

CHINO

INSTRUCTION MANUAL FOR JB SERIES THYRISTOR REGULATOR (Phase-angle firing system/ zero-cross firing system)

Thank you for your purchase of thyristor regulator JB series.

- ◆ Please read this instruction manual carefully to use this unit correctly and safely and also prevent a trouble in advance.

Check your model.

Check your model and its specifications.

To our sales agent and instrumentation contractor

Deliver this instruction manual to your final user.

To user

Keep this instruction manual until you throw into the discard.

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Model Code

A label showing the model code is pasted to the upper part of your unit.

Label

MODEL JB-2030 — Model code
No.005A001 — Serial No.

JB-2□□□

Rated current

020 : 20A
030 : 30A
040 : 40A
050 : 50A
075 : 75A
100 : 100A

Attachment

Name	Remarks	Quantity
Instruction manual	This manual	1 copy

Accessories

(Separate purchase is required.)

For details, refer to Para. 8 (Page 14).

Setters	Fuse units	Rapid fuses
VL-JAL	FU-J020	60PFF20U
VL-JMH	FU-JA030	UR31-30IC
VL-JHL	FU-JA040	UR31-50IC
VL-JAM	FU-JA050	UR31-50IC
—	FU-JA075	UR31-75IC
—	FU-JA100	CR2LS-100G

CHINO

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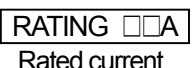
CAUTIONS ON SAFETY

1. Preconditions for Use

This unit is to be mounted inside an indoor instrumentation panel.

2. Symbol Marks Employed in This Unit

● Use in this unit.

Labels	Meanings
 Alert symbol mark	Caution on handling for prevention of an electric shock, injuries, or other accidents.
 Caution on high temperature	Caution on a hot point (radiation fin) for prevention of burn.
 Grounding terminal	Connect a grounding part (mounting hole) to the protective conductor terminal of the power supply equipment.
 RATING □□A Rated current	Make sure that the maximum load current is lower than the rated current.

● Use in this manual.

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

3. Summary

This compact and lightweight single-phase thyristor regulator is designed for high density panel installation, and is applied to wide heating control applications with its various functions including phase-angle firing system/zero-cross firing system selection, soft start time setting, and lower-limit setting.



Warnings/Cautions

1. Mounting direction

Mount your unit vertically with its main circuit terminals (U1, U2) placed downward to ensure air-cooling effect ventilated through its air duct structure.

2. Don't use your unit on any desk.

Make sure to mount your unit on a panel to prevent its trouble or an injury to you by its falling down.

3. Mounting environment

Don't operate your unit at a place where an explosive gas, an inflammable gas, or vapor exists.

4. Don't repair or modify your unit.

To prevent an electric shock accident, a fire, or its trouble, don't repair, modify, or disassemble your unit by any person other than our qualified serviceman.

5. Turn the power supply off for an abnormal symptom.

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

Request for securing the safety

1. Use your unit at lower than the rated current.

Confirm the rated current on the label pasted on the upper part of your unit.

2. Connect a load before turning the power supply on.

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

3. Applicable load

A resistive load is applicable. An inductive load (transformer primary control, maximum magnetic flux density 1.25T) is applicable only when the phase-angle firing system is selected.

4. Mounting of a rapid fuse

Mount a rapid fuse (Separate purchase is required.) for protecting thyristor elements.

5. Countermeasure against digital units

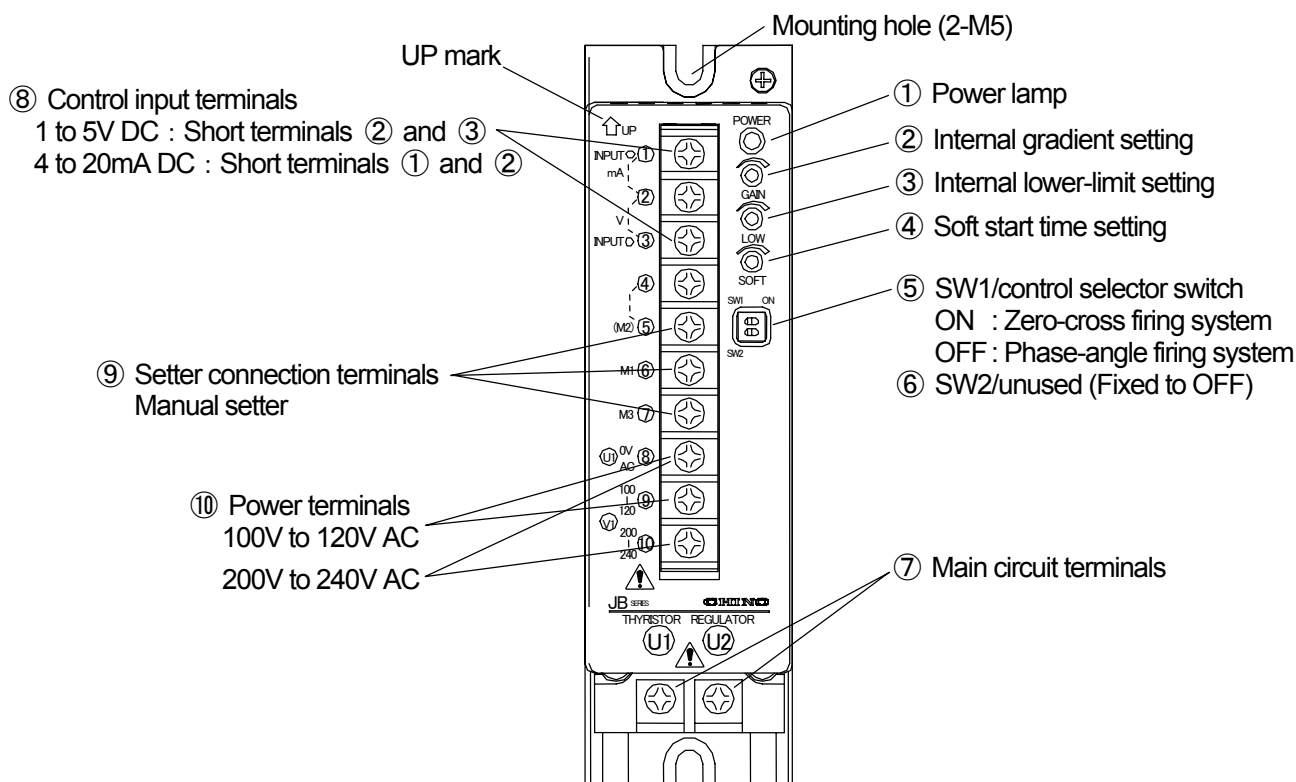
Higher harmonic noises are generated when your unit is used with the phase-angle firing system. Use an insulation transformer, separate your unit from a drive power line, or take other countermeasures.

6. Don't use any unused terminals.

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

1. NAMES OF COMPONENT PARTS

The appearance is sorted into 3 kinds according to the rated current. The following appearance is 30A type. The appearance in other types is almost same as this 30A type.



