# TPR-2SL

Single-phase slim type power regulator

- 60, 85 ㎜ Ultra slim size
- Improved safety by separation of power supply of circuit and power supply of load (Application of Free Voltage)
- Various control methods available depending on loads
- Alarm output is divided into caution and warning
- Various protection functions (Short circuit of partial heat, Overcurrent, Overheating of heat sink, Short circuit of SCR etc.)

## Specification

### ▪ TRP 40/55/70

| TPR- | | | | |
|---|---|---|---|---|
| Model | Low | 2SL040L | 2SL055L | 2SL070L |
| | High | 2SL040H | 2SL055H | 2SL070H |
| Circuit input power | | 100 - 240 V a.c. | | |
| | | 6 W | | 16 W |
| Rated current (40 °C Standard) | | 40 A | 55 A | 70 A |
| Fuse installation | | None | | |
| Cooling method | | Natural cooling | | Forced cooling |
| Weight | | 1388g | | 1478 g |

### ▪ TRP 90/110/130/160/200

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| TPR- | | | | | | |
|---|---|---|---|---|---|---|
| Model | Low | 2SL090L | 2SL110L | 2SL130L | 2SL160L | 2SL200L |
| | High | 2SL090H | 2SL110H | 2SL130H | 2SL160H | 2SL200H |
| Circuit input power | | 100 - 240 V a.c. | | | | |
| | | 20 W | | | | |
| Rated current (40 °C Standard) | | 90 A | 110 A | 130 A | 160 A | 200 A |
| Fuse installation | | Built-in Fuse | | | | |
| Cooling method | | Natural cooling | Forced cooling | | | |
| Weight | | 2820 g | | | | |

### ▪ Common Specifications

| | | |
|---|---|---|
| Power supply voltage | Low | 100 - 240 V a.c. |
| | High | 380 - 440 V a.c. |
| Power frequency | | 50 Hz / 60 Hz (Dual usage) |
| Applying load | | Resistive load |
| Control Input | Current input | 4 - 20 mA d.c. (Impedance : 100 Ω) |
| | Voltage input | 1 - 5 V d.c. (Order specification : 0 - 10 V d.c.) |
| | Contact input | ON / OFF |
| | External VR | External volume (10 ㏀) |
| 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) |
| Display method | | Display by LED |
| Insulation resistance | | Min 100 MΩ (Base on 500 V d.c. mega) |
| Output control range | | 0 ~ 100 % |
| Dielectric strength | | 3,000 V a.c. 50 / 60 Hz for 1 min |
| Line noise | | Noise by noise simulator (3,000 V) |

| | |
|---|---|
| Ambient temperature & humidity | 0 ~ 40 °C (Without Condensation), 30 ~ 85 % RH |
| Storage temperature | -25 °C ~ 70 °C |
| Certification | CE |

## Suffix code

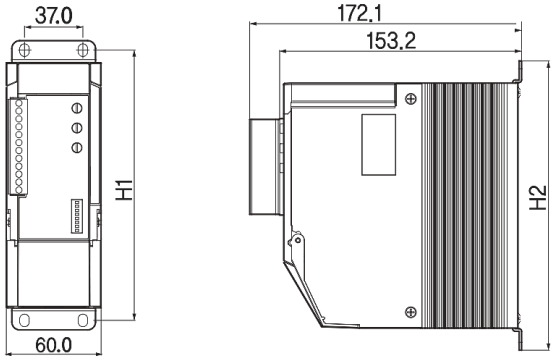
| Model | Code | | | | Content | |
|---|---|---|---|---|---|---|
| TPR-2SL | ☐ | ☐ | -☐ | ☐ | Slim type Single phase power regulator | |
| Rated current | 040 | | | | 40 A | |
| | 055 | | | | 55 A | |
| | 070 | | | | 70 A | |
| | 090 | | | | 90 A | Built-in Fuse |
| | 110 | | | | 110 A | |
| | 130 | | | | 130 A | |
| | 160 | | | | 160 A | |
| | 200 | | | | 200 A | |
| Power supply voltage | | L | | | 100 - 240 V a.c. (Low) | |
| | | H | | | 380 - 440 V a.c. (High) | |
| Options | | | C | | RS485 | |
| | | | | F | Built-in Fuse (Only 40/55/70 A) | |

- Please supply 100 – 240 V a.c. to the control unit of the power controller (Thyristor) separately.

