

# MCCBs for power distribution 1600A

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## Electrical characteristics







			TS1000			TS1250			TS1600			
Type			TS1000			TS1250			TS1600			
Ampere frame			1000			1250			1600			
Pole			3, 4			3, 4			3, 4			
Rated current,(A)	In	-5~40°C	800, 1000			1250			1600			
		50°C	800, 1000			1250			1560			
		65°C	800, 1000			1240			1420			
Rated insulation voltage, (V)		Ui	1000			1000			1000			
Rated impulse withstand voltage, (kV)		Uimp	8			8			8			
Rated operational voltage, (V)		Ue	690			690			690			
			-			-			-			
Rated short-circuit breaking capacity			N	H	L	N	H	N	H	N	H	
IEC60947-2 AC50/60Hz (sym)	Rated ultimate short-circuit breaking capacity, (kA) (Icu)	220/240V	55	75	200	55	75	55	75	55	75	
		380/415V	50	70	150	50	70	50	70	50	70	
		440/460V	50	65	130	50	65	50	65	50	65	
		480/500V	40	50	100	40	50	40	50	40	50	
		660/690V	35	45	-	35	45	35	45	35	45	
		DC	250V 2P	-	-	-	-	-	-	-	-	-
			500V 2P	-	-	-	-	-	-	-	-	-
			750V 3P	-	-	-	-	-	-	-	-	-
		Rated service breaking capacity (Ics)	%Icu	100%	75%	100%	100%	75%	100%	75%	100%	75%
		Rated short-circuit making capacity (kA) (Icw)	AC50/60Hz	1s	25		12	25		25		25
	3s		-			-		-		-		
Overriding instantaneous protection			50		30	50		50		50		
Isolation			○			○			○			
Category			B		A	B		B		B		
Life cycle <sup>Note 1)</sup>	Mechanical (operations)		10000		4000	10000		10000		10000		
	Electrical (operations)	440V	In/2	6000	4000	5000	5000	5000	5000	5000	5000	
			In	5000	3000	4000	4000	2000	2000	2000		
	690V	In/2	4000	3000	3000	3000	2000	2000	2000	2000	1000	
In		2000	2000	2000	2000	1000	1000	1000	1000	1000		
Pollution degree			3			3		3		3		
Dimension (mm)			3-pole			210×327×152.5						
(W×H×D)			4-pole			280×327×152.5						
Weight (kg)			3-pole			13						
			4-pole			16.8						

Note) 1. Life cycle means not guarantee but limitation  
(Quality guarantee: On/Off frequency on the basis of IEC60947-2 within the term of guarantee.)

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## Overview

Classification	N type	A type	P type	S type
Externals				
Current protection	• L / S / I / G / Thermal	• L / S / I / G / Thermal • ZSI(Protective coordination)	• L / S / I / G / Thermal(Continuous) • ZSI(Protective coordination)	• P type
Other protection	-	• Earth leakage (Option)	• Earth leakage(Option) • Over/Under current • Over/Under frequency • Unbalance(Voltage/Current) • Reverse power	• P type
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	• P type
Pre Trip Alarm	-	-	• Overload protection relays : DO (Alarm) (Ground fault is not available when using Pre trip alarm)	• P type
Digital Output	-	• 3DO (Fixed) • L, S/I, G Alarm	• 3DO (Programmable) • Trip, Alarm, General	• P type
IDMTL setting	-	-	• Compliance with IEC60255-3 SIT, VIT, EIT, DT	• P type
Communication	-	• Modbus/RS-485 • Profibus-DP	• Modbus / RS-485 • Profibus-DP	• Modbus / RS-485 • Profibus-DP
Power supply	• Self Power -Power source works over 25% of current of In (one pole)	• Self Power - Power source works over 25% of current of In (one pole) - External power source is required for comm. • AC/DC 100~250V • DC 24~60V	• AC/DC 100~250V • DC 24~60V	• AC/DC 100~250V • DC 24~60V
RTC timer	• Available	• Available	• Available	• Available
LED for trip info.	• Long time delay • Short time delay/Instantaneous • Ground fault	• N type	• N type	• N type
Fault recording	-	• 10 records (No fault records when using self power) (Fault/Current/Date and Time)	• 256 records (Fault/Current/Date and Time)	• 256 records • Last fault wave recording (3 Phase)
Event recording	-	-	• 256 records(Content, Status, Date)	• P type
Operating button	• Reset button	• Reset, Menu Up/Down, Left/Right, Enter	• A type	• A type

