INST.No. INE-316A

CHINO

INSTRUCTION MANUAL FOR JU SERIES SINGLE-PHASE THYRISTOR REGULATOR

Thank you for your purchase of JU series thyristor regulator. Please read this instruction manual carefully to use the unit correctly and safely and also prevent troubles in advance.

Check your model	To our sales agent and instrumentation contractor	To user
Check your model and its specifications.	Deliver this instruction manual to your final user.	Keep this instruction manual until you throw the unit into the discard.

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CHINO

Cautions on safety

1. Preconditions for use

The unit is to be installed inside an indoor instrumentation panel.

2. Symbol marks employed in the unit

Use in the unit

Labels	Meanings
Alert symbol mark	Caution on handling for prevention of an electrical shock, injuries or other accidents
Caution on high temperature	Caution on a hot place (heat sink) for preventing burn
Caution on moving parts	Caution on a rotating place (cooling fan) for preventing injuries
Grounding terminal	Connect the grounding part (mounting hole) to the protective conductor terminal of the power supply equipment.

Use in this manual

Labels	Meanings
Warning	The nonobservance of information under this symbol may result in death, or hazardous, critical or serious injury.
Caution	The nonobservance of information under this symbol may result in a hazardous situation or a light injury or in physical damage to a property.
Reference	Information that you can use as a reference

3. Summary

This JU series single-phase thyristor regulator is the power regulator for controlling of power to a heater of electric furnaces or other equipment, depending on the signal from a controller or a manual setting unit.

Warnings/Cautions

1. Installation direction
Make sure to install the unit vertically with its UP mark (⬆ UP) placed upward to ensure air-cooling effect ventilated through its air duct structure.

2. Don't use the unit on any desk.
Make sure to install the unit on a panel to prevent its trouble or an injury by its falling down.

3. Installation environment
Don't operate the unit at a place where an explosive gas, an inflammable gas, vapor, or conductive substances like carbon, iron powder, etc. exist.

4. Don't repair or modify the unit
To prevent an electrical shock accident, a fire, or its trouble, don't repair, modify, or disassemble the unit by any person other than our qualified servicemen.

5. Turn off the power supply for an abnormal symptom.
If you have abnormal odor, abnormal heating, or other abnormal symptoms, turn off the power supply, and inform of it to your nearest agent of CHINO Corporation.

■ Request for securing safety

1. Use the unit at the rated current or lower.
Confirm the rated current on the label pasted on the upper panel or front panel of the unit.

2. Connect a load before turning on the power supply
Never turn on the power supply without connecting a load in advance to prevent its trouble.

3. Applicable load
A resistive load is applicable. An inductive load (transformer primary control, magnetic flux density 1.2T or less) is applicable only when the phase-angle firing system is selected.

4. Mounting of a rapid fuse
For the models without a rapid fuse, mount a rapid fuse externally for protecting the thyristor element.

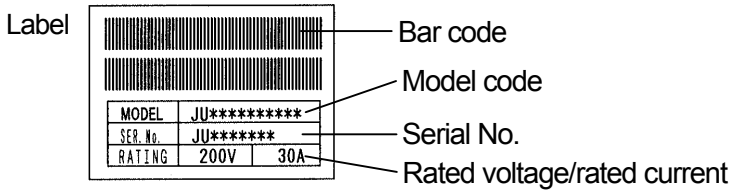
5. Countermeasure against digital units
Higher harmonic noises are generated when the unit is used with the phase-angle firing system. Use an insulation transformer, separate the unit from a power line, or take other countermeasures.

6. Don't use any unused terminals.
Don't connect any signal to any unused terminals to prevent a trouble.

1. Model code

1. Labels for Model and Specifications

The model and the rated voltage/current of the unit are indicated in the labels pasted on upper panel or front panel. Your checking the specifications of the unit is requested before using.



2. Model

1	2	3	4	5	6	7	8	9	10	11	12
J	U	□	□	□	□	□	□	□	□	□	□

Power voltage

10:100V 11:110V 12:120V 20:200V 22:220V
24:240V 38:380V 40:400V 44:440V 99:Others

Rated current

010:10A 020:20A 030:30A 050:50A 075:75A
100:100A 150:150A 200:200A 250:250A 300:300A
400:400A 500:500A 750:750A X00:1000A

Control type and feedback system

V: Phase-angle firing system with voltage feedback/zero-cross firing system *1
A: Phase-angle firing system with current feedback/zero-cross firing system *1
W: Phase-angle firing system with power feedback/zero-cross firing system *1
N: Phase-angle firing system without feedback/zero-cross firing system *1
C: Zero-cross firing system

Rapid fuse

A: Provided N: Not provided

Setting communications unit

0: Not provided (standard)
1: Provided (for installing on the unit)
2: Provided (for installing on a panel) *2
3: Provided (with communications, for installing on the unit)
4: Provided (with communications, for installing on a panel) *2

CT (current transformer)

0: External installation (Rated current 0 to 1000A standard)
1: Built-in (Rated current 10 to 75A only)

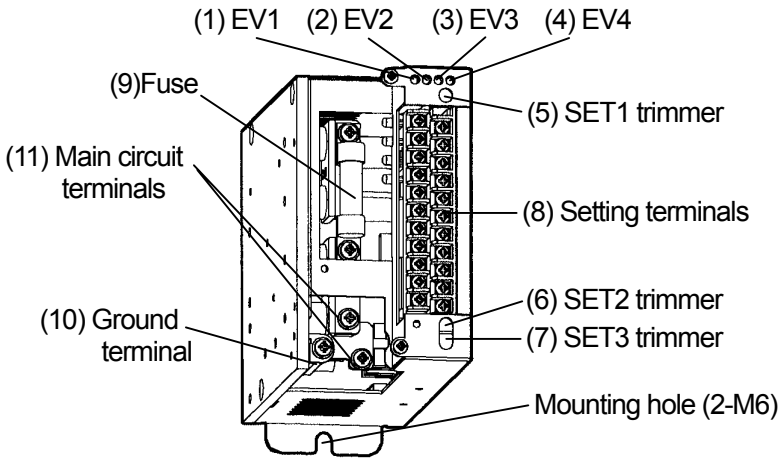
Other functions

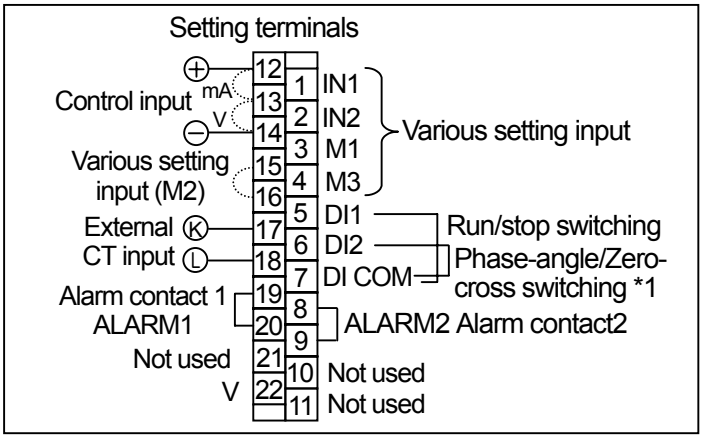
0: Not provided (standard)
1: With heater disconnection alarm *1, *4
2: Current limit function *3, *4
3: Heater disconnection alarm + current limit function (only with the setting communications unit) *4

*1: For the unit with the heater disconnection alarm (without the setting unit), the selection of the phase-angle firing system and the zero-cross firing system is not available.
*2: For installing to a panel, an exclusive cable SH-JUK3 (3m) or SH-JUK5 (5m) is required.
*3: For the unit with the current limit function, the combination with the zero-cross firing system is not available.
*4: For the unit without feedback, neither heater disconnection alarm nor current limit function is available.

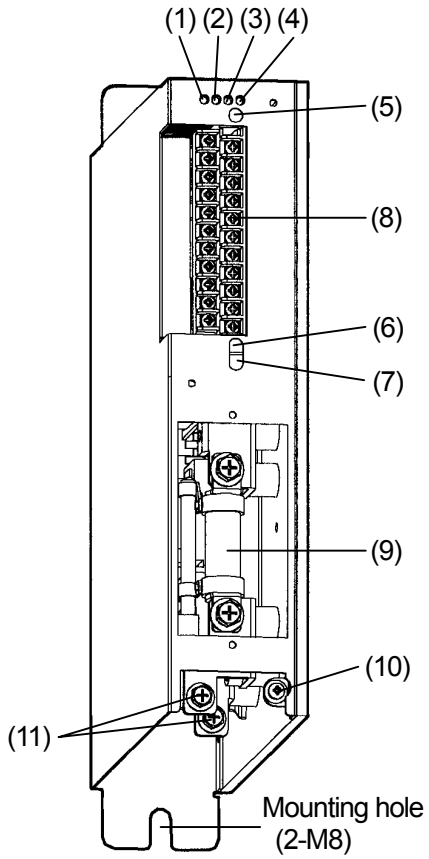
2. Names of component parts

10A, 20A





30A to 75A



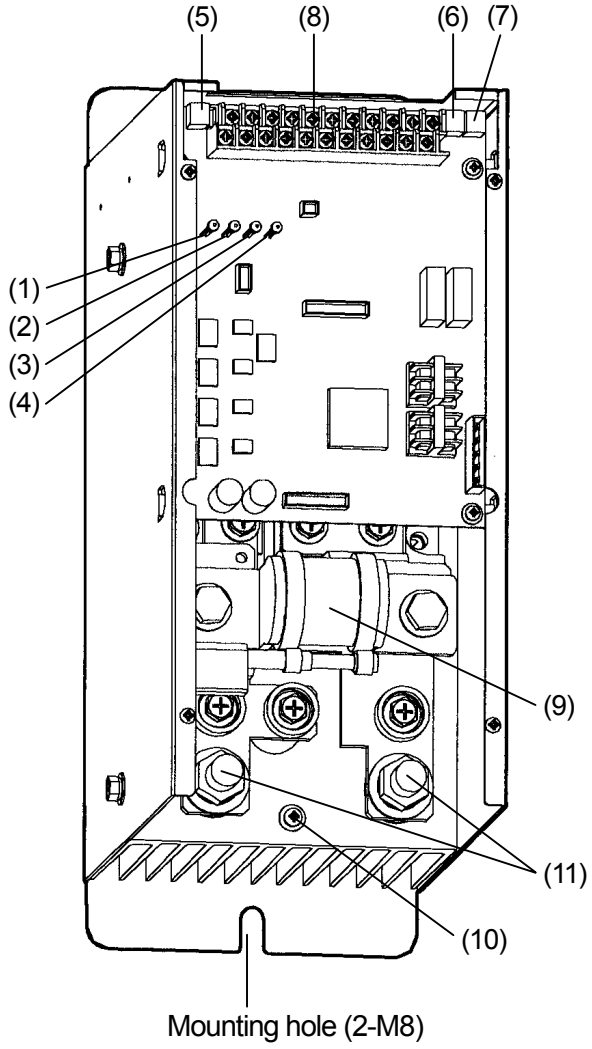
*1 For the unit with the optional heater disconnection alarm (without the setting communications unit), the initial resistance value is set between the control input terminals (6) and (7).

