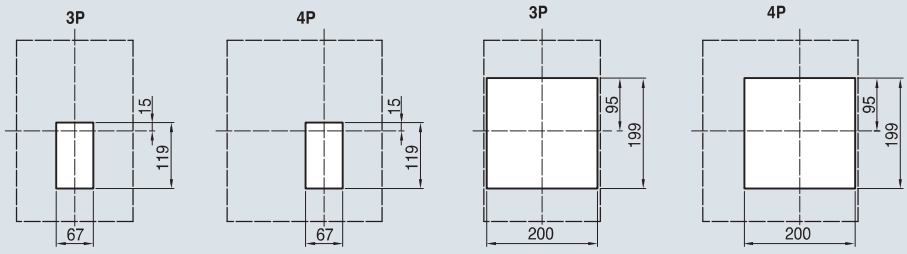
[mm]




### Panel drilling



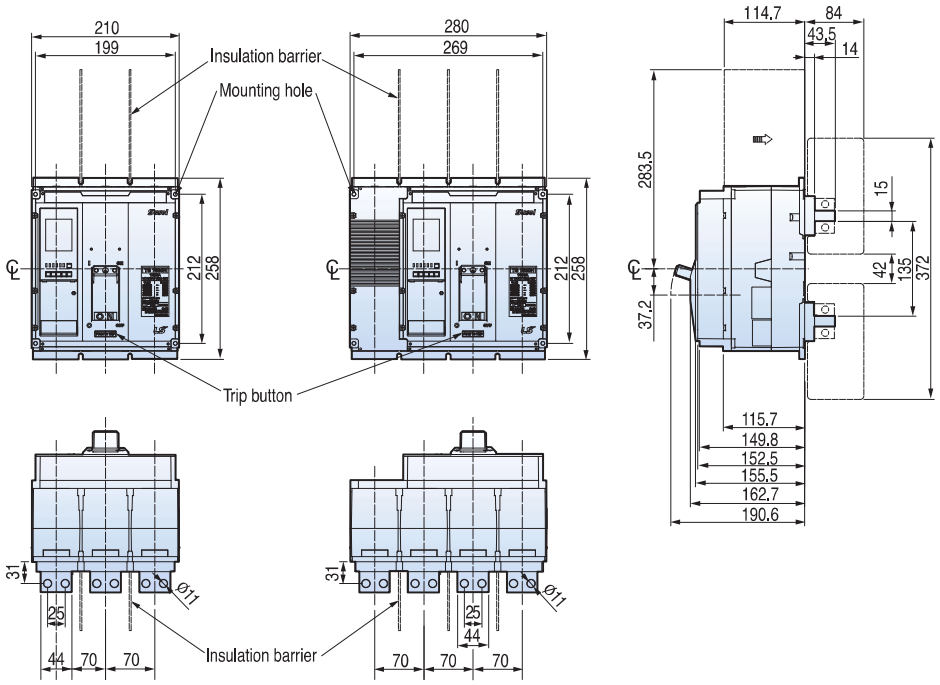

### Front panel cutting



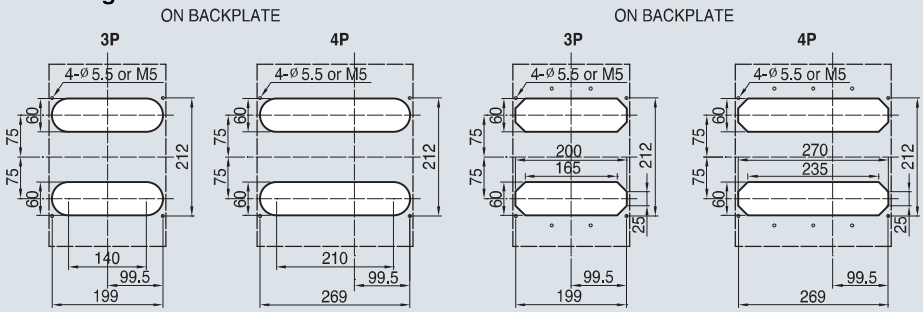
## TS 1000, 1250, 1600A

### Rear Type

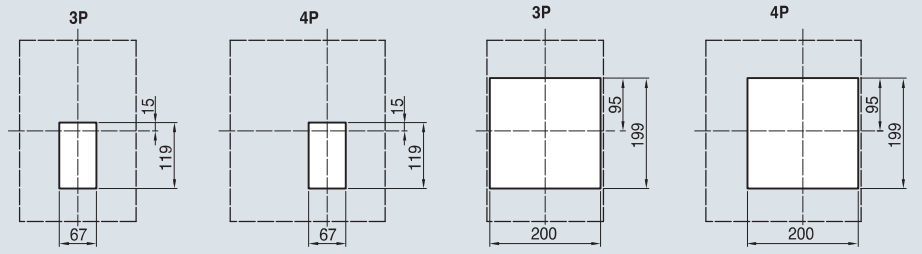
[mm]




### Panel drilling




### Front panel cutting

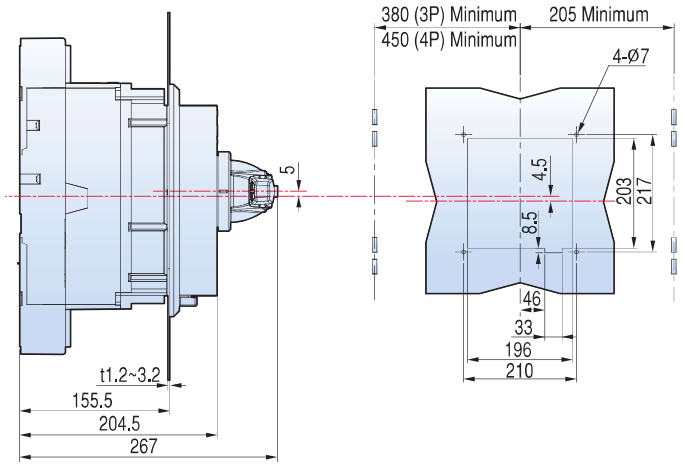


# Rotary handles

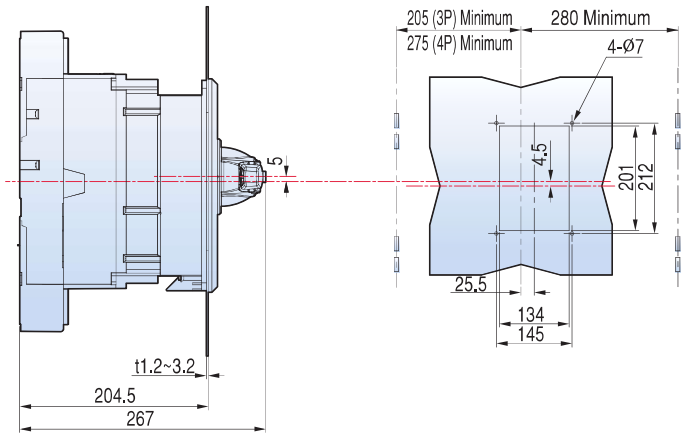
## Direct rotary handles for TS 1600AF

[mm]

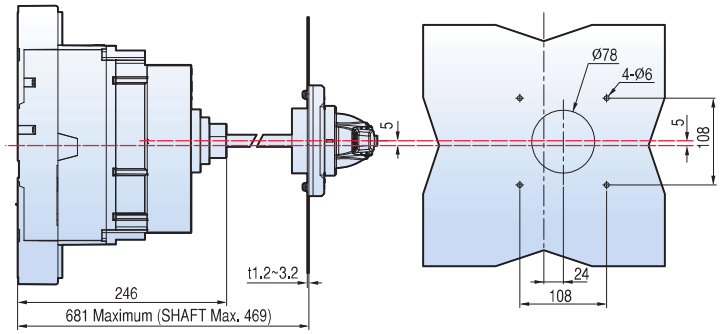
**A Type**




**B Type**



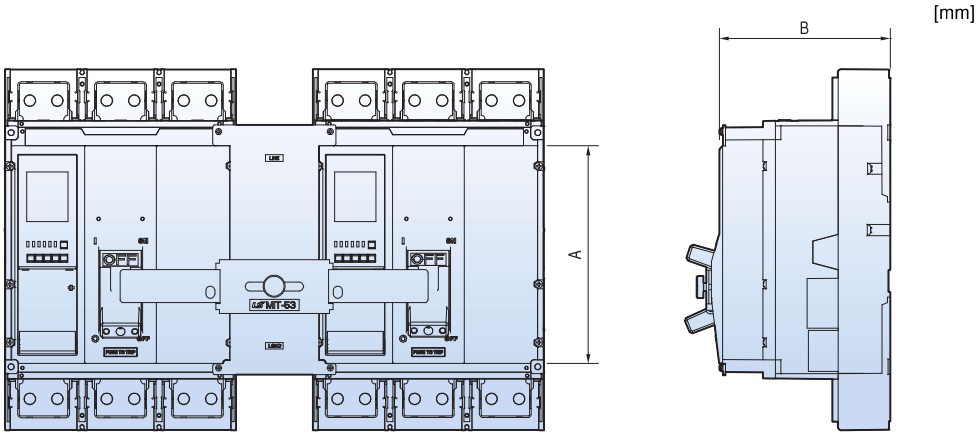

## Extended rotary handle for TS 1600AF



## Locking devices

### Mechanical interlock for TS 1600AF

[mm]

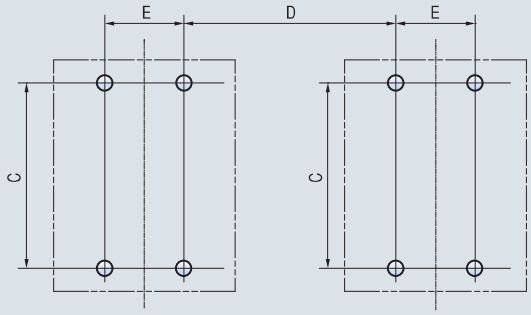



**The cutting of Panel**

| 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 |

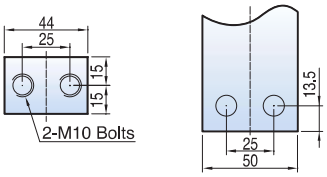
| 4P | D | E |
|---|---|---|
| TS1600 | 11 | 269 |

# Terminals

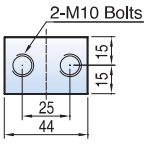
## Front connection with bars for TS1600

[mm]

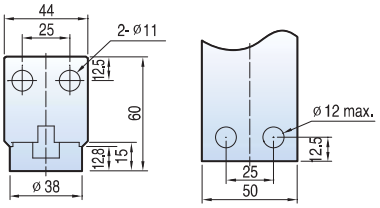
### Top terminal



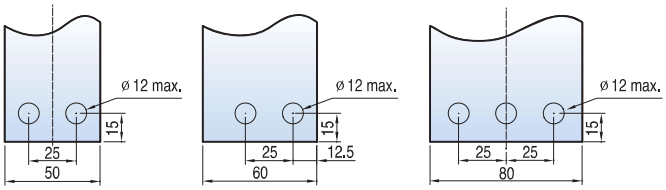

### Bottom terminal



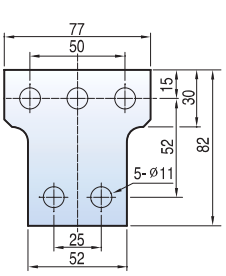

## Rear connection with bars



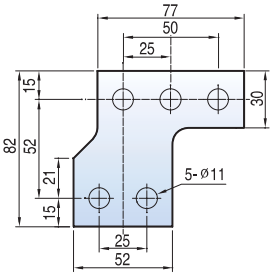

## Connection with Busbar



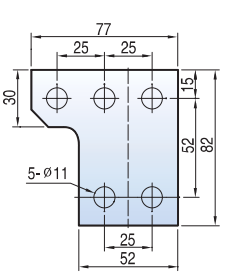

**Middle busbar for 3P**



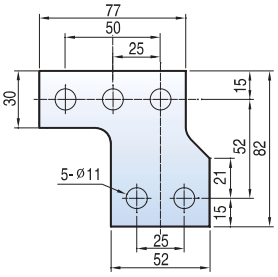

**Left or right busbar for 3P**




**Middle left or middle right busbar for 4P**



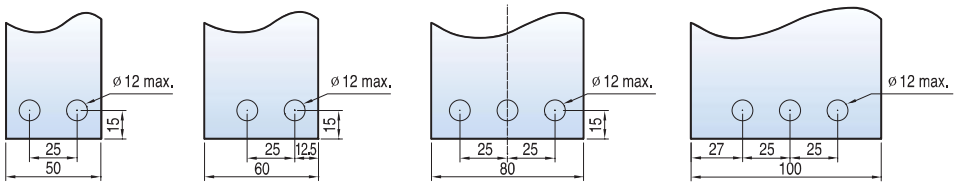

**Left or right busbar for 4P**

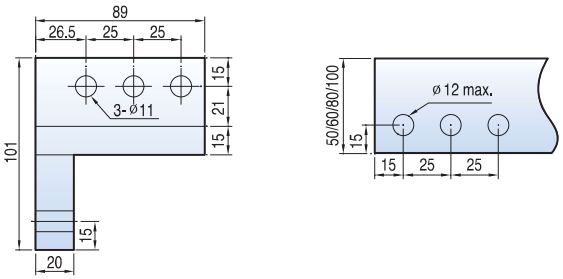


## Terminals

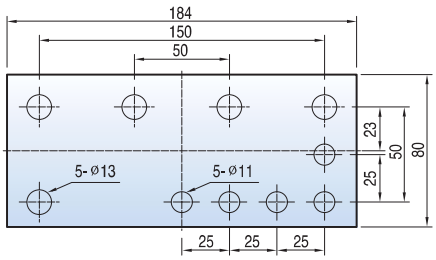
### Front or Rear connection with vertical busbar for TS1600

[mm]