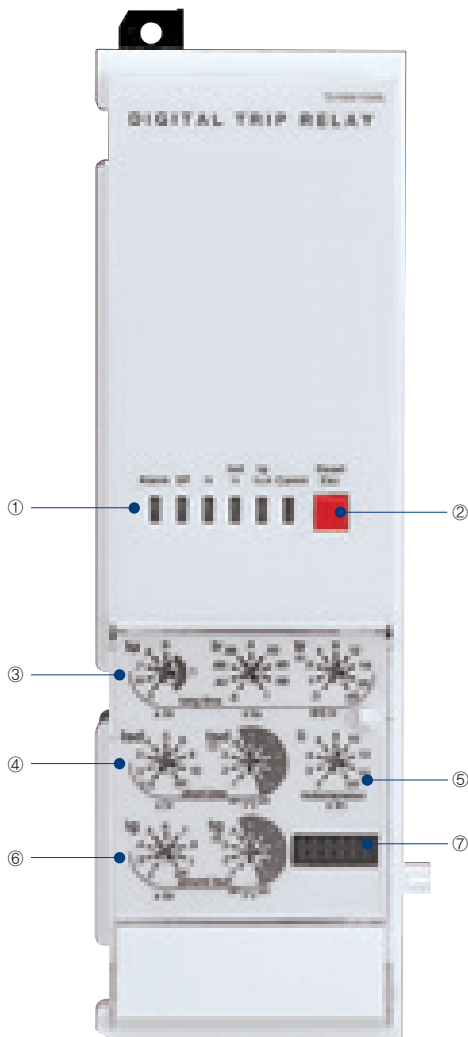
Basic protection function(L / S / I / G)  
is still under normal operation  
without control power.

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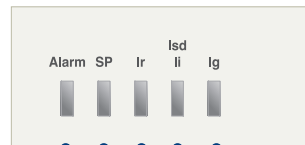
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## N type: 'Normal' type

- 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
- I<sup>2</sup>d/I<sup>2</sup>i: 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>s</sub>d: Short-time current setting, t<sub>s</sub>d: Short-time tripping delay setting

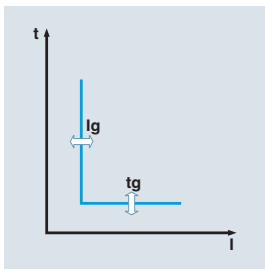
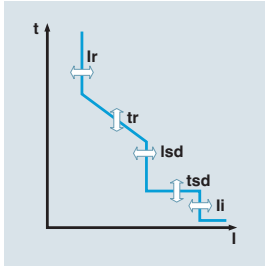
⑤ I<sub>i</sub>: Instantaneous current setting

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)

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## Protection

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

## NV type (For ship only)

### Protection

Long time										
Current setting (A)	$I_r = I_n \times \dots$	0.8	0.9	1.0	1.05	1.1	1.15	1.2	1.25	Off
Time delay (s)	$t_r @ (1.2 \times I_r)$	10	15	20	25	30	40	50	60	100
Accuracy: $\pm 15\%$ or below	$t_r @ (3 \times I_r)$	0.99	1.49	1.99	2.48	2.98	3.97	4.97	5.96	9.93
100ms	$t_r @ (6 \times I_r)$	0.24	0.36	0.48	0.59	0.71	0.95	1.19	1.43	2.38
Short time										
Current setting (A)	$I_{sd} = I_n \times \dots$	2	2.5	2.7	3	3.5	4	4.5	5	Off
Accuracy: $\pm 10\%$										
Time delay (s) @ $10 \times I_r$	$t_{sd}$	$I^2t$ Off	0.05	0.1	0.2	0.3	0.4			
		$I^2t$ On		0.1	0.2	0.3	0.4			
$(I^2t \text{ Off})$	$(I^2t \text{ Off})$	Min. Trip Time(ms)	20	80	160	260	360			
		Max. Trip Time(ms)	80	140	240	340	440			
Instantaneous										
Current setting (A)	$I_l = I_n \times \dots$	2	4	6	8	10	12	14	16	Off
Tripping time		50( $\pm 10$ ms)								

■ The fine-adjustable setting of the rated current [ $I_n$ ]

