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Anantpuram	Bhilai	Gorakhpur	Kolhapur	Nasik	Srinagar	
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Amravati	Bilaspur	Jabalpur	Madurai	Pondicherry	Tirupati	
Akola	Bijapur	Jabli	Malda	Rajkot	Trichy	
Angul	Calicut	Jamshedpur	Mangalore	Rourkela	Trivandrum	
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• Gurgaon - Haryana • Sonapat - Haryana • Kundli - Haryana • Karnal - Haryana • Jabli - Himachal Pradesh



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Customer Care No. :  
18004190198

www.hplindia.com



Air Circuit Breaker

ACB Cat. 01/18

intelliPROTECT intelligent protection

Arc chute



## Air Circuit Breaker 400A - 6300A

Aux. Switch

Motor Assembly



intelliPROTECT  
intelligent protection RANGE



Air Circuit Breaker

**intelliPROTECT**

intelligent protection

RANGE



## Corporate Information

HPL's vision of creating a niche, as a major player in India Electrical Industry with commitment to state-of-the-art technology & world class products.

HPL Group possess 7 State-of-the-art Manufacturing Facilities, ISO 9001 : 2000; ISO 14001; OHSAS 18001 certified located at Gurgaon, Kundli, Panipat, Jabli Himachal Pradesh and Guwahati having 5,00,000 sq. feet covered area to manufacture products conforming to International and India standards.

HPL Products Profile has the following Strategic Business Units :

- LV Switchgears
- LV Protection Devices
- Metering and Energy Management Systems
- Lighting
- Luminaires
- Wires & Cables
- Solar Solutions
- Electrical Wiring Accessories

HPL Products are tested at CPRI, ERDA, ERTL, NPL etc. according to Indian Standards, whereas MCB's Rewireable Switches & Electronic Energy Meters carry ISI marking. Further HPL products have approvals from CPWD state PWD's, MES, BSNL & many more Institutional users.

HPL Group with Head Office at Noida (U.P.) has extensive Sales & Marketing Network of 90 Branch offices & Representative Offices, over 2000+ Authorised Dealers and 27000+ Retailers across country, who are committed to provide solutions and services to customer's delight. HPL is also exporting its products to Middle East, SAARC and European Countries.

HPL range of ACBs are in technical collaboration with **LS Industrial Systems Co. Ltd**, Korea, a US\$ 25 billion group. LS Industrial Systems is a leader in LV, MV & HV Switchgear, Circuit Breakers, Automation, Large scale systems, GIS and Green technologies solutions.



# Air Circuit Breaker *intelliPROTECT* intelligent protection

Range of HPL Air Circuit Breaker meets your demands for high breaking capacity and optimized panel size. Wide range of accessories and connection methods offerings meet the various installation needs & simplified switch board design.

It provides 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.



# Air Circuit Breaker Contents

## Overview

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# Overview

## Product Introduction

### Background Information on Development of intelliprotect series of ACB

It is developed to meet high breaking capacity required for elevated electricity demand, to satisfy compact distribution panel size demanded in markets, to achieve 100% N phase current conducting capacity on single phase load (3Ø4w line), and to increase users convenience by providing various accessories and connecting methods. Moreover, providing total solutions for customers by developing a relay, to achieve absolute protective coordination, and to correspond with IT system.

### Product Offer :

Ics = 100%Icu at 500Vac

1600 AF	3200 AF	5000 AF	6300 AF
65kA	70kA / 85kA	85kA / 100kA	120kA



• Also, ACB with 50kA (Ics = Icu) available upto 3200A.



### Characteristics

- Modularity & Compactness
- Various Accessories Possession.
- Comply with IEC / IS
- Acquire multi-rating (690Vac, 500Vac) standard for all models.
- Impulse Withstand Voltage (Uimp) : 12kV.
- Ics = 100%Icu.
- Icw Ratings :
  - 50kA (for 1 Sec.) to 100kA (for 1 sec.)
  - Also, Icw for 2sec. & 3 sec. available
- Enhanced Life
- Multiple terminal connection choice
- N phase current conducting capacity : 100%
- Suitable for installations with IT system
- Possess various customer oriented digital trips (N, A & P Type)
- The wide spectrum of protection functions with a flexibility of thresholds & trip times make it suitable to meet any type of installation need.
- Advanced measurement function, communication function & additional protection function over and above traditional made it a true choice for any application.

## External Configuration



Fixed type ACB

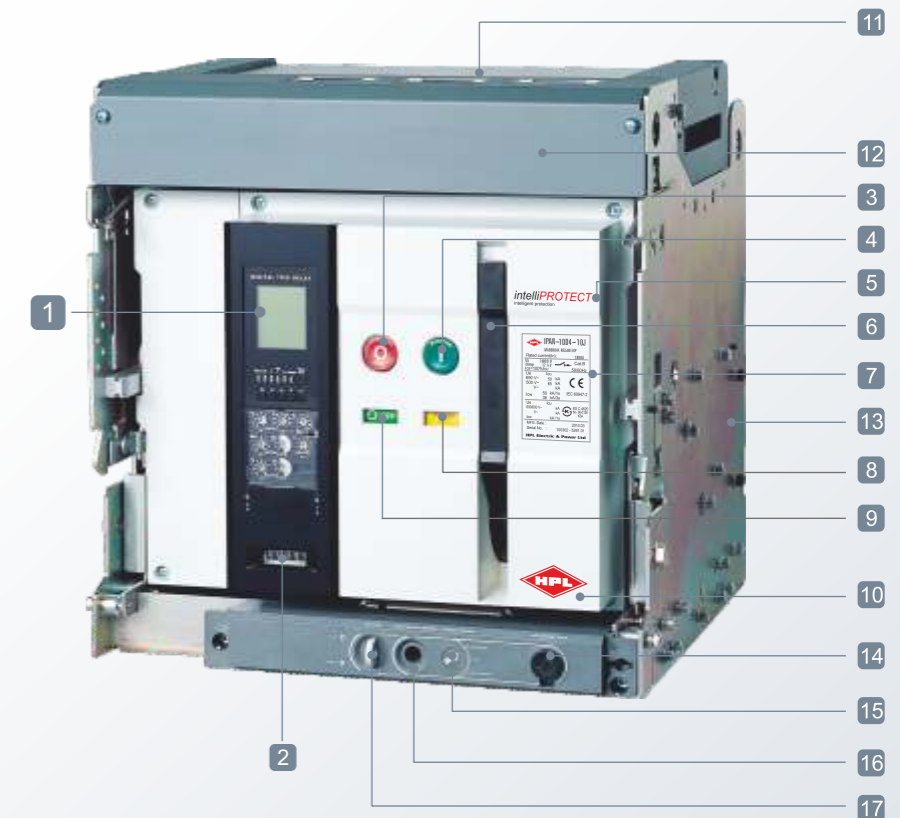
### Terms

1. Trip relay
2. Counter
3. OFF button
4. ON button
5. Series name
6. Charge handle
7. Rated name plate
8. Charge / Discharge indicator
9. ON / OFF indicator
10. Company Logo
11. Arc cover
12. Terminal cover
13. Cradle
14. Handle storage space
15. Position indicator
16. Draw-out handle
17. Pad lock button
18. Arc chute
19. Control cover

Available in Fixed and Draw out - Three pole & Four pole - manual & Electrical draw-out version through out the range.

Offers all the functions & characteristics of a power circuit breaker in a very compact volume.

Also standardization & optimisation of switchboard is simplified - result of innovative integration of components and performance. The uniform height & depth made it a perfect choice of switchboard Manufacturers.



Draw-out ACB

# Overview

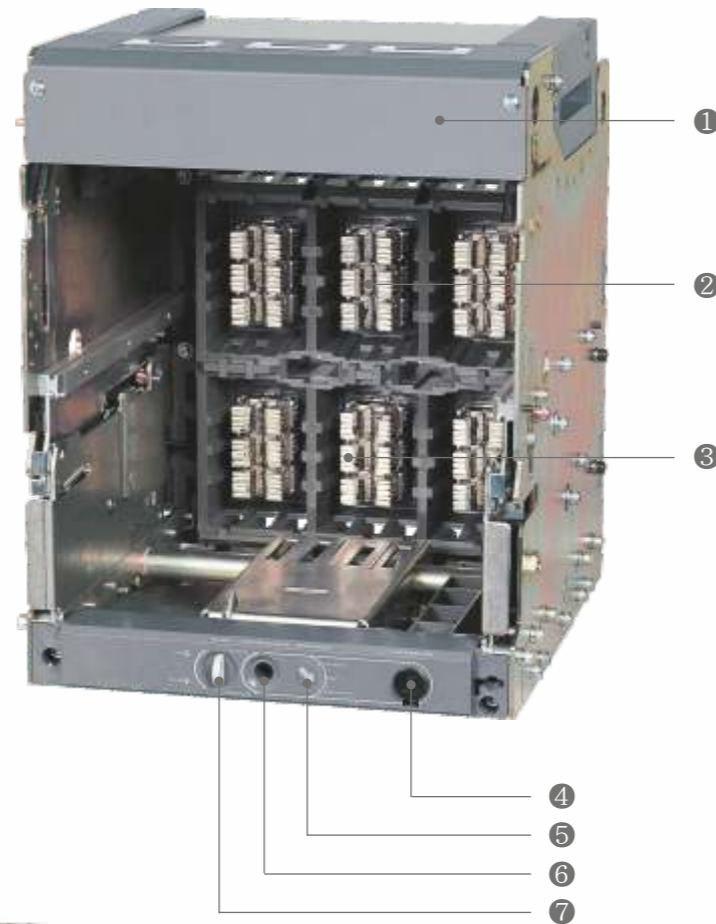
ACBs are built with very strong robust metal structure - can withstand very high level of thermal / dynamic stresses extending there by reliability and dependability along with safety for each installations.

The fixed part of drawout ACB have safety shutters & racking interlock features to extend safety when ACB is withdrawn.

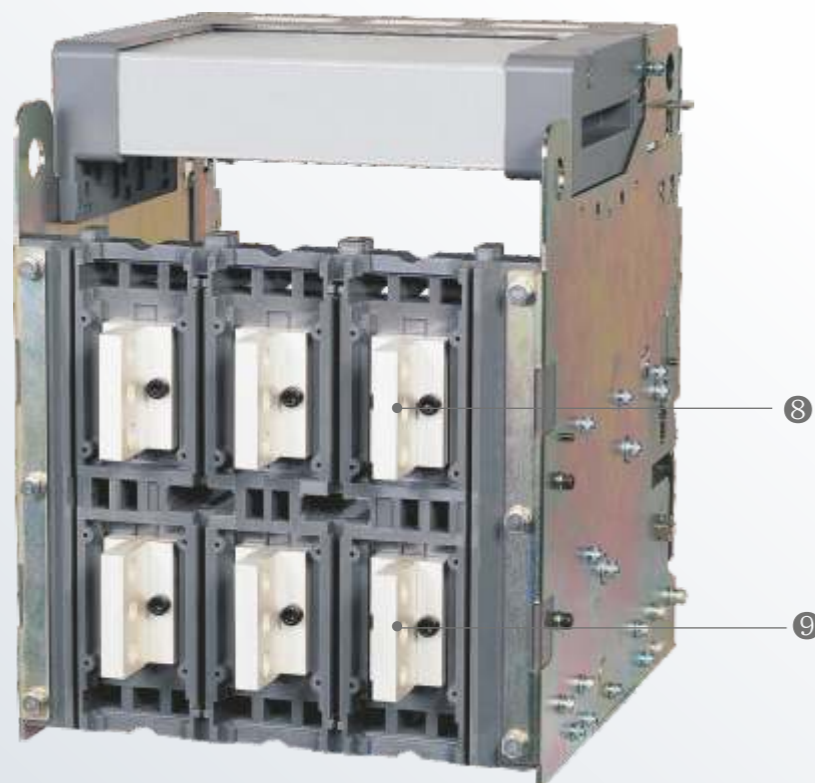
## Terms

1. Terminal cover of control circuit
2. Cradle finger (Line side)
3. Cradle finger (Load side)
4. Handle storage space
5. Position indicator
6. Draw-out handle
7. Pad lock button
8. Connecting conductor (Line side)
9. Connecting conductor (Load side)

**Cradle (Internal)**

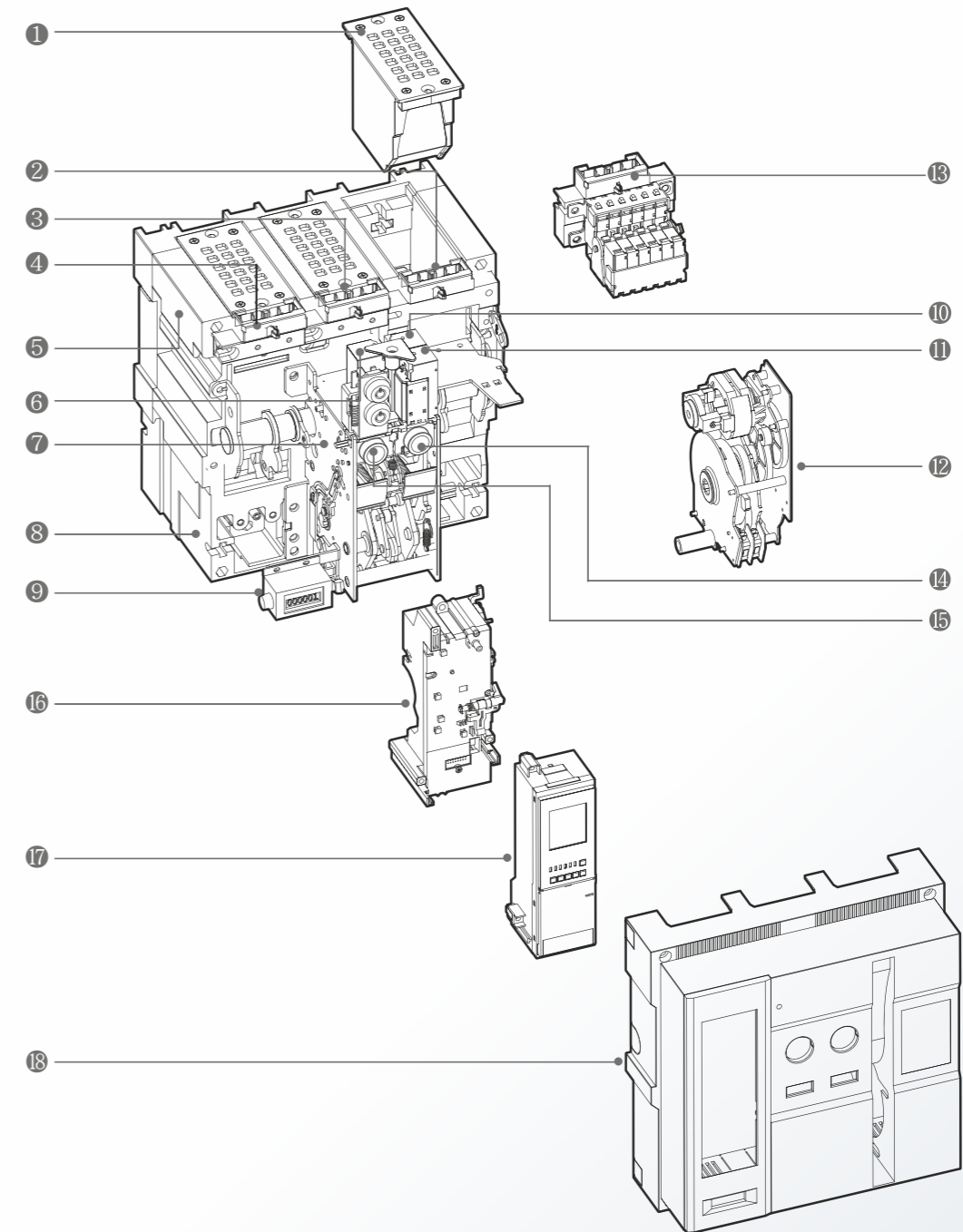


**Cradle (Rear)**



Provision for multiple connection options meets various installation needs and offers ease of termination while fabricating the switch board and during installation.

# Internal Configuration

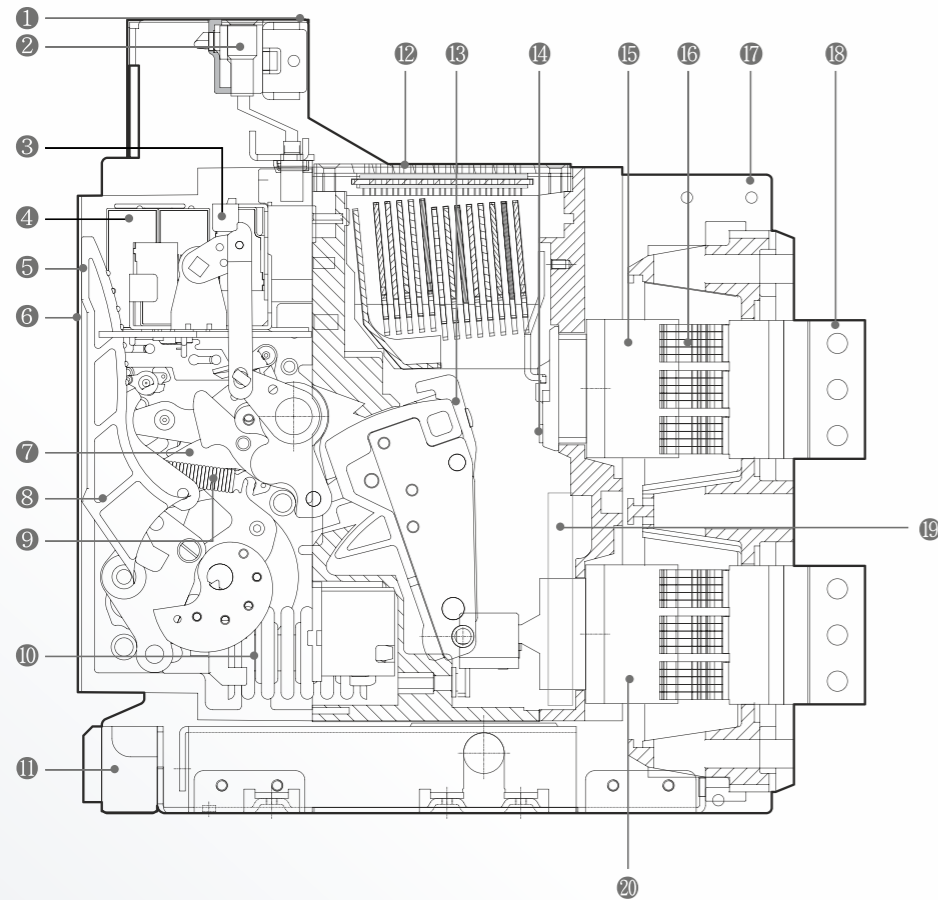


## Terms

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



# Overview



### Terms

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



# Multiple Connections

## Various installations methods

### Standard connection



Horizontal type



Vertical type



Front type

### Mixed connection



Horizontal / Vertical type



Vertical / Horizontal type



Horizontal / Front type



Vertical / Front type



Front / Horizontal type

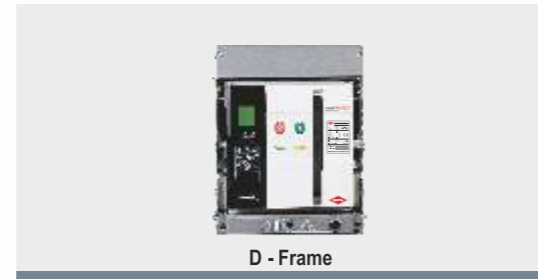


Front / Vertical type

- Front connection type is available to be connected regardless of the depth of main circuit terminal, and it is suited for the panel required for limited installation space.
- The vertical & horizontal type terminal are module type which can compose the vertical & horizontal terminals by rotating 90°  
Above 3200AF - please consult.

# Ratings

Ratings



<b>Type</b>	Ampere frame (AF)		
Rated current(A)	(In max)	at 40°C	
Setting current (A) *	Control trip relay (... × In max)		
Rated current of neutral pole (A)			
Rated insulation voltage(V)	(Ui)		
Rated operating voltage(V)	(Ue)		
Rated impulse withstand voltage (kV)(Uimp)			
Frequency (Hz)			
Number of poles (P)			
Rated breaking capacity (kA sym)	IEC 60947-2 KS C 4620	220V/230V/380V/415V	
AC 50/60Hz		460V/480V/500V	
		550V/600V/690V	
Rated service breaking capacity (kA) (Ics)	... % × Icu		
Rated making capacity (kA peak)	IEC 60947-2 KS C 4620	220V/230V/380V/415V	
AC 50/60Hz		460V/480V/500V	
		550V/600V/690V	
Rated short-time withstand current (kA)	(Icw)	1 sec	
		2 sec	
		3 sec	
Operating time (ms)	Maximum total breaking time		
	Maximum closing time		
Life cycle (time)	Mechanical	Without maintenance	
		With maintenance	
		Electrical	Without maintenance
			With maintenance
Connections **	Draw-out / Fixed	Horizontal connection	
		Vertical connection	
		Front connection	
		Mixed connection	
Weight (kg)	Draw-out type	Main body	
(3P/4P)		(With cradle)	Motor charging type
			Manual charging type
		Cradle only	
	Fixed type	Motor charging type	
		Manual charging type	
External dimensions (mm)		Draw-out type	
(H × W × D)		3P	
		4P	
		Fixed type	
	3P		
	4P		
Trip relay	N, A, P type		

AN06	AN08	AN10	AN12	AN16
630	800	1000	1250	1600
400	630	1000	1250	1600
630	800	(0.4 ~ 1.0) × In max		
400	630	1000	1250	1600
630	800			
1000				
690				
12				
50/60				
3/4				
65				
65				
50				
100%				
143				
143				
105				
50				
42				
36				
40				
80				
20,000				
30,000				
5,000				
10,000				
○				
○				
○				
○				
●				
63/74				
61/72				
29/32				
34/44				
32/42				
430 × 334 × 375				
430 × 419 × 375				
300 × 300 × 295				
300 × 385 × 295				
N, A, P type				

\* Refer to trip relay specification. \*\* ● : Standard : Line=Vertical & Load=Horizontal | ○ : Option



AS20	AS25	AS32	AS40
2000	2500	3200	4000
2000	2500	3200	4000
(0.4 ~ 1.0) × In max			
2000	2500	3200	4000
1,000			
690			
12			
50/60			
3/4			
85			
85			
85			
100%			
187			
187			
187			
85			
75			
65			
40			
80			
15,000			
10,000			
5,000			
10,000			
○			
○			
○			
○			
●			
87/103			
85/101			
44/50			
44/55			
42/53			
430 × 412 × 375			
430 × 527 × 375			
300 × 378 × 295			
300 × 493 × 295			
N, A, P type			



AS50	
4000	
4000	
(0.4 ~ 1.0) × In max	
4000	
1000	
690	
12	
50/60	
3/4	
100	
100	
85	
100%	
220	
220	
187	
85	
75	
65	
40	
80	
10,000	
15,000	
2,000	
5,000	
○	
○	
○	
○	
●	
107/139	
102/145	
65/85	
61/81	
60/80	
460 × 629 × 375	
460 × 799 × 375	
300 × 597 × 295	
300 × 767 × 295	
N, A, P type	

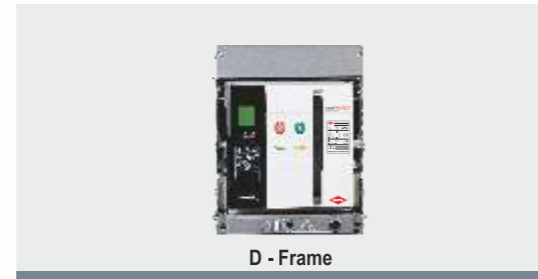


AS40	AS50	AS63
4000	5000	6300
4000	5000	6300
(0.4 ~ 1.0) × In max		
4000	5000	6300
1,000		
690		
12		
50/60		
3/4		
120		
120		
100		
100%		
264		
264		
220		
100		
90		
85		
40		
80		
10,000		
15,000		
2,000		
5,000		
○		
○		
○		
○		
●		
181/223		
179/221		
97/117		
98/123		
96/121		
460 × 785 × 375		
460 × 1015 × 375		
300 × 751 × 295		
300 × 981 × 295		
N, A, P type		

Ratings

# Ratings

Ratings



<b>Type</b>	(AF)	
Ampere frame	(AF)	
Rated current(A)	(In max)	at 40°C
Setting current (A) *	Control trip relay ( ... × In max)	
Rated current of neutral pole (A)		
Rated insulation voltage(V)	(Ui)	
Rated operating voltage(V)	(Ue)	
Rated impulse withstand voltage (kV)(Uimp)		
Frequency (Hz)		
Number of poles (P)		
Rated breaking capacity (kA sym)	IEC 60947-2 KS C 4620	220V/230V/380V/415V
AC 50/60Hz		460V/480V/500V
		550V/600V/690V
Rated service breaking capacity (kA) (Ics)	... % × Icu	
Rated making capacity (kA peak)	IEC 60947-2 KS C 4620	220V/230V/380V/415V
AC 50/60Hz		460V/480V/500V
		550V/600V/690V
Rated short-time withstand current (kA)	(Icw)	1 sec
Operating time (ms)	Maximum total breaking time	
	Maximum closing time	
Life cycle (time)	Mechanical	Without maintenance
		With maintenance
	Electrical	Without maintenance
		With maintenance
Connections **	Draw-out / Fixed	Horizontal connection
		Vertical connection
		Front connection
		Mixed connection
External dimensions (mm) (H × W × D)	Draw-out type	3P
		4P
	Fixed type	3P
		4P
Trip relay	N, A, P type	



BN16	
BN04~BN16	
400, 630, 800, 1000, 1250, 1600	
(0.4 ~ 1.0) × In max	
400, 630, 800, 1000, 1250, 1600	
1000	
690	
12	
50/60	
3/4	
-	
50	
-	
100%	
-	
105	
-	
50	
40	
80	
20,000	
30,000	
5,000	
10,000	
○	
○	
○	
●	
430 x 334 x 375	
430 x 419 x 375	
300 x 300 x 295	
300 x 385 x 295	
N, A, P type	

\* Refer to trip relay specification. \*\* ● : Standard : Line=Vertical & Load=Horizontal | ○ : Option

\* Icw for 2 sec & 3 sec - available on request.



