

# Trip Relay (OCR)

*Trip relays are classified according to function.*

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

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



Metasol 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.

# Metasol ACB Trip relay

**N type**



**A type**



**P type**



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

- L/S/I/G(or EL)
- Thermal
- ZSI (Protective coordination)
- Remote Reset
- Modbus/RS-485
- Profibus-DP
- Self Power
- AC/DC 100~250V
- DC 15~60V
- RTC Timer mounted
- Fault Recording (10EA)

- L/S/ I/G(or EL)
- Thermal (linear hot start)
- UV/OV/OF/UF/rP/Vun/Iun
- Measurement: V/A/W/Wh/F/PF
- ZSI (Protective coordination)
- Remote Reset
- Modbus/RS-485
- Profibus-DP
- AC/DC 100~250V
- DC 15~60V
- RTC Timer mounted
- Event Recording (256EA)
- Fault Recording (256EA)

## *Trip relays series*



### **N Type (Normal)**

- Self-power + Overcurrent protection



### **A Type (Ammeter)**

- Current Meter + Overcurrent protection +  
DO control + Communication



### **P Type (Power Meter)**

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



# 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.







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# Trip relays

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## Trip relay types

Classification	N type	A type	P type	S type
Externals				
Current protection	• L / S / I / G / Thermal	• L / S / I / G(or EL) • Thermal • ZSI (Protective coordination)	• L / S / I / G(or EL) • Thermal (linear hot start) • ZSI (Protective coordination)	• L / S / I / G(or EL) • Thermal (linear hot start) • ZSI (Protective coordination)
Other protection	-	-	• Over/Under voltage • Over/Under frequency • Unbalance(Voltage/Current) • Reverse power	• Over/Under voltage • Over/Under frequency • Unbalance(Voltage/Current) • Reverse power
Measurement function	-	• Current (R / S / T / N)	• 3 Phase Voltage/Current RMS/Vector • Power(P, Q, S), PF(3-Phase) • Energy(Positive/Negative) • Frequency, Demand	• 3 Phase Voltage/Current RMS/Vector • Power(P, Q, S), PF(3-Phase) • Energy(Positive/Negative) • Frequency, Demand • Voltage/Current harmonics (1st~63th) • 3 Phase Waveforms • THD, TDD, K-Factor
Fine adjustment	-	-	• Fine adjustment for long/short time delay/instantaneous/ ground	• Fine adjustment for long/short time delay/instantaneous/ ground
Pre Trip Alarm	-	-	• Overload protection relays : DO (Alarm) (Ground fault is not available when using Pre trip alarm)	• Overload protection relays : DO (Alarm) (Ground fault is not available when using Pre trip alarm)
Digital Output	-	• 3DO (Fixed) • L, S/I, G Alarm	• 3DO (Programmable) • Trip, Alarm, General	• 3DO (Programmable) • Trip, Alarm, General
IDMTL setting	-	-	• Compliance with IEC60255-3 SIT, VIT, EIT, DT	• Compliance with IEC60255-3 SIT, VIT, EIT, DT
Communication	-	• Modbus/RS-485 • Profibus-DP	• Modbus / RS-485 • Profibus-DP	• Modbus / RS-485 • Profibus-DP
Power supply	• Self Power - Power source works over 20% of load current.	• Self Power - Power source works over 20% of load current - External power source are required for comm. • AC/DC 100~250V • DC 15~60V	• AC/DC 100~250V • DC 15~60V	• AC/DC 100~250V • DC 15~60V
RTC timer	-	• Available	• Available	• Available
LED for trip info.	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault	• Long time delay • Short time delay/Instantaneous • Ground fault
Fault recording	-	• 10 records (Fault/Current/Date and Time)	• 256 records (Fault/Current/Date and Time)	• 256 records • Last fault wave form recording (Voltage, current are recorded in 3-phase, and can be read only by communication)
Event recording	-	-	• 256 records(Content, Status, Date)	• 256 records(Content, Status, Date)
Operating button	• Reset button	• Reset, Menu Up/Down, Tap, Enter	• Reset, Menu Up/Down, Tap, Enter	• Reset, Menu Up/Down, Tap, Enter

Each OCR type has Battery in itself.

### 1. Battery lifespan

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

### 2. The display minimum range of OCR current

- 1) A type: When more 15% than rated current (In)
- 2) P/S type: When more 12% than rated current (In)

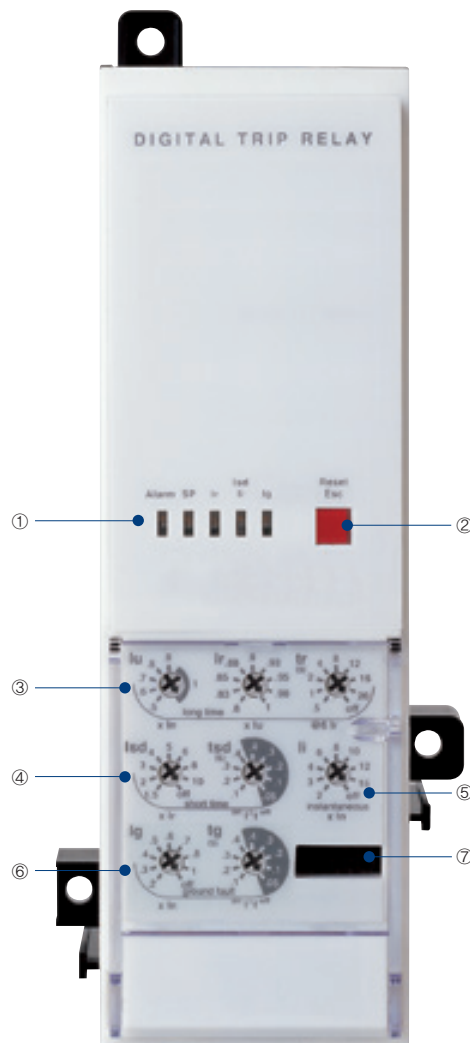
\* L/S/I/G(or EL)configuration as standard (Only. Unable to select ground fault and earth leakage, simultaneously)

# Trip relays

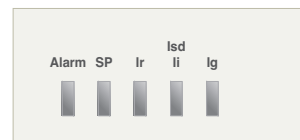
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## N type: 「Normal」 type

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



① LED: Indication of trip info. and overload state



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

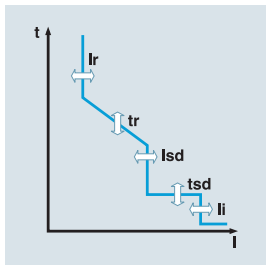
④ I<sub>sd</sub>: Short-time current setting, t<sub>sd</sub>: Short-time tripping delay setting

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

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

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

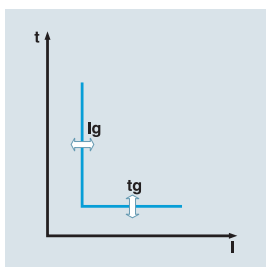
## Protection



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

Short time											
Current setting (A)	Isd = Ir × ...		1.5	2	3	4	5	6	8	10	Off
Time delay (s)	tsd	I²t Off	0.05	0.1	0.2	0.3	0.4				
Accuracy : ±10% or below 50ms		I²t On @(10×Ir)		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)	$I_i = I_n \times \dots$	2	3	4	6	8	10	12	15	Off
Tripping time	below 50ms									



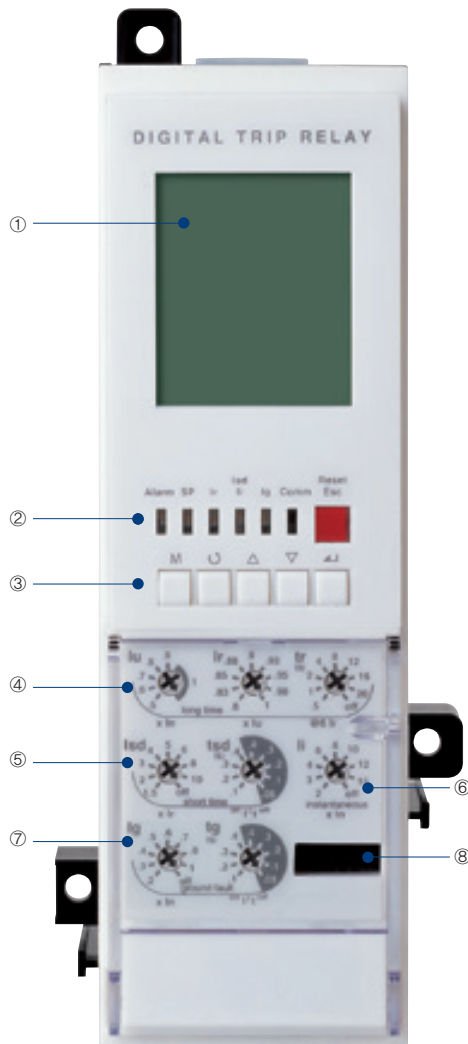
Ground fault												
Pick-up (A)	I <sub>g</sub> = I <sub>n</sub> × ...		0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off	
Time delay (s)	t <sub>g</sub>	I <sup>2</sup> t Off	0.05	0.1	0.2	0.3	0.4					
Accuracy : ±10%(I <sub>g</sub> ≥0.4I <sub>n</sub> )		I <sup>2</sup> t On @(1×I <sub>n</sub> )		0.1	0.2	0.3	0.4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

# Trip relays

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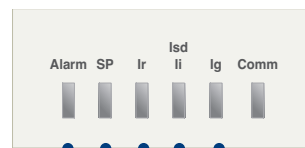
## A type: 「Ammeter」 type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground Fault( or Earth Leakage) Protection
  - Ground Fault : Available to select I<sup>2</sup>t ON/OFF
  - Earth Leakage : Applied to use External CT or Private ZCT  
Available to select Alarm/Trip
- 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



③ Key: Move to menu or reset



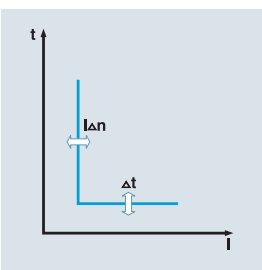
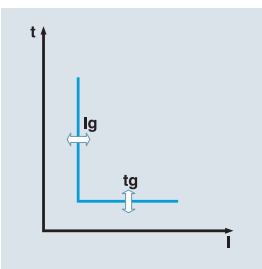
④ lu, lr: Long-time current setting, tr: Long-time tripping delay setting

