

# CONTROLLER

# HA901 HA401

High-Speed  
Digital Controller  
1 or 2 Control loops



CE     
CE,UL,CSA pending

**RKC**  **RKC INSTRUMENT INC.**

# Ultra High Speed

# Temperature Control

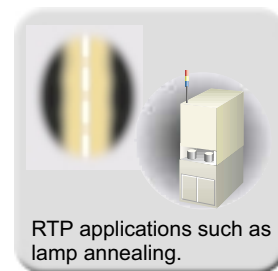
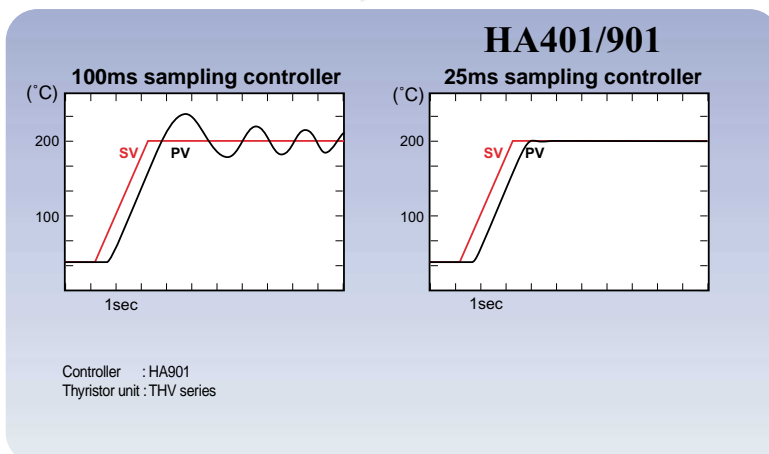
## Sampling

**0.025 sec**

### High-Speed Response >>

### High-speed feedback control of 40 samples per second

HA is a digital controller with a super high speed sampling of control updating cycle time of 25ms (0.025 sec). Supplied with high resolution input and parameters settable in 1/100 sec. for process applications with fast response. Applications in RTP (Rapid Thermal Process) in semiconductor manufacturing process that were difficult to handle with conventional controllers such as lamp annealing with halogen lamps can be solved. Other applications include pressure, flow rate and other process control applications.



RTP applications such as lamp annealing.

It is recommended to use HA400 and HA900 for applications where temperature rises 300 degrees per second.

# The Ultimate In Sampling Speed

# High-speed Digital Controller HA901 HA401

High-Speed controller



## High Performance >>

High input resolution of 200,000 counts or more (approximately 18 bits). Assures stable process control with high speed sampling and good response.

A maximum of two-channel control is available and control mode is selectable from 1 loop, 2 loops, or cascade mode (available soon), and all at fast sampling of 25msec.

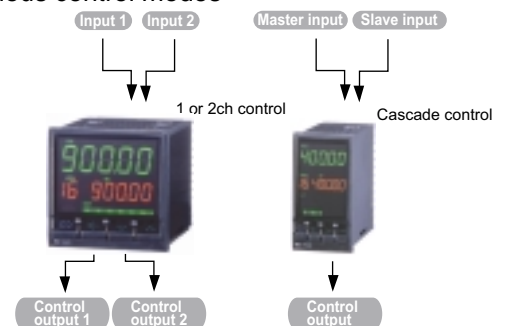
Multi-memory area function which accepts up to 16 sets is supplied as standard. An easy-to-use ramp/soak controller can be set up only by setting SV changing rate limiter and soak time.

Other features include power feed forward function that monitors supply voltage variation and compensate the control output, up to two communication ports that are also used for open network (available soon), output logic function to build simple sequences between devices, and so on.

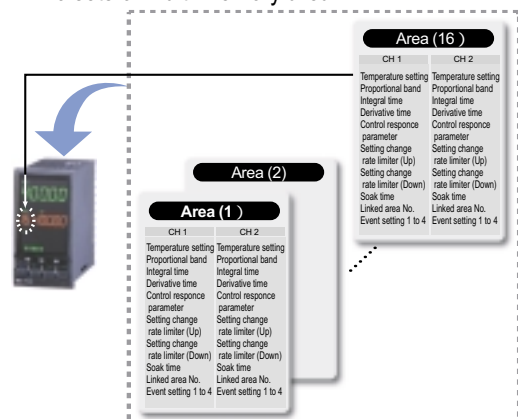
## For various processes >>

Continuous voltage and continuous current inputs are available. Available for various process control applications such as pressure, flow rate, levels, and so on in addition to temperature controls.