## Dimension & Panel cutout

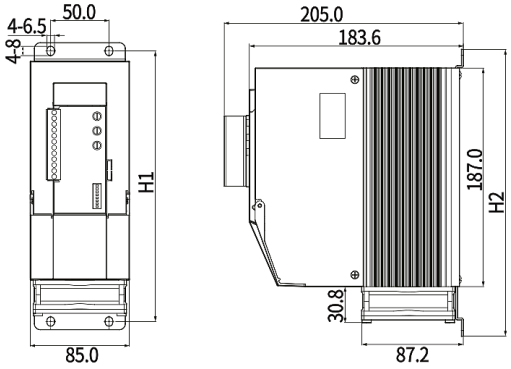
[Unit : mm]

### ▪ 40/55/70 A




| | H1 | H2 |
|---|---|---|
| 40 / 55 A | 171.0 mm | 183.0 mm |
| 70 A (With Cooling fan) | 191.0 mm | 203.0 mm |

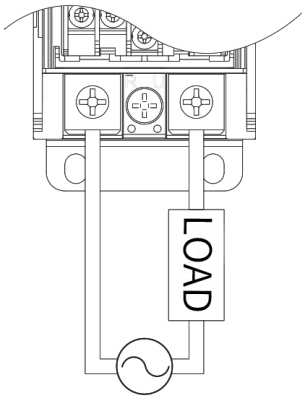
### ▪ 90/110/130/160/200 A




| | H1 | H2 |
|---|---|---|
| 90 A (Without Cooling fan) | 205.0 mm | 219.0 mm |
| 110 / 130 / 160 / 200 A | 231.5 mm | 245.5 mm |

## Connection diagram

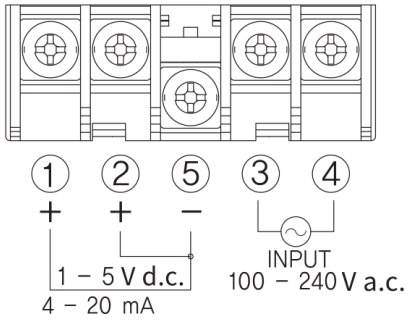
### ▪ Connection diagram of load terminal




- 40 / 55 / 70 A items does not have fuse. It is recommended to install a fast fuse between the input power and the "R" terminal.
  (90 / 110 / 130 / 160 / 200 A items have fast-acting fuse).
- 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 / 110 / 130 / 160 / 200 A : 26 mm

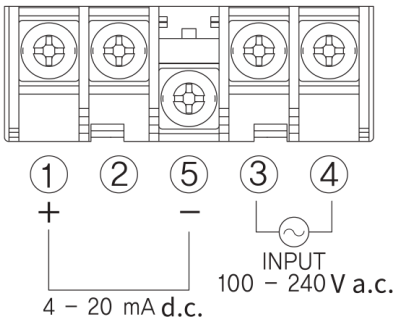
## ▪ Connection diagram of input signal and power terminal

**■ General type**




- Current input : 4 - 20 mA d.c. (connect no. 1 and 5)
- Voltage input : 1 - 5 V d.c. (connect no. 2 and 5)
- Input power voltage (for control unit) : 100 - 240 V a.c. (no. 3 and 4)

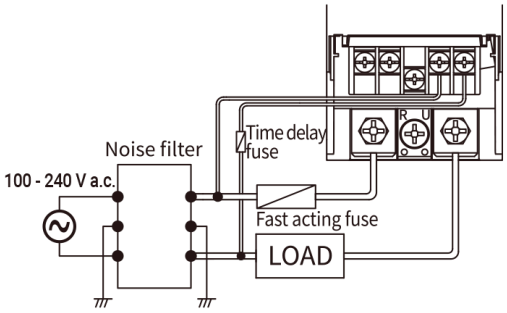
**■ Communication type**




- Current input : 4 - 20 mA d.c. (connect no. 1 and 5)
- Input power voltage (for control unit) : 100 - 240 V a.c. (no. 3 and 4)

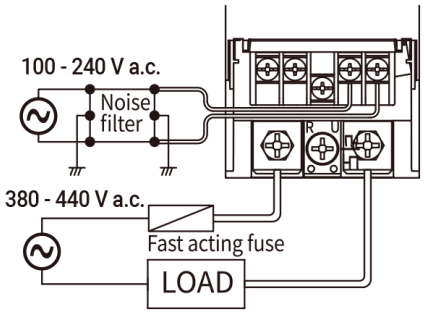
## ▪ Recommended connection diagram

**■ Low**




- In case of low voltage model, we suggest connecting it as following picture. (90/110/130/160/200 A have fuse).