### Extension Busbar



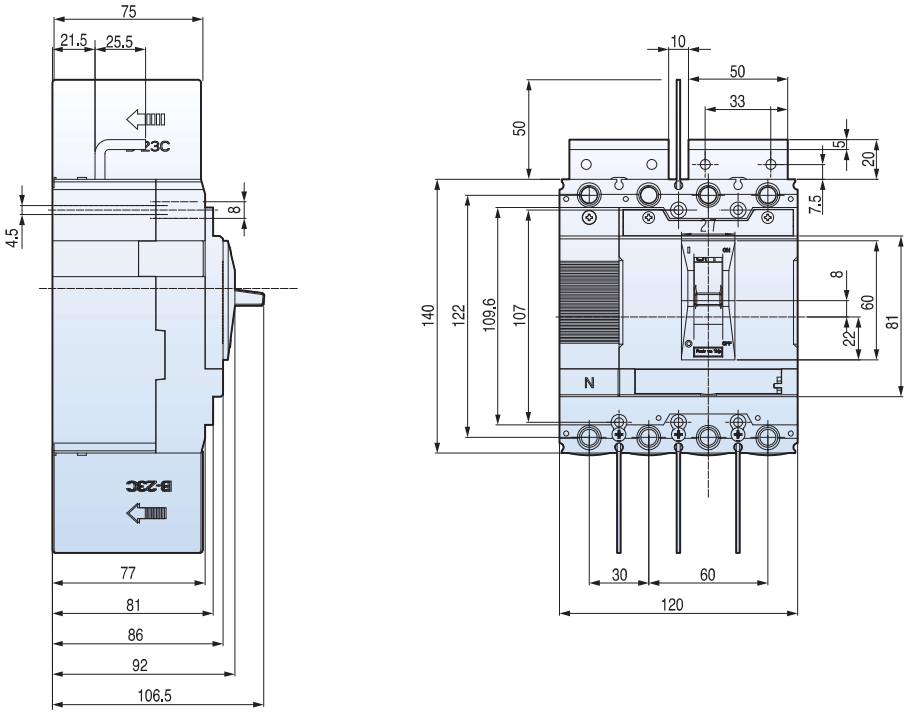
# Overall dimensions (DC1000V PV MCCB)



## TD160

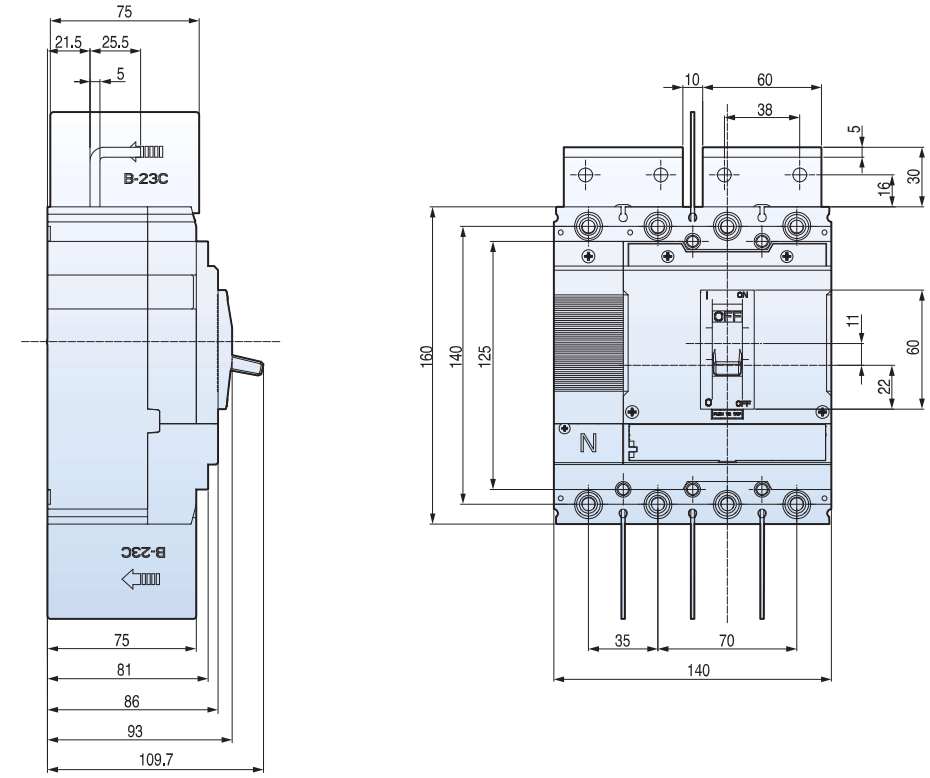
### Dimension of MCCB with short BUSBAR

[mm]




## TS250

### Dimension of MCCB with short BUSBAR



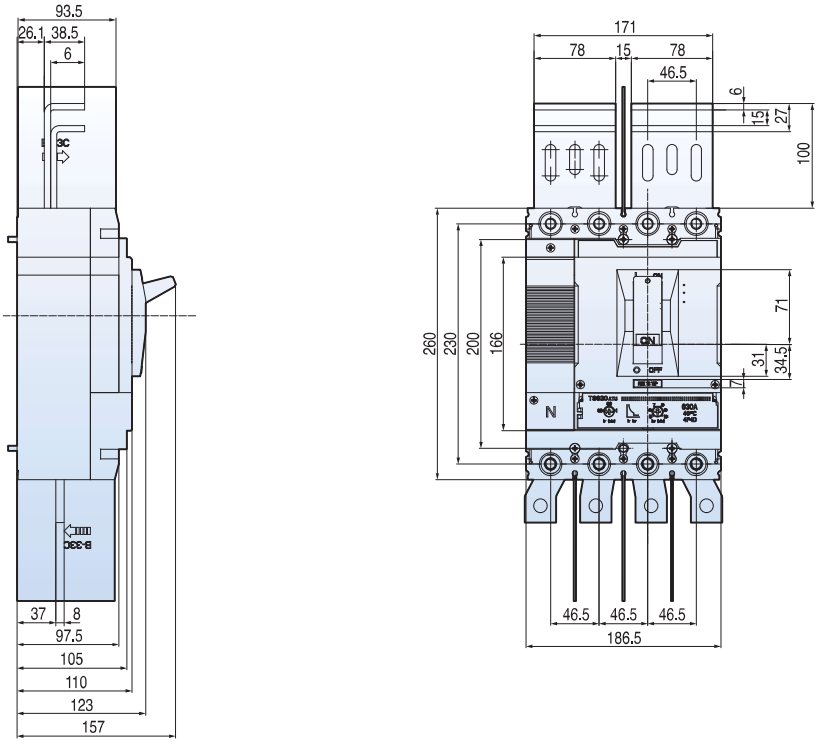
# Overall dimensions (DC1000V PV MCCB)



## TS630

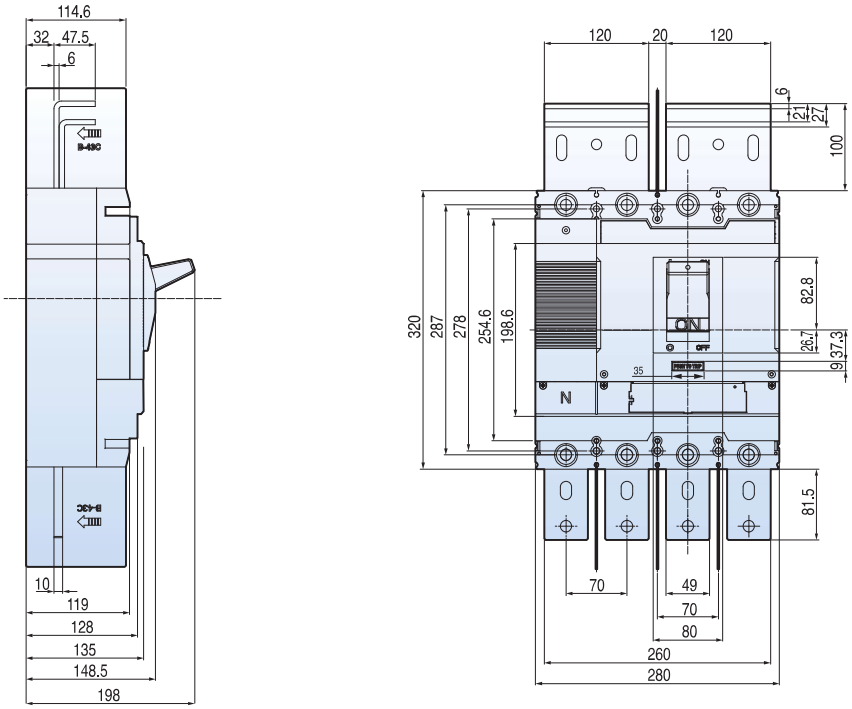
### Dimension of MCCB with short BUSBAR

[mm]




## TS800

### Dimension of MCCB with short BUSBAR

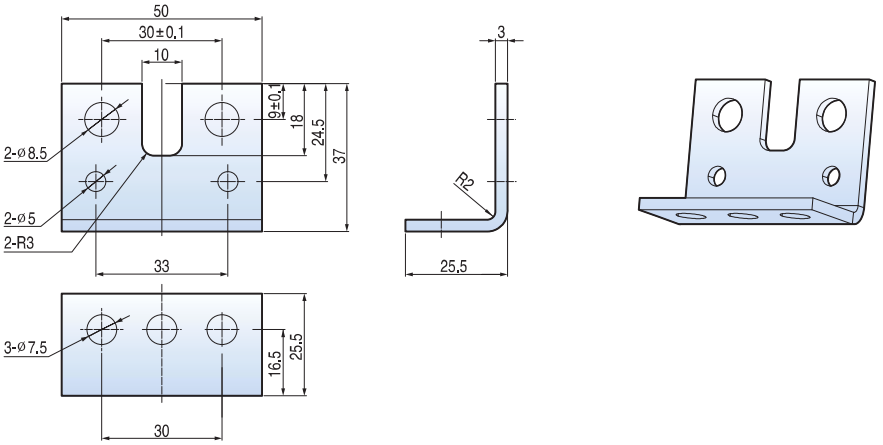


# TD160

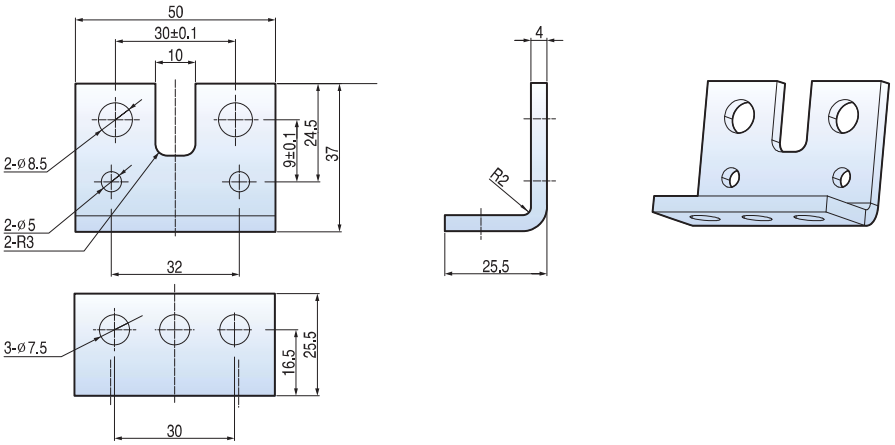
## Short BUSBAR dimension

[mm]

