

MP 11 SERIES

Thyristor Single-Phase Power Regulator with feedback function

Instruction Manual

Thank you for purchasing SHIMAX products. Please check that the delivered product is the item you ordered. Read this instruction manual thoroughly and understand its contents before using this product..

Notice

Please ensure that this manual is given to the final user of the instrument.

Preface

This instruction manual is meant for those who will be involved in wiring, installation, operation and routine maintenance of the MP11 Series .

This manual describes the care, installation, wiring, function, and proper procedures in operating MP11 Series. Keep this manual on hand while using this device. Follow the guidance provided herein.

Matters To Be Attended To For Safety

You will see matters to be attended to for safety, potential damage to equipment and/or facilities and additional instructions under the following heads.

◎This heading indicates matters to be attended to. If this instruction is not observed, hazardous conditions that could cause injury or death of personnel.

⚠“WARNING”

◎This heading indicates matters to be attended to. If this instruction is not observed, hazardous conditions could cause damage to equipment and/or facilities.

⚠“CAUTION”

◎This heading indicates additional instructions and/or notes.

NOTE

⚠“WARNING”

MP11 Series is designed to control electric power such as heater power in general industrial facilities. It must not be used in any way that may adversely affect safety, health, or working conditions.

⚠“WARNING”

- Mount this device on an indoor control panel. Do not touch the charger when using.
- To avoid electrical shock, turn off electricity during wiring operation.
- Do not touch the radiant-heat fin because its temperature becomes high when electricity is turned on or even after it is turned off. Touching may result in a burn.
- To prevent electric shock, earth the ground terminal without fail.
- Do not touch the terminals or chargers when electricity is turned on.
- Take care not to put metal or other foreign matters inside this device.
- When an alien substance is put inside by mistake, cut the power immediately, make sure of safety, and remove the substance.





⚠“CAUTION”

To avoid damage to the connected equipment, facilities or other products due to a fault of this instrument, safety countermeasures must be taken, such as installation of an immediately-cut fuse (option), breaker and overheating protection device.

⚠“CAUTION”

- Power supply voltage, load current, and power supply frequency should be within the rated ranges. Wrong usage reduces the life of the product and/or result in problems with the product.
- Voltage different from that of the input rating should not be connected to the control input terminals. It reduces the life of the product and/or result in problems with the product.
- Fasten the screws tightly after wiring has been done. Otherwise, overheating caused by contact resistance may result in damage by a fire.
- Put the cover for the terminals on after wiring has been done.
- No modification or irregular usage is allowed.

Symbol Marks used for this product

	This mark is to arouse a user's attention regarding electric shock and high temperature.
	This indicates the place (a radiant-heat fin) where the temperature becomes high and may cause a burn.
	This mark is to arouse a user's attention not to touch the chargers when electricity is turned on.
	Earth the terminals without fail to avoid electric shock.

Guarantee and repair

- The term of a guarantee is restricted to the body itself for one year after purchase.
- Within the term of a guarantee, the product will be repaired free if it has broken down even though it has been used properly based on this instruction manual and attached labels.
- Even within the term of a guarantee, the repair is charged in the following cases.
 - (1) Failure or damage due to wrong connections, incorrect usage, or modification.
 - (2) Failure or damage due to transportation, movement, or fall after purchase.
 - (3) Failure or damage due to natural disasters like a fire, earthquake, lightning, or storm/flood disaster, and due to environmental conditions such as gas or salt, and due to voltage failure and so.
- Our company cannot take responsibility about the accident or damage which is caused directly or indirectly due to neglecting the warnings or notes of this handling description.
- When repair is needed, please contact the office or agency of our company.

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1. Confirmation of model code and accessories

A label of model code is put on the left side of the body cover.

TYPE:MP11-0300N0	← Model code
No. :0110000001-001	← Manufacturer's serial number
100 TO 240 V AC~	← Power supply voltage
30A 50/60Hz	← Current-carrying capacity Power supply frequency
SHIMAX CO. LTD. MADE IN JAPAN	

NOTE : Accessory codes are not printed on the label of model code.

◎ Model Code

MP11- : Series

030 : Current-carrying Capacity

001 010: 1 10A, 020: 20A, 030: 30A, 050: 50A, 070: 70A,
100: 100A, 150: 150A, 200: 200A, 300: 300A

0 : Immediately-cut fuse

0: without

1: immediately-cut fuse responding to each current-carrying capacity

N : Communication N: without R: RS-485

0 : Remarks 0: without 9: with

◎ Accessory Instruction Manual 1 set
When optional communication is added: terminal impedance 120Ω 1 piece

※ Regarding accessories (option), refer to Item 8: Accessories (page 13).

2. Caution for proper use

- (1) do not operate the front panel keys with hard or sharp objects. Touch the keys lightly with finger tips.
- (2) To clean, wipe gently with a dry cloth. Do not use solvents such as thinner.

3. Installation

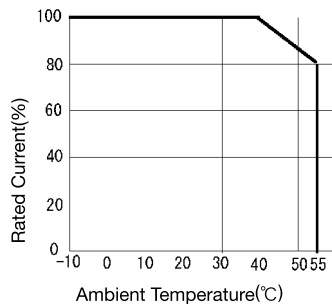
3-1. A place where this device is installed (environmental conditions)

⚠ "CAUTION"

Do not use this instrument under the following conditions. Otherwise, the likelihood of fire and/or other dangerous situations is considerable

- (1) Where flammable gas, corrosive gas, oil mist or dust that can deteriorate electrical insulation is generated or is abundant.
- (2) Where the humidity is over 90%RH or where condensation occurs.
- (3) Where highly intense vibration or impact is generated or can affect the operation of the product.
- (4) Where inductive interference, static electricity, magnetism, and noise are likely to be generated.
- (5) Where there are water drops or direct sun light.
- (6) The rated current is 100% in case of the ambient temperature -10~40°C. If the temperature is over 40°C, reduce load current according to the following chart. The operating temperature is 55°C max. When the ambient temperature is 55°C, load current should be 80% or less of the rated current.

Ambient Temperature - Allowable Current Characteristic



- (7) Where the altitude is above 2,000m.

NOTE: The environmental conditions here comply with the installation category II and the pollution degree 2 set by IEC664.

3-2. Installation

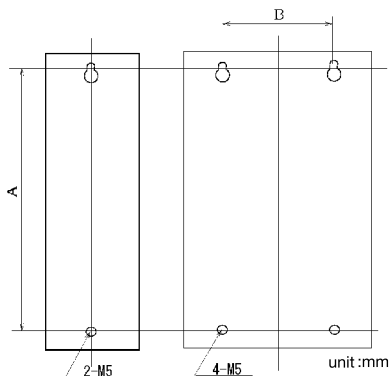
⚠ "CAUTION"

MP11 Series has a structure to be fixed on an indoor panel. Do not use this product on the table/desk or in a non-fixed condition. Improper usage may result in damage to the product due to fall, electric shock, and injury. Fix this device on a panel without fail. Make sure to keep people from touching the charger.

- Screw the regulator on the panel by referring to the Set-up Dimension Drawing.
- Prepare screws (Size M5) to fix the regulator on a panel.
- To enhance a cooling effect, set the regulator up vertically so that the display section is the top and the main circuit terminals are the bottom. No heating unit should be installed under this regulator.

3-3. Set-up Dimension Drawing

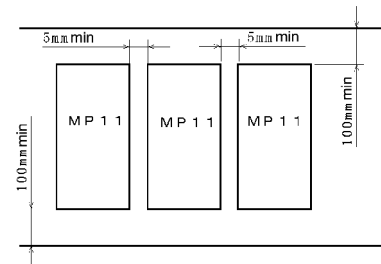
1~10A·20A·30A·50A 70A·100A·150A·200A·300A



Current-carrying capacity	A	B
1~10A	192	81
20A		
30A		
50A		
70A	208	97
100A	208	
150A	228	
200A	228	
300A	261	110

3-4. Set-up Space Drawing

- When two or more MP11s are mounted or when MP11 is mounted next to other devices, or when MP11 is mounted adjacent to the wall, mount MP11s according to the Set-up Space Drawing below to allow a cooling effect.



Internal heating value of MP11 is approximately as follows. Follow the set-up space and Item 3-1 environment conditions. Keep in mind that the set-up site needs to be ventilated and the radiated heat needs to be relieved.

(200V 180° × 2)

Heating value of the body

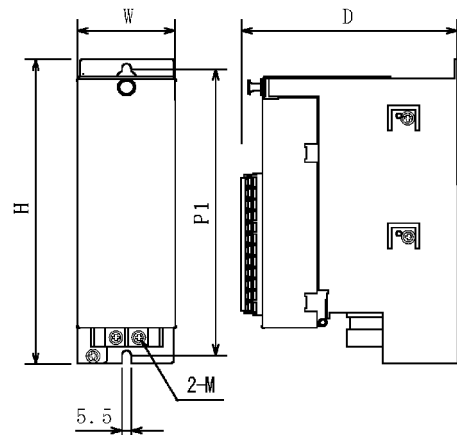
Current-carrying capacity	1~10A	20A	30A	50A	70A	100A
Heating value	12W	26W	42W	63W	86W	132W
Current-carrying capacity	150A	200A	300A			
Heating value	198W	250W	381W			

Heating value of the immediately-cut fuse

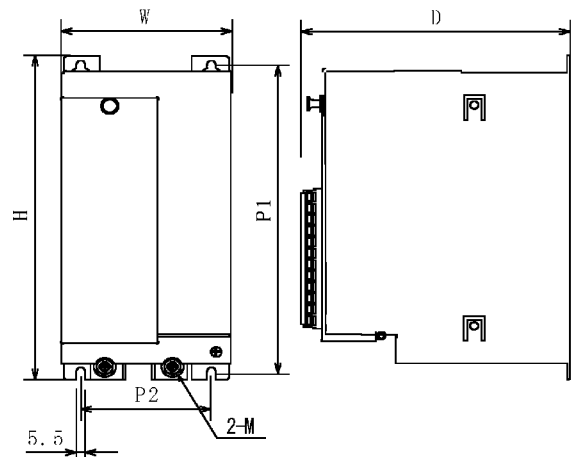
Current-carrying capacity	1~10A	20A	30A	50A	70A	100A
Heating value	1.8W	3.1W	3.7W	6.5W	11.0W	14.0W
Current-carrying capacity	150A	200A	300A			
Heating value	34.0W	45.0W	50.0W			

3-5. External Dimension Chart

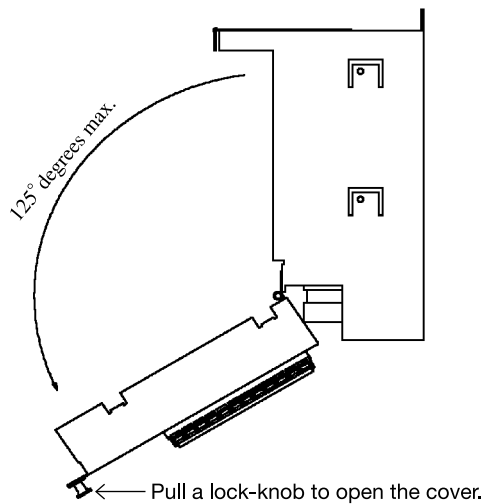
1~10A·20A·30A·50A



70A·100A·150A·200A·300A



Front Opening Drawing

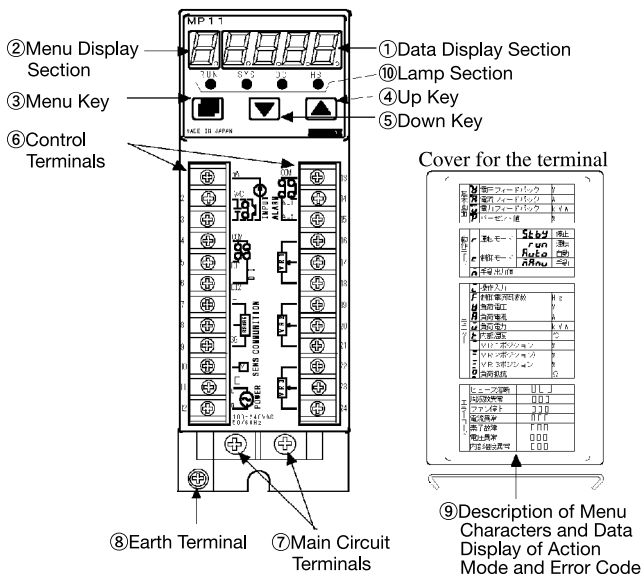


Dimension Table

Unit:mm							
Current-carrying capacity	W	H	D	P1	P2	M	Weight
1~10A・20A	60	204	133	192	—	M4	1.2kg
30A	60	204	133	192	—	M4	1.4kg
50A	70	220	166	208	—	M5	2.2kg
70A	105	220	166	208	81	M6	2.9kg
100A	121	240	195	228	97	M6	3.4kg
150A	121	240	195	228	97	NOTE:M10	3.7kg
200A	121	240	195	228	97	NOTE:M10	3.7kg
300A	134	273	247	261	110	NOTE:M12	6.2kg

