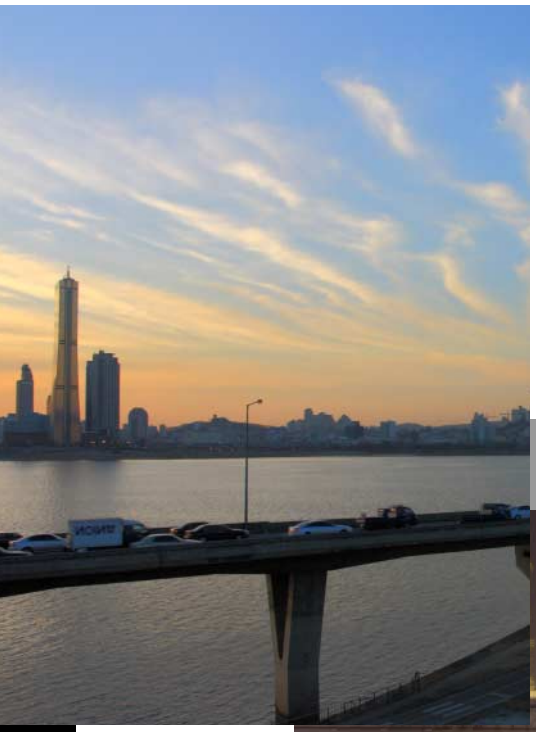
For Nuclear power plant

Susol
Super Solution

For Nuclear power plant

Air Circuit Breakers

LS IS



Susol ACB

LSIS Made It!

Susol Air Circuit Breakers

Super Solution

Contents :

Premium Susol ACB meets your demands for high breaking capacity,
fully line-up, and optimized panel size.
Various accessories and connection methods realize user-friendly handling.

Susol ACB provides you with total solutions 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.

Full line-up & Compact

Up to 4000A, Susol ACB provides fully lined-up 3 frame.
For each frame, there is just one size, which is smaller and more compact.
It makes it possible for you to design the optimized volume panel.

100kA

AH-08~40E

08	800AF
16	1600AF
20	2000AF
40	3200AF

Icu=Ics=100kA/508Vac
W=412(3p), 527(4p)mm

3200~4000AF (AS type)

AS-32~40F

32	3200AF
40	4000AF

Icu=Ics=100kA/508Vac
W=785(3p), 1015(4p)mm

Trip Relay (OCR)

Susol ACB Trip Relay functioning world-best protection can be interlocked with mechanism. It makes the breaking capacity of ACB improved and ACB's life enhanced, and provides advanced functions - measurement, diagnosis, analysis, and communication.

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
- Remote Reset
- Modbus/RS-485
- Profibus-DP

- Self Power
- AC/DC 100~250V
- DC 24~60V
- RTC Timer mounted
- Fault Recording (10EA)

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
- Remote Reset
- Modbus/RS-485
- Profibus-DP

- AC/DC 100~250V
- DC 24~60V
- RTC Timer mounted
- Event Recording (256EA)
- Fault Recording (256EA)
- Fault Wave (S Type)

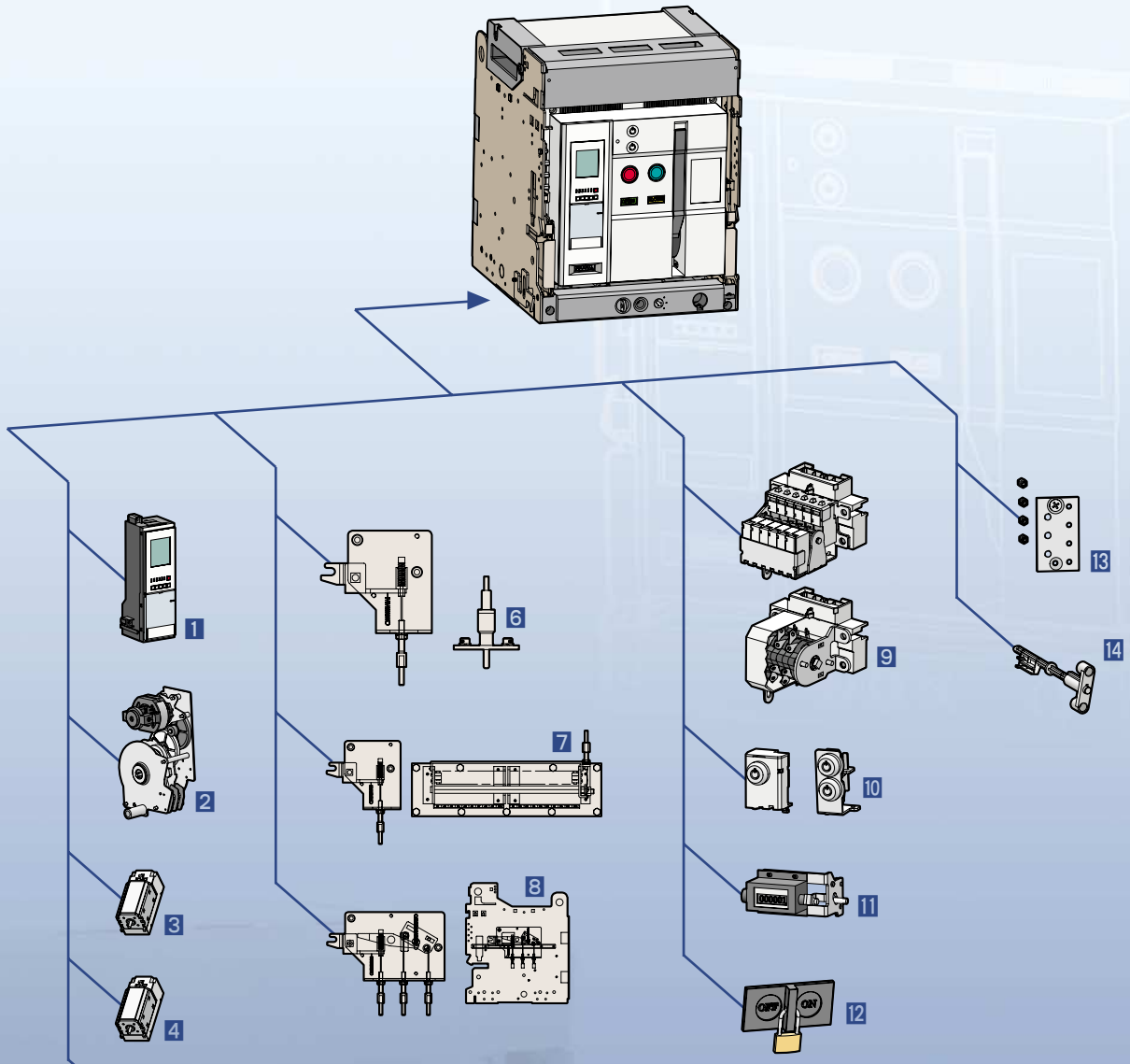
Trip relays series

N Type (Normal)
- Self-power + Current protection

A Type (Ammeter)
- Current Meter + Current protection + DO control + Communication

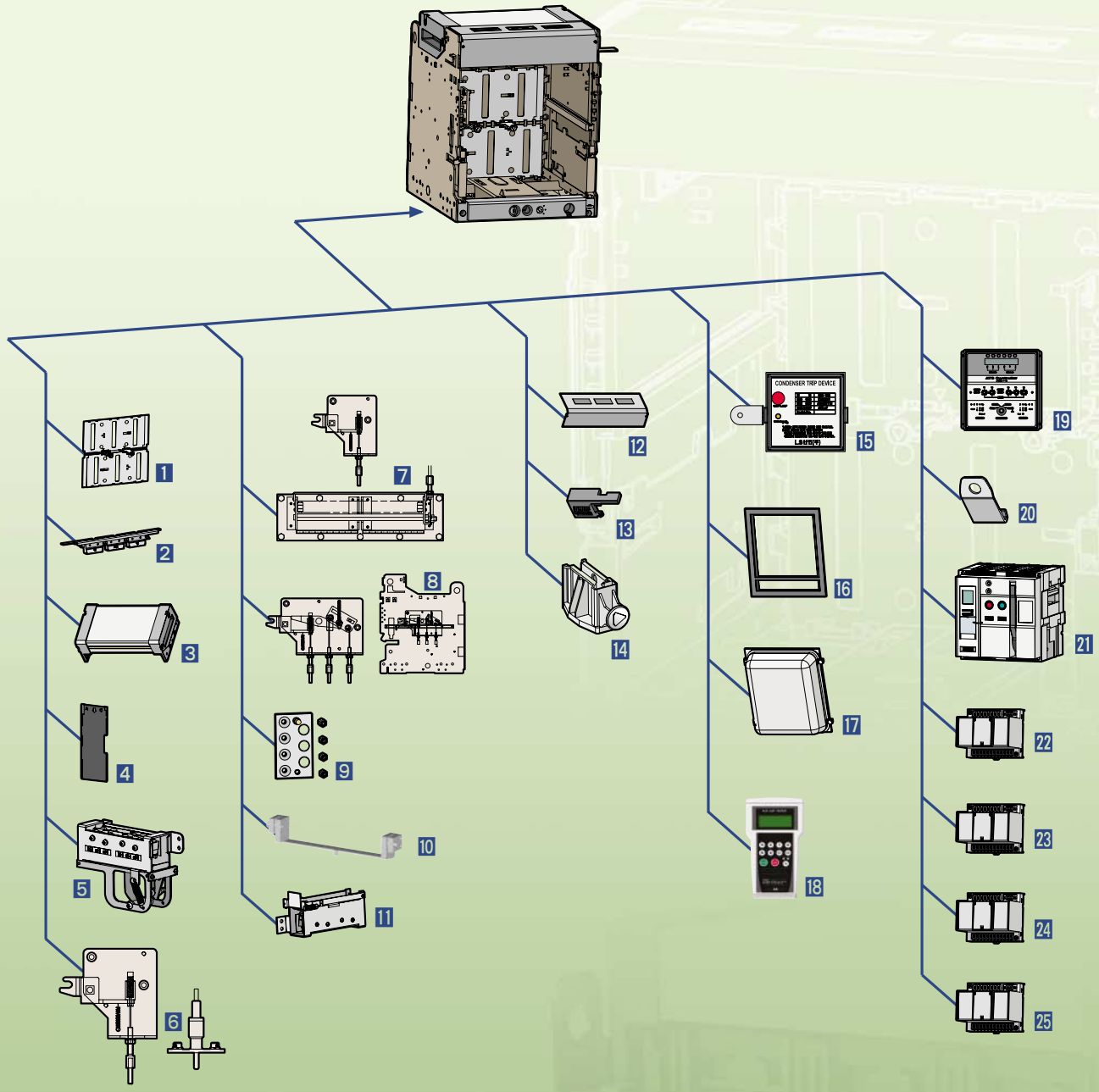
S Type (Supreme)
- P type + Harmonics analysis (63 th) + Fault wave recording

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 (Mechanical Operated Cell Switch)
8 Mechanical Interlock (MI)
9 Auxiliary Switch (AX)
10 Key Lock (K1), Double Key Lock (K3)
11 Counter (C)
12 On/Off Button Lock (B)
13 Miss Insertion Preventing Device (MIP)
14 Manual Reset Button (MRB)



Cradle

1 Safety Shutter (ST)
2 Manual Connector
3 Zero Arc Space (ZAS)
4 Insulation Barrier (IB)
5 Cell Switch (CEL)
6 Door Interlock (DI)
7 MOC (Mechanical Operated Cell switch)
8 Mechanical Interlock (MI)
9 Miss Insertion Prevent Device (MIP)
10 Body Supporter (BSP)
11 Shorting "b" Contact (SBC)
12 Safety Control Cover (SC)
13 Racking Interlock (RI)
14 Safety Shutter Lock (STL)

Other

15 Condenser Trip Device (CTD)
16 Door Frame (DF)
17 Dust Cover (DC)
18 OCR Tester (OT)
19 ATS Controller (ATS)
20 Lifting Hook (LH)
21 Dummy ACB
22 UVT Time Delay Controller (UDC)
23 Profibus-DP Communication module
24 Remote I/O
25 Temperature Alarm

Connection and Installation

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

Multiple connections

Various installation methods

Standard connection

Horizontal type

Vertical type

Mixed connection

Horizontal / Vertical type

Vertical / Horizontal type

- Front connection type is available to be connected regardless of the depth of main circuit terminal, and it is suited for the panel required for limited installation space.
- The vertical and horizontal type terminal are module types which can easily compose the vertical and horizontal terminals by rotating 90°
  Vertical and horizontal terninals are different each other for over 3200AF ACBs

• Please refer to the rating lists (Page 20~21) because the installation method is various according to the rated current.

External structure of ACB

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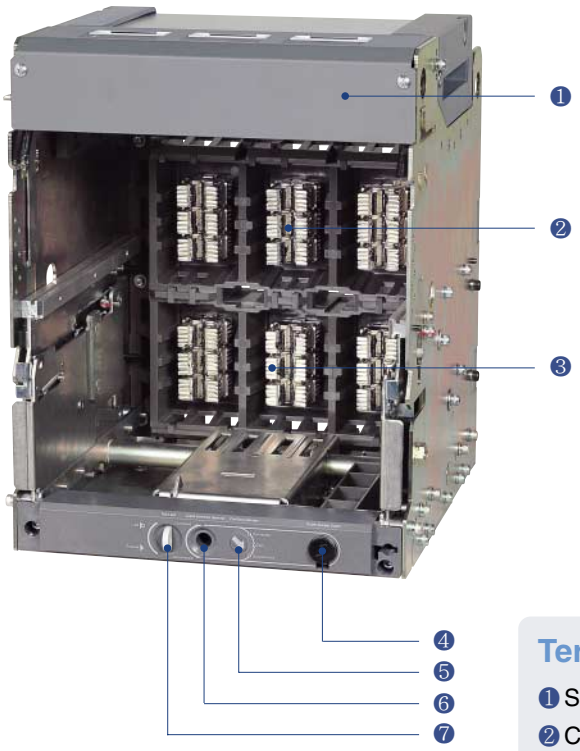
Fixed type ACB

Draw-out ACB (Cradle)

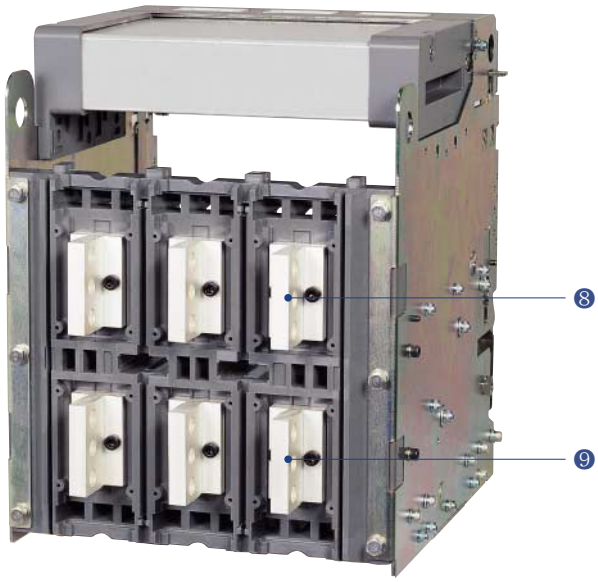
Terms

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 ON/OFF 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 Front cover
⓴ Fixed type bracket

Cradle (Internal)



Cradle (Rear)

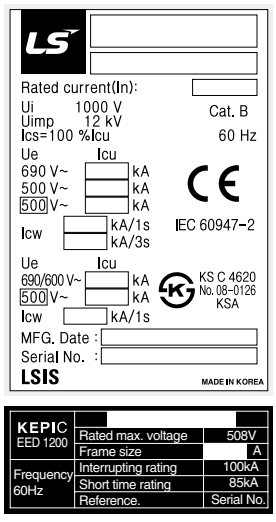


Terms

❶ Safety control cover
❷ Cradle finger
❸ Cradle finger
❹ Draw-out handle
❺ Position indicator
❻ Handle inserting hole
❼ Pad lock button
❽ Connecting terminal
❾ Connecting terminal

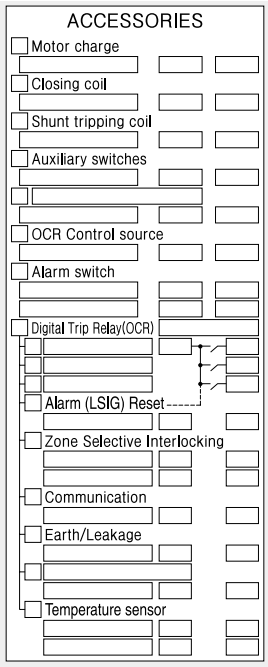
Main nameplate

[Acronym explanation]



- Ui: Rated insulation voltage
- Uimp: Impulse withstand voltage
- Ue: Rated operational voltage (AC base)
- Icu: Ultimate breaking capacity
- Ics: Service breaking capacity
- Icw: Short time withstand current
- MFG. Date: Manufacturing date

[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

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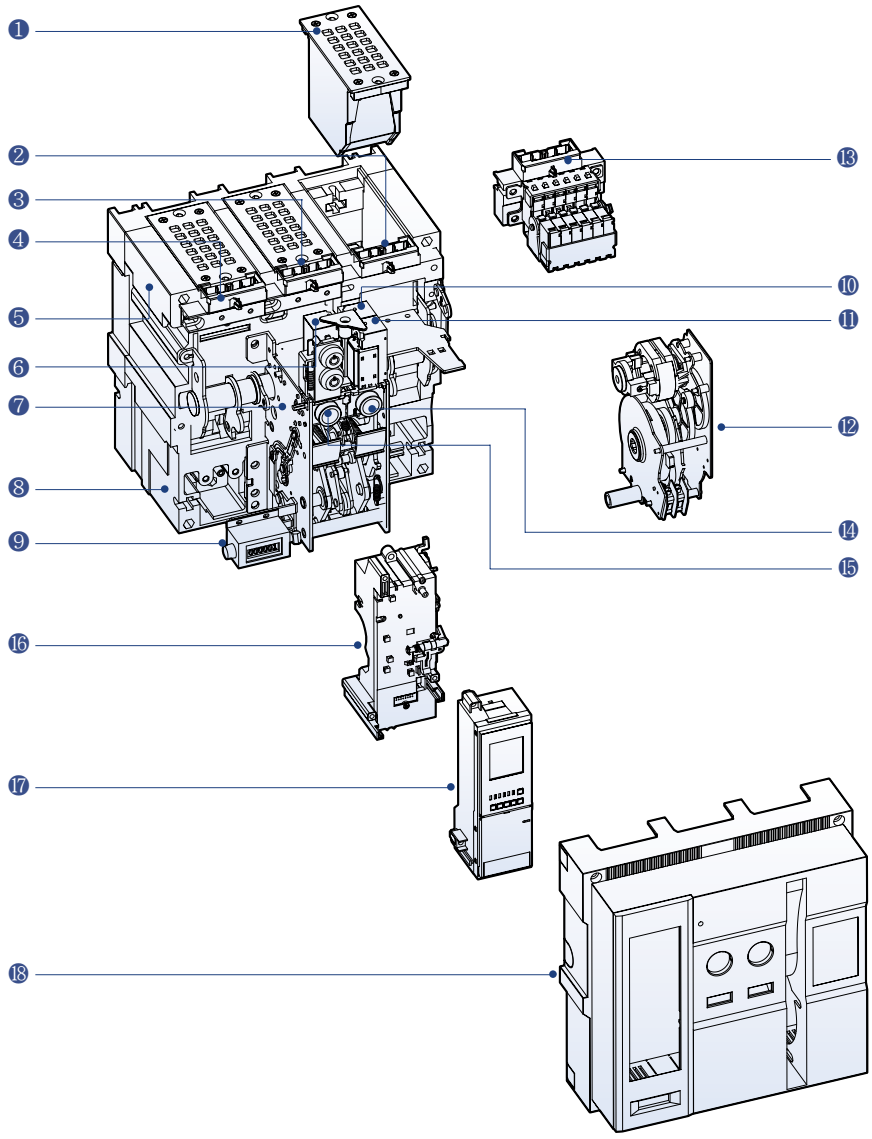
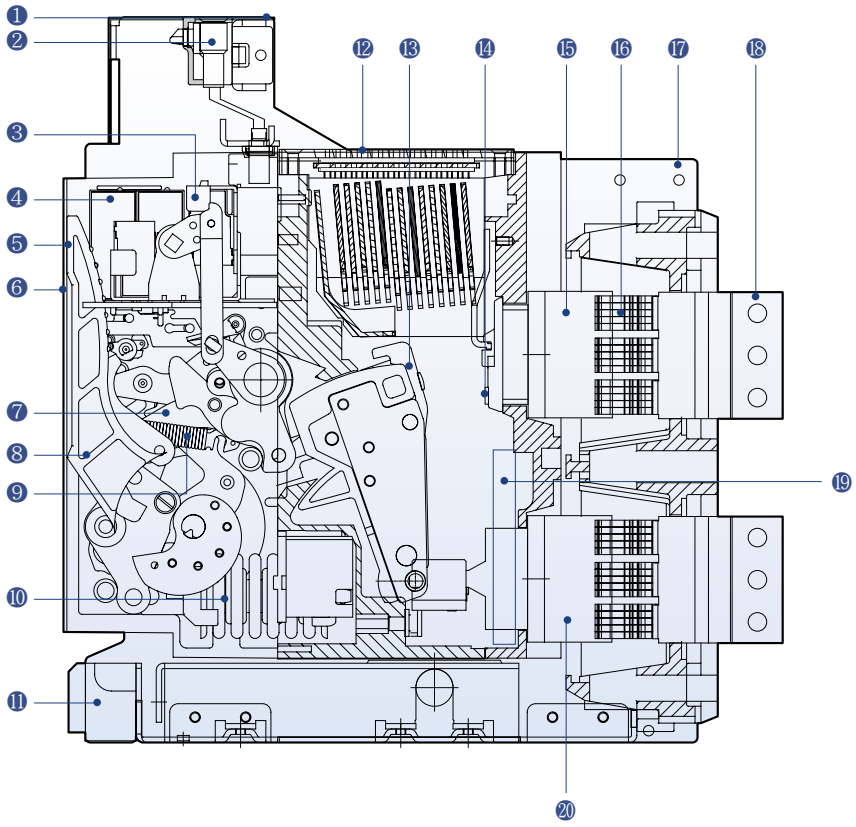


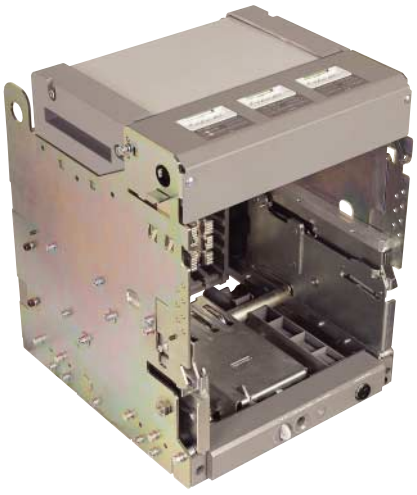
Terms

❶ Arc chute
❷ Aux. switch control terminal
❸ Control power supply terminal
❹ Trip relay control terminal
❺ Carrying grip
❻ Shunt coil
❼ Mechanism
❽ Main body
❾ Counter
❿ Shunt coil
⓫ Closing coil
⓬ Motor Ass'y
⓭ Aux. switch
⓮ ON button
⓯ OFF button
⓰ MTD base
⓱ Trip relay
⓲ Front cover



Terms

❶ Control circuit terminal block
❷ Control terminal
❸ Auxiliary switches
❹ Closing, Shunt, UVT coil
❺ Trip relay
❻ Front cover
❼ Mechanism
❽ Charge handle
❾ Trip spring
❿ Closing spring
⓫ Draw-in/out device
⓬ Arc chute
⓭ Moving contact
⓮ Fixed contact
⓯ Terminal on line side
⓰ Cradle finger
⓱ Cradle
⓲ Connecting terminal
⓳ Power supply CT
⓴ Terminal on load side



ACB & Accessories

AH — 08 E 3 — 08 A

Ampere frame	
08	800AF
16	1600AF
20	2000AF
40	4000AF

Frame sizes & phase array	
E	3P Standard type RST(N)

No. of pole	
3	3P(E)

Rated current (CT Spec.)	
00	Without OCR & CT
08	800A
16	1600A
20	2000A
40	3200A

Connections	
Draw-out type	
A	Automatic connection
Fixed type	
H	Horizontal type
V	Vertical type
M	Mixed type Horizontal Vertical
N	Mixed type Vertical Horizontal
P	Front type

AS — 08 E 3 — 08 A

Ampere frame	
32	3200AF
40	4000AF

Frame sizes & phase array	
F	3P Standard type RST(N)

No. of pole	
3	3P(E)

Rated current (CT Spec.)	
00	Without OCR & CT
32	3200AF
40	4000AF

Connections	
Draw-out type	
A	Automatic connection
Fixed type	
H	Horizontal type
V	Vertical type
M	Mixed type Horizontal Vertical
N	Mixed type Vertical Horizontal
P	Front type

M1 D1 D1 AX NG0 U1 AL

Motor rated voltage

MA	Without Motor
M1	AC/DC 100V~130V
M2	AC/DC 200V~250V
M3	DC 125V
M4	DC 24V~30V
M5	DC 48V~60V
M6	AC 380V~415V
M7	AC 440V~480V
M8	AC 48V

Shunt coil rated voltage

D0	Without Shunt coil
D1	AC/DC 100V~130V
D2	AC/DC 200V~250V
D3	DC 125V
D4	DC 24V~30V
D5	DC 48V~60V
D6	AC 380V~480V
D7	AC 48V

Trip relay

Refer to 26page

Closing coil rated voltage

D0	Without Closing coil
D1	AC/DC 100V~130V
D2	AC/DC 200V~250V
D3	DC 125V
D4	DC 24V~30V
D5	DC 48V~60V
D6	AC 380V~480V
D7	AC 48V

Aux.contact & charging types

AX	Standard OFF-Charge 3a3b
AC	Standard ON-Charge 3a3b
BX	Standard OFF-Charge 5a5b
BC	Standard ON-Charge 5a5b
HX	High capacity OFF-Charge 5a5b
HC	High capacity ON-Charge 5a5b
CC 3)	Standard ON-Charge 6a6b
JC	High capacity ON-Charge 6a6b
TX	TCS OFF-Charge 4a4b Note)
TC	TCS ON-Charge 5a5b Note)

Note) TCS (Trip Circuit Supervision):
The terminal supervising trip circuit and monitoring disconnection or disable of trip.

UVT coil rated voltage

U0	Without UVT coil
U1	AC/DC 100V~130V
U2	AC/DC 200V~250V
U3	DC 125V
U4	DC 24V~30V
U5	DC 48V~60V
U6	AC 380V~480V
U7	AC 48V

* UVT Delay module is available over AC / DC 48V

Option	Type name		Option	Type name		
AL	AL1+MRB		D	DI or MOC	Door Interlock or MOC (Mechanism operated cell switch)	
A1	AL1+MRB+RES (AC110~130V) *AC private use					
A2	AL1+AL2+MRB		K	K1	Key lock	
A3	AL1+MRB+RES (DC110~125V) *DC private use		K2	K2	Key Interlock set	
A4	AL1+MRB+RES (AC200~250V) *AC private use		K3	K3	Key lock double	
A5	AL1+MRB+Auto reset		R 2)	RCS	Ready to close switch	
A6	AL1+AL2+MRB+Auto reset		T 3)	TM	Temperature monitoring	
A7	AL1+MRB+RES (DC110~125V)+Auto reset *DC private use		H1	SHT2	AC/DC 100~130V	Double shunt coil **At using UVT, not applied
A8	AL1+MRB+RES (AC200~250V)+Auto reset *AC private use		H2		AC/DC 200~250V	
A9	AL1+MRB+RES (AC110~130V)+Auto reset *AC private use		H3		DC 125V	
C	C	Counter	H4 1)		DC 24~30V	
S 2)	CS2	Charge switch communication	H5		DC 48~60V	
B	B	On/Off Button lock	H6		AC 380~480V	
M	MI	Mechanical interlock **AN typenot applied	H7		AC 48V	

Note) 1. UVT and SHT2 are alternative.
2. CS2 and RCS are alternative.
3. TM and CC/JC(6a6b) are alternative.
4. Other accessories should be ordered seperately.

