

Derwent  
Top 100  
Global  
Innovator  
2020

Super Solution

# Air Circuit Breakers





# Susoi

## Super Solution

### 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

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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



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

# 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*





*Susol Air Circuit Breakers*

**UL 1066  
ANSI C37**



*Susol Molded Circuit Breakers*



*Susol Magnetic Contactors &  
Overload Relays*

# 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.

**800~1600AF**

**800~3200AF**



W = 13.15" (334mm)

W = 16.22" (412mm)

85kA ..... 100kA

**UAS-08/16D**

08	800AF
16	1600AF

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

**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

**3200~6000AF**



**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



# 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.



# Susol ACB Trip relay

**N type**



**A type**



**P/S type**



- L/S/I/G/Thermal
- Self Power
- RTC Timer mounted
- Fault information (LED)

- 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)

- 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



**P type (Power meter)**

- A type + Power meter + Voltage / Frequency / Unbalance protection



**A type (Ammeter)**

- Current meter + Current protection + DO control + Communication



**S type (Supreme)**

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

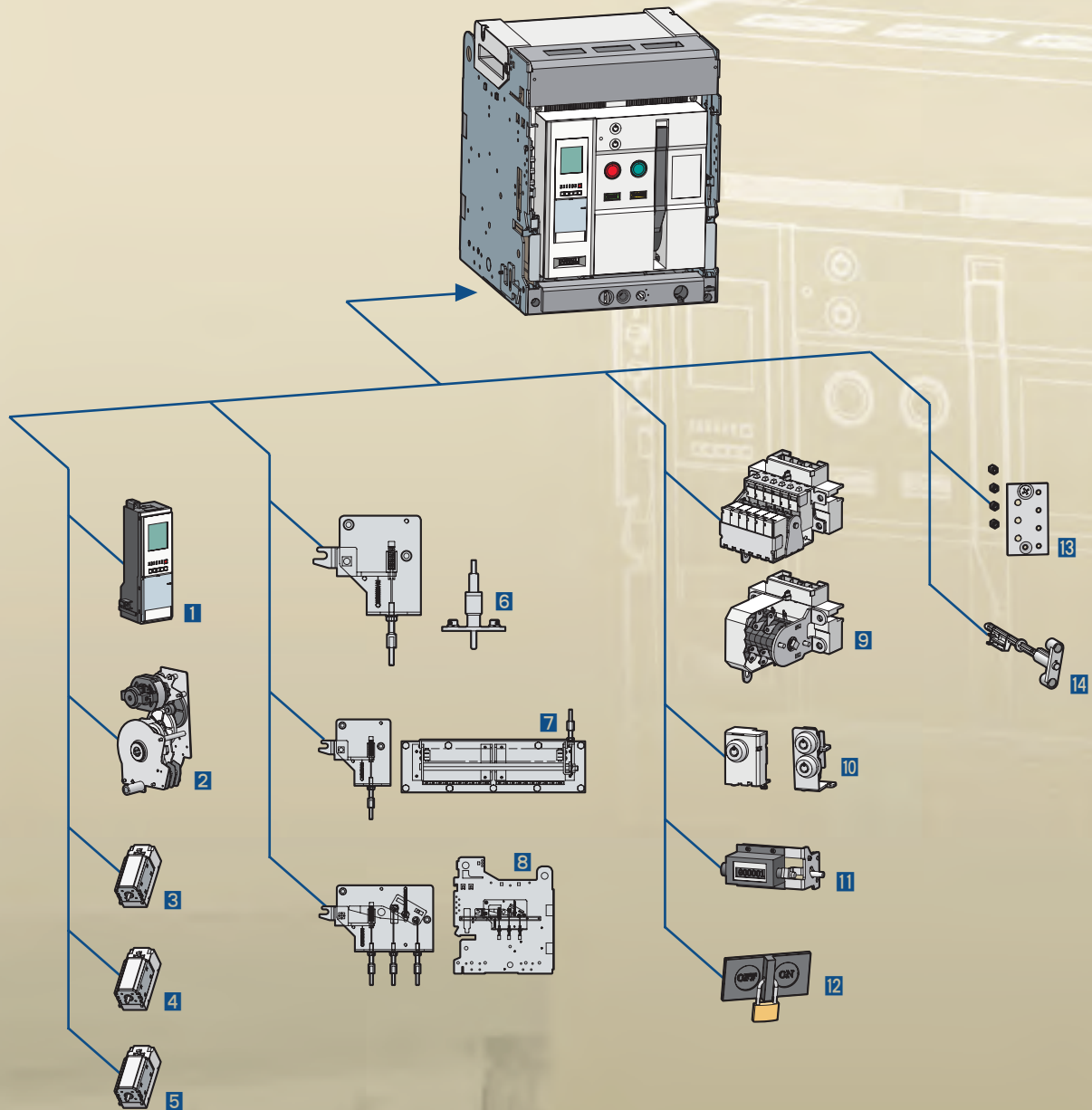


Rating Plug

### Rating Plug for selection of rated current and frequency

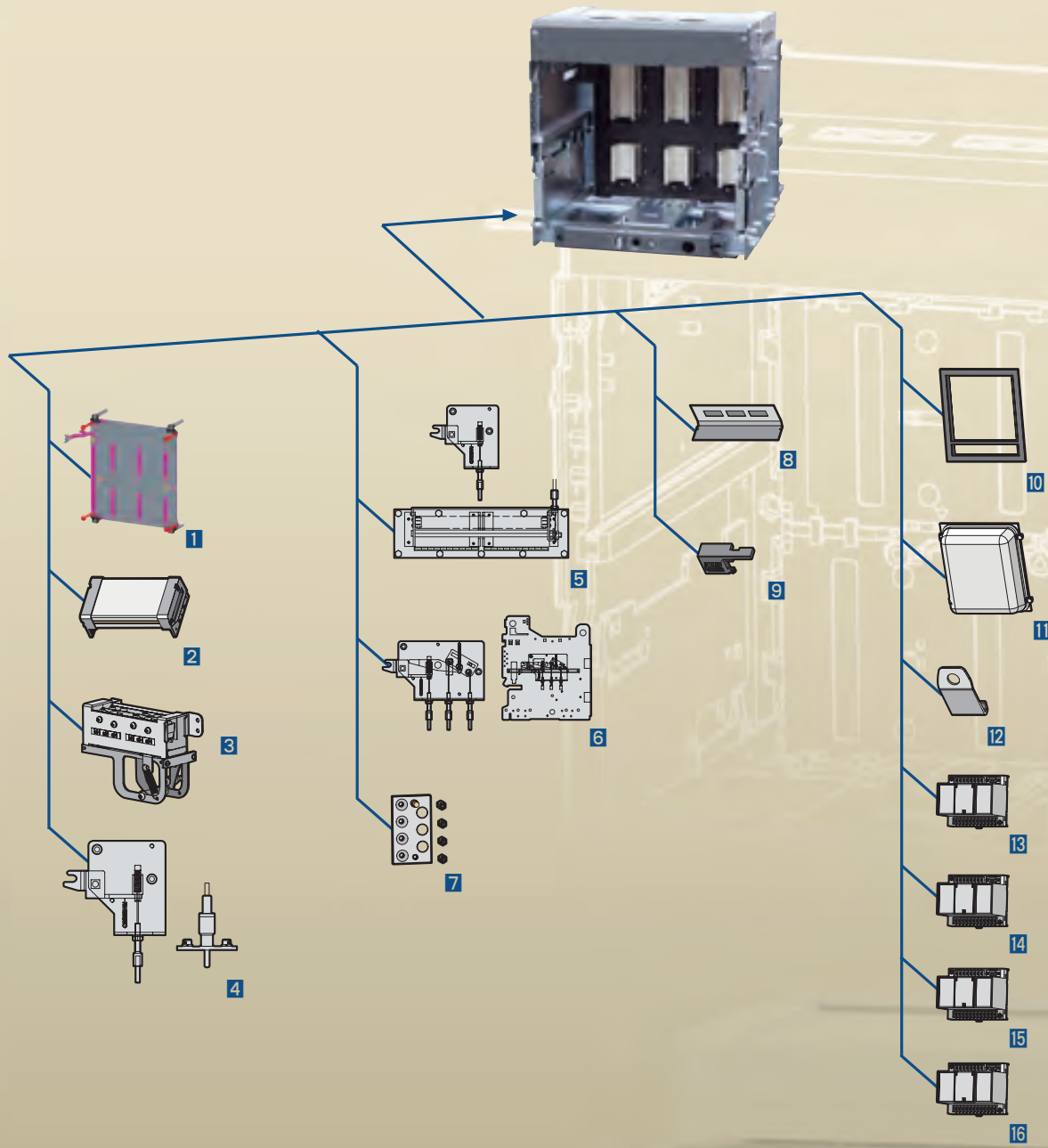
Rating Plug enables the changing rated current(I<sub>n</sub>) without CT replacement  
 Frequency selection switch: set to 50Hz or 60Hz

# Accessories



## ACB

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



## *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)

## *Other*

- 8** Safety Control Cover (SC)
- 9** Racking Interlock (RI)
- 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.

# 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

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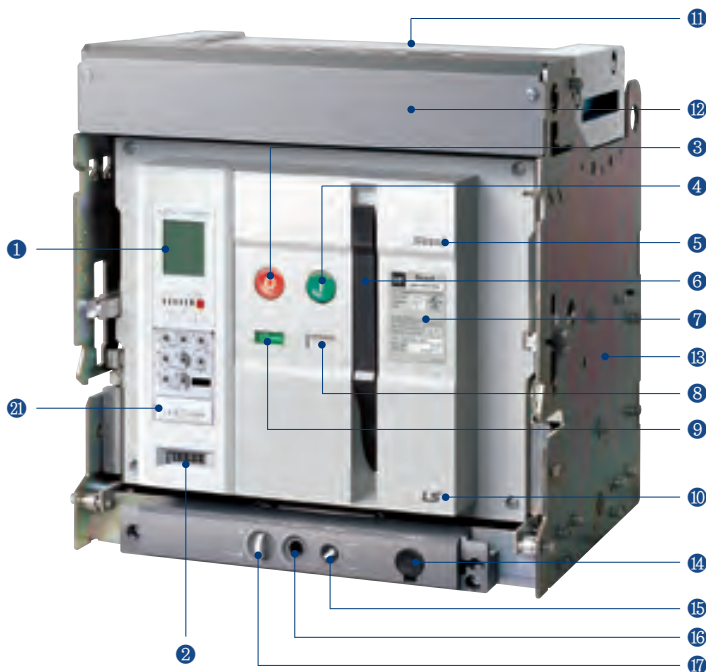
## Fixed type ACB



## Terms

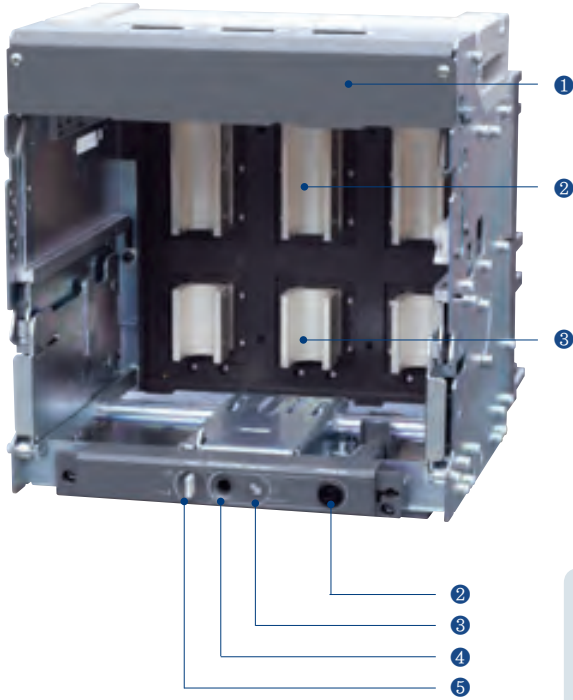
- ① Trip relay
- ② Counter
- ③ OFF button
- ④ ON button
- ⑤ Series name
- ⑥ Charge handle
- ⑦ Rated name plate
- ⑧ Charge/Discharge indicator
- ⑨ Closed/Open indicator
- ⑩ Corporation logo
- ⑪ Arc cover (Zero Arc Space)
- ⑫ Safety control cover
- ⑬ Cradle
- ⑭ Draw-out handle
- ⑮ Position indicator
- ⑯ Handle inserting hole
- ⑰ Pad lock button
- ⑱ Arc chute
- ⑲ Control cover
- ⑳ Fixed type bracket
- ㉑ Rating plug

## Draw-out ACB (Cradle)





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]




**Low Voltage AC Power Circuit Breaker**

Frame Size :

Poles :

Frequency : 50/60 Hz



UL 1066 / ANSI C37.13

Rated Maximum Voltage (V)	254	508	635
Rated Short Circuit Current (kA)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Rated Short Time Current (kA)	<input type="text"/>	<input type="text"/>	<input type="text"/>

Cat.

