## Synergy Susol Switchboards

*Manufactured by Spike Electric Controls using Eatons Power Defense Circuit Breaker technology*

### About:

*The UL891 Compliant High quality Engineering Products

We, at Spike Electric Controls, introduce our Synergy Susol Switchboards range, which is an engineering marvel. We aim to bring you power products that are engineered for safety, reliability, and quality. We are committed to providing our clients with innovative solutions and meeting complex technical requirements with ease.

Our Synergy Susol Switchboards range is compliant with the specifications of the UL891 quality control standard, which is one of the most common and most widely trusted standards for switchboards. The UL standards are essentially a set of safety regulations that have been certified by OSHA (Occupational Safety and Health Administration) in the U.S. These standards have been approved by the U.S. federal government for the safety of workers.

The specifications of the UL891 quality control standard apply to the switchboards rated for 600V or less in accordance with the National Electric Code (NEC) and ANSI/NFPA 70. This standard also covers the switchboards which are used in circuits with available short circuit currents up to 2,000A or less.

Our Synergy switchboards are tested after being subject to a 2,000A fault current. This certifies that our product can survive the extreme physical stress of such an event.

This gives you an assurance that our Synergy Susol Switchboards range will hold up even in the most extreme circumstances.

The UL standards for switchboards focus on all aspects of safety W.R.T the switchboard systems. As per the requirements of the UL certification, our Synergy Susol Switchboards range is periodically sampled and tested to ensure compliance. So, there is a constant testing and thus, our task does not end with getting certified once only.

The badge of the UL certification conveys trust between the manufacturers, governing bodies, and consumers.

### Installation and Maintenance:

Synergy Switchboards – Easy Installation and Maintenance

Our Synergy Susol Switchboards range is built to last and features design innovations that facilitate easy installation and maintenance. These switchboards are easily available to meet the needs of contractors, consultants and end-users.

The Synergy Susol Switchboards range adheres to the highest standards in terms of quality. We offer custom or standard switchboards that are easy to install, we are available 24/7 to assist any installation questions. Spike Electric will provide you with a sales engineers contact information before shipping that you can call directly for any questions 24/7.

Our Synergy Susol Switchboards range designs entail the most frequently requested ratings and options, with faster delivery.

### Features for the Custom Option:

Synergy Susol Switchboards Features for the Custom option

- Circuit breaker and fusible switch mains and feeders
- NEMA Type 1, 12, 4, 4x or Type 3R available
- NEC 2017 Arc Energy Reduction available or also called arc-flash mitigation system available for main breaker
- 6000 Amp Max on Switchboards
- 65 kAIC standard bus bracing. Optional 100 or 200 kAIC
- Voltages – up to 600 Vac or 250 Vdc
- Sequence utility metering – hot or cold
- Internally mounted surge protection devices
- Customer metering
- Main Tie Main
- Dual Generator Input
- Emergency Generator Input Parallel Switchboard
- Automatic Transfer Switch Integrated into Switchboard
- Manuel Transfer Switch Integrated into Switchboard
- Distribution Transformers Integrated into Switchboard
- Mini Power Zone Integrated into Switchboard
- Long-Time Delay · Short-Time Pickup · Short-Time Delay · Instantaneous Pickup · Ground Fault Pickup available on all circuit breakers
- Custom Busway and transformer connections available
- PLC or relay based main automatic transfer schemes
- Microprocessor-based metering and monitoring equipment
- Utility metering provisions

### Features for the Standard Option:

Synergy Susol Switchboards Features for the Standard option

- Voltages to 600 Vac or 250 Vdc
- NEMA enclosure types – indoor and outdoor
- Ratings - up to 6000A, 100 kA SCCR
- Bussing options – aluminum or copper with tin plating or copper with silver plating option
- Distribution configurations available – Single or Double Row I-Line
- Internally mounted surge protection devices

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SYNERGY SWITCHBOARD SOLUTIONS
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# Safe Reliable Energy Solutions

SPIKE ELECTRIC CONTROLS

## Commercial Multi-Metering:

We offer an opportunity for providing revenue metering for multiple tenants in a cost-effective manner. Our aim is to reduce footprint requirements as well as installation time for projects that require top exit of load side cables. This proves to be an ideal option for shopping centers or for shopping malls.

## Features of Commercial Multi-Metering:

- Commercial multi-metering is a hot sequence metering.
- It is available with Lever By-pass or Non-Lever-By-pass construction.
- Switchboard ratings – through 6000A, 100 kA.
- Contains options to add future tenants and future sections.
- Factory installed devices are wired from the meter socket to disconnect.
- NEMA Type 1, 12, 4, 4x or Type 3R available.
- Alignment options include front and rear.
- Meter sections are available in three or six socket section configurations.
- 60-200A without lever by-pass contains inbuilt meter sockets, 5 or 7 jaw, ring type, test block.
- 60-200A lever by-pass contains inbuilt meter sockets, 7 jaw, ringless.
- 400-1200A have current transformer rated meter compartments.

## Synergy Low Voltage Switchboards:

Synergy low voltage switchboards offer an economical way of distributing electricity. These switchboards are customized and may be used as a service entrance equipment or as distribution centers in commercial, institutional, and industrial applications. Synergy low voltage switchboards are enclosed and free-standing structures, which contain circuit breaker for services rated up to 6000A with a maximum voltage of 600 VAC.

In addition, there is an auxiliary section that facilitates cable or bus transition. It also provides additional space for connecting the service conductors to the line side of the main.

The Synergy low voltage switchboard frame mounts various components in the switchboard, which include transfer switches, special metering systems, and throw-over systems.

## Features of Synergy Low Voltage Switchboards:

- Switchboard ampacity to 400A to 6000A
- Voltage: Up to 600Vac, or 250Vdc
- Suitable for service entrance or distribution
- NEMA enclosures – Type 1, 12, 4, 4x or Type 3R
- Testing of short circuit rating of 3 cycles (.05 seconds); or immediate trip of tested OCPD; or braced to UL configuration standards
- Accessibility: front or rear
- Assembling in factory
- Sequence utility metering for hot or cold
- Customer metering
- Availability of protective device accessories
- Fully rated copper bus systems – 1000A per sq in.
- Fully rated aluminum bus systems – 750A per sq in.
- A large array of integrated components available – SPD, distribution transformers, automation, automatic transfer switches, etc.

## Stainless Steel Switchboards & Stainless Steel Nema 4x Switchboards:

Outdoor Stainless steel switchboards are common in highly corrosive environments that a painted steel enclosure may corrode over time. The longevity of the Switchboard is significantly increased when utilizing a stainless-steel Switchboard in those types of environments. When ordering a Nema 4x Switchboard there is a lot of room for error due to some companies not understanding the heat loss calculations that need to be done on a Nema 4X Rated Switchboard. Nema 4x Switchboard should be rated for windblown dust and rain, splashing water, and hose directed water; undamaged by ice which forms on the enclosure. Circuit Breakers, switches, transfer switches and other devices generate allot of heat. The heat needs to escape through a Nema 4x ventilated or AC cooled system or the enclosure needs to be sized properly in order to withstand the internal heat. Nema 4x Switchboards can have issues like nuisance tripping of circuit breakers, over heating of components, which in turn defeats the purpose of the 4x enclosure of increasing the longevity of the internal electrical components. Let Spike Electric Design and build your custom Nema 4x Switchboard. Our team of electrical engineers will ensure the heat calculations are done properly and working with their counterpart mechanical engineers will design the enclosure to fit the custom application.

## Quick Ship Switchboards:

2-3 Week Lead Time

Synergy switchboards are quick ship switchboards which are suitable for use as service entrance equipment on ac systems. We offer custom or standard Speed D quick ship switchboards that feature our unique I-Line plug-on connections in group-mounted construction. You just need a screwdriver to ratchet the line end of a molded-case circuit breaker onto the I-Line bus assembly. This plug-on design facilitates quick installation and mounting of circuit breakers up to 1200A.

## Optional Seismic Compliance of Synergy Switchboards:

Our Synergy Switchboards adhere to the requirements of the International Building Code (IBC), California Building Code (CBC), Office of Statewide Health Planning and Development (OSHPD), and ASCE/SEI 7 based on triaxial shake table testing; for equipment operation after a seismic activity.

A shake table testing was conducted by an independent test facility and compliance was verified to Ip = 1.5. The post test equipment functionality was verified as per the ASCE 7 requirements, which are a part of the seismic designated system.

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# Safe Reliable Energy Solutions

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## Range – Benefits and Applications:

Our Synergy Susol Switchboards range provides various benefits, which include –

- custom or standard installation options
- quick installation time and mounting facility
- offer short lead times and an expedited delivery

## Quality Management System ISO 9001 Manufacturing:

Learn more about our Quality Control Management system

The Synergy Susol Switchboards range has applications in various industries , which include –

- Manufacturing
- Water wastewater
- Commercial buildings
- Healthcare facilities
- Data Centres
- Textile
- Industrial buildings
- Commercial office buildings
- Pharmaceuticals
- Offshore Designs Available
- Oil & Gas

Contact us for product questions. We are happy to help and walk you through the installation process.

## Catalog Number System

**SWBLS 4X 480V SC L 600 50 MB400 T 15-1200 ISOG**

| Catalog Prefix |
|---|
| Synergy Susol Switchboards |

| NEMA Rating | |
|---|---|
| Nema 1 | 1 |
| Nema 3R | 3 |
| Nema 4 Painted | 4 |
| Nema 4x Stainless | 4x |

| Voltage | |
|---|---|
| 3-Phase 4-Wire | 480 |
| 3-Phase 3-Wire | 400V |
| 3-Phase 3-Wire | 600V |

| Bus Material | |
|---|---|
| Aluminum | A |
| Copper | C |
| Silver Plated Copper | SC |

| Cable Incoming | |
|---|---|
| Left | L |
| Right | R |

| Bus Amps |
|---|
| 400 |
| 600 |
| 800 |
| 1200 |
| 1600 |
| 2000 |
| 2500 |
| 3000 |
| 4000 |
| 5000 |
| 6000 |

| Bus Rating | |
|---|---|
| 42ka | 42 |
| 50kA | 50 |
| 65kA | 65 |
| 85kA | 85 |
| 100kA | 100 |
| 200kA | 200 |

| Main Breaker | |
|---|---|
| 400A | MB400 |
| 600A | MB600 |
| 800A | MB800 |
| 1200A | MB1200 |
| 1600A | MB1600 |
| 2000A | MB2000 |
| 2500A | MB25000 |
| 3000A | MB3000 |
| 4000A | MB4000 |
| 5000A | MB5000 |
| 6000A | MB6000 |
| Main Lugs | MLO___ |

| Power Entry | |
|---|---|
| Top Feed | T |
| Bottom Feed | B |

| Branch Breakers | |
|---|---|
| Poles | |
| 1 | 15-1200 |
| 2 | 15-1201 |
| 3 | 15-1202 |

| Enclosure Modifications & Accessories | |
|---|---|
| Isolated Ground | ISOG |
| Austomatic Transfer Switch Section | ATS |
| Manuel Transfer Switch Section | MTS |
| Cam Lok Panel for Generator Feed | CL |
| Main Tie Main | MTM |
| Dual Genrator Input | DGI |
| Mini Power Zone Section 45KVA Transformer & Lighting Panel | MPZ |
| Power Meter W/CT's | PM |
| Surge Protection Device must specify required kA 100kA-400Ka | SPD_____ |
| LSIG | LSIG |
| ARMS | AER |
| Service Enterance Rated | SER |
| Utility Structure | US |

*Custom frame sizes available, we will custom build your switchboard to the size you need.

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UL489 MCCB

Susol Super Solution

# UL891 Switchboard Solution

## Contents



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# Overview

The Susol UL891 switchboard solution meets UL67/UL891 certification standards for bus straps and interiors utilizing UL489 MCCBs.
There are five types of interiors, three types of bus straps, and a wide range of MCCBs available which allow flexibility during the development and selection stage for new panels.
It is a cost effective and allows for safe installation and interchangeability.


**UL489 MCCB**

## LS's supply scope

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# UL891 Switchboard Solution

SPIKE ELECTRIC CONTROLS

## Panel builder

UL891 Switchboard

UL67 Switchboard

## LS's supply scope

* Exclude frames

## Features

- UL67/UL891 Panelboards
- UL489 Molded case circuit breakers
- Main bus, 1200/2000/2400/4000/6000A copper
- Branch-bus direct connection
- Up to 1200A breaker mounted as a branch device
- Double branched 150, 250 and 400AF breakers
- The interior maximum short circuit interrupting rating 100kA at 480Vac
- Individual breaker Protection cover plates

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# Structure

## 1 Blank filler plate

Used to cover blank space on chassis

## 2 Circuit breaker cover

Used to protect breakers and bus straps

- single mounting type
- double mounting type

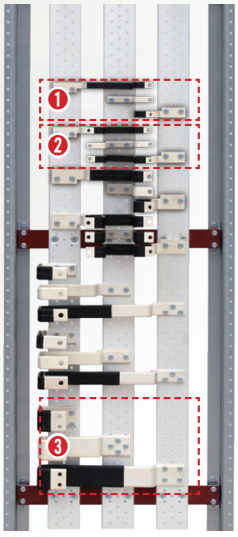
## 3 Filler plate

Filler plates are used to fill and protect unused spaces in the circuit breaker cover

## 4 Bus strap

- single mounting type
- double mounting type
- Installation case

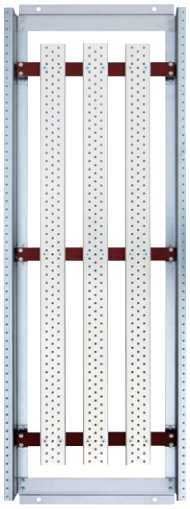
❶ 150AF of single bus strap
❷ 150AF of double bus strap
❸ 800AF of single bus strap




Note : Exclude steel frames of outer angle

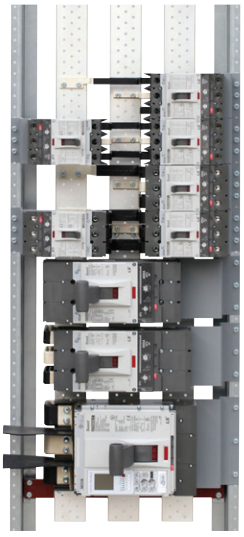
## 5 Interior

- 1200A(single chassis bus)
- 2000A(double chassis bus)
- 2400/4000/6000A



## 6 UL489 MCCB

- Ampere rating: 40~1200A
- Poles : 2, 3
- Various trip units:
  FTU, FMU, ATU, ETS, ETM, OCR, MCP, MCS
- Standards: UL489, IEC60947-2



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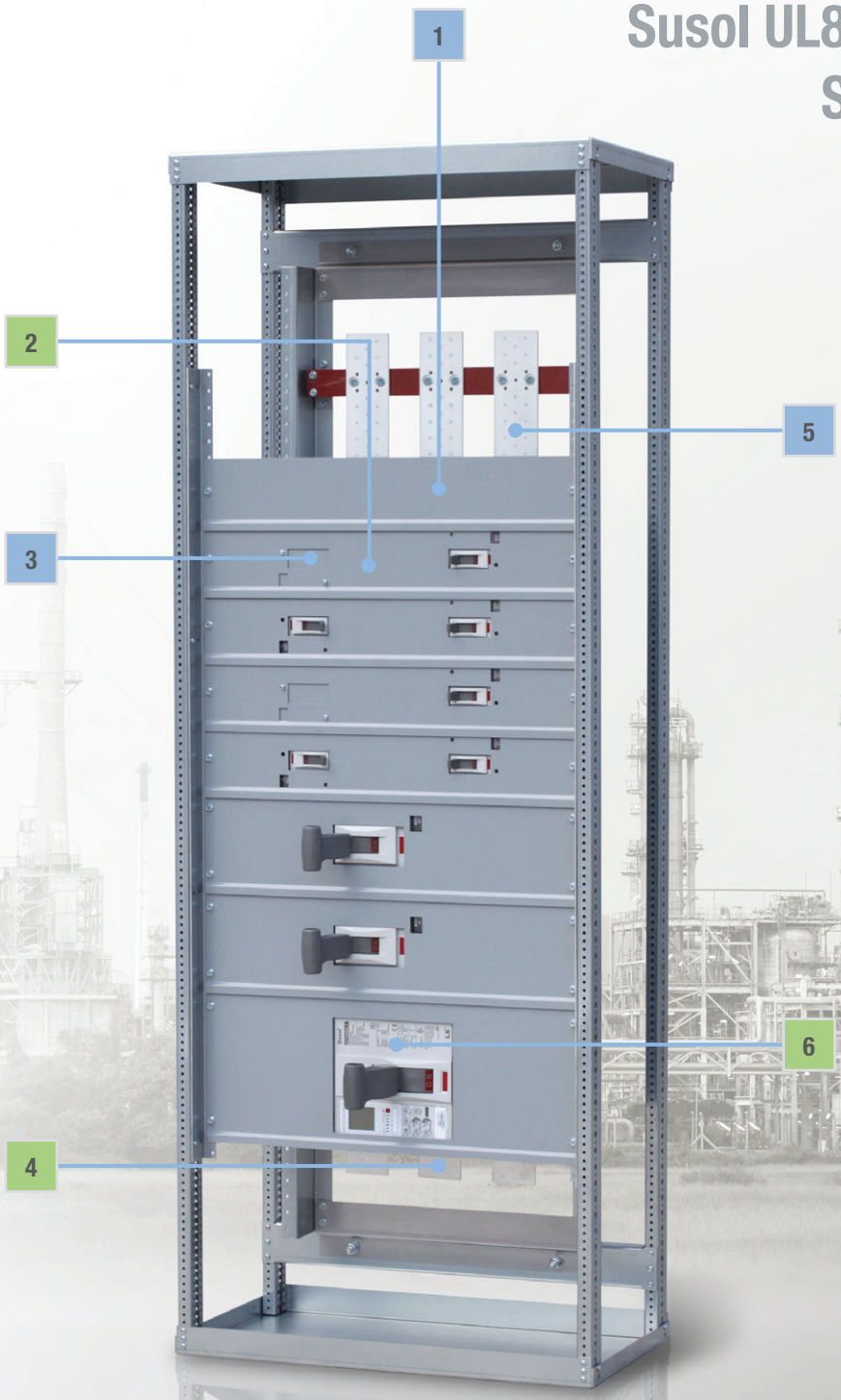
# Susol UL891 Switchboard Solution




* Frames are installed for photography and are not included in the supply range.

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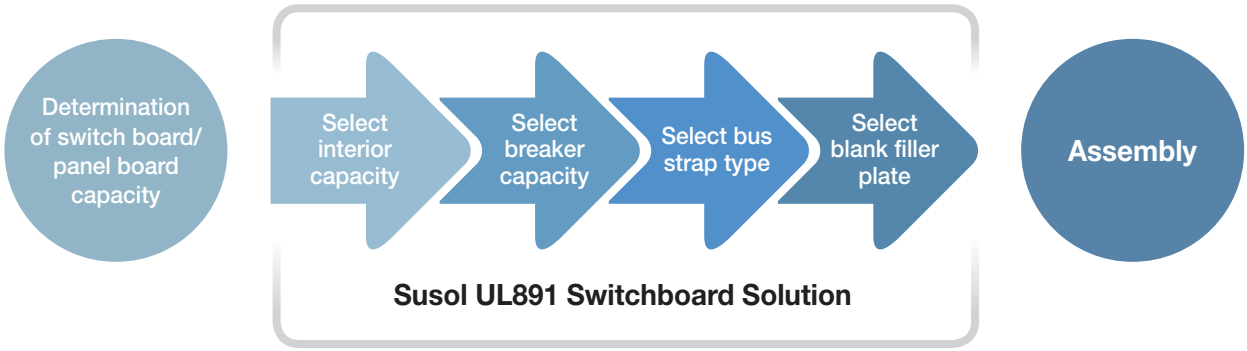
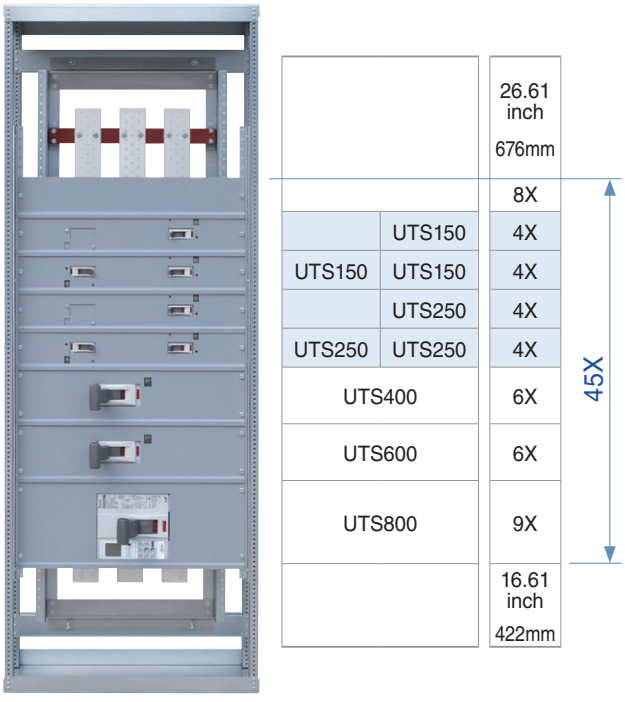
# Features

## Product selection sequence

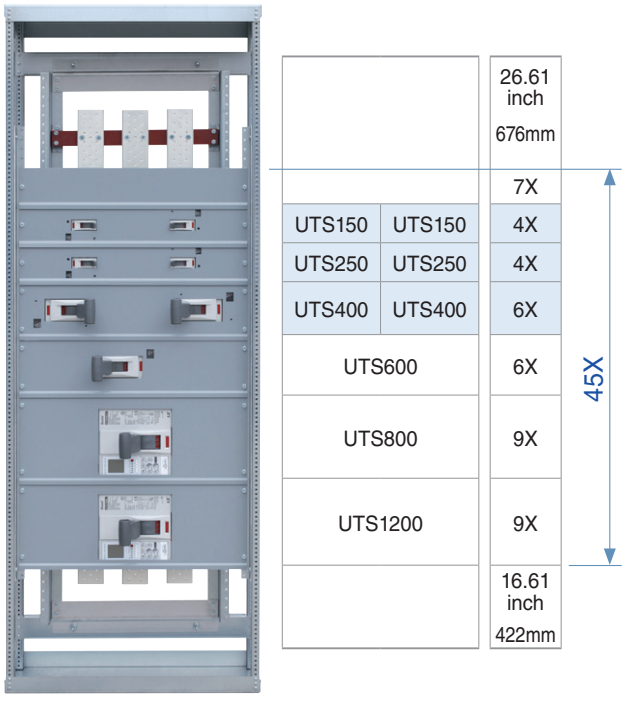



## Chassis layout

1200AF chassis can be utilized for MCCBs UTS 150AF to UTS 800AF. 2000/2400/4000/6000A chassis can be utilized for MCCBs UTS 150AF to UTS 1200AF.
There are dedicated covers for each capacity of the breaker, which are 4X, 6X, and 9X high. Considering the height of circuit breaker cover, the breaker can be installed within 45X heights for the 1200/2000A interior. For 2400/4000/6000A interiors, there are three types of 36/46/66X.
Breakers are installed in order of lowest at the top to highest capacity at the bottom. Install the breakers, and insert the blank filler plate of various heights to fill the remaining space and complete the panel. The top and bottom spaces can be used for ventilation and wire connections.

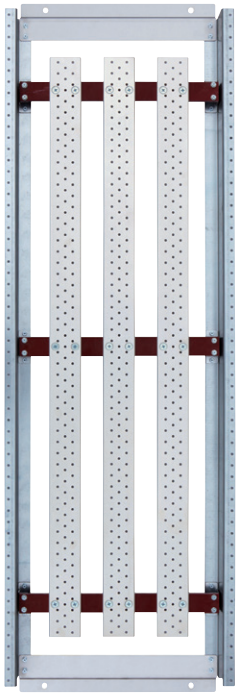



1200A




2000A

## Interior



| Description | | Interior-1200 | Interior-2000 |
|---|---|---|---|
| Rated current | | 1200A | 2000A |
| Rated short-circuit breaking capacity | | 100kA @480Vac | |
| Applicable MCCB | | UTS150, UTS250, UTS400, UTS600, UTS800 | UTS150, UTS250, UTS400, UTS600, UTS800, UTS1200 |
| Minimum enclosure size (W×H×D) | mm | 914.4 × 2,286 × 406.4 | 1,168.4 × 2,286 × 508.2 |
| | inch | 36” × 90” × 16” | 46” × 90” × 20” |
| Standard | | UL67 | |

| Description | | | Interior-2400 | | | Interior-4000 | | | Interior-6000 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rated current | | | 2400A | | | 4000A | | | 6000A | | |
| Rated Short-circuit breaking capacity | | | 100kA @480Vac | | | | | | | | |
| Applicable MCCB | | | UTS150, UTS250, UTS400, UTS600, UTS800, UTS1200 | | | | | | | | |
| Frame size | | | 36X | 46X | 66X | 36X | 46X | 66X | 36X | 46X | 66X |
| | mm | W | 542 | | | 542 | | | 562 | | |
| | | H | 1256.6 | 1520.6 | 1995.8 | 1256.6 | 1520.6 | 1995.8 | 1256.6 | 1520.6 | 1995.8 |
| | | D | 92 | | | 92 | | | 127.3 | | |
| | inch | W | 21.34 | | | 21.34 | | | 22.13 | | |
| | | H | 49.47 | 59.87 | 78.57 | 49.47 | 59.87 | 78.57 | 49.47 | 59.87 | 78.57 |
| | | D | 3.62 | | | 3.62 | | | 5.01 | | |
| Standard | | | UL891 | | | | | | | | |

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# Applicable circuit breakers

## Susol UL MCCB

Susol UL489 MCCBs are designed to protect low voltage electrical systems from damage caused by overloads and short circuits.

UTS150 UTS250 UTS400 UTS600 UTS800 UTS1200

| Breaker type | Ampere frame | Ampere rating | Performance | | | Pole | Trip units | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 80% rating | 100%[1] Rating | kA @480 Vac | | FTU | FMU | ATU | ETS | ETM | OCR | MCP | MCS |
| **UTS150** | 150 | 40/50/60/70/80/90/100/125/150A | N | NT | 35 | 2,3 | ● | ● | ● | ● | - | - | ● | ● |
| | | | H | HT | 65 | | | | | | | | | |
| | | | L | LT | 100 | | | | | | | | | |
| **UTS250** | 250 | 150/160/175/200/225/250A | N | NT | 35 | 2,3 | ● | ● | ● | ● | - | - | ● | ● |
| | | | H | HT | 65 | | | | | | | | | |
| | | | L | LT | 100 | | | | | | | | | |
| **UTS400** | 400 | 250/300/350/400A | N | NT | 35 | 2,3 | ● | ● | ● | ● | ● | - | ● | ● |
| | | | H | HT | 65 | | | | | | | | | |
| | | | L | LT | 100 | | | | | | | | | |
| **UTS600** | 600 | 500/600A | N | - | 35 | 2,3 | ● | ● | ● | ● | ● | - | ● | ● |
| | | | H | - | 65 | | | | | | | | | |
| | | | L | - | 100 | | | | | | | | | |
| **UTS800** | 800 | 400/600/630/800A | N | NT | 35 | 3 | - | - | - | - | - | ● | ● | ● |
| | | | H | HT | 65 | | | | | | | | | |
| | | | L | LT | 100 | | | | | | | | | |
| **UTS1200** | 1200 | 800/1000/1200A | N | - | 35 | 3 | - | - | - | - | - | ● | ● | ● |
| | | | H | - | 65 | | | | | | | | | |
| | | | P | - | 50 | | | | | | | | | |
| | | | L | - | 100 | | | | | | | | | |

Note1) The 100% rated MCCB is available with 90°C wire.