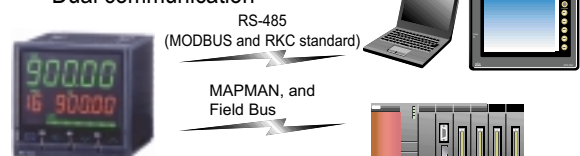
## >> Various control modes



## >> 16 sets of multi-memory area



## >> Dual communication



# Specifications

## Input

Number of inputs	2 points (IN1 to IN2) <ul style="list-style-type: none"> <li>Isolated between each channel</li> <li>2nd input (IN2) can be used as a remote input</li> <li>Cascade connection available</li> <li>Power feed forward function available (Released soon)</li> <li>Specify the number of inputs at the time of ordering.</li> </ul>
Input	<p>a) Low voltage input group</p> <p>Thermocouple : K, J, E, T, R, S, B, N (JIS/IEC) PLII (NBS), W5Re/W26Re (ASTM)</p> <p>RTD : Pt100 (JIS/IEC), JPt100 (JIS)</p> <ul style="list-style-type: none"> <li>3 and 4-wire system</li> <li>(4-wire type is not available for 2-loop control type)</li> </ul> <p>Low voltage : 0 to 1V DC, 0 to 100mV DC, 0 to 10mV DC Current : 4 to 20mA DC, 0 to 20mA DC (Input impedance : 50Ω)</p> <p>b) High voltage input group</p> <p>High voltage : 0 to 5V DC, 1 to 5V DC, 0 to 10V DC</p> <ul style="list-style-type: none"> <li>Inputs are freely selectable within each group.</li> </ul>
Sampling time	0.025 sec. <ul style="list-style-type: none"> <li>Common to 1ch/2ch/Cascade control modes.</li> </ul>
Influence of external resistance	0.25μV/Ω (Thermocouple input)
Influence of lead resistance	0.01°C/Ω (RTD input) <ul style="list-style-type: none"> <li>Maximum 10Ω per wire</li> </ul>
Input break action	Thermocouple input : Up-scale/Down-scale (Selectable) RTD input : Up-scale Low voltage input : Up-scale High voltage input : Value around 0V Current input : Value around 0mA
Input short action	Down-scale (RTD input)
Input digital filter	0.01 to 10.00 sec. (OFF when 0 is set.)
PV bias	-span to +span
PV ratio	0.500 to 1.500
Square root extraction	$PV = \sqrt{\text{Input value} \times \text{PV ratio} + \text{PV bias}}$ Low level cut off : 0.00 to 25.00% of span

## Non-isolated remote setpoint input (Optional)

Input	<p>a) 0 to 1V DC, 0 to 100mV DC, 0 to 10mV DC</p> <p>b) 0 to 5V DC, 1 to 5V DC, 0 to 10V DC</p> <p>c) 4 to 20mA DC, 0 to 20mA DC</p> <ul style="list-style-type: none"> <li>Please specify a) to c) at the time of ordering</li> <li>Not available when a 2-loop type is selected.</li> </ul>
Accuracy	0.1% of span

## Current transfer (CT) input (Optional)

Number of input	Max. 2 points (1point/ch) <ul style="list-style-type: none"> <li>1 point only when power feed forward input is specified.</li> <li>Not isolated from measurement input.</li> </ul>
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## Feed back resistance (FBR) input (Optional)

Number of input	100 to 10kΩ (Standard : 135Ω)
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## Power feed forward (PFF) input (Optional)

- Exclusive power feed transformer is required. (Available soon)

## Event input

Number of input	Up to 7 points
Input rating	Non-voltage contact input
Functions	<p>a) Memory area selection</p> <p>b) Run/Stop switching</p> <p>c) Remote/Local switching</p> <p>d) Auto/Manual switching</p>

