Intelligent Power Control Device

IP3 SERIES

Overview

IP3 Series is a highly functional power regulator corresponding to the three-phase power heater. Various functions are provided as a standard equipment, various alarm functions of the safe design also support it. It can be easily set up by front keys or from an external setting device (volume), it is also compatible with the rated current AC20-100A and with a broad lineup.

Features

- Gradient, ramp up / ramp down can be set by the front key
- Corresponding with the Rich Control Function
- The high-speed response
- The power supply frequency is distinguished automatically : Unnecessary to switch 50/60Hz.

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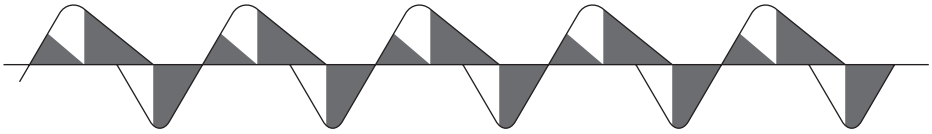
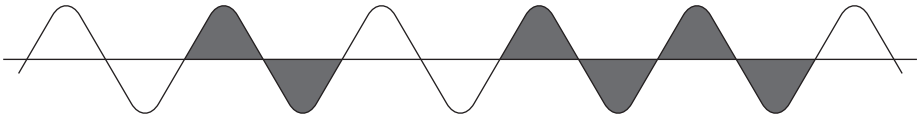
Phase control

The wave form of the load power is switched at a desired phase angle q to provide smooth control.



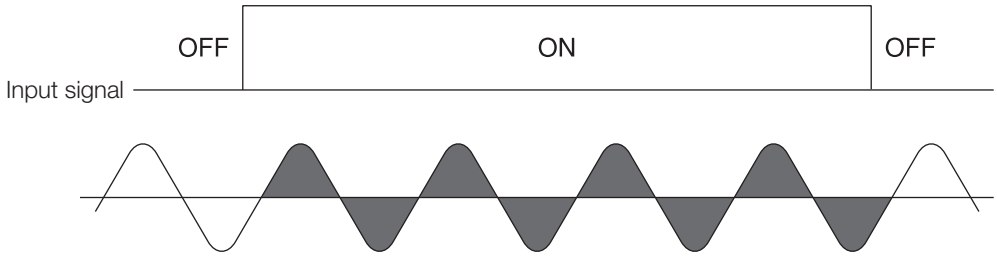
Cycle Control (Continuous proportion)

Power is switched on and off when the supply voltage is at 0V.
This system suppresses high frequency noise inherent to phase control.



Zero-cross control

Supply voltage is switched on and off according to the voltage pulse and contact signals from a controller.



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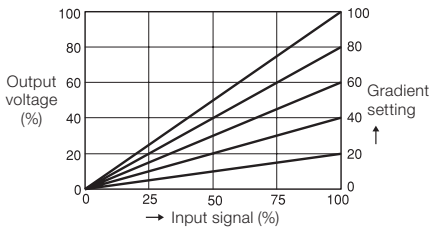
Standard Functions

● Gradient Setting

The relation between the setting input and the output voltage can be set. Gradient setting is possible via front keys or an external setter. Control characteristics may vary with the setting as follows.

1. Auto setting input X Internal gradient setting X External gradient setting
2. Auto setting input X Internal gradient setting
3. Manual setting X Internal gradient setting X External gradient setting

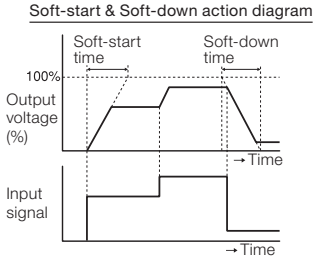
Gradient setting output characteristic diagram



● Ramp Function (Soft-start & Soft-down)

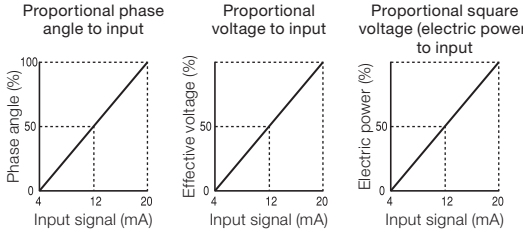
Even if setting input changes abruptly, output changes slowly to suppress inrush current. Ramp-up (Start-up) and ramp down (Start-Down) time can be set in the range of 0.1 to 99.9 sec via front keys.