Names	Functions
(1) EV1 lamp	This lamp lights when the operation of the unit is normal or flickers when it is abnormal. If this lamp flickers, stop running the unit at once and contact your nearest agent of CHINO corporation.
(2) EV2 lamp	Lights when an over-current is detected. Flickers when heater disconnection is detected.
(3) EV3 lamp	Lights when fuse disconnection is detected. (excluding 10A and 20A) Flickers when an abnormal of the thyristor element is detected.
(4) EV4 lamp	Lights when the temperature of the heat sink is abnormal. (excluding 10A to 150A) Flickers when a parameter is stored into memory.
(5) SET1 trimmer	Is used for the settings of ramp and high limit. For details, refer to [5. Settings].
(6) SET2 trimmer	Is used for the setting of soft start time. For details, refer to [5. Settings].
(7) SET3 trimmer	Is used for the settings of elevation and low limit, or optional specifications. For details, refer to [5. Settings].
(8) Setting terminals	These terminals are for input signal and various kinds of setting units. For details, refer to the above figure or [6. Connections].
(9) Fuse	When this over-current protective fuse is blown out, replace it with a new one. Refer to [10. Maintenance].
(10) Ground terminal	Make sure to connect this terminal to the protective conductor terminal.
(11) Main circuit terminals	Main circuit terminals (U1 and U2)

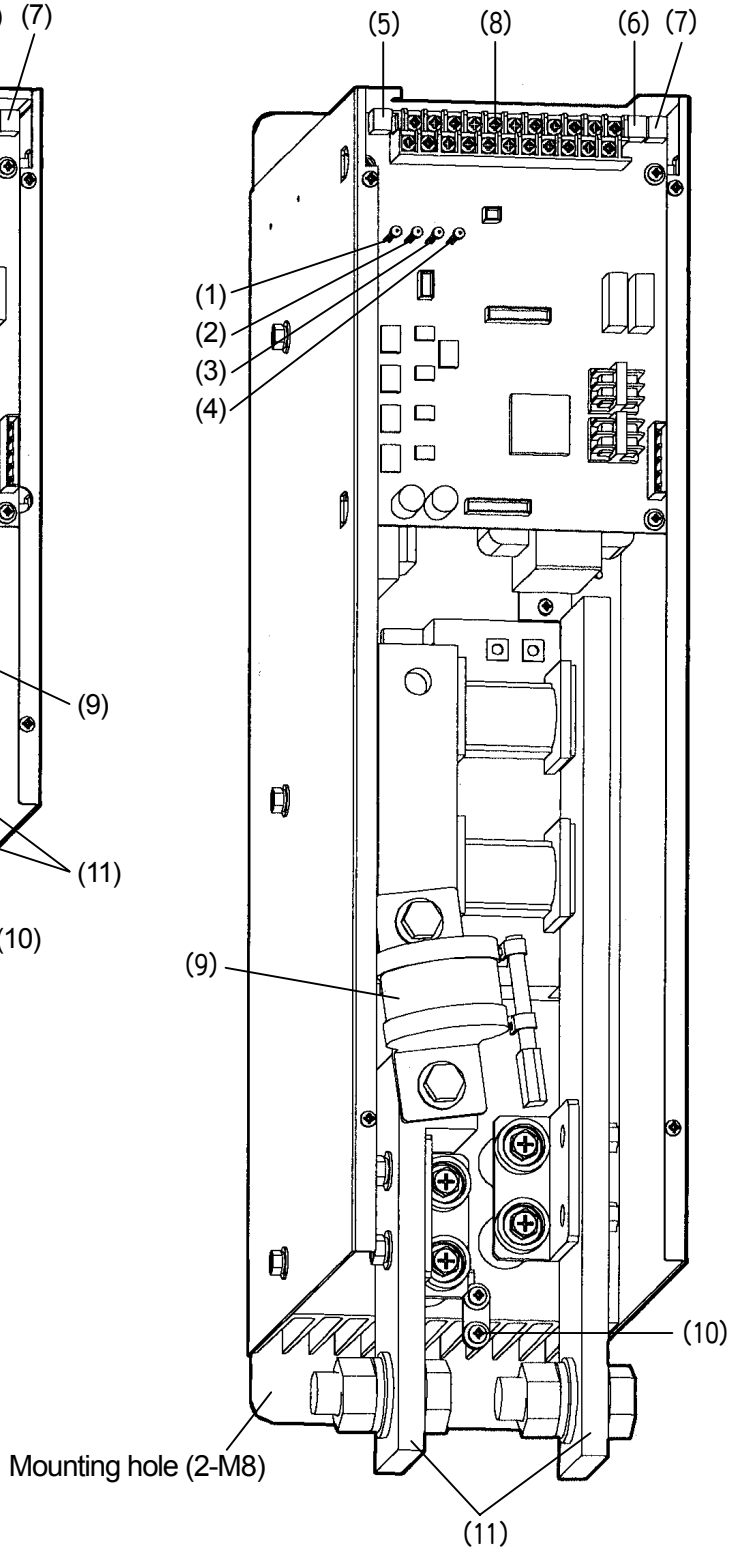
* The above contents may be changed according to the specifications.

2. Names of component parts

100A to 250A



300A to 500A



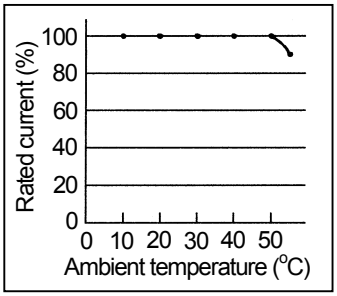
3. Installation

Warning	Make sure to turn off the power supply source before installation to prevent an electrical shock accident. The unit is designed as a back-of-panel type to be installed inside a panel, except accessories (setting units, etc.).

3.1 Cautions on installation

(1) Install the unit with the UP mark (⬆ UP) facing upward.
(2) Install the unit at a clean and well-ventilated place free of dust particles.
(3) Separate the unit from a high temperature generating unit or similar units.
(4) Keep a radiation space (space of the unit) above and below the unit.
(5) Don't install the unit at a place subjected to vibrations and shocks.
(6) Don't place the unit in a corrosive gas atmosphere.
(7) Sufficient strength is required for the installation panel.
(8) The rated current is specified at the reference ambient temperature of 50°C. If the ambient temperature exceeds 50°C, reduce the load current, referring to the right figure.
(The maximum working temperature is 55°C. Use the unit at 90% of the rated current or lower in this case.)

Ambient temperature and allowable current



Reference Mounting of accessories

Refer to external views and mounting diagrams in [11. Accessories].

Rated current and heat generated/weight

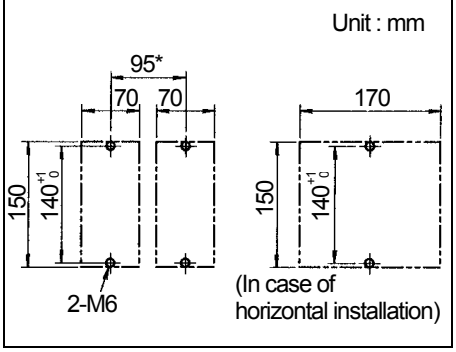
Rated current	Heat generated	Weight	Rated current	Heat generated	Weight
10A	9W	Approx.2Kg	150A	125W	Approx.6Kg
20A	22W	Approx.2Kg	200A	200W	Approx.7Kg
30A	34W	Approx.3Kg	250A	235W	Approx.7Kg
50A	44W	Approx.3Kg	300A	280W	Approx.12Kg
75A	64W	Approx.3Kg	400A	390W	Approx.12Kg
100A	96W	Approx.6Kg	500A	505W	Approx.12Kg

* The weight may differ according to the specifications.

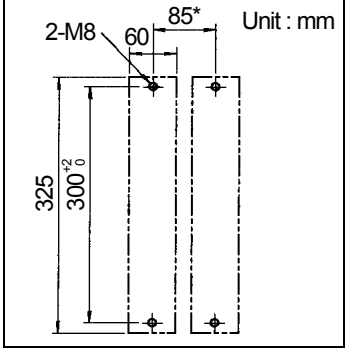
3.2 Installation dimensions

For the external dimensions, refer to [4. External dimensions].

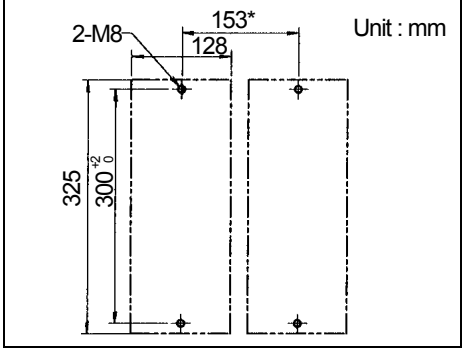
In case of 10A and 20A



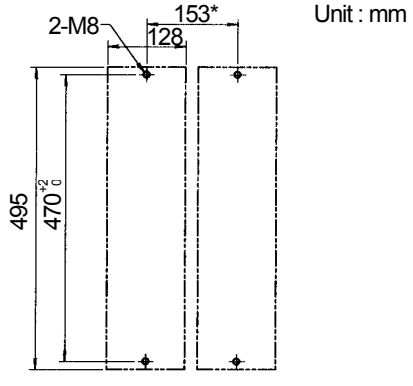
In case of 30A, 50A and 75A



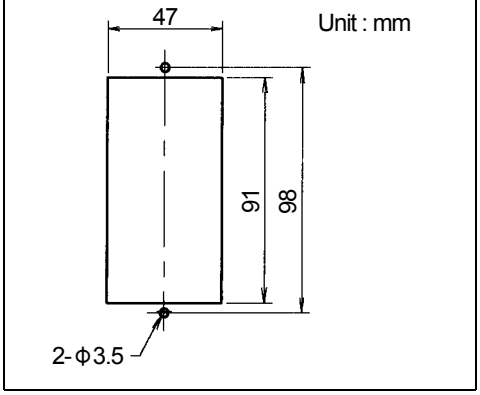
In case of 100A, 150A, 200A and 250A



In case of 300A, 400A and 500A



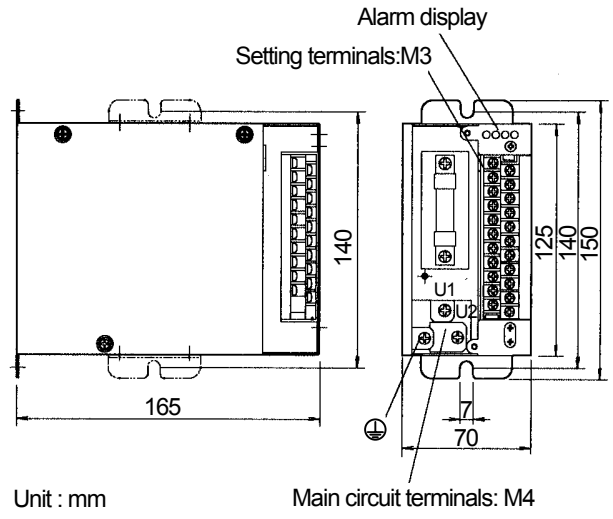
Setting communications unit (for panel mounting only)



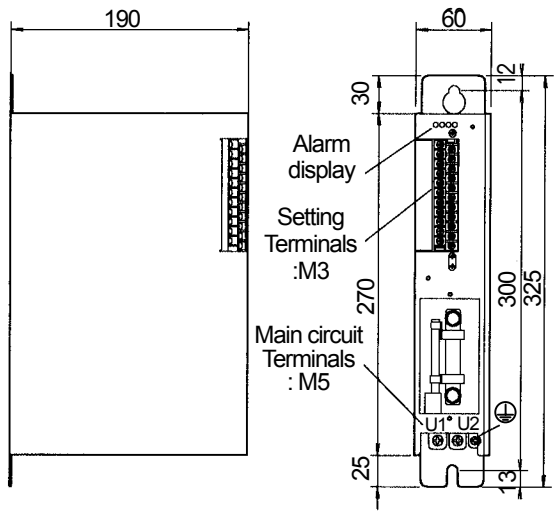
*Minimum space when units are arranged horizontally.