Names	Functions
① Power lamp	Lights (green) when power is applied to power terminals ⑧, ⑨, and ⑩. Flickers in the determining period of power frequency when the power supply is applied.
② Internal gradient setting	Is used to set gradient. The gradient becomes 100% when you turn this trimmer clockwise fully. Set this trimmer to 100% usually. An external gradient setter can be also connected for current/voltage input.
③ Internal lower-limit setting	Is used to set the output value when the control input is 0% (or ON between H and C terminals). The output value becomes 0% when you turn this trimmer counterclockwise fully. Set this trimmer to 0% usually. An external lower-limit setter can be also connected for contact input.
④ Soft start time setting	Is used to set the soft start time. The soft start time becomes about 1 second when you turn this trimmer counterclockwise fully or it becomes about 20 seconds when you turn this trimmer clockwise fully.
⑤ SW1/control selector switch	Selects either zero-cross firing system (ON) or phase-angle firing system (OFF).
⑥ SW2/unused (Fixed to OFF)	Not used. Make sure to keep it turned off.
⑦ Main circuit terminals	Main circuit terminals (U1, U2) to thyristor elements
⑧ Control input terminals	These input terminals are for a current (4 to 20mA DC) signal or a voltage (1 to 5V DC) signal to control output.
⑨ Setter connection terminals	① For current/voltage input.....For the connection to a gradient setter or a manual setter placed externally. ② For contact input.....For the connection to output terminals (H) (C) (L) of a controller, a higher-limit setter or a lower-limit setter.
⑩ Power terminals	These terminals are for the power supply to this unit.. For the power supply of 100 to 120VAC, connect to the terminals ⑧ and ⑨. For the power supply of 200 to 240VAC, connect to the terminals ⑧ and ⑩.

2. INSTALLATION

**Warning**

Make sure to turn the power source off before installation to prevent an electric shock accident. This unit is designed as a back-of-panel type to be mounted inside a panel, except for accessories (setters, etc.).

2.1 Cautions on Installation

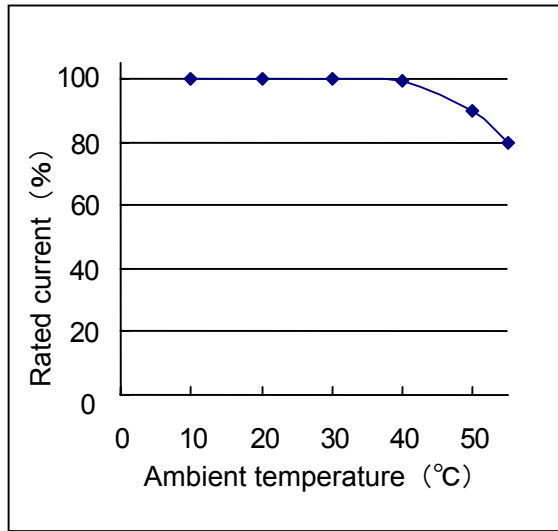
- ① Mount this unit with the UP mark (↑) facing upward.
- ② Mount this unit at a clean and well-ventilated place free of dust particles.
- ③ Separate this unit from a high temperature generating unit or similar unit.
- ④ Keep a radiation space (more than 200mm) above and below this unit.
- ⑤ Don't mount this unit at a place subjected to vibrations and shocks.
- ⑥ Don't mount this unit in corrosive gas atmosphere.
- ⑦ The rated current is specified at an ambient temperature of 40°C as a reference. If the ambient temperature exceeds 40°C, reduce the load current, referring to the right figure. (The maximum operating temperature is 55°C. Use this unit at a current lower than 80% of the rated current in this case.)
- ⑧ Secure sufficient strength of the mounting plate (panel). (More than 1mm thickness is required for an iron plate.)

Reference

Mounting of accessories

Refer to the external views and mounting diagrams in [8. Accessories]

● Ambient temperature and allowable current

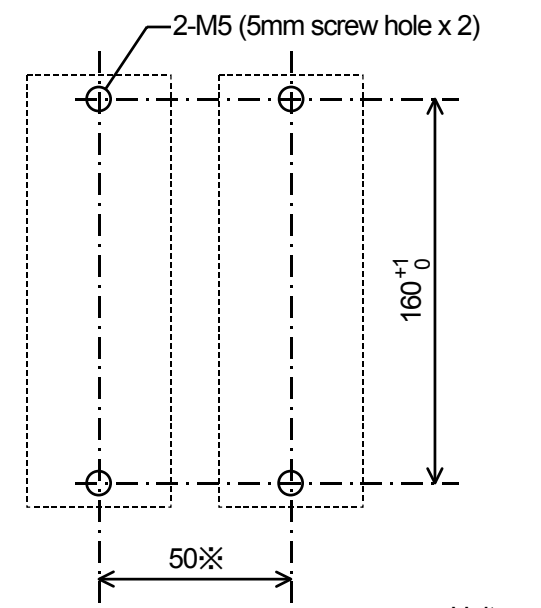


● Rated current and weight

Rating current	Weight
20A	About 1.0kg
30A	About 1.0kg
40A	About 1.3kg
50A	About 1.3 kg
75A	About 1.9kg
100A	About 1.9kg

2.2 Mounting Dimensions

For 20A and 30A



2-M5 (5mm screw hole x 2)

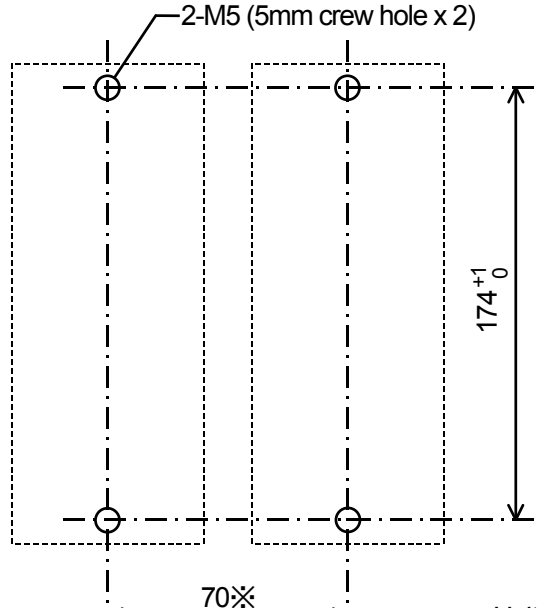
50※

160⁺¹₀

Unit : mm

※Minimum space when units are mounted horizontally.

For 40A and 50A



2-M5 (5mm crew hole x 2)

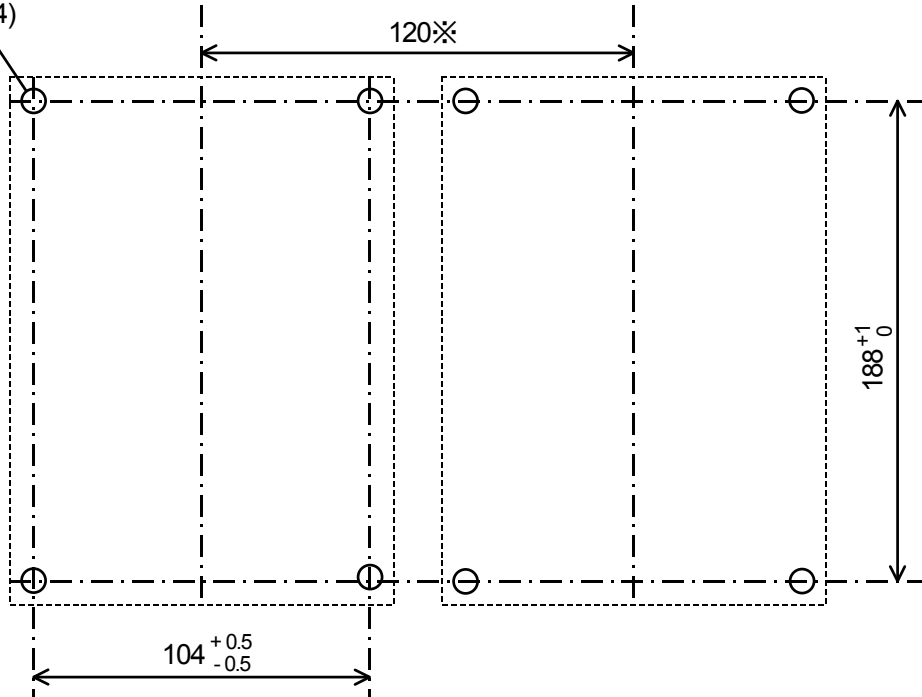
70※

174⁺¹₀

Unit : mm

※Minimum space when units are mounted horizontally.