■ **High**

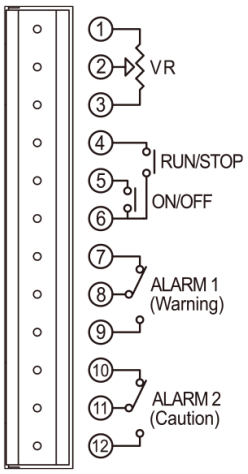



- If the product is used in a place where there is an excessive amount of noise from power then make sure to use a noise filter with proper specification as shown in the picture below. If not, it can be a cause of malfunction.
- When the voltage is used higher than 380 V a.c., please make sure to decrease the input power to 240 V a.c. and connect it separately.
- Protection fuse 0.5A or an equavalent device should be connected in the terminal of power input on circuit.
- Please select a fuse appropriate with operating current/voltage for the fast acting fuse.
  (example) actual operating current 40A :
  BUSSMANN FWH-40 (please use 40 A r.m.s min)

## ▪ Connection diagram of signal and alarm terminal

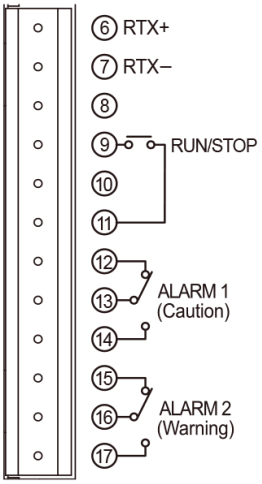
※ When there is an alarm condition, the alarm is on after 3 seconds. If alarm condition is cleared within 3 seconds, the alarm is off.

■ **General type**




| | |
|---|---|
| **No. 1, 2 and 3 : manual VR** | · Use variable resistor of 10 kΩ<br>· Control 0 ~ 100 % manually |
| **No. 4 and 6 : RUN / STOP** | · Be sure to attach RUN contact while it is operating |
| **No. 5 and 6 : ON/OFF control** | · When inputting contact, it is operated with 100% output, irrespective of other control input. |
| **No. 6 :** | · GND terminal of the circuit. |
| **No. 7, 8, 9 : Alarm 1 - Warning** | · This is a “warning” alarm which implies that there may be a cause of damage to the product and load. At this moment, TPR stops the output by itself and “warning” alarm is activated.<br>· Warning error : Overcurrent, overheated heat sink (80 °C), SCR short-circuit, abnormal frequency and power |
| **10, 11, 12 : Alarm2 Caution** | · This is a “caution” alarm which implies there is not a serious problem, but user needs to check for its system because small and minor problems cause this alarm. At this moment, the output of TPR is normally operating but only “caution” alarm is activated.<br>· Caution error : partial load break, overheated heat (60 °C) |
| | · Initially 7 & 8 connect. If alarm 1 is activated, 8 & 9 will be connected.<br>· Initially 10 & 11 connect. If alarm 2 is activated, 11 & 12 will be connected. |