4. External dimensions

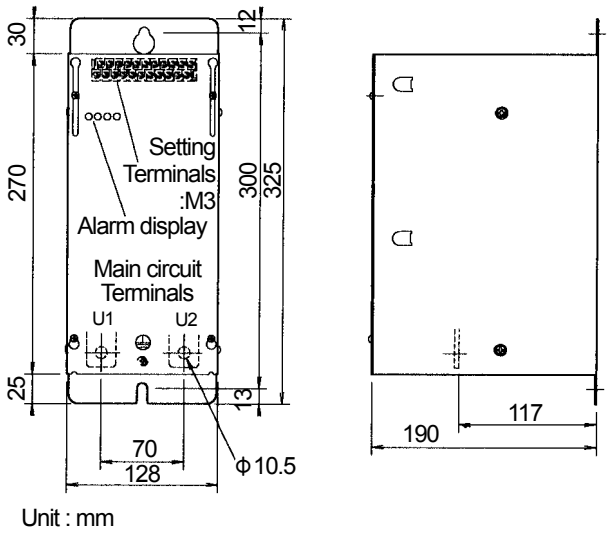
In case of 10A and 20A



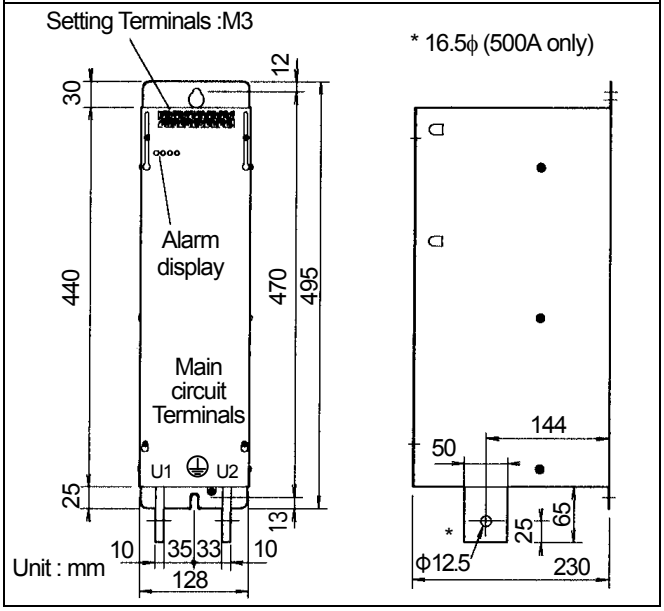
In case of 30A, 50A and 75A



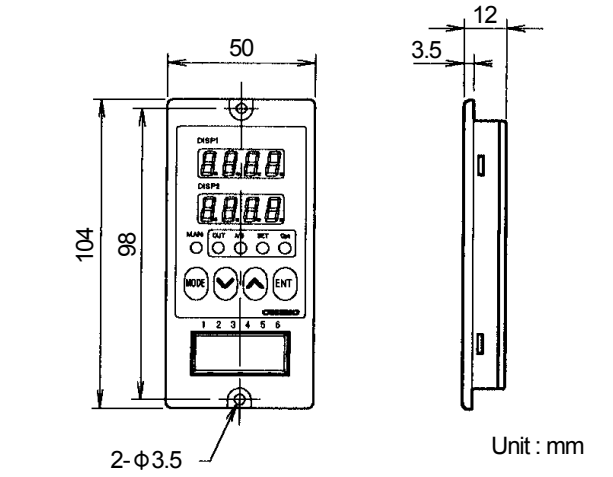
In case of 100A, 150A, 200A and 250A



In case of 300A, 400A and 500A



Setting communications unit (option)



5. Settings

Caution	For various settings, change the settings gradually to avoid affection to a load and peripheral units by an abrupt change of output.

5.1 Common settings to current/voltage input signal and contact input signal

(1) Control system selection
Setting terminals (6) and (7) Open: Phase-angle firing system Short: Zero-cross firing system
*For the unit with the optional heater disconnection alarm (without the setting communications unit), the selection of the phase-angle firing system and the zero-cross firing system is not available.

(2) Soft start time setting (SET2 trimmer)
Soft start time becomes about 1 second when turning this trimmer fully counterclockwise, and becomes 20 seconds when turning it fully clockwise.

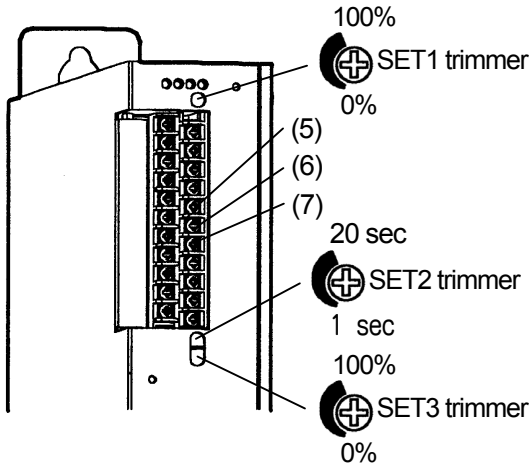
(3) Run/stop selection (5) and (7)
Run can be stopped by short-circuiting setting terminals (5) and (7).

5.2 Settings of current/voltage input signal only

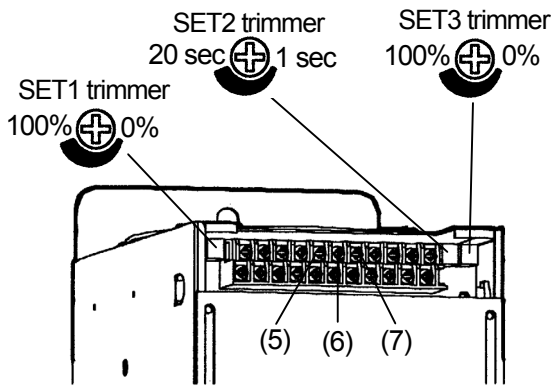
(1) Ramp setting (SET1 trimmer)
Ramp becomes 0% when turning this trimmer fully counterclockwise and becomes 100% when turning it fully clockwise.
Set this trimmer to 100% when the ramp is set by an external setting unit.

(2) Elevation setting (SET3 trimmer)
Elevation becomes 0% when turning this trimmer fully counterclockwise and becomes 100% when turning it fully clockwise.
Set this trimmer to 0% when the elevation is set by an external setting unit.
* For the unit with an optional heater disconnection alarm (without the setting communications unit) or an optional current limit function (without the setting unit), this setting is not available. Install an external elevation setting unit or the setting unit additionally.

For 10A, 20A, 30A, 50A, 75A



For 100A or more current



5.3 Settings of contact input signal only

(1) High limit setting (SET1 trimmer)
High limit becomes 0% when turning this trimmer fully counterclockwise and becomes 100% when turning it fully clockwise.
Be careful the followings.
Actual high limit value % = high limit set value % + low limit set value %

(2) Low limit setting (SET3 trimmer)
Low limit becomes 0% when turning this trimmer fully counterclockwise and becomes 100% when turning it fully clockwise.
* For the unit with an optional heater disconnection alarm (without the setting communications unit) or an optional current limit function (without the setting communications unit), this setting is not available. Install an external low limit setting unit or the setting communications unit additionally.

Default values of trimmers

SET1 trimmer : 100%
SET2 trimmer : 1sec
SET3 trimmer : 0%

5. Settings

5.4 Heater disconnection alarm (option, without the setting communications unit)

(1) Heater disconnection alarm

When the heater resistance value becomes higher than the value being set by the disconnection-ratio setting, EV2 flickers and alarm contact (a contact) is activated to ALARM2.

Disconnection ratio = [(Resistance value of which disconnection is to be detected - initial resistance value)/Initial resistance value] x 100(%)

Disconnection-ratio setting range is 10% to 100%

* Not applicable to silicon carbide (Sic) heaters
* The CT is to be mounted externally. (except the CT built-in type)
* This function is not available to the unit without feedback.
* For the unit with the setting communications unit, refer to the separate instruction manual for the setting communications unit.

(2) Settings of heater disconnection alarm

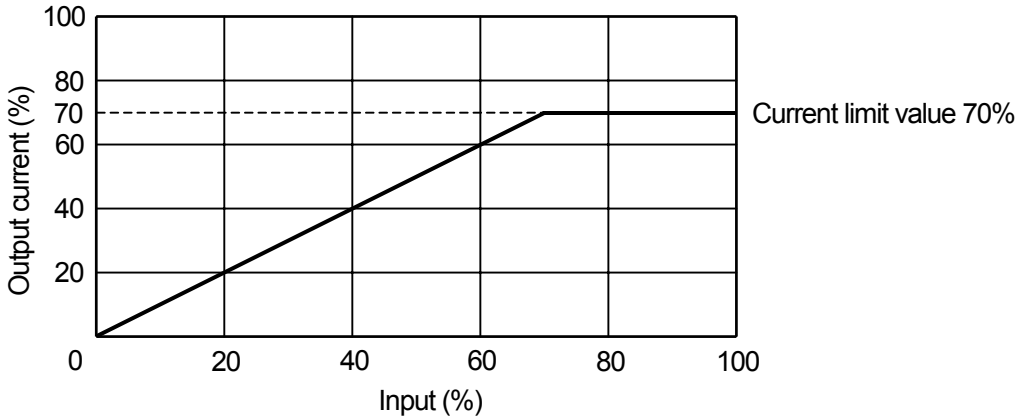
1. Apply an input signal to the unit (thyristor regulator) and continue feeding the power until the load current value is stabilized.
2. After the load current has been stabilized, store the initial resistance value into memory by short-circuiting the control input terminals (6) and (7) for about 1 second. EV4 flickers.
3. Open the control input terminals (6) and (7).
4. Set the disconnection ratio by SET3 trimmer. This ratio becomes 10% when turning this trimmer fully counterclockwise and becomes 100% when turning it fully clockwise.

The settings complete.

5.5 Current limit function (option, without the setting communications unit)

(1) Current limit function

In case of the voltage feedback, for example, a current flows according to the load resistance value and it may exceed the rated current of the thyristor if the voltage is only controlled. This current limit function is for prevention of this current overflow. The example shows the current limit function for the voltage feedback.



(2) Settings of current limit value (SET3 trimmer)

Set the current limit value by SET3 trimmer. This current limit value becomes 0% when turning this trimmer fully counterclockwise and becomes 100% when turning it fully clockwise.

* The CT is to be mounted externally. (except the CT built-in type)
* This function is not available to the unit without feedback.
* For the unit with the setting communications unit, refer to the separate instruction manual for the setting communications unit.

5. Settings

5.6 References

5.6.1 Control system

(a) Phase-angle firing system

The output is controlled by changing the conduction angle θ (ON timing) in the half cycle (180^{o}) of the power supply. The control becomes continuous as compared with the zero-cross firing system. This control system can be used for transformer primary control, too. However, since the output contains higher harmonics, it may cause external noises.

(b) Zero-cross firing system

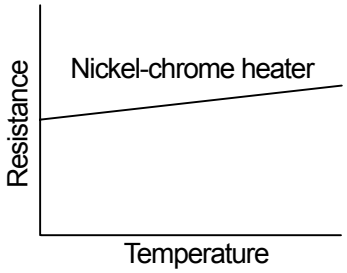
This system controls the output by deciding ON/OFF every cycle of the power supply. Since the power supply is turned on from 0 volt (zero cross point), noises are reduced as compared with the phase-angle firing system. However, the maximum current flows intermittently during ON cycle to cause flickering or the like.

5.6.2 Relation of heater types and feedback

(a) Phase-angle firing system

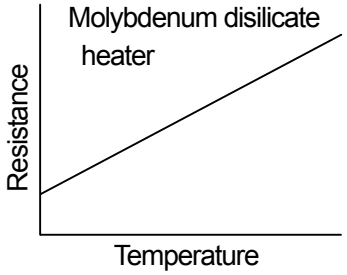
with voltage feedback/without feedback

In case of a heater having a small temperature coefficient of electric resistance like Nickel-chrome heaters, the output power is kept almost constant when the output voltage of the thyristor regulator is kept constant. The voltage feedback type thyristor regulator detects the voltage being applied to the load and feeds it back to be able to obtain a stable output having high linearity.



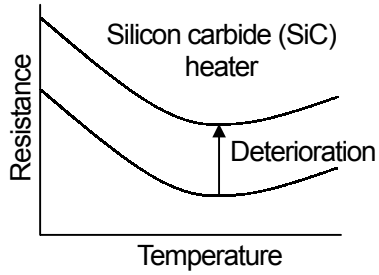
(b) Phase-angle firing system with current feedback

In case of a heater, of which electric resistance is low at low temperature and changes to 6 to 12 times at normal temperature, like Molybdenum disilicide heaters, the output current changes with temperature even if the output voltage is kept constant, and a large current flows at low temperature. Since the current feedback type thyristor regulator detects the current being flow to the load and feeds it back, a current proportional to the input signal is output to be able to obtain very stable control, irrespective of the resistance value change of the heater, when the maximum output of thyristor is set to the maximum rated current value of the heater.



