

THYRISTOR UNIT

THV-A1 SERIES

Power Controller

High Performance
Single Phase Thyristor Unit



High performance power controller with powerful functions

As the THV-A1 single phase power control unit can be used with control modes selectable from constant voltage, constant current and constant power, it can be used with such heaters as noble metals (Platinum and molybdenum), super Kanthal, and SiC (Silicon Carbide) that have changing resistance in accordance with temperature changes. Optional features like heater break alarm and communication can improve system safety and establishment of a supervisory system.

1 Easy and accurate setting

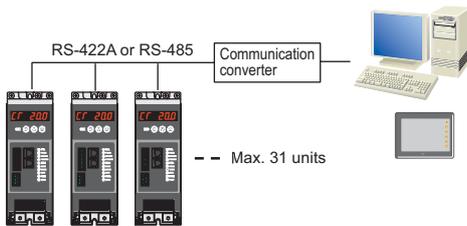
Single phase power controller THV-A1 has an LED display to show set values and input signals, and front keys for easy setting and monitoring. Setting can also be made with an external setting unit (variable resistor).

2 Works against a rapid response

With either the ramp-up (soft-start) or ramp-down (soft-down) set to zero, the THV quickly responds to input changes, and can be used in applications like RTP (Rapid Thermal Process).

3 Communication

With the communication function, a connection to a host computer and an MMI is possible. (Protocol: Modbus-RTU)



4 Memory area

The THV-A1 stores 4 patterns of heater break alarm settings and enables easy change of settings.

- Memory area is not available with heater break alarms for non-linear load.

Area 4	
Maximum load current for alarm	
Heater break alarm set-value	
Heater break alarm 2 set-value	
Thyristor break-down alarm set-value	
Current limiter set-value	
Area 2	
Area 1	
Maximum load current for alarm	
Heater break alarm set-value	
Heater break alarm 2 set-value	
Thyristor break-down alarm set-value	
Current limiter set-value	



5 Three types of control modes are selectable

○ Phase control

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



○ Zero-cross control (Continuous proportional)

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 (Input synchronization system)

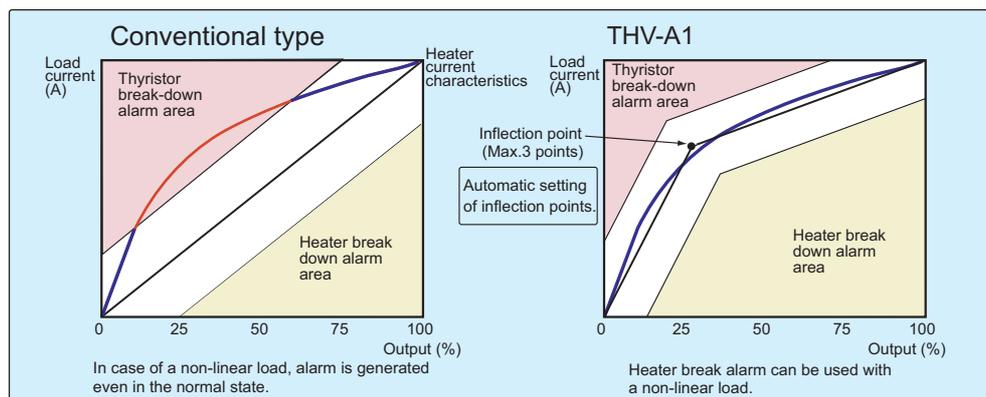
Supply voltage is switched on and off according to the voltage pulse or contact signals from a controller.



6 Detects heater break of non-linear load

Patent pending

Heater break alarm can be used at up to three inflection points in accordance with heater characteristics. The unit can be used with a load with large resistance changes by temperature (e.g. lamp heaters). There is no need of calculation for inflection points as automatic setting is possible.