Ratings

BN32		BS40	
BN20~BN32		BS20~B40	
2000 2500 3200		2000, 2500, 3200, 4000	
(0.4 ~ 1.0) × In max			
2000, 2500, 3200		2000, 2500, 3200, 4000	
1,000			
690			
12			
50/60			
3/4			
70			
50		70	
70			
100%			
154			
105		154	
154			
50		70	
40			
80			
15,000			
20,000			
5,000			
10,000			
○			
○			
○			
○			
●			
430 × 412 × 375		430 × 527 × 375	
430 × 527 × 375		300 × 378 × 295	
300 × 378 × 295		300 × 493 × 295	
300 × 493 × 295		N, A, P type	

BS50	
4000   5000	
4000   5000	
(0.4 ~ 1.0) × In max	
4000   5000	
1000	
690	
12	
50/60	
3/4	
85	
85	
85	
100%	
187	
187	
187	
85	
40	
80	
10,000	
15,000	
2,000	
5,000	
○	
○	
○	
-	
●	
460 × 629 × 375	
460 × 799 × 375	
300 × 597 × 295	
300 × 767 × 295	
N, A, P type	

BS40	BS50	BS63
4000	5000	6300
4000	5000	6300
(0.4 ~ 1.0) × In max		
4000	5000	6300
1,000		
690		
12		
50/60		
3/4		
120		
120		
100		
100%		
264		
264		
220		
100		
40		
80		
10,000		
15,000		
2,000		
5,000		
○		
○		
○		
-		
●		
460 × 785 × 375		
460 × 1015 × 375		
300 × 751 × 295		
300 × 981 × 295		
N, A, P type		



# Trip relay (OCR)

The trip relay of Intelliprotect provides the additional protection functions for voltage, frequency, unbalance, and other 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 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 Relay Types

	N Type	A Type	P Type
Externals			
Current protection	<ul style="list-style-type: none"> <li>L / S / I / G</li> </ul>	<ul style="list-style-type: none"> <li>L / S / I / G</li> <li>ZSI (Protective coordination)</li> </ul>	<ul style="list-style-type: none"> <li>L/S/I/G (Continuous)</li> <li>ZSI (Protective coordination)</li> </ul>
Other protection		<ul style="list-style-type: none"> <li>Earth Leakage (Option)</li> </ul>	<ul style="list-style-type: none"> <li>Earth leakage (Option)</li> <li>Over / Under current</li> <li>Over / Under frequency</li> <li>Unbalance (Voltage/Current)</li> <li>Reverse power</li> </ul>
Measurement Function		<ul style="list-style-type: none"> <li>Current (R / Y / B / N)</li> </ul>	<ul style="list-style-type: none"> <li>3 Phase voltage / Current RMS / Vector</li> <li>Power (P, Q, S), PF (3-phase)</li> <li>Energy (Positive / Negative)</li> <li>Frequency, Demand</li> </ul>
Fine Adjustment			<ul style="list-style-type: none"> <li>Fine adjustment for long/short time delay / instantaneous / ground</li> </ul>
Pre Trip Alarm			<ul style="list-style-type: none"> <li>Overload protection relays : DO (Alarm) (Ground fault is not available when using Pre trip alarm)</li> </ul>
Digital Output		<ul style="list-style-type: none"> <li>3 DO (Fixed)</li> <li>L, S/I, G Alarm</li> </ul>	<ul style="list-style-type: none"> <li>3DO (Programmable)</li> <li>Trip, Alarm, General</li> </ul>
IDMTL setting			<ul style="list-style-type: none"> <li>Compliance with IEC60255-3 SIT, VIT, EIT, DT</li> </ul>
Communication		<ul style="list-style-type: none"> <li>Modbus / RS - 485</li> <li>Profibus - DP</li> </ul>	<ul style="list-style-type: none"> <li>Modbus / RS-485</li> <li>Profibus-DP</li> </ul>
Power supply	<ul style="list-style-type: none"> <li>Self Power</li> <li>- Power source works over 20% of load current</li> </ul>	<ul style="list-style-type: none"> <li>Self Power</li> <li>- Power source works over 20% of load current.</li> <li>- External power source are required for comm.</li> <li>AC / DC 100~250V</li> </ul>	<ul style="list-style-type: none"> <li>AC/DC 100~250V</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">                     Basic protection function (L/S/I/G) is still under normal operation without control power.                 </div>
RTC timer	<ul style="list-style-type: none"> <li>Available</li> </ul>	<ul style="list-style-type: none"> <li>Available</li> </ul>	<ul style="list-style-type: none"> <li>Available</li> </ul>
LED for Trip Info.	<ul style="list-style-type: none"> <li>Long time delay</li> <li>Short time delay / Instantaneous</li> <li>Ground fault</li> </ul>	<ul style="list-style-type: none"> <li>N type</li> </ul>	<ul style="list-style-type: none"> <li>N type</li> </ul>
Fault Recording		<ul style="list-style-type: none"> <li>10 records (Fault / Current / Date and Time)</li> </ul>	<ul style="list-style-type: none"> <li>256 records (Fault/Current/Date and Time)</li> </ul>
Event Record			<ul style="list-style-type: none"> <li>256 records (Content, Status, Date)</li> </ul>
Operating Button	<ul style="list-style-type: none"> <li>Reset button</li> </ul>	<ul style="list-style-type: none"> <li>Reset, Menu Up / Down, Left / Right, Enter</li> </ul>	<ul style="list-style-type: none"> <li>A Type</li> </ul>

# Trip Relays

## N Type : Normal Type

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

## A Type : Ammeter Type

- Overload protection
  - Long-time delay
  - Short-circuit protection
  - Short-time delay / Instantaneous
  - I<sup>2</sup>t On/ Off (for short-time delay)
- Ground / fault protection
  - I<sup>2</sup>t On/ off
- Realization of protective coordination by ZSI (Zonal Selective Interlocking)
- High-performance and high-speed MCU built-in- Accurate measurement with tolerance of 1.0%
- Fault recording
  - Records Max. upto 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



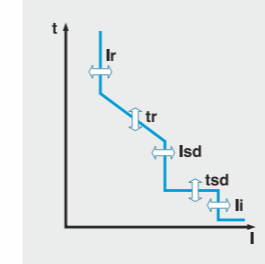
## Protection

### Long time

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

### Short time

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

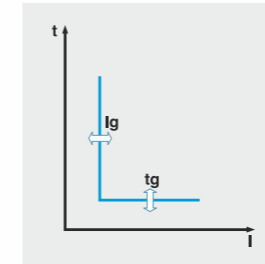


### Instantaneous

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

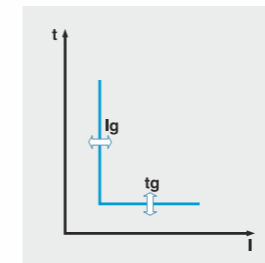
### Ground fault

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



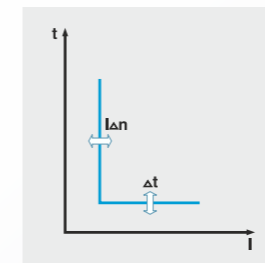
### Earth leakage (Option) For N Type Relay

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



### Earth leakage (Option) For A Type Relay

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



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

Trip Relays

Trip Relays

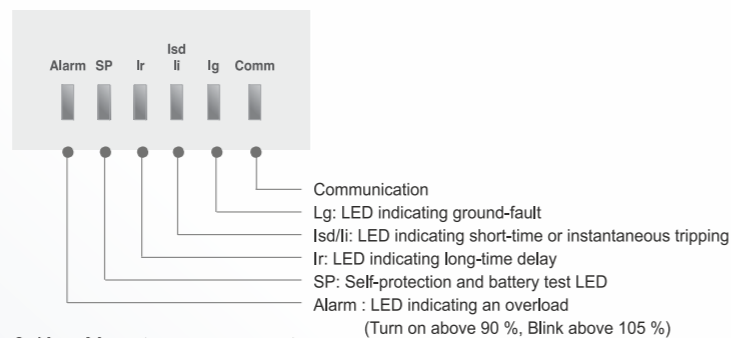
# Trip Relays

## P type: Power meter type

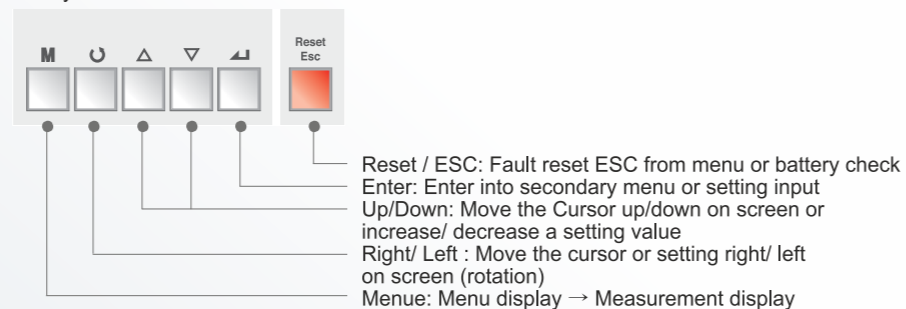
- Overload protection
    - Long-time delay
  - Short-circuit protection
    - Short-time delay / Instantaneous
    - I<sup>2</sup>t On/ Off (for short-time delay)
  - Ground / fault protection
    - I<sup>2</sup>t On/ off
  - Protection for Over Voltage/ Under Voltage/ Over frequency/ Under frequency/ Unbalance/ Reverse power
  - Realization of protective coordination by ZSI (Zonal Selective Interlocking)
  - The fine adjustable setting by knob and Key
  - IDMTL setting (SIT, VIT, EIT, DT 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
  - Fault recording
    - Records Max. up to 256 fault information about fault type, fault phase, fault value, occurrence time of fault
  - Event recording
    - Records event of device related to setting change, operation and state change (Max. up to 256)
  - SBO (Select Before Operation)
    - High reliability for control and setting change method
  - 3 DO (digital output)
    - Programmable for alarm, trip and general DO
  - Communication
    - Modbus/ RS485
    - Profibus-DP



1 Graphic LCD: Indication of measurement and information  
2 LED: Indication of trip info and overload state



3. Key: Move to menu or reset

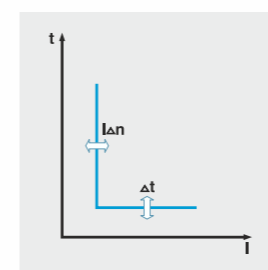
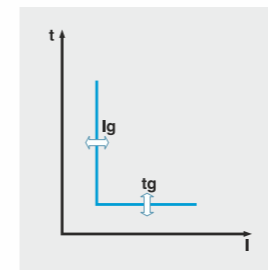
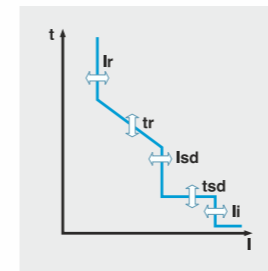


4. Iu, Ir: Long-time current setting, tr: Long-time tripping delay setting  
5. Isd: short-time current setting, tsd: Short-time tripping delay setting  
6. Ii: Instantaneous current setting  
7. Ig: Ground fault current setting, tg : Ground fault tripping delay setting  
8. Test terminal: OCR test terminal (Connected with OCR tester)

## Protection

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

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



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

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

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

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

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

Other protection	Setting range	Pick-up		Time delay(s)		
		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%)	0.2~40sec		
Reverse power	10~500 kW	1kW	± 10%			
Over power	500~5000 kW	1kW	± 10%	1.2~40sec		
Current unbalance	6% ~ 99%	1%	± 2.5% or (* ± 10%)			
Over frequency	60Hz UF_Pick-up ~ 65	1Hz	± 0.1Hz			
Under frequency	50Hz UF_Pick-up ~ 55	1Hz	± 0.1Hz			
Over frequency	60Hz 55Hz ~ OF_Pick-up	1Hz	± 0.1Hz			
Under frequency	50Hz 45Hz ~ OF_Pick-up	1Hz	± 0.1Hz			

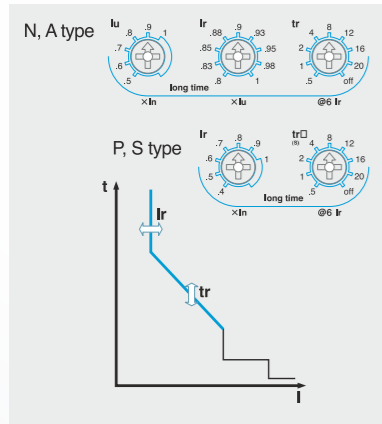
Trip Relays

Trip Relays

# Trip Relays

## Operational Characteristic

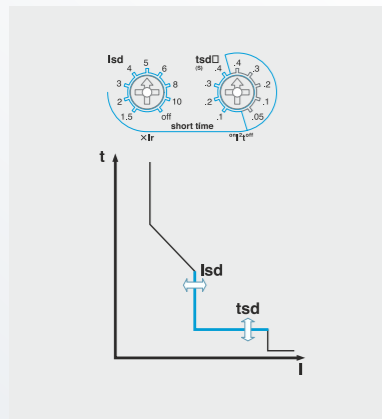
### Long-time delay (L)



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

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

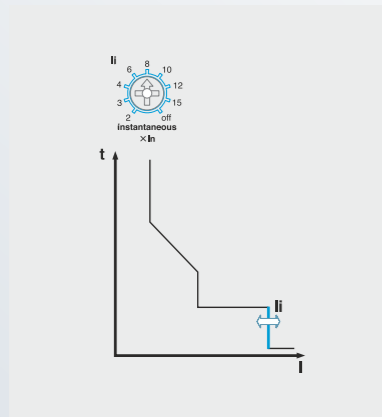
### Short-time delay (S)



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

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

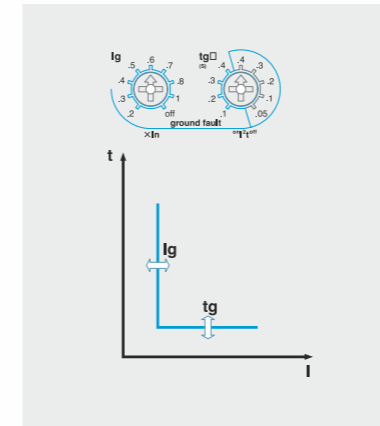
### Instantaneous (I)



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

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

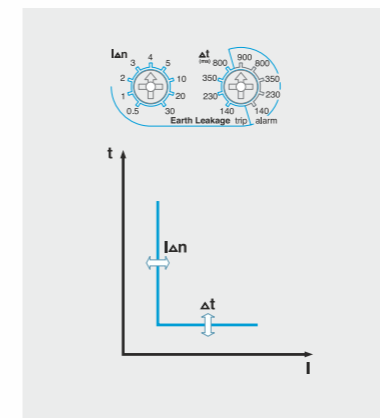
### Ground Fault (G)



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

- Standard current setting knob: Ig
  - Setting range:  $(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-Off) \times I_n$
- Time delay setting knob: 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
- Ground fault current is vector sum of each phase current. Therefore, 3Pole products may operate under its phase-unbalance including ground fault situations (R+Y+B+ (N) Phase)
- When ZSI function was set, the protection operation will take place instantaneously with input absence by downstream devices. It is advised to disable its ZSI function on the last downstream device.
- Ground-fault function 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 ground fault current above setting value after time-delay to protect the circuit from earth leakage. (A, P type)**

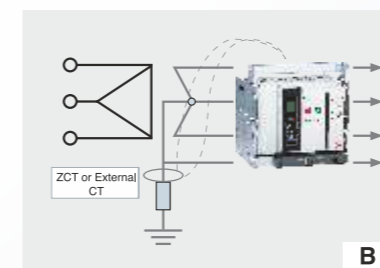
- Standard current setting knob: IΔn
  - Setting range: 0.5-1-2-3-4-5-10-20-30-Off (A)
- Time delay setting knob: Δt
  - Trip time: 140-230-350-800 ms
  - Alarm time: 140-230-350-800-950 ms
- Setting within its alarm range will prevent its breaker from tripping but activating its alarm
- This function is enabled and can be used only with standard ZCT or private external CT (secondary output 5A) selected by customers.
- 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.

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

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

※ **Guideline for the external CT usage**

- Earth-leakage protection characteristics using the standard CT which is installed inside of ACB can protect currents from 20 to 100% range on its rated current
- As rated currents on ACB increases, current that is covered by its standard CT increase as well. This can not protect against small leakage currents.
  - ex) 400A ACB Min. Earth-leakage current  $400A \times 20\% = 80A$
  - 4000A ACB Min. Earth-leakage current  $4000A \times 20\% = 800A$
- Therefore, customers are advised to install an external CT in accordance with its rated currents within its systems, And choose trip relay (E,X type; refer page no. 59) which is required with external CT usage in order to provide earth-leakage functions.



# Trip Relays

## Measurement Function

Class.	Measurement element	Detailed element	Unit	Display range	Accuracy
Current	Line current	Ia, Ib, Ic	A	80A~65,535A	± 3%
	Normal current	I <sub>1</sub>			
	Reverse current	I <sub>2</sub>			
Voltage	Line voltage	Vab, Vbc, Vca	V	60~690V	± 1%
	Phase voltage	Va, Vb, Vc			± 1%
	Normal voltage	V <sub>1</sub>			
	Reverse voltage	V <sub>2</sub>			
Angle	Line-to-line	∠ Vabla, ∠ Vabl, ∠ Vablc,	°	0~360 °	± 1 °
	Line-to-current	∠ VabVbc, ∠ VabVca			± 1 °
	Phase-to-phase	∠ VaVb, ∠ VaVc			± 1 °
	Phase-to-current	∠ Vala, ∠ Vblb, ∠ Vclc			± 1 °
Power	Active power	Pa(ab), Pb(bc), Pc(ca), P	kW	1kW~99,999kW	± 3%
	Reactive power	Qa(ab), Qb(bc), Qc(ca), Q	kVar	1kVar~99,999kVar	± 3%
	Apparent power	Sa(ab), Sb(bc), Sc(ca), S	kVA	1kVA~99,999kVA	± 3%
Energy	Active energy	WHa(ab), WHb(bc), WHc(ca), WH	kWh 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	Iunalance, Vunbalance	%	0.0~100.0	
Demand	Active power demand	Peak demand	kW	1kW~99999kW	
	Current demand	Peak demand	A	80A~65,535A	

Trip Relays

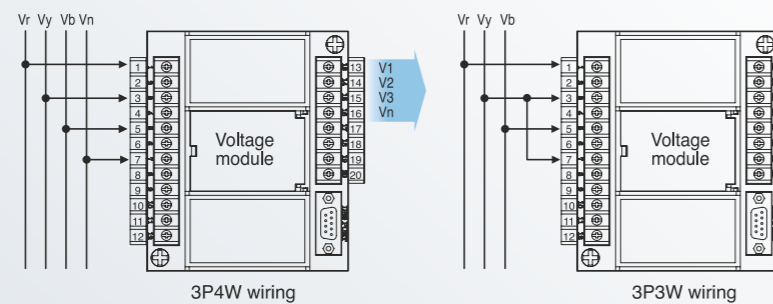
Trip Relays

## Voltage module

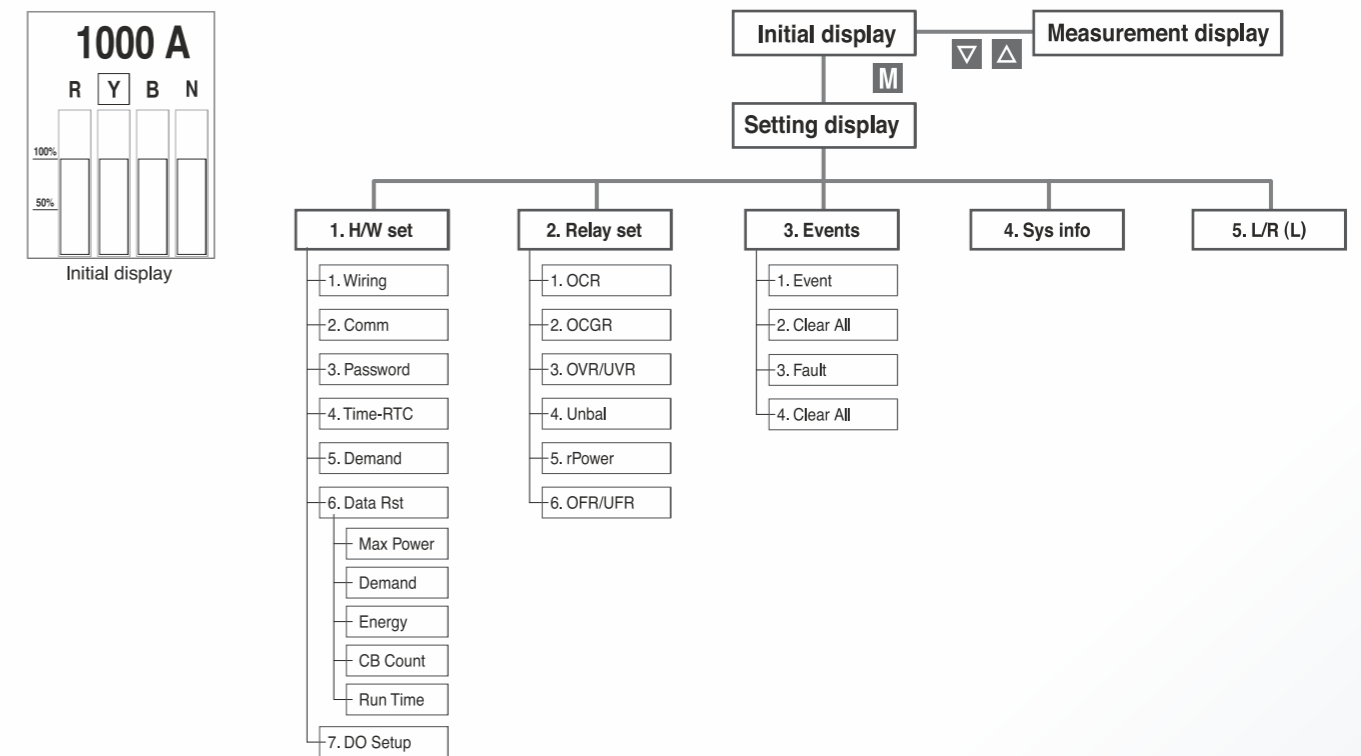


For P type Trip relay, separate voltage module is necessary to measure other element besides current (Seperate purchase is needed)

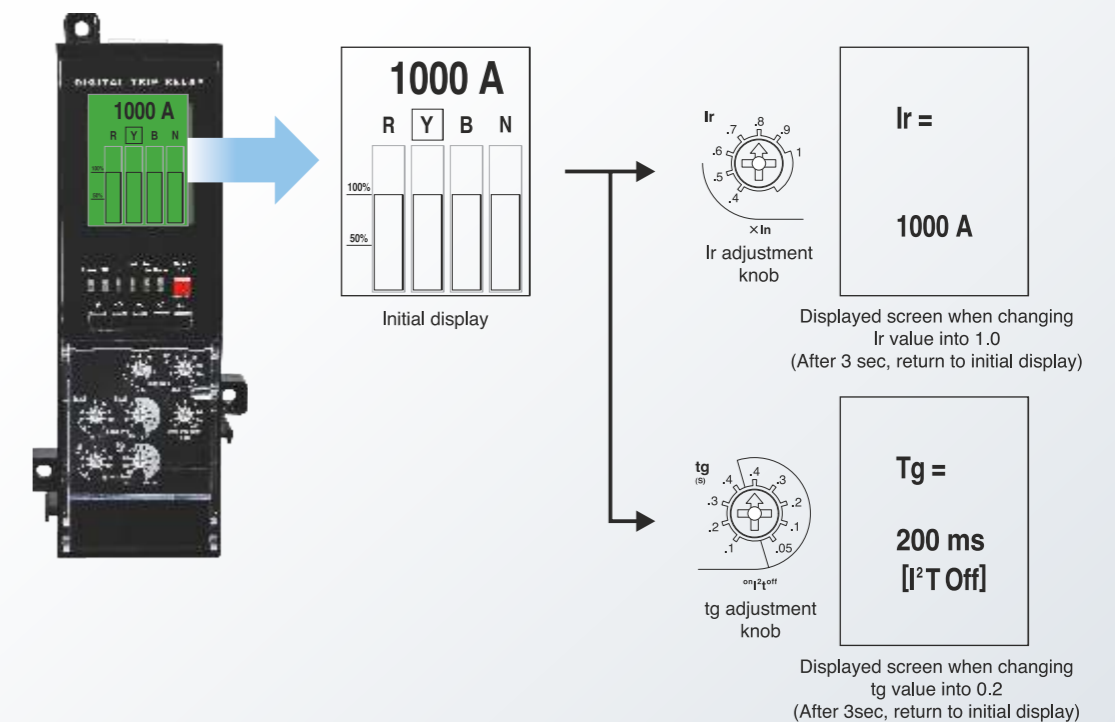
- Voltage input range : AC 60~690V



# Man Machine Interface

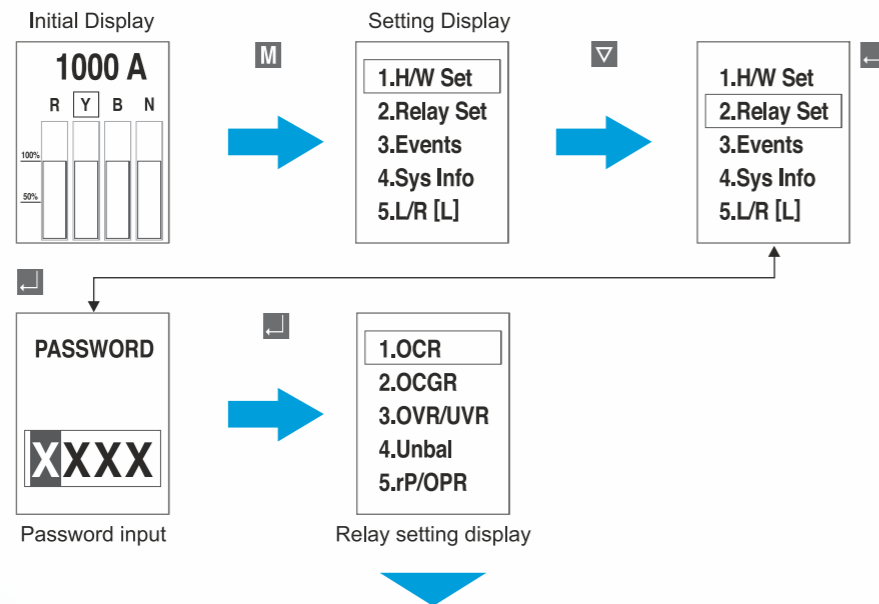


## An example of graphic LCD display



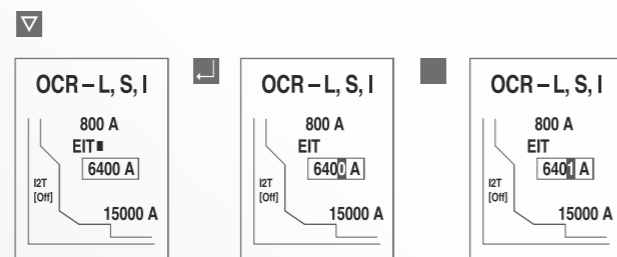
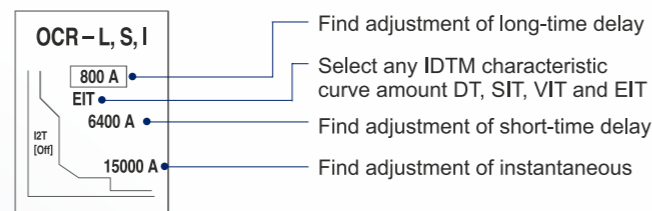
# Trip Relays

## Protection Element Setting

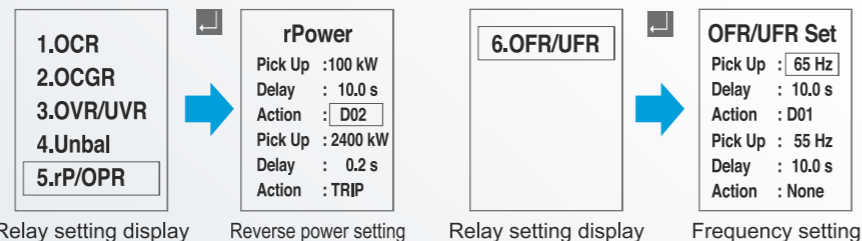
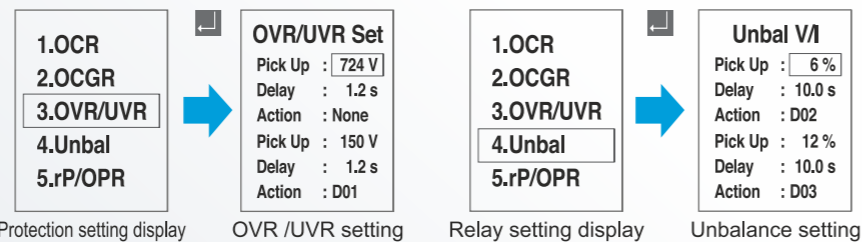


