Power REGULATOR
TPR-3SL-EP
INSTRUCTION MANUAL

Thank you for purchasing HANYOUNG product.
Please check whether the product is the exactly same as you ordered.
Before using the product, please read this instruction manual carefully.
Please keep this manual where you can view at any time

HANYOUNG NUX

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Safety information

Before using the product, please read the safety information thoroughly and use it properly.Alerts declared in the manual are classified to Danger, Warning and Caution by their criticality

⚠ DANGER	DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury
⚠ WARNING	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury
⚠ CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury

⚠ Danger
To prevent electric shock while it is running, put to earth with the fixed screw of the unit and do not touch the radiator panel since it is very hot. Do not touch or contact the input/output terminals because they cause electric shock.

⚠ Warning
• Please install appropriate protective circuit on the outside if malfunction or an incorrect operation may be a cause of leading to a serious accident.
• If you use the product with methods other than specified by the manufacturer, there may be bodily injuries or property damages.
• Since this product is not designed as a safety device if it is used with systems, machines and equipment that could lead to a risk of life or property damage, please implement safety devices and protections for both lives and the applications and plan for preventing accidents.
• To prevent damage or failure of this product, please supply the rated power voltage.
• To prevent electric shock or equipment failure, please do not turn on the power until completing wiring.
• Never disassemble, modify, or repair the product. There is a possibility of malfunction, electric shock, or a risk of fire.
• Please turn off the power when mounting / dismounting of the product. This is a cause of electric shock, malfunction, or failure.

⚠ Caution
• Since the product operating environment influences the product performance and expected life span, please avoid using in the following places.
 · a place where humidity is high and air flow is inappropriate.
 · a place where dust or impurity accumulates, ambient temperature is high and vibration level is high.
 · a place where corrosive gas (such as harmful gas, ammonia, etc.) and flammable gas occur.
 · a place where there is direct vibration and a large physical impact to the product.
 · a place where there is water, oil, chemicals, steam, dust, salt, iron or others (Contamination class 1 or 2).
 · a place where excessive amounts of inductive interference and electrostatic and magnetic noise occur.
 · a place where heat accumulation occurs due to direct sunlight or radiant heat.
• Please do not wipe this product with organic solvents such as alcohol, benzene and others. (Please use mild detergent)
• Please make sure to inspect the product if exposed to water since there is a possibility of electric leakage or a risk of fire.
• Please connect the product and other units after turning off all the power of the product, instruments and units.
• Please make sure that the power control (TPR) is installed perpendicularly.
• Please install the product inside of the control panel and install an exhaust fan onto the top of the control panel.
• Pay attention to the edge of heat sink which is sharp.
• Please close the cover after installation in the place there is a cover.
• The external circuit connected with the product should be connected by an insulated circuit more than basic insulation.

Suffix code

Model	Code			Information
TPR-3SL	□	□	-□	Slim type 3-phase power regulator
Rated current	040			40 A
	055			55 A
	070			70 A
	090			90 A
	130			130 A
	160			160 A
Power supply voltage	L			100 - 240 V a.c.
	H			100 - 440 V a.c.
Option		EP		Each phase control (3 device individual control)

※ The circuit power and fan power must be applied separately 100 - 240 V a.c.
※130 A, 160 A products are FAN power 24 V d.c. Voltage must be applied.

