

IMC-III

Digital Motor Protection Controller



Safety Information

- You have to read safety information before operating it.
- This manual have to be transmitted to end user and captain of maintenance.

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Safety information

**For operating safely and understanding full function,
you have to read this manual in detail and then operate.**

- Please observe this safety information to protect you against danger and accident by operating the unit well and safely.
- The safety information is divided warning into caution, that meanings are like belows ;



Warning

Non-observance can result in death, personal injury or substantial property damage.

Caution

Non-observance can result in a bit injury or damage for unit.

- The indication symbol in the manual means like belows ;



The warning icon indicates the presence of hazard which could result in personal injury.



Only a competent electrician is allowed to carry out the electrical installation.

- Please keep the manual near by IMC-III.



Warning

- **Do not wiring work during operation and power on state.**
This is reason for electric shock.
- **Do not wiring work when the electric line is alive.**
This is for reason for electric shock and damage by current transformer charging current.
- **Do not disassemble in case of no power supply too.**
This is reason for electric shock by charging current inside.
- **Do not disconnect wiring in secondary CT.**
This is reason for fire or explosion.
- **Do not install and operate with wet hand.**
This is reason for electric shock.
- **Do not use damaged cable coating.**
This is reason for electric shock.
- **When you wire cable, you have to wire after compressing the terminal.**
This is reason for electric shock by cable.
- **Please work with protection safe guard or equipment**
- **Please remove the INPUT, OUTPUT wiring, when you measure the insulation voltage or insulation impedance.**
- **Do not change the rating type setting slide S/W during motor operation.**
This is reason for motor damage and wrong movement.
- **The contact point can malfunction due to a big shock. (Over 5g Shock acceleration)**



Caution

▪ Installation and terminal wiring

- **Please supply power to be adaptable to polarity and ratings**

This is reason for damage or fire.

- **Do not let the screw, metal, water, oil get in the product.**

This is reason for the fire.

- **Please observe the ratings of the output contact point.**

This is reason for damage or fire.

- **Please wire the terminal after confirming terminal number.**

This is reason for damage or fire.

- **Please assemble the terminal cover after wiring terminal**

- **Only ZCT for IMC-III is able to use.**

- **Only specialist can install and maintenance the product**

Wrong installation can cause malfunction and accident.

▪ Setting caution

- **When the single phase motor starts, turn off the phase reversal function.**

- **When the Inverter function starts, turn off the earth fault function.**

The earth fault can malfunction when the function is on.

▪ Power supply caution

- **Check the operation and input power supply.**

- **Check the Input / Output terminal wiring.**

▪ Keeping and treatment caution

- **Keep the product in the place where is no humidity and dust.**

- **Do not throw and force when you carry the product.**

This is reason for malfunction and fault.