MFG. Date :

Serial No. :

MADE IN KOREA

[Secondary nameplate]

ACCESSORIES

<input type="checkbox"/> Motor charge	<input type="text"/>
<input type="checkbox"/> Closing coil	<input type="text"/>
<input type="checkbox"/> Shunt tripping coil	<input type="text"/>
<input type="checkbox"/> Auxiliary switches	<input type="text"/>
<input type="checkbox"/> OCR Control source	<input type="text"/>
<input type="checkbox"/> Alarm switch	<input type="text"/>
<input type="checkbox"/> Digital Trip Relay(OCR)	<input type="text"/>
<input type="checkbox"/> Alarm(LSIG) Reset	<input type="text"/>
<input type="checkbox"/> Zone Selective Interlocking	<input type="text"/>
<input type="checkbox"/> Communication	<input type="text"/>
<input type="checkbox"/> Earth/Leakage	<input type="text"/>
<input type="checkbox"/> Temperature sensor	<input type="text"/>

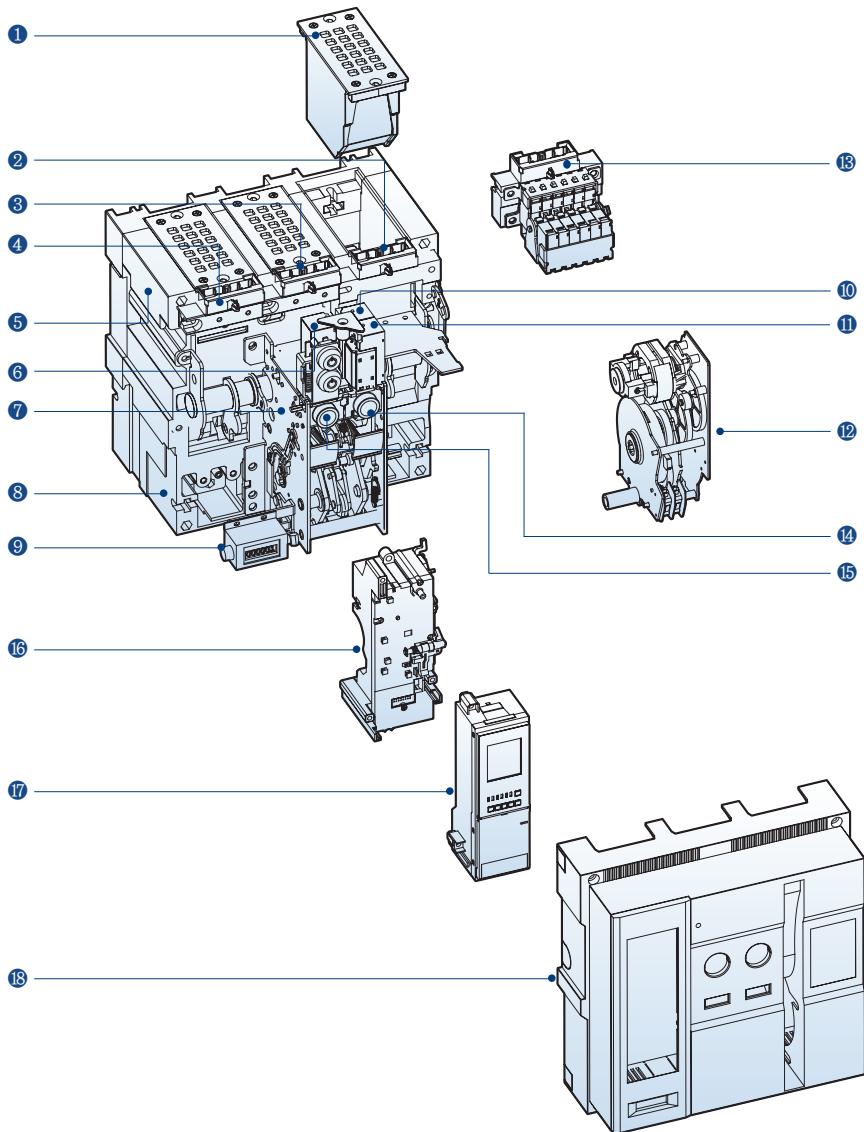
Available Adaptor  
Not For Use As Service Equipment  
Instruction manual 79563466001

Explanation of terminologies

- Motor charge  Control power and terminal No.
- Closing coil  Control power and terminal No.
- 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

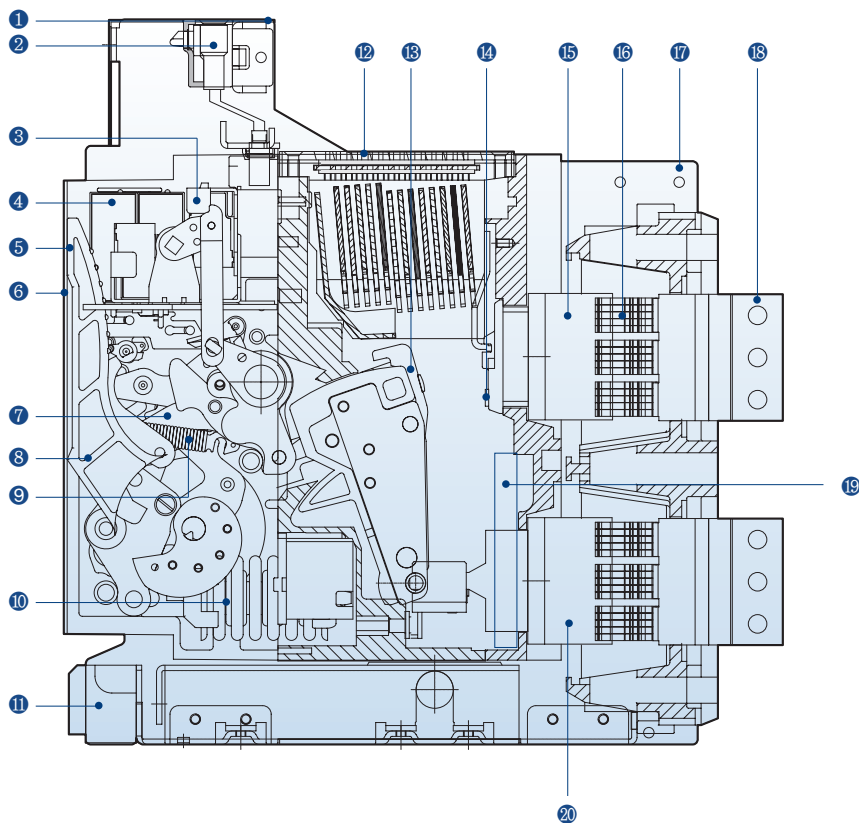
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## Terms

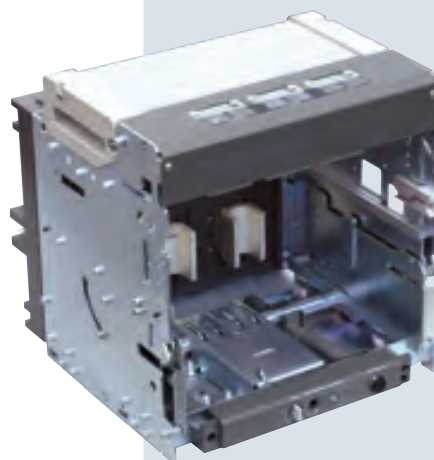
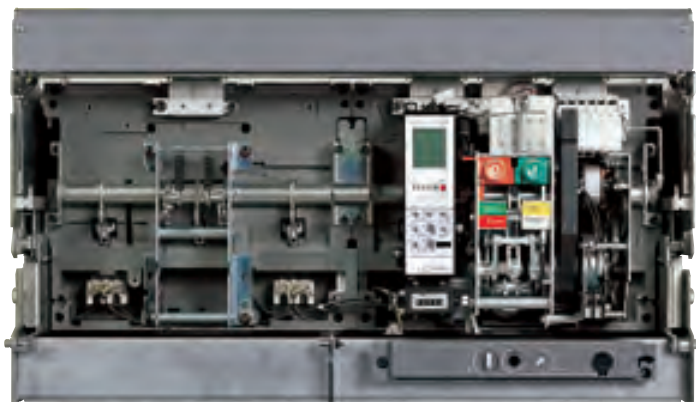
- ① Arc chute
- ② Aux. switch control terminal
- ③ Control power supply terminal
- ④ Trip relay control terminal
- ⑤ Carrying grip
- ⑥ Shunt coil or UVT coil
- ⑦ Mechanism
- ⑧ Main body
- ⑨ Counter
- ⑩ Shunt coil
- ⑪ Closing coil
- ⑫ Motor Ass'y
- ⑬ Aux. switch
- ⑭ Closed button
- ⑮ Open button
- ⑯ MTD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





### 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





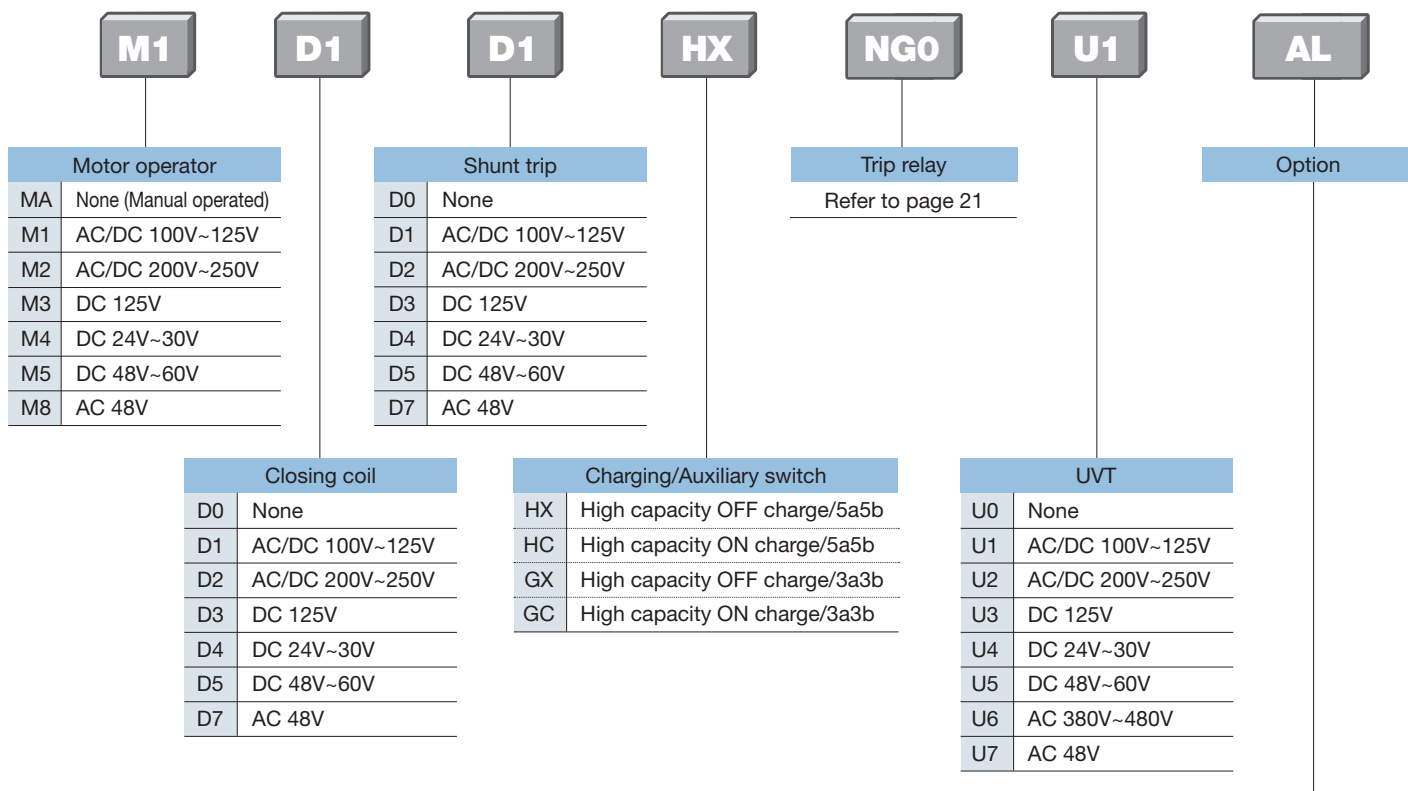
# Ordering

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## Breaker and accessories

Frame type	Frame size	Phasing	Poles	Sensor rating	Mounting and terminal
<b>UAS</b>	16	D	3	16	A
	08 800AF	D 3/4P standard	3 3P	04-08 400A~800A	Mounting
	16 1600AF	RST(N)	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
<b>UAH</b>	32	E	3	32	
	08 800AF	E 3/4P standard	3 3P	04-08 400A~800A	
	16 1600AF	RST(N)	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	3 3P	16-32 1600A~3200A	
	40 4000AF	RST(N)	4 4P	20-40 2000A~4000A	
	50 5000AF	Z 4P reversed NRST		25-50 2500A~5000A	
	60 6000AF			30-60 3000A~6000A	
<b>UAA</b>	16	D	3	00	
	08 800AF	D 3/4P standard	3 3P	Not applied	
	16 1600AF	RST(N)	4 4P		
		W 4Preversed NRST			
	08 800AF	E 3/4P standard			
	16 1600AF	RST(N)			
	20 2000AF	X 4P reversed NRST			
	25 2500AF				
	32 3200AF				
	32 3200AF	G 3/4P standard			
	40 4000AF	RST(N)			
	50 5000AF	Z 4P reversed NRST			
	60 6000AF				

\* 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).



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	SHT2 Note 2) 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		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

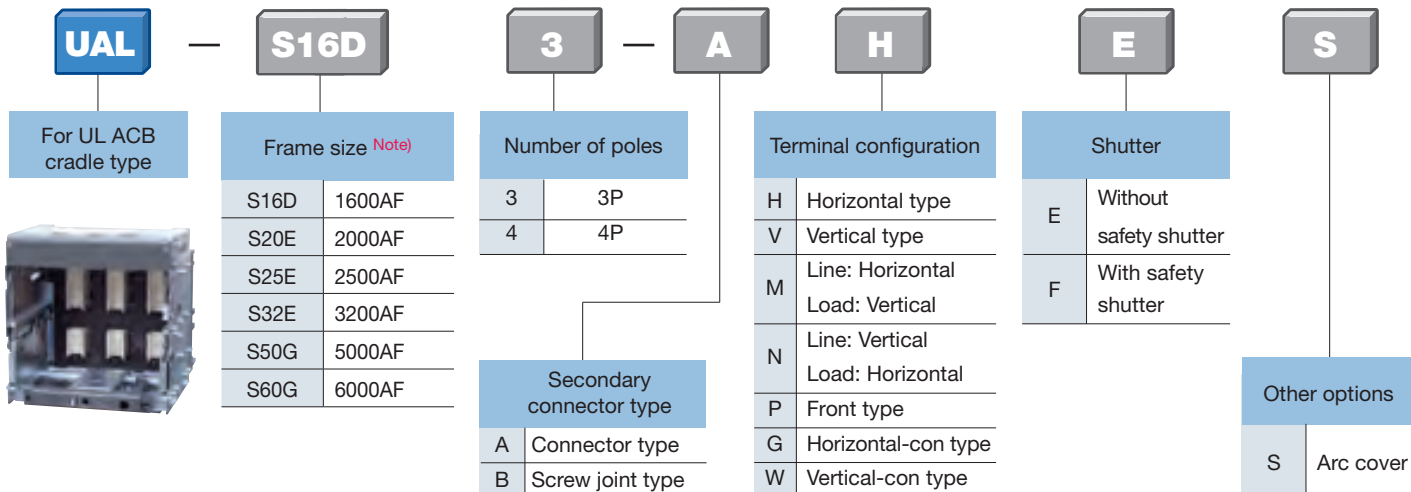
N01	A4 (AL1+MRB +RES(AC200~250V))+B(Lockable On/Off button cover)+K(Key lock)+R(Ready to close switch)+M(Mechanic interlock)+E(Spring auto release)
N02	AL (AL1+MRB)+K(Key lock(OFF lock))+R(Ready to close switch)+D(Door interlock or MOC)+H1(AC/DC 100V ~ 130V, Double shunt coil)+E(Spring auto release)
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

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## Adapter (Cradle)



*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	
UAH-60G	UAH-60Z	S60G

\* Terminals for P type must be ordered separately

\* G and W types can be applicable to S16D (1600AF) only.