Ordering

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Cradle

AL — H16E | 3 — A | H | E | S

AL — LS ACB cradle

H16E — Rated current & frame

H06~16E	AH-06~16E
H20E	AH-20E
H40E	AH-40E
S40F	AS-40F

3 — No. of pole

3	3P

A — Terminal connections

A	Automatic Connection

H — Connections

H	Horizontal type
V	Vertical type

E — Safety shutter

E	Without safety shutter
F	With safety shutter

S — Arc cover (Zero Arc Space)

S	With Arc cover

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 system by vector sum

0

0	Self-Power	60Hz
5	Self-Power	50Hz

A

A	Ammeter

G

G	Ground fault
Z	Ground fault (External CT, Earth Leakage below 30A)
E	Ground fault (External CT, Earth Leakage over 30A)
C	Ground fault + Comm.
K	Ground fault(External CT, Earth Leakage below 30A) + Comm.
X	Ground fault(External CT, Earth Leakage over 30A) + Comm.

* L/S/I/G configuration as standard
* Ground fault system by vector sum(G,C)
* Earth leakage system
  - Z,K: External CT - LS ZCT applied(fault current 0.5~30A, 1600AF)
  - E,X: External CT - Private ZCT applied(faullt current >30A)
* Comm. And output contacts DO NOT work under self-power condition.
  (Only checking LED available)

0

0	Self-Power	60Hz
1	AC/DC 100V~250V	60Hz
2	DC 24V~60V	60Hz
5	Self-Power	50Hz
6	AC/DC 100V~250V	50Hz
7	DC 24V~60V	50Hz

S

S	Supreme meter

C

C	Ground fault + Comm.
K	Ground fault(External CT, Earth Leakage below 30A) + Comm.
X	Ground fault(External CT, Earth Leakage over 30A) + Comm.
A	Pre-Trip Alram + Comm.

* L/S/I/G configuration as standard
* Ground fault system by vector sum
* Earth leakage system
  - K: External CT - LS ZCT applied(fault current 0.5~30A, 1600AF)
  - X: External CT - Private ZCT applied(faullt current >30A)
* Applicable to generator protection purpose
* Comm. And output contacts DO NOT work under self-power condition.
  (Only checking LED available)

1

1	AC/DC 100V~250V	60Hz
2	DC 24V~60V	60Hz
6	AC/DC 100V~250V	50Hz
7	DC 24V~60V	50Hz

Generator Trip relay (OCR)

N

N	Normal

V

V	Pre-Trip Alarm + Without comm.

* Comm. works under control power
* LSIS output contacts works under control power.
  (LED indicators works without control power)

1

1	AC/DC 100V~250V	60Hz
6	AC/DC 100V~250V	50Hz

Note) 1. L/S/I/G configuration as standard
2. Ground fault, earth leakage and pre-trip alarm functions are alternative.
3. The functions like Metering, Communication, ZSI, Remote reset and Digital output are NOT available only under Self-power condition.
4. Voltage module should be required for P and S types(supplied seperately)

Type				
Rated current (In max)		(A)	IEC 60947 - 2 KPIC EED1200 (ANSI 37.13)	at 40°C
Setting current (CT ratio)			(A)	
Rated operating voltage (Ue)		(V)		
Rated insulation voltage (Ui)		(V)		
Frequency		(Hz)		
Number of poles		(P)		
Type of Trip reley				
Rated breaking capacity (Icu) (Sym)		(kA)	ANSI C37, 13, 16, 17, 20.1 ,50 UL 1066 / EED 1200 AC with instantaneous	635V 508V 254V
		(kA)	ANSI C37, 13, 16, 17, 20.1 ,50 UL 1066 / EED 1200 AC without instantaneous	635V 508V 254V
Rated service breaking capacity (Ics)		(kA)		...% × Icu
Rated short-time withstand current (Icw)		(kA)		C(0.5s)-15s-C(0.5s)
Operating time (t)		(ms)		Maximum total breaking time Maximum closing time
Life cycle	ACB	(time)	Mechanical Electrical	
Nuclear power electricity class				
Nuclear power quality class				
Weight		(kg)	Drawout type (Motor charing type)	Main Body only Cradle only Total
External dimension(mm)	Draw-out type		H × W × D	
	Fixed type		H × W × D	
Enclosure dimension(mm)	Draw-out type		H × W × D	
	Fixed type		H × W × D	
Trip relay				
Charging type				

AH-E (KEPIC)			
AH-08E	**AH-16E**	**AH-20E**	**AH-40E**
800	1600	2000	4000
800	1600	2000	3200
400 630 800	400 800 1000 1250 1600	400 630 800 1000 1250 1600 2000	1600 2000 3000 3200
508Vac			
1000Vac			
60Hz			
3P			
Electronic trip device (N/A/S)			
85			
100			
100			
85			
85			
85			
100% × Icu			
85			
50ms			
85ms			
15,000			
5,000			
Class 1E			
Q			
43			46
44			58
87			107
430 × 412 × 375			
300 × 378 × 295			
430 × 512 × 375			
300 × 478 × 295			
Horizontal type / Vertical type			Vertical type
Manual Charging / Motor Charging			

AS-F (KEPIC)	
AS-32F	**AS-40F**
3200	4000
3200	4000
3200	3200 4000
508Vac	
1000Vac	
60Hz	
3P	
Electronic trip device (N/A/S)	
85	
100	
100	
85	
85	
85	
100% × Icu	
85	
50ms	
85ms	
10,000	
2,000	
Class 1E	
Q	
67	
78	
145	
460 × 629 × 375	
300 × 597 × 295	
460 × 729 × 375	
300 × 697 × 295	
Horizontal type / Vertical type	
Manual Charging / Motor Charging	

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 enhanced a durability of devices as well as the breaking capacity of ACB.
Zone selective interlocking function makes the protective coordination more simple and thermal memory can be applied to various loads.

Trip relays series

A Type (Ammeter)
- Current Meter + Current protection + DO control + Communication

N Type (Normal)
- Self-power + Current protection

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

Contents

Trip relay types

Classification	N type	A type	S type
Externals			
Current protection	• L / S / I / G / Thermal	• L / S / I / G / Thermal • ZSI(Protective coordination)	
Other protection	-	• Earth leakage (Option)	
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 • Voltage/Current harmonics (1st~63th)) • 3 Phase Waveforms • THD, TDD, K-Factor
Fine adjustment	-	-	-
Pre Trip Alarm	-	-	-
Digital Output		• 3DO (Fixed) • L, S / I, G Alarm	
IDMTL setting	-	-	-
Communication		• 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 24~60V	• AC/DC 100~250V • DC 24~60V • Basic protection function (L / S / I / G) is still under normal operation without control power.
RTC Timer	-	• 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
Fault recording	-	-	• 256 records (Fault/Current/Date and Time)
Operating button	• Reset button	• Reset, Menu Up/Down, Left/Right, Enter	• Reset, Menu Up/Down, Left/Right, Enter

Generator types

Classification	NV type
Externals	
Current protection	• L / S / I / G / Thermal • ZSI(Protective coordination)
Other protection	-
Measurement function	-
Fine adjustment	-
Pre Trip Alarm	-
Digital Output	• 3DO (Fixed) • L, S / I, G Alarm
IDMTL setting	-
Communication	• Modbus/RS-485 • Profibus-DP
Power supply	• Self Power - Power source works over 20% of load current. External power source are required for comm. • AC/DC 100~250V • DC 24~60V
RTC Timer	• Available
LED for LED	• Long time delay • Short time delay/Instantaneous • PTA
Fault recording	-
Operating button	• Reset button

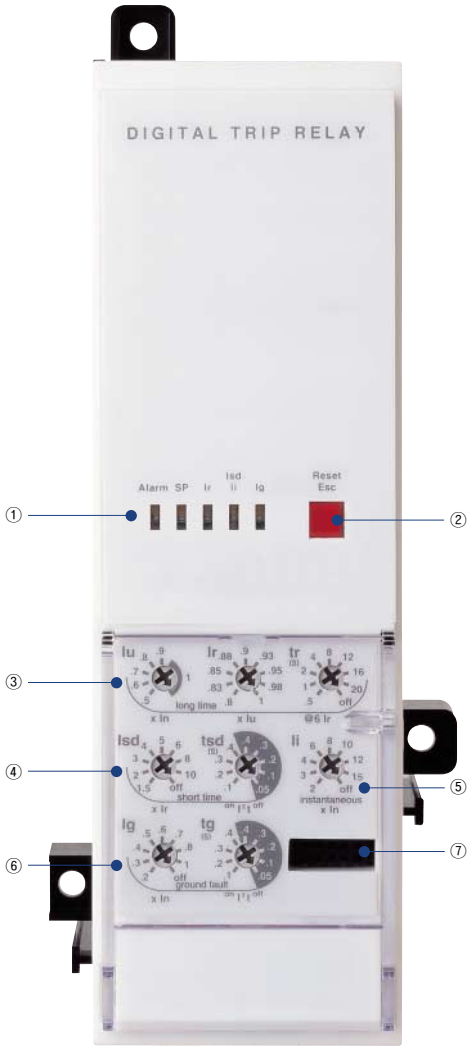
Each OCR type has Battery in itself.

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

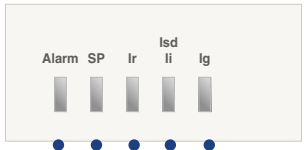
2. The recognizable range of OCR current
   1) 1ø : When more 20% than rated current(In)
      (ratio to In regardless of Iu and Ir)
   2) 3ø : When more 12% than rated current(In)

N type: 「Normal」 type

- Optimized protection function
- OCR, OCGR function according IEC60947-2
- Overload protection
  - -Long-time delay
  - -Thermal
- Short-circuit protection
  - -Short-time delay / Instantaneous
  - -I^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

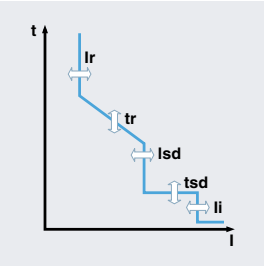
④ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑤ Ii: Instantaneous current setting

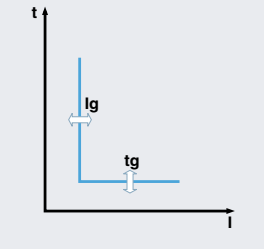
⑥ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

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

Protection



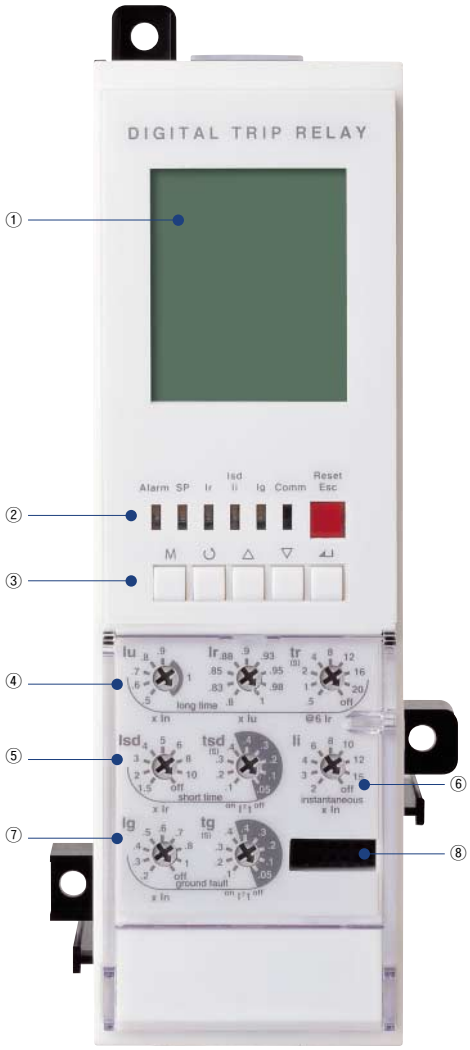
Long time											
Current setting (A)	Iu = In × ...		0.5	0.6	0.7	0.8	0.9	1.0			
	Ir = Iu × ...		0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98	1.0
Time delay (s)	tr@(1.5 × Ir)		12.5	25	50	100	200	300	400	500	Off
Accuracy: ±15% or below	tr@(6.0 × Ir)		0.5	1	2	4	8	12	16	20	Off
100ms	tr@(7.2 × Ir)		0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	Off
Short time											
Current setting (A) Accuracy: ±10%	Isd = Ir × ...		1.5	2	3	4	5	6	8	10	Off
Time delay (s) @ 10 × Ir	tsd	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t 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) Accuracy: ±10%(Ig > 0.4In) ±20%(Ig ≤ 0.4In)	Ig = In × ...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s) @ 1 × In	tg	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t Off)	Min. Trip Time(ms)	20	80	160	260	360				
		Max. Trip Time(ms)	80	140	240	340	440				

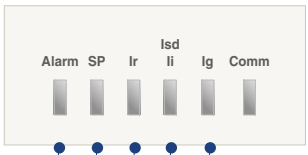
A type: 「Ammeter」 type

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



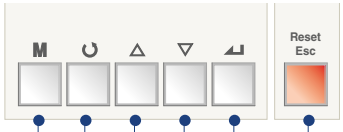
① LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



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

③ Key: Move to menu or reset



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

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

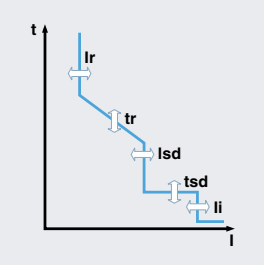
⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑥ Ii: Instantaneous current setting

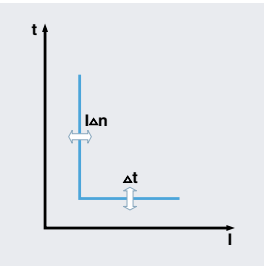
⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

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

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 below	tr@(6.0×Ir)		0.5	1	2	4	8	12	16	20	Off
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) Accuracy: ±10%	Isd = Ir×...		1.5	2	3	4	5	6	8	10	Off
Time delay (s) @ 10×Ir	tsd	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t 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) Accuracy: ±10%(Ig>0.4In) ±20%(Ig≤0.4In)	Ig = In×...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s) @ 1×In	tg	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t Off)	Min. Trip Time(ms)	20	80	160	260	360				
		Max. Trip Time(ms)	80	140	240	340	440				

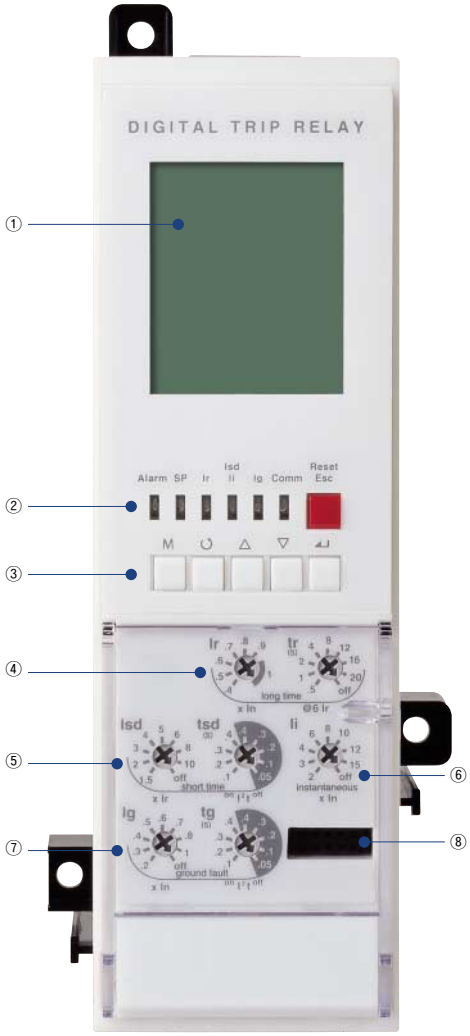


Earth leakage (Option)										
Current setting (A)	I△n		0.5	1	2	3	5	10	20	30	Off
Time delay (ms) Accuracy: ±15%	△t	Alarm Time(ms)	140	230	350	800	950				
		Trip Time(ms)	140	230	350	800					

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

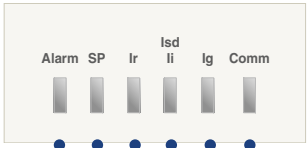
S type: 「Supreme meter」 type

- 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
- Protection for Over voltage/Under voltage/Over frequency/Under frequency/Unbalance/Reverse power
- Realization of protective coordination by ZSI (Zone Selective Interlocking)
- The fine-adjustable setting by knob and Key
- IDMTL setting (SIT, VIT, EIT, DT curve)
  - - Basic setting : “None”. Thermal curve.
- Measurement and Display Function
  - -High detailed measurement for 3 phase current/Voltage/Power/Energy/ Phase angle/Frequency/PF/Demand
  - -128 x 128 Graphic LCD
  - -Indicates current/voltage Vector Diagram and Waveform
- Fault recording
  - -Records Max. up to 256 fault information about fault type, fault phase, fault value, occurrence time of fault
  - -Fault wave recording: records the latest fault wave
- Event recording
  - -Records events of device related to setting change, operation and state change. (Max. up to 256)
- SBO (Select Before Operation)
  - -High reliability for control and setting change method
- Power quality analysis
  - -Measurement for 1st~63th harmonics
  - -THD, TDD, k-Factor
  - -Voltage/current waveform capture
- 3 DO(Digital output)
  - -Programmable for alarm, trip and general DO
- Communication
  - -Modbus/RS485
  - -Profibus-DP



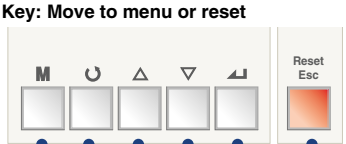
① Graphic LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



Comm: LED indicating comm. state (Blink when running)
Ig: LED indicating ground-fault
Isd/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
(Turn on above 90%, Blink above 105%)

③ Key: Move to menu or reset



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

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

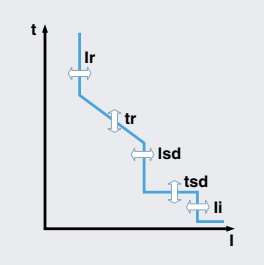
⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

⑥ Ii: Instantaneous current setting

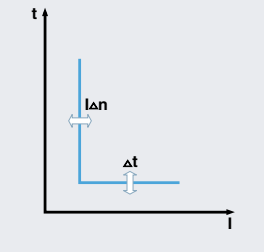
⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

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

Protection



Long time										
Current setting (A)	Iu = 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 below	tr@(6.0×Ir)		0.5	1	2	4	6	12	16	20	Off
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
Accuracy: ±10%										
Time delay (s) @ 10×Ir	tsd	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t 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) Accuracy: ±10%(Ig>0.4In) ±20%(Ig≤0.4In)	Ig = In×...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s) @ 1×In	tg	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t 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△n		0.5	1	2	3	5	10	20	30	Off
Time delay (ms) Accuracy: ±15%	△t	Alarm Time(ms)	140	230	350	800	950				
		Trip Time(ms)	140	230	350	800					

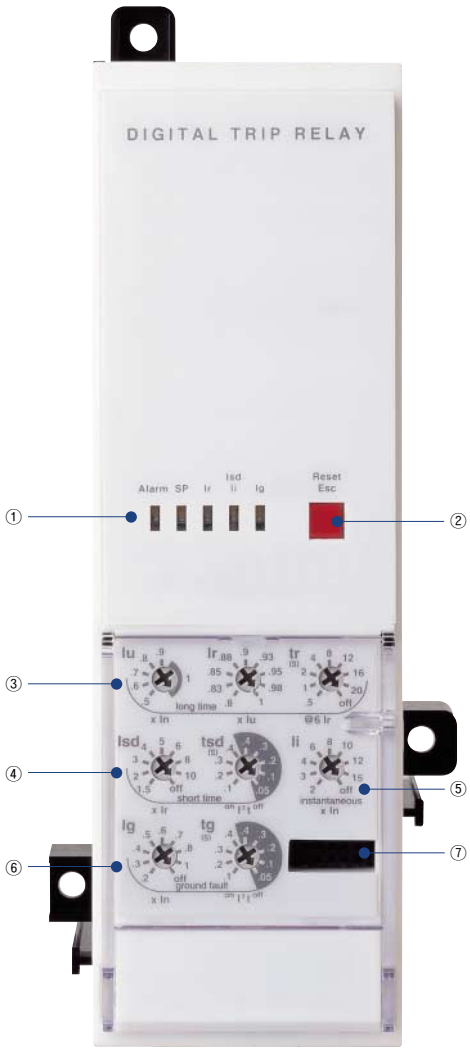
Note) Earth leakage function is available with ZCT or external CT

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

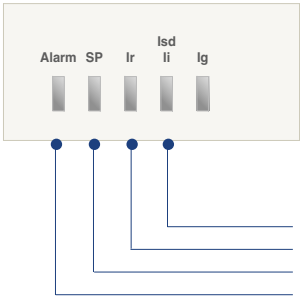
Other protection		Pick-up			Time delay(s)		
		Setting range	Step	Accuracy	Setting range	Step	Accuracy
Under voltage		80V ~ 0V_Pick-up	1V	±5%	1.2~40sec	0.1sec	±0.1sec
Over voltage		UV_Pick-up ~ 980V	1V	±5%			
Voltage unbalance		6% ~ 99%	1%	±2.5% or (*±10%)			
Reverse power		10~500 kW	1kW	±10%	0.2~40sec		
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			

NV type: 「Normal」 type

- Optimized protection function
- OCR function according IEC60947-2
- Overload protection
  - -Long-time delay
  - -Thermal
- Short-circuit protection
  - -Short-time delay / Instantaneous
  - -I^2t On/Off optional (for short-time delay)
- Self-Power
- 3DO(Digital Output)
  - -Fixed



① LED: Indication of trip info. and overload state



② Reset Key: Fault reset or battery check

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

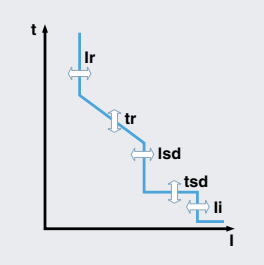
④ Isd: Short-time current setting, tsd: Short-time tripping delay setting

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)

Protection



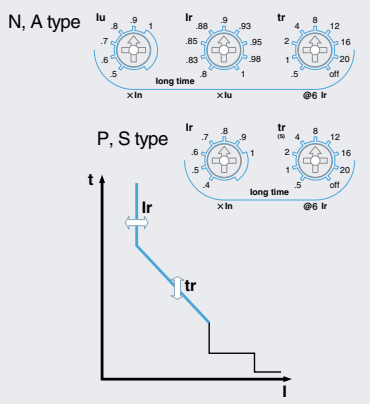
Long time										
Current setting (A)	Ir = In×...		0.8	0.9	1.0	1.05	1.1	1.15	1.2	1.25	Off
Time delay (s)	tr@(1.2×Ir)		10	15	20	25	30	40	50	60	100
Accuracy: ±15% or below	tr@(3×Ir)		0.99	1.49	1.99	2.48	2.98	3.97	4.97	5.96	9.93
100ms	tr@(6×Ir)		0.24	0.36	0.48	0.59	0.71	0.95	1.19	1.43	2.38
Short time										
Current setting (A) Accuracy: ±10%	Isd = Ir×...		2.5	2.7	3	3.5	4	4.5	5	Off	
Time delay (s) @ 10×Ir	tsd	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t 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	4	6	8	10	12	14	16	Off
Tripping time			below 50ms								
Ground fault										
Pick-up (A) Accuracy: ±10%(Ig>0.4In) ±20%(Ig≤0.4In)	Ig = In×...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s) @ 1×In	tg	I²t Off	0.05	0.1	0.2	0.3	0.4				
		I²t On		0.1	0.2	0.3	0.4				
	(I²t Off)	Min. Trip Time(ms)	20	80	160	260	360				
		Max. Trip Time(ms)	80	140	240	340	440				

PTA(Pre Trip Alarm)										
Current setting (A)	Ip = In× ···	0.7	0.8	0.85	0.9	0.95	1.0	.05	1.1	Off
Time delay (s) Accuracy: ±15%	tp@(1.2×Ip)	5	10	15	20	25	30	35	40	45

■ The fine-adjustable setting of the rated current[In]
- In = Ict×[0.4~1.0]
- Setting range: 40~100% of Ict (unit: 0.5%)

Operation characteristics

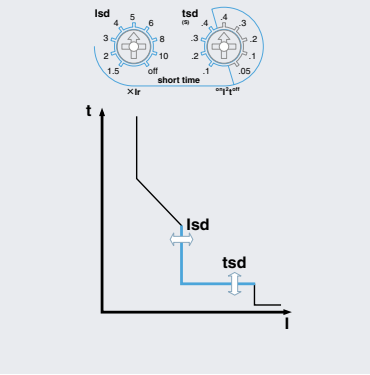
Long-time delay (L)



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
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.

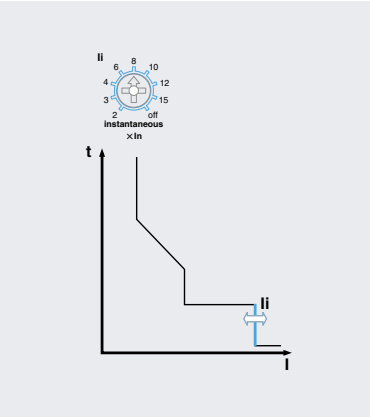
Short-time delay (S)



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 was set, the protection operation will take place instantaneously with input absence by downstream devices. It is advised to disable its ZSI function on the last downstream device.

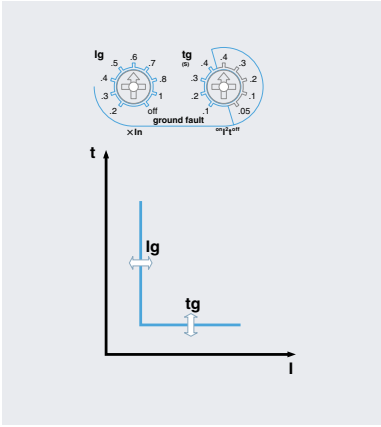
Instantaneous (I)



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

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.

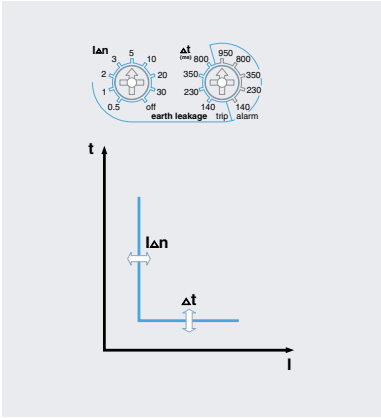
Ground Fault (G)



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

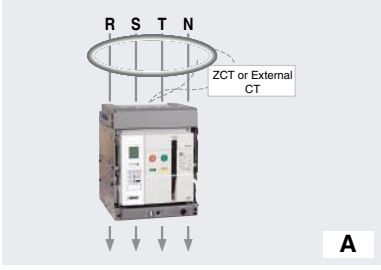
1. Standard setting current knob: Ig
   - Setting range: (0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-Off)×In
2. Time delay setting knob: tg
   - Inverse time (I^2t On): 0.1-0.2-0.3-0.4 sec
   - Definite time (I^2t Off): 0.05-0.1-0.2-0.3-0.4 sec
3. Ground fault current is vector sum of each phase current. Therefore,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

Earth Leakage (G) - Option



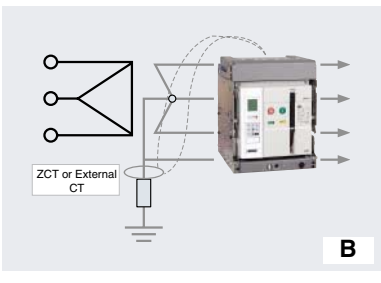
The function for breaking earth leakage current above setting value after time delay to protect the circuit from earth leakage. (A, P, S type)

1. Standard setting current knob: I△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. Settings within its alarm range will prevent its breaker from tripping but activating its alarm.