▪ Scrap caution

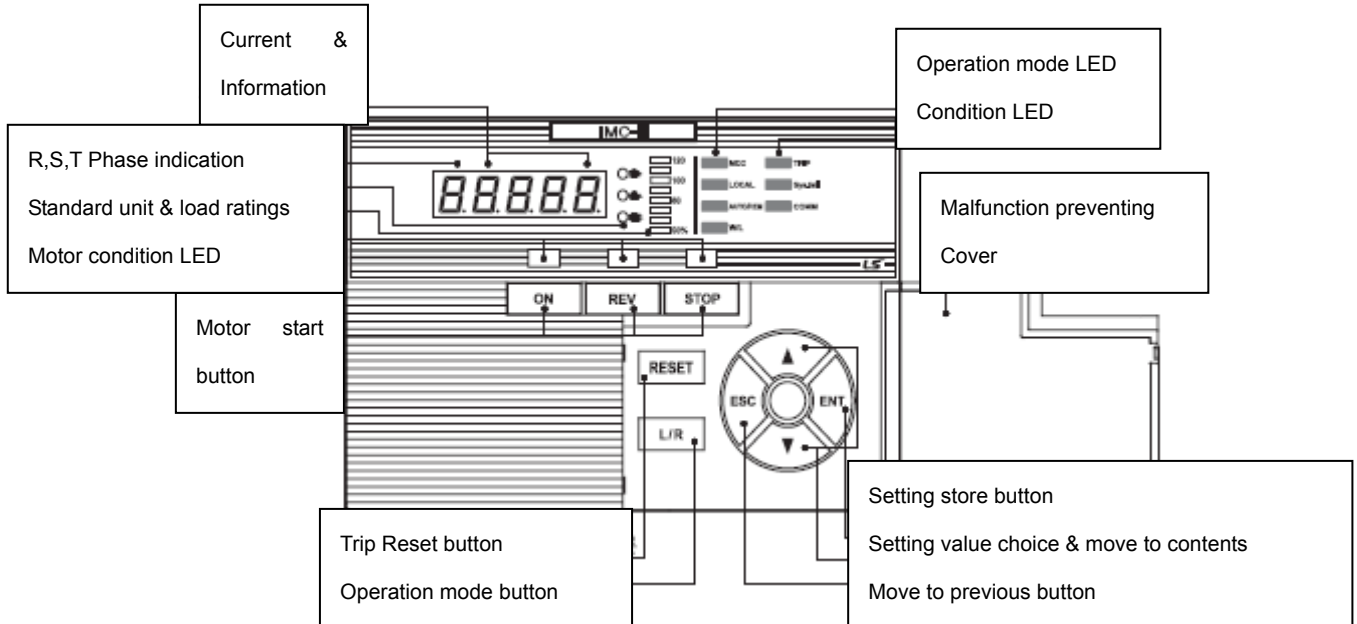
- **When you remove the product, you have to treat as industrial wastes.**

1. General

- IMC-III, is composed of Motor protection relay, LED and current measurement, is Integrated total motor protection and control unit.
- IMC-III is able to apply various motor start type and various sequence within one device.
- IMC-III protect safely with various protection elements(Over current, Under current, Phase reversal, Phase loss, unbalance, stall, locked Rotor Earth fault)
- You can see the all fault analysis, fault current value, operation current and are able to operate all functions with simple button in front of panel.
- When the instantaneous under voltage generates within 10 seconds, It can be re-started in sequence. Because IMC-III has a auto restart circuit as for compensation, and also has a timer for restart.
- IMC-III is possible to operate in the LOP and MCC panel with just simple sequence and is also possible to control in remote with PLC, DCS with RS 485 communication. And IMC-III is able to do a remote monitoring according to 4~20mA output.
- IMC-III includes ON timer or OFF timer inside that is possible to make sequence without timer.
- IMC-III rating is 0.125A~60A within one device.
And it is possible to choose 0.5A~6A/ 5~60A by changing Slide S/W.
- IMC-III is so effective for maintenance and repair that we can store the total operating time and operating time.
- IMC-III is able to indicate 3-phase current and current peak value with just simple button.
- Total operation time ; Total Motor operation time after installing IMC-III
- Operation time ; From motor operation to motor stopping time.