## Performance

Measuring accuracy	See input code table <ul style="list-style-type: none"> <li>Cold junction temperature error : <ul style="list-style-type: none"> <li>±1.0°C(±1.8°F) [at 23°C±2°C(73.4°F±3.6°F)],</li> <li>Within ±1.5°C(±2.7°F) [Between 0 and 50°C(14 to 122°F)]</li> </ul> </li> </ul>
Insulation resistance	<p>More than 500V DC 20MΩ between measured terminals and ground terminals</p> <p>More than 500V DC 20MΩ between power terminals and ground terminals</p> <p>More than 500V DC 20MΩ between measured terminals and power terminals</p>
Dielectric voltage	<p>More than 1000V AC 1 minute between measured terminals and ground terminals</p> <p>More than 1500V AC 1 minute between power terminals and ground terminals</p> <p>More than 2300V AC 1 minute between measured terminals and power terminals</p>

## Control

Number of control	Up to 2 points <ul style="list-style-type: none"> <li>Cascade connection available</li> <li>Power feed forward function available</li> </ul>
Control method	Brilliant PID control (with autotuning) <ul style="list-style-type: none"> <li>Direct action/Reverse action, Position proportioning action (released soon) selectable</li> </ul>
Setting range	<p>a) Proportional band : Temperature input, 0 to input span(°C, °F) Voltage • Current input, 0.0 to 1000.0% of input span</p> <p>b) Integral time : 0.00 to 360.00 sec or 0.0 to 3600.0 sec (selectable)</p> <p>c) Derivative time : 0.00 to 360.00 sec or 0.0 to 3600.0 sec (selectable)</p> <p>d) Control response : Slow, Medium, Fast</p> <p>e) Output limiter : -5.0 to +105.0% (High/Low individual setting)</p> <p>f) Output change rate limiter : 0.0 to 100.0%/sec (Up/down individual setting)</p> <p>d) Proportional cycle : 0.1 to 100.0 sec</p> <p>e) Memory area : 16 sets</p>

## Output

Main output	<p>a) Number of output : Up to 3 points (OUT1 to OUT3)</p> <ul style="list-style-type: none"> <li>OUT3 is isolated from other outputs (Not isolated between OUT1-OUT2).</li> <li>Outputs are isolated for relay output and SSR output.</li> <li>Isolated between input-output and output-power supply.</li> <li>OUT2 and OUT3 are optional.</li> </ul> <p>b) Output function OUT1, 2 : Control output OUT3 : Event output or analog retransmission output (Option)</p> <p>c) Output type</p> <ol style="list-style-type: none"> <li>Relay contact output, Form a contact, 250V AC 3A (resistive load) <ul style="list-style-type: none"> <li>Electric life : 300,000 cycles or more (resistive load)</li> </ul> </li> <li>Voltage pulse output DC 0/12V (Load resistance : more than 600Ω)</li> <li>Current output 4 to 20mA DC, 0 to 20mA DC (Load resistance : less than 600Ω)</li> <li>Continuous voltage output 0 to 5V DC, 1 to 5V DC, 0 to 10V DC (Load resistance : more than 1kΩ)</li> <li>SSR (Triac) output, (Rated current : 0.4A) <ul style="list-style-type: none"> <li>Please specify 1) to 5) at the time of ordering</li> </ul> </li> </ol>
Sub output (Option)	<p>a) Number of output : Up to 2 points (OUT4 to OUT5)</p> <p>b) Output function : Event output (Option)</p> <p>c) Output type : Relay contact output, Form a contact, 250V AC 1A (resistive load) <ul style="list-style-type: none"> <li>Electric life : 300,000 cycles or more (resistive load)</li> </ul> </p>

## Analog retransmission output (Optional)

Number of output	Up to 3 points <ul style="list-style-type: none"> <li>Functions are assignable to OUT1 to OUT3.</li> </ul>
Output function	Measured value (PV)/Setting value (SV)/Manipulated value (MV) Deviation value (DEV)
Scaling range	<p>a) Measured value (PV) : Same as input range</p> <p>b) Setting value (SV) : Same as input range</p> <p>c) Manipulated value (MA) : -5.0 to 105.0%</p> <p>d) Deviation value (DEV) : -span to +span (PV-SV)</p>