Specification

Model	Low	TPR-3SL 040L-EP	TPR-3SL 055L-EP	TPR-3SL 070L-EP	TPR-3SL 090L-EP	TPR-3SL 130L-EP	TPR-3SL 160L-EP
	High	TPR-3SL 040H-EP	TPR-3SL 055H-EP	TPR-3SL 070H-EP	TPR-3SL 090H-EP	TPR-3SL 130H-EP	TPR-3SL 160H-EP
Power supply voltage	Low	100 - 240 V a.c.					
	High	100 - 440 V a.c.					
Circuit input power		100 - 240 V a.c. 18 W					
Power frequency		50/60 Hz (Dual usage)					
Rated current		40 A	55 A	70 A	90 A	130 A	160 A
Applying load		Resistive load					
Current input		4 - 20 mA d.c. (Impedance : 100 Ω)					
Control method		Phase control, Fixed Cycle control, Variable Cycle control, ON/OFF control					
Movement type		SOFT START, SOFT UP/DOWN					
Output voltage		More than 98 % of the power supply voltage (In case of maximum current input)					
Cooling method		Forced cooling					
Display method		Display by LED					
Insulation resistance		Min 100 MΩ (Base on 500 V d.c. mega)					
Output control range		0 ~ 100 %					
Dielectric strength		3000 V a.c. 50/60 Hz for 1 min					
Line noise		Noise by noise simulator (2,500 V)					
Ambient temperature		0 ~ 40 ℃ (Without Condensation)					
Ambient Humidity		30 ~ 85 % RH					
Storage temperature		-25 ~ 70 ℃					
Weight		4,324 g		9,194 g		9,288 g	

Connection diagram

[Unit : mm]
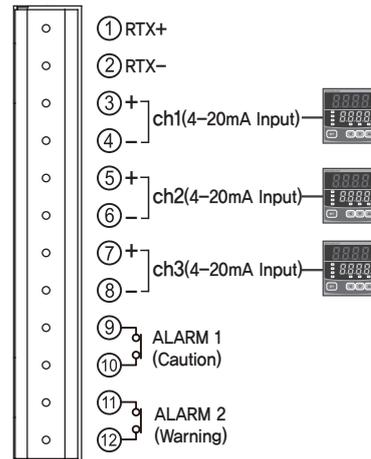
■ Connection diagram of load terminal
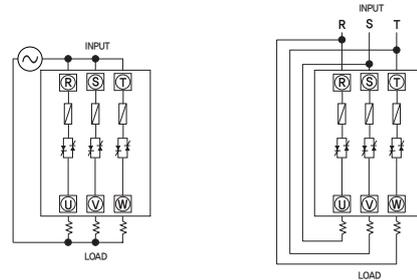
· Inside of TPR, the fuse is installed in the R,S,T input power supply portion depending on the specification of options
· When connecting terminals, please use crimp connectors and securely fasten them due to the high current flow.
 (Max space for solder less terminal connection is 40/55/70 A : 16 mm, 90/130 A : 26 mm)
· Only one channel can be used per temperature controller. (Serial connection disabled)
· Since the internal GND is not separated, use a module or temperature controller that has separate analog inputs for each channel.

■ Connection diagram of signal and alarm terminal

① RTX+
② RTX-
③ + ④ - ch1(4-20mA Input)
⑤ + ⑥ - ch2(4-20mA Input)
⑦ + ⑧ - ch3(4-20mA Input)
⑨ ⑩ ALARM 1 (Caution)
⑪ ⑫ ALARM 2 (Warning)

※ Only one channel can be used per temperature controller. (Serial connection disabled)

• NO. 1, 2 : RS485 Communication connection port
• NO. 3, 4 : Channel 1 4 - 20 mA d.c. input
• NO. 5, 6 : Channel 2 4 - 20 mA d.c. input
• NO. 7, 8 : Channel 3 4 - 20 mA d.c. input
• NO. 9, 10 : Alarm1 caution
 "caution" The alarm is not a serious problem, but it is an alarm that needs to be checked by the user due to abnormal symptoms. At this time, the TPR output will go out to normal and only the alarm will be output.
· Caution error : partial load disconnection, heat sink overheat (60 ℃), overcurrent, power failure, fuse disconnection, FAN error
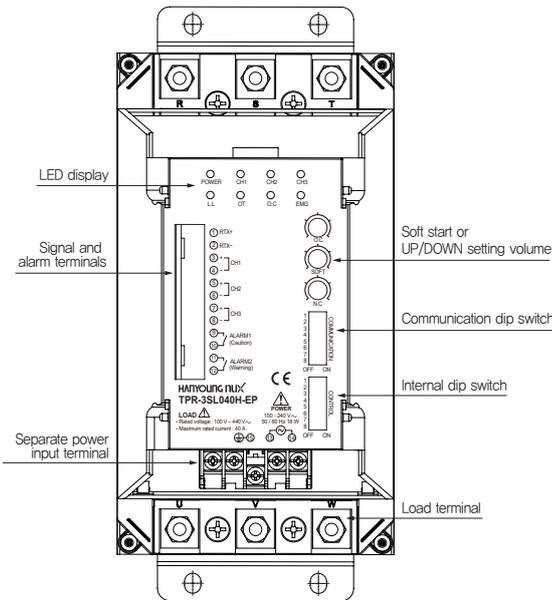• NO. 11, 12 : Alarm2 warning
 If a "Warning" alarm can cause damage to the product and the load, a warning will be issued in the following emergency situations. At this time, the TPR will stop the output itself.
· Warning error : Heat sink overheat (80 ℃), SCR conduction (Short)
※ When the input power (100 - 240 V a.c.) is applied, the alarm relay opens and it is shorted when an alarm occurs. ("B" contact Normal close) In case of using "A" contact
※ If an alarm condition occurs, an alarm is output after 3 seconds, and if the alarm condition is released within 3 seconds, an alarm No output.