## Rating plug

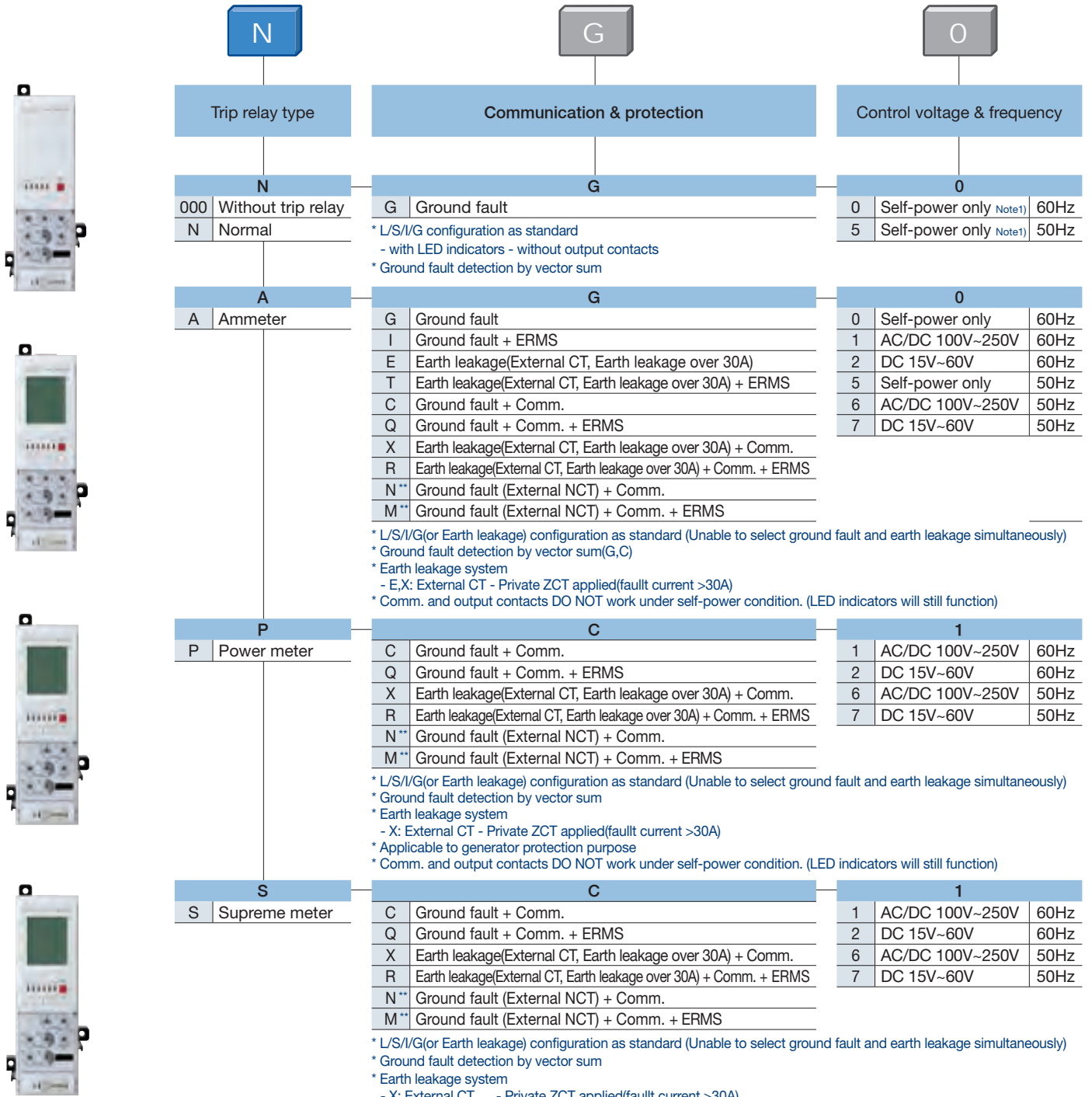
Rating plug classification			ACB ampere frame									
Rating plug code	For none NCT type	For NCT type	Rating	800A	1600A	2000A	2500A	3200A	4000A	5000A	6000A	
	73263466352	73263466372	400A	400A~800A								
	73263466353	73263466373	600A									
	73263466354	73263466374	630A									
	73263466355	73263466375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



# Trip relay



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 Listed/ANSI Certified Susol UA Circuit Breakers

Susol



Type					
AF					
Rated current (In max)	(A)			at 40°C	
Rated current	(A)			at 40°C	
Rated maximum voltage	(V)				
Frequency	(Hz)				
Number of poles	(P)				
Type of trip relay (Electronic trip device)					
Rated short circuit current (kA) (Sym.) UL 1066 ANSI C37.13		With instantaneous	AC	635V	
				508V	
		Without instantaneous	AC	254V	
				508V	
				254V	
Rated short time current	(kA)				
Operating time (t)	(ms)	Maximum total breaking time			
		Maximum closing time			
Life cycle	ACB	(time)	Mechanical	Without maintenance	
				With maintenance	
			Electrical	Without maintenance	
				With maintenance	
Weight	lb (kg)	Drawout type	Main Body	3P	
			with Cradle	4P	
			Only Cradle	3P	
				4P	
			Fixed type	Motor charging type	3P
					4P
External dimension	Draw-out type	in (mm)	H×W×D	3P	
				4P	
				4P	
	Fixed type	in (mm)	H×W×D	3P	
				4P	
				4P	
Enclosure dimension	in (mm)	H×W×D	3P		
			4P		



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UAS-□□□	
08	16
800	1600
	800
400	1000
600	1200
630	1250
800	1600
254V / 508V / 635V	
50 / 60	
3P / 4P	
N, A, P, S (4 type)	
65	
85	
85	
65	
65	
65	
65	
50ms	
80ms	
12,500	
-	
2,800	
-	
154 (70)	
187 (85)	
71 (32)	
84 (38)	
77 (35)	
99 (45)	
16.93×13.15×16.02 (430×334×407)	
16.93×16.5×16.02 (430×419×407)	
11.81×11.81×11.61 (300×300×295)	
11.81×15.16×11.61 (300×385×295)	
19.69×15.75×13.39 (500×400×340)	
19.69×19.69×13.39 (500×500×340)	



<b>Susol</b>				
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				
<b>100</b>				
100				
85				
<b>85</b>				
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)				

<b>Susol</b>			
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			
<b>130</b>			
130			
100			
<b>100</b>			
100			
100			
50ms			
90ms			
10,000		10,000	
-		-	
1,000		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.







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# 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) • Thermal • ZSI(Protective coordination) • ERMS	• L / S / I / G(or Earth leakage) • Thermal(Continuous) • ZSI(Protective coordination) • ERMS	• L / S / I / G(or Earth leakage) • Thermal(Continuous) • ZSI(Protective coordination) • ERMS
Other protection	-	• Earth leakage (Option)	• Earth leakage(Option) • Over/Under voltage • Over/Under frequency • Unbalance(Voltage/Current) • Reverse power	• Earth leakage(Option) • Over/Under voltage • Over/Under frequency • Unbalance(Voltage/Current) • Reverse power
Measurement function	-	• Current (R / S / T / N)	• 3 Phase Voltage/Current RMS/Vector • Power(P, Q, S), PF(3-Phase) • Energy(Positive/Negative) • Frequency, Demand	• 3 Phase Voltage/Current RMS/Vector • Power(P, Q, S), PF(3-Phase) • Energy(Positive/Negative) • Frequency, Demand • Voltage/Current harmonics (1st-63th) • 3 Phase Waveforms • 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) • L, S/I, G Alarm	• 3DO (Programmable) • Trip, Alarm, General	• 3DO (Programmable) • 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 • Profibus-DP	• Modbus / RS-485 • Profibus-DP	• Modbus / RS-485 • Profibus-DP
Power supply	• Self Power - Power source works over 20% of load current.	• Self Power - Power source works over 20% of load current. - External power source are required for comm. • AC/DC 100~250V • DC 15~60V	• AC/DC 100~250V • DC 15~60V	• AC/DC 100~250V • DC 15~60V
RTC timer	-	• Available	• Available	• Available
LED for trip info.	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault
Fault recording	-	• 10 records (Fault/Current/Date and Time)	• 256 records (Fault/Current/Date and Time)	• 256 records • 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)

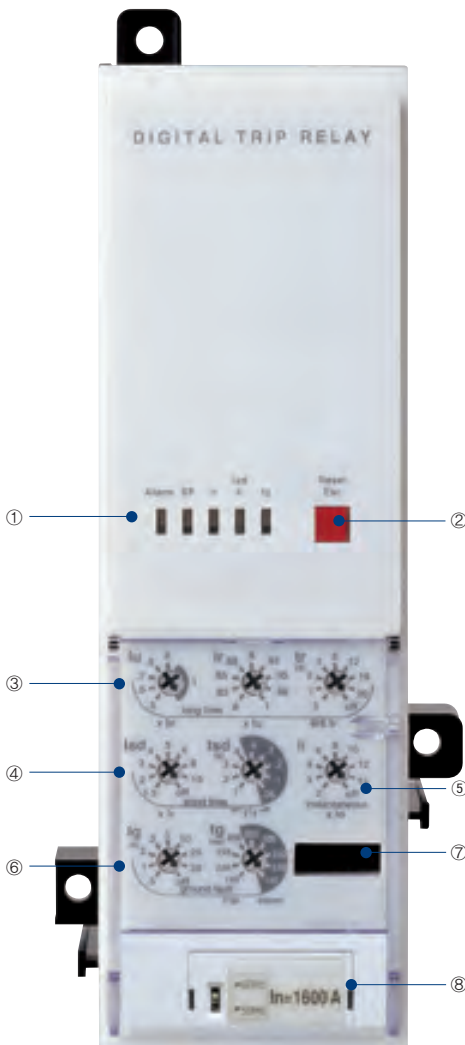
\* L/S/I/G(or Earth leakage) configuration as standard  
Unable to select ground fault and earth leakage simultaneously

# Trip relays

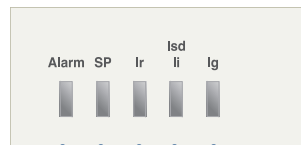
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## N type: 「Normal」 type

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



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



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

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

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

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

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

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

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

### ⑧ Rating plug

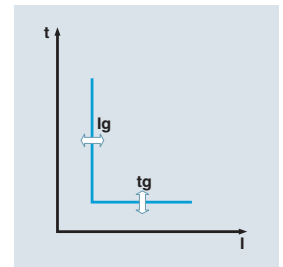
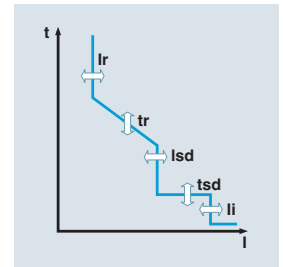
- Rated current setting (45~100% of the AF)
- Frequency selectable(60Hz/50Hz)

# Trip relays

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## Protection

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



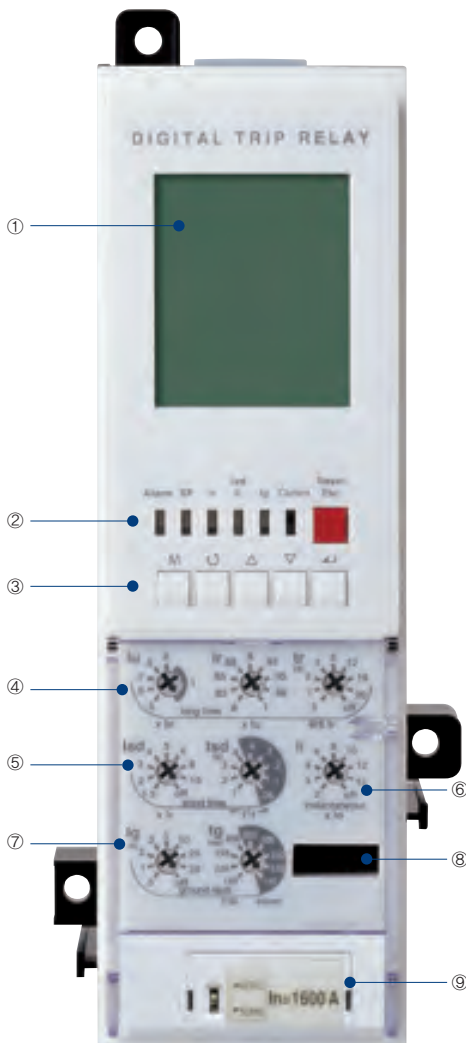


# Trip relays

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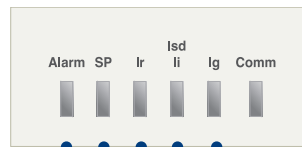
## A type: 「Ammeter」 type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay/Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground fault protection
  - I<sup>2</sup>t On/Off optional
  - 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)



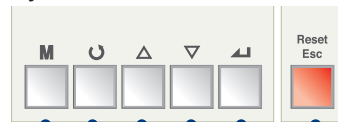
① LCD: Indication of measurement and information

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)

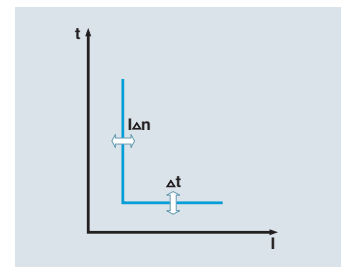
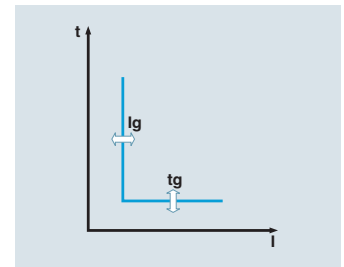
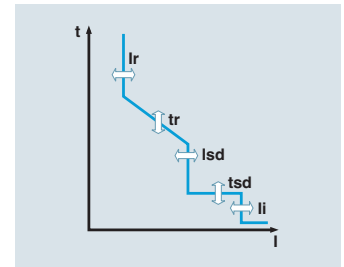
# Trip relays

Susol

## Protection

Long time										
Current setting (A)	$I_u = I_n \times \dots$	0.5	0.6	0.7	0.8	0.9	1.0			
	$I_r = I_u \times \dots$	0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98	1.0
Time delay (s)	$t_r @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500	Off
Accuracy: $\pm 15\%$ or below 100ms	$t_r @ (6.0 \times I_r)$	0.5	1	2	4	8	12	16	20	Off
	$t_r @ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	Off
Short time										
Current setting (A)	$I_{sd} = I_r \times \dots$	1.5	2	3	4	5	6	8	10	Of
Time delay (s)	$t_{sd}$	$I^2 t$ Off	0.05	0.1	0.2	0.3	0.4			
		$I^2 t$ On @ $(10 \times I_r)$	0.1	0.2	0.3	0.4				
Accuracy: $\pm 10\%$ or below 50ms	$(I^2 t \text{ Off})$	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			
Instantaneous										
Current setting (A)	$I_i = I_n \times \dots$	2	3	4	6	8	10	12	15	Off
Tripping time		below 50ms								
Ground fault										
Pick-up (A)	$I_g = I_n \times \dots$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s)	$t_g$	$I^2 t$ Off	0.05	0.1	0.2	0.3	0.4			
		$I^2 t$ On @ $(1 \times I_n)$	0.1	0.2	0.3	0.4				
Accuracy: $\pm 10\%$ ( $I_g \geq 0.4 I_n$ ) $\pm 20%$ ( $I_g < 0.4 I_n$ ) or below 50ms	$(I^2 t \text{ Off})$	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			
Earth leakage (Option)										
Current setting (A)	$I_{\Delta n}$	0.5	1	2	3	5	10	20	30	Off
Time delay (ms)	$\Delta t$	Alarm Time(ms)	140	230	350	800	950			
		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.