NOTE:M10 and M12 are bolt belonging to hexagon hole

4. Name of Each Part



NAME	CONTENT
①Data Display Section	This section displays input values, output values, and setting data
②Menu Display Section	This section displays a character to show what data is displayed
③Menu Key	This key is used to shift a screen between a group of monitor screens and the operation mode screen, to shift a screen between a group of monitor screens and the lead screen of Mode 1 (press the Menu Key for three seconds), to shift a screen among the mode screens, and to register set values and settings when they are changed.
④Up Key	This key is used to shift a screen among a group of monitor screens, to shift a screen to the lead screen of each Mode, and to increase or move forward a set value and setting.
⑤Down Key	This key is used to shift a screen among a group of monitor screens, to shift a screen to the lead screen of each Mode, and to reduce or move backward a set value and setting.
⑥Control Terminals	These are the terminals to connect control circuit's input・power supply・an external variable resistor.
⑦Main Circuit Terminals	These are the terminals to connect thyristor elements (built-in) to a power supply・load
⑧Earth Terminals	For safety, earth the terminal at the grounding resistance 100Ω or below
⑨Description of Characters on the Menu Display,	This section shows what each character on the Menu Display indicates, and Data Display of Operation Mode and Error Code explains operation modes and error codes shown on the Data Display section

⑩Lamp Section		
RUN Lamp (green)	Automatic Operation—light-on	Manual Operation—blinking
SYS Lamp (red)	Light-on when an alarm is posted. Refer to Table of Alarm Function (page 14)	
OC Lamp (red)		
HB Lamp (red)		

5. Wiring

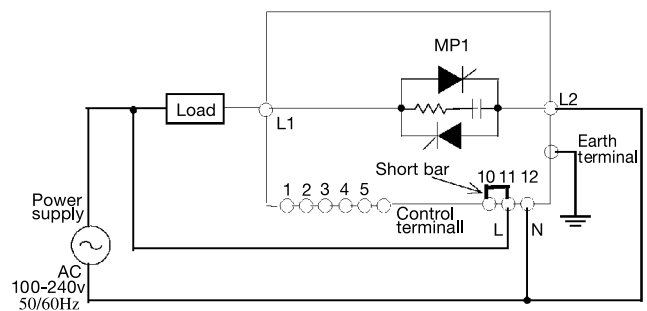
⚠“CAUTION”

- ◎ To prevent electrical shock, turn off electricity during wiring operation.
- ◎ Earth the ground terminal without fail. Otherwise, there is a possibility of electric shock.
- ◎ Avoid touching the wired terminals and chargers when electricity is turned on.

5-1. Wiring of The Main Circuit Terminals and Control Power Supply Terminals

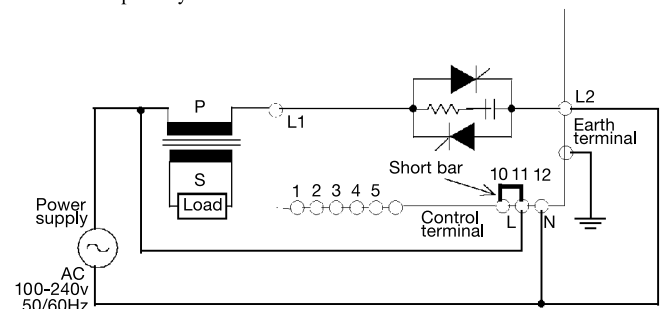
- ◎ Use wires with enough capacity to the load current as the main circuit terminal wires.
- ◎ Terminal screws for the main circuit should be M4 for 1 30A, M5 for 50A, M6 for 70A and 100A, M10 for 150A and 200A, and M12 for 300A. Screw tightly by using a proper sticking-by-presser terminal.(Tightening torque: control terminal M3 0.5 0.6N・m M4 1.2 1.4N・m M5 2.0 2.4N・m M6 2.5 3.0N・m M10 10.0 12.0N・m M12 15.5 18.5N・m)
- ◎ The phase of the main circuit (L1, L2) and the control power supply (11,12) must be the same.

Wiring of The Main Circuit Terminals and Control Power Supply Terminals

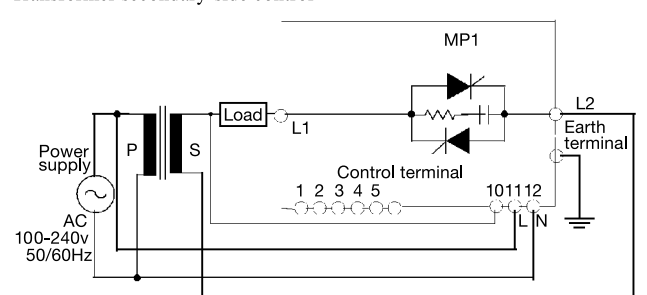


Note: Terminal 12 (N) and L2 should have the same phase. Load should be connected between a power supply and L1 terminal.

Transformer primary-side control



Transformer secondary-side control



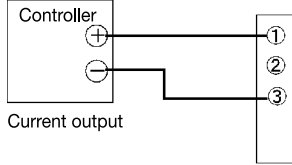
Note: Do wiring after the short bar between Terminal No.10 and Terminal No.11 has been removed.

5-2. Wiring of control terminals

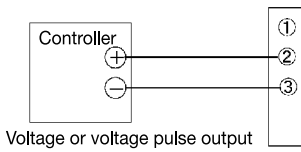
- ◎ Size M3 screws are used for the control terminals. Please use a sticking-by-pressure terminal with its inside diameter 3mm or more and its outside diameter 6mm or more. (Tightening torque 0.5~0.6 N·m)
- ◎ In wiring control terminals, be careful with polarity (±) and noises from a strong electric circuit.

(1) Wiring of control input signal

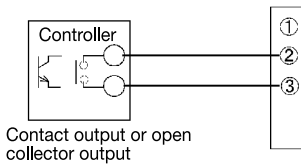
- In case of current signal (4-20mA·0-20mA: receiving impedance approx. 165 Ω), connect control terminal No.1 with (+), and No.3 with (−).



- In case of voltage signal (1-5V·0-5V: input impedance approx. 15k Ω) or in case of voltage pulse (SSR drive voltage) signal (12V DC: input impedance approx. 15k Ω), connect control terminal No. 2 with (+), and No.3 with (−).

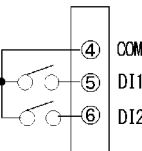


- In case of contact signal (no-voltage) or in case of open collector signal (sink load 5V DC 1mA), connect control terminal No. 2 with (+), and No.3 with (−). There is no polarity in case of contact signal.



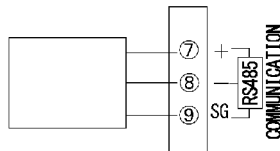
(2) DI terminal

Short-circuit DI terminals to execute allocated functions



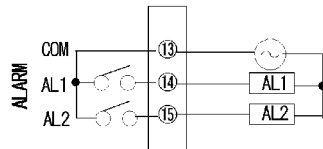
(3) Communication (option) terminal

Wire the terminals for communication.



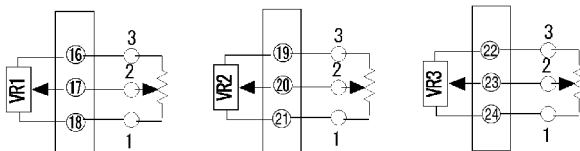
(4) Alarm terminal

Wire the terminals to install circuits to inform through an external buzzer or lamp when something wrong happens.



(5) Variable resistor connect terminal

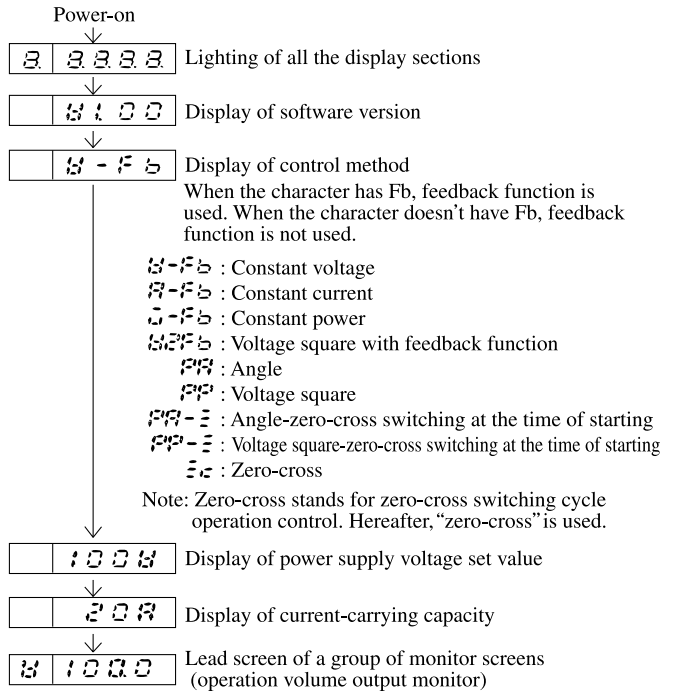
Allocate functions set by an external variable resistor to VR1~VR3. Connect the terminals with the external variable resistor to change the set times or values.



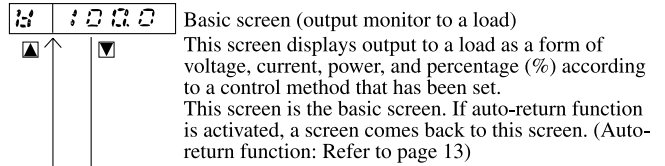
6. Description of screens, functions, and operation

6-1. Lead screen display at power-on

At power-on, the initial screen is displayed, showing data successively as below and moves on to the lead screen (operation volume output monitor) of a group of monitor screens.



6-2. A group of monitor screens



Display range

Control method	Menu display	Display range	Unit
4 - F b	4	0.0~240.0	V
F - F b	F	0.00~10.00	A(1-10A)
0 - F b	0	0.0~300.0	A(20-300A)
4 2 F b	4	0.000~2.400	kVA(1-10A)
	0	0.00~12.00	kVA(20-50A)
	0	0.0~72.0	kVA(70-300A)
	P	0.0~100.0	%

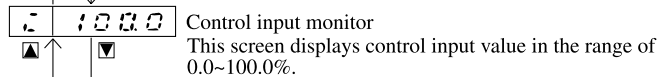
When control method is P P, P P, P P - ε, P P - ε or ε ε, the display range is the same as that of 4 2 F b.

Press ▽ key, and the screen will move to the control input monitor.

Press ▲ key, and the screen will move to the load impedance monitor.

Press ▢ key, and the screen will move to the operation mode setting screen.

Press ▢ key for three seconds, and the screen will move to the lead screen of Mode 1.



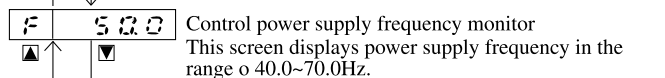
When sampling frequency is OFF in contact·voltage pulse input, the screen displays ON/OFF.

Press ▽ key, and the screen will move to the control power supply frequency monitor.

Press ▲ key, and the screen will move to the basic screen.

Press ▢ key, and the screen will move to the operation mode setting screen.

