

**PION®**  
Registered  
ISO 9001:2015 14001:2015

# 1Phase 30~70A

Thyristor Power Controller  
User's manual

Rev P1EA0

PION-UL1W -030-□□

-050-□□

-070-□□



## Safety information

1. Before using this equipment, be sure to read the safety instructions carefully so that you can prevent safety risks or accidents.
2. When this equipment is installed and used in facility that may cause a huge loss or danger due to malfunction of this equipment, please install and use a separate protective facility for safety.
3. To prevent the electric shock of the equipment caused by an accident, make a 3-class grounding or special 3-class grounding to the outside of the equipment.
4. Make sure that the supply voltage of the power supply matches the rated voltage of this unit and that the load current is within the recommended range of the rated current of the unit.
5. After checking the control input wiring, turn on the control power. If there is no abnormality, make sure that the main input power and load wiring match the wiring method and turn on the power.

**The power supply is very dangerous when the load is open. Be sure to turn on the power after connecting the load.**



**The thyristor is short-circuited characteristically in case of a fault, which makes it impossible to control.**

**If there is no safety device on the outside in case of above, please make a separate safety device for fire and heater breakage due to overheating of the heater and please cut off the main power when not in use.**

### 6. FUSE

- (1) Please use our designated speed fuse for fire prevention and protection of equipment.  
- See the label by device
- (2) When replacing the fuse, be sure to replace after the main power and the control power of the equipment are turned off.

### 7. Operating environment

- (1) Since the operation guarantee temperature is 0°C ~ 50°C, please adjust the ventilation and ambient temperature so that the panel internal temperature does not exceed this. The rated current standard of the device is 45°C. If the ambient temperature exceeds this value, the load current should be lowered.
- (2) Do not install the unit in places where excessive humidity (20 ~ 85% RH) and condensation may occur when using the unit.
- (3) Do not install this product in locations subject to flammable, explosive, or corrosive gases, or where there are electrically conductive materials such as carbon or iron.
- (4) Install it away from high temperature.
- (5) Install it vertically for heat dissipation.

### 8. Arbitrary disassembly, modification and inspection of equipment

- (1) Do not replace any parts other than Fuse and Thyristor Module
- (2) When an error occurs, please request the warranty service to us.  
If the parts inside the device are arbitrarily replaced or manipulated, the product quality cannot be guaranteed.
- (3) Disconnect the power of the equipment and the main power before checking.
- (4) Loose bolts of the main power terminal, the load connection terminal, and the fuse terminal may increase the heat generation and damage the wiring or cause fire. Thus please check the status of the equipment.
- (5) Please be careful not to let foreign matter get inside the device.

9. This manual may be revised without notice to improve the performance of the device and must be kept with the device.

## (!) CAUTION

1. Please conduct an inspection when water has entered the product.  
(It may cause short circuits, fires, and malfunction.)
2. This controller should be used indoors.(It may shorten the controller's life or give an electric shock.)
3. Observe the rated voltage and specification.(It may cause a fire or shorten the controller's life.)
4. Be careful that any of foreign materials do not inflow into the controller.  
(It may cause a fire or malfunction of the controller.)
5. Do not give direct vibration or shock to the controller.  
(It may cause of malfunction of the controller)
6. Do not use chemical detergent or solvent, but use a dry towel in cleaning the controller.  
(It may cause an electric shock or a fire.)
7. Utilization category AC-1
8. Power supply should be insulated and limited voltage/current or Class 2,  
SELV power supply device.
9. Altitude max. 2,000m
10. Pollution degree 2
11. Relay output wires are at least 75 °C of heat resistance and use Copper wires from 18 AWG to 24 AWG.
12. Tighten the screw of the terminal is torque from 0.74 to 0.90 N·m

※ 한글 사용 설명서는 홈페이지([www.pioeng.com](http://www.pioeng.com))의 “자료실”에 업로드 되어 있습니다.

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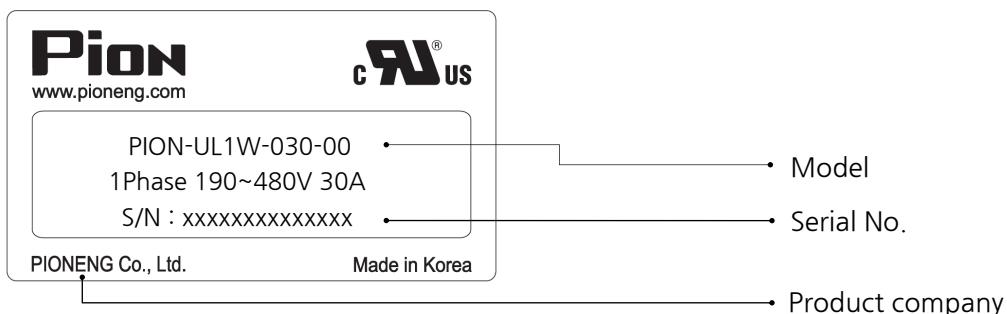
## 1. General

### 1. Device Ordering Model Codes

P | I | O | N - ① | ② | ③ - ④ | ④ | ④ - ⑤ | ⑤ | ⑤ | ⑤ | ⑤ - ⑥

Series	PION	Pion Series
Implementation	①	UL or UD : UL series
INPUT Type	②	1 : Single Phase 2 : Single Phase - 2 Legs 3 : Three Phase
INPUT Voltage (R or R.T)	③	W : AC Free Voltage (AC 190~480V)
Related Current	④	30 ~ 500A
Option	⑤	00 : Basic model D : DC FAN type (Excluding 1P 400,500A models) F : Fast response type I : Current feedback type T : Trans output type(U output data) V : Voltage feedback type P : Power feedback type 2 : two channels control type 3 : three channels control type S : Open delta wiring type C : Channel wiring type B : Fast channel output sensing type
	⑥	Combination of two letters and/or numbers Y : A through Z or 0 through 9 (YY) : S/W option type Blank : Basic type

### 2. Device Label Description



Device label contain basic information and customer service information about product.  
Device label attached bottom of front cover on the product.

## 2. Product Description

### 1. Main Feature

Division	Specification
SCR device	IXYS (USA) - V <sub>RRM</sub> 1600V
Rated Voltage	190~480 VAC ( R.T : Free Voltage )
Rated Current	30A, 50A, 70A
Operation Frequency	50/60 Hz (Automatic discriminating)
Control methods	Phase control, Zero crossing control, Combination control (phase + zero crossing)
Control Input signal	4~20mA, 1~5V, 0~5V, VR10 KΩ, MODBUS (ASCII/RTU)
Load types	Heater coupled load (Phase /Cycle ) Transformer coupled load (Phase), Inductive load (Phase)
Minimum load	More than 1A
Output range	0~99%
Output resolution	Signal (4~20mA etc) Control : 12Bit      MODBUS Control : 14Bit
Environment	Humidity : 20~90% (without condensation)      Ambient temperature : 0~50°C
Insulation Resistance	Power terminal ~ case : More than 200MΩ (at 500VDC)
Cooling method	Forced air cooling type (DC FAN) - With automatic Fan On/Off function (When heat sink temperature exceeds 40°C, FAN On and when it is below 30°C,FAN off)
Control power	35W (including FAN), 24VDC Class 2
Alarm Output	Alarm1,2 (1a 250VAC 3A) : Over Current, Over-heating alarm, Thyristor Failure Over-heating warning, Load open, FAN failure
Basic Function	<ul style="list-style-type: none"> <li>• Current display (True RMS)</li> <li>• Fuse disconnection alarm</li> <li>• RUN/STOP (Contact input)</li> <li>• Soft up/down(0~900sec)</li> <li>• Thyristor failure alarm</li> <li>• Over current setting</li> <li>• Soft start(0~900sec)</li> <li>• Manual output test</li> <li>• Elevation function</li> <li>• MODBUS (RS-485)</li> </ul> <ul style="list-style-type: none"> <li>• Input signal (4~20mA, 1~5V, 0~5V, VR10KΩ)</li> <li>• Equipped with automatic recovery circuit</li> <li>• Transformer coupled load MODE</li> <li>• Main switch (R.T) block display</li> <li>• Status display &amp; alarm display</li> <li>• Fuse speed internal mounting</li> <li>• Loads disconnection Alarm</li> <li>• Max output limit (0~100%)</li> <li>• Manual operation</li> </ul>
Option	<ul style="list-style-type: none"> <li>• Current limit (voltage feedback)</li> <li>• Current / Voltage / Power feedback</li> <li>• FAN (DC FAN) failure ( Excluding 400,500A models)</li> </ul>

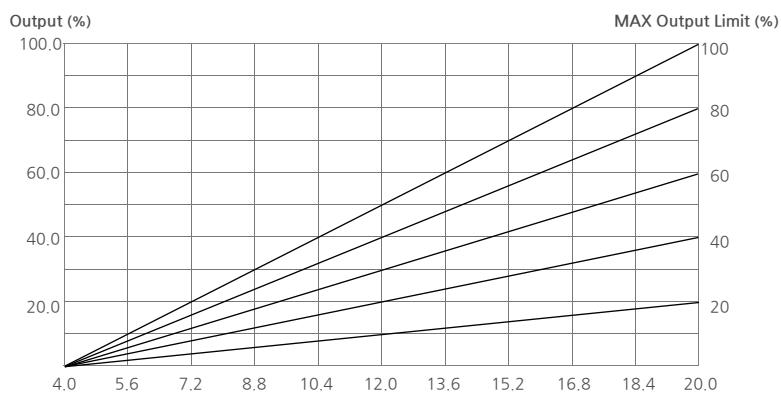
## 2. Product Description

### 2. Products factory settings

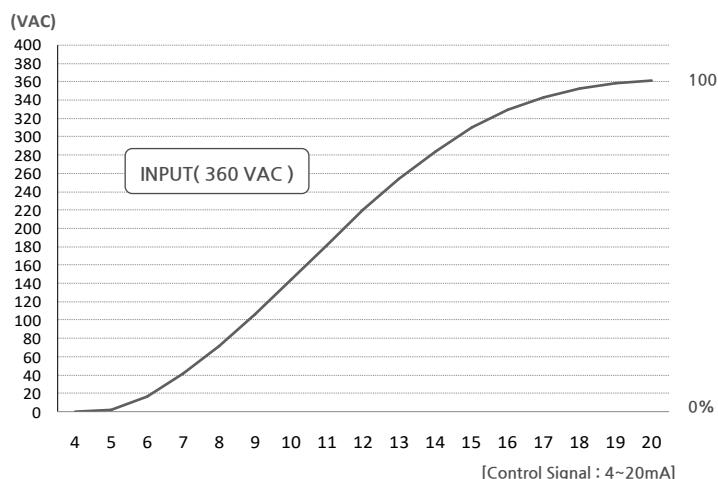
Function	Unit	Default	Reference Page
Max output limit	%	100	22
Soft start time	sec	3	24
Soft up time		2	24
Soft down time		2	24
Control signal		4~20mA	25
Over current	A	Max Value	23
Output display	A / %	Ampere	27
Control method		Phase control	26
Coupled load	Resistive / Inductive	Resistive	27
Attention Temperature alarm	°C	OFF	28
Simultaneous use of control signal & VR10K	ON/OFF	OFF	16
Inductive coupled load MODE	ON/OFF	OFF	27
Open Load alarm	A	OFF	28
MODBUS Function		OFF	17~21

### 3. Output Characteristic

(1) Max Output setting  
Characteristic



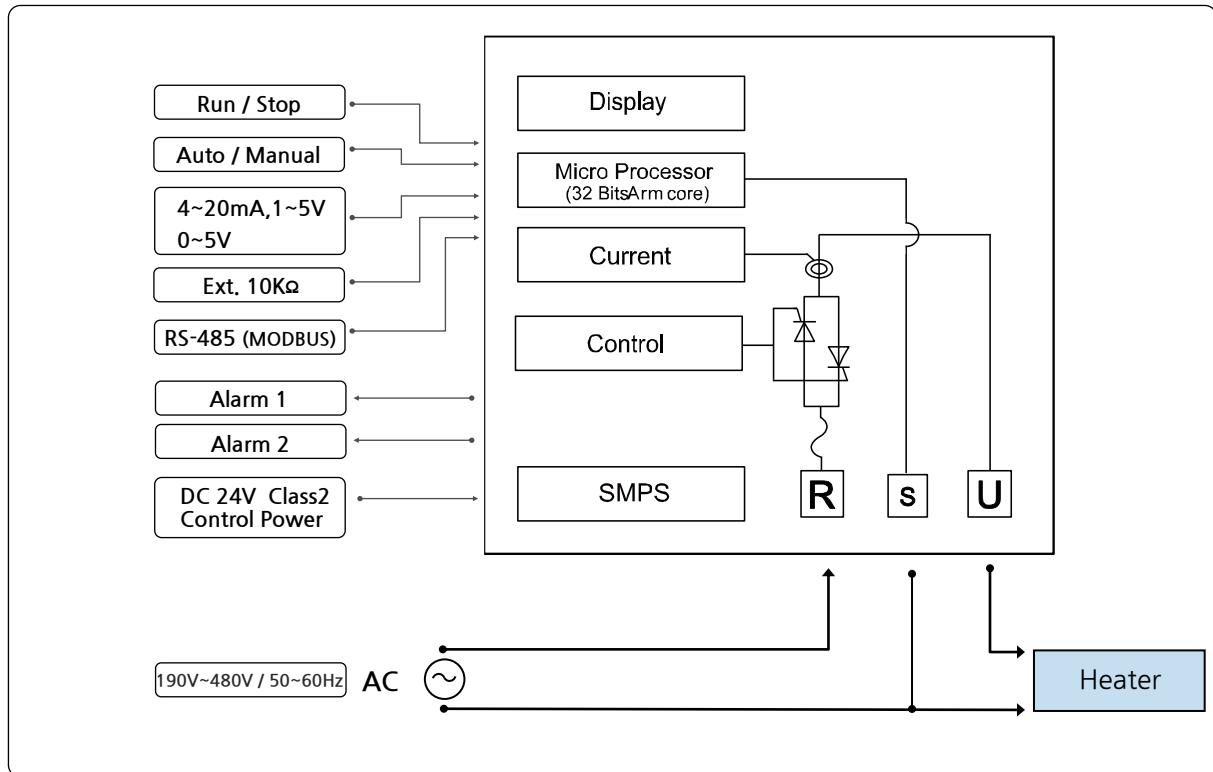
(2) Output voltage  
Depend on input signal



