

HGP MCCB ETU N/D/A/E

Electronic Trip Units

User Guide

09/2019

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For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

Failure to observe this information can result in injury or equipment damage.

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Safety Precautions

Read 'Safety Precautions' carefully. Familiarize yourself with the equipment before installing, operating, or maintaining the equipment.



WARNING

This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



CAUTION

This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury, and this is a warning about unsafe behavior.



WARNING

- ✓ Do not perform wiring work while power is on or operation is in progress.
- ✓ Do not perform all wiring work when the bus line is in live.
- ✓ Check the connection status of the terminals before starting operation.
- ✓ Do not install or operate with wet hands.



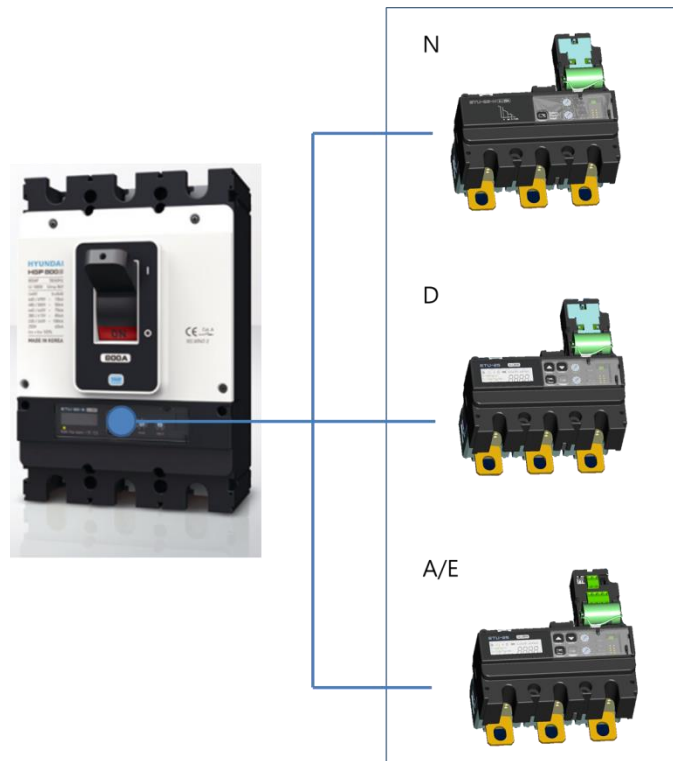
CAUTION

- ✓ Install it by a qualified expert when installing and maintain the equipment.
- ✓ Apply the regular power according to the rating of terminals of the equipment.
- ✓ Do not disassemble the product arbitrarily or shock the outside of the product.
- ✓ Do not allow foreign substances such as screws, metal objects, water or oil to be in the product.

Electrical equipment must be installed, operated and maintained by trained personnel. If not, Hyundai Electric & Energy Systems Co., LTD will not be responsible for any consequences resulting from the use of the equipment.

1. Product summary

1.1. Product outline



1.2. ETU (Electrical trip unit) N type

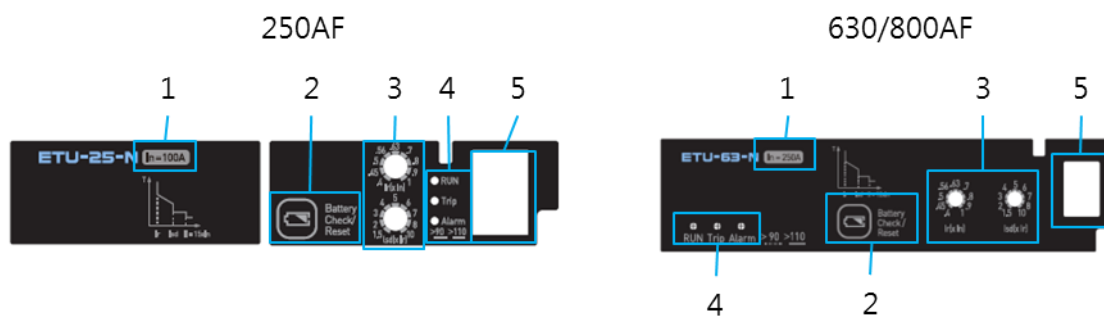
ETU N type applies to protection of switchgears and general industrial use.

It protects against long time, short time, and instant.

It is possible to adjust the pick-up of long time and short time using the front adjustment dial.

Time delay of long time and short time is fixed, and pickup of instant is fixed according to the rating of HGP MCCB.

1.2.1. ETU front



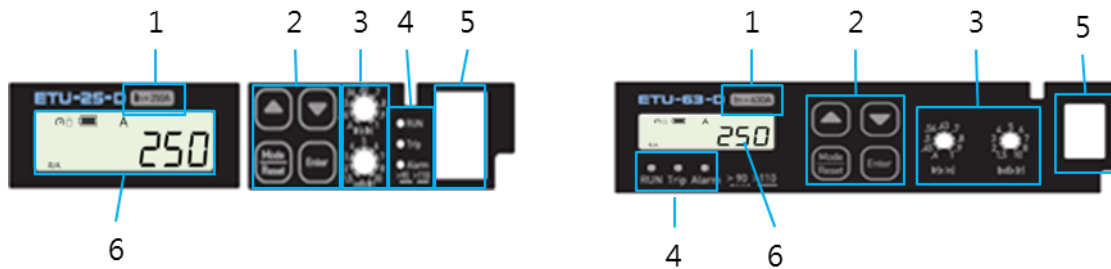
No.	Name	Description
1	Sensor rating	Indicate the In (A) value of ETU for each AF. 250AF: 40A, 100A, 160A, 250A 630AF: 250A, 400A, 630A 800AF: 800A ex) In = 250A
2	Battery check / Reset	When the ETU is operating, user can check the replacement time of the battery by pressing this button. The ETU is in the operating state when Run LED is lit. <ul style="list-style-type: none"> • Available : All 3ea State LED(3) are lit. • Replacement : Only Run LED is lit. Initialize the trip LED of the ETU.
3	Dial	There are 2 dials for protection setting on the front of the ETU. The long and short pickup settings for general protection of the switchgear are adjustable, and time delay setting is fixed at a constant value. (Refer to Protection) Long time protection Ir <ul style="list-style-type: none"> • Equipment protection against overloading • True RMS measurement Short time protection Isd <ul style="list-style-type: none"> • Equipment protection against impedance short circuit. • True RMS measurement
4	State LED	Three states are displayed. <ul style="list-style-type: none"> • RUN: ETU is in operating state. (250A or less : 30%In, etc : 15% In) • Trip: Trip operation. LED is lit when ETU is in operating state after MCCB open. Check the LED, and turn off the LED by pressing “Battery check/Reset” button. • Alarm: Blink (when $I > 0.9 I_r$), On (when $I > 1.1 I_r$)
5	Test Terminal	Test terminal for checking ETU operation. Refer to the manual of Test kit for more information.