## Circuit breaker terminals

UTS150 to UTS1200 frame circuit breakers can be ordered with line side and load side lugs.
The standard lugs can be removed for the installation of bus connections. All lugs are UL/cUL Listed Certified for their proper application and marked for use with aluminum and copper (Al/Cu) or copper only (Cu) conductors. Lugs suitable for copper and aluminum conductors are made of tin-plated aluminum. Mechanical lugs are sold either factory installed or as field installable kits.

| Breaker type | Lug type | Ampere rating | Applicable wire (Copper) | TORQUEN N•m (lb-in) |
|---|---|---|---|---|
| **UTS150** | AL150TS | 1.6~15A | 14 AWG | 4.1 (36.2) |
| | | 20~30A | 12~10 AWG | 5.4 (47.8) |
| | | 40~175A | 8~2/0 AWG | 15.1 (133.6) |
| **UTS250** | AL250TS | 150~175A | 1/0~2/0 AWG | 32 (283.2) |
| | | 200~225A | 3/0~4/0 AWG | |
| | | 250A | 250~350 kcmil | 44 (389.4) |
| **UTS400** | AL400TS | 250, 300A | 1/0 AWG~300 kcmil | 40.5 (358.5) |
| | | 350, 400A | 350~600 kcmil | 54 (478) |
| **UTS600** | AL600TS | 500, 600A | 2/0 AWG~350 kcmil | 40.5 (358.5) |
| **UTS800** | AL800TS | 400, 600, 630, 800A | 3/0 AWG~300 kcmil | 45 (398.3) |
| **UTS1200** | AL1200TS | 800, 1000, 1200A | 3/0 AWG~350 kcmil | 45 (398.3) |

Note1) For the UTS150, barriers are required when connecting the breaker to the bus.

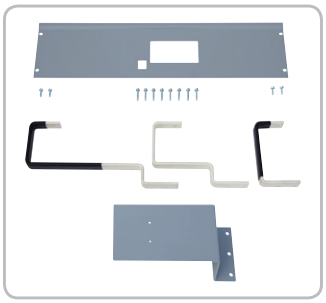
[ UTS150 + barrier ]

[ Barrier for UST150 ]

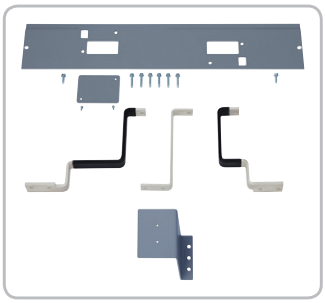
## Bus strap kits

Each kit includes copper connectors, mounting brackets, cover, hardware and instructions.

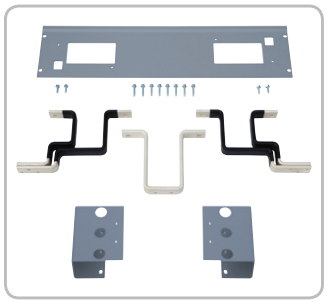
**Bus strap kits composition**



Single center



Single



Double

**Installed appearance**

| Breaker type | Pole | Space required | | Mounting type | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 1200A | | | 2000A | | |
| | | Inch. (mm) | "X" | Single center | Single | Double | Single center | Single | Double |
| UTS150 | 2, 3 | 4.16 (105.6) | 4X | - | ● | ● | - | ● | ● |
| UTS250 | 2, 3 | 4.16 (105.6) | 4X | - | ● | ● | - | ● | ● |
| UTS400 | 2, 3 | 6.24 (158.4) | 6X | ● | - | - | ● | ● | ● |
| UTS600 | 2, 3 | 6.24 (158.4) | 6X | ● | - | - | ● | - | - |
| UTS800 | 3 | 9.36 (237.6) | 9X | ● | - | - | ● | - | - |
| UTS1200 | 3 | 9.36 (237.6) | 9X | - | - | - | ● | - | - |

Note) 1. X=1.04 Inches (26.4mm)
2. Single center: There is one open space.
3. Single: A filler plate is provided that covers one of the two spaces.
4. Circuit breaker is not included.
5. The single center types have L type (line side to the left) and R type (line side to the right) depending on the position of the breaker.

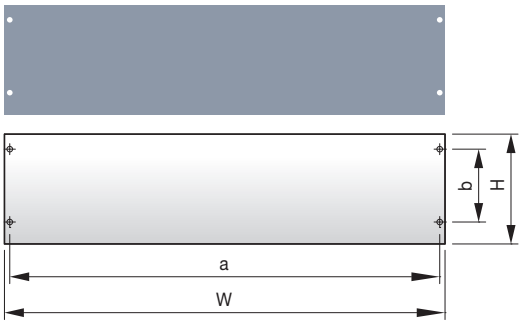
# Type of protective cover

## Blank filler plate

Used to cover blank space on chassis. All plate heights are measured in “X” units.
1X equals 1.04 inches (26.4 mm)
The blank filler plate heights are from 2X to 9X.

2X~4X

5X~9X



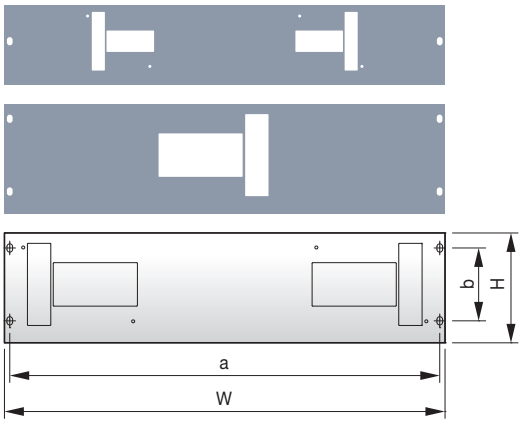

### Dimensions

| Blank | Frame | | Hole spacing | | |
|---|---|---|---|---|---|
| | W | H | a | b | |
| | inch. (mm) | inch. (mm) | inch. (mm) | inch. (mm) | X |
| 2X | 24.53 (623) | 2.08 (52.8) | 23.94 (608) | - | - |
| 3X | | 3.12 (79.2) | | - | - |
| 4X | | 4.16 (105.6) | | - | - |
| 5X | | 5.20 (132.0) | | 3.12 (79.2) | 3X |
| 6X | | 6.24 (158.4) | | 4.16 (105.6) | 4X |
| 7X | | 7.28 (184.8) | | 5.20 (132.0) | 5X |
| 8X | | 8.32 (211.2) | | 6.24 (158.4) | 6X |
| 9X | | 9.36 (237.6) | | 7.28 (184.8) | 7X |

Note) 1. hole size: Ø8×12
2. A box contains 5EA(7X~9X) or 10EA(2X~6X) blank filler plates and is sold on a box-by-box basis.

## Circuit breaker cover

All bus strap kits include a circuit breaker cover.



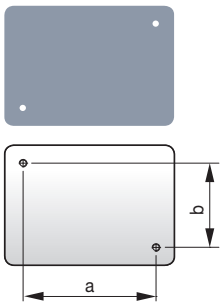

### Dimensions

| Circuit breaker | Frame | | Hole spacing | | |
|---|---|---|---|---|---|
| | W | H | a | b | |
| | inch. (mm) | inch. (mm) | inch. (mm) | inch. (mm) | X |
| UTS150/250 | 24.53 (623) | 4.16 (105.6) | 23.94 (608) | - | - |
| UTS400/600 | | 6.24 (158.4) | | 4.16 (105.6) | 4X |
| UTS800/1200 | | 9.36 (237.6) | | 7.28 (184.8) | 7X |

Note) hole size: Ø8×12

## Filler plate

The filler plates are used for single mounting in the double mounting type of the UTS150/250 and UTS400. The filler plates are required in addition to circuit breaker cover whenever a branch circuit breaker is specified.




### Dimensions

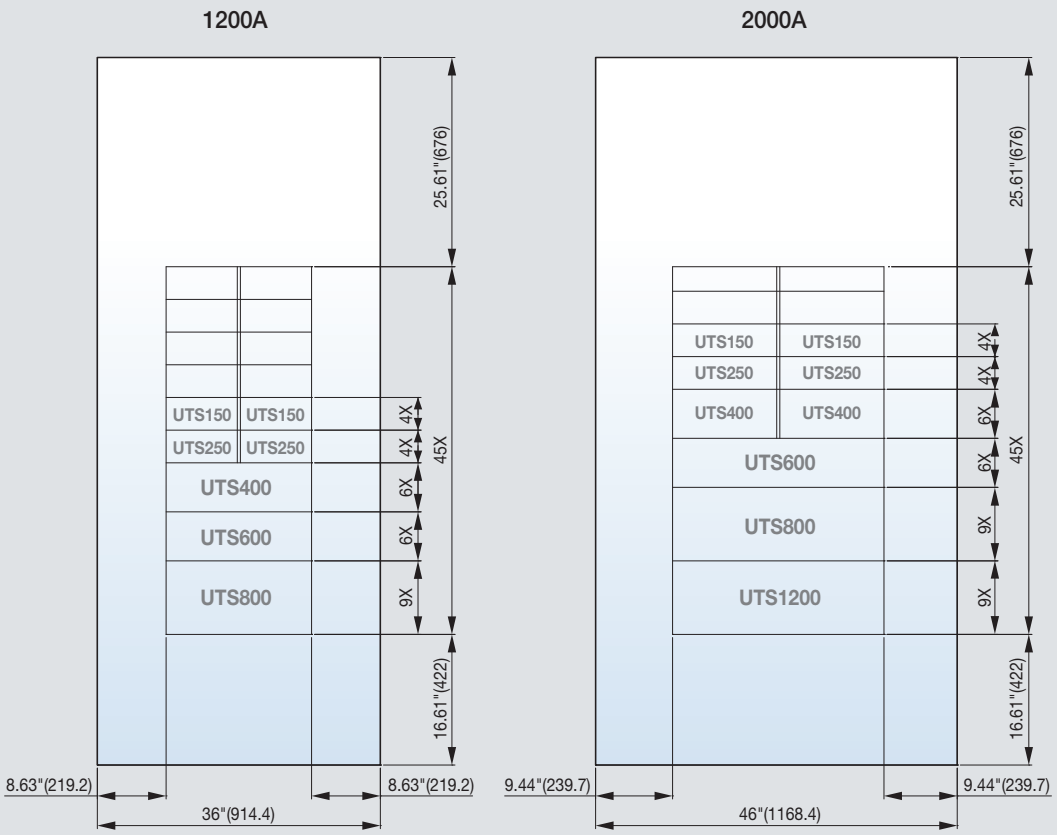
| Circuit breaker | Hole spacing | | Hole size |
|---|---|---|---|
| | a | b | |
| | inch. (mm) | inch. (mm) | |
| UTS150/250 | 3.47 (88.1) | 2.87 (73) | NO. 8-32 UNC |
| UTS400/600 | 6.12 (155.5) | 4.21 (107) | |

Note) A box contains 30EA filler plates and is sold on a box-by-box basis.

# Dimensions

## Chassis layout

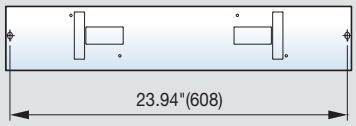
Dimension: inch[mm]



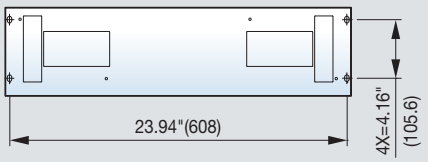
## Circuit breaker cover

Dimension: inch[mm]

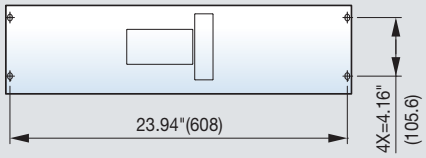
UTS150/250 Double



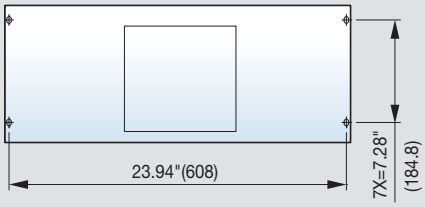

UTS400 Double




UTS400/600 Single




UTS800/1200 Single



# Part numbering

## Circuit breakers

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

UTS – 250 N FTU 250A 3P LO UL

| Model |
|---|
| UL type TS |

| Ampere frame |
|---|
| 150 |
| 250 |
| 400 |
| 600 |

| Type | |
|---|---|
| N | Normal, 80% rating |
| H | High, 80% rating |
| L | Current limit, 80% rating |
| NT | N type 100% rating |
| HT | H type 100% rating |
| LT | L type 100% rating |

| Trip unit | |
|---|---|
| FTU | Fixed trip unit |
| FMU | Fixed magnetic trip unit |
| ATU | Adjustable trip unit |
| ETS | Electronic trip unit standard |
| ETM | Electronic trip unit multi function |
| MCP | Motor circuit protector |
| MCS | Molded case switch |

| Rated current |
|---|

| Poles | |
|---|---|
| 2P | 2Pole |
| 3P | 3Pole |

| Terminals | |
|---|---|
| LO | Lugs load side |
| - | Bolt-on |

| Suffix | |
|---|---|
| UL | UL |

### Trip unit: OCR

UTS – 1200 N A G O 1600A 3P LO UL

| Model |
|---|
| UL type TS |

| Ampere frame |
|---|
| 800 |
| 1200 |

| Type | |
|---|---|
| N | Normal, 80% rating |
| H | High, 80% rating |
| P | Premium, 80% rating |
| L | Current limit, 80% rating |
| NT | N type 100% rating |
| HT | H type 100% rating |
| PT | P type 100% rating |
| LT | L type 100% rating |

| OCR-I | |
|---|---|
| N | Normal |
| A | Ammeter |
| P | Power meter |
| S | Super meter |
| MCP | Motor circuit protector |
| MCS | Molded case switch |

| OCR-II | |
|---|---|
| G | Communication(X) |
| E | Com.(X) + Outer CT (G/F) |
| C | Communication(O) |
| X | Com.(O) + Outer CT (G/F) |

| OCR-III | |
|---|---|
| 0 | Power(X), 60Hz |
| 1 | AC/DC 100~250V, 60Hz |
| 2 | DC 24~60V, 60Hz |
| 5 | Power(X), 50Hz |
| 6 | AC/DC 100~250V, 50Hz |
| 7 | DC 24~60V, 50Hz |

| Rated current |
|---|

| Poles | |
|---|---|
| 2P | 2Pole |
| 3P | 3Pole |

| Terminals | |
|---|---|
| LO | Lugs load side |
| - | Bolt-on |

| Suffix | |
|---|---|
| UL | UL |

## Bus strap kits

**BSK** — **S - 3P** — **UTS150** — **UL**

| Model |
|---|
| Bus strap kits |

| Code | Bus strap type | Pole | Line side |
|---|---|---|---|
| S - 2P | Single | 2P | - |
| S - 2P | Single | 3P | - |
| SC - 2PL | Single center | 2P | Left |
| SC - 3PL | Single center | 3P | Left |
| SC - 2PR | Single center | 2P | Right |
| SC - 3PR | Single center | 3P | Right |
| D - 2P | Double | 2P | - |
| D - 3P | Double | 3P | - |

| Ampere frame of circuit breaker | |
|---|---|
| UTS150 | (1200A BKS-S, D)<br>(2000A BKS-S, D) |
| UTS250 | (1200A BKS-S, D)<br>(2000A BKS-S, D) |
| UTS400 | (1200A BKS-SC)<br>(2000A BKS-S, SC, D) |
| UTS600 | (1200A BKS-SC)<br>(2000A BKS-SC) |
| UTS800 | (1200A BKS-SC)<br>(2000A BKS-SC) |
| UTS1200 | (2000A BKS-SC) |

## Blank filler plate

**BFP** — **5X** — **UL**

| Model |
|---|
| Blank filler plate |

| Protection cover size | |
|---|---|
| 2X~6X | 2X~6X (Set of 10) |
| 7X~9X | 7X~9X (Set of 5) |

Note) A box contains 5 or 10 protector cover blanks and is sold on a box-by-box basis.

## Filler plate

**FP** — **UTS150/250** — **UL**

| Model |
|---|
| Filler plate |

| Applicable MCCB |
|---|
| UTS150/250 (Set of 30) |
| UTS400/600 (Set of 30) |

Note) A box contains 30 protector cover fillers and is sold on a box-by-box basis.

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# Super Solution for Protection

The new Susol series with thermal-magnetic circuit breakers are designed to protect low voltage electrical systems from damage caused by overloads and short circuits.

## FOR POWER DISTRIBUTION

High breaking capacity
Optimum coordination technique
Powerful engineering tools
Reverse feeding

## FOR PROTECTION OF MOTORS AND THEIR CONTROL DEVICES

Optimal overload protection
Guaranteed Short Circuit Current Ratings

## FOR CONTROLLING AND DISCONNECTING CIRCUITS

## FOR EXTENSIVE APPLICATIONS

Wide range of optimized auxiliaries and accessories

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# SUSOL MCCBS AT A GLANCE.

## 1 FOR POWER DISTRIBUTION

- High breaking capacity
- Optimum coordination technique
- Powerful engineering tools
- Reverse feeding

## 2 FOR PROTECTION OF MOTORS AND THEIR CONTROL DEVICES

- Optimal overload protection
- Guaranteed Short Circuit Current Ratings

## 3 FOR EXTENSIVE APPLICATIONS

- Wide range of optimized auxiliaries and accessories

## 4 FOR CONTROLLING AND DISCONNECTING CIRCUITS

UTE100

UTS150

UTS250

UTS400

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★★★Made in the USA★★★

# UL Feeder Circuit Breakers

SPIKE ELECTRIC CONTROLS

## SIMPLIFIED PRODUCT RANGE

- **AF**: 100AF, 150AF, 250AF, 400AF, 600AF, 800AF, 1200AF
- **Ampere Range**: 15A ~ 1200A
- **Pole**: 2P, 3P

## VARIABLE ACCESSORIES

- Electrical auxiliaries[AX, AL, UVT, SHT]
- Extended and direct mount rotary handle
- Flange handle with flexible cable and linkage
- Variable depth mechanism
- Locking devices
- LUG for CU/AL cable with UL486

## HIGH PERFORMANCE

- Ultimate breaking capacity (kA rms)
- Max 100kA @480VAC and 50kA @600V

## STANDARDS

- **World class with UL489**
  - UL489
  - CSA
- **IEC60947-2**
- **Class 1E for Nuclear power plant**
  - EQ : Environment Qualification
  - SQ : Seismic Qualification

## VARIOUS TRIP UNITS

- **ATU**: Adjustable thermal & magnetic unit
- **FMU**: Adjustable thermal, fixed magnetic unit
- **FTU**: Fixed thermal & magnetic unit
- **ETS**: Electronic trip unit (LI, LSI)
- **ETM**: Electronic trip unit (LSIG, Multi-function unit)
- **OCR**: Electronic trip unit

## MCP CHARACTERISTIC

- Simplified product range
  - **AF**: 150AF, 250AF, 400AF, 600AF, 800AF, 1200AF
  - **Ampere Range**: 1.6A ~ 1200A Only 3 Pole use
- **Standards**
  - Instantaneous circuit breaker with UL489
  - Motor protector with MC and Relay with UL508
- **IEC60947-2**

## MCS CHARACTERISTIC

- Simplified product range
  - **AF**: 100AF, 150AF, 250AF, 400AF, 600AF, 800AF, 1200AF
  - **Ampere Range**: 100A ~ 1200A
  - **Pole**: 2P, 3P
- **Standards**
  - World class with UL489
- **IEC60947-2**


UTS600


UTS800


UTS1200

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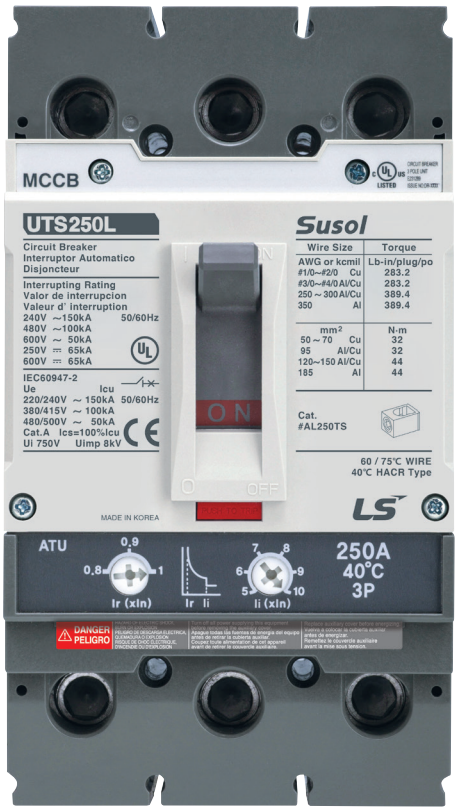
# Engineered for Optimal Protection




## SUSOL SERIES OFFER VARIOUS TRIP UNITS :

- **ATU** (Adjustable thermal & magnetic unit)
- **FMU** (Adjustable thermal, fixed magnetic unit)
- **FTU** (Fixed thermal & magnetic unit)
- **ETS** (Electronic trip unit for UTS150…UTS600)
- **ETM** (Electronic trip unit for UTS400, UTS600)
- **OCR** (Electronic trip unit for UTS800, UTS1200)

## THERMAL MAGNETIC TRIP UNITS

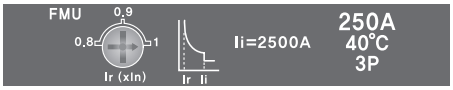
- UTE100...UTS600 frame
- 15-600 amperes
- Factory-installed
- Several versions by rated current and function

### FTU

- Fixed Thermal. 15A~600A
- Fixed Magnetic. 400A~6000A


### FMU

- Adjustable Thermal. 25A~600A( 0.8~1 x In)
- Fixed Magnetic. 400A~6000A




### ATU

- Adjustable Thermal. 100A~600A( 0.8~1 x In)
- Adjustable Magnetic. 500A~6000A(5~10 x In)


### MCP

- Adjustable Magnetic. 10A~6000A


### MCS

- Fixed Magnetic. 1000A~6000A


## ELECTRONIC TRIP UNITS

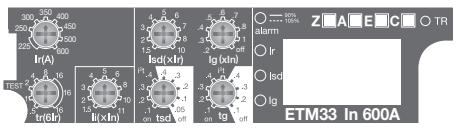
- UTS150…UTS600 frame
- 15~600 amperes
- Factory-installed
- Several versions by rated current and function

### ETS

- Electronic trip unit for UTS150…UTS600


### ETM

- Electronic trip unit for UTS400, UTS600

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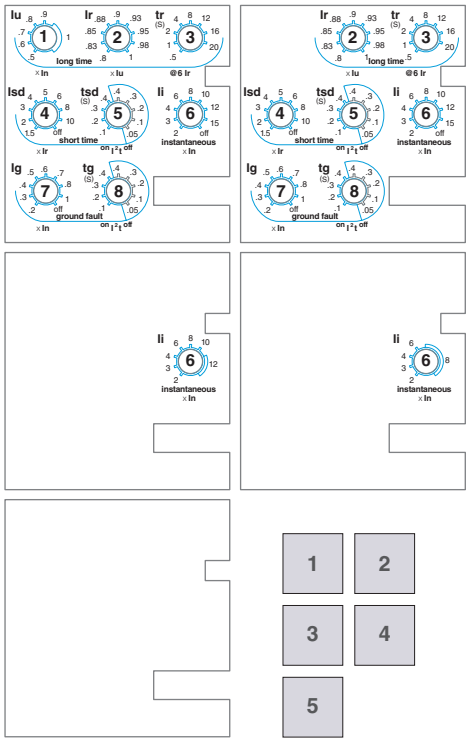
## ELECTRONIC TRIP UNITS

- UTS800, UTS1200 Frame
- 400-1200 Amperes
- Factory-installed internal trip units.
- Several versions by rated current and function



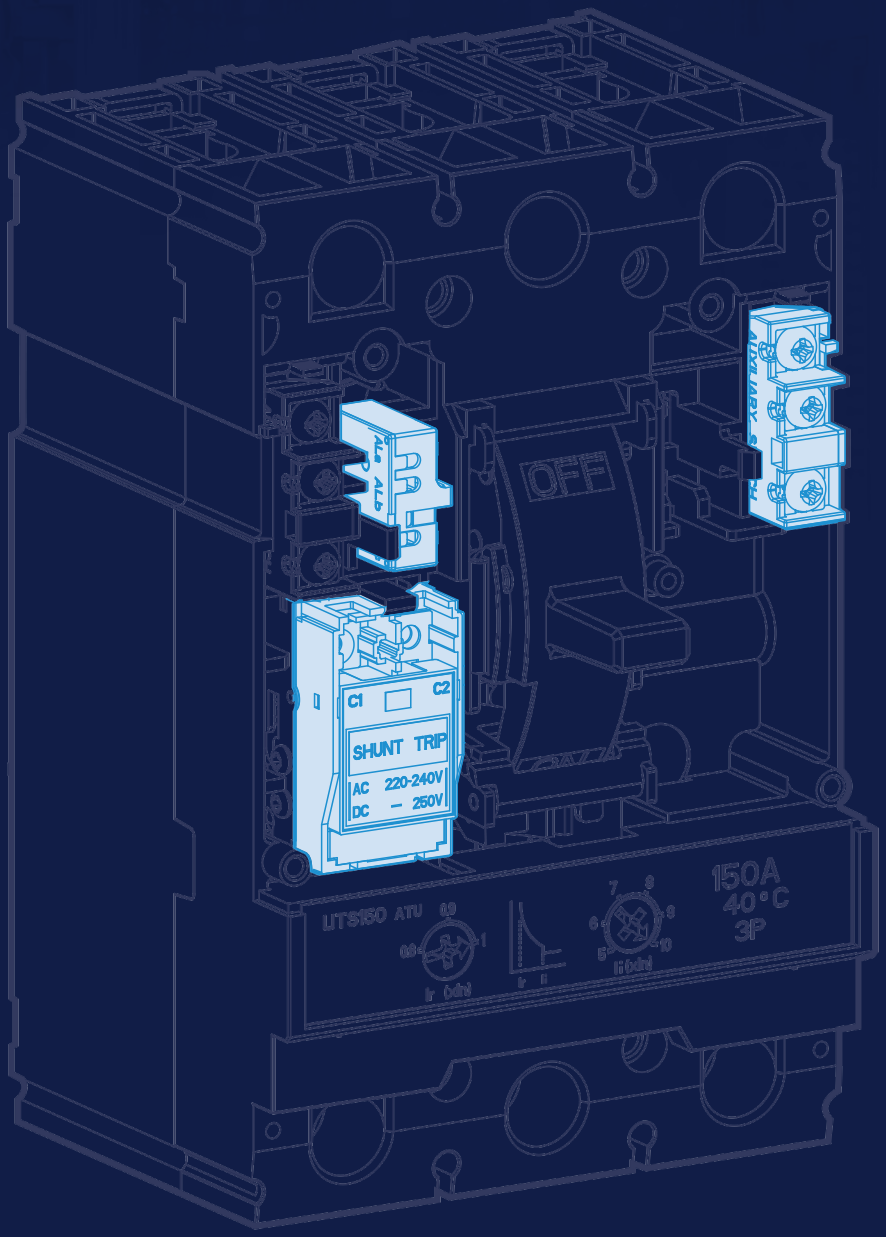


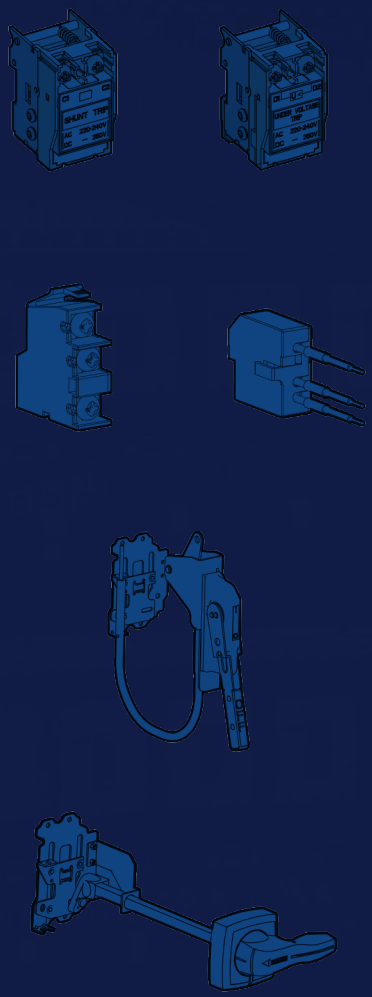
1. N, A type Knob information
2. P, S type Knob information
3. MCP800 type Knob information
4. MCP1200 type Knob information
5. MCS800/1200 type Knob information

