

KP2000 SERIES DIGITAL PROGRAM CONTROLLER



The KP2000 series is a 96x96mm digital program controller with the indicating accuracy of $\pm 0.1\%$, the control cycle of approximately 0.1 seconds and maximum 30 program patterns (maximum 19 steps/pattern).

The configuration of highly functional system is enabled by various options including 2 transmission signal outputs, 2 communications ports and arbitrarily-allocation of digital inputs/outputs.



■ FEATURES

● Large easy-to-view 5-digit display

Process value (PV) and set value (SV) are displayed by large easy-to-view 5-digit display indicators. The resolution of 0.1°C is enabled for more than 1000°C .

● Outstanding controllability

Two types of PID algorithms, the position-type PID algorithm and the speed-type PID algorithm, have been installed. You can select the optimum PID algorithm for an object controlled.

● Program pattern

Settings of maximum 19 steps per pattern and maximum 30 sets of patterns are enabled. Repeating of a whole program pattern, linking of program patterns and repeating of a specific step in a program pattern are enabled, too.

● Versatile control functions provided

Versatile control functions, such as the automatic PID system, which executes control by PID parameters preset at every SV sections, and selection of the 2-output control system from PID system and split system for 2-output types, are available.

● Communications 2-port type provided

Models with 2 communications ports are available. In addition, speeding up and highly-functionalization of communications have been realized. For example, you can use 1 port for high order communications with a personal computer and another port for the communications remote (digital remote) function. The communications protocol can be arbitrarily selected from [MODBUS] and [PRIVATE].

● Transmission signal 2-output type provided

2 types of transmission signal output, the high-precision type (0.1% of full scale) and the general type (0.3% of full scale), are available. Transmission signal 2-output types with these 2 transmission signal outputs and models with transmitter power supply are available.

● DI/DO arbitrarily-allocation

When the digital input (DI) or the digital output (DO) is added, arbitrarily-allocation for assigning functions to those DI/DO's is enabled. It is the function enabling allocations such as [External drive input] to DI1 to DI3 and [Pattern selecting input] to DI4 to DI6.

● Output up to 8 points of time signals enabled

With the 8 digital outputs type added, up to 8 points of time signals can be outputted by allocating time signal TS1 to TS8.

● Heater disconnection alarm

The heater disconnection alarm can be added to ON-OFF pulse output types or SSR drive pulse types only.



By connecting the designated CT externally, the current value of heater is measured and can be indicated on the operation screen.

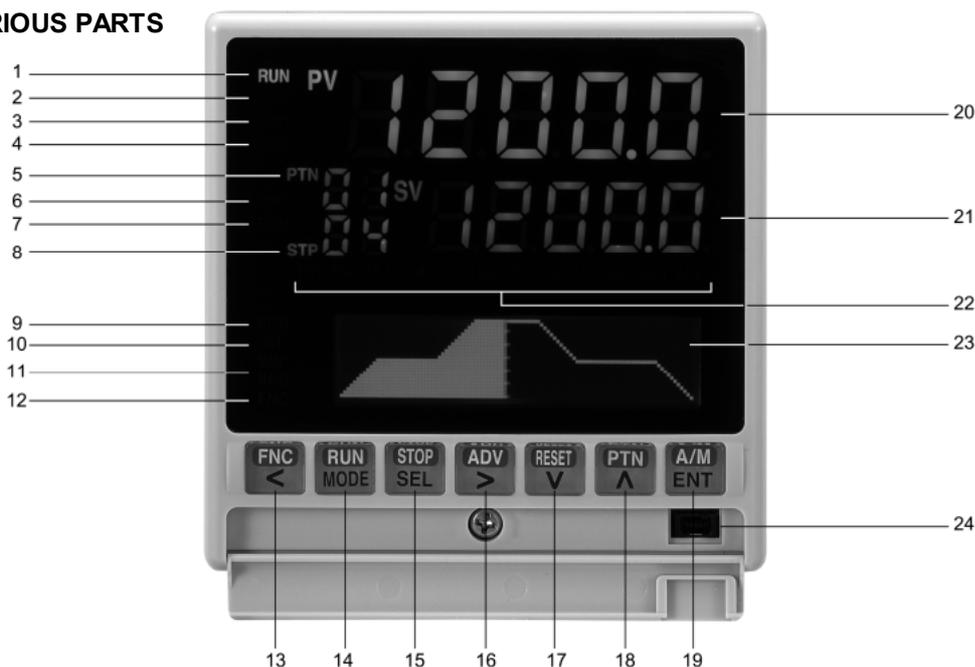
● Conforming to international safety standards and European directives (CE)