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

⑥ li: Instantaneous current setting

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

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



Long time

Note) Unable to select ground fault and earth leakage, simultaneously

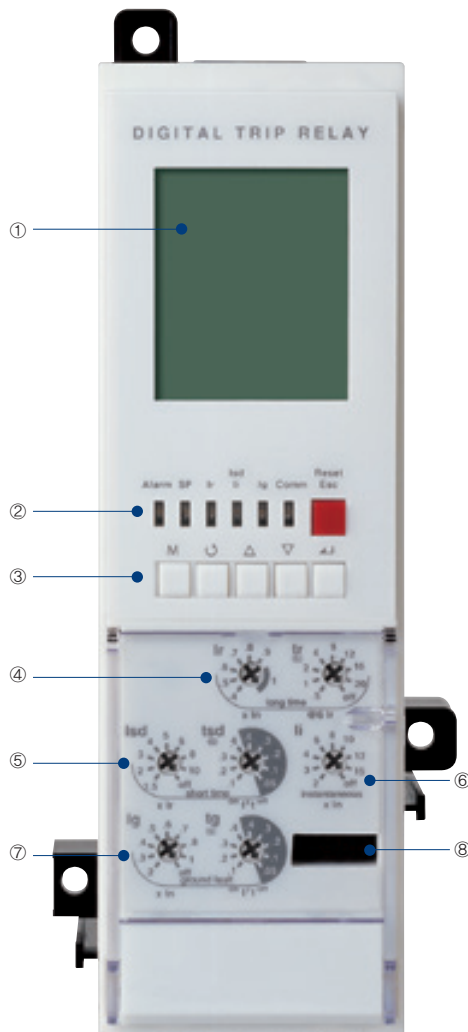


# Trip relays

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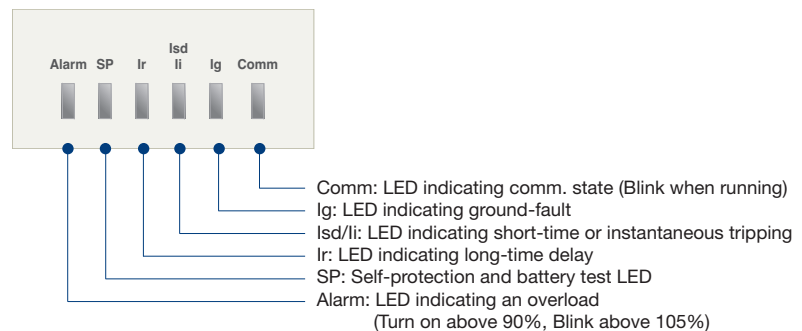
## P type: 'Power meter' type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground Fault( or Earth Leakage) Protection
  - Ground Fault : Available to select I<sup>2</sup>t ON/OFF
  - Earth Leakage : Applied to use External CT or Private ZCT  
Available to select Alarm/Trip
- 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
- Event recording
  - Records events of device related to setting change, operation and state change. (Max. up to 256)
- SBO (Select Before Operation)
  - High reliability for control and setting change method
- 3 DO(Digital output)
  - Programmable for alarm, trip and general DO
- Communication
  - Modbus/RS485
  - Profibus-DP

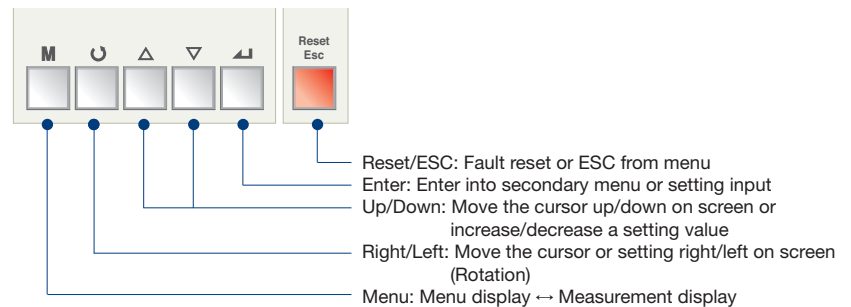


① Graphic LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



③ Key: Move to menu or reset



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

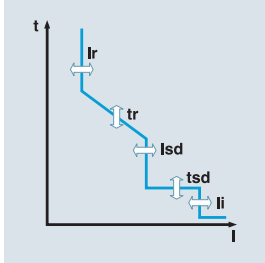
⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

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)

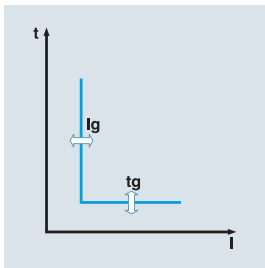
## Protection



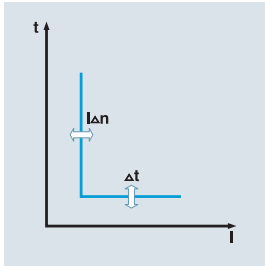
Long time										
Current setting (A)	$I_r = I_n \times \dots$	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
Time delay (s)	$tr @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500	Off
Accuracy: $\pm 15\%$ or below 100ms	$tr @ (6.0 \times I_r)$	0.5	1	2	4	8	12	16	20	Off
	$tr @ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5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

Short time										
Current setting (A)	$I_{sd} = I_r \times \dots$	1.5	2	3	4	5	6	8	10	Off
Time delay (s)	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4				
Accuracy: $\pm 10\%$ or below 50ms	$I^2t$ On @ $(10 \times I_r)$		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)	$I_i = I_n \times \dots$	2	3	4	6	8	10	12	15	Off
Tripping time		below 50ms								



Ground fault										
Pick-up (A)	$I_g = I_n \times \dots$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off
Time delay (s)	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4				
Accuracy: $\pm 10\%$ ( $I_g \geq 0.4 I_n$ ) $\pm 20\%$ ( $I_g < 0.4 I_n$ ) or below 50ms	$I^2t$ On @ $(1 \times I_n)$		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				



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

Note) Unable to select ground fault and earth leakage, simultaneously

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

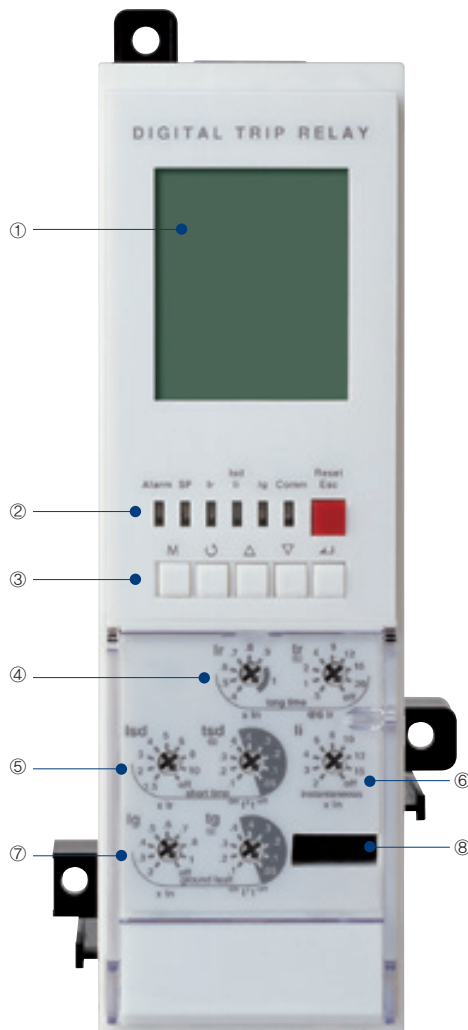
Other protection		Pick-up			Time delay(s)		
		Setting range	Step	Accuracy	Setting range	Step	Accuracy
Under voltage		80V ~ 0V_Pick-up	1V	±5%	1.2~40sec	0.1sec	±0.1sec
Over voltage		UV_Pick-up ~ 980V	1V	±5%			
Voltage unbalance		6% ~ 99%	1%	±2.5% or (±10%)			
Reverse power		10~500 kW	1kW	±10%	0.2~40sec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

# Trip relays

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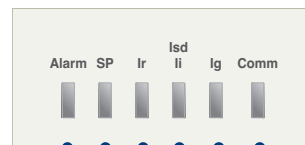
## S type: 'Supreme meter' type

- Overload protection
  - Long-time delay
  - Thermal
- Short-circuit protection
  - Short-time delay / Instantaneous
  - I<sup>2</sup>t On/Off optional (for short-time delay)
- Ground Fault( or Earth Leakage) Protection
  - Ground Fault : Available to select I<sup>2</sup>t ON/OFF
  - Earth Leakage : Applied to use External CT or Private ZCT Available to select Alarm/Trip
- 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

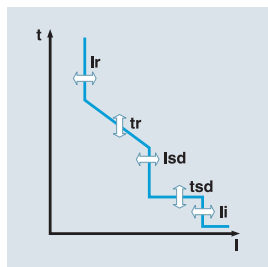
⑤ Isd: Short-time current setting, tsd: Short-time tripping delay setting

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)

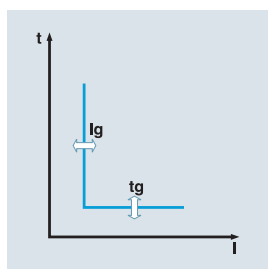
## Protection



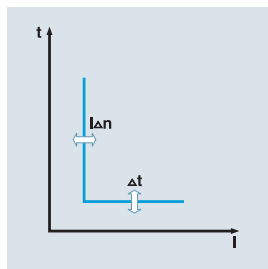
Long time										
Current setting (A)	$I_r = I_n \times \dots$	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
Time delay (s)	$tr @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500	Off
Accuracy: $\pm 15\%$ or below 100ms	$tr @ (6.0 \times I_r)$	0.5	1	2	4	8	12	16	20	Off
	$tr @ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5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