Soft-start & Soft-down action diagram



● Output modes

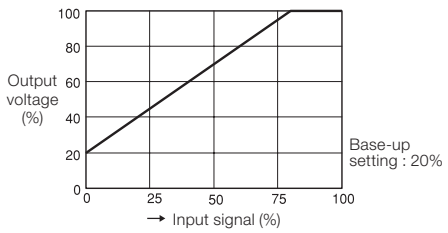
When phase control is selected for linear load (R: resistor), output mode can be selected from Proportional phase angle to input, proportional voltage to input, and proportional square voltage (electric power) to input.



● Base-up setting (Output bias)

When the setting input is zero, the output can be set via front keys.
(Base-up setting is valid when output limiter low is set to 0.0)

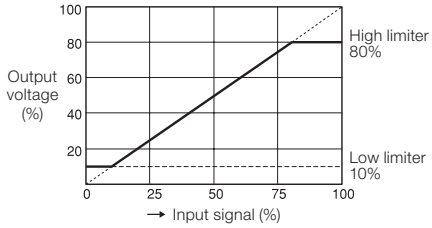
Base-up output characteristic diagram



● Output limiter (High & Low)

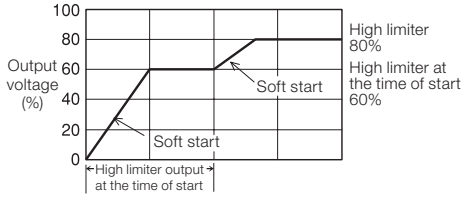
Highest and lowest output values can be set via front keys.

High & Low limiter characteristic diagram



● Output limiter High at start-up

This function limits the highest output for the period of a preset time after power-ON and control mode change from Stop to Run. It makes the IP3 Series suitable for heaters which cause rush current flow, such as Halogen lamp, Tungsten, Platinum, and Molybdenum heaters.



● Event input and alarm function

The contact input can be configured to Run/Stop, Auto/Manual or alarm interlock reset. The alarm types are reverse phase detection, power frequency abnormal, and FAIL. Alarm output will go on, when any of them goes in alarm status. Optional heater break alarm and over-current alarm can be also configured as an output (alarm logic selection).

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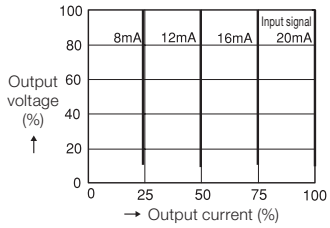
Options

● Constant current control (For phase control only)

This function maintains the output current constant when a load or a power supply fluctuates. It makes the IP3 Series suitable for heaters of which resistance greatly changes by temperature change, such as Platinum, Molybdenum, Tungsten, and Kanthal heaters.

Constant current control characteristic diagram



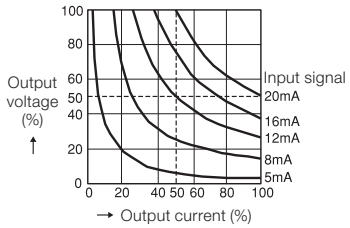
● Constant power control (For phase control only)

This function controls the output to make its effective value power proportional to the input. It makes the IP3 Series suitable for heaters of which resistance gradually increases by temperature or time, such as silicon carbide type heater.

This function controls its effective value power at 50% of the rating shown in the diagram below.

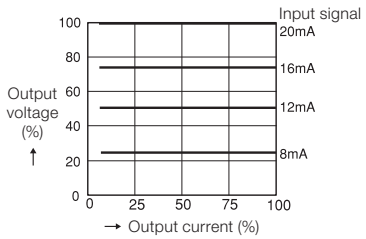
- From the diagram below, constant power control is expressed as a curve obtained from a line between two points which is a 50% of the rating of the unit; a point at 100% voltage x 50% current and a point at 50% voltage x 100% current.