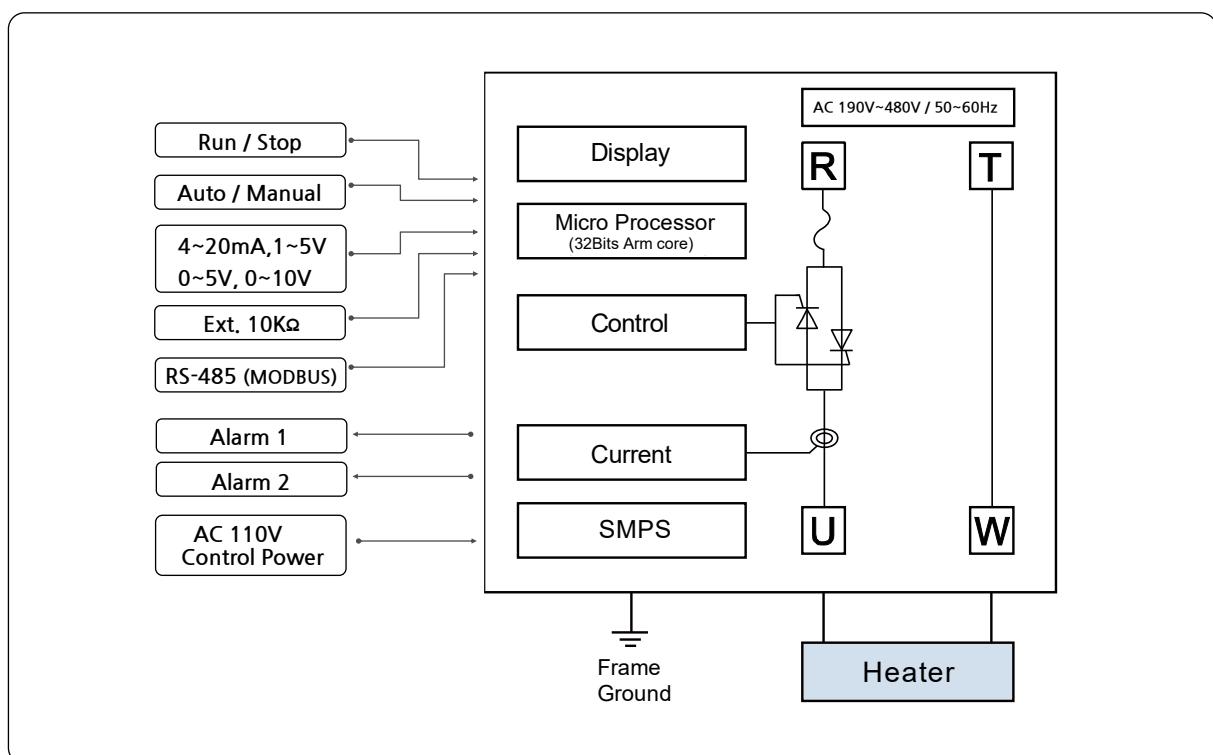
## 2. Product Description

### 4. System configuration

#### (1) Single Phase (30A~70A)

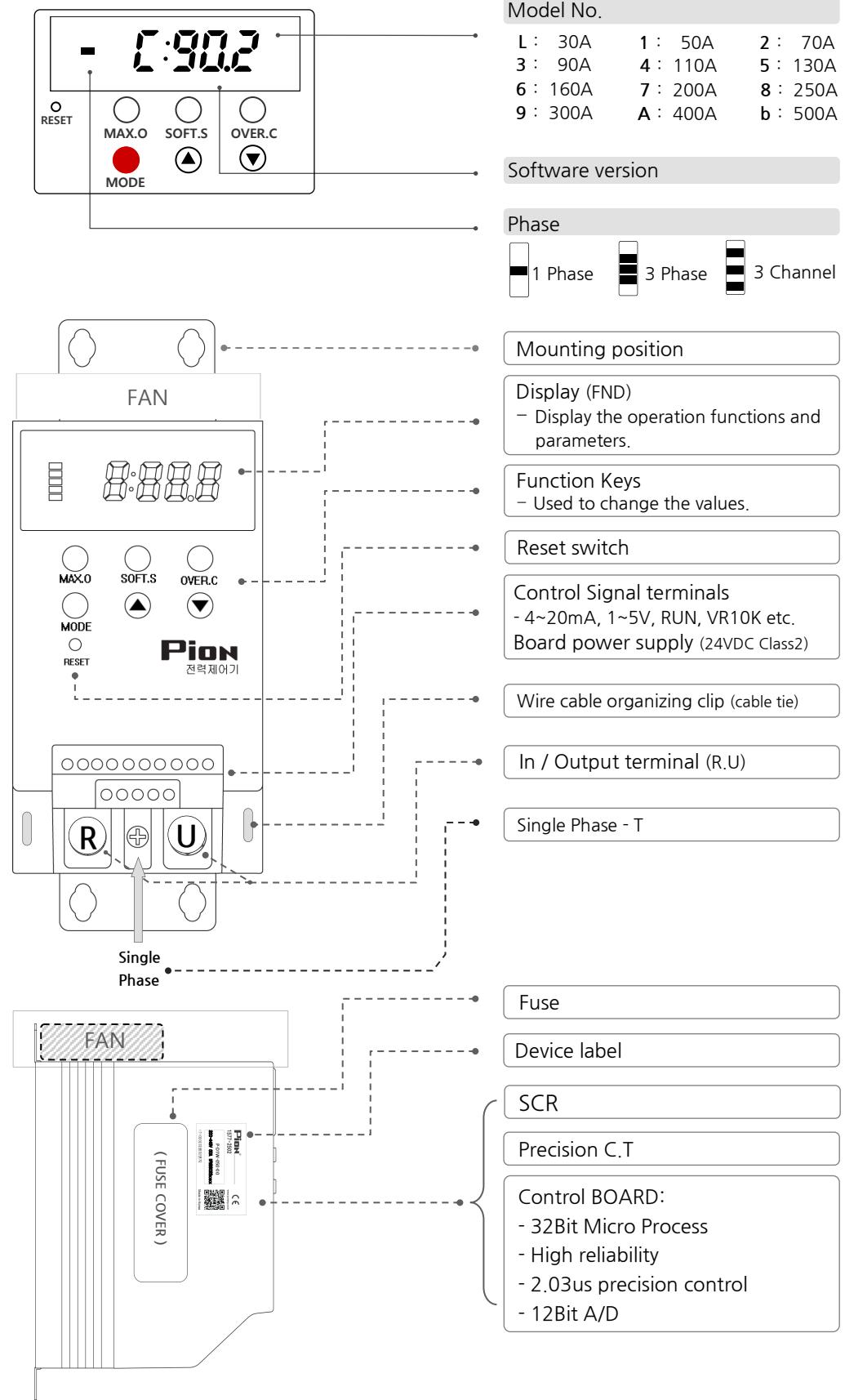


#### (2) Single Phase (90A~500A)



## 2. Product Description

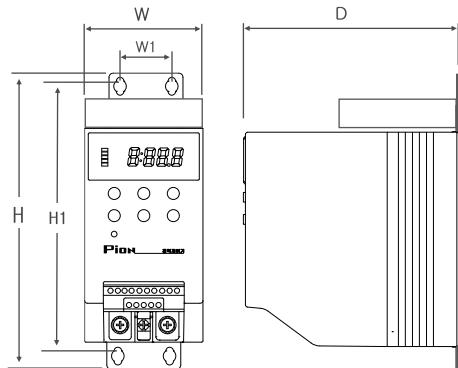
### 5. Power ON Display / Parts Description



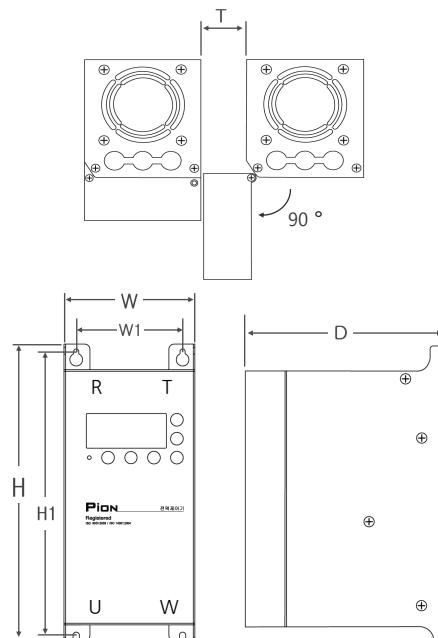
### 3. Install

#### 1. Dimension & Mounting

##### (1) Dimensions



[Single phase 30A~70A]



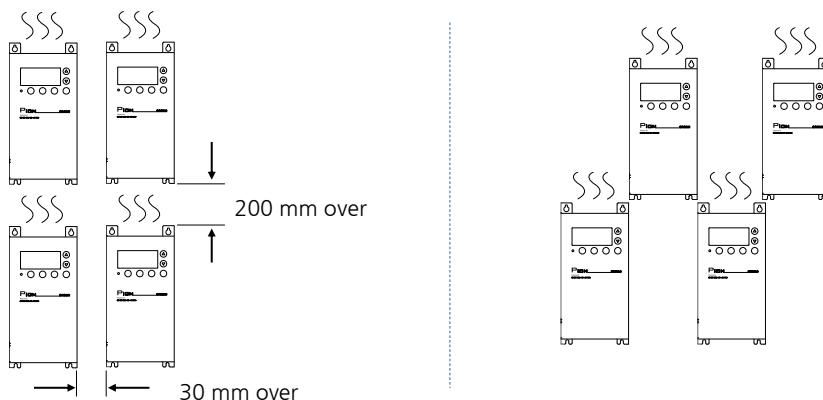
[ Single phase 90A~500A ]

Rated Current	W	H	D	W1	H1	T	kg	Attachment Bolt	Main Power Bolt
30,50,70	80	206	144	35	188	20	3	M4	M6/(S)M5
90,110, 130	124	282	190	101	270	30	5	M4	M6
160, 200	124	384	207	101	372	30	7	M4	M8
250, 300	166	409	210	143	397	50	10	M4	M8
400, 500	294	570	266	230	550	50	37	M6	M12

- PION-UL1W-030 / 050 / 070-0V (or OP) :

When using the voltage and power feedback option, please refer to the separate installation drawing(CAD) on the PIONENG website.

#### (2) Mounting



- To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.
- The instrument shall be mounted perpendicularly.
  - Do not block the ventilation openings.
  - When mounting more than 2 devices, must have gap at least 30 or 50 mm.

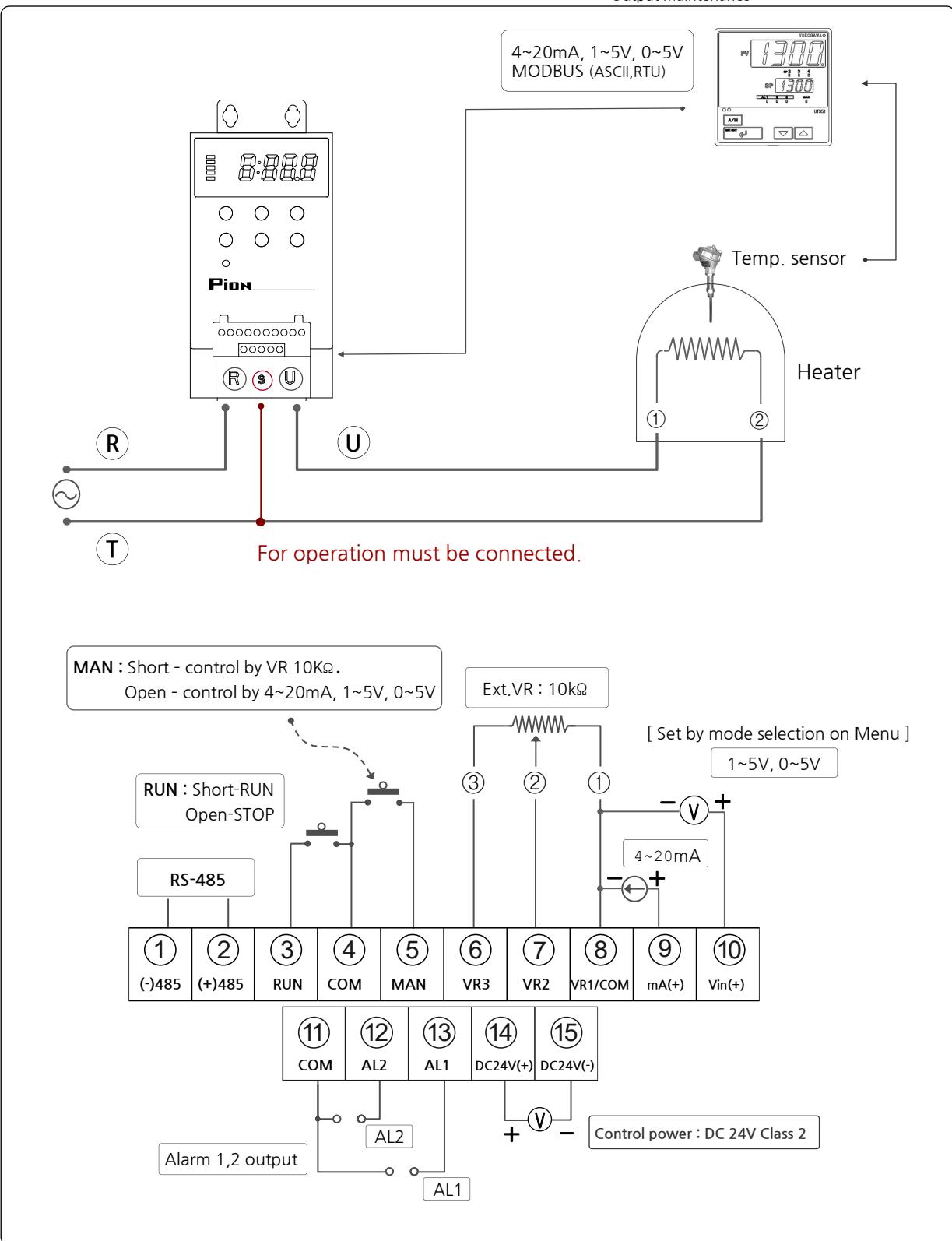
### 3. Install

#### 2. Control Terminals description & Flow chart of the operation

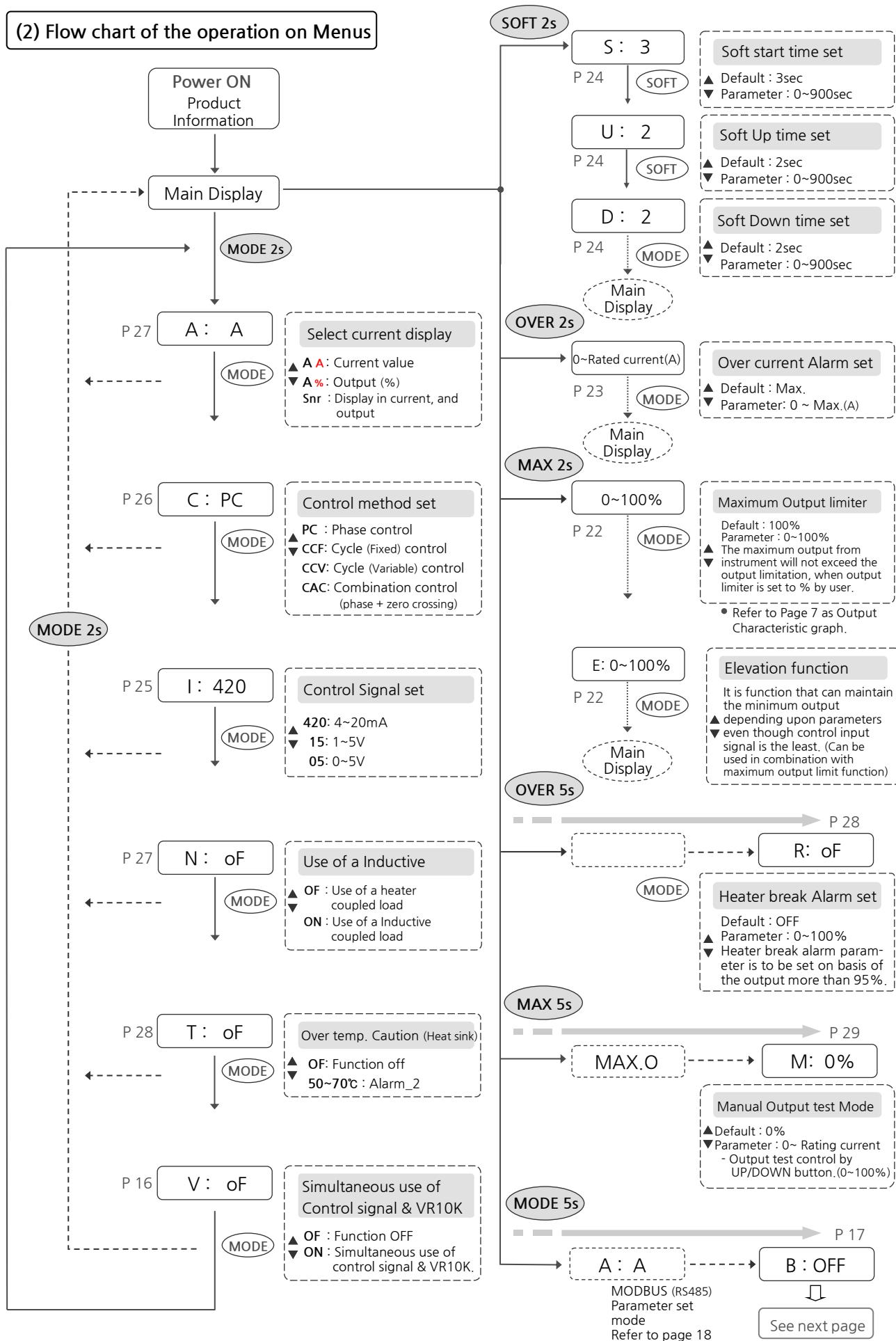
##### (1) Control Input Terminals Description

###### Alarm 1,2 : N.O (Normally Open)

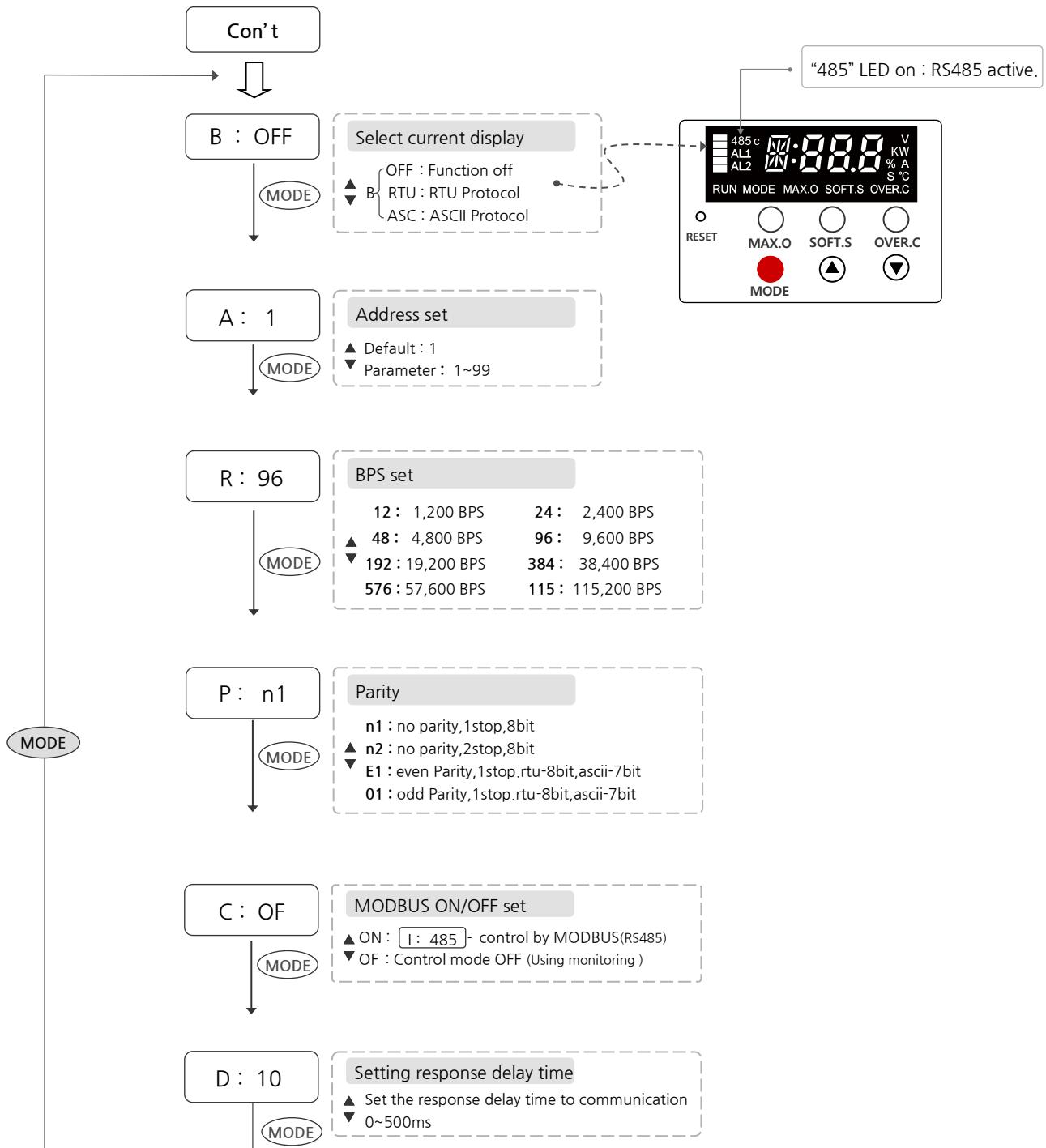
- AL1 : Over current, Over-heating alarm, Thyristor failure
  - Output cut off
- AL2 : Over-heating warning, FAN failure(option),Load open
  - Output maintenance