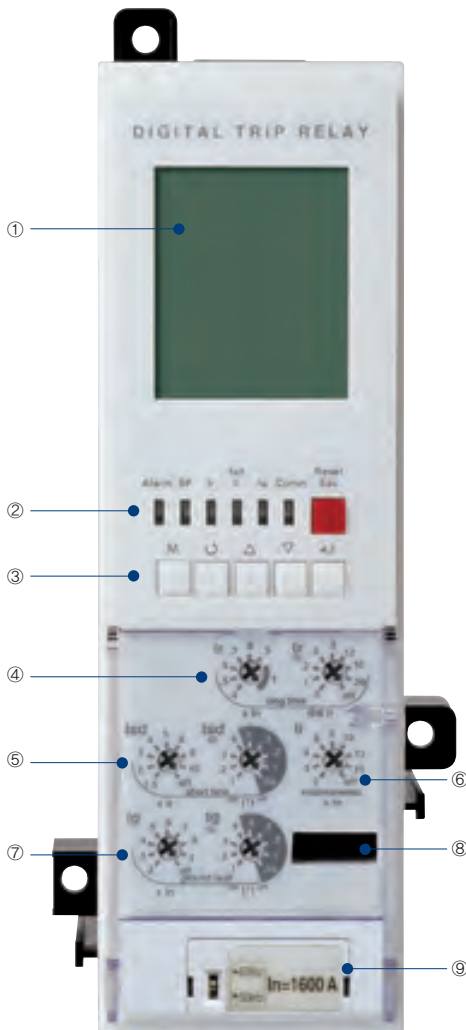


# Trip relays

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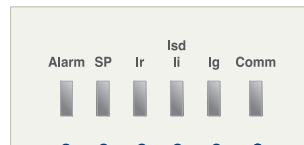
## P type: 「Power meter」 type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay/Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground fault protection
  - I<sup>2</sup>t On/Off optional
  - 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\*I<sub>n</sub>)
- 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



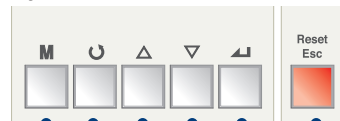
① Graphic LCD: Indication of measurement and information

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

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## Protection

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

Short time										
Current setting (A)	$I_{sd} = I_r \times \dots$	1.5	2	3	4	5	6	8	10	Off
Time delay (s) Accuracy: $\pm 10\%$ or below 50ms	$t_{sd}$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4			
		$I^2t$ On @ $(10 \times I_r)$	0.1	0.2	0.3	0.4				
	$(I^2t$ Off)	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			

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

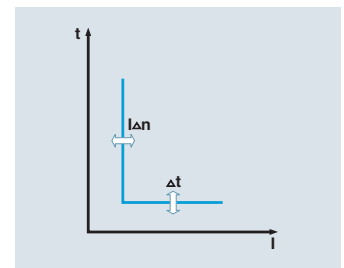
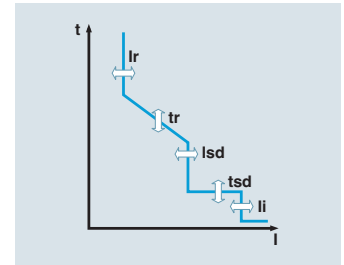
Ground fault										
Pick-up (A)	$I_g = I_n \times \dots$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s) Accuracy: $\pm 10\%$ ( $I_g \geq 0.4 I_n$ ) $\pm 20\%$ ( $I_g < 0.4 I_n$ ) or below 50ms	$t_g$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4			
		$I^2t$ On @ $(1 \times I_n)$	0.1	0.2	0.3	0.4				
	$(I^2t$ Off)	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			

Earth leakage (Option)										
Current setting (A)	$I_{\Delta n}$	0.5	1	2	3	5	10	20	30	Off
Time delay (ms) Accuracy: $\pm 15\%$	$\Delta t$	Alarm Time(ms)	140	230	350	800	950			
		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)	$I_p = I_r \times \dots$	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1
Time delay (s)	$t_p @ (1.2 \times I_p)$	1	5	10	15	20	25	30	35	Off
Accuracy: $\pm 15\%$										

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



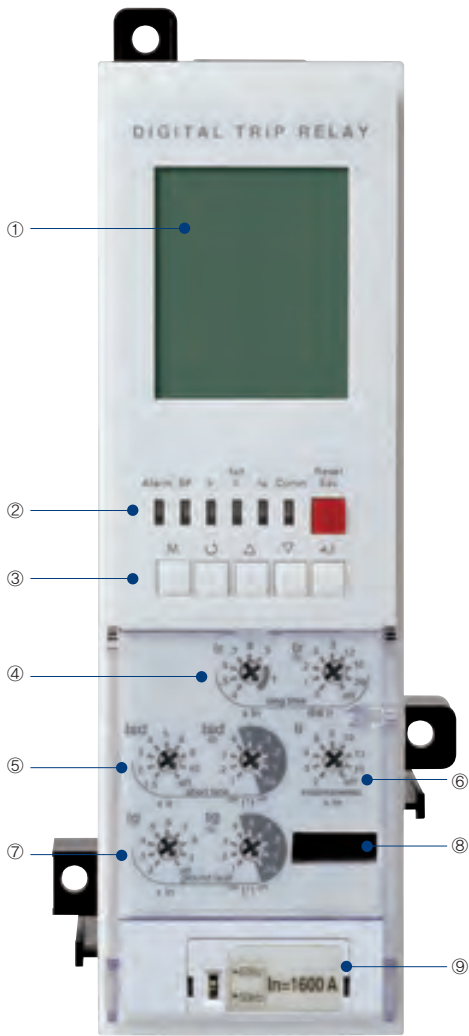


# Trip relays

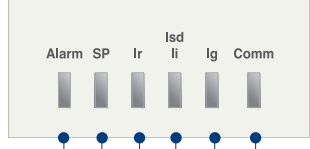
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## S type: 「Supreme meter」 type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay/Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground fault protection
  - I<sup>2</sup>t On/Off optional
  - 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\*I<sub>n</sub>)
- 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)

# Trip relays

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## Protection

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

Short time											
Current setting (A)	$I_{sd} = I_r \times \dots$	1.5	2	3	4	5	6	8	10	Off	
Time delay (s) Accuracy: $\pm 10\%$ or below 50ms	$t_{sd}$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4				
		$I^2t$ On @ $(10 \times I_r)$	0.1	0.2	0.3	0.4					
	$(I^2t$ Off)	Min. Trip Time(ms)	20	80	160	260	360				
		Max. Trip Time(ms)	80	140	240	340	440				

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

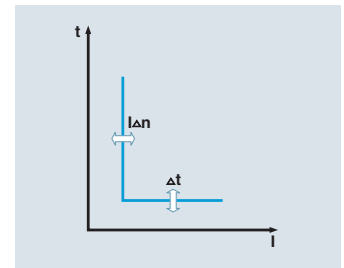
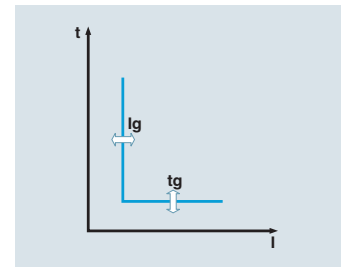
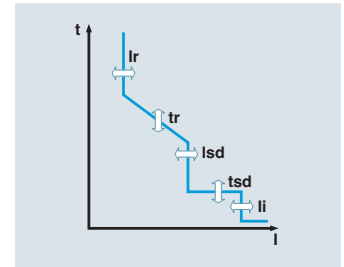
Ground fault											
Pick-up (A)	$I_g = I_n \times \dots$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off	
Time delay (s) Accuracy: $\pm 10\%$ ( $I_g \geq 0.4 I_n$ ) $\pm 20\%$ ( $I_g < 0.4 I_n$ ) or below 50ms	$t_g$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4				
		$I^2t$ On @ $(1 \times I_n)$	0.1	0.2	0.3	0.4					
	$(I^2t$ Off)	Min. Trip Time(ms)	20	80	160	260	360				
		Max. Trip Time(ms)	80	140	240	340	440				

Earth leakage (Option)											
Current setting (A)	$I_{\Delta n}$	0.5	1	2	3	5	10	20	30	Off	
Time delay (ms) Accuracy: $\pm 15\%$	$\Delta t$	Alarm Time(ms)	140	230	350	800	950				
		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)	$I_p = I_r \times \dots$	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95	1
Time delay (s)	$t_p @ (1.2 \times I_p)$	1	5	10	15	20	25	30	35	Off
Accuracy: $\pm 15\%$										

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



# Trip relays

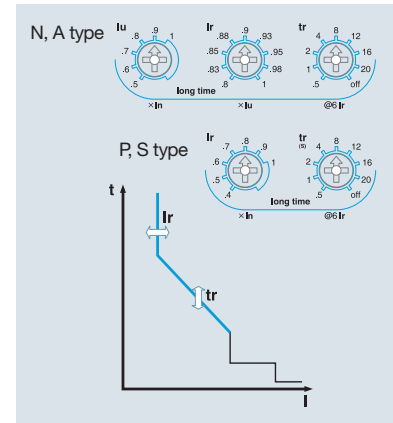
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## Operation characteristics

### Long-time delay (L)

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

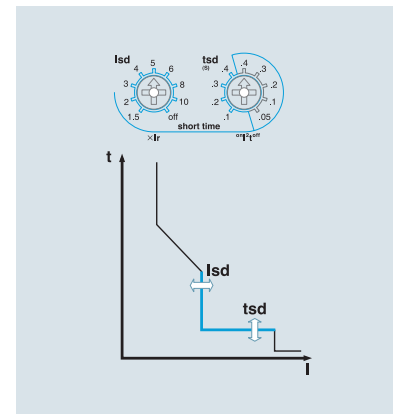
- Standard current setting knob: Ir
  - 1) Setting range in P type and S type:  $(0.4-0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
  - 2) Setting range in N type and A type:  $(0.4 \sim 1.0) \times I_n$ 
    - Iu:  $(0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
    - Ir:  $(0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0)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



### Short-time delay (S)

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

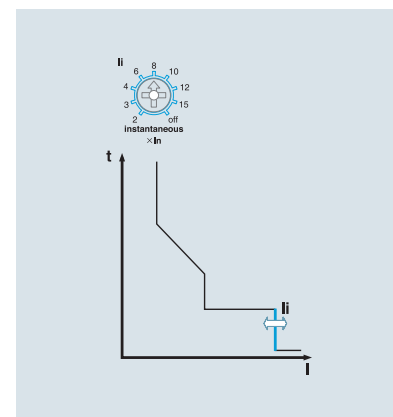
- Standard current setting knob: Isd
  - Setting range:  $(1.5-2-3-4-5-6-8-10-Off) \times I_r$
- Time delay setting knob: tsd
  - Standard operating time is based on the time of  $10 \times I_r$ .
  - Inverse time ( $I^2t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2t$  Off): 0.05-0.1-0.2-0.3-0.4 sec
- Relay operates basing on the largest load current among R/S/T/N phase.
- 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.**

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



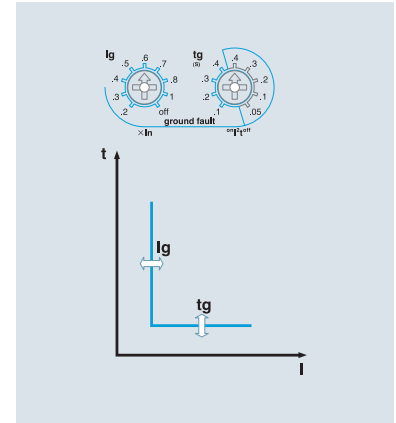
# Trip relays

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## Ground Fault (G)

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

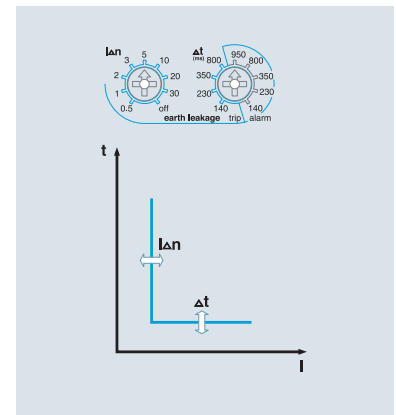
- Standard setting current knob:  $I_g$ 
  - Setting range:  $(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-Off) \times I_n$
- Time delay setting knob:  $t_g$ 
  - Inverse time ( $I^2t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2t$  Off): 0.05-0.1-0.2-0.3-0.4 sec
- Ground fault current is vector sum of each phase current. Therefore, 3Pole products may operate under its phase-unbalance including ground fault situations.  $(R+S+T+(N))$  Phase
- 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.
- 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)**

- Standard setting current knob:  $I_{\Delta n}$ 
  - Setting range: 0.5-1-2-3-5-10-20-30-Off (A)
- Time delay setting knob:  $\Delta t$ 
  - Trip time: 140-230-350-800 ms
  - Alarm time: 140-230-350-800-950 ms
- Setting values within the alarm range will not trip the breaker but will activate its alarm.
- This function is enabled and can be used only with private external CT (secondary output 5A) selected by customers.
- 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.

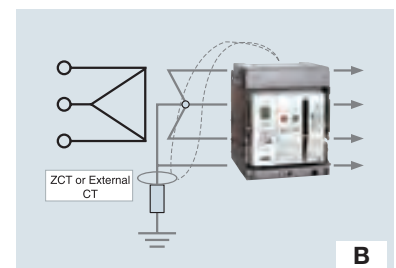
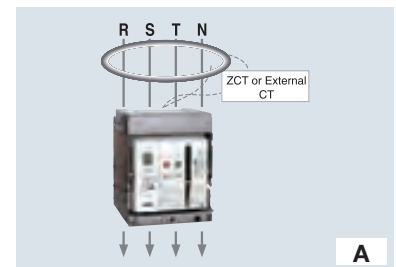


### ※ Use cautions with earth-leakage current settings

- 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 ( $0.5A \times 20 = 10A$ )

### ※ 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  $400A \times 20\% = 80A$   
4000A ACB Min. Earth-leakage current  $4000A \times 20\% = 800A$
- Therefore, customers are advised to install an external CT in accordance with its rated currents within its systems. And choose trip relay (E, X type) which is required with external CT usage in order to provide earth-leakage functions.