# Specifications

## Event (Alarm) output (Optional)

Number of event output	Up to 4 points (Event 1 to 4)
Event types	Deviation high, Deviation low, Deviation high/low, Band, Process high, Process low, Set value high, Set value low, LBA • LBA is assignable to event outputs 3 and 4.
Setting range	a) Deviation alarm Event setting : -input span to +input span Event action differential gap : 0 to input span b) Process alarm/Set value Event setting : Same as input range Event action differential gap : 0 to input span c) LBA LBA time setting : 0 to 7200 sec. (LBA is OFF when 0 is set) LBD deadband setting : 0 to input span *Each channel is independently settable in case of 2ch type.
Output	Assignable to main output (OUT3) or aux.output(OUT4 ~ 5).
Other functions	a) HOLD action (Valid for deviation/band/PV alarms only) b) Selection of event action for input abnormality. * Delay timer function is valid due to addition of output logic function.

## Heater break alarm : HBA (Optional) (Available soon)

Number of alarm	2 points
CT type	CTL-6-P-N, CTL-12-S56-10L-N (Specify when ordering)
Input range	CTL-6-P-N : 0 to 30A CTL-12-S56-10L-N : 0 to 100A
Display range	0.0 to 100.0A
Display accuracy	±5% of input value or ±2A (whichever is larger)
Output	Assignable to main output(OUT3) or aux.outputs(OUT4 ~ 5).

## Output logic function (Optional)

Inputs for logic circuit	Analog signal : Control output value : Up to 2 points  Digital signal : a) Position proportioning action output status : 2 points b) Event action status : 4 points c) HBA action status : Up to 2 points d) Event input status : Up to 7 points e) Operating status : 3 points (LOCAL/REMOTE/RUN) f) Running area number : 4 points
Output	Logic outputs from OUT1 ~ 5 (assignable) * Front LEDs are also used.
Other functions	a) Selection of energize/de-energize action b) Measurement of output delay timer.

## Memory area function

Number of area	16 points
Setting item in area	a) Set value (SV) b) Event 1 to 4 • Events 3 and 4 include LBA and LBD settings. c) Proportional band d) Integral time e) Derivative time f) Control response g) Setting change rate limiter (High/Low) h) Soak time • 0.01sec setting : 0 min 0 sec 00 to 9 min 59 sec 99 • 1sec setting : 0 hr 0 min 00 sec to 9 hr 59 min 59 sec 0.01sec/1sec is selectable. i) Linking area number : OFF, 1 to 16

## Communications (Optional)

Number of communication	Max. 2 communication ports.
Communication method COM1	Based on RS-485/RS-232C • Please specify at the time of ordering.
Protocol COM1	a) ANSI X3.28 sub-category 2.5 A4 (RKC standard comm) b) MODBUS • Selectable
Communication method COM2	Based on RS-485/RS-422A/RS-232C • Please specify at the time of ordering.
Protocol COM2	a) ANSI X3.28 sub-category 2.5 A4 (RKC standard comm) b) MODBUS • Selectable
Communication speed	2400, 9600S, 19200, 38400 bps (selectable)
Bit configuration	a) RKC standard/ANSI protocol Start bit : 1, Data bit : 7 or 8 Parity bit : 1 (odd or even) or none. Stop bit : 1 or 2 b) MODBUS protocol Start bit : 1, Data bit : 8 (binary or byte data) Parity bit : 1 (odd or even) or none. Stop bit : 1 or 2 (Fixed to 1 bit for parity 1) • Selectable
Maximum connection	31 units  • Open network (DeviceNet/Profibus) coming soon.

## General Specifications

Supply voltage	a) 90 to 264V AC [Rating: 100-240V AC] (50/60Hz) b) 24V AC±10% [including supply voltage variation] (50/60Hz) c) 24V DC±10% [including supply voltage variation] (Rating 24V DC)
Power consumption	a) 100-240V AC type HA901: 19VA (240V), 13VA (100V) HA401: 17VA (240V), 12VA (100V) b) 24V DC/AC types HA901: 12VA (24V AC), 300mA (24V DC) HA401: 11VA (24V AC), 270mA (24V DC)
Power failure	A power failure of 20msec or less will not affect the control action. If power failure of more than 20msec occurs, controller will restart. HOT start (1,2) or COLD start (selectable).
Memory backup	Backed up by non-volatile memory. (Data retaining period : Approx. 10 years, Number of writing : Approx. 100,000 times, • Depending on storage and operating conditions.
Ambient temperature	-10 to 50°C (14 to 122°F)
Ambient humidity	20 to 85%RH (No dew condensation)
Weight	HA901 : 460g HA401 : 360g
External dimensions	See external dimensions
Operating environment	Free from corrosive and flammable gas and dust.  Free from external noise, vibration, shock and exposure to direct sunlight.