Press ▢ key for three seconds, and the screen will move to the lead screen of Mode 1.



Press ▽ key, and the screen will move to the load voltage monitor.

Press ▲ key, and the screen will move to the control input monitor.

Press ▢ key, and the screen will move to the operation mode setting screen.

Press ▢ key for three seconds, and the screen will move to the lead screen of Mode 1.

To the load voltage monitor

18 100.0

Load voltage monitor

This screen displays voltage impressed to a load in the range of 9.6~240.0V.
When the load voltage is less than 9.6V, ---- is displayed on the screen because of an out-of-measurement area.
In the case of zero-cross control, the screen displays an executed value of output ON cycle.
Press \blacktriangledown key, and the screen will move to the load current monitor.
Press \blacktriangle key, and the screen will move to the control power supply frequency monitor.
Press \blacksquare key, and the screen will move to the operation mode setting screen.
Press \blacksquare key for three seconds, and the screen will move to the lead screen of Mode 1.

18 20.0

Load current monitor

This screen displays current flowing to a load in the range of 4% the maximum value of the current-carrying capacity.
Display range 0.00~100.0A (1-10A)
0.0~300.0A (20-300A)
When the load current is less than 4% of the current-carrying capacity, ---- is displayed on the screen because of an out-of-measurement area.
In the case of zero-cross control, the screen displays an executed value of output ON cycle.
Press \blacktriangledown key, and the screen will move to the load power monitor.
Press \blacktriangle key, and the screen will move to the load voltage monitor.
Press \blacksquare key, and the screen will move to the operation mode setting screen.
Press \blacksquare key for three seconds, and the screen will move to the lead screen of Mode 1

5 20.0

Load power monitor

This screen displays load power in kVA.
Display range 0.000~200.0 kVA (1-10A)
0.00~100.0 kVA (20-50A)
0.0~70.0 kVA (70-300A)
When either the load voltage or load current monitor displays ----, the display of this screen is also ----.
In the case of zero-cross control, the screen displays executed value of output ON cycle.
Press \blacktriangledown key, and the screen will move to the internal temperature monitor.
Press \blacktriangle key, and the screen will move to the load current monitor.
Press \blacksquare key, and the screen will move to the operation mode setting screen.
Press \blacksquare key for three seconds, and the screen will move to the lead screen of Mode 1.

6 25.0

Internal temperature monitor

This screen displays internal temperature of the body in the range of 20~110℃
Press \blacktriangledown key, and the screen will move to the VR1 position monitor.
Press \blacktriangle key, and the screen will move to the load power monitor.
Press \blacksquare key, and the screen will move to the operation mode setting screen.
Press \blacksquare key for three seconds, and the screen will move to the lead screen of Mode 1.

- 100.0

VR1 position monitor

This screen displays a set value when external variable resistor 1 is connected.
If external variable resistor 1 is not connected, indefinite numbers are displayed.
Press \blacktriangledown key, and the screen will move to the VR2 position monitor.
Press \blacktriangle key, and the screen will move to the internal temperature monitor.
Press \blacksquare key, and the screen will move to the operation mode setting screen.
Press \blacksquare key for three seconds, and the screen will move to the lead screen of Mode 1

= 50.0

VR2 position monitor

This screen displays a set value when external variable resistor 2 is connected.
If external variable resistor 2 is not connected, indefinite numbers are displayed.
Press \blacktriangledown key, and the screen will move to the VR3 position monitor.
Press \blacktriangle key, and the screen will move to the VR1 position monitor.
Press \blacksquare key, and the screen will move to the operation mode setting screen.
Press \blacksquare key for three seconds, and the screen will move to the lead screen of Mode 1.

To VR3 position monitor

= 25.0

VR3 position monitor

This screen displays a set value when external variable resistor 3 is connected.
If external variable resistor 3 is not connected, indefinite numbers are displayed.
Press \blacktriangledown key, and the screen will move to the load impedance monitor.
Press \blacktriangle key, and the screen will move to the VR2 position monitor.
Press \blacksquare key, and the screen will move to the operation mode setting screen.
Press \blacksquare key for three seconds, and the screen will move to the lead screen of Mode 1.

2 33.3

Load impedance monitor

This screen displays a load impedance value operated based on load voltage and load current.
Display range 0.0~999.9Ω (1-70A)
0.00~999.9Ω (100-300A)
When both/either the load voltage and/or load current monitor displays ----, the display of this screen is also ----.
When voltage FB value is 15V or less, the display of this screen is also ----.
When zero-cross output cycle is 10% or less, the display of this screen is also ----.
When the load impedance value is beyond the display limit, the display of this screen is ----.
Press \blacktriangledown key, and the screen will move to the basic screen.
Press \blacktriangle key, and the screen will move to the VR3 position monitor.
Press \blacksquare key, and the screen will move to the operation mode setting screen.
Press \blacksquare key for three seconds, and the screen will move to the lead screen of Mode 1.

To the basic screen

6-3. Operation mode • Control mode • Manual output value screen

By pressing \blacksquare key, any monitor screen shifts to the operation mode screen. Another press of the same key shifts the screen to the control mode screen. By pressing the same key on the control mode screen, the screen moves to the operation volume output monitor screen when the control mode is set to "automatic". When the control mode is set to "manual", the screen shifts to the manual output value setting screen.

Monitor screens

1 50.0

Operation mode

Initial Value 50.0
Setting Range 50.0~ Stop of operation
Operation

By pressing \blacktriangle key when the screen displays 50.0, the display changes to 50.0 and a dot beside the least decimal place starts blinking, which indicates the setting is being changed. By pressing \blacksquare key, blinking of the dot goes out, 50.0 is registered, and the mode changes to operation.
By pressing \blacktriangledown key when the screen displays 50.0, the display changes to 50.0 and a dot beside the least decimal place starts blinking, which indicates the setting is being changed. By pressing \blacksquare key, blinking of the dot goes out, 50.0 is registered, and the mode changes to stop of operation.
If control method is changed, the setting is initialized. When the operation mode is allocated to DI, the setting can not be changed on this screen.
Press the \blacksquare key, and the screen will move to the control mode screen.

2 50.0

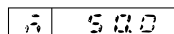
Control mode

Initial Value 50.0
Setting Range 50.0~ Automation
Manual

By pressing \blacktriangle key when the screen displays 50.0, the display changes to 50.0 and a dot beside the least decimal place starts blinking, which indicates the setting is being changed. By pressing \blacksquare key, blinking of the dot goes out, 50.0 is registered, and the mode changes to manual control output.
By pressing \blacktriangledown key when the screen displays 50.0, the display changes to 50.0 and a dot beside the least decimal place starts blinking, which indicates the setting is being changed. By pressing \blacksquare key, blinking of the dot goes out, 50.0 is registered, and the mode changes to automatic control output.
When the control mode is allocated to DI, the setting can not be changed on this screen.
Press the \blacksquare key at the time of 50.0, and the screen will move to the operation volume output monitor screen.
Press the \blacksquare key at the time of 50.0, and the screen will move to the manual output value setting screen.

To the basic screen at the time of 50.0

To the manual output value setting screen at the time of 50.0



Manual output value setting Initial Value : The value shown on the manual output initial value setting screen

Setting Range :

Control method	Display range	Unit
电压	0.0~240.0	V
电流	0.00~10.00	A(1-10A)
	0.0~300.0	A(20-300A)
功率	0.000~2.400	kVA(1-10A)
	0.00~12.00	kVA(20-50A)
	0.0~72.0	kVA(70-300A)
反馈	0.0~100.0	%

When control method is 电压, 电流, 功率 or 反馈, the setting range is the same as that of 电压.

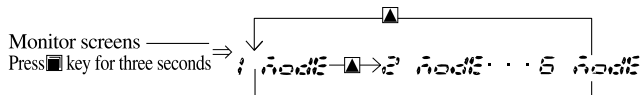
- Setting is changed by ▲ or ▼ key. There is no need to register the setting by ■ key.
- When control mode is changed from 手动 to 反馈, or control method is changed, the setting returns to the initial value. When control method is 电压 or 功率 and power supply voltage is set lower than manual output value, the value is displayed.
- When power supply is cut and is turn on again at the time of manual mode, the setting returns to the value shown on the manual output initial value setting screen. However, the setting on the initial value setting screen is 平衡 (balanceless-bumpless), manual output value is 0.
- This screen is not displayed when control mode is 反馈 or when the setting of manual output initial value is 平衡. Press ■ key, and the screen will move to the basic screen.

To the basic screen

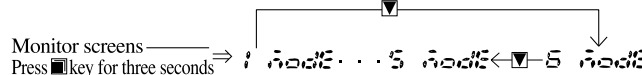
6-4 Mode 1~6 screens

By pressing ■ key for three seconds, any mode screen shifts to the lead screen of Mode 1. Press of ▲ key on the lead screen of Mode 1 shifts the screen to the lead screen of Mode 2. Another press of ▲ key shifts the screen to the lead screen of Mode 3, Mode 4. Press of ▼ key shifts the screen reversely from Mode 1 to Mode 6, to Mode 5, to Mode 4.

※Mode 6 screens are displayed when communication option is added. By pressing ■ key for three seconds on the lead screen of each Mode, the screen shifts to the basic screen.



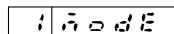
Basic screen ← Press ■ key for three seconds



By pressing ■ key on the lead screen of each Mode, the screen shifts to a setting screen of the mode. Every time the key is pressed, the screen moves to the next setting screen. By pressing ■ key on the last setting screen of the mode, the screen moves back to the lead screen.

When a setting on each setting screen has to be changed, call a set value you want to change on the setting item display screen by ▲ or ▼ key, choose a numerical value or item you want by ▲ or ▼ key (a dot beside the least decimal place is blinking), then register it by ■ key (the blinking of the dot goes out). ■ key serves as a blinking key when pressed while a dot beside the least decimal place is blinking (while setting is being changed). The same key serves as a screen shift key when pressed while a dot beside the least decimal place is not blinking.

(1) A group of Mode 1 screens



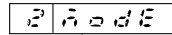
The lead screen of Mode 1
There is no setting on this screen.
Press ■ key, and the screen will move to the key lock setting screen.



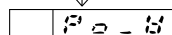
Key lock setting Initial value: 0 (OFF)
Setting range: 0 (OFF), 1 (ON)

When key lock is set to 1 (ON), no change of setting, except for a change of key lock setting, can be done on the screen. Each setting screen serves as a setting confirmation screen. When key lock is allocated to DI, the setting can not be changed on this screen. Press ■ key, and the screen will move to the lead screen of Mode 1.

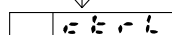
(2) A group of Mode 2 screens



The lead screen of Mode 2
There is no setting on this screen.
Press ■ key, and the screen will move to the power supply voltage setting screen.

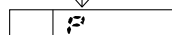


Power supply Initial value : 200 V
voltage setting Setting range : 0.0~250.0 V
This setting is the base for voltage failure detection and other control factors, such as proportional action, integral action in the control method with feedback function. Basically, the maximum value of the power supply voltage is set here.
When 电压, 功率, or 反馈 is chosen as a control method, 0.0~250.0 V in the setting range cannot be selected. When 电压, 功率, 反馈, or 反馈 is chosen as a control method and the setting is 0.0 here, voltage failure alarm is not detected.



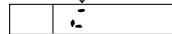
Control method setting Initial value : 电压
Setting range :
电压 : Constant voltage
电流 : Constant current
功率 : Constant power
反馈 : Voltage square with feedback function
反馈 : Angle
反馈 : Voltage square
反馈 : Angle-zero-cross switching at the time of starting
反馈 : Voltage square-zero-cross switching at the time of starting
反馈 : Zero-cross

※When the character has 反馈, feedback function is used. When the character doesn't have 反馈, feedback function is not used. When the power supply voltage setting is 0.0, 电压, 功率, and 反馈 are not displayed.
反馈 The time to switch a phase control to zero-cross in ■, and ■ setting is the set time on the starting limiter time setting screen. Press ■ key in the control method with feedback function, the screen will move to P (proportional band) setting screen. When the control method is without feedback function, the screen will move to the control input type setting screen.