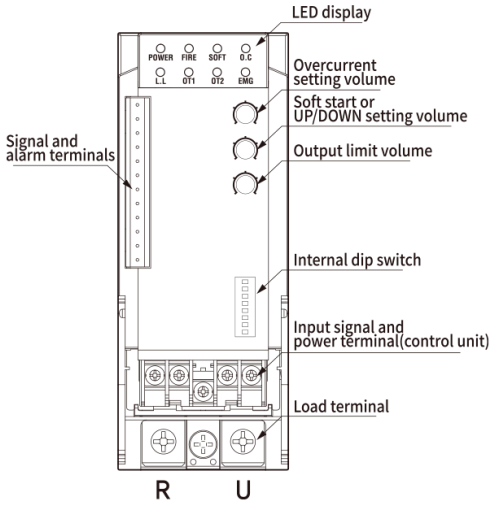
■ **Communication type**



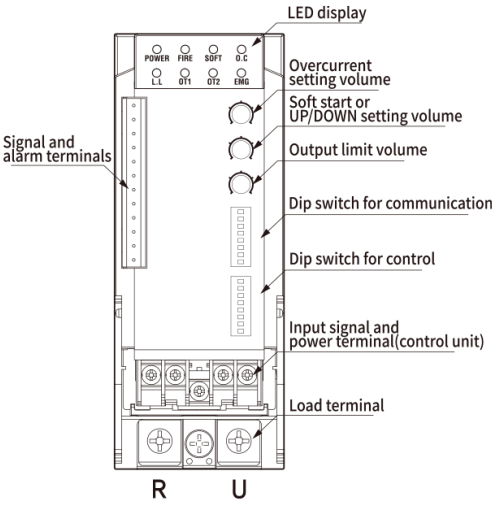

| | |
|---|---|
| 6, 7 : | 485 communication connected port |
| 9, 11 : RUN / STOP | · Always stick the RUN contact in operation |
| 12, 13, 14 : Alarm 1 caution | · It is not a serious problem when "Caution" Alarm is on. But, it is a sign of disorder so it is required to be checked out. In this way, TPR's output is fine but, only alarm is on.<br>· Error for caution occurrence : disconnection of partial load, overheating of heat sink(60 °C), overcurrent, disorder of frequency, disorder of power supply (disconnection of Fuse) |
| 15, 16, 17 : Alarm 2 warning | · When there is a damage in the product and the load through "Warning" alarm, warning is on by the following emergency situations. In this way, TPR is automatically stopped.<br>· Error of warning occurrence : Overheating of heat sink (80 °C), SCR short, Disorder of FAN |
| | · When input power (100-240 V a.c.) is supplied, the contact is changed to 16, 17 from 13, 14. When warning alarm is on, the contact is changed from 15, 16 to 12, 13. |

## Part name and function

### ▪ General type




### ▪ Communication type




### ▪ LED indicator and explanation

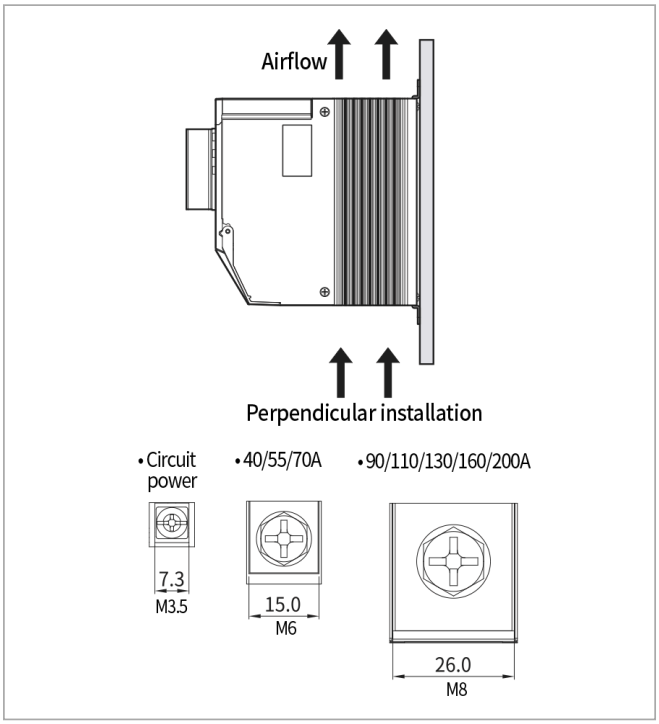
| LED indicator name | Description |
|---|---|
| POWER | POWER indicator turns ON when the power is being supplied separately. |
| FIRE | FIRE indicator turns ON proportionally to the control output according to the control input. It lights longer if the output amount is large and it is continuously ON if it outputs 100 % continuously. |
| SOFT | To use Soft start, Soft up/down function, turn Soft VR clockwise and SOFT indicator will turn ON. |
| O.C | ▪To protect the product and load in the event of overcurrent, lights up when the current exceeds the O.C VR set value.<br>▪FAN break : The indicatior flashes when the fan is broken. (Special order spec)<br>▪Over load : When SCR is shorted, the power is turned on and 100% output is exited irrespective of the control input state. If current is over 5A in each control period, it flashes. |
| L.L | ▪ If the DIP switch 2 is turned OFF after the power is turned on, the heater value will be detected after confirming the capacity of the heater while automatically outputting 0 ~ 100%. When the heater value detection is completed, the LL LED remains on. When dip switch 2 is turned ON again, the LED turns off and the partial heater disconnection detection function starts. If the heater value is less than 30% of the heater value detected at the initial setting for 6 seconds, "Caution" alarm output and LL LED lights up.<br>▪If you want to use the partial heater disconnection detection function automatically, set the DIP switch to the ON state to automatically detect the heater value and start the detection function (but dectention not possible if the heater is already disconnected). Fixed cycle control is not applicable. |