The controller is conformity with European directives (CE), and is UL and c-UL approved.

● Conforming to RoHS

The controller is an environmental consideration product which does not contain directed hazardous substances such as lead, etc.

■ NAMES OF VARIOUS PARTS



Display

1. Operation status (RUN) indication
Lights in operation.
2. Operation stop (STOP) indication
Lights in the state of operation stop.
3. RESET indication
Lights when operation is cancelled and returns to the start point.
4. Constant value operation (CONST) indication
Light in constant value operation.
5. Pattern No. (PTN) indication
6. Alarm-standby (WAIT) indication
Lights in alarm-standby status or when alarm is cancelled.
Blinks when standby time alarm is activated.
7. Program remote (REM) indication
Lights when operation is executed by digital input.
8. Executing step number (STP) indication
The step No. being executed is indicated.
(Blinks in real temperature compensation operation.)
9. Error (ERR) indication
Lights when sampling of input is abnormal.
10. Auto-tuning operation (AT) indication
Lights in auto-tuning operation.
11. Manual operation (MAN1/MAN2) indication
Lights when the output No.1 or No. 2 is in manual output operation.
12. Function (FNC) operation indication
Lights when the function key is operated.
20. Process value (PV) indication
21. Set value (SV) indication
22. Time signal (TS1 to TS8) indication
- Alarm activation (AL1 to 4) indication

Function keys

13. FNC key
With the operation screen displayed, pressing it puts the controller in the operation key mode. With the settings screen displayed, pressing it puts the controller in the setting key mode and it operates to move the cursor backwards.
14. RUN key
In the operation key mode, it operates as RUN key. With the settings screen displayed, pressing it puts the controller in the setting key mode and it is used for switching between the operation screen and the mode screen of Mode 0, or for switching from the settings screen to the mode screen.
15. STOP key
In the operation key mode, it operates as STOP key. With the settings screen displayed, pressing it puts the controller in the setting key mode and it is used to switch the settings screen.
16. ADV (Advance) key
In the operation key mode, it operates as ADV key. With the settings screen displayed, pressing it puts the controller in the setting key mode and it is used for moving the cursor and for selecting a parameter.
17. RESET key
In the operation key mode, it operates as RESET key. With the settings screen displayed, pressing it puts the controller in the setting key mode and it is used for changing a setting value (or selecting a parameter) in descending order.
18. PTN (Pattern) key
In the operation key mode, it operates as PTN key. With the settings screen displayed, pressing it puts the controller in the setting key mode and it is used for changing a setting value (or selecting a parameter) in ascending order.
19. A/M (Auto/Manual) key
In the operation key mode, it operates as A/M key. With the settings screen displayed, pressing it puts the controller in the setting key mode and it is used for registering the settings.

Lower display

23. A wide variety of operation screens are prepared and arbitrarily-selection is enabled.
On the whole program pattern display screen, the simultaneous display of the shape of whole program pattern and the progressed pattern position has been realized.