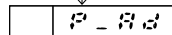
P (proportional band) setting Initial value : 300.0%
Setting range : 0.1~999.9%

The set value on the power supply voltage setting screen when the control method is set to constant voltage. The rated current when the control method is set to constant current. The set value on the power supply voltage setting screen x the rated current when the control method is set to constant power. When the control method is set to voltage square with feedback function, the setting is done in percentage to the squared value of a set value on the power supply voltage setting screen. Set the proportional band relatively wide when the control result is quick and there is a possibility of overshoot or hunting. Set the band relatively narrow when the control result takes time and is slow. This screen is not displayed when feedback function is not used. Press ■ key, and the screen will move to I (integral cycle) setting screen.



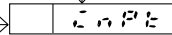
I (integral cycle) setting Initial value : 4 CYCLE
Setting range : 1~9999 CYCLE

Integral cycle can be set on this screen when feedback function is used. Set the integral cycle relatively wide when the control result is quick and there is a possibility of overshoot or hunting. Set the cycle relatively narrow when the control result takes time and is slow. Integral time (second) is the set cycle ÷ power supply frequency. This screen is not displayed when feedback function is not used. Press ■ key, and the screen will move to the control input type setting screen.

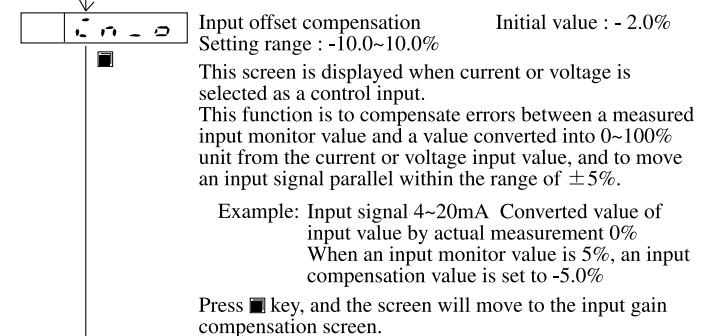
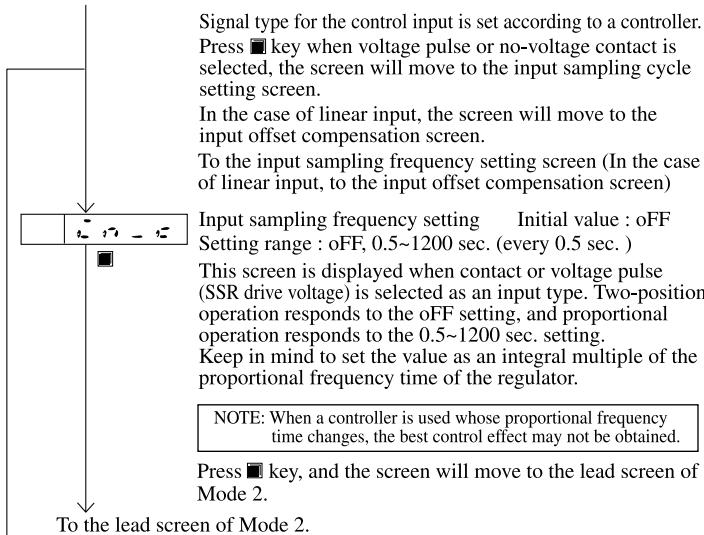


Phase Angle Correction Setting Initial Value: 0.0%
Setting Range: 0.0~100.0%

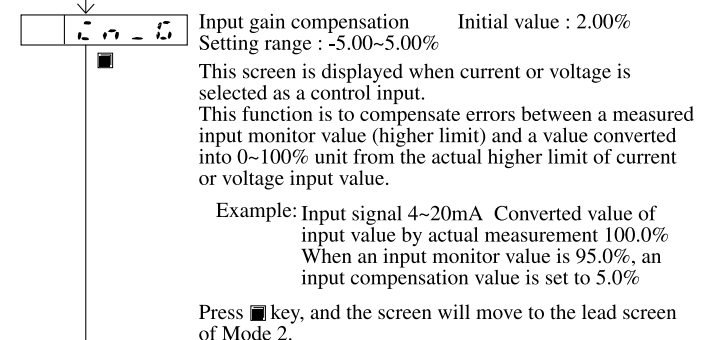
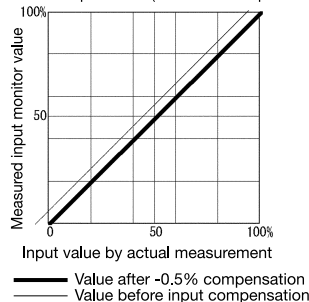
When there is a possibility of false firing due to differences of phase angle at the time of inductive load, this setting prevents the false firing by bringing firing point forward. Phase angle 0~180° responds to 0.0~100.0%
Example: To bring the point forward by 9°, the setting is 9÷180×100=5.0% Press ■ key, and the screen will move to the control input type setting screen.



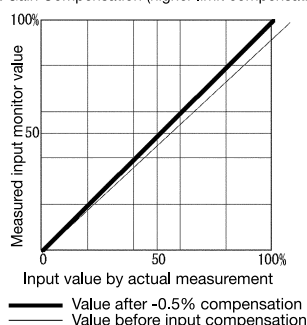
Control input type setting screen Initial value : 4~20 mA
Setting range : 4~20 4~20 mA
0~20 0~20 mA
1~5 1~5 V
0~5 0~5 V
5~5 voltage pulse (SSR drive voltage)
无电压 no-voltage contact



Input Offset Compensation (lower limit compensation) Drawing

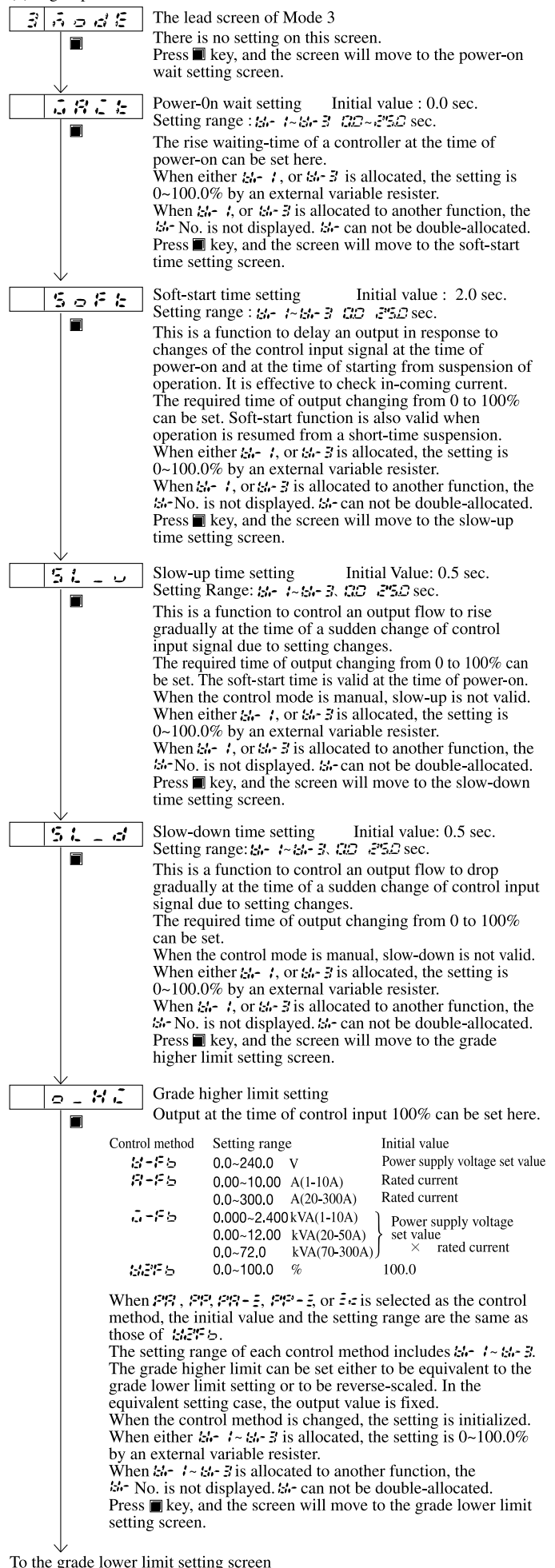


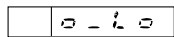
Input Gain Compensation (higher limit compensation) Drawing



To the lead screen of Mode 2

(3) A group of Mode 3 screens





Grade lower limit setting

Output at the time of control input 0% (base output) can be set here.

Control method	Setting range	Initial value
U-Fb	0.0~240.0 V	0.0
A-Fb	0.00~10.00 A(1-10A) 0.0~300.0 A(20-300A)	0.00 0.0
K-Fb	0.000~2.400 kVA(1-10A) 0.00~12.00 kVA(20-50A) 0.0~72.0 kVA(70-300A)	0.000 0.00 0.0
U-Fb	0.0~100.0 %	0.0

When U-Fb, A-Fb, K-Fb, or U-Fb is selected as a control method, the initial value and the setting range are the same as those of U-Fb.

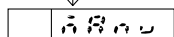
The setting range of each control method includes U-Fb. The grade lower limit can be set either to be equivalent to the grade higher limit setting or to be reverse-scaled. In the equivalent setting case, the output value is fixed.

When the control method is changed, the setting is initialized.

When either U-Fb or A-Fb is allocated, the setting is 0~100.0% by an external variable resistor.

When U-Fb is allocated to another function, the U-Fb No. is not displayed. U-Fb can not be double-allocated.

Press key, and the screen will move to the manual output initial value setting screen.



Manual output initial value setting

Manual output initial value at the time of control mode being changed from "automatic" to "manual" can be set here.

Control method	Setting range	Initial value
U-Fb	0.0~240.0 V, U-Fb	0.0
A-Fb	0.00~10.00 A, U-Fb (1-10A) 0.0~300.0 A, U-Fb (20-300A)	0.00 0.0
K-Fb	0.000~2.400 kVA, U-Fb (1-10A) 0.00~12.00 kVA, U-Fb (20-50A) 0.0~72.0 kVA, U-Fb (70-300A)	0.000 0.00 0.0
U-Fb	0.0~100.0 %, U-Fb	0.0

When U-Fb, A-Fb, K-Fb, or U-Fb is selected as a control method, the initial value and the setting range are the same as those of U-Fb.

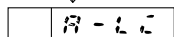
The setting range of each control method includes U-Fb. When U-Fb is selected, the mode becomes a balanceless bumpless operation, and an automatic output value just before the switch-over serves as a manual output value.

When the control method is changed, the setting is initialized. When either U-Fb or A-Fb is allocated, the setting is 0~100.0% by an external variable resistor.

When U-Fb is allocated to another function, the U-Fb No. is not displayed. U-Fb can not be double-allocated.

Press key when a control method with feedback function is used, and the screen will move to the current limiter value setting screen.

When a control method without feedback function is used, the screen will move to the current alarm value setting screen.



Current limiter value setting

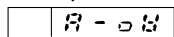
Initial value : 110% of the rated current
Setting range : U-Fb 0.00~1.00 (1-10A)
A-Fb 0.0~300.0 (20-300A)

This screen is displayed when a control method with feedback function is used. A limiter value can be set here in the range of 0~110.0% of the rated current of the body, in order to restrain the maximum current value. A current is clipped to the set maximum value.

When U-Fb or A-Fb is allocated to another function, the U-Fb No. is not displayed. U-Fb can not be double-allocated.

Press key, and the screen will move to the starting output higher limiter value setting screen.

To the starting output higher limiter value setting screen



Current alarm value setting

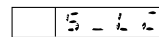
Initial value : 110% of the rated current
Setting range : U-Fb 0.00~1.00 (1-10A)
A-Fb 0.0~300.0 (20-300A)

This screen is displayed when a control method without feedback function is used. If a current value rises beyond the set value, OC lamp lights on. When current alarm is allocated, an alarm output terminal becomes electrically connected. When the current value goes down by 1% of the rated current from the set value, the alarm is cancelled.

There is no alarm operation when zero-cross is selected as a control method. The conditions of the setting range, initial value, and U-Fb are the same as those of current limiter value setting.