Constant power control characteristic diagram



● Constant Voltage control (For phase control only)

Constant voltage control characteristic diagram



● Heater break alarm

This function measures load current and compares it with a heater break alarm set value. Alarm will be activated if the load current goes into alarm ranges. Maximum two alarm set points can be set for the heater break alarm, which could be used for heater-deterioration alarm and heater-break alarm.

(Note) For phase control, heater break alarm does not work when the load current is less than 15% of maximum load current.

● Fuse break alarm

The alarm goes on when a fast blown fuse is blown. The fuse with alarm output function must be used to use this function.

● Over-current alarm

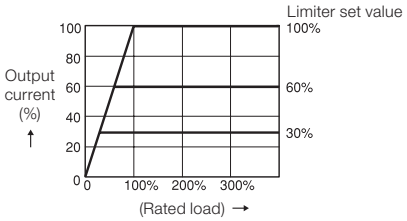
The alarm goes on when the load current exceeds 120% of the rated current.

● Load current limiter (For phase control only)

This function limits the load current value to the heater. The setting range is 30 to 100% of the rated current.

(Note) If the load has a large inrush current, use soft-start function along with this function to suppress the inrush current. This function alone can not prevent the inrush current.

Current limiter characteristic diagram



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Specifications

Maximum Load Current	20A AC, 30A AC, 45A AC, 60A AC, 80A AC, 100A AC
Control Method	Phase control, Cycle control Zero-cross control (Selectable)
Applicable Load	Phase control : Linearity (R:Resistor) load, Control of primary side of a transformer (magnetic field density 8,000 gauss or less) Cycle control Zero-cross control : Linearity (R:Resistor) load
Input Signal	Group 1 (Field-programmable within Group) Current input 4 to 20mA DC (Input impedance : 100Ω) Current input 0 to 20mA DC (Input impedance : 100Ω) Voltage input 0 to 5V DC (Input impedance : 30kΩ) Voltage input 1 to 5V DC (Input impedance : 30kΩ) Voltage pulse input 0/12V DC (Input impedance : 30kΩ) Non-voltage contact input Group 2 (Field-programmable within Group) Voltage input 0 to 10V DC (Input impedance : 68kΩ) Voltage pulse input 0/12V DC (Input impedance : 68kΩ) Voltage pulse input 0/24V DC (Input impedance : 68kΩ) Non-voltage contact input
Minimum Load Current	1A
Output Voltage Range	0 to 98% of rated voltage
Power Supply Voltage	180 to 264V AC (Including power supply voltage variation) Rating : 200 to 240V AC
Power consumption	Less than 17VA
Power Frequency	50/60Hz (Automatic discriminating)
Allowable Power Frequency Variation	50Hz±1Hz, 60Hz±1Hz, (Performance guarantee range) 45 to 54.9Hz (50Hz), 55 to 64.9Hz (60Hz) (Operating guarantee range)
Output Setting Range	Gradient setting : 0.0 to 100.0% [Front key], 0 to 100% [External setting unit] Output limiter (High) : 0.0 to 100.0% [Front key] Output limiter (Low) : 0.0 to 100.0% [Front key] Output limiter at start-up (High) : 0.0 to 100.0% [Front key] Output limiter time at start-up : 0.0 to 600.0 sec [Front key] Base-up setting (Output bias) : 0.0 to 100.0% [Front key] Manual setting : 0.0 to 100% [Front key] 0 to 100% [External setting unit]
Output mode	When phase control is selected for linearity load (R: resistor), output mode can be selected from Proportional phase angle to input, proportional voltage to input, and proportional square voltage (electric power) to input.)
Cooling method	Natural convection
Allowable Ambient Temperature	Performance guarantee range: 0 to +40°C Operating guarantee range: -15 to +55°C
Operating ambient humidity	5 to 95%RH (No-condensation) Absolute humidity : MAX.W.C 29.3g/m^3 dry air at 101.3kPa
Dielectric voltage	Between main circuit terminals, power terminals and heat sink 2000V AC for one minute.
Insulation resistance	Between main circuit terminals, power terminals and heat sink 20MΩ or more (500V DC)
Self-diagnostic function	Check item Board check, EEPROM check, Adjustment data check, Set value range check Action at abnormality : FAIL lamp ON, Thyristor output OFF (The alarm output can be output from the alarm terminals.)
Mounting Method	Vertical mounting
Weight	Approx. 5.8kg (20 to 60A), Approx. 13.6kg (80A,100A)