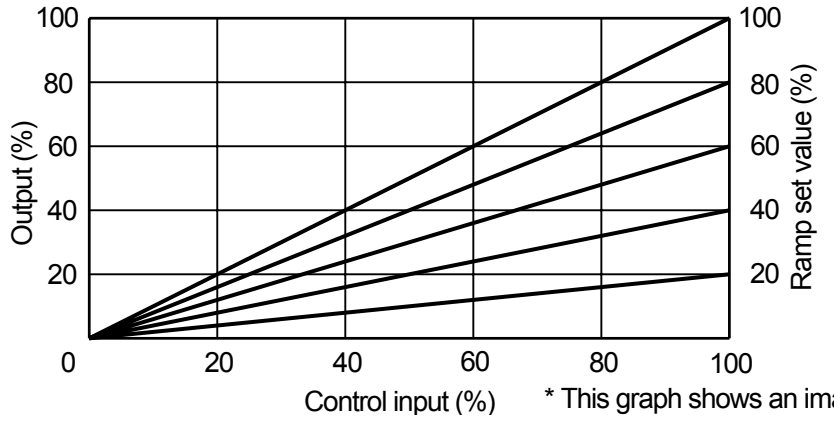
(c) Phase-angle firing system with power feedback type

In case of a heater, of which electric resistance value changes according to the heating temperature and the resistance value deteriorates down to about 4 times the initial value due to a secular change, like Silicon carbide (SiC) heaters, the output power changes with temperature and also changes due to a secular change even if the output voltage is kept constant. Since the power feedback type thyristor regulator detects the voltage and current to the load and feeds them back after multiplying them, the power proportional to the input signal is output, irrespective of a resistance value change of the heater, and a change due to deterioration of the heater is also corrected automatically.



5. Settings

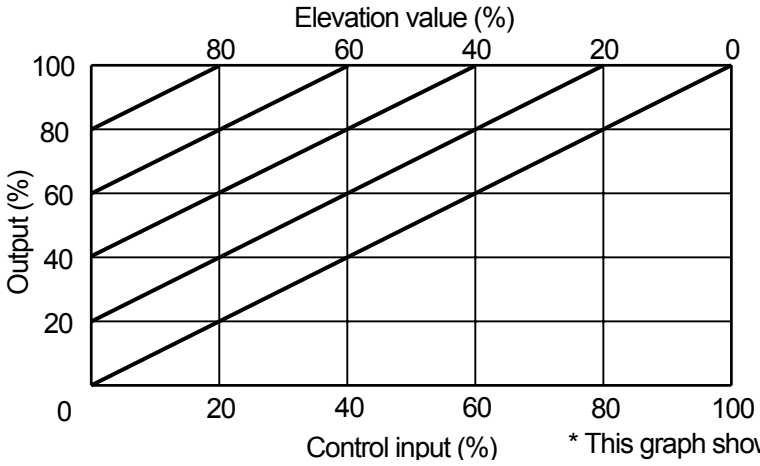
5.6.3 Ramp setting (current/voltage input only)



Ramp can be set by the built-in trimmer or connecting a 10kΩ variable resistor to the setting input terminals. This is effective for a 3-zone electric furnace, etc. where three thyristor regulators are controlled with one controller.

* This graph shows an image and is different from actual one.

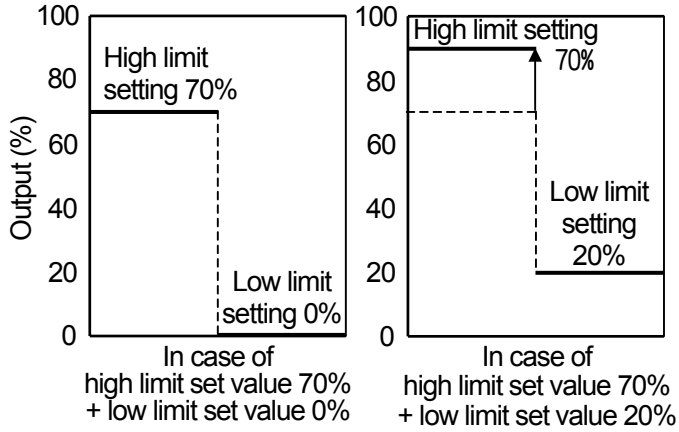
5.6.4 Elevation setting (current/voltage input only)



Elevation can be done by the built-in trimmer or connecting a 10kΩ variable resistor to the setting input terminals. A constant base power can be applied to an electric furnace, etc., even if the output from a controller is minimized.

* This graph shows an image and is different from actual one.

5.6.5 High limit/low limit settings (Contact input only)



High limit and low limit can be set by the built-in trimmers or connecting 10kΩ variable resistors to the control input terminals. When these limits are set by the built-in trimmers only, be careful the followings.
Actual high limit value (%) = high limit set value (%) + low limit set value (%).

* This graph shows an image and is different from actual one.

Actual high limit value % = High limit set value (%) + low limit set value (%).

5.6.6 Soft start

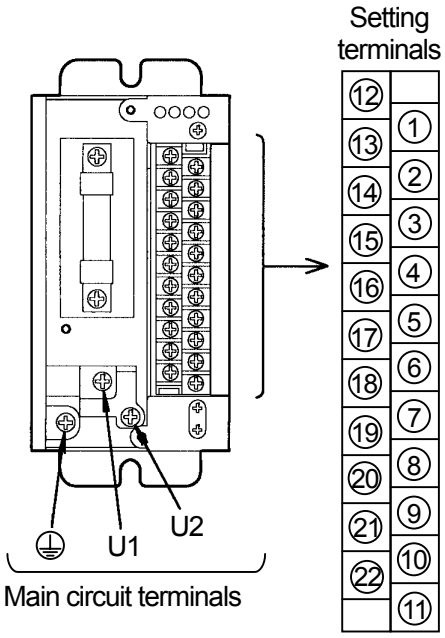
This function is provided to increase the output gradually up to the specified output when the power supply is turned on or when the control input value changes abruptly. This function can prevent a surge current from being generated due to an abrupt change of the primary control output of transformer. The time (from 0% to 100% output) can be set from about 1 second to 20 seconds.

6. Connections

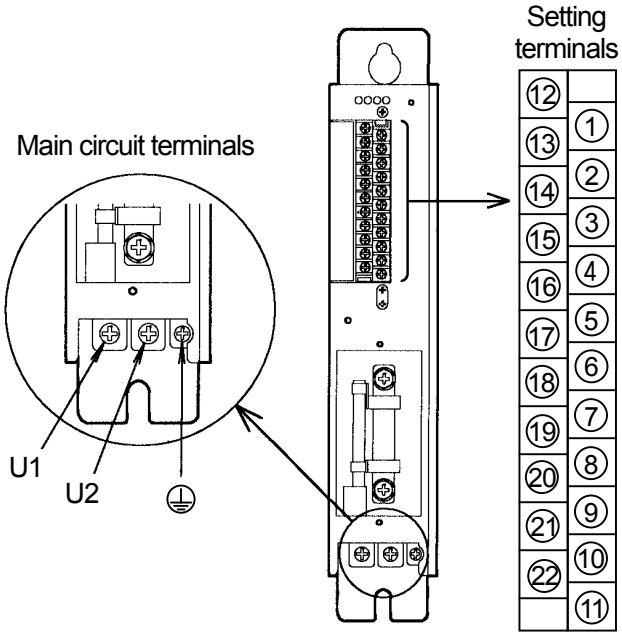
6.1 Preparation for connections

Be careful that the locations of the setting terminals and main circuit terminals differ depended on models.

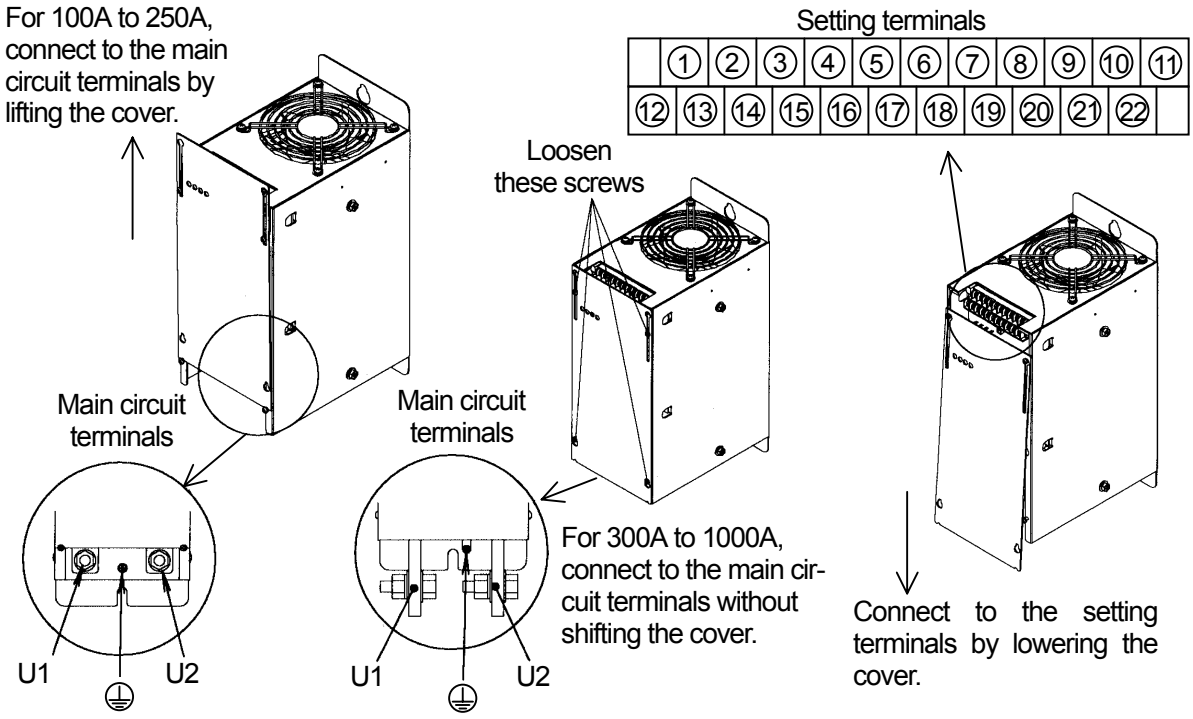
10・20A



30 to 75A



100 to 500A



Caution: Fasten the cover screws securely after connections.

6. Connections

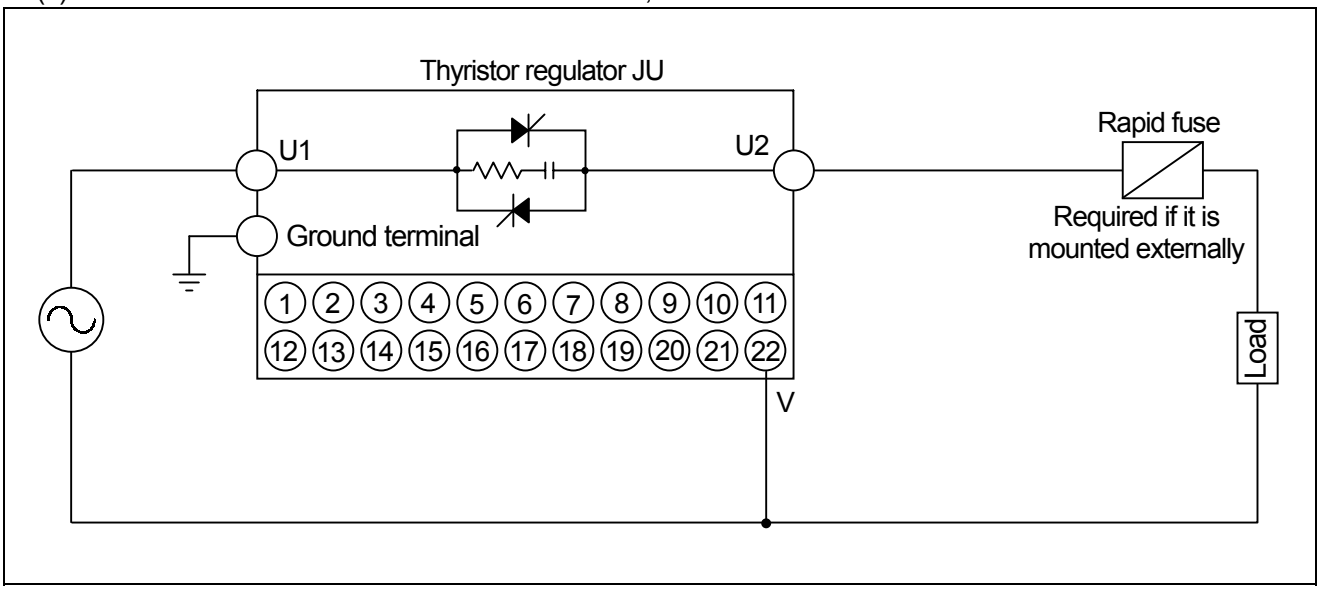
Caution	(1) Turn off the power source before connections to prevent an electric shock accident. (2) Perform connections by experienced persons having the basic knowledge of wiring.