Output screen



Time screen



Pattern screen

■ INPUT SPECIFICATIONS

Input signal:	Thermocouple B, R, S, K, E, J, T, N, WRe5-WRe26, W-WRe26, NiMo-Ni, CR-AuFe, PR5-20, PtRh40-PtRh20, Platinel II, U, L DC voltage ±10mV, ±20mV, ±50mV, ±100mV, ±5V, ±10V DC 0 to 20 mA Resistance thermometer Pt100, JPt100, Old Pt100, JPt50, Pt-Co
Measuring range:	Thermocouple 28 ranges, DC voltage 6 ranges, DC current 1 range, Resistance thermometer 14 ranges. *For details, refer to [Measurement ranges].
Accuracy rating:	± 0.1% of measurement range ± 1 digit *For details, refer to [Detailed specifications of accuracy ratings].
Reference junction compensation accuracy:	K, E, J, T, N, Platinel II --- ±0.5°C or a value equivalent to ±20µV, whichever is greater (at ambient temperature of 23°C ± 10°C) Others --- ±1.0°C or a value equivalent to ± 40µV, whichever is greater
Resolution:	Approximately 1/30000
Sampling rate:	Approximately 0.1 seconds
Burnout:	Upscale burnout is only enabled in thermocouple, DC voltage (±50mV or less) and resistance thermometer (3-wire type). For the burnout, the output value of Output No. 1 can be set arbitrarily, the output value of Output No. 2 is fixed at 0% and the high limit alarm is set at ON (for the upscale burnout). (The burnout is disabled in DC voltage (±100mV or more), DC current, resistance temperature (4-wire type).
Input impedance:	Thermocouple 1MΩ or more DC voltage 1MΩ or more DC current Approximately 250Ω
Allowable signal source resistance:	Thermocouple 100Ω or less DC voltage (mV) 100Ω or less DC voltage (V) 300Ω or less
Allowable wire resistance (resistance thermometer):	5Ω or less (Same resistance for all wires)
Rated current (resistance thermometer):	Approximately 1mA
Maximum allowable input:	Thermocouple ±20V or less DC voltage ±20V or less DC current ±30mA or less ±7.5V or less Resistance thermometer 500Ω or less, ±5V or less
Maximum common mode voltage:	30VAC
Common mode rejection ratio:	130dB or more (50/60Hz)
Normal mode rejection ratio:	50dB or more (50/60Hz)

■ DISPLAY SPECIFICATIONS

Display element:	Upper display LED Lower display LCD (with back light) 108 x 24 dots
Display content:	Upper display PV 5-digit, SV 5-digit, status indications, etc. Lower display MV, output status, setting screens, etc.

■ CONTROL SPECIFICATIONS

Control cycle:	Approximately 0.1 seconds
Output type:	ON-OFF pulse type, ON-OFF servo type, Current output type, SSR drive pulse type, Voltage output type
ON-OFF pulse type:	Output signal ON-OFF pulse conductive signal Contact capacity Resistive load 100 to 240VAC 30VDC 5A or less Inductive load 100 to 240VAC 30VDC 2.5A or less Smallest load 5VDC 10mA or more Contact protection Small CR element built-in ON-OFF pulse cycle 1 to 180 seconds
ON-OFF servo type:	Output signal ON-OFF servo conductive signal Contact capacity of standard load Resistive load 100 to 240VAC 30VDC 5A or less Inductive load 100 to 240VAC 30VDC 2.5A or less Smallest load 5VDC 10mA or more Contact capacity of very light load Resistive load 100 to 240VAC 30VDC 20mA or less Inductive load 100 to 240VAC 30VDC 20mA or less Smallest load 5VDC 1mA or more Feedback resistance 100Ω to 2kΩ Contact protection Small CR element built-in
Current output type:	Output signal 4 to 20mA Load resistance 750Ω or less
SSR drive pulse type:	Output signal ON-OFF pulse voltage signal Output voltage ON voltage 12VDC ± 20% OFF voltage 0.8VDC or less Load current 20mA or less Pulse cycle 1 to 180 seconds
Voltage output type:	Output signal 0 to 10V Output impedance Approx 10Ω Load resistance 50kΩ or more
Output limiter:	-5.0 to 105.0%
Rate-of-change limiter for output:	0.1 to 100.0%
Output preset:	With P action (Settings of I and D = 0), Output at PV = SV -100.0 to 100.0% Output No. 2 is 0%.
Output deadband:	In case of 2-position control (Setting of P = 0), Setting range 0.1 to 9.9%
Control action:	With direct/reverse selection
Output at PV abnormality:	Over-range, under-range, abnormal internal data
Manual output operation:	Output by manual setting -5.0 to 105.0% MAN → AUTO Balanceless bumpless AUTO → MAN Keeping output at AUTO