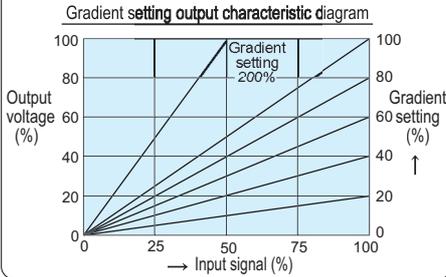


Standard Functions

Gradient setting

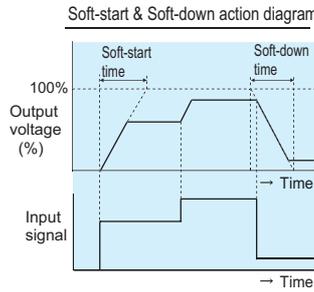
The relation between the setting input and the output voltage can be set. Gradient setting is possible via front keys or an external setter. Control characteristics may vary with the setting as follows.

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



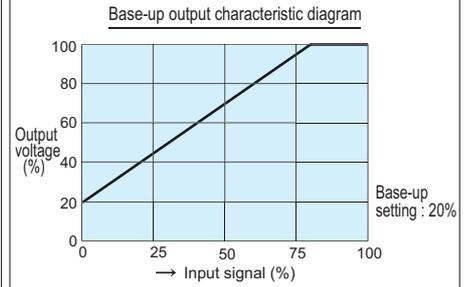
Ramp function (Soft-start & Soft-down)

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 100.0 sec via front keys.



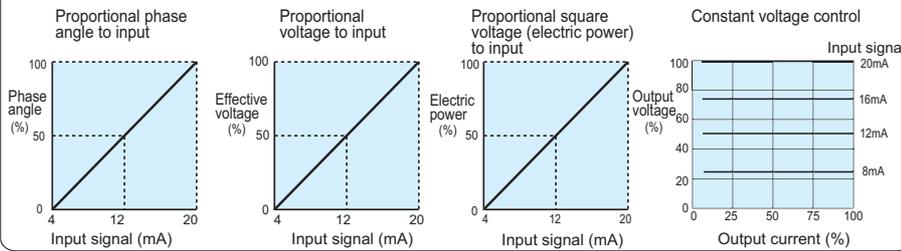
Base-up setting (Output bias)

Output bias can be set via front keys. (Base-up setting is valid when output limiter low is set to 0.0)



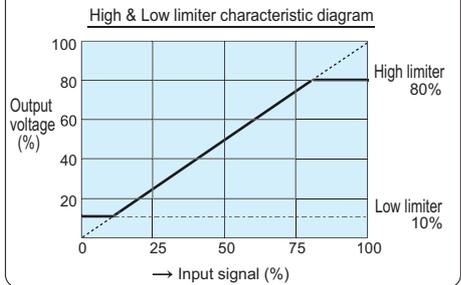
Output modes

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



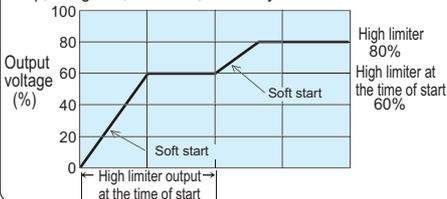
Output limiter (High & Low)

Output highest and lowest values can be set via front keys.



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 THV-A1 Series suitable for heaters which cause rush current flow, such as Halogen lamp, Tungsten, Platinum, and Molybdenum heaters.



Event input

Functions can be assigned to three external contact inputs. Switching of functions can be made externally with contact signals.

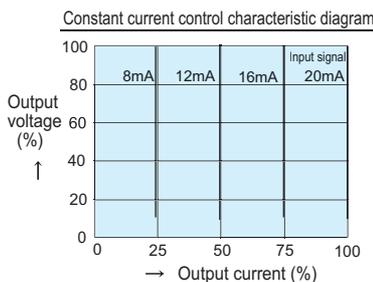
RUN/STOP
Auto/Manual
Alarm interlock reset
Heater break alarm : Use/Unuse
Soft-up/Soft/down : Use/Unuse
Key lock : Use/Unuse
Over current alarm : Use/Unuse
Multi-memory area selection (DI: 2 points)

* Heater break alarm, over current alarm and multi-memory area selection are optional.

Optional Functions

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 THV Series suitable for heaters of which resistance greatly changes by temperature change, such as Platinum, Molybdenum, Tungsten, and Kanthal heaters.