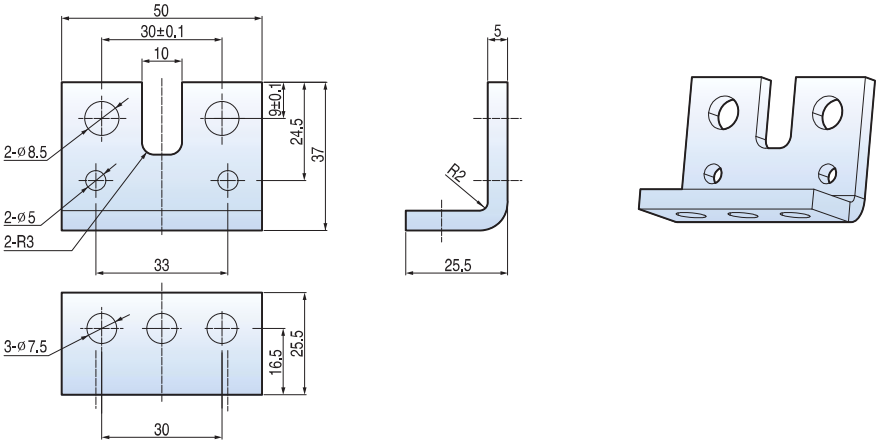
### TD160 3t Short Busbar




### TD160 4t Short Busbar




### TD160 5t Short Busbar

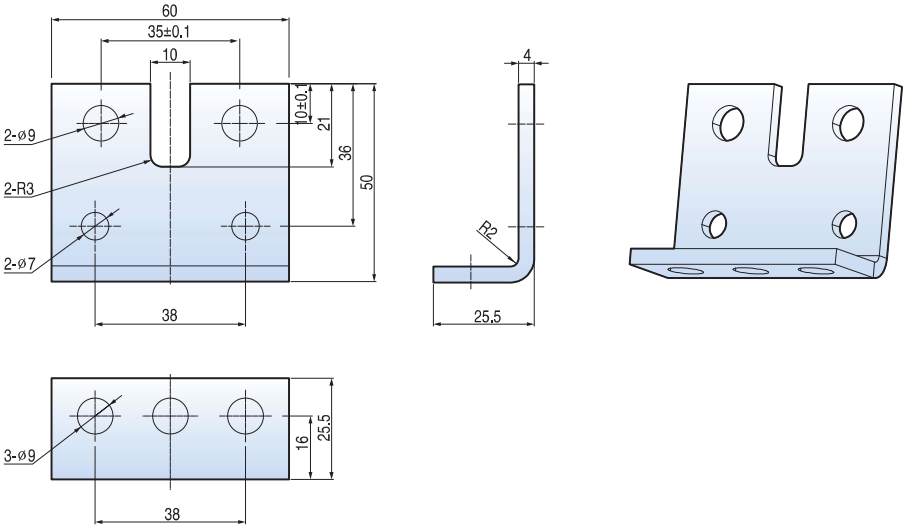


# TS250

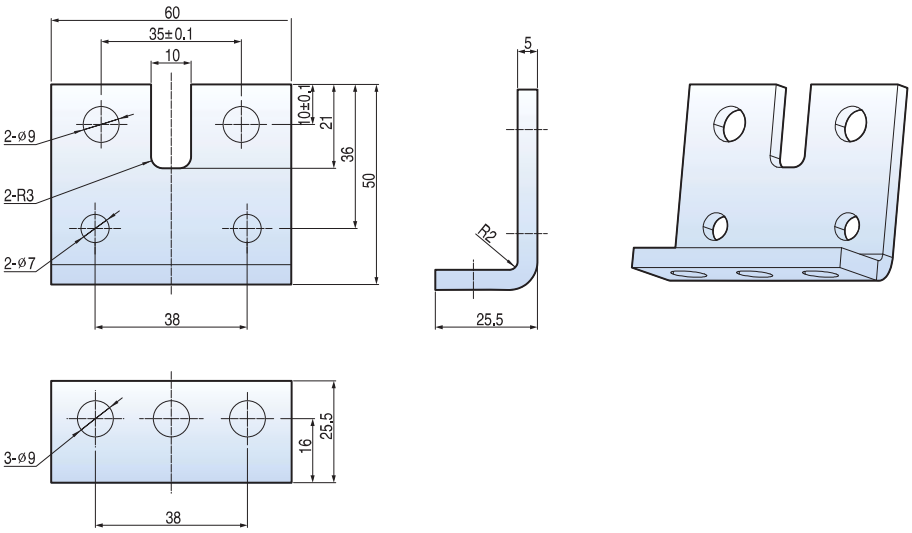
## Short BUSBAR dimension

### TS250 4t Short Busbar

[mm]




### TD250 5t Short Busbar

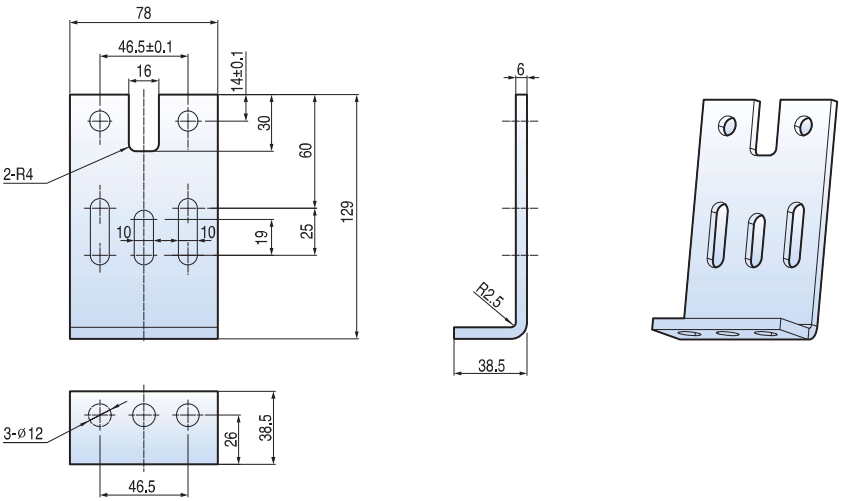


# TS630

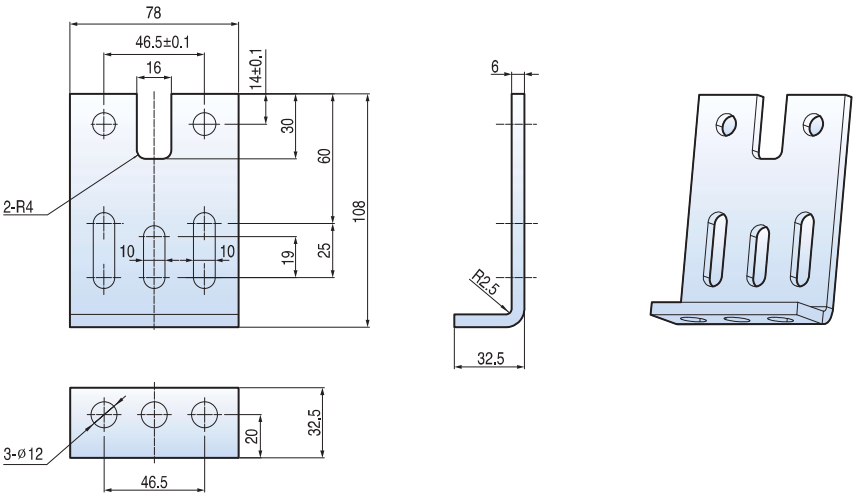
## Short BUSBAR dimension

### TS630 Lower Short Busbar

[mm]




### TS630 Upper Short Busbar

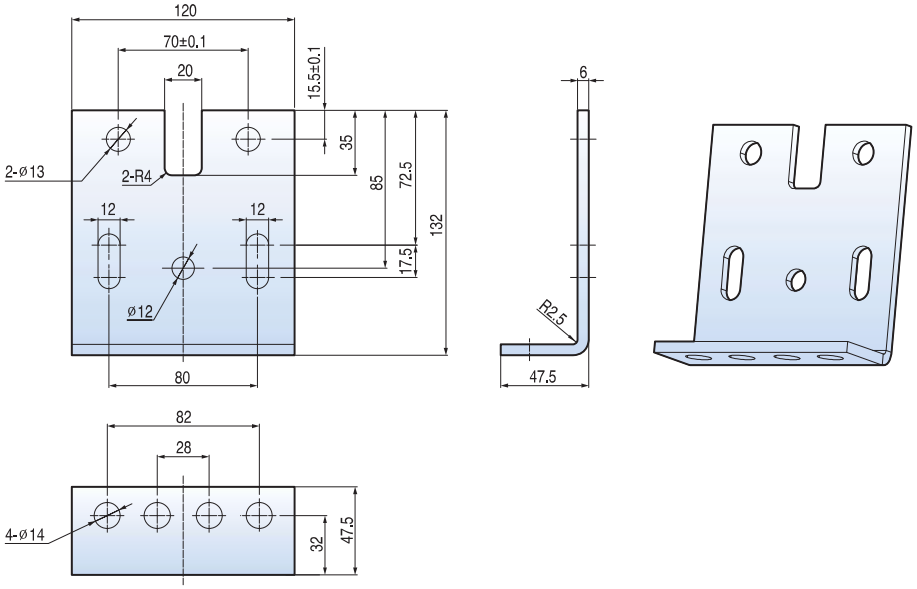


# TS800

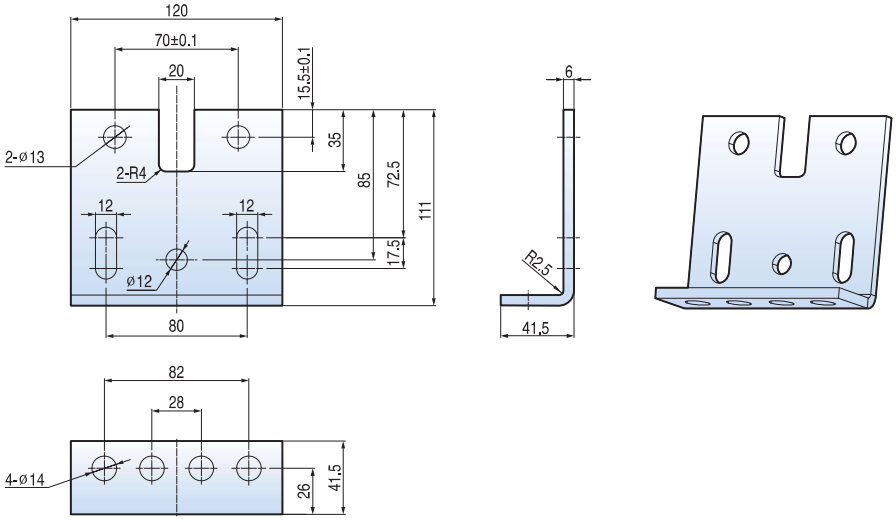
## Short BUSBAR dimension

[mm]

### TS800 Lower Short Busbar




### TS800 Upper Short Busbar




MCCB
DIGITAL TRIP RELAY
Susol
TS 1600H
1600A
Ui 1000V Uimp 8kV
Ue(V) Icu(kA)
220/240 ~ 85kA
380/415 ~ 70kA
440/460 ~ 65kA
480/500 ~ 50kA
TS 630L
TS 250L
TD 160L
TS 160H
TS 250L
250A
40°C
3P
TRIP
ON
OFF
In 250A

# 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
Protection of resistance welding circuits ..... A-7-11
Use of circuit-breakers for capacitor banks ..... A-7-12
Using circuit-breakers in DC networks ..... A-7-15
Circuit breakers for 400Hz networks ..... A-7-16
Protection of several kinds of loads ..... A-7-18

## Protective coordination

Discrimination & Cascading ..... A-7-20
Cascading, network 220/240V ..... A-7-21
Cascading, network 380/415V ..... A-7-25
Motor protection cascading, network 220/240V ..... A-7-30
Motor protection cascading, network 380/415V ..... A-7-31
Protection discrimination table, Discrimination ..... A-7-33
Motor protection discrimination table ..... A-7-43
Type 2 Coordination according to IEC60947-4-1 ..... A-7-45

## How to calculate short-circuit current value

Various short-circuit ..... A-7-53
With percent impedance ..... A-7-55
With a simple formula ..... A-7-57
Calculation example ..... A-7-59
Combination of transformer and impedance ..... A-7-63
Various short-circuit ..... A-7-64
Calculation example ..... A-7-65
Calculation graph ..... A-7-67

# 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 (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 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 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.

## Temperature derating

**Derating chart**

- Connection type: Plug-in
- Trip unit: FTU, FMU, ATU

| MCCB | Rating (A) | Fixed MCCB (c/w Thermal-magnetic trip unit) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 10℃ | 20℃ | 30℃ | 40℃ | 45℃ | 50℃ | 60℃ | 70℃ |
| TD100 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 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 |

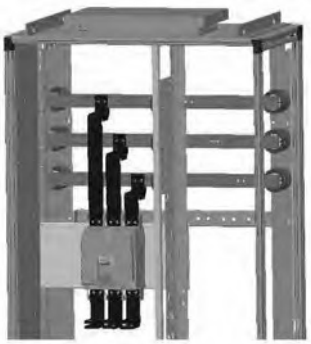
## Derating table

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 mm²
- 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 mm²
- 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 $mm^2$
- 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

IP □ □

- First characteristic numeral ×(numerals 0 to 6, or letter ×)
- Second characteristic numeral ×(numerals 0 to 8, or letter ×)
- Code letters (international Protection)

### 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= $3I^2R$)

# 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 240V | 1 phase 230V | | |
| 3 to 4 | 5 to 6 | 9 to 11 | 16 | |
| 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 | FTU |
| 23 to 29 | 40 to 50 | 69 to 87 | 125 | FMU |
| 29 to 37 | 51 to 64 | 89 to 111 | 160 | ATU |
| 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 | | 0.8 |
| 9 to 19 | 16 to 32 | 27 to 56 | 100 | | 0.8 |
| 15 to 30 | 25 to 52 | 44 to 90 | 160 | ETS | 0.8 |
| 23 to 46 | 40 to 80 | 70 to 139 | 250 | ETM | 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 |

# 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÷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÷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 operating current (A) | The rated current of MCCB (A) | Breaking capacity (kA) sym 85 | 100 | 120 | 200 |
|---|---|---|---|---|---|
| 12 | 16 | TD100N | TD100H | TD100L | |
| 16 | 20 | | | | |
| 20 | 25 | | | | |
| 25 | 32 | | | | |
| 32 | 40 | | | | |
| 40 | 50 | | TD100H TS100N | TD100L TS100H | TD100L TS100L |
| 50 | 63 | | | | |
| 64 | 80 | | | | |
| 80 | 100 | | | | |
| 100 | 125 | TD160N | TD160H TS160N | TS160H | TD160L TS160L |
| 128 | 160 | | | | |
| 160 | 200 | TS250N | | TS250H | TS250L |
| 200 | 250 | | | | |
| 240 | 300 | TS400N | | TS400H | TS400L |
| 320 | 400 | | | | |
| 400 | 500 | TS630N | | TS630H | TS630L |
| 504 | 630 | | | | |
| 560 | 700 | TS800N | | TS800H | TS800L |
| 640 | 800 | | | | |

## AC460V

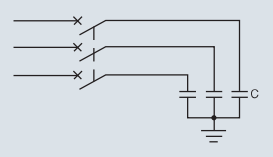
| The maximum operating current (A) | The rated current of MCCB (A) | Breaking capacity (kA) sym 50 | 65 | 70 | 85 | 100 | 130 |
|---|---|---|---|---|---|---|---|
| 12 | 16 | TD100N TS100N | TD100H TS100H | | TD100L TS100L | | |
| 16 | 20 | | | | | | |
| 20 | 25 | | | | | | |
| 25 | 32 | | | | | | |
| 32 | 40 | | | | | | |
| 40 | 50 | | | | | | |
| 50 | 63 | | | | | | |
| 64 | 80 | | | | | | |
| 80 | 100 | | | | | | |
| 100 | 125 | TD160N TS160N | TD160H TS160H | | TD160L TS160L | | |
| 128 | 160 | | | | | | |
| 160 | 200 | TS250N | TS250H | | TS250L | | |
| 200 | 250 | | | | | | |
| 240 | 300 | TS400N | | TS400H | | TS400L | |
| 320 | 400 | | | | | | |
| 400 | 500 | TS630N | | TS630H | | TS630L | |
| 504 | 630 | | | | | | |
| 560 | 700 | TS800N | | TS800H | | TS800L | |
| 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<br>TS100N/H/L 100A<br>TD160N/H/L 100A<br>TS160N/H/L 100A | TD100N/H/L 50A<br>TS100N/H/L 50A |
| 30 | 65 | TD160N/H/L 125A<br>TS160N/H/L 125A<br>TS250N/H/L 125A | TD100N/H/L 100A<br>TS100N/H/L 100A<br>TD160N/H/L 100A<br>TS160N/H/L 100A |
| 55 | 140 | TS250N/H/L 250A | TD160N/H/L 125A<br>TS160N/H/L 125A<br>TS250N/H/L 125A |