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

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



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



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

Note) Unable to select ground fault and earth leakage, simultaneously

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

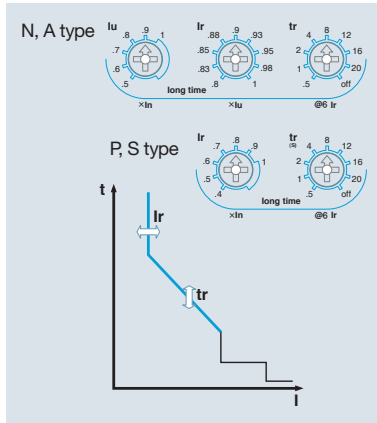
Other protection		Pick-up			Time delay(s)		
		Setting range	Step	Accuracy	Setting range	Step	Accuracy
Under voltage		80V ~ 0V_Pick-up	1V	±5%	1.2~40sec	0.1sec	±0.1sec
Over voltage		UV_Pick-up ~ 980V	1V	±5%			
Voltage unbalance		6% ~ 99%	1%	±2.5% or (±10%)			
Reverse power		10~500 kW	1kW	±10%	0.2~40sec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

# Trip relays

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## Operation characteristics

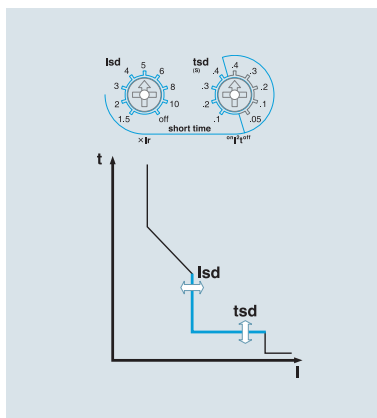
### Long-time delay (L)



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

- Standard current setting knob:  $I_r$ 
  - Setting range in P type and S type:  $(0.4-0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
  - Setting range in N type and A type:  $(0.4 \sim 1.0) \times I_n$ 
    - $I_u$ :  $(0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
    - $I_r$ :  $(0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0) \times I_u$
- Time delay setting knob:  $t_r$ 
  - 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
- Relay pick-up current
  - When current over  $(1.15) \times I_r$  flows in, relay is picked up.
- Relay operates basing on the largest load current among R/S/T/N phase.

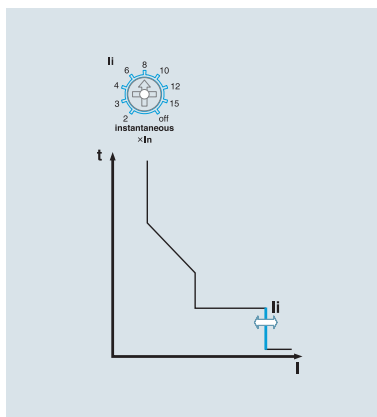
### Short-time delay (S)



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

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

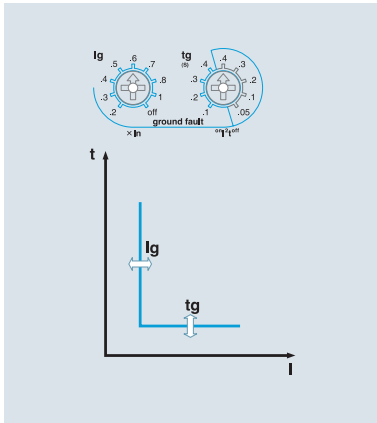


**The function for breaking fault current above the setting value within the shortest time to protect the circuit from short-circuit.**

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



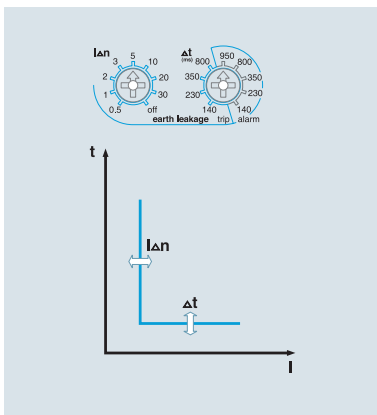
## Ground Fault (G)



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

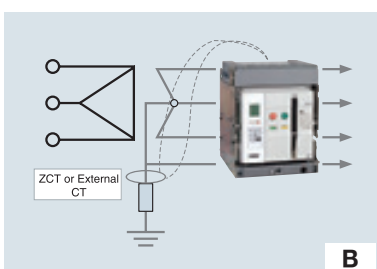
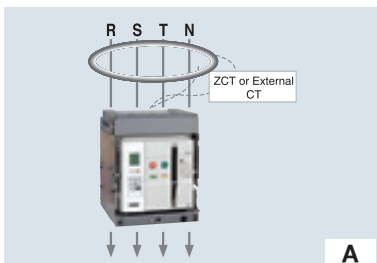
1. Standard setting current knob:  $I_g$ 
  - Setting range:  $(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-Off) \times I_n$
2. Time delay setting knob:  $t_g$ 
  - Inverse time ( $I^2t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2t$  Off): 0.05-0.1-0.2-0.3-0.4 sec
3. Ground fault current is vector sum of 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:  $I_{\Delta n}$ 
  - Setting range: 0.5-1-2-3-5-10-20-30-Off (A)
2. Time delay setting knob:  $\Delta t$ 
  - 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.
4. This function is enabled and can be used only with standard ZCT provided by LS or private external CT (secondary output 5A) selected by customers.
5. 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 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 ( $0.5A \times 20 = 10A$ )

### ※ 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) which is required with external CT usage in order to provide earth-leakage functions.

# Trip relays

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## Measurement function

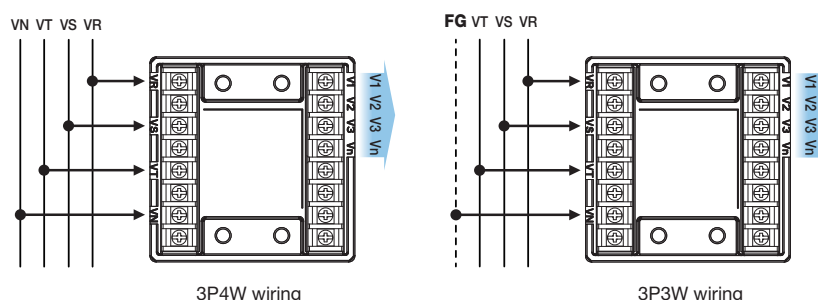
Class.	Measurement element	Detailed element	Unit	Display range
Current	Line current	Ia, Ib, Ic	A	A type: 0.15In~17In P/S type: 0.12In~1.6In
	Normal current	I <sub>1</sub>		
	Reverse current	I <sub>2</sub>		
Voltage	Line voltage	Vab, Vbc, Vca	V	60~690V
	Phase voltage	Va, Vb, Vc		
	Normal voltage	V <sub>1</sub>		
	Reverse voltage	V <sub>2</sub>		
Angle	Line-to-line	∠VabIa, ∠VabIb, ∠VabIc,	°	0~360°
	Line-to-current	∠VabVbc, ∠VabVca		
	Phase-to-phase	∠VaVb, ∠VaVc		
	Phase-to-current	∠VaIa, ∠VbIb, ∠VcIc		
Power	Active power	Pa(ab), Pb(bc), Pc(ca), P	kW	1kW~99,999kW
	Reactive power	Qa(ab), Qb(bc), Qc(ca), Q	kVar	1kVar~99,999kVar
	Apparent power	Sa(ab), Sb(bc), Sc(ca), S	kVA	1kVA~99,999kVA
Energy	Active energy	WHa(ab), WHb(bc), WHc(ca), WH	kWh MWh	1kWh~9999.99MWh
	Reactive energy	VARHa(ab), VARHb(bc), VARHc(ca), VARH	kVarh Mvarh	1kVarh~9999.99MVarh
	Reverse active energy	rWHa(ab), rWHb(bc), rWHc(ca), rWH	kWh MWh	1kWh ~9999.99MWh
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~99,999kW
	Current demand	Peak demand	A	80A~65,535A
Harmonics	Voltage harmonics	1st~63th harmonics of Va(ab), Vb(bc), Vc(ca)	V	60~690V
	Current harmonics	1st~63th harmonics of Ia, Ib, Ic	A	80A~65,535A
	THD, TDD		%	0.0~100.0
	K-Factor		-	0.0~100.0



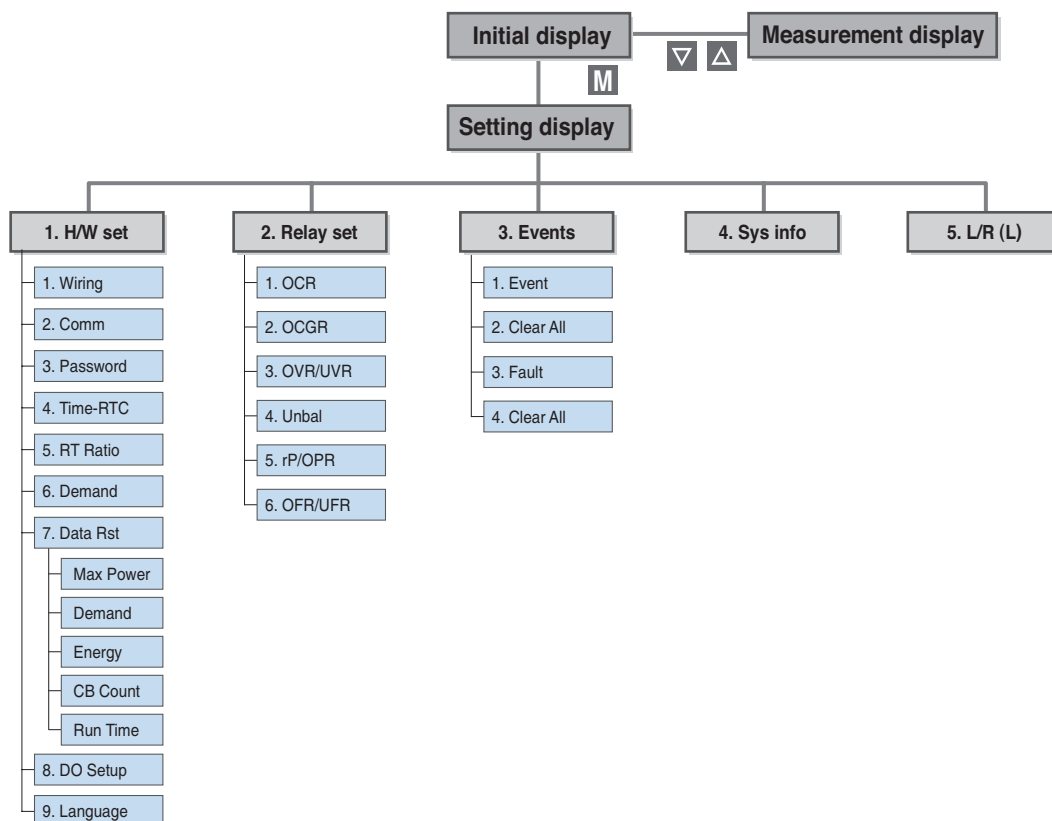
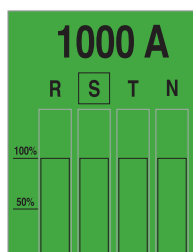
### Voltage module

