TPR-3SL

Slim type three-phase power regulator

- It is the slimmest type among 3-phase thyristor power regulators under the same rating (110 ㎜)
- Good design of the heat sink and various protection circuits make it durable.
- Improved safety by separation of power supply of circuit and power supply of load (Free Voltage, 90 - 450 V a.c.)
- Various alarm functions (Short circuit of heater, Imbalance of load, Overheating of heat sink, Overcurrent etc.)

Specification

▪ TPR 40/55/70

Model	Low	TPR-3SL040L	TPR-3SL055L	TPR-3SL070L
	High	TPR-3SL040H	TPR-3SL055H	TPR-3SL070H
Circuit input power		100 - 240 V a.c. 18 W		
Rated current		40 A	55 A	70 A
Weight		4,044 g		4,324 g

▪ TPR 90/130/160

Model	Low	TPR-3SL090L	TPR-3SL130L	TPR-3SL160L
	High	TPR-3SL090H	TPR-3SL130H	TPR-3SL160H
Circuit input power		100 - 240 V a.c. 20 W		
Rated current		90 A	130 A	160 A
Weight		9,100 g		

▪ Common Specifications

Load 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 ㎃ d.c. (Impedance : 100 Ω)
	Voltage input	1 - 5 V d.c.
	Contact input	ON / OFF
	External VR	External volume (10 kΩ)
Control method		Phase control, Fixed Cycle control, Variable Cycle control, ON/OFF control (General type only)
Movement type		SOFT START, SOFT UP/DOWN
Output voltage		More than 98 % of the power voltage (in case of maximum current input)
Cooling method		▪Natural cooling (40 A, 55 A) ▪Forced cooling (70 A, 90 A, 130 A, 160 A)
Display method		Output display by LED
Insulation resistance		Min 100 MΩ (based on 500 V d.c. mega)
Leakage current		Less than 20 mA
Rated impulse withstand voltage (Uimp)		2,500 V
Output control range		0 ~ 100 %
Dielectric strength		3,000 V a.c. 50/60 Hz for 1 min
Line noise		Noise by noise simulator (2,500 V)
Ambient temperature & humidity		0 ~ 40 °C (without condensation), 30 ~ 85 % RH
Storage temperature		-25 °C ~ 70 °C
Certification		CE

Suffix code

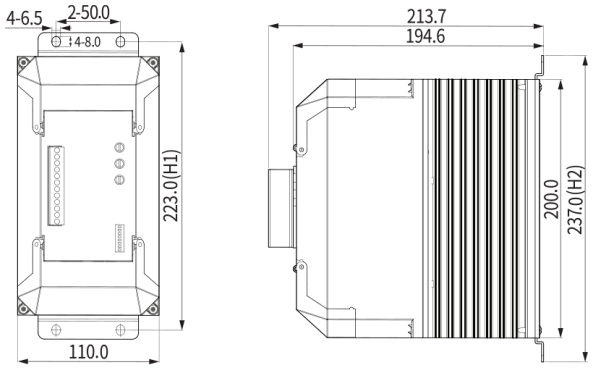
Model	Code					Content
TPR-3SL	☐	☐	-☐	☐	☐	Slim type 3-phase thyristor power regulator
Rated current	040					40 A
	055					55 A
	070					70 A
	090					90 A
	130					130 A
	160					160 A
Load voltage		L				100 - 240 V a.c. (Low)
		H				380 - 440 V a.c. (High)
Option			C			RS485
				N		No Fuse
					F	Fan mounted (option for 40A, 55 A models)

- Circuit and fan need 100 - 240 V a.c. voltage power separately.

Dimension & Panel cutout

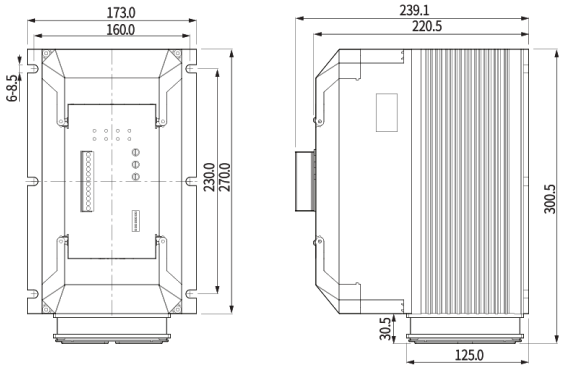
[Unit : ㎜]