## (2) Flow chart of the operation on Menus



## 3. Install



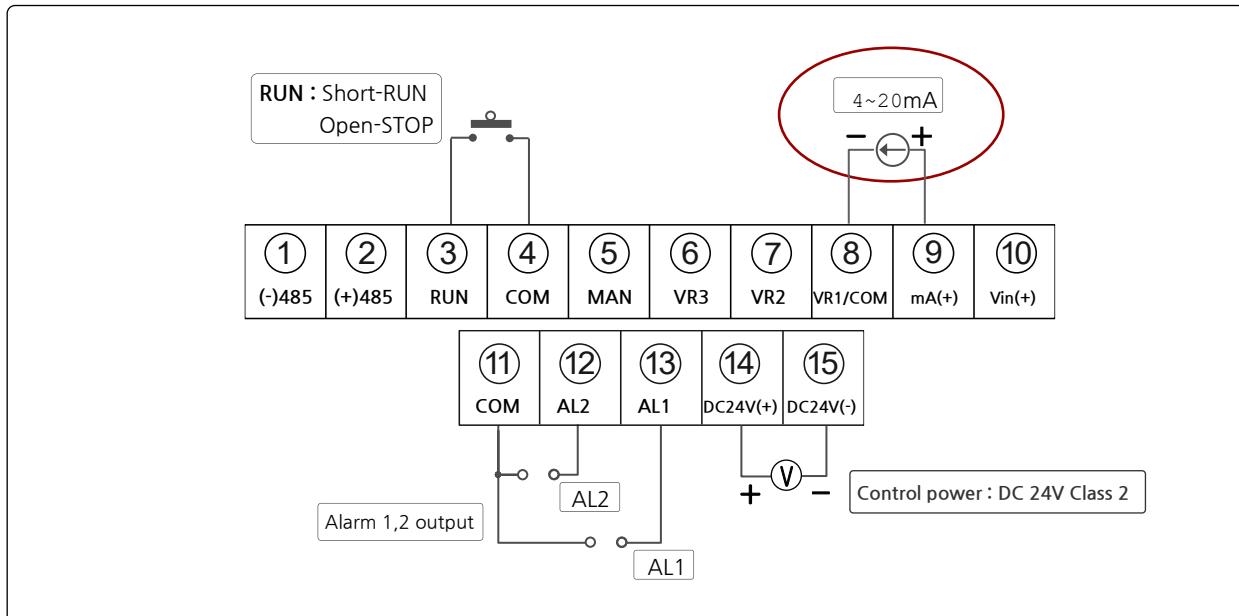
### 3. Install

#### 3. Control signal connection description

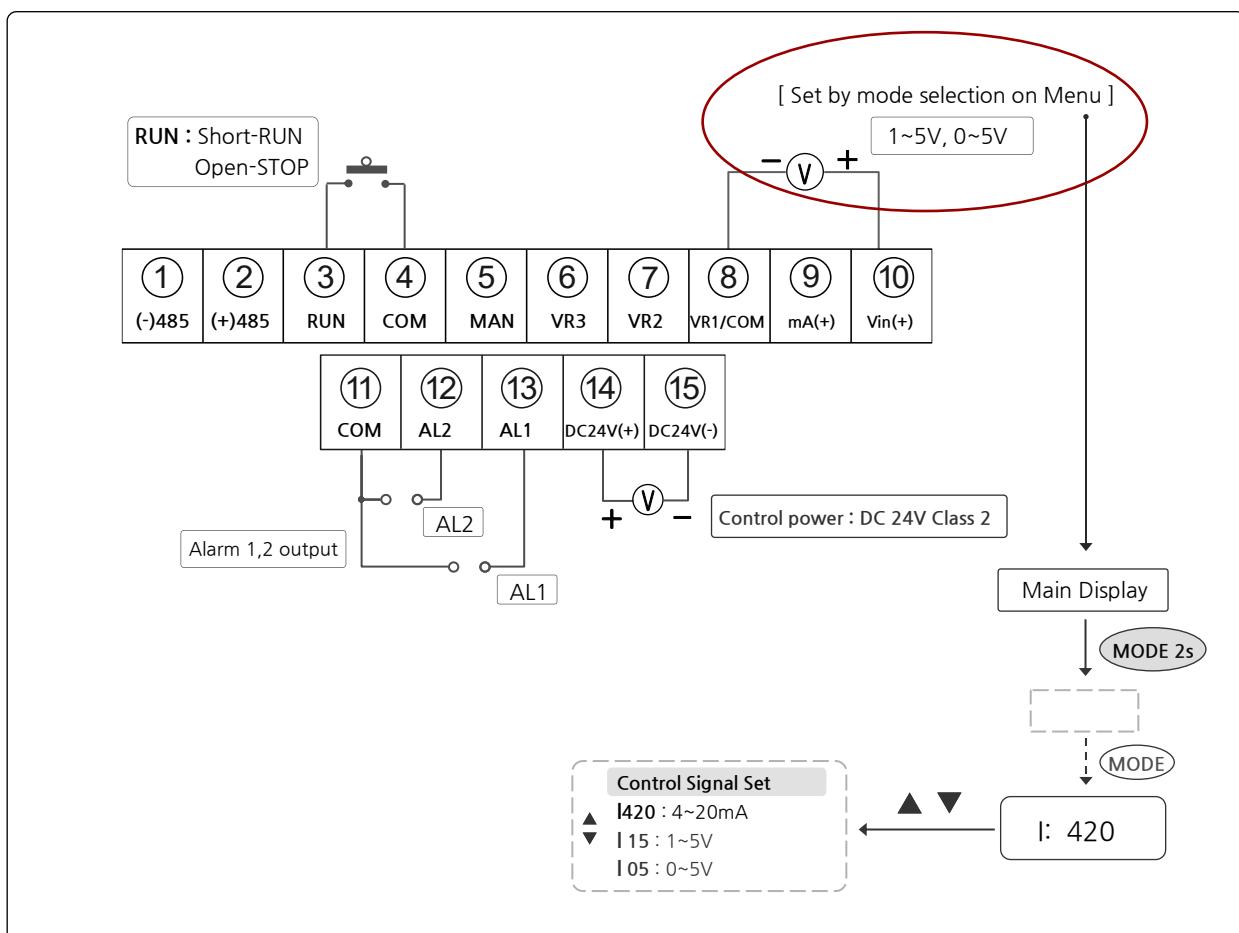
(1) Current input 4~20mA DC

Alarm 1,2 : N.O (Normally Open)

AL1 : Over current, Over-heating alarm, Thyristor failure  
   - Output cut off  
 AL2 : Over-heating warning, FAN failure(option), Load open  
   - Output maintenance



(2) Voltage input 1~5V , 0~5VDC



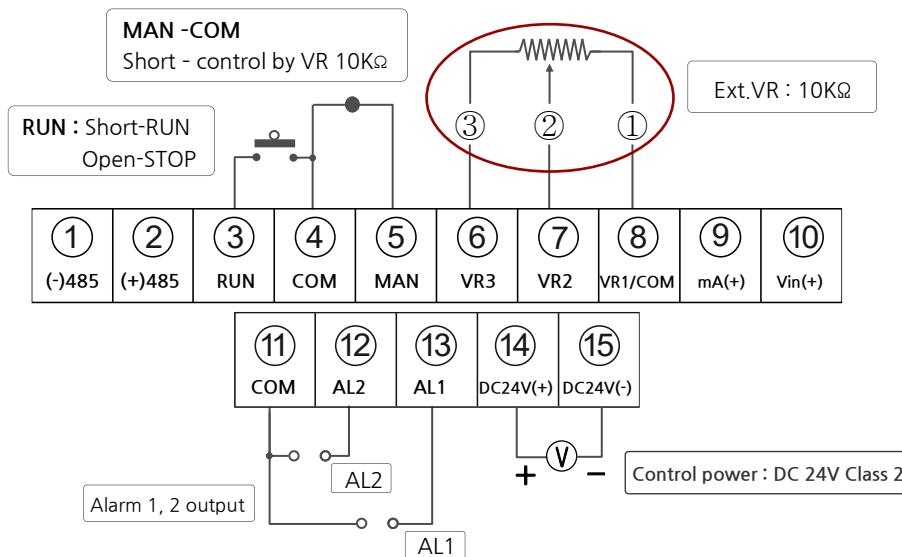
### 3. Install

#### 3. Control signal connection description

##### (3) External VR10K input

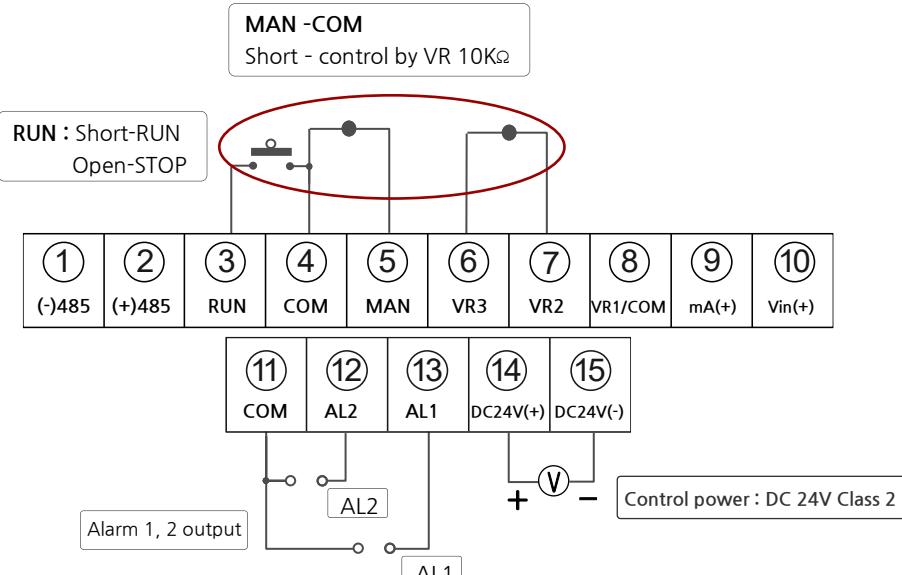
##### Alarm 1,2 : N.O (Normally Open)

AL1 : Over current, Over-heating alarm, Thyristor failure  
 - Output cut off  
 AL2 : Over-heating warning, FAN failure(option), Load open  
 - Output maintenance



- For using external VR10K, short connector pin4 (COM) with connector pin5 (MAN).

##### (4) Relay ON/OFF control

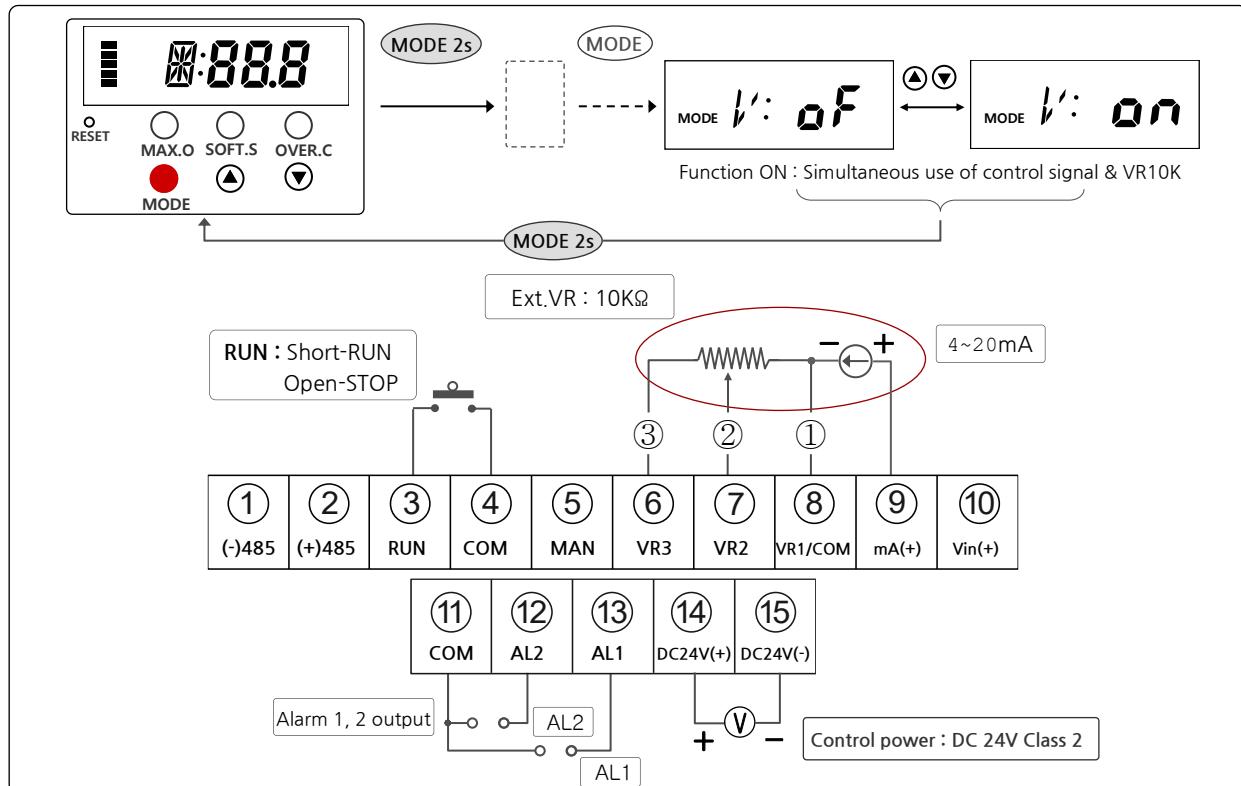


- To run using RUN pin with RELAY, it also using MAX.O or VR10K with short connector pin6 (VR3) and pin7 (VR3).