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

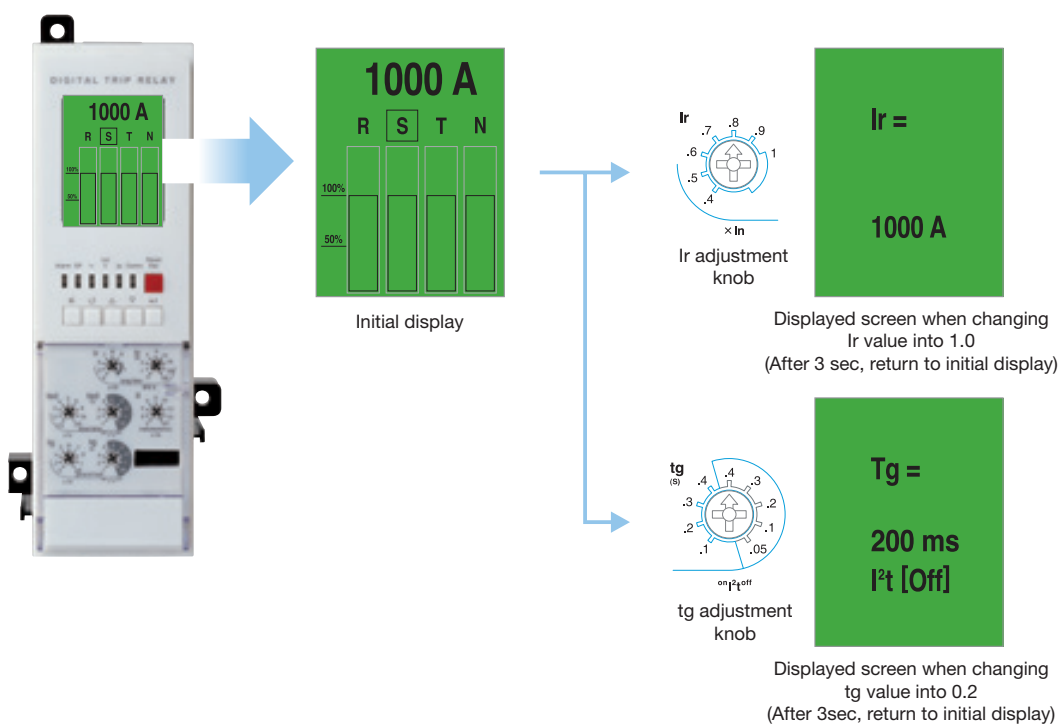
- Voltage input range: AC 60~690V
- Input/Output Ratio → 220V: 200mV



## Man machine interface



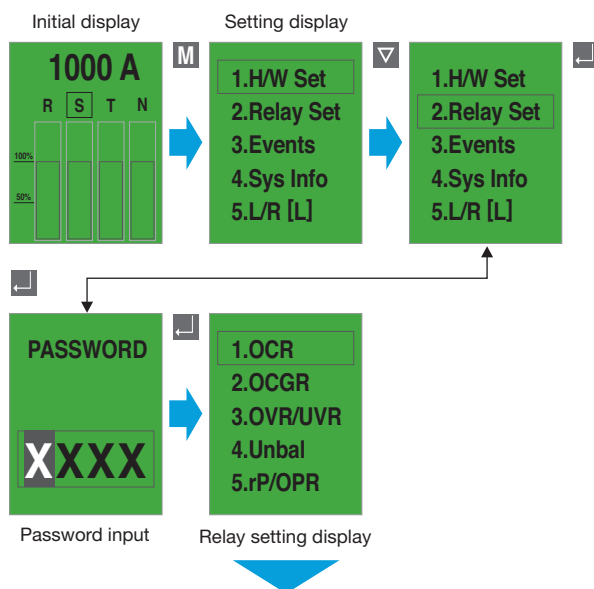
## An example of graphic LCD display



# Trip relays

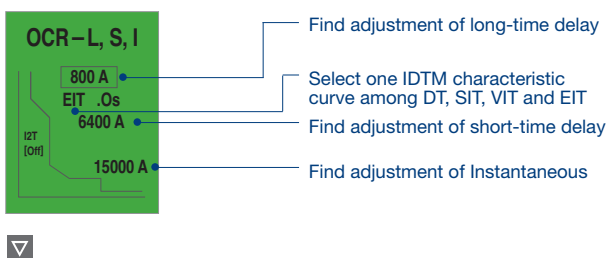
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## Protection element setting

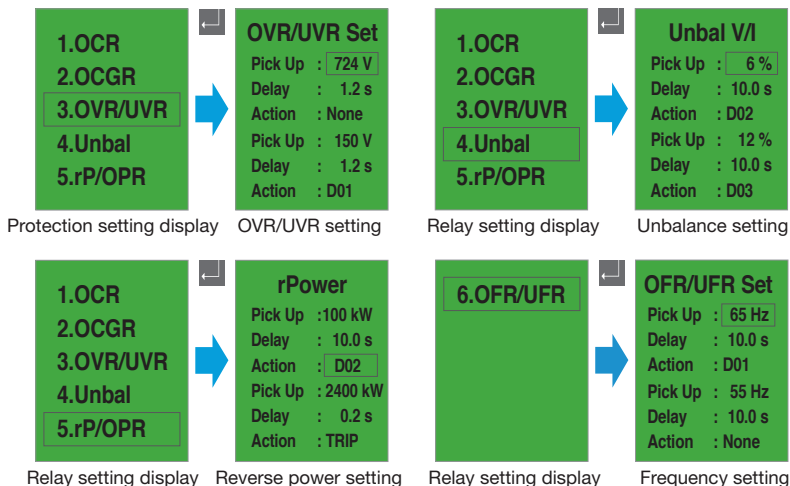
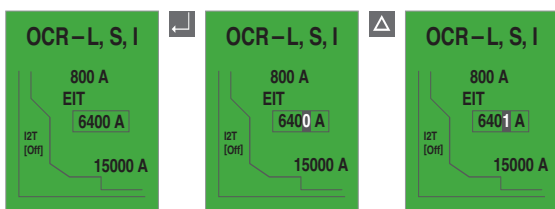


## Find adjustment of protection setting current

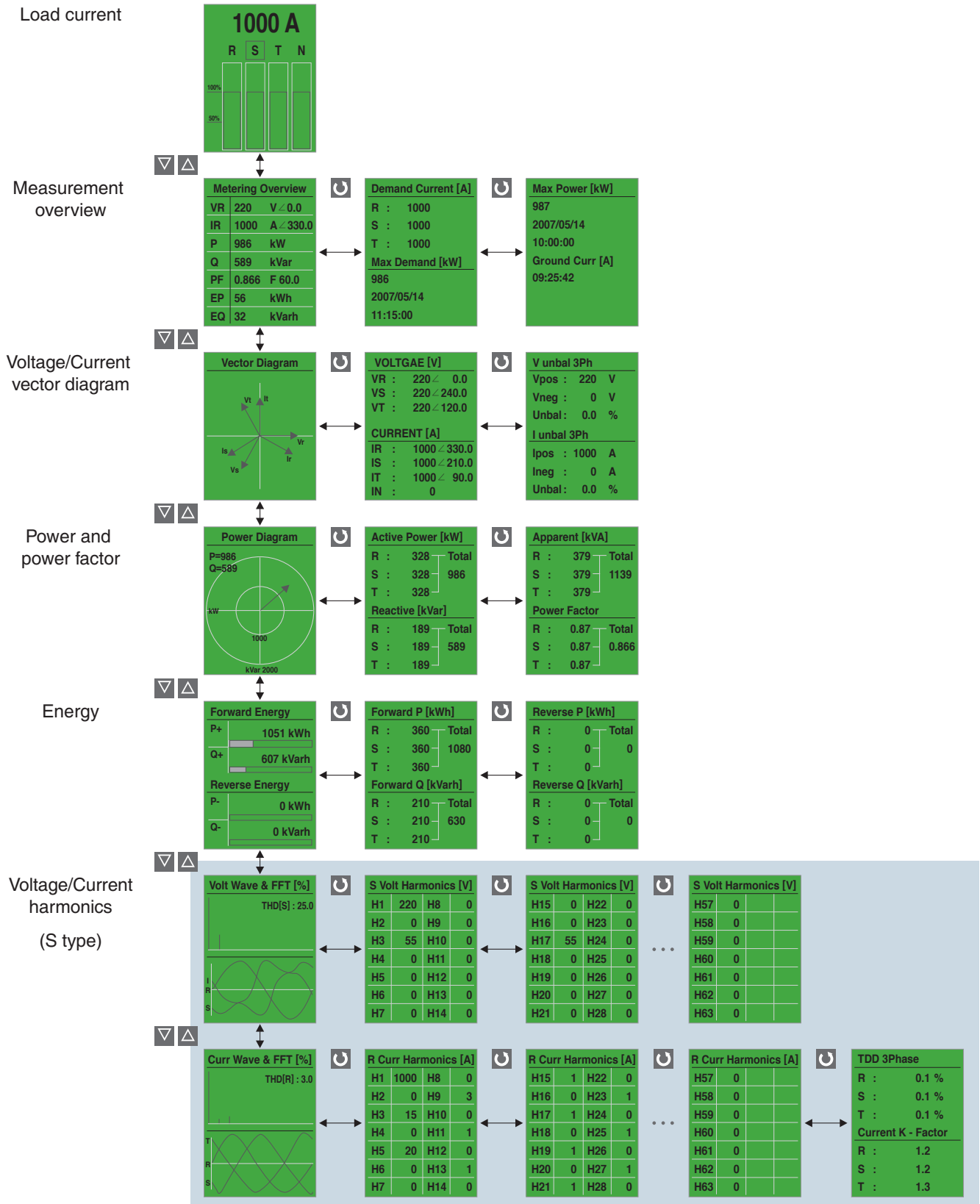
- OCR and OCGR's current setting is basically controlled by knob's setting values.
- The fine current that cannot be controlled by knob is adjustable by using  $\nabla$ ,  $\Delta$  key.
- Fine adjustment is only adjustable in the present knob and next knob's setting range, when moving knob, the adjusted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