# FUTURING SMART ENERGY

## FOR EXTENSIVE APPLICATIONS

Wide range of optimized auxiliaries and accessories



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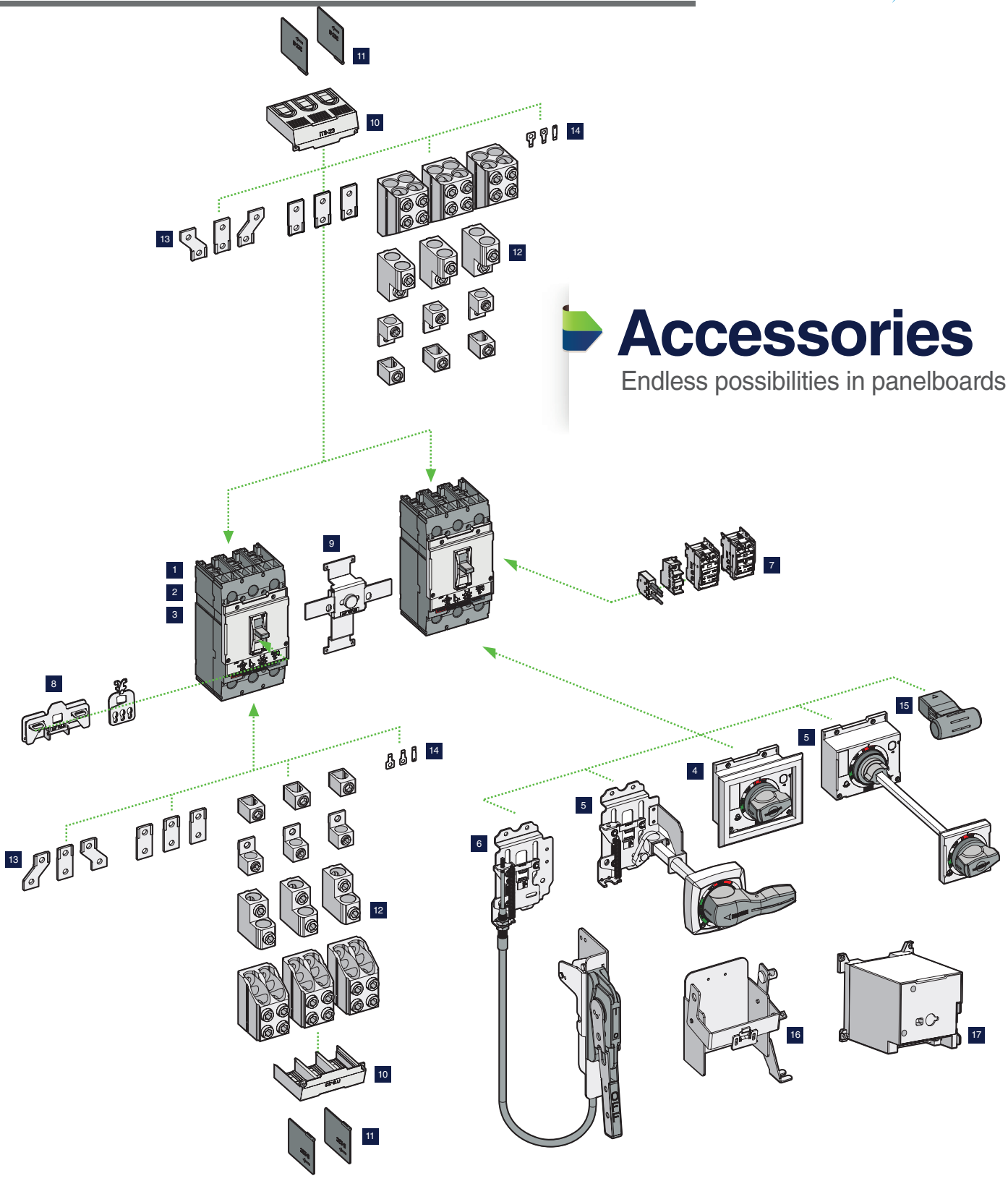
# Accessories

Endless possibilities in panelboards




1. Molded Case Circuit Breaker
2. Motor Circuit Protector
3. Molded Case Switch
4. Direct Rotary Handle
5. Extended Handle
6. Flange Cable Handle
7. Inner Accessories (AL, AX, UVT, SHT)
8. Locking Device (Handle)
9. Mechanical Interlock
10. Terminal Shield
11. Interphase Barriers
12. Mechanical Lugs
13. Busbar Connectors
14. Control wire Terminal
15. Aux. Handle
16. Operating Mechanism (VDM/COM)
17. Motor operator (MOP)

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# Series Overview




| Frame | | UTE100 | | | UTE100 | | | UTS150 | | | UTS250 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Maximum rated current | | 100A | | 30A | 100A | | 30A | 150A | | | 250A | | |
| Number of poles | | 2 | | | 3 | | | 2, 3 | | | 2, 3 | | |
| Breaker type | | E | N | H | E | N | H | N | H | L | N | H | L |
| UL489/CSA C22.2 | | UTE100 | | | UTE100 | | | UTS150 | | | UTS250 | | |
| Interrupting capacity (kA rms) AC(50/60HZ) UL, CSA | 120/240V | 50 | 65 | 100 | 50 | 65 | 100 | - | - | - | - | - | - |
| | 240V ac | 50 | 65 | 100 | 50 | 65 | 100 | 65 | 100 | 150 | 65 | 100 | 150 |
| | 480V ac | 25 | 35 | 65 | 25 | 35 | 65 | 35 | 65 | 100 | 35 | 65 | 100 |
| | 600V ac | | - | | | - | | 18 | 35 | 50 | 18 | 35 | 50 |
| | 600Y/347V ac | 14 | 18 | 35 | 14 | 18 | 35 | - | - | - | - | - | - |
| UL489 DC | | UTE100 | | | UTE100 | | | UTS 150 | | | UTS 250 | | |
| Interrupting capacity (kA) DC UL, CSA | 250V dc-2P | 16 | 25 | - | 16 | 25 | - | 35 | 50 | 65 | 35 | 50 | 65 |
| | 500V dc-3P | | - | | 25 | 35 | - | - | - | - | - | - | - |
| | 600V dc-3P | | - | | | - | | 35 | 50 | 65 | 35 | 50 | 65 |
| IEC 60947-2 | | UTE100 | | | UTE100 | | | UTS150 | | | UTS250 | | |
| Ultimate breaking capacity, (kA rms) AC 50/60Hz, Icu | 220/240V | 50 | 65 | 65 | 50 | 65 | 65 | 65 | 100 | 150 | 65 | 100 | 150 |
| | 380/415V | 25 | 35 | 35 | 25 | 35 | 35 | 35 | 65 | 100 | 35 | 65 | 100 |
| | 480/500V | | - | | | - | | 18 | 35 | 50 | 18 | 35 | 50 |
| Service breaking capacity, Ics (%Icu) | | 100% | | | 100% | | | 100% | | | 100% | | |
| Insulation voltage, Ui | | 750 Vac | | | 750 Vac | | | 750 Vac | | | 750 Vac | | |
| Impulse withstand voltage, Uimp | | 8 kVac | | | 8 kVac | | | 8 kVac | | | 8 kVac | | |
| Rated short-time withstand current (Icw) | | - | | | - | | | - | | | - | | |
| Utilization category | | A | | | A | | | A | | | A | | |
| TRIP UNITS<br>F : Fixed<br>A : Adjustable<br>T : Thermal<br>M : Magnetic<br>E : Electronics | Amperes | 15~100A | | 15~30A | 15~100A | | 15~30A | 40~150A | | | 150~250A | | |
| | ATU | - | | | - | | | ● | | | ● | | |
| | FMU | - | | | ● | | | ● | | | ● | | |
| | FTU | ● | | | ● | | | ● | | | ● | | |
| | ETS | - | | | - | | | ● (60,100,150A) | | | ● (150, 250A) | | |
| | ETM | - | | | - | | | - | | | - | | |
| | OCR | - | | | - | | | - | | | - | | |
| MCP | Amperes | - | | | - | | | 1.6~60A<br>100~150A | | | 220A | | |
| | MCP | - | | | - | | | ● | | | ● | | |
| MCS | Amperes | 100A | | - | 100A | | - | 150A | | | 250A | | |
| | MCS | ● | | - | ● | | - | ● | | | ● | | |
| Unit mounted | | ● | | | ● | | | ● | | | ● | | |
| Mechanical lugs | | ● | | | ● | | | ● | | | ● | | |
| Busbar connectors | | ● | | | ● | | | ● | | | ● | | |
| Control wire terminal kit | | - | | | - | | | ● | | | ● | | |
| Terminal shields | | - | | | - | | | - | | | - | | |
| Interphase barriers | | ● | | | ● | | | ● | | | ● | | |
| Shunt trip | | ● | | | ● | | | ● | | | ● | | |
| Undervoltage trip | | ● | | | ● | | | ● | | | ● | | |
| Auxiliary switch | | ● | | | ● | | | ● | | | ● | | |
| Alarm switch | | ● | | | ● | | | ● | | | ● | | |
| Fault alarm switch | | - | | | - | | | ● | | | ● | | |
| Flange cable handle | | ● | | | ● | | | ● | | | ● | | |
| Flange variable-depth mechanism | | ● | | | ● | | | ● | | | ● | | |
| Directly-mounted rotary operating handle | | - | | | ● | | | ● | | | ● | | |
| NEMA-Door-mounted operating mechanisms | | ● | | | ● | | | ● | | | ● | | |
| IEC-Door-mounted operating mechanisms | | ● | | | ● | | | ● | | | ● | | |
| Mechanical interlocks | | - | | | ● | | | ● | | | ● | | |
| Handle padlock attachment | | ● | | | ● | | | ● | | | ● | | |
| Motor operator | | - | | | - | | | ● | | | ● | | |
| Weight(approximate) lbs.(kg) | 2-Pole | 1.64(0.74) | | | - | | | 3.44(1.56) | | | 3.88(1.76) | | |
| | 3-Pole | - | | | 2.33(1.06) | | | 3.95(1.79) | | | 4.49(2.04) | | |
| Dimensions Inches(mm) | W x H x D | W | H | D | W | H | D | W | H | D | W | H | D |
| | 2-Pole | 2.01(51) | 5.12(130) | 3.44(87.5) | - | - | - | 4.13(105) | 6.50(165) | 3.44(87.5) | 4.13(105) | 7.48(190) | 3.44(87.5) |
| | 3-Pole | - | - | - | 2.99(76) | 5.12(130) | 3.44(87.5) | 4.13(105) | 6.50(165) | 3.44(87.5) | 4.13(105) | 7.48(190) | 3.44(87.5) |

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| UTS400 | | | UTS600 | | | UTS800 | | | UTS1200 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 400A | | | 600A | | | 800A | | | 1200A | | | |
| 2, 3 | | | 2, 3 | | | 3 | | | 3 | | | |
| N | H | L | N | H | L | N | H | L | N | H | P | L |
| UTS400 | | | UTS600 | | | UTS800 | | | UTS1200 | | | |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| 65 | 100 | 150 | 65 | 100 | 150 | 65 | 100 | 150 | 50 | 100 | 65 | 150 |
| 35 | 65 | 100 | 35 | 65 | 100 | 35 | 65 | 100 | 35 | 65 | 50 | 100 |
| 18 | 35 | 50 | 18 | 35 | 50 | 18 | 35 | 50 | 18 | 25 | 50 | 35 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| UTS400 | | | UTS600 | | | UTS800 | | | UTS1200 | | | |
| 35 | 50 | 65 | 35 | 50 | 65 | | - | | | - | | |
| - | - | - | - | - | - | | - | | | - | | |
| 35 | 50 | 65 | 35 | 50 | 65 | | - | | | - | | |
| UTS400 | | | UTS600 | | | UTS800 | | | UTS1200 | | | |
| 65 | 100 | 150 | 65 | 100 | 150 | 65 | 100 | 150 | 50 | 100 | 65 | 150 |
| 35 | 65 | 100 | 35 | 65 | 100 | 35 | 65 | 100 | 35 | 65 | 50 | 100 |
| 18 | 35 | 50 | 18 | 35 | 50 | 18 | 35 | 50 | 18 | 25 | 50 | 35 |
| 100% | | | 100% | | | 100% | | | 100% | | | |
| 750 Vac | | | 750 Vac | | | 1000 Vac | | | 1000 Vac | | | |
| 8 kVac | | | 8 kVac | | | 8 kVac | | | 8 kVac | | | |
| - | | | - | | | 18kA | - | - | 25kA | - | 25kA | - |
| A | | | A | | | B | A | A | B | A | B | A |
| 250/300/350/400A | | | 500/600A | | | 400/600/630/800A | | | 800/1000/1200A | | | |
| ● | | | ● | | | - | | | - | | | |
| ● | | | ● | | | - | | | - | | | |
| ● | | | ● | | | - | | | - | | | |
| ●(250, 400A) | | | ●(400, 600A) | | | - | | | - | | | |
| ●(250, 400A) | | | ●(400, 600A) | | | - | | | - | | | |
| - | | | - | | | ● | | | ● | | | |
| 320A | | | 500A | | | 800A | | | 1200A | | | |
| | | | | | | | | | | | | |
| ● | | | ● | | | ● | | | ● | | | |
| 400A | | | 600A | | | 800A | | | 1200A | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| - | | | - | | | - | | | - | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | - | | | - | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | ● | | | ● | | | |
| ● | | | ● | | | - | | | - | | | |
| 12.02(5.45) | | | 13.45(6.10) | | | - | | | - | | | |
| 13.89(6.30) | | | 15.79(7.16) | | | 31.35(14.22) | | | 40.28(18.27) | | | |
| W | H | D | W | H | D | W | H | D | W | H | D | |
| 5.51(140) | 11.42(290) | 4.33(110) | 5.51(140) | 13.39(340) | 4.33(110) | - | - | - | - | - | - | |
| 5.51(140) | 11.42(290) | 4.33(110) | 5.51(140) | 13.39(340) | 4.33(110) | 8.27(210) | 12.88(327.2) | 6(152.5) | 8.27(210) | 16.26(413) | 6(152.5) | |

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Derwent Top 100 Global Innovator 2020

Susol Super Solution

# Air Circuit Breakers


c UL US

LS ELECTRIC

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## Codes and standards

UA Series are manufactured and tested in accordance with the following standards Low-Voltage Power Circuit Breaker

- ANSI C37.13
- ANSI C37.16
- ANSI C37.17
- ANSI C37.50
- UL 1066 (cULus Listed)
- CSA C22.2 No.31-10

Note) Throughout this document, the phrase "ANSI Certified" means the product meets the requirements of UL 1066 and ANSI C37

## Contents

Premium Susol ACB meets your demands for high breaking capacity with full line-up up to 6000A, all in optimized frame sizes for panel design.
Various accessories and connection methods realize user-friendly handling.

Susol ACB provides the total solution with an advanced trip relay for measurement, diagnosis, analysis, and communication as well as protective functions for absolute protective coordination and electric power monitoring system.

Susol
Super Solution

c UL us

## UL listed/ANSI certified
## Low-Voltage Power Circuit Breaker UA series

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# LS SuperSolution series

- **Modular design**
- **High (130kA) breaking capacity  full line-up to 6000A**
- **Satisfy the needs for compact sized panels**
- **N-Phase conducting capacity 100%**
- **Interchangeable trip unit and rating plug**

## Safety

Monitor temperatures for safety (Optional)

- Careful selection of materials
- Zero arc space
- Perform discriminations between upstream and downstream levels

## User convenience

Various connection types for main circuit terminals

- Easy installation of accessories
- Interchangeable Trip unit and Rating plug

## Intelligent trip relay

Various advanced functions for protection, measurement, diagnosis, analysis, communication

*Susol Manual Motor Starters*

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# UL 1066
# ANSI C37

*Susol Air Circuit Breakers*

*Susol Molded Circuit Breakers*

*Susol Magnetic Contactors & Overload Relays*

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# Full line-up & Compact

**Up to 6000A, Susol ACB provides a full line-up of 3 compact frame sizes.**
**Enables users to design panels of optimal volume.**


## 85kA

### UAS-08/16D

| | |
|---|---|
| **08** | 800AF |
| **16** | 1600AF |

85kA at 508Vac
W=13.15" (334mm) 3p,
16.50" (419mm) 4p

## 100kA

### UAH-08~32E

| | |
|---|---|
| 08 | 800AF |
| 16 | 1600AF |
| 20 | 2000AF |
| 25 | 2500AF |
| 32 | 3200AF |

100kA at 508Vac
W=16.22" (412mm) 3p,
20.75" (527mm) 4p

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# 130kA

- **High breaking capacity: 85/100/130kA (at 508Vac)**
- **3 ampere frame sizes: 1600/3200/6000AF**
- **N phase current conducting capacity: 100%**

## UAH- 32~60G

| | |
|---|---|
| 32 | 3200AF |
| 40 | 4000AF |
| 50 | 5000AF |
| 60 | 6000AF |

130kA at 508Vac
W=30.91" (785mm) 3p,
39.96" (1015mm) 4p

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# Trip Relay (OCR)

## *Trip relays are classified according to function.*

**Trip relays are classified according to their uses and functions to maximize customers' satisfaction. Classified trip relays and easy installation.**

- Protection: overload, short current, ground fault, earth leakage, under voltage, over voltage, under frequency, over frequency, reverse power, unbalance, etc
- Measurement: voltage, ampere, power, energy, frequency, power factor, harmonics, etc.
- Event & fault recording: Max. 256 events & faults
- Communication: Modbus/RS-485, Profibus-DP


**Susol ACB trip relay, which can be interlocked with the breaker mechanism, provides the world's best protection. It improves the breaking capacity, enhances the ACB's life, and provides advanced functions - measurement, diagnosis, analysis, and communication.**

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# Susol ACB Trip relay

## N type

- L/S/I/G/Thermal

- Self Power
- RTC Timer mounted
- Fault information (LED)

## A type

- L/S/I/G/Thermal
- ZSI
- ERMS
- Modbus/RS-485
- Profibus-DP

- Self Power
- AC/DC 100~250V
- DC 15~60V
- RTC timer mounted
- Fault recording (10EA)

## P/S type

- L/S/ I/G/Thermal(Continuous)
- UV/OV/OF/UF/rP/Vun/Iun
- Measurement: V/A/W/Wh/F/PF
- Harmonics (63th), Waveform (S Type)
- ZSI
- ERMS
- Modbus/RS-485
- Profibus-DP

- AC/DC 100~250V
- DC 15~60V
- RTC timer mounted
- Event recording (256EA)
- Fault recording (256EA)
- Fault wave (S Type)

## *Trip relays series*

**N type (Normal)**
- Self-power + Current protection

**A type (Ammeter)**
- Current meter + Current protection + DO control + Communication

**P type (Power meter)**
- A type + Power meter + Voltage / Frequency / Unbalance protection

**S type (Supreme)**
- P type + Harmonics analysis (63 th) + Fault wave recording

Rating Plug

## Rating Plug for selection of rated current and frequency

Rating Plug enables the changing rated current(In) without CT replacement
Frequency selection switch: set to 50Hz or 60Hz

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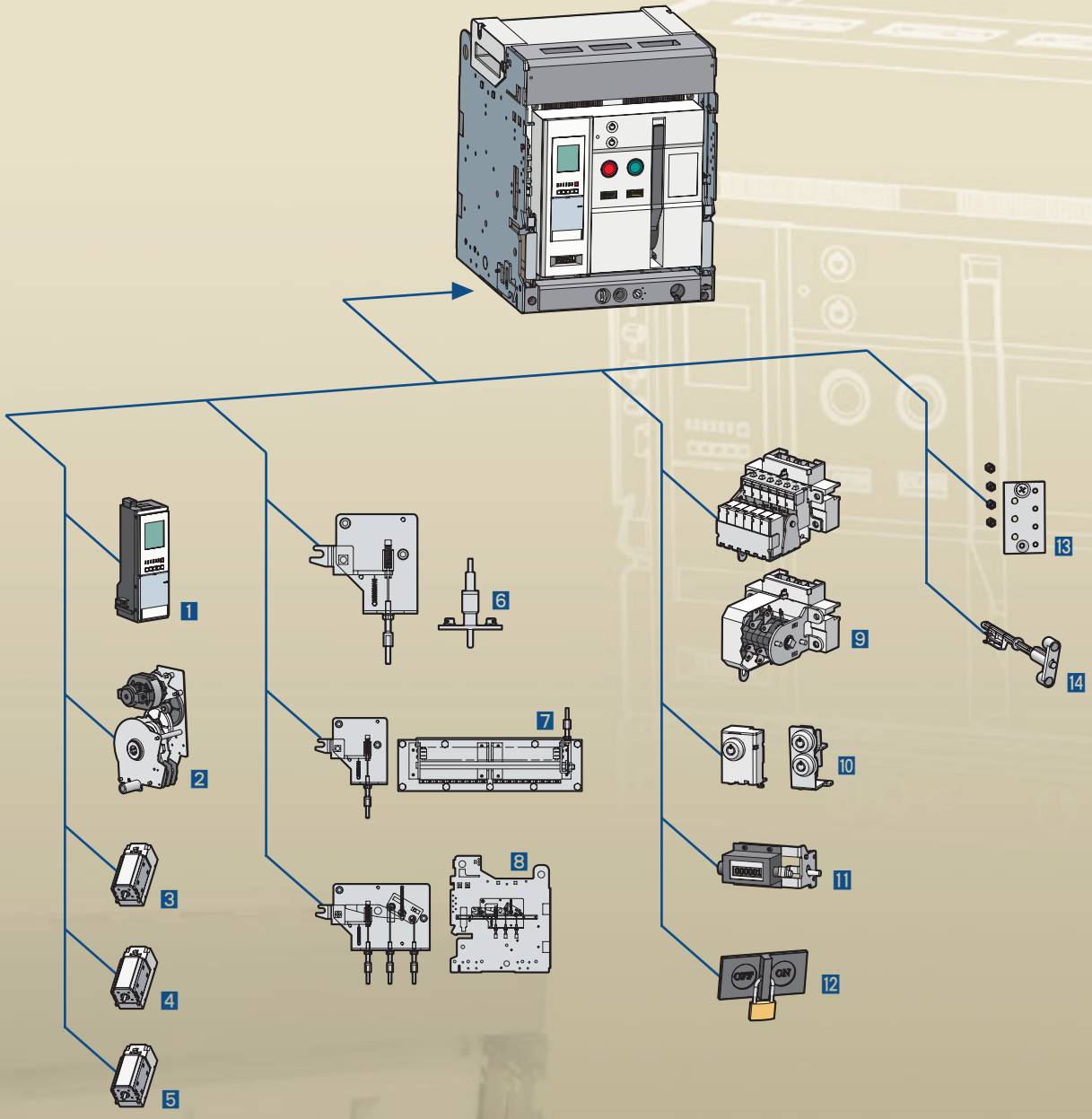
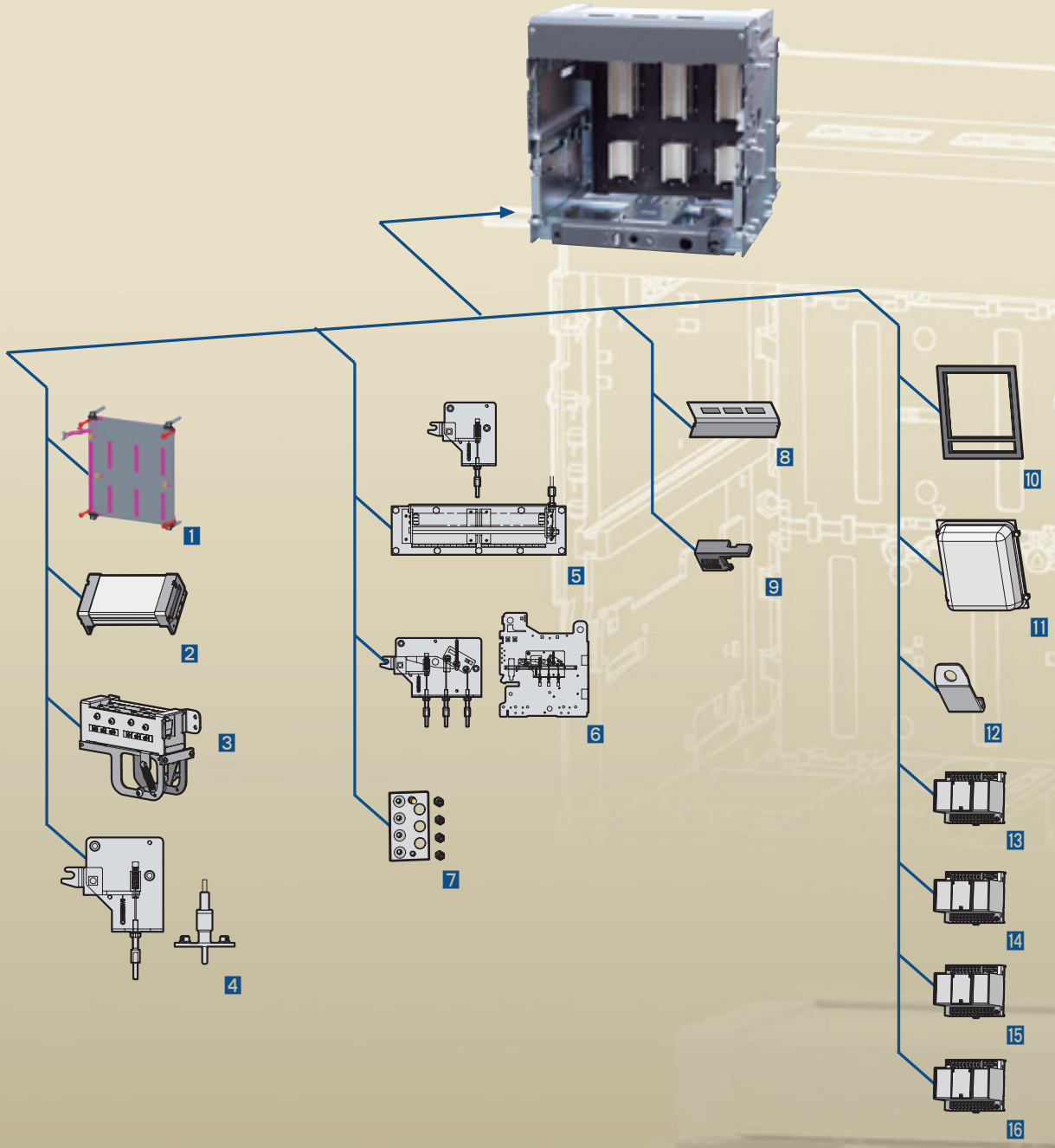
# Accessories




## ACB

1. Trip relay (OCR)
2. Motor (M)
3. Closing Coil (CC)
4. Shunt Coil (SHT)
5. Under Voltage Trip Device (UVT)
6. Door Interlock (DI)
7. MOC (Mechanically Operated Cell Switch)
8. Mechanical Interlock (MI)
9. Auxiliary Switch (AX)
10. Key Lock (K1), Double Key Lock (K3)
11. Counter (C)
12. Lockable On/Off Button Cover (B)
13. Mis-Insertion Prevention Device (MIP)
14. Manual Reset Button (MRB)




## Cradle

1 Safety Shutter (ST)
2 Zero Arc Space (ZAS)
3 Cell Switch (CEL)
4 Door Interlock (DI)
5 MOC (Mechanical Operated Cell Switch)
6 Mechanical Interlock (MI)
7 Mis-Insertion Prevention Device (MIP)
8 Safety Control Cover (SC)
9 Racking Interlock (RI)

## Other

10 Door Frame (DF)
11 Dust Cover (DC)
12 Lifting Hook (LH)
13 UVT Time Delay Controller (UDC)
14 Profibus-DP Communication Module
15 Remote I/O
16 Temperature Alarm

# Connection and Installation

Diversified terminal connection methods of the ACB main circuit for users.