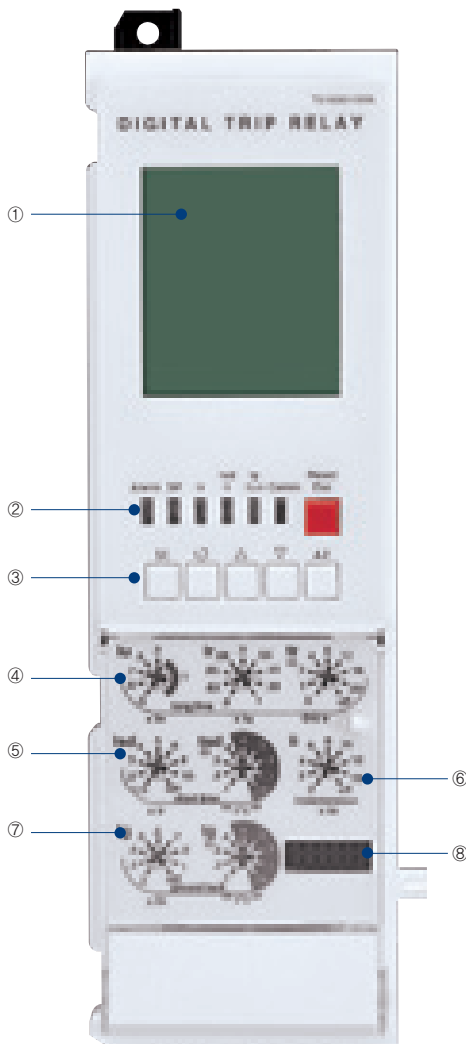
- $I_n = I_{ct} \times [0.4 \sim 1.0]$
- Setting range: 40~100% of  $I_{ct}$  (unit: 0.5%)

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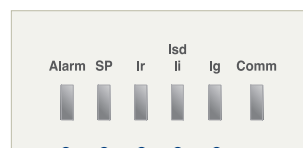
## A type: 'Ammeter' type

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



① LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



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

③ Key: Move to menu or reset



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

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

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

⑥ Ii: Instantaneous current setting

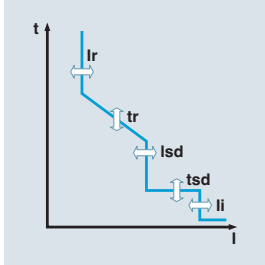
⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

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

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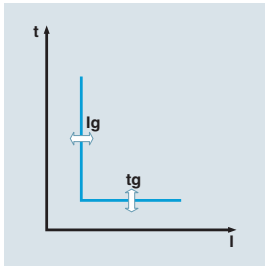
## Protection



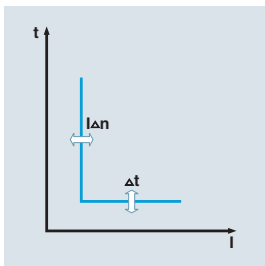
Long time											
Current setting (A)	$I_u = I_n \times \dots$	0.5	0.6	0.7	0.8	0.9	1.0				
	$I_r = I_u \times \dots$	0.8	0.83	0.85	0.88	0.9	0.93	0.95	0.98	1.0	
Time delay (s)	$t_r @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500	Off	
Accuracy: $\pm 15\%$ or below 100ms	$t_r @ (6.0 \times I_r)$	0.5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

Short time											
Current setting (A)	$I_{sd} = I_r \times \dots$	1.5	2	3	4	5	6	8	10	Off	
Accuracy: $\pm 10\%$ Time delay (s) @ $10 \times I_r$	tsd	$I^2 t$ Off	0.05	0.1	0.2	0.3	0.4				
		$I^2 t$ On	0.1	0.2	0.3	0.4					
(I <sup>2</sup> t 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		50( $\pm 10$ ms)								