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



## Measurement element display



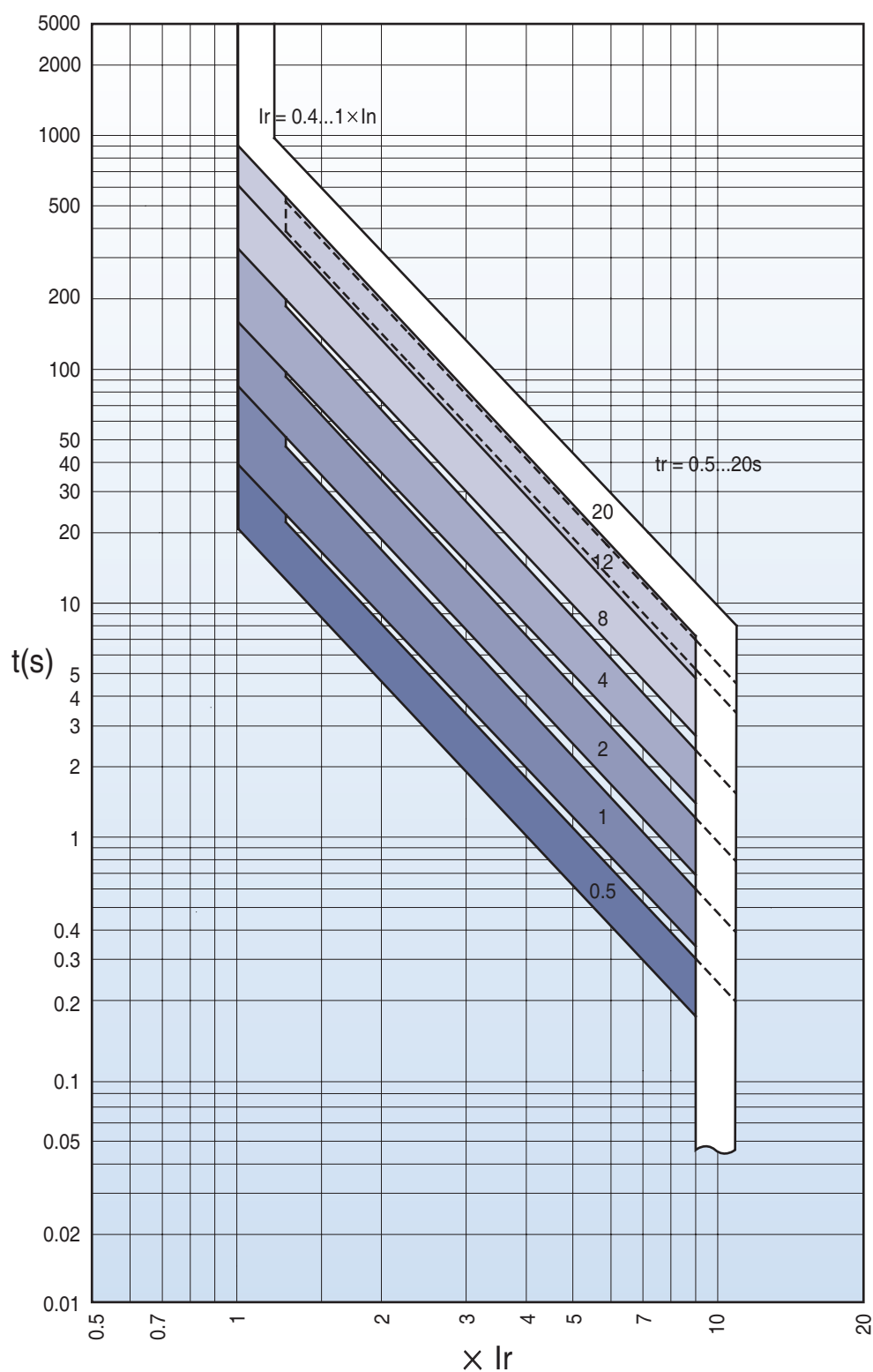


# Trip relays

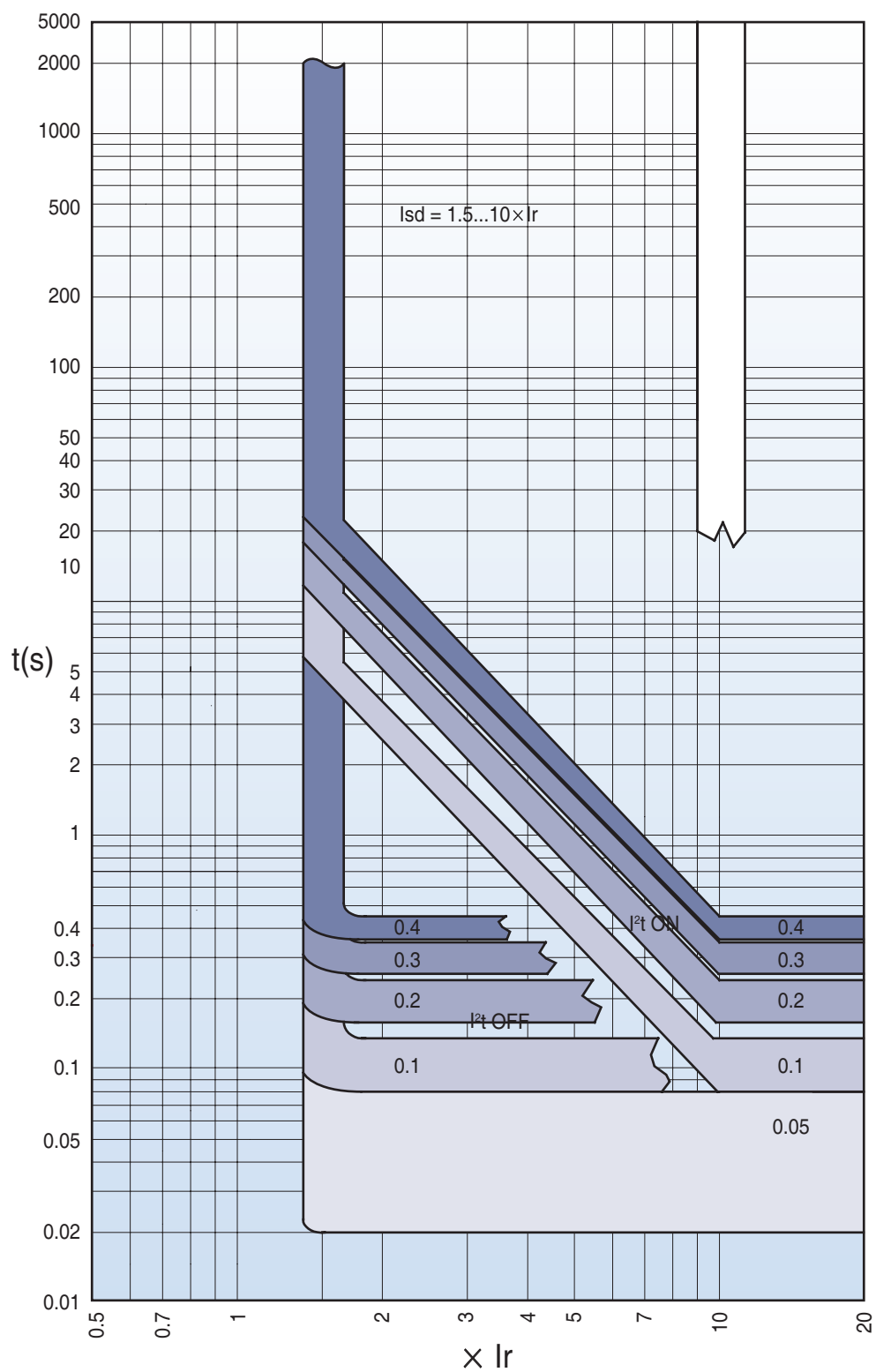
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## Characteristics curves

Long-time delay (L)