▪ 40/55/70 A

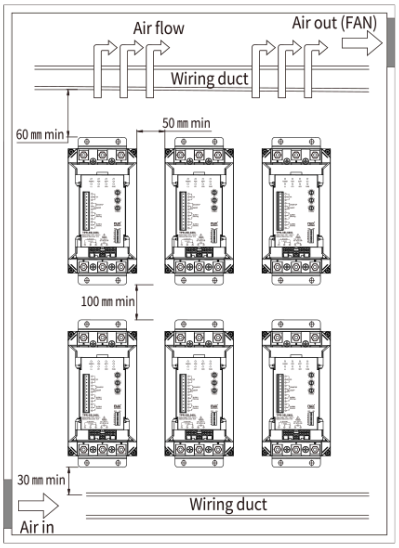


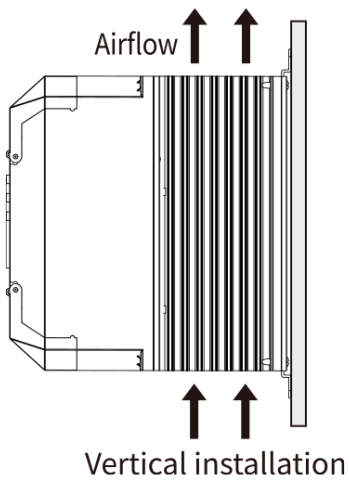
	H1	H2
70 A (With cooling fan)	249.5 mm	263.5 mm

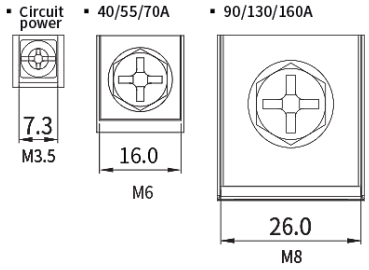
▪ 90/130/160 A



Installation



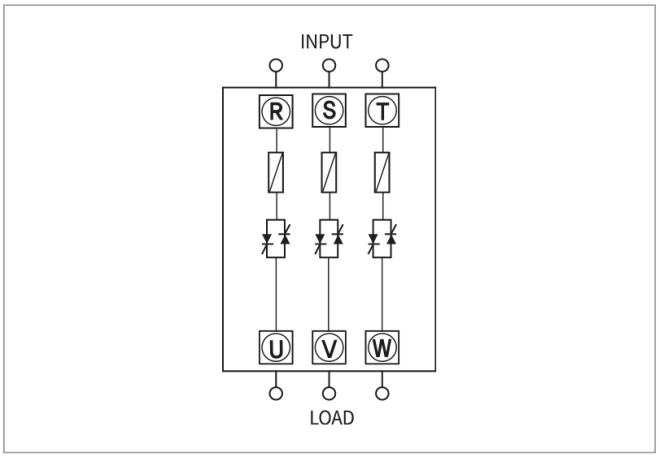




- Please install it perpendicularly. If the product is installed vertically in unavoidable circumstances, please use 50 % of rated current.
- When multiple products are closely installed, install them keeping a distance of more than a width of 5 cm and a length of 10 cm as shown in the picture.
- In order to not block the air flow, please install the wiring duct less than the half of the heat sink height.
- Please consider if the air flow is good enough when installing the product. If the ambient temperature is as low as possible in the inside then the product life span, durability and reliability improve. The operating ambient temperature is 0 °C ~ 40 °C. Please refer to the following graph. However, if the ambient temperature is higher than 40 °C, the max. load current decreases as below.
- When wiring, use crimp connectors for high current flow terminal. If the contact surface of the connectors and terminals are poor, it may lead to a fire since the wires and terminal get overheated.
- Before applying power, this model needs 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 installing this model to a panel.
- 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