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# Multiple connections

## *Various installation methods*

### Standard connection

Horizontal type

Vertical type

Front type

### Mixed connection

Horizontal / Vertical type

Vertical / Horizontal type

Horizontal / Front type

Vertical / Front type

Front / Horizontal type

Front / Vertical type

- **Front connection type is available to be connected regardless of the depth of main circuit terminal and it is suited for panels with limited installation space.**
- **The vertical and horizontal type terminal are module type which can be adjusted by rotating the module 90 degrees.**

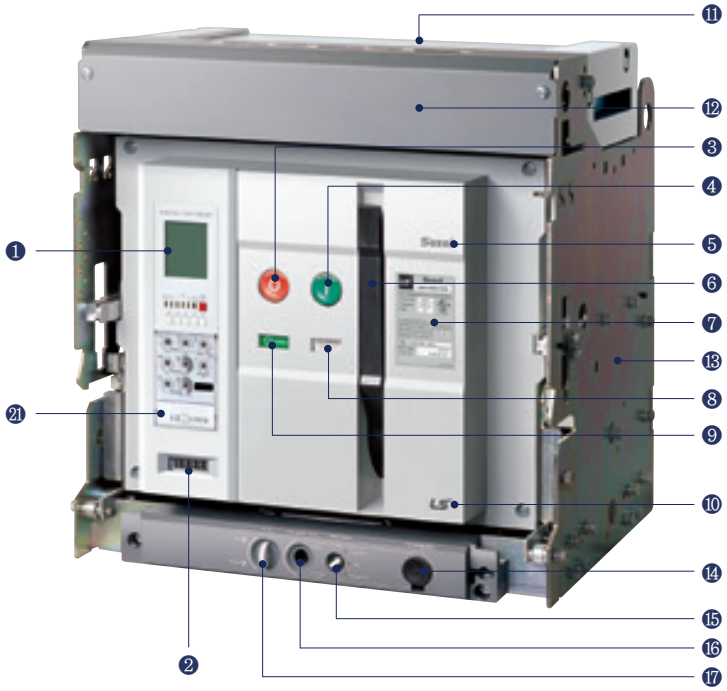
• Please refer to the rating lists (Page 22~25) because the installation method varies according to the rated current.

# External Configuration

***Susol***

## Fixed type ACB


## Draw-out ACB (Cradle)

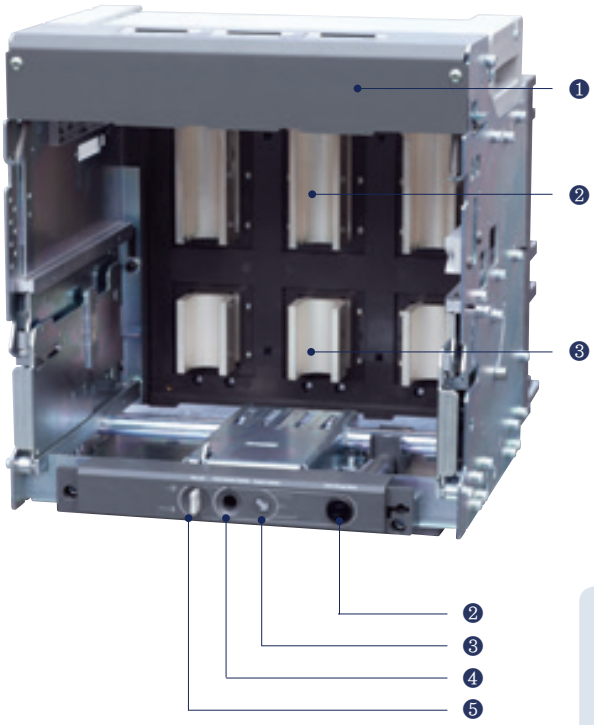



## Terms

❶ Trip relay
❷ Counter
❸ OFF button
❹ ON button
❺ Series name
❻ Charge handle
❼ Rated name plate
❽ Charge/Discharge indicator
❾ Closed/Open indicator
❿ Corporation logo
⓫ Arc cover (Zero Arc Space)
⓬ Safety control cover
⓭ Cradle
⓮ Draw-out handle
⓯ Position indicator
⓰ Handle inserting hole
⓱ Pad lock button
⓲ Arc chute
⓳ Control cover
⓴ Fixed type bracket
㉑ Rating plug

## *Susol*

### Cradle (Internal)



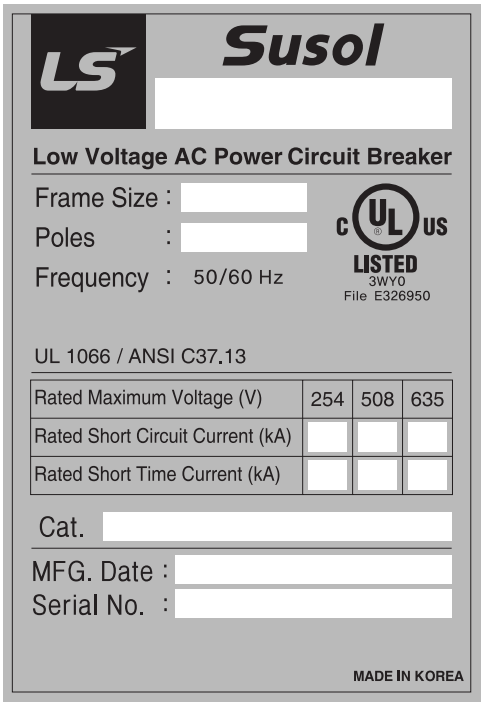

### Cradle (Rear)


### Terms

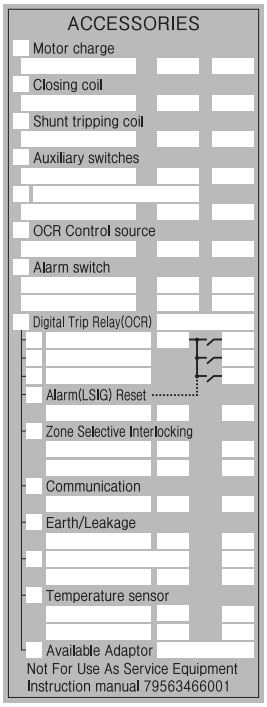
1. Safety control cover
2. Draw-out handle
3. Position indicator
4. Handle inserting hole
5. Pad lock button
6. Connecting conductor (Line side)
7. Connecting conductor (Load side)

## Main nameplate

**[Acronym explanation]**




**[Secondary nameplate]**



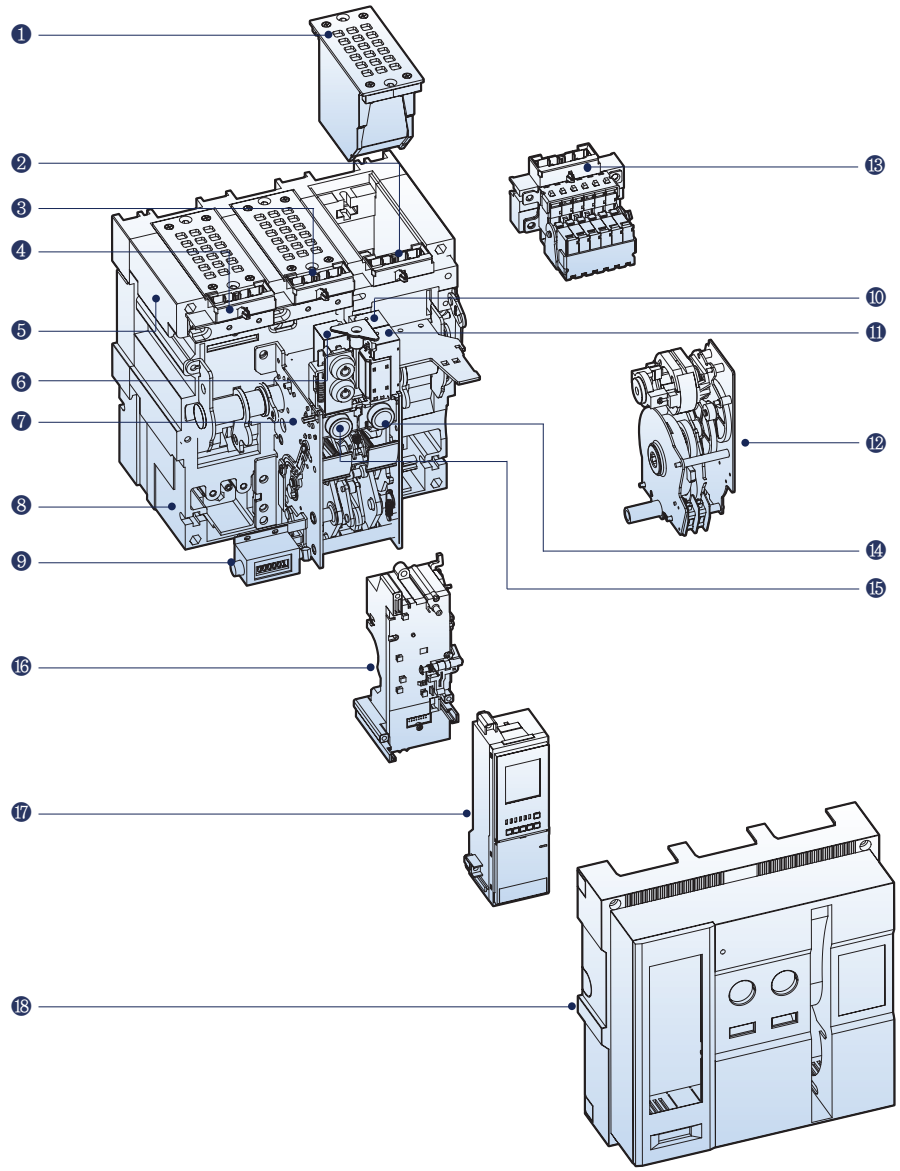

**Explanation of terminologies**

- Motor charge
- Closing coil
- Shunt tripping coil

  Control power and terminal No.
- Auxiliary switches: Contact specification and terminal No.
- Under voltage trip: UVT terminal No.
- OCR control source: Trip relay control power
- Alarm switch: Alarm and terminal No.
- Digital trip relay: Switching diagram
- Z.S.I: Input/Output terminal No.
- Reset: LED/LCD reset
- Communication: Communication and terminal No.
- Voltage module: Phase voltage and symbol
- Earth/Leakage: Ground fault / Earth leakage input terminal No.

# Internal Configuration

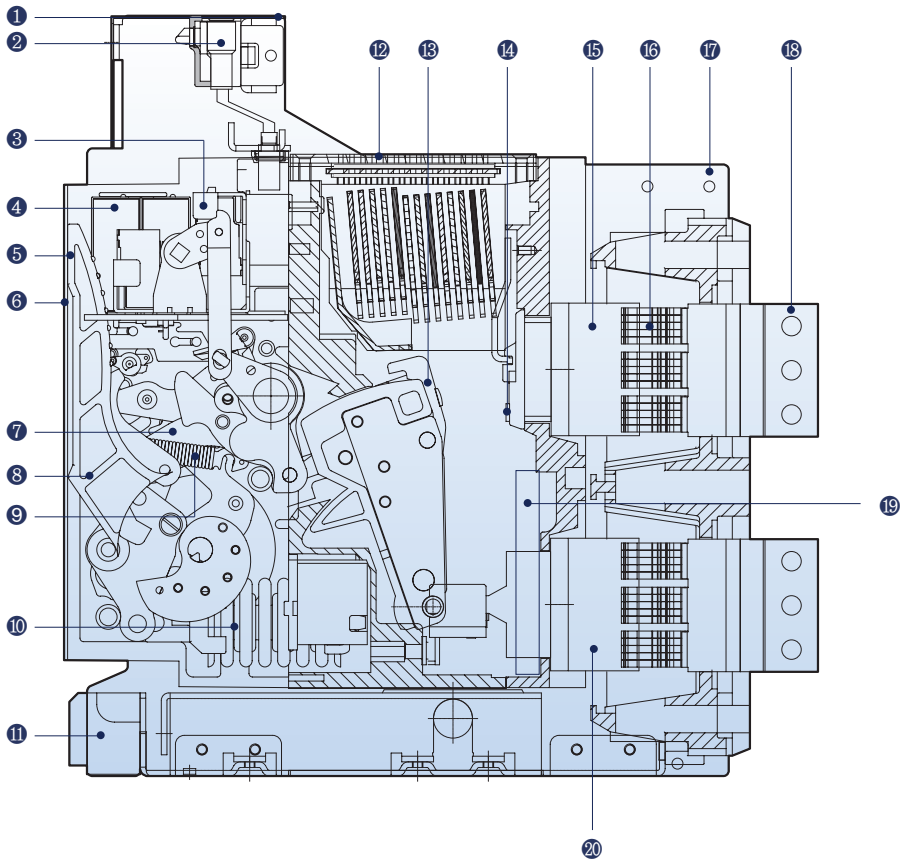
***Susol***




## Terms

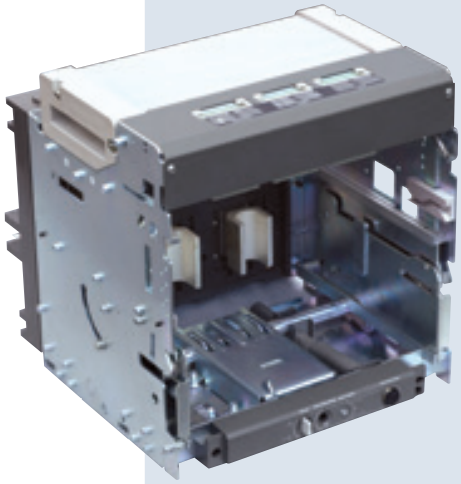
1. Arc chute
2. Aux. switch control terminal
3. Control power supply terminal
4. Trip relay control terminal
5. Carrying grip
6. Shunt coil or UVT coil
7. Mechanism
8. Main body
9. Counter
10. Shunt coil
11. Closing coil
12. Motor Ass'y
13. Aux. switch
14. Closed button
15. Open button
16. MTD base
17. Trip relay
18. Front cover

## *Susol*




### Terms

1. Control circuit terminal block
2. Control terminal
3. Auxiliary switches
4. Closing, Shunt, UVT coil
5. Trip relay
6. Front cover
7. Mechanism
8. Charge handle
9. Trip spring
10. Closing spring
11. Draw-in/out device
12. Arc extinguishing part
13. Moving contact
14. Fixed contact
15. Conductor on line side
16. Cradle finger
17. Cradle
18. Connecting conductor
19. CT (Current transformer)
20. Conductor on load side



# Ordering

## *Susol*

## Breaker and accessories

**UAS — 16 D 3 — 16 A**

| Frame type | Frame size | | Phasing | | Poles | | Sensor rating | | Mounting and terminal | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 08 | 800AF | D | 3/4P standard RST(N) | 3 | 3P | 04~08 | 400A~800A | Mounting | |
| | 16 | 1600AF | | | 4 | 4P | 08~16 | 800A~1600A | A | Drawout |
| | | | W | 4P reversed NRST | | | | | Fixed | |
| | | | | | | | | | H | Horizontal terminals |
| | | | | | | | | | V | Vertical terminals |
| | | | | | | | | | M | Horizontal for line |
| | | | | | | | | | | Vertical for load |
| | | | | | | | | | N | Vertical for line |
| | | | | | | | | | | Horizontal for load |
| | | | | | | | | | P | Front terminal |
| | | | | | | | | | G | Horizontal-con type |
| | | | | | | | | | W | Vertical-con type |

**UAH — 32 E 3 — 32**

| Frame type | Frame size | | Phasing | | Poles | | Sensor rating | |
|---|---|---|---|---|---|---|---|---|
| | 08 | 800AF | E | 3/4P standard RST(N) | 3 | 3P | 04~08 | 400A~800A |
| | 16 | 1600AF | | | 4 | 4P | 08~16 | 800A~1600A |
| | 20 | 2000AF | X | 4P reversed NRST | | | 10~20 | 1000A~2000A |
| | 25 | 2500AF | | | | | 12~25 | 1200A~2500A |
| | 32 | 3200AF | | | | | 16~32 | 1600A~3200A |
| | 32 | 3200AF | G | 3/4P standard RST(N) | 3 | 3P | 16~32 | 1600A~3200A |
| | 40 | 4000AF | | | 4 | 4P | 20~40 | 2000A~4000A |
| | 50 | 5000AF | Z | 4P reversed NRST | | | 25~50 | 2500A~5000A |
| | 60 | 6000AF | | | | | 30~60 | 3000A~6000A |

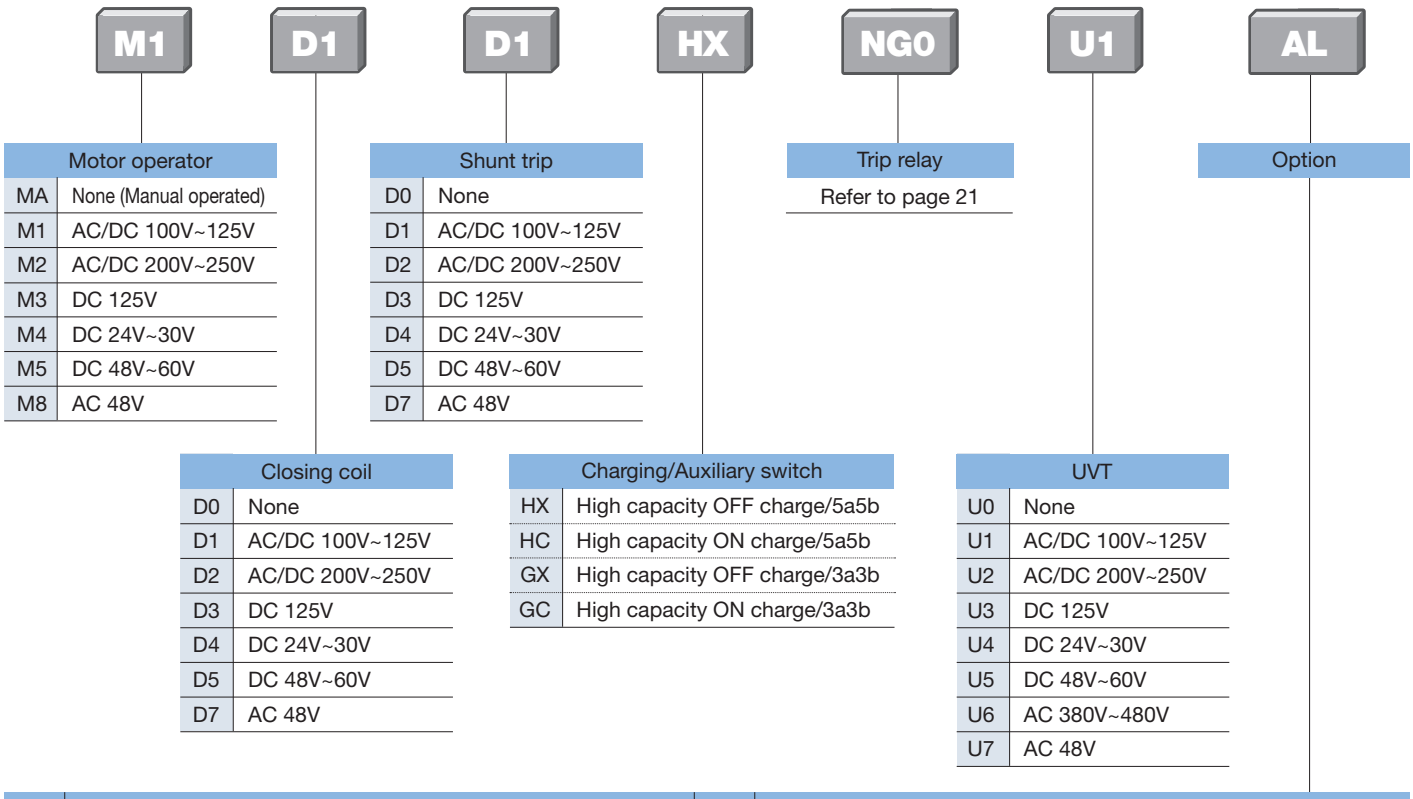
* Terminals for P type must be ordered separately
* G and W types can be applicable to D-Frame only
* Front terminal is only available for 800~2000A
* 3200AF(E, X), 6000AF(G,Z) offers only vertical type terminals (Busbar).

**UAA — 16 D 3 — 00**

| Frame type | Frame size | | Phasing | | Poles | | Sensor rating |
|---|---|---|---|---|---|---|---|
| | 08 | 800AF | D | 3/4P standard RST(N) | 3 | 3P | Not applied |
| | 16 | 1600AF | | | 4 | 4P | |
| | | | W | 4Preversed NRST | | | |
| | 08 | 800AF | E | 3/4P standard RST(N) | | | |
| | 16 | 1600AF | | | | | |
| | 20 | 2000AF | X | 4P reversed NRST | | | |
| | 25 | 2500AF | | | | | |
| | 32 | 3200AF | | | | | |
| | 32 | 3200AF | G | 3/4P standard RST(N) | | | |
| | 40 | 4000AF | | | | | |
| | 50 | 5000AF | Z | 4P reversed NRST | | | |
| | 60 | 6000AF | | | | | |

# Internal Configuration

***Susol***




| Motor operator | |
|---|---|
| MA | None (Manual operated) |
| M1 | AC/DC 100V~125V |
| M2 | AC/DC 200V~250V |
| M3 | DC 125V |
| M4 | DC 24V~30V |
| M5 | DC 48V~60V |
| M8 | AC 48V |

| Shunt trip | |
|---|---|
| D0 | None |
| D1 | AC/DC 100V~125V |
| D2 | AC/DC 200V~250V |
| D3 | DC 125V |
| D4 | DC 24V~30V |
| D5 | DC 48V~60V |
| D7 | AC 48V |

| Trip relay |
|---|
| Refer to page 21 |

| Option |
|---|

| Closing coil | |
|---|---|
| D0 | None |
| D1 | AC/DC 100V~125V |
| D2 | AC/DC 200V~250V |
| D3 | DC 125V |
| D4 | DC 24V~30V |
| D5 | DC 48V~60V |
| D7 | AC 48V |

| Charging/Auxiliary switch | |
|---|---|
| HX | High capacity OFF charge/5a5b |
| HC | High capacity ON charge/5a5b |
| GX | High capacity OFF charge/3a3b |
| GC | High capacity ON charge/3a3b |

| UVT | |
|---|---|
| U0 | None |
| U1 | AC/DC 100V~125V |
| U2 | AC/DC 200V~250V |
| U3 | DC 125V |
| U4 | DC 24V~30V |
| U5 | DC 48V~60V |
| U6 | AC 380V~480V |
| U7 | AC 48V |

| Code | Description | | Code | Description | |
|---|---|---|---|---|---|
| AL | AL1+MRB | | K | K1 | Key lock |
| A1 | AL1+MRB +RES (AC110~130V) *AC only | | K2 | K2 | Key Interlock set |
| A2 | AL1+AL2 +MRB | | K3 | K3 | Key Interlock double |
| A3 | AL1+MRB +RES (DC110~125V) *DC only | | K5 | K5 | Profalux lock (CAMLOCK type) |
| A4 | AL1+MRB +RES (AC200~250V) *AC only | | K6 | K6 | Kirkkey lock (CAMLOCK type) |
| A5 | AL1+MRB +Auto reset | | K7 | K7 | Kirkkey lock (CN22 type) |
| A6 | AL1+AL2 +MRB +Auto reset | | R | RCS | Ready to close switch |
| A7 | AL1+MRB +RES (DC110~125V) +Auto reset *DC only | | T | TM | Temperature monitoring |
| A8 | AL1+MRB +RES (AC200~250V) +Auto reset *AC only | | H1 | | AC/DC 100V ~125V, Double shunt coil |
| A9 | AL1+MRB +RES (AC110~130V) +Auto reset *AC only | | H2 | | AC/DC 200V ~250V, Double shunt coil |
| S | CS2 | Charge switch communication | H3 | SHT2 Note 2) | DC 125V, Double shunt coil |
| B | B | Lockable On/Off button cover | H4 | | DC 24V ~30V, Double shunt coil |
| M | MI | Mechanical interlock | H5 | | DC 48V ~60V, Double shunt coil |
| D | DI or MOC | Door interlock or MOC (Mechanism operated cell switch) | H7 | | AC 48V, Double shunt coil |

| | |
|---|---|
| N01 | A4 (AL1+MRB +RES(AC200~250V))+B(Lockable On/Off button cover)+K(Key lock)+R(Ready to close switch)+M(Mechanic interlock)+ E(Spring auto release) |
| N02 | AL (AL1+MRB)+K(Key lock(OFF lock))+R(Ready to close switch)+D(Door interlock or MOC)+H1(AC/DC 100V ~ 130V, Double shunt coil)+E(Spring auto release) |
| N03 | B(Lockable On/Off button cover)+K2(Key interlock set)+R(Ready to close switch)+T(Temperature monitoring) |
| N04 | A4(AL1+MRB+RES(AC200~250V))+B(Lockable On/Off button cover)+K(Key lock(OFF lock))+M(Mechanical interlock)+T(Temperature monitoring) |
| N05 | A1(AL1+MRB+RES110~130V)+B(Lockable On/Off button cover)+K(Key lock(OFF lock))+R(Ready to close switch)+ M(Mechanical interlock)+T(Temperature monitoring) |
| N06 | A2(AL1+AL2+MRB)+K(Key lock(OFF lock))+R(Ready to close switch)+T(Temperature monitoring) |

Note) 1. * Codes for over 5 optional accessories are composed separately 2. UVT and SHT2 can not be selected together. Select one of two.
3. C(counter) is provided as standard.