1.3. ETU (Electrical trip unit) D/A/E type

ETU D/A/E type applies to protection of switchgears and general industrial use.

It is possible to adjust the pick-up of long time and short time using the front adjustment dial.

It is possible for A/E type to check measurement value and protection setting information through communication at SCADA



No.	Name	Description
1	Sensor rating	Indicate the In (A) value of ETU for each AF. 250AF: 40A, 100A, 160A, 250A 630AF: 250A, 400A, 630A 800AF: 800A ex) In = 250A
2	Up / Down, Mode / Reset button	When the ETU is operating, the displayed information can be switched, and setting values can be changed. <ul style="list-style-type: none"> • Long time delay setting • Short time delay setting • Setting of ground fault and time delay • Instant pickup setting • Switching the information displayed on LCD • Initializing trip information after trip operation
3	Dial	There are 2 dials for protection setting on the front of the ETU. The long and short pickup settings for general protection of the switchgear are adjustable, and time delay setting is fixed at a constant value. (Refer to Protection) Long time protection Ir <ul style="list-style-type: none"> • Equipment protection against overloading • True RMS measurement Short time protection Isd <ul style="list-style-type: none"> • Equipment protection against impedance short circuit. • True RMS measurement
4d	State LED	Three states are displayed. <ul style="list-style-type: none"> • RUN: ETU is in operating state. (250A or less : 30%In, etc : 15% In) • Trip: Trip operation. LED is lit when ETU is in operating state after

		<p>MCCB open. Check the LED, and turn off the LED by pressing “Battery check/Reset” button.</p> <ul style="list-style-type: none"> Alarm: Blink (when $I > 0.9 I_r$), On (when $I > 1.1 I_r$)
5	Test Terminal	<p>Test terminal for checking ETU operation. Refer to the manual of Test kit for more information.</p>
6	LCD	<p>LCD shows load current, voltage and relay setting information. The screen can be changed with Up / Down button.</p>

1.4. ETU power supply

All ETU models are powered by the Current transformers(CT) in the HCP MCCB. In case of A/E type, external power supply must be connected in order to use additional functions.

- Communication function
- ZSI(Zone Selectivity Interlocking)
- Save system events

A battery is used for auxiliary functions. The battery is primary battery, and the following functions are provided. The Battery replacement cycle may vary depending on the environment.

- RTC(Real time clock)
- Trip LED light
- Thermal Memory

NOTICE

- | |
|--|
| <ul style="list-style-type: none"> • Battery is consumables. It can be used for 6 years under normal use conditions. (Separate purchase item) |
|--|

1.5. LCD Display

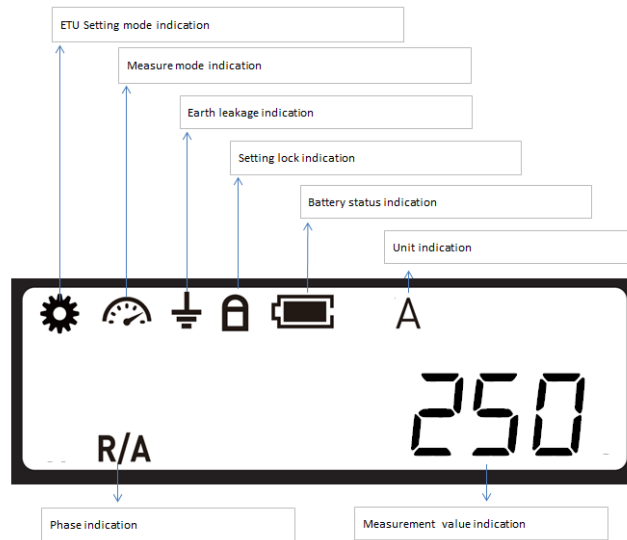
LCD information check is available only for ETU D/A/E type. LCD displays information differently for each type.

LCD displays ETU protection setting information and load measurement value.

- D/A type: current display
- E type: current, voltage, power display

If an external power supply is connected, information on the protective elements of the ETU can be displayed and set even when the MCCB is open.

* LCD configuration / ICON (N type is not applicable)



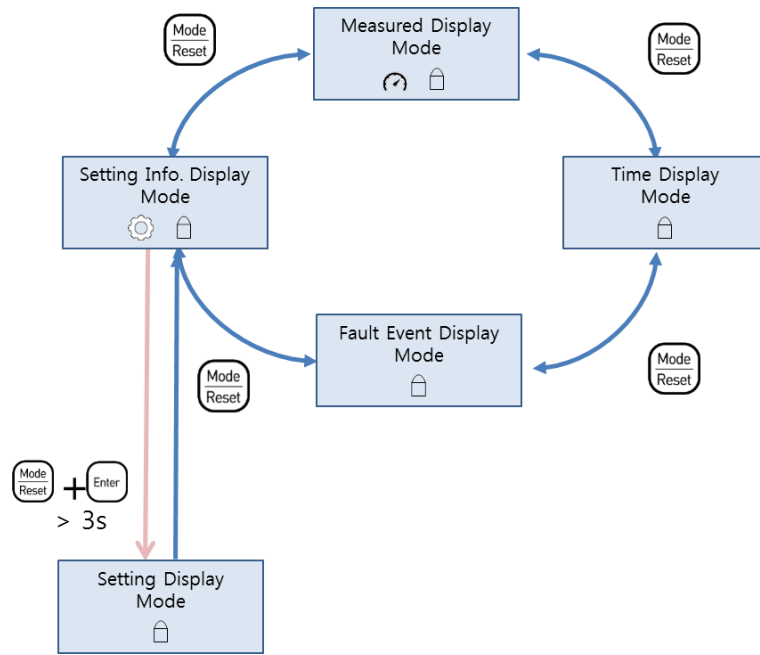
1.6. LCD operation and setting

Main screen displays current which is true rms value.