For 75A and 100A



4-M5 (5mm screw hole x 4)

120※

104^{+0.5}_{-0.5}

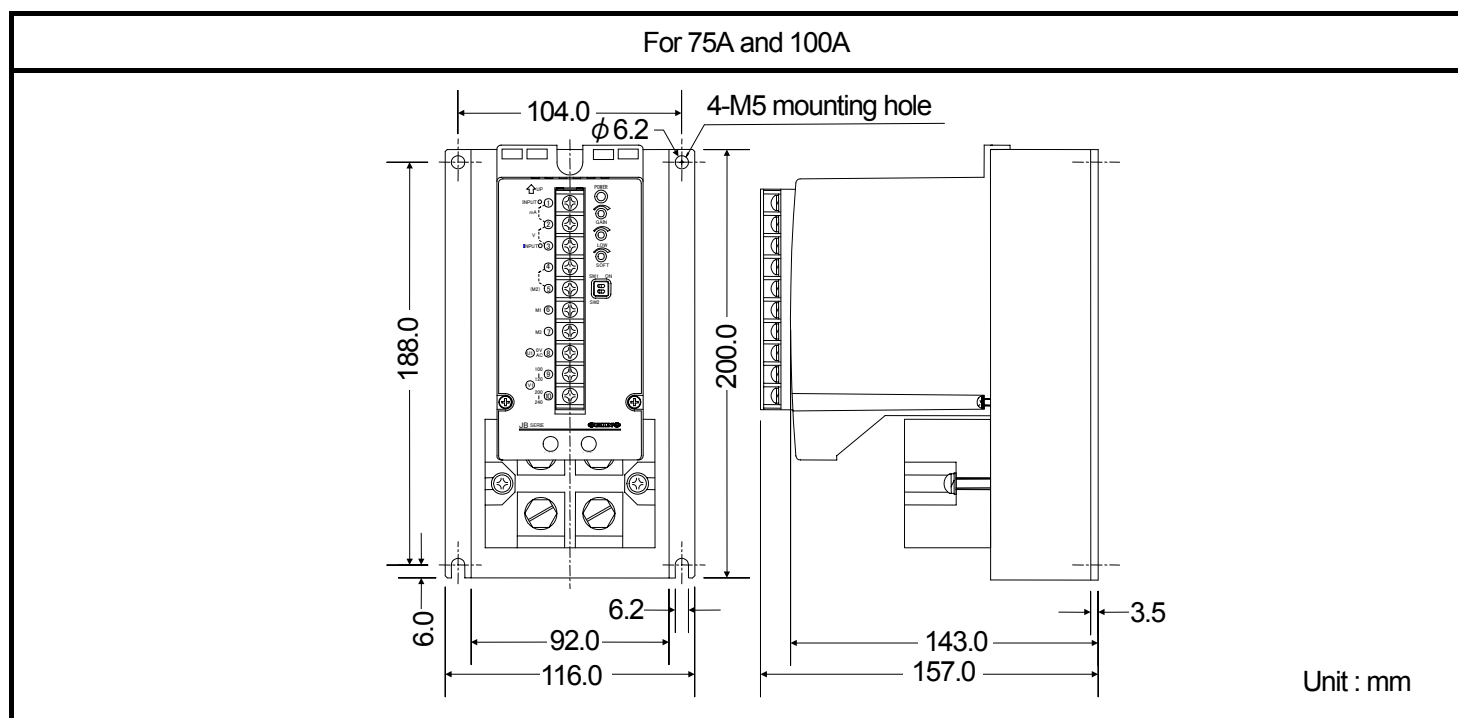
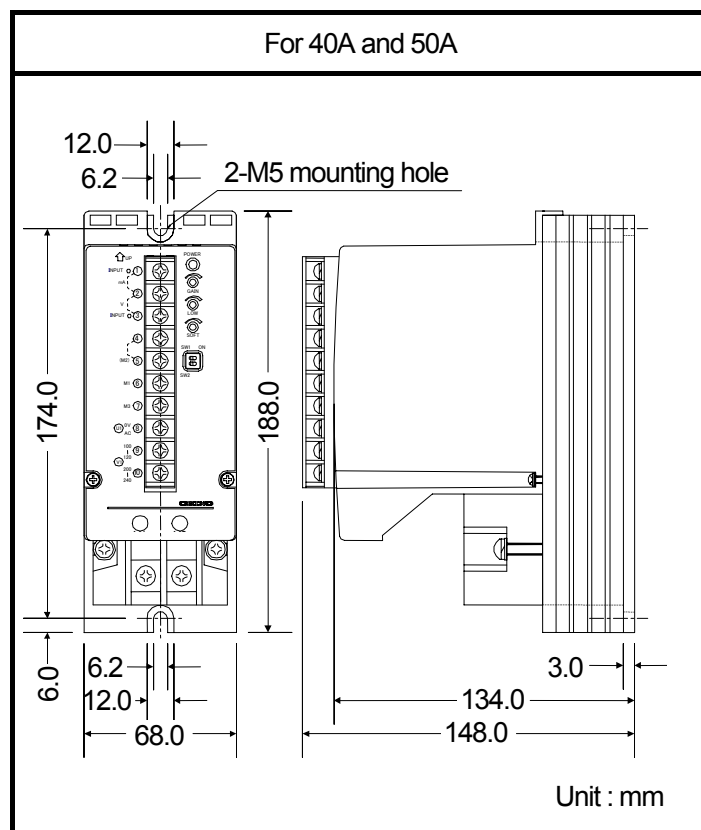
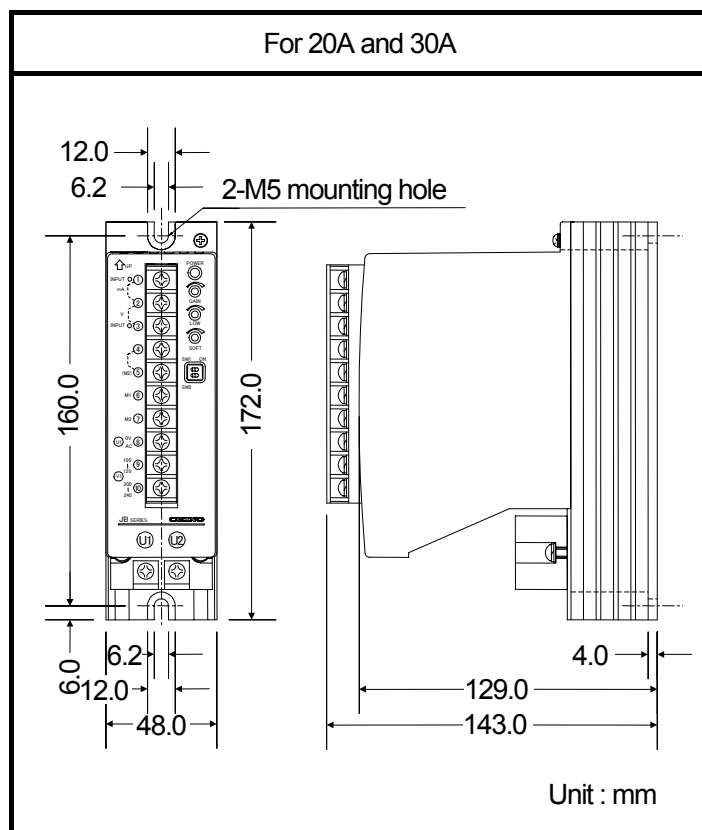
188⁺¹₀

Unit : mm

※Minimum space when units are mounted horizontally.

(Caution) Keep a radiation space of more than 200mm above and below this unit.