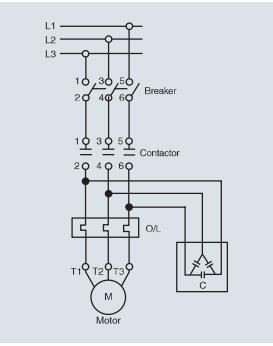
# Application
# Use of circuit-breakers for capacitor banks




Capacitor circuit

## Application for protection of capacitor circuit

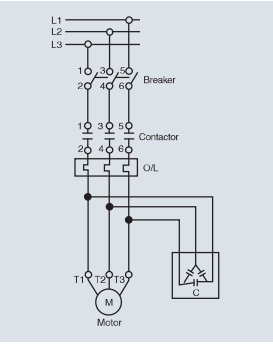
In order to reduce system losses (less than 0.5W/kvar in low voltage) and voltage drops in the power distribution system, reactive power compensation or power factor correction is generally undertaken. As a result, the power fed into the system is used as active power and costs will be saved through 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:

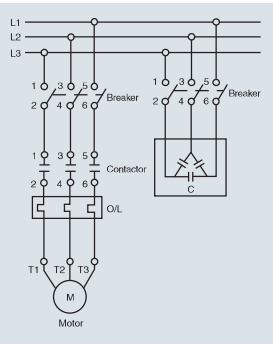
- Asynchronous motors: An asynchronous motor is a large consumer of inductive reactive energy. The amount of reactive power consumed is between 20% and 25% of the rated power of the motor (depending on its speed).

- 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.




Usual connection diagram

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:

Maximum expected rated current= Rated current of the capacitor bank × 1.5 (RMS value)

# Application
# Use of circuit-breakers for capacitor banks

## 220V, 50/60Hz Circuit

| Capacitor rating kVAR | Single-phase circuit | | Three-phase circuit | |
|---|---|---|---|---|
| | Capacitor rated current (A) | MCCB rated current (A) | Capacitor rated current (A) | MCCB rated 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.

# Application
# Use of circuit-breakers for capacitor banks

## 440V, 50/60Hz Circuit

| Capacitor rating kVAR | Single-phase circuit | | Three-phase circuit | |
|---|---|---|---|---|
| | Capacitor rated current (A) | MCCB rated current (A) | Capacitor rated current (A) | MCCB rated 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**

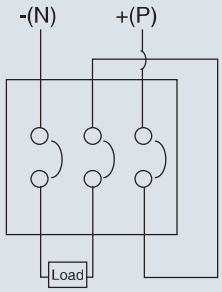
The followings are the most important criteria for selection of suitable circuit breaker for DC networks.

- 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

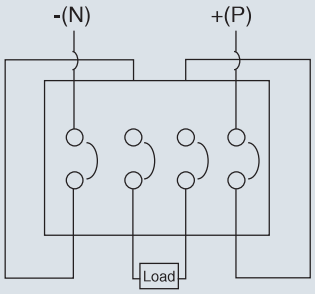
**Setting range of the trip values**

- 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.**



Recommended wiring method
for DC500V circuit



Recommended wiring method
for DC600V circuit

| | Model | Trip unit | Applicable to DC circuits | Breaking capacity (kA) |
|---|---|---|---|---|
| Thermal magnetic | TD100N,TD160N | FTU FMU ATU | ○ | 42 |
| | TS100N,TS160N, TS250N TS400N, TS630N TS800N | | ○ | 50 |
| | TD100H, TD160H | | ○ | 65 |
| | TS100H, TS160H, TS250H TS400H, TS630H TS800H | | ○ | 85 |
| | TD100L, TD160L TS100L, TS160L, TS250L TS400L, TS630L TS800L | | ○ | 100 |
| Electronic | TS250, TS630, TS800 | ETS, ETM | Impossible to use to DC circuits | |

# 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 (A) in 400 Hz | Applied circuit breaker (MCCB) | Trip unit | Multiplier factors (K1, K2) | |
|---|---|---|---|---|
| | | | K1 (Thermal trip units) | K2 (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 | | 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 | | | 0.8 | 2 |
| 630 | TS800N, TS800H, TS800L | | 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 (A) in 400 Hz | Applied circuit breaker (MCCB) | Trip unit | Multiplier factors (K1, K2) | |
|---|---|---|---|---|
| | | | K1 (Thermal trip units) | K2 (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 |

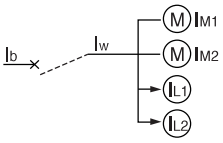
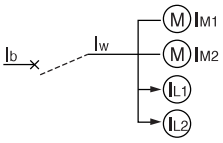
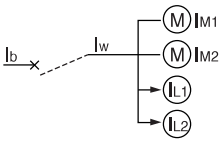
Note) ATU × Adjustable thermal and magnetic trip unit
K1 × Multiplier factor of rated current (In)
K2-Multiplier factor of instantaneous current due to the induced magnetic fields
ETS × Electronic trip unit (Standard)
ETM × Electronic trip unit (Multi-function)

# 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 ($I_M$: motors, $I_L$: others) | Permissible current in cable or wire: $I_w$ | The rated current of circuit breaker: $I_b$ |
|---|---|---|
| In case of, $\Sigma I_M \leq \Sigma I_L$  | $I_w \geq \Sigma I_M + \Sigma I_L$ | Choose the low value among two formulas: $I_b \geq 3\Sigma I_M + \Sigma I_L$. and $I_b \leq 2.5 I_w$<br><br>It's permitted to select the above value only if $I_w$ (above 100A) isn't subject to the rated current of circuit breaker. |
| In case of, $\Sigma I_M > \Sigma I_L$, $\Sigma I_M \leq 50A$  | $I_w \geq 1.25\Sigma I_M + \Sigma I_L$ | |
| In case of, $\Sigma I_M > \Sigma I_L$, $\Sigma I_M > 50A$  | $I_w \geq 1.1\Sigma I_M + \Sigma I_L$ | |

**The rated current of breakers as the main circuit of 3 phase inductive loads (AC 220V)**

| Capacity of loads In total (below kW) | The maximum operating current (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 |
| | | 4.8 | 8 | 11.1 | 17.4 | 26 | 34 | 48 | 65 | 79 | 93 | 125 | 160 | 190 | 230 | 310 | 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)**

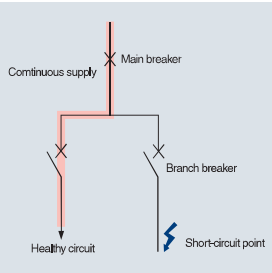
| Capacity of loads In total (below kW) | The maximum operating current (below A) | Capacity of the highest motor (kW / A) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0.75 | 1.5 | 2.2 | 3.7 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 30 | 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.

# 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



<Discrimination>

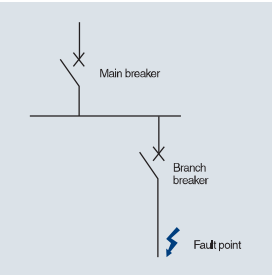
According to IEC60947-2, the discrimination can be defined as follows.

**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.

## Cascading



<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.

# Protective coordination
# Cascading, network 220/240V

## 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) | 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 TD & 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 | | | | | | | | | |

# 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 TD & 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 | | | | | | | | | |

# 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 TD & 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 | | | | | | |

# 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 TD & 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 | | | | |

# 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 TD & 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 | | | | | | | | | |

# 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 TD & 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 | | | | | | | | | |

# 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 TD & 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 | | | | | | |

# 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 TD & 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 TD & 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 TD & 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 TD & 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 |

**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 TD & 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 | | | | |

# 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 TD & 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 TD & 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 TD & 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 | | | | | | |

**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 TD & 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
# Protection discrimination table, Discrimination

## Complementary technical information

**Main: Susol MCCB 100~800AF** **Branch: AB type MCCB**

| Branch breaker | | Main breaker Rating (A) | | TD100N/H/L Trip units-Thermal magnetic | | | | | | | | | TD160N/H/L | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 80 | 100 | 100 | 125 | 160 |
| AB100 | N | Trip units-Thermal magnetic | ~10 | | | | 0.4 | 0.5 | 0.5 | 0.5 | 0.63 | 0.8 | T | T | T |
| | | | 15 | | | | | 0.5 | 0.5 | 0.5 | 0.63 | 0.8 | T | T | T |
| | | | 20 | | | | | 0.5 | 0.5 | 0.5 | 0.63 | 0.8 | 9 | 9 | 9 |
| | | | 30 | | | | | | | 0.5 | 0.63 | 0.8 | 9 | 9 | 9 |
| | | | 40 | | | | | | | | 0.63 | 0.8 | 9 | 9 | 9 |
| | | | 50 | | | | | | | | 0.63 | 0.8 | 8 | 8 | 8 |
| | | | 60 | | | | | | | | | 0.8 | 8 | 8 | 8 |
| | | | 75 | | | | | | | | | | | 8 | 8 |
| | | | 100 | | | | | | | | | | | | 8 |
| AB125 | S | | 15 | | | | | | 0.5 | 0.5 | 0.63 | 0.8 | 10 | 10 | 10 |
| | | | 20 | | | | | | 0.5 | 0.5 | 0.63 | 0.8 | 9 | 10 | 10 |
| | | | 30 | | | | | | | 0.5 | 0.63 | 0.8 | 9 | 9 | 9 |
| | | | 40 | | | | | | | | 0.63 | 0.8 | 9 | 9 | 9 |
| | | | 50 | | | | | | | | 0.63 | 0.8 | 8 | 8 | 8 |
| | | | 60 | | | | | | | | | 0.8 | 8 | 8 | 8 |
| | | | 75 | | | | | | | | | | 8 | 8 | 8 |
| | | | 100 | | | | | | | | | | | 8 | 8 |
| | | | 125 | | | | | | | | | | | | 8 |
| | H | | 15 | | | | | 0.5 | 0.5 | 0.5 | 0.63 | 0.8 | 10 | 10 | 10 |
| | | | 20 | | | | | | 0.5 | 0.5 | 0.63 | 0.8 | 9 | 10 | 10 |
| | | | 30 | | | | | | 0.5 | 0.5 | 0.63 | 0.8 | 9 | 9 | 9 |
| | | | 40 | | | | | | | 0.5 | 0.63 | 0.8 | 9 | 9 | 9 |
| | | | 50 | | | | | | | | 0.63 | 0.8 | 8 | 8 | 8 |
| | | | 60 | | | | | | | | 0.63 | 0.8 | 8 | 8 | 8 |
| | | | 75 | | | | | | | | | 0.8 | 8 | 8 | 8 |
| | | | 100 | | | | | | | | | | | 8 | 8 |
| | | | 125 | | | | | | | | | | | | |
| AB203 | N | Trip units-Thermal magnetic | 100 | | | | | | | | | | | | |
| | | | 125 | | | | | | | | | | | | |
| | | | 150 | | | | | | | | | | | | |
| | | | 175 | | | | | | | | | | | | |
| | | | 200 | | | | | | | | | | | | |
| | | | 225 | | | | | | | | | | | | |
| | | | 250 | | | | | | | | | | | | |
| | S | | 100 | | | | | | | | | | | | |
| | | | 125 | | | | | | | | | | | | |
| | | | 150 | | | | | | | | | | | | |
| | | | 175 | | | | | | | | | | | | |
| | | | 200 | | | | | | | | | | | | |
| | | | 225 | | | | | | | | | | | | |
| | | | 250 | | | | | | | | | | | | |
| | H | | 100 | | | | | | | | | | | | |
| | | | 125 | | | | | | | | | | | | |
| | | | 150 | | | | | | | | | | | | |
| | | | 175 | | | | | | | | | | | | |
| | | | 200 | | | | | | | | | | | | |
| | | | 225 | | | | | | | | | | | | |
| | | | 250 | | | | | | | | | | | | |