Press key, and the screen will move to the starting output higher limiter value setting screen.

To the starting output higher limiter value setting screen



Starting higher limiter value setting

The output maximum value at the time of power-on in the U-Fb status or at the time of switching from U-Fb to A-Fb can be set here.

Control method	Setting range	Initial value
U-Fb	0.0~240.0 V	Power supply voltage set value
A-Fb	0.00~10.00 A(1-10A) 0.0~300.0 A(20-300A)	Rated current Rated current
K-Fb	0.000~2.400 kVA(1-10A) 0.00~12.00 kVA(20-50A) 0.0~72.0 kVA(70-300A)	Power supply voltage set value × rated current
U-Fb	0.0~100.0 %	

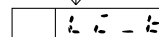
When U-Fb, A-Fb, K-Fb, or U-Fb is selected as a control method, the initial value and the setting range are the same as those of U-Fb.

The setting range of each control method includes U-Fb. When the control method is changed, the setting is initialized.

When either U-Fb or A-Fb is allocated, the setting is 0~100.0% by an external variable resistor.

When U-Fb or A-Fb is allocated to another function, the U-Fb No. is not displayed. U-Fb can not be double-allocated.

Press key, and the screen will move to the starting limiter time setting screen.



Starting limiter time setting

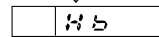
Initial value : U-Fb
Setting range : U-Fb 0.00~1.00

The time to maintain the starting higher limiter output value can be set here. This is also used for a switching time from a phase control to zero-cross control when a control method is U-Fb or A-Fb.

When either U-Fb or A-Fb is allocated, the setting is 0~100.0% by an external variable resistor.

When U-Fb or A-Fb is allocated to another function, the U-Fb No. is not displayed. U-Fb can not be double-allocated.

Press key, and the screen will move to the snapped-heater-wire detection level setting screen.



Snapped-heater-wire (disconnection of heater wire) detection level setting

Setting range	Initial value
VR1~VR3, OFF, 0.1~999.9 Ω (1~70A)	999.9 Ω
VR1~VR3, OFF, 0.01~99.99 Ω (100~300A)	99.99 Ω

The detection level of snapped-heater-wire can be set in the form of impedance value. If load impedance value is beyond the set impedance value for three seconds, it is detected.

When OFF is selected here, there is no detection.

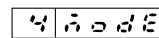
When either U-Fb or A-Fb is allocated, the setting is 0~100.0% by an external variable resistor.

When U-Fb or A-Fb is allocated to another function, the U-Fb No. is not displayed. U-Fb can not be double-allocated.

Press key, and the screen will move to the lead screen of Mode 3.

To the lead screen of Mode 3

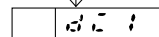
(4) A group of Mode 4 screens



The lead screen of Mode 4

There is no setting on this screen.

Press key, and the screen will move to the DI1 setting screen.



DI1 setting

Initial value : non (no allocation)
Actions allocated to DI1 can be set here.

Setting range	non	No allocation
COM-DI1 terminal open	COM-DI1 terminal close	
Stop of operation	Start of operation	
Automatic operation	Manual operation	
Currently-set control method	Zero-cross	
Key-lock OFF	Key-lock ON	

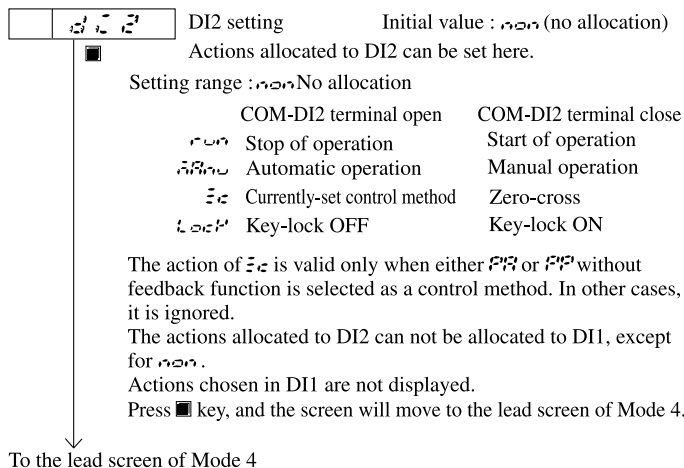
The action of U-Fb is valid only when the phase control without feedback function is selected as a control method. In other cases, it is ignored.

The actions allocated to DI1 can not be allocated to DI2, except for non.

Actions chosen in DI2 are not displayed.

Press key, and the screen will move to DI2 setting screen.

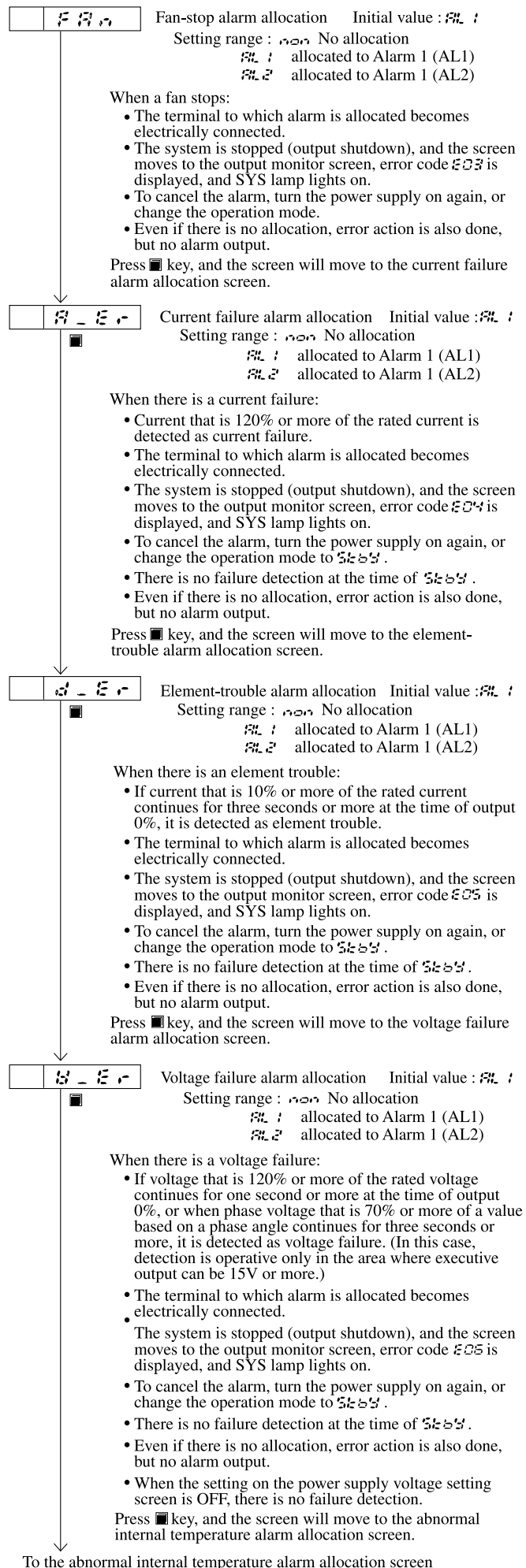
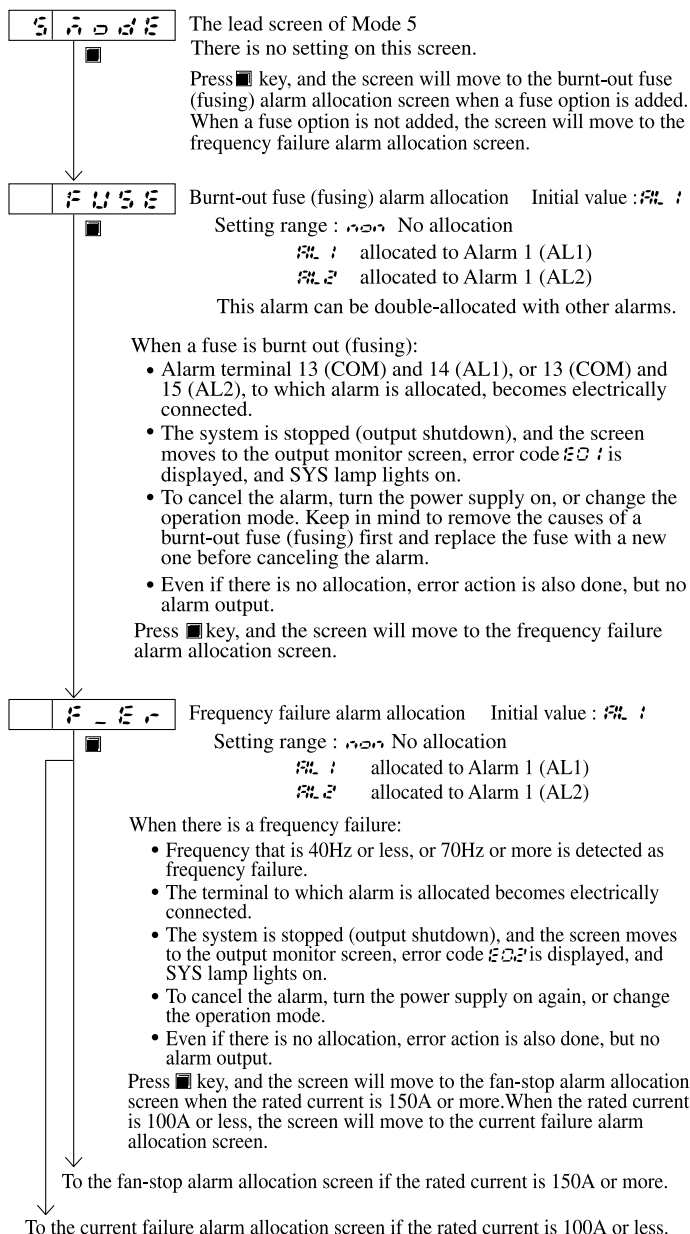
To the DI2 starting

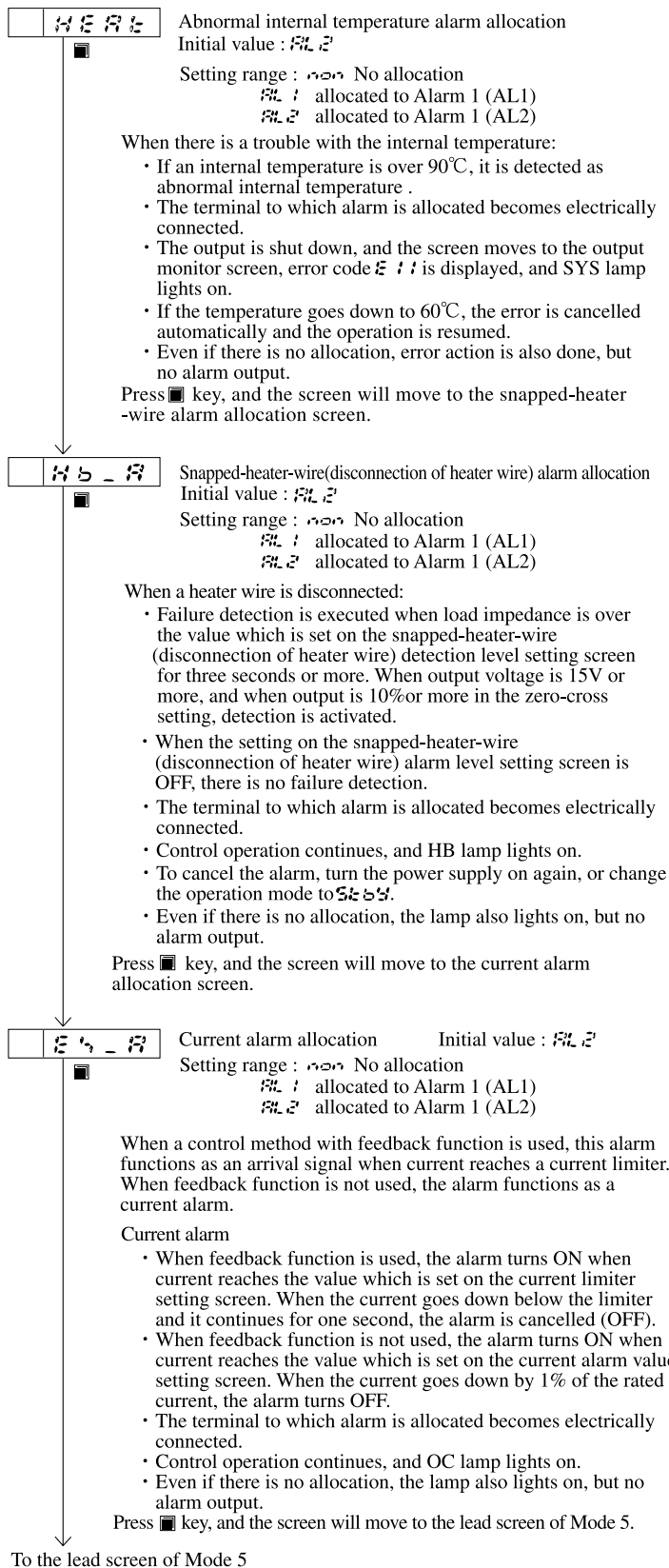


DI action

- DI action is executed by opening and closing control terminal 4 (COM) and 5 (DI1) or 4 (COM) and 6 (DI2).
- Actions allocated to DI are not operated by the keys on the screen.
- Actions except for those allocated to Key-lock ON can be executed even when key-lock is ON.
- The distance of DI wiring needs to be within 30 meters.