## Compliance with Standards

CE Mark, UL Recognized, CSA Certified, C-Tick mark (Pending)



## Input Code Table

### ● Input Code Table

Input type	Range	Code	Measuring accuracy	Resolution	
Low voltage group (Thermocouple, RTD, voltage, current)	K	-200 to 1372°C, -328 to 2501°F	K	*	1°C, 0.1°C 1°F, 0.1°F (Selectable)
	J	-200 to 1200°C, -328 to 2192°F	J	Less than -100°C (-148°F): ±1.0°C (±1.8°F)	
	T	-200 to 400°C, -328 to 752°F	T	-100 to 500°C (-148 to 932°F): ±0.5°C (±0.9°F)	
	E	-200 to 1000°C, -328 to 1832°F	E	More than 500°C (932°F): ±(0.1% of Reading+1 digit)	
	PLII	0 to 1390°C, 32 to 2534°F	A		
	N	0 to 1300°C, 32 to 2372°F	N	*	
	S	-50 to 1768°C, -58 to 3000°F	S	-50 to 1000°C (-58 to 1832°F): ±1.0°C (±1.8°F)	
	R	-50 to 1768°C, -58 to 3000°F	R	More than 1000°C (1832°F): ±(0.1% of Reading+1 digit)	
	W5Re/W26Re	0 to 2300°C, 32 to 3000°F	W		
	B	0 to 1800°C, 32 to 3000°F	B	Less than 400°C (752°F): ±70.0°C (±126°F) *	
				400 to 1000°C (752 to 1832°F): ±1.0°C (±1.8°F)	
				More than 1000°C (1832°F): ±(0.1% of Reading+1 digit)	
High voltage group	Pt100 (3 wire)**	-200 to 850°C, -328 to 1562°F	D	Less than 200°C (±392°F): ±0.2°C (±0.4°F)	1°C, 0.1°C, 0.01°C, 1°F, 0.1°F, 0.01°F, (Selectable)
	JPt100 (3 wire)	-200 to 600°C, -328 to 1112°F		More than 200°C (±392°F): ±(0.1% of Reading+1 digit)	
	Pt100 (4 wire)**	-200 to 850°C, -328 to 1562°F	C		
	Pt100 (4 wire)**	-200 to 600°C, -328 to 1112°F			
	0 to 10mV DC	-20000 to 20000	3	±(0.1% of Span)	
	0 to 100mV DC	(Programmable within 20,000 span)			
	0 to 1V DC **				
	0 to 20mA DC	-20000 to 20000	8		
	4 to 20mA DC **	(Programmable within 20,000 span)			
	0 to 5V DC	-20000 to 20000	6		
0 to 10V DC	(Programmable within 20,000 span)				
1 to 5V DC**					

\* Cold junction temperature compensation error : ±1.0°C (±1.8°F) [at 23°C±2°C (73.4°F±3.6°F),  
Within ±1.5°C (±2.7°F) [Between 0 and 50°C (14 to 122°F)]

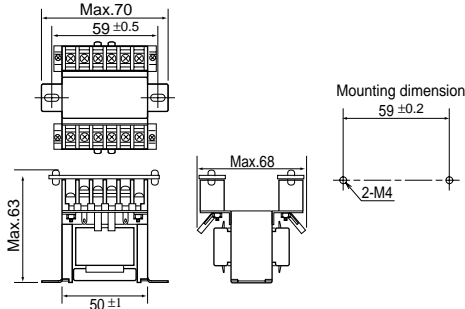
\*\* : Factory default setting.

\*\*\* : 4-wire RTD input type is available only on a single loop type.

## Power feedback transformer

(For Power feed forward input)

Supplied when power feed forward function is specified.