6.2 Cautions on connections

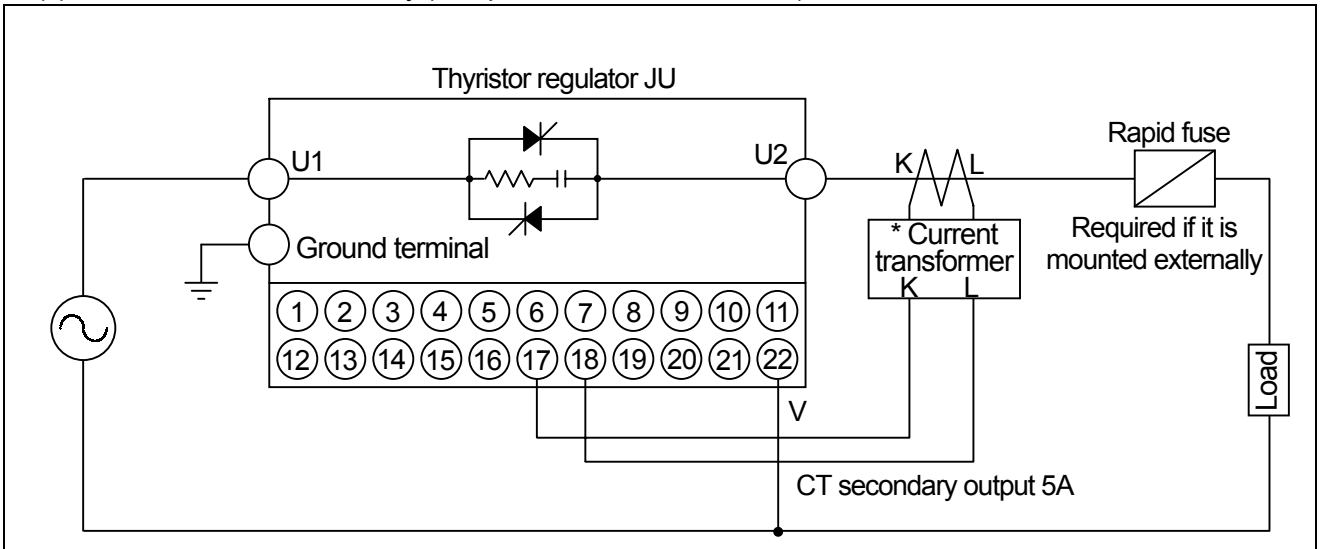
- For connecting to the main circuit, use a cable having a sufficient allowance to the load current.
- For connecting to other terminals, twist a 0.3 to 0.75mm^2 cable.

6.3 Main circuit terminals/power terminals (U1, U2/V)

(1) For the CT built-in for a rated current of 10A to 75A, Without feedback



(2) For the CT mounted externally (except the unit without feedback)



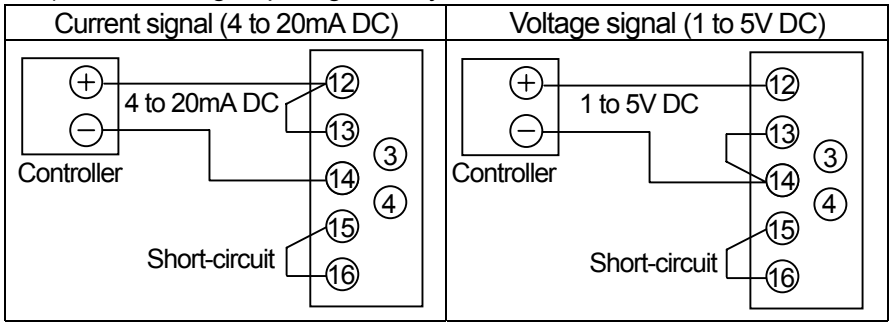
* Current transformer is absolutely necessary for the unit with current or power feedback.
For the unit with voltage feedback, current transformer is necessary for over-current alarm, heater disconnection alarm, and current limit function.