2. Hardware and construction

2.1 Front

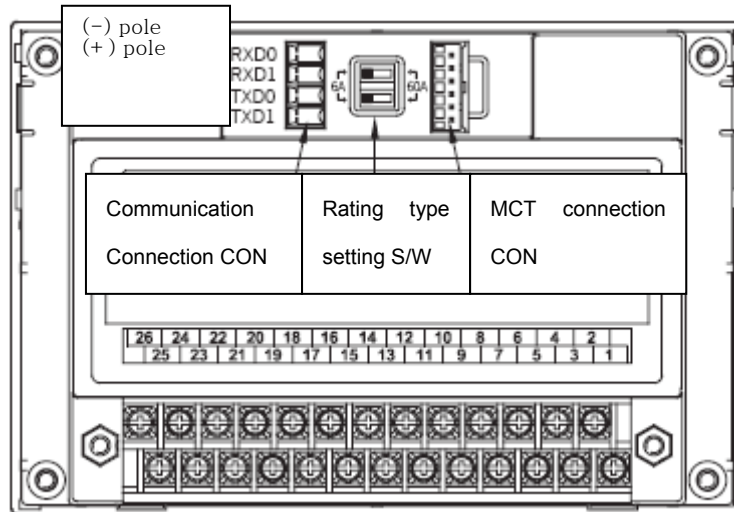


Button	Basic function
ON	Motor start(Forward direction)
REV	Motor start(Reverse direction)
STOP	Motor stop
RESET	Trip condition release
L/R	Operation mode (Local/Remote)
ESC	Move to previous menu
ENT	Store setting value
UP	Movement menu (Increase)
DOWN	Movement menu (decrease)

(NOTE)

1. When you push the RESET button for 3 seconds IMC-III indicates 3 phase current.
2. When you push ESC+ENT simultaneously, IMC-III indicates fault analysis.
 - If there is no fault, IMC-III indicates “non”
 - In this case, every push the button indicates 3 phase (fault) current sequence.
 - When you push the ESC+ENT button simultaneously one more time, it comes back normal mode.

2.2 Rear



(NOTE)

1. Connect the MCT terminal to CON.
2. In case of using RS485/RS422/4~20mA output, after wiring cable to 4 pin connector which is attached to communication connection CON, connect to communication connection CON.

2.3 Terminal composition

Terminal No.	Input/Output	Function
1	INPUT	Choice LOP operation mode S/W
2		1,3,4,5,6 Terminal COMM(COM1)
3		External ON S/W
4		Reverse rotation input at Forward/Reverse start
5		External STOP S/W
6		External RESET S/W
7		External M/C condition input
8		F-S Mode external input
9		7,8,10,11 Terminal COMM(COM2)
10		External input trip1
11		External trip2
12	OUTPUT	Motor ON output (F/R start / Forward rotation output)
13		Y-DELTA start ; Y contact output
		INVERTER start ; INVERTER contact output
		Direct start ; Not in use
		Forward / reverse start ; not in use
	REACTOR start ; Not in use	
14	OUTPUT	Y-DELTA start ; Y contact output
		Forward/reverse start ; reverse rotation
		REACTOR start ; Reactor (R)output
		INVERER start ; BYPASS contact output
		Direct start ; Not in use
		12,13,14,16 terminal COMM(VCC1)
		LOP condition signal output
		Auto condition signal output
		W/L condition signal output
		Trip output (1a)
		17,18,19,21,22 Terminal COMM(VCC2)
21	ON DELAY TIMER	
22	OFF DELAY TIMER	
23	INPUT	Operation power supply
24		Operation power supply
25		ZCT input
26		ZCT input

3. Ratings

3.1 Standard circumstance

IMC-III shall be complied to below standard ;

- 1) Temperature
 - Normal temperature ; $-10^{\circ}\text{C} \sim 55^{\circ}\text{C}$
 - Storing temperature ; $-20^{\circ}\text{C} \sim 70^{\circ}\text{C}$
- 2) Humidity condition ; Humidity less 80%
- 3) Using place
 - Altitude ; Less 2,000m above the sea level.
 - No vibration and impact place.
 - No air pollution place

3.2. Product ratings

Division	Range	Remark
Operation power supply	AC220V / AC110V	Name plate
Input power supply	AC220V / AC110V	Name plate
Frequency	50/60Hz	
Power consumption	Less 6W	
Current changing range	0.5~6A / 5~60A(Common)	Selectable
Out put contact capacity	5A/250AC (Impedance load)	Output contact 9EA
ZCT standard	200mA / 0.1mA	Exclusive ZCT