| | TS100N/H/L | | | | | TS160N/H/L | | | TS250N/H/L | | | | TS400N/H/L | | TS630N/H/L | | TS800N/H/L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Trip units-Thermal magnetic/Electronic | | | | | | | | | | | | | | | | |
| | 40 | 50 | 63 | 80 | 100 | 100 | 125 | 160 | 125 | 160 | 200 | 250 | 300 | 400 | 500 | 630 | 800 |
| | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T |
| | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T |
| | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T |
| | | | T | T | T | T | T | T | T | T | T | T | T | T | T | T | T |
| | | | | T | T | T | T | T | T | T | T | T | T | T | T | T | T |
| | | | | T | T | T | T | T | T | T | T | T | T | T | T | T | T |
| | | | | | T | T | T | T | T | T | T | T | T | T | T | T | T |
| | | | | | | | T | T | T | T | T | T | T | T | T | T | T |
| | | | | | | | | T | T | T | T | T | T | T | T | T | T |
| | 10 | 10 | 10 | 11 | 11 | 11 | 12.5 | 12.5 | 15 | 15 | 18 | 18 | T | T | T | T | T |
| | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 12.5 | 15 | 15 | 15 | 18 | T | T | T | T | T |
| | | | 8 | 10 | 11 | 11 | 11 | 11 | 15 | 15 | 15 | 18 | 20 | T | T | T | T |
| | | | | 8 | 11 | 11 | 11 | 11 | 15 | 15 | 15 | 15 | 20 | T | T | T | T |
| | | | | 8 | 11 | 11 | 11 | 11 | 15 | 15 | 15 | 15 | 20 | 20 | T | T | T |
| | | | | | 8 | 8 | 8 | 11 | 12.5 | 12.5 | 12.5 | 12.5 | 20 | 20 | 20 | T | T |
| | | | | | | | 8 | 11 | 12.5 | 12.5 | 12.5 | 12.5 | 20 | 20 | 20 | T | T |
| | | | | | | | | 11 | 12.5 | 12.5 | 12.5 | 12.5 | 20 | 20 | 20 | T | T |
| | | | | | | | | 11 | 12.5 | 12.5 | 12.5 | 12.5 | 20 | 20 | 20 | T | T |
| | 10 | 10 | 10 | 11 | 11 | 11 | 12.5 | 12.5 | 15 | 15 | 18 | 18 | 25 | 25 | 25 | 25 | T |
| | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 12.5 | 15 | 15 | 15 | 18 | 25 | 25 | 25 | 25 | T |
| | | | 8 | 10 | 11 | 11 | 11 | 11 | 15 | 15 | 15 | 18 | 20 | 25 | 25 | 25 | T |
| | | | | 8 | 11 | 11 | 11 | 11 | 15 | 15 | 15 | 15 | 20 | 25 | 25 | 25 | T |
| | | | | 8 | 11 | 11 | 11 | 11 | 15 | 15 | 15 | 15 | 20 | 20 | 25 | 25 | T |
| | | | | | 8 | 8 | 8 | 11 | 12.5 | 12.5 | 12.5 | 12.5 | 20 | 20 | 20 | 25 | T |
| | | | | | | | 8 | 11 | 12.5 | 12.5 | 12.5 | 12.5 | 20 | 20 | 20 | 25 | T |
| | | | | | | | | 11 | 12.5 | 12.5 | 12.5 | 12.5 | 20 | 20 | 20 | 25 | T |
| | | | | | | | | 11 | 12.5 | 12.5 | 12.5 | 12.5 | 20 | 20 | 20 | 25 | T |
| | | | | | | | 8 | 8 | | | 8 | 8 | T | T | T | T | T |
| | | | | | | | | 8 | | | | 8 | T | T | T | T | T |
| | | | | | | | | | | | | | 15 | 15 | 15 | 15 | T |
| | | | | | | | | | | | | | 12.5 | 12.5 | 15 | 15 | T |
| | | | | | | | | | | | | | 11 | 12.5 | 12.5 | 12.5 | T |
| | | | | | | | | | | | | | 11 | 11 | 12.5 | 12.5 | T |
| | | | | | | | | | | | | | 11 | 11 | 12.5 | 12.5 | T |
| | | | | | | | 8 | 8 | | | 8 | 8 | 18 | 18 | 18 | 18 | T |
| | | | | | | | | 8 | | | | 8 | 18 | 18 | 18 | 18 | T |
| | | | | | | | | | | | | | 15 | 15 | 15 | 15 | T |
| | | | | | | | | | | | | | 12.5 | 12.5 | 15 | 15 | T |
| | | | | | | | | | | | | | 11 | 12.5 | 12.5 | 12.5 | T |
| | | | | | | | | | | | | | 11 | 11 | 12.5 | 12.5 | T |
| | | | | | | | | | | | | | 11 | 11 | 12.5 | 12.5 | T |
| | | | | | | | 8 | 8 | | | 8 | 8 | 18 | 18 | 18 | 18 | 28 |
| | | | | | | | | 8 | | | | 8 | 18 | 18 | 18 | 18 | 28 |
| | | | | | | | | | | | | | 15 | 15 | 15 | 15 | 28 |
| | | | | | | | | | | | | | 12.5 | 12.5 | 15 | 15 | 28 |
| | | | | | | | | | | | | | 11 | 12.5 | 12.5 | 12.5 | 28 |
| | | | | | | | | | | | | | 11 | 11 | 12.5 | 12.5 | 28 |
| | | | | | | | | | | | | | 11 | 11 | 12.5 | 12.5 | 28 |

# Protective coordination
# Protection discrimination table, Discrimination

## Complementary technical information

**Main: Susol TD 100/160** **Branch: Susol TD 100/160**

| Branch breaker | | Main breaker Rating (A) | | TD100N/H/L Trip units-Thermal magnetic/Electronic | | | | | | | | | TD160N/H/L | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 80 | 100 | 100 | 125 | 160 |
| TD100 | N | Trip units-Thermal 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 |
| | | | 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 |
| | | | 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 |
| TD160 | N | | 100 | | | | | | | | | | | 1 | 1.6 |
| | | | 125 | | | | | | | | | | | | 1.25 |
| | | | 160 | | | | | | | | | | | | |
| | H | | 100 | | | | | | | | | | | | 1.6 |
| | | | 125 | | | | | | | | | | | | 1.25 |
| | | | 160 | | | | | | | | | | | | |
| | L | | 100 | | | | | | | | | | | | 1.6 |
| | | | 125 | | | | | | | | | | | | 1.25 |
| | | | 160 | | | | | | | | | | | | |

# 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 Rating (A) | | TS100N/H/L | | | | | TS160N/H/L | | | TS250N/H/L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Trip units-Thermal magnetic/Electronic | | | | | | | | | | | |
| | | | | 40 | 50 | 63 | 80 | 100 | 100 | 125 | 160 | 125 | 160 | 200 | 250 |
| TD100 | N | Trip units-Thermal 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 |
| TD160 | N | | 100 | | | | | | | 1 | 1.6 | 1 | 2.6 | 4 | 5 |
| | | | 125 | | | | | | | | 1.25 | | 1.25 | 4 | 5 |
| | | | 160 | | | | | | | | | | | | 5 |
| | H | | 100 | | | | | | | 1 | 1.6 | 1 | 2.6 | 4 | 5 |
| | | | 125 | | | | | | | | 1.25 | | 1.25 | 4 | 5 |
| | | | 160 | | | | | | | | | | | | 5 |
| | L | | 100 | | | | | | | 1 | 1.6 | 1 | 2.6 | 4 | 5 |
| | | | 125 | | | | | | | | 1.25 | | 1.25 | 4 | 5 |
| | | | 160 | | | | | | | | | | | | 5 |

# Protective coordination
# Protection discrimination table, Discrimination

## Complementary technical information

**Main: Susol TS 400/630/800(Electronic)** **Branch: Susol TS 100/160**

| Branch breaker | | Main breaker Rating (A) | | TS400N/H/L | | TS630N/H/L | | TS800N/H/L |
|---|---|---|---|---|---|---|---|---|
| | | | | Trip units-Thermal magnetic/Electronic | | | | |
| | | | | 300 | 400 | 500 | 630 | 800 |
| TD100 | N | Trip units-Thermal 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 |

# Protective coordination
# Protection discrimination table, Discrimination

## Complementary technical information

**Main: Susol 1000/1250/1600** **Branch: Susol TS 100/160**

| Branch breaker | | Main breaker Rating (A) | | TS1000L | | TS1000N/H | | TS1250N/H | TS1600N/H |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Trip units-Electronic(Instant OFF) | | | | | |
| | | | | 800 | 1000 | 800 | 1000 | 1250 | 1600 |
| TD100 | N | Trip units-Thermal 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 | 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 | 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 |

# 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 Rating (A) | TS100N/H/L | | | | | TS160N/H/L | | | TS250N/H/L | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Trip units-Thermal magnetic/Electronic | | | | | | | | | | | |
| | | | 40 | 50 | 63 | 80 | 100 | 100 | 125 | 160 | 125 | 160 | 200 | 250 |
| TS100 | N | 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 | | | | | | | | | | | | |
| | | 250 | | | | | | | | | | | | |
| | H | 125 | | | | | | | | | | | 1.25 | 2.5 |
| | | 160 | | | | | | | | | | | | 2.5 |
| | | 200 | | | | | | | | | | | | |
| | | 250 | | | | | | | | | | | | |
| | L | 125 | | | | | | | | | | | 1.25 | 2.5 |
| | | 160 | | | | | | | | | | | | 2.5 |
| | | 200 | | | | | | | | | | | | |
| | | 250 | | | | | | | | | | | | |

Trip units-Thermal magnetic

# 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 Rating (A) | | TS400N/H/L | | TS630N/H/L | | TS800N/H/L |
|---|---|---|---|---|---|---|---|---|
| | | | | Trip units-Thermal magnetic/Electronic | | | | |
| | | | | 300 | 400 | 500 | 630 | 800 |
| TS100 | N | Trip units-Thermal 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 |

# Protective coordination
# Protection discrimination table, Discrimination

## Complementary technical information

**Main: TS1000/1250/1600** **Branch: TS100/160/250**

| Branch breaker | | Main breaker Rating (A) | | TS1000L | | TS1000N/H | | TS1250N/H | TS1600N/H |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Trip units-Electronic(Instant OFF) | | | | | |
| | | | | 800 | 1000 | 800 | 1000 | 1250 | 1600 |
| TS100 | N | Trip units-Thermal 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 |

# Protective coordination
# Protection discrimination table, Discrimination

## Complementary technical information

**Main: Susol TS 400/630/800(Electronic)** **Branch: Susol TS 400/630/800**

| Branch breaker | | Main breaker Rating (A) | TS400N/H/L | | TS630N/H/L | | TS800N/H/L |
|---|---|---|---|---|---|---|---|
| | | | Trip units-Thermal magnetic/Electronic | | | | |
| | | | 300 | 400 | 500 | 630 | 800 |
| TS400 | N | 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 | | | | | |

Trip units-Thermal magnetic

## Complementary technical information

**Main: Susol TS 1000/1250/1600** **Branch: Susol TS 400/630/800/1000/630/800(Electronic)**

| Branch breaker | | Main breaker Rating (A) | TS1000L | | TS1000N/H | | TS1250N/H | TS1600N/H |
|---|---|---|---|---|---|---|---|---|
| | | | Trip units-Electronic(Instant OFF) | | | | | |
| | | | 800 | 1000 | 800 | 1000 | 1250 | 1600 |
| TS400 | N | 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 | 800 | | | | | 25 | 25 |
| | | 1000 | | | | | | 25 |
| | H | 800 | | | | | 25 | 25 |
| | | 1000 | | | | | | 25 |
| | L | 800 | | | | | 50 | 50 |
| | | 1000 | | | | | | 50 |

Trip units-Thermal magnetic (TM)

Trip units-Electronic

# Protective coordination
# Motor protection discrimination table

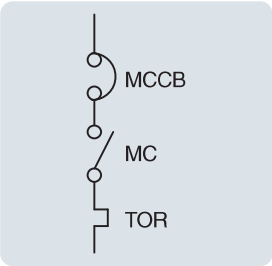
## Complementary technical information

**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 | | | | | | | | | | |

| | TD160N/H/L | | | TS250N/H/L | | TS100N/H/L | | TS160N/H/L TS250N/H/L | | | TS400N/H/L 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 |
| | | | | | | | | | | | | 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 |
| | | | | | | | | | | | | T | T | T |
| | | | | | | | | | | | | | | |

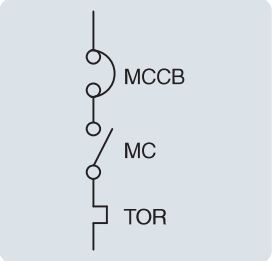
# Protective coordination
# Type 2 Coordination according to IEC60947-4-1




| 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 |

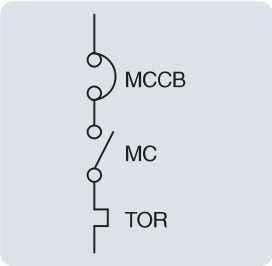
# Protective coordination
# Type 2 Coordination according to IEC60947-4-1




| 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 Ir (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 |

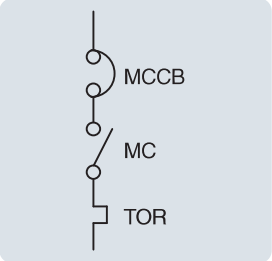
# Protective coordination
# Type 2 Coordination according to IEC60947-4-1




| 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 Ir (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 |

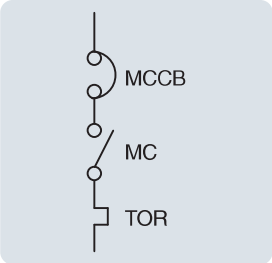
## Protective coordination
## Type 2 Coordination according to IEC60947-4-1




| 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 Ir (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 | 42kA | 72kA | 130kA |
| TS100 | 42kA | 72kA | 130kA |

| Motor | | MCCB | | Contactor | Thermal overload relay | |
|---|---|---|---|---|---|---|
| kW | A | Type | Rating Ir (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 |

# Protective coordination
# Type 2 Coordination according to IEC60947-4-1]

## 440V - N type

| Rated operational power | | MCCB | | Contactor | Thermal overload relays | | Short circuit breaking capacity | |
|---|---|---|---|---|---|---|---|---|
| kW | Current[A] 440V | Type | Rating [A] | Type | Type | Setting range [A] | Ir[kA] | Iq[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] 440V | Type | Rating [A] | Type | Type | Setting range [A] | Ir[kA] | Iq[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 |

# 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] 440V | Type | Rating [A] | Type | Type | Setting range [A] | Ir[kA] | Iq[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 |

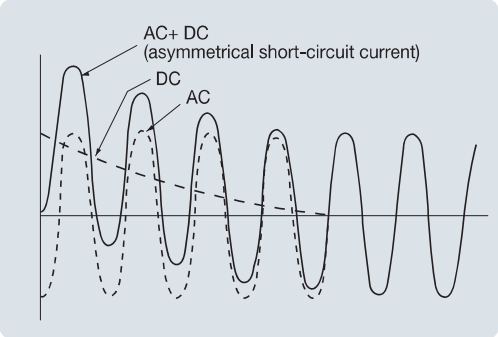
# How to calculate short-circuit current value
# Various short-circuit

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 wrings, 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: Imax

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.

$$Imax = \gamma I\ (rms)sym$$

### Network impedance for calculating short-circuit current value

Bellows should be considered for the calculation as the impedance components affecting circuit to trouble spot from short-circuit power.

a. 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.