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



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

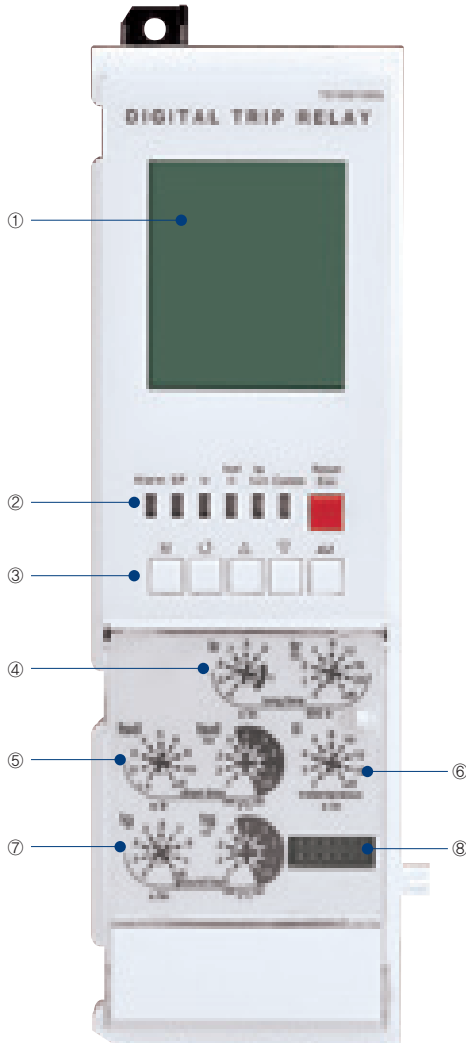
Note) Earth leakage function is available with ZCT or external CT

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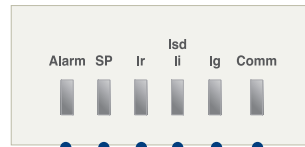
## P type: 'Power meter' type

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



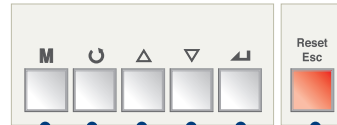
① Graphic LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



- Comm: LED indicating comm. state (Blink when running)
- Ig: LED indicating ground-fault
- I<sup>2</sup>t/I<sup>2</sup>i: LED indicating short-time or instantaneous tripping
- I<sup>2</sup>r: LED indicating long-time delay
- SP: Self-protection and battery test LED
- Alarm: LED indicating an overload (Turn on above 90%, Blink above 105%)

③ Key: Move to menu or reset



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

④ I<sup>2</sup>r: Long-time current setting, t<sub>r</sub>: Long-time tripping delay setting

⑤ I<sup>2</sup>s<sub>d</sub>: Short-time current setting, t<sub>s<sub>d</sub></sub>: Short-time tripping delay setting

⑥ I<sub>i</sub>: Instantaneous current setting

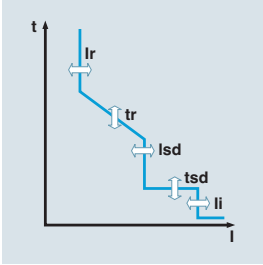
⑦ I<sub>g</sub>: Ground fault current setting, t<sub>g</sub>: Ground fault tripping delay setting

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

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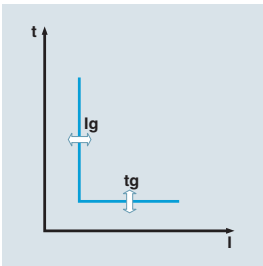
## Protection



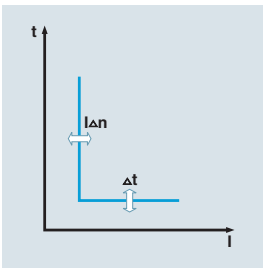
Long time										
Current setting (A)	$I_r = I_n \times \dots$	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
Time delay (s)	$t_r @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500	Off
Accuracy: $\pm 15\%$ or below	$t_r @ (6.0 \times I_r)$	0.5	1	2	4	8	12	16	20	Off
100ms	$t_r @ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5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