3.3 Protection function

Division	Operating condition	Operating time	Remark
Over current	More 110% than setting current	1 ~ 60S	Standard 600% Operating time(Inverse time)
Phase loss	Current unbalance rates over 70%	Within 1.5S	
Unbalance	Current unbalance rates 30 ~ 50% setting	Within 5S	
Phase reversal	Changing current phase	Within 0.1S	For Only operating time
Under current	Rated current 30 ~ 70%	Within 3S	Minimum current 0.35A
Stall	Rated current 150 ~ 300%	Within 5S	
Locked Rotor	Rated current 200~700%	Within 0.5S	
Earth fault	Ground current setting (100~2500mA)	0.05~1S	

4. Operation and setting

4.1 Setting value construction

- A-Group

Menu	contents	Setting value	Basic values
1.CHR	Operating characteristic (Inverse/Definite time)	Ind/dEF	Inu
2. O-t	Operating time	1~60/1(S)	60
3. d-t	Operating delay time (Definite time ; dEF)	1~200/1(s)	200 (In case of Inu, do not indicate)
4.r-C	Rating current setting	0.5~6/0.1A 5~60/1(A)	6/60
5.Ctr	CT ratio setting	0.25, 0.5, 1~200/1	1
6.dru	Operating mode	Dir / y-d / F-r / Ind / lut	Dir
7.d-t	Y operating time	1~120 / 1(s)	Reactor operating time
8.ydt	Y-D changing time	0.05, 0.1, 0.2(s)	-
9.s-t	Under voltage compensation time	OFF, 1~10 / 1(s)	OFF
10.sd	Re-start time	0~300 / 1(s)	

(NOTE)

1. Inu ; Inverse characteristic, dEF ; Definite time characteristic
2. No 4 menu is changed to 0.5 ~6A or 5 ~ 60A by rating type setting SLIDE S/W setting
3. dir ; Direction start, y-d ; y-delta start , F-r ; Forward/reverse start,
Ind ; Inductor start , Lut ; Inverter start
4. You are not able to do a setting No.5 menu in case of 60A type.
5. No10 menu does not indicate in case of No.9 function is OFF.

▪ B-Group

Menu	contents	Setting value	Basic values
1.Loc	Lock protection	OFF, 200~700/100(%)	OFF
2. StL	Stall protection	OFF, 150,200,300	OFF
3. P-F	Phase Loss protection	OFF/ON	ON
4.P-U	Unbalance Protection	OFF, 30,40,50%	OFF
5.r-P	Phase reversal protection	OFF/ON	OFF
6.U-C	Under current protection	OFF, 30 ~ 70 / 5(%)	OFF
7.g-F	Earth fault protection	OFF/ON	OFF
8.g-C	Earth fault operating current	0.1,0.2,0.5,1.0,1.5,2.0,2.5(A)	0.1
9.g-t	Earth fault operating time	0.05,0.1 ~ 1.0 / 0.1(s)	0.05
10.gd	Earth fault delay	OFF/ON	OFF

(NOTE)

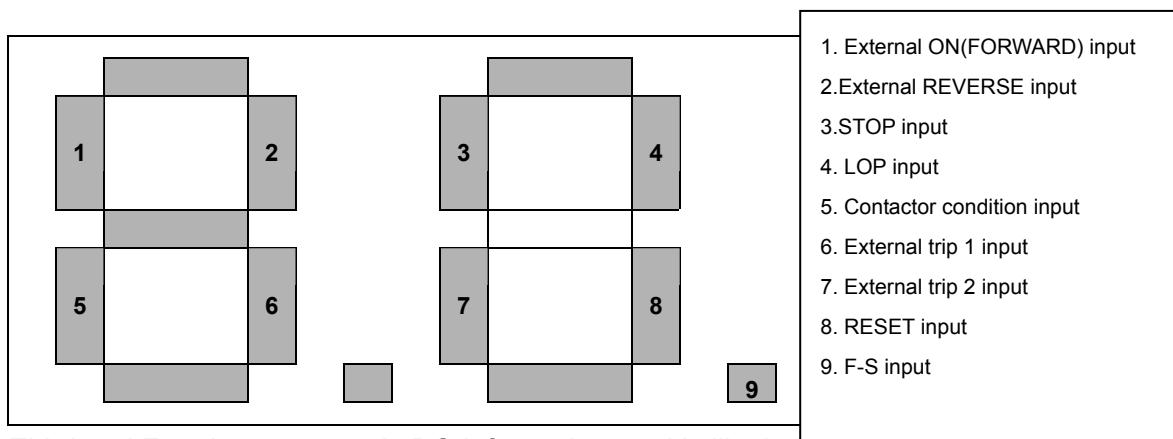
1. When the INVERTER operates, turn off the earth fault function
2. Phase reversal protection operates only in a starting time.