| | |
|---|---|
| | ▪It will not operate when the output is below 20%. |
| 0.T1 | Lights up when the heat sink temperature rises above 60 °C during control. At this time, the operation operates normally, and the alarm is canceled when the heat sink temperature falls below approximately 50 °C. |
| 0.T2 | On / off when the heat sink temperature rises above 80° C during control |
| EMG | The EMG LED indicator is ON in the following situations<br>1. Abnormal status with power: when circuit power (24 V d.c.) is being supplied, EMG LED is ON if the load power is not being supplied or the heater is disconnected.<br>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

| Number | OFF | ON | Initial setting mode |
|---|---|---|---|
| No. 1 | RESET CLEAR RESET | RESET |  |
| No. 2 | Use function of manual partial load break | Use function of auto partial load break | |
| No. 3 | Partial load disconnection | - | |
| No. 4 | - | Fixed cycle control | |
| No. 5 | | Variable cycle control | |
| No. 4, 5 | | Phase control | |
| No. 6 | - | Limit mode (Not using internal VR) | |
| No. 7 | Use external and internal V.R simultaneously | 1 - 5 V d.c. | |
| No. 8 | | External VR | 1. input mode : 4 - 20 mA d.c.<br>2. control mode : phase control |
| No. 7, 8 | | 4 - 20 ㎃ d.c. | |

## 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 5cm and a length of 10cm 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 °C. Please refer to the following graph. However, if the ambient temperature is higher than 40 °C, the maximum load current is decreasing like the below.

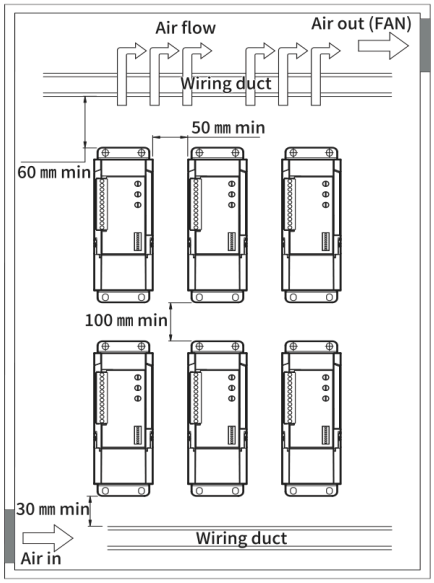
5. When connecting R and U, please securely fasten them with using crimp connectors since high current flows into these terminals. If the contact surface of the connectors and terminals are poor, it may lead to a fire since the wires and terminal gets overheated.

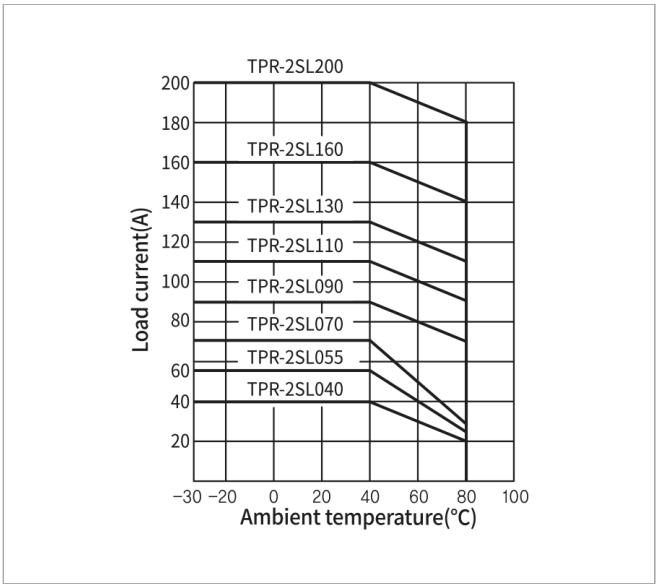
6. Before applying power, this model need more than the third class grounding to prevent electric shock. This model does not have separate grounding terminal so we suggest using grounding terminal and bracket together when install this model to a panel.