■ Connection diagram of input signal and power terminal

⑬ ⑭ INPUT 100 - 240 V a.c.

⑮ ⑯ INPUT 24 V d.c.   ⑬ ⑭ INPUT 100 - 240 V a.c.
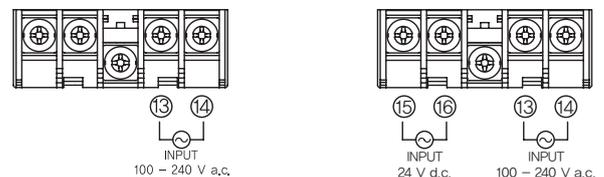
· Extra input power supply (For circuit power and FAX operation power) : 100 - 240 V a.c. (13, 14) Have to connect power to operate unit (Even if do not need to use FAN).

· Extra input power supply (For circuit power) : 13, 14
· FAN-driven power source : 15, 16

Part name and function

- LED display
- Signal and alarm terminals
- Separate power input terminal
- Soft start or UP/DOWN setting volume
- Communication dip switch
- Internal dip switch
- Load terminal

HANYOUNG NUX
TPR-3SL040H-EP

Appearance

■ 40A / 55A / 70A   ■ 90A   ■ 130A / 160A

■ Indicating LED and functions

LED indicator name	Description
POWER	POWER indicator is ON when the power is being supplied to the control unit
CH1	Lights up when an alarm related to channel 1 occurs.
CH2	Lights up when an alarm related to channel 2 occurs.
CH3	Lights up when an alarm related to channel 3 occurs.
L,L	• When the heater is configured in parallel with the partial heater disconnection function, at least one of them is disconnectedThis function is to maintain the process while detecting the heater disconnection. • Detectable when using less than 3 parallel heaters. (In case of 4 or more parallel configurations) • The total load capacity is not detected within the range of less than 6A and 0 to 20%. • Part heater disconnection detection operation method (scan function) – Corresponds to phase control, variable cycle control – After circuit and load power supply is turned on, the LL LED flashes 0 to 100% The heater value is detected while sequentially outputting the output. – If the initial scan function is used only once after connecting the heater, the value stored in the internal CPU Therefore, no further operation is required in the future. – If you do not use the scan function and leave the initial mode 2 ON, Partial heater disconnection function is activated. It is not precise in the way that it is detected by calculation formula automatically.
OT	• The LED flashes when the heat sink temperature rises above 60 °C during control. Operation is normal, and if the heatsink temperature drops below about 50 °C Will be released. • If the heat sink temperature rises above 80 °C during control, the LED will light up and TPR output will stop.
O.C	• When an overcurrent occurs, it will light up if a current above a set value is generated to protect the product and load. Operation stop (can be set by communication) • FAN failure: Flashing when FAN fails
EMG	EMG LED lighting situation is as follows. 1. Power failure: The load power is turned on when the circuit power (100 – 240 V a.c.) is applied Lights when the heater is disconnected. 2. SCR short: When SCR is shorted, the power is on without control input and TPR output Since the heater continues to overheat, the current continues to flow without the control input. The EMG LED flashes when it flows. (10 A or more)