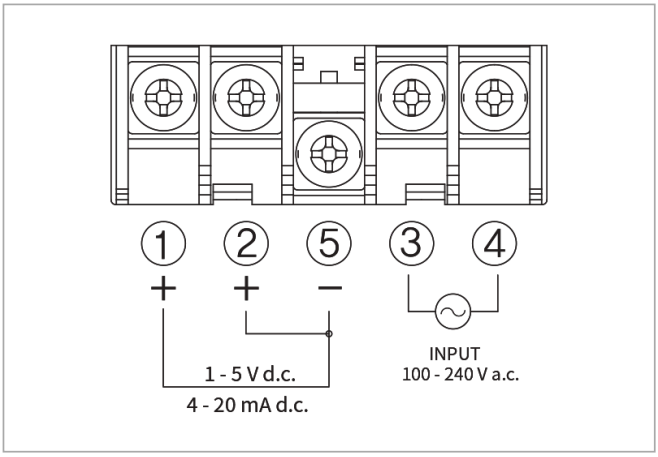
Connection diagrams

+ Connection diagram of load terminal



- Inside the thyristor power regulator (TPR), a fuse (FUSE) is mounted on the R, S, T input power part as standard.
- 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, 90/130/160 A: 26 mm)

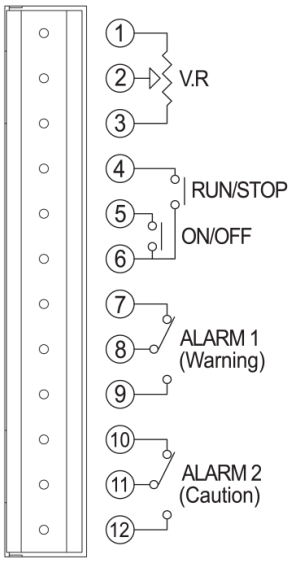
+ Connection diagram of input signal and power terminals



- Current input : 4 - 20 mA d.c. (connect no. ① and ⑤)
- Voltage input : 1 - 5 V d.c. (connect no. ② and ⑤)
- Extra input power supply (for circuit power and fan operation power) : 100 - 240 V a.c. (③, ④) need to connect power to operate unit (even if the fan is not used).

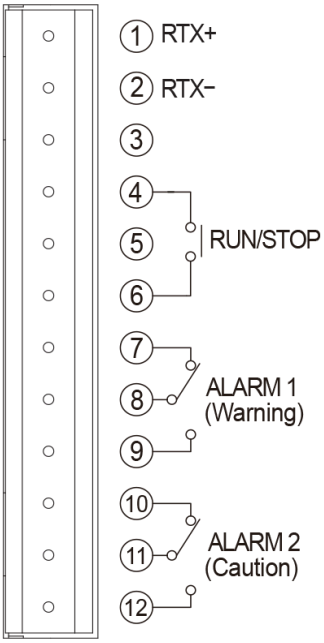
+ Connection diagrams of signal and alarm terminal

- Standard type



No. 1 , 2, 3 : manual VR	- Use variable resistor of 10 kΩ - 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. 7, 8 and 9 : Alarm 1 - Warning	- This is a “warning” alarm which implies that there may be a cause of damage to the product and load. The alarm will be activated when the following emergency situations occur. At this moment, TPR stops the output by itself. - Warning errors: overcurrent, SCR short-circuit, fuse disconnection, power failure
No. 10, 11, 12 : Alarm 2 (Caution)	- This is a “caution” alarm which implies there is not a serious problem, but user needs to check for its system because minor problems cause this alarm. At this moment, the output of TPR is normally operating and only “caution” alarm is activated. - Caution error: load unbalance, load disconnection, overheated heat sink (85 °C)
- Initially 7 and 8 connected, If alarm 1 is activated, 8 and 9 will be connected. - Initially 10 and 11 connected, If alarm 2 is activated, 11 and 12 will be connected.	