# Trip relays

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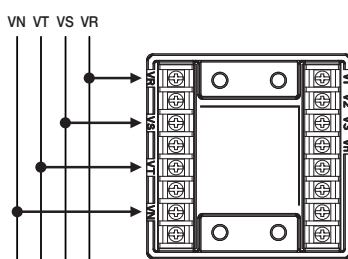
## Measurement function

Class.	Measurement element	Detailed element	Unit	Display range	Accuracy
Current	Line current	Ia, Ib, Ic	A	A type: 0.15In~17In P/S type: 0.12In~1.6In	±3%
	Normal current	I <sub>1</sub>			
	Reverse current	I <sub>2</sub>			
Voltage	Line voltage	Vab, Vbc, Vca	V	60~690V	±1%
	Phase voltage	Va, Vb, Vc			±1%
	Normal voltage	V <sub>1</sub>			
	Reverse voltage	V <sub>2</sub>			
Angle	Line-to-line	∠VabIa, ∠VablIb, ∠VabIc,	°	0~360°	±1°
	Line-to-current	∠VabVbc, ∠VabVca			±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), WHc(ca), WH	kWh MWh	1kWh~9999.99MWh	±3%
	Reactive energy	VARHa(ab), VARHb(bc), VARHc(ca), VARH	kVarh Mvarh	1kVarh~9999.99MVarh	±3%
	Reverse active energy	rWHa(ab), rWHb(bc), rWHc(ca), rWH	kWh MWh	1kWh ~9999.99MWh	±3%
Freq.	Frequency	F	Hz	45~65Hz	
Power factor	Power factor(PF)	PFa(ab), PFb(bc), PFc(ca), PF		+: Lead, -: Lag	
Unbalance	Unbalance rate	Iunbalance, Vunbalance	%	0.0~100.0	
Demand	Active power demand	Peak demand	kW	1kW~99999kW	
	Current demand	Peak demand	A	80A~65,535A	
Harmonics	Voltage harmonics	1st~63th harmonics of Va(ab), Vb(bc), Vc(ca)	V	60~690V	
	Current harmonics	1st~63th harmonics of Ia, Ib, Ic	A	80A~65,535A	
	THD, TDD		%	0.0~100.0	
	K-Factor		-	0.0~100.0	

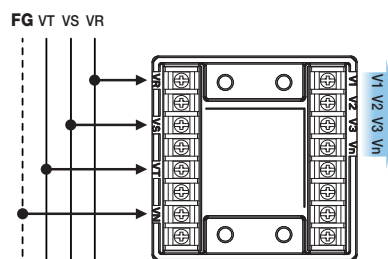
## Voltage module

For P and S type trip 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



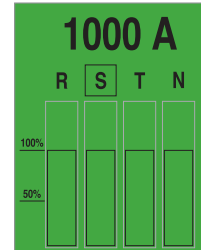
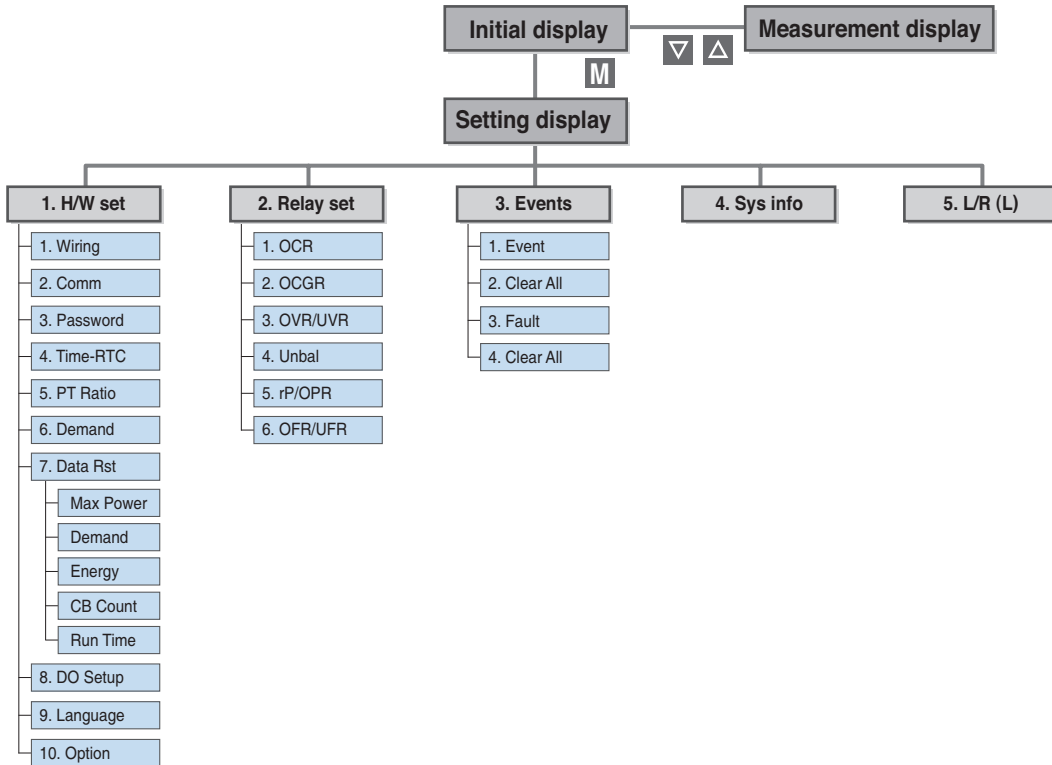
3P3W wiring



# Trip relays

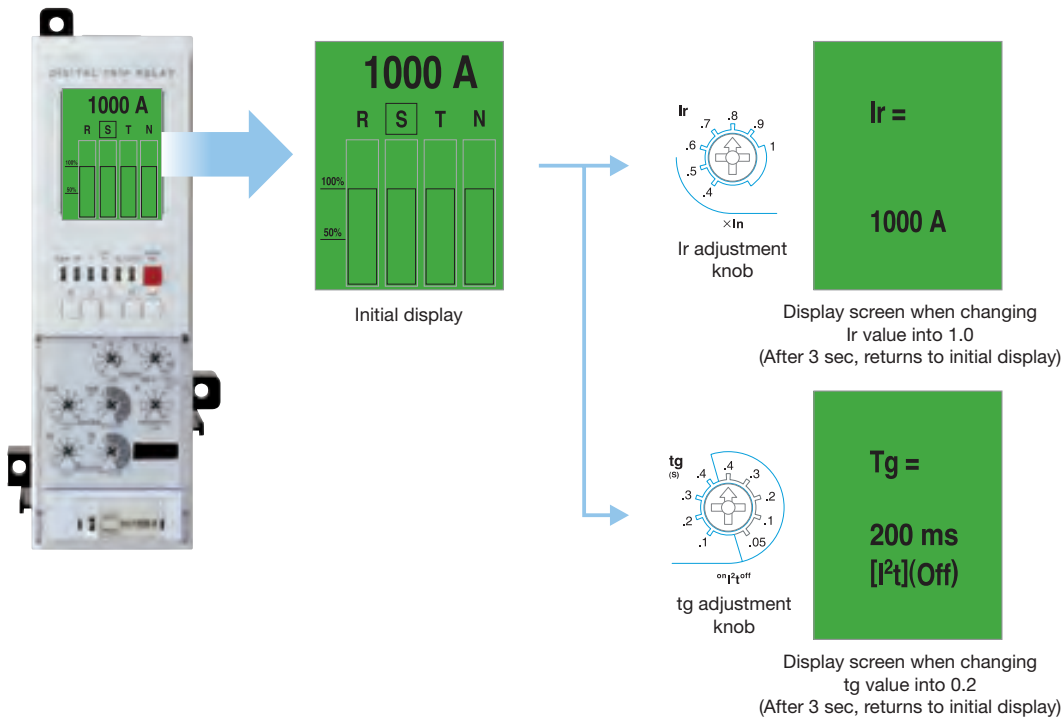
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## Man machine interface



Initial display

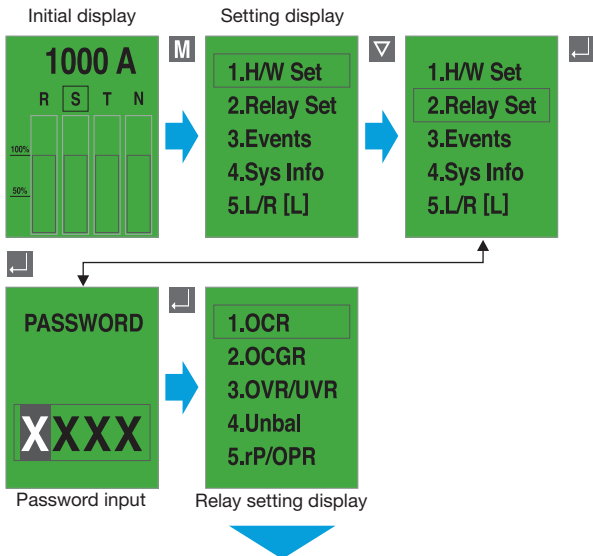
## An example of graphic LCD display



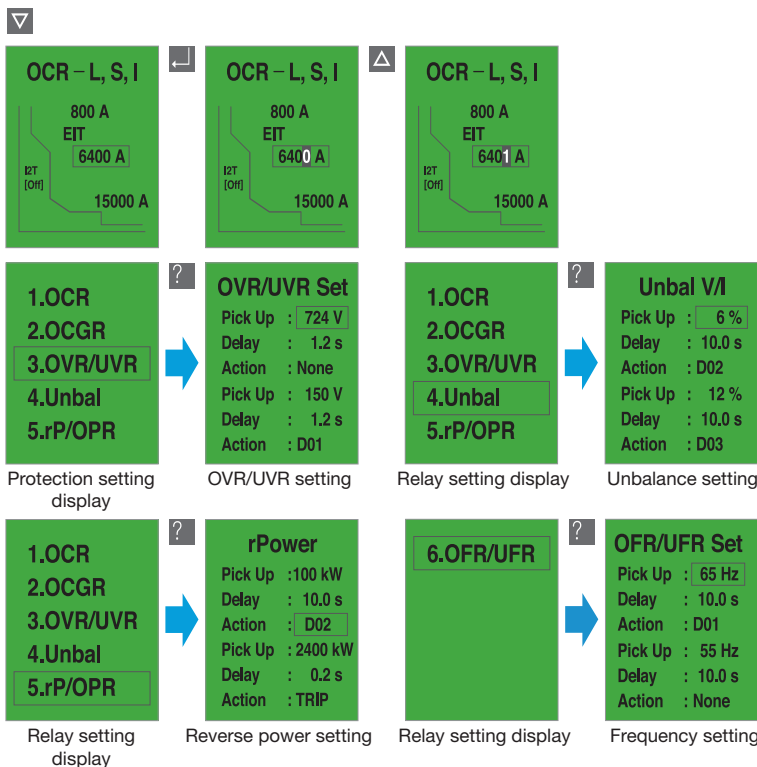
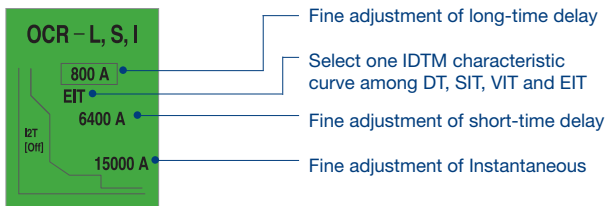
# Trip relays

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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  $\nabla$ ,  $\Delta$  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.

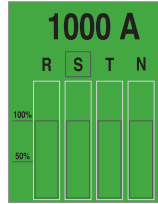
- The setting method of OCGR is same with OCR's, fine adjustment is available.

# Trip relays

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## Measurement element display

Load current



Measurement overview

<b>Metering Overview</b> VR 220 V ∠ 0.0 IR 1000 A ∠ 330.0 P 986 kW Q 589 kVar PF 0.866 F 60.0 EP 56 kWh EQ 32 kVarh	<b>Demand Current [A]</b> R : 1000 S : 1000 T : 1000 Max Demand [kW] 986 2007/05/14 11:15:00	<b>Max Power [kW]</b> 987 2007/05/14 10:00:00
--	---	--

Voltage/Current vector diagram

<b>Vector Diagram</b> 	<b>VOLTAGE [V]</b> VR : 220 ∠ 0.0 VS : 220 ∠ 240.0 VT : 220 ∠ 120.0 <b>CURRENT [A]</b> IR : 1000 ∠ 330.0 IS : 1000 ∠ 210.0 IT : 1000 ∠ 90.0 IN : 0	<b>V unbal 3Phase</b> Vpos : 220 V Vneg : 0 V Unbal : 0.0 % <b>I unbal 3Phase</b> Ipos : 1000 A Ineg : 0 A Unbal : 0.0 %
---------------------------	--	---

Power and power factor

<b>Power Diagram</b> 	<b>Active Power [kW]</b> R : 328 Total S : 328 986 T : 328 <b>Reactive [kVar]</b> R : 189 Total S : 189 589 T : 189	<b>Apparent [kVA]</b> R : 379 Total S : 379 1139 T : 379 <b>Power Factor</b> R : 0.87 Total S : 0.87 0.866 T : 0.87
--------------------------	--	--