■ Internal dip switch operation

Number	OFF	ON	Initial setup mode
No. 1	–	RESET (Functioning stops)	
No. 2	load volume scan	Partial load disconnection function	
No. 3	Not Using	Restart mode	
No. 4		cycle control fixed cycle method	
No. 5	–	cycle control variable cycle method	
No. 4, 5		Phase control	
No. 6	Not Using		
No. 7	3 channel function fixed	use all 1, 2, 3 channels	
No. 8	–	4 – 20 mA d.c.	
No. 7, 8	Check 8 LED lights	–	

OFF   ON
1
2
3
4
5
6
7
8

1. Input mode : 4 – 20 mA d.c.
2. Control Mode: Phase control

※ The reset operates after turning off the switch 1 and turning it on again through the CPU reset
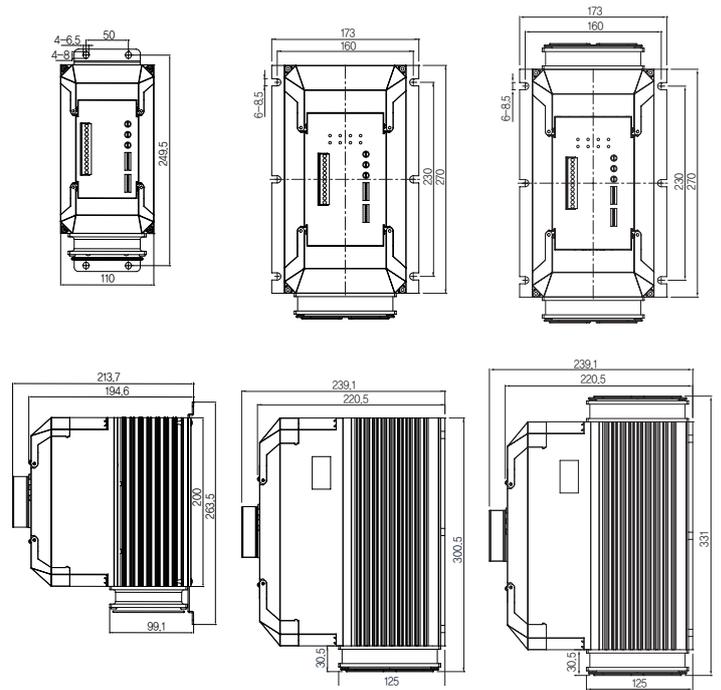
Communication specifications (communication setting dip switch)

1. Communication method: RS485 2–wire half–duplex
2. Communication speed : 2400, 4800, 9600, 19200 bps
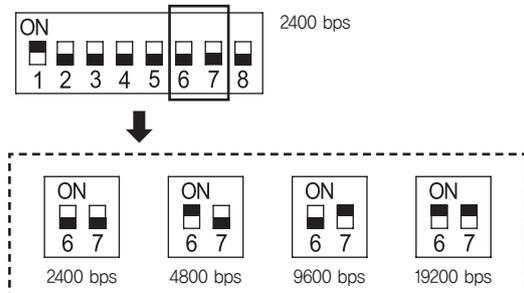3. Maximum number of connections : 31 pcs
4. Protocol : ModBus RTU, ModBus ASCⅡ

■ Address(ID) settings

• You can set the ID through the DIP S/W from 1 to 5.
• Set from 1 to 31.
• Please reset when you change the communication settings

예)

ID:1   ID:2   ID:3   ID:4   ID:5   ID:6
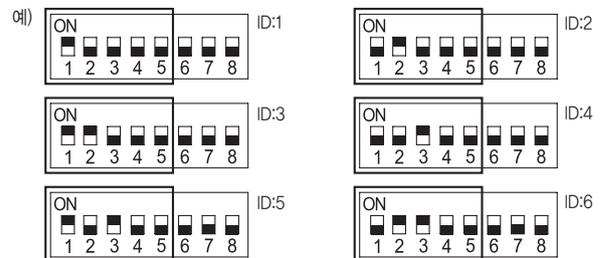
■ Communication speed setting

• Set the baud rate to 6 or 7 in DIP S / W

ON
1 2 3 4 5 6 7 8   2400 bps

2400 bps   4800 bps   9600 bps   19200 bps

■ Select communication protocol

• Set the communication protocol to No. 8 of DIP S / W.