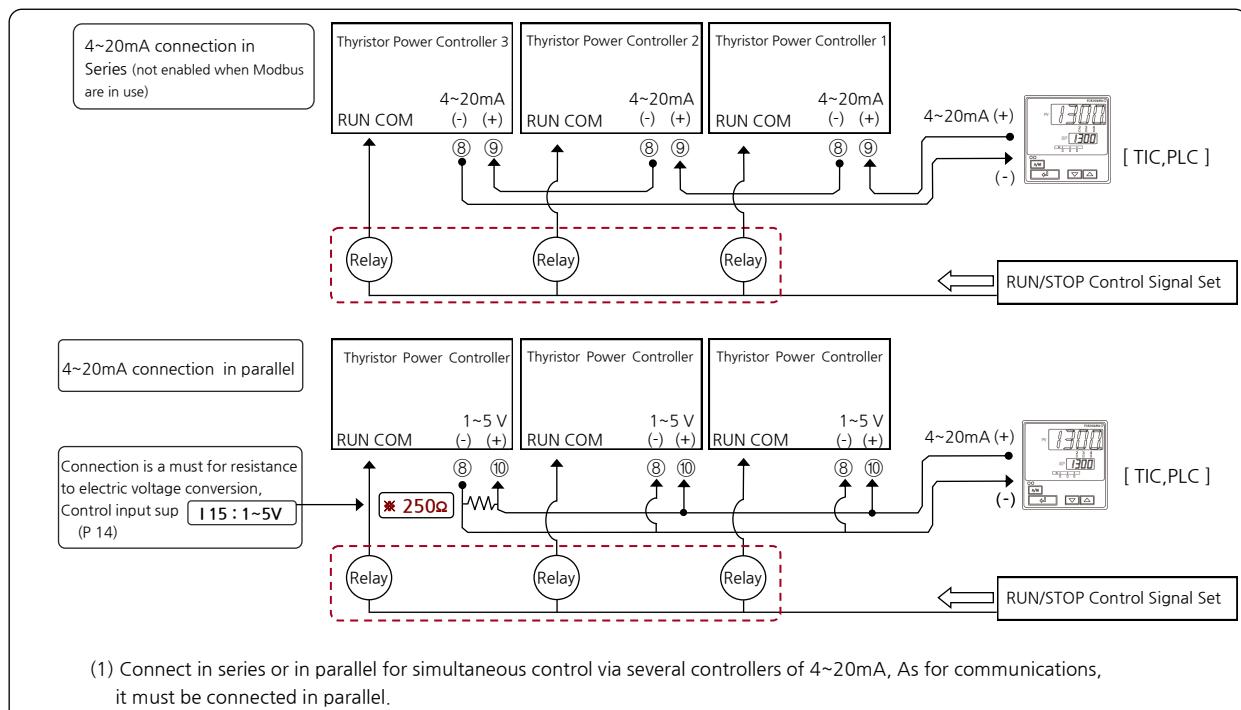
### 3. Install

#### 3. Control signal connection description

##### (5) Simultaneous use of control signal & VR10K



##### (6) For simultaneous control of several power controllers by use with single unit of 4~20mA



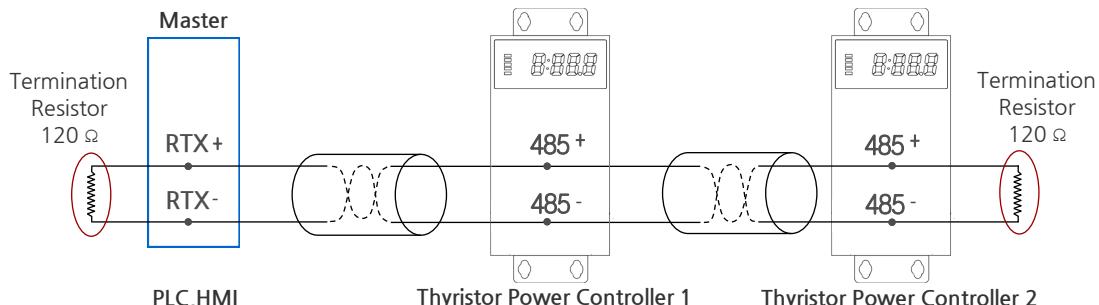
### 3. Install

#### 3. Control signal connection description

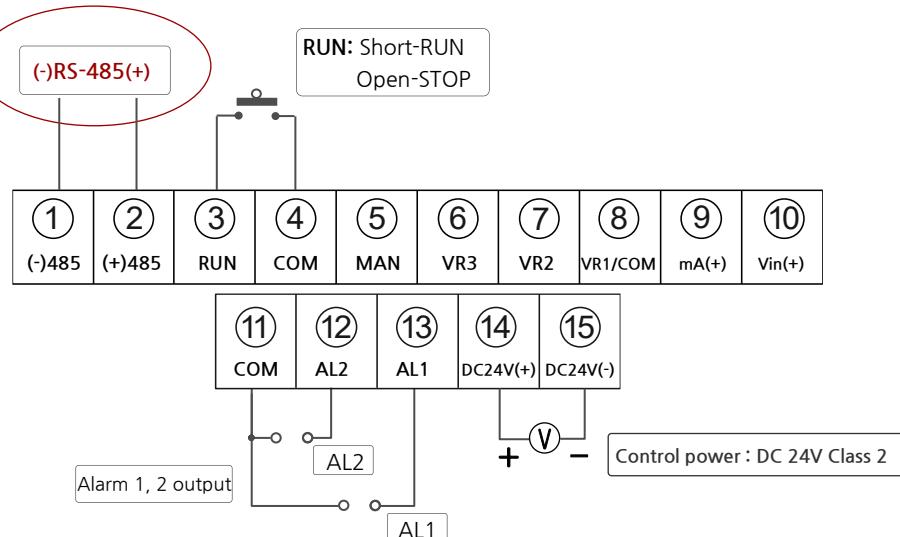
##### (6) MODBUS (RS-485) control

##### Alarm 1,2 : N.O (Normally Open)

- AL1 : Over current, Over-heating alarm, Thyristor failure
  - Output cut off
- AL2 : Over-heating warning, FAN failure(option), Load open
  - Output maintenance



- Connect termination resistor to termination with 120Ω 1/4(W) as above.
- Use a shielded wire. => It may cause a communication error.



After pressing MODE button more than 5sec, will be entered MODBUS (RS-485) communication protocol parameter setting mode.



##### Example) The setting sequence in case you want to control output via communication.

- 1) In case communication function is set at communication setting mode (Mode key 5 seconds), It becomes communication possible state.
- 2) In order to control Thyristor output via communication, select and set C: on at the communication setting mode or write 1 on MC register (address 201).
- 3) Cause short circuit to RUN terminal 3,4
- 4) Write 1 on R register (address 202).
- 5) In case of three phase or single phase, write the output control value (the value between 0~10000) on SC register (address 401). In case of 3CH, write control output value on RC (address 400), SC (address 401), and TC register (address 402).
- 6) In case of feedback control, there are two ways, one way is the way mentioned 5 above and the other way is writing the value of control current/voltage/power directly on FTH:FTL register (address 433:434).

## MODBUS Data Format

## &lt;&lt; Data Format &gt;&gt;

		Output Off : 0x0000 Output On : 0xff00						
1. Read Discrete Inputs Read Coils	Request	Device ID	Function Code(2, 1)	Start Addr Hi byte	Start Addr Lo byte	No. of Inputs-Hi byte	No. of Inputs-Lo byte	Error Check
	Response	Device ID	Function Code(2, 1)	No. of Bytes (n)	Byte 1	~~~	Byte n	Error Check
2. Write Single Coil	Request	Device ID	Function Code(5)	Addr Hi byte	Addr Lo byte	Output Hi byte	Output Lo byte	Error Check
	Response	Device ID	Function Code(5)	Addr Hi byte	Addr Lo byte	Output Hi byte	Output Lo byte	Error Check
3. Write Multiple Coils	Request	Device ID	Function Code(15)	Start Addr Hi byte	Start Addr Lo byte	No. of Coils-Hi byte	No. of Coils-Lo byte	No. of bytes (n)
		byte 1	~~~	byte n	Error Check			
	Response	Device ID	Function Code(15)	Start Addr Hi byte	Start Addr Lo byte	No. of Coils-Hi byte	No. of Coils-Lo byte	Error Check
4. Read Input Registers Read Holding Registers	Request	Device ID	Function Code(4, 3)	Start Addr Hi byte	Start Addr Lo byte	No. of Regs-Hi byte	No. of Regs-Lo byte	Error Check
	Response	Device ID	Function Code(4, 3)	No. of Bytes (n)	1st Reg Hi byte	1st Reg Lo byte	~~~	Error Check
5. Write Single Register	Request	Device ID	Function Code(6)	Addr Hi byte	Addr Lo byte	Reg Hi byte	Reg Lo byte	Error Check
	Response	Device ID	Function Code(6)	Addr Hi byte	Addr Lo byte	Reg Hi byte	Reg Lo byte	Error Check
6. Write Multiple Registers	Request	Device ID	Function Code(16)	Start Addr Hi byte	Start Addr Lo byte	No. of Regs-Hi byte	No. of Regs-Lo byte	No. of bytes (n)
		1st Reg Hi by	1st Reg Lo byte	~~~	Error Check			
	Response	Device ID	Function Code(16)	Start Addr Hi byte	Start Addr Lo byte	No. of Regs-Hi byte	No. of Regs-Lo byte	Error Check
7. Read/Write Multiple Registers	Request	Device ID	Function Code(23)	Read Start Addr Hi byte	Read Start Addr Lo byte	No. of Read Regs-Hi	No. of Read Regs-Lo	Write Start Addr Hi byte
		Write Start Addr Lo byte	No. of Write Reg-Hi byte	No. of Write Reg-Lo byte	No. of Write bytes(n)	1st Reg Hi byte	1st Reg Lo byte	~~~
		Error Check						
	Response	Device ID	Function Code(23)	No. of Read Bytes(n)	1st Reg Hi byte	1st Reg Lo byte	~~~	Error Check
8. Error		Device ID	Function Code+0x80	Exception Code	Error Check			

## &lt;&lt; Supported Function Codes &gt;&gt;

구 분	Function Code	Start Address
Read Only (Input Discrete)	2	100
Read/Write (Coils)	1, 5, 15	200
Read Only (Input Registers)	4	300
Read/Write (Holding Registers)	3, 6, 16, 23	400
Error Function Code	Function code + 0x80	

## &lt;&lt; Exception Code &gt;&gt;

Exception Code	Exception Code
Function Code Error	1
Data Address Error	2
No. of Data Error	3
Read/Write Error	4

## &lt;&lt; Function Code &gt;&gt;

		Function Code
Bit Access	Read Discrete Inputs	2
	Read Coils	1
	Write Single Coil	5
	Write Multiple Coils	15
Word (16 bits) Access	Read Input Registers	4
	Read Holding Registers	3
	Write Single Register	6
	Write Multiple Registers	16
	Read/Write Multiple Registers	23

## &lt;&lt; Reference &gt;&gt;

MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b3  
MODBUS over Serial Line Specification and Implementation Guide V1.02

## MODBUS Example

## 1. Example - RTU

No.	Function	Function Code	Example	Request	Response	비고
1	Read Discrete Inputs	2	Start Address 100 Read 10 Inputs	01 02 00 64 00 0A B9 D2	01 02 02 00 00 B9 B8	100- 1st byte bit0(LSB) 101- 1st byte bit1 102- 1st byte bit2 103- 1st byte bit3 104- 1st byte bit4 105- 1st byte bit5 106- 1st byte bit6 107- 1st byte bit7(MSB) 108 - 2nd byte bit0 109 - 2nd byte bit1
2	Read Coils	1	Start Address 200 Read 10 Coils	01 01 00 C8 00 0A 3D F3	01 01 02 00 00 B9 FC	In the same way as above
3	Read Input Registers	4	Start Address 300 Read 10 Registers	01 04 01 2C 00 0A B0 38	01 04 14 00 00 00 00 00 07 00 00 00 26 00 00 00 00 00 00 00 00 00 00 67 CB	
4	Read Holding Registers	3	Start Address 400 Read 10 Registers	01 03 01 90 00 0A C4 1C	01 03 14 00 00 00 00 00 00 00 64 00 1E 00 03 00 02 00 02 00 23 00 55 33 6E	
5	Write Single Coil	5	Address 201 Write 1 Coil	01 05 00 C9 FF 00 5C 04	01 05 00 C9 FF 00 5C 04	00 00 : OFF FF 00 : On
6	Write Multiple Coils	15	Start Address 201 Write 2 Coils	01 0F 00 C9 00 02 01 00 02 87	01 0F 00 C9 00 02 04 34	
7	Write Single Register	6	Address 403 Write 1 Register	01 06 01 93 00 50 78 27	01 06 01 93 00 50 78 27	
8	Write Multiple Registers	16	Start Address 403 Write 5 Registers	01 10 01 93 00 05 0A 00 64 00 1E 00 03 00 02 00 02 53 A9	01 10 01 93 00 05 F1 DB	

## 2. Example - ASCII

No.	Function	Function Code	Example	Request	Response	비고
1	Read Discrete Inputs	2	Start Address 100 Read 10 Inputs	3A 30 31 30 32 30 30 36 34 30 30 30 41 38 46 0D 0A	3A 30 31 30 32 30 32 30 30 30 30 46 42 0D 0A	
2	Read Coils	1	Start Address 200 Read 10 Coils	3A 30 31 30 31 30 30 43 38 30 30 30 41 32 43 0D 0A	3A 30 31 30 31 30 32 30 30 30 30 46 43 0D 0A	
3	Read Input Register	4	Start Address 300 Read 10 Registers	3A 30 31 30 34 30 31 32 43 30 30 30 41 43 34 0D 0A	3A 30 31 30 34 31 34 30 30 30 30 30 30 30 30 30 30 30 37 30 30 30 30 30 32 36 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 42 41 0D 0A	
4	Read Holding Registers	3	Start Address 400 Read 10 Registers	3A 30 31 30 33 30 31 39 30 30 30 30 41 36 31 0D 0A	3A 30 31 30 33 31 34 30 32 33 30 30 35 35 37 30 0D 0A	
5	Write Single Coil	5	Address 201 Write 1 Coil	3A 30 31 30 35 30 30 43 39 46 46 30 30 33 32 0D 0A	3A 30 31 30 35 30 30 43 39 46 46 30 30 33 32 0D 0A	
6	Write Multiple Coils	15	Start Address 201 Write 2 Coils	3A 30 31 30 46 30 30 43 39 30 30 30 32 30 31 30 30 32 34 0D 0A	3A 30 31 30 46 30 30 43 39 30 30 30 32 32 35 0D 0A	
7	Write Single Register	6	Address 403 Write 1 Register	3A 30 31 30 36 30 31 39 33 30 30 36 34 30 31 0D 0A	3A 30 31 30 36 30 31 39 33 30 30 36 34 30 31 0D 0A	
8	Write Multiple Registers	16	Start Address 403 Write 5 Registers	3A 30 31 31 30 30 31 39 33 30 30 30 35 30 41 30 30 36 34 30 30 31 45 30 30 30 33 30 30 30 32 30 30 30 32 43 33 0D 0A	3A 30 31 31 30 30 31 39 33 30 30 30 35 35 36 0D 0A	

## MODBUS Map (Rev 6.8)

Access	Functions	Address	Descriptions	Default	Remarks
		Dec	Hex		
1 Bit	Read Only (Input Discrete)	100	0064	OR Load Open alarm - R	0
		101	0065	OS Load Open alarm - S	0
		102	0066	OT Load Open alarm - T	0
		103	0067	OF Over heating alarm	0
		104	0068	OC Over Current alarm	0
		105	0069	LO Open Load alarm	0
		106	006A	OA Temperature Alarm	0
		107	006B	FW Failure FAN alarm	0
		108	006C	IM Manual Terminal Contact(1:On)	0
		109	006D	IR RUN Terminal Contact(1:On)	0
		110	006E	FN Fan Status (1: On 0: OFF)	0
		111	006F	Rb Thyristor Failure or leakage R	0
		112	0070	Sb Thyristor Failure or leakage S	0
		113	0071	Tb Thyristor Failure or leakage T	0
		114	0072	OCr Over Current alarm - R	0
		115	0073	OCs Over Current alarm - S	0
		116	0074	OCT Over Current alarm - T	0
		117	0075	LOR Open Load alarm - R	0
		118	0076	LOT Open Load alarm - S	0
		119	0077	LOT Open Load alarm - T	0
		120	0078	ACOF Main Power Status(1:Off)	0
		121	0079	tmb Temperature sensor failure of the heat sink	0
		122	007A	TCOF 4~20mA, 1~5V no input	0
		123	007B	Ovr Over voltage alarm - R	0
		124	007C	Ovs Over voltage alarm - S	0
		125	007D	Ovt Over voltage alarm - T	0
		126	007E	Sts Status - Run(1) / Stop(0)	0
		127	007F	Cta CT Failure alarm	0
		128	0080	Vta VT Failure alarm	0
		129	0081	Ar AC lost R	0
		130	0082	As AC lost S	0
		131	0083	At AC lost T	0
16 Bits (Word)	Read/Write (Coils)	200	00C8	RS Reset (1) (Maintaining a'1 until the Write"0")	1
		201	00C9	MC When MC is "1", the MODBUS can control. Only when MC is "1", registers that can be written. -R (address 202), FC (address 203) RC/SC/TC (address 400~402) FTH"FTL (address 433:434)	0
		202	00CA	R Run (1)	1
		203	00CB	FC Enable the manual terminal(3,4) to select a control input signal when FC is '1'.(only available when MC is '1')	0
		204	00CC	SP Outputs the value from the AP1,2 to alarm relay(1)	0
		205	00CD	AP1 This value is output to the ALARM1 (if SP'1')	0
		206	00CE	AP2 This value is output to the ALARM2 (if SP'1')	0
		207	00CF	ML Max Output limite function by the Manual Volume. on (1)	0
		300	012C	M MODEL No.	-
		301	012D	PS 3P (0), 1P (1), 3CH (3)	0
16 Bits (Word)	Read Only (Input Registers)	302	012E	CT CT Option: S(2),RT(5),RST(7)	7
		303	012F	VT VT Option : VT (8)	0
		304	0130	CM Rated Current (A)	-
		305	0131	RO Output Value - R (0~10000)	0
		306	0132	SO Output Value - S (0~10000)	0
		307	0133	TO Output Value - T (0~10000)	0
		308	0134	- NA	0
		309	0135	- NA	0
		310	0136	- NA	0
		311	0137	F Frequence x 100 (Hz)(ex. 59.99Hz - 5999)	0
		312	0138	vv Voltage (ex. 15.4V - 154)	0
		313	0139	T Temperature(-30~150)	0
		314	013A	Di1 Input Discrete(Address 100~115) b15~b8 : Address 107~100 b7~ b0 : Address 115~108	-
		315	013B	Di2 Input Discrete(Address 116~131) b15~b8 : Address 123~116 b7~ b0 : Address 131~124	-
		316	013C	ra Current - R (ex. 10.1A - 101)	0
		317	013D	sa Current - S (ex. 10.1A - 101)	0
		318	013E	ta Current - T (ex. 10.1A - 101)	0
		319	013F	PH Watt - High Word	0
		320	0140	PL Watt - Low Word	0
		321	0141	aa Current - Average (ex. 10.1A - 101)	0
		322	0142	rv Voltage- R (0.1V Resolution)	0
		323	0143	sv Voltage - S (0.1V Resolution)	0
		324	0144	tv Voltage - T (0.1V Resolution)	0
		325	0145	PrH Power - R High Word	0
		326	0146	Prl Power - R Low Word	0
		327	0147	Psh Power - S High Word	0
		328	0148	Pst Power - S Low Word	0
		329	0149	Pth Power - T High Word	0
		330	014A	Ptl Power - T Low Word	0
		331	014B	FV Firmware version	-
		332	014C	LM VR 10K (Terminal 8-7)	0
		333	014D	LC 4~20mA (Terminal 8-9)	0
		334	014E	LV Vin (Terminal 8-10)	0
		335	014F	-	-
		336	0150	-	-
		337	0151	-	-
		338	0152	-	-
		339	0153	P1 Reserved	-
		340	0154	R0 Reserved	-
Read/Write (Input Registers)		341	0155	M1 Reserved	-
		342	0156	rH Resistance R High word	-
		343	0157	rL Resistance R Low word	-
		344	0158	sH Resistance S High word	-
		345	0159	sL Resistance S Low word	-
		346	015A	tH Resistance T High word	-
		347	015B	tL Resistance T Low word	-