There are 5 kinds of LCD display mode.

User can switch the screen with Mode/Reset button and move to protective elements setting mode by pressing Mode/Reset and Enter button.

- Measurement value display mode
- Time display mode
- Fault event display mode
- Protective elements setting information display mode
- Protective elements setting mode


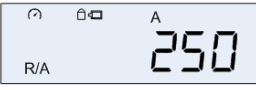
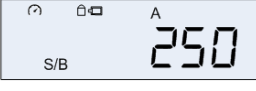
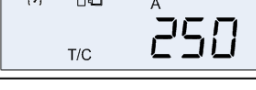




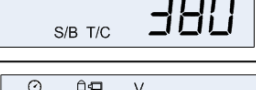
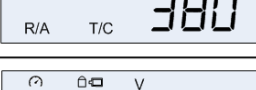


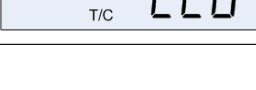







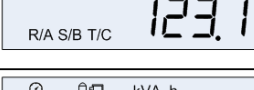

1.6.1. Measurement value display mode

User can move to the display of each phase information with , button.



The phase information is displayed sequentially and periodically with certain period.





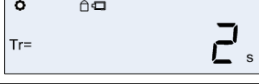
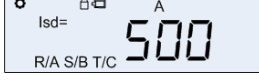
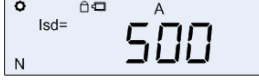


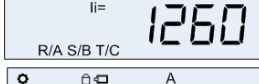
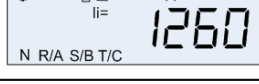
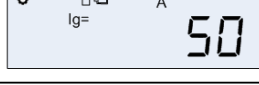
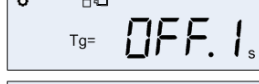
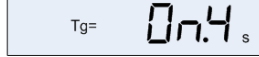
In case of E type, user can switch Current ↔ Voltage ↔ Power ↔ Energy menus with button.




model	mode	order	description	
D/A/E		1	Instantaneous current I1	
		2	Instantaneous current I2	
		3	Instantaneous current I3	
		4	Instantaneous neutral current IN (4p or with ENCT)	
		5	Instantaneous ground current Ig	
E		6	phase to phase voltage U12	
		7	phase to phase voltage U23	
		8	phase to phase voltage U31	
		9	phase to phase voltage V1N	
		10	phase to phase voltage V2N	
		11	phase to phase voltage V3N	

model	mode	order	description	
E		12	Total active power Ptot	
		13	Total reactive power Qtot	
		14	Total apparent power Stot	
		15	active energy Ep (readout and reset)	
		16	reactive energy Eq (readout and reset)	
		17	apparent energy Es (readout and reset)	



1.6.2. Protective elements setting information display mode

User can move to the display of each information with ,  button.

model	mode	order	description	
D/A/E	 	1	Ir long time Protection Pickup value	
		2	Ir long time Protection neutral pickup value (4P or with ENCT)	
		3	tr long time Protection time delay @ 6 Ir	
		4	I _{sd} short time protection pickup value	
		5	I _{sd} short time protection neutral pickup value (4P or with ENCT)	
		6	tsd short time protection time delay • ON: I ² t active • OFF: I ² t reactive	
				
		7	I _i Instantaneous protection pickup value (4P or with ENCT 일 때, N상 표시)	 
		8	I _g Ground fault protection pickup value	
9	tg Ground fault protection time delay value • ON: I ² t active • OFF: I ² t reactive			
				



model	mode	order	description
D/A/E	 	10	통신 address 1 ~ 250
		11	통신 baud rate b 9.6 : 9600 bps b 19.2: 19200 bps b 38.4: 38400 bps
		12	Thermal on/off  on/ off 확인
		13	ENCT 연결 상태 (only 3P) ECon : with ENCT Enon : non
E		14	ENVT 연결 상태 (only 3P) ECon : with ENVT Enon : non

1.6.3. Protective elements setting mode










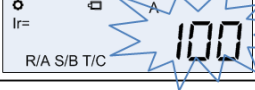














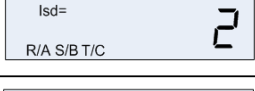


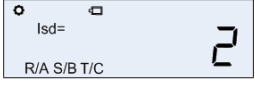



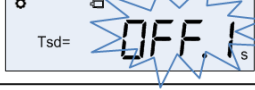




In protective elements setting information mode,  and  (lock) icons are displayed. While lock icon is displayed, the setting information cannot be changed.





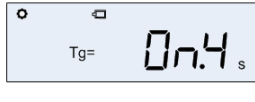
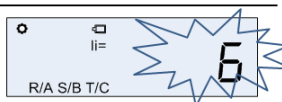
If Mode/Reset and Enter button are pressed simultaneously for more than 3 seconds, the lock icon disappears.

The lock icon is displayed again, if there is no button input, or Mode/Reset button is pressed.

User can move to the display of each information with ,  button.