7. Tighten the screws of the terminal block with the specified torque.
M3.5 : 0.6 ~1.2 N.m
M6 : 4.41~4.9 N.m
M8 : 8.82~9.80 N.m

### + Installation interval

### + Current - temperature characteristics

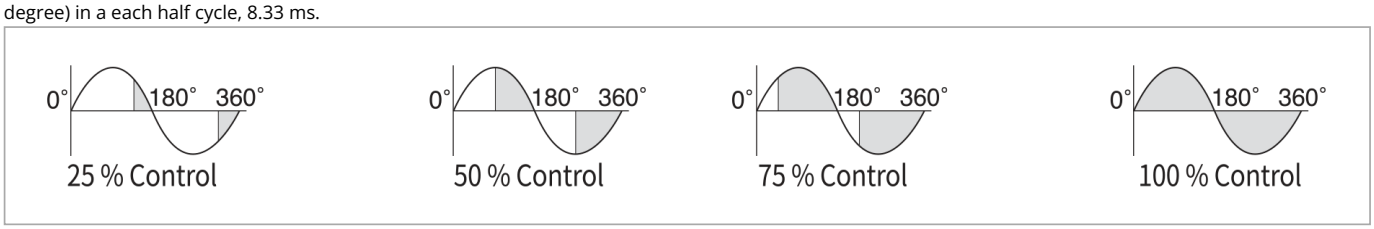


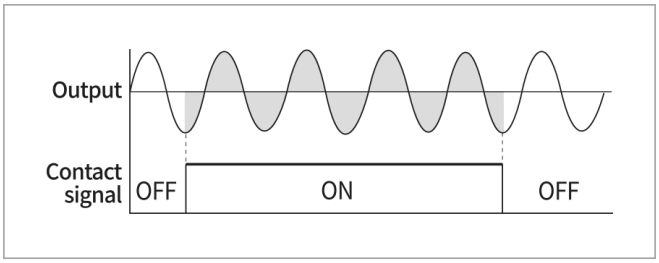

## Function descriptions

### + Phase control

- Phase control is to control the AC power supplyapplied 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.

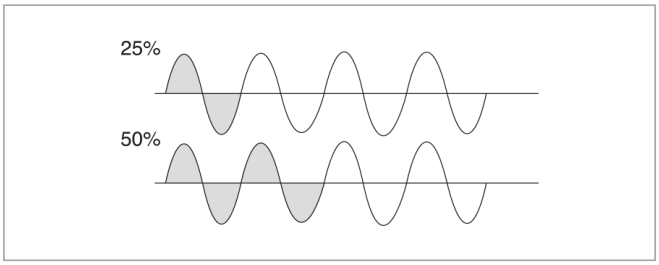



### + ON/OFF control



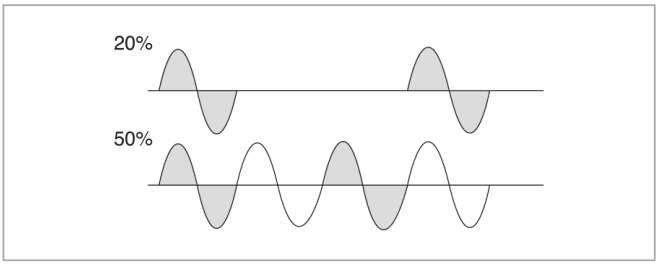

- If ON/OFF contact is ON, then the output is 100 %. ON/OFF always operates near zero point.
- Even though the control input signal is ON, the output is 100 % when ON/OFF control is used.

### + Fixed cycle control




- As setting the constant cycle of the output,(1 sec), 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




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

### + Restart function

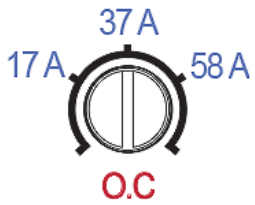
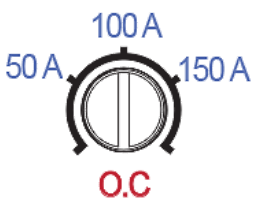
When a warning or caution alarm occurs, TPR gives alarm 1 or 2 or stop the output. This function is used to return to normal operation mode when factors caused errors are eliminated. This function is able to set up when Fuse/Power Supply is in disorder, Heat sink over heat, SCR Short is occurred. (When Overcurrent is occurred, this function is not working)