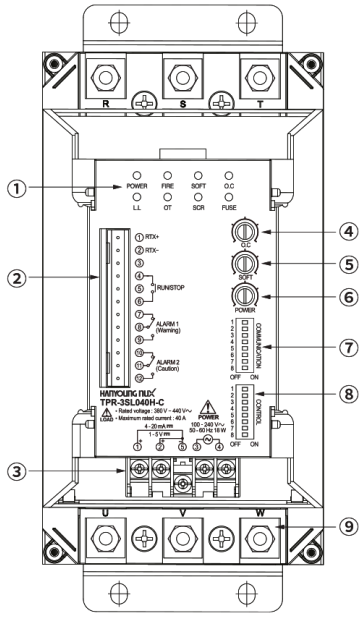
- Communication type



No. 1, 2 :	- 485 communication connection port
No. 4, 6 : RUN/STOP	- Be sure to attach RUN contact while it is operating.
No. 7, 8 and 9 : Alarm 1 - Warning	- This is a “warning” alarm which implies that there may be a cause of damage to the product and load. The alarm will be activated when the following emergency situations occur. At this moment, TPR stops the output by itself - Warning errors : overcurrent, SCR short-circuit, fuse disconnection, power failure
10, 11, 12 : Alarm 2 (Caution)	- This is a “caution” alarm which implies there is not a serious problem, but user needs to check for its system because minor problems cause this alarm. At this moment, the output of TPR is normally operating and only “caution” alarm is activated. - Caution error : load unbalance, load disconnection, overheated heat sink (85 °C)
- Initially 7 and 8 connected, If alarm 1 is activated, 8 & 9 will be connected. - Initially 10 and 11 connected, If alarm 2 is activated, 11 & 12 will be connected.	

Part names and functions

▪ Part names



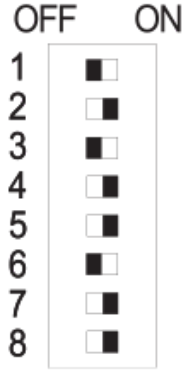
No	Name
①	LED display
②	Signal and alarm terminals
③	Input signal and alarm terminal
④	Over current setting volume
⑤	Soft start or UP/DOWN setting volume
⑥	Output limit volume
⑦	Communication dip switch (Communication type only)
⑧	Control dip switch
⑨	Load terminal

▪ LED indicators and descriptions

LED indicator name	Description
POWER	POWER indicator turns ON when the power is being supplied separately. RS485 Flashes during communication. (Communication type only)
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	When there is overcurrent, if the current flows higher than O.C VR set value, then O.C indicator turns ON, to protect the product and the load and alarm 1 is activated.
L.L	When the load is disconnected : in a situation where output is over 10 %, if load current is not detected, the alarm is activated. When the load is unbalanced : in a situation where output is over 10 %, if the load unbalance between phases is over 5 A, the alarm is activated. (Phase control only)
O.T	When heat sink temperature rise over 80 °C', O.T indicator turns ON. Alarm 2 output will be activated but the operation will continue normally. When temperature goes below 70 °C, alarm will turn OFF.
FUSE	When inner fuse is disconnected, when load power is not input, or in a situation where circuit power supply (100 - 240 V a.c.) is applied, if any phase of load power supply is not working or inner part of FUSE is disconnected, alarm output ALARM1 is activated.
SCR	Under certain circumstances, if the internal SCR is shorted, the power supply will continue to be conductive even if there is no control input and TPR output, so that the heater will continue to overheat. So SCR indicator turns ON if current continues to flow for more than 10 A in any phase without control input.

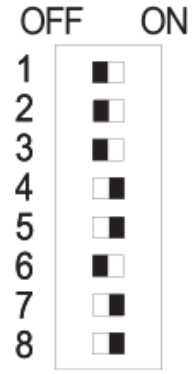
▪ Internal dip switch operation

■ **Standard type**

Number	OFF	ON	Initial setup mode
No. 1	-	RESET (Stop MCU function)	 1. Input mode 4 - 20 ㎃ d.c. 2. Control Mode: Phase control 3. Extra : Restart is in use, Inner VR is in use
No. 2	Disable the inner POWER VR	Inner Power VR in use	
No. 3	Restart mode in use	Restart mode not used	
No. 4	-	Fixed Cycle Control	
No. 5		Variable Cycle Control	
No. 4, 5		Phase control	
No. 6	Disable the external VR	Enable the external VR	
No. 7	-	1 - 5 V d.c.	
No. 8		Enable the external VR(for control)	
No. 7, 8		4 - 20 mA d.c.	

※ The internal VR and the external VR can not be enabled simultaneously. (Alarm will be ON when dip switches 2 and 6 are enabled at the same time.)

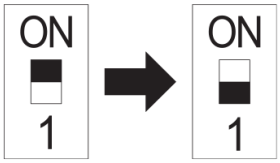
■ **Communication type**

Number	OFF	ON	Initial setup mode
No. 1	-	RESET (Stop MCU function)	
No. 2	Not used		
No. 3	Restart mode in use	Restart mode not used	
No. 4	-	Fixed Cycle Control	
No. 5		Variable Cycle Control	
No. 4, 5		Phase control	
No. 6	Not used		
No. 7	-	1 - 5 V d.c.	
7,No. 8		4 - 20 mA d.c.	