※Use cautions with earth-leakage current settings

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



※Guideline for the external CT usage

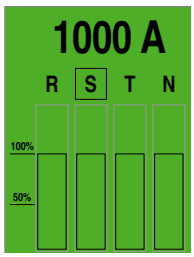
- Earth-leakage protection characteristics using the standard CT which is installed inside of ACB can protect currents from 20 to 100% range on its rated current.
- As rated currents on ACB increases, current that is covered by its standard CT increase as well. This can not protect against small leakage 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.

Measurement function

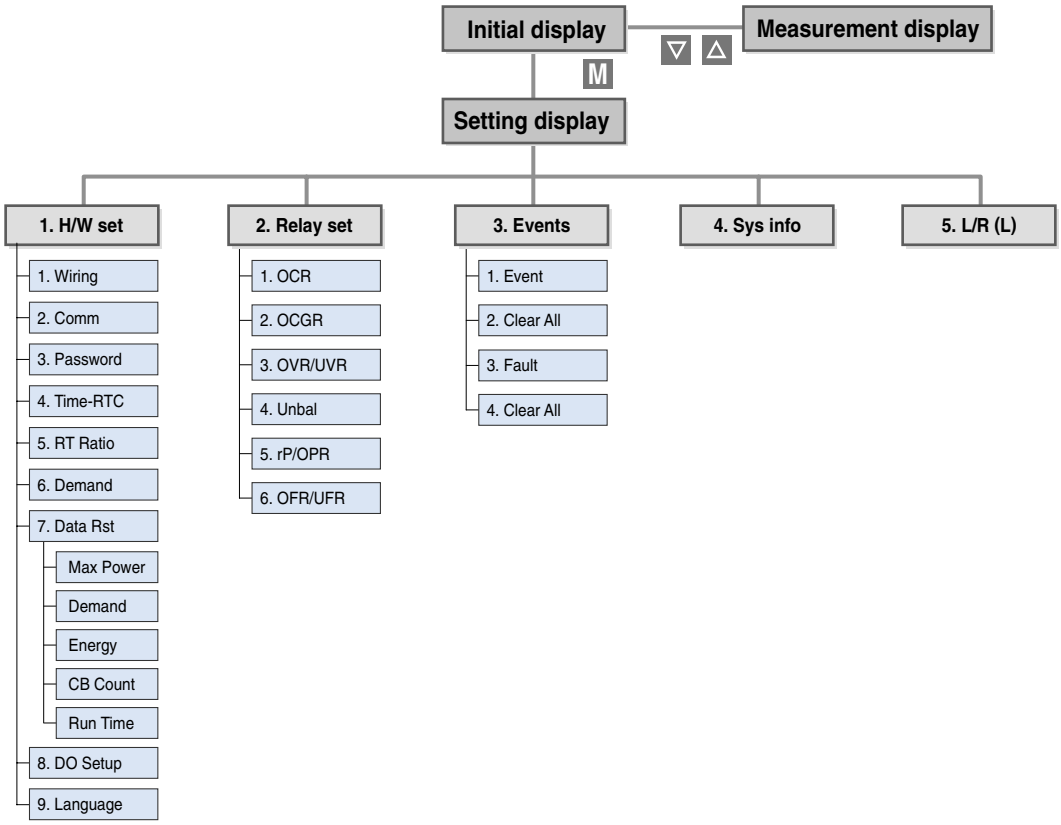
S type / P type / A type

Class.	Measurement element	Detailed element	Unit	Display range	Accuracy
Current	Line current	Ia,Ib,Ic	A	80A~65,535A	±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 Line-to-current	∠VaIa, ∠VaIb, ∠VaIc, ∠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), 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	

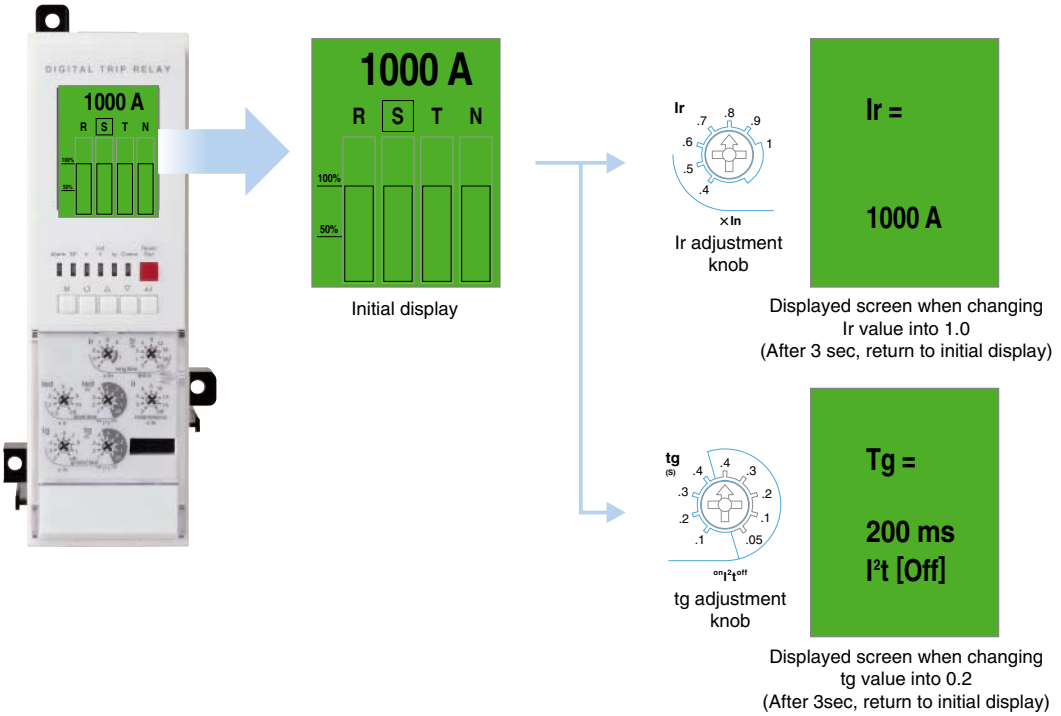
Man machine interface



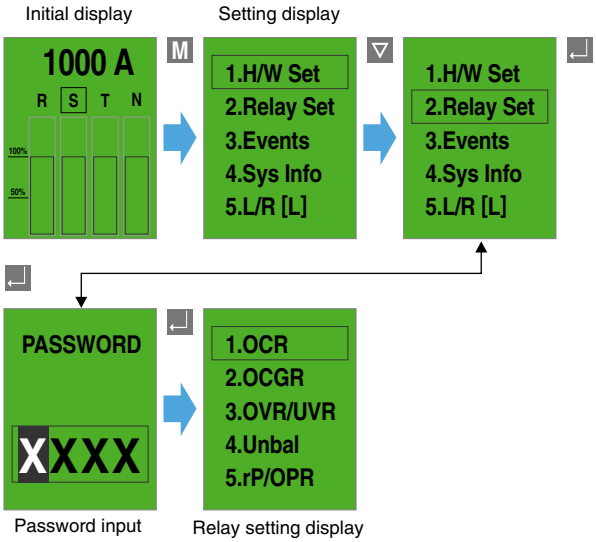
Initial display



An example of graphic LCD display

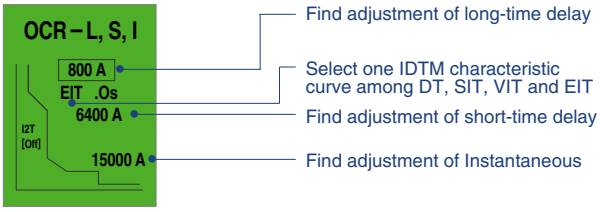


Protection element setting

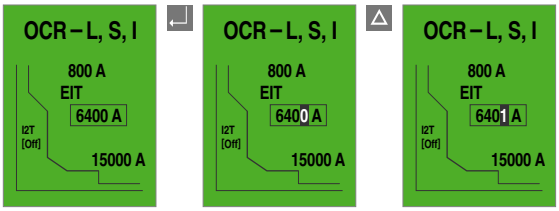


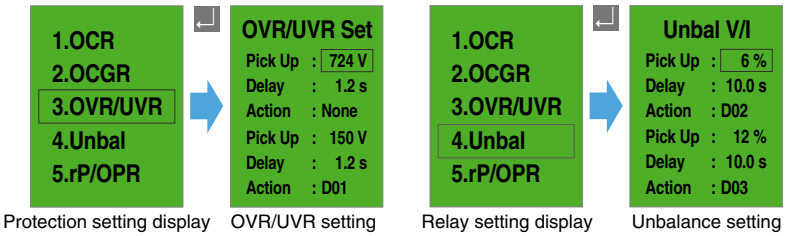
Find adjustment of protection setting current

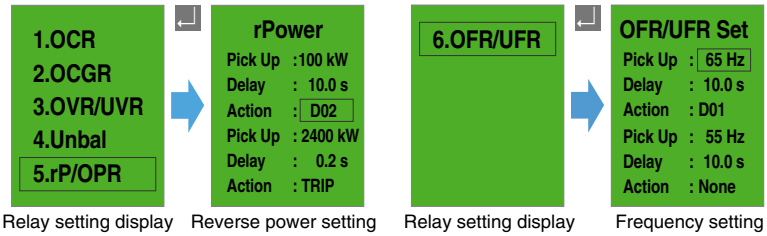
- OCR and OCGR's current setting is basically controlled by knob's setting values.
- The fine current that cannot be controlled by knob is adjustable by using ▽, △ key.
- Fine adjustment is only adjustable in the present knob and next knob's setting range, when moving knob, the adjusted data becomes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



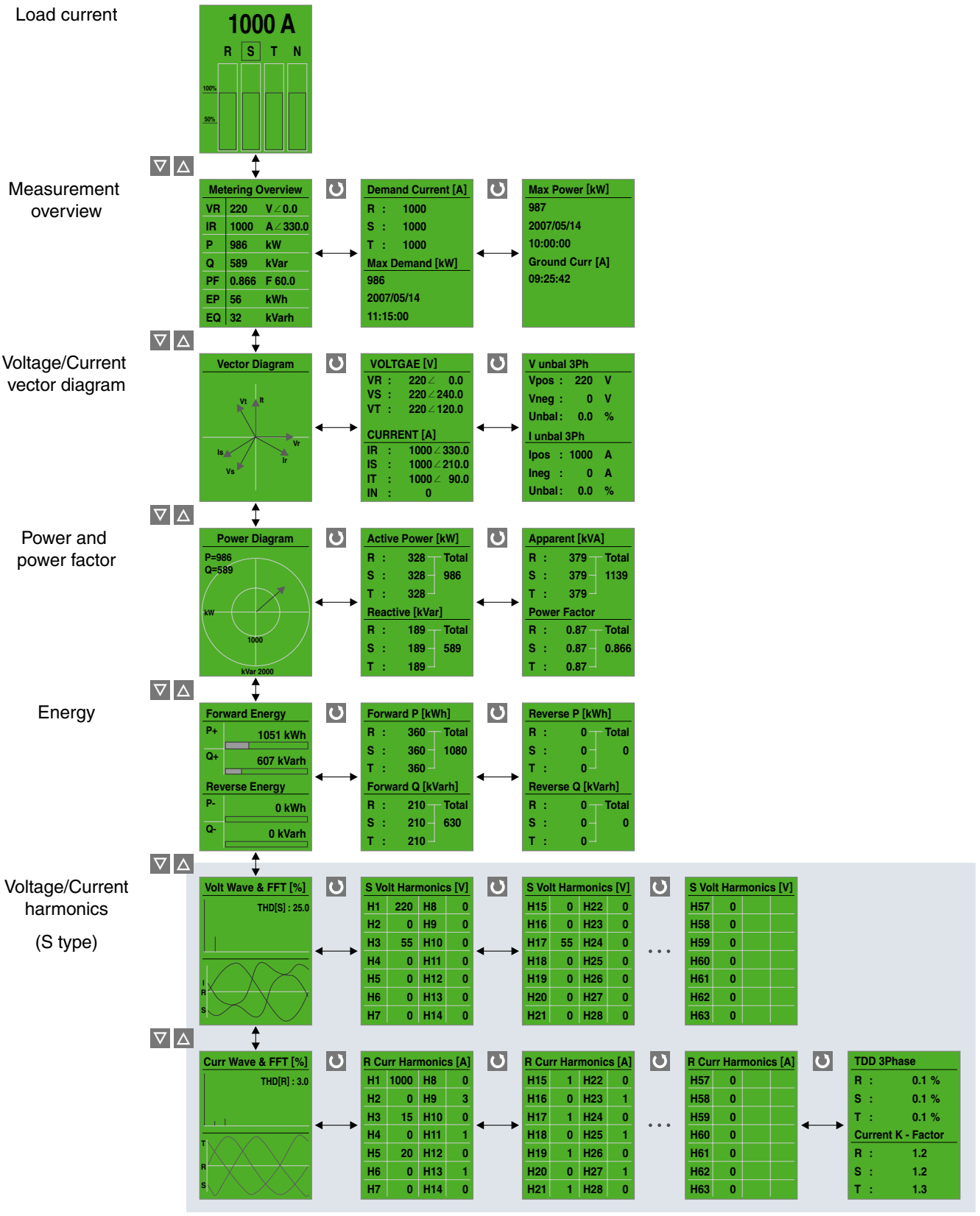
- The setting method of OCGR is same with OCR's, fine adjustment is available.





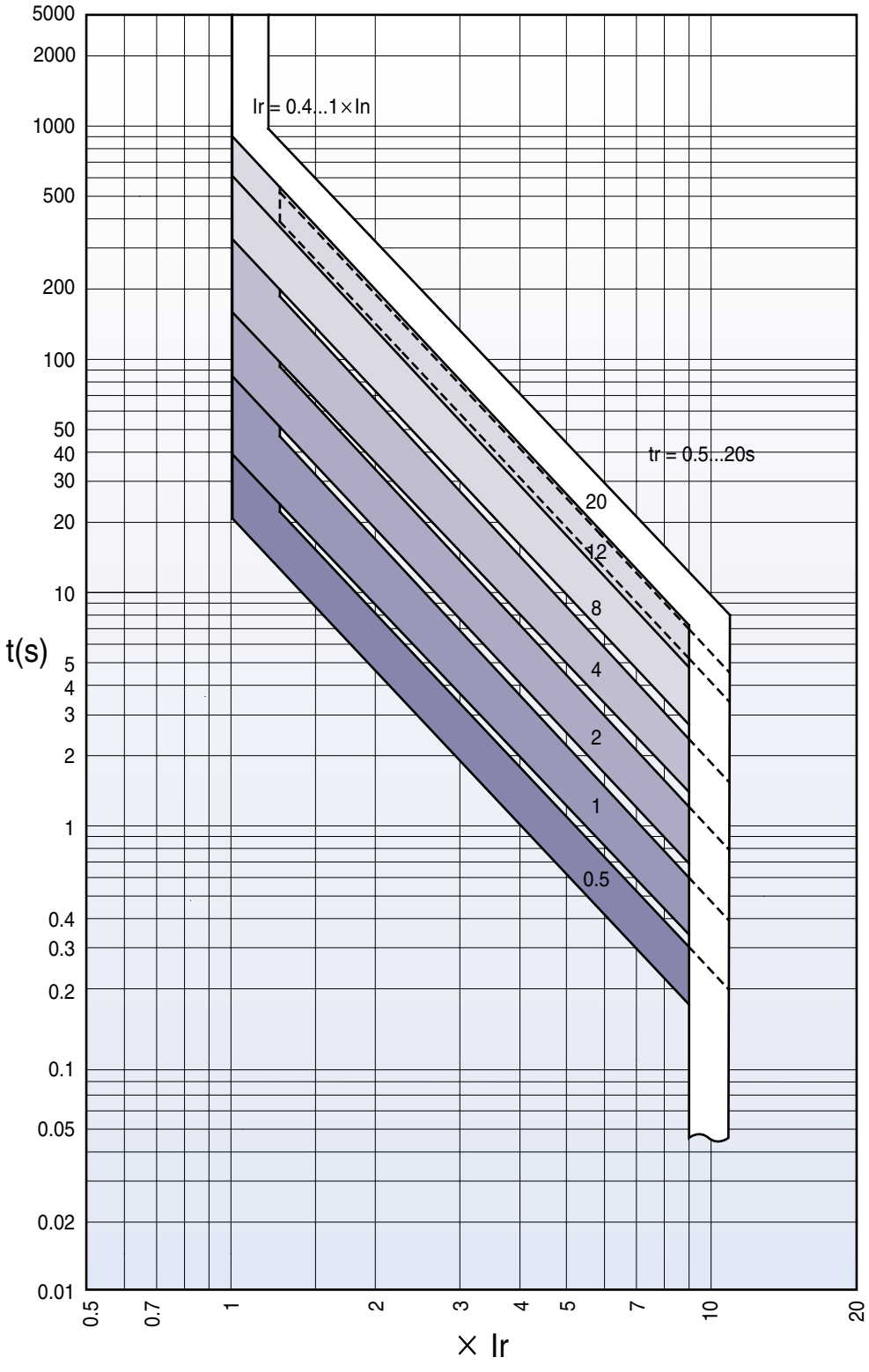


Measurement element display

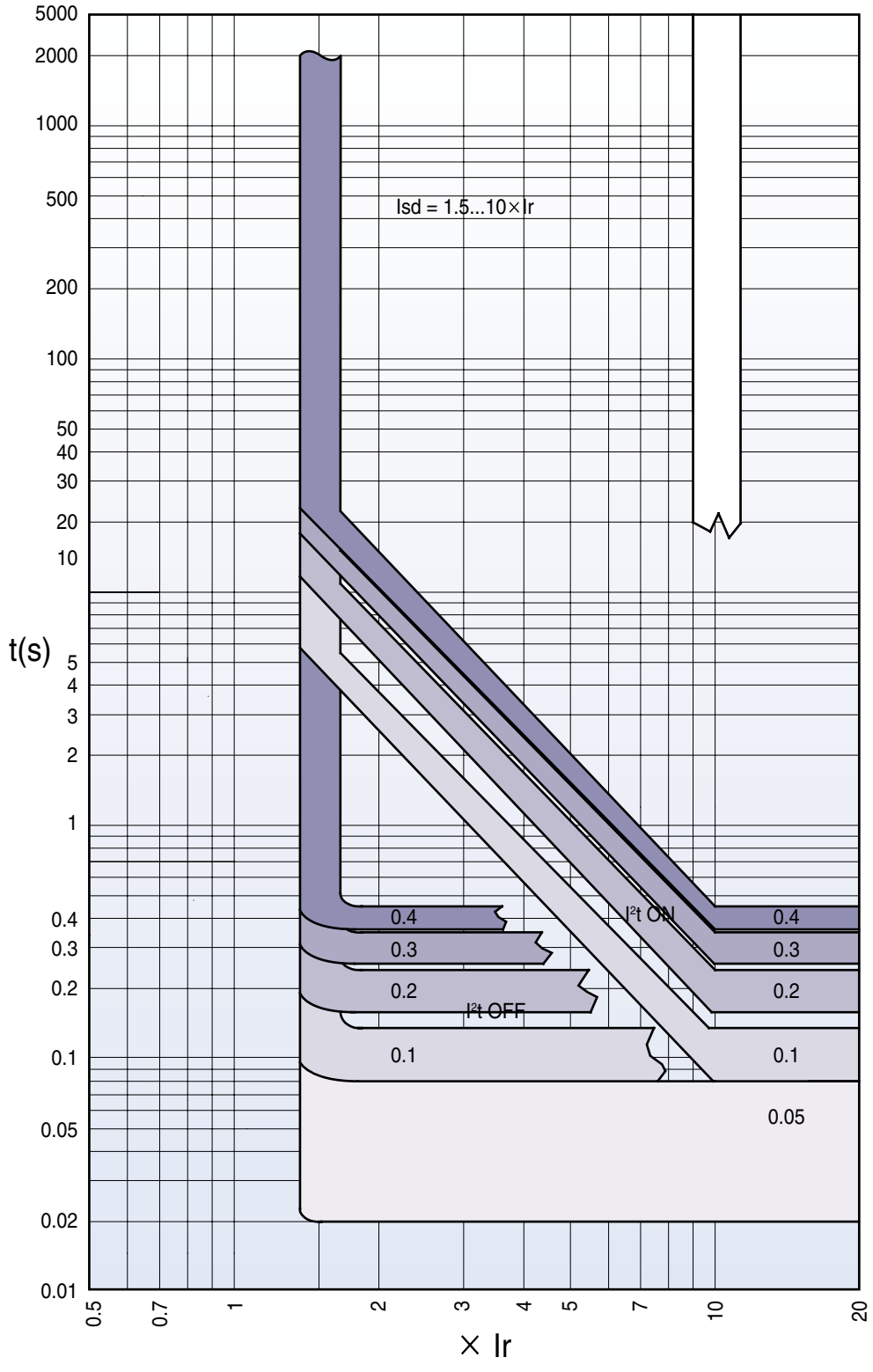


Characteristics curves

Long-time delay (L)

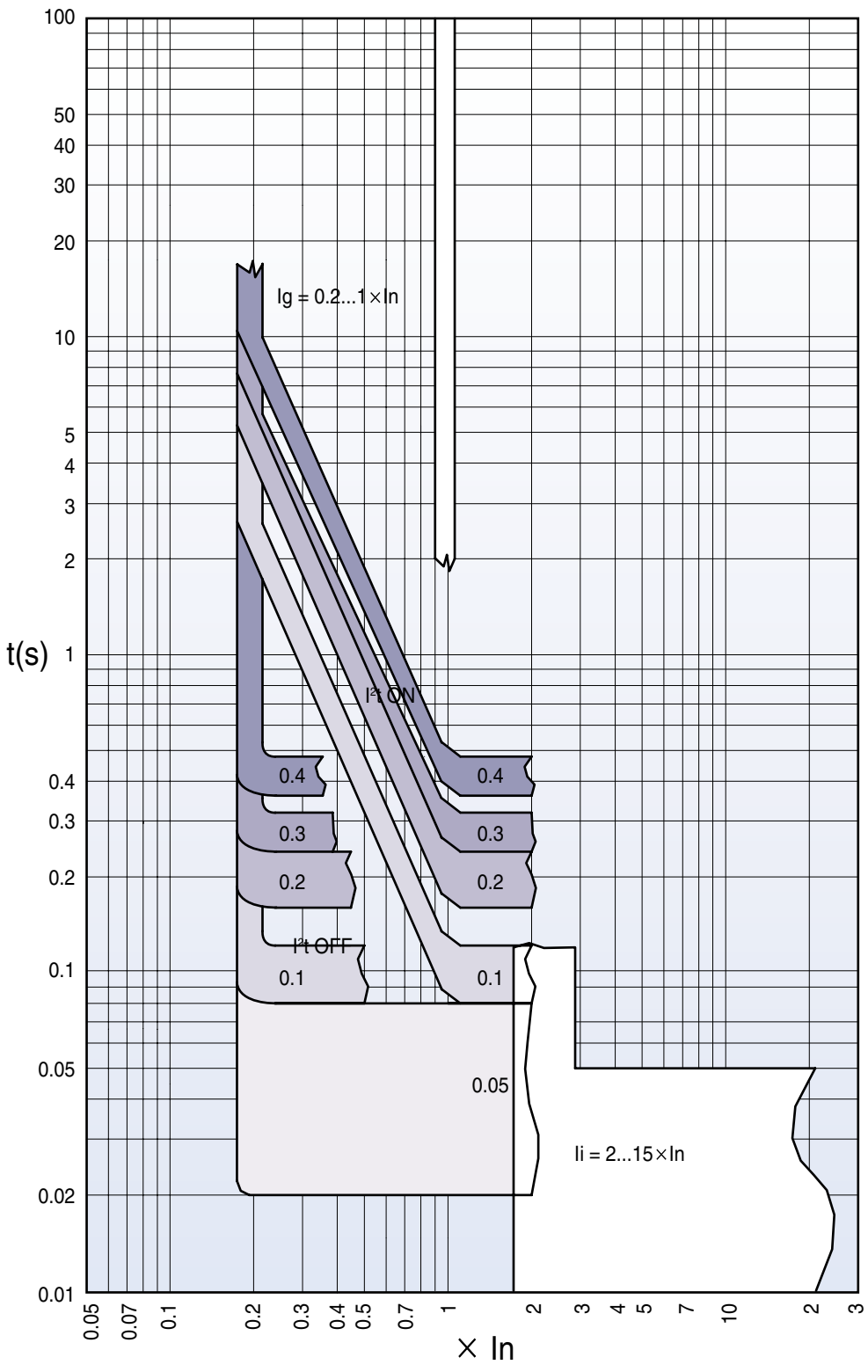


Short-time delay (S)

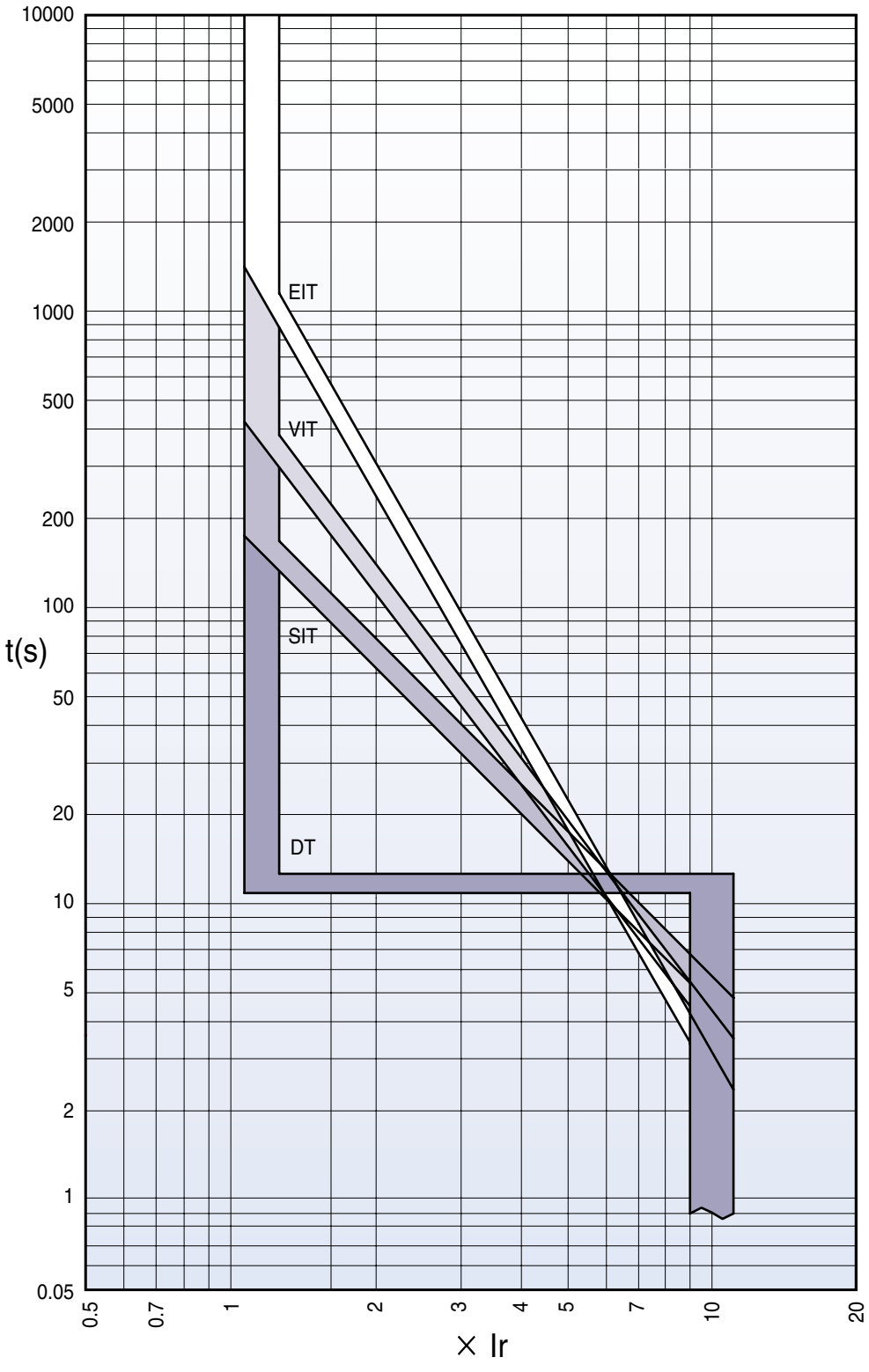


Characteristics curves

Instantaneous (I)
Ground fault (G)