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

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



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



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

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

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

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

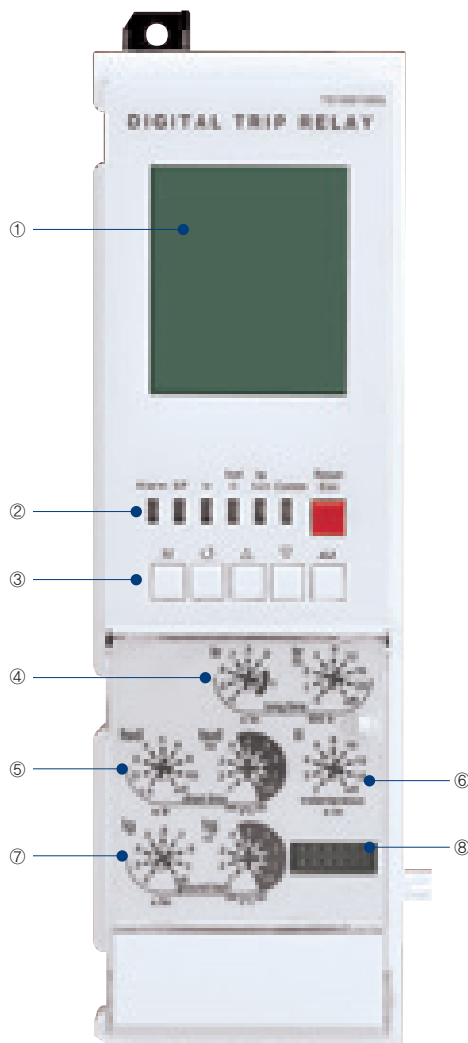


# MCCBs for power distribution 1600A

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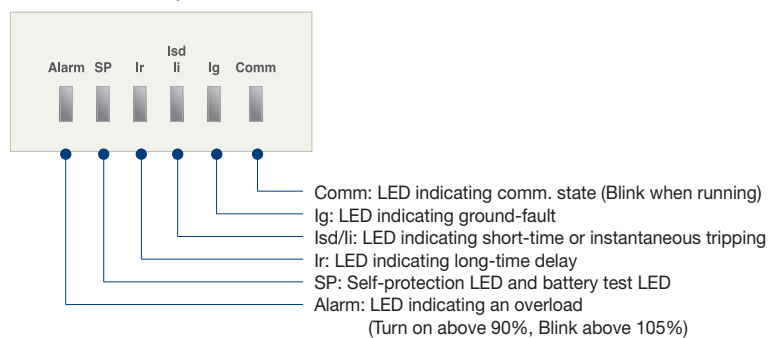
## S type: 'Supreme meter' type

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

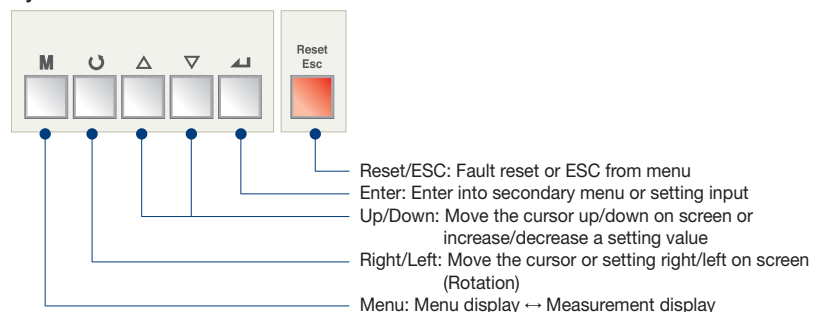


① Graphic LCD: Indication of measurement and information

② LED: Indication of trip info. and overload state



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

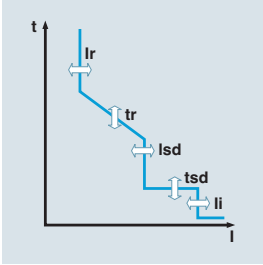
⑦ Ig: Ground fault current setting, tg: Ground fault tripping delay setting

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

# MCCBs for power distribution 1600A

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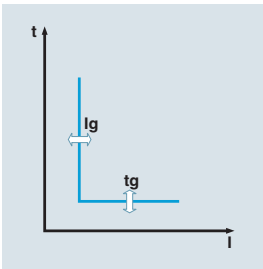
## Protection



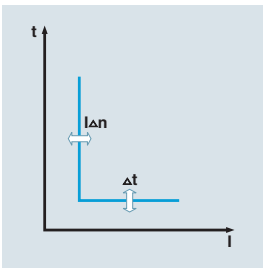
Long time										
Current setting (A)	$I_u = I_n \times \dots$	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
Time delay (s)	$t_r @ (1.5 \times I_r)$	12.5	25	50	100	200	300	400	500	Off
Accuracy: $\pm 15\%$ or below	$t_r @ (6.0 \times I_r)$	0.5	1	2	4	6	12	16	20	Off
100ms	$t_r @ (7.2 \times I_r)$	0.34	0.69	1.38	2.7	5.5	8.3	11	13.8	Off

Short time											
Current setting (A)	$I_{sd} = I_r \times \dots$	1.5	2	3	4	5	6	8	10	Off	
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)	$I_{li} = I_n \times \dots$	2	3	4	6	8	10	12	15	Off
Tripping time		50( $\pm 10$ ms)								