# Ordering

***Susol***

## Adapter (Cradle)

**UAL** — **S16D** **3** — **A** **H** **E** **S**

**For UL ACB cradle type**

**Frame size** Note)

| | |
|---|---|
| S16D | 1600AF |
| S20E | 2000AF |
| S25E | 2500AF |
| S32E | 3200AF |
| S50G | 5000AF |
| S60G | 6000AF |

**Number of poles**

| | |
|---|---|
| 3 | 3P |
| 4 | 4P |

**Secondary connector type**

| | |
|---|---|
| A | Connector type |
| B | Screw joint type |

**Terminal configuration**

| | |
|---|---|
| H | Horizontal type |
| V | Vertical type |
| M | Line: Horizontal<br>Load: Vertical |
| N | Line: Vertical<br>Load: Horizontal |
| P | Front type |
| G | Horizontal-con type |
| W | Vertical-con type |

**Shutter**

| | |
|---|---|
| E | Without safety shutter |
| F | With safety shutter |

**Other options**

| | |
|---|---|
| S | Arc cover |

* Terminals for P type must be ordered separately
* G and W types can be applicable to S16D (1600AF) only.

Note) The corresponding Breaker Adapter

| Breaker | | Adapter |
|---|---|---|
| UAS-08D | UAS-08W | S16D |
| UAS-16D | UAS-16W | |
| UAH-08E | UAH-08X | S20E |
| UAH-16E | UAH-16X | |
| UAH-20E | UAH-20X | |
| UAH-25E | UAH-25X | S25E |
| UAH-32E | UAH-32X | S32E |
| UAH-32G | UAH-32Z | S50G |
| UAH-40G | UAH-40Z | |
| UAH-50G | UAH-50Z | |
| UAH-60G | UAH-60Z | S60G |

## Rating plug

| Rating plug classfication | | | | ACB ampere frame | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | For none NCT type | For NCT type | Rating | 800A | 1600A | 2000A | 2500A | 3200A | 4000A | 5000A | 6000A |
| Rating plug code | 73263466352 | 73263466372 | 400A | 400A~ 800A | | | | | | | |
| | 73263466353 | 73263466373 | 600A | | | | | | | | |
| | 73263466354 | 73263466374 | 630A | | | | | | | | |
| | 73263466355 | 73263466375 | 800A | | 800A~ 1600A | | | | | | |
| | 73263466356 | 73263466376 | 1000A | | | 1000A~ 2000A | | | | | |
| | 73263466357 | 73263466377 | 1200A | | | | 1200A~ 2500A | | | | |
| | 73263466358 | 73263466378 | 1250A | | | | | | | | |
| | 73263466359 | 73263466379 | 1600A | | | | | 1600A~ 3200A | | | |
| | 73263466360 | 73263466380 | 2000A | | | | | | 2000A~ 4000A | | |
| | 73263466361 | 73263466381 | 2500A | | | | | | | 2500A~ 5000A | |
| | 73263466362 | 73263466382 | 3000A | | | | | | | | 3000A~ 6000A |
| | 73263466363 | 73263466383 | 3200A | | | | | | | | |
| | 73263466364 | 73263466384 | 3600A | | | | | | | | |
| | 73263466365 | 73263466385 | 4000A | | | | | | | | |
| | 73263466366 | 73263466386 | 5000A | | | | | | | | |
| | 73263466367 | 73263466387 | 6000A | | | | | | | | |

* A rating plug ranging from 50 to 100% of the ACB ampere frame should be used.

* The minimum value of the OCR self-power supply is based on the CT rating, not the rating plug rating.

## *Susol*

# Trip relay

**N** | **G** | **0**

| Trip relay type | Communication & protection | Control voltage & frequency |
|---|---|---|

### N

| | |
|---|---|
| 000 | Without trip relay |
| N | Normal |

### G

| | |
|---|---|
| G | Ground fault |

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

### 0

| | | |
|---|---|---|
| 0 | Self-power only Note1) | 60Hz |
| 5 | Self-power only Note1) | 50Hz |

### A

| | |
|---|---|
| A | Ammeter |

### G

| | |
|---|---|
| G | Ground fault |
| I | Ground fault + ERMS |
| E | Earth leakage(External CT, Earth leakage over 30A) |
| T | Earth leakage(External CT, Earth leakage over 30A) + ERMS |
| C | Ground fault + Comm. |
| Q | Ground fault + Comm. + ERMS |
| X | Earth leakage(External CT, Earth leakage over 30A) + Comm. |
| R | Earth leakage(External CT, Earth leakage over 30A) + Comm. + ERMS |
| N ** | Ground fault (External NCT) + Comm. |
| M ** | Ground fault (External NCT) + Comm. + ERMS |

### 0

| | | |
|---|---|---|
| 0 | Self-power only | 60Hz |
| 1 | AC/DC 100V~250V | 60Hz |
| 2 | DC 15V~60V | 60Hz |
| 5 | Self-power only | 50Hz |
| 6 | AC/DC 100V~250V | 50Hz |
| 7 | DC 15V~60V | 50Hz |

* L/S/I/G(or Earth leakage) configuration as standard (Unable to select ground fault and earth leakage simultaneously)
* Ground fault detection by vector sum(G,C)
* Earth leakage system
  - E,X: External CT - Private ZCT applied(faullt current >30A)
* Comm. and output contacts DO NOT work under self-power condition. (LED indicators will still function)

### P

| | |
|---|---|
| P | Power meter |

### C

| | |
|---|---|
| C | Ground fault + Comm. |
| Q | Ground fault + Comm. + ERMS |
| X | Earth leakage(External CT, Earth leakage over 30A) + Comm. |
| R | Earth leakage(External CT, Earth leakage over 30A) + Comm. + ERMS |
| N ** | Ground fault (External NCT) + Comm. |
| M ** | Ground fault (External NCT) + Comm. + ERMS |

### 1

| | | |
|---|---|---|
| 1 | AC/DC 100V~250V | 60Hz |
| 2 | DC 15V~60V | 60Hz |
| 6 | AC/DC 100V~250V | 50Hz |
| 7 | DC 15V~60V | 50Hz |

* L/S/I/G(or Earth leakage) configuration as standard (Unable to select ground fault and earth leakage simultaneously)
* Ground fault detection by vector sum
* Earth leakage system
  - X: External CT - Private ZCT applied(faullt current >30A)
* Applicable to generator protection purpose
* Comm. and output contacts DO NOT work under self-power condition. (LED indicators will still function)

### S

| | |
|---|---|
| S | Supreme meter |

### C

| | |
|---|---|
| C | Ground fault + Comm. |
| Q | Ground fault + Comm. + ERMS |
| X | Earth leakage(External CT, Earth leakage over 30A) + Comm. |
| R | Earth leakage(External CT, Earth leakage over 30A) + Comm. + ERMS |
| N ** | Ground fault (External NCT) + Comm. |
| M ** | Ground fault (External NCT) + Comm. + ERMS |

### 1

| | | |
|---|---|---|
| 1 | AC/DC 100V~250V | 60Hz |
| 2 | DC 15V~60V | 60Hz |
| 6 | AC/DC 100V~250V | 50Hz |
| 7 | DC 15V~60V | 50Hz |

* L/S/I/G(or Earth leakage) configuration as standard (Unable to select ground fault and earth leakage simultaneously)
* Ground fault detection by vector sum
* Earth leakage system
  - X: External CT - Private ZCT applied(faullt current >30A)
* Applicable to generator protection purpose
* Comm. and output contacts DO NOT work under self-power condition. (LED indicators will still function)

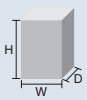
** AN, PN, SN, AM, PM, SM provide the function to detect and protect the ground fault current by applying the NCT (Neutral CT) in the neutral wire when 3pole circuit breaker is used in 3-phase 4-wire system.
Please use NCT with the secondary output of 5A rating. (NCT is not provided)

Note) 1. L/S/I/G(or Earth leakage) configuration as standard (Unable to select ground fault and earth leakage simultaneously)
2. Ground fault, earth leakage and pre-trip alarm functions are mutually exclusive.
3. Functions like Metering, Communication, ZSI, Remote reset and Digital output are NOT available only under Self-power condition.
4. P and S types require voltage module to be purchased separately.

# Ratings for UL Listing/ANSI Certified Susol UA Circuit Breakers

## *Susol*

| | | | | | Susol | |
|---|---|---|---|---|---|---|
| Type | | | | | UAS-□□D | |
| AF | | | | | 08 | 16 |
| Rated current (In max) | (A) | | | at 40°C | 800 | 1600 |
| Rated current | (A) | | | at 40°C | | 800 |
| | | | | | 400 | 1000 |
| | | | | | 600 | 1200 |
| | | | | | 630 | 1250 |
| | | | | | 800 | 1600 |
| Rated maximum voltage | (V) | | | | 254V / 508V / 635V | |
| Frequency | (Hz) | | | | 50 / 60 | |
| Number of poles | (P) | | | | 3P / 4P | |
| Type of trip relay (Electronic trip device) | | | | | N, A, P, S (4 type) | |
| Rated short circuit current (Sym.) UL 1066 ANSI C37.13 | (kA) | With instantaneous | AC | 635V | 65 | |
| | | | | **508V** | **85** | |
| | | | | 254V | 85 | |
| | | Without instantaneous | AC | 635V | 65 | |
| | | | | **508V** | **65** | |
| | | | | 254V | 65 | |
| Rated short time current | (kA) | | | | 65 | |
| Operating time (t) | (ms) | Maximum total breaking time | | | 50ms | |
| | | Maximum closing time | | | 80ms | |
| Life cycle ACB | (time) | Mechanical | Without maintenance | | 12,500 | |
| | | | With maintenance | | - | |
| | | Electrical | Without maintenance | | 2,800 | |
| | | | With maintenance | | - | |
| Weight | lb (kg) | Drawout type | Main Body with Cradle | 3P | 154 (70) | |
| | | | | 4P | 187 (85) | |
| | | | Only Cradle | 3P | 71 (32) | |
| | | | | 4P | 84 (38) | |
| | | Fixed type | Motor charging type | 3P | 77 (35) | |
| | | | | 4P | 99 (45) | |
| External dimension | Draw-out type | in (mm) | H×W×D | 3P | 16.93×13.15×16.02 (430×334×407) | |
| | | | | 4P | 16.93×16.5×16.02 (430×419×407) | |
| | Fixed type | in (mm) | H×W×D | 3P | 11.81×11.81×11.61 (300×300×295) | |
| | | | | 4P | 11.81×15.16×11.61 (300×385×295) | |
| Enclosure dimension | | in (mm) | H×W×D | 3P | 19.69×15.75×13.39 (500×400×340) | |
| | | | | 4P | 19.69×19.69×13.39 (500×500×340) | |



## Susol

| Susol | | | | |
|---|---|---|---|---|
| UAH-□□E | | | | |
| 08 | 16 | 20 | 25 | 32 |
| 800 | 1600 | 2000 | 2500 | 3200 |
| 400 | 800 | 1000 | 1200 | 1600 |
| 600 | 1000 | 1200 | 1250 | 2000 |
| 630 | 1200 | 1250 | 1600 | 2500 |
| 800 | 1250 | 1600 | 2000 | 3000 |
| | 1600 | 2000 | 2500 | 3200 |
| 254V/508V/635V | | | | |
| 50/60 | | | | |
| 3P/4P | | | | |
| N, A, P, S (4 type) | | | | |
| 85 | | | | |
| **100** | | | | |
| 100 | | | | |
| 85 | | | | |
| **85** | | | | |
| 85 | | | | |
| 85 | | | | |
| 50ms | | | | |
| 80ms | | | | |
| 12,500 | | | | 12,500 |
| - | | | | - |
| 2,800 | | | | 1,000 |
| - | | | | - |
| 214 (97) | | | 245 (111) | 326 (148) |
| 269 (122) | | | 309 (140) | 414 (188) |
| 99 (45) | | | 123 (56) | 205 (93) |
| 121 (55) | | | 152 (69) | 256 (116) |
| 101 (46) | | | 110 (50) | 196 (89) |
| 126 (57) | | | 137 (62) | 249 (113) |
| 16.93×16.22×16.02 (430×412×407) | | | | |
| 16.93×20.75×16.02 (430×527×407) | | | | |
| 11.81×14.88×11.61 (300×378×295) | | | | |
| 11.81×19.41×11.61 (300×493×295) | | | | |
| 19.69×19.69×13.39 (500×500×340) | | | | |
| 19.69×24.21×13.39 (500×615×340) | | | | |

| Susol | | | |
|---|---|---|---|
| UAH-□□G | | | |
| 32 | 40 | 50 | 60 |
| 3200 | 4000 | 5000 | 6000 |
| 1600 | 2000 | 2500 | 3000 |
| 2000 | 2500 | 3000 | 3200 |
| 2500 | 3000 | 3200 | 3600 |
| 3000 | 3200 | 3600 | 4000 |
| 3200 | 3600 | 4000 | 5000 |
| | 4000 | 5000 | 6000 |
| 254V/508V/635V | | | |
| 50/60 | | | |
| 3P/4P | | | |
| N, A, P, S (4 type) | | | |
| 100 | | | |
| **130** | | | |
| 130 | | | |
| 100 | | | |
| **100** | | | |
| 100 | | | |
| 100 | | | |
| 50ms | | | |
| 90ms | | | |
| 10,000 | | | |
| - | | | |
| 1,000 | | | |
| - | | | |
| 489 (222) | | | 709 (321) |
| 626 (284) | | | 919 (417) |
| 276 (125) | | | 482 (218) |
| 355 (161) | | | 630 (286) |
| 227 (103) | | | 433 (196) |
| 287 (130) | | | 561 (255) |
| 18.11×30.91×16.02 (460×785×407) | | | |
| 18.11×39.96×16.02 (460×1015×407) | | | |
| 11.81×29.57×11.61 (300×751×295) | | | |
| 11.81×38.62×11.61 (300×981×295) | | | |
| 31.5×32.48×13.39 (800×825×340) | | | |
| 31.5×41.54×13.39 (800×1055×340) | | | |

# Trip relay(OCR)


The trip relay of Susol ACB provides the additional protection functions for voltage, frequency, unbalance, and others in addition to main protection functions for over current, short-circuit, ground fault. It supports the advanced measurement functions for voltage, current, power, electric energy, harmonics, communication function, and others.
Analog trip function interlocked with mechanism enhances the durability as well as the breaking capacity of the ACB.
Zone selective interlocking function makes the protective coordination more simple and thermal memory can be applied to various loads.

## Contents

# Trip Relays

***Susol***

## Trip relay types

| Classification | N type | A type | P type | S type |
|---|---|---|---|---|
| Externals |  |  |  |  |
| Current protection | • L / S / I / G | • L / S / I / G(or Earth leakage)<br>• Thermal<br>• ZSI(Protective coordination)<br>• ERMS | • L / S / I / G(or Earth leakage)<br>• Thermal(Continuous)<br>• ZSI(Protective coordination)<br>• ERMS | • L / S / I / G(or Earth leakage)<br>• Thermal(Continuous)<br>• ZSI(Protective coordination)<br>• ERMS |
| Other protection | - | • Earth leakage (Option) | • Earth leakage(Option)<br>• Over/Under voltage<br>• Over/Under frequency<br>• Unbalance(Voltage/Current)<br>• Reverse power | • Earth leakage(Option)<br>• Over/Under voltage<br>• Over/Under frequency<br>• Unbalance(Voltage/Current)<br>• Reverse power |
| Measurement function | - | • Current (R / S / T / N) | • 3 Phase Voltage/Current RMS/Vector<br>• Power(P, Q, S), PF(3-Phase)<br>• Energy(Positive/Negative)<br>• Frequency, Demand | • 3 Phase Voltage/Current RMS/Vector<br>• Power(P, Q, S), PF(3-Phase)<br>• Energy(Positive/Negative)<br>• Frequency, Demand<br>• Voltage/Current harmonics (1st~63th)<br>• 3 Phase Waveforms<br>• THD, TDD, K-Factor |
| Fine adjustment | - | - | • Fine adjustment for long/short time delay/instantaneous/ ground | • Fine adjustment for long/short time delay/instantaneous/ ground |
| Pre Trip Alarm | - | - | • Overload protection relays : DO (Alarm) (Ground fault is not available when using Pre trip alarm) | • Overload protection relays : DO (Alarm) (Ground fault is not available when using Pre trip alarm) |
| Digital Output | - | • 3DO (Fixed)<br>• L, S/I, G Alarm | • 3DO (Programmable)<br>• Trip, Alarm, General | • 3DO (Programmable)<br>• Trip, Alarm, General |
| IDMTL setting | - | - | • Compliance with IEC60255-3 SIT, VIT, EIT, DT | • Compliance with IEC60255-3 SIT, VIT, EIT, DT |
| Communication | - | • Modbus/RS–485<br>• Profibus–DP | • Modbus / RS-485<br>• Profibus-DP | • Modbus / RS-485<br>• Profibus-DP |
| Power supply | • Self Power<br>- Power source works over 20% of load current. | • Self Power<br>- Power source works over 20% of load current.<br>- External power source are required for comm.<br>• AC/DC 100~250V<br>• DC 15~60V | • AC/DC 100~250V<br>• DC 15~60V<br>Basic protection function(L / S / I / G) is still under normal operation without control power. | • AC/DC 100~250V<br>• DC 15~60V |
| RTC timer | - | • Available | • Available | • Available |
| LED for trip info. | • Long time delay<br>• Short time delay/Instantaneous<br>• Ground fault | • Long time delay<br>• Short time delay/Instantaneous<br>• Ground fault | • Long time delay<br>• Short time delay/Instantaneous<br>• Ground fault | • Long time delay<br>• Short time delay/Instantaneous<br>• Ground fault |
| Fault recording | - | • 10 records (Fault/Current/Date and Time) | • 256 records (Fault/Current/Date and Time) | • 256 records<br>• Last fault wave recording (voltage, current are recorded in 3-phase, and can be read only by communication) |
| Event recording | - | - | • 256 records(Content, Status, Date) | • 256 records(Content, Status, Date) |
| Operating button | • Reset button | • Reset, Menu Up/Down, Tap, Enter | • Reset, Menu Up/Down, Tap, Enter | • Reset, Menu Up/Down, Tap, Enter |

Each OCR type has Battery in itself.

1. Battery lifespan
   1) When turned off: 14~28years
   2) When using 1 LED consecutively or turned off: 7~14days

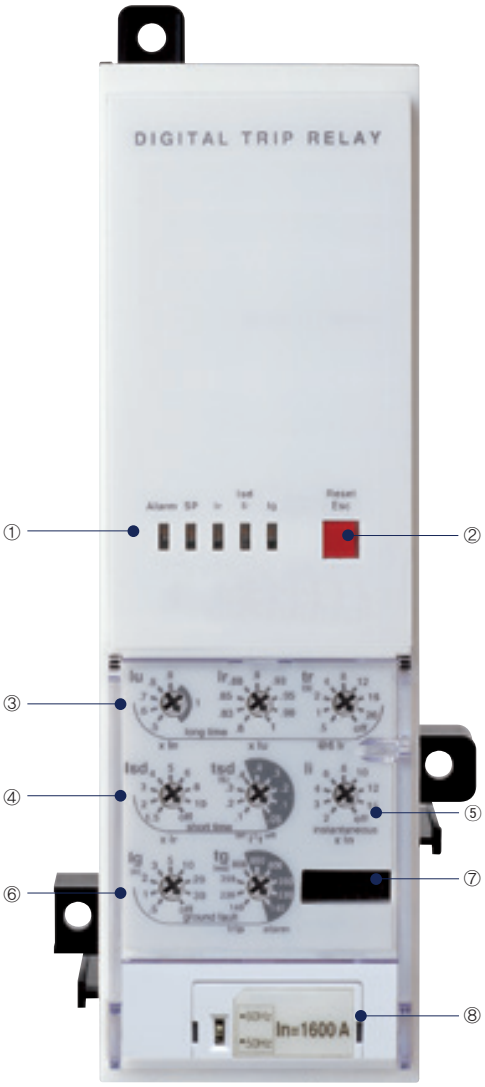
2. The display minimum range of OCR current
   1) A type: When more 15% than rated current (In)
   2) P/S type: When more 12% than rated current (In)

* L/S/I/G(or Earth leakage) configuration as standard
Unable to select ground fault and earth leakage simultaneously

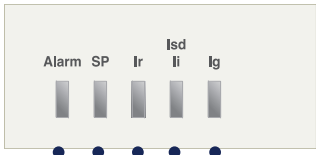
# Trip Relays
***Susol***

## N type: 「Normal」 type

- Optimized protection function
- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - $I^2t$ On / Off optional (for short-time delay)
- Ground fault protection
  - $I^2t$ On / Off optional
- Self-Power




**① LED: Indication of trip info. and overload state**




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

**② Reset Key: Fault reset or battery check**

**③ Iu, Ir: Long-time current setting, tr: Long-time tripping delay setting**

**④ Isd: Short-time current setting, tsd: Short-time tripping delay setting**

**⑤ Ii: Instantaneous current setting**

**⑥ Ig: Ground fault current setting, tg: Ground fault tripping delay setting**

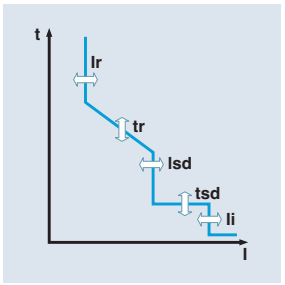
**⑦ Test terminal: OCR test terminal (Connected with OCR tester)**

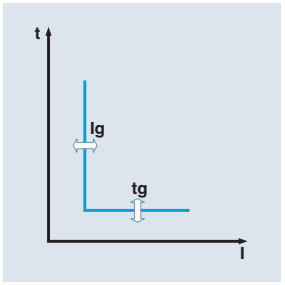
**⑧ Rating plug**
- **Rated current setting (45~100% of the AF)**
- **Frequency selectable(60Hz/50Hz)**

# Trip Relays
***Susol***

## Protection

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Long time** | | | | | | | | | | | |
| Current setting (A) | Iu = In×... | | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | | | |
| | Ir = Iu×... | | 0.8 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |
| Time delay (s) | tr@(1.5×Ir) | | 12.5 | 25 | 50 | 100 | 200 | 300 | 400 | 500 | Off |
| Accuracy: ±15% or | tr@(6.0×Ir) | | 0.5 | 1 | 2 | 4 | 8 | 12 | 16 | 20 | Off |
| below 100ms | tr@(7.2×Ir) | | 0.34 | 0.69 | 1.38 | 2.7 | 5.5 | 8.3 | 11 | 13.8 | Off |
| **Short time** | | | | | | | | | | | |
| Current setting (A) | Isd = Ir×... | | 1.5 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | Off |
| Time delay (s) | tsd | $I^2t$ Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | | | | |
| Accuracy: ±10% or | | $I^2t$ On @(10×Ir) | | 0.1 | 0.2 | 0.3 | 0.4 | | | | |
| below 50ms | ($I^2t$ Off) | Min. Trip Time(ms) | 20 | 80 | 160 | 260 | 360 | | | | |
| | | Max. Trip Time(ms) | 80 | 140 | 240 | 340 | 440 | | | | |
| **Instantaneous** | | | | | | | | | | | |
| Current setting (A) | Ii = In×... | | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 15 | Off |
| Tripping time | | | below 50ms | | | | | | | | |
| **Ground fault** | | | | | | | | | | | |
| Pick-up (A) | Ig = In×... | | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | Off |
| Time delay (s) | tg | $I^2t$ Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | | | | |
| Accuracy: ±10%(Ig≥0.4In) | | $I^2t$ On @(1×In) | | 0.1 | 0.2 | 0.3 | 0.4 | | | | |
| ±20%(Ig<0.4In) | ($I^2t$ Off) | Min. Trip Time(ms) | 20 | 80 | 160 | 260 | 360 | | | | |
| or below 50ms | | Max. Trip Time(ms) | 80 | 140 | 240 | 340 | 440 | | | | |

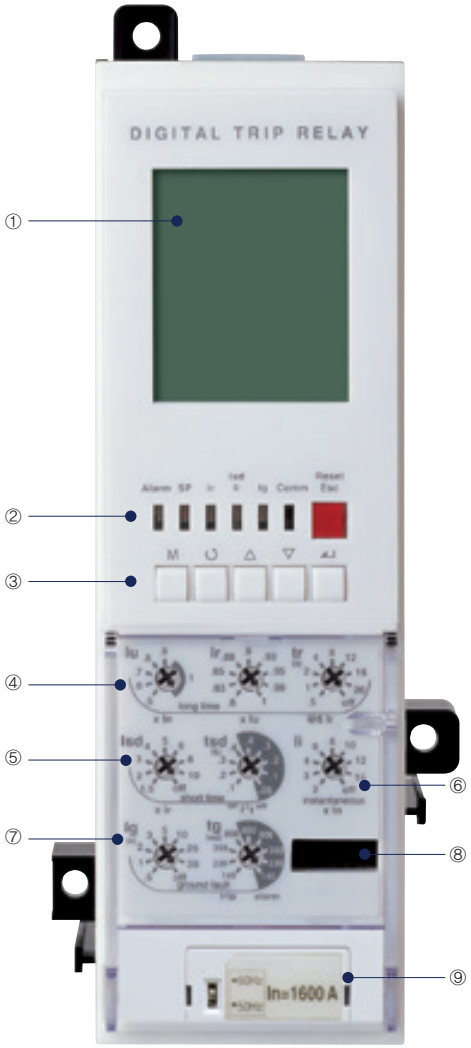


# Trip Relays
***Susol***

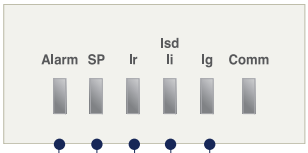
## A type: 「Ammeter」 type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - $I^2t$ On / Off optional (for short-time delay)
- Ground fault protection
  - $I^2t$ On / Off optional
  - Trip / Alarm selectable (need external power)
  - Blocking Time (0~60s)
    Does not detect ground fault during Blocking time.
- Realization of protective coordination by ZSI
  (Zone Selective Interlocking)
  - Disable / Enable Selectable
- High-performance and high-speed MCU built-in
  - Accurate measurement with tolerance of 1.0%
- Measurement and Display Function
  - High detailed measurement for current
  - character LCD type
- Fault recording
  - Records Max. up to 10 fault information about fault type, fault phase, fault data, occurrence time of fault
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- 3 DO(Digital Output)
  - Fixed
- Communication
  - Modbus / RS485
  - Profibus-DP
- ERMS
  - Arc Flash Reduction
  - Instantaneous setting value is minimized. (2*In)