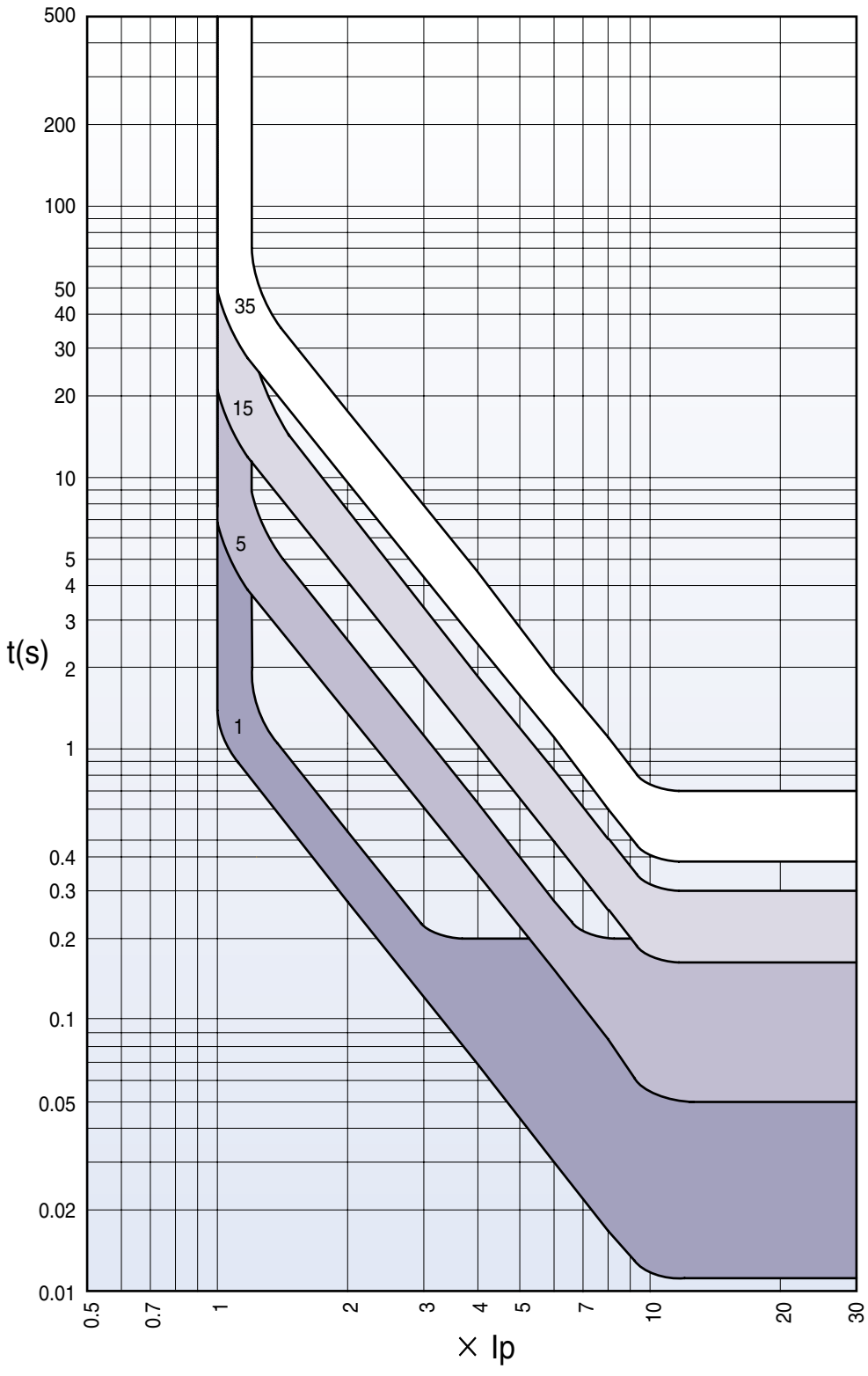


IDMTL


10000
5000
2000
1000
500
200
100
50
20
10
5
2
1
0.05
t(s)
EIT
VIT
SIT
DT
0.5
0.7
1
2
3
4
5
7
10
20
× Ir

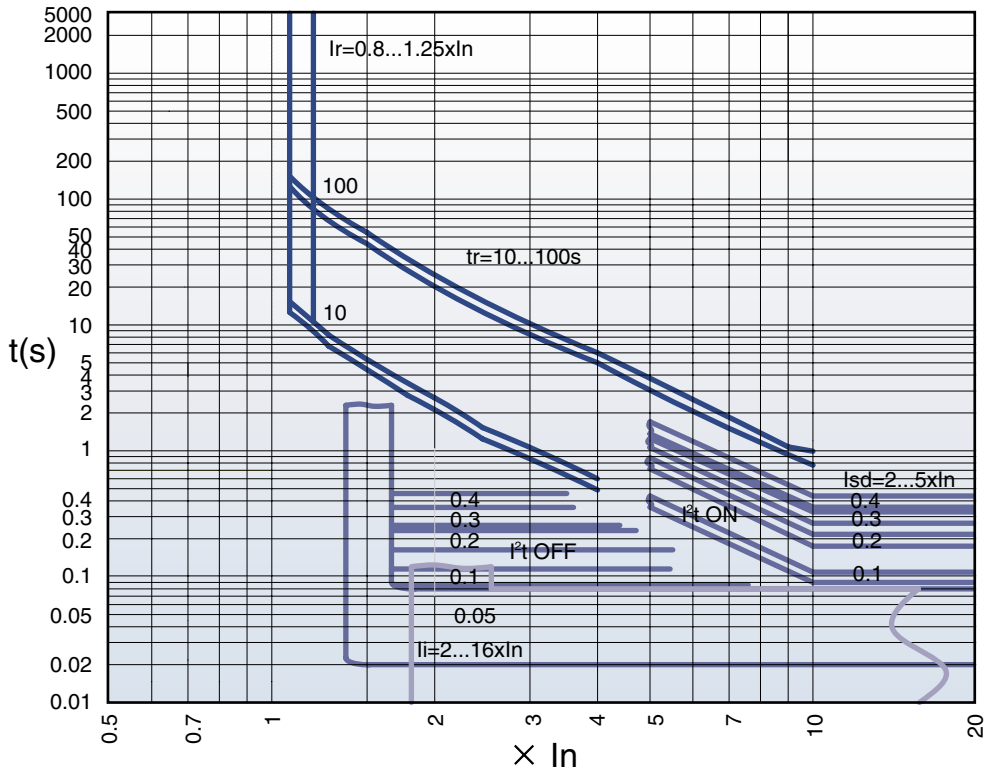
Characteristics curves

Pre Trip Alarm

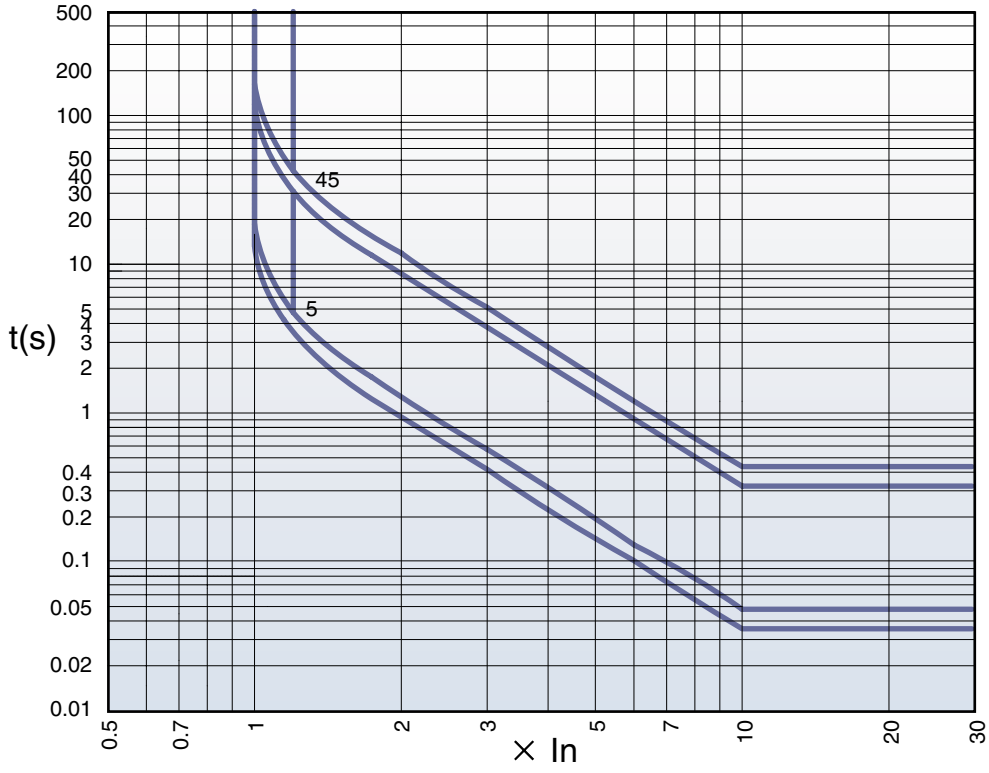


Generator curves

Long-time delay (L)
Short-time delay (S)
Instantaneous (I)



Pre Trip Alarm



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

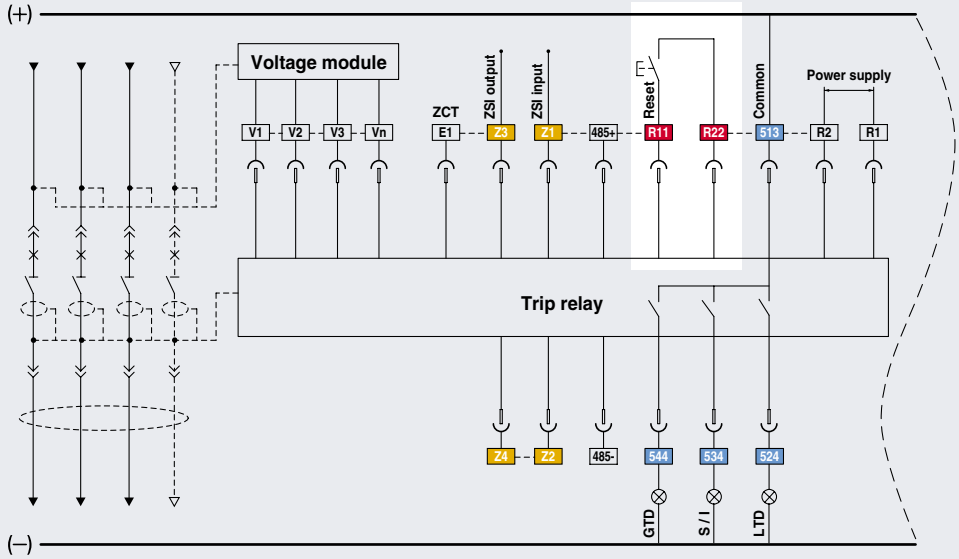
**In case of that ACB operates due to accidents or over current,
Trip relay indicates the information of the accident through the LED and LCD.
Trip relay A and S type is possible to perform the remote reset by digital input,
and have 3 DO(Digital output).**

1. Methods to reset Trip relay is to push the Reset button on the frontal side and to use the remote reset.

2. Digital input
   - [R11-R22] input: Remote reset
   - [Z1-Z2] Input: ZSI input
   - [E1-E2] Input: ZCT for earth leakage detection or external CT input

※All DI are dry contact that has 3.3V of recognition voltage. When inputting close by SSR(Solid State Relay) or open-collector, connect collector(Drain) to R11.

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

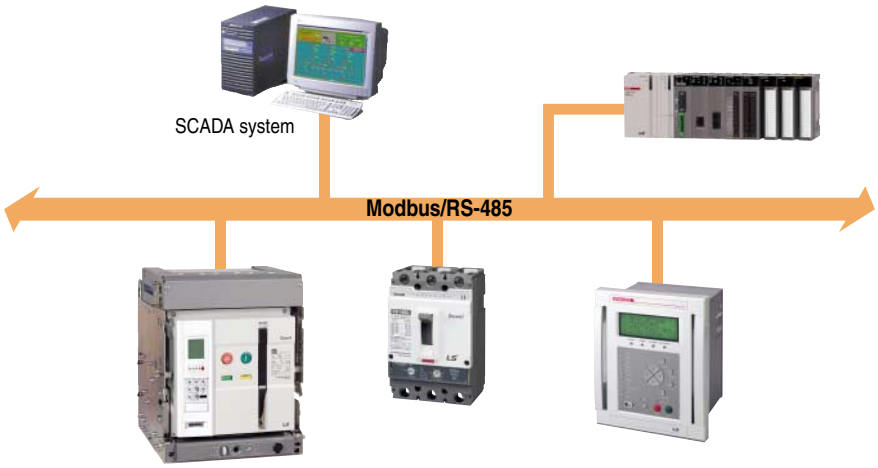


Trip Relay	Digital Output	Long time	Short time	Instantaneous	Ground	Overload Alarm	OVR	UVR	rPower	Vunbal	Iunbal	OFR	UFR	OPR	Note
P, S type	DO1(524)	●	○	○	○	○	○	○	○	○	○	○	○	○	Programmable
	DO2(534)	○	●	●	○	○	○	○	○	○	○	○	○	○	
	DO3(544)	○	○	○	●	○	○	○	○	○	○	○	○	○	
A type	DO1(524)	●	×	×	×	Not available		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

Communication

Modbus/RS-485

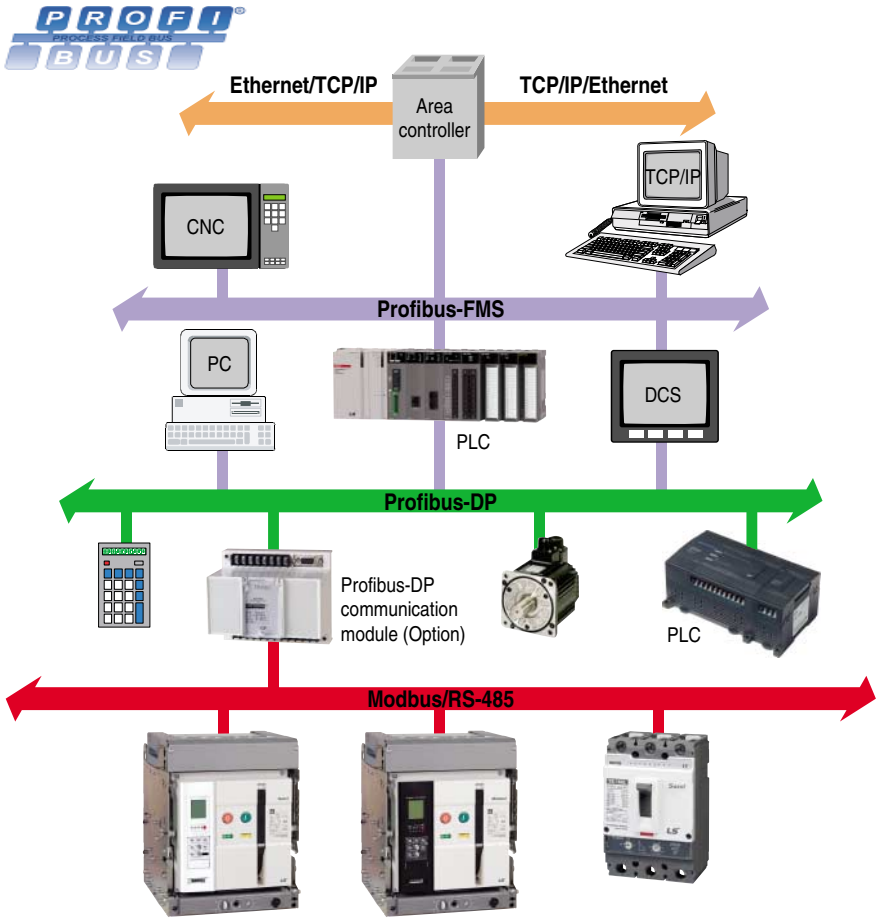
- Operation mode: Differential
- Distance: Max. 1.2km
- Cable :
  General RS-485 shielded twist 2-pair cable
- Baud rate :
  9600bps, 19200bps, 38400bps
- Transmission method: Half-Duplex
- Termination: 100Ω



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: 100Ω
- Standard: EN 50170 / DIN 19245

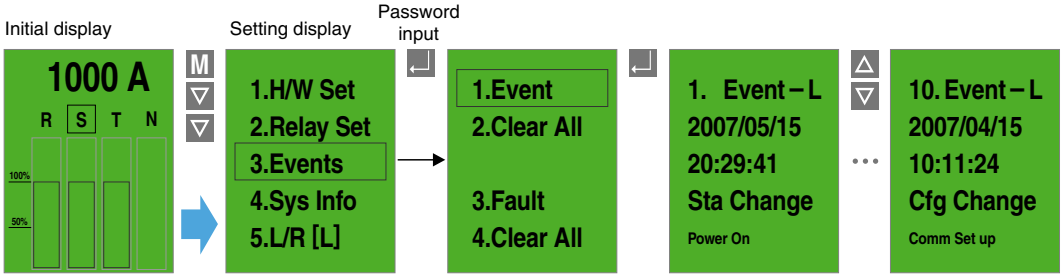
Profibus-DP communication module (Option)



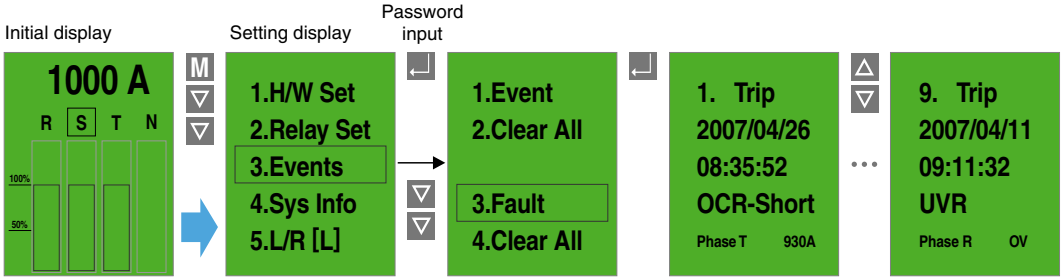
Event & fault recording (S type)

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

Event information display



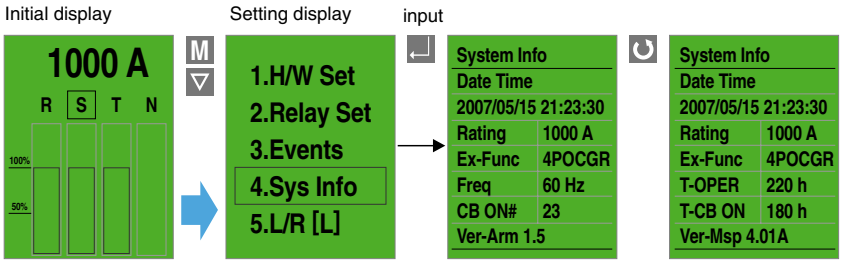
Fault information display



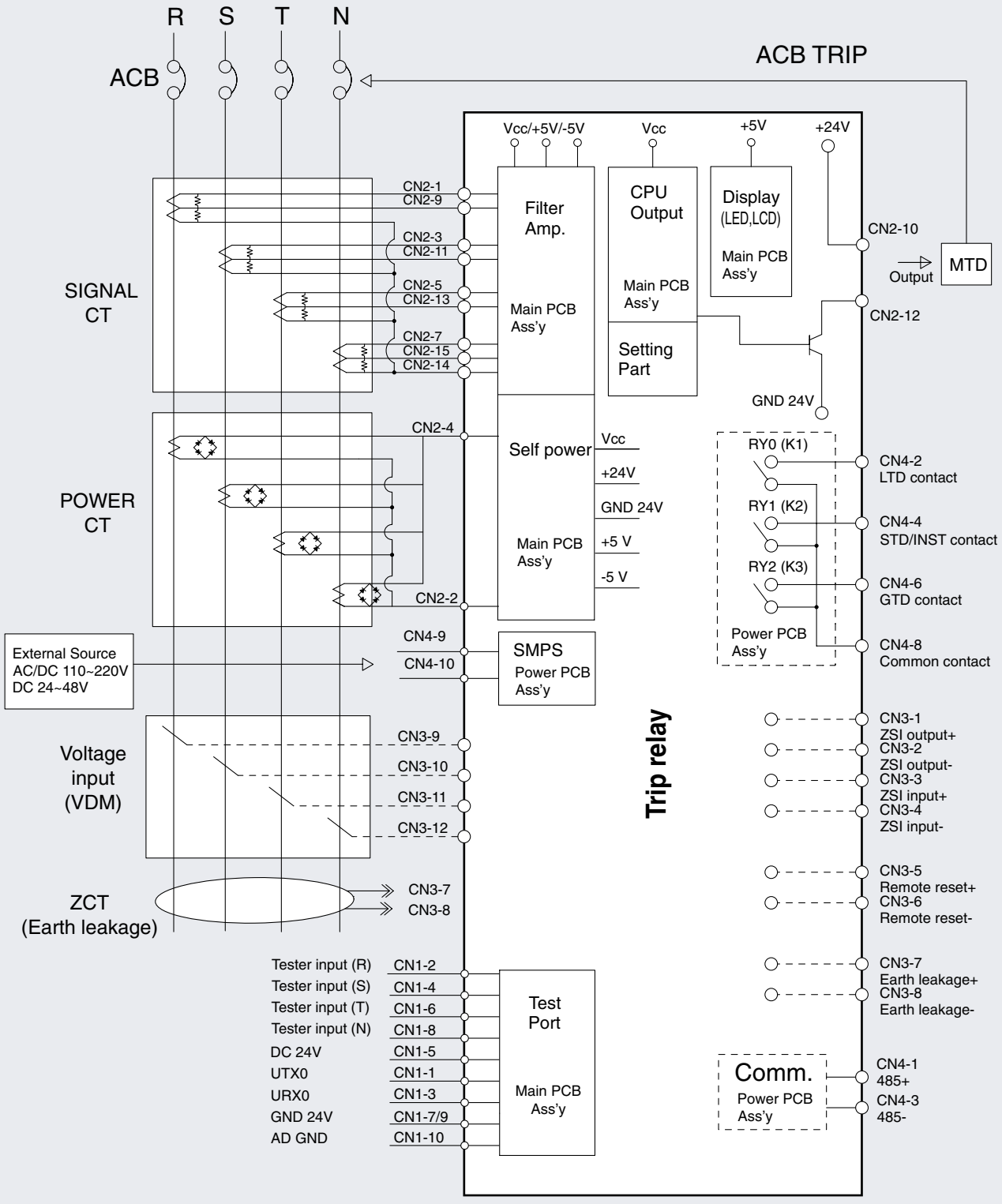
System information

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



System block diagram



Accessories

Susol

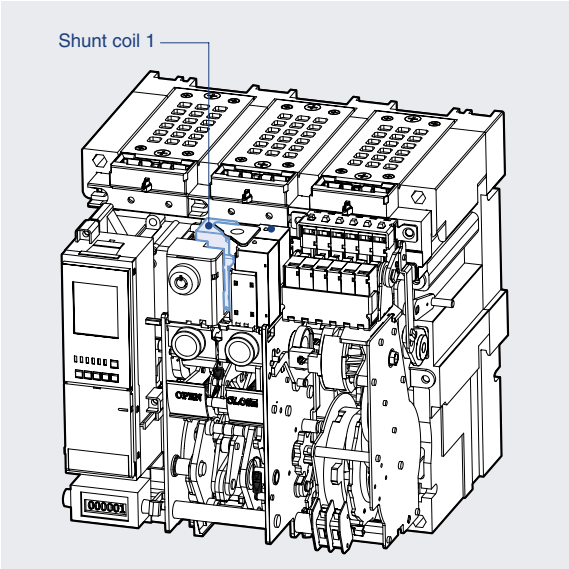
Mounting	Accessories		AH		Remark	Page
			Standard	Option		
Internal	SHT 1	Shunt coil	●	-	*	50
	SHT 2	Double Shunt coil	-	○	*	51
	CC	Closing coil	●	-	*	52
	M	Motor	●	-	*	53
	CS1	Charge switch	●	-	*	53
	CS2	Charge switch communication	-	○	*	53
	UVT	Under Voltage Trip device	-	○	*	54
	AL	Trip Alarm Contact	-	○	*	55
	MRB	Manual Reset Button	-	○	*	56
	RES	Remote Reset switch	-	○	*	57
	RCS	Ready to Close switch	-	○	*	58
	C	Counter	●	-	*	58
	AX	Auxiliary switch	-	○	*	59
	SL	Slow closing lever	-	○	-	-
	TM	Temperature alarm	-	○	*	75
External	K1	Key Lock	-	○	*	60
	K2	Key Interlock Set	-	○	*	60
	K3	Double Key Lock	-	○	*	61
	B	On/Off Button lock	-	○	*	61
	LH	Lifting hook	-	○	-	62
	CTD	Condenser trip device	-	○	-	62
	DC	Dust cover	-	○	-	64
	OT	OCR Tester	-	○	-	63
	A	Auto Connector	●	-	*	-

* Seperate purchasing is not allowed. Each item should be purchased with the main body.

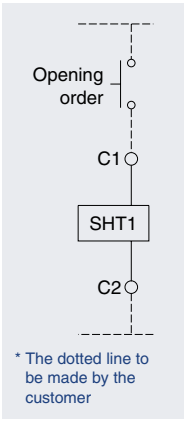
Mounting	Accessories		AH		Remark	Page
			Standard	Option		
Trip relay	N	N type	-	○	*	24
	A	A type	-	○	*	26
	S	S type	-	○	*	28
	NV	NV type	-	○	*	30
	VM	Voltage Module	-	○	**	77
	ZCT	ZCT for the earth leakage	-	○	-	-
Cradle	SBC	Shorting "b" contact	-	○	-	64
	MI	Mechanical interlock	-	○	-	66
	ST	Safety shutter	-	○	*	66
	STL	Safety shutter lock	-	○	-	67
	DF	Door Frame	-	○	-	67
	MIP	Miss insertion prevent device	-	○	-	73
	MOC	Mechanical operated cell switch	-	○	-	65
	CEL	Cell Switch	-	○	-	69
	DI	Door Interlock	-	○	-	70
	ZAS	Zero Arc Space (Arc cover)	●	-	*	70
	SC	Safety control cover	●	-	***	71
	BSP	Body Supporter	-	○	*	71
	RI	Racking interlock	-	○	-	72
	PL	Pad Lock/ Position Lock	●	-	*	72
	IB	Insulation barrier	●	-	*	68
	UDC	UVT time delay controller	-	○	*	74
	ADP	Compatible Adapter	-	○	-	-
Other	RPH	Reverse Phase ACB	-	○	-	-
	DUM	Dummy ACB	-	○	-	-
	VAD	Various Connection Type	-	○	-	-
	RCO	Remote I/O	-	○	-	76
	PC	Profibus-DP comm. module	-	○	-	-

* Seperate purchasing is not allowed. Each item should be purchased with the main body.
** Voltage module should be purchased with S type trip relay.
*** It is available only when the control block is in the mode of auto-connection.

