Slim Type Single-Phase 3-Channel Thyristor Power Regulator

TPR-3CH-EC

HANYOUNG NUX

INSTRUCTION MANUAL

HANYOUNGNUX CO.,LTD
28, Gilpa-ro 71beon-gil,
Michuhol-gu, Incheon, Korea
TEL : +82-32-876-4697
http://www.hynux.com

Thank you for purchasing Hanyoung Nux products. Please read the instruction manual carefully before using this product, and use the product correctly. Also, please keep this instruction manual where you can view it any time.

MB0701KE180702

Safety information

Please read the safety information carefully before the use, and use the product correctly.
The alerts declared in the manual are classified into **Danger**, **Warning** and **Caution** according to their importance

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

⚠ DANGER
- To prevent electric shock while it is running, put to earth with the fixed screw of the unit and do not touch the heat sink since it is very hot.
- The input/output terminals are subject to electric shock risk. Never let the input/output terminals come in contact with your body or conductive substances.

⚠ WARNING
- If there is a possibility that a malfunction or abnormality of this product may lead to a serious accident, install an appropriate protection circuit on the outside.
- Any use of the product other than those specified by the manufacturer may result in personal injury or property damage.
- When used in equipment with a high risk of personal injury or property damage (examples: medical devices, nuclear control, ships, aircrafts, vehicles, railways, combustion devices, safety devices, crime/disaster prevention equipment etc.) install double or triple safety devices and prevent accidents. Failure to do so may result in fire, personnel accident or property damage.
- Please supply the rated power voltage, in order to prevent product breakdowns or malfunctions.
- To prevent electric shocks and malfunctions, do not supply the power until the wiring is completed.
- Never disassemble, modify, process, improve or repair this product, as it may cause abnormal operations, electric shocks or fires.
- Please disassemble the product after turning OFF the power. Failure to do so may result in electric shocks, product abnormal operations or malfunctions.
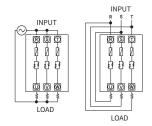
⚠ CAUTION
- Since the product installing place influences the product performance and expected life span, please avoid using in the following places:
  - a place where humidity is high and air flow is inappropriate.
  - a place where dust or impurity accumulates, ambient temperature is high and vibration level is high.
  - a place where corrosive gases (such as harmful gases, ammonia, etc.) and flammable gases 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, electrostatic or magnetic noise occur.
  - a place where heat accumulation occurs due to direct sunlight or radiant heat.
- Please do not wipe the product with organic solvents such as alcohol, benzene, etc. (use neutral detergents).
- When water enters, short circuit or fire may occur, so please inspect the product carefully.
- Please connect the product and other units after turning off all the power of the product, instruments and units.
- Please make sure that the thyristor power regulator (TPR) is installed vertically.
- 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.
- When installing the product, install it in an enclosed space with a cover, and then close the cover.
- The external circuit connected with the product should be connected by an insulated circuit more than basic insulation.
- The temperature of the body and the heat sink may be extremely high when electric current is applied, which may cause burns.

Suffix code

Model	Code			Information
TPR-3CH	□	□	-□	Slim type single-phase 3-channel power regulator
Rated current	040			40 A
	055			55 A
	070			70 A
	090			90 A
	130			130 A
	160			160 A
Power voltage		L		100 - 240 VAC
		H		100 - 440 VAC
Option			EC	EtherCAT Communication control

※ Circuit and fan need 24 VDC voltage power separately.