## Find adjustment of protection setting current

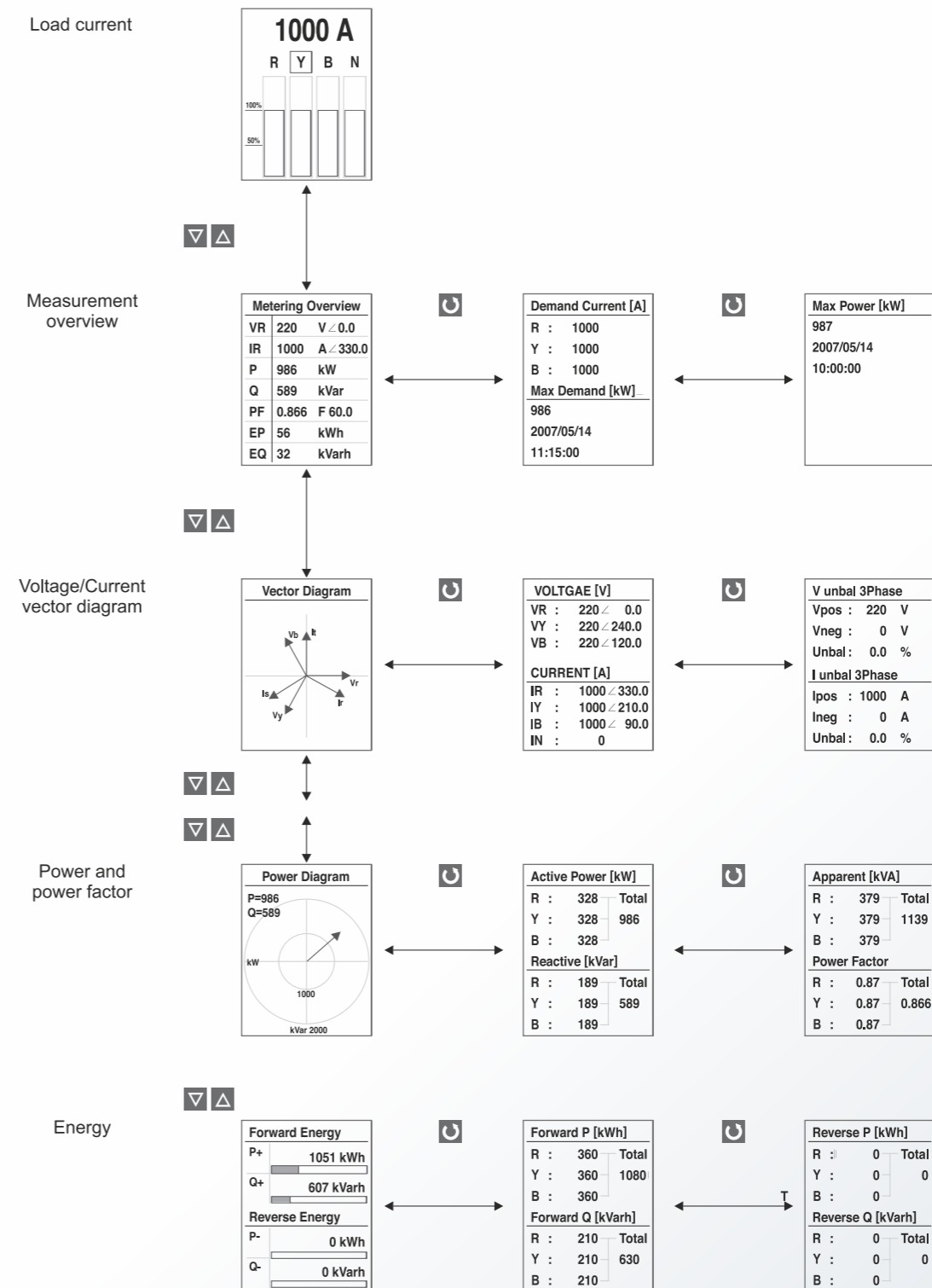
- OCR and OCGR's current setting is basically controlled by knob's setting values.
- The fine current that cannot be controlled by knob is adjustable by using  $\nabla$ ,  $\Delta$  key.
- Fine adjustment is only adjustable in the present knob and next knob's setting range, when moving knob, the adjusted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



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



# Measurement Element Display



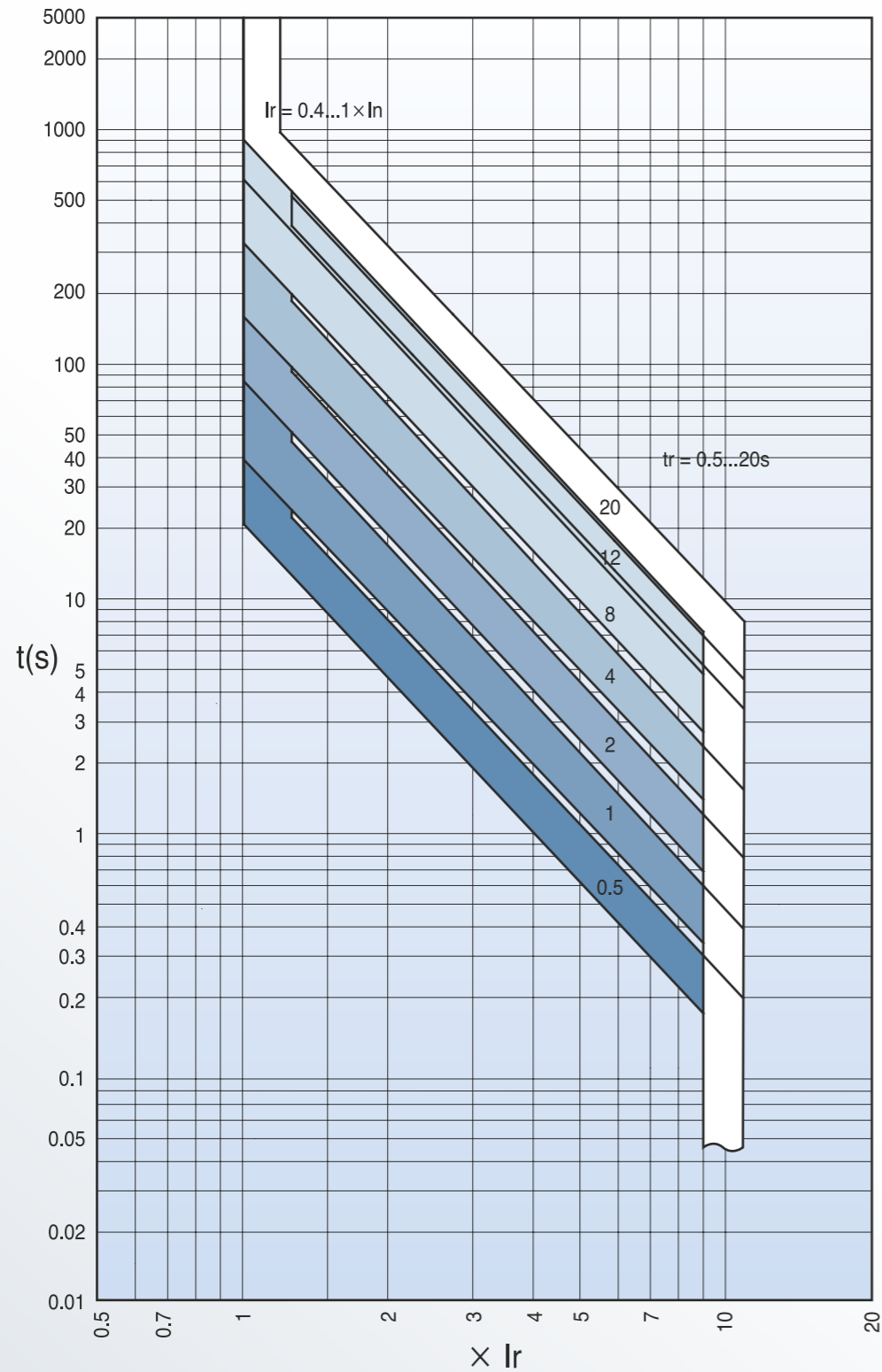
Trip Relays

Trip Relays

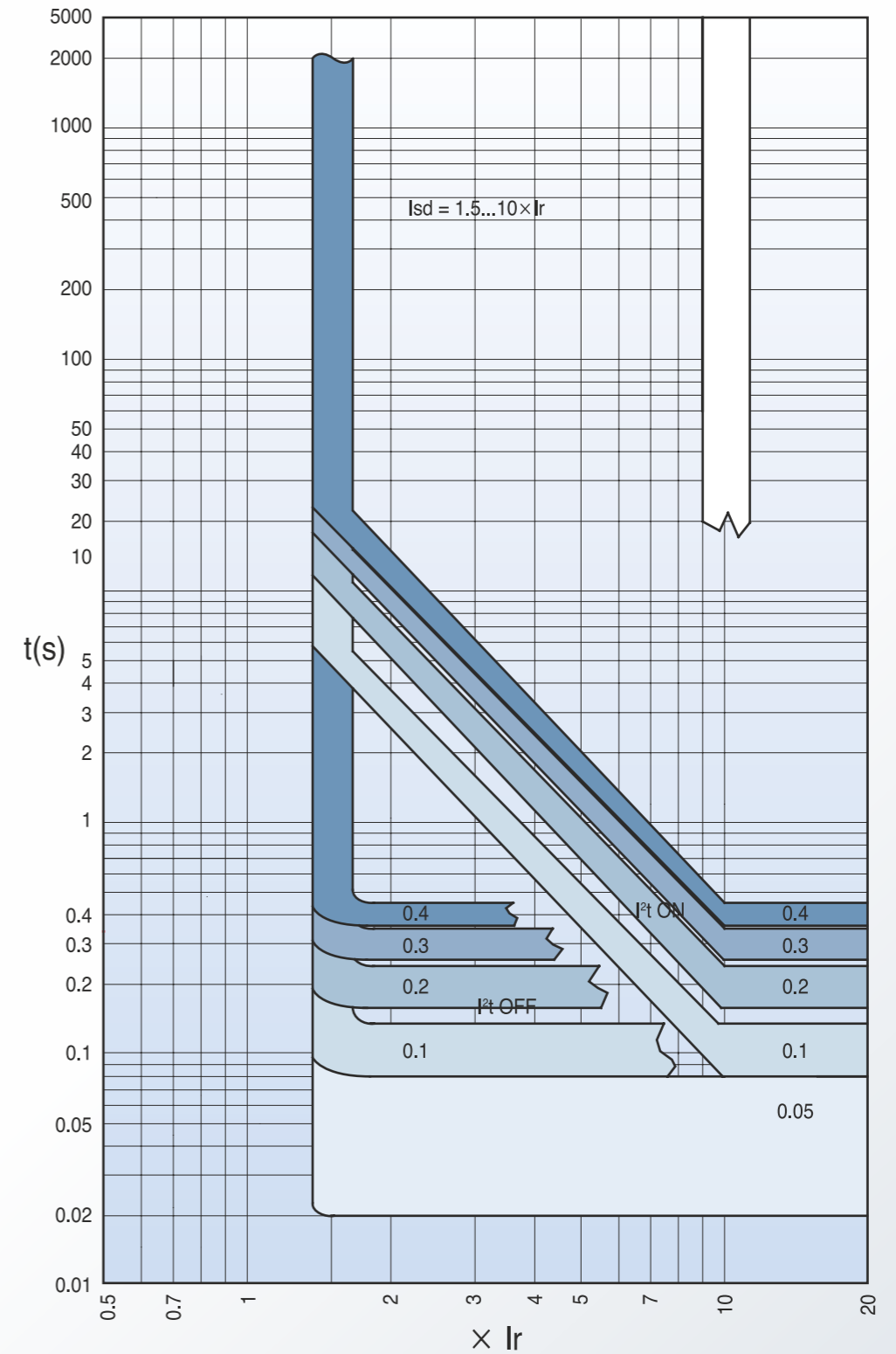
# Trip Relays

## Characteristic Curves

Long-time delay (L)



Short-time delay (S)



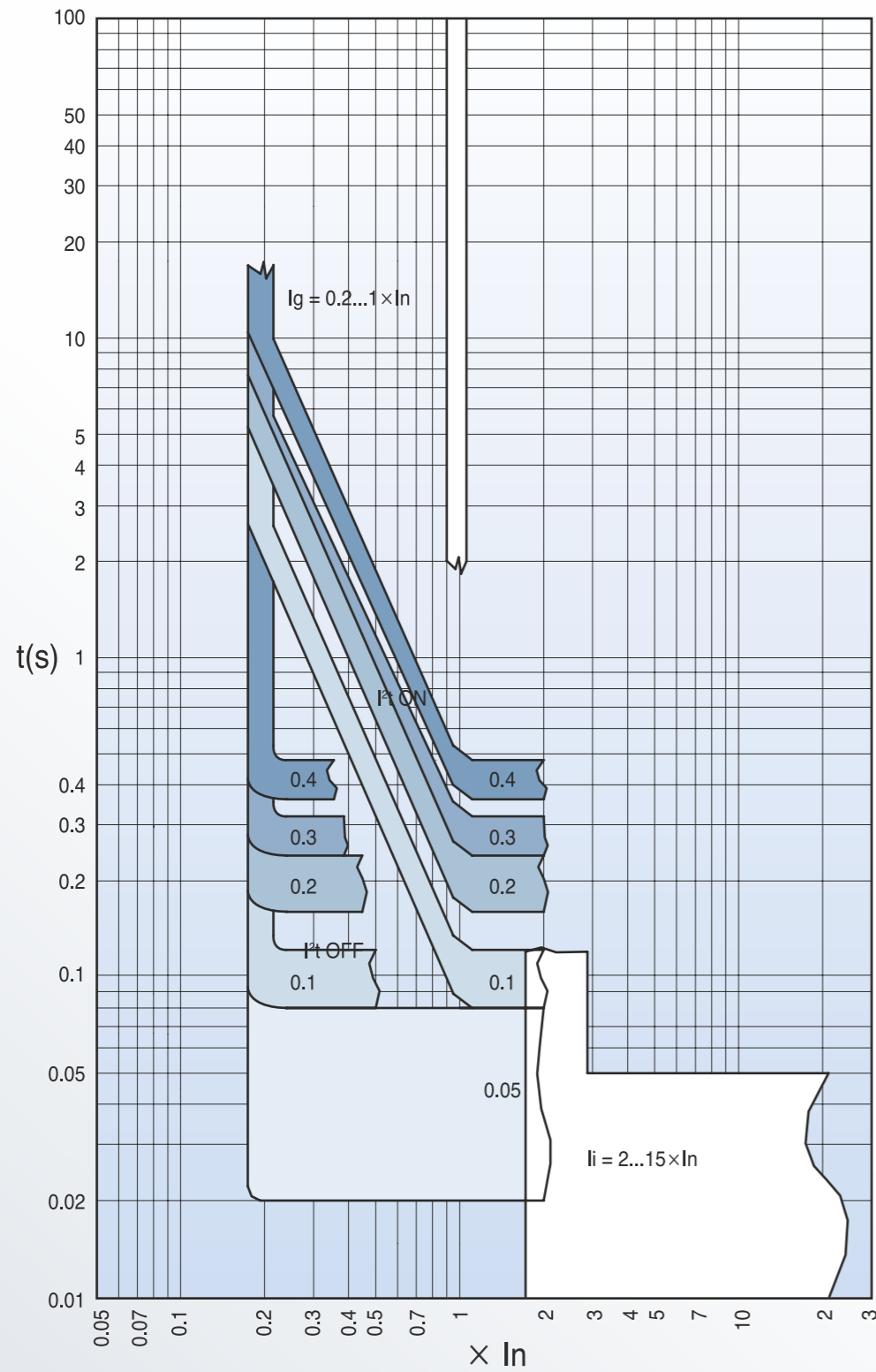
Trip Relays

Trip Relays

# Trip Relays

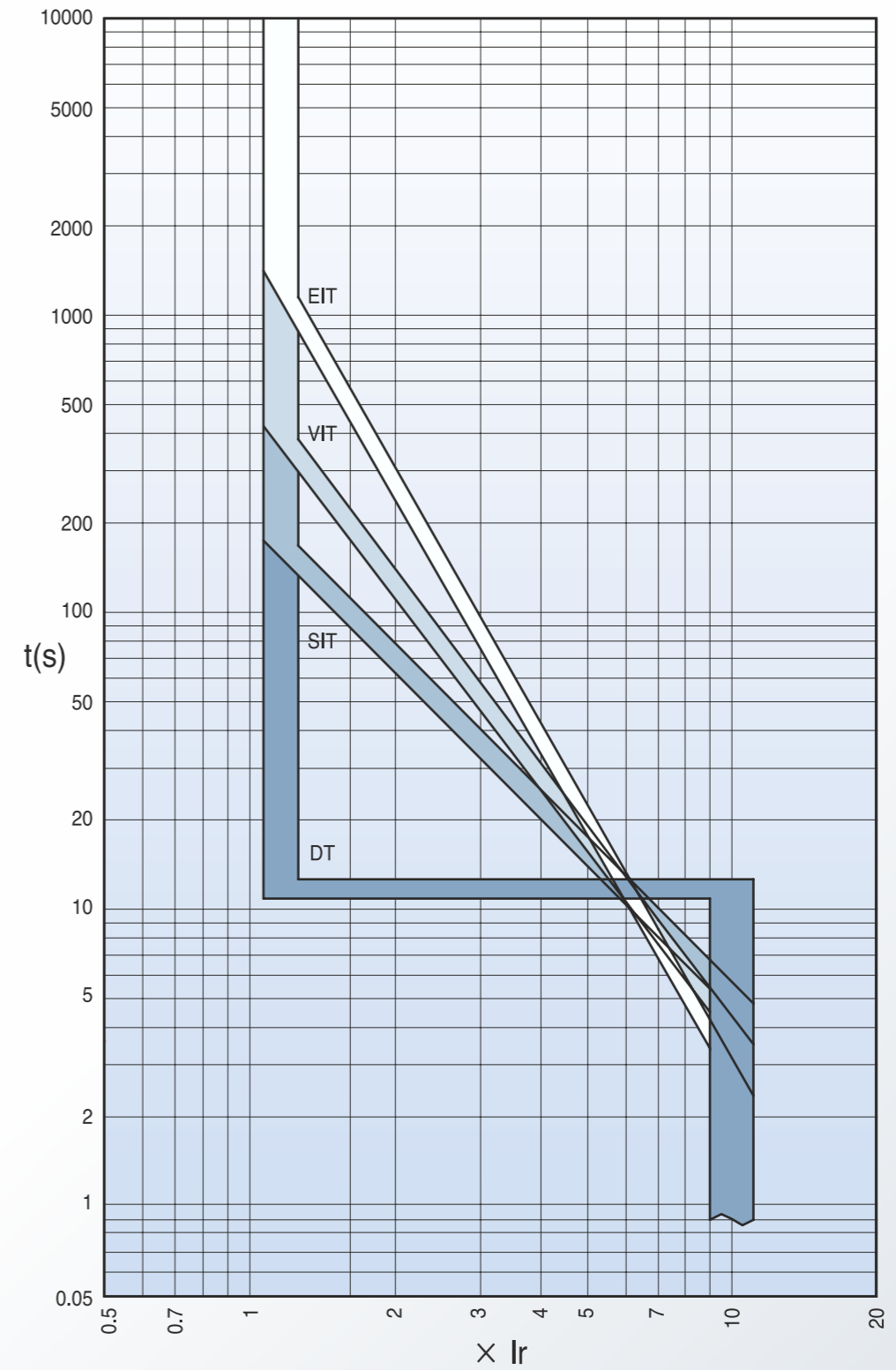
## Characteristic Curves

Instantaneous (I)  
Ground fault (G)



Trip Relays

IDMTL

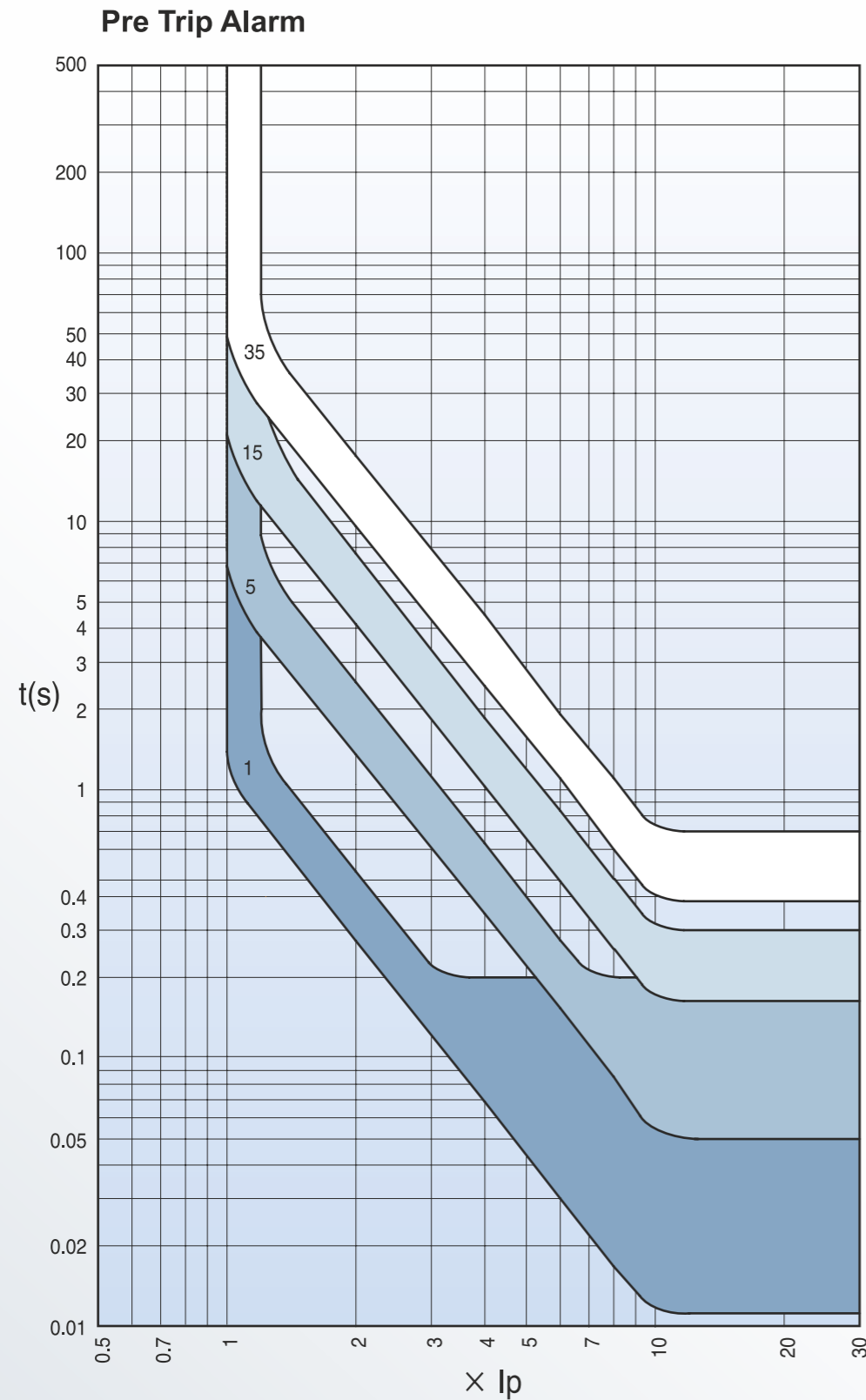


Trip Relays



# Trip Relays

## Characteristic Curves

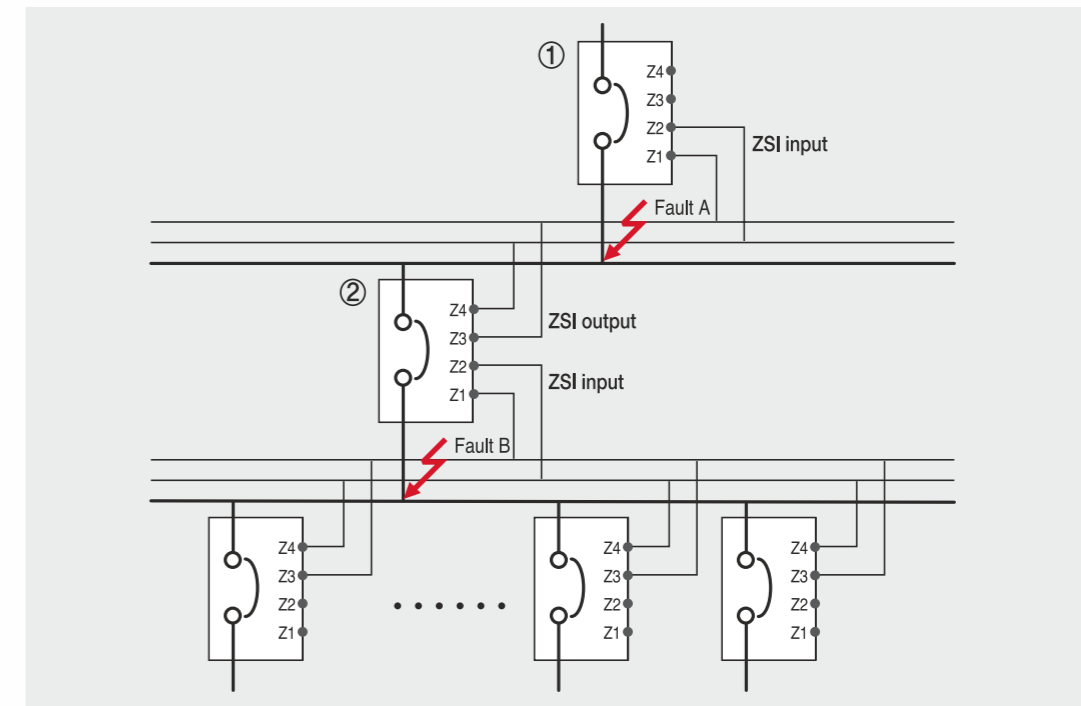


Trip Relays

## ZSI – Zonal Selective Interlocking (A, P type)

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

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



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

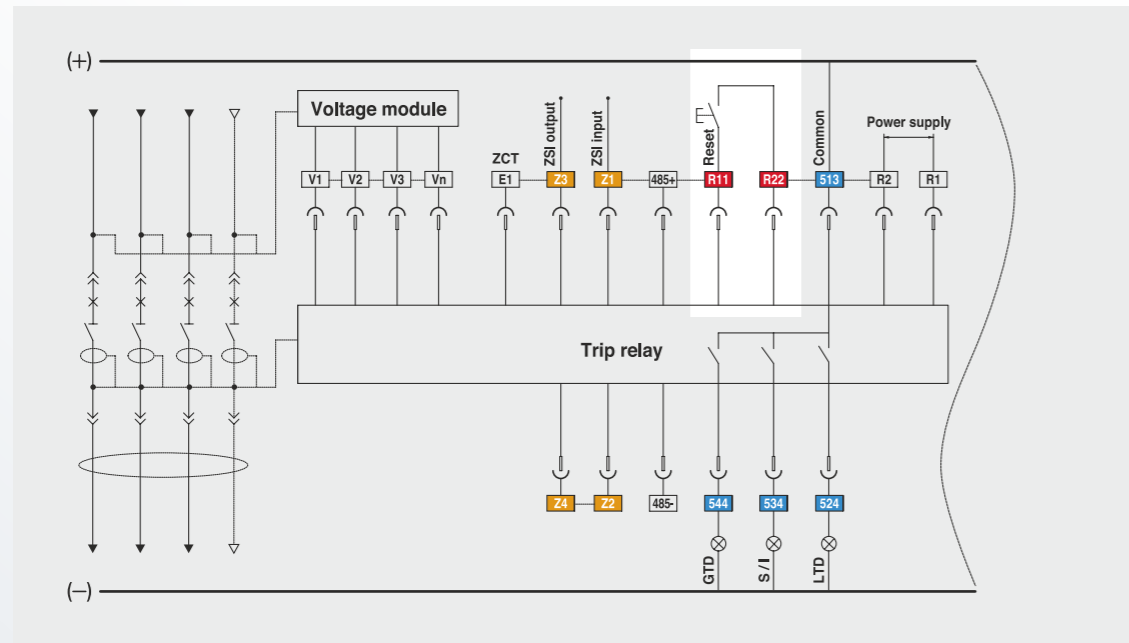
Trip Relays

# Trip Relays

## Remote Reset and Digital I/O (A, P type)

In case of that ACB operates due to accidents or over current, Trip relay indicates the information of accident through the LED and LCD. Trip relay A & P 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 3.3 V of recognition voltage. When inputting close by SSR ( Solid State Relay) or open- collector, connect collector (drain) to R11
3. Digital output 3 a(524,534 544-513)
  - Fault output : Long/ Short time delay, Instantaneous, Ground fault, UVR, OVR, UFR, OFR, r power, Vunbal, lunbal
  - (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	lunbal	OFR	UFR	OPR	Note
P type	DO1(524)	●	○	○	○	○	○	○	○	○	○	○	○	○	Programmable
	DO2(534)	○	●	●	○	○	○	○	○	○	○	○	○	○	
	DO3(544)	○	○	○	●	○	○	○	○	○	○	○	○	○	
A type	DO1(524)	●	×	×	×	Not available									Fixed
	DO2(534)	×	●	●	×										
	DO3(544)	×	×	×	●										