Shunt Coil [SHT1]



- SHT1 is a control device which trips a circuit breaker from remote place, when applying voltage continuously or instantaneously over 200ms to coil terminals(C1, C2).
- When UVT coil is installed, its location is changed.



Wiring Diagram

1. Rated voltage and characteristics of Trip coil

Rated voltage [Vn]		Operating voltage range [V]	Power consumption (VA or W)		Trip time [ms]
DC [V]	AC [V]		Inrush	Steady-state	
24~30	-	0.7~1.1 Vn	200	5	Less than 40ms
48~60	48	0.7~1.1 Vn			
100~130	100~130	0.7~1.1 Vn			
200~250	200~250	0.7~1.1 Vn			
-	380~480	0.7~1.1 Vn			

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

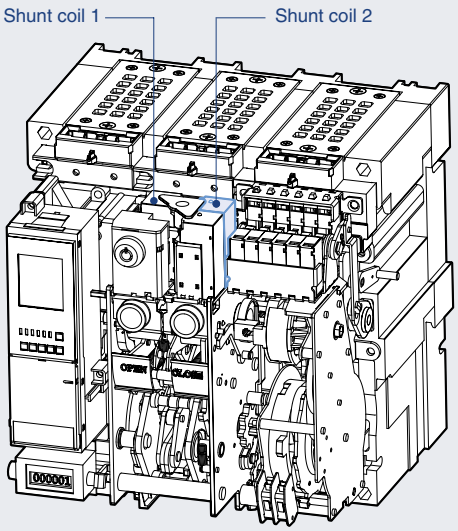
2. Specification of the wire

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

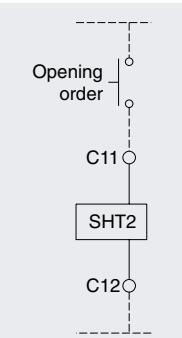
The maximum wire length

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

Double Shunt Coil [SHT2]



- SHT2 is a control device which trips a circuit breaker doubly from the outside. When SHT1 doesn't operate normally, it can trip a circuit breaker safely.
- Shunt coil 1: Install it at existing location.
- Shunt coil 2: Install it on the right side of the Shunt coil 1
- It is not available with UVT coil when installing double shunt coil.



Wiring Diagram

1. Rated voltage and characteristics of Trip coil

Rated voltage [Vn]		Operating voltage range [V]	Power consumption (VA or W)		Trip time [ms]
DC [V]	AC [V]		Inrush	Steady-state	
24~30	-	0.7~1.1 Vn	200	5	Less than 40ms
48~60	48	0.7~1.1 Vn			
100~130	100~130	0.7~1.1 Vn			
200~250	200~250	0.7~1.1 Vn			
-	380~480	0.7~1.1 Vn			

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

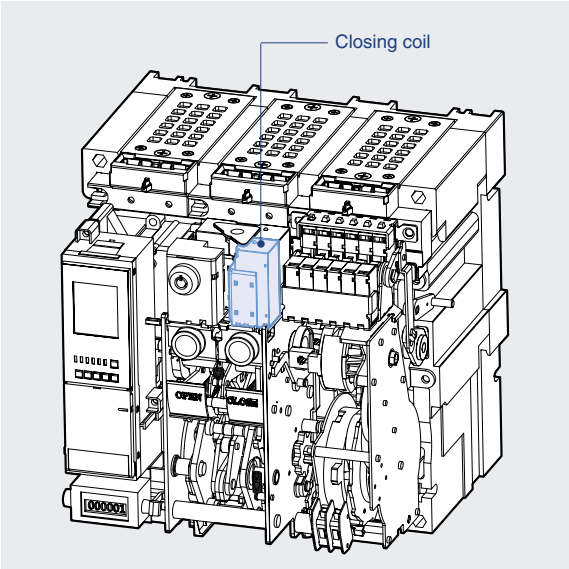
2. Specification of the wire

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

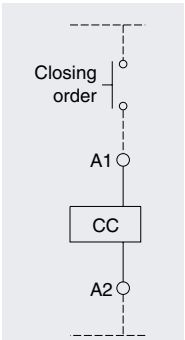
The maximum wire length

		Rated voltage [Vn]			
		DC 24~30 [V]		DC/AC 48 [V]	
Wire type		#14 AWG ($2.08mm^2$)	#16 AWG ($1.31mm^2$)	#14 AWG ($2.08mm^2$)	#16 AWG ($1.31mm^2$)
Operating voltage	100%	95.7m	61m	457.8m	287.7m
	85%	62.5m	38.4m	291.7m	183.2m

Closing Coil [CC]



- It is a control device which closes a circuit breaker, when the voltage is applied continuously or instantaneously over 200ms to the coil terminals (A1, A2).



Wiring Diagram

1. Rated voltage and characteristics of Closing coil

Rated voltage [Vn]		Operating voltage range [V]	Power consumption (VA or W)		Shunt time [ms]
DC [V]	AC [V]		Inrush	Steady-state	
24~30	-	0.85~1.1 Vn	200	5	Less than 80ms
48~60	48	0.85~1.1 Vn			
100~130	100~130	0.85~1.1 Vn			
200~250	200~250	0.85~1.1 Vn			
-	380~480	0.85~1.1 Vn			

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

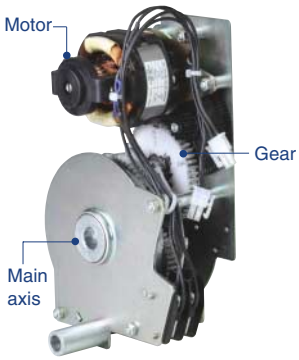
2. Specification of the wire

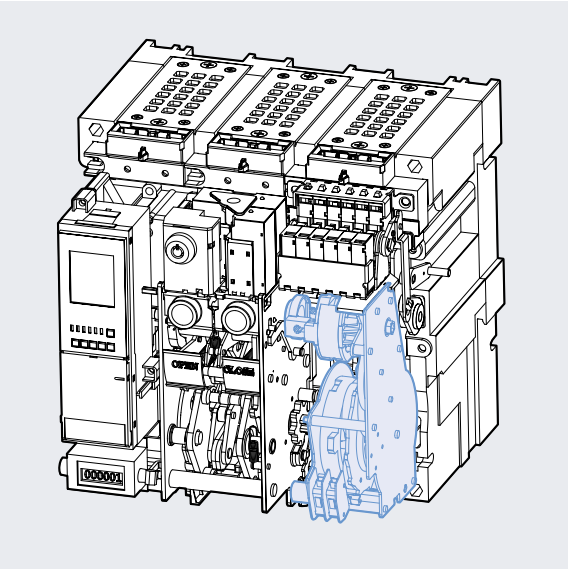
- Refer to the below table regarding the length and specification of wire when using trip coil with DC 24~30[V] or DC/AC 48~60[V] of rated voltage.

The maximum wire length

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

Motor [M]





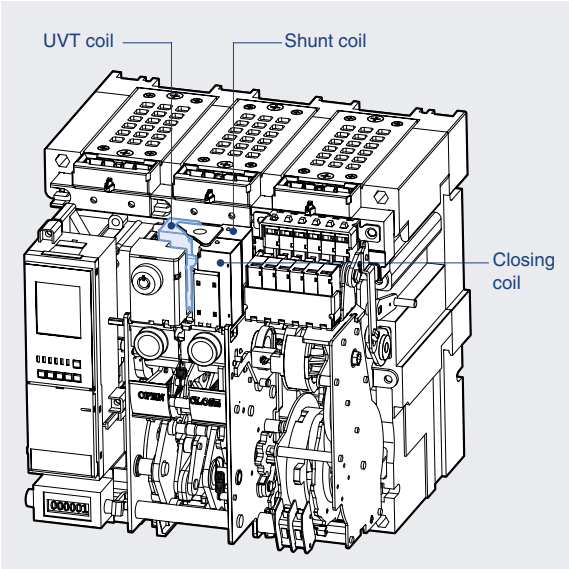
- Charge the closing spring of a circuit breaker by the external power source. Without the external power source, charge manually.
- Operating voltage range(IEC 60947) 85%~110%Vn

Input voltage(V)	DC 24~30V	AC/DC 48~60V	AC/DC 100~130V	AC/DC 200~250V	AC 380V	AC 440~480V
Load current(max.)	5A	3A	1A	0.5A	0.3A	0.3A
Starting current(Max.)	5 times of load current					
Load rpm(Motor)	15000 ~ 19000 rpm					
Charge time	Less than 5sec.					
Dielectric strength	2kV/min					
Using temperature range	-20˚ ~ 60˚					
Using humidity range	Max. RH 80% (No dew condensation)					
Endurance	15,000 cycle (Load connection, 2 times/min)					
Charge switch	10A at 250VAC					

Charge Switch [CS1]
Charge Switch Communication [CS2]

- It is a built-in contact which sends the signal to the outside, when motor charging is completed. (2a)
- It has a “1a” contact for communication and the other “1a” contact for complete charging.
- When using an extra communication module (Remote I/O), the state of contacts can be displayed through the network.
- 10A at 250VAC

Under Voltage Trip device [UVT]



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

1. Rated voltage and characteristics of UVT coil

Rated voltage [Vn]		Operating voltage range [V]		Power consumption (VA or W)		Trip time [ms]
DC [V]	AC [V]	Pick up	Drop out	Inrush	Steady-state	
24~30	-	0.65~0.85 Vn	0.4~0.6 Vn	200	5	Less than 50ms
48~60	48					
100~130	100~130					
200~250	200~250					
-	380~480					

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

2. Specification of the wire

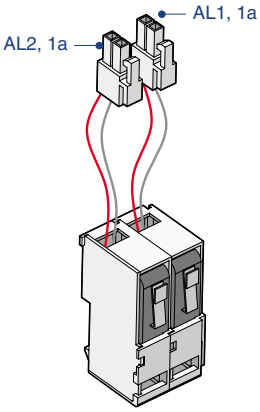
- Refer to the below table regarding the length and specification of wire when using trip coil with DC 24~30[V] or DC/AC 48~60[V] of rated voltage.

The maximum wire length

		Rated voltage [Vn]			
		DC 24~30 [V]		DC/AC 48 [V]	
Wire type		#14 AWG (2.08mm²)	#16 AWG (1.31mm²)	#14 AWG (2.08mm²)	#16 AWG (1.31mm²)
Operating voltage	100%	48.5m	30.5m	233.2m	143.9m
	85%	13.4m	8.8m	62.5m	39.3m

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

Trip Alarm Contact [AL]

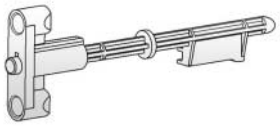


- When a circuit breaker is tripped by OCR which operates against the fault current (Over Current Relay), Trip Alarm switch provides the information regarding the trip of circuit breaker by sending the electrical signal from the mechanical indicator on front cover of main circuit breaker or internal auxiliary switch. (Installed at the inside of circuit breaker)
- When a circuit breaker tripped by fault current, a mechanical trip indicator (MRB, Manual Reset Button) pops out from the front cover and the switch (AL) which sends control signal electrically is conducted to output the information occurred from fault circuit breaker.
- MRB and AL can be operated only when tripping by OCR, but doesn't be operated by Off button and OFF operation of trip coil.
- To re-close a circuit breaker after a trip, press MRB to reset it for closing.
- 2pcs of electrical trip switch (AL1, AL2, 1a) are provided (Option)
- Trip alarm contact and MRB(Manual reset bottom) need to be purchased together.

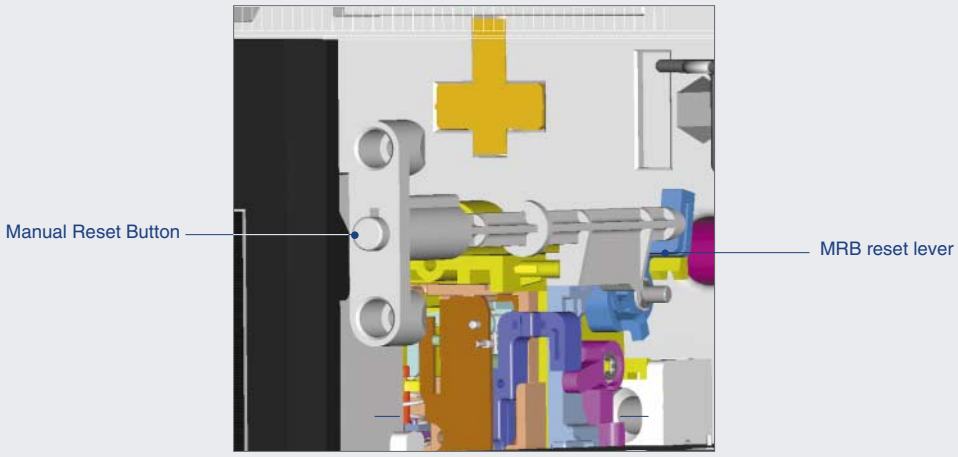
1. Electrical characteristics of trip alarm contact

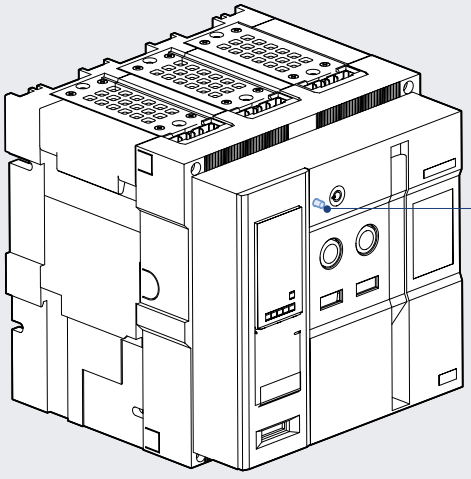
Rated voltage [V]	Non-inductive load (A)		Inductive load (A)		Inrush current
	Resistive load	lamp load	Inductive load(A)	Motor load	
8V DC	11	3	6	3	MAX. 24A
30V DC	10	3	6	3	
125V DC	0.6	0.1	0.6	0.1	
250V DC	0.3	0.05	0.3	0.05	
250V AC	11	1.5	6	2	

Manual Reset Button [MRB]



- It is a function which resets a circuit breaker manually when a circuit breaker is tripped by OCR.
- When a circuit breaker tripped by fault current, a mechanical trip indicator (MRB, Manual Reset Button) pops out from the front cover and the switch(AL) which sends control signal electrically is conducted to output the information occurred from fault circuit breaker.
- MRB can be operated only by OCR but not by OFF operation of circuit breaker. To re-close a circuit breaker after a trip, press MRB to reset it for closing.

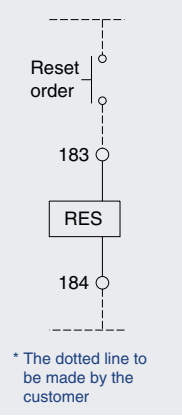




Note) The manual reset button is protruded in the event of trip.

Remote Reset Switch [RES]

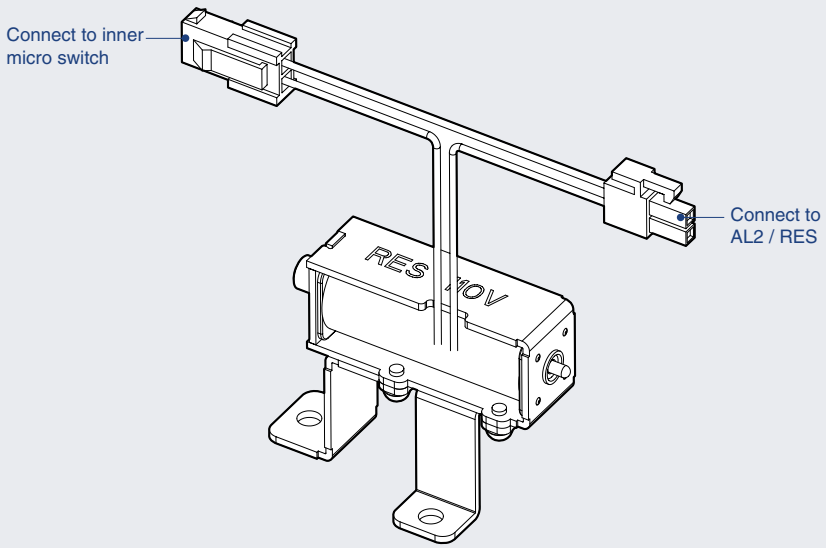
- Following tripping, this function resets the "fault trip" alarm contacts(AL) and the mechanical indicator(MRB) and enables circuit breaker closing.
  Push button switch : AC 125V 10A, AC 250V 6A, DC 110V 2.2A, DC 220V 1.1A Resistive load
- In case of auto reset type circuit breaker
  Following tripping, a reset of Manual Reset Button(MRB) or Remote Reset Switch(RES) is no longer required to enable circuit breaker closing.
  The mechanical indicator(MRB) and electrical indicator(AL) remain in fault position until the reset button is pressed.
- AL2 and RES are alternative.



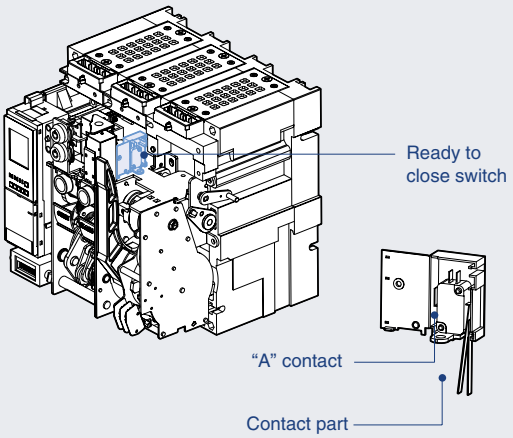
Wiring Diagram

1. Rated voltage and rated current of RES

Rated voltage	Operating current(Max.)		Operating time	Wire spec.
AC/DC 100~130V	AC	6A	Less 40ms	#14 AWG (2.08 mm²)
	DC	5A		
AC/DC 200~250V	AC	3A		#16 AWG (1.31 mm²)
	DC	2.5A		



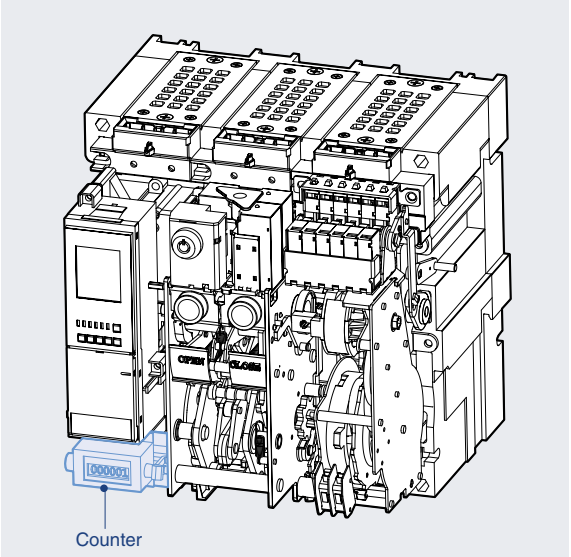
Ready to Close Switch [RCS]



- It interlocks with mechanism of circuit breaker.
- It indicates the status that the circuit breaker is ready to do closing operation.
- When mechanism is in OFF position and in Charge, contact is output with "ON" and it indicates that mechanism can be closed.

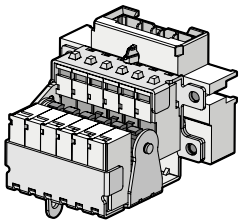
Classification	Standard		Remark
Contactor Capacity	250/125 Vac	10 A	
	250 Vdc	0.3 A	
	125 Vdc	0.6 A	
	48 Vdc	3 A	
	24 Vdc	5 A	

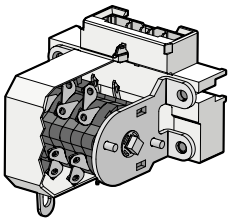
Counter [C]

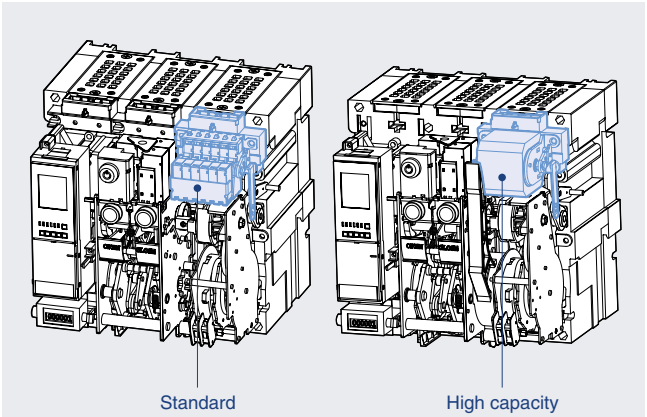


- It displays the total number of ON/OFF operation of ACB.

Auxiliary switch [AX]



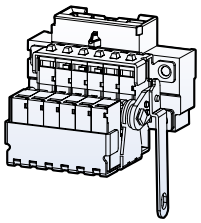
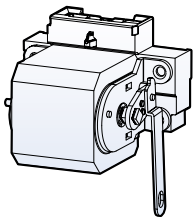




- It is a contact used to monitor ON/OFF position of ACB from remote place.

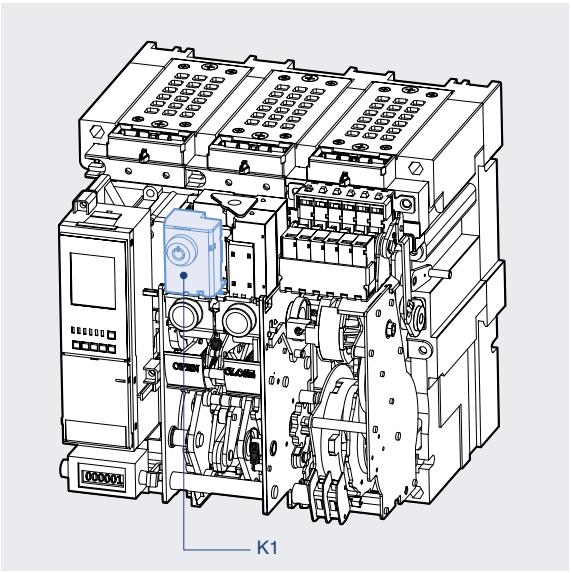
AUX. contact & charging types	
AX	Standard OFF charge 3a3b
AC	Standard ON charge 3a3b
BX	Standard OFF charge 5a5b
BC	Standard ON charge 5a5b
HX	High capacity OFF charge 5a5b
HC	High capacity ON charge 5a5b
CC	Standard ON charge 6a6b
JC	High capacity ON Charge 6a6b

Standard classification

Standard		High capacity	
2000AF	4000, 6300AF	2000AF	4000, 6300AF
			

Classification			Standard		High capacity		Remark
			Resistive load	Inductive load	Resistive load	Inductive load	
Contact capacity	AC	490V	5A	6A	5A	2.5A	
		250V	10A	6A	10A	10A	
		125V	10A	6A	10A	10A	
	DC	250V	0.3A	0.3A	3A	1.5A	
		125V	0.5A	0.6A	10A	6A	
		30V	10A	6A	10A	10A	
No. of Contact that can be used		AX	3a3b		-		Standard charging type
		BX	5a5b		-		
		HX	-		5a5b		
		AC	3a3b		-		Rapid auto-reclosing charging type
		BC	5a5b		-		
		CC	6a6b		-		
		HC	-		5a5b		
		JC	-		6a6b		

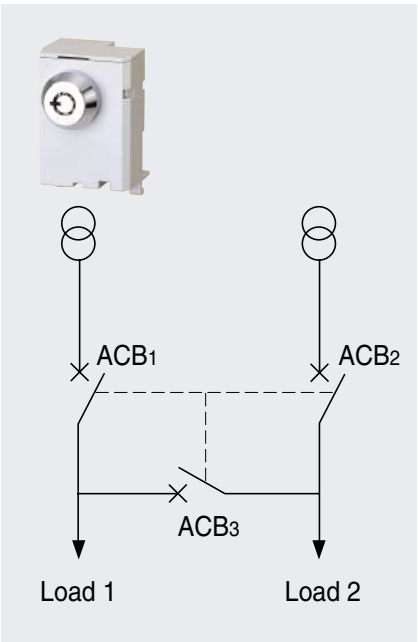
Key Lock [K1]



- It is a device for locking which prevents a certain circuit breaker from being operated by user's discretion when two or more circuit breakers are used at the same time.
- K1: Preventing mechanical closing

Key Interlock Set [K2]

Wiring

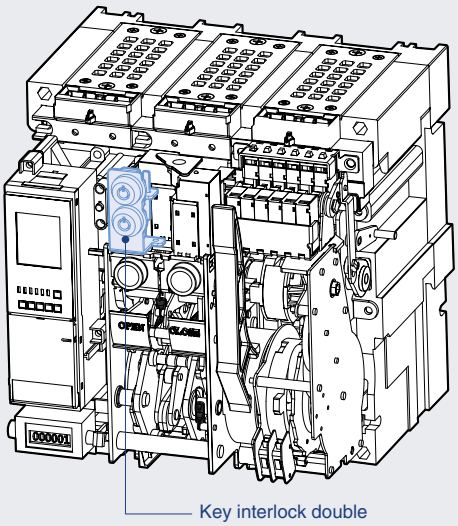


- 3 circuit breakers can be arranged for the continuous power supply to the load side and be interlocked mutually by using Key Lock embedded in each circuit breaker.

ACB-1	ACB-2	ACB-3	Status	
			LOAD1	LOAD2
●	●	●	OFF	OFF
●	○	○	ON	ON
○	●	○	ON	ON
○	○	●	ON	ON
●	●	○	OFF	OFF
●	○	●	OFF	ON
○	●	●	ON	OFF

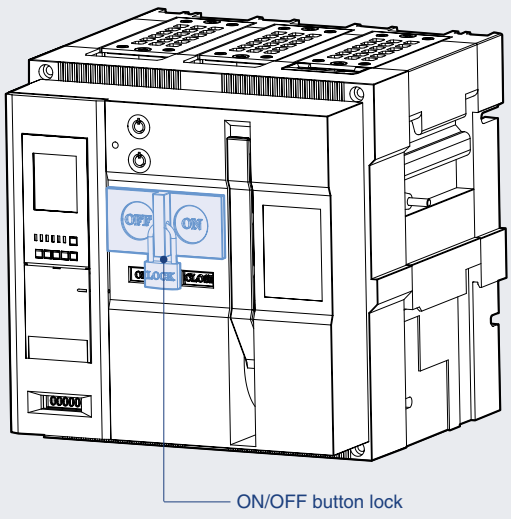
○: Release ●: Lock

Double Key Lock [K3]



- When only two keys are released at the same time, circuit breakers operate. Handling method is same as K1.

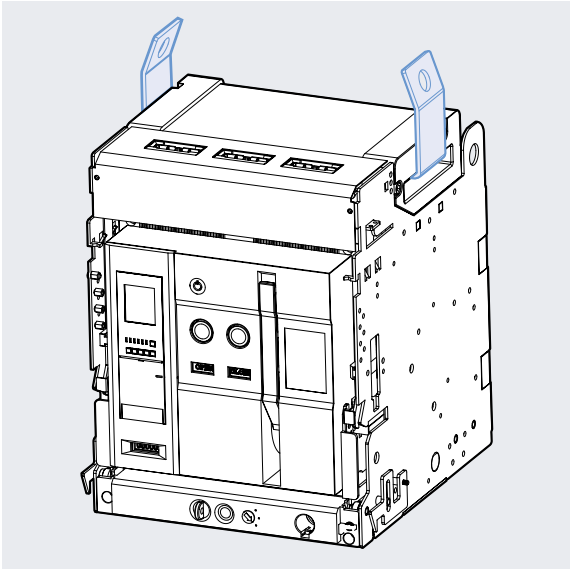
ON/OFF Button Lock [B]



- It is to prevent manual operation of ACB's closing/tripping button due to user's wrong handling.
- It is not possible to handle ON/OFF operation under the "Button lock" status.

Note) Padlocks(Ø5 ~ Ø6) are not supplied.