Specifications

Model	Low	TPR-3CH040L-EC	TPR-3CH055L-EC	TPR-3CH070L-EC	TPR-3CH090L-EC	TPR-3CH130L-EC	TPR-3CH160L-EC
	High	TPR-3CH040H-EC	TPR-3CH055H-EC	TPR-3CH070H-EC	TPR-3CH090H-EC	TPR-3CH130H-EC	TPR-3CH160H-EC
Power voltage	Low	100 - 240 VAC					
	High	100 - 440 VAC					
Circuit power	Input voltage	24 VDC					
	Current consumption	208 mA			458 mA		
	Power consumption	5 W			11 W		
Power frequency		50/60 Hz (common)					
Rated current		40 A	55 A	70 A	90 A	130 A	160 A
Applying load		Resistive load					
Control method		Phase control, Fixed Cycle control, Variable Cycle control					
Movement type		SOFT START / DOWN					
Output voltage		More than 98 % of the power supply voltage (in case of maximum current input)					
Cooling method		Forced cooling					
Display method		Output display by LED					
Insulation resistance		Min 100 MΩ (Based on 500 VDC mega)					
Output control range		0 ~ 100 %					
Dielectric strength		3,000 VAC 50/60 Hz for 1 min					
Line noise		Noise by noise simulator (2,500 V)					
Ambient temperature		0 ~ 40 ℃ (no condensation)					
Ambient Humidity		30 ~ 85 % RH					
Storage temperature		-25 ℃ ~ 70 ℃					
Approval		CE					
Weight		4,324 g			9,194 g		9,288 g

Connection diagrams

Connection diagram of load
Connection diagram of load

INPUT
INPUT R S T
LOAD
LOAD

- Inside of TPR, the fuse is installed in the R,S,T input power supply portion.
- When connecting terminals, please use solderless terminals and securely fasten them due to the high current flow (the space for solderless terminal connection is 40/55/70 A: 16 mm, 90/130/160 A : 26 mm)

Connection diagram of input signal and power terminal

24 VDC

Connection diagram of signal and alarm terminal

① ② ALARM1 (Caution)
③ ④ ALARM2 (Warning)

- No. 5, 6 : Alarm 1 (Caution)
  The "Caution" alarm means that there is not a serious problem, but an abnormal situation has occurred, so the user needs to check it. At this moment, the output of TPR is normally operating and only the output of alarm is activated.
  - Errors for "Caution" alarm: partial load break, heat sink overheating (60 ℃), over current, fuse disconnection, abnormal fan and power.
- No. 7, 8 : Alarm 2 (Warning)
  The "Warning" alarm means that there may be a cause of damage to the product and load. In the following emergency situations, "Warning" output is activated. At this moment, TPR stops the output by itself.
  - Errors for "Warning" alarm: heat sink overheating (80 ℃), SCR short-circuit
  ※ When the input power (24 VDC) is applied, the alarm relay will be shorted and open when an alarm occurs.
- No. 7, 8 : Alarm 2 (Warning)
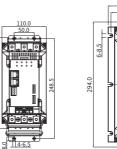 The "Warning" alarm means that there may be a cause of damage to the product and load. In the following emergency situations, "Warning" output is activated. At this moment, TPR stops the output by itself.
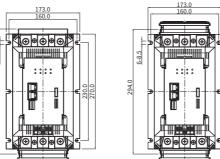 - Errors for "Warning" alarm: heat sink overheating (80 ℃), SCR circuit
  ※ When the input power (24 VDC) is applied, the alarm relay will be shorted and open when an alarm occurs.
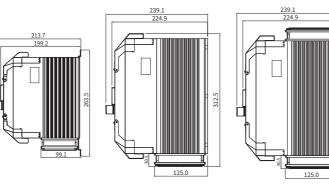 ※ If an alarm condition occurs, the alarm will be output after 3 seconds. If the alarm condition is corrected within 3 seconds, the alarm will not be output.

Dimensions and panel cutout

[Unit : ㎜]
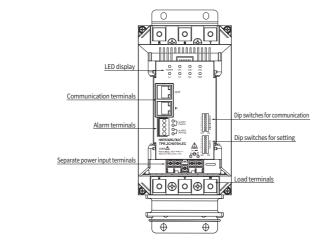
■ 40A / 55A / 70A

■ 90A

■ 130A / 160A

Part names and functions

- LED display
- Communication terminals
- Alarm terminals
- Separate power input terminals
- Dip switches for communication
- Dip switches for setting
- Load terminals

■ LED display and description

LED display	Description
POWER	The light is on when the circuit power supply is applied
CH1	The light is on in case of warning related to Channel 1.
CH2	The light is on in case of warning related to Channel 2.
CH3	The light is on in case of warning related to Channel 3.