1.6.3.1. Protection elements setting

1. 계전 설정			
1	Ir 설정 화면  	 +  > 3s 유지 자물쇠 표시 사라짐	
1.1	자물쇠 사라짐 	 flashing + 설정 변경 가능 상태	
1.2	Ir 설정 	  원하는 전류 값 설정 step 1A 미세조정 및 dial 조정 ~ max dial 설정 값	
1.3	Ir 설정 저장 	 설정 값 저장	
2	tr 설정 화면 	 이동  flashing + 설정 변경 가능 상태	
2.1	tr 설정 및 저장 	  원하는 trip time 설정 0.5 ~ 16  설정 값 저장	
3	Isd 설정 이동 	 이동	
3.1	Isd 설정 화면 	 pickup range dial 설정 1.5 ~ 10	
4	tsd 설정 화면 	 이동  flashing + 설정 변경 가능 상태	
4.1	tsd 설정 및 저장 	  time delay 설정 OFF.1 : I2t off 0.1s On.4 : I2t on 0.4s  설정 값 저장	












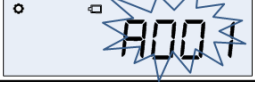


















1. 계전 설정			
5	Ig 설정 	 이동  flashing + 설정 변경 가능 상태	
5.1	Ig 설정 및 저장 	  pick up range 0.2 ~ 1 x In  설정 값 저장	
6	tg 설정 	 이동  flashing + 설정 변경 가능 상태	
6.1	tg 설정 및 저장 	  time delay 설정 0.1 ~ 0.4 OFF.1 : I2t off 0.1s On.4 : I2t on 0.4s  설정 값 저장	
7	Ii 설정 	 이동  flashing + 설정 변경 가능 상태	
7.1	Ii 설정 및 저장 	  pick up range 1.5 ~ 11 x In 4P or with ENCT 일 경우 N 표시됨  설정 값 저장	
8	IN 설정 	 이동 pickup range dial 로 설정 off - 0.5 - 1 - 1.6	

1.6.3.2. Communication setting

ETU transfers information to SCADA through Modbus-RTU.

Refer to the ETU Modbus profile manual for more information.

- Protocol: RS-485, Modbus-RTU
- Start bit: 1 bit
- Data bit: 8 bit
- Parity: none (fixed)
- Stop bit: 2 bit(fixed)
- Error check: CRC
- Address: 1 ~ 249
- Baud rate: 9600, 19200, 38400 bps
















2. 통신 설정 address (A/E)			
9	통신 주소 설정 화면  	 +  > 3s 유지 자물쇠 표시 사라짐	
9.1	자물쇠 표시 사라짐 	 flashing + 설정 변경 가능 상태	
9.2	설정 	  address 설정 1 ~ 250	
9.3	설정 저장 	 저장	
10	통신 baud rate 설정 화면  	 +  > 3s 유지 자물쇠 표시 사라짐	
10.1	자물쇠 표시 사라짐 	 flashing + 설정 변경 가능 상태	
10.2	설정 	  원하는 통신 속도를 설정 합니다. b 9.6 : 9600 bps b 19.2: 19200 bps b 38.4: 38400 bps	
10.3	설정 저장 	 저장	

1.6.3.3. Thermal on/off

HGP MCCB has ‘Thermal image’ function. This function is for simulating the thermal energy of the bus bar that flows on the normal phase to prevent fire due to heat and to protect the equipment.

Cooling time is 20 minutes before and after trip.

It is possible to deactivate the Thermal memory function under certain circumstances in the following setting screen.

3. Thermal ON/OFF (A/E)			
11	Thermal on/off 화면 	 이동  설정 표시	
11.1	Thermal on/off 설정 	 flashing + 설정 변경 가능 상태   설정 변경 on: thermal on off: thermal off I ² t 적용	
11.2	Thermal on/off 저장 	 저장	
11.3	Thermal on/off 화면 	 화면 이동	

1.6.3.4. ENCT / ENV T connection

This function is to measure the current and voltage flowing in the neutral conductor by connecting the neutral line to the 3-phase MCCB.









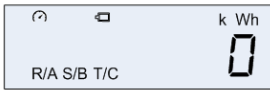


In order to use the ENCT function, supplied NCT must be connected.

In order to measure the phase voltage in 3-phase MCCB, ENCT function must be activated. If not, the voltage is measured as a phase-to-phase voltage.

- This function will be provided in the future.

1.6.3.5. Energy initialization

Accumulated energy value so far is initialized.

에너지 리셋 (active, reactive, apparent) E type			
1	에너지 계측 화면 	 +  > 3s 유지 자물쇠 표시 사라짐	
2	자물쇠 표시 사라짐 	계측 값이 flashing 됨	
3	에너지 reset 	 에너지 값이 reset 됩니다.	
6	에너지 계측 화면으 로 복귀 		

2. Protection

WARNING

- This equipment must be installed by a properly qualified person.
- All power must be turned off before operating the ETU or the internal accessories.
- Be sure to check the rated voltage before power supply.

2.1. ETU N type

2.1.1. Long time protection

The time delay is fixed, and pickup is adjustable. Long time operation curve include the thermal image function.

L Long-time protection

Pick-up [A]	$I_r =$	dial setting	0.4	0.45	0.5	0.56	0.63	0.7	0.8	0.9	1
Time delay [s]	$t_r =$	Fixed									
		$1.5 \times I_r$	378								
accuracy	$\pm 20\%$	$6 \times I_r$	16								
		$7.2 \times I_r$	11								
Thermal memory			20 minutes								

Thermal Memory

Thermal Memory function is to cool the conductor in HGP MCCB after trip. The cooling time is 20 minutes before and after trip.

CAUTION

- Thermal memory function is implemented with a battery. This function is disabled when the battery is removed.
- Even if there is no battery, use the equipment after cooling for 20 minutes for the product life and safety.
- Battery is consumables. It can be used for 6 years under normal use conditions.

2.1.2. Short time protection

The definite time curve or inverse time curve is applied to short time protection.

I_{sd} pickup is set with dial, and short time is tripped at a fixed t_{sd} time delay.

S Short-time protection

Pick-up [A]	$I_{sd} = I_r \times$	dial setting	1.5	2	3	4	5	6	7	8	10
accuracy	$\pm 15\%$										
	$t_{sd} =$	Fixed									
Time delay [s]		non tripping time	0.08								
		max time	0.14								

2.1.3. Instantaneous protection

It protects switchboards and device against very large short circuit current.

The instantaneous protection works as a definite time at I_i pickup setting value without time delay.