ON
1 2 3 4 5 6 7 8

RTU   →   RTU   ASCⅡ
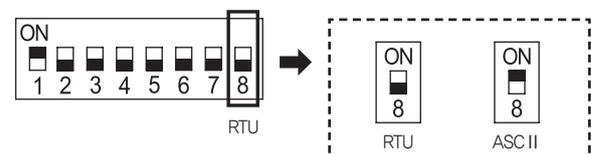
■ Communication setting (ModBus RTU/ASCⅡ)

communication setting			
Communication speed	2400, 4800, 9600, 19200		bps
Communication protocol	ModBus RTU	ASC Ⅱ	
Parity bit	Even	None	bit
Data bit	8	7	bit
Stop bit	1		bit
ID	1 ~ 31		

Structure (RTU)					
Division	Address(ID)	Function	Start Address	No. of Data	CRC
Request	1	1	2	2	2
Division	Address(ID)	Function	No. of Data	Data	CRC
Response	1	1	1	2	2

Example (RTU)							
Division	Address(ID)	Function	Start Address		No. of Data		CRC
Request	0x01	0x03	0x00	0x01	0x00	0x01	0xD5 0xCA
Division	Address(ID)	Function	No. of Data	Data		CRC	
Response	0x01	0x03	0x02	0x00	0x00	0xB8 0x44	

Structure (ASC Ⅱ)					
Division	Address(ID)	Function	Start Address	No. of Data	LRC
Request	2	2	4	4	2
Division	Address(ID)	Function	No. of Data	Data	LRC
Response	2	2	2	4	2

Example (ASC Ⅱ)								
Division	Address(ID)	Function	Start Address		No. of Data		LRC	END
Request	0x01 0x31	0x03 0x33	0x30 0x30 0x30 0x31		0x30 0x30 0x30 0x31		0x46 0x41	0x0D 0x0A
Division	Address(ID)	Function	No. of Data	Data		LRC	END	
Response	0x30 0x31	0x30 0x33	0x30 0x32	0x30 0x30 0x30 0x30		0x46 0x41	0x0D 0x0A	

Protocol	MODBUS RTU	MODBUS ASCII
Speed	2400, 4800, 9600, 19200 bps	
Parity	Even	Even
Data bit	8	7
Stop bit	1	1
ID	1 ~ 31	

BOLD : RAM DATA	
READ	monitoring
READ/WRITE	Configurable

Communication MAP				
	PROCESS	INFO	CAL	–
Address	0	100	200	–
0		System	Scan Start	
1	AlarmStatus		Scan Out Mode	
2	CH1 Status		CH1 Complete	
3	CH2 Status			
4	CH3 Status		CH1 LL Rate	
5		Rev	CH2 Complete	
6	Soft Time	Out Mode		
7			CH2 LL Rate	
8	CH1 Output	LL Use Mode	CH3 Complete	
9	CH1 Current			
10	CH2 Output		CH3 LL Rate	
11	CH2 Current	Protocol		
12	CH3 Output	BPS		
13	CH3 Current	Parity		
14	CH1 Input	Stop Bit		
15	CH2 Input	Data Length		
16	CH2 Input	Address		
17		R.Time		
18		CH1 Enable		
19		CH2 Enable		
20		CH3 Enable		
21		CH1 Power Limit		
22		CH2 Power Limit		
23		CH3 Power Limit		
24		CH1 OC Limit		
25		CH2 OC Limit		
26		CH3 OC Limit		