Ground fault											
Pick-up (A)											
Accuracy: $\pm 10\%$ ( $I_g > 0.4 I_n$ ) $\pm 20\%$ ( $I_g \leq 0.4 I_n$ )	$I_g = I_n \times \dots$	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	Off	
		$I^2t$ 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)											
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) Earth leakage function is available with ZCT or external CT

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

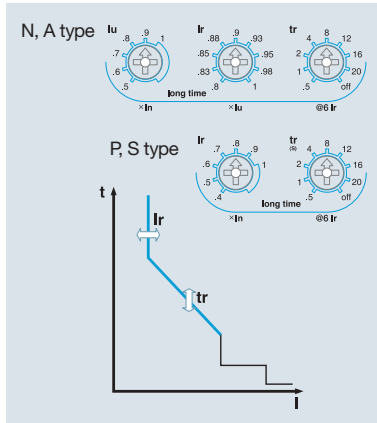
Other protection	Pick-up			Time delay(s)		
	Setting range	Step	Accuracy	Setting range	Step	Accuracy
Under voltage	80V ~ 0V_Pick-up	1V	$\pm 5\%$	1.2~40sec	0.1sec	$\pm 0.1$ sec
Over voltage	UV_Pick-up ~ 980V	1V	$\pm 5\%$			
Voltage unbalance	6% ~ 99%	1%	$\pm 2.5\%$ or ( $* \pm 10\%$ )			
Reverse power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

# MCCBs for power distribution 1600A

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## Operation characteristic

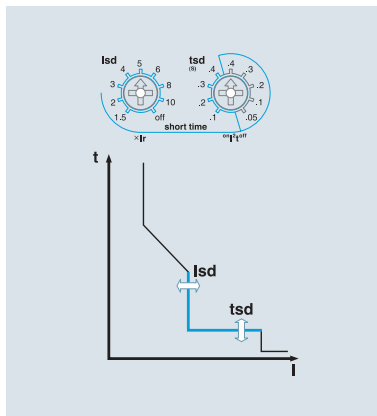
### Long-time delay (L)



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

- Standard current setting knob:  $I_r$ 
  - 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:  $(0.4 \sim 1.0) \times I_n$ 
    - $I_{lu}$ :  $(0.5-0.6-0.7-0.8-0.9-1.0) \times I_n$
    - $I_r$ :  $(0.8-0.83-0.85-0.88-0.9-0.93-0.95-0.98-1.0) \times I_n$
- 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 (9 modes)
- Relay pick-up current
  - When current over  $(1.15) \times I_r$  flows in, relay is picked up.
- Relay operates basing on the largest load current among R/S/T/N phase.

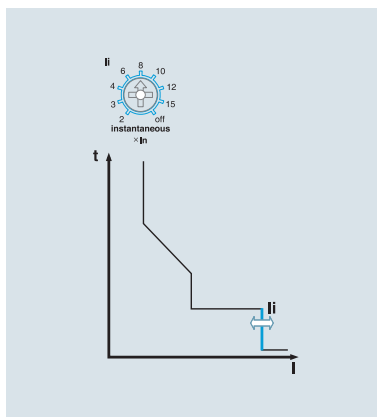
### Short-time delay (S)



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

- Standard current setting knob:  $I_{sd}$ 
  - 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 ( $I^2 t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2 t$  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)



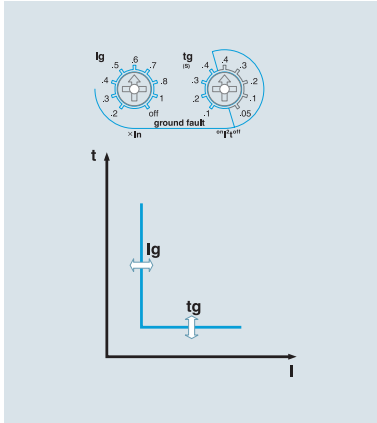
The function for breaking fault current above the setting value within the shortest time to protect the circuit from short-circuit.

- 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 50 ( $\pm 10$ )ms.