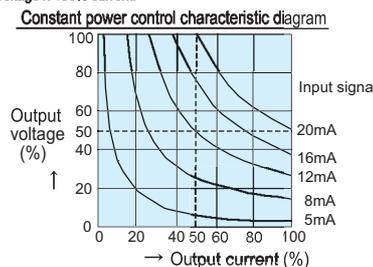


Constant power control (For phase control only)

This function controls the output to make its effective value power proportional to the input. It makes the THV 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.

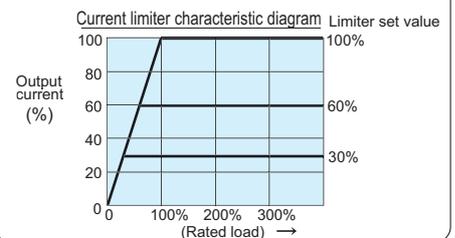
* From the diagram below, constant power control is expressed as a curve obtained from a line between two points which is a 50% of the rating of the unit; a point at 100% voltage x 50% current and a point at 50% voltage x 100% current.



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.



Over-current alarm

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

Communication

Communication function (RS-485 or RS-422A) enables the unit to be connected to a host computer and a MMI. The communication protocol is Modbus RTU.

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.

Alarm output

The alarm types are Power supply voltage abnormal, Power frequency abnormal, Board alarm, Over current alarm, Fuse break alarm, Thyristor break alarm, and Heater break alarm. Alarm output will go on, when any of them goes in alarm status.

(Alarm logic selection, Alarm output : 2 points)

Specifications

Rated current : 20A, 30A, 45A, 60A, 80A, 100A AC

Control method : Phase 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)

Input signal : Zero-cross control : Linearity (R:Resistor) load

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 : 60kΩ)
- Voltage pulse input 0/12V DC (Input impedance : 60kΩ)
- Voltage pulse input 0/24V DC (Input impedance : 60kΩ)
- Non-voltage contact input

Input sampling cycle : 0.5 cycle of power cycle

Min. load current : 0.5A (at 98% output of rated voltage)

Output voltage range : 0 to 98% of rated voltage

Power OFF leakage current : 27mA AC rms or less (load voltage 200V rms, 60Hz, Ta=25°C)

Power supply voltage : 90 to 264V AC (Including power supply voltage variation)
Rating : 100 to 240V AC

Power consumption : Less than 6VA (at 100V AC), Rush current 10A or less
Less than 8VA (at 240V AC), Rush current 24A or less

Power frequency : 50/60Hz (Automatic detection)

Allowable power frequency variation : 50±1Hz, 60±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 200.0% [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 (Low) : 0.0 to 600.0 sec [Front key]
- Base-up setting (Output bias) : -10.0 to 100.0% [Front key]
- Manual setting : 0.0 to 100% [Front key]
- 0 to 100% [External setting unit]

Output mode : a) Constant voltage control
b) Proportional phase angle • Proportional voltage • Proportional square voltage • Proportional square voltage feed back [when phase control is selected for linearity load (R: resistor)]
c) Constant current control
d) Constant power control
• a), b) : Standard function, c), d) : Optional function

Cooling method : Natural convection

Operating ambient temperature : Performance guarantee range: 0 to +40°C
Operation guarantee range: -15 to +55°C

Operating ambient humidity : 5 to 95%RH (Non-condensing)
Absolute humidity : MAX.W.C 29.3g/m³ dry air at 101.3kPa

Dielectric voltage : Between main circuit terminals, power terminals and heat sink 2000V AC for one minute.
Between main circuit terminals, power terminals and input terminals 2000V AC for one minute.