Explanation by address

Process (0 ~ 99)				
Address	Parameter	Explanation	Setting range	Unit
1	AlarmStatus	Alarm status information	Refer to Bit Information	
2	CH1 Status	CH1 Status information	Refer to Bit Information	
3	CH2 Status	CH2 Status information	Refer to Bit Information	
4	CH3 Status	CH3 Status information	Refer to Bit Information	
5	–	–	–	–
6	Soft Time	Soft start Setting time	0 ~ 60	sec
7	–	–	–	–
8	CH1 Output	SCR CH1 Yield	0 ~ 100	%
9	CH1 Current	SCR CH1 Load current value	0 ~ CT (max)	(x10) A
10	CH1 Output	SCR CH2 Yield	0 ~ 100	%
11	CH1 Current	SCR CH2 Load current value	0 ~ CT (max)	(x10) A
12	CH1 Output	SCR CH2 Yield	0 ~ 100	%
13	CH1 Current	SCR CH2 Load current value	0 ~ CT (max)	(x10) A
14	CH1 Input	CH1 4 – 20 mA Control signal input	0 ~ 100	%
15	CH2 Input	CH2 4 – 20 mA Control signal inpu	0 ~ 100	%
16	CH3 Input	CH3 4 – 20 mA Control signal inpu	0 ~ 100	%

Infomation (100 ~ 199)				
Address	Parameter	Explanation	Setting range	Unit
100	System	SCR Product Setup Status	0x0030 : TPR3SLEP	
101	–	–		
102	–	–		
103	–	–		
104				
105	Rev	SCR Revision		
106	Out Mode	Control method setting status	0: phase control, 1: fixed cycle cycle control, 2: Variable cycle cycle control	
108	LL Use Mode	Whether the partial heater break function is used	0: Disable partial heater disconnection function 1: Using partial heater disconnection function	
111	Protocol	Protocol setting status	2 : ASCII, 3 : RTU	
112	BPS	Communication speed setting status	0 : 2400, 1 : 4800, 2 : 9600, 3 : 19200	
113	Parity	Parity bit setting status	0 : None, 1 : Odd, 2 : Even	
114	STOP BIT	Stop bit setting state	1, 2	
115	DATA LENGTH	Data length	7, 8	
116	ADDRESS	ID (SCR communication number)	1 ~ 31	
117	R.TIME	Response time	0 ~ 10	
118	CH1 Enable	Decide whether to use CH1	0 : Do not use this channel 1 : Use this channel	
119	CH2 Enable	Decide whether to use CH2		
120	CH3 Enable	Decide whether to use CH3		
121	CH1 Power Limit	CH1 output limit setting	0 ~ 100	%
122	CH2 Power Limit	CH2 output limit setting	0 ~ 100	%
123	CH3 Power Limit	CH3 output limit setting	0 ~ 100	%
124	CH1 OC Limit	Set CH1 overcurrent value	0 ~ CT (max)	(x10) A
125	CH2 OC Limit	Set CH2 overcurrent value	0 ~ CT (max)	(x10) A
126	CH3 OC Limit	Set CH3 overcurrent value	0 ~ CT (max)	(x10) A

Calibration (200 ~ 299)				
Address	Parameter	Explanation	Setting range	Unit
200	Scan Start	Partial load disconnection scan	0 : Operating, 1:LL Scan	
201	Scan Out Mode	Control mode for partial load disconnection scan	0: phase control, 1: fixed cycle cycle control, 2: Variable cycle cycle control	
202	CH1 Complete	CH1 heater value saved	0 : No scan data, 1 : Complete	
204	CH1 LL Rate	CH1 Parallel heater breaks	1 ~ 6	EA
205	CH2 Complete	CH2 heater value saved	0 : No scan data, 1 : Complete	
207	CH2 LL Rate	CH2 Parallel heater breaks	1 ~ 6	EA
208	CH3 Complete	CH3 heater value saved	0 : No scan data, 1 : Complete	
210	CH3 LL Rate	CH3 Parallel heater breaks	1 ~ 6	EA