6. Connections

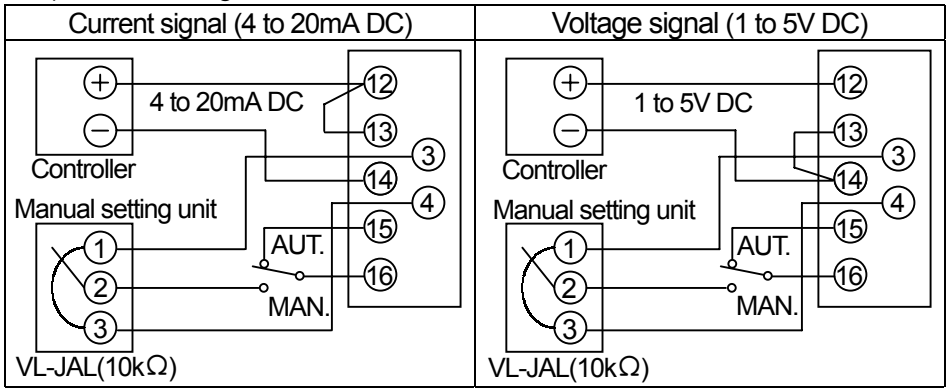
6.4 Setting input terminals

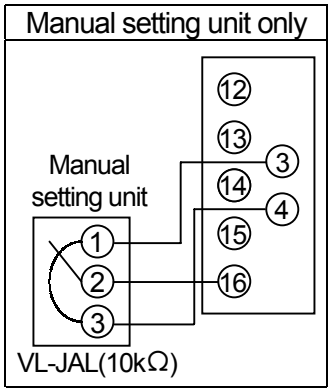
6.4.1 Current/voltage input signals

1) Current/voltage input signals only

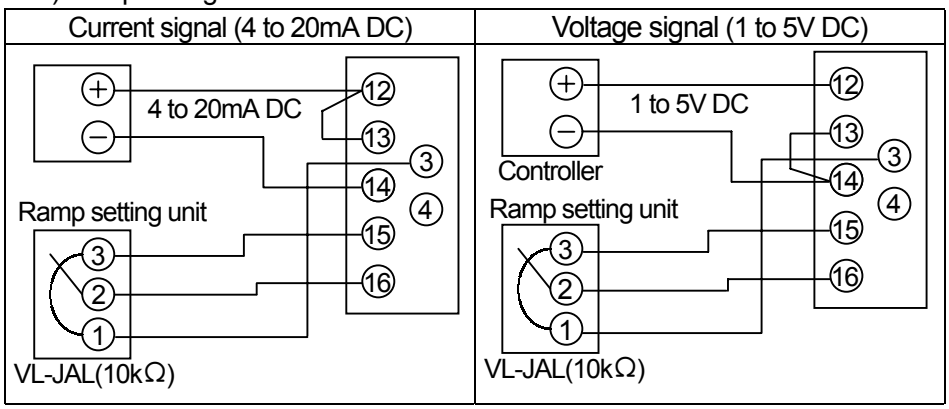


2) Manual setting unit and auto/manual selector switch

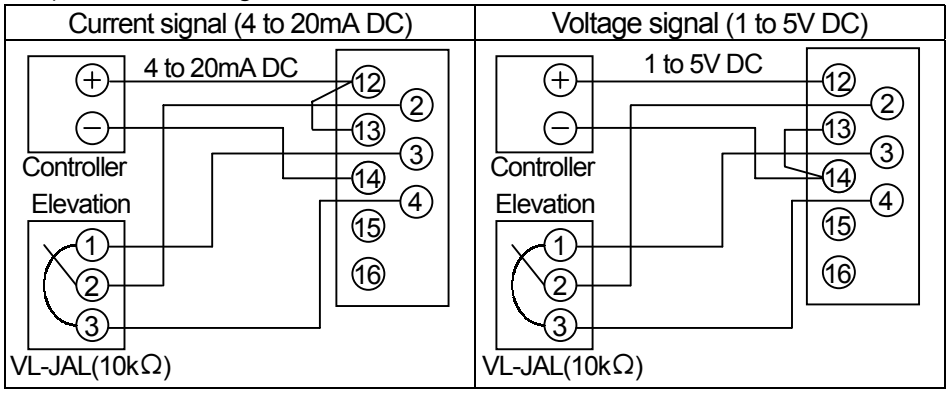




3) Ramp setting unit

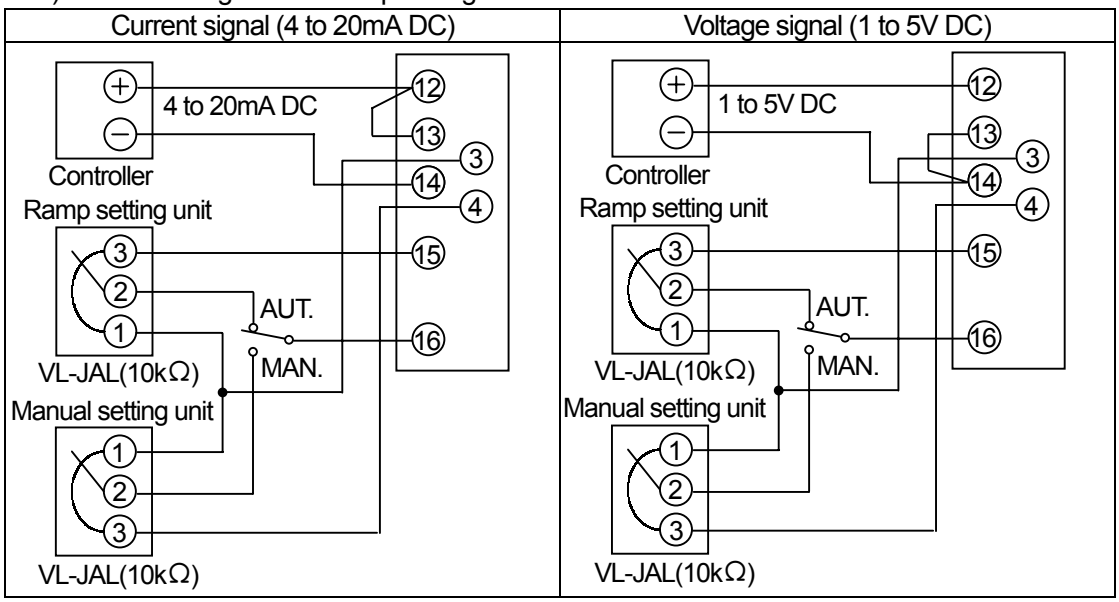


4) Elevation setting unit

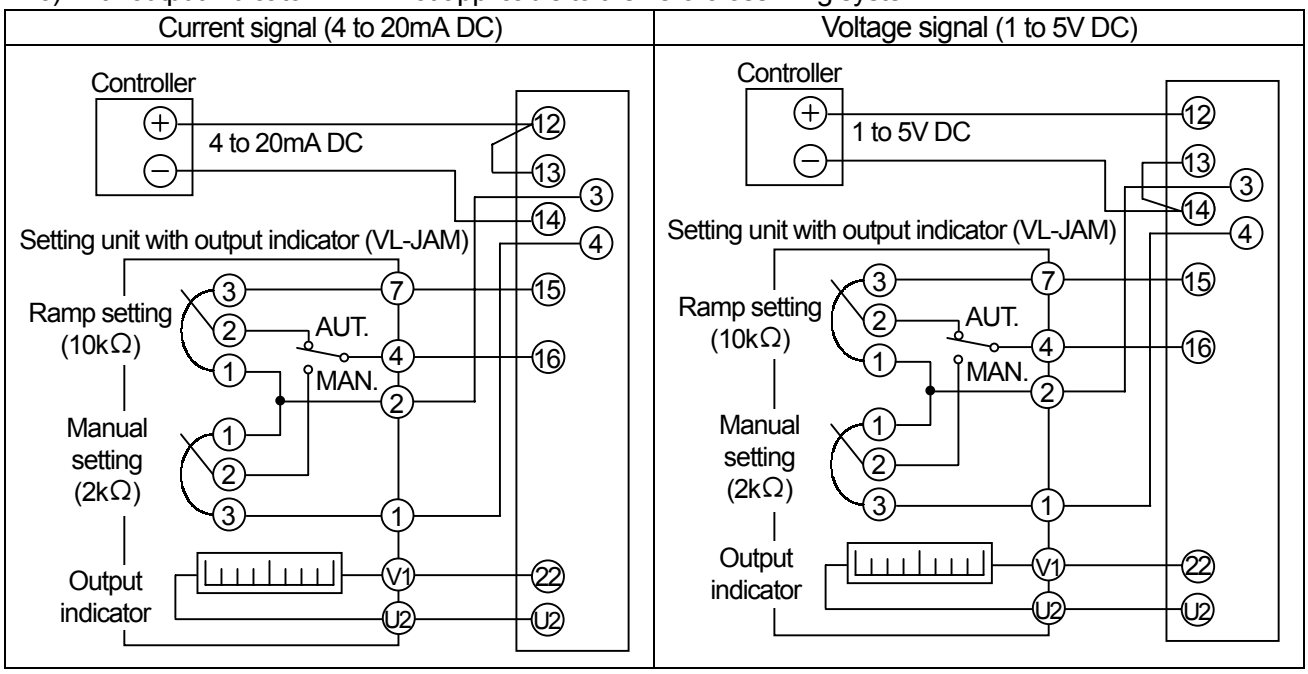


6. Connections

5) Manual setting unit and ramp setting unit

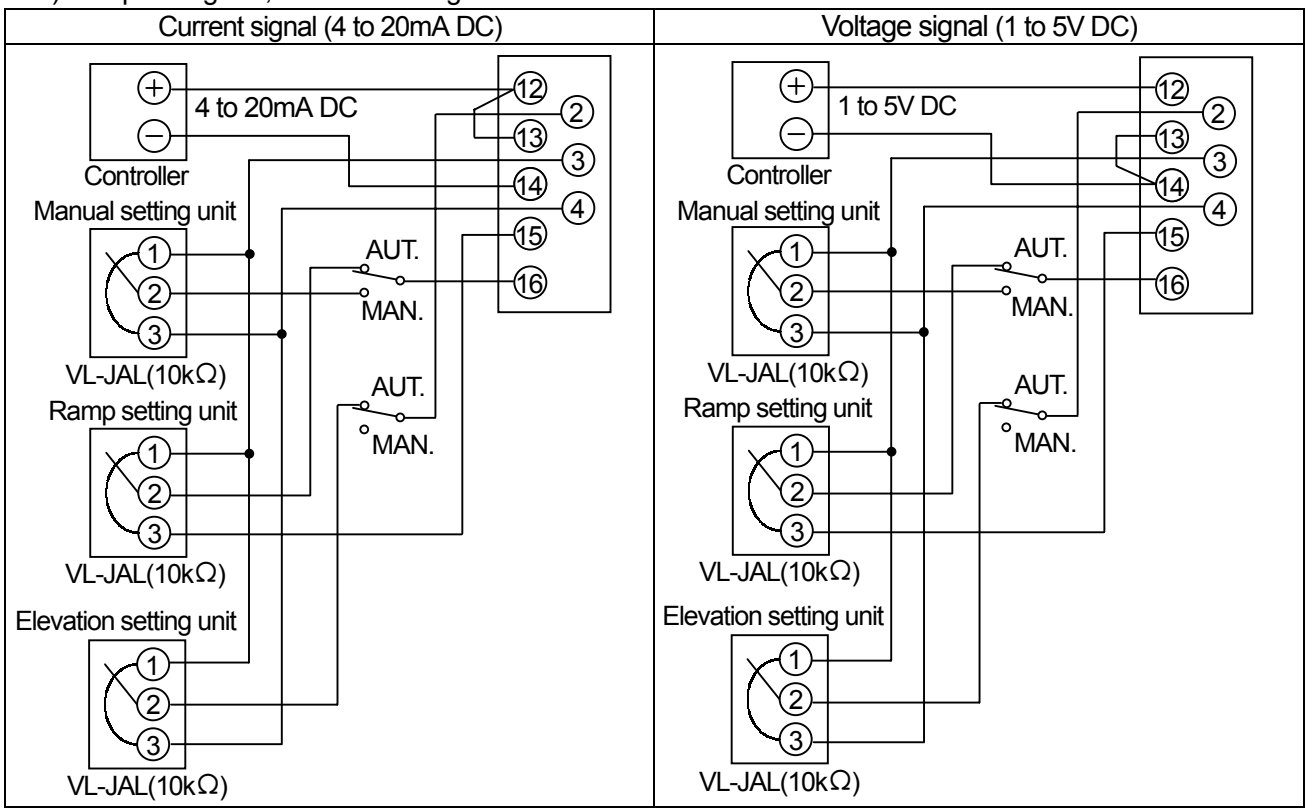


6) With output indicator * Not applicable to the zero-cross firing system

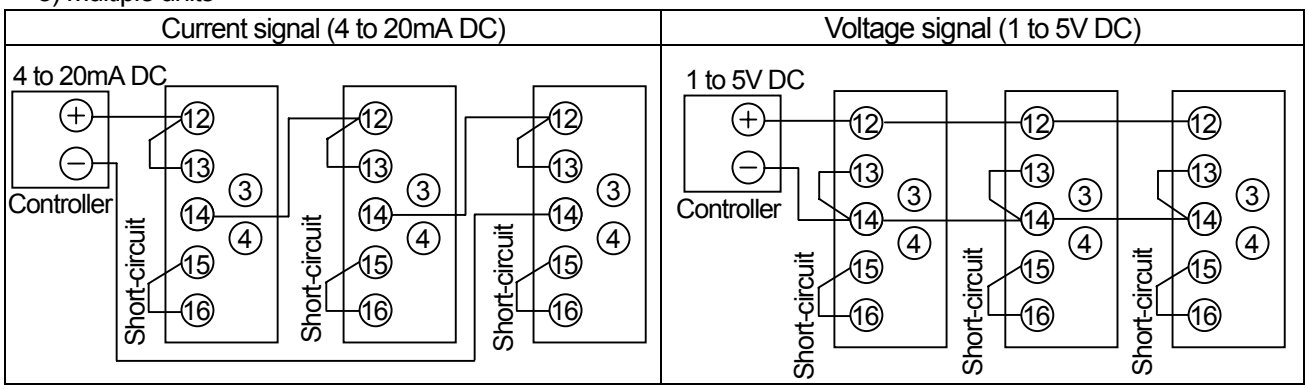


6. Connections

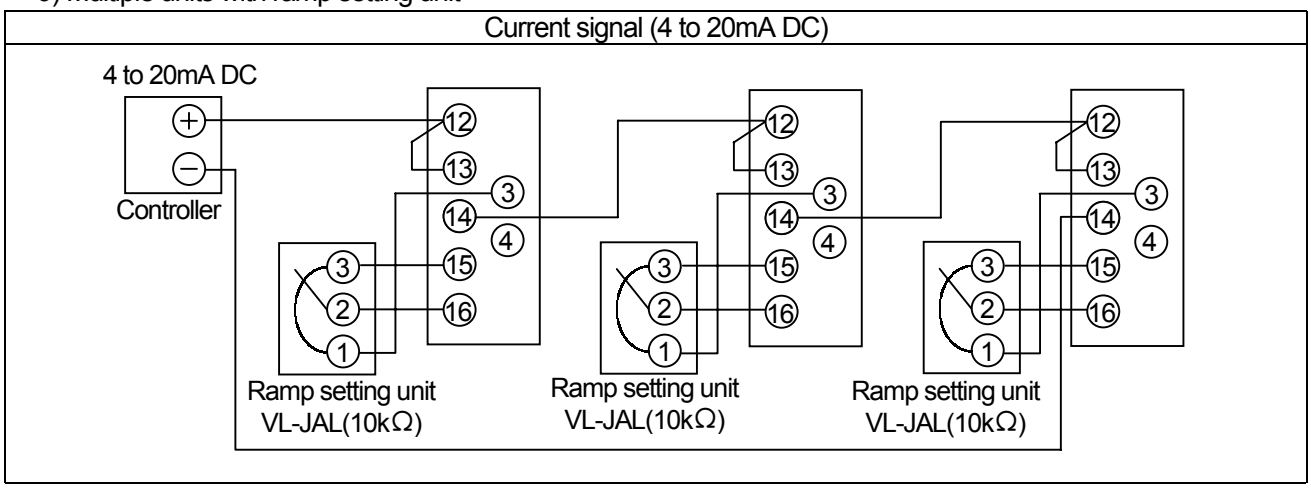
7) Ramp setting unit, elevation setting unit and auto/manual selector switch



8) Multiple units

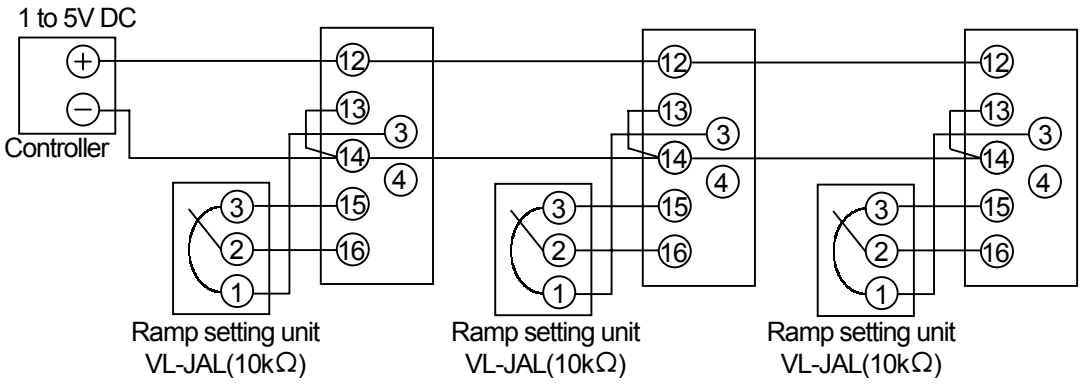


9) Multiple units with ramp setting unit



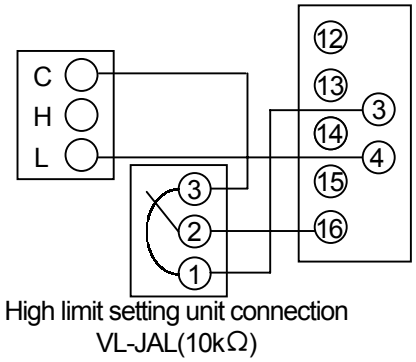
6. Connections

Voltage signal (1 to 5V DC)

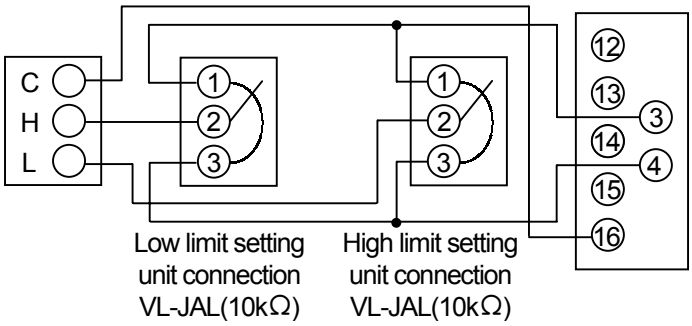


6.4.2 Contact input signal

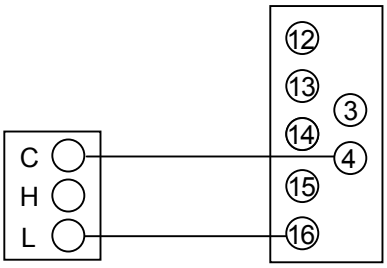
Connection of high limit setting unit



Connection of high limit setting unit and low limit setting unit



Using setting trimmers of this unit only



Low limit setting …
Use the low limit setting trimmer of this unit.
High limit setting …
Use the high limit setting trimmer of this unit.
* For the settings of the trimmers, refer to 5.3 Settings of contact input signal only.