L.L	- The partial heater break detection is a function to constantly keep the process while detecting heater disconnections, when more than one of them is disconnected, when the heater is configured in parallel.
	- Can be detected when using less than 6 parallel heaters.
	- It is not detected if that total load capacity is less than 5A and between 0~20% .
	- Partial heater break detecting instruction (Scan function)
	  - This function is required for phase control and variable cycle control
	  - This function is not available when Switch No.3 is on
	  - Turn off switch No. 2 after that power to circuit and load is on. Then, while LL LED flashes, it detects heater value and sequentially outputs 0 ~ 100% at the same time.
	  - If you use the initial one time scan function after connecting the heater, the value is stored in the internal CPU, so no separate operation is required in the future.
	  - If it is set to ON in the initial mode 2 without using the scan function, the automatic partial heater break function is activated. It is not precise, because it is a detection method by an automatic formula.

OT	- When the temperature of heat sink rises more than 60℃ during control, LED flashes. At that time the control is normally operated, and the alarm will be disabled when the heat sink temperature goes down below 50℃. - If the temperature of heat sink rises more than 80℃ during control, LED lights on, and TPR output stops.
O.C	- In case of overcurrent, the indicator lights on if a current above set value is generated, in order to protect the product and the load, and operation stops (settable by communication). - Fan break : The indicator flashes when the fan is broken.
EMG	The EMG LED indicator is ON in the following situations: 1. Abnormal status with power: when circuit power (24 VDC) is being supplied, EMG LED is ON if the load power is not being supplied or the heater is disconnected. 2. SCR short: If the SCR is shorted, the power supply will continue to be conductive even when there are no control input and TPR output, and the heater will continue overheating. Therefore, if the current continues to flow without the control input, the EMG LED will flash (detectable when the load current is 10A or more)

■ Internal dip switch operation

No.	OFF	ON	Default Mode
No.1	-	RESET (function stop)	
No.2	Load capacity scan	Use partial load break function	
No.3	Use restart mode	Disable restart mode	OFF ON
No.4	-	Fixed cycle control	1 2 3 4 5 6 7 8
No.5	-	Variable cycle control	
No.4, 5	-	Phase control	
No.6	Not used (normal operation during ON)		
No.7	3 channel function stop	-	
No.8	LED 8 light check	-	
No.7, 8	-	All 1, 2, 3 channel use	

* Switch No. 1 RESET operates if switch No. 1 is turned on and then turned on with internal MCU RESET.

Alarm description

Alarm	Description	Alarm mode
FAN	Fan break	Alarm 1 (Caution)
OC	Overcurrent	
LL	Disconnection of parallel connected heaters	
Alarm Bimetal	Heat sink above 60℃	
Emergency Bimetal	Heat sink above 80℃	Alarm 2 (Warning)
Heat Short	Internal SCR short	
EMG	Failure of supplying power for load	Alarm 1 (Caution)

Sync Manager

1) RxPDO Mapping

	SM2, PDO assignment 0x1c12		
Index	Size(Byte.bit)	Name	PDO content
0x1601	6	TPR OUTPUT	Index 0x7010:01 – Ch1 Output Index 0x7010:02 – Ch2 Output Index 0x7010:03 – Ch3 Output