3. EXTERNAL DIMENSIONS



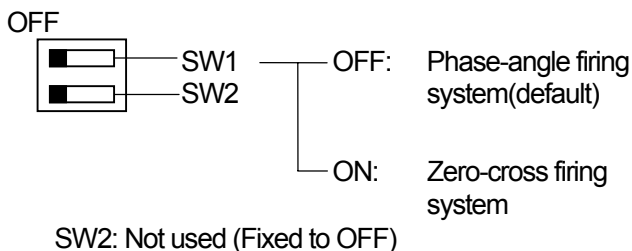
4. SETTINGS



Caution

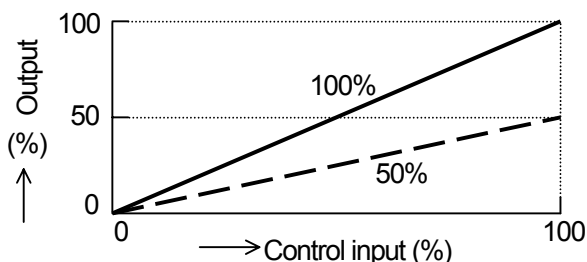
When you change the control system, we recommend to turn the power source off.
For the gradient setting and the lower-limit setting, change the settings gradually to avoid affection to a load or peripheral units by an abrupt change of output.

4.1 Control System Selection (SW1)



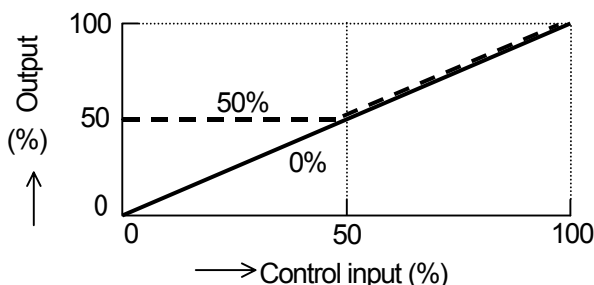
4.2 Gradient Setting (GAIN)

External gradient setter	
Not connected	Connected
Set the gradient by this trimmer	Set this trimmer to 100% and set the gradient by an external gradient setter.



4.3 Lower-limit Setting (LOW)

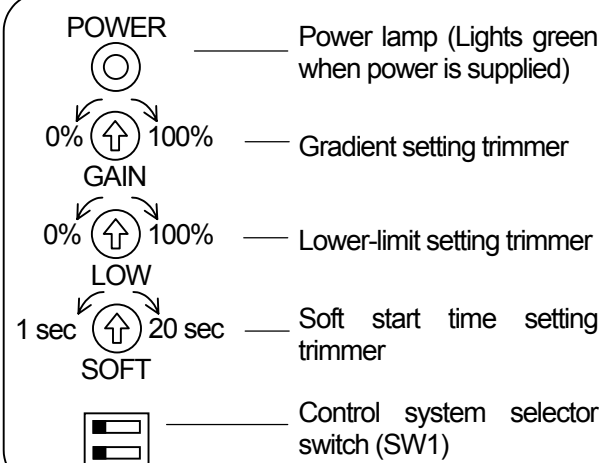
This trimmer is used to set the output value when the control input is 0%. Set this trimmer to 0% by turning it fully counterclockwise usually.



※ The above figure shows the lower-limit setting when the gradient is set to 100%.

4.4 Soft Start Time Setting (SOFT)

The soft start time becomes approx. 1 seconds when turning this trimmer fully counterclockwise, and becomes approx. 20 seconds when turning this trimmer fully clockwise



Reference1 Control system

● Phase-angle firing system.....The system for controlling the output by changing the conductive angle θ (ON timing) in the half cycle (180°) of the power supply. The control becomes continuous as compared with the zero-cross firing system. This control system is also used for transformer primary control. However, since the output contains higher harmonics, it may cause external noises.

● Zero-cross firing system.....The systems for controlling the output by deciding ON/OFF in every cycle of the power supply. Since the power supply is turned on from 0V (zero cross point) voltage, noises are reduced as compared with the phase-angle firing system. However, since the maximum current flows during each ON cycle it may cause flickering.

Reference2 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. You can set the time (from 0% to 100% output) from about 1 second to 20 seconds.

5. CONNECTIONS



Warning

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

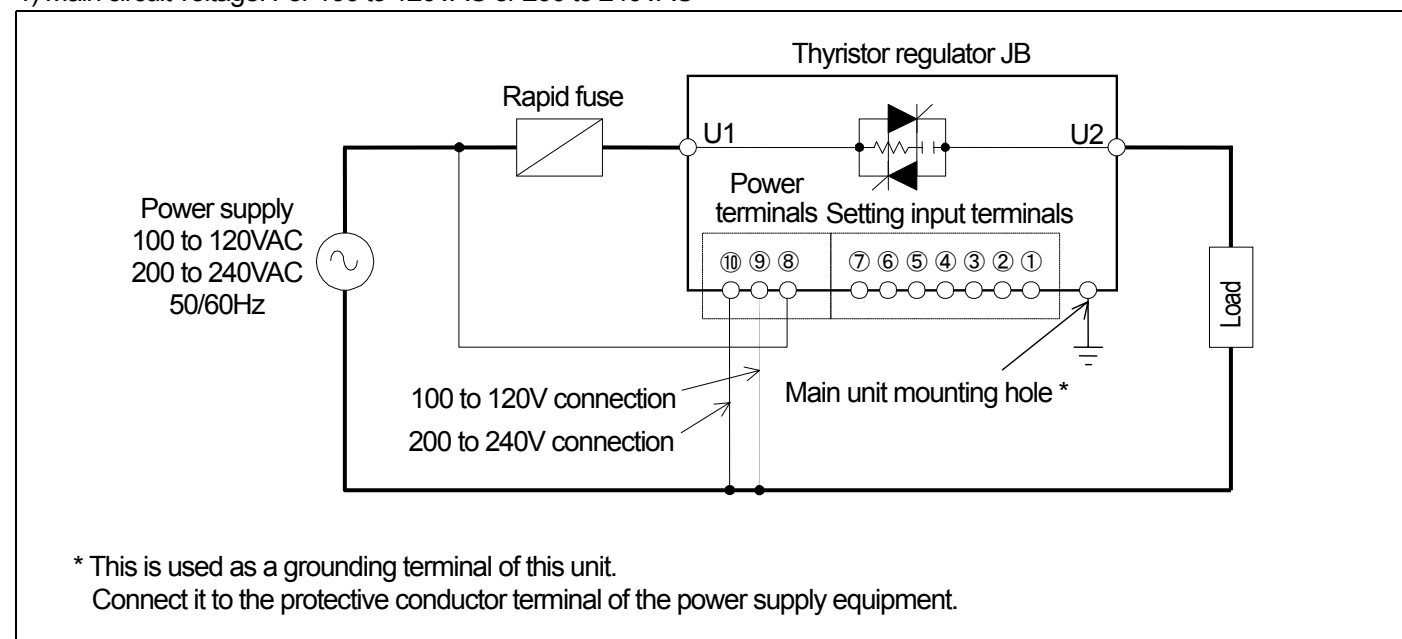
5.1 Cautions on Connections

- ◆ For the connections to the main circuit, use a cable having a sufficient allowance to a load current.
- ◆ For the connections to other terminals, twist 0.3 ~ 0.75mm² cables.