1. Input mode 4 - 20 ㎃ d.c.
2. Control Mode: Phase control
3. Extra : Restart is in use

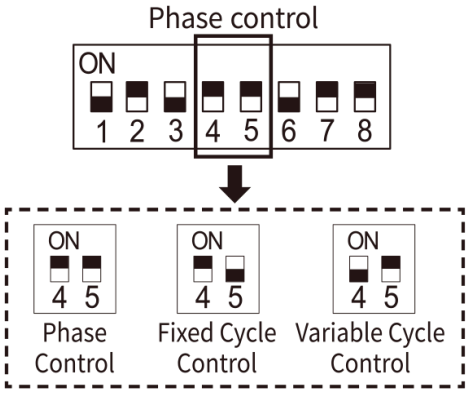
※ The external VR is not supportable for communication type model (TPR-▫▫▫▫-C▫▫).

▪ Reset description

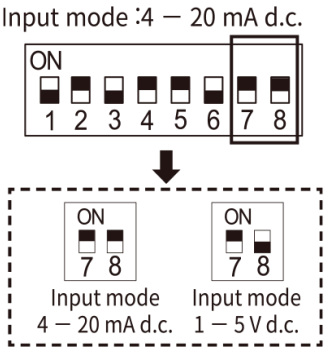


- When using RESET, set DIP S / W No. 1 to ON and then OFF again.

▪ Control mode setting



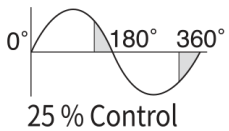
▪ Input mode setting

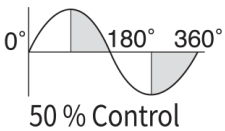


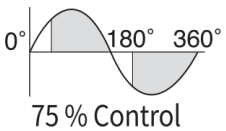
Function descriptions

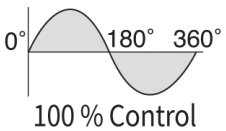
+ Phase control

- The phase control method is to input 1/2 CYCLE to AC power and output power proportionally between 0 and 180 degrees for 8.33 ms according to the control signal.



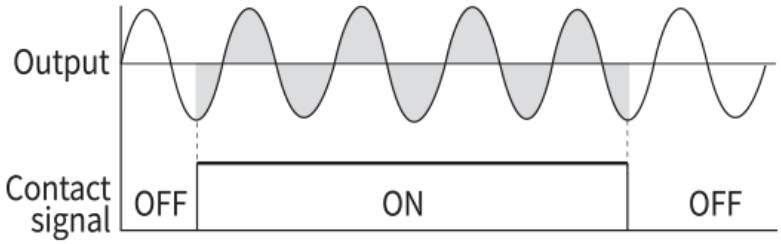






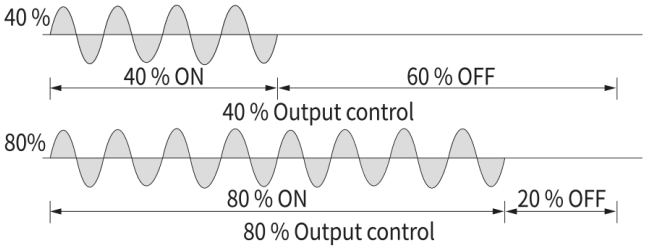
+ ON/OFF control (General type only)

- 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.



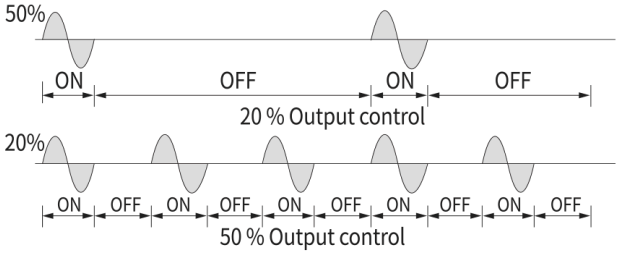
+ Fixed cycle control

- 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

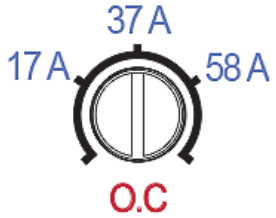
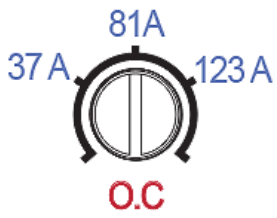
When a warning or caution alarm occurs, TPR gives alarm 1 or 2 or stop the output. This function is used to return to normal operation mode when factors caused errors are eliminated. This function is able to set up when Fuse/Power Supply is in disorder, Heat sink over heat, SCR Short is occurred. (When 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.