▪ C-Group

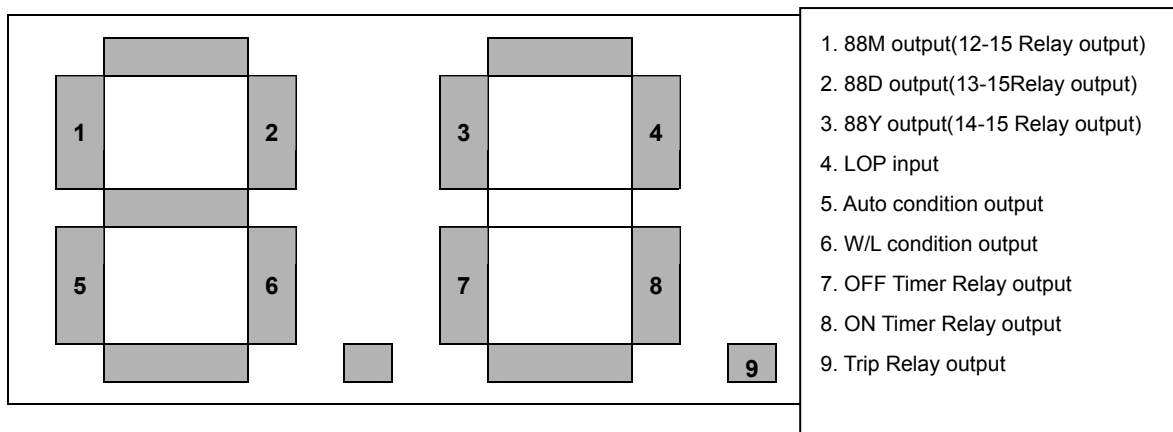
Menu	contents	Setting value	Basic values
1.I-O	Input/Output information	4 SEG indication	
2. trt	Total operating time	Check total operating time	Time check, setting disabled
3. r-t	Operating time	Check operating time	Time check, setting disabled
4.srt	Operating time setting	OFF, 10~8760/10(H)	-
5.CCh	Contact check	OFF/ON	ON
6.n-F	User contact point	Nor /t-d /F-S	nor
7.tOn	ON DELAY TIMER	0~300/1(s)	
8.tOF	OFF DELAY TIMER	0~300/1(s)	
9.t-c	Compare timer	0~300/1(s)	
10.Ar	Auto - return	OFF, 1~20/1(M)	OFF
11.Ad	Communication address	1~255	1
12.bS	Communication address	96, 192,384	96
13.SP	SWAP	ON/OFF	ON

(NOTE)

1. Total operation and operation time check
 - Total operation time ; Working -> Hour, minute
 - Operation time ; Operation time-> working->Hour, minute
 - After reaching the setting operation time, “OrH” is indicated.
 - In nor mode, Alarm contact (20-21 terminal) is going out.
2. Auto returning function is applied to only over current trip.
3. When the contactor check function is OFF, you are not able to check contactor,.
4. On/OFF timer is able to do a t-d / F-S choice setting.
5. 12,13 menu are indicated in only Modus bus communication mode.
6. I/O information is like below ;
 - First, second 7-segment is DI information and is like below ;



- Third and Fourth 7-segment is DO information, and is like below ;



4.2 Setting mode operation

4-2.1 Setting mode

If you push the UP/DOWN button, you can find 3 groups.