## VR Explanation

### + O.C (overcurrent setting function)

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

**+ VR gradation for overcurrent setting position.**

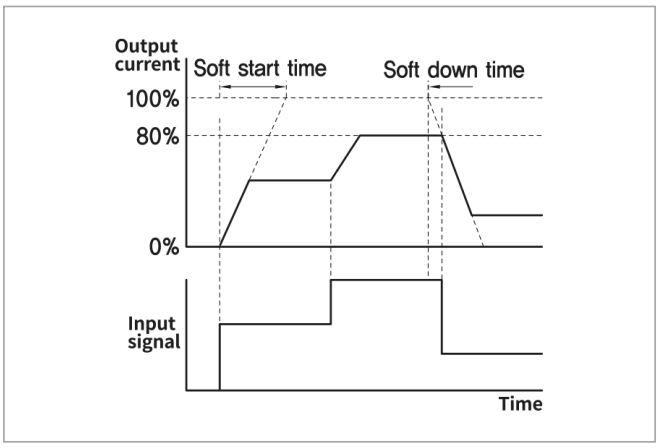
| TPR-2SL040/055/070 | TPR-2SL090/110/130/160/200 |
|---|---|
|  |  |





- The overcurrent setting can be different depending on the types of load or VR tolerance. In order to set an accurate position of the overcurrent setting, adjust the control signal that TPR can have the current that needs to be alarmed. Turn the O.C VR until the O.C indicator is ON. The position of the O.C VR is the overcurrent setting value.
- If OC VR turning to the right of the maximum, overcurrent function does not work.

### + SOFT START



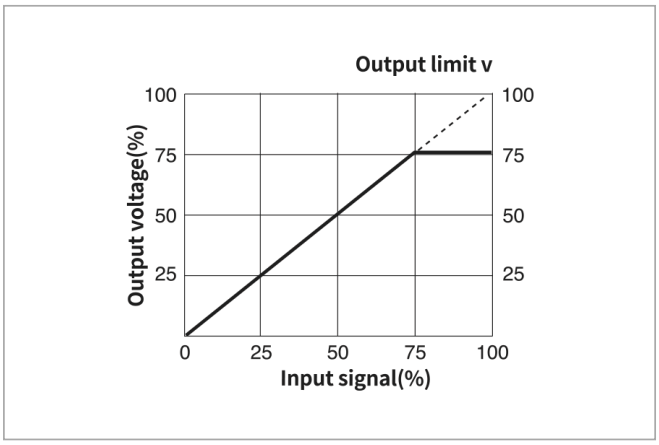

This volume is to set time for Soft start or Soft up/down.
(Only phase control, ON/OFF control)

**- 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 60 second.
(Example : 20 mA : 60 sec, 12 mA : 30 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 15 second.

- If VR turn up to the right, the function does not work. And if VR turn right, time will be reduced.

### + POWER (output limit function)

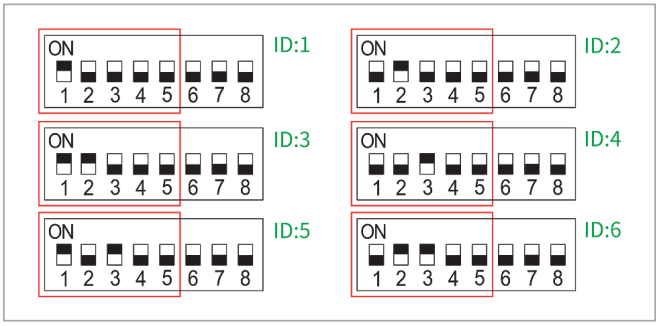



- This function is to limit the output regardless of the control input amount. Even though the control input is 100 %, the output will decrease as turning POWER volume counterclockwise.