Lifting Hook [LH]



- It is a device to make an ACB easy to shift.
- Please hang it to both handles of the arc cover.

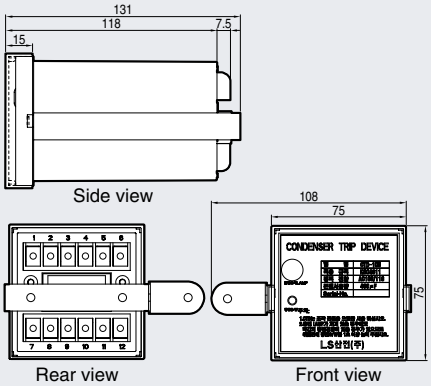
Condenser Trip Device [CTD]

- It gets a circuit breaker tripped electrically within regular time when control power supply is broken down and is used with Shunt coil, SHT. In case there is no DC power, It can be used as the rectifier which supplies DC power to a circuit breaker by rectifying AC power.

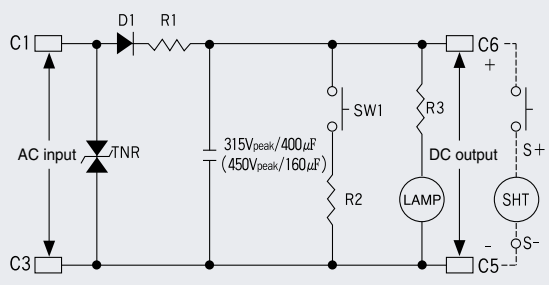
Ratings

Ratings	Specification	
Model	CTD-100	CTD-200
Rated input voltage (V)	AC 100/110	AC 200/220
Frequency (㎐)	50/60	50/60
Rated charge voltage (V)	140/155	280/310
Charging time	Within 5S	Within 5S
Trip possible time	Over 3 min.	Over 2 min.
Range of Input voltage (%)	85~110	85~111
Condenser capacity	400㎌	160㎌

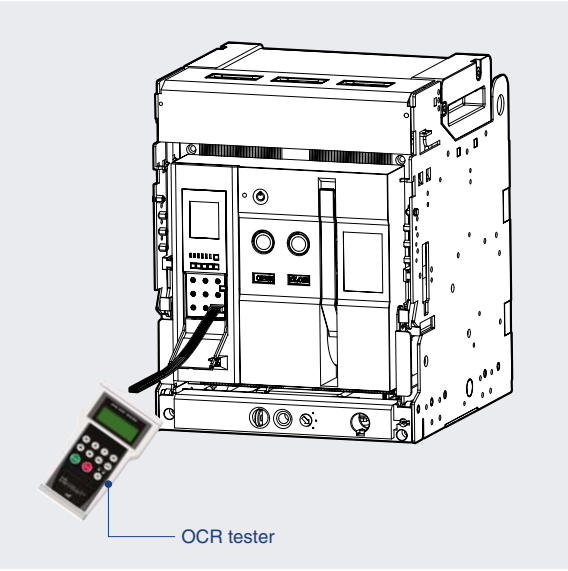
External dimension



Circuit diagram



OCR Tester [OT]



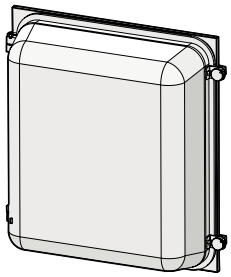
- It is a device which can test for the operation of Trip Relay under no power condition.

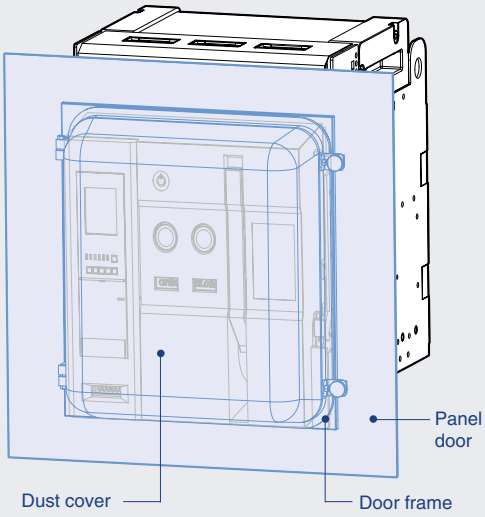
1. Maximum 17 times rated current can be inputted.
2. It is possible to enter the current value and phase on each of R/S/T/N
3. Frequency is adjustable.
4. It is available to test for long time delay/short time delay/instantaneous /ground fault.

Configuration

R S T N	R, S, T, N phase signal input
▲ ▼	Increase/Decrease signal input
ENT. ESC	Signal setting/Delete
START STOP	Waveform generation/Stop
50Hz 60Hz Hz	Select frequency

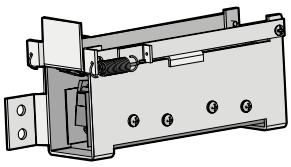
Dust Cover [DC]

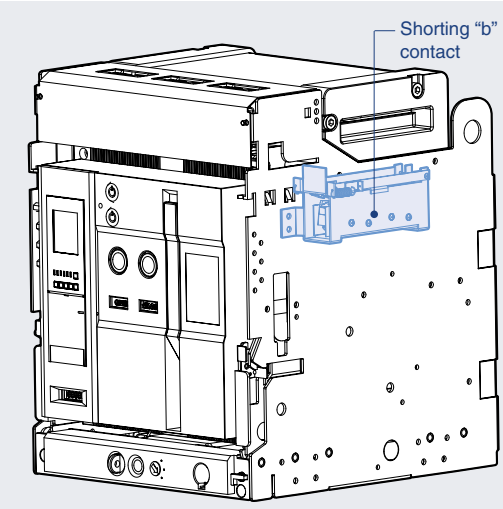




- Attach it to the door frame.
- It protects the product against the dust (IP5X) which may cause fault operation and enhances the sealing degree by being mounted to protrude type of panel.
- It is transparent so that the front side of ACB is visible and the Cover can be opened/closed even if ACB is drawn out to until TEST position.

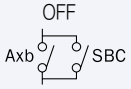
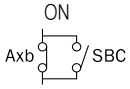
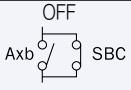
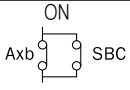
Shorting “b” Contact [SBC]



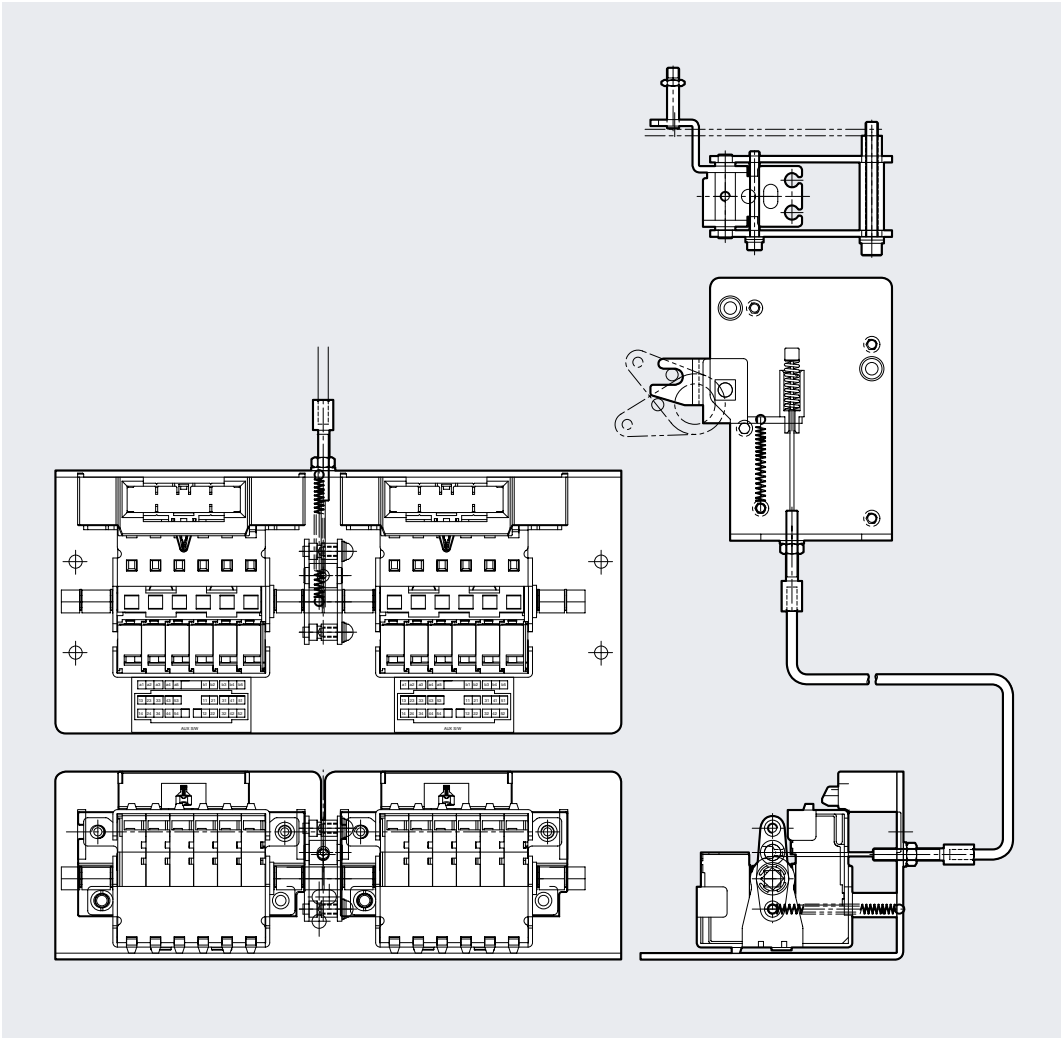


- It is the contact which keeps the external control circuit in normal by Aux. contact which disconnects “Axb” when ACB is moved from CONNECTED position to TEST position. The number of “shorting b-contact” corresponds to the number of “Axb” (4b)

Contact condition (Link between Axb and shorting “b” contact)

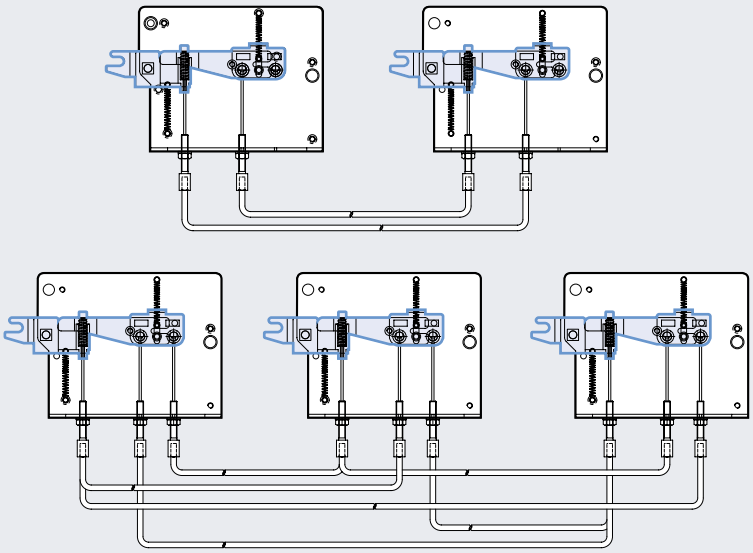
ACB position \ ACB condition	Close position [Auxiliary contact(Axb):OFF]	Open position [Auxiliary contact(Axb):ON]
Connected position (Shorting b contact : OFF)	OFF 	ON 
Test position (Shorting b contact : ON)	OFF 	ON 

Mechanical Operated Cell Switch [MOC]



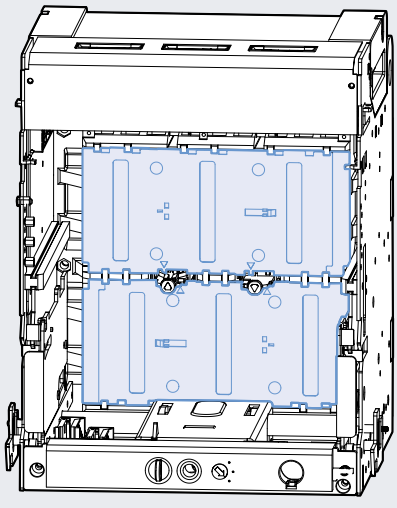
- It is the contact (10a10b) which displays the ON/OFF condition of ACB.
  It mechanically operates only when the breaker is “CONNECTED” position.
  A standard type and a high capacity type is available.
- The contact capacity is as same as the ratings of aux. contacts.
- When MOC link is installed to cradle, MOC can be equipped with the inside of panel.

Mechanical Interlock [MI]

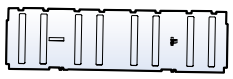


- It is used to interlock closing and trip between two or three breakers mechanically so as to prevent unintended operation at the same time.
- Wire type interlock can be applied upto 3 breakers

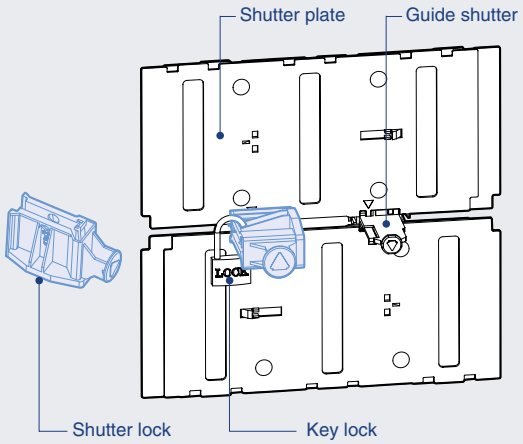
Safety Shutter [ST]



- It is the automatic safety device to protect the connectors of main circuit by cutting off dangerous contact from outside while the breaker is drawn out. When the ACB is drawn in, the shutter is automatically opened.
- There are 4 types of Safety Shutter and they are divided as shown in figure below.

The types of safety shutter plate	
2000AF, 3P	4000/6300AF, 3P
	
2000AF, 4P	4000/6300AF, 4P
	

Safety Shutter Lock [STL]



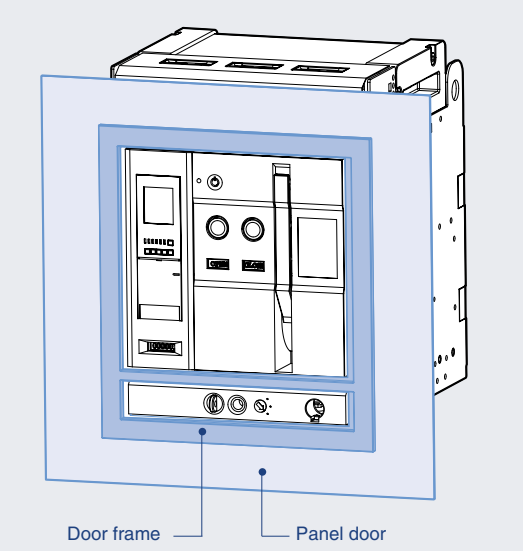
- It is a locking device which prevents safety shutter from being opened when it is closed.
  → If shutter lock is connected with guide shutter, the guide shutter can not be pushed structurally.
  Thus, it is not available to open the safety shutter.

Note) Padlocks(Ø5 ~ Ø6) are not supplied.

Door Frame [DF]

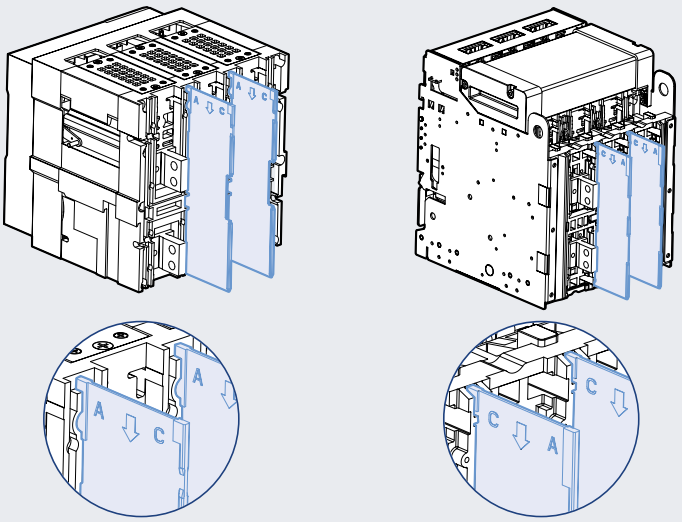
Fixed type

Draw-out type



- When structuring the embedded type of ACB panel, it protects the protrude front of ACB and the cutting side of panel door by attaching it to the panel door.

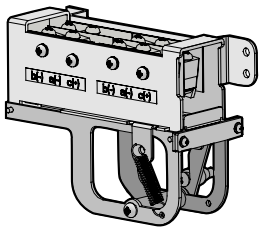
Insulation Barrier [IB]

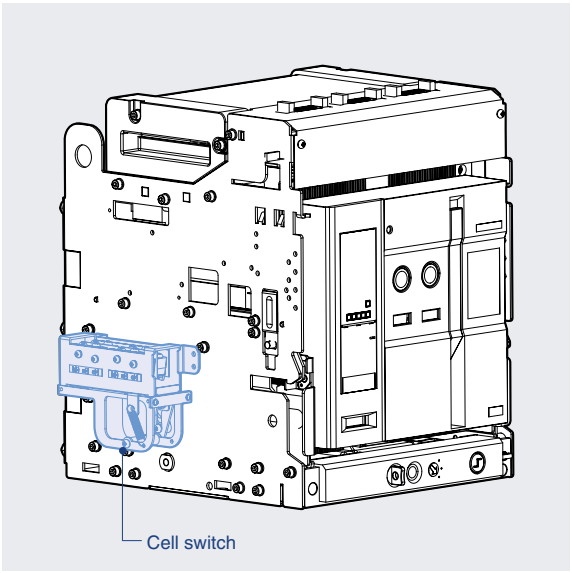


Fixed type　　Draw-out type

- Insulation barrier prevents the arc which may arise and result in short-circuit between phases in advance
- As “C” stands for “CRADLE”, install the insulation barrier in the direction of “C” in case of Draw-out type.
- As “A” stands for “ACB main frame”, install the insulation barrier in the direction of “A” in case of Fixed type.

Cell Switch [CEL]





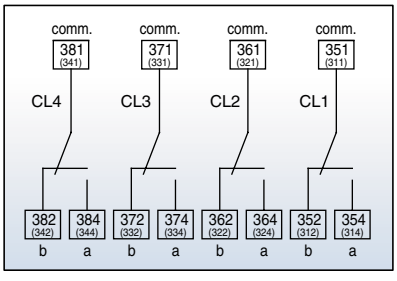
- It is a contact which indicates the present position of ACB.(CONNECTED, TEST, DISCONNECTED)

<Contact configuration>
4C: 1Disconnected +1Test +2Connected
8C: 2Disconnected +2Test +4Connected

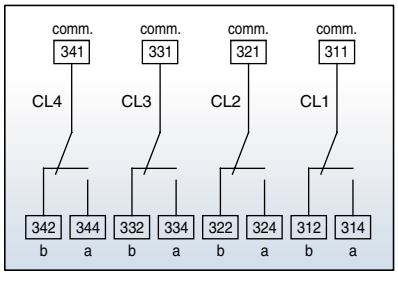
※ Contact configuration can be changeable if necessary.

ACB position			DISCONNECTED		CONNECTED
Draw-in and draw-out position			DISCONNECTED	TEST	CONNECTED
Contact operation	CL-C (Connected)		OFF		ON
	CL-T (Test)		OFF	ON	
	CL-D (Disconnected)		ON	OFF	
Contact capacity	Voltage(V)		Resistive load		Inductive load
	AC	460V	5		2.5
		250V	10		10
		125V			
	DC	250V	3		1.5
		125V	10		10
		30V	10		10
Contact number			4C		

Terminal (4C, 8C)

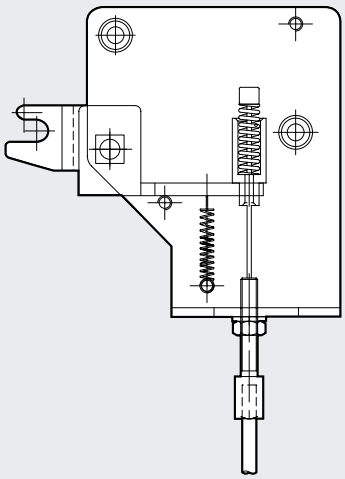


4C attached to the right side of cradle



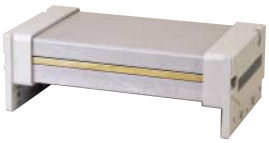
4C attached to the left side of cradle

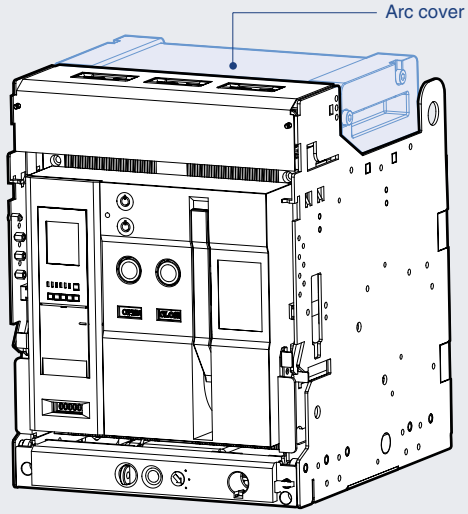
Door Interlock [DI]



- It is a safety device which does not allow the panel door to open when a circuit breaker is in the “ON” position.

Zero Arc Space [ZAS]



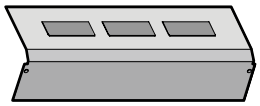


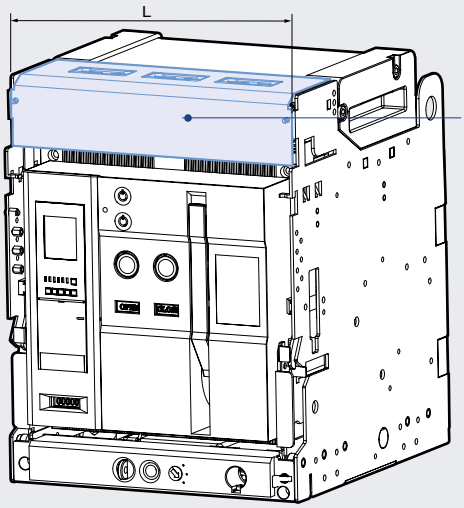
- Arc which may arise while breaking fault current is extinguished first by Arc chute in main body of circuit breaker and then completely extinguished by Arc cover.
  By preventing arc from exposing to the outside, it protects itself from all kinds of accidents.

- It is categorized into 2 types by ratings and poles.

Ampere Frame	Cover Length (mm)
AH-4000AF 3P	359.4
AS-4000AF 3P	576.4

Safety Control Cover [SC]



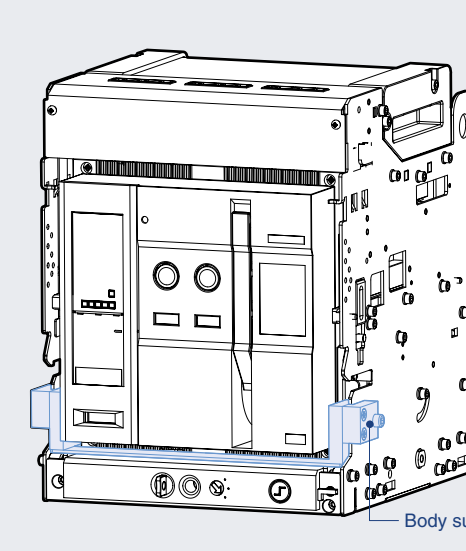


- It protects control terminals which exposes to the outside, and prevents the damages resulted from foreign substances.
- It is categorized into 8 types by ratings and poles.

Ampere frame	Cover length (mm)
2000AF 3P	334
2000AF 4P	419
4000AF 3P	412
4000AF 4P	527
5000AF 3P	629
5000AF 4P	799
6300AF 3P	785
6300AF 4P	1015

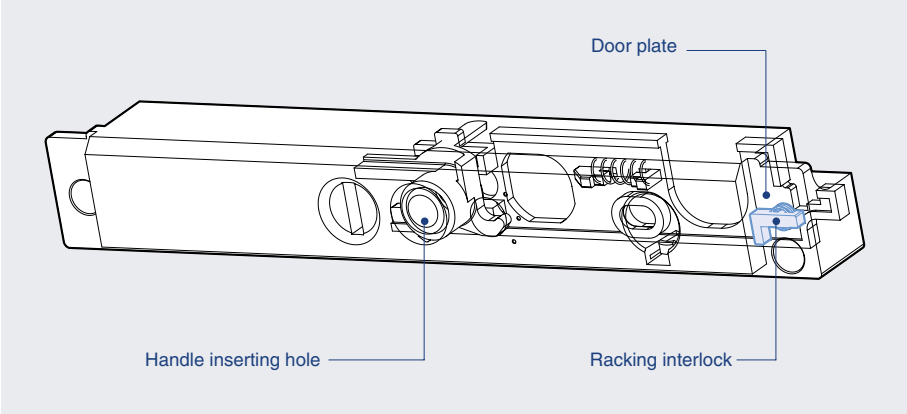
- It is available only when the control block is in the mode of auto-connection.

Body Supporter [BSP]



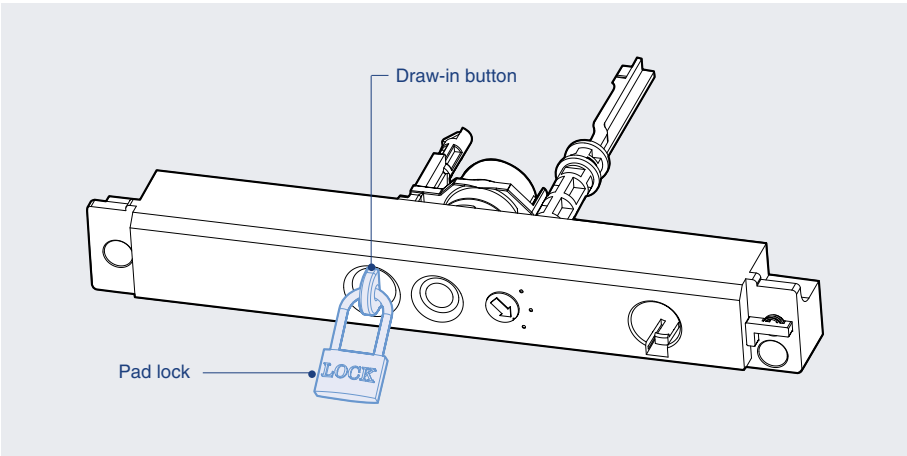
- It interlocks the main body of circuit breaker and cradle mechanically to fix the former in connected position. Therefore, all draw-in/outs are not available.

Racking Interlock [RI]



- When panel door is opened, Draw in/out handle doesn't be inserted. Thus, panel handle can be inserted only when panel door is closed.