2) TxPDO MAPPING

	SM3, PDO assignment 0x1c13		
Index	Size(Byte.bit)	Name	PDO content
0x1A00	2	Alram Status	Index 0x6000:02 – Fan Fail Index 0x6000:03 – OC Fail Index 0x6000:04 – LL Fail Index 0x6000:05 – Alram Bimetal Index 0x6000:06 – Emergency Bimetal Index 0x6000:07 – Heat Short Index 0x6000:08 – Power Fail Index 0x6000:0A – Com Error Index 0x6000:0B – Out Mode
0x1A01	6	Ch1 Status	Index 0x6010:01 – Power Fail Index 0x6010:02 – LL Fail Index 0x6010:03 – OC Fail Index 0x6010:04 – Heat Short Fail Index 0x6010:0A – MV OUT Index 0x6010:0B – HBC Index 0x6010:0C – Complete Index 0x6010:0C – SET IN
0x1A02	6	Ch2 Status	Index 0x6020:01 – Power Fail Index 0x6020:02 – LL Fail Index 0x6020:03 – OC Fail Index 0x6020:04 – Heat Short Fail Index 0x6020:0A – MV OUT Index 0x6020:0B – HBC Index 0x6020:0C – Complete Index 0x6020:0C – SET IN
0x1A03	6	Ch3 Status	Index 0x6030:01 – Power Fail Index 0x6030:02 – LL Fail Index 0x6030:03 – OC Fail Index 0x6030:04 – Heat Short Fail Index 0x6030:0A – MV OUT Index 0x6030:0B – HBC Index 0x6030:0C – Complete Index 0x6030:0C – SET IN

Input Data

1) Index 6000 Alram Status

Index(hex)	Name	Description	Data Type	Flags	Default
6000:02	Fan Fail	Cooling fan break	BOOLEAN	RO	0x00
6000:03	OC Fail	Overcurrent	BOOLEAN	RO	0x00
6000:04	LL Fail	Disconnection of more than 1 parallel connected heater	BOOLEAN	RO	0x00
6000:05	Alram Bimetal	Heat sink above 60℃	BOOLEAN	RO	0x00
6000:06	Emergency Bimetal	Heat sink above 80℃	BOOLEAN	RO	0x00
6000:07	Heat Short	Short of internal SCR elements	BOOLEAN	RO	0x00
6000:08	Power Fail	Load power failure	BOOLEAN	RO	0x00
6000:0A	ComE	Internal communication error (warning)	BOOLEAN	RO	0x00
6000:0B	Out Mode	0 : phase control 2 : variable cycle control	UINT16	RO	0x00

2) Index 60n0 Channel n Status(ch1~ch3)

Index(hex)	Name	Description	Data Type	Flags	Default
60n0:01	Power Fail	Load power failure	BOOLEAN	RO	0x00
60n0:02	LL Fail	Disconnection of more than 1 parallel connected heaters	BOOLEAN	RO	0x00
60n0:03	OC Fail	Over-current	BOOLEAN	RO	0x00
60n0:04	Heat Short Fail	Short of internal SCR elements	BOOLEAN	RO	0x00
60n0:0A	MV Out(0~100%)	TPR output	BOOLEAN	RO	0x00
60n0:0B	HBC(A, no decimal point X10)	TPR output current (heater)	BOOLEAN	RO	0x00
60n0:0C	SET IN	Control input set value	BOOLEAN	RO	0x00

Output Data

Index(hex)	Name	Description	Data Type	Flags	Default
7010:01	CH1 OUTPUT	TPR CH1 OUTPUT(0~100%)	UINT16	RW	0x00
7010:02	CH2 OUTPUT	TPR CH2 OUTPUT(0~100%)	UINT16	RW	0x00
7010:03	CH3 OUTPUT	TPR CH3 OUTPUT(0~100%)	UINT16	RW	0x00

Standard objects(0x1000~0x1FFF)

1) Index 8000 TPR INFO

Index(hex)	Name	Description	Data Type	Flags	Default
0x8000:01	TPR H/W VERSION	TPR H/W VERSION (current version)	UINT16	RO	0x0000
0x8000:02	TPR S/W VERSION	TPR S/W VERSION (current version)	UINT16	RO	0x0000
0x8000:03	SOFT VR	SOFT VR (0~60sec) (soft start time setting)	UINT16	RW	0x0000

2) Index 80n0 TPR Setting Channel for Ch.1~3 (1 ≤n ≤ 3)