# MCCBs for power distribution 1600A

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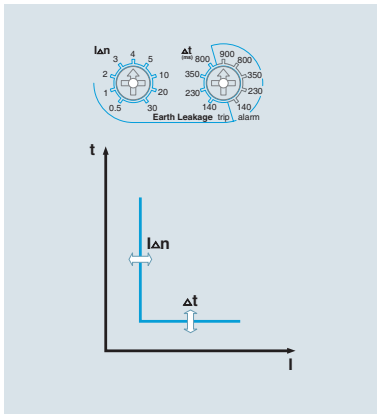
## Ground Fault (G)



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

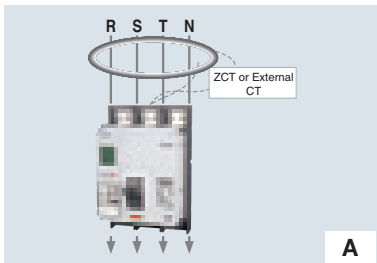
- Standard setting current knob:  $I_g$ 
  - Setting range:  $(0.2-0.3-0.4-0.5-0.6-0.7-0.8-1.0-Off) \times I_n$
- Time delay setting knob:  $t_g$ 
  - Inverse time ( $I^2t$  On): 0.1-0.2-0.3-0.4 sec
  - Definite time ( $I^2t$  Off): 0.05-0.1-0.2-0.3-0.4 sec
- Ground fault current is vector sum of each phase current. Therefore, 3Pole products may operate under its phase-unbalance including ground fault situations.(R+S+T+(N) Phase)
- When ZSI function 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 functions are basically provided with products equipped with a trip relay through its internal CT that is embedded in each phase.(But, it can't be used with earth-leakage protection function at the same time)

## Earth Leakage (G) - Option



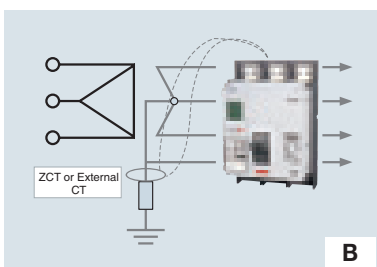
The function for breaking earth leakage current above setting value after time delay to protect the circuit from earth leakage. (A, P, S type)

- Standard setting current knob:  $I_{\Delta n}$ 
  - Setting range: 0.5-1-2-3-4-5-10-20-30-Off (A)
- Time delay setting knob:  $\Delta t$ 
  - Trip time: 140-230-350-800 ms
  - Alarm time: 140-230-350-800-950 ms
- Settings 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 provided by LS 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 provided by LS, the setting range is from 0.5 to 30A which is based on its primary current. But MCCB 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 MCCB can protect currents from 20 to 100% range on its rated current.
- As rated currents on MCCB increases, current that is covered by its standard CT increase as well. This can not protect against small leakage currents.  
ex) 400A MCCB Min. Earth-leakage current  $400A \times 20\% = 80A$   
4000A MCCB 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.

# MCCBs for power distribution 1600A

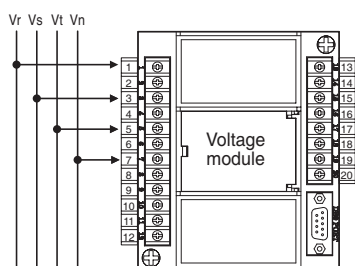
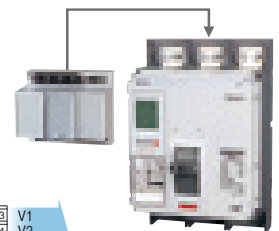
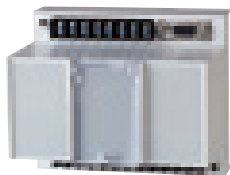
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## Measurement function