After indicating group you want, ENT button goes to the next group.

In the next group, if you push the ENT button, you can find setting contents.

After showing the contents you want, ENT button goes to the appropriate contents.

4-2.2 Setting value storing

If you push the UP/DOWN button, you can find 3 groups.

After indicating group you want, ENT button goes to the next group.

In the next group, if you push the ENT button, you can find setting contents.

After showing the contents you want, ENT button goes to the appropriate contents.

As you push the UP/DOWN button, the setting value is changed.

After changing the setting value, if you push the ENT button, setting values are stored.

4-2.3 Changing to Normal operating mode

After changing the setting contents, If you enter the ENT button, it will be returned normal operating mode.

4-2.4 Setting value searching

If you push the UP/DOWN button, you can find 3 groups.

After indicating group you want, ENT button goes to the next group.

In the next group, if you push the ENT button, you can find setting contents.

After showing the contents you want, ENT button goes to the appropriate contents.

(NOTE)

1. Notice that changing setting is possible only during motor operation.
2. If you will not operate for a while (10s), HMI will come back current measurement mode.

4.3 Operation mode choice function

Operation priority ranking ; LOCAL > MCC > Auto, W/L > Remote

- 1) Local – Local operation mode (LOP ; Local Operation Panel)
Local operation mode is maximum priority mode, it is possible to control motor at emergency situation in local site. You are able to close only in Local site, IMC-III blinks local LED at that time. In this time, you can operate on the another mode. If you are not able to operate by IMC-III, check the switch is closed to LOP.

- 2) MCC – MCC operation mode (Motor Control Center)
You are able to control by IMC-III of MCC panel. When the MCC LED blinks by handling L/R button, it is possible to control motor by IMC-III.

- 3) Auto , W/L – PLC auto operation mode
IMC-III is able to be auto operation and remote control. When the Auto/Remote, W/L LED blinks by handling L/R button, it is possible to control motor by IMC-III. By operation priority, it is possible to control in MCC and IMC-III motor operation mode is changed to MCC.

- 4) Remote – Communication operation mode
IMC-III has function of remote monitoring control by Data communication. When the Auto/Remote LED blinks by handling L/R button, it is possible to do a remote control and monitoring by RS485, RS422. By operation priority, it is possible to control in MCC and IMC-III motor operation mode is changed to MCC.

(NOTE) 4~20mA output product is able to monitor at the remote place.
(Load shall be less 500Ω)

5. Indications

5.1 Fault analysis indication

Indication	Description	Setting value
O-L	Over current trip	Check Rating current and time
U-C	Under current trip	Check rating current
P-F	Phase loss trip	Check wiring / contactor
P-U	Unbalance trip	Check Wiring/contactor/motor coil
Loc	Rotor locked trip	Check Rating current/time/motor inside
StL	Stall trip	Check motor axis
r-P	Phase reversal trip	Check wiring
g-F	Earth fault trip	Check Wiring and earth fault
T2-F	No input within time setting	Check wiring and time
OrH	Reaching the operation setting time	