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Standard functions	• Digital input (DI) : 3 points, Non-voltage contact input RUN/STOP, Auto/Manual, Alarm interlock reset • Gradient setting (External setting unit is optional) • Soft-up/Soft-down : 0.0 to 99.9sec • Alarm output : 2 points Open collector output, 24V DC, Max.100mA Energized/De-energized is selectable. Output logic selection function 1. Heater break alarm ※1 2. Thyristor break alarm ※1 3. OR logic of heater break alarm ※1 and thyristor break alarm ※1 4. OR logic of FAIL, power frequency abnormal, reverse phase detection, over-current alarm ※1, fuse break down ※1 5. OR logic of all alarm ※1 : Optional alarm type • ON/OFF control (External setting units are optional)
Option function	• Heater break alarm Current measuring accuracy : ±2A (20A, 30A type) ±10% of Max. load current (45A, 60A, 80A, 100A type) Number of alarm delay times : 0 to 99 times • Load current limiter Setting range : 0 to 22A (20A type), 0 to 33A (30A type) 0 to 50A (45A type), 0 to 66A (60A type) 0 to 88A (80A type), 0 to 110A (100A type)

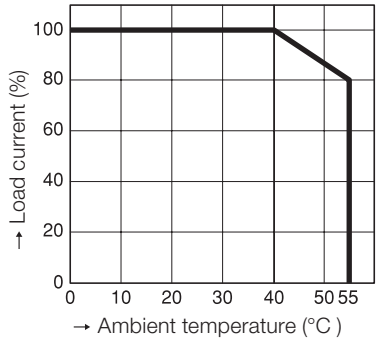
● Table of Stability

Function	Operating condition	Stability
Constant voltage	Power supply variation : Within ±10% Load variation : 2 times	Within ±2% of full scale
Constant current	Power supply variation : Within ±10% Load variation : 2 times	Within ±2% of full scale
Constant power variation	Power supply variation: Within ±10% Load variation : 2 times	Within ±4% of full scale

● Table of internal calorific value

Rated load current (A)	20	30	45	60	80	100
Internal calorific value (W)	82	118	172	226	298	370

● Temperature characteristics of load current



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● Model and Suffix Code

Specifications	Model and Suffix Code	IP3 – □ PZ □ □*□ □ N □
Type	Three Phase Thyristor Unit	
Power supply	200 to 240V AC	2
Control method	Phase control/Cycle control/Zero-cross control (programmable, default: phase control)	PZ
Max. load current	20A AC	020
	30A AC	030
	45A AC	045
	60A AC	060
	80A AC	080
	100A AC	100
Input signal *1	0 to 5V DC	4
	0 to 10V DC	5
	1 to 5V DC	6
	0 to 20mA DC	7
	4 to 20mA DC	8
Output mode *2, *3	Standard (Proportional phase angle • Proportional voltage • Proportional square voltage)	N
	Standard + Constant voltage control	6
	Standard + Constant voltage control (with heater break alarm and load current limiter)	V
	Standard + Constant current control (with heater break alarm and load current limiter)	E
	Standard + Constant power control (with heater break alarm and load current limiter)	W
Fast-blow fuse *2	No fast-blow fuse	N
	With fast-blow fuse (No fuse break alarm output)	F
	With fast-blow fuse (With fuse break alarm output)	S
Optional function	No optional function	N
Accessories *3, *4, *5	Setter (Volume, knob, Scale plate) 1 unit + Connector (Plug)	-1
	Setter (Volume, knob, Scale plate) 2 units + Connector (Plug)	-2
	Connector (Plug)	-9
	Terminal Cover	-A

*1 : Input signal is programmable within group.

Group 1	0 to 20mA DC	4 to 20mA DC	0 to 5V DC	1 to 5V DC	Voltage pulse 0/12V DC	Non-voltage contact

Group 2	0 to 10V DC	Voltage pulse 0/12V DC	Voltage pulse 0/24V DC	Non-voltage contact

*2 : When optional heater break alarm and load current limiter are specified, over-current alarm and thyristor break alarm are also supplied.