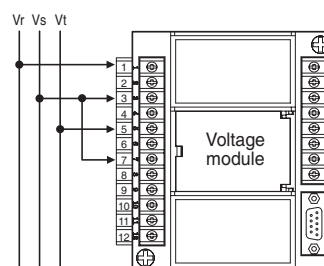
Class.	Measurement element	Detailed element	Unit	Display range	Accuracy
Current	Line current	$I_a, I_b, I_c$	A	80A~65,535A	±3%
	Normal current	$I_1$			
	Reverse current	$I_2$			
Voltage	Line voltage	$V_{ab}, V_{bc}, V_{ca}$	V	60~690V	±1%
	Phase voltage	$V_a, V_b, V_c$			±1%
	Normal voltage	$V_1$			
	Reverse voltage	$V_2$			
Angle	Line-to-line	$\angle V_{abla}, \angle V_{b\Delta}, \angle V_{c\Delta}$	°	0~360°	±1°
	Line-to-current	$\angle V_{ab}V_{bc}, \angle V_{ab}V_{ca}$			±1°
	Phase-to-phase	$\angle V_aV_b, \angle V_aV_c$			±1°
	Phase-to-current	$\angle V_{aI}, \angle V_{bI}, \angle V_{cI}$			±1°
Power	Active power	$P_a(ab), P_b(bc), P_c(ca), P$	kW	1kW~99,999kW	±3%
	Reactive power	$Q_a(ab), Q_b(bc), Q_c(ca), Q$	kVar	1kVar~99,999kVar	±3%
	Apparent power	$S_a(ab), S_b(bc), S_c(ca), S$	kVA	1kVA~99,999kVA	±3%
Energy	Active energy	$WH_a(ab), WH_b(bc), WH_c(ca), WH$	kWh MWh	1kWh~9999.99MWh	±3%
	Reactive energy	$VARH_a(ab), VARH_b(bc), VARH_c(ca), VARH$	kVarh Mvarh	1kVarh~9999.99MVarh	±3%
	Reverse active energy	$rWH_a(ab), rWH_b(bc), rWH_c(ca), rWH$	kWh MWh	1kWh~9999.99MWh	±3%
Freq.	Frequency	F	Hz	45~65Hz	
Power factor	Power factor(PF)	$PF_a(ab), PF_b(bc), PF_c(ca), PF$		+ : Lead, - : Lag	
Unbalance	Unbalance rate	$I_{unbalance}, V_{unbalance}$	%	0.0~100.0	
Demand	Active power demand	Peak demand	kW	1kW~99999kW	
	Current demand	Peak demand	A	80A~65,535A	
Harmonics	Voltage harmonics	1st~63th harmonics of $V_a(ab), V_b(bc), V_c(ca)$	V	60~690V	
	Current harmonics	1st~63th harmonics of $I_a, I_b, I_c$	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 (Separate purchase is needed)  
- Voltage input range: AC 60~690V



3P4W wiring



3P3W wiring

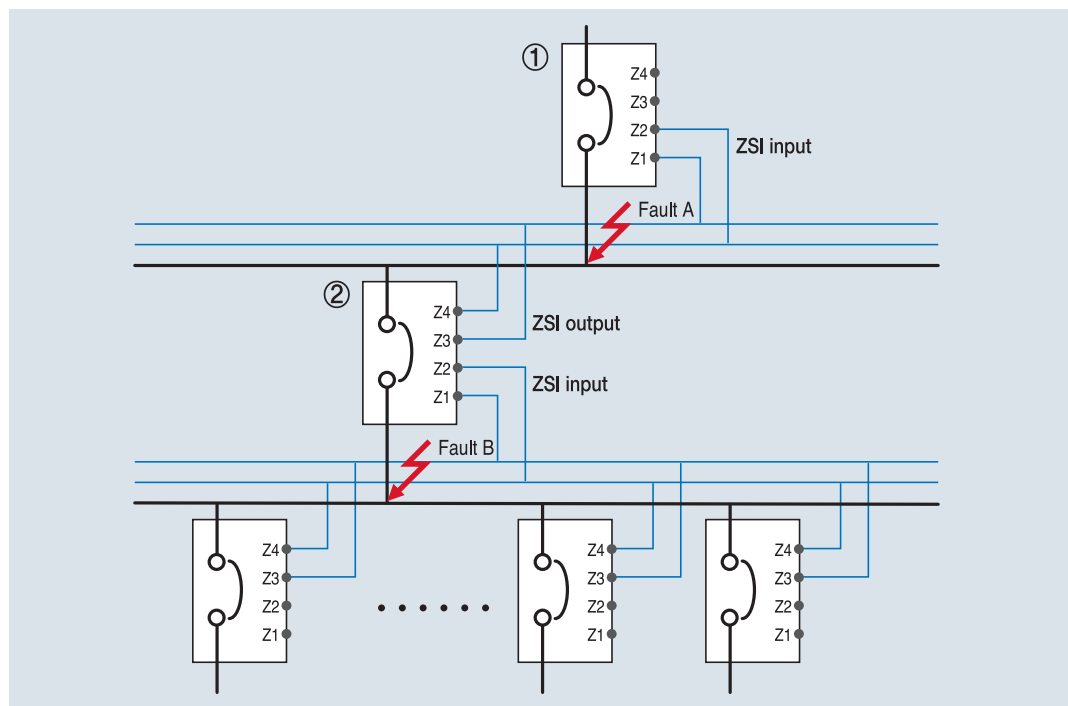
# MCCBs for power distribution 1600A

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## 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 MCCB 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.