# Short-time delay (S)

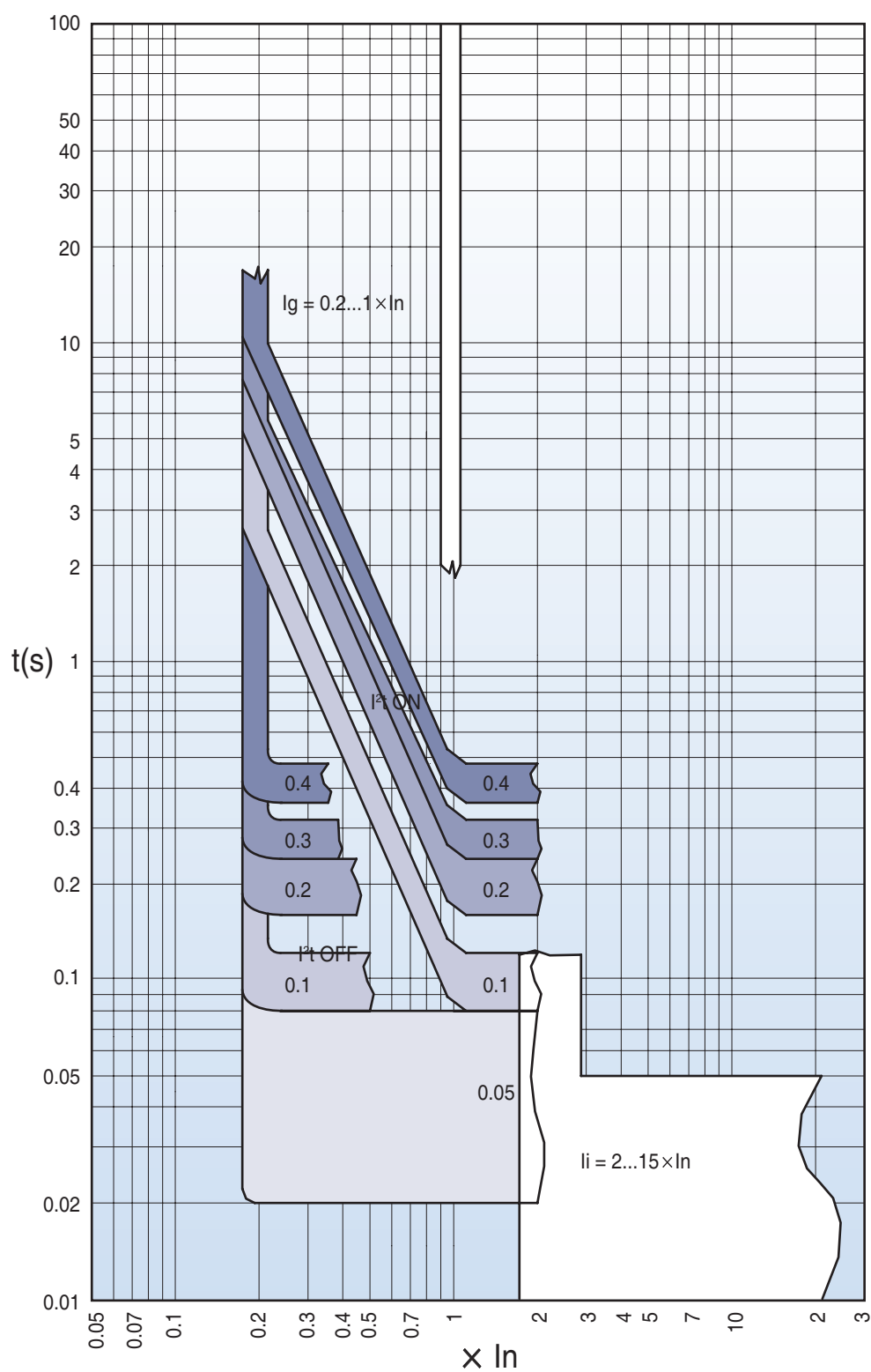


# Trip relays

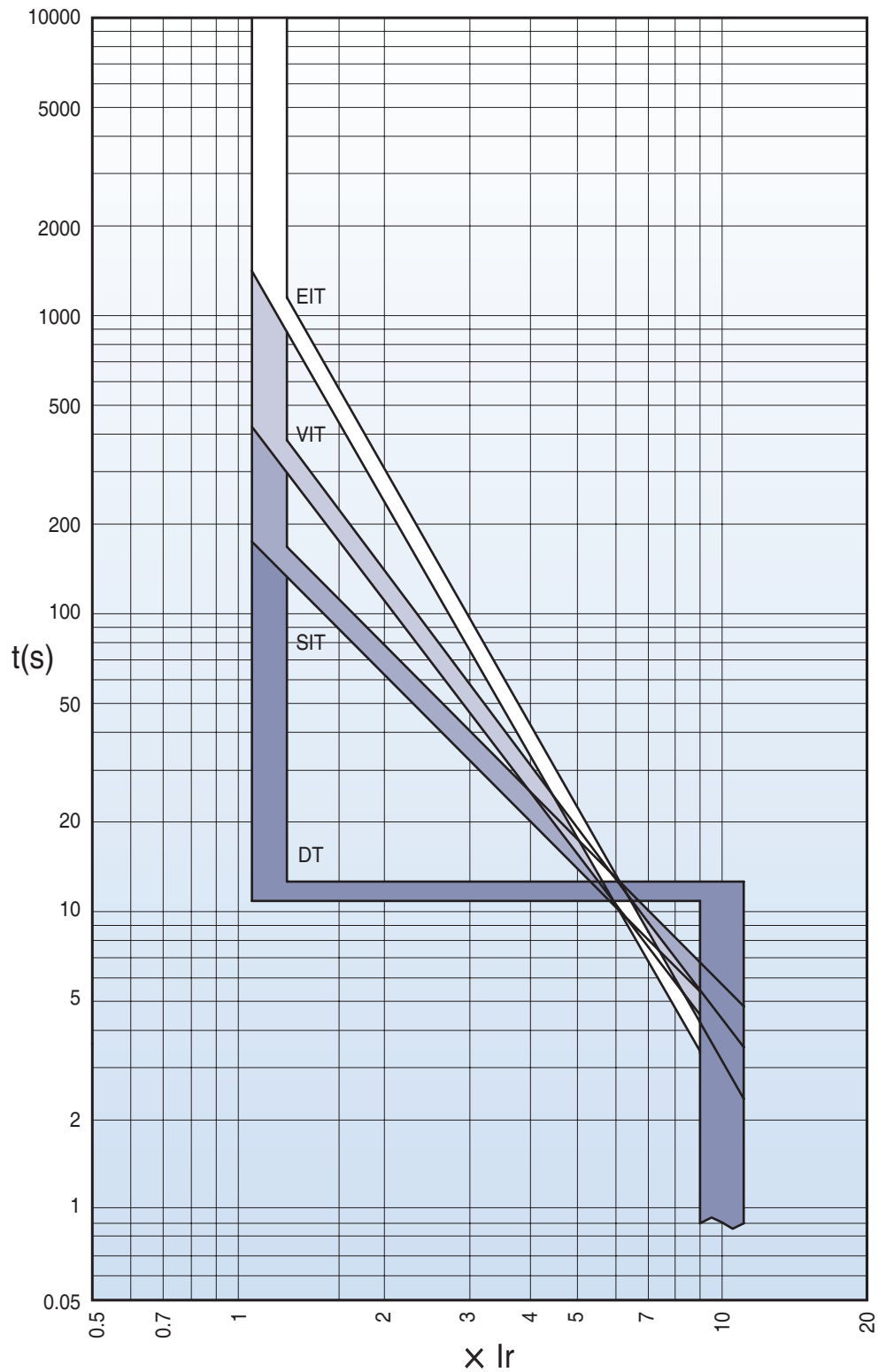
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## Characteristics curves

Instantaneous (I)  
Ground fault (G)