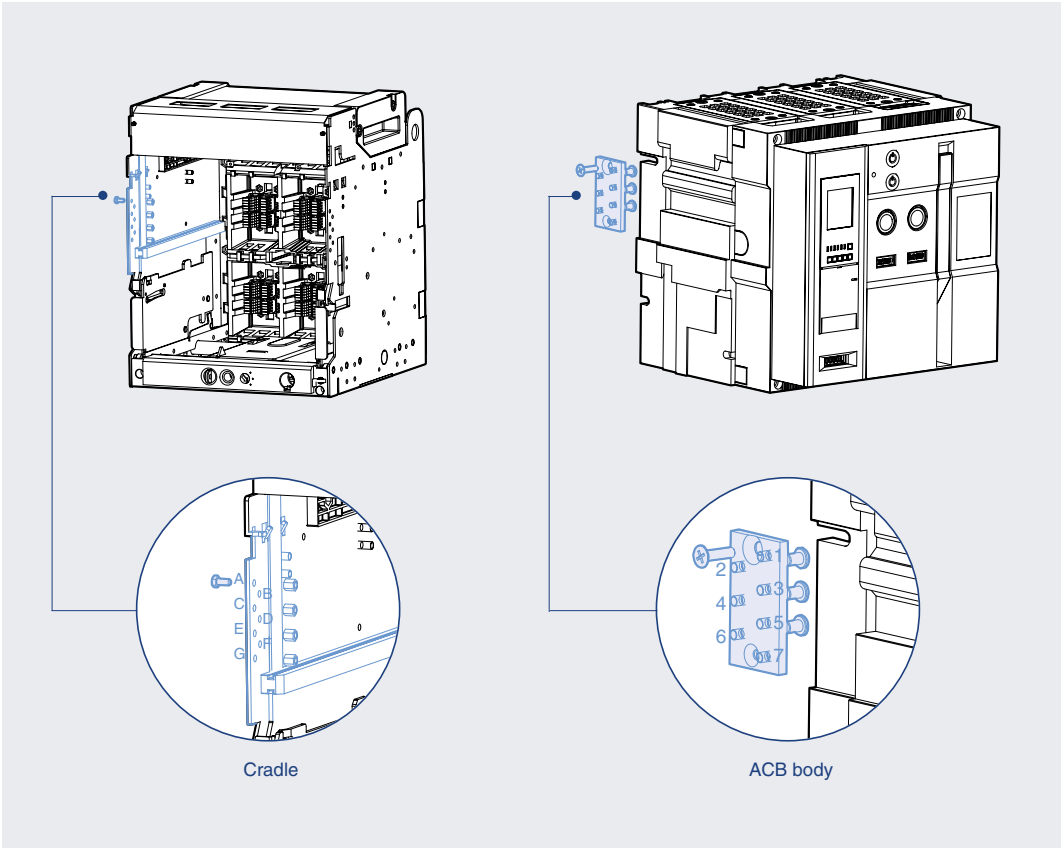
Pad Lock / Position Lock [PL]



ACB is subject to restriction regarding moving in connected, test, disconnected when drawing in or out. If main body of ACB is placed in 3 positions, it is locked and stopped when drawing in or out.

- As shown in the figure, if draw-in/out button pops out, it means locking is operating.
- To continue Draw-in/out operation, release lock by pushing Draw-in/out button
- In case it is locked as shown in the figure above, main body of ACB can not be drawn in or out into the cradle.
- For the lock device, user has to purchase it. (Ø5 ~ Ø6)

Miss Insertion Prevent Device [MIP]



- When the main body of ACB is inserted to the cradle, if the ratings of ACB does not match with cradle, it mechanically prevents ACB from being inserted into cradle of ACB.
- The installation method is variable according to ratings.

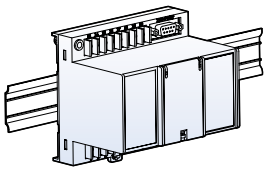
Cradle	ACB
ABCD	567
ABCE	467
ABCF	457
ABCG	456
ABDE	367
ABDF	357
ABDG	356
ABEF	347

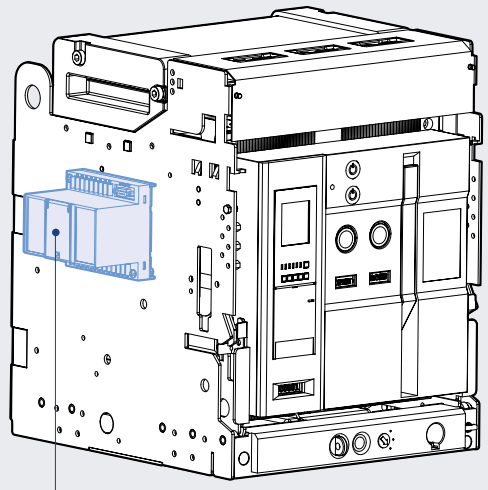
Cradle	ACB
ADEF	237
ADEG	236
ADFG	235
AEFG	234
BCDE	167
BCDF	157
BCDG	156
BCEF	147

Cradle	ACB
ABEG	346
ABFG	345
ACDE	267
ACDF	257
ACDG	256
ACEF	247
ACEG	246
ACFG	245

Cradle	ACB
BCEG	146
BDEF	137
BDEG	136
BDFG	135
CDEF	127
CDEG	126
CEFG	124
DEFG	123

UVT Time Delay Controller [UDC]





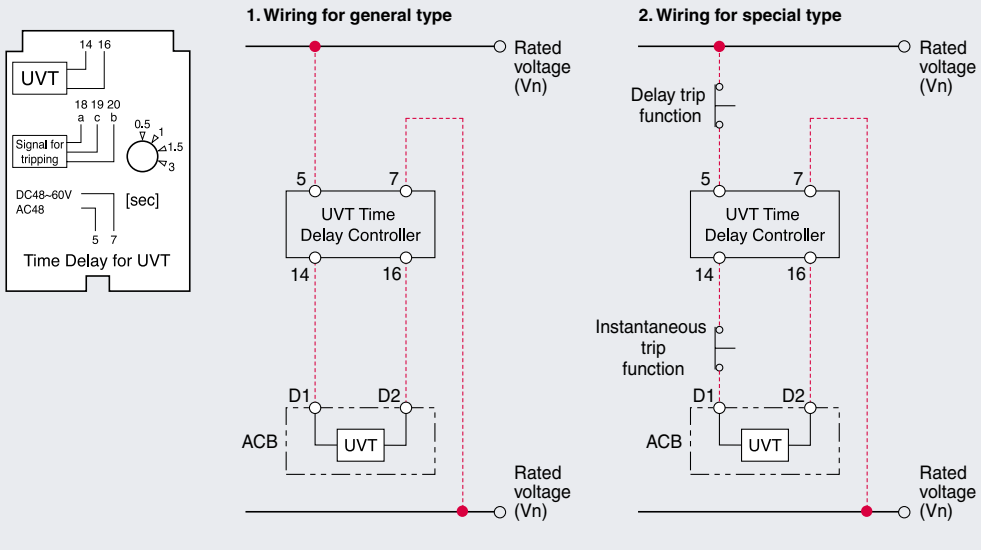
- UVT is a device which makes ACB tripped automatically to prevent the accident on load side due to under voltage or power breakdown. There are two types, Instantaneous type and time delay type.
- It can be installed on the rail or to the cradle.
- Instantaneous type: only available with UVT coil.
-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

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

Rated voltage [Vn]		Operating voltage range [V]		Power consumption (VA or W)		Trip time[s]
DC [V]	AC [V]	Pick up	Drop out	Inrush	Steady-state	
48~60	48	0.65~0.85 Vn	0.4~0.6 5Vn	200	5	0.5, 1, 1.5, 3
100~130	100~130					
200~250	200~250					
-	380~480					

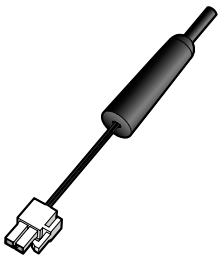
Note) Operating voltage range is the min. rated standard for each rated voltage (Vh).

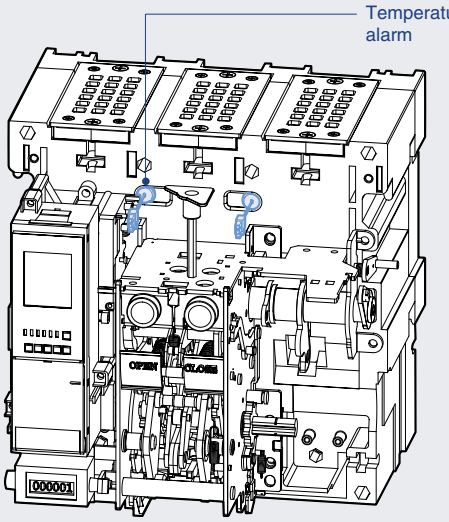
2. Wiring



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

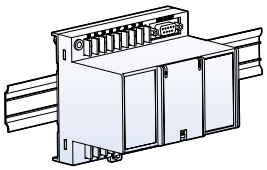
Temperature Alarm [TM]

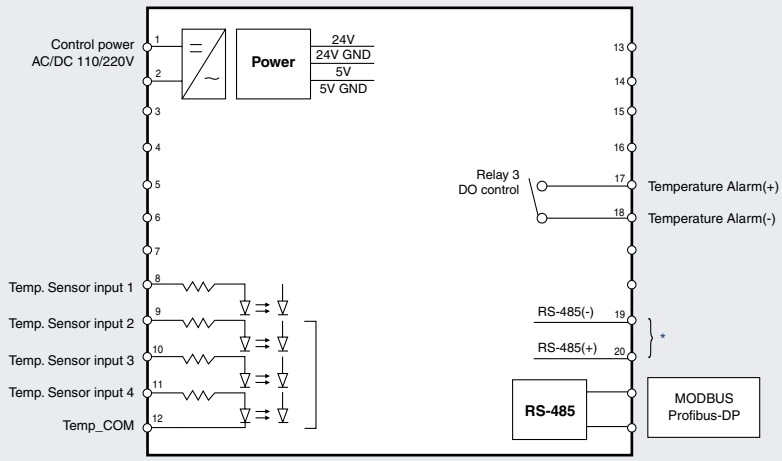




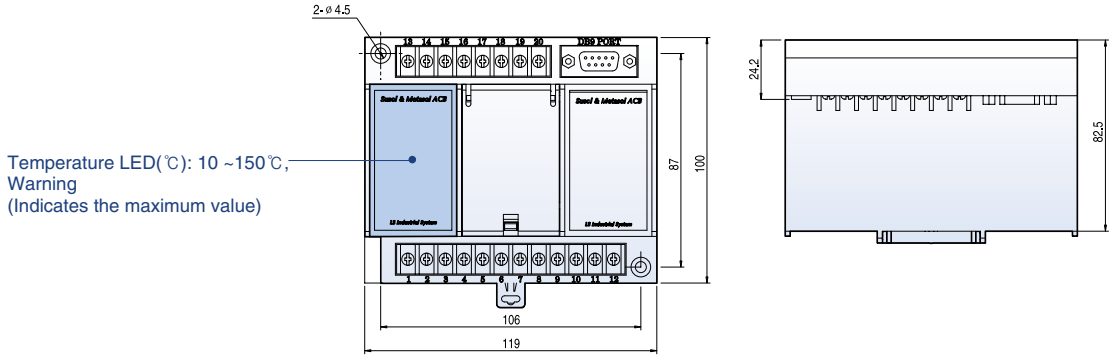
- Temperature Alarm Unit is a device to show the temperature through a sensor inside of ACB.
- The temperature sensor can be installed up to 2 and the output is connected to control terminal blocks.
- It displays the maximum temperature of them and transmits through a network.
- If the temperature is higher than a standard, an alarm can occur.
- Temperature alarm unit communicates with Modbus / RS-485 basically, Profibus-DP need to be purchased separately.
- Temperature alarm unit is installed on the cradle or the inside of panel.

Temperature alarm



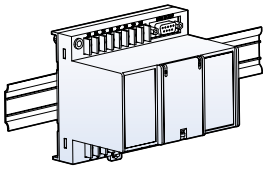


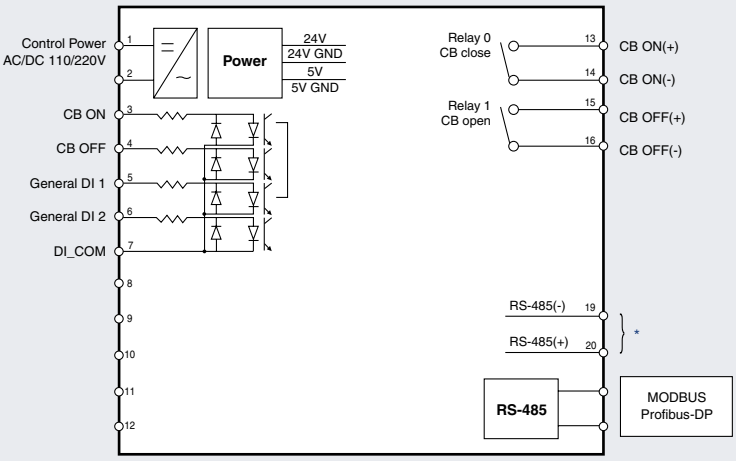
*In case of using Profibus-DP communication, it needs to communicate with ACB trip relay.



Remote I/O Unit [RCO]

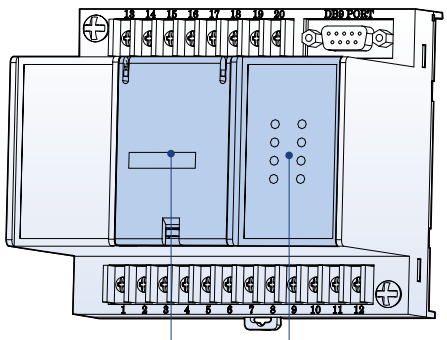
Remote I/O Unit





*In case of using Profibus-DP communication, it needs to communicate with ACB trip relay.

Classification		Applied range	Remarks
CB control	Contact switching capacity	AC230V 16A / DC30V 16A	
	Max. switching capacity	3680VA, 480W	
Alarm	Contact switching capacity	AC230V 6A / DC25V 6A	Induction load (cos∅=0.4, L/R=7ms)
	Max. switching capacity	1880VA, 150W	



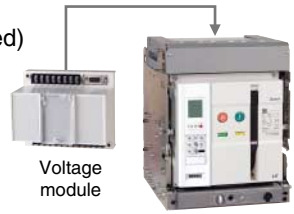
- Baud rate setting
- Comm. address setting
- Temperature setting

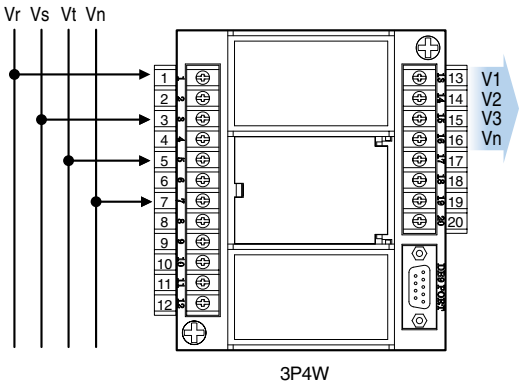
- Remote I/O unit has the I/O contact which can trip or close the ACB from the remote site by communication.
- For the General DO, the output of DI1 or DI2 is selectable.
- Remote I/O Unit communicates with Modbus / RS-485 communication basically, Profibus-DP need to be purchased separately.
- It supports SBO (Select Before Operation) function and guarantees the control reliability.
- Remote I/O Unit can be installed on the cradle of ACB or the inside of panel.

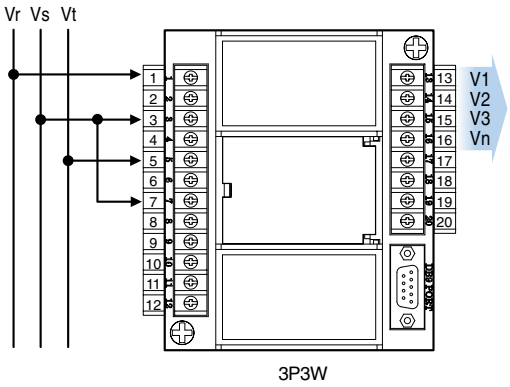
LED		Status
1	DI1	Indicates digital Input #1condition
2	DI2	Indicates digital Input #2condition
3	DO ON	Indicates temperature alarm output is ON
4	DO OFF	Indicates temperature alarm output is OFF
5	CB ON	Indicates circuit break close condition
6	CB OFF	Indicates circuit break open condition
7	RUN LED	Indicates unit run condition
8	CB ERROR	Indicates circuit break terminal Disconnection / control Err condition

Voltage module

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



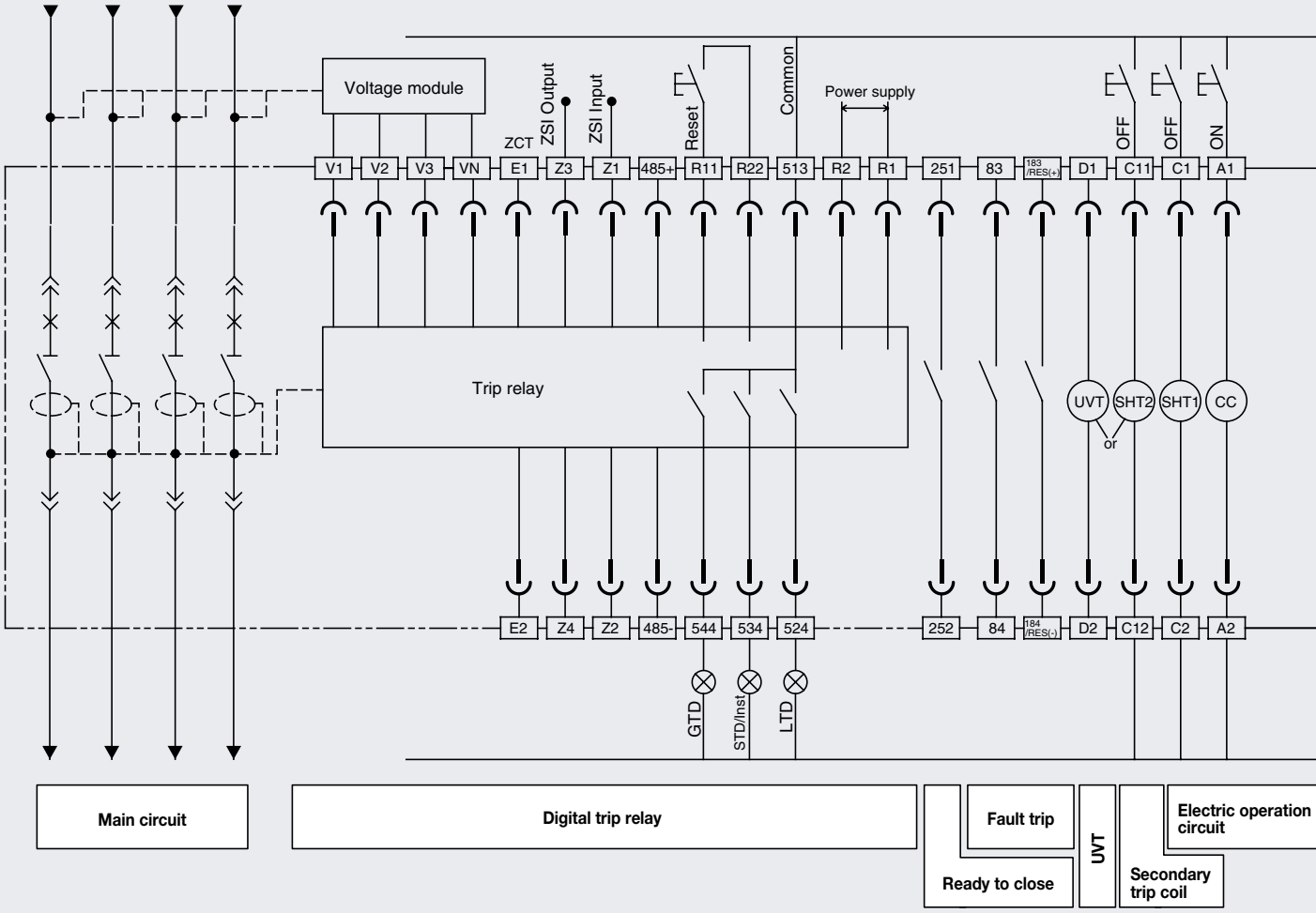




Electrical diagram

Susol

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

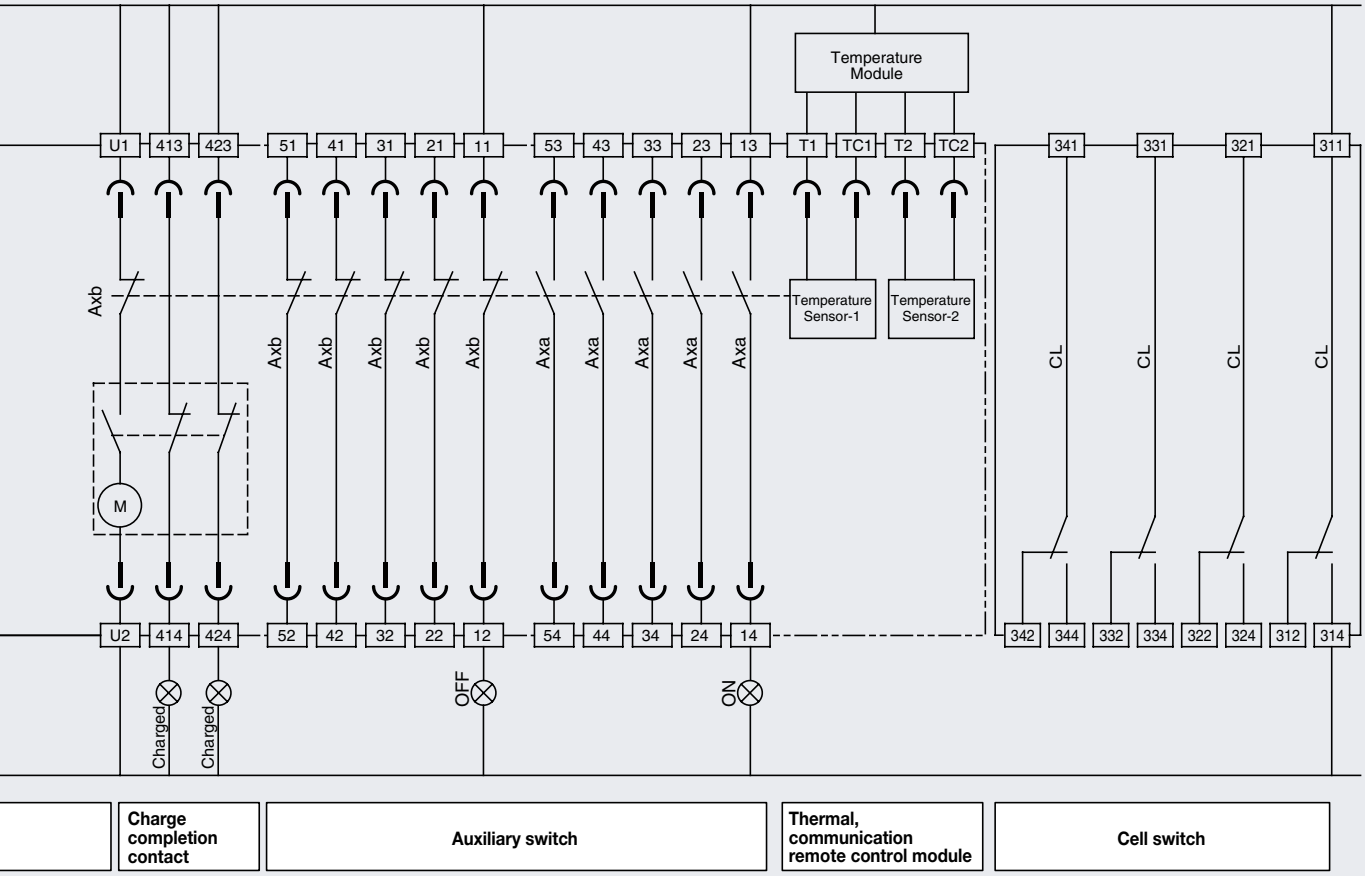


Terminal code description

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
R11 R22	Alarm reset (Trip cause LED, Alarm contact)
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 "OFF-Charging"
3. The standard of auxiliary contact is 3a3b. The auxiliary switch in above diagram is composed of 5a5b. See 48 page 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 33 for the connection of Trip relay and the page 43 for UVT.
7. For connecting RS-485 verify if the polarity is correct



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

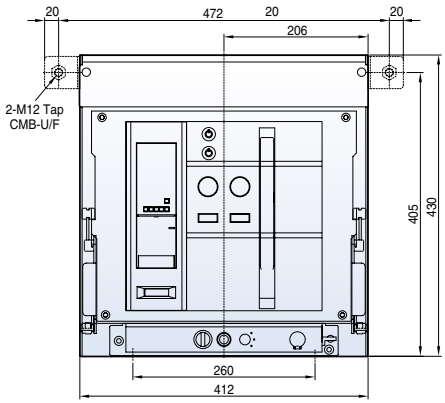
Accessory code description

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
SHT1	Shunt tripping device 1
SHT2	Shunt tripping device 2
UVT	UVT coil

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

Draw-out type 4000AF (800~2000A : AH-08~20E)

Front view



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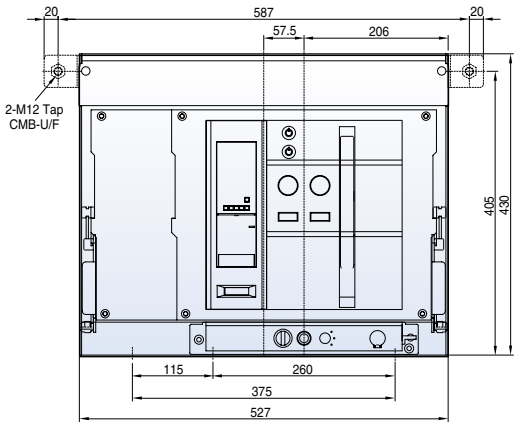

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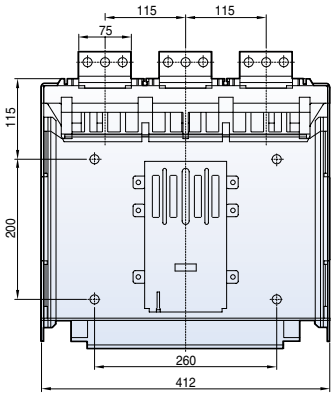
Vertical type



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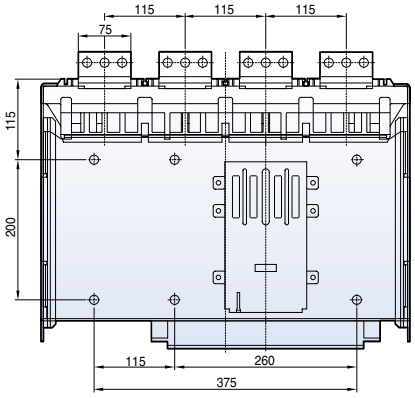

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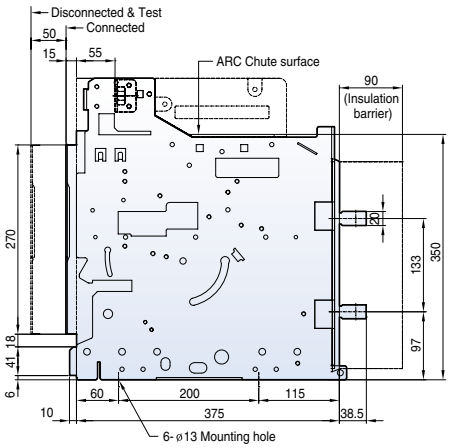

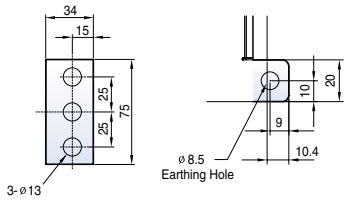

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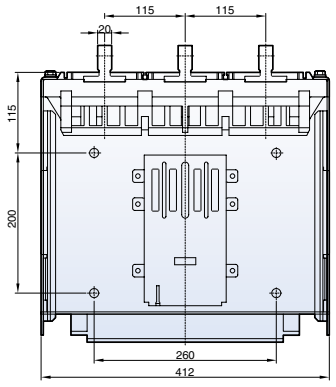
Horizontal type



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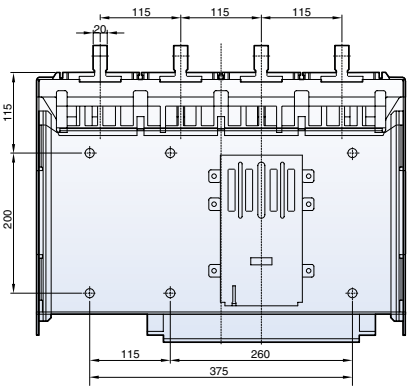