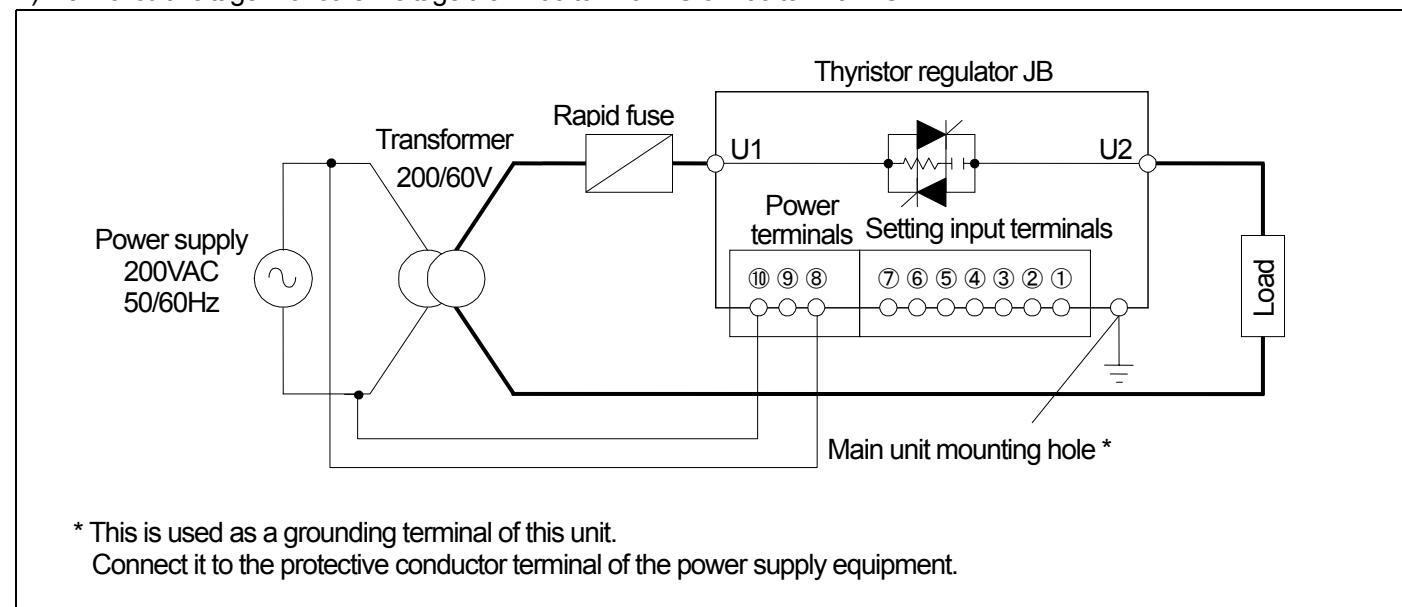
5.2 Main Circuit Terminals/Power Terminals (U1, U2 / ⑧ ⑨ ⑩)

Make sure that the phase of the main circuit (U1, U2) is same as the phase of the power supply (⑧ ⑨ ⑩). (U1 and ⑧, U2 and ⑨ or ⑩). If the phases are different, you can not get a normal output.

1) Main circuit voltage: For 100 to 120VAC or 200 to 240VAC



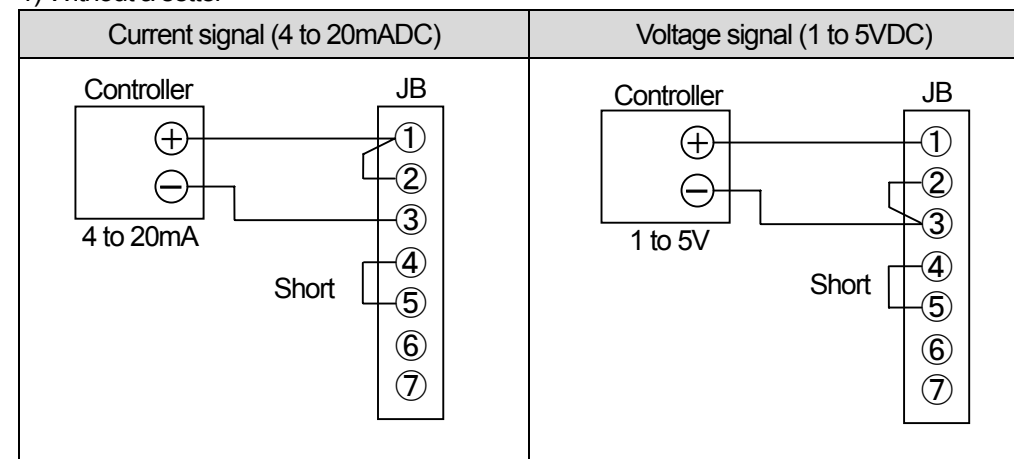
2) Main circuit voltage: For other voltage than 100 to 120VAC or 200 to 240VAC



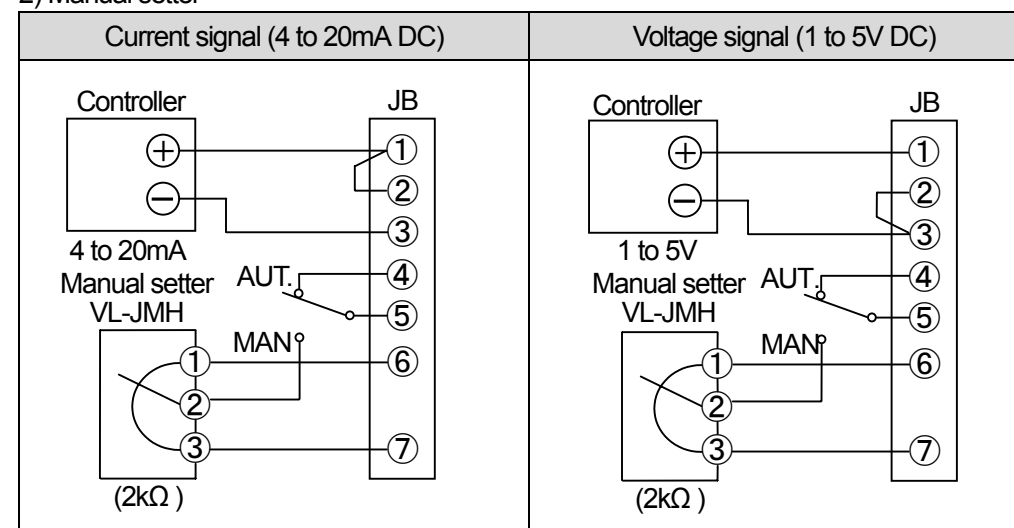
5.3 Setting Input Terminals (① to ⑦)