■ SETTING SPECIFICATIONS

Number of patterns:	30 patterns
Pattern repetition ...	Maximum 9999 times
Number of steps:	19 steps/pattern
Step repetition ...	Maximum 99 times
Control relations:	PID 8 types P 0 to 999.9% I ∞, 1 to 9999 seconds D 0 to 9999 seconds A.R.W. (Anti reset windup)
High limit ---	0 to 100.0%
Low limit ---	-100 to 0.0%
Output relations:	Output deadband Output preset Output limiter 8 types Rate-of-change limiter for output 8 types
Alarm relations:	Alarm value 4 points 8 types, alarm types, alarm deadband, alarm delay

■ ALARM SPECIFICATIONS

Number of alarm points:	4 points
Alarm types:	Absolute value alarm, deviation alarm, absolute value deviation alarm, setting value alarm, output value alarm, FAIL, timer
Output signal:	Relay output signal (a contact) 1 common terminal for AL1 and AL2, 1 common terminal for AL3 and AL4 Contact capacity Resistance load 100 to 240VAC 30VDC 3A or less Inductive load 100 to 240VAC 30VDC 1.5A or less Smallest load 5VDC 10mA or more

■ GENERAL SPECIFICATIONS

Rated power voltage:	General power supply specifications 100 to 240VAC 24V Power supply specifications 24VAC/24VDC
Rated power supply frequency:	General power supply specifications 50/60Hz 24V Power supply specification 50/60Hz (24VAC)
Maximum power consumption:	General power supply specifications Without options 100VAC 10VA 240VAC 15VA With options 100VAC 15VA 240VAC 20VA 24V Power supply specifications Without options 24VAC 10VA 24VDC 5W With options 24VAC 15VA 24VDC 10W
Working temperature range:	-10 to 50°C
Working humidity range:	10 to 90%RH
Power failure countermeasures:	Settings stored in EEPROM (Rewrite count: One million times or less) and stored by a lithium battery for 5 years or more
Terminal screws:	M3.5
Insulation resistance:	Between primary terminals and secondary terminals 20MΩ or more (500VDC) Between primary terminals and ground terminal 20MΩ or more (500VDC) Between secondary terminals and ground terminal 20MΩ or more (500VDC)
Withstand voltage:	Between primary terminals and secondary terminals 1500VAC (For 1 minute) Between primary terminals and ground terminal 1500VAC (For 1 minute) Between secondary terminals and ground terminal 500VAC (For 1 minute) *Primary terminal: Terminals for power supply (100 to 240VAC), control output and alarm output
Casing:	Fire-retardant polycarbonate
Color:	Gray or black
Mounting:	Panel mounting
External dimensions:	96 (H) x 96 (W) x 127 (D) mm *The depth from the front panel is 120mm.
Weight:	Without options Approximately 450g With options Approximately 580g

■ SAFTY STANDARD

CE:	EN61326: 1997 +A1+A2+A3 EN61010-1: 2001 (Overvoltage category II, pollution degree 2) * Under the test conditions of EMC directives, there may be variation of indication value or output value which is equivalent to maximum ±10% or maximum 2mV, whichever is greater..
UL:	UL61010-1 2nd edition
c-UL:	CAN/CSA C22.2 No.61010-1-04