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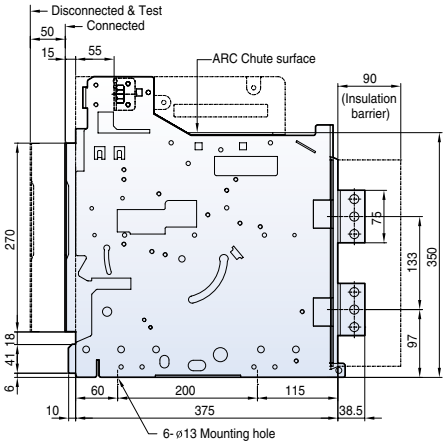
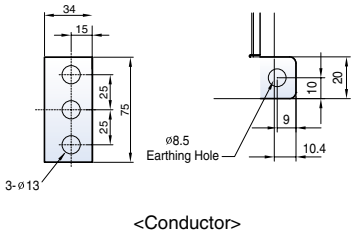
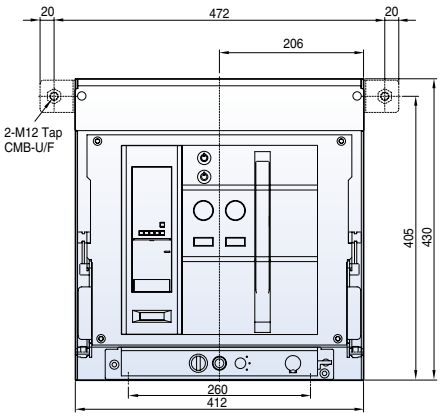




<Conductor>

Draw-out type 4000AF (3200A : AH-40E)

Front view



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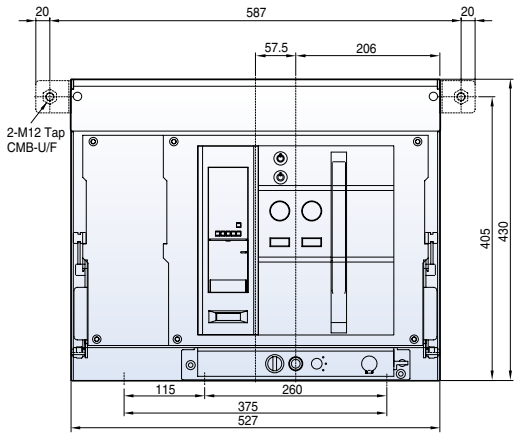

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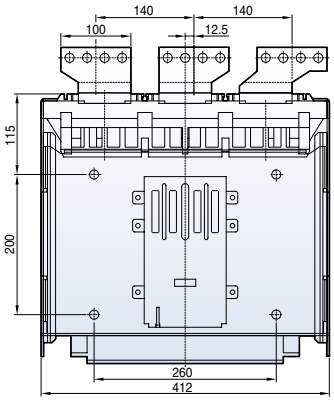
Vertical type



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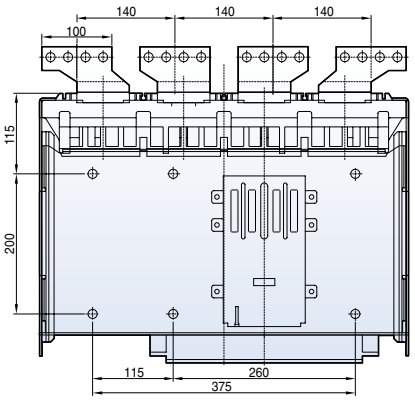

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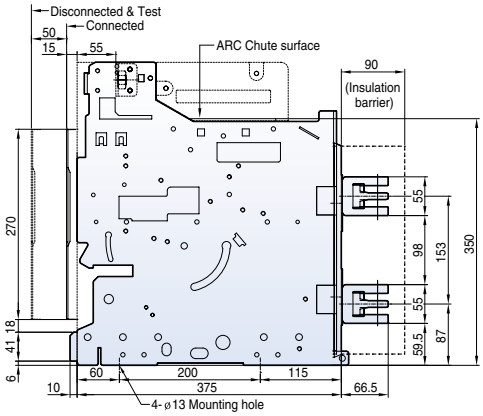
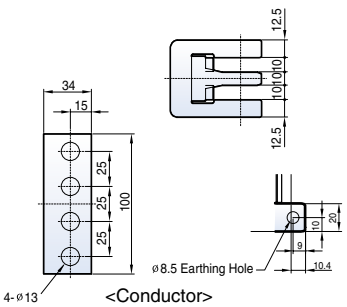
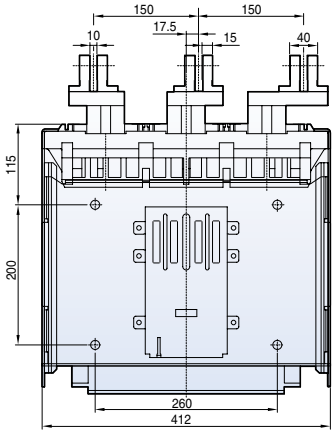




Horizontal type



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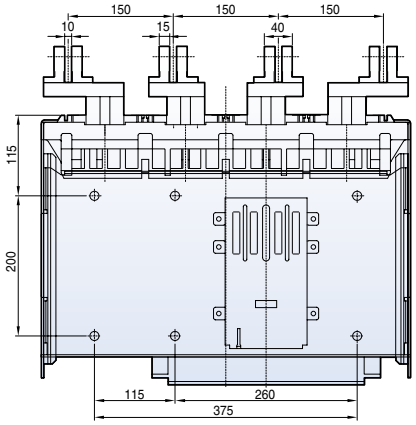

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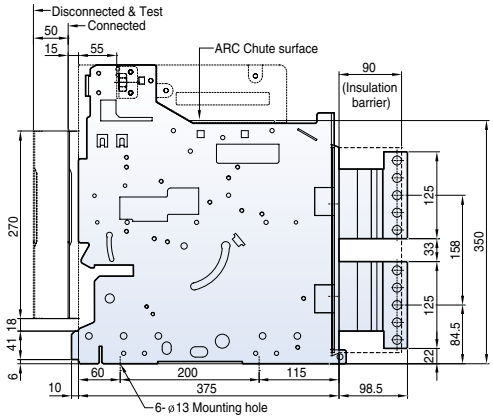
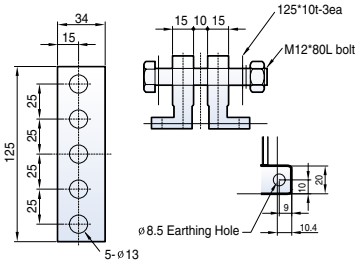
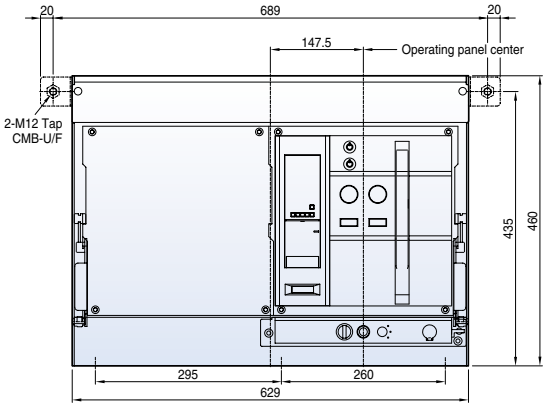




<Conductor>

Draw-out type 4000AF (3200~4000A : AS-32~40F)

Front view



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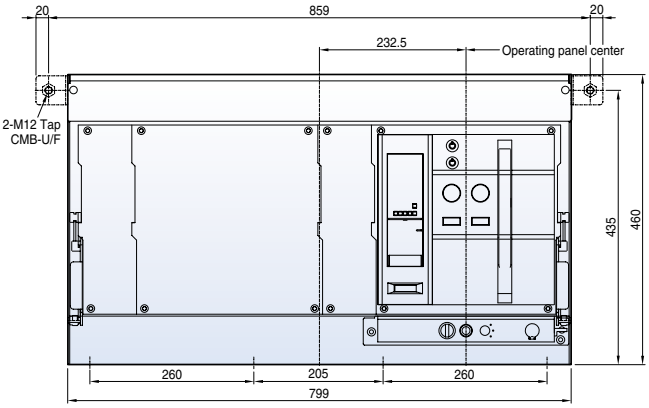

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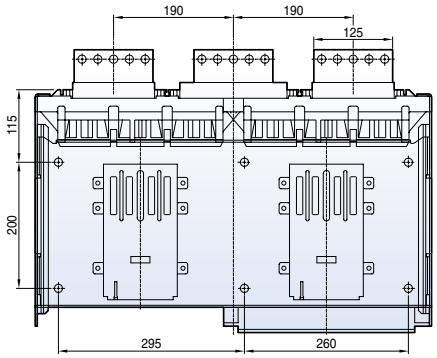
Vertical type



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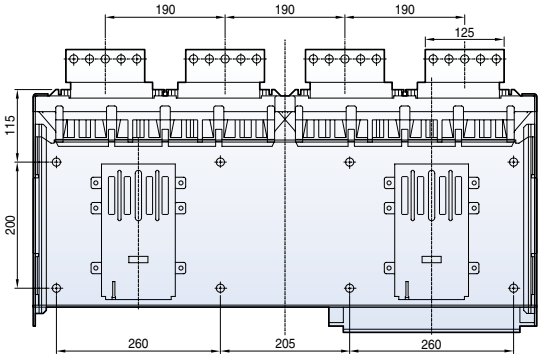

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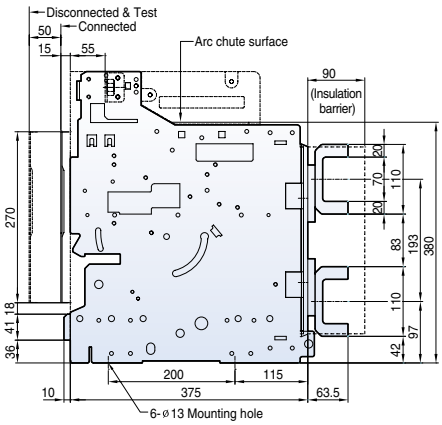

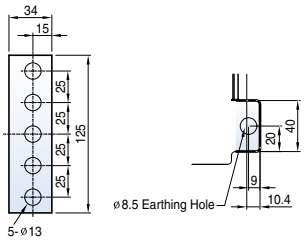

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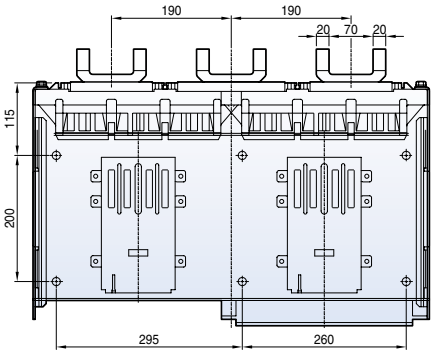
Horizontal type



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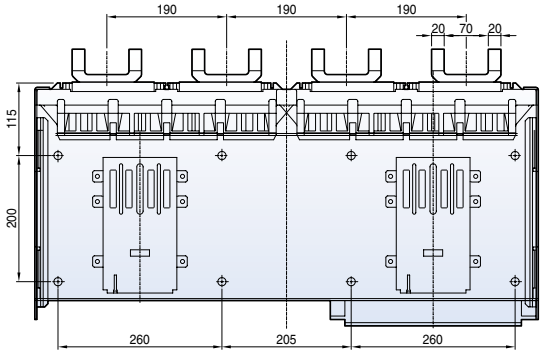

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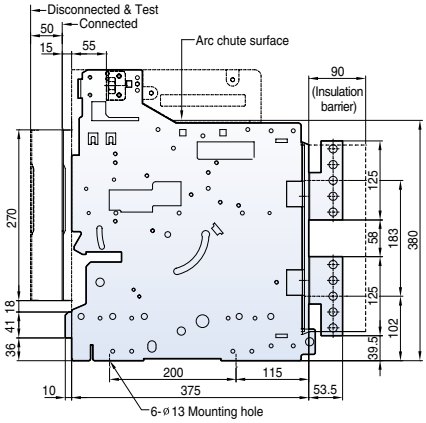
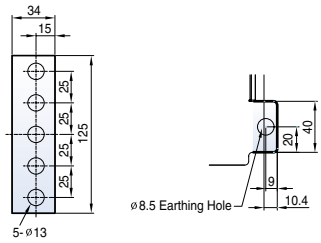
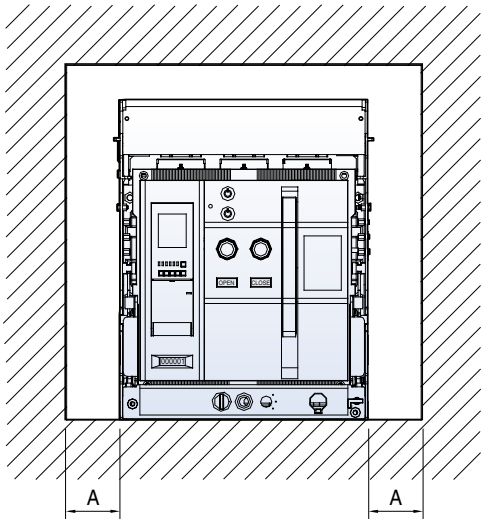


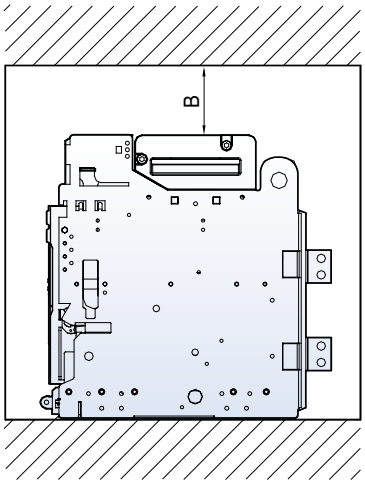


<Conductor>

Insulation voltage

You should keep the isolation distance between ACB and panel as below table.



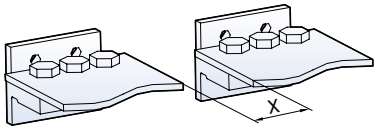


Type		A	B
Fixed	AH	50	150
Draw out	AH	50	150

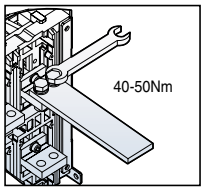
Note) When drawing the distribution panel, it is available to use regardless of the distance between ACB and the wall of the panel because Susol ACB(draw-in/out type) extinguishes the arc in the Arc Chute and Arc Cover clearly.

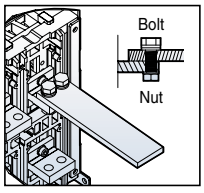
Minimum isolation distance

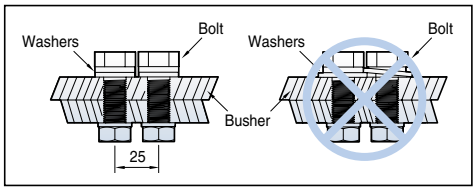
For the safety, all the electric charging parts need to be installed over minimum isolation distance.



Insulating voltage (Ui)	Minimum isolation distance (X min)
600V	8 mm
1000V	14 mm







Screw type	Tightening torque			
	Standard(kgf · cm)	Tolerance	Standard(N.m)	Tolerance
M8	135	±16	13.3	±1.6
M10	270	±32	26.5	±3.2
M12	480	±57	46.6	±5.6

Temperature derating

Temperature derating

Frame	Rated current	ACB terminal	Applicable busbar size										
				Horizontal type					Vertical type				
				40℃	45℃	50℃	55℃	60℃	40℃	45℃	50℃	55℃	60℃
4000AF AH - E	800A	20t×75×1ea	5t×100×3ea	800A	800A	800A	800A	800A	800A	800A	800A	800A	800A
	1600A		5t×100×4ea	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A	1600A
	2000A		10t×100×3ea	2000A	2000A	2000A	2000A	2000A	2000A	2000A	2000A	2000A	2000A
	3200A	10t×100×3ea	10t×125×3ea	3200A	3200A	3100A	3000A	2900A	3200A	3200A	3150A	3050A	2950A
4000AF AS - F	3200A	20t×125×2ea	10t×100×4ea	3200A	3200A	3100A	3000A	2900A	3200A	3200A	3150A	3050A	2950A
	4000A		10t×125×4ea	4000A	4000A	3900A	3750A	3600A	4000A	4000A	3900A	3800A	3700A

Altitude

Susol ACB is designed for operation at altitudes under 2000m. At altitudes higher than 2000m, emitting heat is lowered and operating voltage, continuous current capacity, and breaking capacity will be reduced. Durability of the insulation is also reduced according to the atmosphere pressure. According to the below table, change the ratings upon a service condition.

Item \ Altitude [m]	2000m	3000m	4000m	5000m
Withstand voltage [V]	3500	3150	2500	2100
Average insulating voltage [v]	1000	900	700	600
Max. using voltage [V]	690	590	520	460
Current compensation constant	1×In	0.98×In	0.96×In	0.94×In

Operating conditions

Ambient temperature

ACB devices can operate under the following temperature conditions
- The electrical and mechanical characteristics are stipulated for an ambient temperature of -5°C to +40°C
- The average temperature should be within + 35°C
- Reduce the continuous conducting current when the temperature is over 45°C (refer to temperature derating)
- Storage condition : -20°C to + 60°C is recommended.

Environment

Under clean air;
Maximum temperature + 40°C (relative humidity should be under 85%)
Maximum temperature + 20°C (relative humidity should be under 90%)
Do not apply under corrosive or ammonia gas circumstances
($H_2S \leq 0.01$ppm, $SO_2 \leq 0.01$ppm, $NH_3 \leq$ a few ppm)

*** Extreme atmosphere conditions**

Under high temperature and/or high humidity, the insulation durability, electrical and mechanical features could be deteriorated. At this conditions, increasing corrosion-resistant dealing needs. Corrosion-resistant parts need under this conditions.

Internal resistance and power consumption (per pole)

AF	Rated current (A)	Draw-out type	
		Inner resistance (mΩ)	Power consumption (W/3Phase)
AH-40E	800	15	29
	1,600	15	115
	2,000	15	180
	3,200	11	338
AS-40F	3,200	12	369
	4,000	12	576

Note) 1. Above power consumption is whole power consumption for each Rated current, 50/60Hz, 3/4pole.
2. This is inner assistant value per 1 pole.
3. Power factor = 1.0

AH, AS series Air Circuit Breakers comply with the following international standard;

IEC 60947-1

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

IEC 60947-2

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

The following certificates are available on a request.
- CE Declaration of conformity
- Certificate of conformance test (CB) - IEC 60947
- Full type test report issued by KEMA
- Letter of origin
- Taiwan TPC

CE conformity marking

The CE conformity marking shall indicate conformity to all the obligations imposed on the manufacturer, as regards his products, by virtue of the European Community directives providing for the affixing of the CE marking.
When the CE marking is affixed on a product, it represents a declaration of the manufacturer or of his authorized representative that the product in question conforms to all the applicable provisions including the conformity assessment procedures. This prevents the Member States from limiting the marketing and putting into service of products bearing the CE marking, unless this measure is justified by the proved non-conformity of the product.

IECEE CB SCHEME

The IECEE CB Scheme is the world's first truly international system for acceptance of test reports dealing with the safety of electrical and electronic products. It is a multilateral agreement among participating countries and certification organizations. A manufacturer utilizing a CB test report issued by one of these organizations can obtain national certification in all other member countries of the CB Scheme.
The Scheme is based on the use of international (IEC) Standards. If some members' national standards are not yet completely harmonized with IEC Standards, national differences are permitted if clearly declared to all other members. The CB Scheme utilizes CB Test Certificates to attest that product samples have successfully passed the appropriate tests and are in compliance with the requirements of the relevant IEC Standard and with the declared national differences of various member countries.
The main objective of the Scheme, is to facilitate trade by promoting harmonization of the national standards with international Standards and cooperation among product certifiers worldwide in order to bring product manufacturers a step closer to the ideal concept of "one product, one test, one mark, where applicable'.

- LR, ABS, DNV, KR, BV, GL, RINA, NK
- GOST, TPC

Ordering sheet

For faster quote processing, please use the following request for ordering sheet. For each section, check the applicable box or enter value cerresponding to your choice.

Receipt	LSIS co., Ltd	Order date				Distributor name
Project		Contractor				
Delivery place		Delivery date		PNL Maker		

ACB main body	Type of ACB	☐ AH (Susol) ☐ AS (Susol)	Quantity
	Frame size	☐ E (800~4000AF) ☐ F (3200~4000AF)	
	Ratings	AF	
	Rated current (CT)	A	
	Trip relay	☐ NO ☐ YES	

Type		Frequency 60Hz	Frequency 50Hz	Control voltage No	Control voltage AC/DC 100~250V	Control voltage DC 24~60V	Comm. No	Comm. Yes	Optional function Earth leakage detection	Optional function External CT ground fault
N	Normal	☐ NGO	☐ NG5	●	-	-	●	-	-	-
A	Ammeter	☐ AGO	☐ AG5	●	-	-	●	-	-	-
		☐ AG1	☐ AG6	-	●	-	●	-	-	-
		☐ AG2	☐ AG7	-	-	●	●	-	-	-
		☐ AZ0	☐ AZ5	●	-	-	●	-	●	-
		☐ AZ1	☐ AZ6	-	●	-	●	-	●	-
		☐ AZ2	☐ AZ7	-	-	●	●	-	●	-
		☐ AE0	☐ AE5	●	-	-	●	-	-	●
		☐ AE1	☐ AE6	-	●	-	●	-	-	●
		☐ AE2	☐ AE7	-	-	●	●	-	-	●
		☐ AC1	☐ AC6	-	●	-	-	●	-	-
		☐ AC2	☐ AC7	-	-	●	-	●	-	-
		☐ AK1	☐ AK6	-	●	-	-	●	●	-
		☐ AK2	☐ AK7	-	-	●	-	●	●	-
		☐ AX1	☐ AX6	-	●	-	-	●	-	●
		☐ AX2	☐ AX7	-	-	●	-	●	-	●

Type		Frequency 60Hz	Frequency 50Hz	Control voltage AC/DC 100~250V	Control voltage DC 24~60V	Comm.	Optional function Earth leakage detection	Optional function External CT ground fault	Optional function Pre-Trip Alarm
S	Supreme meterr	☐ SC1	☐ SC6	●	-	●	-	-	-
		☐ SC2	☐ SC7	-	●	●	-	-	-
		☐ SK1	☐ SK6	●	-	●	●	-	-
		☐ SK2	☐ SK7	-	●	●	●	-	-
		☐ SX1	☐ SX6	●	-	●	-	●	-
		☐ SX2	☐ SX7	-	●	●	-	●	-
		☐ SA1	☐ SA6	●	-	●	-	-	●
		☐ SA2	☐ SA7	-	●	●	-	-	●

Note) - Standard function: Ground fault detection
- Communication function is not available under no control voltage
- S(Supreme) Meter is also available for generator protection
- S Meter needs the accessory(VDM) for voltage measurement

ACB main body	No.of poles	☐ 3-pole ☐ Standard type (R, S, T, N)					
	Installation type	☐ Draw-out type					
	Closing type	☐ Manual closing					
		☐ Electrical closing					
		• Charge method: Charging completion contact(1b) is basically installed			☐ Standard type (OFF-Charge method) ☐ Rapid auto-reclosing type (ON-Charge method)		
		• Motor operating voltage		☐ AC/DC 100V~130V ☐ AC/DC 200V~250V	☐ DC 125V ☐ DC 380V~415V	☐ DC 24V~30V ☐ AC 440V~480V	☐ AC 48V~60V ☐ AC 48V
	Closing voltage	☐ AC/DC 100V~130V	☐ DC 125V	☐ AC/DC 200V~250V	☐ DC 24V~30V	☐ DC 48V~60V	☐ AC 380V~480V ☐ AC 48V
	Trip voltage	☐ AC/DC 100V~130V	☐ DC 125V	☐ AC/DC 200V~250V	☐ DC 24V~30V	☐ DC 48V~60V	☐ AC 380V~480V ☐ AC 48V
ACB cradle	Cradle type	☐ No safety shutter (E class)			☐ Safety shutter attachment (F class)		
	Terminal connection	☐ Manual connection			☐ Automatic connection		
	Connections	☐ Horizontal		☐ Vertical		☐ Front connection	
		☐ Line: Horizontal, Load: Vertical		☐ Line: Vertical, Load: Horizontal		☐ Separate order/ User Installation	

ACB accessory	ACB Main body	Standard accessory	• Aux. contact(AX)	☐ Standard type (3a3b, Standard installation)		☐ Extended type (5a5b) Note)		☐ High capacity (5a5b) Note)
			• Key Lock(K1, K3)			☐ Single key, K1 (ON - Lock)		☐ Double key, K3 (ON - Lock)
			• Undervoltage trip device (UVT, Instantaneous)					
			☐ AC/DC 100V~130V	☐ AC/DC 200V~250V	☐ DC 125V	☐ DC 24V~30V	☐ DC 48V~60V	☐ AC/DC 380V~480V ☐ AC 48V
			• Mechanical operation contact (MOC), Door Interlock (DI)			☐ Non-attachment type		☐ Attachment type
			• Mechanical interlock (MI)			☐ Non-attachment type		☐ Attachment type
			• Counter(C) Note 2)			☐ Non-attachment type		☐ Attachment type
			• Miss insertion preventive device (MIP)			☐ Non-attachment type		☐ Attachment type
			• Double shunt coil(SHT2)			☐ Non-attachment type		☐ Attachment type
			• Ready-to-close switch(RCS)			☐ Non-attachment type		☐ Attachment type
			• Trip alarm switch, Manual reset button(AL, MRB)			☐ Non-attachment type		☐ Attachment type
			☐ Key interlock (K2, ON - Lock)			☐ ON/OFF Button Lock		☐ Temperature Alarm
	ACB Cradle	Standard accessory	☐ Safety shutter lock(STL)					
			☐ Zero arc space(ZAS)					
	Separate purchase	Main body mounting	☐ Insulation barrier(IB)					
			☐ Slow closing lever(SL)					
		Cradle mounting	• Cell switch(CL)	☐ 4c	☐ 8c			
			☐ Door interlock(DI)					
			• Mechanical operation contact (MOC)			☐ Standard type (10a10b)		☐ High capacity(10a10b)
			• Mechanical Interlock (MI)			☐ Wire type (2 terminals)		☐ Wire type (3 terminals)
			• Shortening b-contact (SBC, 4b Max)		☐ 1b	☐ 2b	☐ 3b	☐ 4b
			• Miss insertion preventive device (MIP)			☐ Non-attachment type		☐ Attachment type
			☐ Cradle mounting block(CMB)	☐ Safety control cover(SC)				
			☐ Racking interlock(RI)	☐ Insulation barrier(IB) Note 2)				
		External mounting	• UVT time delay controller(UDC)					
			☐ AC/DC 100V~130V	☐ AC/DC 200V~250V	☐ DC 125V	☐ DC 48V~60V	☐ AC 380V~480V	☐ AC 48V
			☐ Door frame (DF)	☐ Condenser trip device (CTD)			☐ OCR tester	
			☐ Dust cover(DC)	☐ Profibus-DP Comm.(PC)		☐ Temperature alarm(TM)		☐ Remote I/O(RCO)

Note) Aux. contact with extended/high capacity type adopts the rapid auto-reclosing method and available up to 6a6b.

Green Innovators of Innovation

Safety Instructions

- For your safety, please read user's manual thoroughly before operating.
- Contact the nearest authorized service facility for examination, repair, or adjustment.
- Please contact a qualified service technician when you need maintenance.
  Do not disassemble or repair by yourself!
- Any maintenance and inspection shall be performed by the personnel having expertise concerned.

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CHEONG-JU PLANT

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Specifications in this catalog are subject to change without notice due to continuous product development and improvement.

Global Network

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2013. 11 Susol Nuclear power plant Air Circuit Breakers (E) 2013. 07/(01) 2013. 11 Printed in Korea STAFF