# IDMTL

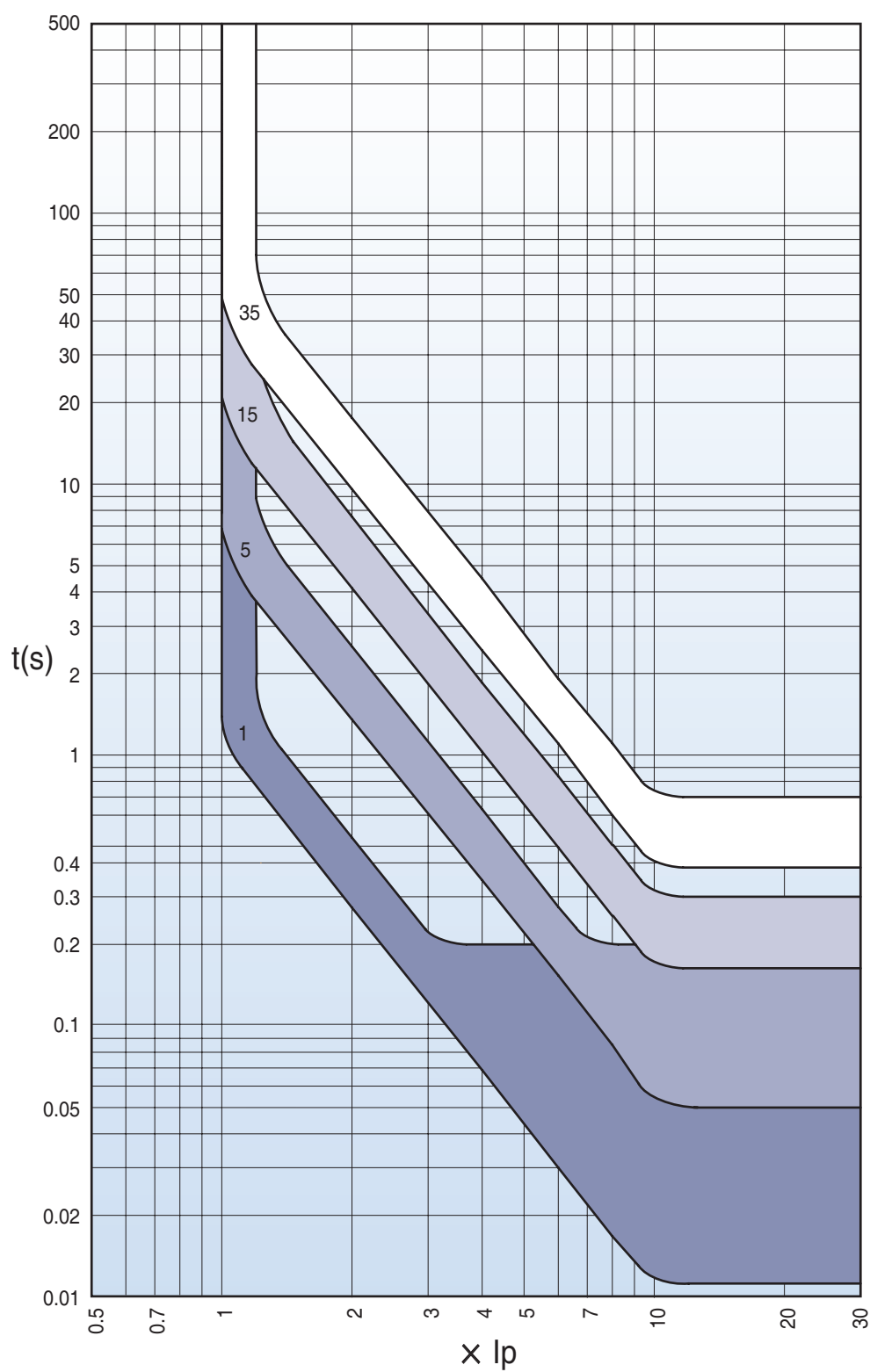


# Trip relays

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## Characteristics curves

### Pre Trip Alarm

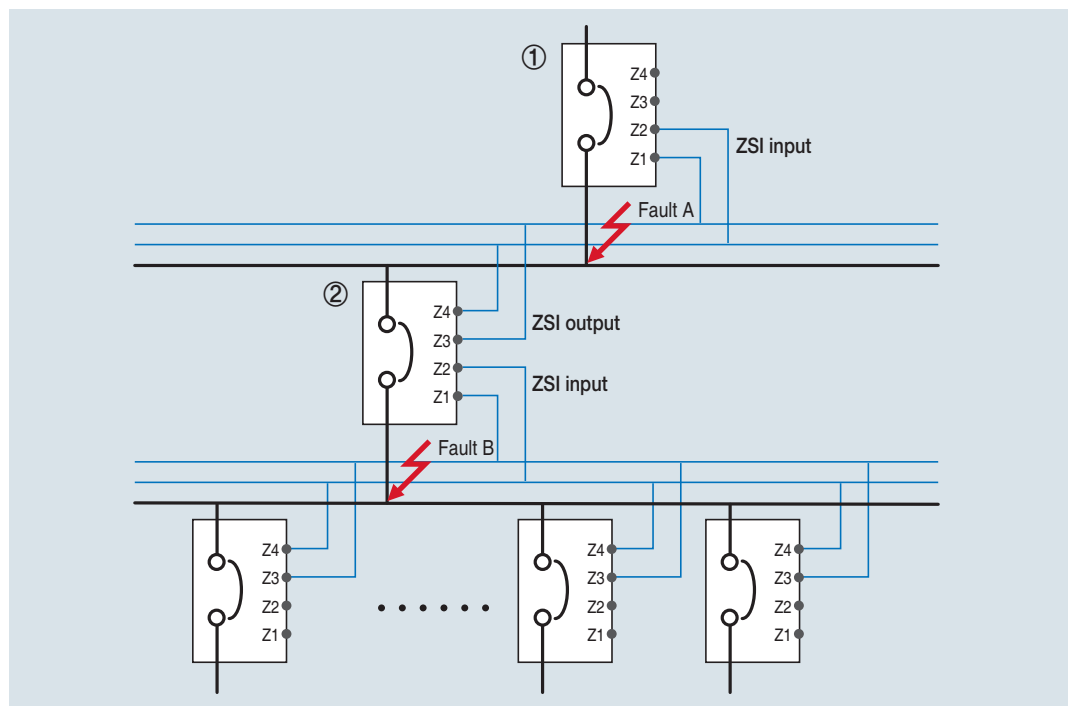




## ZSI - Zone Selective Interlocking (A, P, S type)

**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. 3m.



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

# Trip relays

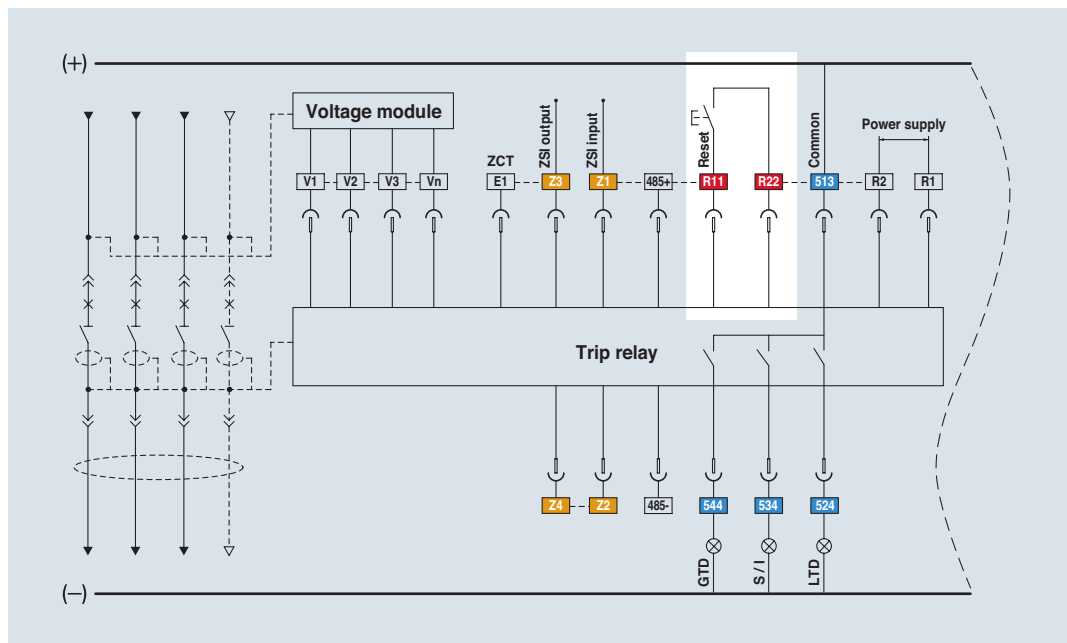
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## Remote reset and digital I/O (A, P, S type)

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, P 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.

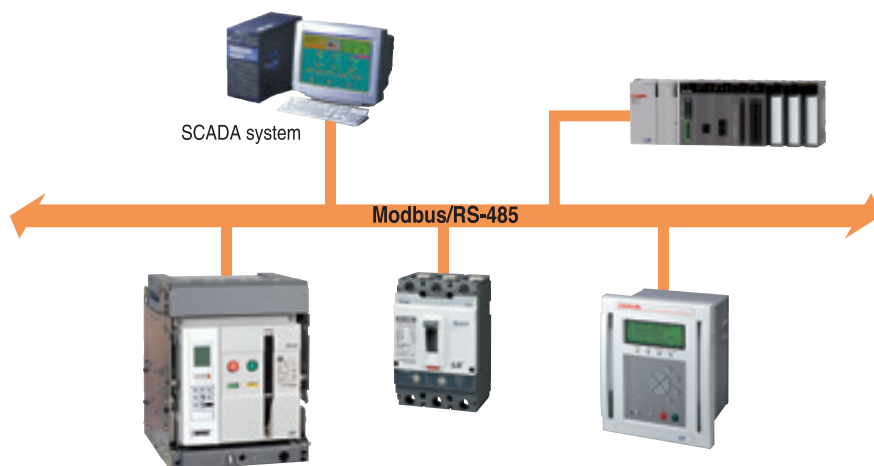


Trip Relay	Digital Output	Long time	Short time	Instantaneous	Ground	Overload Alarm	OV	UV	rPower	Vunbal	Iunbal	OFR	UFR	OPR	Note
P, S type	DO1(524)	●	○	○	○	○	○	○	○	○	○	○	○	○	Programmable
	DO2(534)	○	●	●	○	○	○	○	○	○	○	○	○	○	
	DO3(544)	○	○	○	●	○	○	○	○	○	○	○	○	○	
A type	DO1(524)	●	×	×	×	Not available				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

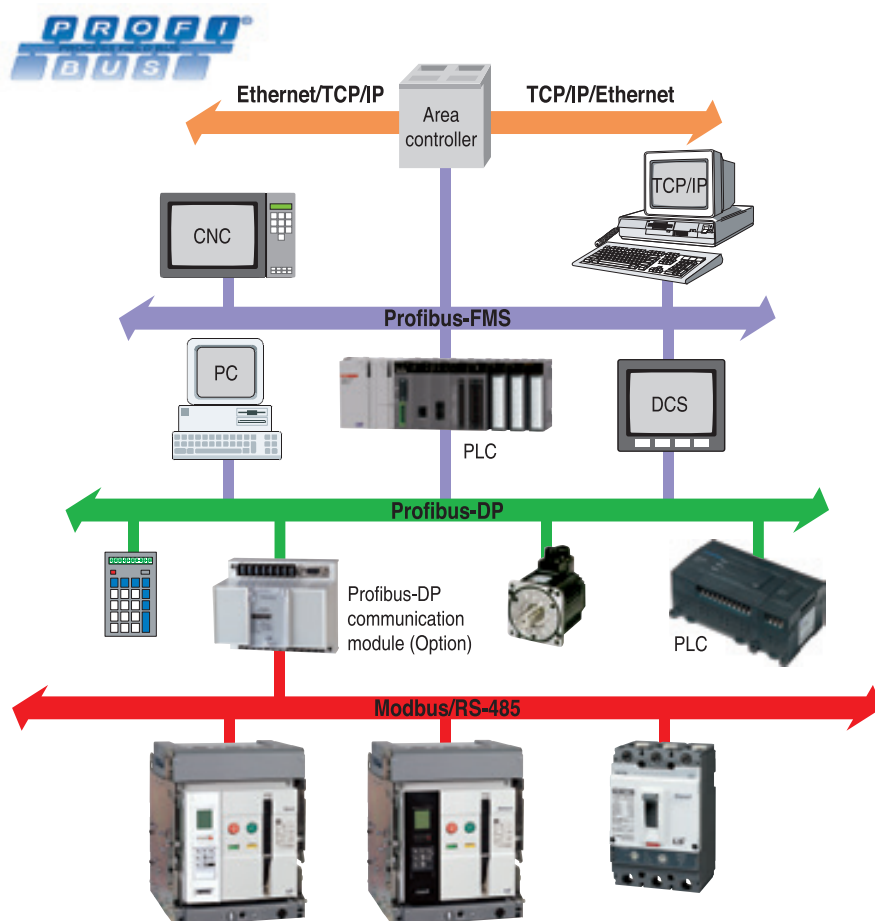


### Profibus-DP

- 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)



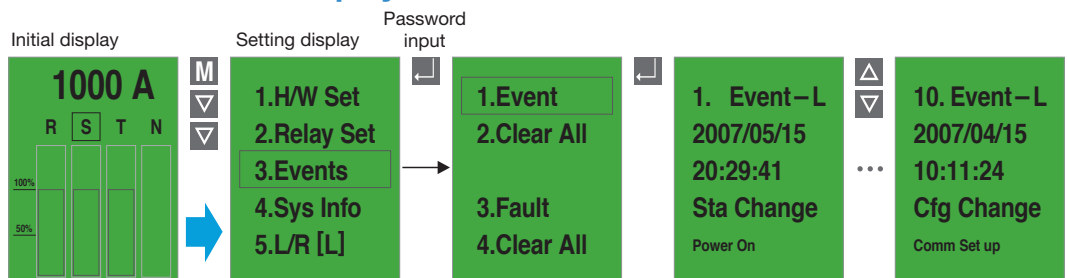
# Trip relays

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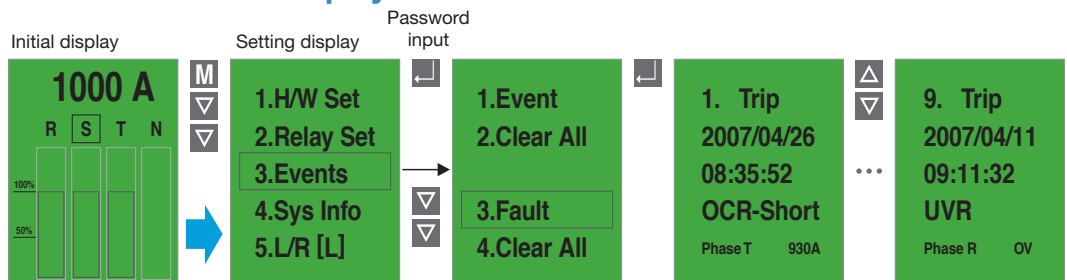
## Event & fault recording (P, S type)