5.3.1 Current/voltage input signals

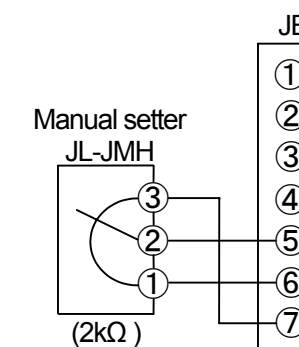
1) Without a setter



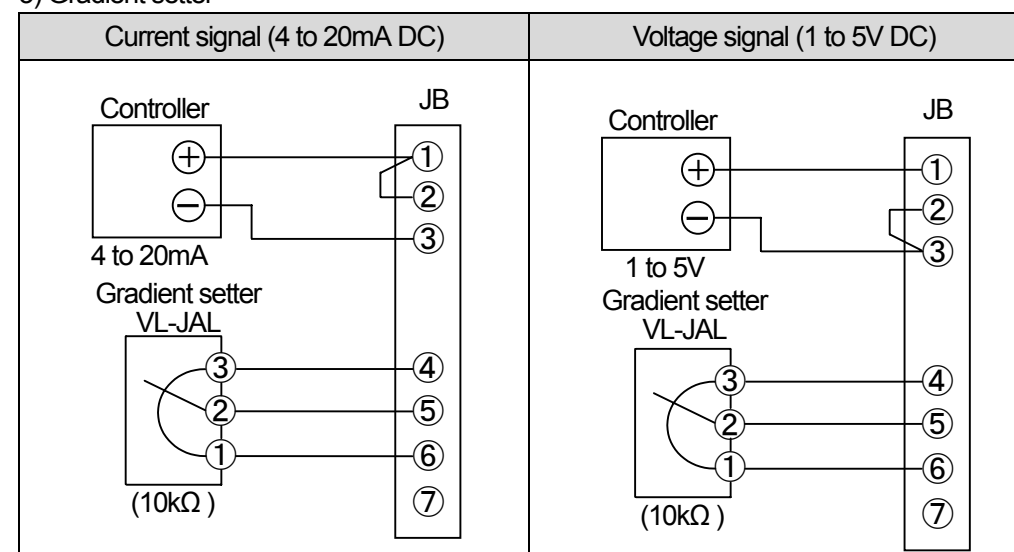
2) Manual setter



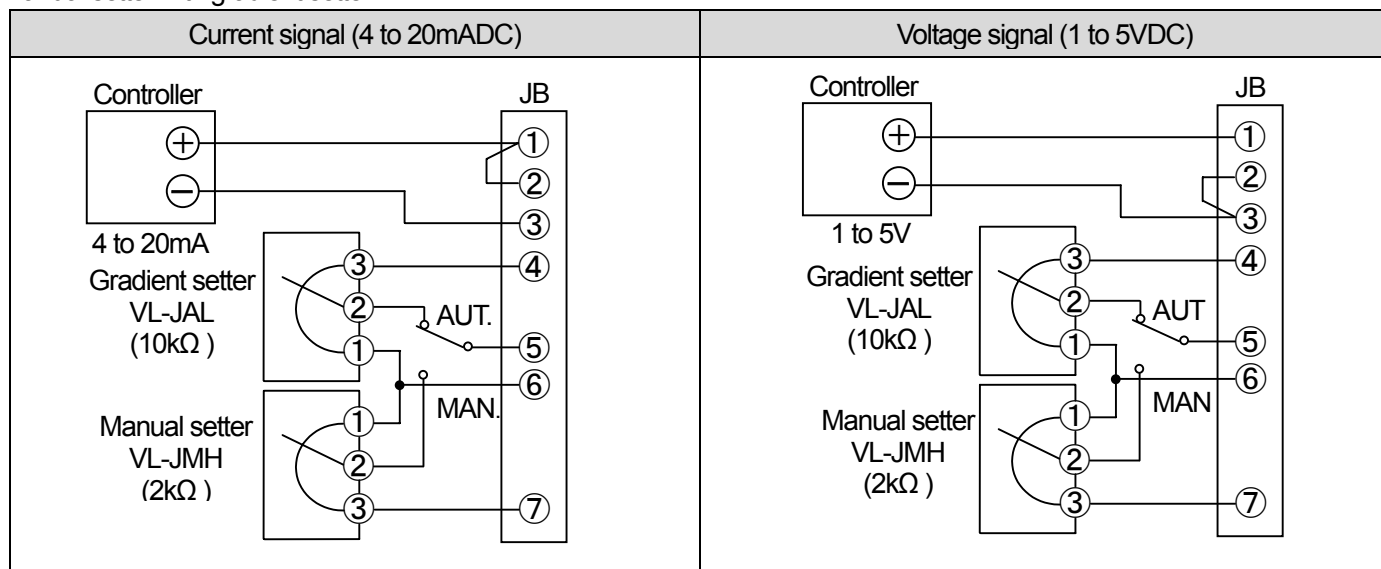
For manual setter only



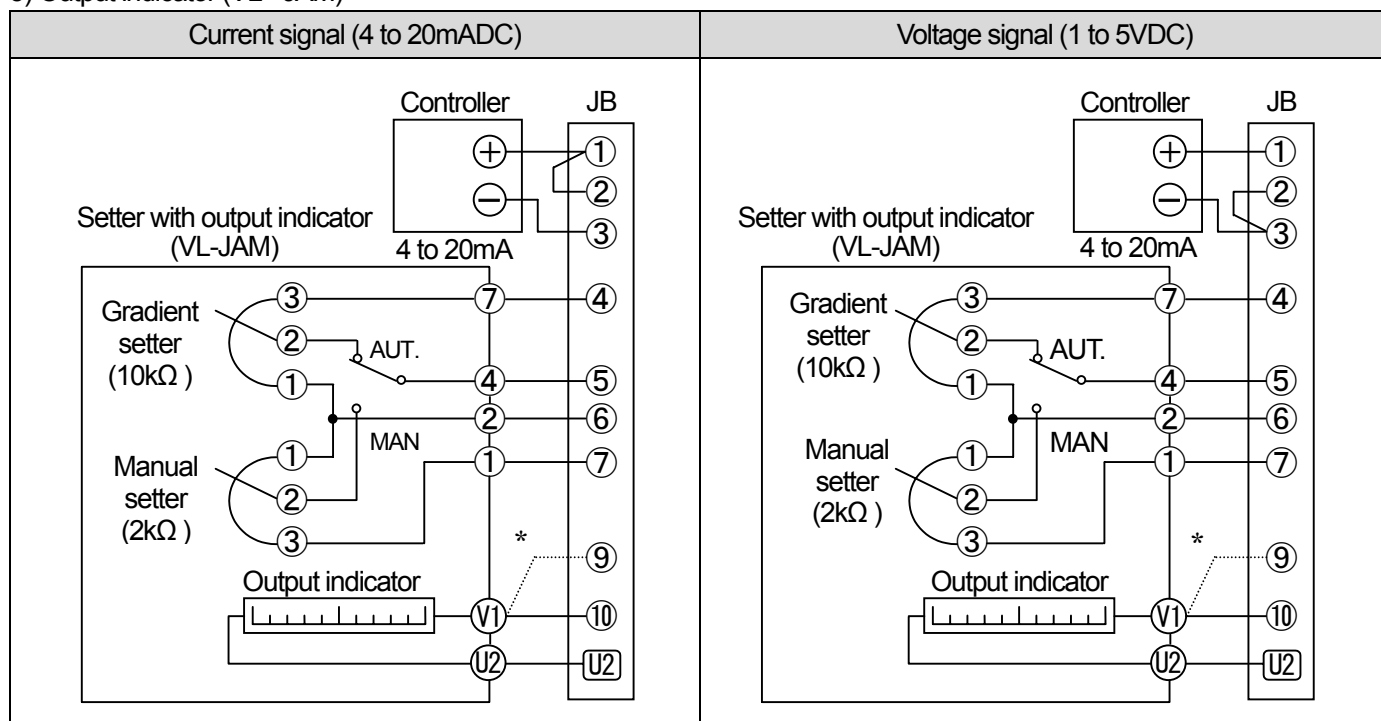
3) Gradient setter



4) Manual setter with gradient setter

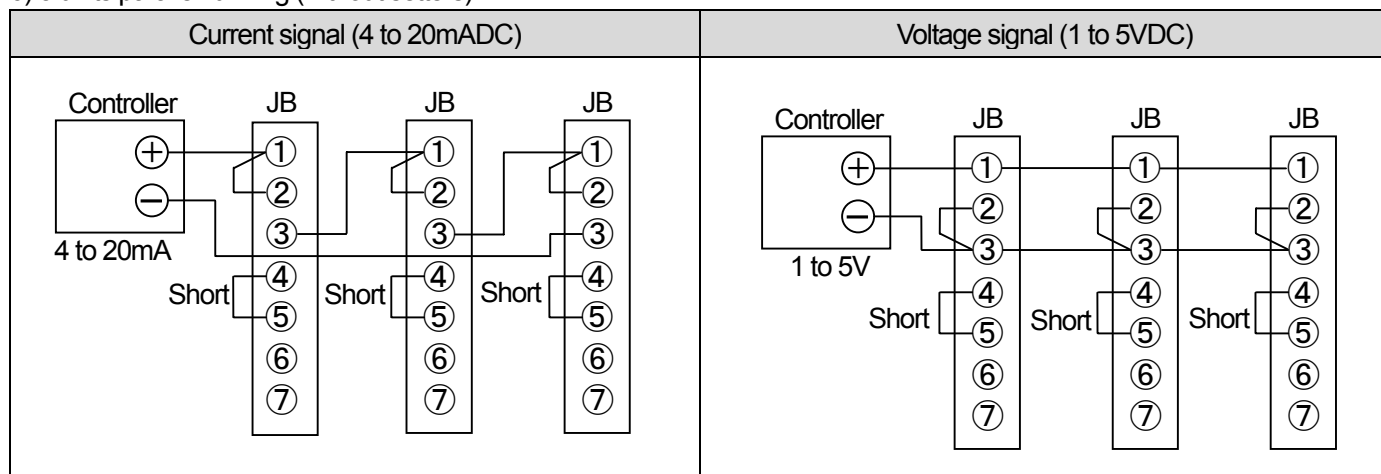


5) Output indicator (VL - JAM)