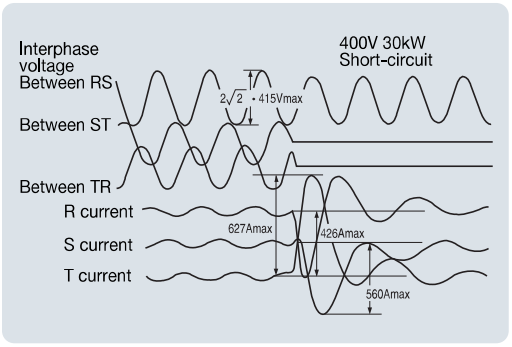
b. Impedance of incoming transformer Its amount is upon the capacity of transformer and primary voltage. Generally this impedance can be regarded as reactance and refer to <Table.4>, <Table.5>.

## 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 ( Ω ), percent impedance formula (%), unit formula (per unit) can be applied to calculate short-circuit current value.

### Ohm formula [ Ω ]

Short-circuit current value is calculated by converting into ohm value [ Ω ]

### 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

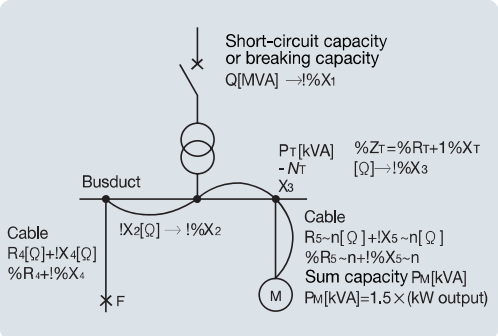
The rated current of transformer shall be the base value.

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 $Z_B = \frac{V_B^2}{P_B \times 10^3} = \frac{V_T^2}{P_T \times 10^3}$ [ Ω ]




<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: %ZT
It generally indicates as percent impedance. If base capacity is equal to transformer capacity, %ZT 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: %Xm
Transformer capacity shows the value in kW, so it is converted into unit, kVA.
(kVA value) ≒1.5×(Output of motor, kW)
%Xm= 25% Converting it from base capacity

$$\frac{P_M}{\%Xm} = \frac{P_B}{\%Xm}$$

(Converting formula for different capacity)

d. Impedance of busduct, cable
Cable: Area of cross-section & length
Busduct: Rated current

In <Fig.5>, <Fig.6>
$Z_C$ = ( Ω per each unit length) × (length) [ Ω ]
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.

# 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.

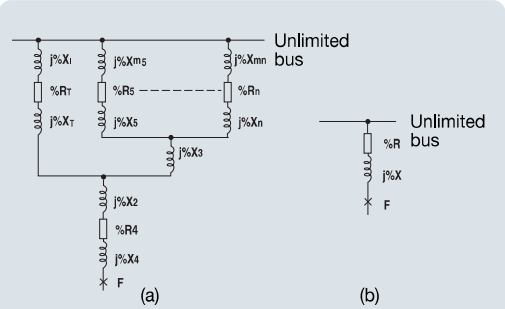
### Calculating impedance

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

$I_F(3\phi) = I_F(\text{rms})\text{sym}\,(3\phi)$

$$= \frac{P_B \times 10^3}{\sqrt{3}V_B \bullet \%Z} \times 100$$

$$= \frac{I_B}{\%Z} \times 100[A]$$

Calculate various short-circuit current value with $\alpha$, $\beta$, $\gamma$ values from <Fig.5> like

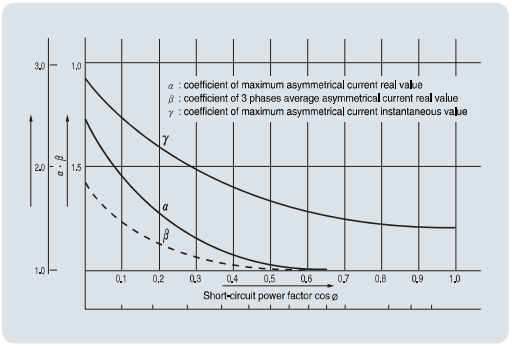
short-circuit power factor $\cos\phi = \frac{\%R}{\%Z}$

3 phases average asymmetrical real value
$I_F(\text{rms})\text{ave} = \beta I_F(\text{rms})\text{sym}$
Maximum average asymmetrical real value
$I_F(\text{rms})\text{asym} = \Omega\, I_F(\text{rms})\text{sym}$
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 ø )= $\frac{\sqrt{3}}{2}$
(3phases short-circuit current) × $\alpha$ (or $\gamma$)




<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

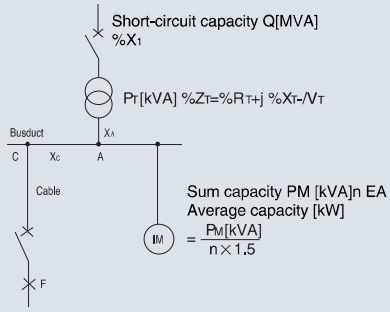
It shall be the rated current of transformer.

$P_B$= PT [kVA]

$V_B$= VT [V]

$I_B$= IT [A]

$$Z_B = \frac{VT_B\ [\Omega]}{PT \times 103}$$




<Fig.6> Base value

### Short-circuit current from incoming circuit

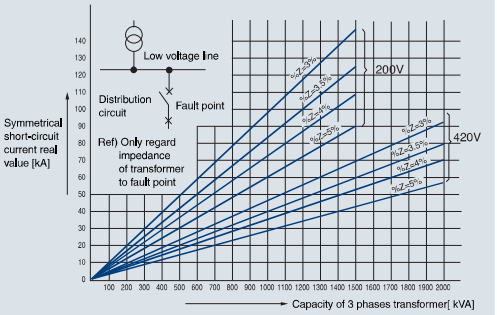
Disregard the impedance value of primary part of transformer. Calculate short-circuit current value according to <Fig.7>.
(If the impedance value of primary part of transformer is considered, calculate the current value as below formula)

$$I_A(R) = \frac{I_B}{\sqrt{(\%R_T)^2 + (\%X_1 + \%X_T)^2}} \times 100[A]$$

$$\%X_1 = \frac{P_B}{Q \times 10^3} \times 100\ [\%]$$

If the value of $\%R_T$ is not clear, $\%Z_T \fallingdotseq \%T_T$

$$I_A(R) = \frac{I_B}{\%X_1 + \%X_T} \times 100[A]$$




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 Zt (%) Impedance line which is mostly close to Zt (%) shall be selected to calculate it.
i.e. 420V, Zt= 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 × Σ (Rated current of motor)

### Symmetrical short-circuit current at point A

$I_A$= $I_A$ (R)+$I_A$ (M)

### Decreasing coefficient caused by busduct

Obtaining the value of $\frac{l \cdot I_A}{10VT}$

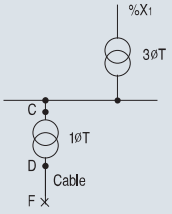
Calculate decreasing coefficient from <Fig.10>

### 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: $X_D$[ Ω ] (impedance of 1 ø T)



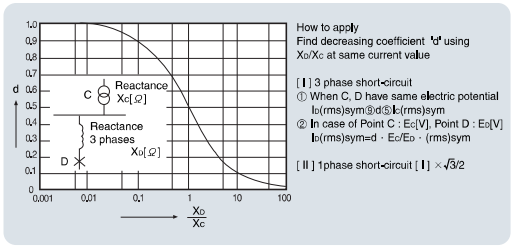
# How to calculate short-circuit current value

Calculating the value of $X_D/X_C$ and decreasing coefficient d from the reactance of <Fig.9>.
Current at point D $I_D = d \cdot I_C$

Impedance of 1 phase transformer $X_D = X\,(1\,\phi)\,\frac{1}{2}$

a. Short-circuit current at $E_C$ voltage base
$I_D$ (rms)sym · 3ø = d · $I_C$ (rms)sym · 3ø

b. Short-circuit current at $E_D$ voltage base
$I_D$ (rms)sym · 3ø = d · $I_C$ (rms)sym · 3ø × $E_C/E_D$




<Fig.9> Decreasing coefficient of short-circuit current by reactance: d

### Coefficient d for cables

Calculating the value of $\frac{l\ I_D}{10V_T}$

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

$I_F$ (rms)sym= b × $I_D$[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>

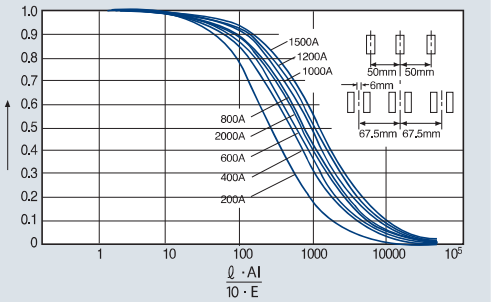
- 3 phases short-circuit asymmetrical current average value
  $I_F$ (rms)ave= $\beta I_F$ (rms)sym
- Maximum asymmetrical real value
  $I_F$ (rms)ave= $\alpha I_F$ (rms)sym
- Maximum asymmetrical instantaneous value
  $I_F$ (rms)ave= $\gamma I_F$ (rms)sym

<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 |

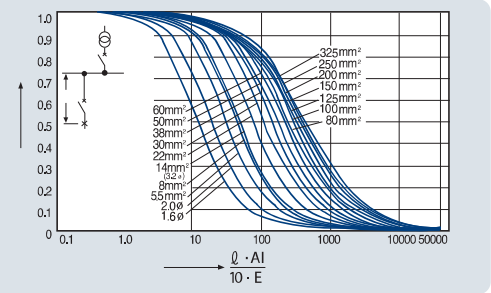
### 1 phase short-circuit

(Each current)= $\frac{\sqrt{3}}{2}$ × 3 phases short-circuit current × $\gamma$ (or $\alpha$)

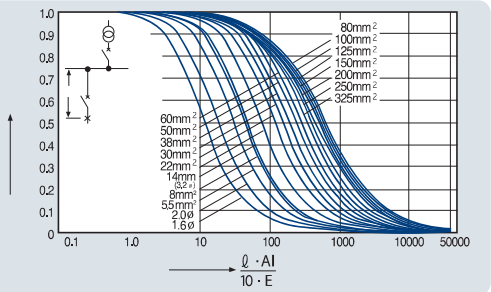



| Busduct Ratings (A) | Material | General busduct Size [mm] [Ω/m] | Resistance R [Ω/m] | Reactance X [Ω/m] | Impedance Z [Ω/m] |
|---|---|---|---|---|---|
| 200 | Cu | 3×25 | $2.41\times10^{-4}$ | $1.312\times10^{-4}$ | $2.74\times10^{-4}$ |
| 400 | Cu | 6×40 | $0.751\times10^{-4}$ | $1.02\times10^{-4}$ | $1.267\times10^{-4}$ |
| 600 | Cu | 6×50 | $0.607\times10^{-4}$ | $0.91\times10^{-4}$ | $1.094\times10^{-4}$ |
| 800 | Cu | 6×75 | $0.412\times10^{-4}$ | $0.72\times10^{-4}$ | $0.830\times10^{-4}$ |
| 1000 | Cu | 6×100 | $0.315\times10^{-4}$ | $0.60\times10^{-4}$ | $0.678\times10^{-4}$ |
| 1200 | Cu | 6×125 | $0.261\times10^{-4}$ | $0.516\times10^{-4}$ | $0.578\times10^{-4}$ |
| 1500 | Cu | 6×150 | $0.221\times10^{-4}$ | $0.449\times10^{-4}$ | $0.500\times10^{-4}$ |
| 2000 | Cu | 6×125×2 | $0.129\times10^{-4}$ | $0.79\times10^{-4}$ | $0.800\times10^{-4}$ |

<Fig.10> Decreasing coefficient of general busduct (Cu)



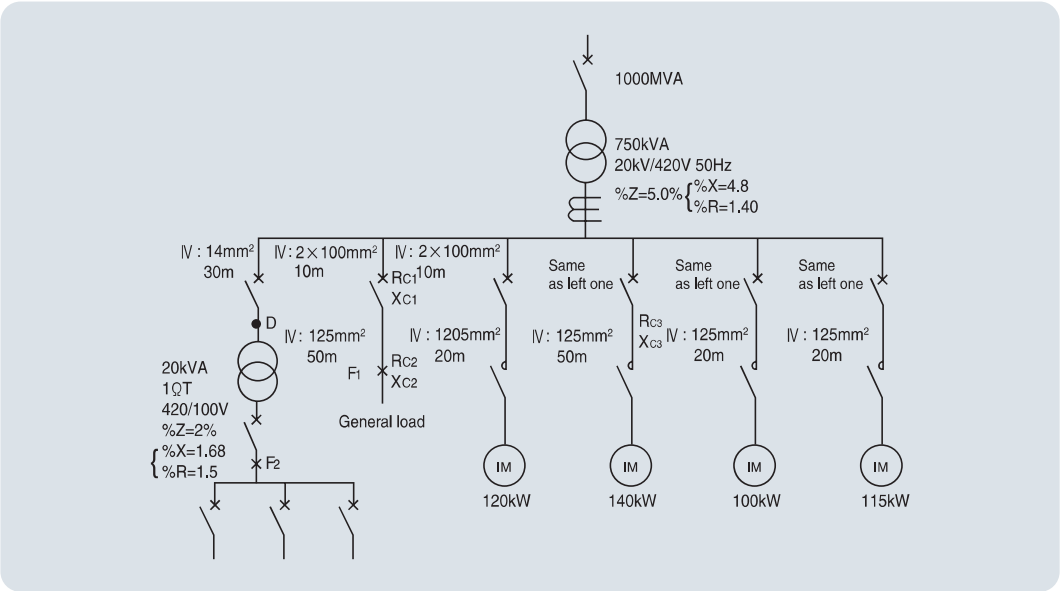

<Fig.11> Decreasing coefficient b in cable (600V IV)