Insulation resistance : Between main circuit terminals, power terminals and heat sink 20MΩ or more (500V DC)
Between main circuit terminals, power terminals and input terminals 20MΩ or more (500V DC)

Self-diagnostic function : Check item
a) Data check, Back-up check, Power frequency check, Main circuit power supply check, A/D converter check
b) Power supply voltage check, Watch dog-timer
Action at abnormality :
Check item a) : Control stop, Board abnormality lamp ON, Thyristor output OFF
Check item b) : Action stop, FAIL lamp ON, Thyristor output OFF

Mounting method : Vertical mounting

Weight : Approx. 1.4kg (20A, 30A), Approx. 1.6kg (45A, 60A)
Approx. 2.4kg (80A, 100A)

Standard functions : • Auto/Manual selection (External manual setting unit is optional)
• Gradient setting (External setting unit is optional)
• Soft-up/Soft-down : 0.0 to 100.0sec
• Digital input (DI) : 3 points, Non-voltage contact input
RUN/STOP, Auto/Manual, Alarm interlock reset
Heater break alarm : Use/Unuse, Soft-up/Softdown : Use/Unuse
Key lock : Use/Unuse, Over current alarm : Use/Unuse
Multi-memory area selection (For heater break alarm) (Selectable)

Option function : • ON/OFF control (External setting units are optional)
• Alarm output : 2 points
Open collector output, 250V AC, 1A (Resistive load)
Energized/De-energized is selectable.
(Heater break alarm, Thyristor break alarm, Fuse break alarm, Power supply voltage abnormal, Power frequency abnormal, Over current alarm, Board alarm)
* Selectable

Option function : • Heater break alarm
Current measuring accuracy : ±2% of rated load current
Number of alarm delay times : 0 to 99 times
Memory area : 4 areas

• Load current limiter
Setting range : 0.0 to 22.0A (20A type)
0.0 to 33.0A (30A type)
0.0 to 50.0A (45A type)
0.0 to 66.0A (60A type)
0.0 to 88.0A (80A type)
0.0 to 110A (100A type)

• Heat sink temperature abnormality

• Communication function
Communication method : RS-485 (2-wire, half-duplex)
RS-422A (4-wire, half-duplex)
Synchronous method : Start-stop synchronous type
Communication speed : 9600 bps
Protocol : Modbus-RTU
Data format : Start bit : 1, Data bit : 8, Parity bit : None
Stop bit : 1
Maximum connection : 31 units

Compliance with Standards : UL : UL508
cUL : C22.2 No.14
CE marking : LVD : EN60947-4-3
OVERVOLTAGE CATEGORYII,
POLLUTION DEGREE 2,
Class II (Reinforced insulation)
EMC : EN60947-4-3

• A specified noise filter must be used
SOSHIN ELECTRIC CO., LTD
HF2030A-UP (20A,30A)
HF2050A-UP (45A)
HF2060A-UP (60A)
HF2080A-UP (80A)
HF2100A-UP (100A)

Table of Stability

Function	Operating condition	Stability
Constant voltage variation	Power supply variation : Within ±10% Load variation : 2 times	Within ±2% of full scale
Constant current variation	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)	23	34	56	72	95	116

• Temperature characteristics of load current

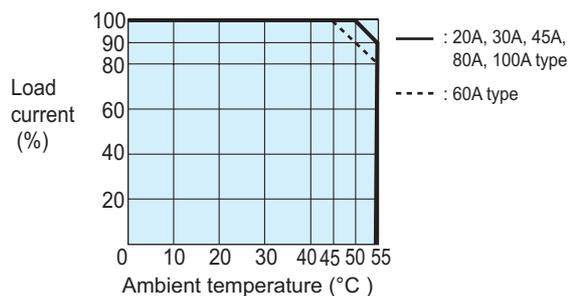


Table of Output Setting Methods

The THV-A1 has three output setting methods; input signal from a controller, external manual setting from a setting unit, and internal manual setting via front keys. Which Output setting method is used is decided by a combination of external contact input status and a parameter of external contact input action selection via front keys.