*3 : When contact input or/and alarm output is required, specify the connector as an accessory.

*4 : Setters are for external gradient setting, external manual setting, and external high/low setting for on/off control.
Use two units of setter in the following cases;
- When external gradient setting and external manual setting are required.
- High/low setting for on/off control is used.

*5 : It is possible to specify more than one accessories by adding suffix code at the end. (Example: -1-9)

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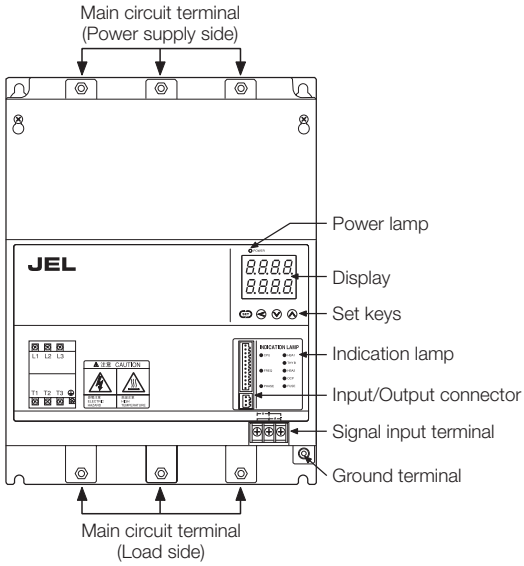
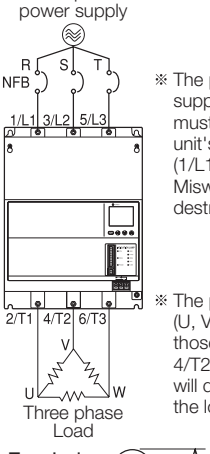
■ External Wiring



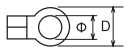
Main circuit



※ The phases of the power supply wirings (R, S, T) must match those of the unit's main circuit (1/L1, 3/L2, 5/L3). Miswiring will damage or destroy the load.

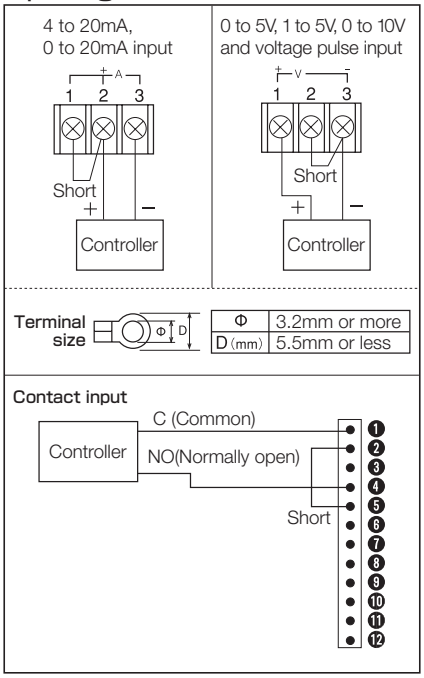
※ The phases of the load (U, V, W) must match those of the unit (2/T1, 4/T2, 6/T3). Miswiring will damage or destroy the load.

Terminal size



No. / Item	1/L1,3/L2,5/L3, 2/T1,4/T2,6/T3		
	20A/30A	45A/60A	80A/100A
Φ	4.3mm or more	6.4mm or more	8.4mm or more
D (mm)	9.5mm or less	12.0mm or less	22.0mm or less