Energy

<b>Forward Energy</b> P+ 1051 kWh Q+ 607 kVarh <b>Reverse Energy</b> P- 0 kWh Q- 0 kVarh	<b>Forward P [kWh]</b> R : 360 Total S : 360 1080 T : 360 <b>Forward Q [kVarh]</b> R : 210 Total S : 210 630 T : 210	<b>Reverse P [kWh]</b> R : 0 Total S : 0 0 T : 0 <b>Reverse Q [kVarh]</b> R : 0 Total S : 0 0 T : 0
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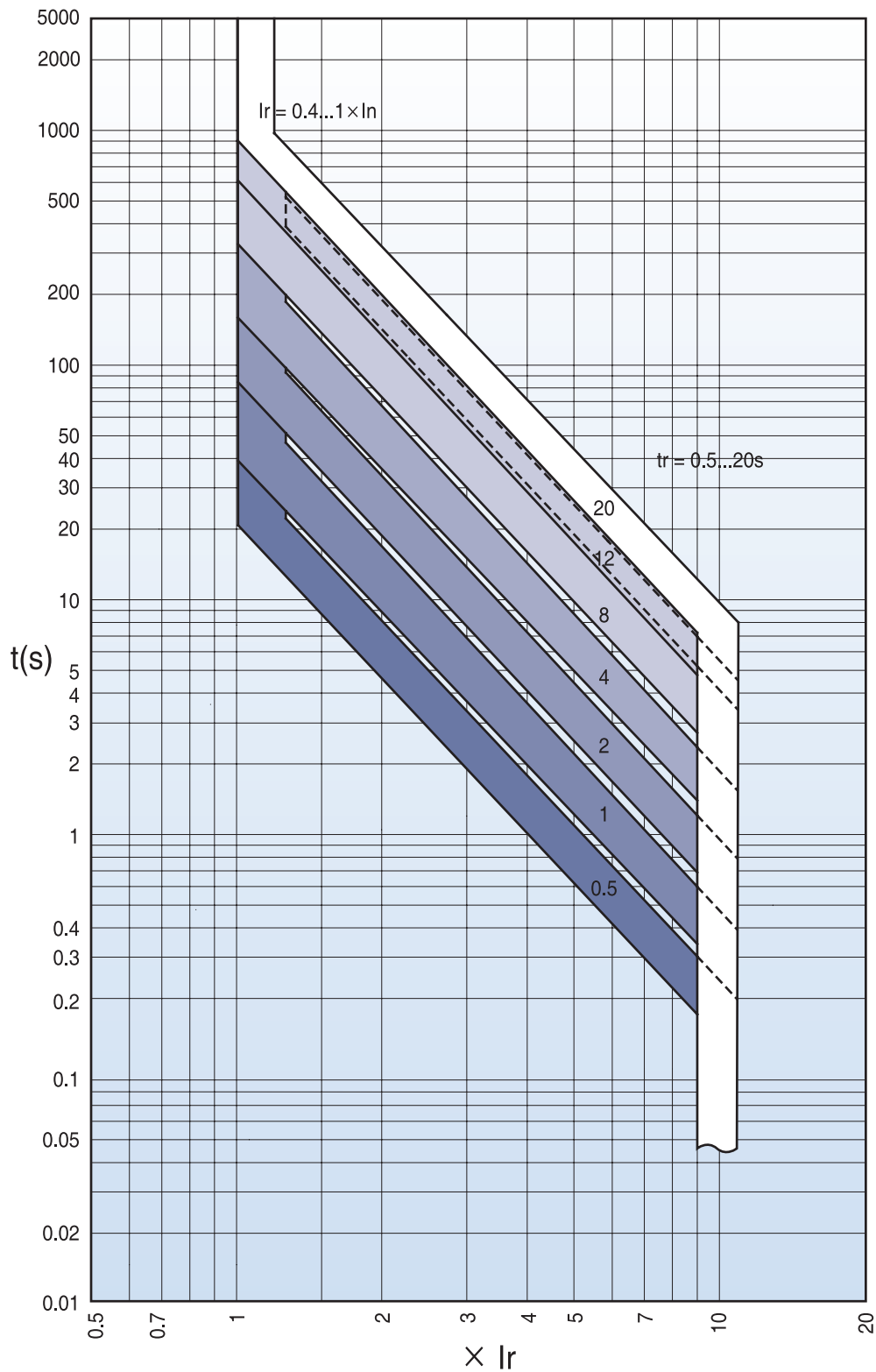
Voltage/Current harmonics (S type)

<b>Volt Wave &amp; FFT [%]</b> THD[S] : 25.0 	<b>S Volt Harmonics [V]</b> H1 220 H8 0 H2 0 H9 0 H3 55 H10 0 H4 0 H11 0 H5 0 H12 0 H6 0 H13 0 H7 0 H14 0	<b>S Volt Harmonics [V]</b> H15 0 H22 0 H16 0 H23 0 H17 55 H24 0 H18 0 H25 0 H19 0 H26 0 H20 0 H27 0 H21 0 H28 0	<b>S Volt Harmonics [V]</b> H57 0 H58 0 H59 0 H60 0 H61 0 H62 0 H63 0	
<b>Curr Wave &amp; FFT [%]</b> THD[R] : 3.0 	<b>R Curr Harmonics [A]</b> H1 1000 H8 0 H2 0 H9 3 H3 15 H10 0 H4 0 H11 1 H5 20 H12 0 H6 0 H13 1 H7 0 H14 0	<b>R Curr Harmonics [A]</b> H15 1 H22 0 H16 0 H23 1 H17 1 H24 0 H18 0 H25 1 H19 1 H26 0 H20 0 H27 1 H21 1 H28 0	<b>R Curr Harmonics [A]</b> H57 0 H58 0 H59 0 H60 0 H61 0 H62 0 H63 0	<b>TDD 3Phase</b> R : 0.1 % S : 0.1 % T : 0.1 % <b>Current K - Factor</b> R : 1.2 S : 1.2 T : 1.3



## Characteristics curves

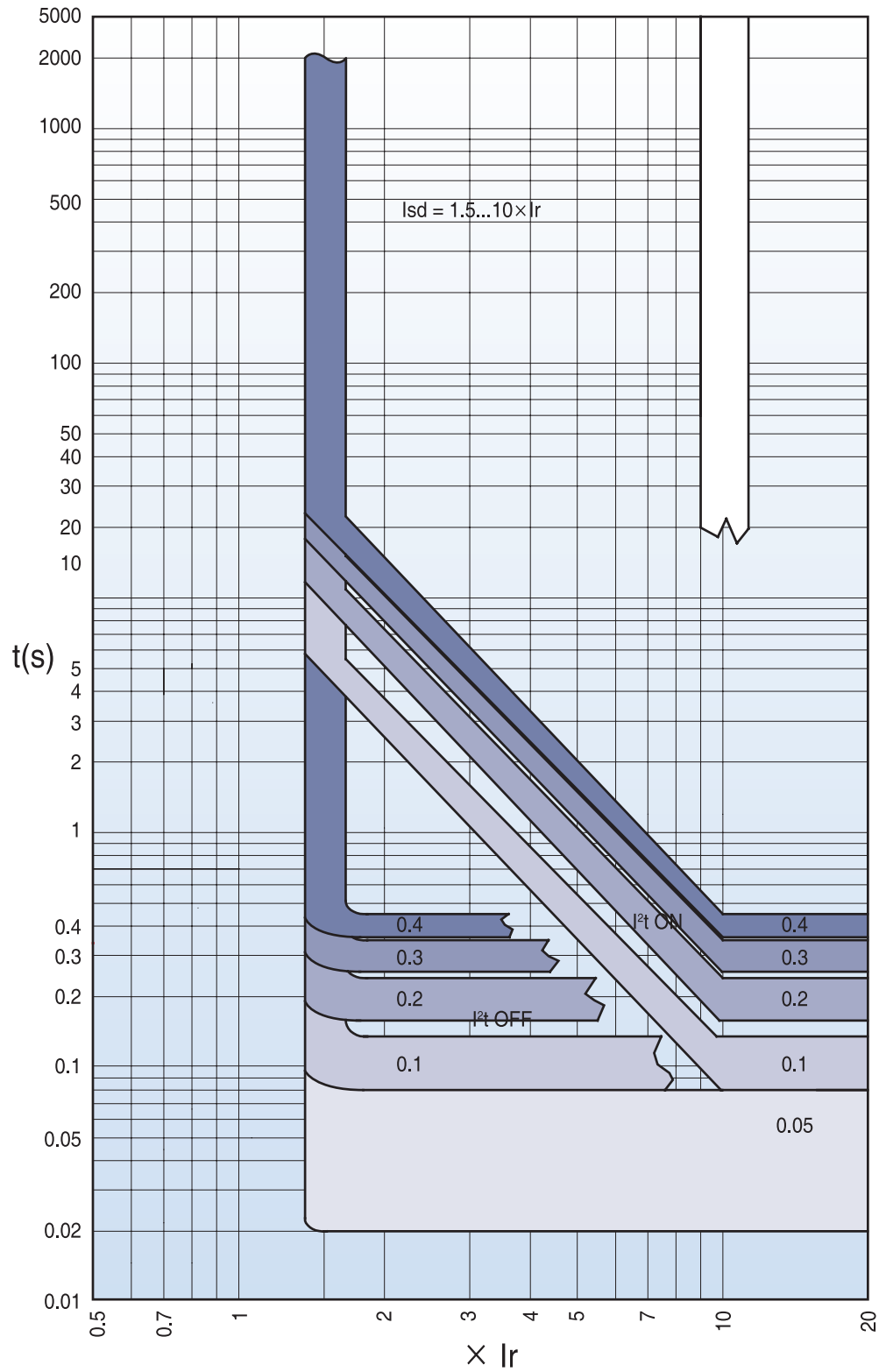
Long-time delay (L)



# Trip relays

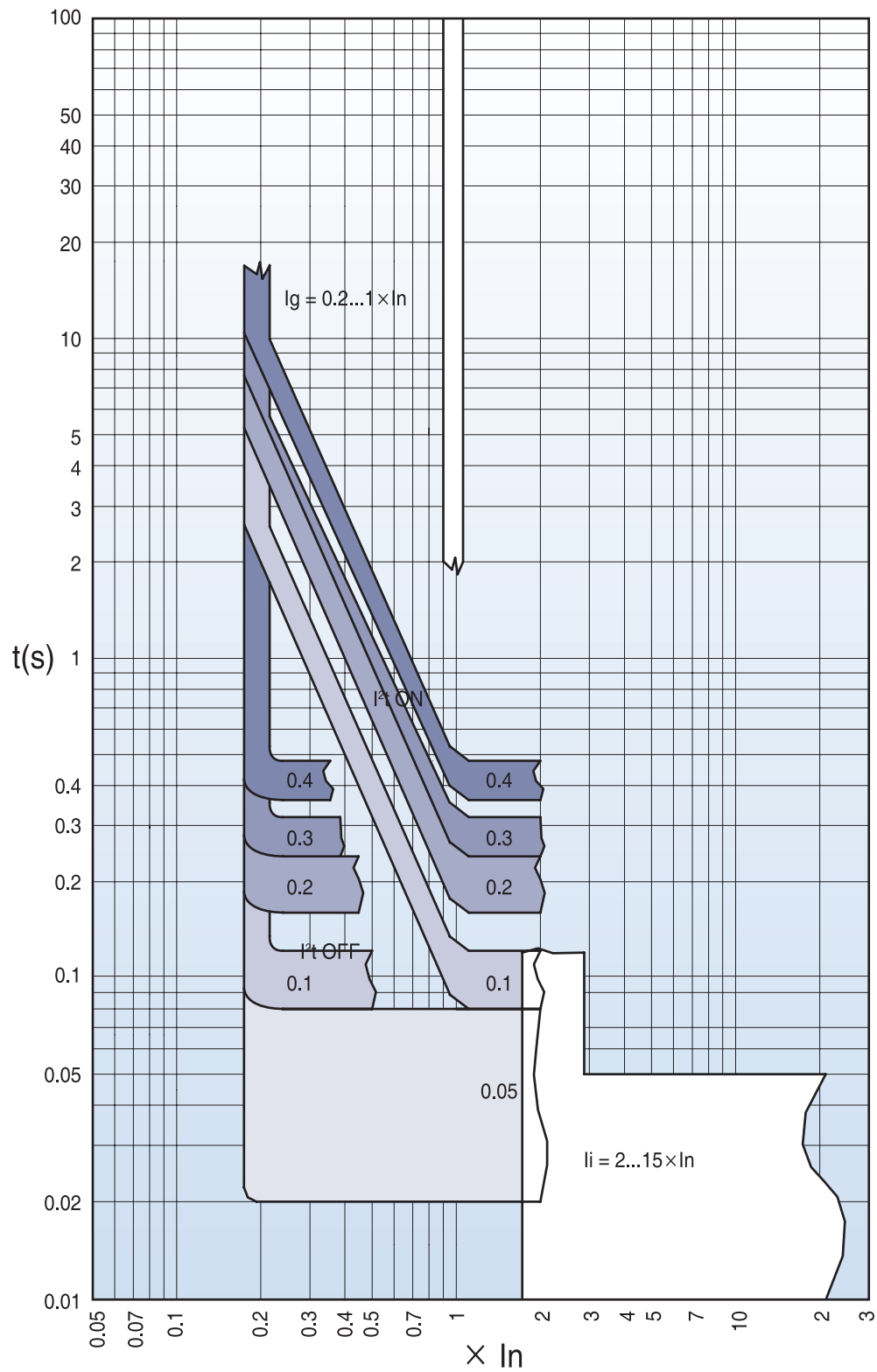
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## Short-time delay (S)



## Characteristics curves

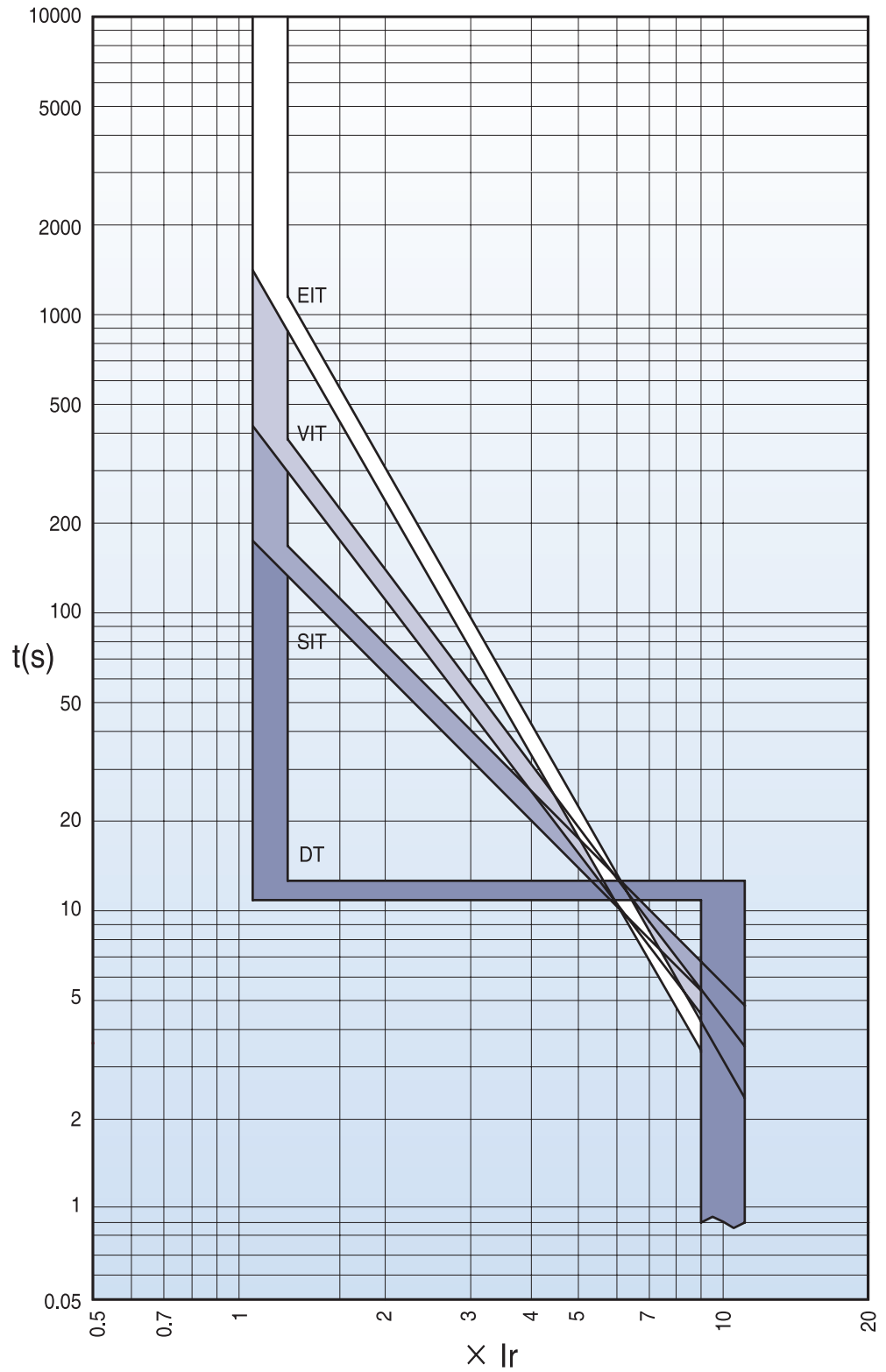
Instantaneous (I)  
Ground fault (G)