Trip Relays

# Communication

## Modbus/RS-85

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



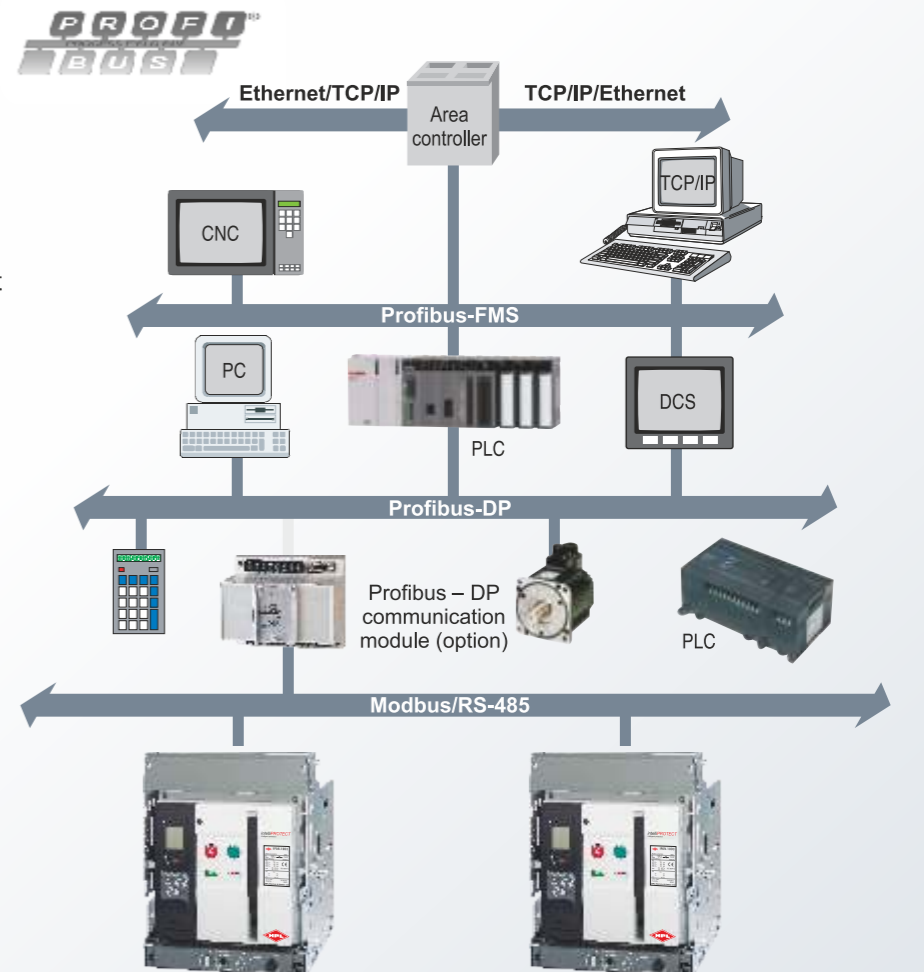
Trip Relays

## Profibus-DP

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



Profibus – DP communication module (option)

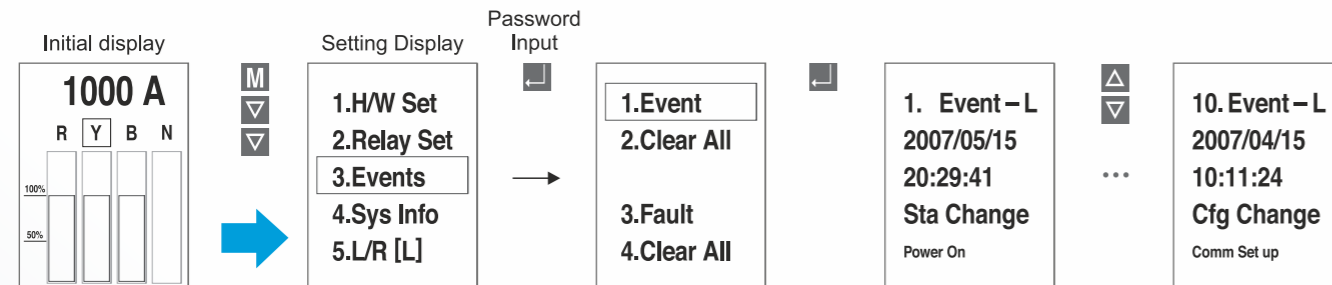


# Trip Relays

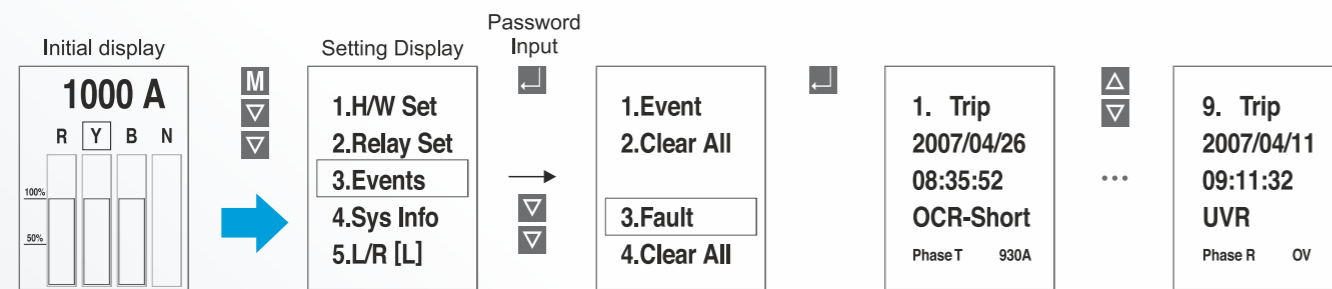
## Event & Fault Recording (P type)

When there are events such as setting change, info. change, error of self-diagnose, state change, P 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

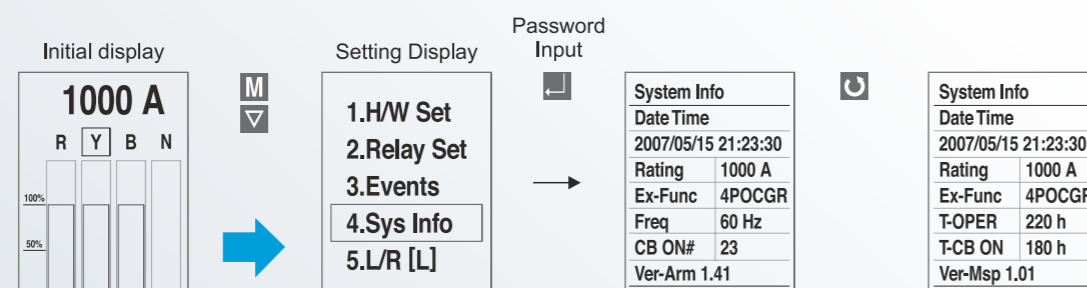


### System Information

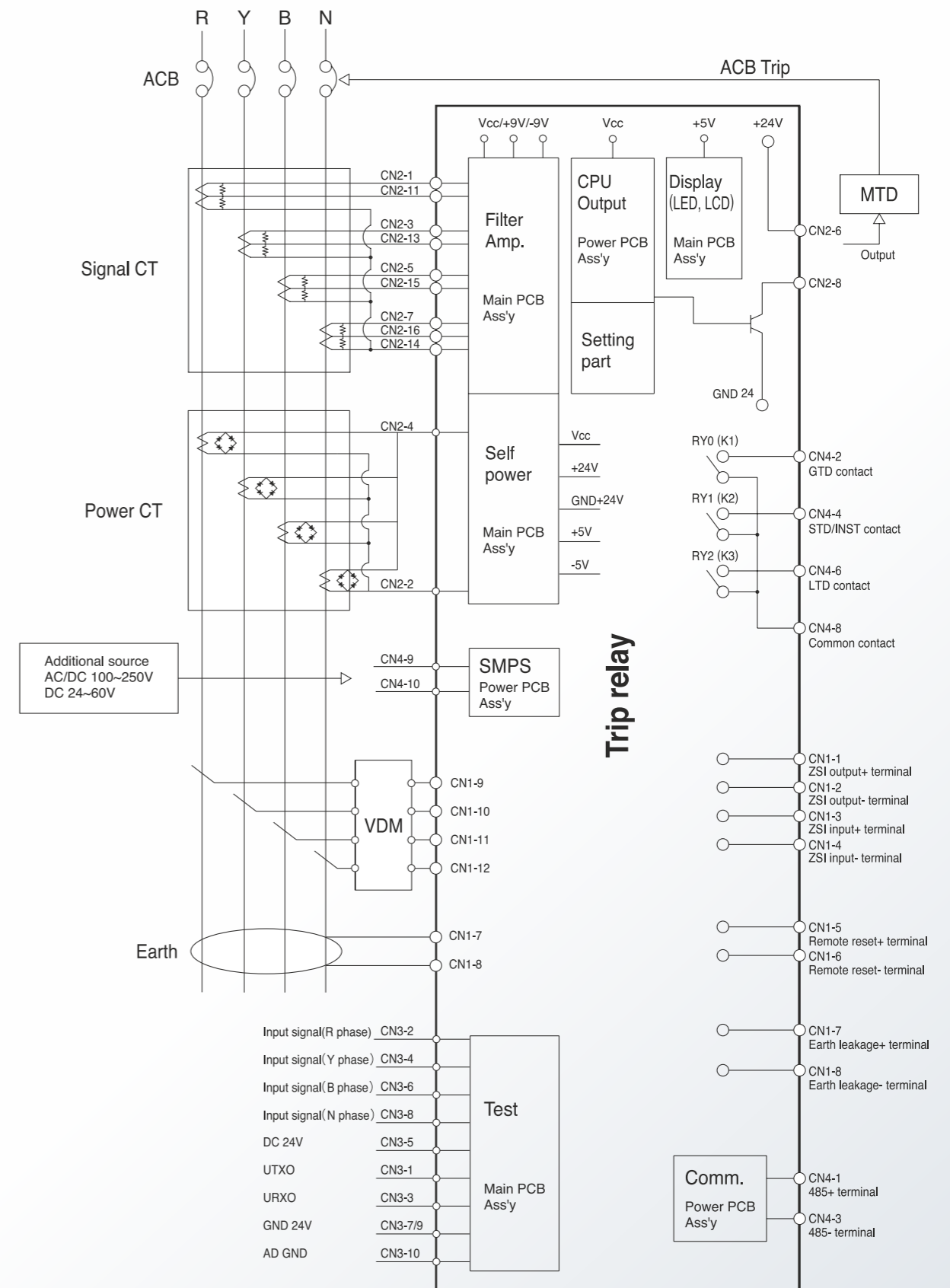
P type can indicate information as followings with the information of the ACB.

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

### System Information display



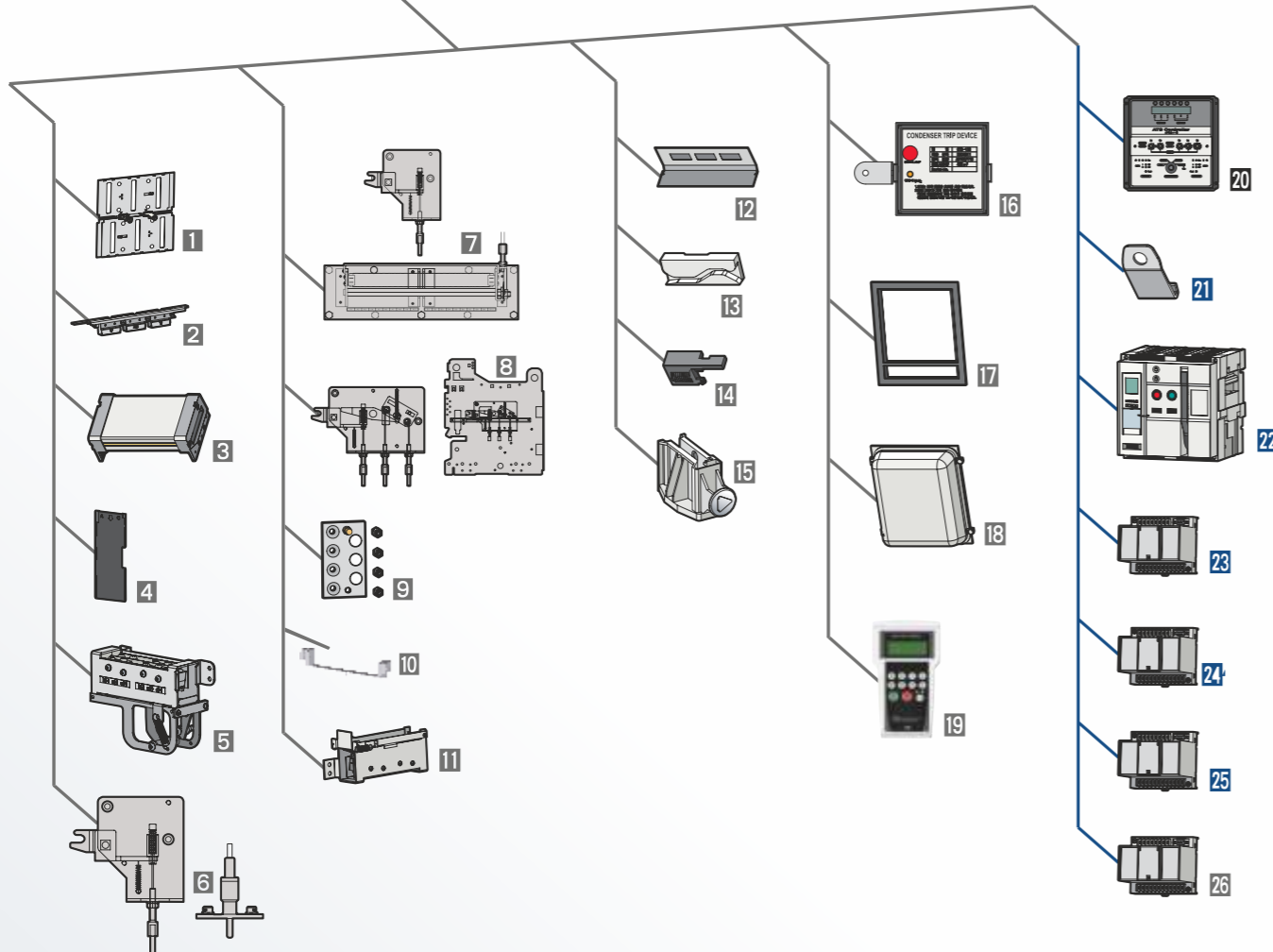
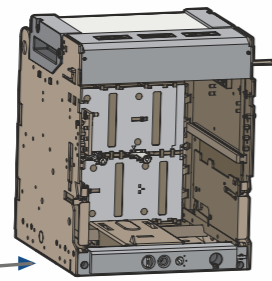
# System Block Diagram



Trip Relays

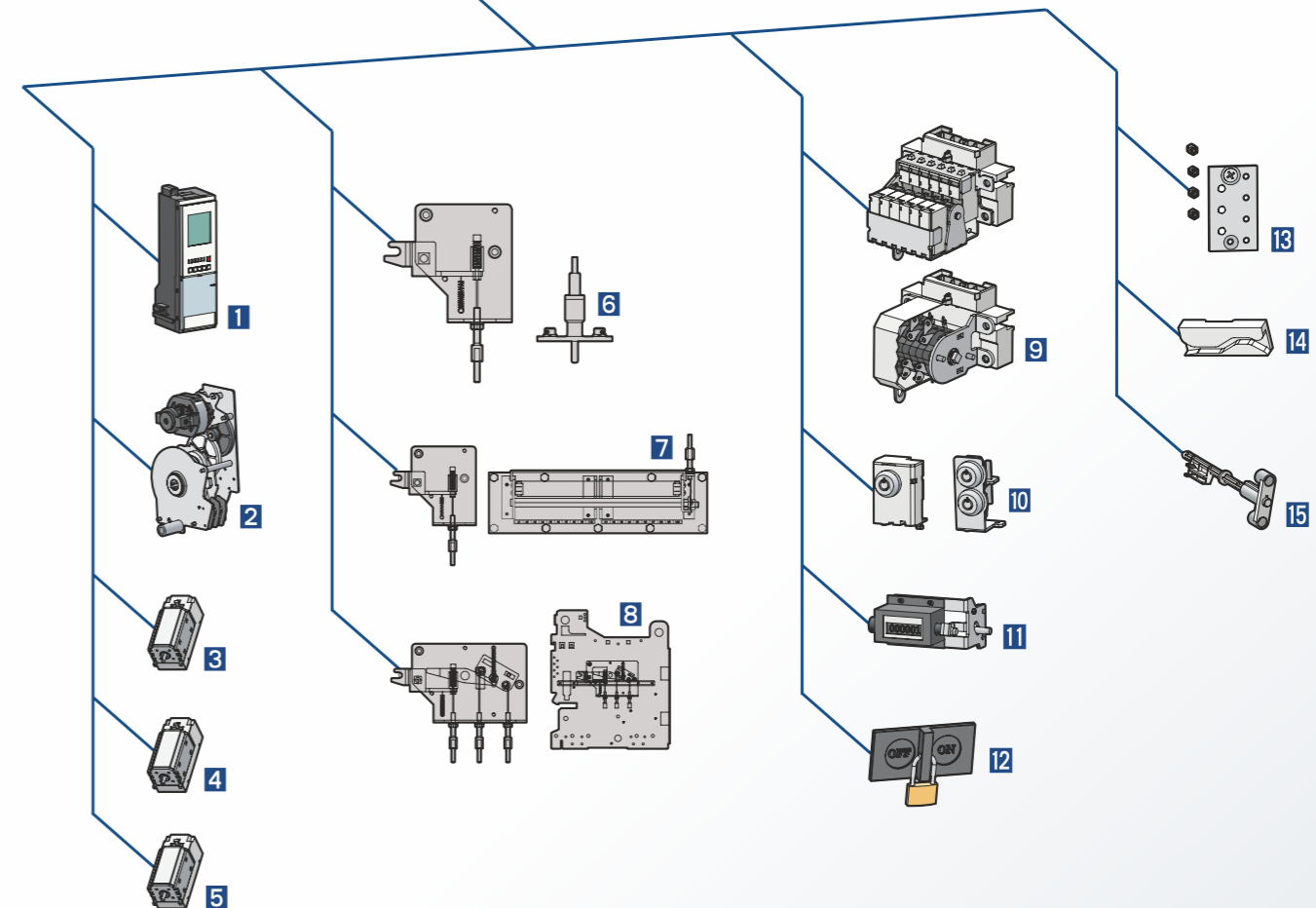
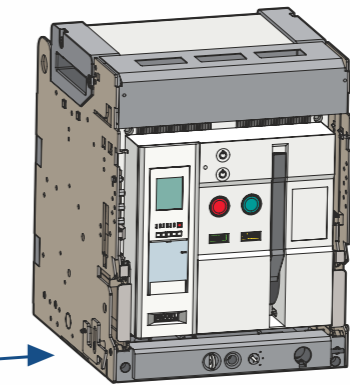
Trip Relays

# Accessories



### Cradle

- |   |  |                                      |
|---|--|--------------------------------------|
| 1 Safety Shutter (IPST)                     | 10 Cradle Mounting Block (IPCMB)             | 18 Dust Cover (IPDC)                 |
| 2 Manual Connector                          | 11 Shorting "b" Contact (IPSBC)              | 19 OCR Tester (IPOT)                 |
| 3 Zero Arc Space (IPZAS)                    | 12 Safety Control Cover (IPSC)               | 20 ATS Controller (IPATS)            |
| 4 Insulation Barrier (IPIB)                 | 13 Automatically Discharge Mechanism (IPADM) | 21 Lifting Hook (IPLH)               |
| 5 Cell Switch (IPCEL)                       | 14 Racking Interlock (IPRI)                  | 22 Dummy ACB                         |
| 6 Door Interlock (IPDI)                     | 15 Safety Shutter Lock (IPSTL)               | 23 UVT Time Delay Controller (IPUDC) |
| 7 Mechanically Operated Cell Switch (IPMOC) |  | 24 Profibus-DP Communication Module  |
| 8 Mechanical Interlock (IPMI)               | <b>Others</b>                                | 25 Remote I/O                        |
| 9 Miss Insertion Preventing Device (IPMIP)  | 16 Condenser Trip Device (IPCTD)             | 26 Temperature Alarm                 |
|   | 17 Door Frame (IPDF)                         |                                      |



### ACB

- |   |  |
|---|--|
| 1 Trip Relay (IPOCR)                        | 9 Auxiliary Switch (IPAX)                              |
| 2 Motor (IPM**)                             | 10 Key Lock, Double Key Lock (IPK1, IPK2, IPK3, IPK32) |
| 3 Closing Coil (IPCC**)                     | 11 Counter (IPC)                                       |
| 4 Shunt Coil (IPSHT**)                      | 12 On/Off Button Lock (IPB)                            |
| 5 Under Voltage Trip Device (IPUVT**)       | 13 Miss Insertion Preventing Device (IPMIP)            |
| 6 Door Interlock (IPDI)                     | 14 Automatically Discharge Mechanism (IPADM)           |
| 7 Mechanically Operated Cell Switch (IPMOC) | 15 Manual Reset Button (IPMRB)                         |
| 8 Mechanical Interlock (IPMI)               |  |

\*\*Voltage Selection

Accessories

Accessories

# Accessories



Mounting	Accessories		AN		Remark
			Standard	Option	
Internal	IPSHT1	Shunt Coil		<input type="radio"/>	*
	IPSHT2	Second Shunt Coil		<input type="radio"/>	*
	IPCC	Closing Coil		<input type="radio"/>	*
	IPM	Motor		<input type="radio"/>	*
	IPCS1	Charge Switch		<input type="radio"/>	*
	IPCS2	Charge switch Communication		<input type="radio"/>	*
	IPUVT	Under Voltage Trip Device		<input type="radio"/>	*
	IPAL	Trip Alarm Contact		<input type="radio"/>	*
	IPMRB	Manual Reset Button		<input type="radio"/>	*
	IPRES	Remote Reset Switch		<input type="radio"/>	*
	IPRCS	Ready to Close Switch		<input type="radio"/>	*
	IPC	Counter		<input type="radio"/>	*
	IPAX	Auxiliary Switch		<input type="radio"/>	*
	IPTM	Temperature Alarm		<input type="radio"/>	*
External	IPK1	Key Lock		<input type="radio"/>	*
	IPK2	Key interlok Set		<input type="radio"/>	*
	IPK3	Double key lock		<input type="radio"/>	*
	IPB	On/Off button Lock		<input type="radio"/>	*
	IPLH	Lighting Hook		<input type="radio"/>	
	IPCTD	Condenser Trip Device		<input type="radio"/>	
	IPATS	Automatic Transfer Switch Controller		<input type="radio"/>	
	IPDC	Dust Cover		<input type="radio"/>	
	IPDF	Door Frame	●		
	IPOT	OCR Tester		<input type="radio"/>	
	IPJ	Manual Connector		<input type="radio"/>	*
	IPA	Automatic Connector	●		*

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



Mounting	Accessories		AN		Remark
			Standard	Option	
Trip relay	IPN	N Type		<input type="radio"/>	*
	IPA	A Type		<input type="radio"/>	*
	IPP	P Type		<input type="radio"/>	*
	IPVM	Voltage Module		<input type="radio"/>	**
	IPZCT	ZCT for the earth leakage		<input type="radio"/>	
	IPSBC	Shorting "b" Contact		<input type="radio"/>	
	Cradle	IPMI	Mechanical Interlock		<input type="radio"/>
IPST		Safety Shutter	●		*
IPSTL		Safety Shutter Lock		<input type="radio"/>	
IPMIP		Miss Insertion Prevent Device		<input type="radio"/>	
IPMOC		Mechanical Operated Cell Switch		<input type="radio"/>	
IPCEL		Cell Switch		<input type="radio"/>	
IPDI		Door Interlock		<input type="radio"/>	
IPZAS		Zero Arc Space		<input type="radio"/>	*
IPSC		Safety Control Cover	●		***
IPBSP		Body Supporter		<input type="radio"/>	*
IPRI		Racking Interlock		<input type="radio"/>	
IPPL		Pad Lock / Position Lock	●		*
IPIB		Insulation Barrier		<input type="radio"/>	*
IPUDC		UVT Time delay Controller		<input type="radio"/>	
IPADP		Compatible Adapter		<input type="radio"/>	
IPRPH	Reverse Phase ACB		<input type="radio"/>		
Other	IPDUM	Dummy ACB		<input type="radio"/>	
	IPVAD	Various Connection Type		<input type="radio"/>	
	IPRCO	Remote I/O		<input type="radio"/>	
	IPPC	Profibus-DP comm.module		<input type="radio"/>	

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

\*\*Voltage module should be purchased with P type trip relay.