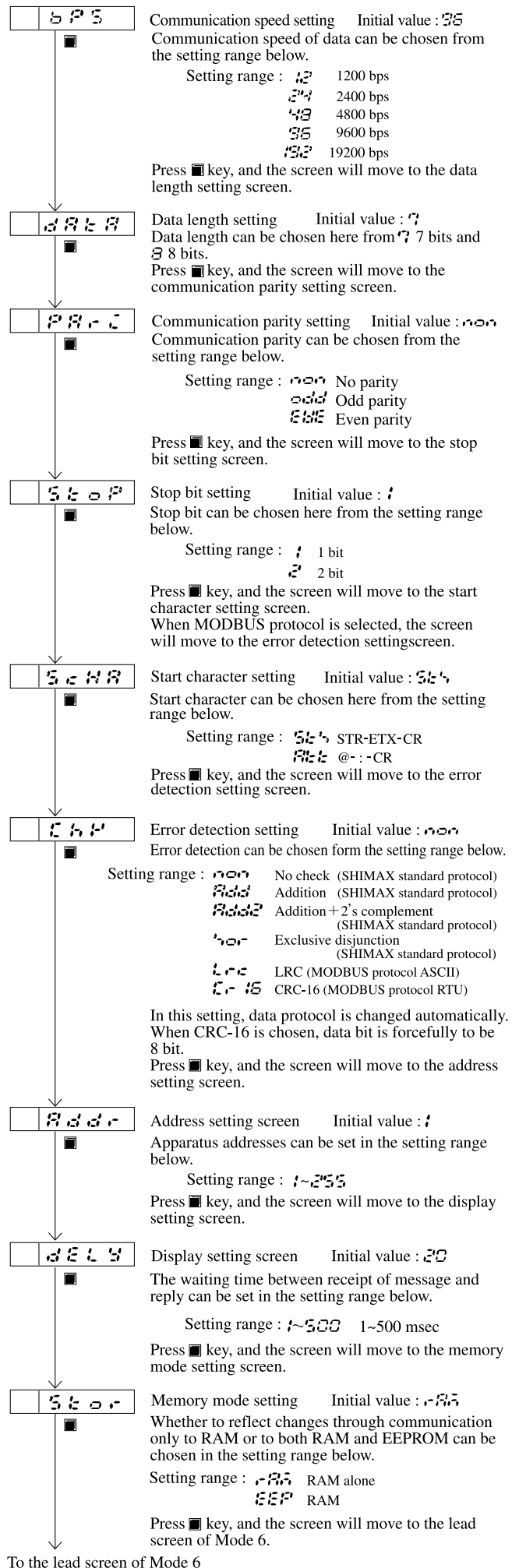
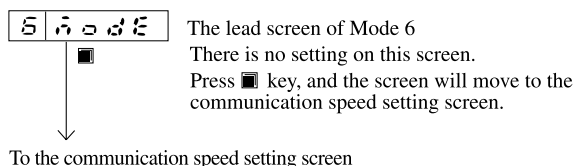
(5) A group of Mode 5 screens



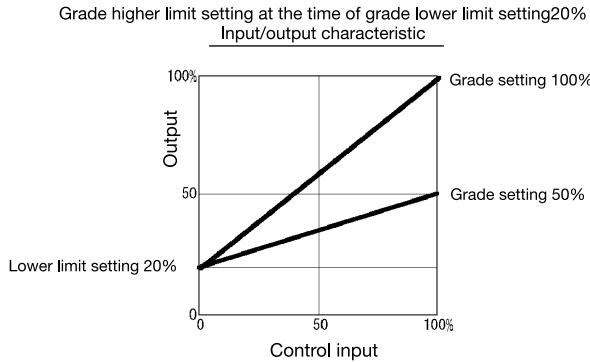
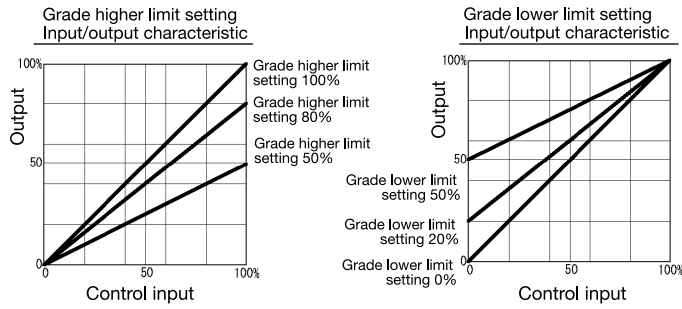


(6) A group of Mode 6 screens

Mode 6 screens are not displayed if communication (RS-485) option is not added on the communication option setting screen. Refer to the appurtenant communication instruction manual.



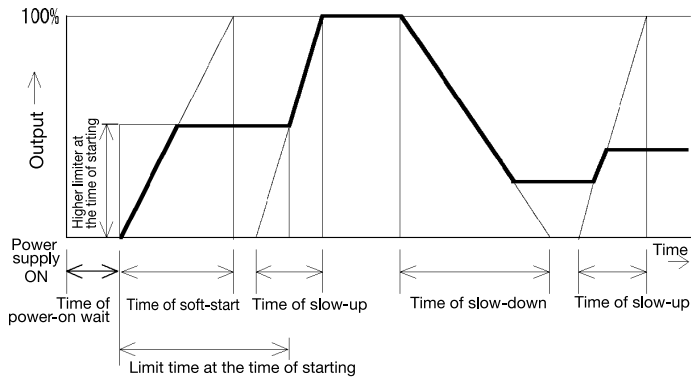
6-5. Graphs of input/output characteristic of the grade higher and lower limit setting



- ⊙ Grade lower limit setting is the output value at the time of control input value 0%, that is the base output.
- ⊙ Grade higher limit setting is the output value at the time of control input value 100%.

6-6. Time of power-on wait, soft-start, slow-up and slow-down, and function of higher limiter at the time of starting and limit time at the time of starting

- (1) Power-on wait
The rise waiting time of a controller at the time of power-on is set, in order to adjust timing between a control signal and the body.
- (2) The set time of soft-start, slow-up, and slow-down is the time in which output rises from 0% up to 100%. Each of the grade is fixed and the actual time needed is proportional to a deviation.



- (3) Soft-start function is valid only once at the time of power-on. However, if the deviation of input and output at the time of power-on is 0, soft-start operation is not activated. When the deviation of input and output becomes 0 (for example, when input drops within the time of soft-start) while soft-start operation is on, soft-start function is over at that time.

NOTE :

Slow-up and slow-down operation restrains a sudden change of load voltage and load current at the time of a sudden change of input or setting. However, in some control systems, this operation may affect the control.

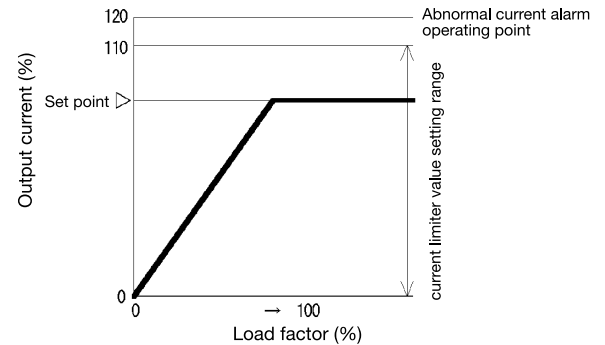
- (4) Time of higher limiter at the time of starting and limit time at the time of starting
At the time of power-on during an operation, or at the time of switching from suspension to operation, an output value is restrained to the set value during the time that has been set.

6-7. Current limiter and current alarm

(1) Current limit

This is a function to restrain output current in a control method with feedback function. This function protects a thyristor by restraining current when a load whose inrush current is big, such as a pure-metal heater and a lump heater. Since this function restrains electric current to the set value by lowering an output voltage, an output voltage drops when the load factor becomes over 100%.

If an inrush current of load is big, current limit operation can not be in time. In that case, set the time of soft-start to 2~3 seconds or more.



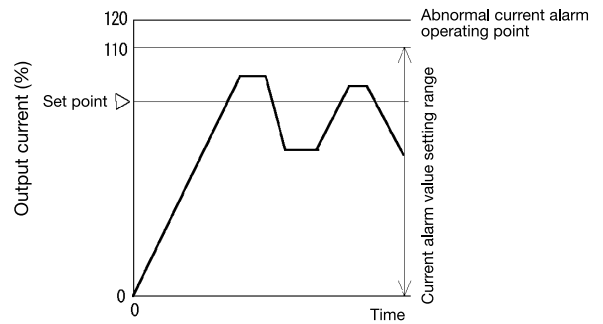
(2) Current alarm

This is a function to generate a current arrival signal in a phase control method with feedback function.

Current alarm output

ON
OFF

OFF when an output current goes down below 1% of the rated current



6-8. Snapped-heater-wire (disconnection of heater wire) alarm function

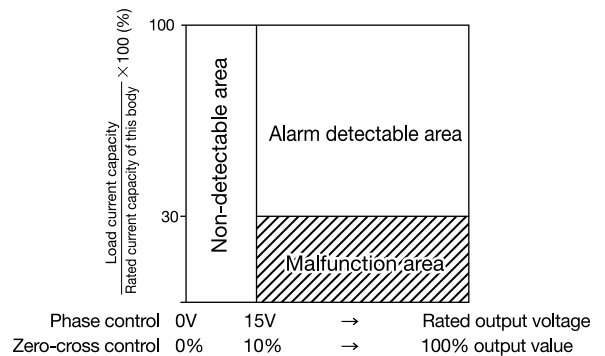
Alarm detection starts when a load resistance goes over the value that is set on the snapped-heater-wire (disconnection of heater wire) detection level setting screen for three seconds.

Detection is possible when an output voltage is 15V or more, or when an output is 10% or more in a zero-cross control.

When the value is set to 30% or less of the rate of this body (load current rated current), there is a possibility of alarm malfunctioning. So when this function is used, set the disparity to be small between the actual load resistance and the rated capacity of this body.

When several heaters are used, a set value is different depending on how many disconnected wires outputs an alarm. The more heater are used, the smaller the detection resistance per a wire is. Pay a close attention to the choices.

The waves of voltage and current are different in a transformer resistance, and the voltage and current may not be proportional to each other. This can cause a low detection accuracy. Pay a close attention to the setting.

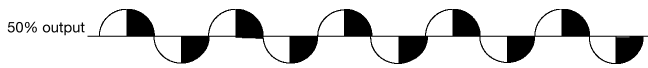


When this function is used, set the disparity to be small between the load capacity and the rated capacity of this body

6-9. Description of control method

(1) Phase control method

This method is to successively control the power to the load by changing the phase angle of AC voltage applied to the load.