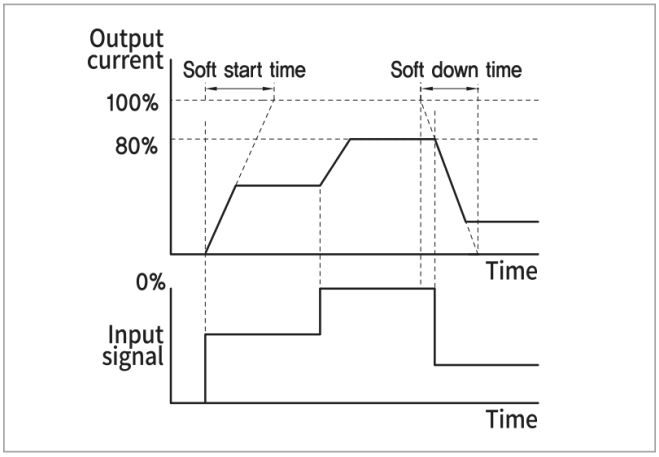
TPR-3SL040/055/070	TPR-3SL090/130/160
	

- Depending on load type and VR error, overcurrent setting position can be different.
- The overcurrent setting position may differ depending on the load type and VR error. To adjust the correct overcurrent position, adjust the control input to the current to be set, then turn the OC VR. The OC alarm output position is set to the overcurrent setting.

※ Communication type

- Default : 40/55/70 A overcurrent limit : 840/90/130/160 A overcurrent limit : 1920
(overcurrent limit value is set to O.C VR set value X 10)
- When address [7] is used for communication, the communication value is applied. The communication setting range is (0 ~ 2000)

+ SOFT



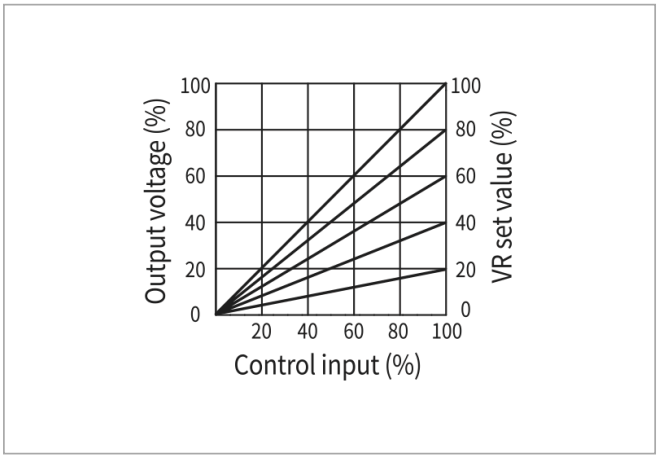
This volume is to set time for Soft start or Soft up/down

- 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

+ POWER (output limit function)

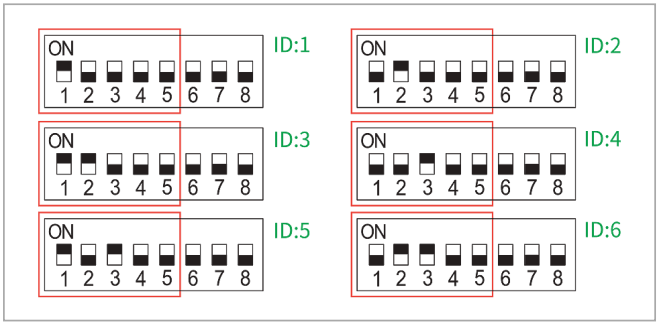


- This function is to limit the output regardless of he control input amount. Even though the control input is 100%, the output will decrease as turning POWER volume counterclockwise.