7. Operation

Warning	Turn off the power source to the unit before operation to prevent an electric shock accident.

7.1 Check

(1) Check all connections again.
(2) Check the power voltage and the load capacity again.
(3) Measure the insulation resistance with a 500V megger. Execute the dielectric strength test with the main circuit terminals U1 and U2 short-circuited.
(4) Install the unit vertically with its UP mark (⬆ UP) placed upward to ensure air-cooling effect. If the unit is installed in other direction, the interior becomes hot to cause a failure or a trouble.
(5) Check the control system, various settings and switches again.

7.2 Operation

1) Automatic operation

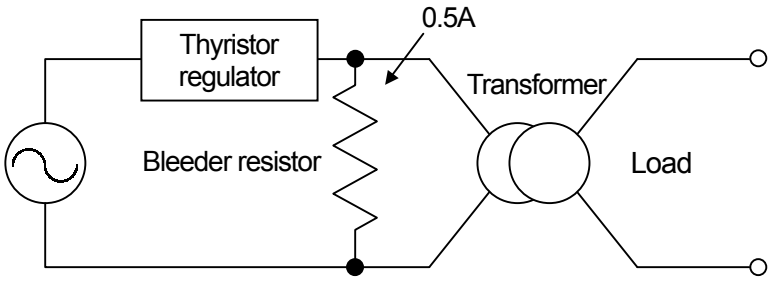
(1) Set the set value (SV) of the controller.
(2) If the auto/manual selector switch is connected, select it to AUTO.
(3) Set the ramp.
(4) Make sure that the stable control is executed. If the control is unstable, change the parameters (PID constants in particular) of the controller and adjust the ramp setting

2) Manual operation

(1) If the auto/manual selector switch is connected, select it to MANUAL.
(2) Set a desired output by manually.
(3) Change the setting manually while monitoring the temperature.

Caution

Make sure not to operate the unit without any load. If operated, in case of the primary side control of the transformer, it may be burnt or the fuse may be blown out.
Connect a bleeder resistor flowing a current of about 0.5A to the primary side of the transformer as shown in the figure. Select the resistor with sufficient rated power.



memo

8. Alarm and error indications

8.1 Error indications

If an error is detected, the lamps of EV1 to EV4 on the front panel light or flash.
Take suitable remedial measures, referring to the following contents.

* For the unit without feedback, an abnormal operation and an abnormal power voltage only are indicated by lamps. (No alarm output is available.)

● Goes off ○ Lights ◑ Flashes

LED display	Error No.	Error contents	Remedial measures	Operation condition after an alarm activated
Over-current alarm ○ ○ ● ● EV1 EV2 EV3 EV4 (Lights)	Err1	This alarm activates when the current exceeding 1.2 times the rated current flows. The thyristor gate is turned off to protect the thyristor from an over-current.	Eliminate the cause of this failure, and then turn on the power supply again.	Operation will stop. (Thyristor gate-off)
Fuse blown-out alarm ○ ● ○ ● EV1 EV2 EV3 EV4 (Lights)	Err2	This alarm activates when the rapid fuse is blown out due to a momentary over-current.	Eliminating the cause of this failure, and then replace it with a new one.	Operation will stop. (Thyristor gate-off)
Heat sink overheat alarm ○ ● ● ○ EV1 EV2 EV3 EV4 (Lights)	Err3	This alarm activates when the heat sink is overheated. The thyristor gate is turned off to protect the thyristor from an abnormal temperature.	Check the rotation of the cooling fan or the installation place. Eliminate the cause of this failure, and then turn on the power supply again.	Operation will stop. (Thyristor gate-off)
Abnormal operation ◑ ● ● ● EV1 EV2 EV3 EV4 (Flashes)	Err4	This alarm activates when the control circuit abnormality is detected by self-diagnostic function.	Stop the operation of the unit at once and contact your nearest agent of CHINO Corporation.	Operation will continue. *1
Heater disconnection alarm (option) ○ ◑ ● ● EV1 EV2 EV3 EV4 (Flashes)	Err5	This alarm activates when the heater disconnection is detected.	Repair the heater, and then turn on the power supply again. This alarm also activates if the CT is not connected correctly.	Operation will continue. *1
Abnormal thyristor element alarm ○ ● ◑ ● EV1 EV2 EV3 EV4 (Flashes)	Err6	This alarm activates when blown-open or blown-short of the thyristor element is detected.	Stop the operation of the unit at once and contact your nearest agent of CHINO Corporation.	Operation will continue. *1
Abnormal power voltage ○ ○ ○ ○ EV1 EV2 EV3 EV4 (Lights)(Lights)(Lights)(Lights)	Err7	This alarm activates when the power voltage is abnormal (85VAC or lower in 100V system, 170VAC or lower in 200V system, and 340VAC or lower in 400V system.	Check the power source.	Operation will continue. *1

* 1: By connecting alarm contact to the Run/Stop switching terminals (5) and (7), the operation can be stopped.

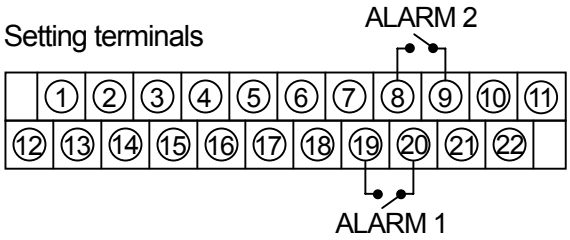
*2: If the unit is damaged by short-circuit, turn off the main power supply to stop the operation.

8. Alarm and error indications

8.2 Kinds of alarms

An alarm output is activated at the setting terminals (19) and (20) (for Alarm 1) or (8) and (9) (for Alarm 2). For lamp indications of alarms, refer to [8.2 Error indications].

Kinds of alarms	Alarm output terminals
Over-current alarm,Fuse blown-out alarm Heat sink overheat alarm	⑲-⑳ ALARM1
Abnormal operation Heater disconnection alarm (option) Abnormal thyristor element alarm	⑧-⑨ ALARM2



Contact capacity of alarm relay: Max. 250VAC, 1A (resistive load)

* Kinds of alarms differ depended on models.
* For the unit without feedback, the alarm output is not available.

9. Troubleshooting

1) Output continues

Check and symptoms	Causes and remedial measures
(1) Is the load open? Meter deflects through the snubber (CR).	Connect the load correctly or mount a light load.
(2) Is the low limit set to 100%?	Set the low limit to be near 0% and check the output.
(3) Check if the CT is connected correctly. (For the unit with current feedback or power feedback only)	Connect the CT correctly.

2) Output is not proportional to the control input.

Check and symptoms	Causes and remedial measures
(1) Is the low limit set to be high?	Set the low limit to be near 0% and check the output.
(2) Is the ramp set to be low?	Set the ramp to be near 100% and check the output.
(3) Are the phases of the power supply and the main circuit same?	The phases should be same. Refer to Paragraph 6.3.
(4) Is the power supply distorted?	If the power waveform is distorted, the output is not proportional to the input. Use the power supply having no distorted waveform and check the output.

3) No output appears.

Check and symptoms	Causes and remedial measures
(1) EV1 lamp does not light	Power terminal (setting terminal (22)) is not connected correctly. Connect it correctly.
(2)EV1 lamp lights.	(1) The phases of the power supply and the main circuit are not same. →The phases should be same. Refer to Paragraph 6.3. (2) The ramp is set to 0%. →Set it to be near 100% and check the output. (3) Input connections are not correct. Connect them correctly. (4) The input signal is abnormal. Apply normal input signal.

10. Maintenance

10.1 Daily check and maintenance

The following checks are required for using the unit under the best conditions.

Items	Contents
Fastening of bolts and screws on the terminal board	If the bolts of the main circuit terminals (U1, U2), in which a large current flows, are loose, these bolts may be heated to cause wiring damage.
Cleaning	If the unit is installed at a place where conductive dust particles like iron powder, carbon are existed, the particles may attach to the unit to cause a failure or a trouble due to poor insulation. Remove attached dust particles by using a cleaner.

10.2 Consumable parts

Caution	Don't repair or modify the unit by replacing any parts by persons other than our qualified servicemen. For replacing consumable parts or other parts, contact your nearest agent of CHINO Corporation.

Consumable parts and reference exchange intervals

Part names	Reference exchange intervals	Working conditions and others
Cooling fan (200 to 500A)	2 to 3 years	Ambient temperature 0 to 50ºC
Cooling fan (750 to 1000A)	1 to 2 years	
Ignition board	5 to 8 years	The life depends largely upon the atmospheric conditions.

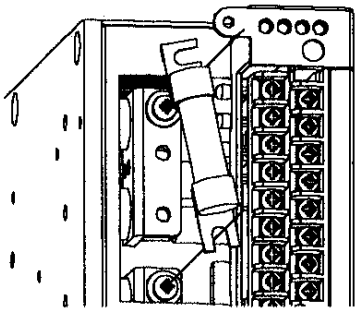
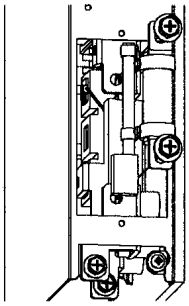
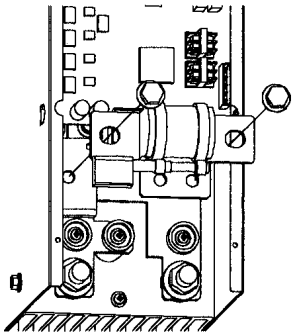
Reference Consumable parts

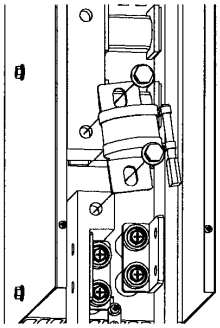
The economical life of the unit may be 10 years. Accordingly, the parts, of which lives are supposed to be more than 10 years, are excluded from the consumable parts.

10. Maintenance

10.3 Replacement of rapid fuse

Warning	Turn off the power supply to the unit before replacing the rapid fuse for preventing an electric shock accident. For the replacement of the rapid fuse, use the specified tool and keep the specified fastening torque for preventing an accident.

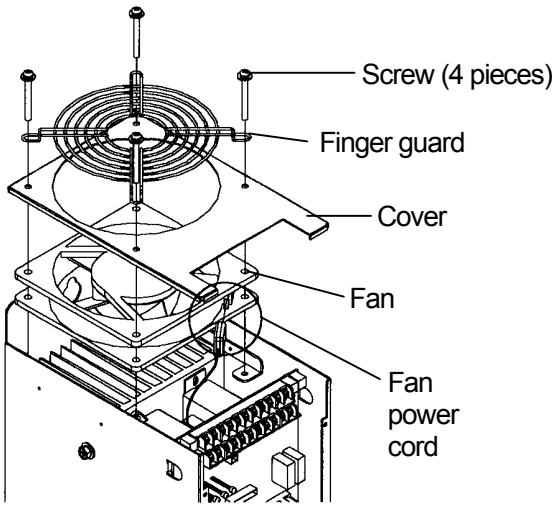
10･20A	30 to 75A	100 to 250A
 Fastening torque:3N･m	 Fastening torque:5N･m	 Fastening torque:12N･m

300 to 500A
 Fastening torque: 25N･m

10.4 Replacement of cooling fan

Warning	Turn off the power supply to the unit before replacing the cooling fan for preventing an electric shock accident.