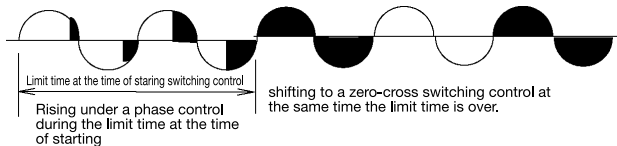


(2) Zero-cross switching control

This method is to control output by turning a thyristor ON-OFF when the voltage becomes 0. Since the output is turned on or off at 0V, there is less noise compared to phase control.

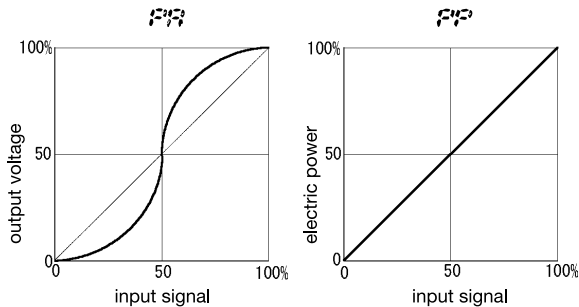


(3) Phase control -zero-cross switching control



※ Zero-cross switching restrains a load (platinum, molybdenum, tungsten, infrared lamp, etc.) which generates inrush current at the time of power-on.

(4) Output/input characteristic of angle control in case of a phase control, and input/output characteristic of a voltage square control



- In case of an angle control, in response to an input signal, an output voltage draws S-shaped curve.
- In case of a voltage control, in response to an input signal, an output draws a nearly straight line, which is proportional to voltage (in case of a fixed impedance load)

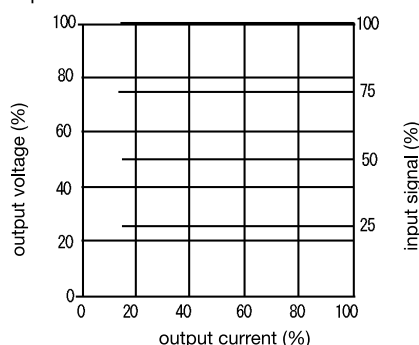
6-10. Feedback function

Feedback function is to detect a current or voltage of a thyristor under a phase control, and to control them to the set values through control signals from a regulator. This function keeps a fluctuation small to the power-supply voltage or a load. There are constant voltage (voltage feedback), constant current (current feedback), constant electric power (electric power feedback), and voltage square feedback. Characteristics of each feedback function are as follows:

(1) Constant voltage

This function corresponds to a load (iron, chromium, nichrome, etc) whose electric resistance is small and supplies voltage output proportional to control input regardless of power supply voltage changes/load changes.

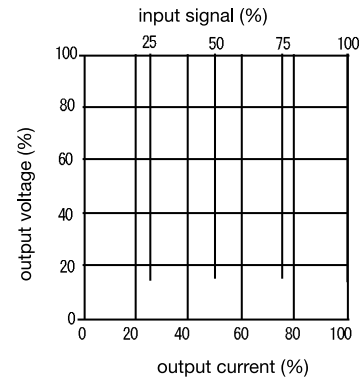
output characteristic



(2) Constant current

This function corresponds to load (platinum, molybdenum, tungsten, etc) whose temperature coefficient of electric resistance goes up to 6~12 times in the normal temperature. It supplies a current proportional to control input regardless of power supply voltage changes / load changes.

output characteristic

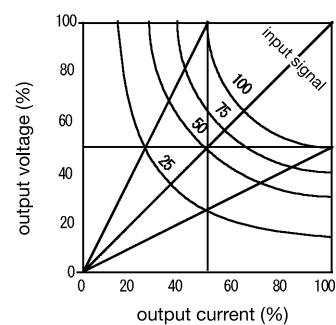


(3) Constant electric power

In the case that a load is silundum (sic) luminous body, secular changes of resistance / electric resistance occurs due to generation of heat. This function supplies electricity output proportional to control input regardless of load resistance value.

Output characteristic is that a curve connected between a point of output voltage 100% × output current 50% and a point of output voltage 50% × output current 100% is equivalent to 50% of output. So set output current capacity of this body to double the load capacity.

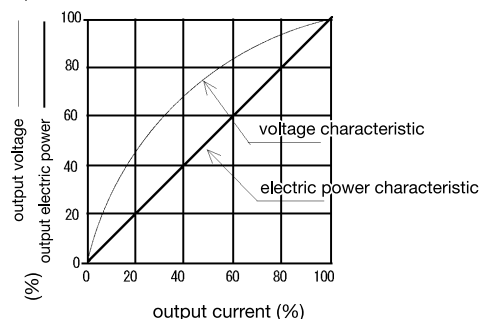
output characteristic



(4) Voltage square feedback

Control input corresponds to a squared value of output voltage. Electric power to a constant resistance is proportional to a squared voltage. If this can be used in a constant-resistance heater (iron, chromium, etc.), the function serves as a kind of constant electric controls and supplies electric power responding to a control input.

output characteristic

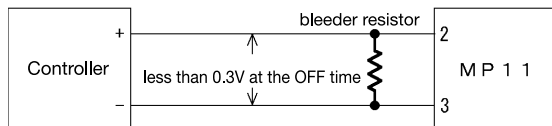


6-11. Matters to be attended to in the use of transformer load

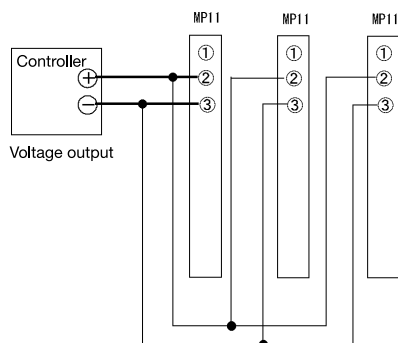
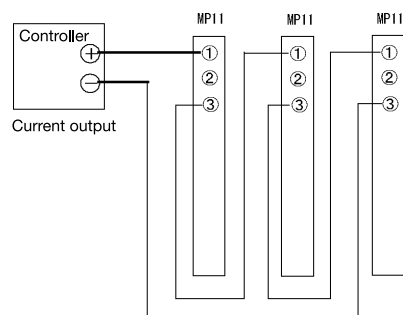
- Transformers to be used are single-phase compound-wound transformers (the secondary load is resistance load), and single-layer winding transformers (such as slide transformers) can not be used.
- Magnetic flux density of a transformer should be 1.25T or less.
- Do not operate with the secondary side of a transformer open. Otherwise, the winding resistance of the transformer alone becomes a load, and overcurrent can damage the thyristor.

6-12. Input

- (1) When contact input is chosen, open collector signals also run this regulator. Contact impedance should be 100Ω or less at the closing time, and $10k\Omega$ or more at the opening time. In case of open collector, sink load is 5V DC, 1mA.
Leakage current of a transistor used in an open collector should be 0.2mA or less at the OFF time, and residual current at the ON time should be 0.3V or less.
- (2) When voltage pulse (SSR drive voltage) is chosen, leakage current of this regulator should be 0.1mA or less at the OFF time. If it is not possible, connect a bleeder resistor to the output terminal of a controller or to terminal 2-3 of MP11 so that the residual electric charge of MP11 control input is less than 0.3V at the OFF time.



- (3) When more than one MP11 are connected to one controller, input terminals of MP11 are connected in series in case of current signal, and in parallel in case of voltage signal.



6-13. Operation at the time of power breakdown

Operation of MP11 at the time of power breakdown is as follows:

- (1) If a power breakdown is less than 3 msec., operation is continued.
- (2) When control voltage is 100V, output becomes 0% at 3~60msec. power breakdown. When control voltage is 200V, output becomes 0% at 3~120msec. power breakdown. In both cases, according to soft-start set time, it goes back to operation status.
- (3) When control voltage is 100V, the system goes to reset status at more than 60msec. power breakdown. When control voltage is 200V, the system goes to reset status at more than 120msec. power breakdown. In both cases, the operation is resumed just like at a normal power-on.

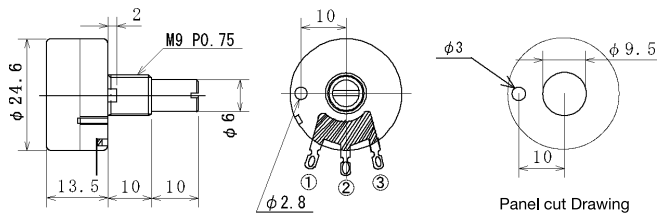
7. Auto-return function

When there is no key operation for three minutes on the screens other than the monitor screens, the screen automatically shifts to the basic screen.

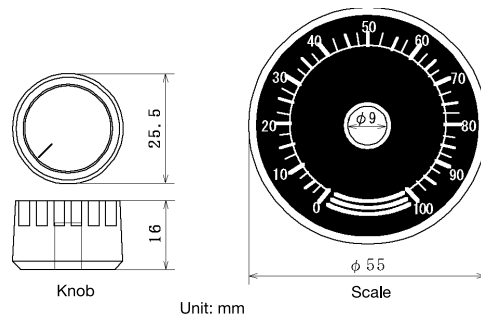
8. Accessory

8-1. External variable resistor set (variable resistor, knob, and scale)

Accessory code : ATT03



External variable resistor (resistance: 10k Ω characteristic: B)



8-2. Immediately-cut Fuse

made by Hinode Denki Seisaku-jo (Hinode Electric Laboratory)

Accessory code	Fuse Rating	
250GH-20S: responding to the body 1~10A	(20A)	Hinode Electric Co., LTD
250GH-32S: responding to the body 20A	(32A)	
250GH-40S: responding to the body 30A	(40A)	
250GH-63S: responding to the body 50A	(63A)	
250GH-100S: responding to the body 70A	(100A)	
250GH-125S: responding to the body 100A	(125A)	
250GH-250S: responding to the body 150A	(250A)	
250GH-315S: responding to the body 200A	(315A)	
250GH-450S: responding to the body 300A	(450A)	

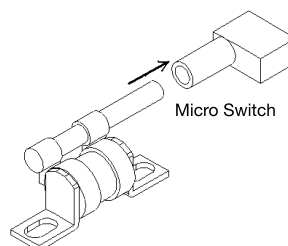
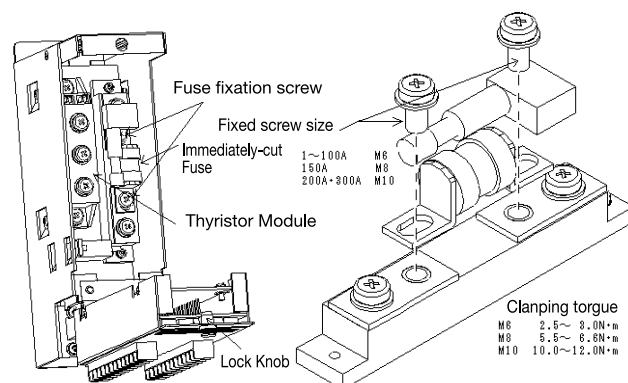
9. Change of immediately-cut Fuses

⚠ "WARNING"

NOTE:

In changing immediately-cut fuses, cut the electric power first for safety reasons. Otherwise, there is a possibility of electric shock or of damaging the body itself and the connected equipment.

If an error code $\text{E} \square \text{F}$ is displayed on the data display screen, and SYS lamp lights on, it indicates fusing of immediately-cut fuse. Replace the burnt-out fuse with a new one.



How to change fuses:

1. Cut the power
2. Open the front by pulling a lock knob
3. Undo the screw of a fuse
4. Pull the micro-switch sideways
5. Replace the old one with a new one.