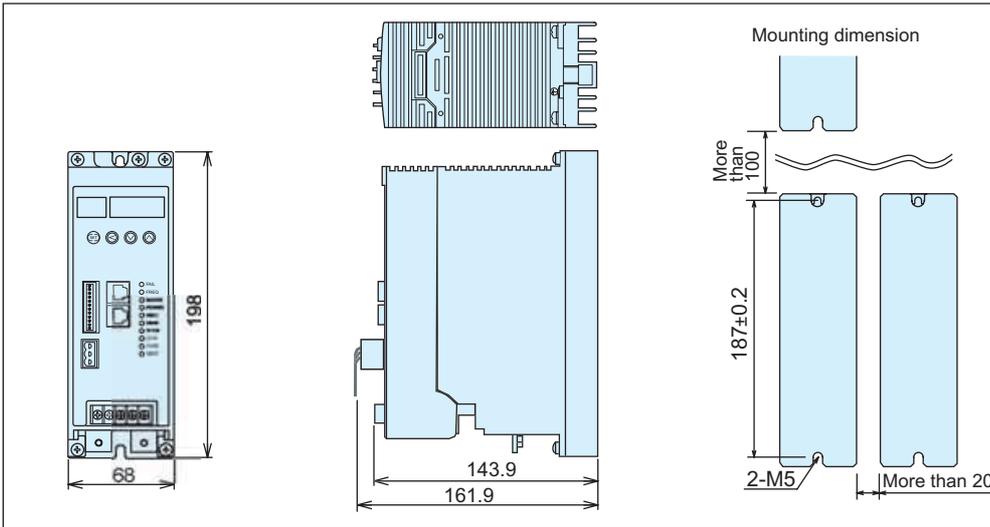
External contact action selection	External contact input status	
	Close	Open
Internal manual setting via front keys	Internal manual setting	Internal manual setting
External manual setting	External manual setting	External manual setting
Internal manual setting via front keys / Input signal	Internal manual setting	Input signal from controller
External manual setting / Input signal	External manual setting	Input signal from controller

- External contact action selection is valid when external contact input is assigned to the automatic/manual switching.
- External contact is open when a connector is not used.

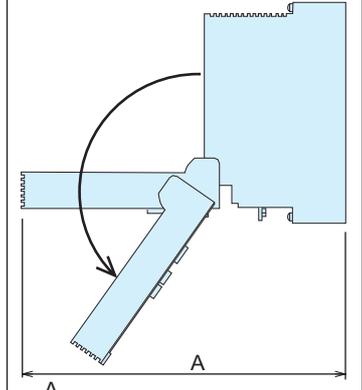
External Dimensions

Unit : mm

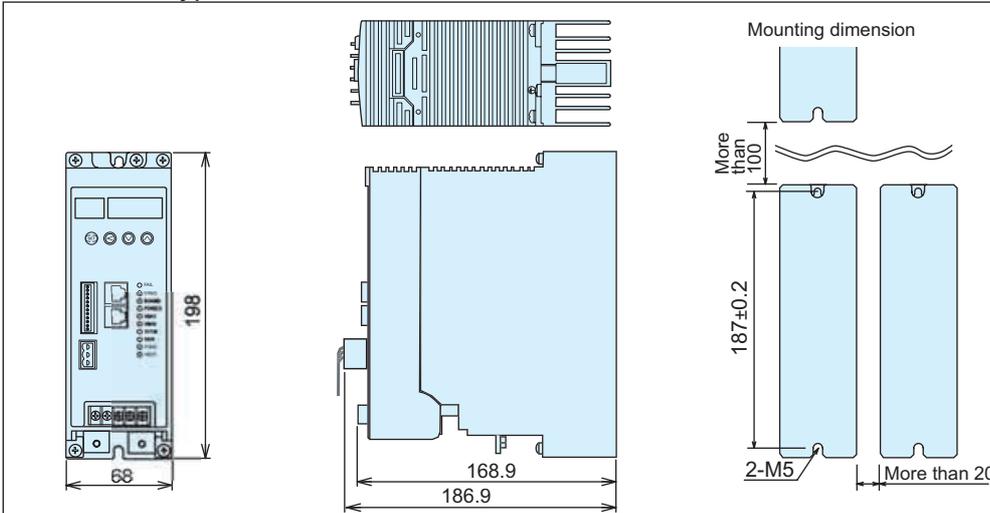
○ 20A, 30A type



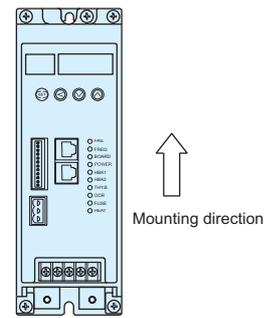
• The front of the instrument can be opened to allow replacement of the fast-blow fuse. When installing the instrument, leave enough space to allow the cover to be opened.