Access	Functions	Address	Descriptions	Default	Remarks
		Dec	Hex		
16 Bits (Word)	Read/Write (Holding Registers)	400	0190	RC	Control output value - R (0~10000) If the MODBUS_Control(MC) is 1, then the control output(RC,SC,TC) will be operate.
		401	0191	SC	Control output value - S (0~10000) If this is not 3CH, control outputs use only S_Phase.
		402	0192	TC	Control output value - T (0~10000)
		403	0193	MO	MAX Limite value (0~100) (except 3CH) Address 422~424 used for setting respective channels in case of 3CH
		404	0194	OCS	Over current (0~Rated current) (A) 3CH - Over Current R.phase
		405	0195	SS	SoftStart time (0~900_sec) 3
		406	0196	SU	SoftUp time (0~900_sec) 2
		407	0197	SD	SoftDown_time (0~900_sec) 2
		408	0198	FT	Fan Operation Temperature (30~60, 0: On) 37, 40
		409	0199	FA	Over heating ALARM (65~90) 80, 85
		410	019A	CI	Control signal: 4~20mA(0), 1~5v(1), 0~10v(3), 3CH(4), 485(5)
		411	019B	CT	Phase control(0), FIXED cycle control(1), Variable cycle control(2), Current feedback(3), Voltage feedback(4), Power feedback(5), Current limit(6) 0
		412	019C	LC	NA -
		413	019D	WT	Over heating attention alarm (50~70, 0: Off) 0
		414	019E	CoI	Coils (Address 200~207) b15~b8 : Address 207~200 Data b7 ~b0 : Address 207~200 Write Enable - To write a Coils area units are available in Word, after the "We" bit to '1'.(ex. Run : 0x0404) Set the bit in the lower byte to "1" that corresponds to the address to write and write the bit data of the corresponding address to the upper byte.(ex. Run : 0x0404, Stop : 0x0004)
		415	019F	MB	MODBUS Control mode : Off(0), RTU(1), ASCII(2) 0
		416	01A0	MA	ID : 1~99 1
		417	01A1	MR	BaudRate : 1200 (0), 2400 (1), 4800 (2), 9600 (3) 19200 (4), 38400 (5), 57600 (6), 115200 (7) 3
		418	01A2	MP	Parity/Stop : 0- Even Parity, 1_stop, rtu 8bit, ascii 7bit 1- Odd Parity, 1_stop, rtu 8bit, ascii 7bit 2- No Parity, 1_stop, 8bit 3- No parity, 2_stop, 8bit 2
		419	01A3	Tx	Transmission output MAX current(option) 0~Rated current(A) CM
		420	01A4	Txs	Current display (By Transmission) : 0- Average current 1- R Phase current 2- S Phase current 3- T Phase current 4- Average output 8- Voltage 12- Power 0
		421	01A5	Txa	Transmission output tuning : 0~99~198 (-99~0~99) 200
		422	01A6	MOr	Output limit(%) - R (0~100) (3CH Only) 100
		423	01A7	MOs	Output limit(%) - S (0~100) (3CH Only) 100
		424	01A8	MOT	Output limit(%) - T (0~100) (3CH Only) 100
		425	01A9	PC	Feedback control output current max value (A) (1~Rated current) - ex) 102 - 10.2A
		426	01AA	PV	Feedback control output voltage max value (V) (1~500V) 380 ex) 10 - 10V
		427	01AB	PW	Feedback control output power max value (KW) (1~Rated power) ex) 103 - 10.3KW - 3P Model power : (Model current x 480 x 1.732) / 100 1P Model power : (Model current x 480) / 10
		428	01AC	PP	Feedback control Kp (1~250) 65
		429	01AD	PI	Feedback control Ki (0~250) 35
		430	01AE	PD	Feedback control Kd (0~250) 20
		431	01AF	PT	Feedback control PID control Type 0 - Original PID control 1- Modified PID control 1
		432	01B0	CE	Feedbackcontrol Modified PID control - counter (1~100) -
		433	01B1	FTH	Feedback control Target High Word 0
		434	01B2	FTL	Feedback control Target Low Word 0
		435	01B3	Lr	Open load alarm current R (A) (ex 125 > 12.5A) (0:off) 0 ex) 125 -> 12.5A
		436	01B4	Ls	Open load alarm current S (A) (ex 125 > 12.5A) (0:off) 0 ex) 125 -> 12.5A
		437	01B5	Lt	Open load alarm current T (A) (ex 125 > 12.5A) (0:off) 0 ex) 125 -> 12.5A
		438	01B6	Ai	Current input adjustment(0~400) (4~20mA, 1~5v, 0~5v, 0~10v) 200
		439	01B7	Ac	Current value adjustment(0~400) 200
		440	01B8	Av	Voltage value adjustment(0~400) 200
		441	01B9	RWT	Response wait time (ms) (0~500) 10 Response Time = proceeding time + RWT + data transmission time
		442	01BA	EV	Elevation (0~100) 0 Output = Elevation + Control output
		443	01BB	OV	Over Voltage (30~500V, 0:off) 0
		444	01BC	Drs	Data Resolution ( 0 : 0.1, 1 : 0.01 ) 0 The resolution will be set for currents (ra,sa,ta,aa), voltage(rv,sv,tv,vv), and electricity (PH:PL, PrH:PrL,PsH:PsL, PtH:Ptl)
		445	01BD	PVr	Feedback control output voltage max value (V) (1~500) R 380 ex) 10 - 10V
		446	01BE	Pvt	Feedback control output voltage max value (V) (1~500) T 380 ex) 10 - 10V
		447	01BF	Coi2	Coils (Address 208~215) b15~b8 : Address 215~208 Data b7 ~b0 : Address 215~208 Write Enable - To write a Coils area units are available in Word, after the "We" bit to '1'.(ex. Run : 0x0404) Set the bit in the lower byte to "1" that corresponds to the address to write and write the bit data of the corresponding address to the upper byte.(ex. Run : 0x0404, Stop : 0x0004)
		448	01C0	PCR	Feedback control output current max value (A) (1~Rated current) R - ex) 102 - 10.2A
		449	01C1	PCT	Feedback control output current max value (A) (1~Rated current) T - ex) 102 - 10.2A
		450	01C2	PPR	Feedback control output power max value (KW) (1~Rated power) R ex) 103 - 10.3KW - 3P Model power : (Model current x 480 x 1.732) / 100 1P Model power : (Model current x 480) / 10
		451	01C3	PPt	Feedback control output power max value (KW) (1~Rated power) T ex) 103 - 10.3KW - 3P Model power : (Model current x 480 x 1.732) / 100 1P Model power : (Model current x 480) / 10
		452	01C4	aTc	Switching rate from angle to cycle control for combination control 40 25~85%
		453	01C5	cTa	Switching rate from cycle to angle control for combination control 0 0~75%, cTa should not be greater than aTc-5.
		454	01C6	OCSR	Over current R (0~Rated current) (A) - 3CH - Over Current R phase
		455	01C7	OCT	Over current T (0~Rated current) (A) - 3CH - Over Current T phase

Note 1) Address for the Modbus Map shall be based on "base 0".

Address for the Modbus master devices (PLC, touch panel etc) may be either "base 0"

or "base 1" depending on the manufacturer, owing to different interpretation of Modbus protocol.

The address base for the Modbus master can be obtained by reading "Input Registers address 340 (0x154)".

The access address of Modbus master = Address + address base of Modbus master.

Note 2) If the single-phase, use s\_phase

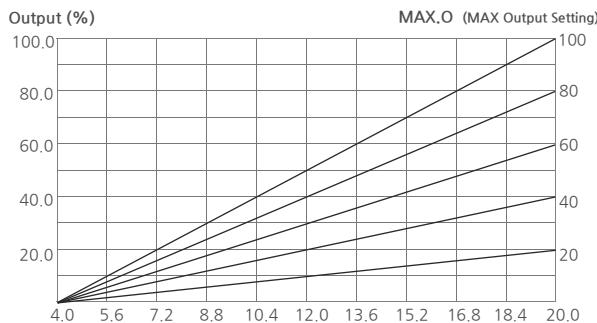
Note 3) Option : Feedback Control, Transmission output, Voltage measurement, Power measurement, Resistance measurement,  
3 Channel control, Fan alarm

## 4. Functions and Operation

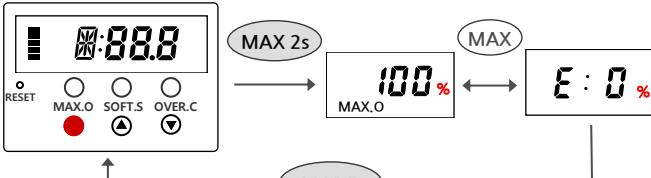
### 1. MAX Output Limit

This function limits the output range. Default : 100% (MAX), Parameter range : 0~100%

This function is to limit the output regardless of the control input amount & protecting heater or to removing hunting, so on. [ See the Table 4-1 ]



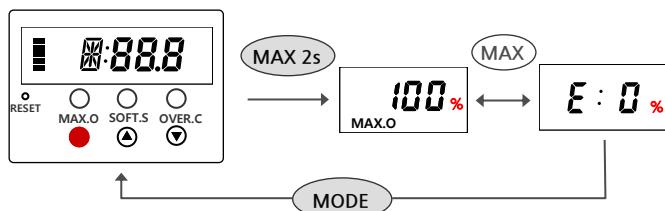
[Table 4-1]



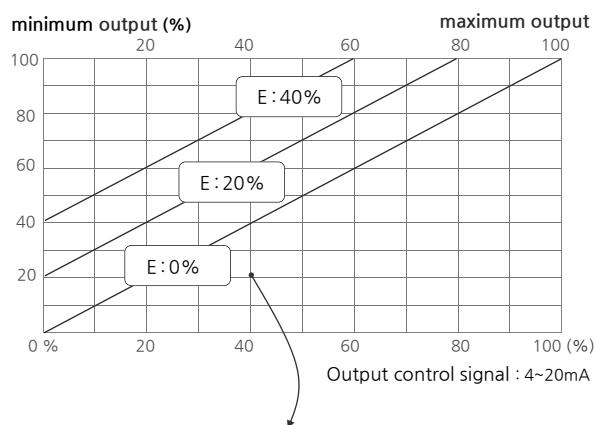
To set MAX Power Limit range, set parameter using the up/down key. Parameter range : 0 ~ 100%

### 2. Elevation

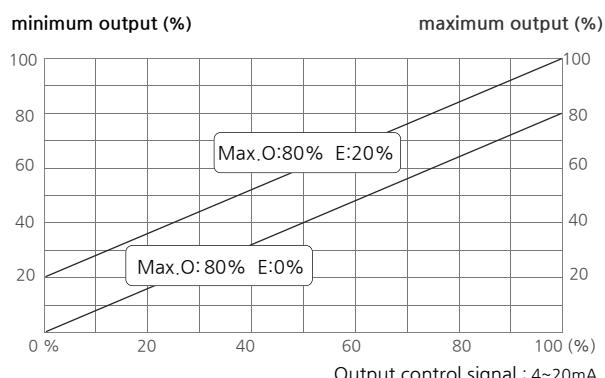
This function is used when constant output needs to be maintained even if control input signal is 0% and it increases the output as many as elevation setting value. For the setting of parameter, please see how to operate keys as described above.



Control your desired elevation value by % using up/down key, and press MODE key once for return to main display.



ex:> Elevation parameter (%)



ex:> Above graph illustrates the output characteristics in case of using elevation function in combination with maximum output limit function.

## 4. Functions and Operation

### 3. Over Current Set

When current exceeds rated current by set condition, alarm is activated. In this case, output power is turn off and then Alarm1 is activated. The setting range is "0 ~ rating current"

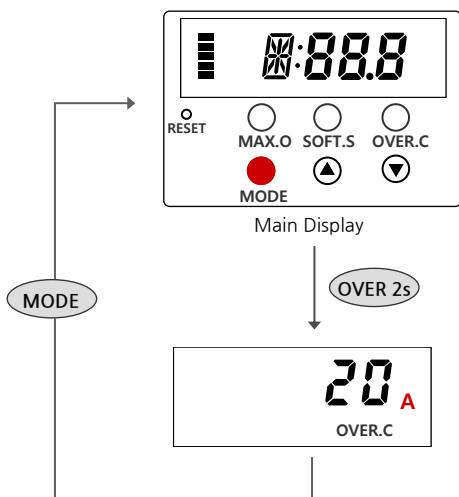
The following is table of max parameter for maximum OVER.C based on each product. [Table 4-2]

**\* The alarm is released only by**

1. RESET
2. Control Power OFF -> ON
3. RUN Contact (Terminal ③-④) OFF -> ON

Table 4-2

Rating Capacity (A)	OVER.C MAX (A)	Rating Capacity (A)	OVER.C MAX (A)
30	33	160	170
50	55	200	210
70	75	250	265
90	95	300	315
110	120	400	420
130	140	500	520



Main Menu/Display

Press and hold the "Over.C" key for 2 seconds.

Over Current set

To set Over Current range, set parameter using the UP/DOWN key.

Parameter range : 0 ~ Max rated current (A)  
[See the Table 4-2]



Over Current Alarm indicating

Alarm on : Output power shunt off.

Alarm LED is on

Terminal ⑪, ⑫ pin : Alarm1 output.

Relay is closed when alarm is on.  
( N.O : Normal Open )

## 4. Functions and Operation

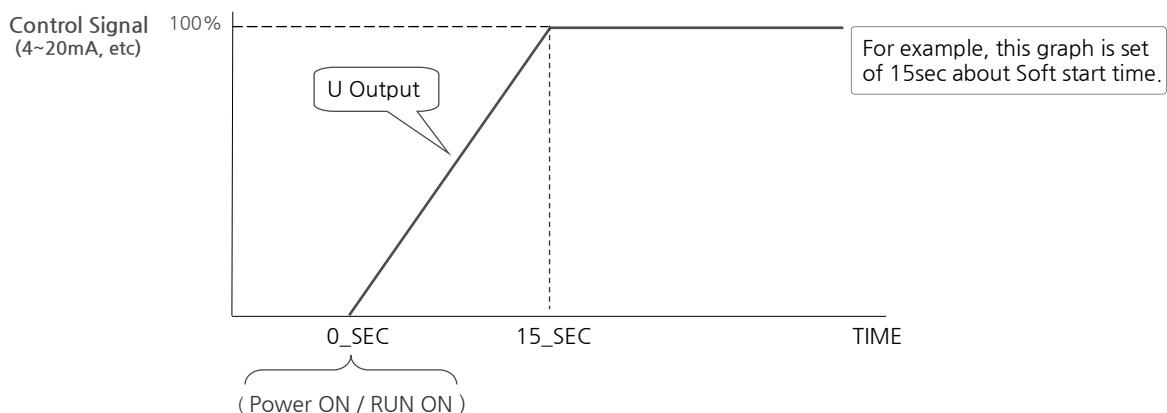
### 4. Soft start / UP / Down time set

#### (1) Soft start time set

Soft-start function gradually ramp up the output voltage to the demand level over the set time to prevent a sudden change in load or voltage.

The soft-start time sets from 0sec to 900sec.

The Soft start function is operated one time when power on or STOP to RUN.

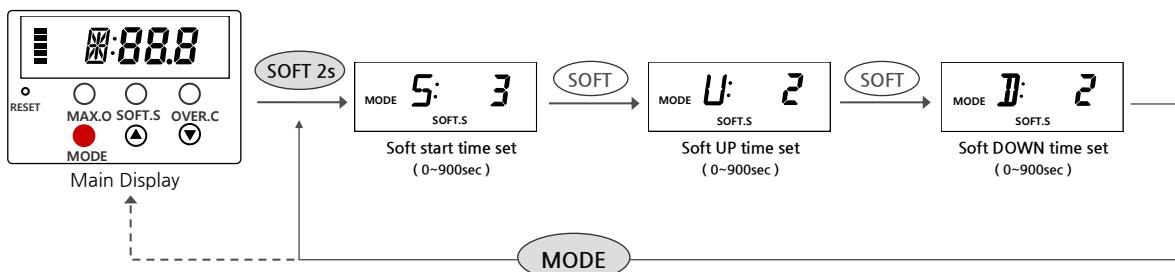


#### (2) Soft UP / DOWN time set

Soft UP/DOWN function gradually ramp up/down the output voltage to the demand level over the set time to prevent a sudden change in load or voltage. (The soft-start time sets from 0sec to 900sec)  
The Soft UP/DOWN function is operated every time when changed to control output power by input control signal.



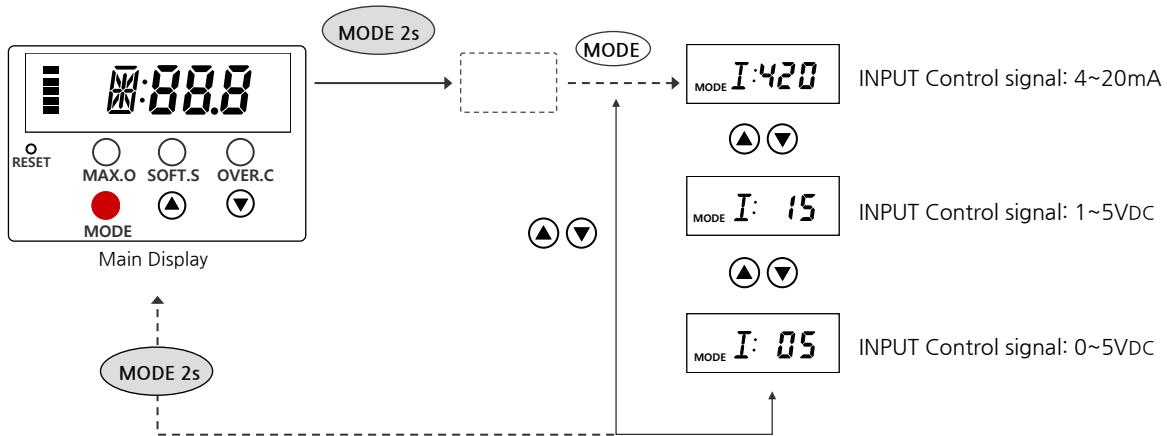
#### (3) Soft Start / UP/ DOWN time set



## 4. Functions and Operation

### 5. Control signal set

The Pion-series supports input control signal of 4~20mA, 1~5V, 0~5V.  
Please select a signal type you want to use in the following mode.