<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

$P_B$ = 750kVA $V_B$ = 420V

$I_B$ = 1031A $Z_B$ = 0.237 Ω

(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

$\%R_T$ = 1.4%

$\%X_T$ = 4.8%

c. 1 Ø 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

[2×100mm² 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]

$$\%R_{C3} = \frac{0.00007 \times 50}{0.237} \times 100 = 1.47\ [\%]$$

$$\%X_{C3} = \frac{0.00013 \times 50}{0.237} \times 100 = 2.74\ [\%]$$

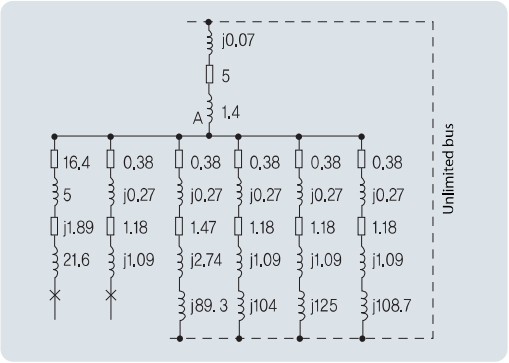
[14mm² 30m]

$$\%R_{C4} = \frac{0.00013 \times 30}{0.237} \times 100 = 16.45\ [\%]$$

$$\%X_{C4} = \frac{0.00015 \times 30}{0.237} \times 100 = 1.88\ [\%]$$

# How to calculate short-circuit current value

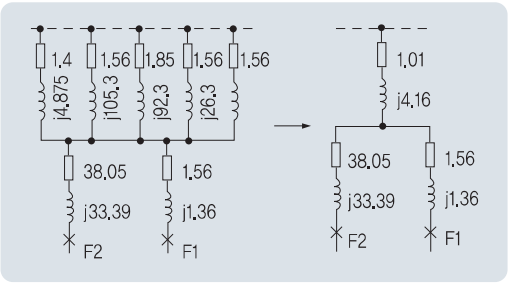
(3) Preparing a impedance map
Connect short-circuit supplier to the unlimited bus.




<Fig.14>

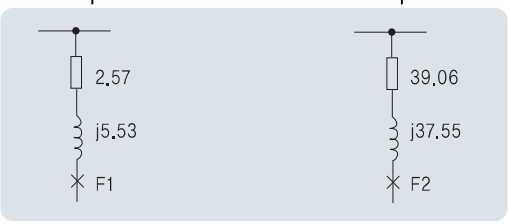
**Calculating impedance**

Calculate it in serial/parallel type formula




<Fig.15>

a. Fault point $F_1$ b. Fault point $F_2$




$\%Z_1 = \sqrt{(2.57)^2 + (5.53)^2} = 6.1[\%]$ $\%Z_2 = \sqrt{(39.06)^2 + (37.55)^2} = 54.2[\%]$

(5) Calculation of asymmetrical short-circuit current

a. Fault point $F_1$

$$I_{F1}\,(\text{rms})\text{sym} = \frac{1031}{6.1} \times 100 = 16900[\text{A}]$$

$$\cos \phi_1 = \frac{2.57}{6.1} = 0.422$$

b. Fault point $F_2$ (1 phase circuit)

$$I_{F2}\,(\text{rms})\text{sym} = \frac{1031}{54.2} \times 100 = 1902[\text{A}] \cdots \text{(at 100V)}$$

$$= \frac{1031}{54.2} \times 100 \times \frac{420}{100} = 7989[\text{A}] \cdots \text{(at 420V)}$$

$I_{F2}$ (rms)sym is short-circuit current. Therefore, convert it into 1 phase short-circuit current.

$$I_{F2}\,(\text{rms})1\,\Omega\,\text{sym} = 7989 \times \frac{\sqrt{3}}{2} = 6919[\text{A}]$$

$$\cos \phi_2 = \frac{39.06}{54.2} = 0.72$$

(6) Various short-circuit current
Calculate $\alpha$, $\beta$, $\gamma$ from <Fig.5>.

a. Fault point $F_1$
$\cos \phi_1 = 0.422$
$\alpha = 1.05$ $\beta = 1.3$ $\gamma = 1.74$
$I_{F1}$ (rms)ave$= 1.03 \times 16900 = 17407$ [A]
$I_{F1}$ (rms)asym$= 1.05 \times 16900 = 17745$ [A]
$I_{F1}$max$= 1.74 \times 16900 = 29406$ [A]

b. Fault point $F_2$
$\cos \phi_2 = 0.72$
$\alpha = 1.0$ $\beta = 1.48$
$I_{F2}1\,\phi$ (rms)asym$= 1.0 \times 6919$ [A]
$I_{F2}1\,\phi$ max$= 1.48 \times 6919 = 10240$ [A]

**Simple calculation formula**

(1) Base value
$P_B = 750$kVA $V_B = 420$V
$I_B = 1031$A $Z_B = 0.237\,\Omega$

(2) Short-circuit current of incoming circuit
Disregard the impedance of primary part of transformer
In <Fig.7> $I_{A(R)} = 20500$ A

(3) Short-circuit current of motor
Sum of motor capacity=
$(120+140+100+115) \times 1.5 = 713$ [kVA]

$$I_{A(M)} = \frac{713}{\sqrt{3} \times 420} \times 4 = 3920[\text{A}]$$

(4) Symmetrical short-circuit current at point A
$I_A = 20500+3920 = 24420$ [A]

# How to calculate short-circuit current value Calculation example

(5) Decreasing short-circuit current for cable

a. At point $F_1$

- $2\times100mm^2$ 10m

  $2\times100mm^2$ 10m= $100mm^2$ 5m

$$\frac{l}{10E}\,I_A=\frac{20\times24420}{10\times420}=29.1$$

Coefficient b= 0.935

Short-circuit current value at point C

Ic (rms)sym= $0.935\times24420=$ 22850 [A]

- $125mm^2$ 20m

$$\frac{l}{10E}\,I_C=\frac{20\times22850}{10\times420}=108.9$$

$I_{F1}$ (rms) sym= $0.785\times244850=$ 17940 [A]

b. At point $F_1$

- $14mm^2$ 30m

$$\frac{l}{10E}\,I_C=\frac{30\times24420}{10\times420}=174.4$$

Coefficient b= 0.249

$I_D$ (rms)3 ø sym= $0.24\times24420=$ 6080 [A]

- Decreasing by the reactance (1 ø Tr)dp

  Convert the value of '%X of 1 ø Tr' to base capacity

  $X_D=750\times2/20=75\%$

  Impedance of primary part at 1 ø Tr

$$XA=\frac{I_B}{I_D}\times100=\frac{1031}{6080}\times100[\%]$$

Convert $X_D$ to equivalent 3 phases, and

$$\frac{X_D/2}{X_A}=\frac{750\times2\times6080}{20\times2\times1031\times100}=2.21$$

Coefficient d of <Fig.9> d= 0.32

$I_{F2}$ (rms)3 ø sym= $0.32\times6080=1945$ [A] (400V)

$= 0.32\times6080\times420/100$

$= 817$ [A] (100V)

$$\therefore\ I_{F2}\text{ (rms)1 ø sym}=8171\times\frac{\sqrt{3}}{2}=7076\text{ [A]}$$

(6) Various short-circuit current

Find $\alpha$, $\beta$, $\gamma$ from <Table.1>

a. At point $F_1$

$\alpha=1.25$ $\beta=1.13$ $\gamma=2.17$

IF1 (rms)ave= $1.13\times17940=$ 20272 [A]

IF1 (rms)asym= $1.25\times17940=$ 22425 [A]

IF1max= $2.17\times17940=$ 38930 [A]

b. At point $F_2$

$\alpha=1.13$ $\gamma=1.94$

IF21 ø (rms)asym= $1.13\times7076=$ 7945 [A]

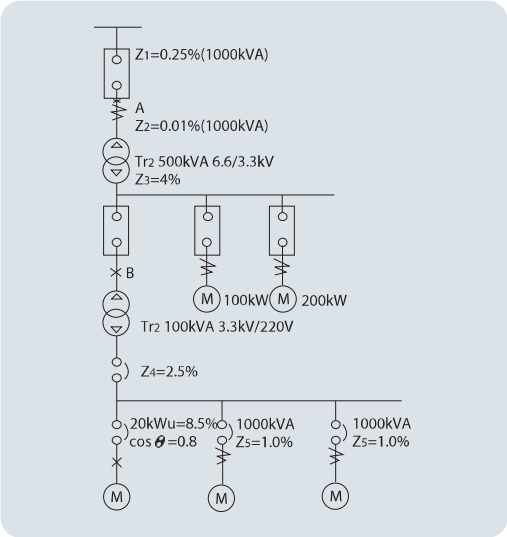
IF21 ø max= $1.94\times7076=$ 13727 [A]

<Table.2> Comparison of short-circuit

| Fault point | | $F_1$ | $F_2$ |
|---|---|---|---|
| Symmetrical short-circuit current real value | Percent impedance calculation value | 16900A | 6919A |
| | Simple formula calculation value | 17940A | 7076A |
| | | 106% | 102% |
| 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

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

$$I_{nA}=\frac{500[kVA]\times1000}{\sqrt{3}\times6.6[kV]\times1000}=43.7[A]$$

② Rated current $I_{nB}$ at point B

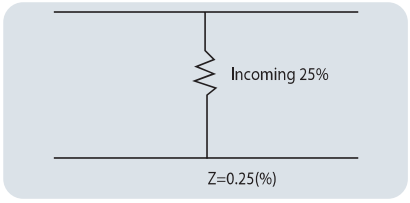
$$I_{nB}=\frac{100[kVA]\times1000}{\sqrt{3}\times3.3[kV]\times1000}=17.5[A]$$

$$I_{nC}=\frac{20[kW]\times1000}{\sqrt{3}\times220[V]\times0.85\times0.8}=77.2[A]$$

(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 $I_{SA}$

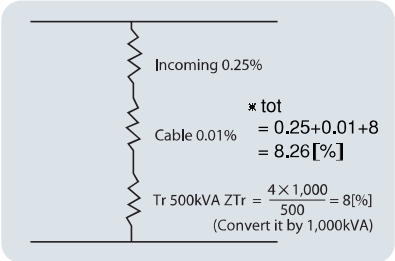
$$I_{SA}=\frac{1000[kVA]\times1000\times100}{\sqrt{3}\times6.6[kV]\times1000\times0.25\%}=34990[A]$$

∗ Breaking capacity of breaker [MVA]
MVA= 3 short-circuit current[kA] line to line voltage[kV]

② Short-circuit current at point B: $I_{SB}$

a) Impedance Map

∗ Serial sum of impedance
Ztot= 0.25+0.01+8= 8.26[%]



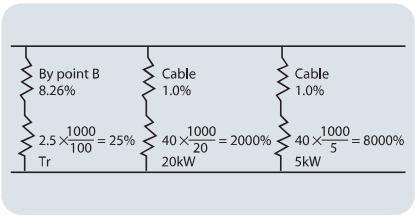

b) Short-circuit current $I_{SC}$

$$I_{SB}=\frac{1000[kVA]\times1000\times100}{\sqrt{3}\times3.3[kV]\times1000\times8.26}=2118[A]$$

∗ Breaking capacity of breaker [MVA]
MVA= $\sqrt{3}$ short-circuit current [kA] line to line voltage[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 $I_{SC}$

$$I_{SC}=\frac{1000[kVA]\times1000\times100}{\sqrt{3}\times220[V]\times32.58[\%]}=8055\ [A]$$

**Calculation formula**

Rated current $In=\frac{\text{Transformer capacity}}{\sqrt{3}\times\text{Rated voltage}}$

Short-circuit current $Is=\frac{\text{Transformer capacity}\times100}{\sqrt{3}\times\text{Rated voltage}\times\%Z}$

# How to calculate short-circuit current value
# Combination of transformer and impedance

<Table. 3> Combination of transformer and impedance

| Transformer / Impedance / Transformer capacity (VA) | 3 phases transformer | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6.3kV/210V Oil Tr. | | | 6.3kV/210V Mold Tr. | | | 20kV/420V Mold Tr. | | | 20kV/420V Oil Tr. | | |
| | 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 / Impedance / Transformer capacity (VA) | 1 phase transformer | | | | | |
|---|---|---|---|---|---|---|
| | 6.3kV/210V Oil Tr. | | | 6.3kV/210V Mold Tr. | | |
| | 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 | | | |

<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 | 0.00020 | 0.00012 | 0.00031 | 0.0089 |
| ø 2mm | | | | 0.0056 |
| ø 3.2mm | | | | 0.0022 |
| 5.5mm² | | | | 0.0033 |
| 8mm² | | | | 0.0023 |
| 14mm² | 0.00015 | 0.00010 | 0.00026 | 0.0013 |
| 22mm² | | | | 0.00082 |
| 30mm² | | | | 0.00062 |
| 38mm² | | | | 0.00048 |
| 50mm² | 0.00013 | 0.00009 | 0.00022 | 0.00037 |
| 60mm² | | | | 0.00030 |
| 80mm² | | | | 0.00023 |
| 100mm² | | | | 0.00018 |
| 125mm² | | | | 0.00014 |
| 150mm² | | | | 0.00012 |
| 200mm² | | | | 0.00009 |
| 250mm² | | | | 0.00007 |
| 325mm² | | | | 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)