\* When ordering transformer for replacement, please specify one of the following model codes.  
100 to 120V AC type : PFT-01  
200 to 240V AC type : PFT-02

## CT (Current transformer)

(Sold separately)

Name	Model code
Current transformer for heater break alarm	CTL-6-P-N (0 to 30A) CTL-12-S56-10L-N (0 to 100A)

\* When a heater break alarm (HBA) is used, please specify relay output or voltage pulse output for the relevant channel output.

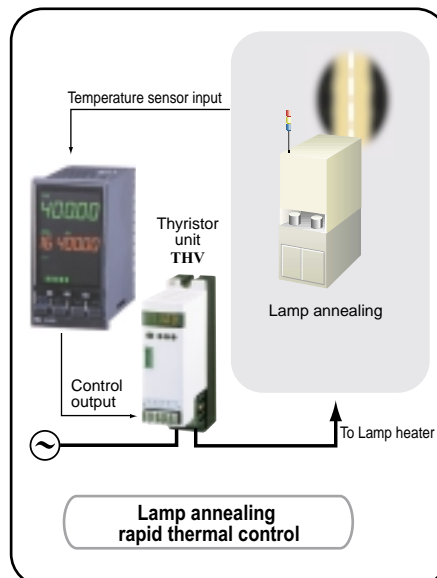
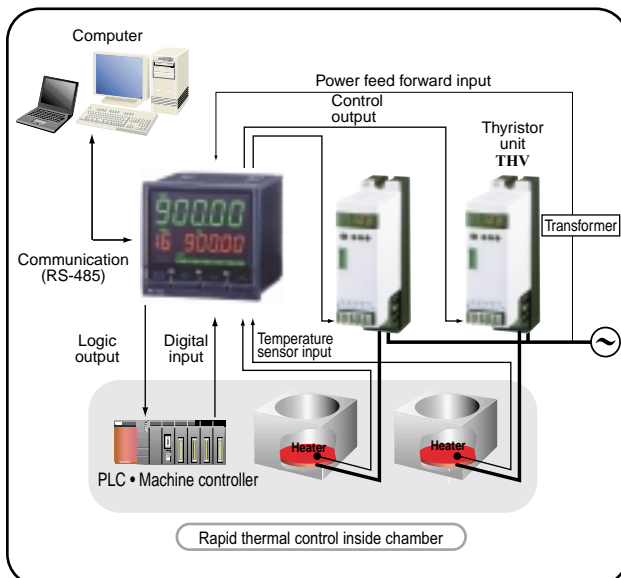
White color based type is also available. Choose your favorite color or according to the application environmental colors.



\* Black base and white base are the same in price and functions.

## Applications example

\* HA900 and HA400 are similar in functions.



**New!**

Thyristor unit THV series

20A  
30A

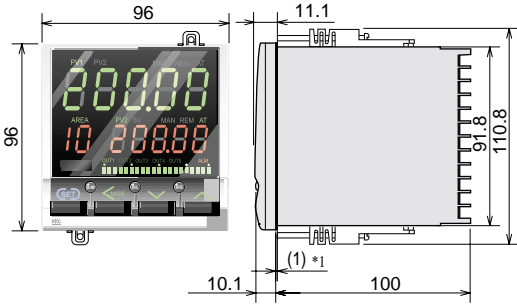
Digital control for high speed response and high resolution.  
Compact size of 48mm width.  
Easy setting and monitoring of gradient setting, etc via front keys and 7-segment LEDs.

Catalog No.: CTHV01

# External Dimensions

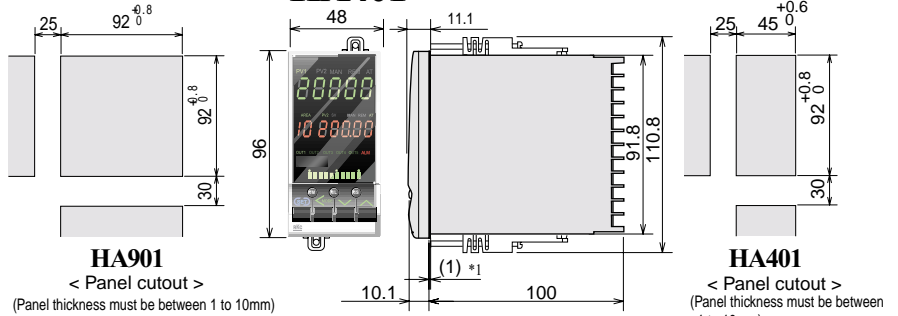
(Unit:mm)

## HA901



\*1 Packing is supplied with a water- and dust-proof type. Not attachable in the field.