After setting the control input signal, please check the input terminal connection.

## 4. Functions and Operation

### 6. Control method (Phase control, Zero crossing control, Combination control)

The Pion series can be selected one of two control methods.

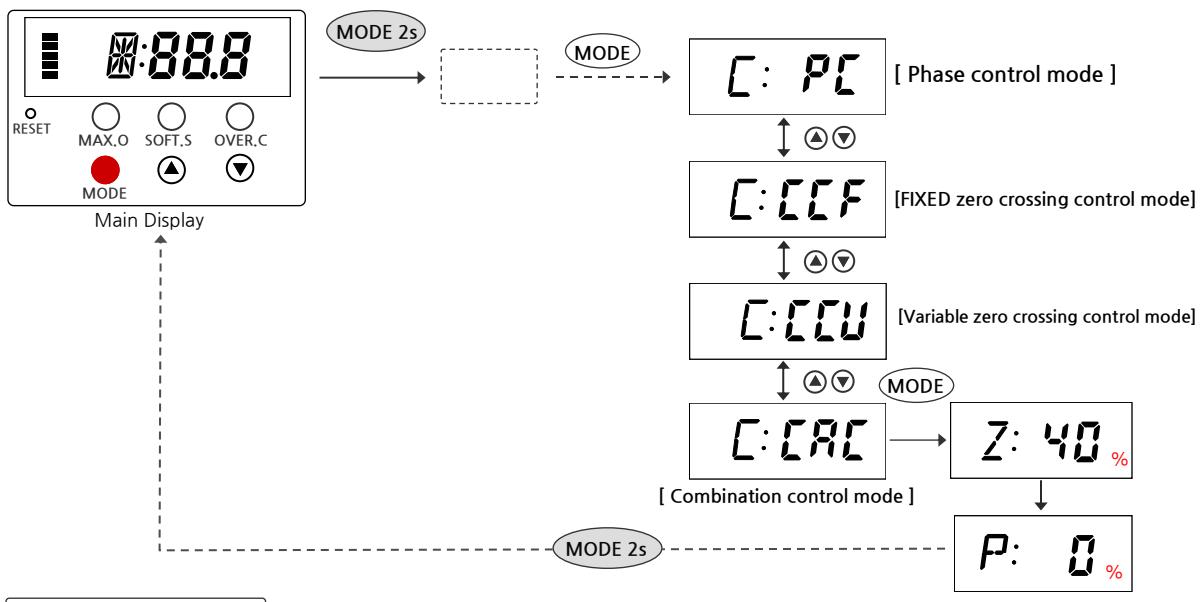
Phase control - Precise control is possible but occurs harmonic noise. Because it generates harmonic noise and may cause malfunction to electronic devices around it, you need to use noise filter for equipment reliability.

Zero crossing control (FIXED cycle control)

- No harmonic noise / Hunting may occur / Inductive coupled load can not be used

Combination control - Z : Zero crossing control mode at phase control when over the set value(%)

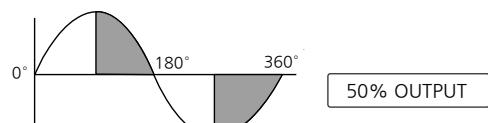
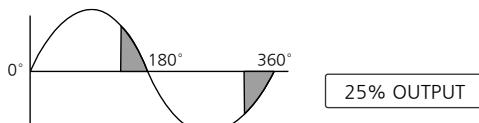
P : When it is less than the set value(%), it changes to control the phase control mode from zero crossing



#### Phase control

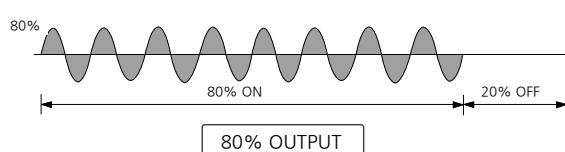
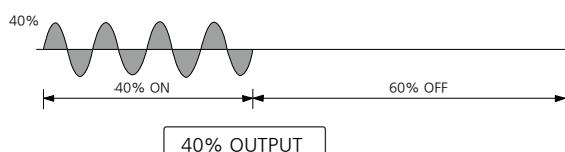
Phase control is to continuously control electric power supplied to load by changing phase angle of AC voltage applied to the load. High precision control can be controlled by 0.5 us per unit.

(The high harmonic noise may be generated.)

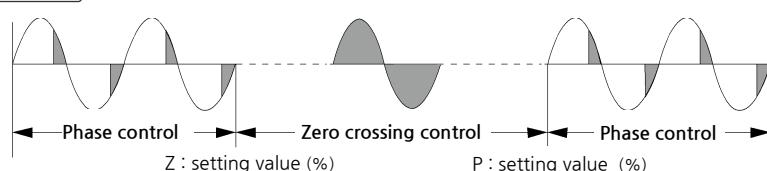


#### Zero crossing control

Zero-cross control is to control electric power supplied to load by turning the power supply voltage ON and OFF at the point of 0V AC. The high harmonic noise can be suppressed compared with phase control (Don't apply to inductive load)



#### Combination control



## 4. Functions and Operation

### 7. Current Monitor / Display

Can set indicating value contents of display on operating mode. Selected possible indicating current (A) / Percent (%) as below.

Average value of current with R,T or R phase current , T phase current.

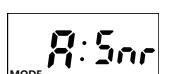
The Pion series indicated value of current with precision True RMS.



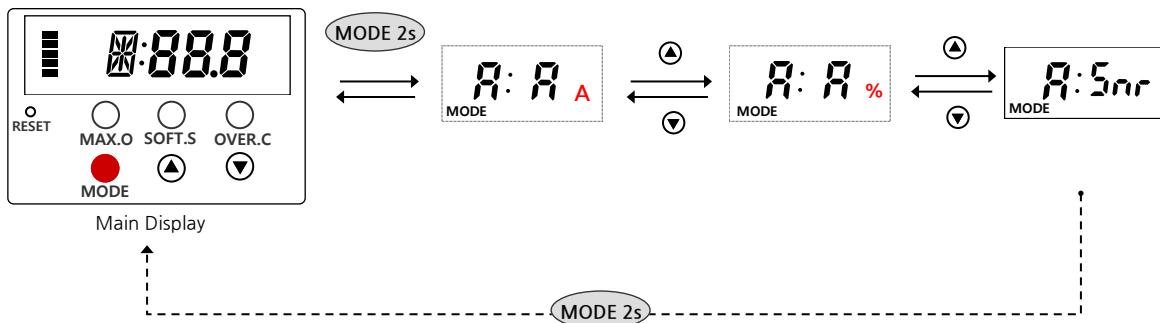
Current value (A)



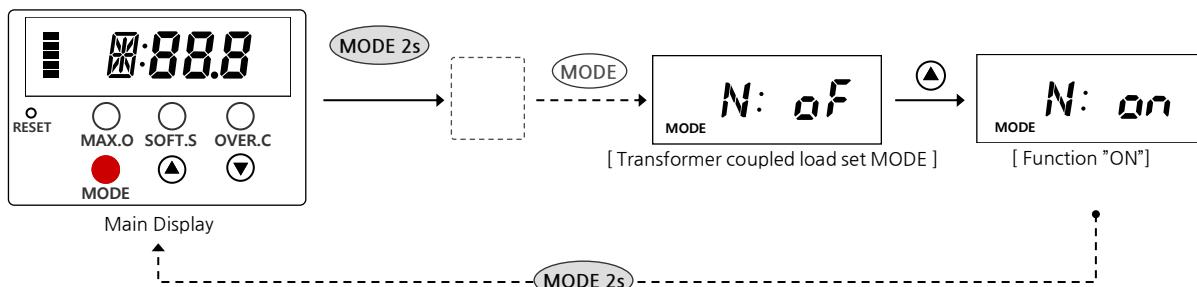
Output (%)



Display in average current, average voltage (option),  
Power (option), and output



### 8. Setting Transformer Coupled Load



- If the Thyristor Power Controller is used to transform load, be sure to turn ON the transformer load function. Normally, the heater coupled load must use as set value to "of".

## 4. Functions and Operation

### 9. Temperature (Heat sink) warning alarm

The Pion series will be provided caution alarm about over-heating depend on heat-sink condition.

#### Temperature (Heat sink) warning alarm

Set temperature range by user for alerting. [ 50~70°C, or OFF] (Default is OFF)

In this case, output power is normal operation, and Alarm 2 is just activated.

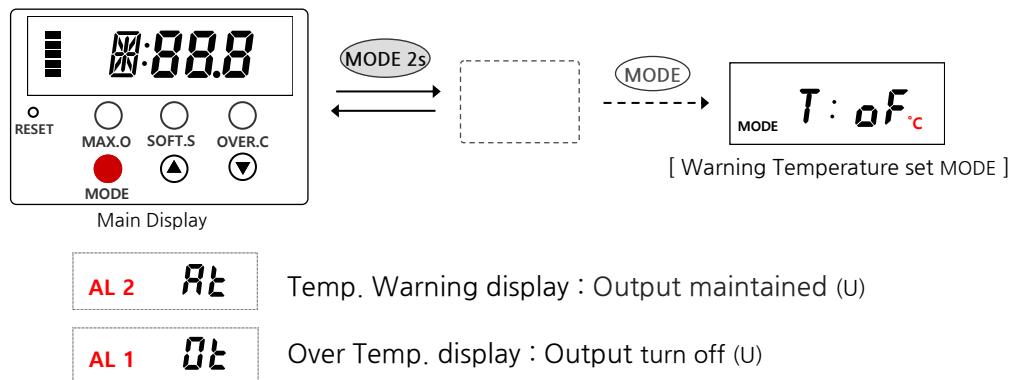
Alarm2 : Output signal is 11pin, 12pin on terminal. RELAY NO [Normal OPEN]

#### Over-heating (Heat sink) alarm

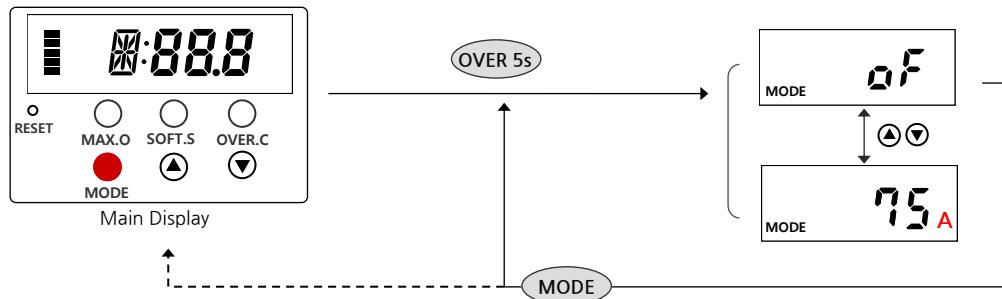
When temperature reached 85°C on heat-sink, alarm is forcedly activated.

In this case, output power is interrupted and then Alarm 1 is activated.

Alarm1 : Output signal is 11pin, 13pin on terminal. RELAY NO [Normal OPEN]



### 10. Loads disconnection Alarm



#### Detection condition of Loads disconnection

As load disconnection alarm function is set, when detected less than value of set current.

Output is more than 30% this function acts.

To become a function is activated, it must maintain output at least 3 seconds.

(Outputs (R.T) variations is within 2% & maintain more 3 seconds )

In the cycle control mode, it does not operate ability.

The Pion series will be provided load disconnection alarm depend on setting current value by user.

· If load is disconnected during operation with detection condition by user, Alarm 2 is activated.

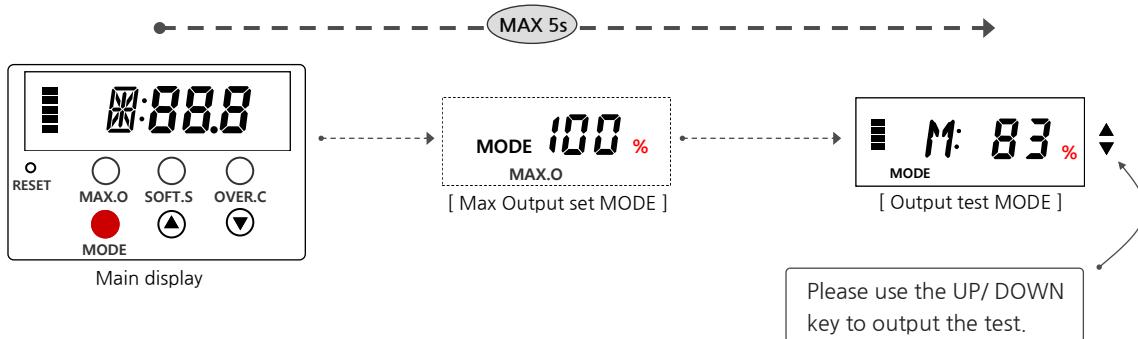
· Alarm 2 : Output signal is 11pin, 12pin on terminal. RELAY NO [Normal OPEN]

- Please be sure to set the maximum output limit value to 100% before you use this function.

## 4. Functions and Operation

### 11. Output Power Test mode operation

This function is self test mode for output power without input control signal.  
The range is 0% to 100% about output power.



- If not output, please check the RUN-COM terminal connection.
- Test mode will return to the MAIN-DISPLAY after being maintained for 1 min, and the output is reset.  
(If there is no key input)

### 12. Thyristor Failure Alarm

When detect Thyristor failure , alarm1 is activated.

[The pin3 connector (RUN) and pin4 connector (COM) is shorted on terminal.]

Alarm1 : Output signal is 11pin,13pin on terminal. Relay is closed when alarm is on.

RELAY N.O [Normal OPEN]

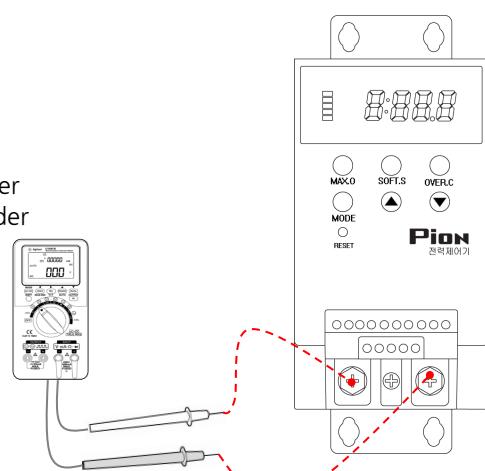
- Condition of Thyristor failure detection in instrument
  - Output power is more than 5A over 5seconds @ control signal = 0

For example

**AL 1 5b**

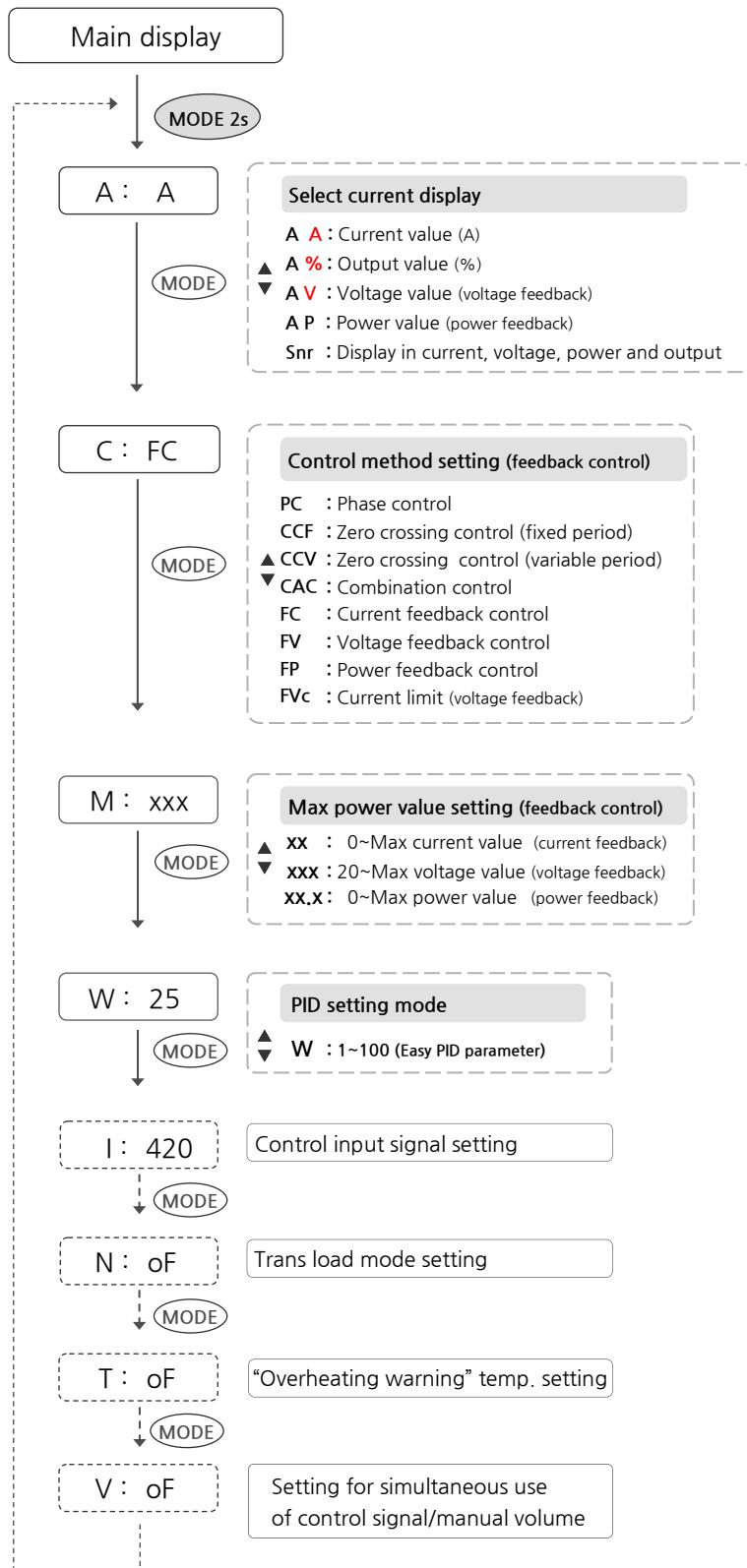
[ Thyristor Break Message ]