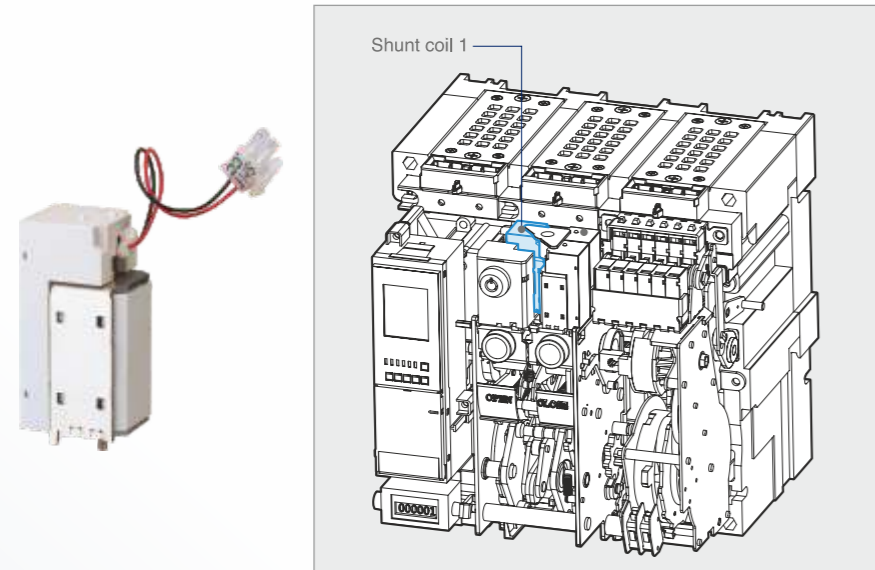
\*\*\*It is available only when the control block is in the mode of auto-connection.

Accessories

Accessories

# Accessories

## Shunt Coil [IPSHT1]



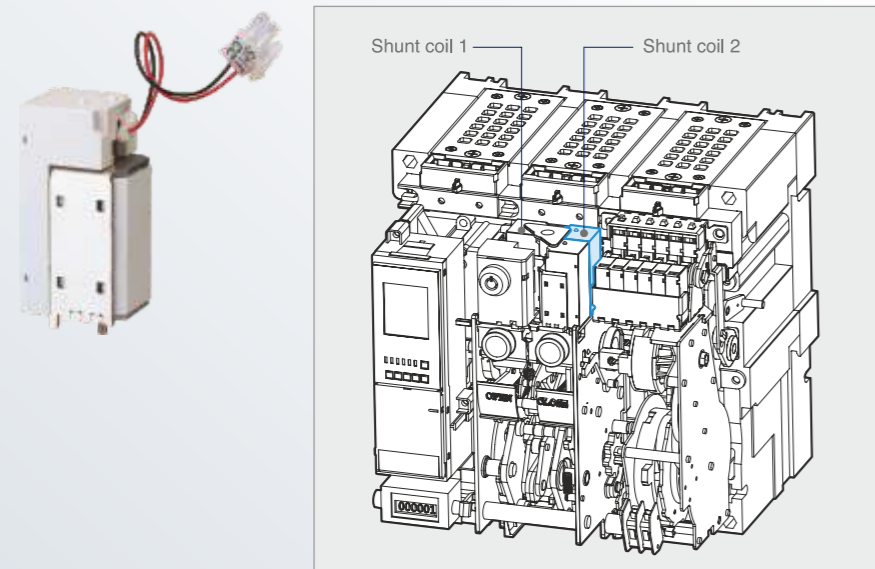
- IPSHT 1 is a control device which trips a circuit breaker from remote place, when applying voltage continuously or instantaneously over 200 ms to coil terminals (C1, C2)
- When IPUVT coil is installed, its location is changed.

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

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

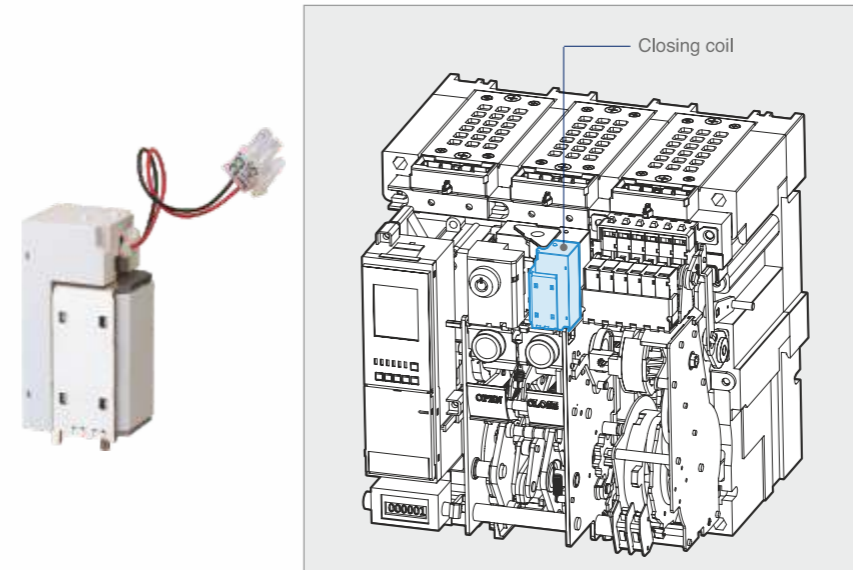
Note) Operating voltage range is the min. rated voltage standard for each rated voltage(Vn).

## Second Shunt Coil [IPSHT2]



- IPSHT 2 is a control device which trips a circuit breaker doubly from the outside. When IPSHT1 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 IPUVT coil when installing second shunt coil.

## Closing Coil [IPCC]



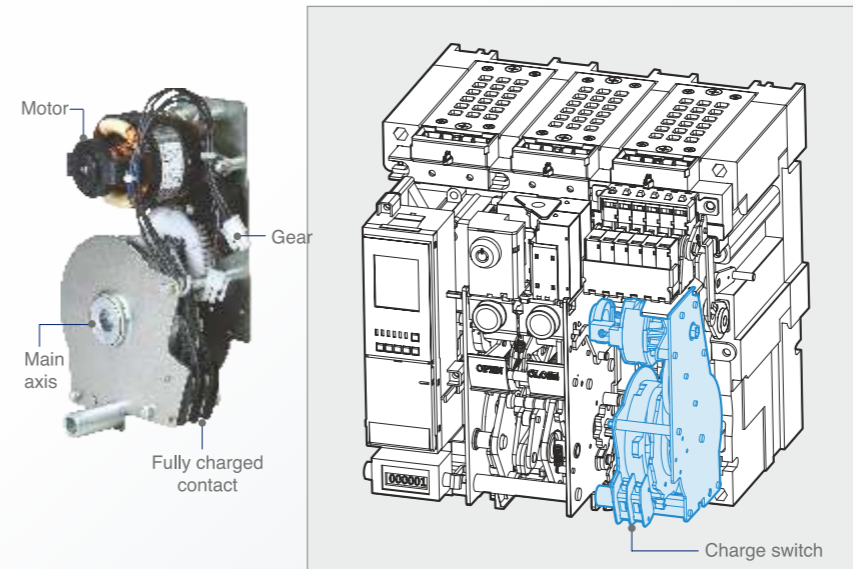
- It is control device which closes a circuit breaker, when the voltage is applied continuously or instantaneously over 200 ms to coil terminals. (A1, A2)

### 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	-	0.75~1.1 Vn	200	5	Less than 80ms
48~60	48	0.75~1.1 Vn			
100~130	100~130	0.75~1.1 Vn			
200~250	200~250	0.75~1.1 Vn			
-	380~480	0.75~1.1 Vn			

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

## Motor [IPM]



- 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

# Accessories

## Motor [IPM]

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					

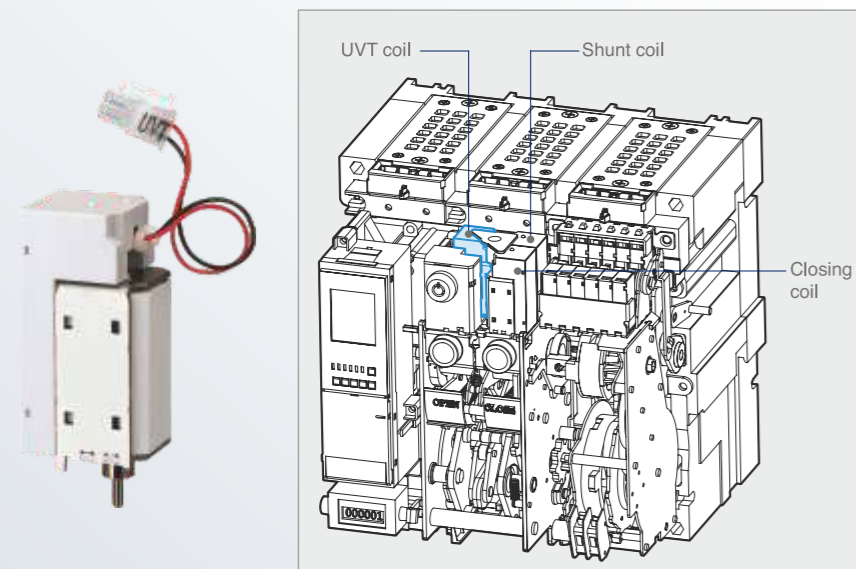
## Charge Switch [IPCS1]

## Charge Switch Communication [IPCS2]

- 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

Charge Switch Communication [CS2] is optional only at AS type.

## Under Voltage Trip device [IPUVT]



- If the voltage of the main or the control power is under voltage, IPUVT which is installed inside of the breaker breaks the circuit automatically.
- Please connect with IPUVT time-delay function because IPUVT is technically instantaneous type.
- The closing of a circuit breaker is impossible mechanically or electrically if control power not supplied to IPUVT. To close the circuit breaker, 65-85 % of rated voltage should be applied to both terminal of IPUVT coil (D1, D2).
- *When using IPUVT coil, the second 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 (Vn).

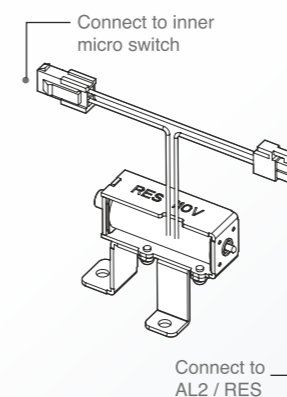
## Trip Alarm Contact [IPAL]

- When a circuit breaker is tripped by OCR which operate 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 main 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 (IPMRB, Manual Reset Button) pops out from the main cover and the switch (IPAL) which sends control signal electrically is conducted to output the information occurred from fault circuit breaker.
- IPMRB and IPAL 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 IPMRB to reset it for closing.
- 2pcs of electrical trip switch (AL1, AL2, 1a) are provided (Option)
- Trip alarm contact and IPMRB (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	

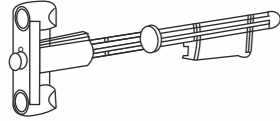
## Remote Reset Switch [IPRES]



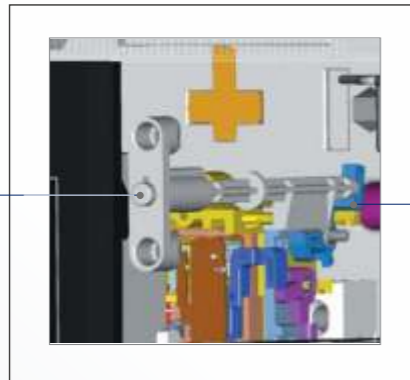
- Following tripping, this function resets the 'fault trip' alarm contacts (IPAL) and the mechanical indicator (IPMRB) and enables circuit breaker closing.
- Push button switch: IPAC 125 V 10 A, AC 250 V 6 A, DC 110 V 2.2 A, DC 220 V 1.1 A Resistive load
- In case of auto reset type circuit breaker
- Following tripping, a reset of Manual Reset Button (IPMRB) or Remote Reset Switch (IPRES) is no longer required to enable circuit breaker closing.
- The mechanical indicator (IPMRB) and electrical indicator (IPAL) remain in fault position until the reset button is pressed
- AL 2 and RES are alternative

# Accessories

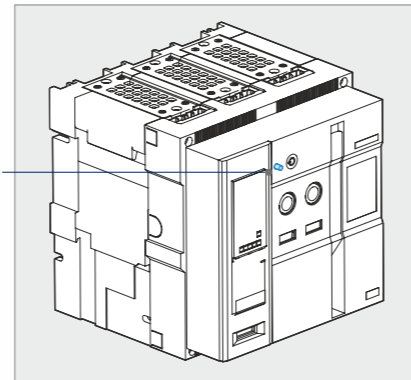
## Manual Reset Button [IPMRB]



- 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 indication (IPMRB, Manual Reset Button) Pops out from the main cover and the switch (SDE) which sends control signal electrically is conducted to output the information occurred from fault circuit breaker.
- IPMRB can be operated only by OCR but not by OFF operation of circuit breaker. To re-close a circuit breaker after a trip, press IPMRB to reset it for closing.



Manual reset button

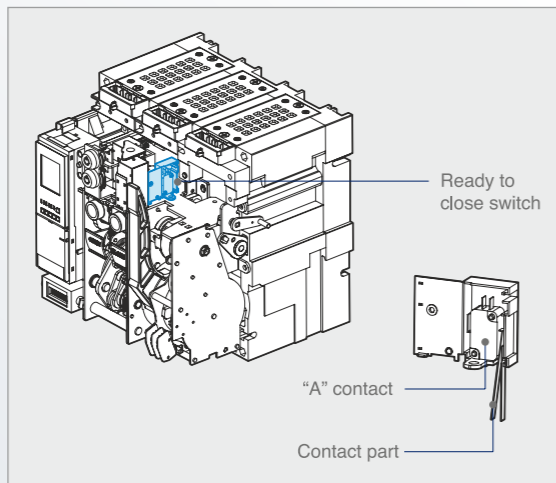


Manual reset button

MRB reset lever

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

## Ready to Close Switch [IPRCS]



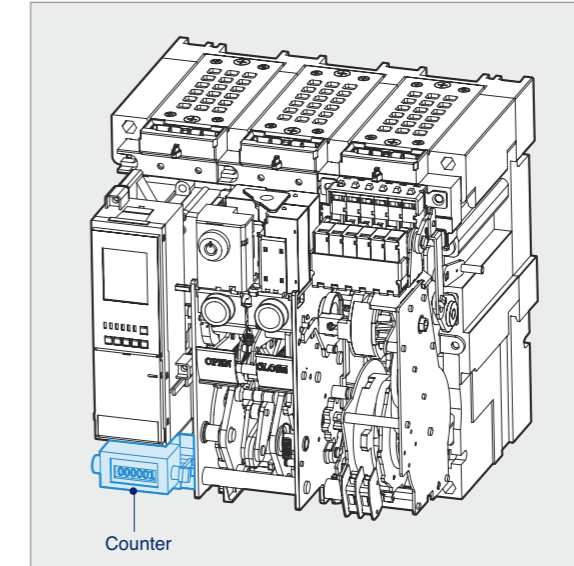
Ready to close switch

"A" contact

Contact part

- 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 or in charge, contact is output with "ON" and it indicates that mechanism can be closed.

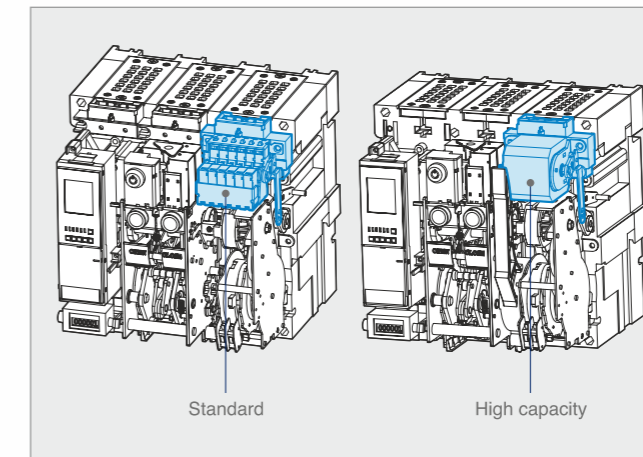
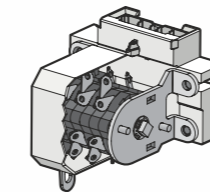
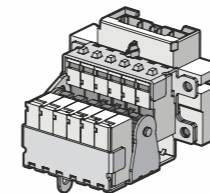
## Counter [IPC]



Counter

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

## Auxiliary Switch [IPAX]

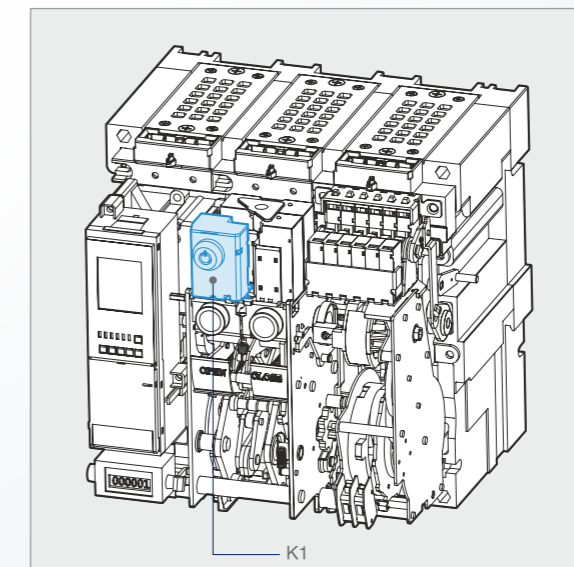


Standard

High capacity

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

## Key Lock [IPK1]



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.  
IPK1 : Preventing mechanical closing

Accessories

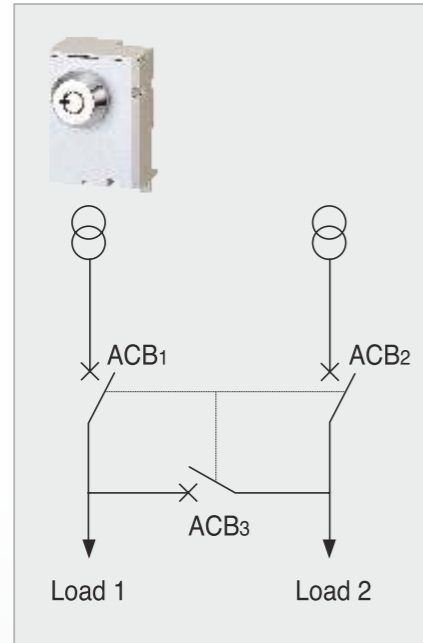
Accessories



# Accessories

## Key Interlock Set [IPK2]

### Wiring

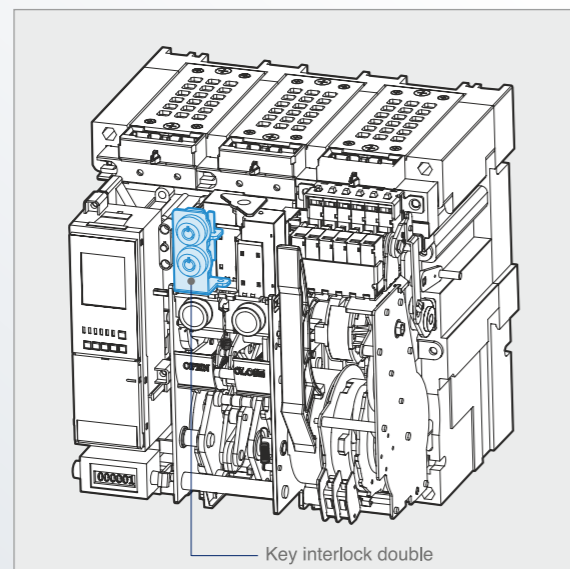


- 3 Circuit breakers can be arranged for continuous power supply to the load side and be interlocked mutually by using Key Lock embedded in each circuit breaker.

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

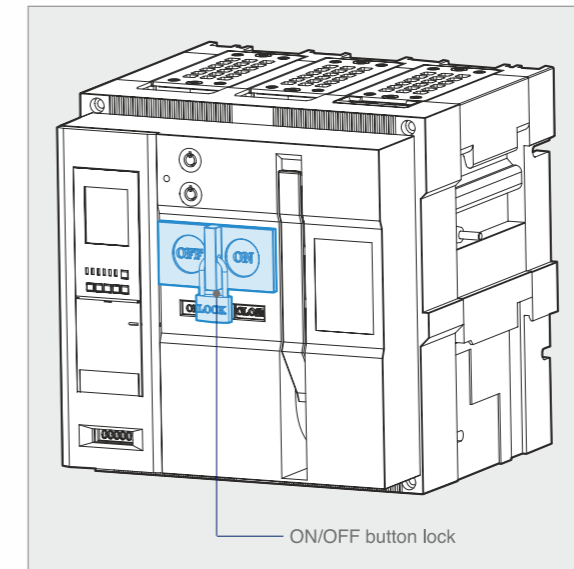
○: Release ●: Lock

## Double Key Lock [IPK3]



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

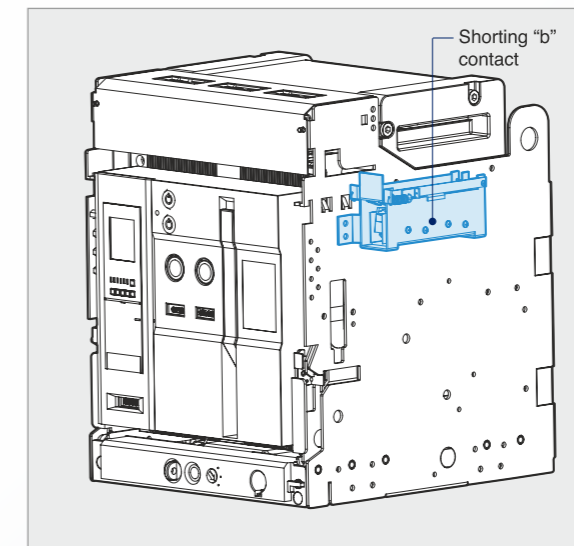
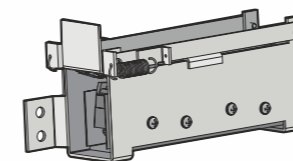
## ON/OFF Button Lock [IPB]



- 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.

## Shorting "b" Contact [IPSBc]



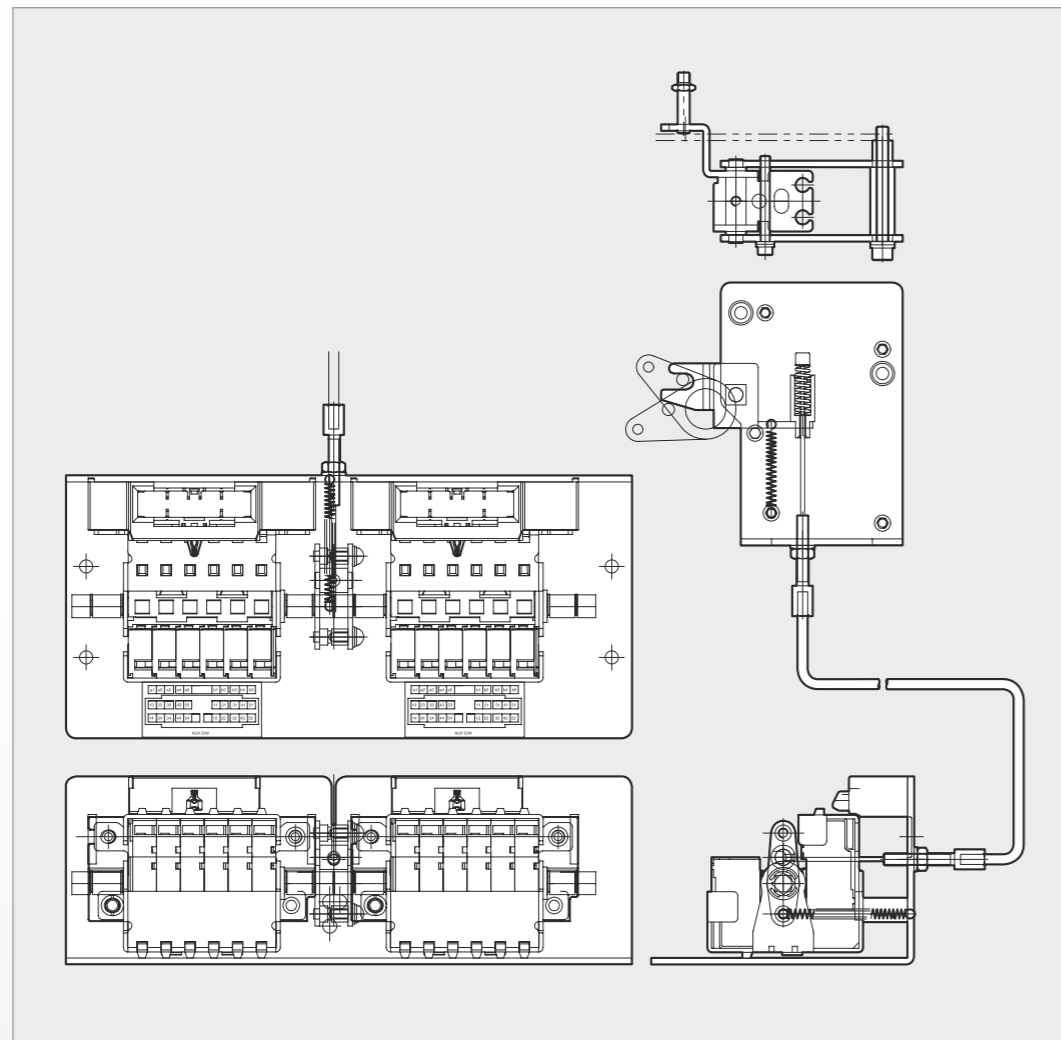
- It is the contact which keeps the external control circuit in normal by Aux. contact which disconnects "Axb" when ACB is moved from CONNECTED position to TEST position. The number of "shorting b-contact" corresponds to the number of "Axb" (4b)

### Contact condition (Link between Axb and shorting "b" contact)

ACB location	ACB condition	CLOSE	OPEN
		Shorting "b" contact	CONNECTED location
	TEST location	ON	ON
Auxiliary contact (Axb)	CONNECTED location	OFF	ON
	TEST location	OFF	ON

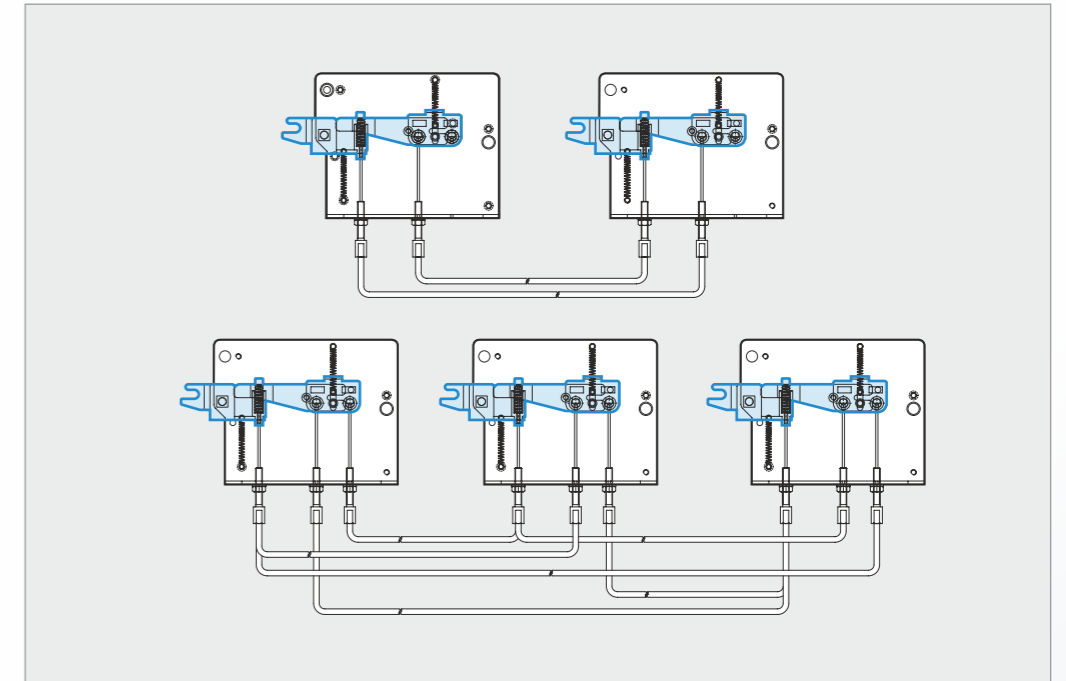
# Accessories

## Mechanical Operated Cell Switch [IPMOC]



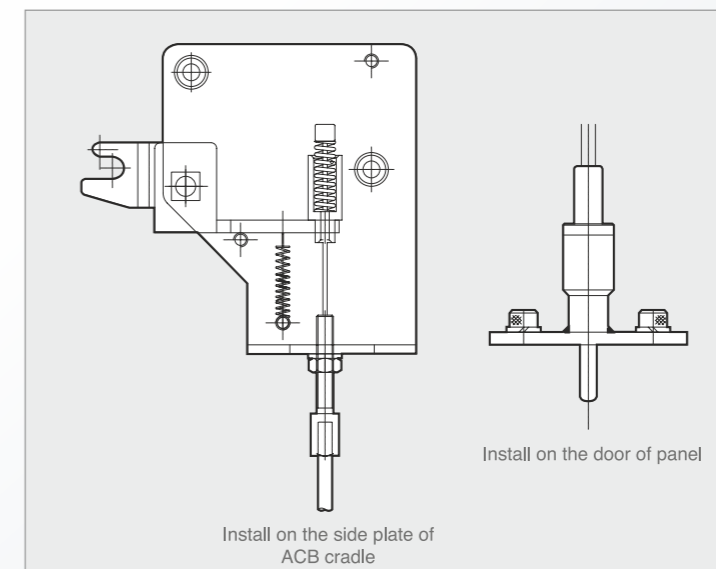
- It is the contact (10a10b) which displays the ON/OFF condition of ACB. It mechanically operates only when the breaker is "CONNECTED" position. A standard type and a high capacity type is available.
- The contact capacity is as same as the rating of aux. contacts.
- When IPMOC link is installed to cradle,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

## Mechanical Interlock [IPMI]



- 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.