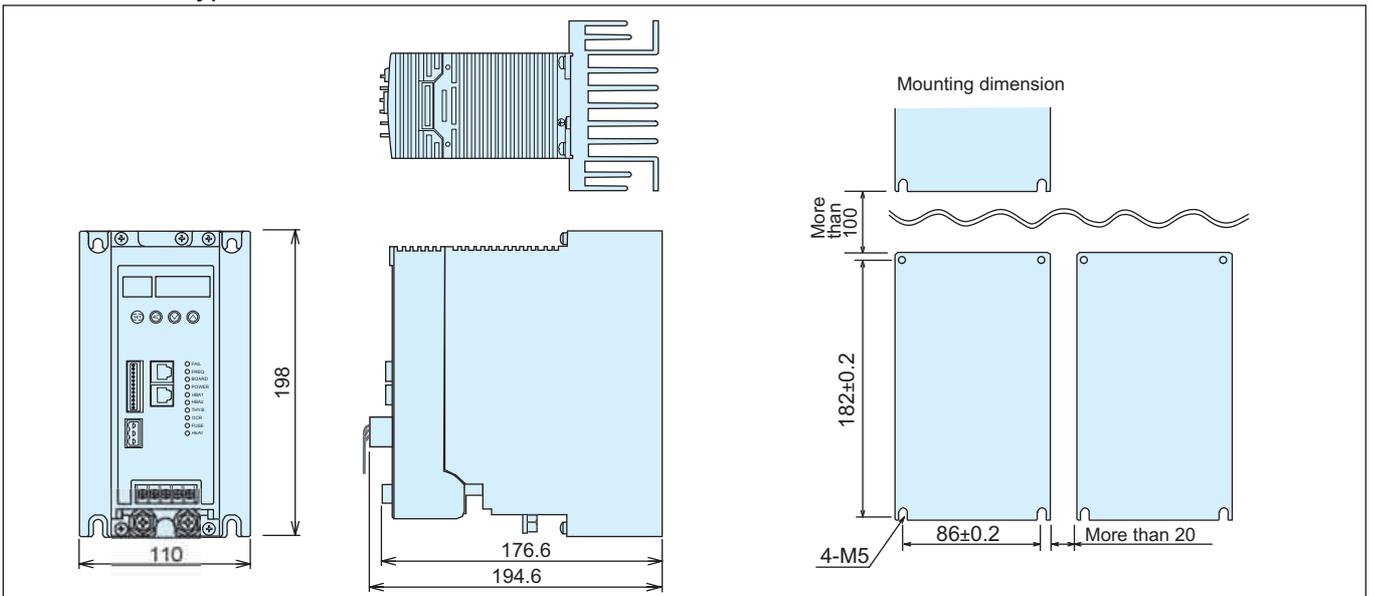
○ 45A, 60A type



• Install the instrument as illustrated in the drawing to increase the cooling effect.