- Resistor check on
  - Normal : 600K $\Omega$  over
  - Failure : 100K $\Omega$  under



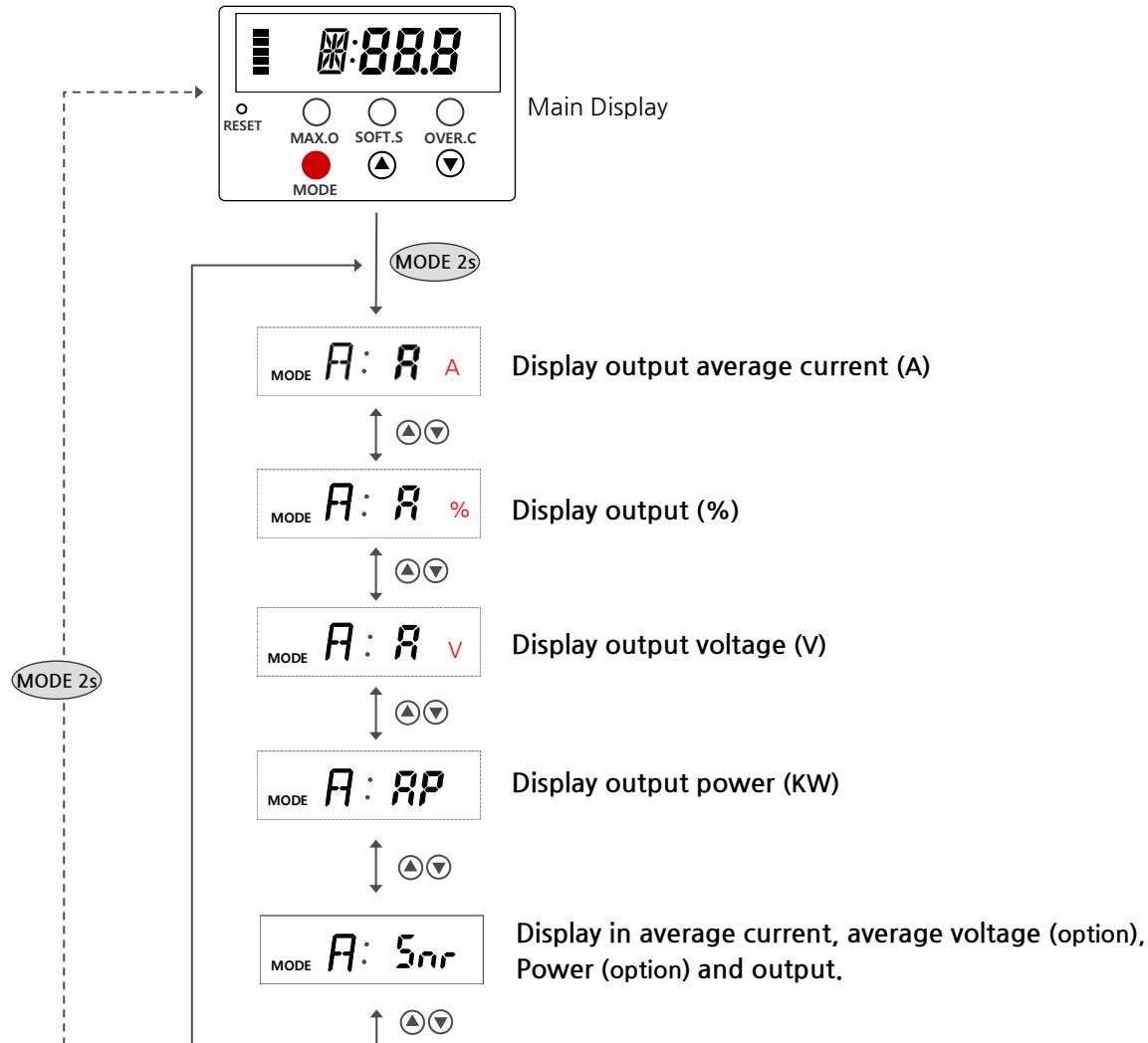
## 5. Option

### 1. Feedback option operation flow chart



## 5. Option

### 2. Display setting in feedback control



- Selected display value becomes transmitted power parameter in transmission power option.

### 3. Adjusting output response sensibility in feedback control

When using feedback control (current / voltage / power), you can adjust the output response sensitivity by setting the parameters below.



Hunting diminishes although response becomes slow.

Hunting increases although response becomes fast.

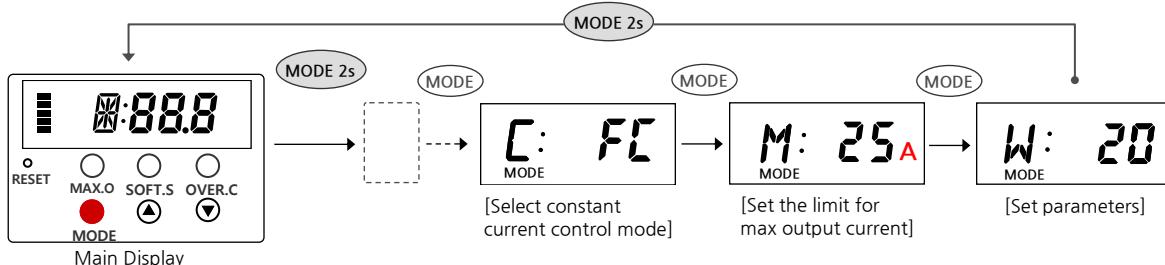
Make sure to change the initial factory setting value little by little in commissioning.

**[Caution]** This should not be used to respond to instantaneous change of input voltage occurred by noise and hunting coming through input voltage.

## 5. Option

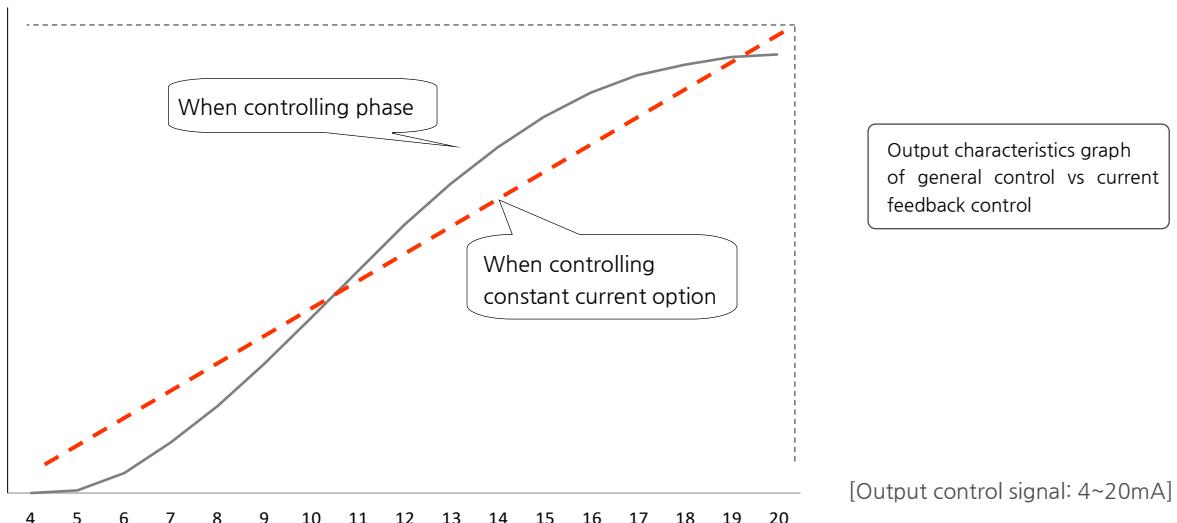
### 4. Current feedback (constant current)

Current feedback functions to output current constantly regardless of input voltage (R/T) or load capacity. Make sure to set max. current output value "M:Setting value" for optimized constant current control. (3 phase:all models / single phase: all models except 25A)

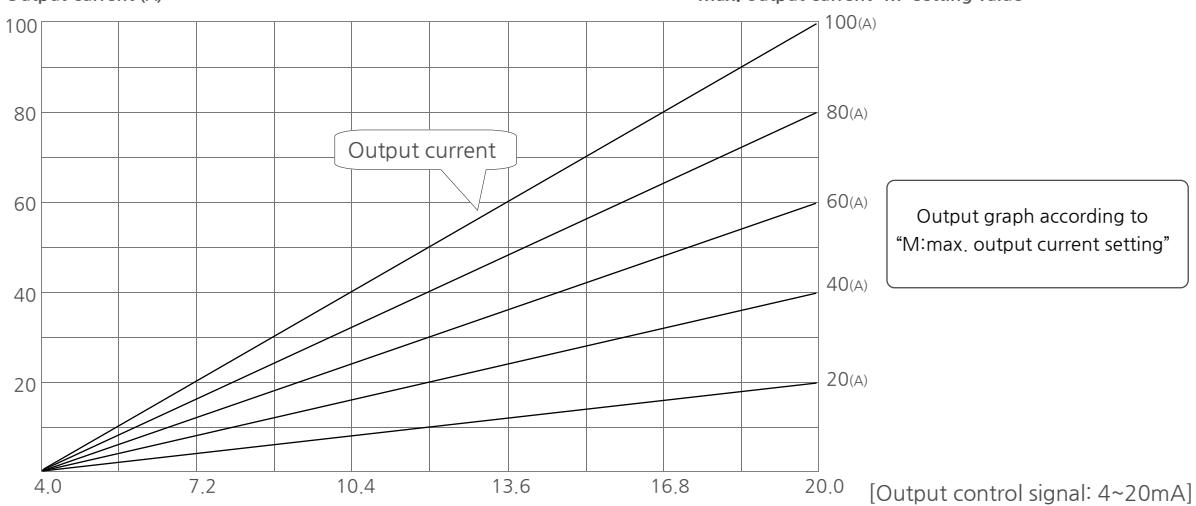


[Caution] Since output voltage tends to grow continuously if max. current consumed by load is lower than "M:setting value" in commissioning, make sure to check M: setting value".

Output current (A)



Output current (A)



## 5. Option

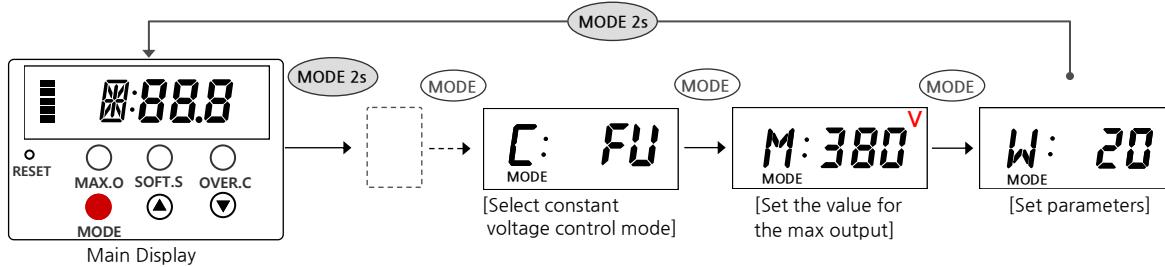
### 5. Voltage feedback (constant voltage/current limit)

- PION-UL1W-030 / 050 / 070-0V(or OP) :  
When using the voltage and power feedback option, please refer to the separate installation drawing (CAD) on the PIONENG website.

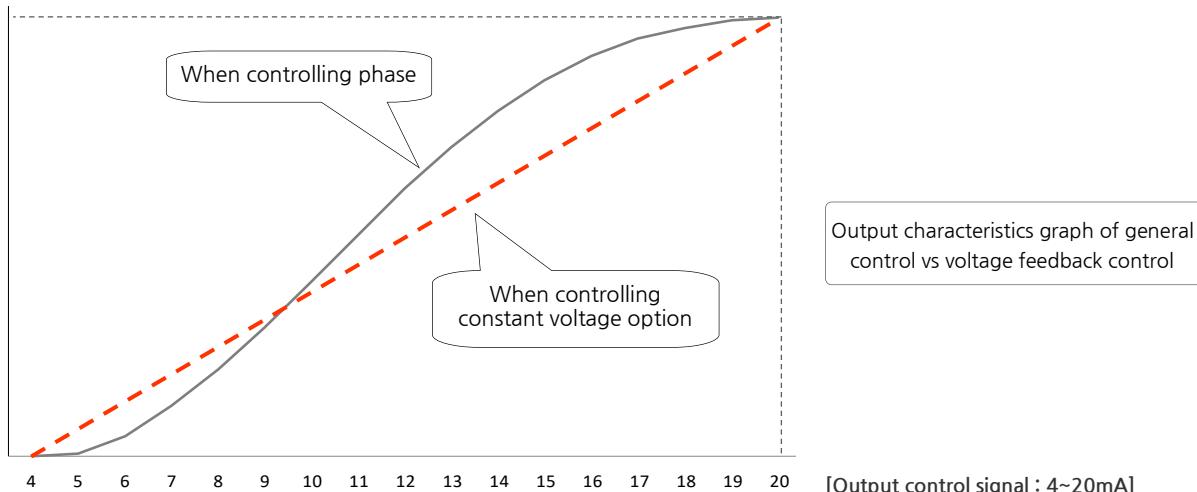
#### (1) Voltage feedback

[Caution] This should not be used to respond to instantaneous change of input voltage.

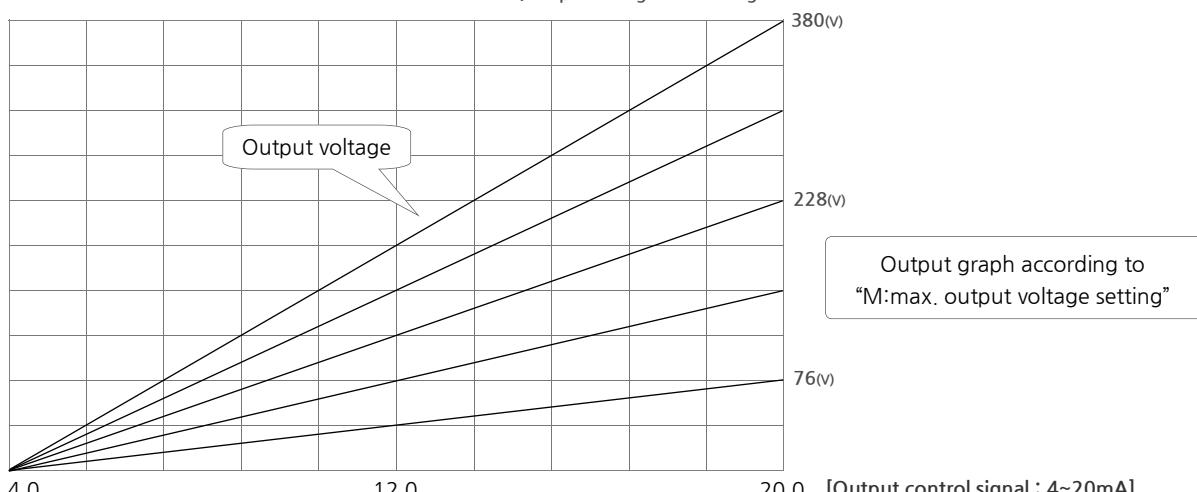
Voltage feedback functions to output voltage constantly regardless of input voltage (R/T) or load current. It maintains output voltage constantly regardless of input voltage varying depending on environments or time bands. Make sure to set max. voltage output value "M:Setting value" for optimized constant voltage control.