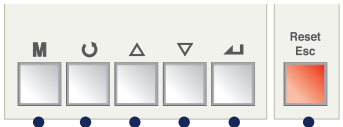

**① LCD: Indication of measurement and information**

**② LED: Indication of trip info. and overload state**




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

**③ Key: Move to menu or reset**




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

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

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

**⑥ Ii: Instantaneous current setting**

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

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

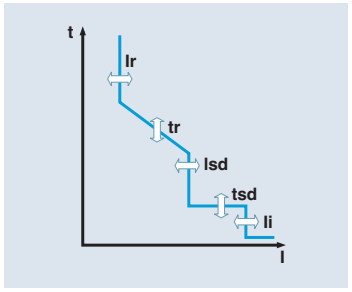
**⑨ Rating plug**
- **Rated current setting (45~100% of the AF)**
- **Frequency selectable(60Hz/50Hz)**

# Trip Relays

## *Susol*

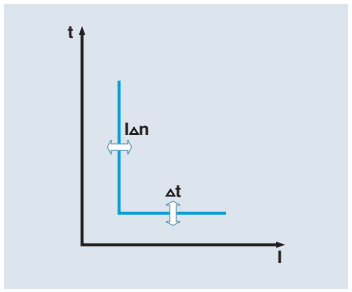
### Protection

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Long time** | | | | | | | | | | | |
| Current setting (A) | Iu = In×... | | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | | | |
| | Ir = Iu×... | | 0.8 | 0.83 | 0.85 | 0.88 | 0.9 | 0.93 | 0.95 | 0.98 | 1.0 |
| Time delay (s) | tr@(1.5×Ir) | | 12.5 | 25 | 50 | 100 | 200 | 300 | 400 | 500 | Off |
| Accuracy: ±15% or | tr@(6.0×Ir) | | 0.5 | 1 | 2 | 4 | 8 | 12 | 16 | 20 | Off |
| below 100ms | tr@(7.2×Ir) | | 0.34 | 0.69 | 1.38 | 2.7 | 5.5 | 8.3 | 11 | 13.8 | Off |
| **Short time** | | | | | | | | | | | |
| Current setting (A) | Isd = Ir×... | | 1.5 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | Of |
| Time delay (s) | tsd | $I^2t$ Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | | | | |
| Accuracy: ±10% or | | $I^2t$ On @(10×Ir) | | 0.1 | 0.2 | 0.3 | 0.4 | | | | |
| below 50ms | ($I^2t$ Off) | Min. Trip Time(ms) | 20 | 80 | 160 | 260 | 360 | | | | |
| | | Max. Trip Time(ms) | 80 | 140 | 240 | 340 | 440 | | | | |
| **Instantaneous** | | | | | | | | | | | |
| Current setting (A) | Ii = In×... | | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 15 | Off |
| Tripping time | | | below 50ms | | | | | | | | |
| **Ground fault** | | | | | | | | | | | |
| Pick–up (A) | Ig = In×... | | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | Off |
| Time delay (s) | tg | $I^2t$ Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | | | | |
| Accuracy: ±10%(Ig≥0.4In) | | $I^2t$ On @(1×In) | | 0.1 | 0.2 | 0.3 | 0.4 | | | | |
| ±20%(Ig<0.4In) | ($I^2t$ Off) | Min. Trip Time(ms) | 20 | 80 | 160 | 260 | 360 | | | | |
| or below 50ms | | Max. Trip Time(ms) | 80 | 140 | 240 | 340 | 440 | | | | |





| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Earth leakage (Option)** | | | | | | | | | | | |
| Current setting (A) | I△n | | 0.5 | 1 | 2 | 3 | 5 | 10 | 20 | 30 | Off |
| Time delay (ms) | △t | Alarm Time(ms) | 140 | 230 | 350 | 800 | 950 | | | | |
| Accuracy: ±15% | | Trip Time(ms) | 140 | 230 | 350 | 800 | | | | | |

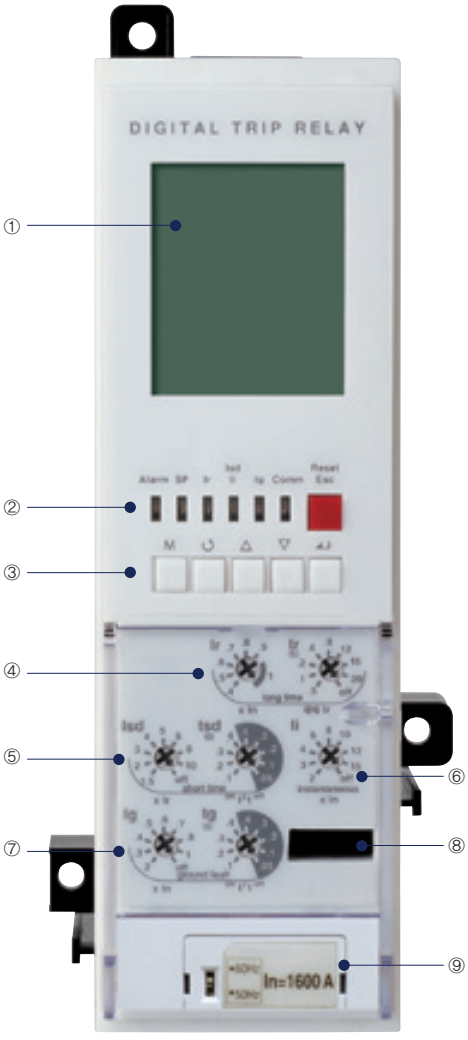



Note) Current setting values are secondary current of the external CT.
Recommended not to use current setting values more than 5A.

# Trip Relays
***Susol***

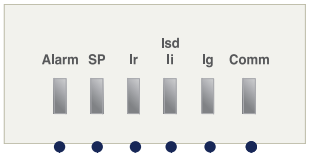
## P type: 「Power meter」 type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - $I^2t$ On / Off optional (for short-time delay)
- Ground fault protection
  - $I^2t$ On / Off optional
  - Trip / Alarm selectable (need external power)
  - Blocking Time (0~60s)
    Do not ground fault detect during Blocking time
- Protection for Over voltage / Under voltage / Over frequency / Under frequency / Unbalance / Reverse power
- Realization of protective coordination by ZSI (Zone Selective Interlocking)
  - Disable / Enable Selectable
- Fine-adjustable setting by knob and key
- ERMS
  - Arc Flash Reduction
  - Instantaneous setting value is minimized. (2*In)
- IDMTL setting (SIT, VIT, EIT, DT curve)
  - Basic setting : “None”. Thermal curve.
- Measurement and Display Function
  - High detailed measurement for 3 phase current / Voltage / Power / Energy / Phase angle / Frequency / PF / Demand
  - 128 x 128 Graphic LCD
  - Indicates current / voltage Vector Diagram and Waveform
- Fault recording
  - Records Max. up to 256 fault information about fault type, fault phase, fault value, occurrence time of fault
- Event recording
  - Records events of device related to setting change, operation and state change. (Max. up to 256)
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- 3 DO(Digital output)
  - Programmable for alarm, trip and general DO
- Communication
  - Modbus / RS485
  - Profibus-DP



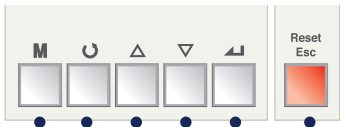

**① Graphic LCD: Indication of measurement and information**

**② LED: Indication of trip info. and overload state**




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

**③ Key: Move to menu or reset**




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

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

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

**⑥ Ii: Instantaneous current setting**

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

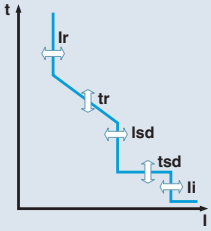
**⑧ Test terminal: OCR test terminal (Connected with OCR tester)**

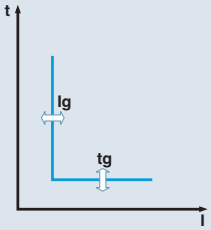
**⑨ Rating plug**
- **Rated current setting (45~100% of the AF)**
- **Frequency selectable(60Hz/50Hz)**

# Trip Relays
## *Susol*

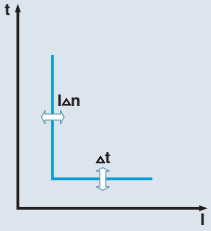
## Protection

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Long time** | | | | | | | | | | |
| Current setting (A) | Ir = In×... | | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | |
| Time delay (s) | tr@(1.5×Ir) | | 12.5 | 25 | 50 | 100 | 200 | 300 | 400 | 500 | Off |
| Accuracy: ±15% or | tr@(6.0×Ir) | | 0.5 | 1 | 2 | 4 | 8 | 12 | 16 | 20 | Off |
| below 100ms | tr@(7.2×Ir) | | 0.34 | 0.69 | 1.38 | 2.7 | 5.5 | 8.3 | 11 | 13.8 | Off |
| **Short time** | | | | | | | | | | |
| Current setting (A) | Isd = Ir×... | | 1.5 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | Off |
| Time delay (s) | tsd | $I^2t$ Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| Accuracy: ±10% or | | $I^2t$ On @(10×Ir) | | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| below 50ms | ($I^2t$ Off) | Min. Trip Time(ms) | 20 | 80 | 160 | 260 | 360 | | | |
| | | Max. Trip Time(ms) | 80 | 140 | 240 | 340 | 440 | | | |
| **Instantaneous** | | | | | | | | | | |
| Current setting (A) | Ii = In×... | | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 15 | Off |
| Tripping time | | | below 50ms | | | | | | | | |
| **Ground fault** | | | | | | | | | | |
| Pick–up (A) | Ig = In×... | | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | Off |
| Time delay (s) | tg | $I^2t$ Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| Accuracy: ±10%(Ig≥0.4In) | | $I^2t$ On @(1×In) | | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| ±20%(Ig<0.4In) | ($I^2t$ Off) | Min. Trip Time(ms) | 20 | 80 | 160 | 260 | 360 | | | |
| or below 50ms | | Max. Trip Time(ms) | 80 | 140 | 240 | 340 | 440 | | | |




| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Earth leakage (Option)** | | | | | | | | | | |
| Current setting (A) | I△n | | 0.5 | 1 | 2 | 3 | 5 | 10 | 20 | 30 | Off |
| Time delay (ms) | △t | Alarm Time(ms) | 140 | 230 | 350 | 800 | 950 | | | | |
| Accuracy: ±15% | | Trip Time(ms) | 140 | 230 | 350 | 800 | | | | | |




Note) Current setting values are secondary current of the external CT.
Recommended not to use current setting values more than 5A.

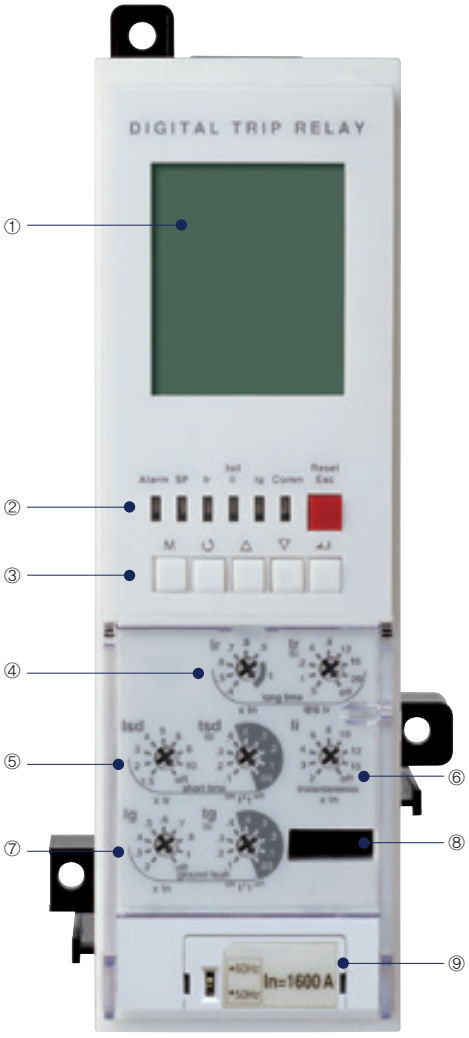
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **PTA(Pre Trip Alarm)** | | | | | | | | | | |
| Current setting (A) | Ip = Ir x ··· | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1 |
| Time delay (s) | tp@(1.2×Ip) | 1 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | Off |
| Accuracy: ±15% | | | | | | | | | | |

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

# Trip Relays
***Susol***

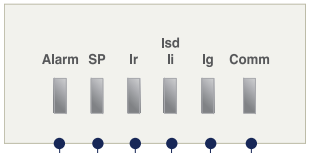
## S type: 「Supreme meter」 type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - $I^2t$ On / Off optional (for short-time delay)
- Ground fault protection
  - $I^2t$ On / Off optional
  - Trip / Alarm selectable (need external power)
  - Blocking Time (0~60s)
    Do not ground fault detect during Blocking time
- Protection for Over voltage / Under voltage / Over frequency / Under frequency/Unbalance/Reverse power
- Realization of protective coordination by ZSI (Zone Selective Interlocking)
  - Disable / Enable
- Fine-adjustable setting by knob and Key
- IDMTL setting (SIT, VIT, EIT, DT curve)
  - Basic setting : “None”. Thermal curve.
- ERMS
  - Arc Flash Reduction
  - Instantaneous setting value is minimized. (2*In)
- Measurement and Display Function
  - High detailed measurement for 3 phase current / Voltage / Power / Energy / Phase angle / Frequency / PF / Demand
  - 128 x 128 Graphic LCD
  - Indicates current / voltage Vector Diagram and Waveform
- Fault recording
  - Records Max. up to 256 fault information about fault type, fault phase, fault value, occurrence time of fault
  - Fault wave recording: records the latest fault wave
- Event recording
  - Records events of device related to setting change, operation and state change. (Max. up to 256)
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- Power quality analysis
  - Measurement for 1st~63th harmonics
  - THD, TDD, k-Factor
  - Voltage / current waveform capture
- 3 DO(Digital output)
  - Programmable for alarm, trip and general DO
- Communication
  - Modbus / RS485
  - Profibus-DP



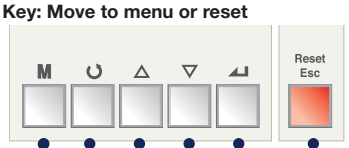

**① Graphic LCD: Indication of measurement and information**

**② LED: Indication of trip info. and overload state**




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

**③ Key: Move to menu or reset**




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

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

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

**⑥ Ii: Instantaneous current setting**

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

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

**⑨ Rating plug**
- **Rated current setting (45~100% of the AF)**
- **Frequency selectable(60Hz/50Hz)**

5914 E. Sam Houston Pkwy S. Houston TX 77034 | Toll Free 1.844.279.8295 | Local Factory Support 832.243.5372 | Fax 832.569.5645
sales@spikeelectric.com | spikeelectric.com

# Trip Relays
***Susol***

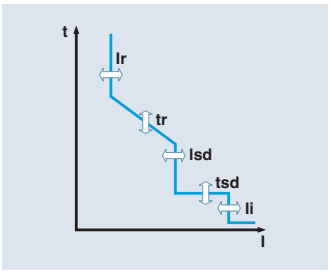
## Protection

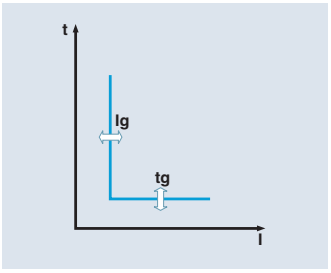
| Long time | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Current setting (A) | Ir = In×... | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | | |
| Time delay (s) | tr@(1.5×Ir) | 12.5 | 25 | 50 | 100 | 200 | 300 | 400 | 500 | Off |
| Accuracy: ±15% or | tr@(6.0×Ir) | 0.5 | 1 | 2 | 4 | 8 | 12 | 16 | 20 | Off |
| below 100ms | tr@(7.2×Ir) | 0.34 | 0.69 | 1.38 | 2.7 | 5.5 | 8.3 | 11 | 13.8 | Off |

| Short time | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Current setting (A) | Isd = Ir×... | 1.5 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | Off |
| Time delay (s) | tsd | $I^2t$ Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| Accuracy: ±10% or | | $I^2t$ On @(10×Ir) | | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| below 50ms | ($I^2t$ Off) | Min. Trip Time(ms) | 20 | 80 | 160 | 260 | 360 | | | |
| | | Max. Trip Time(ms) | 80 | 140 | 240 | 340 | 440 | | | |

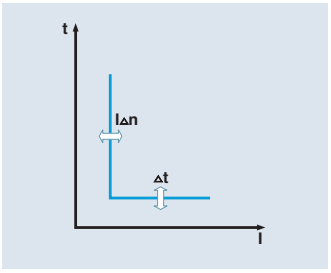
| Instantaneous | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Current setting (A) | Ii = In×... | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 15 | Off |
| Tripping time | | below 50ms | | | | | | | | |

| Ground fault | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Pick–up (A) | Ig = In×... | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 1.0 | Off |
| Time delay (s) | tg | $I^2t$ Off | 0.05 | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| Accuracy: ±10%(Ig≥0.4In) | | $I^2t$ On @(1×In) | | 0.1 | 0.2 | 0.3 | 0.4 | | | |
| ±20%(Ig<0.4In) | ($I^2t$ Off) | Min. Trip Time(ms) | 20 | 80 | 160 | 260 | 360 | | | |
| or below 50ms | | Max. Trip Time(ms) | 80 | 140 | 240 | 340 | 440 | | | |




| Earth leakage (Option) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Current setting (A) | I△n | 0.5 | 1 | 2 | 3 | 5 | 10 | 20 | 30 | Off |
| Time delay (ms) | △t | Alarm Time(ms) | 140 | 230 | 350 | 800 | 950 | | | |
| Accuracy: ±15% | | Trip Time(ms) | 140 | 230 | 350 | 800 | | | | |




Note) Current setting values are secondary current of the external CT.
Recommended not to use current setting values more than 5A.

| PTA(Pre Trip Alarm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Current setting (A) | Ip = Ir x ··· | 0.6 | 0.65 | 0.7 | 0.75 | 0.8 | 0.85 | 0.9 | 0.95 | 1 |
| Time delay (s) | tp@(1.2×Ip) | 1 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | Off |
| Accuracy: ±15% | | | | | | | | | | |

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

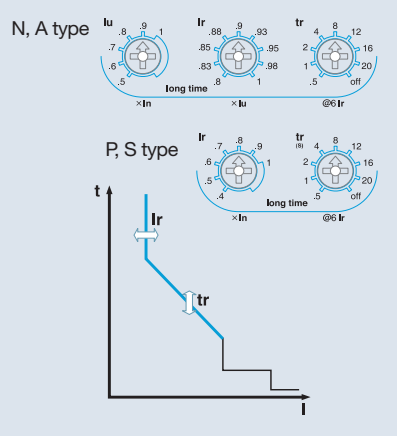
# Trip Relays
***Susol***

## Operation characteristics

### Long-time delay (L)

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

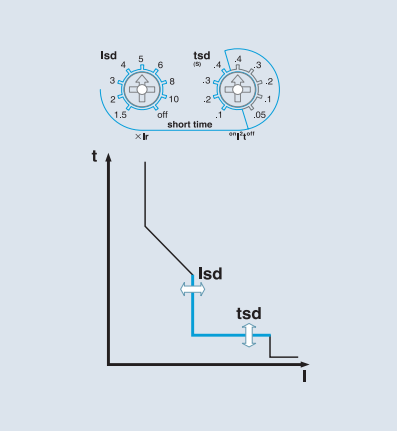
1. Standard current setting knob: Ir
   1) Setting range in P type and S type: (0.4-0.5-0.6-0.7-0.8-0.9-1.0)×In
   2) Setting range in N type and A type: (0.4 ~1.0)×In
      - Iu: (0.5-0.6-0.7-0.8-0.9-1.0)×In
      - Ir: (0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0)×Iu
2. Time delay setting knob: tr
 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




### Short-time delay (S)

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

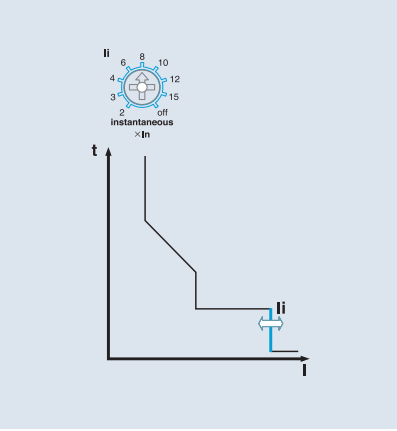
1. Standard current setting knob: Isd
   - Setting range: (1.5-2-3-4-5-6-8-10-Off)×Ir
2. Time delay setting knob: tsd
   - Standard operating time is based on the time of 10×Ir.
   - Inverse time ($I^2t$ On ): 0.1-0.2-0.3-0.4 sec
   - Definite time ($I^2t$ Off): 0.05-0.1-0.2-0.3-0.4 sec
3. Relay operates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




### Instantaneous (I)

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

1. Standard current setting knob: Ii
   - Setting range: (2-3-4-6-8-10-12-15-Off)×In
2. Relay operates basing on the largest load current among R/S/T/N phase.
3. Total breaking time is below 50ms.
4. When using the ERMS function, Instantaneous setting value is applied as 2*In (N type OCR does not apply)

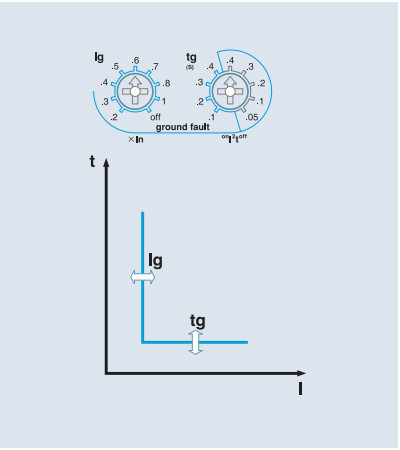


# Trip Relays
***Susol***

## Ground Fault (G)

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

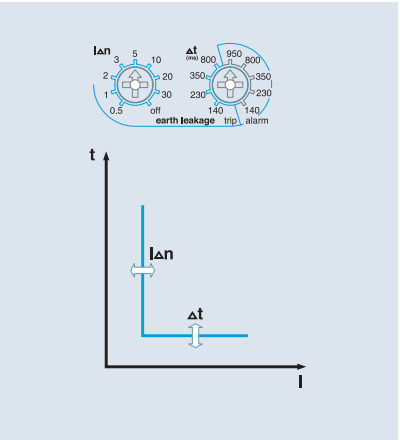
1. Standard setting current knob: Ig
   - Setting range: (0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-Off)×In
2. Time delay setting knob: tg
   - Inverse time ($I^2t$ On): 0.1-0.2-0.3-0.4 sec
   - Definite time ($I^2t$ Off): 0.05-0.1-0.2-0.3-0.4 sec
3. Ground fault current is vector sum of each phase current. Therefore,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




## Earth Leakage (G) - Option

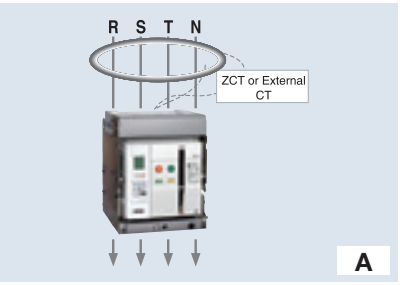
**The function for breaking earth leakage current above setting value after time delay to protect the circuit from earth leakage. (A, P, S type)**

1. Standard setting current knob: I△n
   - Setting range: 0.5-1-2-3-5-10-20-30-Off (A)
2. Time delay setting knob: △t
   - Trip time: 140-230-350-800 ms
   - Alarm time: 140-230-350-800-950 ms
3. Setting values within the alarm range will not trip the breaker but will activate its alarm.
4. This function is enabled and can be used only with private external CT(secondary output 5A) selected by customers.
5. When ZSI function is set, the protection operation will take place instantaneously with input absence by downstream devices. It is advised to disable its ZSI function on the last downstream device.