# Trip relays

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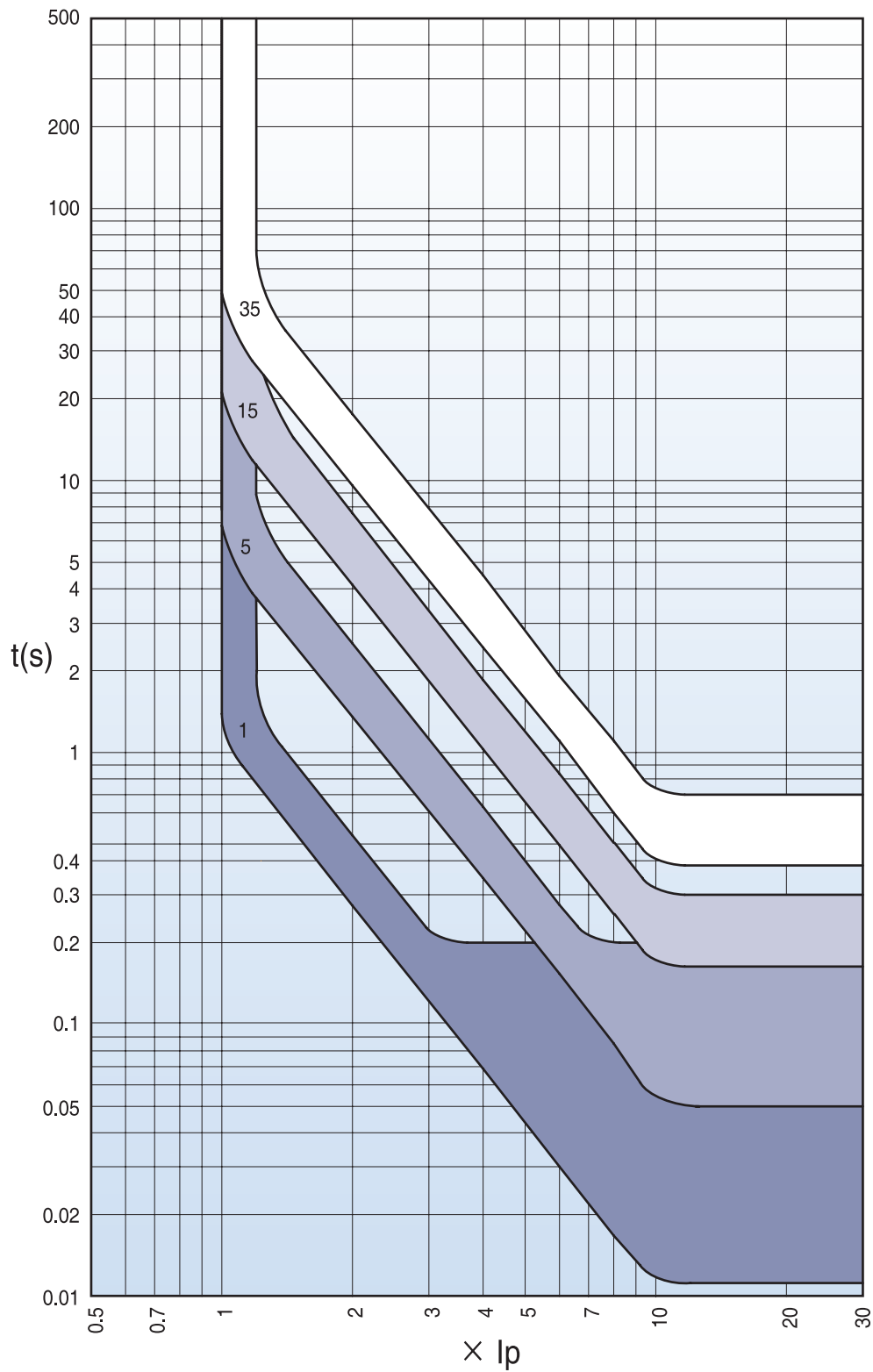
## IDMTL





## Characteristics curves

### Pre Trip Alarm



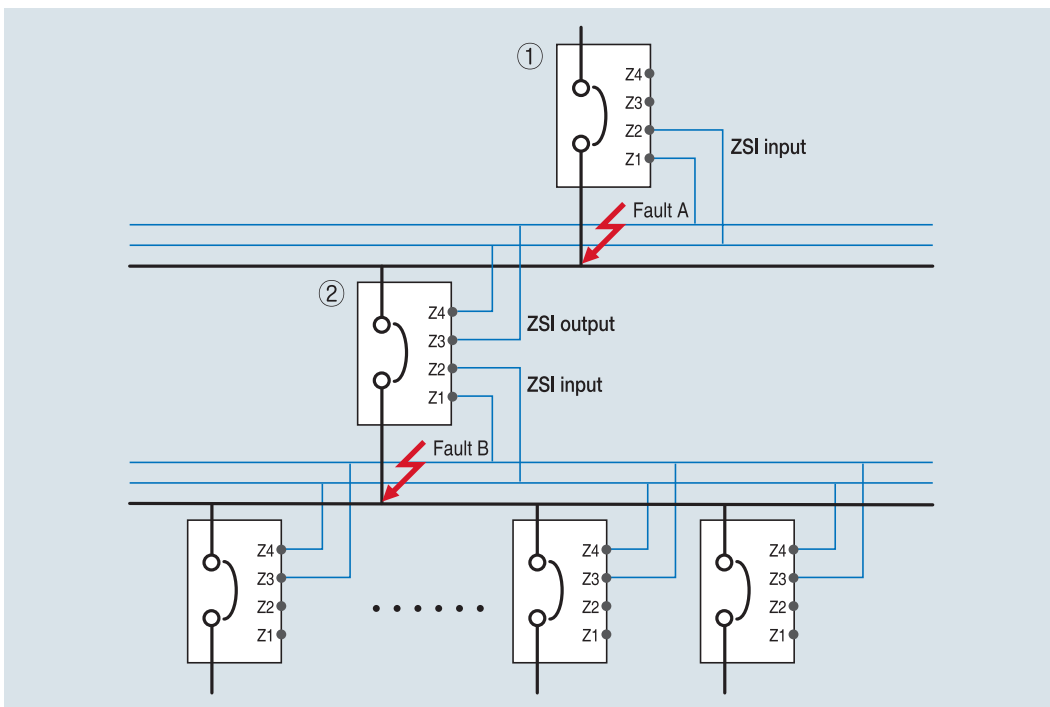
# Trip relays

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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.

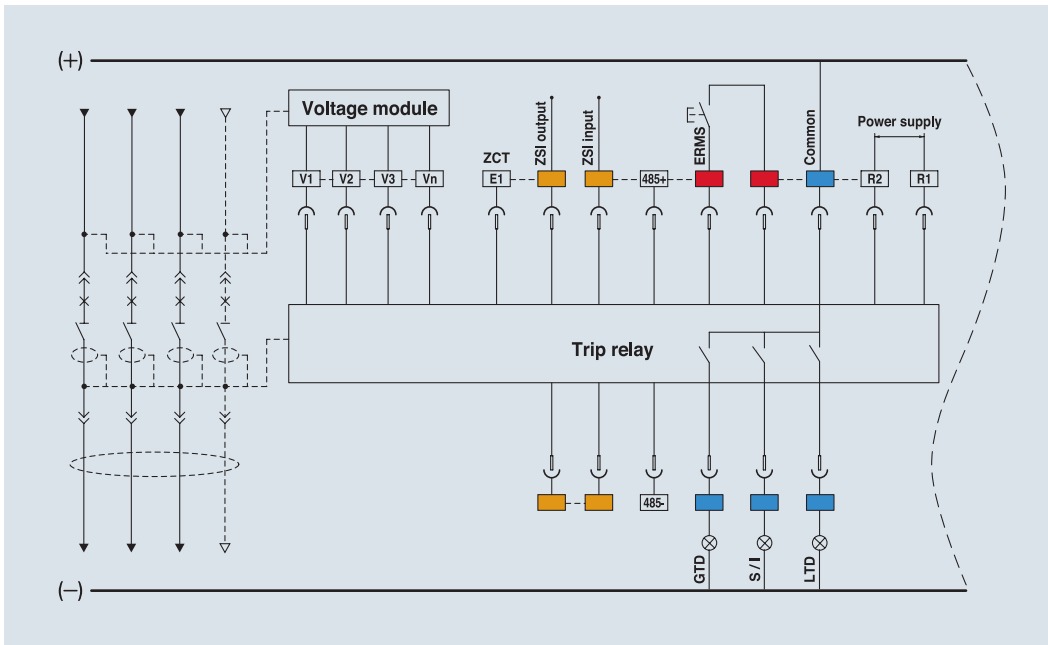
# Trip relays

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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( $2 \cdot I_n$ ). 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)	×	×	×	●										

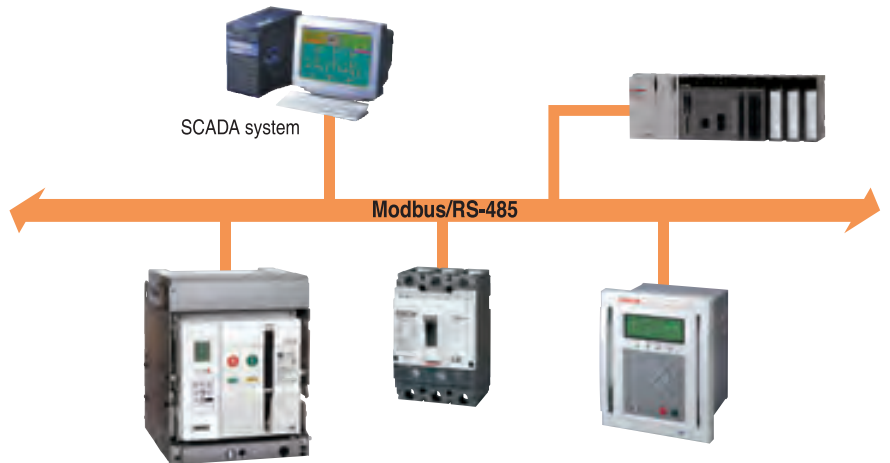
# Trip relays

Susol

## 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

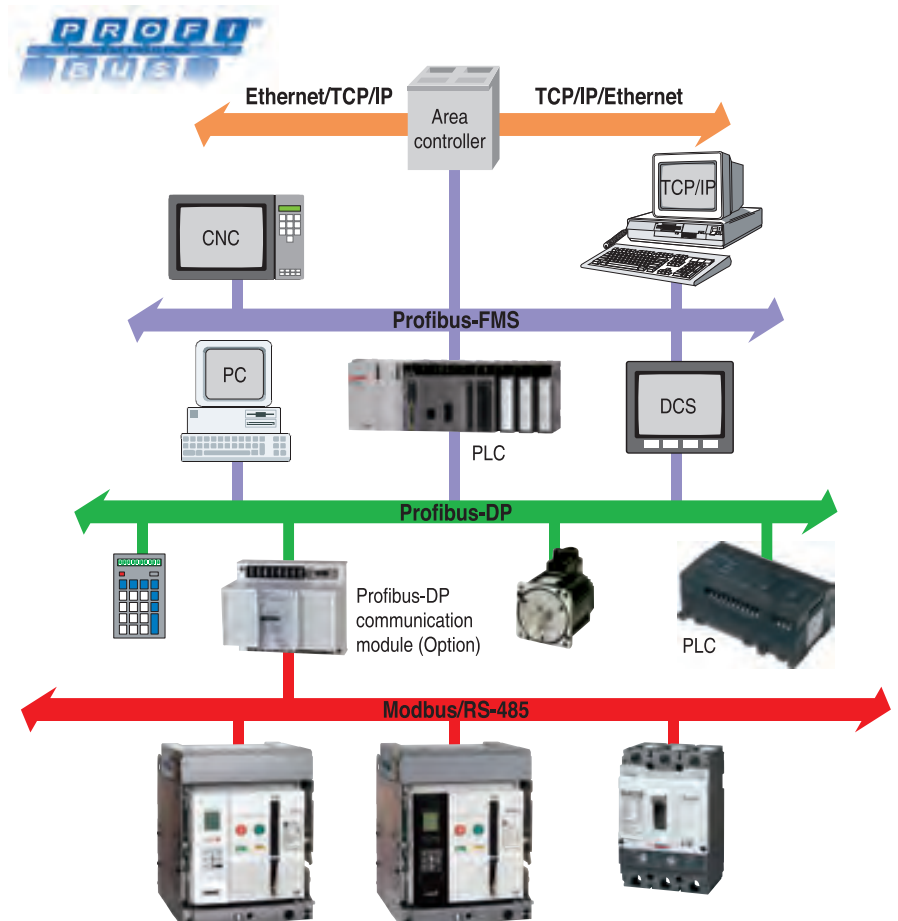


### Profibus-DP

- 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)





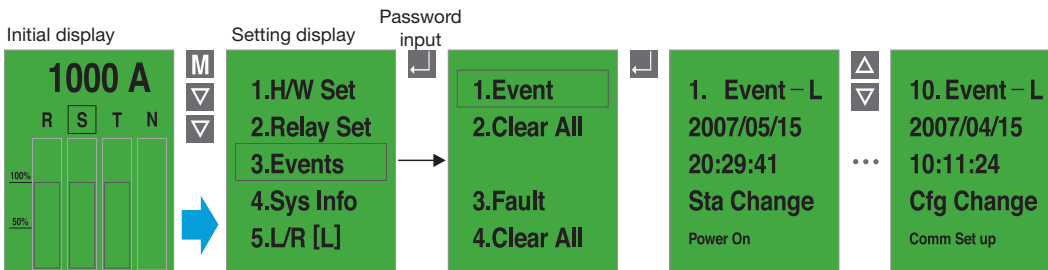
# Trip relays

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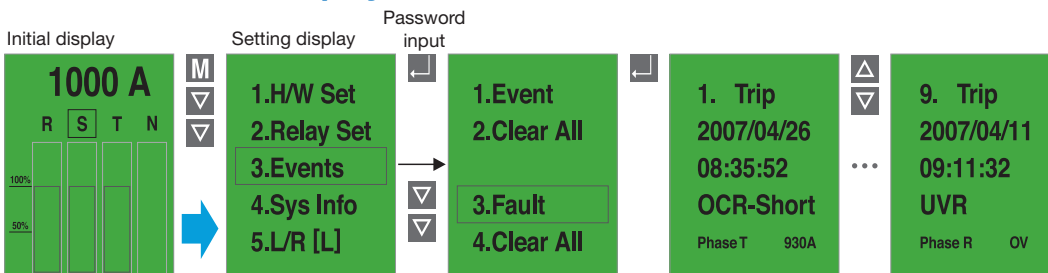
## Event & fault recording (P, S type)