I_i is fixed according to rated current(I_n)

I Instantaneous protection

Pick-up [A]	$I_i =$															
accuracy $\pm 15\%$		<table border="1"> <tr><td>$I_n = 40$ A</td><td>600</td></tr> <tr><td>$I_n = 100$ A</td><td>1500</td></tr> <tr><td>$I_n = 160$ A</td><td>2400</td></tr> <tr><td>$I_n = 250$ A</td><td>3000</td></tr> <tr><td>$I_n = 400$ A</td><td>4800</td></tr> <tr><td>$I_n = 630$ A</td><td>6900</td></tr> <tr><td>$I_n = 800$ A</td><td>8800</td></tr> </table>	$I_n = 40$ A	600	$I_n = 100$ A	1500	$I_n = 160$ A	2400	$I_n = 250$ A	3000	$I_n = 400$ A	4800	$I_n = 630$ A	6900	$I_n = 800$ A	8800
$I_n = 40$ A	600															
$I_n = 100$ A	1500															
$I_n = 160$ A	2400															
$I_n = 250$ A	3000															
$I_n = 400$ A	4800															
$I_n = 630$ A	6900															
$I_n = 800$ A	8800															
Time delay [s]		maximum time ≤ 0.05														

2.1.4. Neutral protection

3-phase circuit breaker does not protect neutral line.

When protecting the neutral line of 4-phase circuit breaker, the operation range is set with dial.

Neutral protection protects long time, short time, and instantaneous.

Pickup of neutral line is proportional to long time(I_r) pickup setting and short time(I_{sd}) pickup setting.

Time delay setting of neutral line is equal to long time(I_r) time delay setting and short time(I_{sd}) time delay setting.

Pickup setting of neutral line is equal to that of instant(I_i).

- OFF: Neutral line is not protected.
- 0.5: Neutral line is protected at 0.5 times the I_r setting. It is possible to set over 16A.
- 1: Neutral line is protected at the I_r setting.
- 1.6: Neutral line is protected at 1.6 times the I_r setting. However, in the range exceeding 0.63 times the rated value, the neutral wire is protected at 1time.

IN Neutral protection

Pick-up	$I_N = I_r \times$	OFF	0.5	1	1.6
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2.2. ETU D/A/E type

2.2.1. Long time protection

Switchboard and devices are protected against overload with adjustable pickup and time delay settings. The pickup setting can be set in 1A increments precisely.

For long time protection, the inverse time curve is applied, and the Thermal image function is included.

L Long-time protection											
Pick-up [A]	Ir=	dial setting	0.4	0.45	0.5	0.56	0.63	0.7	0.8	0.9	1
		Button setting	1A step. Max pickup = dial setting								
Time delay [s]	tr=	Button setting	0.5	1	2	4	6	8	16		
		accuracy $\pm 20\%$	1.5 x Ir	11.8	23.7	47.3	94.7	142	189	378	
			6 x Ir	0.5	1	2	4	6	8	16	
			7.2 x Ir	0.345	0.69	1.38	2.76	4.2	5.5	11	
Thermal memory			20 minutes								

Thermal Memory

Thermal Memory function is to cool the conductor in HGP MCCB after trip. The cooling time is 20 minutes before and after trip.

!	CAUTION
<ul style="list-style-type: none"> • Thermal memory function is implemented with a battery. This function is disabled when the battery is removed. • Even if there is no battery, use the equipment after cooling for 20 minutes for the product life and safety. • Battery is consumables. It can be used for 6 years under normal use conditions. 	

2.2.2. Short time protection

For short time protection, the definite time curve or inverse time curve (I^2t) is applied. It is possible to adjust the pick-up using the front adjustment dial, and the button is used to set the time delay.

S Short-time protection											
Pick-up [A]	Isd=Ir x	dial setting	1.5	2	3	4	5	6	7	8	10
		accuracy $\pm 15\%$									
Time delay[s]	tsd=	Button setting	I^2_{OFF}	0.1	0.2	0.3	0.4				
			I^2_{ON}	0.1	0.2	0.3	0.4				
		non tripping time	0.08	0.14	0.23	0.35					

max time 0.14 0.2 0.32 0.5

2.2.3. Instantaneous protection

Switchboard and devices are protected against very large short circuit current. The instantaneous protection works as a definite time at I_i pickup setting value without time delay.

I Instantaneous protection												
Pick-up [A] accuracy ±15%	I _i = I _n x	Button setting	In = 40A									
			In = 100A	1.5	2	4	6	8	10	11	12	13
			In = 160A									
			In ≥ 250A	1.5	2	4	6	8	10	11		
Time delay [s]	maximum time ≤0.05											

2.2.4. Ground fault protection

For ground fault protection, the definite time curve or inverse time curve is applied. It is possible to set the I_g pickup and t_g time delay with the front buttons of ETU.

G Ground-fault protection													
Pick-up [A] accuracy ±15%	I _g = I _n x	Button setting	In > 40A	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1	OFF	
			In = 40A	0.4	0.5	0.6	0.7	0.8	1	OFF			
Time delay [s]	tsd =	Button setting	I2OFF	0.1	0.2	0.3	0.4						
			I2ON	0.1	0.2	0.3	0.4						
		non tripping time			0.08	0.14	0.23	0.35					
		max time			0.14	0.20	0.32	0.5					

2.2.5. Neutral protection

3-phase circuit breaker does not protect neutral line.

When protecting the neutral line of 4-phase circuit breaker, the operation range is set with dial.

Neutral protection protects long time, short time, and instantaneous.

Pickup of neutral line is proportional to long time(I_r) pickup setting and short time(I_{sd}) pickup setting.

Time delay setting of neutral line is equal to long time(I_r) time delay setting and short time(I_{sd}) time delay setting.

Pickup setting of neutral line is equal to that of instant(I_i).

- OFF: Neutral line is not protected.
- 0.5: Neutral line is protected at 0.5 times the I_r setting. It is possible to set over 16A.