## Communication

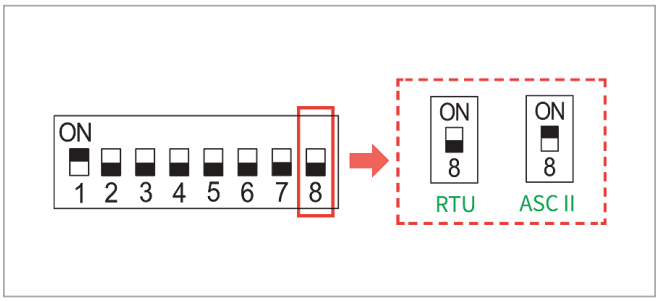
1. Communication method : RS485 2-wire half-duplex
2. Communication speed : 2400, 4800, 9600, 19200 bps
3. Maximum number of connections : 31
4. Protocol : ModBus RTU, ModBus ASCII

### + Address (ID) setting



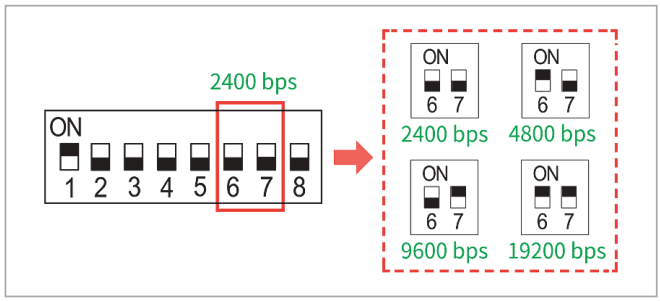

- Set the ID with DIP S/W no. 1~5
- Set 1 ~ 31 (except 0).
- When communication setting is changed, the change is applied after reset.

## + Communication protocol selection




= Set the communication protocol with DIP S/W no. 8 =

## + Communication speed setting




= Set the communication speed with DIP S/W no. 6 / 7 =

## + Communication setting (ModBus RTU/ASCII)

**- Communication settings**

| | | |
|---|---|---|
| Communication speed | 2400, 4800, 9600, 19200 bps | |
| Protocol | ModBus RTU | ASC II |
| Parity bit | Even bit | None bit |
| Data bit | 8 bit | 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 (ASCII)**

| | | | | | |
|---|---|---|---|---|---|
| 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 (ASCII)**

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

**- Process (0 x 0000 ~ ) : READ**

| Modbus Address | Address | Parameter | Content | Setting range | Unit |
|---|---|---|---|---|---|
| 40002 | 0x0001 | Alarm Status | Alarm status information | Refer to BIT Information | |
| 40003 | 0x0002 | CT value | Output current value 16bit | 0 ~ CT max (X10) | A |
| 40004 | 0x0003 | PWR LMT | Output limit value | 0 ~ 100 | % |
| 40005 | 0x0004 | DIP SW Status | DIP switch setting status | Refer to BIT Information | |
| 40006 | 0x0005 | - | - | - | - |
| 40007 | 0x0006 | - | - | - | - |
| 40008 | 0x0007 | - | - | - | - |
| 40009 | 0x0008 | - | - | - | - |
| 40010 | 0x0009 | - | - | - | - |
| 40011 | 0x0010 | - | - | - | - |
| 40012 | 0x0011 | - | - | - | - |
| 40013 | 0x0012 | - | - | - | - |
| 40014 | 0x0013 | - | - | - | - |

※ PWRLMT Initial value : 100, OCLMT Initial value : 786

**- BIT Information**

| Parameter | Alarm Status | Content | DIP SW Status | Content |
|---|---|---|---|---|
| Address | 0x0001 | | 0x0004 | |
| Bit 0 | - | - | - | - |
| Bit 1 | FAN Fail | DC FAN break | IN MODE | Control input selection status<br>1 : 4 ~ 20 mA |
| Bit 2 | OC Fail | Overcurrent | - | - |
| Bit 3 | LL Fail | Partial heater burnout occurred | OUT MODE | Current control mode state<br>01 : fixed cycle control<br>10 : variable cycle control<br>11 : phase control |
| Bit 4 | Over Temp 60 | Heat sink above 60 °C | | |
| Bit 5 | Over Temp 80 | Heat sink above 80 °C | - | - |
| Bit 6 | Heat Short | When internal device is shorted<br>(when control signal is not applied) | LL MODE | Status of partial heater disconnection setting<br>0 : OFF 1 : ON |
| Bit 7 | Power Fail | Failure of supplying power for load | - | - |
| Bit 8 | - | - | - | - |
| Bit 9 | - | - | - | - |
| Bit 10 | - | - | - | - |
| Bit 11 | - | - | - | - |
| Bit 12 | - | - | - | - |
| Bit 13 | - | - | - | - |
| Bit 14 | - | - | - | - |
| Bit 15 | - | - | - | - |