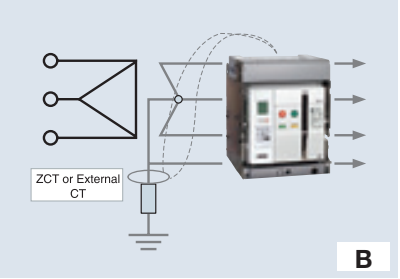

**※ Use cautions with earth-leakage current settings**

- When using ZCT provided by customers, the setting range should be from 0.5 to 5A based on its secondary current.(Secondary output rating : 5A)
  Hence, under 100:5A CT, if trip relay is set to 0.5A, earth-leakage exceeding 10A will activate its operation (0.5A×20 = 10A)




**※ Guideline for external CT usage**

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



# Trip Relays

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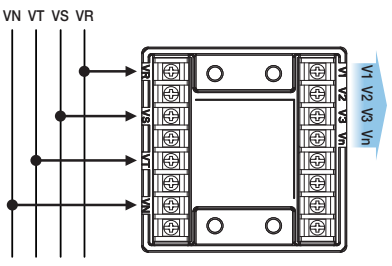
## Measurement function

| Class. | Measurement element | Detailed element | Unit | Display range | Accuracy |
|---|---|---|---|---|---|
| Current | Line current | Ia,Ib,Ic | A | A type: 0.15In~17In<br>P/S type: 0.12In~1.6In | ±3% |
| | Normal current | $I_1$ | | | |
| | Reverse current | $I_2$ | | | |
| Voltage | Line voltage | Vab,Vbc,Vca | V | 60~690V | ±1% |
| | Phase voltage | Va,Vb,Vc | | | ±1% |
| | Normal voltage | $V_1$ | | | |
| | Reverse voltage | $V_2$ | | | |
| Angle | Line-to-line<br>Line-to-current | ∠VabIa, ∠VabIb, ∠VabIc,<br>∠VabVbc, ∠VabVca | ° | 0~360° | ±1° |
| | Phase-to-phase | ∠VaVb,∠VaVc | | | ±1° |
| | Phase-to-current | ∠VaIa, ∠VbIb, ∠VcIc | | | ±1° |
| Power | Active power | Pa(ab), Pb(bc), Pc(ca), P | kW | 1kW~99,999kW | ±3% |
| | Reactive power | Qa(ab), Qb(bc), Qc(ca), Q | kVar | 1kVar~99,999kVar | ±3% |
| | Apparent power | Sa(ab), Sb(bc), Sc(ca), S | kVA | 1kVA~99,999kVA | ±3% |
| Energy | Active energy | WHa(ab), WHb(bc),<br>WHc(ca), WH | kWh<br>MWh | 1kWh~9999.99MWh | ±3% |
| | Reactive energy | VARHa(ab), VARHb(bc),<br>VARHc(ca), VARH | kVarh<br>Mvarh | 1kVarh~9999.99MVarh | ±3% |
| | Reverse active energy | rWHa(ab), rWHb(bc),<br>rWHc(ca), rWH | kWh<br>MWh | 1kWh ~9999.99MWh | ±3% |
| Freq. | Frequency | F | Hz | 45~65Hz | |
| Power factor | Power factor(PF) | PFa(ab), PFb(bc), PFc(ca), PF | | +: Lead, -: Lag | |
| Unbalance | Unbalance rate | Iunalance, Vunbalance | % | 0.0~100.0 | |
| Demand | Active power demand | Peak demand | kW | 1kW~99999kW | |
| | Current demand | Peak demand | A | 80A~65,535A | |
| Harmonics | Voltage harmonics | 1st~63th harmonics of<br>Va(ab),Vb(bc),Vc(ca) | V | 60~690V | |
| | Current harmonics | 1st~63th harmonics of Ia,Ib,Ic | A | 80A~65,535A | |
| | THD, TDD | | % | 0.0~100.0 | |
| | K-Factor | | - | 0.0~100.0 | |

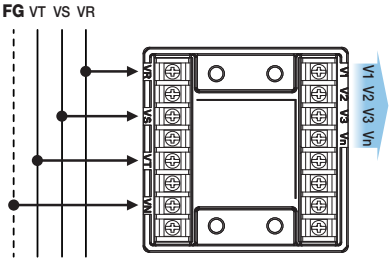
## Voltage module

For P and S type trip relays, a separate voltage module is necessary to measure other elements beside the current. (Separate purchase necessary)

- Voltage input range: AC 60~690V
- Input/Output Ratio → 220V: 200mV




3P4W wiring




3P3W wiring

# Trip Relays

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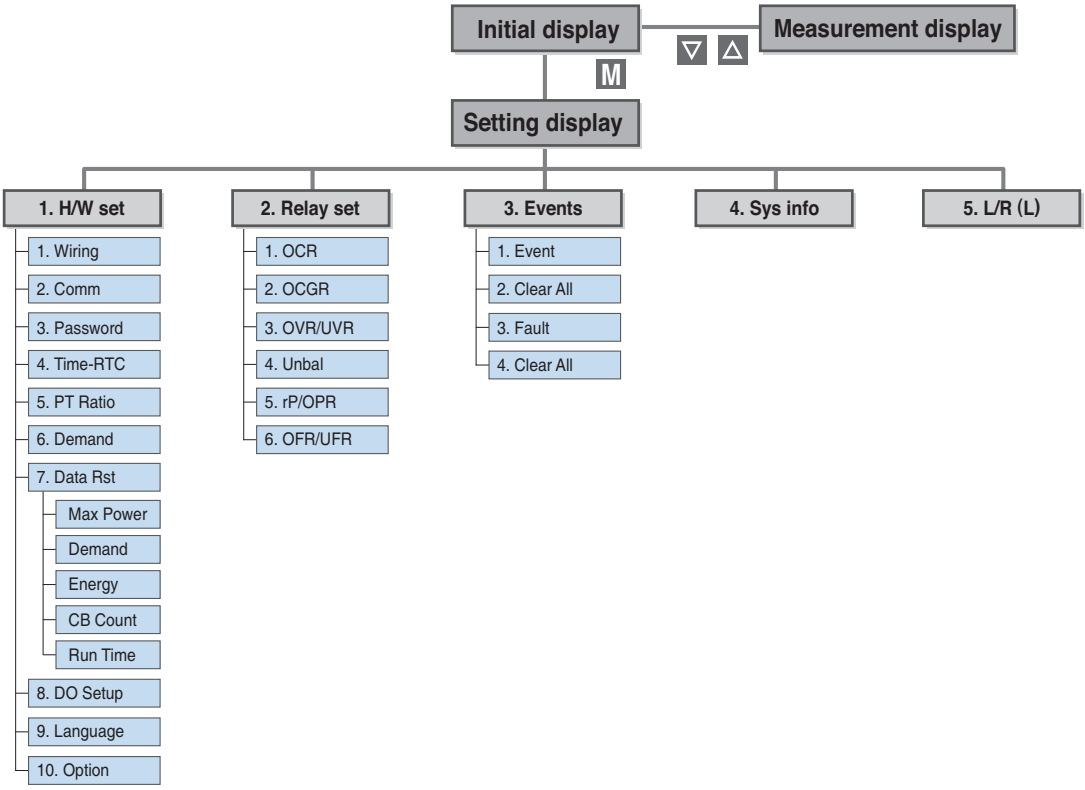
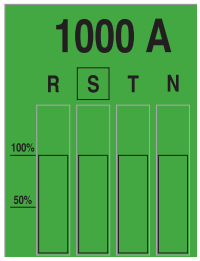
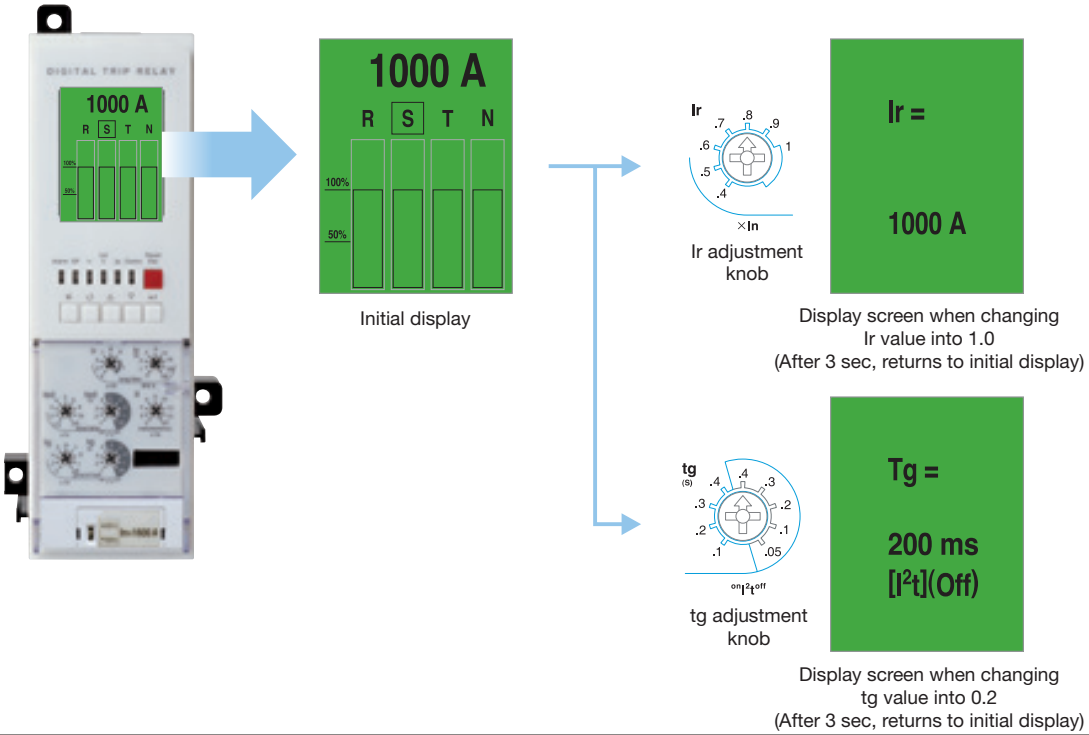
## Man machine interface




Initial display

## An example of graphic LCD display



# Trip Relays

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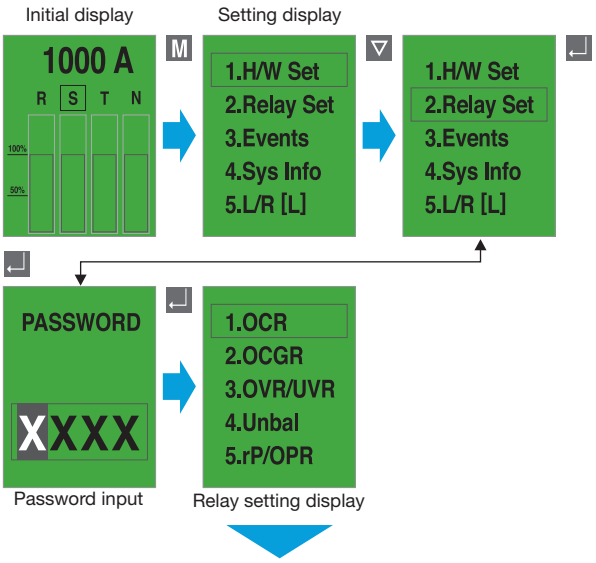
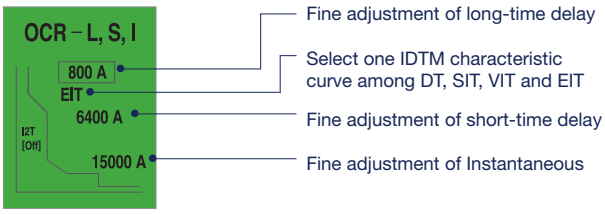
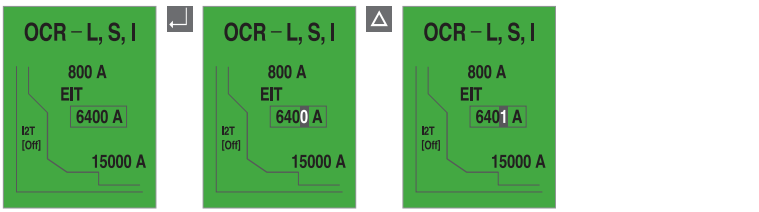
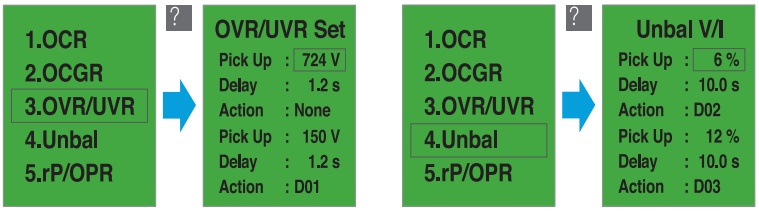
## Protection element setting

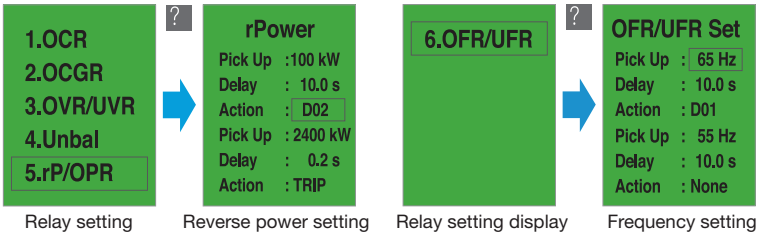



## Fine adjustment of protection setting current



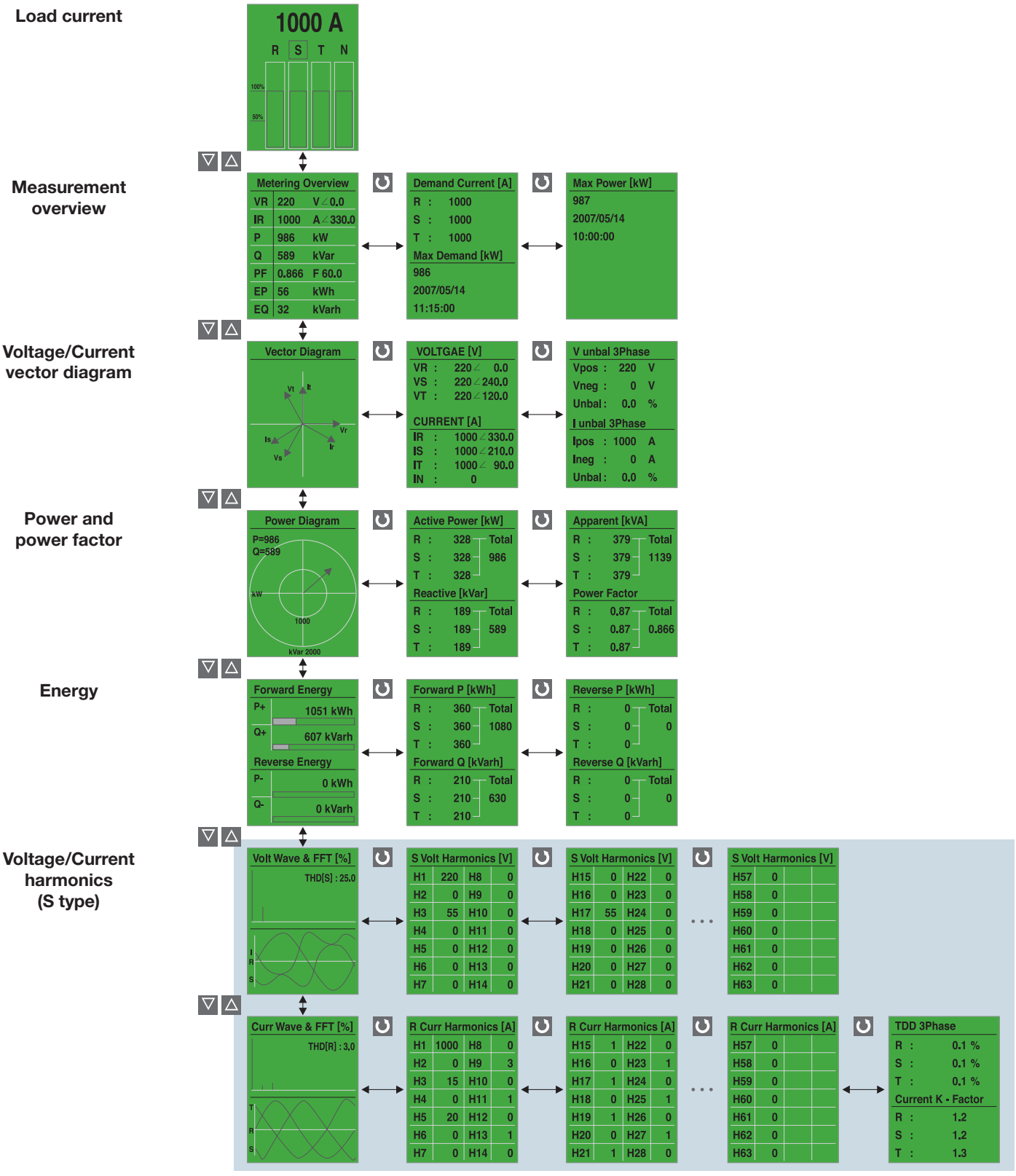




- OCR and OCGR's current setting is basically controlled by knob's setting values.
- The fine current that cannot be controlled by knob is adjustable by using ▽, △ key.
- Fine adjustment is only adjustable in the present knob and next knob's setting range, when moving knob, the adjusted data becomes reset state.

- The setting method of OCGR is same with OCR's, fine adjustment is available.

# Trip Relays
***Susol***

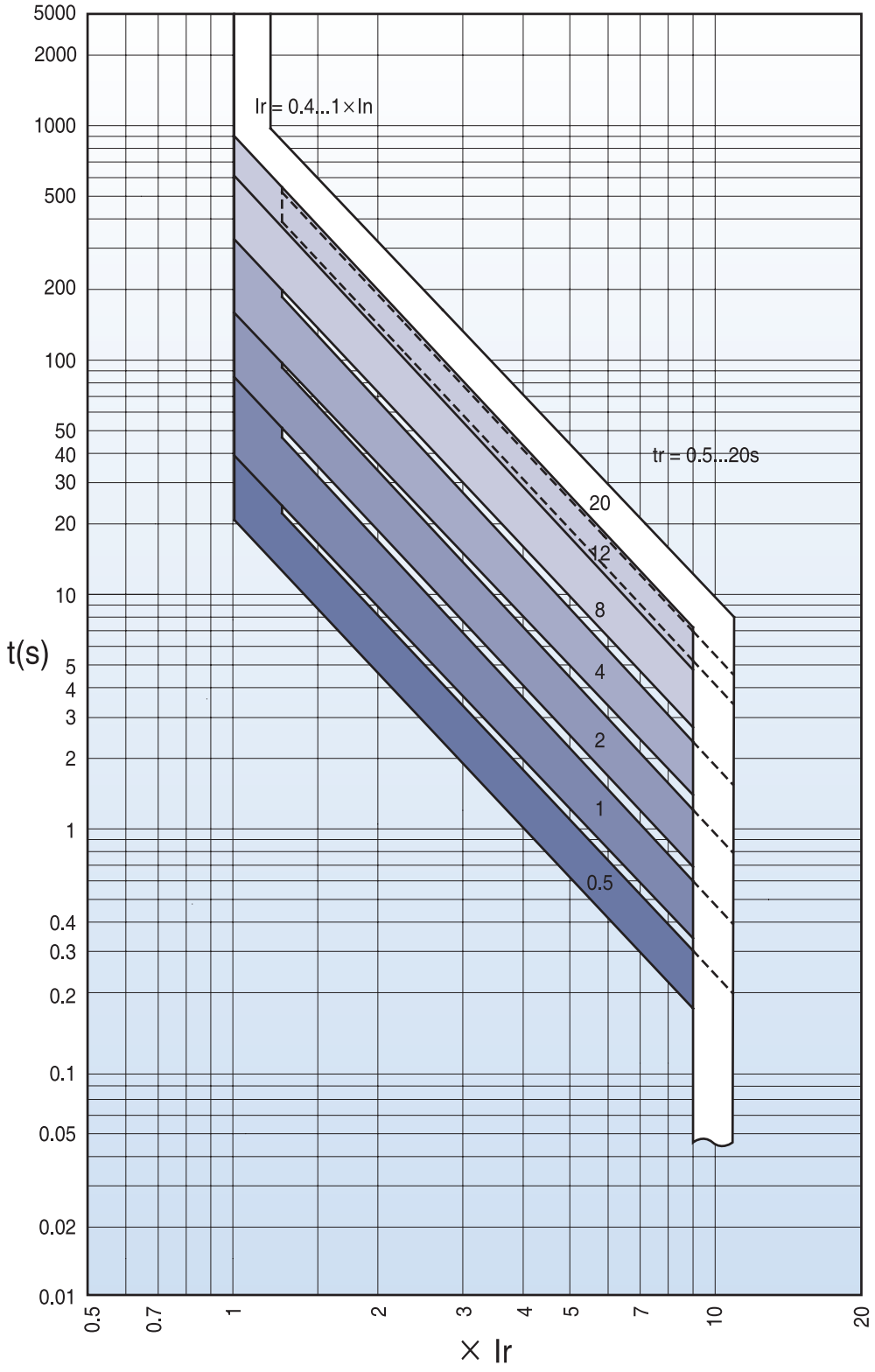
## Measurement element display



# Trip Relays
***Susol***

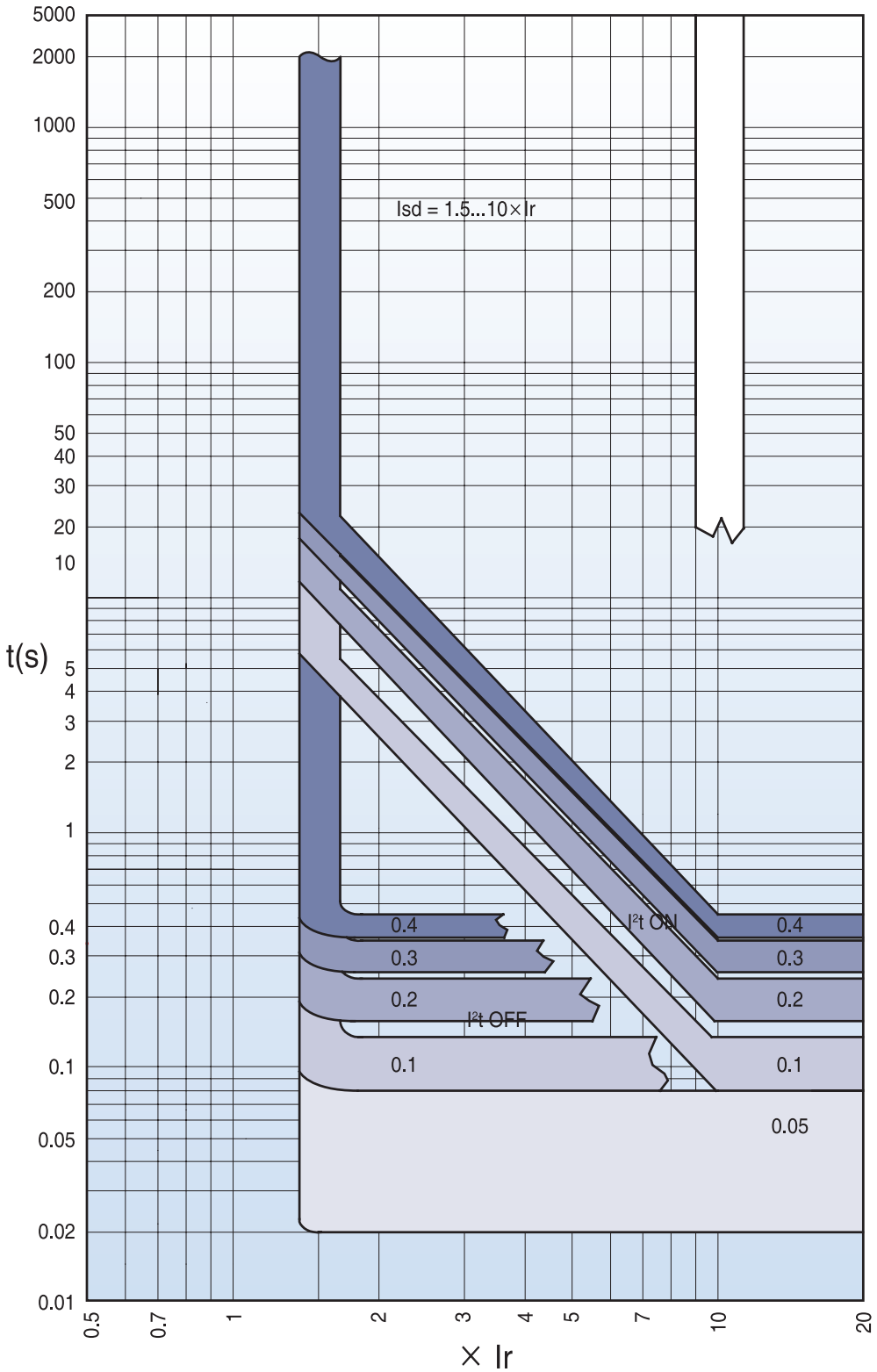
## Characteristics curves

### Long-time delay (L)



# Trip Relays
## *Susol*

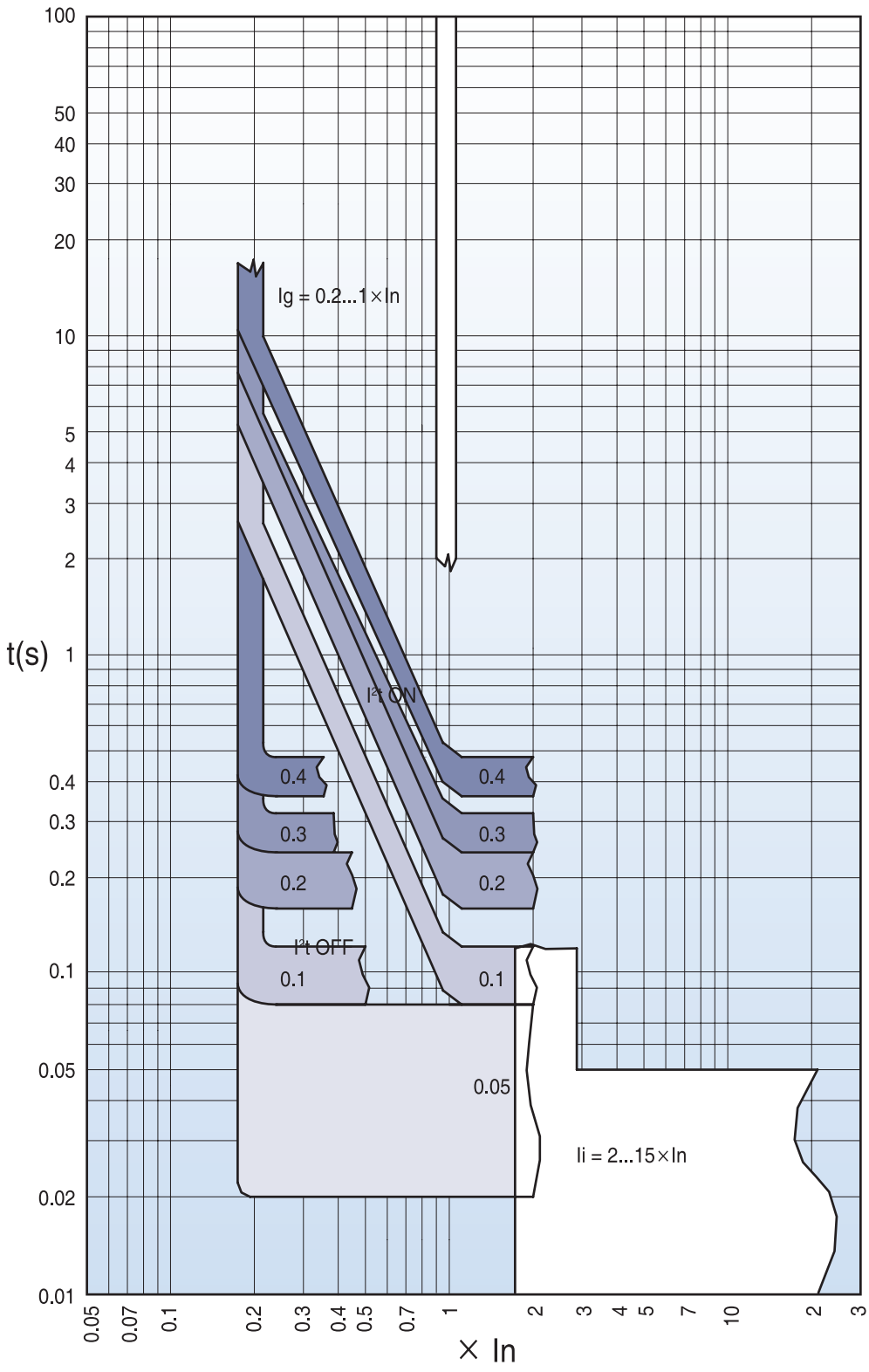
### Short-time delay (S)