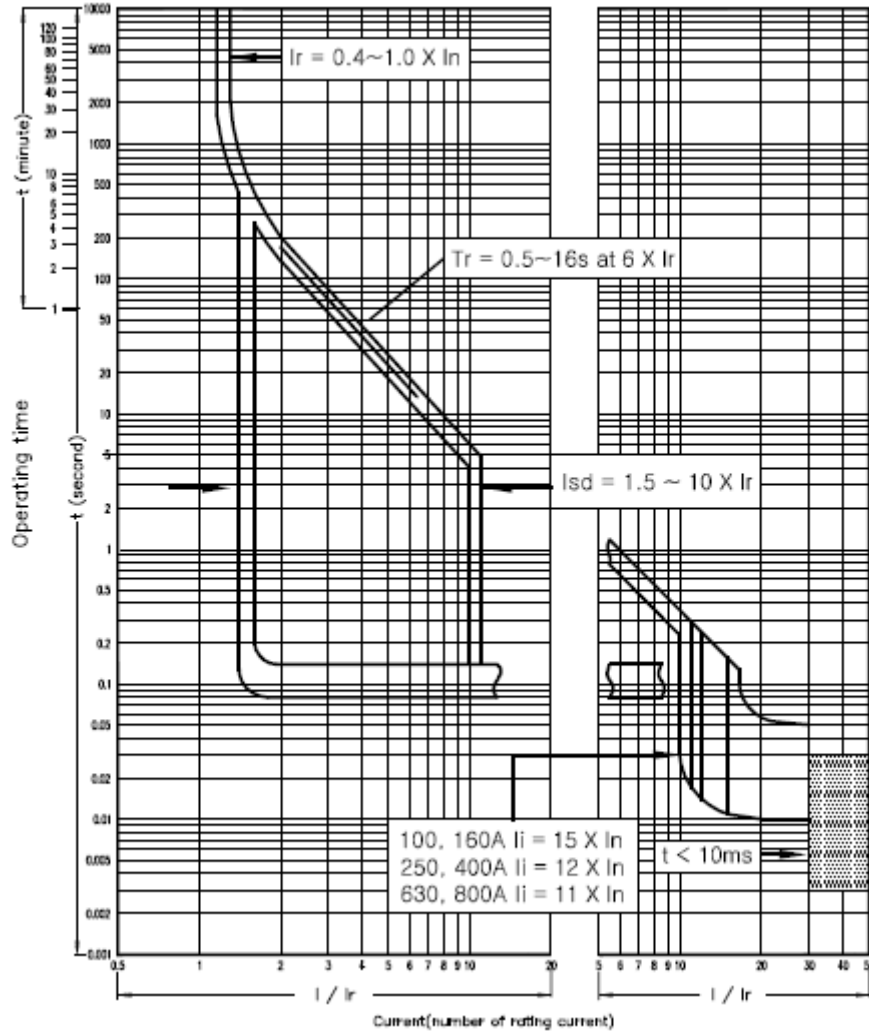
- 1: Neutral line is protected at the I_r setting.
- 1.6: Neutral line is protected at 1.6 times the I_r setting. However, in the range exceeding 0.63 times the rated value, the neutral wire is protected at 1time.

IN Neutral protection

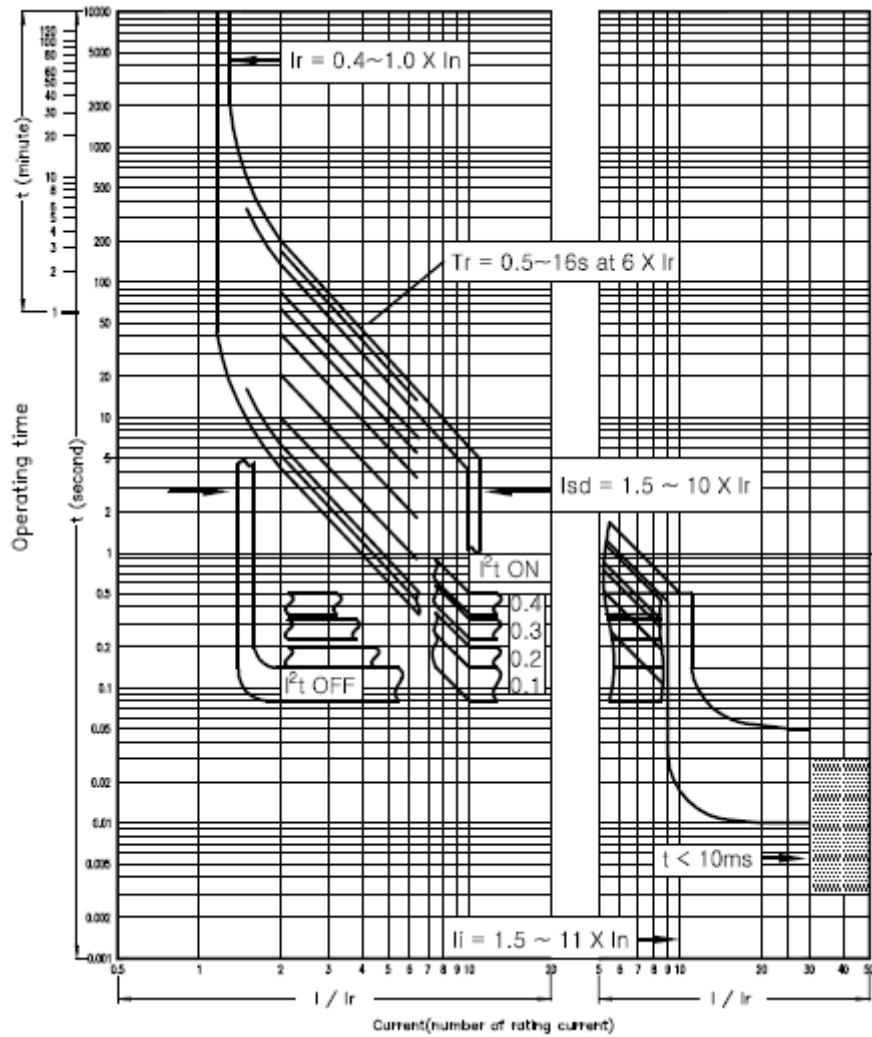
Pick-up	$I_N = I_r \times$	OFF	0.5	1	1.6
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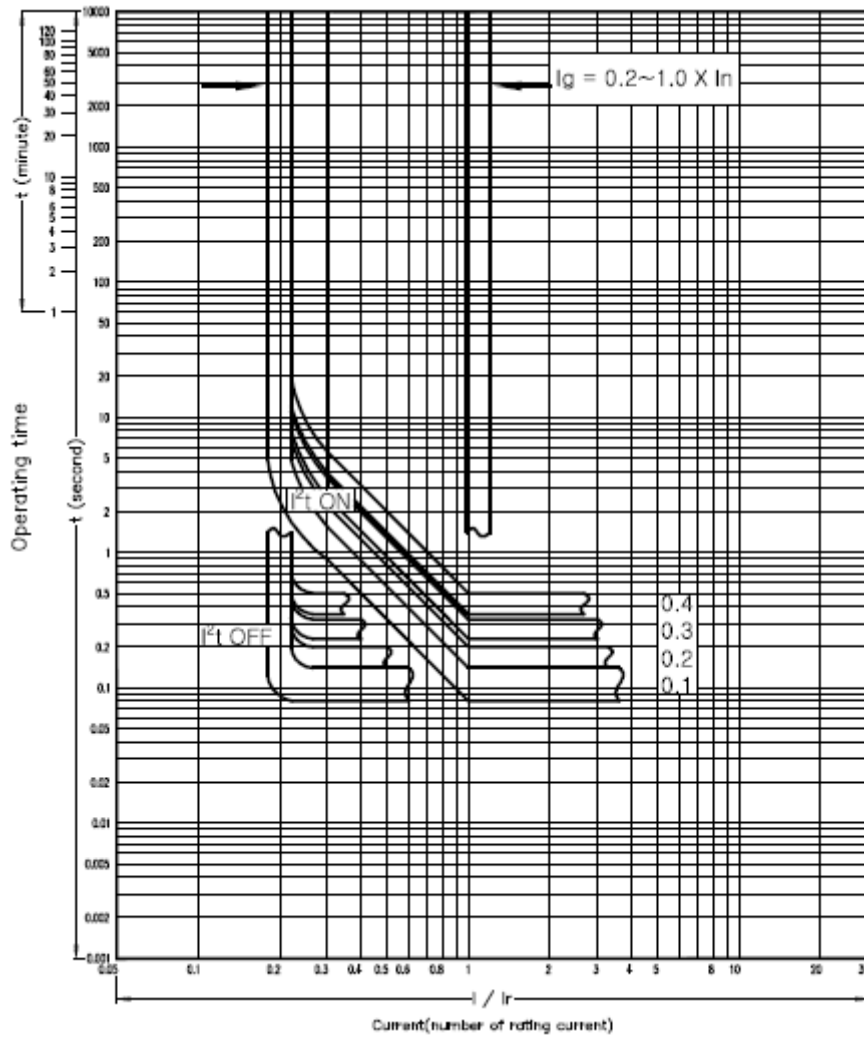
2.2.6. Characteristic curve