Input signal



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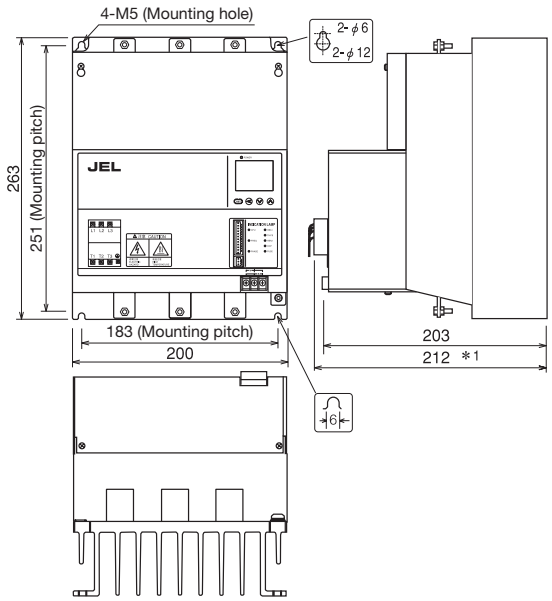
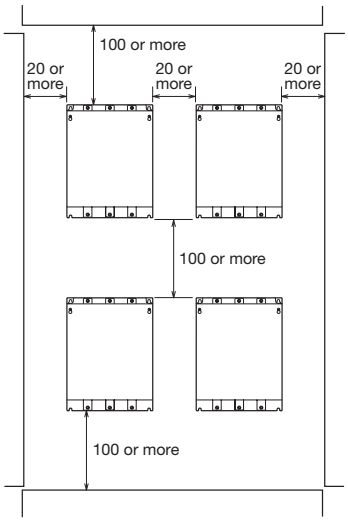
■ External Dimensions (Unit : mm)

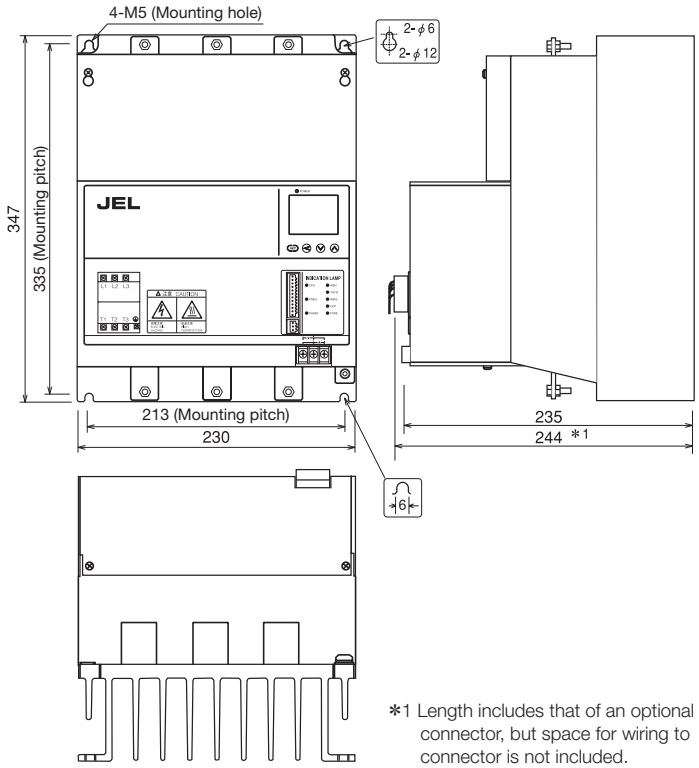
○ 20A, 30A, 45A, 60A



● When multiple units are installed, space between units must satisfy the rules shown in the drawing below.



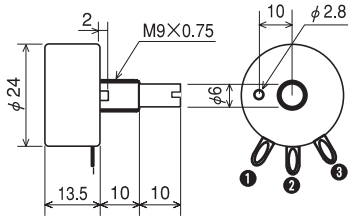
○ 80A, 100A



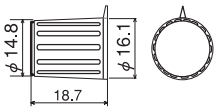
*1 Length includes that of an optional connector, but space for wiring to connector is not included.

Accessories (Unit : mm)

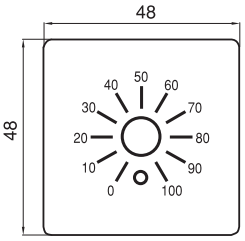
● Gradient setter, Manual setter, High/Low setter : IP3-S01



Volume
(Resistance:5kΩ, B)



Knob



Scale plate

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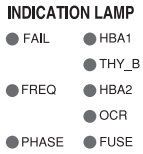
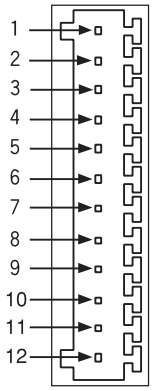
■ Indication Lamp



Lamp	Contents
FAIL	FAIL(Self-diagnostic abnormality)
FREQ	Power frequency abnormality
PHASE	Reverse phase detection
HBA1	Heater break alarm SV1
THY_B	Thyristor break alarm
HBA2	Heater break alarm SV2
OCR	Over current alarm
FUSE	Fuse break alarm

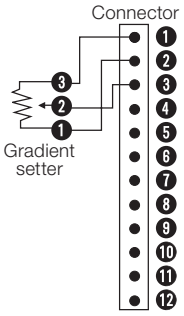
* Up to two alarm set points can be set for the heater break alarm.
* Fuse break alarm lamp is available when a fast blow fuse with fuse break alarm output is used.