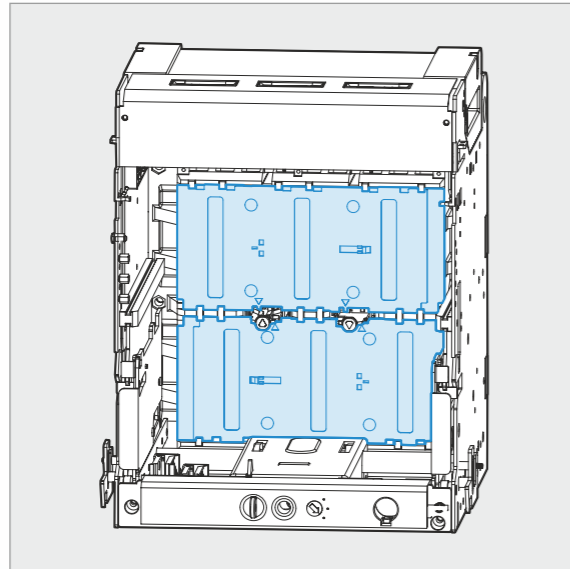
## Door Interlock [IPDI]



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

# Accessories

## Safety Shutter [IPST]

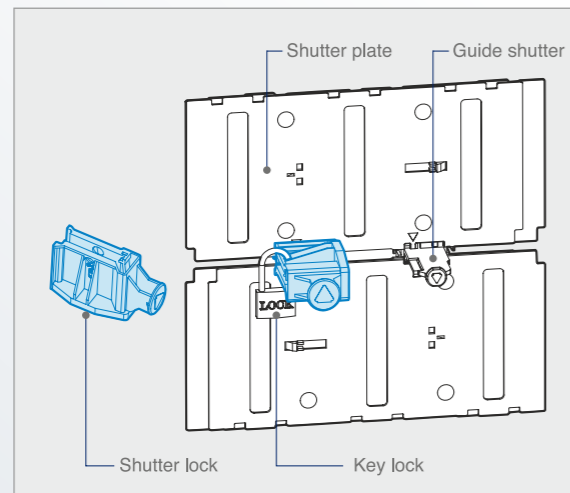


- It is the automatic safety device to protect the connectors of main circuit by cutting off dangerous contact from outside while the breaker is drawn out. When the ACB is drawn in, the shutter automatically opened.
- There are 4 types of safety shutter and they are divided as shown in figure below.

The types of safety shutter plate

2000/5000AF, 3P	4000/6300AF, 3P
2000/5000AF, 4P	4000/6300AF, 4P

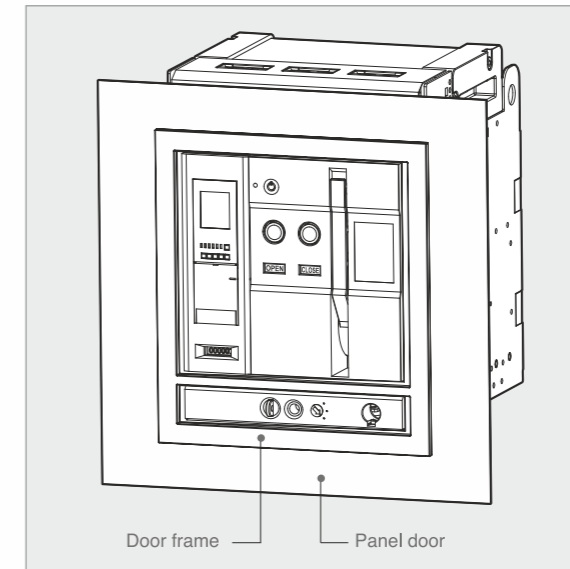
## Safety Shutter Lock [IPSTL]



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

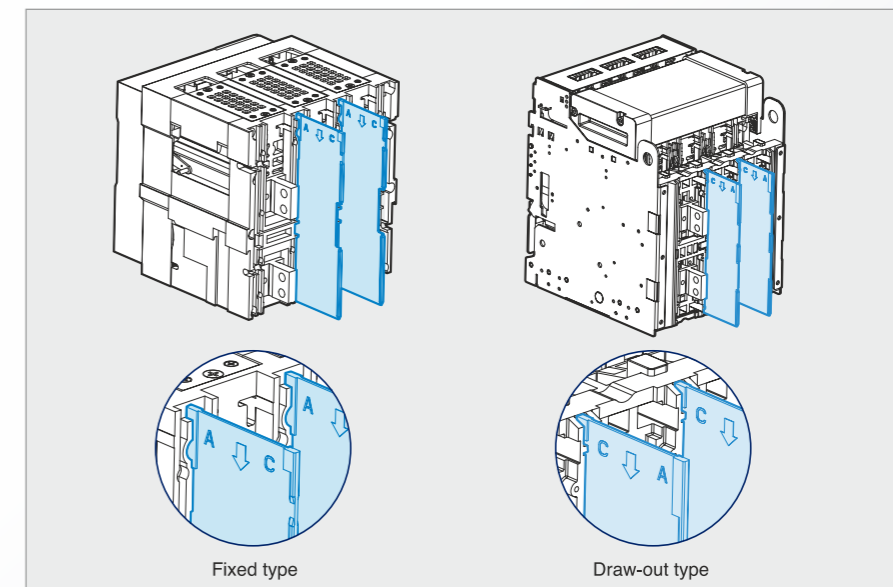
Note) Padlocks (Ø5 ~ Ø6) are not supplied.

## Door Frame [IPDF]



- 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.

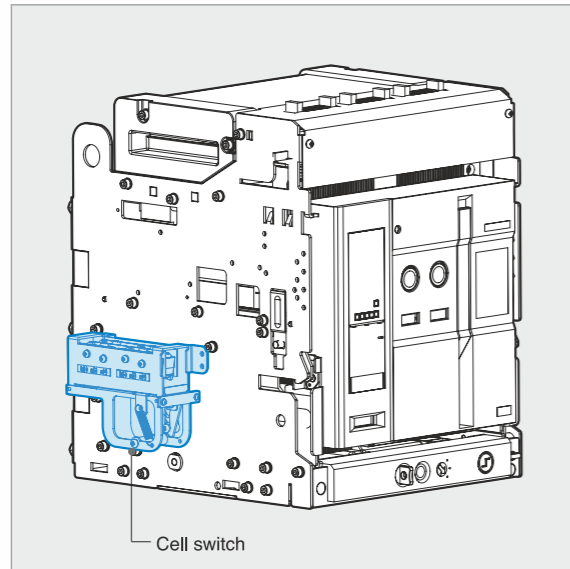
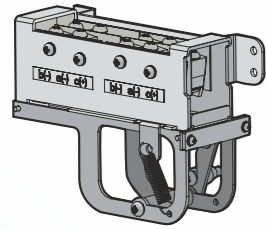
## Insulation Barrier [IPIB]



- 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.

# Accessories

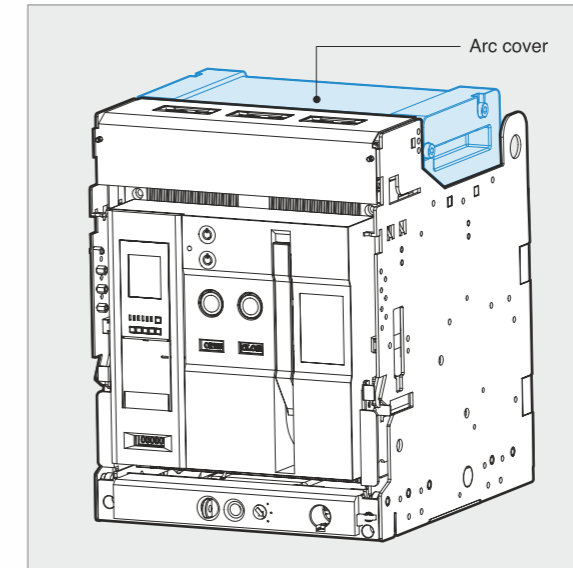
## Cell Switch [IPCEL]



- It is a contact which indicates the present position of ACB. (CONNECTED, TEST, DISCONNECTED)
- <Contact configuration>  
4C : 1 Disconnected + 1 Test + 2 Connected  
8C : 2 Disconnected + 2 Test + 4 Connected
- \* 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	ON
	CL-T (Test)	OFF	ON	ON
	CL-D (Disconnected)	ON	OFF	ON
Contact capacity	AC	Voltage(V)		Inductive load
		Resistive load		
		460V	5	2.5
	250V	10	10	
	125V	10	10	
	DC	250V	3	1.5
125V		10	10	
30V		10	10	
Contact number		4C		

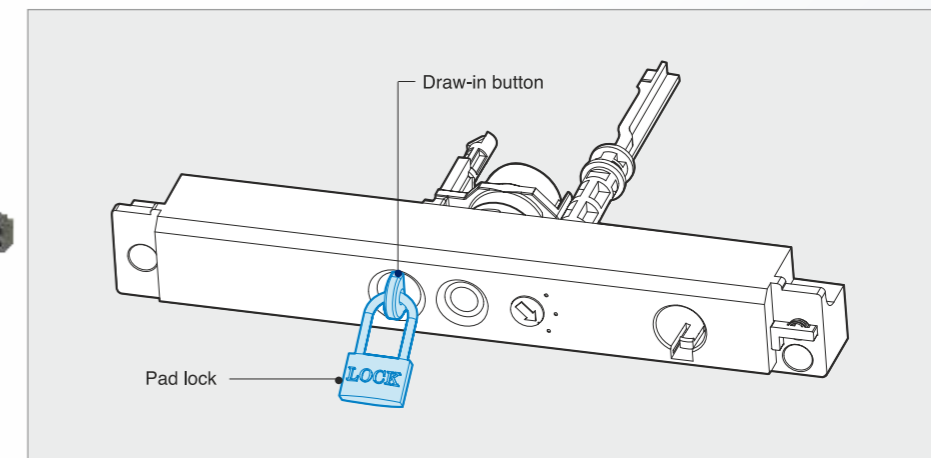
## Zero Arc Space [IPZAS]



- 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 8 types by ratings and poles.

Ampere frame	Cover length (mm)
2000AF 3P	281.4
2000AF 4P	366.4
4000AF 3P	359.4
4000AF 4P	474.4
5000AF 3P	576.4
5000AF 4P	746.4
6300AF 3P	732.4
6300AF 4P	962.4

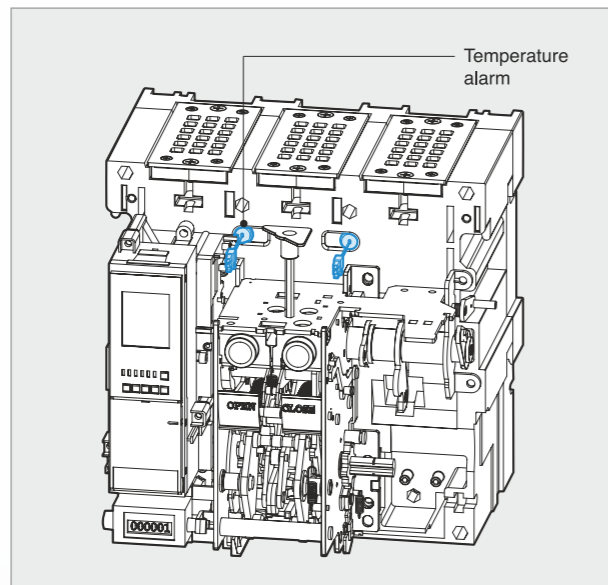
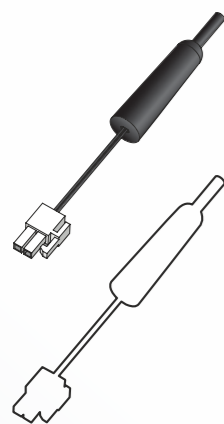
## Pad Lock / Position Lock [IPPL]



- 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)

# Accessories

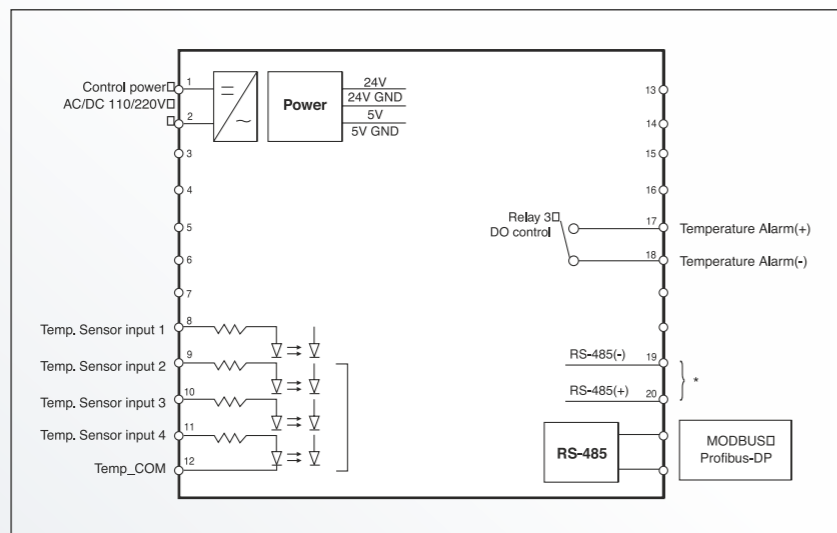
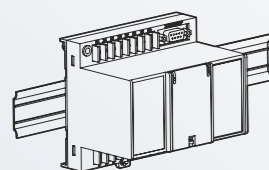
## Temperature Alarm [IPTM]



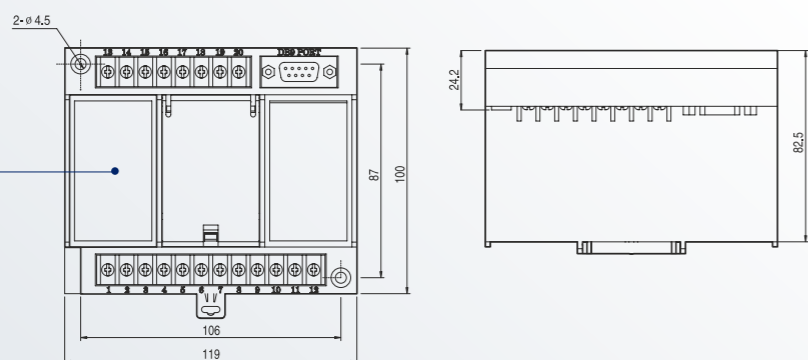
- Temperature Alarm Unit is a device to show the temperature through a sensor inside of ACB.
- The temperature sensor can be installed up to 4 and the output is connected to control terminal blocks.
- It displays the maximum temperature of them and transmits through a network.
- If the temperature is 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.

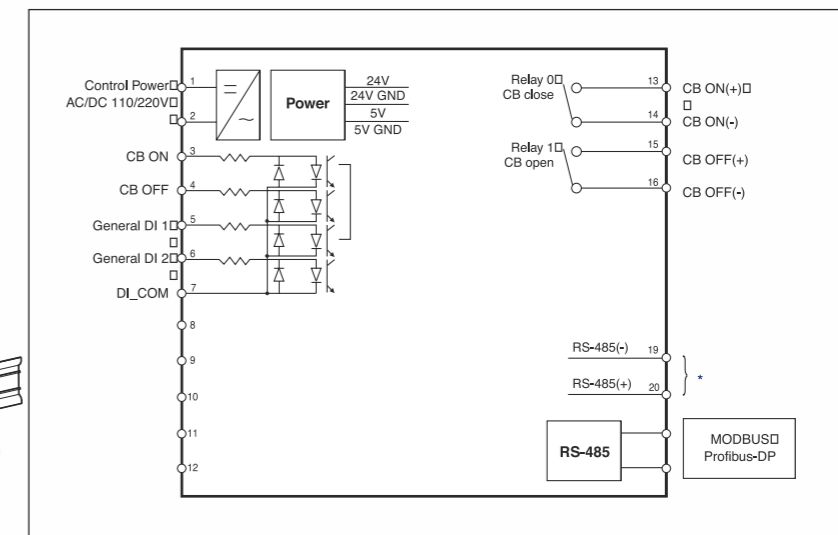
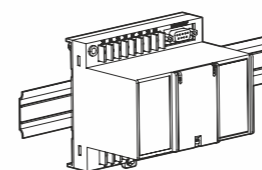


Temperature LED(°C): 10 ~150°C, Warning (Indicates the maximum value)

## Remote I / O Unit [IPRCO]

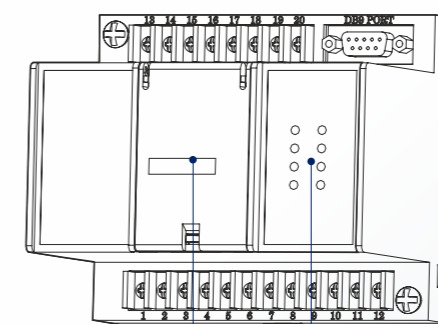


Remote I/O Unit



\*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 (cosφ=0.4, L/R=7ms)
	Max. switching capacity	1880VA, 150W	



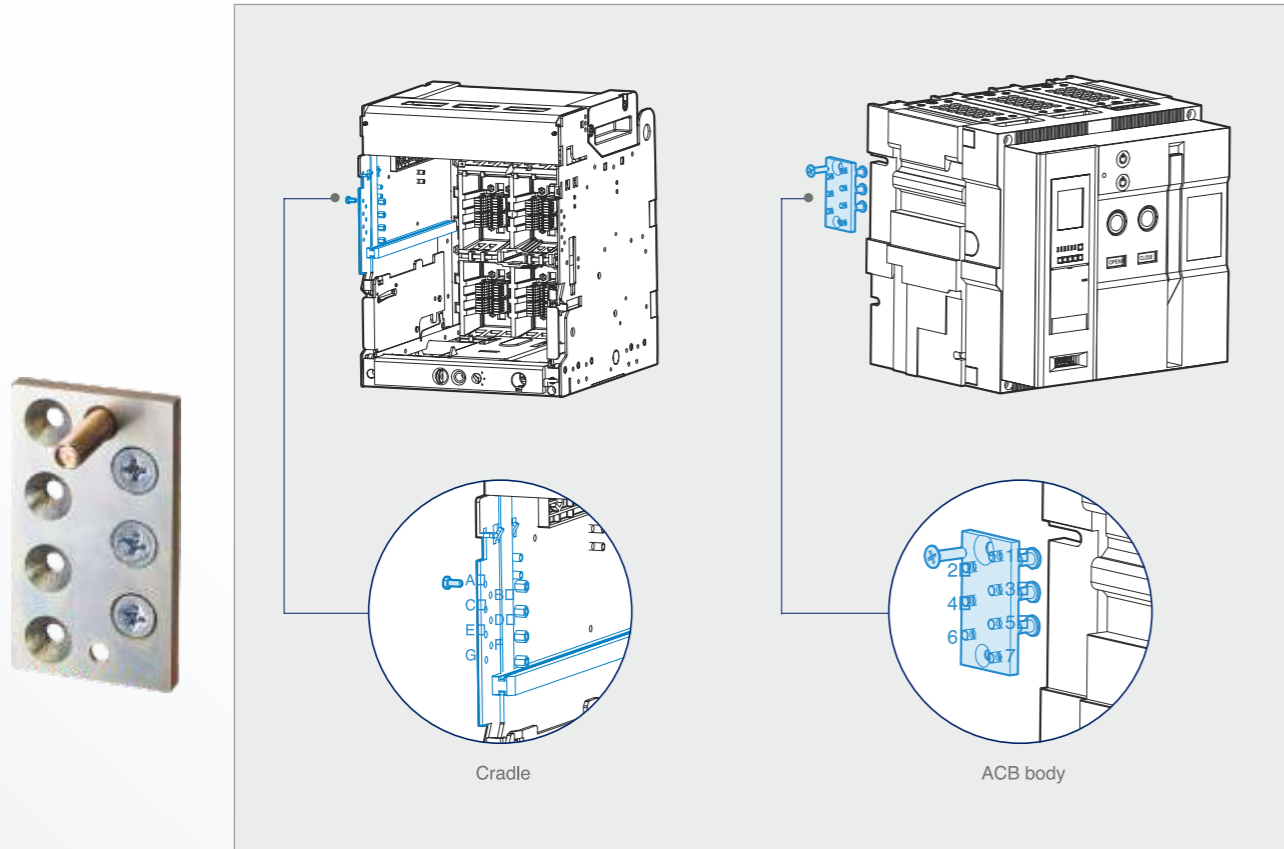
- Baud rate setting
- Comm. address setting
- Temperature setting

- 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

# Accessories

## Miss Insertion Prevent Device [IPMIP]



- 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.

# Ordering Code

1,2 TYPE	3,4 ACB/CT RATING	5 No. of POLES	6 Manual / Electrical FIXED/DRAW OUT	7,8,9,10,11,12 CODE			13,14,15 TRIP RELAY	Communication & Protection	CONTROL VOLTAGE & FREQUENCY
				MOTOR	CC	SHT			
BN/ AN	630A	3-POLE	3 MANUAL/ELECTRICAL FIXED	M0	D0	D0	NIL	WITHOUT TRIP RELAY (CODE:- 000)	
	800A	4-POLE	4	M1	D1	D1	AC/DC 100-130V	G SELF POWERED,50HZ	
BN	1000A		MANUAL DRAW OUT	M2	D2	D2	AC/DC 200-250V	N	Without Communication + L/S/I/G
	1250A		ELECTRICAL DRAW OUT	M3	D3	D3	DC 125V		SELF POWERED,60HZ
BS/ AS	1600A			M4	D4	D4	DC 24-30V		
	2000A			M5	D5	D5	DC 48-60V	A	Without Communication
BS/ AS	2500A			M6	D6	D6	AC 380-415V		Without Communication + Earth Leakage
	3200A			M7	D7	D7	AC 48V		Without Communication + Earth Leakage
BS/ AS	2000A			M8	D8	D8	AC 440-480V		Communication
	2500A								Communication + Earth Leakage
BS/ AS	3200A								Communication + Earth Leakage
	4000A								Communication + Earth Leakage
BS/ AS	5000A								Communication
	6300A							P	Communication + Earth Leakage
									Communication + Earth Leakage
									Communication + Pre-Trip Alarm

**"NORMAL" type Release**  
 \* L/S/I/G configuration supplied as standard  
 - With LED Indicators  
 - Without output contacts  
 \* Ground fault system is by vector sum

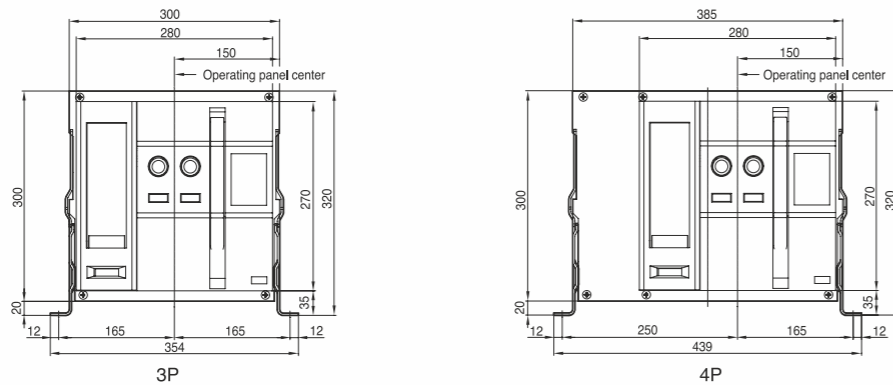
**"AMMETER" type Release**  
 \* L/S/I/G configuration supplied as standard  
 \* Ground fault system is by vector sum(G,C)  
 \* Earth Leakage system  
 -Z,K: External CT- HPL ZCT to be used for fault current 0.5- 30A, 1600AF  
 -E,X: External CT- Customer has to use on his own for fault current > 30A  
 \* Communication and output contacts DO NOT work under self power condition

**"POWER METER" type Release**  
 \* L/S/I/G configuration supplied as standard  
 \* Ground fault system is by vector sum(G,C)  
 \* Earth Leakage system  
 -K: External CT- HPL ZCT to be used for fault current 0.5- 30A, 1600AF  
 -X: External CT- Customer has to use on his own for fault current > 30A  
 \* Applicable for generator protection purpose