2.2.6.1. ETU N type



2.2.6.2. ETU D/A/E type





3. Measurement function

3.1. Instantaneous value

The current of each phase is measured as true rms value.

ETU E type measures current and voltage of each phase.

- 3P : phase-to-phase voltage, 4P: phase voltage

ETU D/A/E type shows current, voltage, and power through front LCD.

3.2. Ground fault current measurement

The ground fault current is calculated by measuring the phase current. The ground fault current is calculated as follows for each MCCB type.

- 3P: $I_g = I_R + I_S + I_C$
- 4P: $I_g = I_R + I_S + I_C + I_N$

3.3. ETU D/A type

Measurement	Unit	Display	
		ETU LCD	Communication
R phase current	A	D / A	A
S phase current	A	D / A	A
T phase current	A	D / A	A
N phase current	A	D / A	A
Ground fault current	A	D / A	A
Max current	A		A
Min current	A		A
Average current	A		A

3.4. ETU E type

3.4.1. Current

The phase value of the current is not displayed for 3P circuit breaker.

Measurement	Unit	Display	
		ETU LCD	Communication
R phase current	A	E	E
S phase current	A	E	E
T phase current	A	E	E
N phase current	A	E	E
Ground fault current	A	E	E
Max current	A		E
Min current	A		E
Average current	A		E
Each phase unbalanced current	%		E
MAX unbalanced current	%		E

3.4.2. Voltage

For 3P circuit breaker, phase-to-phase voltage is measured. The phase of phase-to-phase voltage is not measured.

Measurement	Unit	Display	
		ETU LCD	Communication
Vr phase voltage / Vrs phase-to-phase voltage	V	E	E
Vs phase voltage / Vst phase-to-phase voltage	V	E	E
Vt phase voltage / Vtr phase-to-phase voltage	V	E	E
Max phase-to-phase voltage	V		E
Min phase-to-phase voltage	V		E
Average phase-to-phase voltage	V		E
Unbalanced phase-to-phase voltage	V		E
Max unbalanced phase-to-phase voltage	V		E

3.4.3. Power

Power is calculated with 2 Wattmeter or 3 Wattmeter.

3 phase MCCB : 2 Wattmeter

4 phase MCCB : 3 Wattmeter

In 2 Wattmeter calculation, it is impossible to calculate each phase power. The power value for each phase is display as 0. Only total power value is displayed.

Measurement	Unit	Display	
		ETU LCD	Communication
Total active power	kW	E	E
Total reactive power	kVAR	E	E
Total apparent power	kVA	E	E
Total power factor			E
Phase active power	kW		E
Phase reactive power	kVAR		E
Phase apparent power	kVA		E
Phase power factor			E

3.4.4. Energy

Total active, reactive and apparent power are calculated. Energy represents power consumption per hour, and it is updated every second. The energy value is saved to memory in ETU on an hourly basis.

In 3 phase circuit breaker, energy is calculated as 2 Wattmeter, and the phase energy is displayed as zero. Only total energy is displayed.

The saved energy can be reset by communication.

(Refer to the communication manual)

Measurement	Unit	Display	
		ETU LCD	Communication
Total active power	kWh	E	E
Total reactive power	kVARh	E	E
Total apparent power	kVA	E	E
Phase active power	kW		E
Phase reactive power	kVAR		E
Phase apparent power	kVA		E
Phase inverse active power	kWh		E
Phase inverse reactive power	kVARh		E

3.4.5. Demand current, demand power

Average value calculated within certain time(demand time) is displayed. The default is set to 15 minutes, and time setting is available with communication.