[$\times 10^{-4}$ Ω /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 |

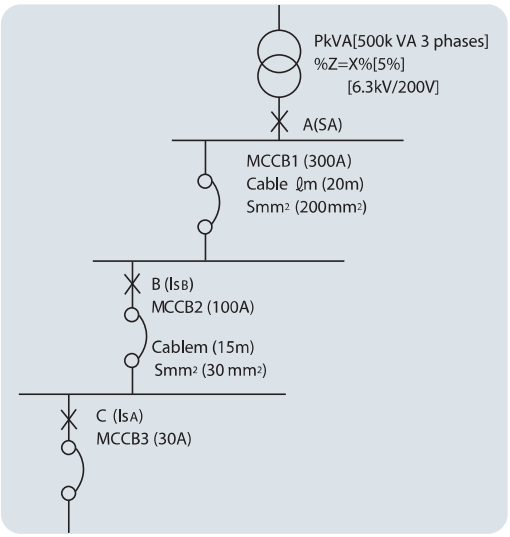
<Table.6> Impedance sample of Bus and busduct (50Hz)

[$\times 10^{-4}$ Ω /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)
$Is_1$ coordinates – Short-circuit current value (kA)
$Is_2$ coordinates – Short-circuit current value affected cable condition (kA)
ⓐ Line - % impedance of transformer (%)
ⓑ Line - Length of cable (m)
ⓒ Line - Square mm of cable ($mm^2$)
ⓓ Line - $Is_2$ (kA)

Remark) ⓒ line shows the length of hard vinyl cable (600V IV)

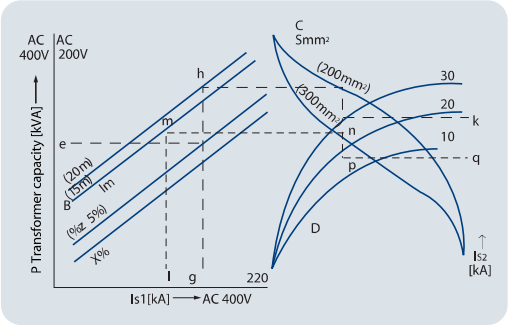
### How to calculate short-circuit current value

(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 $Is_1$ coordinates, find the value (h) of B line
- Move (h) to parallel direction of Is, and find the cross point (i) to C line.
- Move (i) to parallel direction of $Is_2$, and find the cross point value (j) to D line (g), finally find (k) of $Is_2$

(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 $Is_2$ 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.



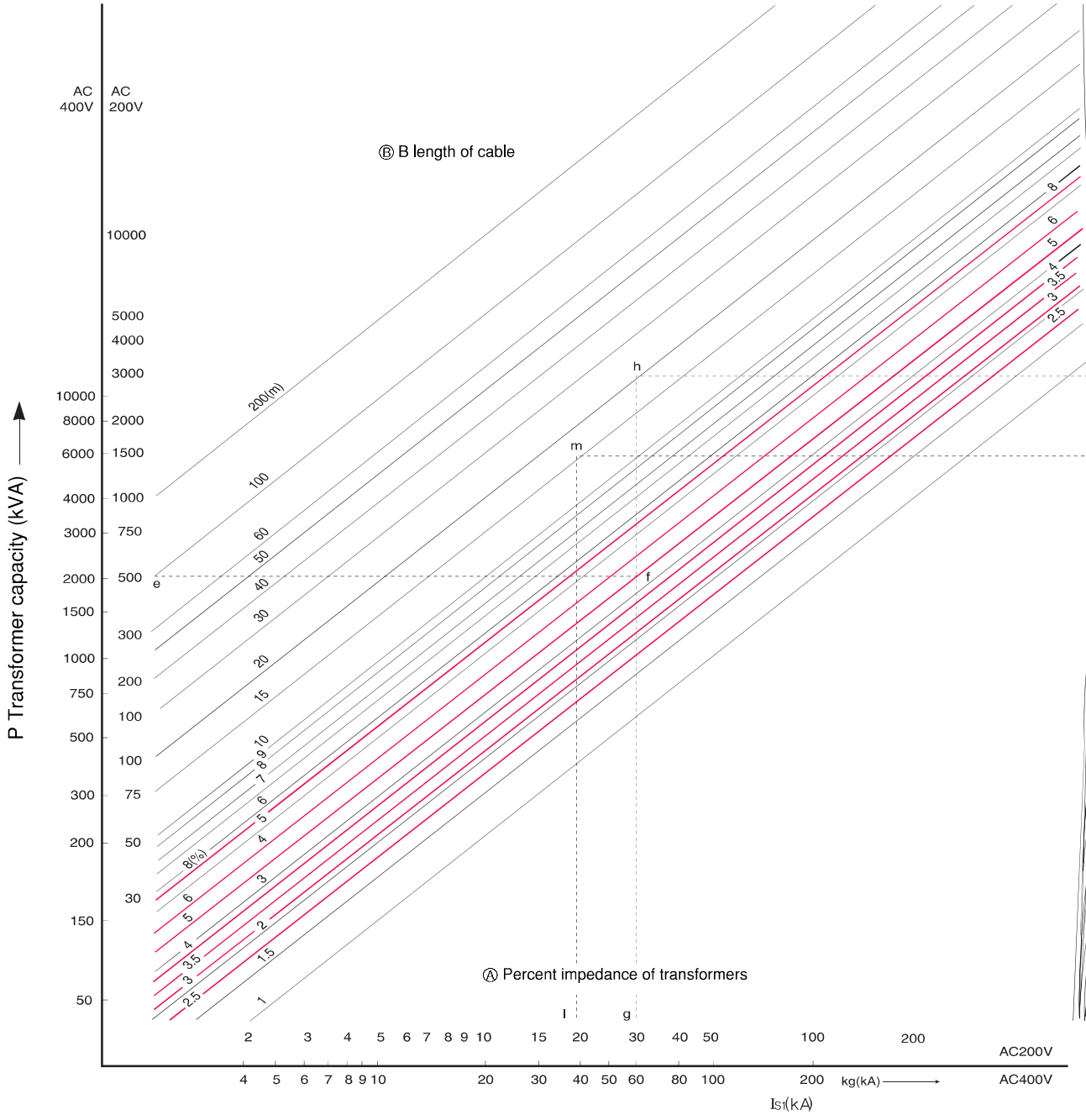
## How to calculate short-circuit current value
## Calculation graph

**(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 $Is_1$ direction and finally find (g).
- $I_{SA}$= 29kVA (g)

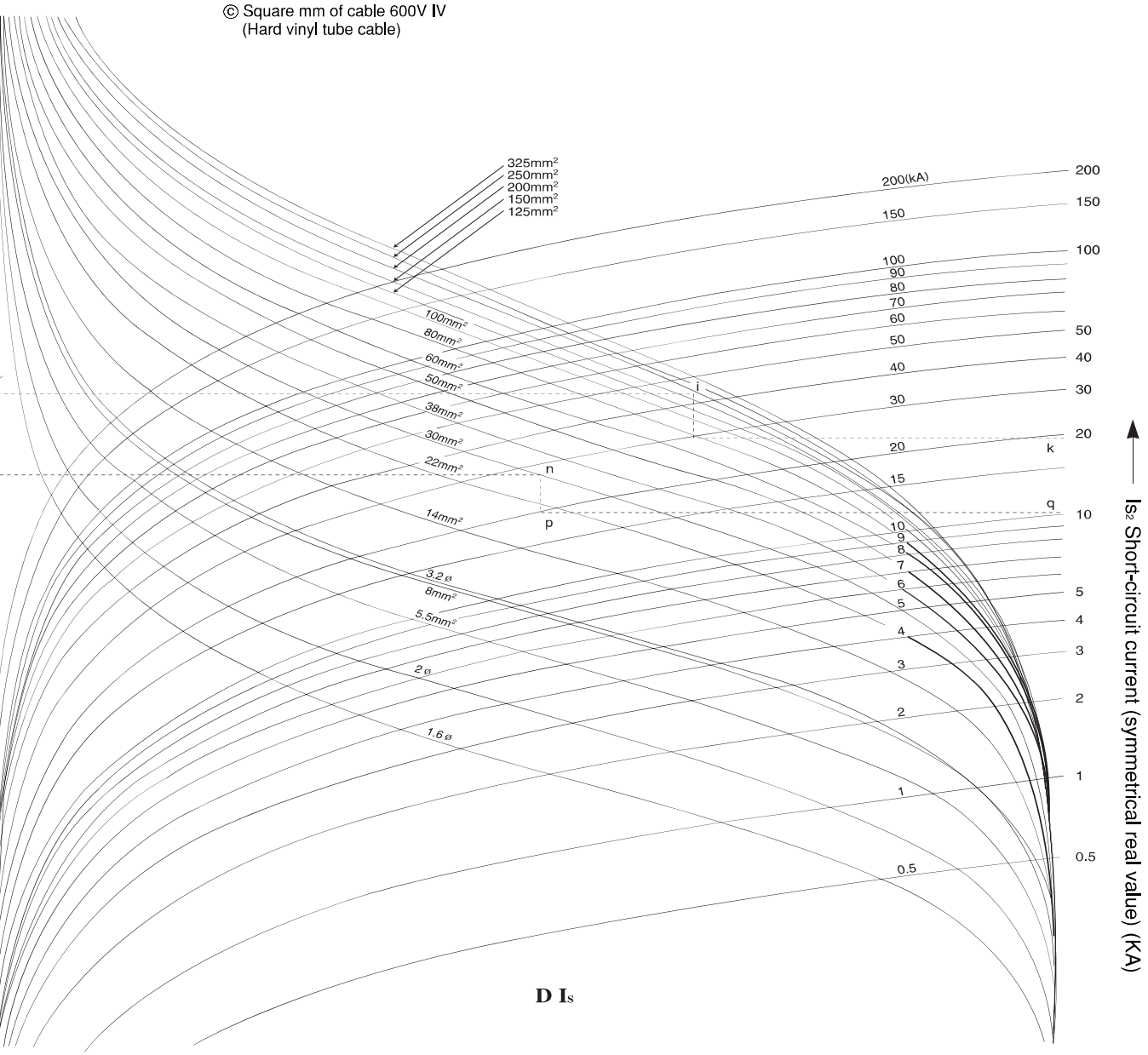
**(2) Short-circuit current value at point B ($I_{SB}$)**

- Find value h of B line (20mm) at g (= 29kA) of $Is_1$ coordinates
- Move h parallely to the direction of $Is_1$, and find value I at the cross point with C line (200mm)
- Move I parallely to the direction of $Is_2$, and find value j at the cross point with D line (g= 29kA)
- $I_{SB}$= 19kA (k)



**(3) Short-circuit current value at point C ($I_{sc}$)**

- Find $Is_1$ 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 $Is_1$ coordinates, and find the cross point n at C line (30mm).
- Move n parallelly to the direction of $Is_1$ and find the cross point p of $Is_2$with D line.
- Isc= 10kA (g)



# Certifications

## Susol

| Type | | Approvals | | | | | | Certificates |
|---|---|---|---|---|---|---|---|---|
| | Cerficate | Safety certi | IEC | UL | cUL | GB | Gosstandart | KEMA |
| | Mark and name | | CE | UL | cUL | CCC | GOST | KEMA |
| Type | | Korea | Europe | U.S.A | U.S.A | China | Russia | Netherlands |
| MCCB Susol | TE100S | | ● | | | | | ● |
| | TE100N | | ● | | | | | ● |
| | 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 Susol UL | TD125NU | | | ● | ● | | | |
| | TD125HU | | | ● | ● | | | |
| | TS250NU | | | ● | ● | | | |
| | TS250HU | | | ● | ● | | | |
| | TS400NU | | | ● | ● | | | |
| | TS400NU | | | ● | ● | | | |
| | TS800NU | | | ● | ● | | | |
| | TS800HU | | | ● | ● | | | |

Note) ●: Completion

# Certifications

**Susol**

| Type | | Approvals | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mark and name | | KR | LR | BV | ABS | GL | DNV | RINA |
| Type | | Korea | U.K | France | U.S.A | Germany | Norway | 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 | ● | ● | ● | ● | ● | ● | ● |
| | TD160L FMU | ● | ● | ● | ● | ● | ● | ● |
| 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

*Susol*

| Type | | Approvals | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mark and name | | KR | LR | BV | ABS | GL | DNV | RINA |
| Type | | Korea | U.K | France | U.S.A | Germany | Norway | Italy |
| TS 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 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 630AF | TS630E | ● | ● | ● | | | ● | ● |
| | TS630E ETS | ● | ● | ● | | | ● | ● |
| | TS630E ETM | ● | ● | ● | | | ● | ● |
| | TS630S | ● | ● | ● | | | ● | ● |
| | TS630S ETS | ● | ● | ● | | | ● | ● |
| | TS630S ETM | ● | ● | ● | | | ● | ● |
| | TS630P | ● | ● | ● | | | ● | ● |
| | TS630P ETS | ● | ● | ● | | | ● | ● |
| | TS630P ETM | ● | ● | ● | | | ● | ● |

Note) ●: Completion

# Certifications

Susol

| Type | Mark and name | KR | LR | BV | ABS | GL | DNV | RINA |
|---|---|---|---|---|---|---|---|---|
| Type | | Korea | U.K | France | U.S.A | Germany | Norway | Italy |
| TS 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 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 | ● | ● | ● | ● | ● | ● | ● |

Note) ●: Completion

# Memo

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Tel: 86-28-8612-9151 Fax: 86-28-8612-9236 e-mail: yangcf@lsis.com.cn

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Tel: 86-532-8501-6568 Fax: 86-532-583-3793 e-mail: lirj@lsis.com.cn

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**LSIS Gurgaon Office >> Gurgaon ,India**
Address: 109 First Floor, Park Central, Sector-30, Gurgaon- 122 002, Haryana, India

FUTURING SMART ENERGY



**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 a 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.

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