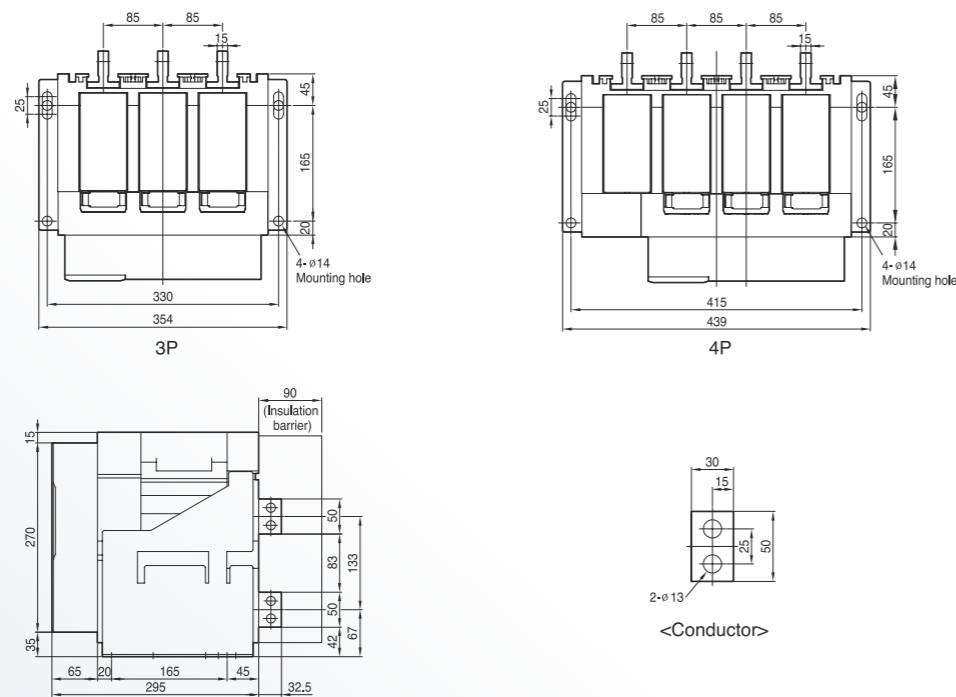
# Dimensions

## Fixed Type 1600AF (630~1600A : D - Frame)

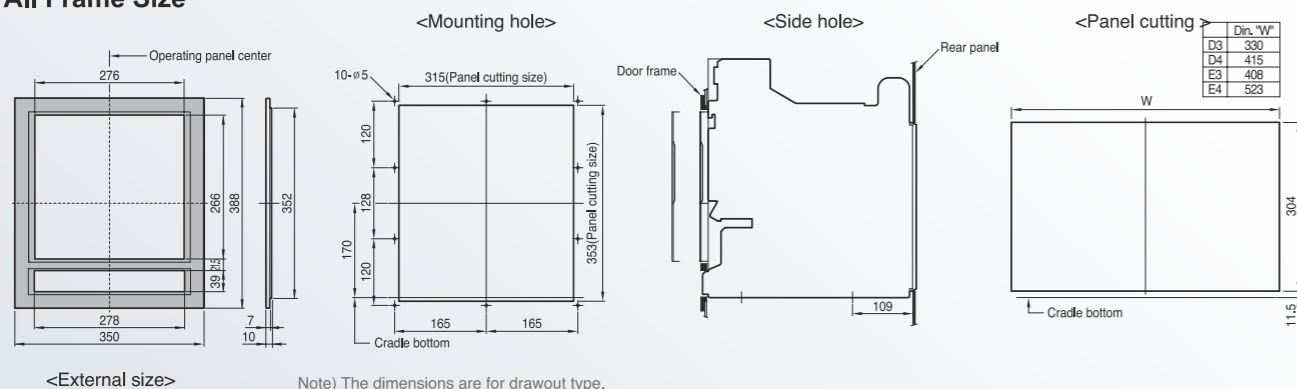
Front view



Vertical type



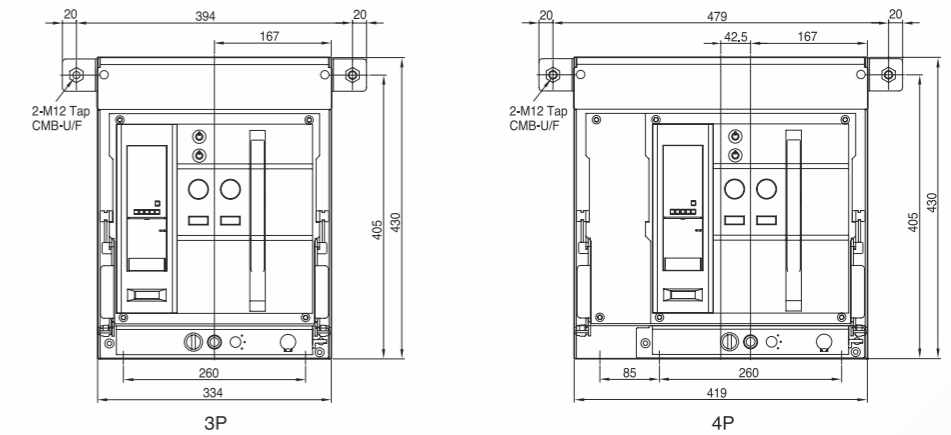
### Door Frame : IPDF (For Draw-out type only) All Frame Size



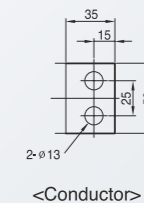
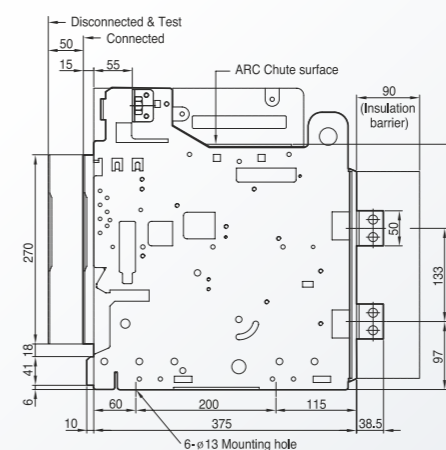
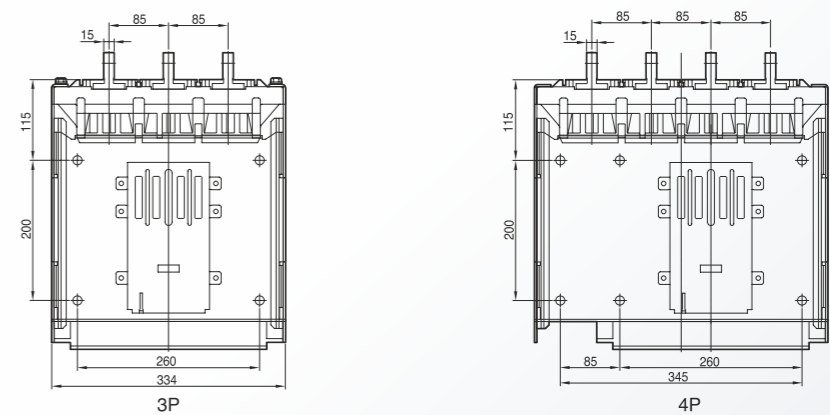
Note) The dimensions are for drawout type.