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



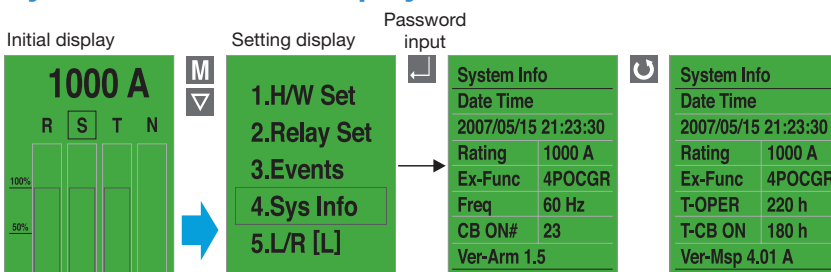
\* Fault information is recorded only when there is external control power

## 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

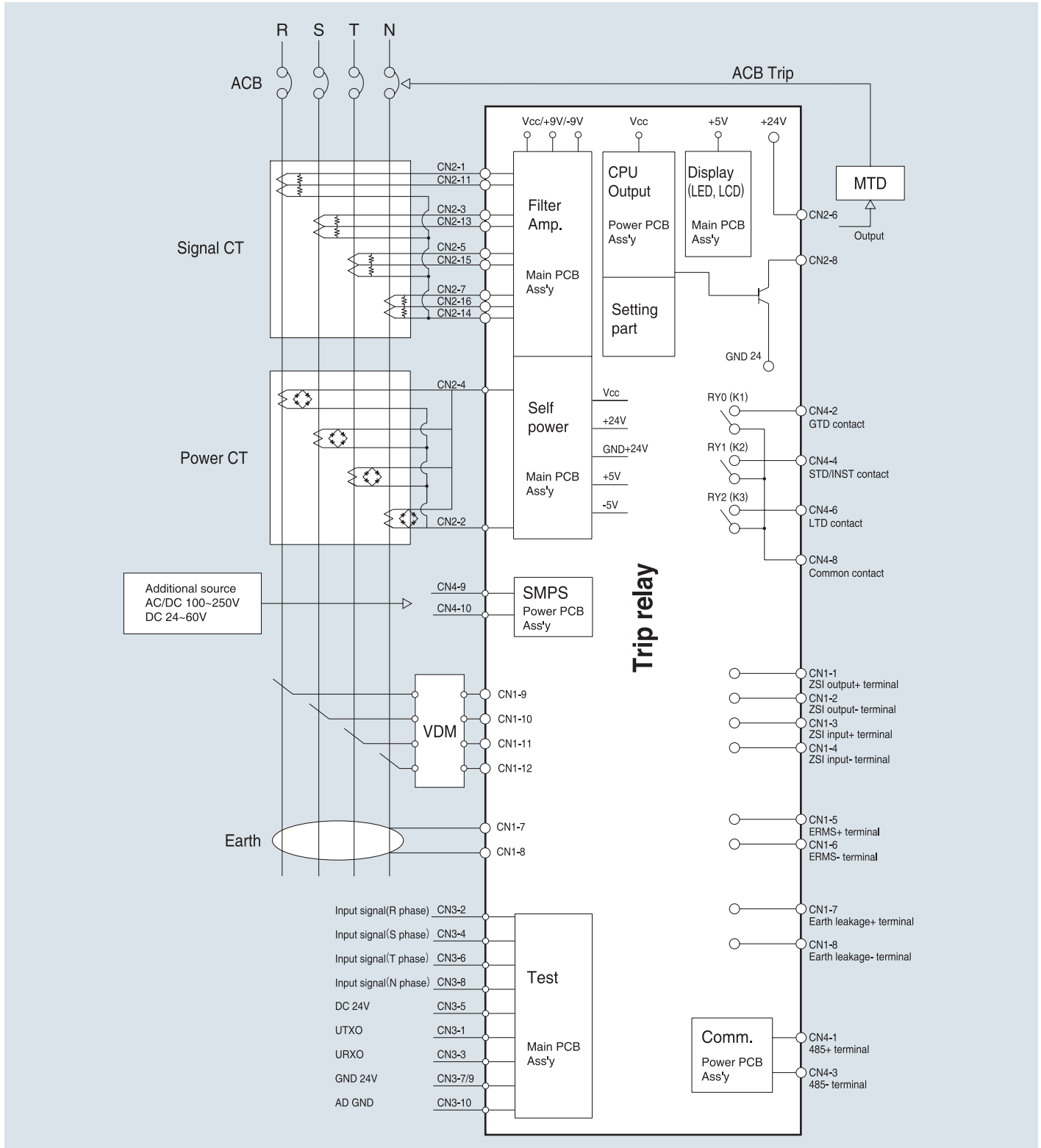
### System information display



# Trip relays

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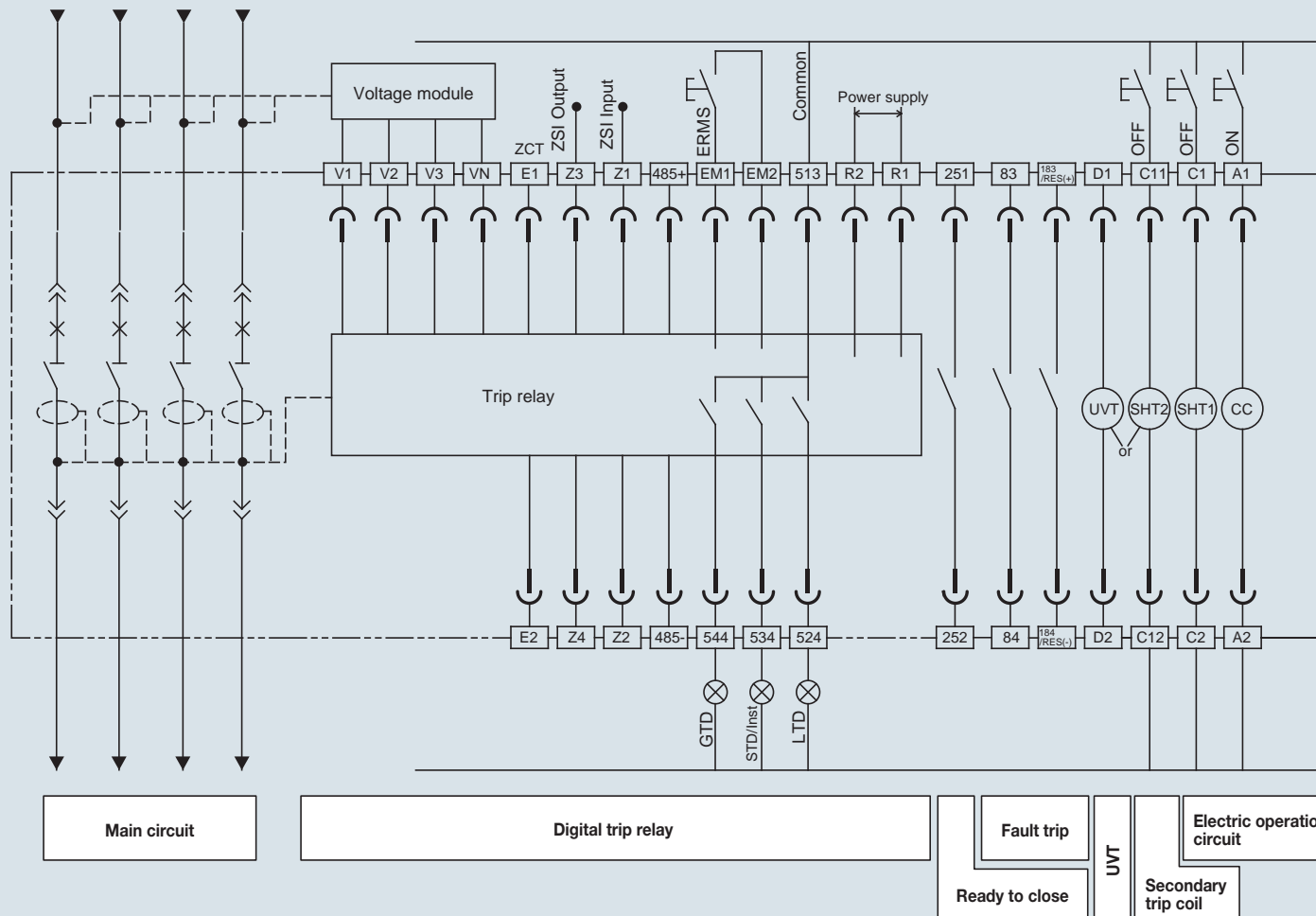
## System block diagram



# Electrical diagram

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This diagram is based on "CONNECTED" position of a circuit breaker and Opening, Motor charging, Releasing of locking plate should be normal condition.

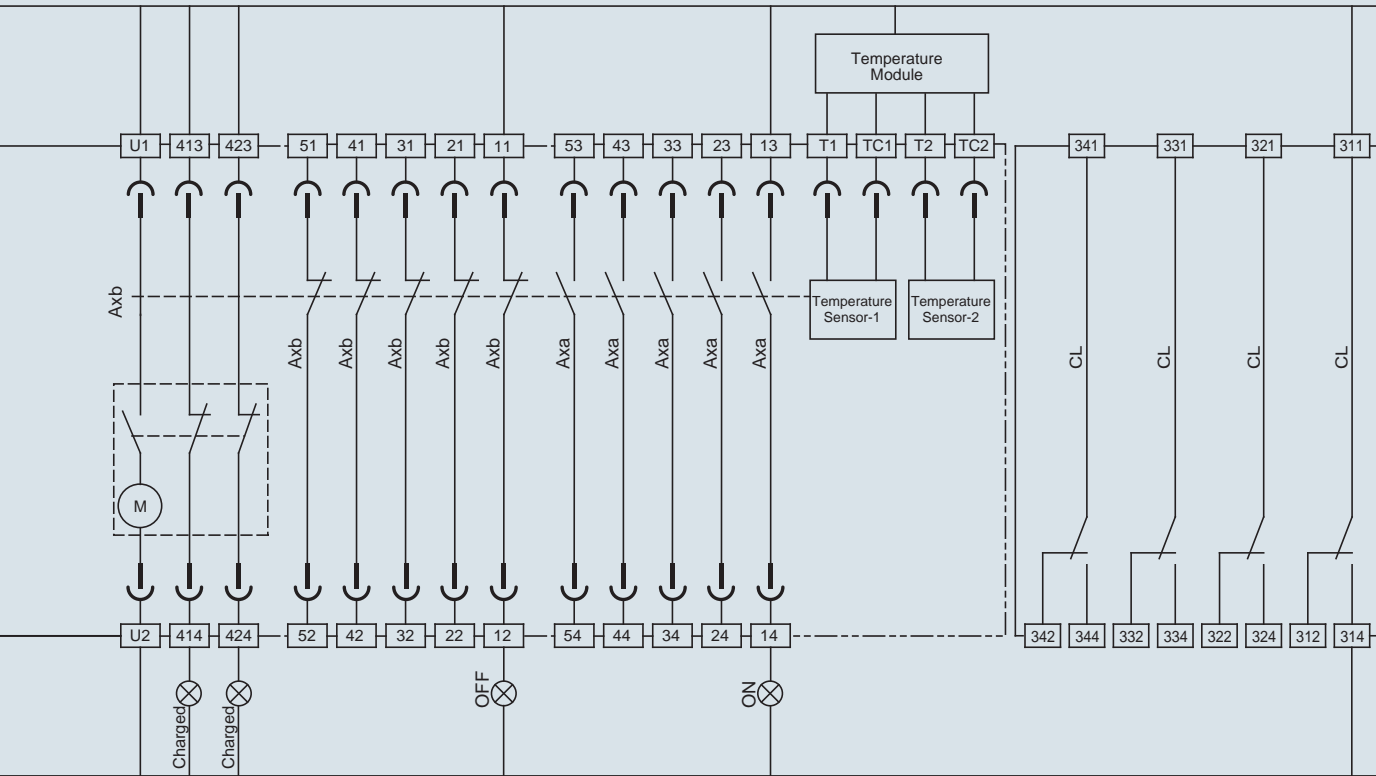


## Terminal code description

13	14	~	63	64	Auxiliary switch "a"
11	12	~	61	62	Auxiliary switch "b"
413	414				Charged signal
423	424				Charged signal communication
U1	U2				Motor charging
A1	A2				Closing coil
C1	C2				Shunt trip
C11	C12				2nd shunt trip

D1	D2	Voltage input terminal of UVT	
83	84	Alarm1 "a"	
183	184	Alarm2 "a"	
251	252	Ready to close switch	
R1	R2	Control power	
513	~	544	Alarm contact
EM1	EM2	ERMS	
485+	485-	RS-485 communication	

- Note) 1. The diagram is shown with circuits de-energized, all devices open, connected and charged and relays in normal position  
 2. Relay is normal condition and charging type is "ON-Charging"  
 3. The standard auxiliary contact is 3a3b. The auxiliary switch in above diagram is composed of 5a5b. See page 59 for more detail on auxiliary switches.  
 4. Option  
 - Ready to close contact, Trip alarm contact, UVT coil, Fully charged contact, secondary trip coil  
 - Cell switch, Temperature module, Voltage module, Remote close-open module, ZCT, ZSI  
 5. Please consult us for the use of ZSI (Zone selective Interlocking).  
 6. Refer to the page 24 for the connection of Trip relay and the page 56 for UVT.  
 7. For connecting RS-485 verify if the polarity is correct



Charge completion contact

Auxiliary switch

Thermal, communication remote control module

Cell switch

Accessory code description

Z1   Z2	ZSI input
Z3   Z4	ZSI output
E1   E2	ZCT
VN ~ V3	Voltage module
TC1 , TC2 ~ T1 , T2	Temperature module
311 ~ 344	Position switch

Ax	Auxiliary switch
LTD	Long time delay trip indicator
STD/Inst	Short time delay/instantaneous
GTD	Ground fault trip indicator
CL	Cell switch
(M)	Motor
(CC)	Closing coil
(SH1)	Shunt tripping device 1
(SH2)	Shunt tripping device 2
(UVT)	UVT coil

—	Internal wiring
—	External wiring (by customer)
⌋	Connector of the control circuit terminal of drawout type