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



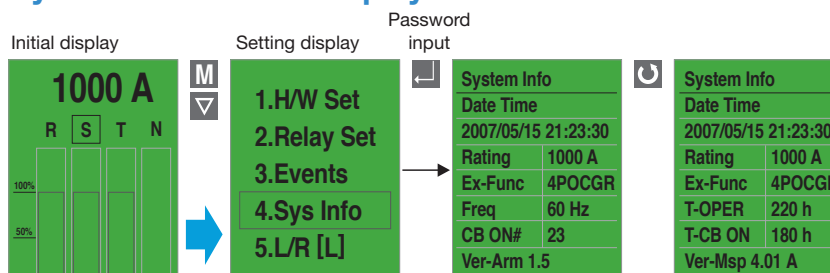
\* Fault information is recorded only when there is external control power

## System information

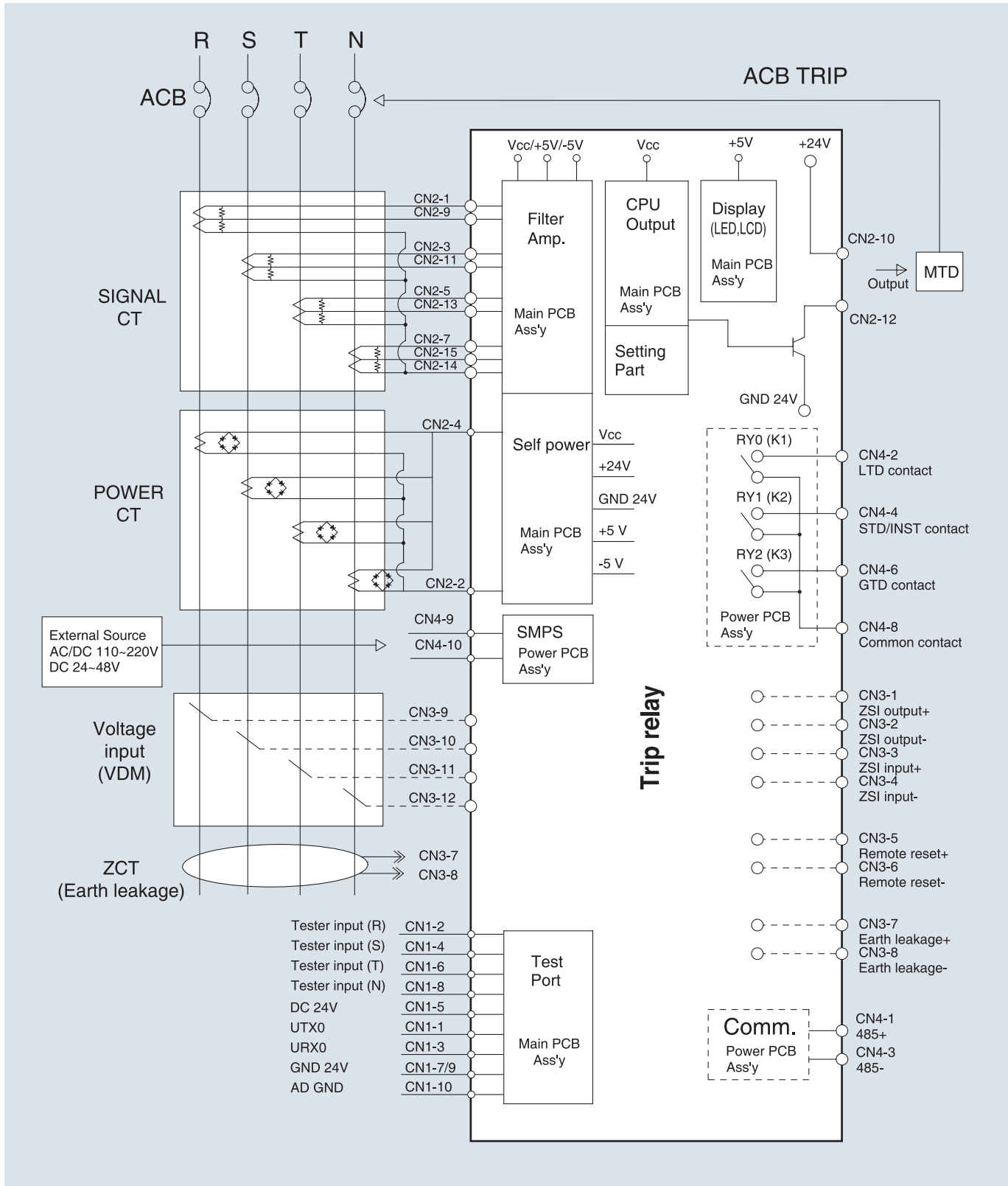
P and S type can indicate information as followings with the information of the ACB.

- 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

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Mounting	Accessories		AH		AS		AN		Remark	Page
			Standard	Option	Standard	Option	Standard	Option		
Internal	SHT1	Shunt Coil	●	○	●	○	●	○	*	70
	SHT2	Double Shunt Coil		○		○			*	71
	CC	Closing Coil	●	○	●	○	●	○	*	72
	M	Motor	●	○	●	○	●	○	*	73
	CS1	Charge Switch	●	○	●	○	●	○	*	73
	CS2	Charge Switch Communication		○		○		○	*	73
	UVT	Under Voltage Trip Device		○		○		○	*	74
	AL	Trip Alarm Contact		○		○		○	*	75
	MRB	Manual Reset Button		○		○		○	*	75
	RES	Remote Reset Switch		○		○		○	*	76
	RCS	Ready to Close Switch		○		○		○	*	76
	C	Counter	●			○		○	*	83
	AX	Auxiliary Switch		○		○		○	*	77
	TM	Temperature Alarm		○		○		○	*	94
External	K1	Key Lock		○		○		○	*	78
	K2	Key Interlock Set		○		○		○	*	78
	K3	Double Key Lock		○		○		○	*	79
	B	On/Off Button lock		○		○		○	*	79
	LH	Lifting Hook		○		○		○		79
	CTD	Condenser Trip Device		○		○		○		79
	ATS	Automatic Transfer Switch Controller		○		○		○		81
	DC	Dust Cover		○		○		○		83
	DF	Door Frame		○		○		○		87
	OT	OCR Tester		○		○		○		82
	J	Manual Connector		○		○	●		*	
	A	Automatic Connector	●		●		○	*		

Note) 1. Reduplicate of AL is not available  
 2. Reduplicate of Key lock is not available  
 3. Reduplicate of Double shunt coil is not available. It can not be used simultaneously with UVT.  
 4. RCS and CS2 cannot be used simultaneously  
 5. TM and auxiliary contacts TX, TC, CC, JC cannot be used simultaneously.  
 \* Seperate purchasing is not allowed. Each item should be purchased with the main body.

## Front connection terminal types

Connection type	Code	Description	Breaker
Front connection/Standard	62363461507	SUB ASS'Y, ADAPTER KIT ASS'Y_FRONT, AN/AS/AH-D3	D3-Frame
Front connection/Standard	62363462510	SUB ASS'Y, ADAPTER KIT ASS'Y_FRONT, AN/AS/AH-D4	D4-Frame
Front connection/Standard	62363463507	SUB ASS'Y, ADAPTER KIT ASS'Y_FRONT, AN/AS/AH-E3	E3-Frame
Front connection/Standard	62363464512	SUB ASS'Y, ADAPTER KIT ASS'Y_FRONT, AN/AS/AH-E4	E4-Frame
Front connection/Mixed	62363461508	SUB ASS'Y, ADAPTER KIT ASS'Y_F&V/H, AN/AS/AH-D3	D3-Frame
Front connection/Mixed	62363462511	SUB ASS'Y, ADAPTER KIT ASS'Y_F&V/H, AN/AS/AH-D4	D4-Frame
Front connection/Mixed	62363463506	SUB ASS'Y, ADAPTER KIT ASS'Y_F&V/H, AN/AS/AH-E3	E3-Frame
Front connection/Mixed	62363464511	SUB ASS'Y, ADAPTER KIT ASS'Y_F&V/H, AN/AS/AH-E4	E4-Frame



Mounting	Accessories		AH		AS		AN		Remark	Page
			Standard	Option	Standard	Option	Standard	Option		
Trip relay	N	N type		○		○		○	*	44
	A	A type		○		○		○	*	46
	P	P type		○		○		○	*	48
	S	S type		○					*	50
	VM	Voltage Module		○		○		○	**	54
	ZCT	ZCT for the earth leakage		○		○		○		
Cradle	SBC	Shorting "b" Contact		○		○		○		89
	MI	Mechanical Interlock		○		○		○		85
	ST	Safety Shutter		○		○		○	*	86
	STL	Safety Shutter Lock		○		○		○		86
	MIP	Miss Insertion Prevent Device		○		○		○		92
	MOC	Mechanical Operated Cell Switch		○		○		○		84
	CEL	Cell Switch		○		○		○		88
	DI	Door Interlock		○		○		○		85
	ZAS	Zero Arc Space	●			○		○	*	89
	SC	Safety Control Cover	●		●		●		***	90
	BSP	Body Supporter		○		○		○	*	90
	RI	Racking Interlock		○		○		○		91
	PL	Pad Lock/ Position Lock	●		●		●		*	91
	IB	Interphase Barrier	●			○		○	*	87
	UDC	UVT Time Delay Controller		○		○		○		93
	ADP	Compatible Adapter		○		○		○		
Other	RPH	Reverse Phase ACB		○		○		○		
	DUM	Dummy ACB		○		○		○		
	VAD	Various Connection Type		○		○		○		25
	RCO	Remote I/O		○		○		○		95
	PC	Profibus-DP comm. module		○		○		○		65

Note) 1. MI cannot be used simultaneously with DI or MOC

2. MI, DI and MOC cannot be used simultaneously with SBC.

3. CEL for right side attachment type is not available when using MI, DI and MOC.

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

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

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

## Option



55223460402

HANDLE ASS'Y, DRAW,  
LONG



55223460404

HANDLE ASS'Y, DRAW,  
LONG, AL-D, E, F, G, HXX