NOTE: Pay a close attention to the tightening torque

10. Specification

- Control Method : Phase control with feedback function constant voltage, constant current, constant power, voltage square angle, voltage square, zero-cross (*)angle at the time of starting-zero-cross switching(*), voltage square at the time of starting-zero-cross switching (*)Zero-cross (*) is zero-cross switching cycle
- Operation control : Characteristic of constant voltage $\pm 3\%$ FS or below against power supply change $\pm 10\%$ (load fixed, output voltage \leq power supply voltage x 0.9) $\pm 5\%$ FS or below against load change 4 times (power supply fixed)
- Characteristic of constant current : $\pm 3\%$ FS or below against power supply change $\pm 10\%$ (power supply fixed) $\pm 5\%$ FS or below against load change 4 times (power supply fixed)
- Characteristic of constant power : $\pm 3\%$ FS or below against power supply change $\pm 10\%$ (power supply fixed) $\pm 5\%$ FS or below against load change 4 times (power supply fixed)
- Power Supply Voltage : 100~240V AC $\pm 10\%$ 50/60Hz
- Control circuit power supply : 15~240V AC $\pm 10\%$ 50/60Hz (The phase of control power supply and main circuit power supply should be the same.)
- Power Supply Frequency : 45~65Hz automatic discrimination (The system stops below 40Hz or above 70Hz)
- Current-carrying Capacity : 18 types: 1A~10A (1A calibration), 20A, 30A, 50A, 70A, 100A, 150A, 200A, 300A
- Control Range of Output Voltage : 0~98% of the power supply voltage
- Lowest Load Capacity : 0.5A (rated current 100A and below) 1.0A (rated current 150A and above)
- Applicable Load : Phase control Resistive load, inductive load (the primary side of transformer: magnetic flux density 1.25T and below)
Phase at the time of starting-zero-cross control Resistive load
Zero-cross control Constant resistive load
- Control Input (Multi-input) : Current 4~20mA DC, 0~20mA DC receiving impedance approx.165 Ω
Voltage 1~5V DC, 0~5V DC input impedance approx.15k Ω
No-voltage contact or open collector (sink load approx.1mA/5V)
Voltage pulse (SSR drive voltage) 12V DC input impedance approx.15k Ω
- Control Input : Current•voltage 1/(power supply frequency×2) sec.
Input Sampling Cycle Contact•voltage pulse two-position (ON-OFF) action! 2mS
proportional control 0.5~120.0 sec. (0.5 sec. calibration) changeable on the input sampling cycle setting screen of Mode 2.
- Input Accuracy of Control Value : $\pm (1.0\% + 1 \text{ digit}) \pm 2\%$ in case of the 0~4mA, 0~1V range
- Display : 7-segment green LED 1 digit (display of menu No.) + red LED 4 digits (display of data) character height 10mm
Light green (RUN) light-on - automatic (自動) operation blinking - manual (手動) operation light-off - stop of operation (停止)
red (SYS) } light-on at the time of alarm Refer to Table of Alarm Function
red (OC) }
red (HB) }
- Monitor Display : Operation value output, operation input, control power supply frequency, load voltage, load current, load power, internal temperature, VR1~VR3 position, load impedance
- Functions Equipped as Standard : Power-on wait, soft-start, slow-up, slow-down, grade higher limit, grade lower limit, manual output
current limiter (current restraint), higher limiter at the time of starting, input offset compensation, input gain compensation, alarm output 2 points, DI 2 points
- Alarm Type : Error code display: burnt-out fuse (fusing), frequency failure, stop of a fan, current failure, trouble of elements, voltage failure, abnormal internal temperature — SYS light ON
Light : current limit, current alarm — OC light ON snapped-heater wire (disconnection of heater wire) — HB light ON
- Alarm Output : 2 points in common, rating 1A 240V AC resistive load

TABLE of ALARM FUNCTION								
Alarm Type	Control Method		Alarm Display	Alarm Output	Operational Condition at the time of Alarm Action	Causes of Alarm Action	Main Elements of Trouble	Cancellation of Alarm
		Light	error code					
Burnt-out Fuse (Fusing)	All Control Methods	SYS	Ⓔ Ⓓ !	Output from the allocated alarm terminal	Suspension of Operation	Burnt-out Fuse.(Fusing)	Overcurrent	The alarm is cancelled when control power is turned on or if the operation mode is changed.
Frequency failure		SYS	Ⓔ Ⓓ 2			Either of the following: The frequency of control power supply is 40Hz and less or 70Hz and more.	Power Supply Distortion, overnoise	
Stop of a Fan		SYS	Ⓔ Ⓓ 3			A cooling fan is stopped.(Current 150A or more)	Fan Failure, adhesion of dust	
Current failure		SYS	Ⓔ Ⓓ 4			Output current is 120% or more of the rated current value for one second.	Decrease of Load Impedance	
Trouble of Elements		SYS	Ⓔ Ⓓ 5			10% or more output for three seconds when an output signal is 0%.	Short-circuit of SCR, heater loop	
Voltage failure		SYS	Ⓔ Ⓓ 6			Either of the following: Voltage is 120% and more of the set voltage for one second or 70% and less of the calculated output value for three seconds.	Sudden Increase of Operation Voltage Disconnection of SCR, Disconnection of SENS wiring	
Abnormal Internal Temperature		SYS	Ⓔ ! !			The internal temperature is 90℃ or over.	Overload,Increase of Ambient Temperature	
Snapped Heater Wire (Disconnection) of heater wire			HB			Operation is continued even after an alarm output	In case of phase control: Output voltage is 15V or more. In case of zero-cross switching cycle operation control: The resistance value of a heater is above the set value for three seconds when output is 10% or more.	Disconnection of Heater wire
Current Limiter	Phase Control when feedback is used	OC	Normal screen	The higher limit value of output current is clipped to the set value.	The current level reaches the current limiter set value.	Disconnection of Heater wire	The alarm is turned on or off at the set point.	
Current Alarm	Phase Control when feedback is not used			Operation is continued even after an alarm output	Above the current alarm set value			

- Setting : Operation by using three keys on the front
- DI : 2 points operation mode (RUN-STBY), control mode (AUTO-MANU), control method (phase control without feedback function - zero-cross)
- Cooling of elements : 100A and below natural cooling 150A and above compulsory air-cooling
- Protection of elements : Digital abnormal current (120% of the rated current) gate breaker circuit or immediately-cut fuse (option)
- Protection of internal Overheat : Operation stops in response to the alarm of abnormal internal temperature

■OPTION

- Immediately-cut Fuse : Cum alarm output
- External variable resistor set : 1~3 sets (external variable resistor B, 10k Ω , knob, and scale)

●Communication

Communication Type : EIA standard in conformity to RS-485

Communication Mode : Two-channel half-duplex multi-drop (bus) mode

Synchronous Mode : Start-stop synchronization

Communication Distance : 500m max. (depending on environmental conditions)

Communication Speed : 1200, 2400, 4800, 19200bps (initial value: 9600)

Data format : START/1bit, STOP/1.2bit, DATA/7.8bit, PARITY/non. odd. eve (initial value: 7N1)

Slave Address : 1~255 (initial value:1)

Error Detection : none, addition, addition + 2' s complement, exclusive disjunction, CRC-16, LCR (Initial value: none)

Flow Control : none

Delay : 1~500 resolution 1 (initial value: 20)

Communication Code : ASCII code or binary code

Protocol : SHIMAX standard protocol or MODBUS-ASCII, MODBUS-RTU protocol

Terminal Impedance : 120Ω (external resistor termination) when communication option is added

Maximum Number of

Units to be connected : 32 units (a host included, depending on environmental conditions)

Isolation : Isolated from any other input/output and power supply

■General Specification

●Data storage : Non-volatile memory (EEPROM)

●Use Environment condition : Temperature -10~55°C (Guaranteed range for operation 0~40°C)

Humidity : 90%Rh or below (No condensation)

Altitude : 2000m above sea level max.

Category : II

Pollution degree : 2

●Storage Temperature : -20~65°C

●Input Noise Ratio of Rejection : Normal 50dB and above Common 100dB and above

●Insulation Resistance : Between control-input and power supply 20MΩ and above (500V DC)

: Between power supply and chassis 20MΩ and above (500V DC)

: Between control-input and operation-output 20MΩ and above (500V DC)

●Withstand Voltage : Between control-input and chassis 500V AC per minute

: Between power supply and chassis 2000V AC per minute

: Between control-input and operation output 2300V AC per minute

●Withstand Impulse Noise : Power supply normal/common mode 100ns/1 μs ± 1500V or above

Reaction to Power failure: Power failure of approx. 3ms or less is ignored.

When it continues for more than 3ms, operation resumes by the function of soft-start after the output becomes 0%.

●Set-up space : 5mm or more on the right and left sides, 100mm or more on the up and bottom sides

(No heating units should be installed under this regulator.)

●Mounting : Vertical mounting

●External Dimension

/ Weight :	1 ~ 20 A	W 60 × H 204 × D 133 mm / 1.2 kg
	30 A	W 60 × H 204 × D 133 mm / 1.4 kg
	50 A	W 70 × H 220 × D 166 mm / 2.2 kg
	70 A	W 105 × H 220 × D 166 mm / 2.9 kg
	100 A	W 121 × H 240 × D 195 mm / 3.4 kg
	150 A	W 121 × H 240 × D 195 mm / 3.7 kg
	200 A	W 121 × H 240 × D 195 mm / 3.7 kg
	300 A	W 134 × H 273 × D 247 mm / 6.2 kg

●Set-up dimension : 1 ~ 30 A 192 mm (M5 × 2)

50 A 208 mm (M5 × 2)

70 A 208 × 81 mm (M5 × 4)

100 ~ 200 A 228 × 97 mm (M5 × 4)

300 A 261 × 110 mm (M5 × 4)

●Internal temperature : 200 V 180° × 2

	body	Immediately-cut Fuse
1 ~ 10 A	12 W	1.8 W
20 A	26 W	3.1 W
30 A	42 W	3.7 W
50 A	63 W	6.5 W
70 A	86 W	11.0 W
100 A	132 W	14.0 W
150 A	198 W	34.0 W
200 A	250 W	45.0 W
300 A	381 W	50.0 W

11. Table of display characters, figures, and alphabet

1	1	I	J	J
2	2		K	K
3	3		L	L
4	4		I	I
5	5		M	M
6	6	S	N	N
7	7		o	o
8	8		P	P
9	9		Q	Q
0	0	O	r	r
A		A	s	s
B		B	T	T
C		C	t	t
c		c	U	U
D		D	u	u
E		E	V	V
F		F	W	W
G		G	X	X
H		H	Y	Y
h		h	Z	Z
i		i		
1	1			
2	2			
3	3			

12. Main causes of trouble and check points

If there seems to be something wrong with this product, check the following. (Especially at the time of first operation and after setting is changed)

- ① Whether power supply is applied.
- ② Whether wiring is done properly
- ③ Whether the type and capacity of the load is appropriate to MP11
- ④ Whether each setting is correctly done
- ⑤ Whether they type and level of the control input signal is appropriate

Trouble	Likely cause	Check points
There is no output	<ul style="list-style-type: none"> •No voltage is applied to the control power supply terminal (No.8 and 9) •Grade setting is around 0% or a variable resistor is not connected when xx is chosen. •Control input signal is not correct. 	<ul style="list-style-type: none"> •Check voltage between terminal No.8 and 9 with a tester. •Check whether LED is blinking. •Check the set value on the grade setting screen •Check whether a variable resistor is connected when xx is chosen and the wiring is done as shown on page 4, 5-2 (5). The scale of the variable resistor is not supposed to be around 0% •Check whether the wiring (page 4, 5-2 (1)), type, level, and polarity of the control input signal is appropriate
Output does not become 0	<ul style="list-style-type: none"> •The lower limit setting is not 0% •Control input signal is big. 	<ul style="list-style-type: none"> •Check the set value on the lower limit setting screen •Check the type, level of the signal and check the controller (Signal source)
There is load voltage though the current is OA.	<ul style="list-style-type: none"> •Load is released 	<ul style="list-style-type: none"> •Check the heater and the wiring of the main circuit terminal.
Output is not proportional to input signal, and is unstable	<ul style="list-style-type: none"> •The phase of the main circuit power supply(L1, L2) and the control power supply (control terminal 11, 12) is different. 	<ul style="list-style-type: none"> •The phase of L1 and 11(L), and L2 and 12(N) should be the same, (Refer to page 3 Wiring of The Main Circuit Terminals and Power Supply Terminals for Control)

If there is still something wrong even after inspecting and checking the items mentioned above, there may be some mechanical trouble with the product. Please contact the office or agency of our company.

The contents of this instruction are subject to change without notice

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