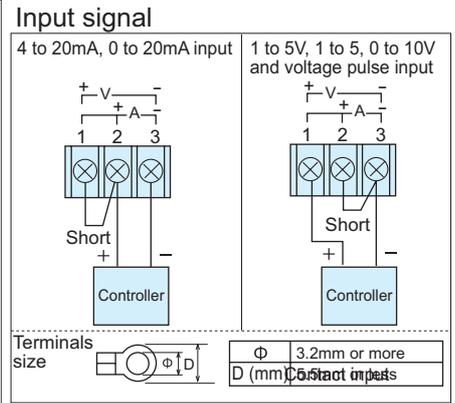
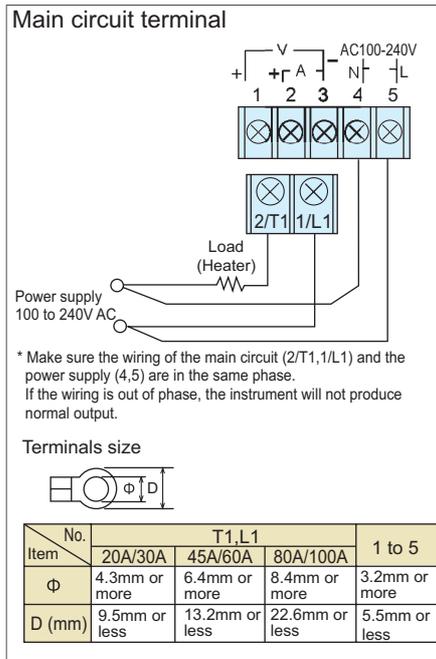
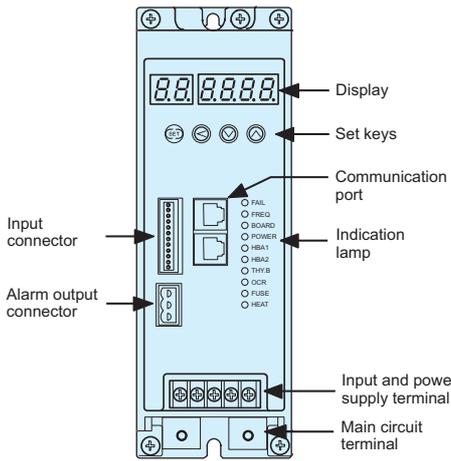


○ 80A, 100A type



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

External Wiring



Indication Lamp

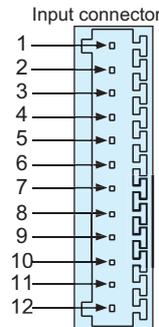
INDICATION LAMP

- FAIL
- FREQ
- BOARD
- POWER
- HBA1
- HBA2
- THY.B
- OCR
- FUSE
- HEAT

Lamp	Contents
FAIL	FAIL(Self-diagnostic abnormality)
FREQ	Power frequency abnormality
BOARD	Board abnormality
POWER	Power supply voltage abnormality
HBA1	Heater break alarm SV1
HBA2	Heater break alarm SV2
THY_B	Thyristor break alarm
OCR	Over current alarm
FUSE	Fuse break alarm
HEAT	Heat sink temperature abnormality

* 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

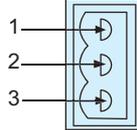


* Connector (Plug side) is optional.

Pin No.	Contents
1	+5V (Gradient setting input)
2	0V (Gradient setting input)
3	Gradient setting input (0 to 5V input by gradient setter)
4	+5V (Manual setting input)
5	0V (Manual setting input)
6	Manual setting input (0 to 5V input by manual setter)
7	External contact input 1 (DI1)
8	External contact input 2 (DI2)
9	External contact input 3 (DI3)
10	0V (External input)
11	0V (External input)
12	0V (External input)

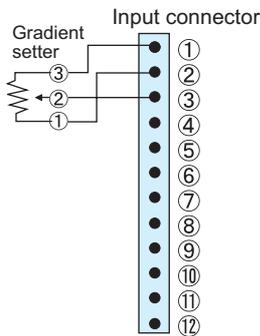
• Pins 10-12 are internally connected.

Alarm output connector

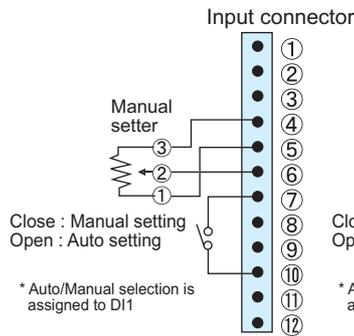


Pin No.	Contents
1	Digital output 1 (DO1) : Relay contact output
2	Digital output 2 (DO2) : Relay contact output
3	COM : Common