* 200: If it is 1, the status is being scanned. 0 is displayed after scanning is completed
    (3 channels are scanned at the same time)
* 201: Control method setting status being scanned
* 202: If it is 1, the scan is completed and the heater value is stored in the internal storage
    device (If it is 0, it is not saved, not scanned)
* 204: Set to 3 for 3 heaters
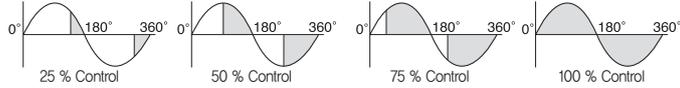   (Low load malfunction concern Output 20% or less Detection prohibited

BIT Information				
Parameter	AlarmStatus	CH1 Status	CH2 Status	CH3 Status
Address	1	2	3	4
Bit 0	–	Power Fail	Power Fail	Power Fail
Bit 1	FAN Fail	LL Fail	LL Fail	LL Fail
Bit 2	OC Fail	OC Fail	OC Fail	OC Fail
Bit 3	LL Fail	SCR Short	SCR Short	SCR Short
Bit 4	Over Temp 60	–	–	–
Bit 5	Over Temp 80	–	–	–
Bit 6	SCR Short	–	–	–
Bit 7	Power Fail	–	–	–
Bit 8 ~ 15	–	–	–	–

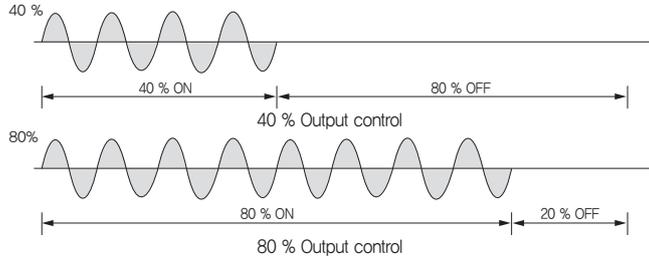| Explanation about SCR Alarm		
Alarm (LED)	Alarm Description	Checking list
Power Fail (EMG lighting)	When load power is not applied	1. Confirmation of load power voltage for each channel (Example: Check 1CH load voltage when 1CH POWER Fail) 2. Check that the load power breaker is ON (Reset, turn on / off) 3. SCR load power input terminal R, S, T wiring check
	Fuse disconnected	1. Open the upper case of SCR and check the fuse disconnection (Shot is normal when measuring the fuse tester after the load power is turned off)
	When the heater is disconnected	1. Check the resistance value of the load connected to the SCR (disconnection and disconnection) 2. Check the SCR heater connection terminals U, V, W wiring
SCR Short (EMG flashing)	Internal SCR element shorted	1. Symptom: When 4 mA and control input are not applied, load current When more than 5 A flows. 2. Confirm: Check several channel SCR Short 3. Generation channel 4 ~ 20 mA Input part voltage is less than 0.4 V, Ensure current is measured in clampmeter (SCR failure if confirmed, replacement required)
OC Fail (OC lighting)	In case of overcurrent	1. When the current exceeding the OC Limit setting value flows to the load 2. Clamp meter connected to overcurrent identified channels U, V, W Check the current on the wiring
Fan Fail (OC flashing)	FAN failure	1. Make sure that the cooling fan on the bottom of the SCR is rotating 2. Make sure that there is foreign substance in the cooling fan
LL Fail (LL lighting)	One or more disconnection in parallel heater configuration	1. Check if the heater value is saved using the Scan function (communication) 2. If you do not know whether or not you have scanned the control signal (4 ~ 20 mA) When there is no scan, DIP SW 2 turns OFF and scan progress, LL LED When it changes to flashing, it changes to switch ON position again. 3. Check the resistance value of the heater. Comparison of the resistance value of the part (When the resistance value becomes high,
Over Temp 60 (OT flashing)	Heat sink temperature Over 60 degrees	1. Check if cooling fan is rotating well 2. Identify the cooling unit inside the panel 3. If an alarm occurs immediately upon power-on, the SCR internal fault
Over Temp 80 (OT lighting)	When the heat sink temperature is 80 degrees or higher	