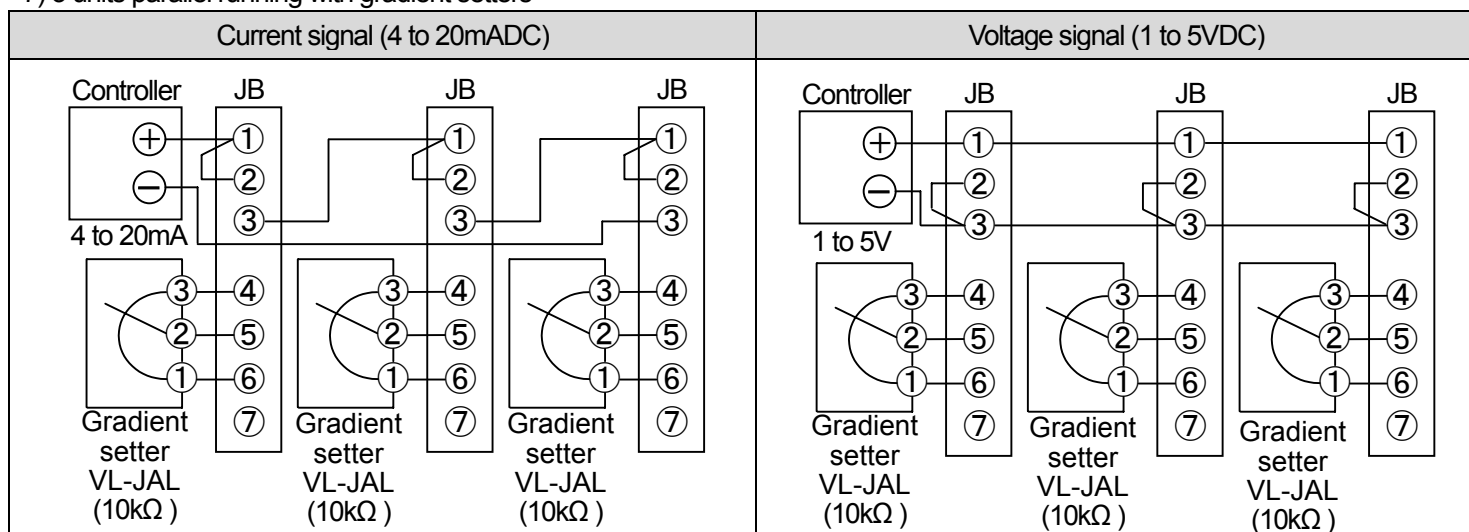


* ⑨ only when the power voltage of main circuit is 100 to 120V and ⑩ in other voltage.

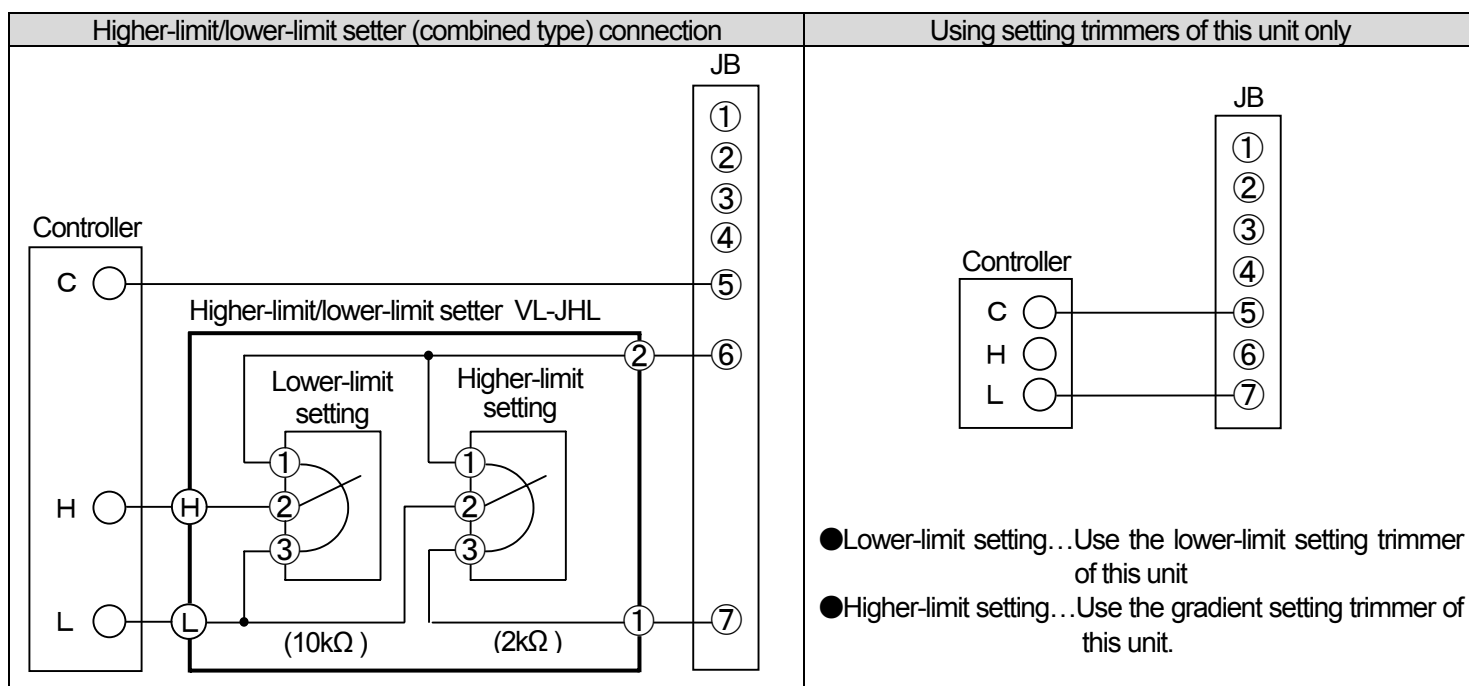
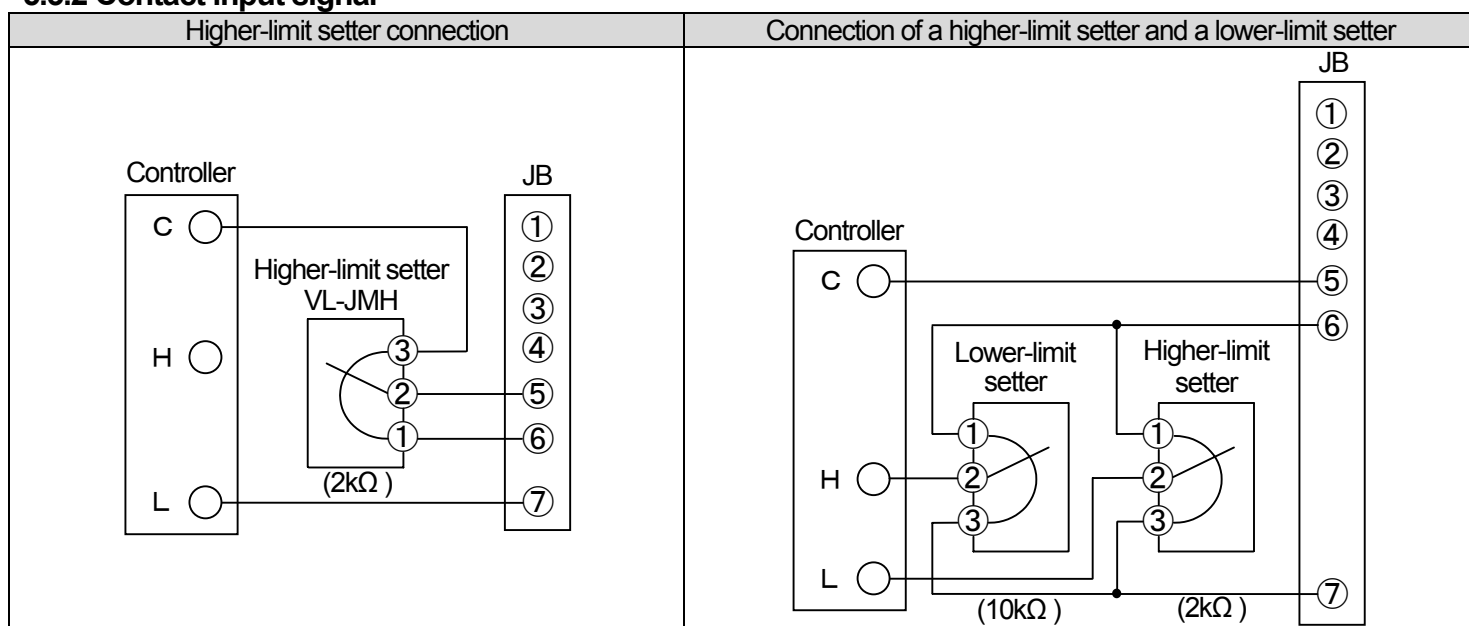
6) 3 units parallel running (without setters)