Index(hex)	Name	Description	Data Type	Flags	Default
0x80n0:01	Enable/Disable	Enable : channel use Disable : no channel use (decide the use or non-use for each channel)	BOOLEAN	RW	TRUE
0x80n0:02	PWR LIMIT	POWER LIMIT(0~100%) * setting output limit function (example: if set to 50%, it is limited to 50% even if control input is 50% or more)	UINT8	RW	100
0x80n0:04	OC LIMIT	OC LIMIT (A, no decimal point X10) * overcurrent value setting (initial value : 120% of the product rating)	UINT16	RW	787
0x80n0:05	START RATE	START RATE (10~100%) * partial load break detection inhibited area setting (example: when 25 is set, disconnection detection is prohibited in the range of output 25% or less)	UINT16	RW	25
0x80n0:06	LIMIT RATE	LIMIT RATE (1~6) * set number of parallel connected heaters for each channel when partial load is disconnected	UINT16	RW	4

3) Index 8040 TPR START

Index(hex)	Name	Description	Data Type	Flags	Default
0x8040:01	START	Partial load break scan 0: operating, 1: LL Scan * At START, output is automatically generated by 10% and heater value (current value) is saved.	BOOLEAN	RW	0

4) Index 8050 OUT TYPE

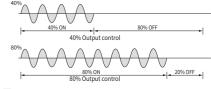| Index(hex)	Name	Description	Data Type	Flags	Default
0x8050:01	TPR OUT TYPE	Control method setting 0: phase control, 1: fixed cycle control 2: variable cycle control	UINT16	RW	DIP switch set value priority

Function description

■ Phase control
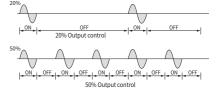The phase control method is to input 1/2 CYCLE to AC power and output power proportionally between 0 ~ 180 ° for 8.33 ms according to control signal.

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

■ Fixed cycle control

40% Output control
80% Output control

The output is set at a fixed cycle (1s) and the ON / OFF control is repeatedly controlled at a constant rate according to the control input.

■ Variable cycle control

20% Output control
50% Output control

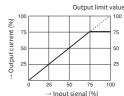It is a method to control by using the cycle number of AC sine waveform, not by controlling the cycle.

■ Restart function
If a warning or an alarm condition occurs, alarm output, operation stop, etc. are used. If the cause of the error disappears, the function returns normally.

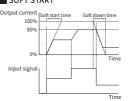### ■ O.C (overcurrent setting function)
The function to protect the power regulator (TPR) and the load in case of overcurrent. Alarm output when a current over the set overcurrent value occurs. Overcurrent setting initial value set to 120% of each product rating.

■ POWER (output limit function)

This function is to limit the output regardless of the control input.
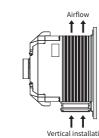It can be set by communication - set to 100% at shipment

■ SOFT START

- **SOFT**
  This function sets the soft start / down time as communication (initial factory setting 0) (phase control, variable cycle control modes)
- Soft start / down: Start-up current (inrush current) is a function to protect from big loads and gradually raise the output.
  When the control input is applied, it is activated when the power is turned on, and when the control input is turned on while power is applied. It is set to 15 seconds at the maximum value (0 ~ 60)
  (Example: 100% of control input: 15 seconds, 50%: 7.5 seconds)
  '- If the set value is 0, this function does not work. The closer the set value is to 0, the shorter the time.

Installation and precautions

Airflow
Vertical installation

1. Please install it vertically. If the product is installed horizontally in unavoidable circumstances, please use 50 % of rated current.
2. When multiple products are closely installed, please install them with a distance of more than 5 cm (horizontally) and more than 10 cm (vertically) as shown in the picture.
3. In order not to 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. The lower the internal ambient temperature, the longer the life span of the product, and the better the durability and reliability of the product. The operating ambient temperature is 0 ℃ ~ 40 ℃.
5. When wiring, use solderless terminals and securely tighten the terminal section where high current flows. If the joint surface is not good, wiring and terminals may overheat and cause fires.
6. Before applying power, this model need power to 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 installing this model to a panel.

Air flow — Air out (FAN)
Wiring duct
min. 60 mm — min. 50 mm
min. 100 mm
min. 30 mm
Air in
Wiring duct