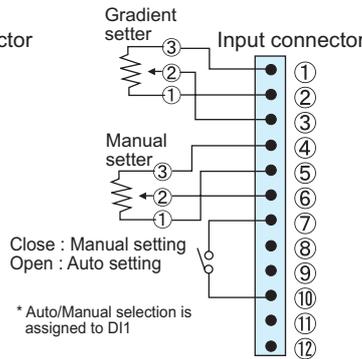
• Auto setting (With gradient setter)



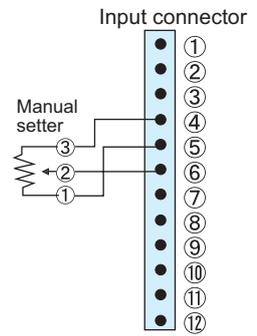
• Auto/Manual setting selection



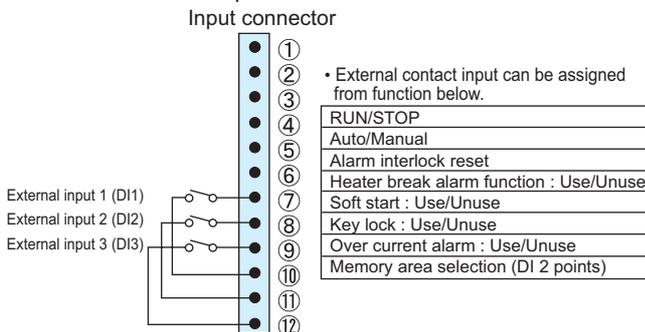
• Auto/Manual setting selection (With gradient setter)



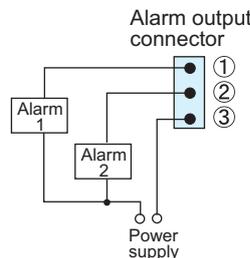
• Manual setting (With manual setter)



• External contact input



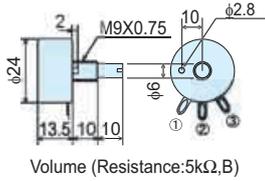
• Alarm output



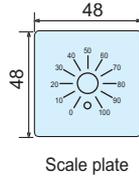
● Accessories

- Gradient setter, Manual setter, High/Low setter : THVP-S01

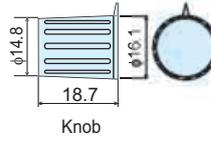
Unit : mm



Volume (Resistance:5kΩ,B)



Scale plate



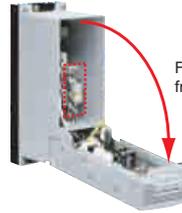
Knob

- Model code * Please refer to the following codes to order accessories.

Name	Model Code
Setter	THVP-S01
Input connector (plug)	THWP-C01
Alarm output connector (plug)	THVAP-C01

Name	Model Code	
Fast-blow fuse	20A	THVAP-F20
	30A	THVAP-F30
	45A	THVAP-F45
	60A	THVAP-F60
	80A *1	THVAP-F45 (2 pieces)
	100A *1	THVAP-F60 (2 pieces)

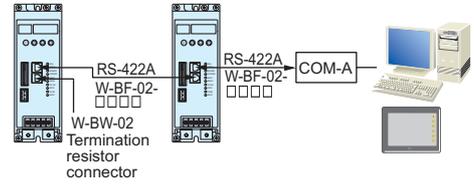
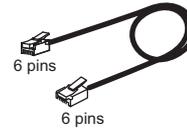
*1 : A fast-blow fuse for 80A uses two 45A rapid blow fuses (THVAP-F45).
A fast-blow fuse for 100A uses two 60A rapid blow fuses (THVAP-F60).



Fast-blow fuse can replace from the front.

Communication cable for
Model :
W-BF-02-500 (0.5m)
W-BF-02-1000 (1m)
W-BF-02-3000 (3m)

Termination resistor connector
Model : W-BW-01
(For RS-485)
Model : W-BW-02
(For RS-422A)



Single-phase Thyristor Units

THV series



(20,30A type)

(45A, 60A, 80A, 100A type)

Compact and space-saving size



20A 60A
30A 80A
45A 100A

Three-phase Thyristor Units

THW series

High performance power controller with powerful functions



20A 60A
30A 80A
45A 100A

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