7) 3 units parallel running with gradient setters



5.3.2 Contact input signal



6. OPERATION

6.1 Check



Warning

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

- ① Check the connections again.
- ② Check the power voltage and the load capacity again.
- ③ Measure the insulation resistance with a 500V megger. Short main circuit terminals U1 and U2 for the dielectric strength test.
- ④ This unit becomes hot due to self-cooling type. Make sure to mount the unit with the UP mark (↑) facing upward so as not to interrupt the radiation effect. If the unit is mounted in the direction other than specified, the interior becomes hot to cause a failure or a trouble.
- ⑤ Check the control system selection again.

6.2 Operation

1) In case of auto run

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

2) In case of manual run

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

7. MAINTENANCE

7.1 Daily Check and Maintenance

The checking and inspection of the following points are required to keep this unit run under the best conditions at all times.

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

7.2 Consumable Parts



Caution

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

Parts names	Reference exchange intervals	Working conditions and others
Control PCB	5 to 8 years	The higher the ambient temperature is the shorter the life is. In addition, the life depends largely upon the atmospheric conditions (kinds of gases, kinds and degree of dust particles, etc.).

8. ACCESSORIES (Separate purchase is required.)

8.1 Setter

Model	VL-JAL	VL-JMH	VL-JHL
Use	Gradient setting, lower-limit setting	Manual setting, higher-limit setting	Higher-limit /lower-limit setting (Higher-limit/lower-limit combined type)
Specifications	Variable resistor 10kΩ	Variable resistor 2kΩ	Variable resistor 10kΩ (For lower-limit), 2kΩ (For higher-limit)
External dimensions Mounting diagram			

Model	VL-JAM
Use	Output indicator (Gradient setting + manual setting + auto/manual selector switch)
Specification	Voltmeter (0 to 150V or 0 to 250V) Variable resistor 10kΩ, 2kΩ
External dimensions Mounting diagram	

8.2 Fuse Unit

Model		FU-J020	Model		FU-JA030 to JA100	
Applicable current		20A	Applicable current		JA030:30A JA040:40A JA050:50A	JA075:75A JA100:100A _____
Specification		Rapid fuse + holder	Specification		Rapid fuse + holder with cover	
Mounting hole size φ 5.5 (Mounting hole) M5 screw Unit: mm Weight: Approx. 110g			Rapid fuse Micro switch Unit: mm Weight: Approx. 250g Contact signal connection terminal Mounting hole size φ 3.5 hole M5 screw (female)			

8.3 Rapid Fuse

Rated current	Type
20A	60PFF20U
30A	UR31-30IC
40A	UR31-50IC
50A	UR31-50IC
75A	UR31-75IC
100A	CR2LS-100G

9. TROUBLESHOOTING

1) Output continues.

Check and symptoms	Causes and remedial measures
① Is the load open?	Connect the load correctly.
② Is lower-limit set to 100%?	Set the lower-limit to be near 0% and monitor the condition.

If this unit is not restored to normal condition as a result of the above remedial measures, the thyristor element may be defective. Contact your nearest sales agent of CHINO Corporation.

2) Output is not proportional to the control input.

Check and symptoms	Causes and remedial measures
① Is the lower-limit set to be high?	Set the lower-limit to be near 0% and check the condition.
② Is the gradient set to be low?	Set the gradient to be near 100% and check the condition.
③ Are the phases of the power supply and main circuit same?	The phases should be same. Refer to the connection diagram in 5.2.
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 condition.

If this unit is not restored to normal condition as a result of the above remedial measures, the unit may be defective. Contact your nearest sales agent of CHINO Corporation.

3) No output

Check and symptoms	Causes and remedial measures
① Power lamp (green) does not light.	① Power terminals (⑧ to ⑩) are not connected correctly. → Connect them correctly.
	② The main circuit and/or the load are connected correctly. → Connect them correctly.
② Power lamp (green) lights.	① The phases of the power supply and the main circuit are not same. → The phases should be same. Refer to the connection diagram in 5.2.
	② Gradient set to 0%. → Set it to near 100% and check the condition.
	③ Input connections (① to ⑦ terminals) are wrong. → Connect them correctly.
	④ Input signal is abnormal. → Apply normal input signal.
③ Power lamp (green) flickers.	Power supply is distorted. → Refer to 2)④.

If the unit is not restored to normal condition as a result of the above remedial measures, the unit may be defective. Contact your nearest sales agent of CHINO Corporation.

10. GENERAL SPECIFICATIONS

Phase	: Single phase
Rated voltage	: 100 to 120VAC, 200 to 240 AC (100V system and 200V system are selected at terminals.)
Allowable voltage fluctuation	: -10% to +10% of the rated voltage
Rated frequency	: 50/60Hz (Automatic selection)
Allowable frequency fluctuation	: ± 2 Hz (operation guarantee) and ± 1 Hz (performance guarantee) of the rated frequency
Rated current	: 20, 30, 40, 50, 75, 100A AC
Input signal	: 4 to 20mADC, 1 to 5VDC or on-off contact signal
Input resistance	: 100 Ω (4 to 20mADC), 25k Ω (1 to 5VDC)
Output range	: 0 to 98% of the rated voltage
Minimum load current	: 0.5A (at 98% output)
Applicable load	: Resistive load and inductive load (Transformer primary control: Phase-angle firing system only, Magnetic flux density 1.25T or less)
Control system	: Phase-angle firing system without feedback Zero-cross firing system * Selectable by DIP switches
Output setting range	: Gradient setting.....0 to 100% of the output range (A setting trimmer is built in.) Lower-limit setting0 to 100% of the output range (A setting trimmer is built in.)
Other functions	: Soft start, soft up-down (1 to 20 seconds variable) Soft start at recovery from momentary interruption
Working temperature range	: -15°C to +55°C (Operation guarantee), 0 to 40°C (Performance guarantee)
Working humidity range	: 30% to 90% RH (No dew condensation is allowable.)
Insulation resistance	: Minimum 500VDC, 20M Ω Between main circuit terminals, power terminals, and power terminals and a case
Dielectric strength	: 2000V AC 1 minute between main circuit terminals and a case