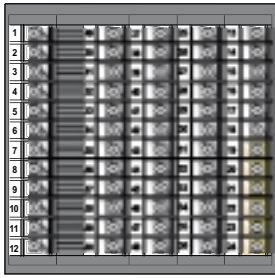
## HA401



\*1 Packing is supplied with a water- and dust-proof type. Not attachable in the field.

## Rear terminal plate

### HA901

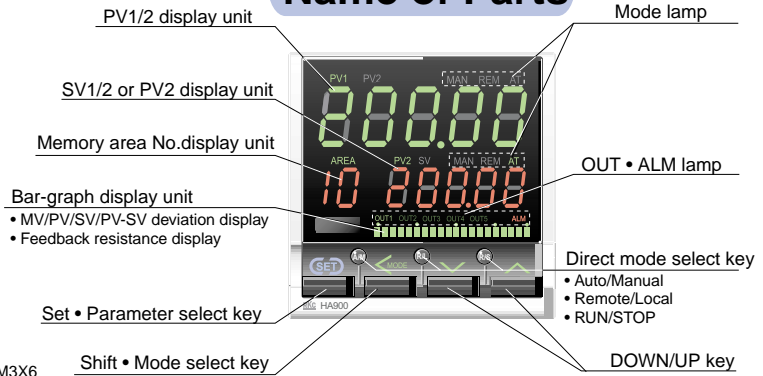


### HA401



• Use the solder less terminal appropriate to the screw size. Screw size : M3X6

## Name of Parts



No	Description
1	Power supply
2	Power supply
3	Output 5 (OUT5) *
4	Output 4 (OUT4) *
5	Output 3 (OUT3) *
6	Output 3 (OUT3) *
7	Output 2 (OUT2) *
8	Output 2 (OUT2) *
9	Output 2 (OUT2) *
10	Output 2 (OUT2) *
11	Output 1 (OUT1) *
12	Output 1 (OUT1) *

No	Description
49	37
50	38
51	39
52	40
53	41
54	42
55	43
56	44
57	45
58	46
59	47
60	48

No	Description
25	Communication *
26	Communication
27	Communication
28	Communication
29	Communication
30	Communication *
31	Event input 1 to 4
32	Event input 1 to 4
33	Event input 1 to 4
34	Event input 1 to 4
35	Event input 5 *
36	Event input 5 *

No	Description
13	Communication 1 *
14	Event input 6 to 7
15	Event input 6 to 7
16	CT1, CT2 input *
17	Feedback resistance input
18	CT1 input + Power feed forward input
19	No.1 Input (IN1) *
20	No.1 Input (IN1) + Non-isolated type remote input
21	No.1 Input (IN1)
22	No.1 Input (IN1) + No.2 Input (IN2)
23	No.1 Input (IN1) + No.2 Input (IN2)
24	No.1 Input (IN1) + No.2 Input (IN2)

Functions (A) to (C) and types (1) to (3) must be specified at the time of ordering.

\*: Option



• Before operating this product, read the instruction manual carefully to avoid incorrect operation.  
 • This product is intended for use with industrial machines, test and measuring equipment. It is not designed for use with medical equipment.  
 • If it is possible that an accident may occur as a result of the failure of the product or some other abnormality, an appropriate independent protection device must be installed.  
 • When installing this product, avoid the following:  
 • Direct exposure to sunlight.

• An ambient temperature lower than 0°C or higher than 50°C  
 • Areas subject to high humidity. Ambient humidity should not be lower than 45% or higher than 85%RH  
 • Direct contact with water.  
 • Corrosive environments.  
 • Hazardous areas containing explosive or flammable gases.  
 • Vibration or shock.  
 • Areas subject to electrical noise caused by inductive interference, static electricity or magnetic fields.

**RKC** RKC INSTRUMENT INC.  
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