## Draw- Out Type 1600AF D - Frame

Front view



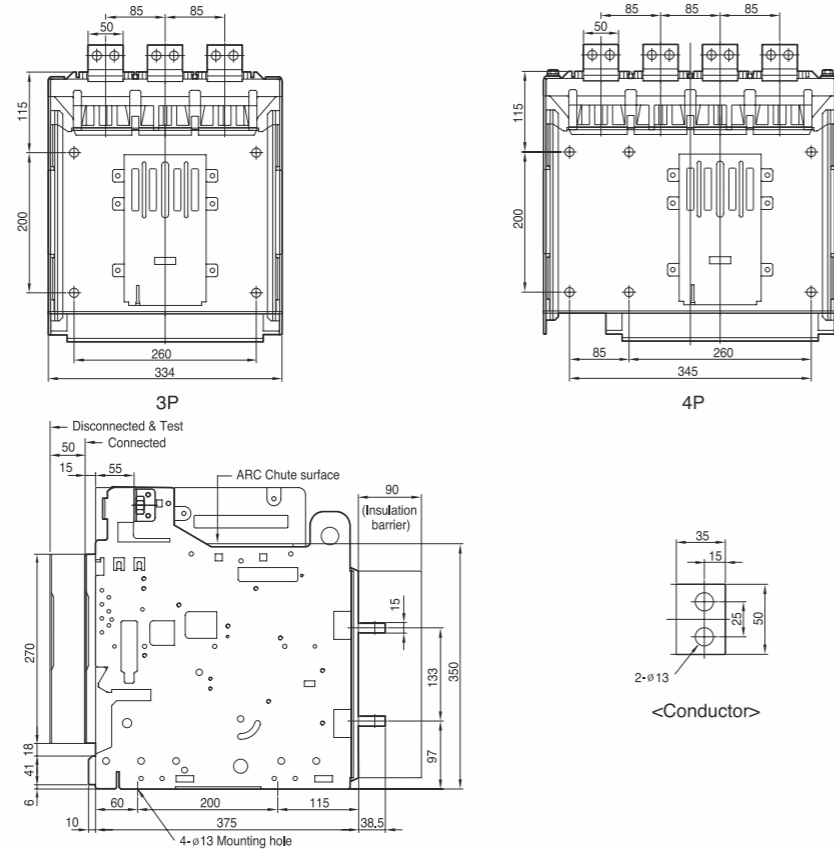
Vertical type



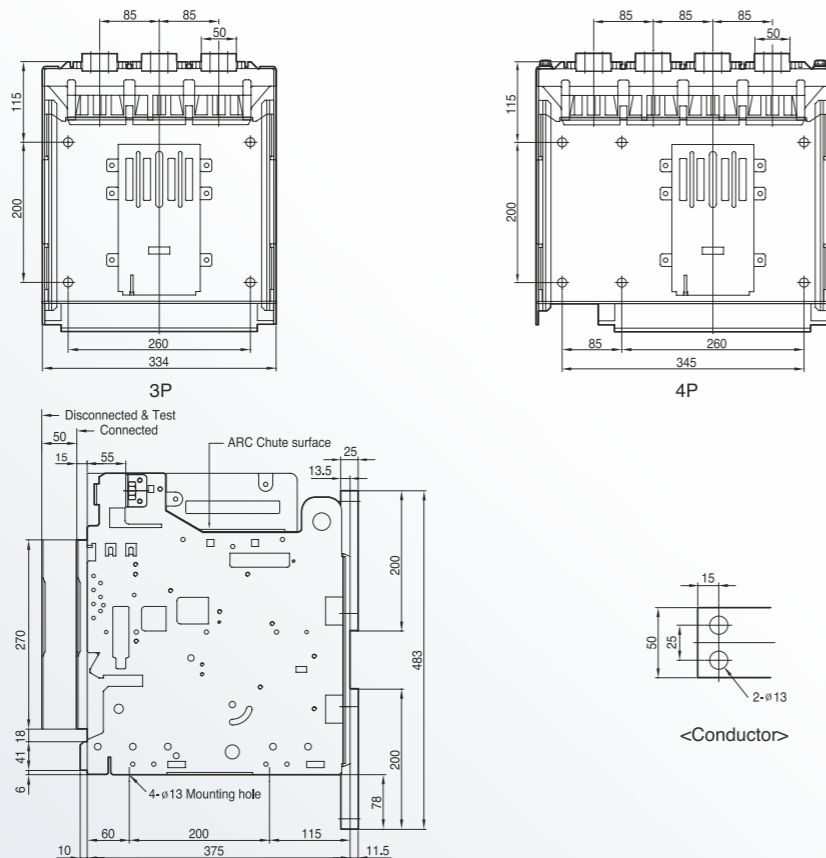
# Dimensions

## Draw- Out Type 1600AF (630-1600A: D - Frame)

Horizontal type

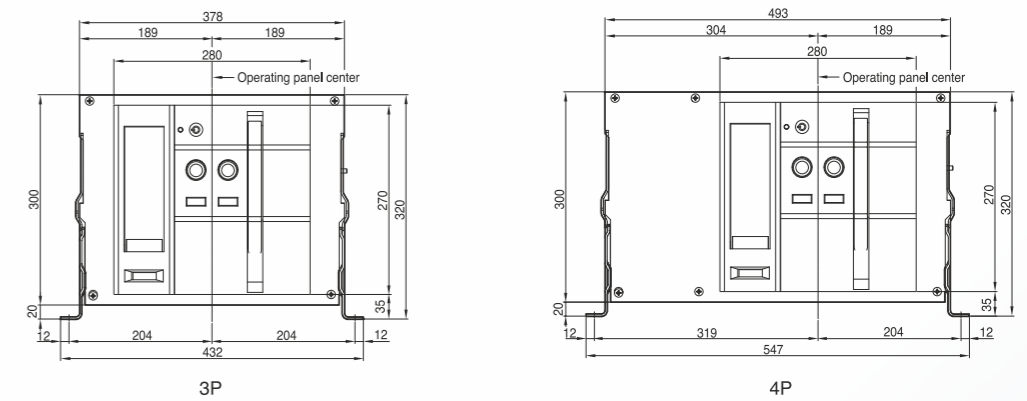


Front connection type

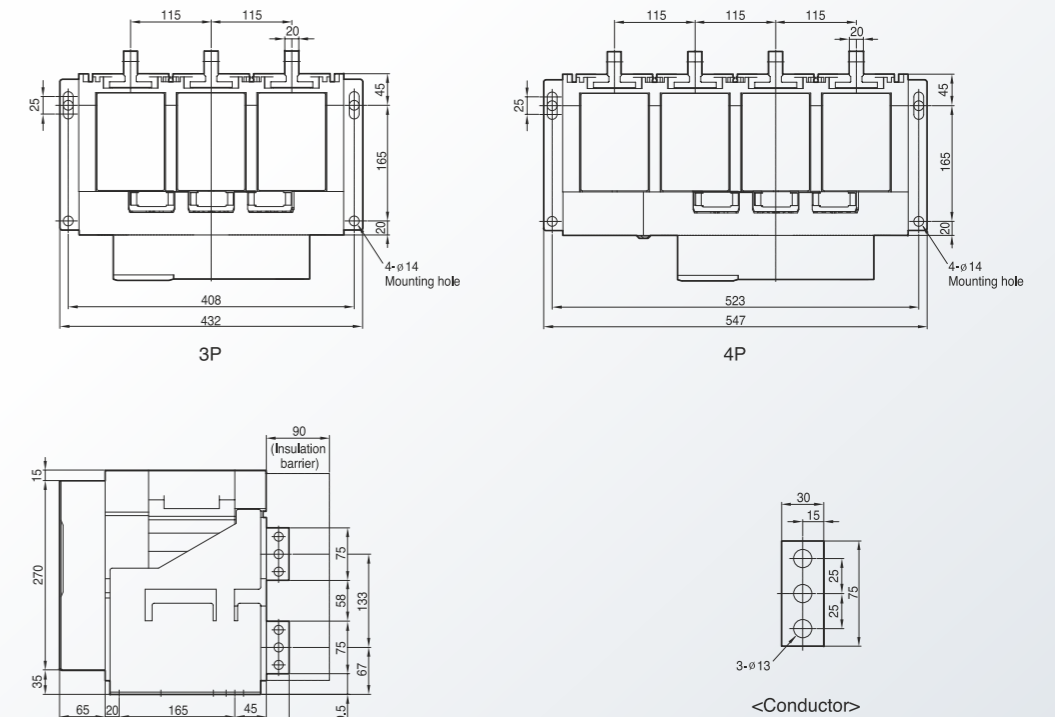


## Fixed Type 4000AF (2000~3200A : E - Frame)

Front view



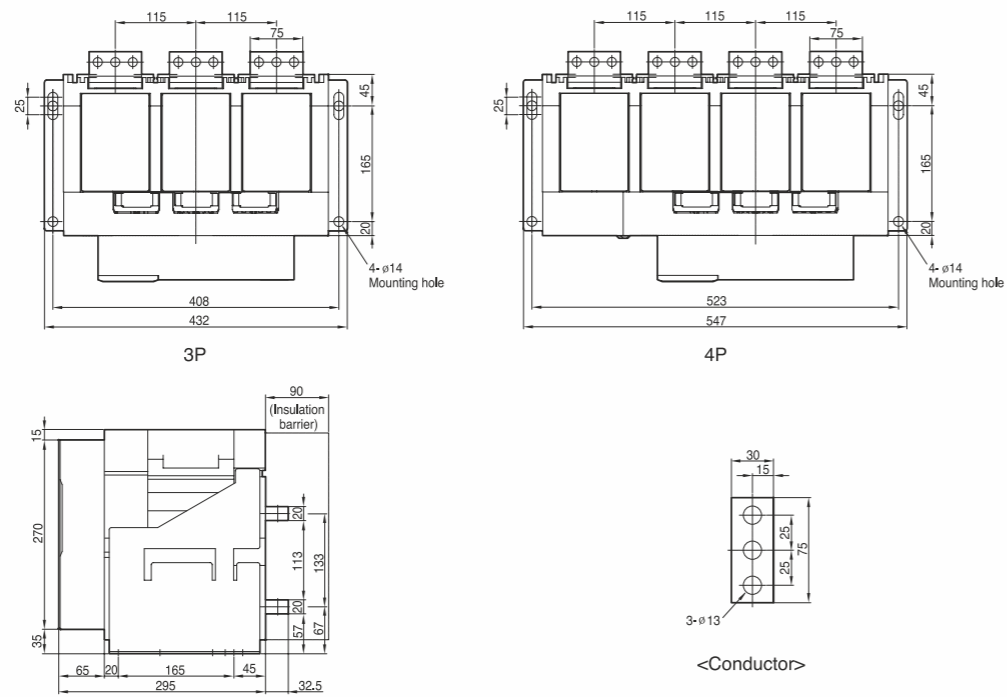
Vertical type





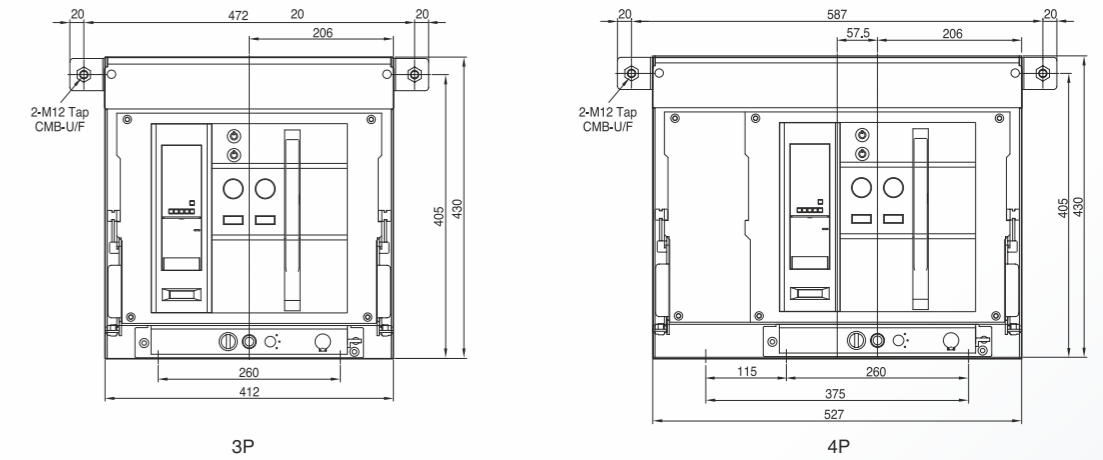
# Dimensions

Horizontal type

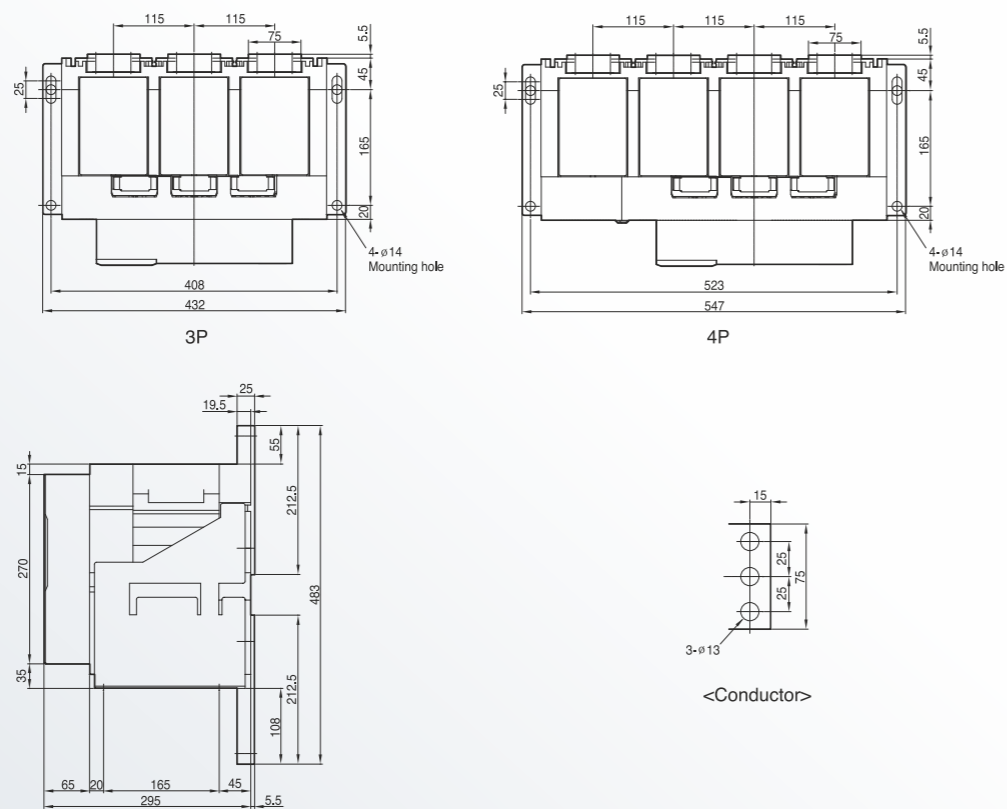


# Draw-Out Type 4000AF (2000~3200A : E - Frame)

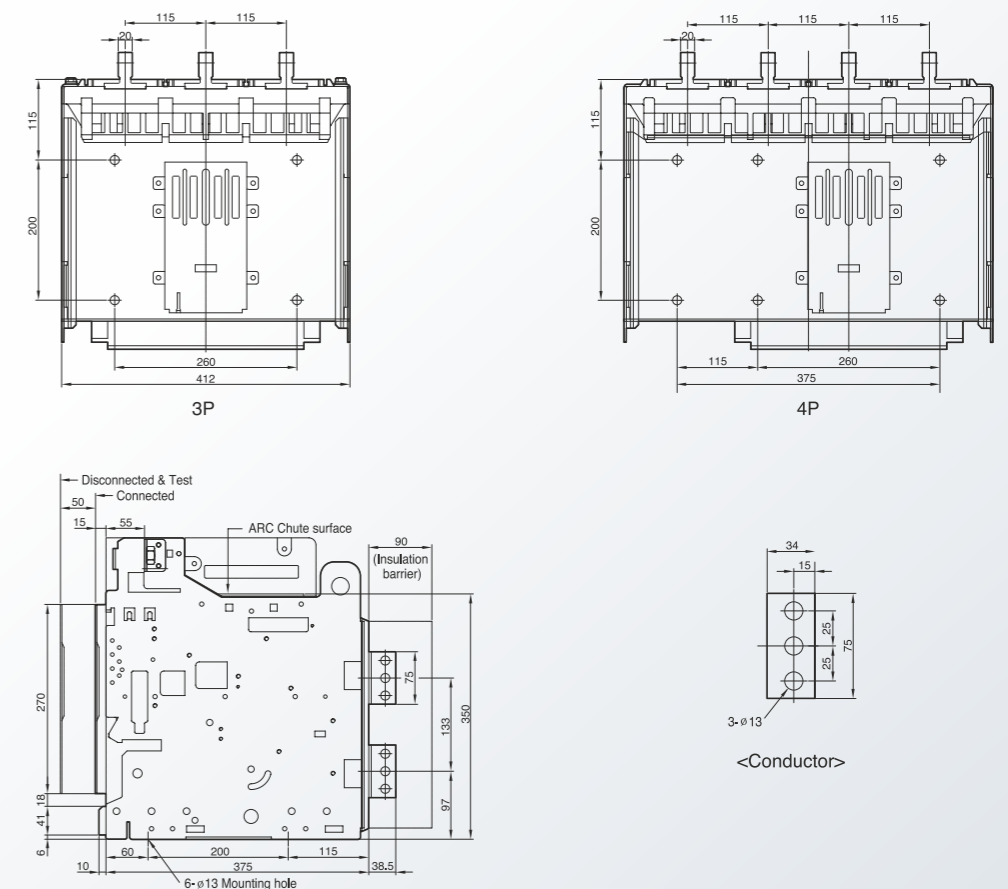
Front view



Front Connection type

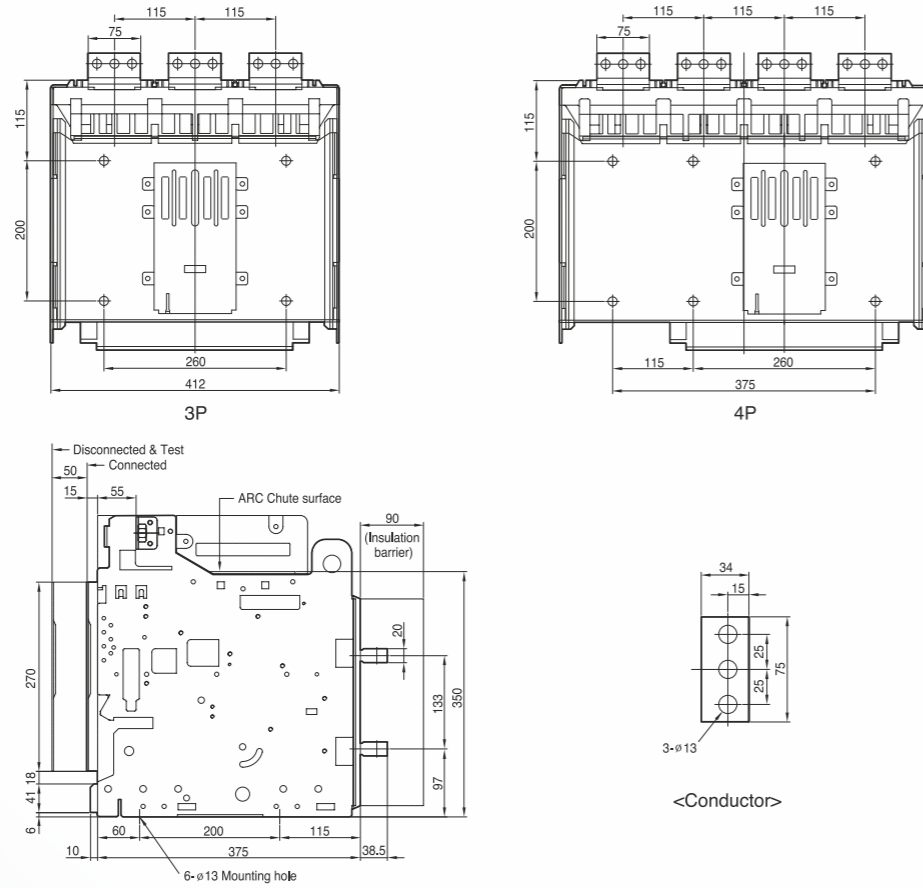


Vertical type

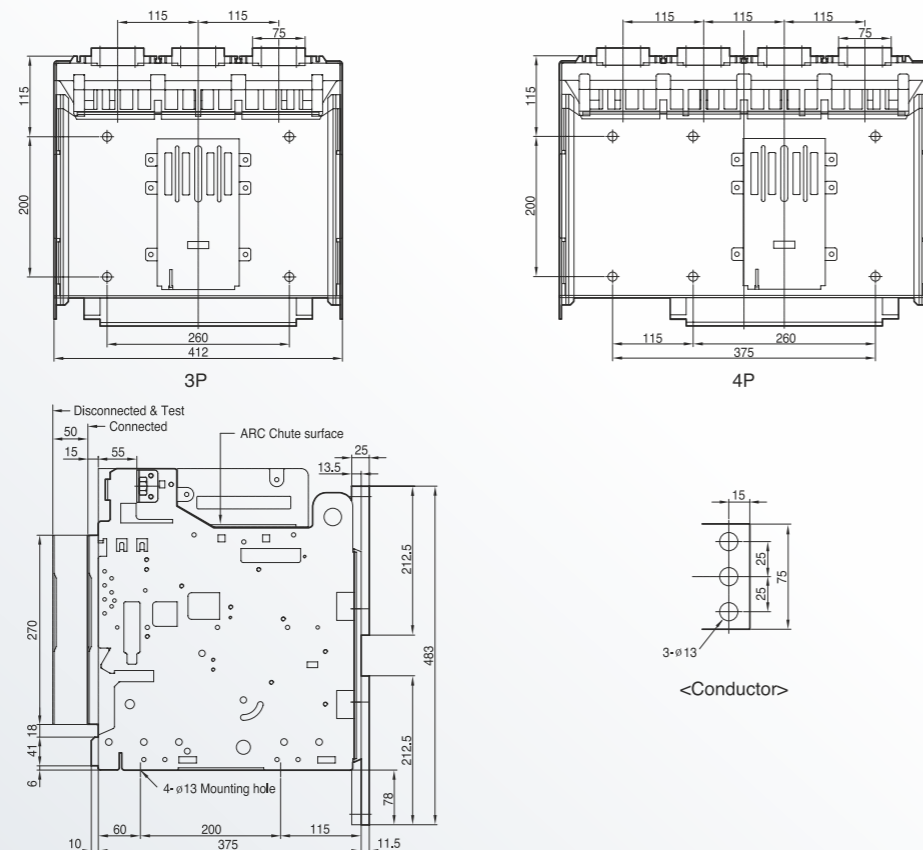


# Dimensions

Horizontal type

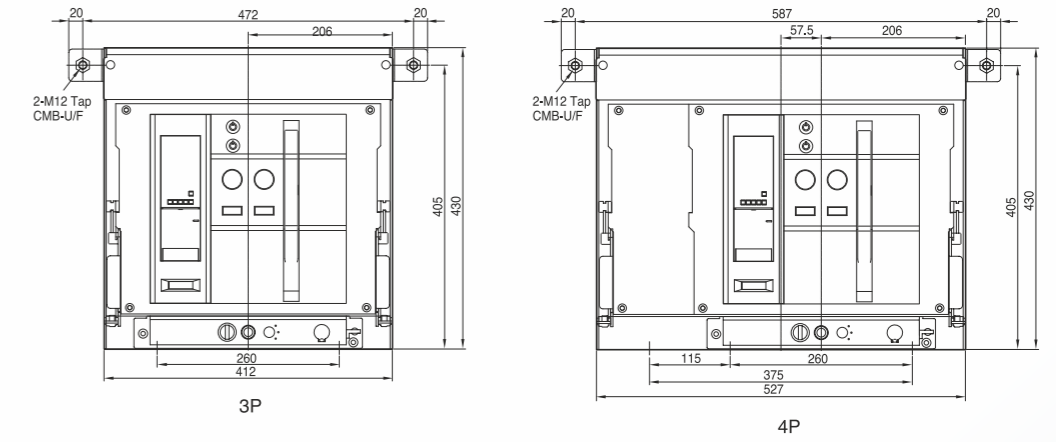


Front connection type

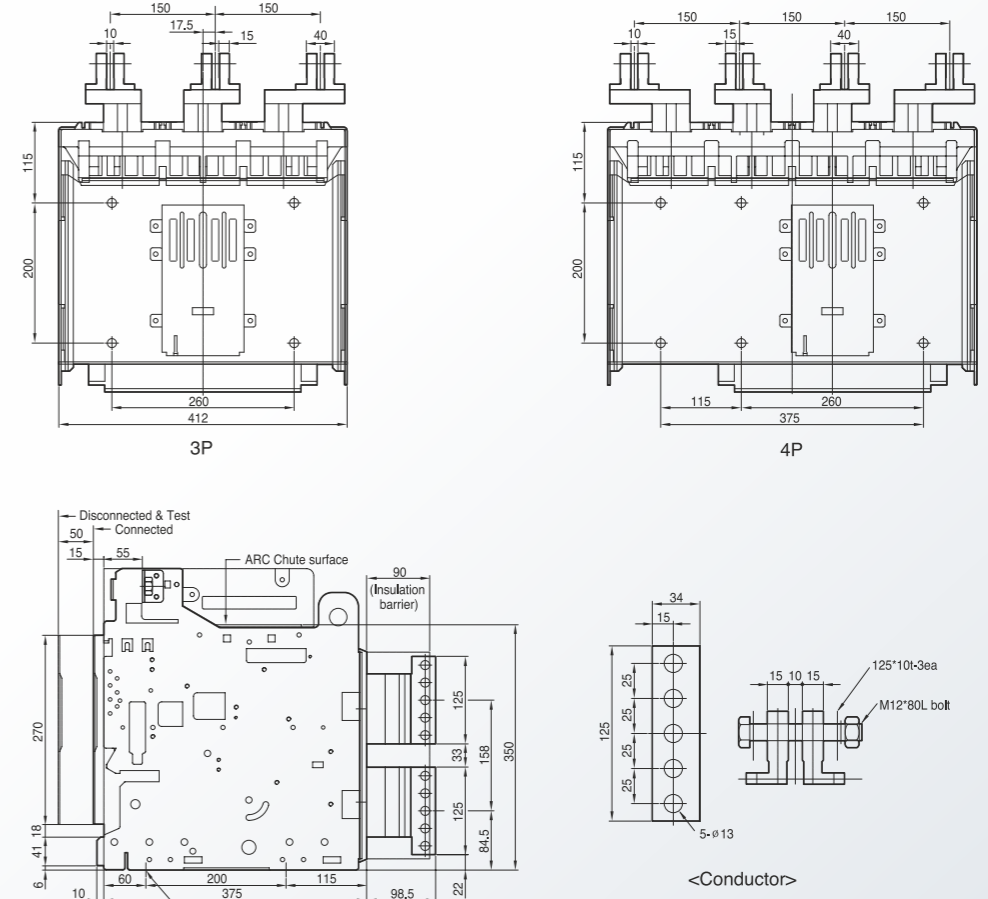


# Draw-Out Type 4000AF (4000A : E - Frame)

Front view

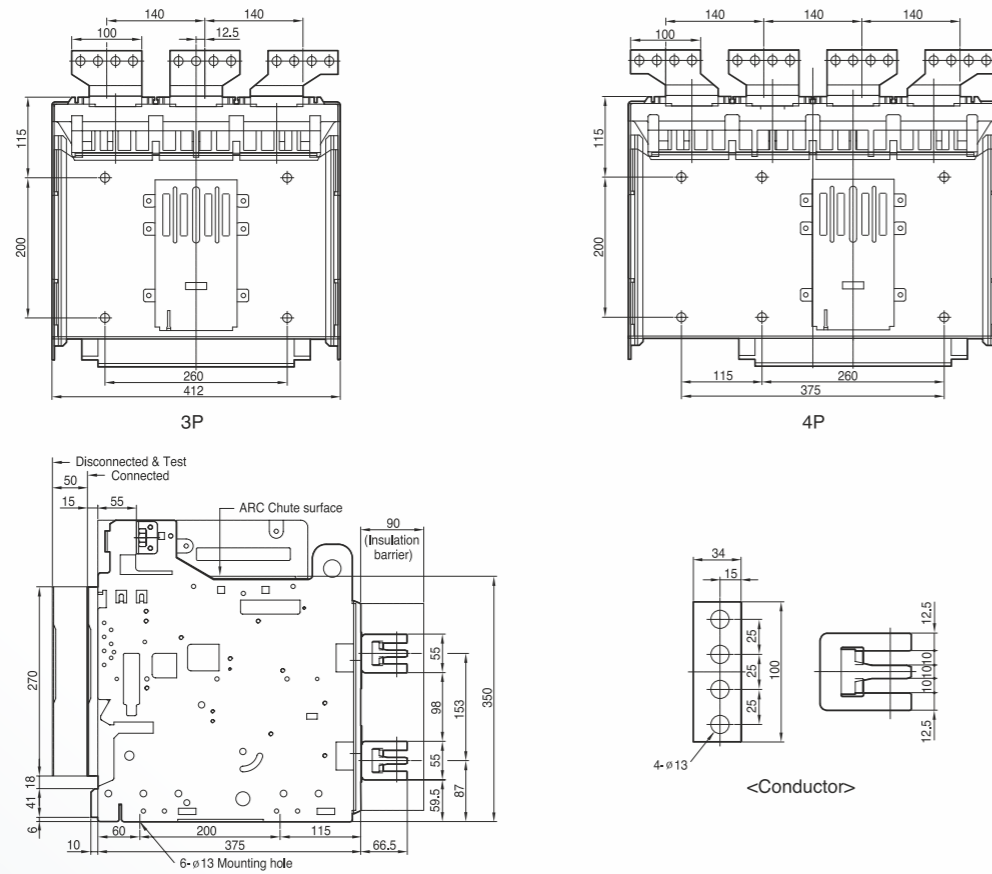


Vertical type

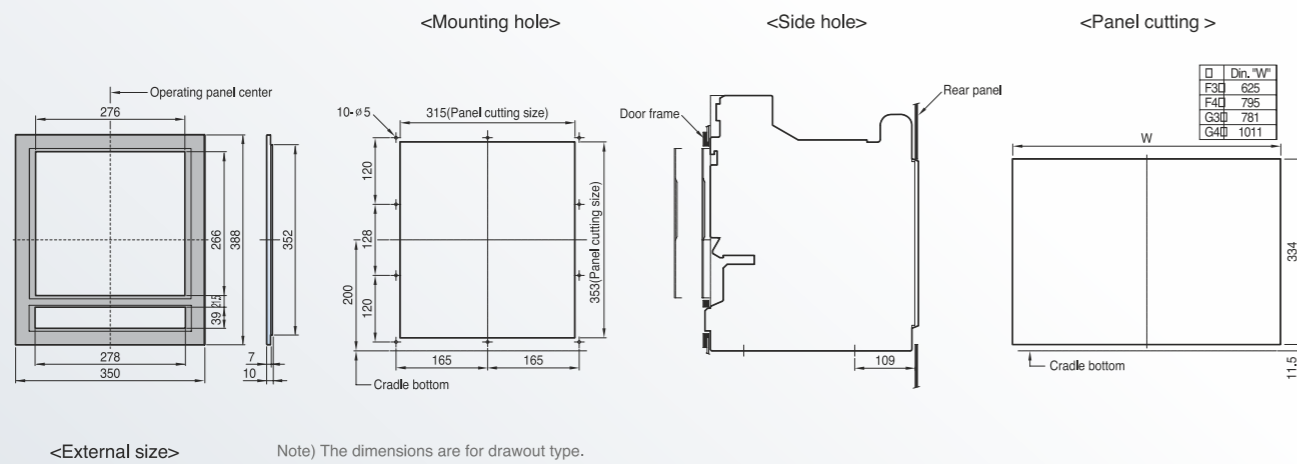


# Dimensions

## Horizontal type

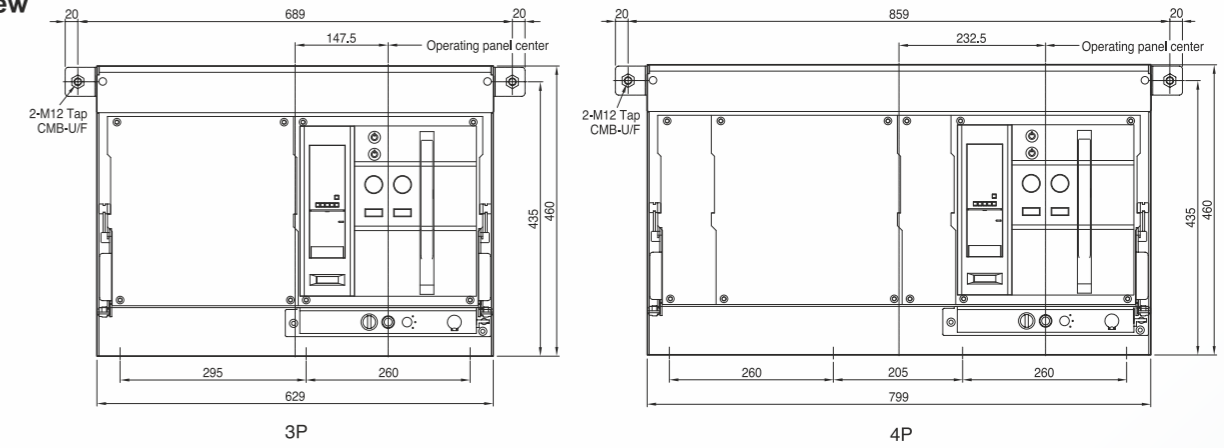


## Door Frame : IPDF (For Fixed Type Only) (AH-G,AS-F)

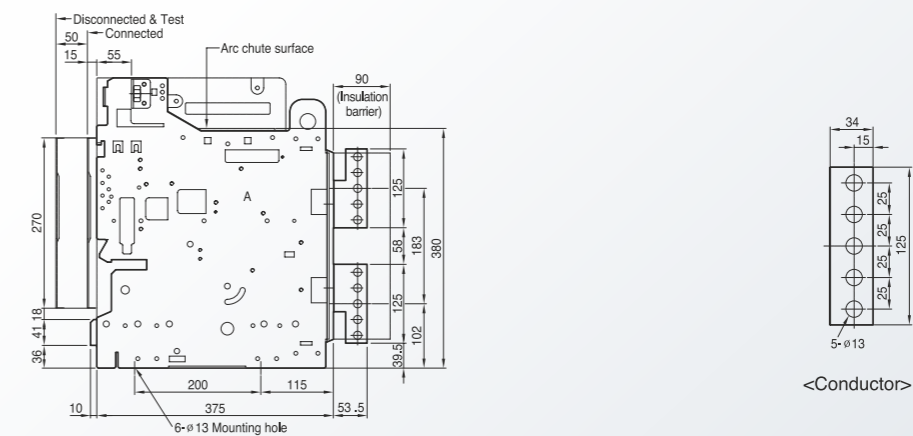
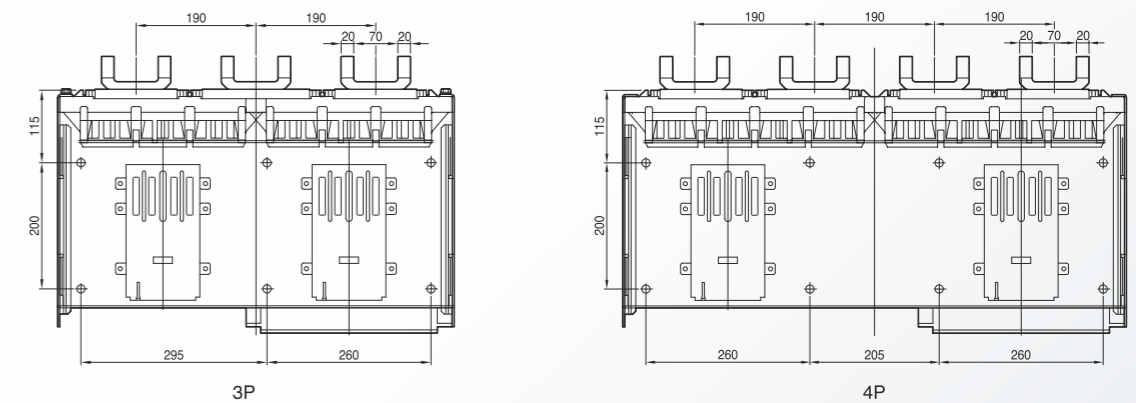


# Draw-Out Type 5000AF F - Frame

## Front view



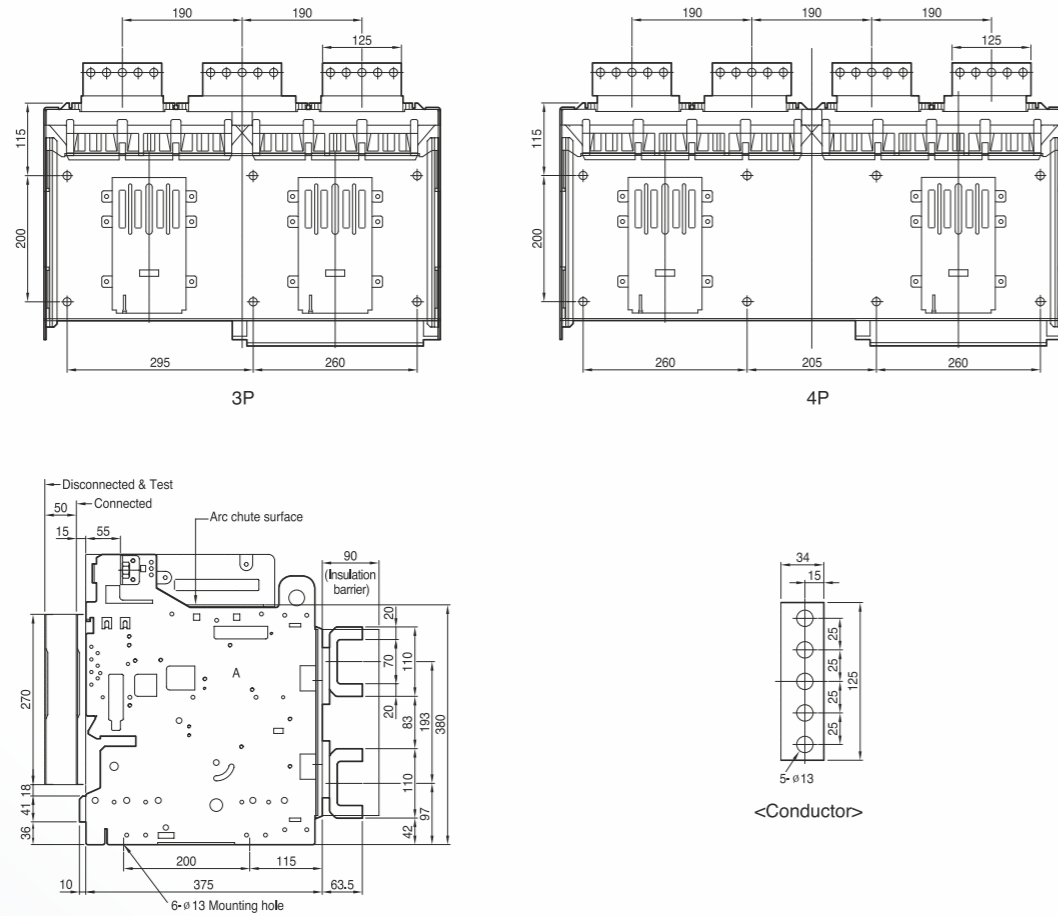
## Vertical type



Dimensions

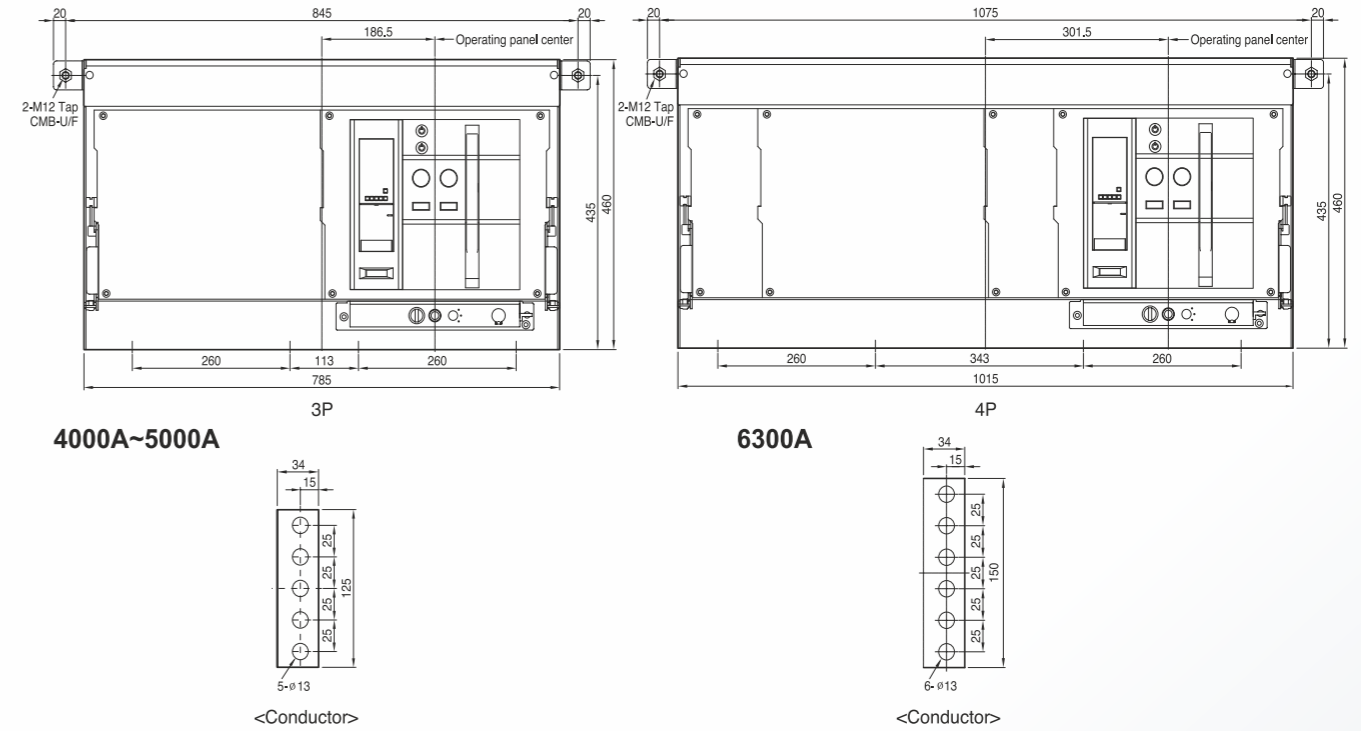
Dimensions

**Horizontal type**

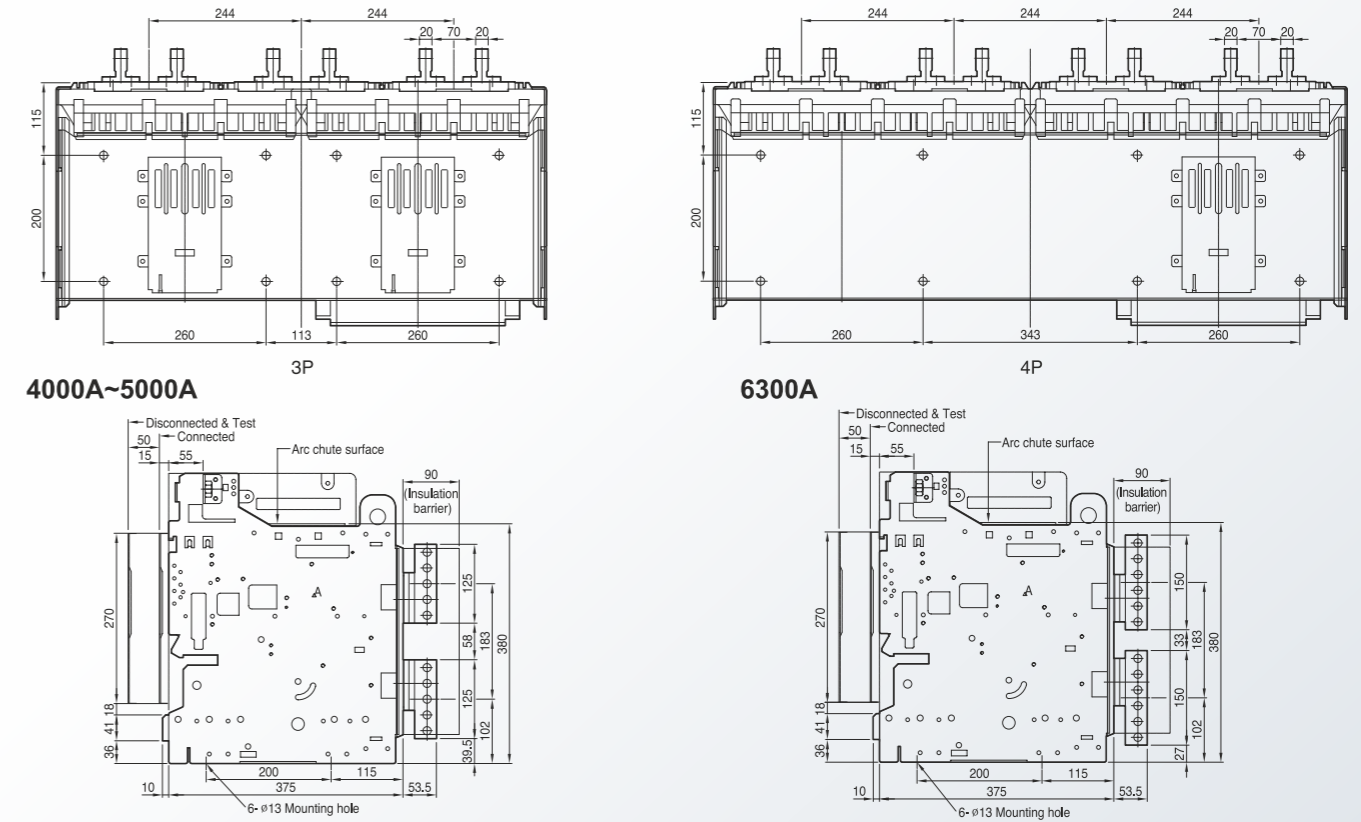


**Draw-Out Type 6300AF G - Frame**

**Front view**



**Vertical type**



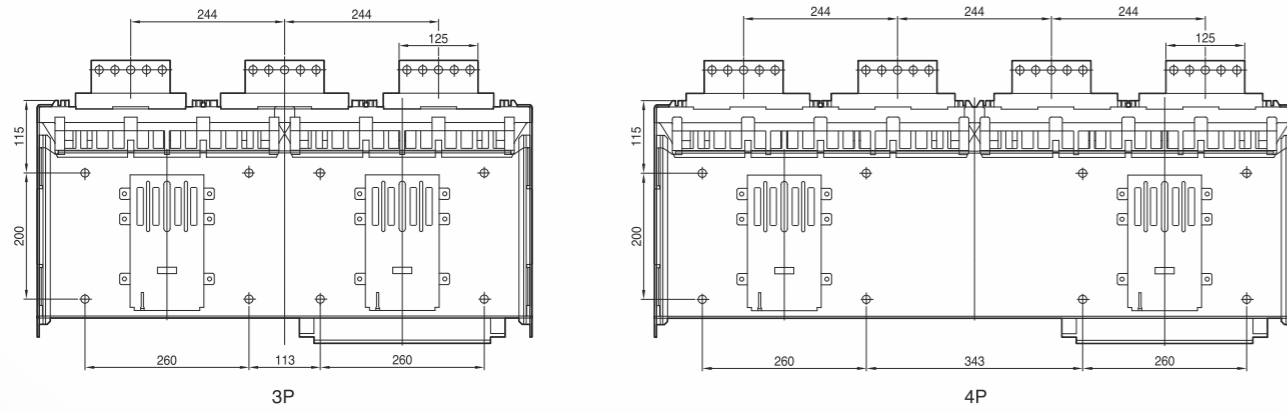
Dimensions

Dimensions

# Dimensions

Horizontal type

4000A~5000A



6300A