Function description

■ Phase control

Phase control is to control the AC power supply applied to the load proportionally according to the control input signal as changing phase angle (0 ~ 180 degree) in a each half cycle, 8.33 ms.
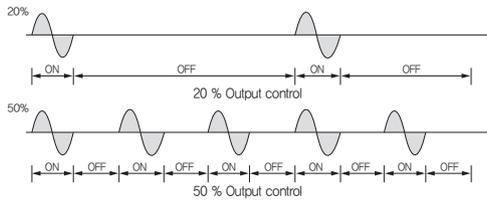

25 % Control   50 % Control   75 % Control   100 % Control

■ Fixed cycle control

40 % ON   80 % OFF

40 % Output control

80 % ON   20 % OFF

80 % Output control

As setting the constant cycle of the output, fixed cycle control is to control the AC power supply repeatedly with a constant rate of ON/OFF according to the control input.
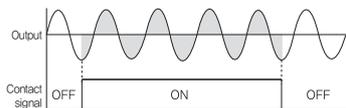
■ Variable cycle control

ON   OFF   ON   OFF

20 % Output control

ON   OFF   ON   OFF   ON   OFF   ON   OFF   ON   OFF

50 % Output control

Without setting a constant cycle, variable cycle control is to control AC power supply with using the number of cycle.

■ ON/OFF control

If ON/OFF contact is ON, then the output is 100 %. ON/OFF always operates near zero point.

Output

Contact signal   OFF   ON   OFF

• Even though the control input signal is ON, the output is 100 % when ON/OFF control is used.

■ Restart function

When a warning or caution alarm occurs, TPR gives alarm 1 or 2 or stop the output. This function is used to return to normal operation mode when factors caused errors are eliminated.

■ O.C (overcurrent setting function)

When overcurrent occurs, protection function for TPR and load (Only for phase control)

■ POWER (output limit function)

This function is to limit the output regardless of the control input amount. Can be set by communication – Even though the control input is 100 %
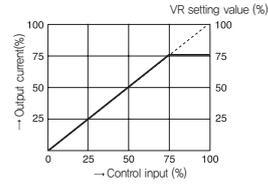

■ V.R Explanation

• SOFT
  This volume is to set time for Soft start or Soft up/down.
  (only applicable to phase control, ON/OFF control)
– Soft start : Protection functions against big load of start current (inrush current).
   It increases output softly. When control input is applied and power is on, Soft start operates when rung signal is applied. In case of maximum VR, it set 50 second.
    (Example : 20 mA : 50 sec, 12 mA : 25 sec)
– Soft up / down : When run signal and power are applied and if control input is applied, it will operate. It case of maximum VR, it set 10 second.
– If VR turn up to the right, the function does not work. And if VR turn right, time will be reduced.

Installation
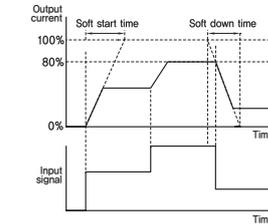
Airflow
Perpendicular installation
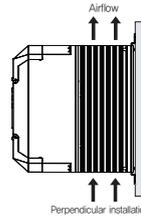
1. Please install it perpendicularly. If the product is installed vertically in unavoidable circumstances, please use 50 % of rated current.
2. When multiple products are closely installed, please install them with keeping a distance of more than a width of 5 cm and a length of 10 cm as shown in the picture.
3. In order to not block the air flow, please install the wiring duct less than the half of the heat sink height.
4. Please consider whether the air flow is good enough when installing the product. If the ambient temperature is as low as possible in the inside then the life span of the product is increasing as the durability and reliability of the product are improving. The operating ambient temperature is 0 ℃ ~ 40 ℃. Please refer to the following graph. However, if the ambient temperature is higher than 40 ℃, the maximum load current is decreasing like the below.
5. When wiring, please use crimp connectors to high current flows terminal. If the contact surface of the connectors and terminals are poor, it may lead to a fire since the wires and terminal gets overheated
6. Before applying power, this model need more than the third class grounding to prevent electric shock. This model does not have separate grounding terminal so we suggest using grounding terminal and bracket together when install this model to a panel.