Communication (communication setting dip switch)

1. Communication method : RS485 2-wire half-duplex
2. Communication speed : 9600, 19200, 38400, 57600 bps
3. Maximum number of connections : 31
4. Protocol : ModBus RTU, ModBus ASCII

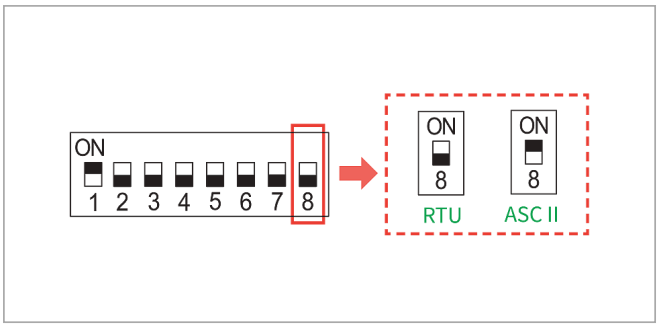
+ Address (ID) setting



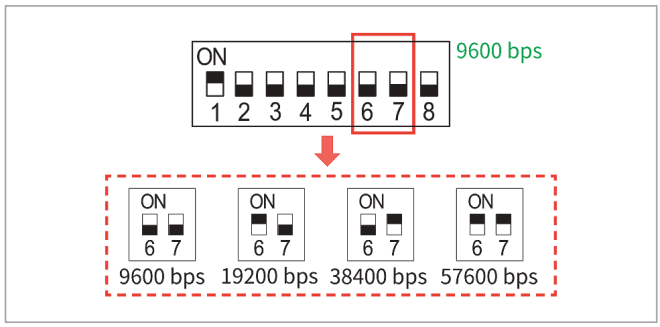
- Set the ID with DIP S/W no. 1 ~ 5
- Set 1 ~ 31 (except 0).
- When communication setting is changed, the change is applied after reset.

+ Communication protocol selection

+ Communication speed setting



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



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

+ Communication setting (ModBus RTU/ASCII)

Communication settings			
Communication speed	9600, 19200, 38400, 57600		bps
Protocol	ModBus RTU	ModBus 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 (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)																
구분	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	9600, 19200, 38400, 57600 bps	
Parity	Even	None
Data bit	8	7
Stop bit	1	1
ID	1 ~ 31	

BOLD : RAM DATA	
READ	monitoring

Communication MAP	
	PROCESS

READ/WRITE	configurable

Address	0
0	System ID
1	Alarm Status
2	U Current
3	V Current
4	W Current
5	PWR LMT
6	DIP SW Status
7	OC VR
8	SOFT VR
9	MV OUT
10	LL Control A
11	Rev
12	Protocol
13	BPS
14	Parity
15	Stop Bit
16	Data Length
17	Address

Content by Address				
Process (0~)				
Address	Parameter	Content	Setting range	Unit
0	System ID	product name	-	
1	Alarm Status	Alarm status information	Refer to Bit Information	
2	U Current	"U" phase load current value(Phase control only)	0 ~ CT max (X 10)	A
3	V Current	"V" phase load current value(Phase control only)	0 ~ CT max (X 10)	A
4	W Current	"W" phase load current value(Phase control only)	0 ~ CT max (X 10)	A
5	PWR LMT	Output limit set value	0 ~ 100	%
6	DIP SW Status	DIP switch set value	Refer to Bit Information	
7	OC VR	Overcurrent set value	0 ~ 200A (x10)	%
8	SOFT VR	Soft time set value	0 ~ 60	SEC
9	MV OUT	Output amount	0 ~ 100	%
10	LL Control A	Load deviation imbalance phase difference setting	5 ~ 20 (X 10)	A
11	Rev	Firmware version	FW version : difference 8 BIT, down 8 BIT	Ver.
12	Protocol	protocol	0 : MODBUS RTU, 1 : MOBUS ASCII	
13	BPS	Communication speed	0 : 9600, 1 : 19200 2 : 38400, 3 : 57600	BPS
14	Parity	Parity	0 : NONE , 1 : EVEN	
15	Stop Bit	Stop bit	0 : not used, 1 : 1BIT, 2 : 2BIT	BIT
16	Data Length	Data length	7 : 7 , 8 : 8	
17	Address	Equipment address	Address : 1 ~ 255	

- BIT Information

Parameter	Alarm Status	DIP SW Status
Address	1	6
Bit 0	-	-
Bit 1	OC Fail	OUT MODE (00 : not used , 01 : Variable period , 10 : Fixed cycle, 11 : Phase control)
Bit 2	LL Fail	
Bit 3	Over Temp 80	IN MODE (0 : 1 ~ 5 V, 1 : 4 ~ 20 mA)
Bit 4	Heat Short	
Bit 5	Power Fail	-

Bit 6	-	-
Bit 7	-	-
Bit 8 ~15	-	-