# Trip Relays
***Susol***

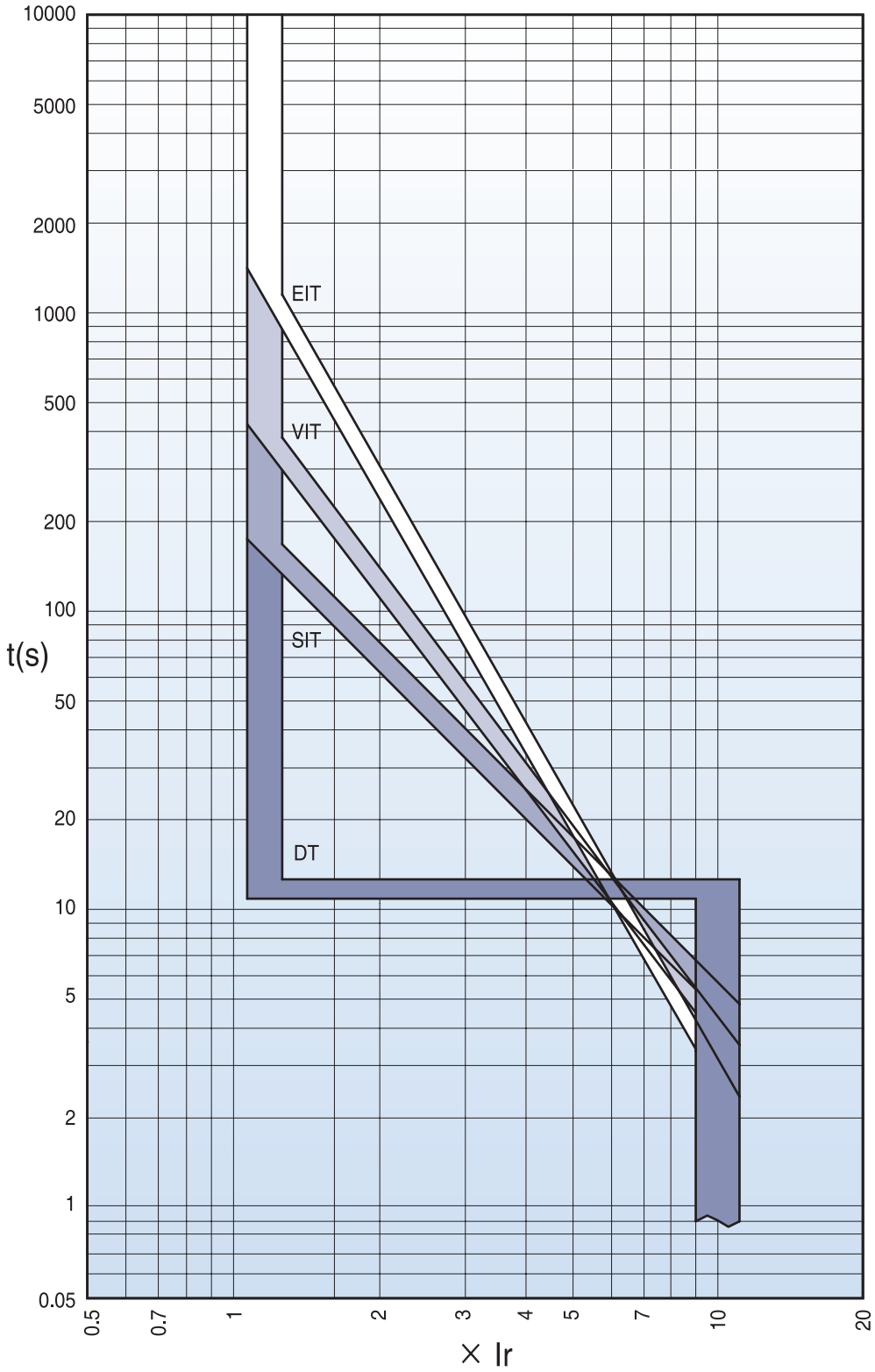
## Characteristics curves

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



# Trip Relays
## *Susol*

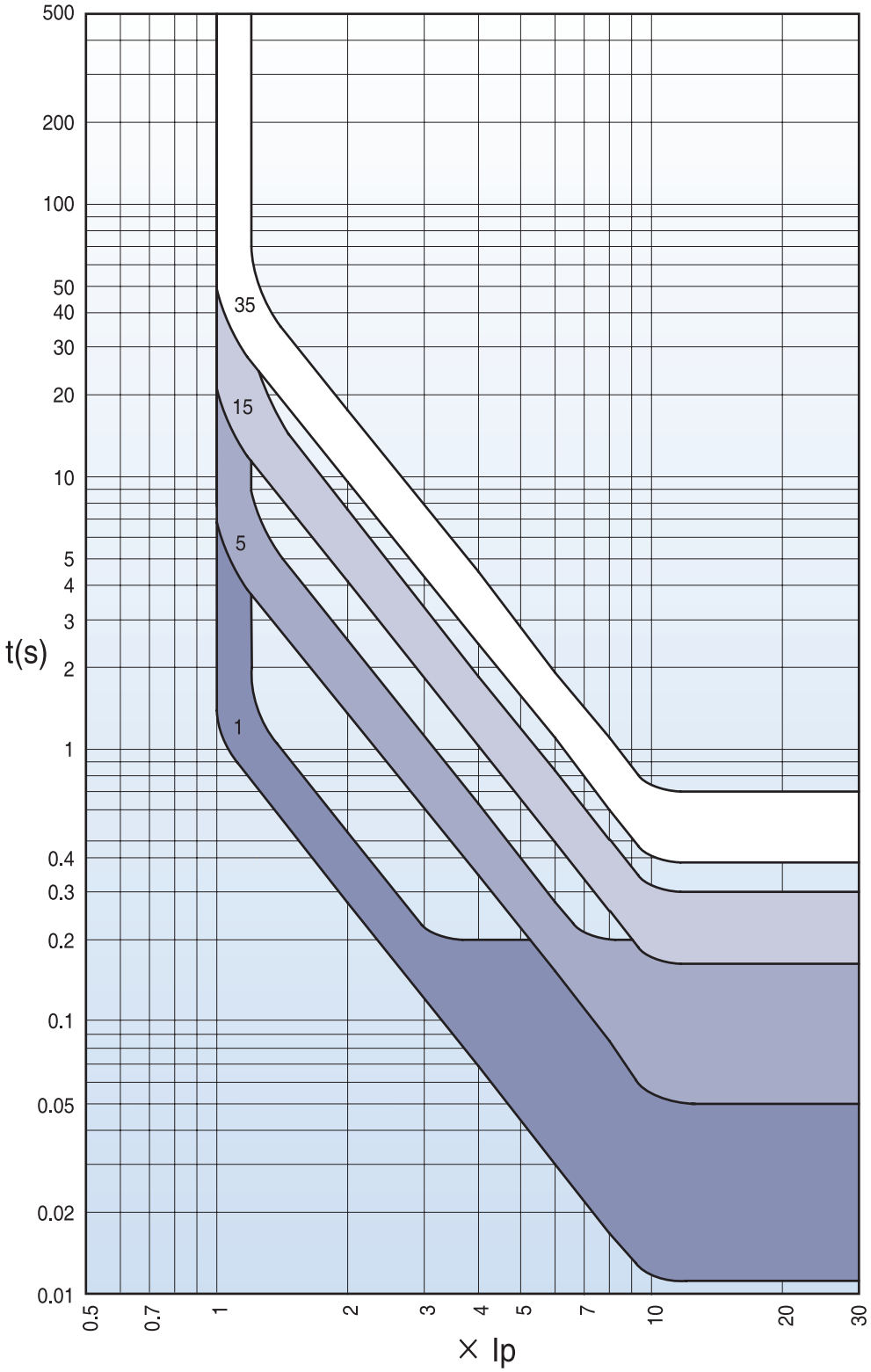
### IDMTL



# Trip Relays
***Susol***

## Characteristics curves

### Pre Trip Alarm



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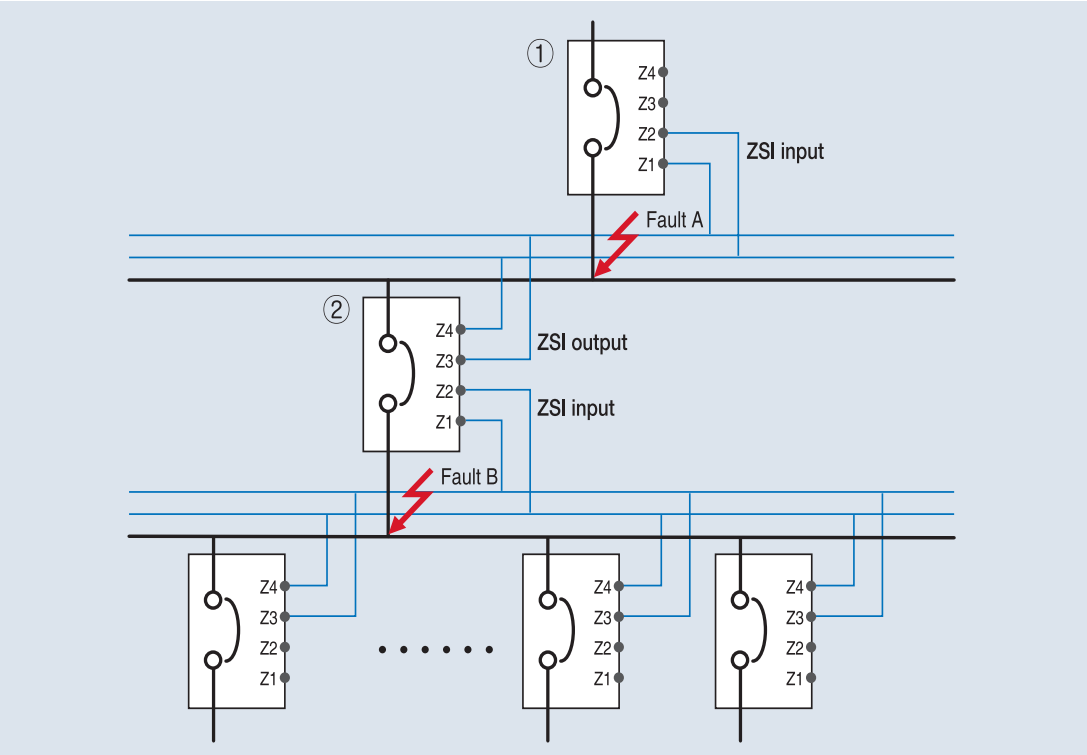
## ZSI - Zone Selective Interlocking (A, P, S type)

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

1. In the case that a short time-delay or a ground fault accident occurs in a ZSI built-in system, the breaker at the accident site sends a ZSI signal to halt the upstream breaker's operation.
2. To prevent a breakdown, the trip relay of the ACB at the accident site activates trip operation with no time delay.
3. The upstream breaker that receives the ZSI signal adheres to a pre-set short time-delay or ground fault time-delay for protective coordination in the system.
   However, the upstream breaker that does not receive the signal will trip instantaneously.
4. For normal ZSI operation, operation time should be arranged accordingly so that downstream circuit breakers will react before upstream breakers under overcurrent/short time delay/ground fault situations.
5. ZSI connecting line needs to be Max. 3m.




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

# Trip Relays

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

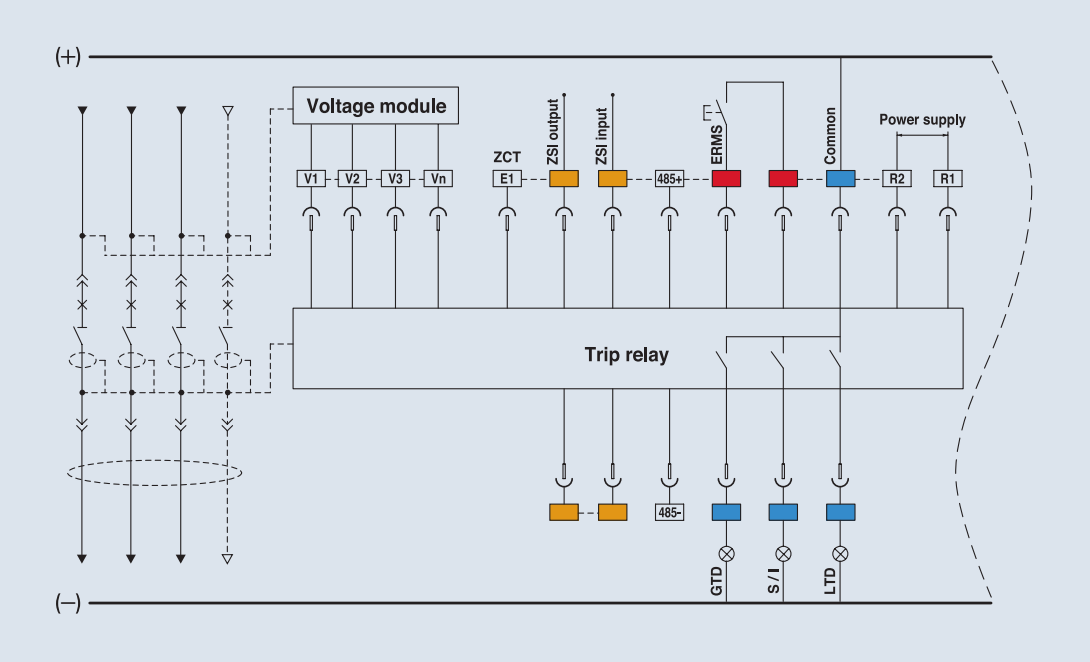
**ERMS(Energy Reduction Maintenance Setting) is a function to reduce the arc energy to ensure workers' safety. When using the ERMS function, the instantaneous setting value is minimized(2*In). A, P, and S type trip relays are able to perform the ERMS by digital input and have 3 DO (digital output).**

1. To use the ERMS function, short both ends of ERMS terminal

2. Digital input
   - [EM1-EM2] input: ERMS
   - [Z1-Z2] Input: ZSI input
   - [E1-E2] Input: ZCT for earth leakage detection or external CT input

※ All DI are dry contact that has 3.3V of recognition voltage. When inputting close by SSR(Solid State Relay) or open-collector, connect collector (Drain) to EM1.

3. Digital output 3a (524, 534, 544-513)
   - Fault output: Long/Short time delay, Instantaneous, Ground fault, UVR, OVR, UFR, OFR, rPower, Vunbal, Iunbal
     (Maintains state as Latch form until user pushes reset.)
   - General DO: when setting L/R as remote, it is available to control close/open remotely by using communication.




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

# Trip Relays
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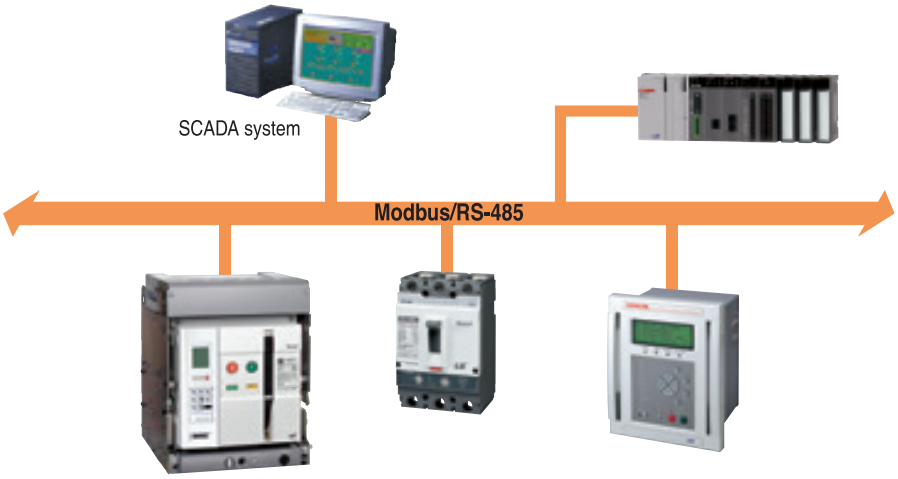
## Communication

### Modbus/RS-485

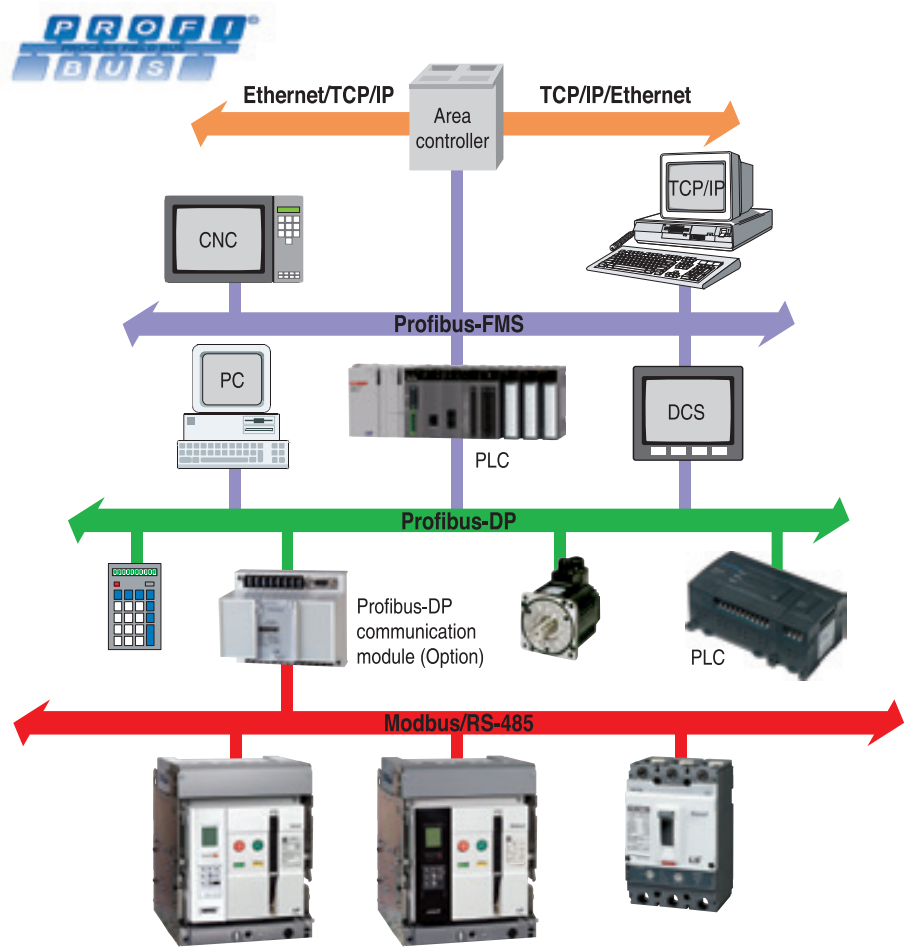
- Operation mode: Differential
- Distance: Max. 1.2km
- Cable :
  General RS-485 shielded twist 2-pair cable
- Baud rate :
  9600bps, 19200bps, 38400bps
- Transmission method: Half-Duplex
- Termination: 100Ω




### Profibus-DP

- Profibus-DP module is installed separately (Option)
- Operation mode: Differential
- Distance: Max. 1.2km
- Cable :
  Profibus-DP shielded twist 2-pair cable
- Baud rate: 9600bps~12Mbps
- Transmission method: Half-Duplex
- Termination resistor: 100Ω
- Standard: EN 50170/DIN 19245

Profibus-DP communication module (Option)



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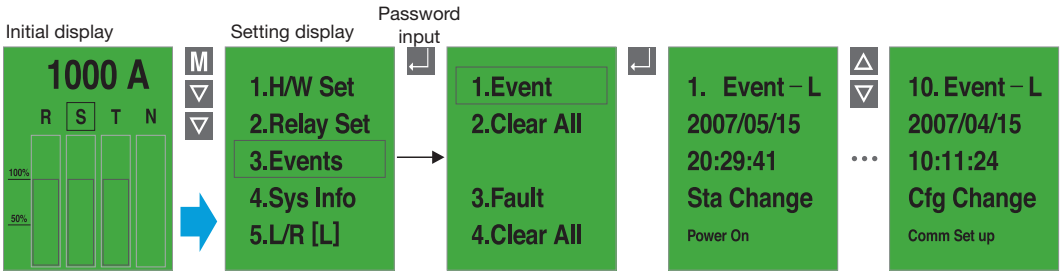
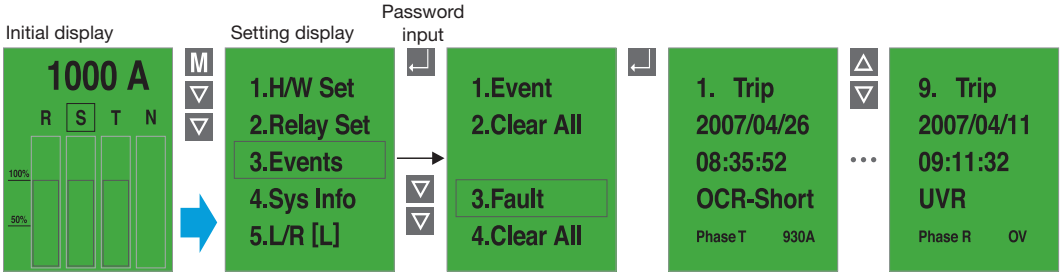
## Event & fault recording (P, S type)

When events such as setting change, information change, self-diagnosis error, and status change occur, the P and S types can record up to 256 events in accordance with time(ms). In addition, they can record up to 526 (up to 10 for A type) faults, including information such as fault cause, fault phase, fault value, and so on, in accordance with time(ms).

### Event information display




### Fault information display

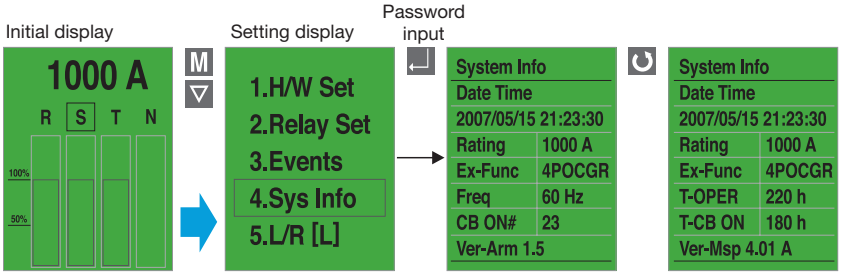



* Fault information is recorded only when there is external control power

## System information

P and S type can display the ACB's information as following.
- Present time: year/month/date/hour/minute/ms
- ACB current ratings
- N-phase current ratings: 100%
- Frequency information: 60Hz / 50Hz
- Closing numbers of breaker: CB ON numbers
- Trip relay operating time: OCR ON time
- ON time of breaker: CB ON time
- F/W ver. information

### System information display



# Trip Relays
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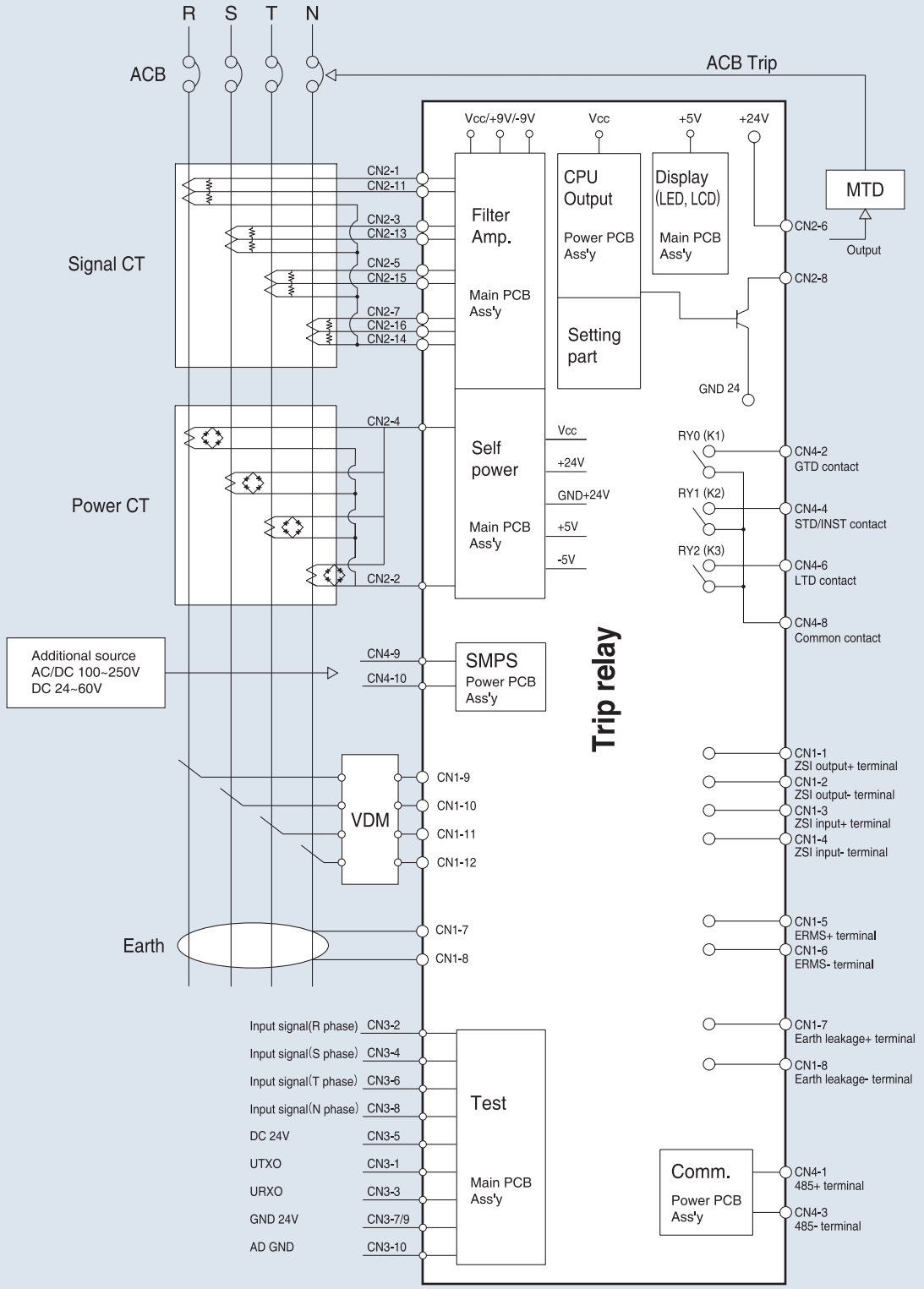
## System block diagram



# Accessories

## *Susol*

| Mounting | Accessories | | AH | | Page |
|---|---|---|---|---|---|
| | | | Standard | Option | |
| Internal | SHT1 | Shunt Coil | | ○ | 52 |
| | SHT2 | Double Shunt Coil | | ○ | 53 |
| | CC | Closing Coil | | ○ | 54 |
| | M | Motor | | ○ | 55 |
| | CS1 | Charge Switch | | ○ | 55 |
| | CS2 | Charge Switch Communication ** | | ○ | 55 |
| | UVT | Under Voltage Trip Device | | ○ | 56 |
| | AL | Trip Alarm Contact ** | | ○ | 57 |
| | MRB | Manual Reset Button ** | | ○ | 57 |
| | RES | Remote Reset Switch | | ○ | 58 |
| | RCS | Ready to Close Switch | | ○ | 58 |
| | C | Counter | ● | | 65 |
| | AX | Auxiliary Switch | | ○ | 59 |
| | TM | Temperature Alarm ** | | ○ | 74 |
| External | K1 | Key Lock | | ○ | 60 |
| | K2 | Key Interlock Set | | ○ | 60 |
| | K3 | Double Key Lock | | ○ | 61 |
| | K5 | Profalux Lock (CAMLOCK Type) | | ○ | 60 |
| | K6 | Kirkkey Lock (CAMLOCK Type) | | ○ | 60 |
| | K7 | Kirkkey Lock (CN22 Type) | | ○ | 60 |
| | B | Lockable ON/OFF Button Cover | | ○ | 61 |
| | LH | Lifting Hook | | ○ | 62 |
| | CTD | Condenser Trip Device * | | ○ | 62 |
| | ATS | Automatic Transfer Switch Controller * | | ○ | 63 |
| | DC | Dust Cover | | ○ | 65 |
| | DF | Door Frame | | ○ | 68 |
| | OT | OCR Tester * | | ○ | 64 |

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