Output voltage (V)



Max. output voltage "M" setting value



## 5. Option

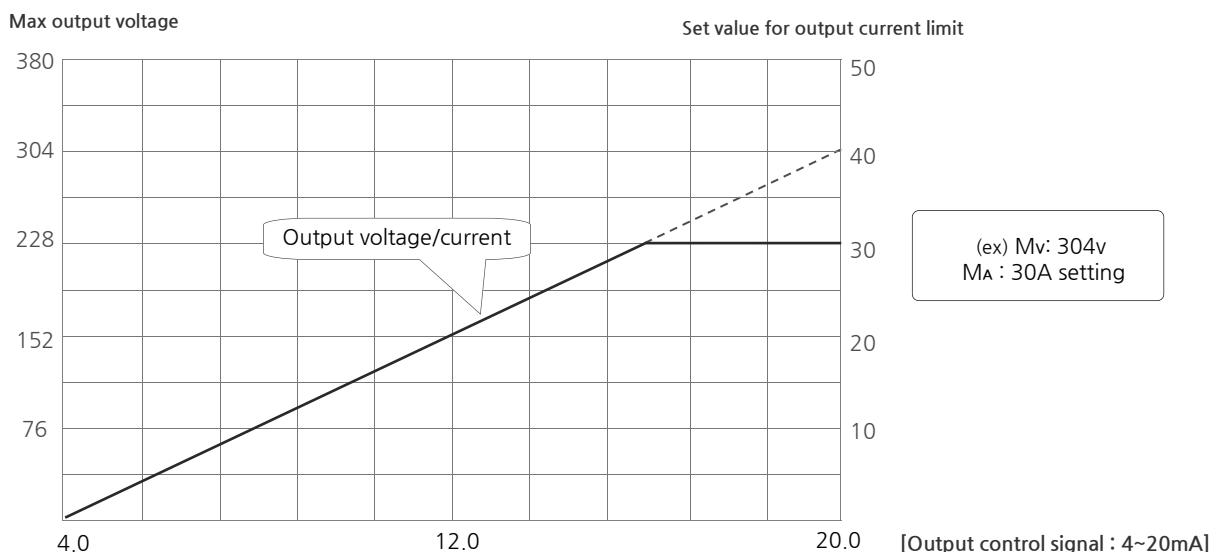
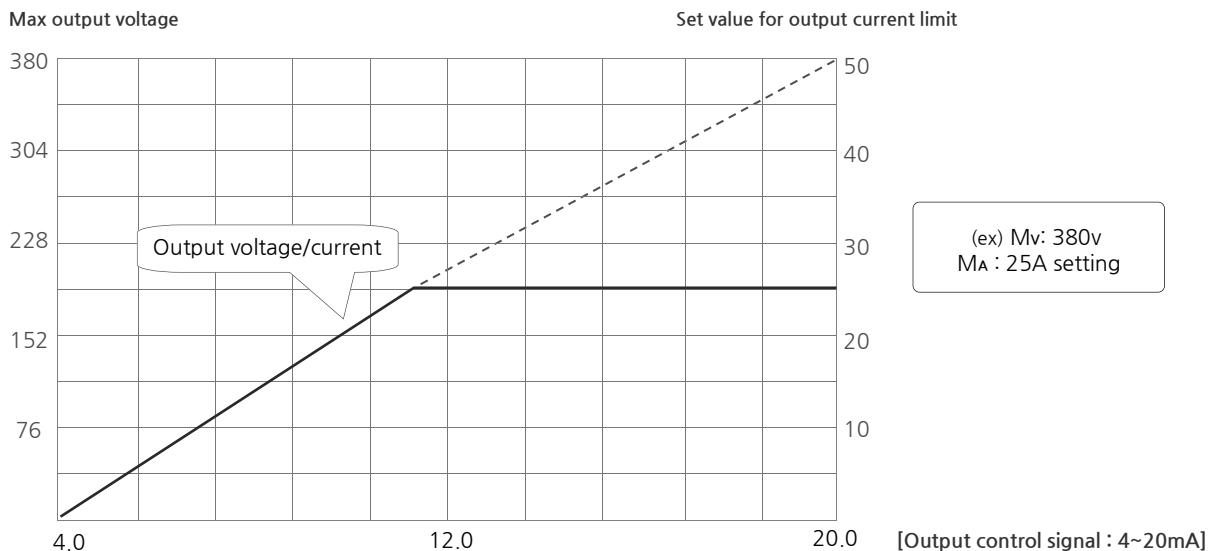
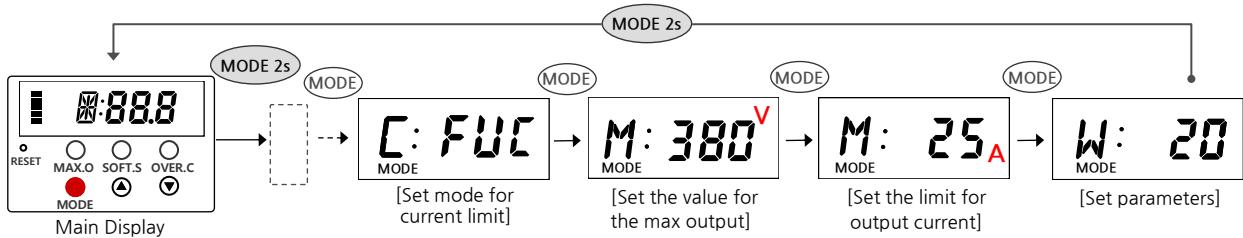
### 5. Voltage feedback (constant voltage/current limit)

#### (2) Current limit

- PION-UL1W-030 / 050 / 070-0V(or OP) :  
When using the voltage and power feedback option, please refer to the separate installation drawing (CAD) on the PIONENG website.

[Caution] This should not be used to respond to instantaneous change of input voltage.

Current limit function provides both low voltage feature and limit on max output current at the same time. Time. The output (current, voltage) increases according to control signals but never exceeds the "set value of the maximum current."



## 5. Option

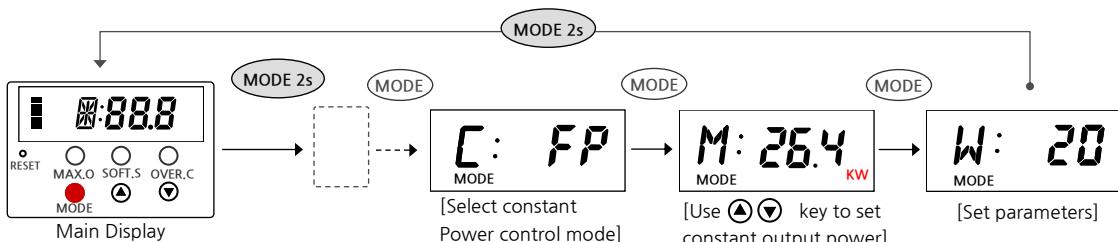
### 6. Power feedback (constant power)

- PION-UL1W-030 / 050 / 070-0V(or OP) :  
When using the voltage and power feedback option, please refer to the separate installation drawing (CAD) on the PIONENG website.

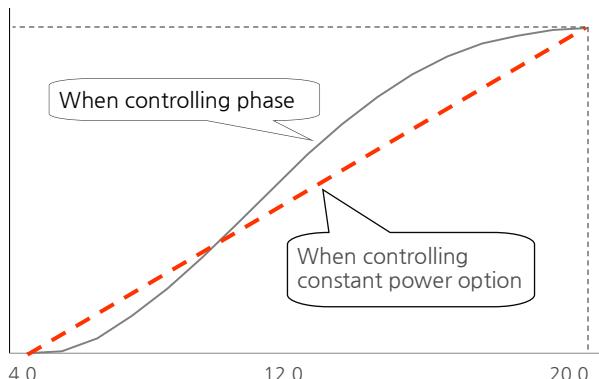
[Caution] This should not be used to respond to instantaneous change of input voltage.

Power feedback functions to output voltage constantly regardless of input voltage (R/T) or load current. Make sure to set max. power output value "M:Setting value" for optimized constant power control as follows.

Ex:> Method for setting power feedback parameter at input voltage : 220V(phase), load current:120A  
Max. power (KW) = 220(V) x 120(A) = 26,400(KW) Set to "M:26.4" (unit:KW).



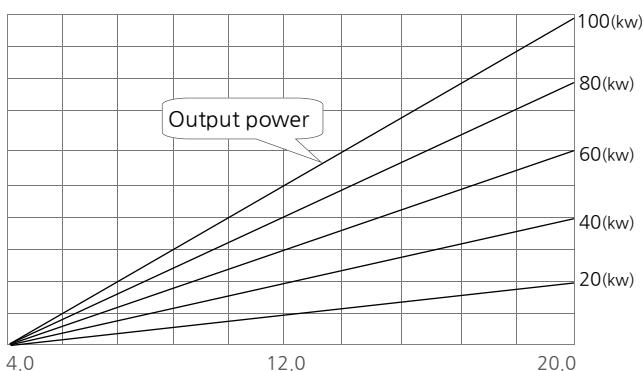
Output power (P)



Output characteristics graph of general control vs power feedback control

[Output control signal: 4~20mA]

Max. output power "M" setting value



Output graph according to "M:max. output power setting"

[Output control signal: 4~20mA]

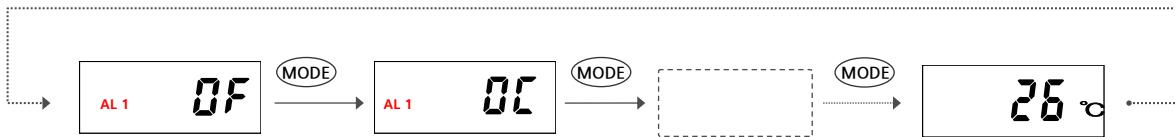
## 6. Description of Alarm (Display)

### 1. Alarm Check 1

Alarm 1,2 : N.O (Normally Open)

AL1 : Output cut off

AL2 : Output maintenance



When various types of alarms are issued simultaneously, they are displayed sequentially in order as described above. Heat sink temperature is displayed lastly and returned to the initial state.

※ The alarm is released only by

1. RESET
2. Control Power OFF -> ON
3. RUN Contact (Terminal ③-④) OFF -> ON

**OFF**

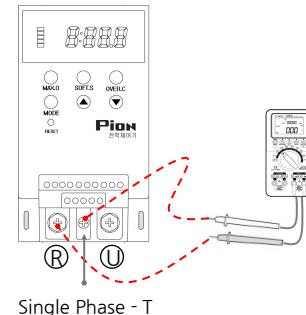
RUN signal is not input : Check short state of ③-④ terminals  
Check [P 14] RUN terminal connection

**ACOF**

It is not the main power (R,T) input

**TCOF**

4~20mA (⑧,⑨) has been not wired or has been wired in reverse polarity.

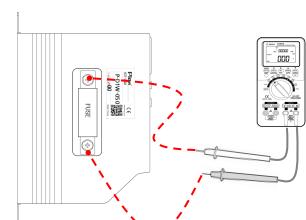


**AL 1 OF**

Power is not input on R,T: Check power input or broken fuse  
Operated only when RUN contact inputs (③-④) are short

Alarm 1

※ Check AC Voltage with tester



**AL 1 OC**

Over current on U : Check leakage of load (heater)

Alarm 1

[P 23]

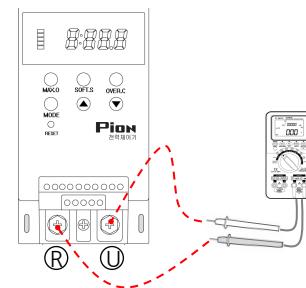
**AL 1 5b**

Thyristor breakage alarm : When Thyristor is broken and current flows regardless of control state  
Alarm 1 [P 29]

※ Check Thyristor resistance with tester

Normal : 600KΩ or more

Broken : 100KΩ or less



## 6. Description of Alarm (Display)

### 1. Alarm Check 2

Alarm 1,2 : N.O (Normally Open)

AL1 : Output cut off

AL2 : Output maintenance



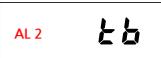
**Over Temp. Alarm** : When the temp. of heat sink exceeds 85°C  
automatically released at 70°C or less



**Overheating Warning** : When the temp. of heat sink exceeds alarm warning temp.  
[P 28]



**U heater breakage alarm** : Check breakage of load (heater)  
[P 28]



**Heater breakage alarm** : Output by "Alarm 2 A contact output", and output operation  
is maintained



**FAN failure alarm** : It occurs when the fan does not operate under normal operation  
conditions.

- **FAN automatic On/Off function**  
(Fan On when the heat sink temperature is above 40°C, Fan Off when below 30°C)

### Alarm when using option

#### Constant current / Constant power option



**CT failure alarm** : It occurs when CT failure and load disconnection or load is too small during  
constant current / constant power control.  
(ex: ~90A model 2A)

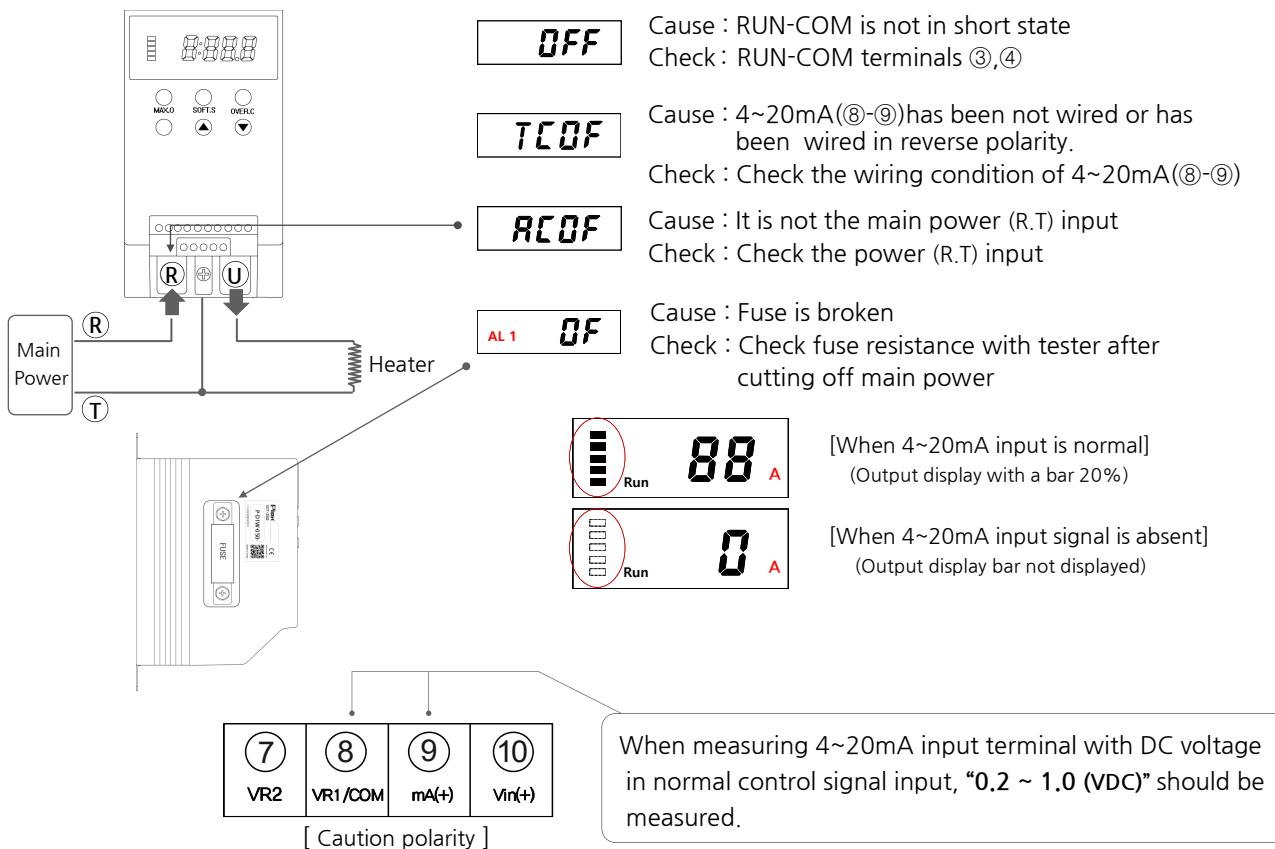
#### Constant voltage / Constant power option



**VT failure alarm** : Occurs when voltage measurement is not possible, such as VT failure during  
constant voltage / constant power control.

## 7. Appendix

### 1. When there is no output during commissioning (in controlling 4~20mA)



### 2. Formula for calculating design load (ampere) ( $\sqrt{3} = 1.732$ )

$$[3 \text{ phase, resistive load (A)}] = \frac{\text{Heater capacity (W)}}{1.732 \times \text{voltage (V)}} \times 1.3$$

$$[3 \text{ phase, inductive load (A)}] = \frac{\text{Heater capacity (W)}}{1.732 \times \text{voltage (V)}} \times 2.0$$

$$[1 \text{ phase, resistive load (A)}] = \frac{\text{Heater capacity (W)}}{\text{voltage (V)}} \times 1.3$$

$$[1 \text{ phase, inductive load (A)}] = \frac{\text{Heater capacity (W)}}{\text{voltage (V)}} \times 2.0$$

The value with no "x1.3" is referred to actual load(A), and value with "x1.3" to design load(A). Since rated capacity of the company is base don room temp. of 25°C, rated voltage input, the capacity should be calculated considering site conditions (temp., input voltage) by applying design load in selecting a model (capacity).

## 7. Appendix

### 3-1. Accurate measurement method of Thyristor (SCR) output current and voltage

- To accurately measure the output current and voltage of the thyristor (SCR), it should be measured with a measuring device marked with a true RMS
- The AC current and voltage measurement method has an average value measurement method and an True RMS value measurement method.

1. The average value measurement method is used to measure sine wave, and most measuring devices uses this method.
2. The True RMS value measurement method is used to measure distorted waveform such as SCR output waveform.

In general, the value measured by the average value measurement method is less than the value measured by the True RMS value measurement method. Depending on the degree of distortion its deviation may be different and the value measured for the average value might be less than 50% in a few cases. For the sine wave, the two measurements are identical.

- The PION power controller uses the True RMS measurement method.

When panel meters are installed separately, by using the True RMS measurement method panel meter, its deviation from the display value of PION power controller can be minimized

### 3-2. How to check Thyristor (SCR) output voltage

- The load must be connected to measure the output voltage of the Thyristor (SCR).
- Thyristor (SCR) is a semiconductor device that has a leakage current and could cause electric shock. therefore, be sure to turn off the main power when working.
- The leakage current varies depending on the type of SCR, and may be 5 to 100mA or higher. When the voltage is measured in the absence of a load, a large voltage is measured regardless of the control voltage due to the leakage current.
- When the load is connected, the leakage current flows through the load and the abnormal voltage is extinguished so that the normal control output voltage measurement becomes possible.

- UL Code : E522708
- Thyristor Power controller HS Code : 8504.31-2000

**Pion<sup>®</sup>**  
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ISO 9001:2015 14001:2015

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