Measurement	Unit	Display	
		ETU LCD	Communication
Demand IR	A		E
Demand IS	A		E
Demand IS	A		E
Demand IN	A		E
Demand Total active power	kW		E
Demand Total reactive power	kVAR		E
Demand Total apparent power	kVA		E

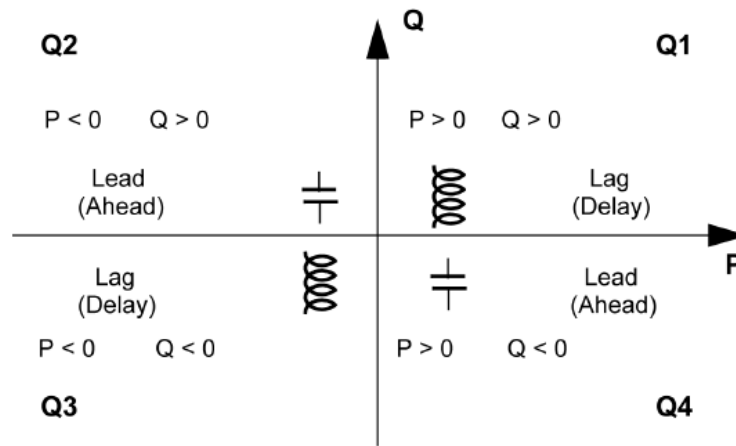
3.5. Power sign

Active power has 2 kinds of sign as below.

- + sign: Power consumption
- – sign: Power supply

The sign of the reactive power is as follows.

- When inductive load is applied, that is, when the phase of current lags that of voltage, active power and reactive power have the same sign.
- When capacitive load is applied, that is, when the phase of current precedes that of voltage, active power and reactive power have the opposite sign.



Power supply line can be connected to the top or bottom of the HGP MCCB. The sign of power is basically set to (+) when power supply line is connected to the upper part and the load is connected to the lower part, so that the power flow occurs. If power supply line is connected to the lower part, it is possible that the sign of power is changed to (-) to prevent confusion. User can change the sign by communication setting. (Refer to the communication manual.)

4. Alarm

By default, all alarm setting is deactivated.

User can set the alarm through communication.

When a trip occurs, it can be linked with alarm LED with FAL block which is option. (only ETU E type)

The operation standard and time can be confirmed and set by communication.

Settings	Pickup and time settings	Note	Unit
UVR setting	OFF / ALARM	OFF	
UVR PICKUP setting value	100 to OVR PICKUP setting value	5V step	V
UVR DROPOUT setting value	UVR PICKUP setting value to OVR PICKUP setting value	5V step	V
UVR PICKUP DELAY setting value	1 to 1500	1s step	sec
UVR DROPOUT DELAY setting value	1 to 1500	1s step	sec
OVR setting	OFF / ALARM	OFF	
OVR PICKUP setting value	UVR PICKUP setting value to 1100	5V step	V
OVR DROPOUT setting value	100 to OVR PICKUP setting value	5V step	V
OVR PICKUP DELAY setting value	1 to 1500	1s step	sec
OVR DROPOUT DELAY setting value	1 to 1500	1s step	sec
U-unbal setting	OFF / ALARM	OFF	
U-unbal PICKUP setting value	2 to 30	1% step	%
U-unbal DROPOUT setting value	2 to U-unbal PICKUP setting value	1% step	%
U-unbal PICKUP DELAY setting value	1 to 1500	1s step	sec
U-unbal DROPOUT DELAY setting value	1 to 1500	1s step	sec

I-unbal setting	OFF / ALARM	OFF	
I-unbal PICKUP setting value	5 to 60	1% step	%
I-unbal DROPOUT setting value	5 to I-unbal PICKUP setting value	1% step	%
I-unbal PICKUP DELAY setting value	1 to 1500	1s step	sec
I-unbal DROPOUT DELAY setting value	1 to 1500	1s step	sec
UFR setting	OFF / ALARM	OFF	
UFR PICKUP setting value	45 to OFR PICKUP setting value	0.5Hz step	Hz
UFR DROPOUT setting value	UFR PICKUP setting value to OFR PICKUP setting value	0.5Hz step	Hz
UFR PICKUP DELAY setting value	1 to 1500	1s step	sec
UFR DROPOUT DELAY setting value	1 to 1500	1s step	sec
OFR setting	OFF / ALARM	OFF	
OFR PICKUP setting value	UFR PICKUP setting value to 65	0.5Hz step	Hz
OFR DROPOUT setting value	45 to OFR PICKUP setting value	0.5Hz step	Hz
OFR PICKUP DELAY setting value	1 to 1500	1s step	sec
OFR DROPOUT DELAY setting value	1 to 1500	1s step	sec

5. Trouble shooting

Event	The check and inspections	Operations
prior to startup	inspection of the switchboard check no waste has been left behind from assembling the equipment (wiring, tools, shavings, metallic particles, etc.)	Visual inspection and functional testing, replacement.
	Rating and breaking capacity (indication on the rating plate)	
	Identification of the trip units (type, rating)	
	Protection settings (overload, short-circuit etc.) N type ETU: visually check the position of the switches. D, A, E type ETU: visually check the position of the switches and on the LCD of ETU	
operation	check operation of the ETU Run LED turn on: over 15% In (rated current) For 100A and 160A: over 30A	diagnostics and repairs by HE service
	check the battery status For D, A, E types : visually check it on LCD of the ETU (see HGP MCCB catalog – ETU display) For N types: press the Battery check key and visually check to turn LED's on the ETU on (see catalog – ETU indication)	visual inspection and replacement
After the replacement of battery	using the Test kit for ETU, set the date on ETU (see the test kit manual – setting) check the data on LCD of the ETU	visual check

communication error	Communication parameter settings (address, baud rate) connect only A, E types to Modbus network. visually check the setting of comm. parameter on the LCD of ETU (see HGP catalog – ETU display)	visual inspection and functional testing replacement.
	Polling period that the master request on is over 500ms (recommended.) and keep the small segment(max distance 1km and a daisy chain topology)	
After tripping	ETU fault alarm Led reset press the reset key on the ETU	visual inspection and check the load network.
	check fault event on LCD of the ETU (see catalog – ETU display)	



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