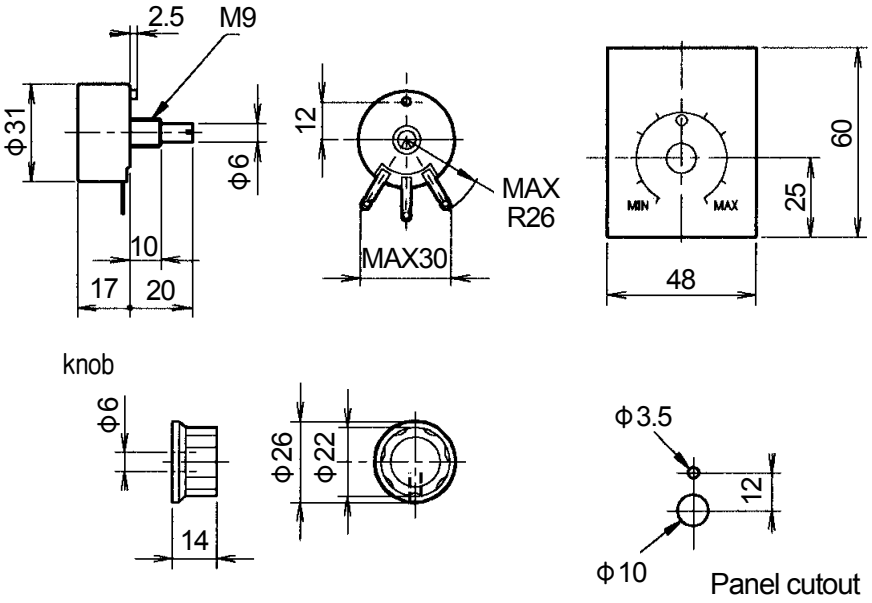
(1) Remove four M4 screws.
(2) Disconnect the fan cord from the cooling fan and replace the cooling fan with a new one.
(3) Connect the fan cord to the new cooling fan. Be careful with the mounting direction of the cooling fan.
(4) Fix the cooling fan by using screws together with the cover and the finger guard.



11. Accessories

11.1 Various setting units

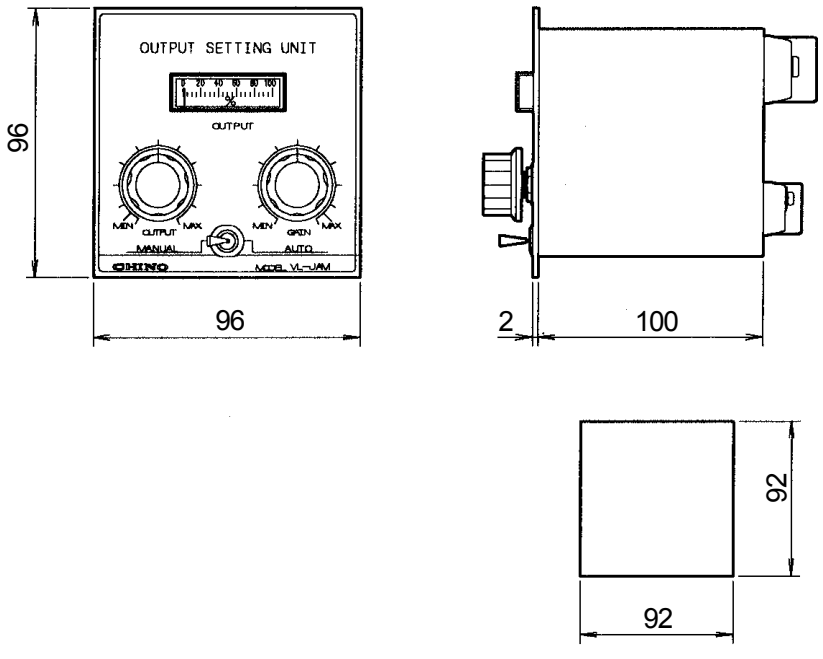
11.11.1 VL-JAL



Specifications
Variable resistor: 10kΩ
Use: Ramp setting
Elevation setting
High limit/low limit settings

11.11.2 VL-JAM□

1,2,4



Specifications
Voltmeter: 1:0 to 150V
2:0 to 250V
4:0 to 500V
to be specified
Variable resistor: 10kΩ・2kΩ
Use: Output indicator
Ramp setting
+ manual setting
+ auto /manual selector switch
* Not applicable to the zero-cross firing system.

11. Accessories

11.2 Rapid fuses

Voltage	Current	Type
100V to 240V	10A	350KH-15
	20A	350KH-30
	30A	250GH-50S
	50A	250GH-75S
	75A	250GH-100S
	100A	250GH-160S
	150A	250GH-200S
	200A	250GH-315S
	250A	250GH-350S
	300A	250GH-450S
	400A	250GHW-630S
	500A	250GHW-710S

Voltage	Current	Type
380V to 440V	10A	600KH-15
	20A	600KH-30
	30A	660GH-50S
	50A	660GH-80S
	75A	660GH-100S
	100A	660GH-160S
	150A	660GH-200S
	200A	660GH-315S
	250A	660GH-350S
	300A	660GH-450S
	400A	660GH-630S
	500A	660GH-710S

11.3 Current transformers

Current	Type	Cable turn number	Type
10A	CPI-1TR 100AT	10	TYPE1
20A	CPI-1TR 100AT	5	TYPE1
30A	CPI-1TR 150AT	5	TYPE1
50A	CPI-1TR 100AT	2	TYPE1
75A	CPI-1TR 150AT	2	TYPE1
100A	CPI-1TR 100AT	1	TYPE1
150A	CPI-1TR 150AT	1	TYPE1
200A	CPI-1TR 200AT	1	TYPE1
250A	CPI-1TR 250AT	1	TYPE1
300A	CPI-1TR 300AT	1	TYPE2
400A	CPI-1TR 400AT	1	TYPE2
500A	CPI-1TR 500AT	1	TYPE2

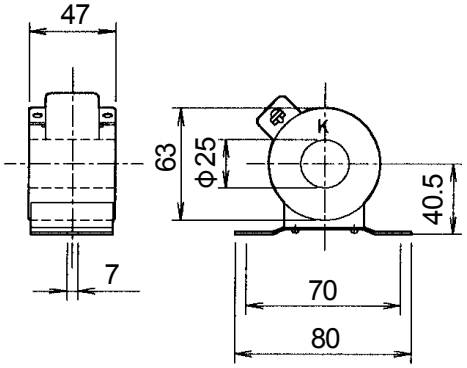
11.4 Exclusive cable between thyristor unit and setting communications unit (for panel mount type only)

Type	Specifications
SH-JUK3	3m
SH-JUK5	5m

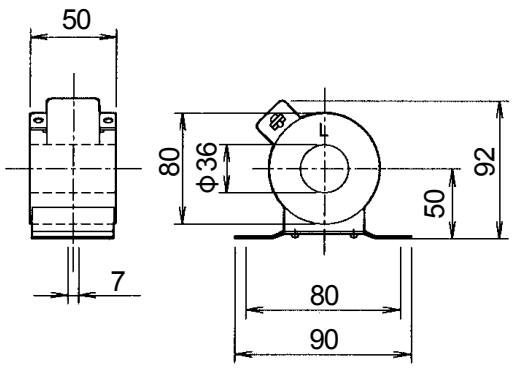
11.5 Main circuit terminal cover

Type	Specifications
SH-JUR500	For rated current 300 to 500A

TYPE1



TYPE2



12. General specifications

Thyristor unit

No. of phases :Single phase
Rated voltage :100, 110, 120, 200, 220, 240, 380, 400, 440VAC (to be specified)
Allowable voltage fluctuation range :-10% to +10% of the rated voltage
Rated frequency :50/60Hz (automatic switching)
Allowable frequency fluctuation :±2Hz (performance guarantee ±1Hz) of the rated frequency
Rated current :10, 20, 30, 50, 75, 100, 150, 200, 250, 300, 400, 500A, 750A, 1000A (to be specified)
Input signal :4 to 20mADC, 1 to 5VDC, on-off contact signal, or manual (variable resistor 10kΩ) is selected at terminals.
Input resistance :100Ω (4 to 20mADC), 25kΩ (1 to 5VDC)
Output range :Voltage feedback … 0 to 98% of rated voltage
Current feedback … 0 to 100% of rated current
Power feedback … 0 to 98% of rated voltage x 0 to 100% of rated current
Without feedback … 0 to 98% of the rated voltage
Output control system :Specified at purchasing, or selection of phase-angle firing system or zero-cross firing system by a contact signal
Feedback :Without feedback /voltage feedback/current feedback/power feedback (to be specified)
External CT input :0 to 5A with reference to the full scale of the rated current
Output accuracy :(1) Without feedback… Within ±10% of rated voltage
(2) Voltage feedback… Within ±3% of rated voltage
(when voltage fluctuates ±10% of the rated voltage)
(3) Current feedback…Within ±3% of rated voltage
(when load resistance changes 1 to 10 times)
(4) Power feedback…Within ±3% of rated current (when load resistance changes 1 to 3 times or the voltage fluctuates ±10% of the rated voltage)
Minimum load current :0.5A (at 98% output of rated voltage)
Applicable load :Resistive load and inductive load (Transformer primary control: In case of phase-angle firing system only, Magnetic flux density 1.2T or less)
Output setting range :Ramp setting … 0 to 100% of the output range (A built-in setting trimmer or an external setting unit)
Elevation setting … 0 to 100% of the output range (A built-in setting trimmer or an external setting unit)
Alarm :2 alarm outputs (Max. 250A, 1AAC)
(1) Alarm contact 1 activates with LED lit for over-current *1, rapid fuse blown-out *2, or heat sink overheat *3.
(2) Alarm contact 2 activates with LED flashed for heater disconnection *1, abnormal thyristor element, or abnormal operation.
*1: With the CT built-in or mounted externally
*2: 30A or higher *3: 200A or higher
Caution: For the unit without feedback, LED lamps indicate alarms for abnormal operation and abnormal power voltage but no alarm output activates.
Over-current protection :Thyristor gate off (more than 120% of the rated current) when the CT is built in or mounted externally.
Cooling system :Self-cooling for the rated current of 150A or lower, or by a cooling fan for the rated current of 200A higher
Other functions :Soft start/soft up-down (1 to 20 seconds variable)
Soft start at recovery from momentary power interruption, heater disconnection alarm (option), current limit function (option), run/stop switch
Working temperature range :-10 to 55ºC (Performance guarantee 0 to 50ºC)
Working humidity range :30% to 90% RH (No dew condensation is allowable.)
Insulation resistance :50MΩ or higher at 500VDC between power terminals and case
Dielectric strength :1 minute at 2000VAC (for models with the rated voltage from 100 to 240V) or 1 minute at 2500VAC (for models with the rated voltage of 380V or higher)

12. General specifications

Setting communications **unit (option)**

Setting : Output setting (0 to 100%), high limit/low limit setting (0 to 100%), ramp setting (0 to 100%), soft start time setting (1 to 20 seconds), heater disconnection alarm setting (Setting range 10 to 100%, Applicable to only models with a heater disconnection alarm function), phase-angle firing system/zero-cross firing system switching, feedback type switching, current limit function, run/stop switch

Display :Output values (voltage, current, power), alarm display, various set values

Installation method : Installed on a thyristor unit or on a panel (Connect the thyristor unit and the setting communications unit by the exclusive cable SH-JUK3 (3m) or SH-JUK5 (5m) when the setting communications unit is installed on the panel.)

Power supply : Supplied from the thyristor unit

Working temperature range : -10 to 55ºC

Working humidity range : 30% to 90% RH (No dew condensation is allowable)

Weight : Approx. 50g

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