■ Connector

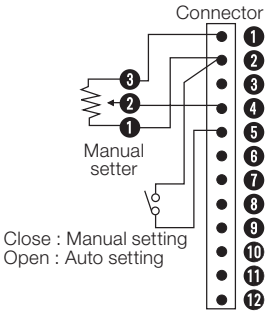


Pin No.	Contents
1	+5V output
2	0V (GND)
3	Gradient setting input (0 to 5V input by gradient setter)
4	Manual setting input (0 to 5V input by manual setter)
5	External contact input (Auto/manual setting selection) Pin No.2 - No.5, Open : Auto setting mode Pin No.2 - No.5, Close : Manual setting mode.
6	External contact input (RUN/STOP selection) Pin No.2 - No.6, Open : Stop mode Pin No.2 - No.6, Close : Run mode.
7	External contact input (Alarm interlock reset) Pin No.2 - No.6, Close : Alarm interlock reset
8	Unused
9	DC24V (+)
10	Open collector output (+) : Alarm 1 output
11	Open collector output (+) : Alarm 2 output
12	0V

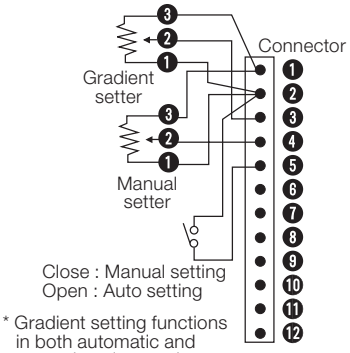
• Auto setting (With gradient setter)



• Auto/Manual setting selection

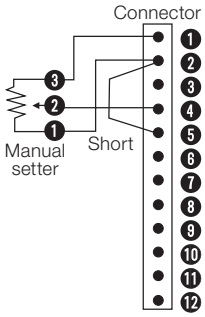


• Auto/Manual setting selection (With gradient setter)

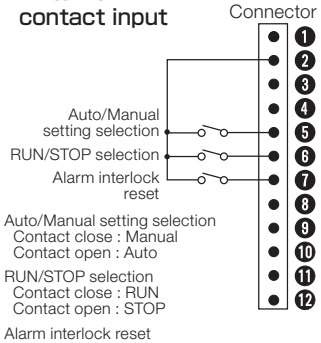


* Gradient setting functions in both automatic and manual setting modes.

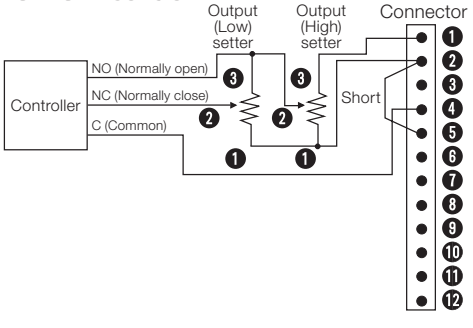
• Manual setting (With manual setter)



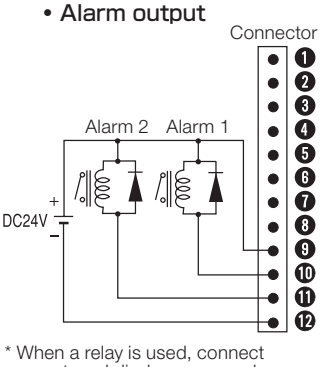
• External contact input



• ON/OFF control



• Alarm output



* When a relay is used, connect an external diode or use a relay with diode inside.

※ Description in the catalogue is subject to change without notice. Please read the specifications thoroughly before using.
※ Please contact JEL SYSTEM for further information.