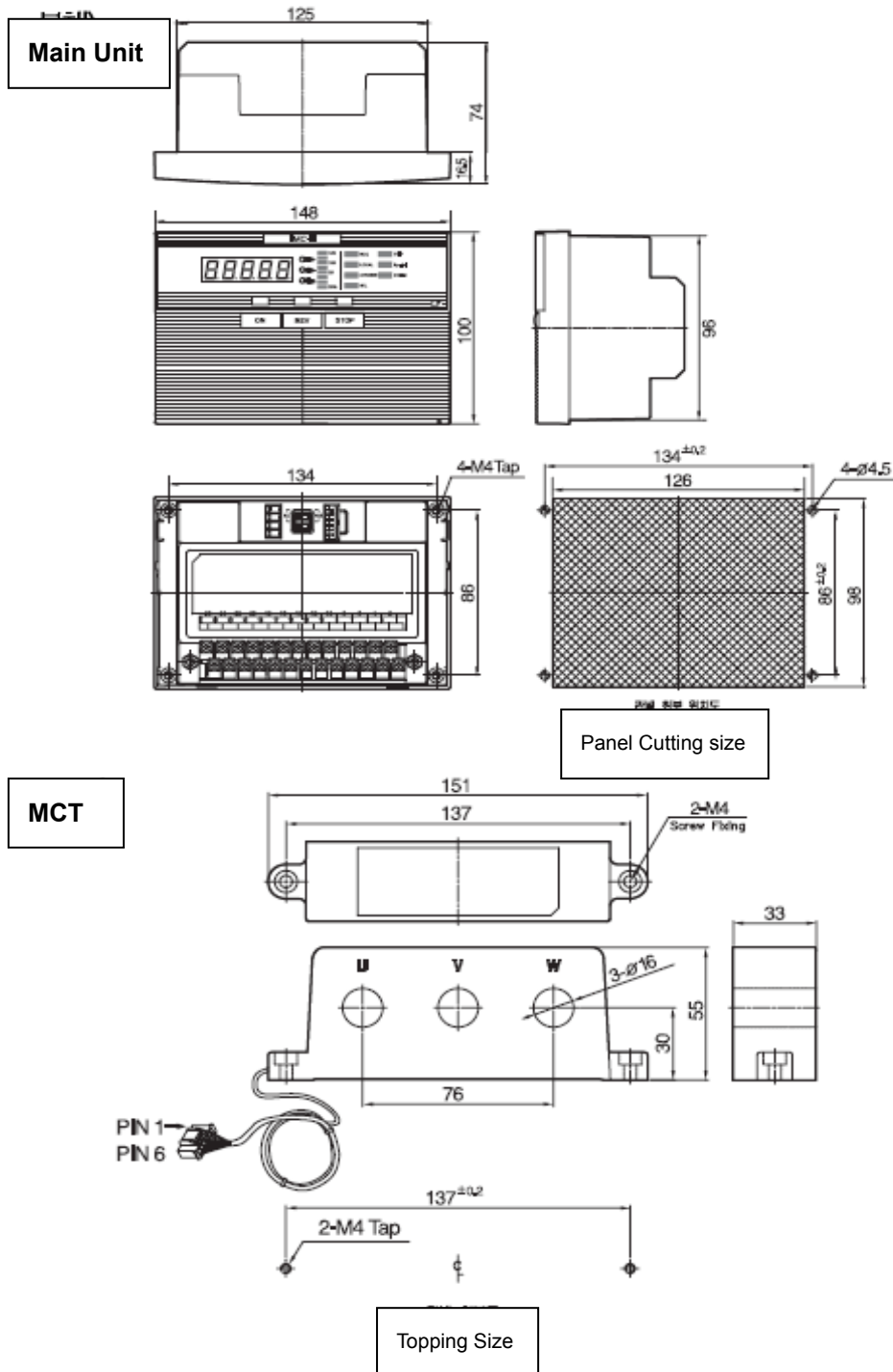
(NOTE)

1. IMC-III does not indicate current value on the Phase reversal trip.
2. Ground current is indicated mA on the earth fault trip.

5.2 Self supervision

Indication	Description
Err1	Output contact OFF , Mc condition input contact ON
Err2	Output contact ON, MC condition input contact OFF
Err3	Simultaneous Input 'FOR' input and 'REV' input
Err4	EEPROM

6. Overall dimension



7. Ordering number