■ REFERENCE OPERATING CONDITIONS

Ambient temperature:	23°C ±2°C
Ambient humidity:	55%RH ±5% (No dew condensation)
Power voltage:	General power supply specifications 100VAC ±1% 24V power supply specifications 24VDC ±1%
Power supply frequency:	General power supply specifications 50/60Hz ±0.5% 24V power supply specifications DC
Mounting angle:	Forward or backward ±3°, lateral ±3°
Installation height:	Altitude 2000m or below
Vibration:	0m/s ²
Shock:	0m/s ²
Mounting condition:	Single-unit panel mounting (Space above, below, right and left of unit is needed.)
Wind:	None
External noise:	None
Warm up time:	30 minutes or longer

■ NORMAL OPERATING CONDITIONS

Ambient temperature:	-10°C to 50°C (-10°C to 40°C for closed mounting)
Ambient humidity:	10 to 90%RH (no dew condensation)
Power voltage:	General power supply specifications 90 to 264VAC 24V Power supply specifications 21.6 to 26.4VDC/AC
Power supply frequency:	General power supply specifications 50/60Hz ± 2% 24V Power supply specifications DC, 50/60Hz ± 2%
Mounting angle:	Forward or backward ±10°, lateral ±10°
Installation height:	Altitude 2000m or below
Vibration:	2m/s ²
Shock:	0m/s ²
Mounting condition:	Single-unit panel mounting (Space above and below of the unit is needed.)
External noise:	None
Rate of ambient temperature change:	10°C/hour or less

■ TRANSPORT CONDITIONS

Ambient temperature:	-20°C to 60°C
Ambient humidity:	5 to 90%RH (no dew condensation)
Vibration:	4.9m/s ² (10 to 60Hz)
Shock:	392m/s ² Under the condition that the unit is packed for shipment by the factory

■ STORAGE CONDITIONS

Ambient temperature:	-20°C to 60°C For long term storage, the temperature should be 10°C to 30°C.
Ambient humidity:	5 to 90%RH (no dew condensation)
Vibration:	0m/s ²
Shock:	0m/s ² Under the condition that the unit is packed for shipment by the factory

■ OPTIONS

● Transmission signal output

Output a signal corresponding to set value (SV), process value (PV), manipulated value (MV), etc.

Number of output:	1 point	
Output signal:	4 - 20mA (Load resistance 400Ω or less)	
	0 - 1V	(Output resistance Approx. 10Ω, Load resistance 50kΩ or more)
	0 - 10V	(Output resistance Approx. 10Ω, Load resistance 50kΩ or more)
Output accuracy:	High-precision type	±0.1% of full scale
	General type	±0.3% of full scale
Output resolution:	High-precision type	Approx. 1/30000
	General type	Approx. 1/15000

● Communications interface

With RS232C, RS422A or RS485, the setting and measured values of the controller can be transmitted to a master CPU and various parameters can be set by the master CPU.

Number of communications port:	2 ports
Communications type:	RS232C, RS422A, RS485
Communication speed:	2400/4800/9600/19200/38400 bps
Protocol:	MODBUS (RTU), MODBUS (ASCII), PRIVATE

● Heater disconnection alarm

It is the function for detecting heater disconnection by CT input.

Measurement range:	10 to 100A AC (50/60Hz)
Accuracy rating:	±5.0% of full scale ± 1 digit
Designated CT:	Use [CTL-12-S36-8] made by URD Co., Ltd.

● Panel sealing

By mounting the controller to a panel, it has the panel sealing equivalent to [IP54 compliance].

● Terminal cover

It covers the terminals for safe. The cover is transparent.

● 2-output type

2 kinds of output with direct and reverse actions are outputted and simultaneous control of heating/cooling is enabled.

Control period:	Approx. 0.1 seconds
Output type:	ON-OFF pulse type, Current output type, Voltage output type, SSR drive pulse type
	Any combinations of these types are enabled.
Control system:	PID system

● Digital input (DI)

The following switching is enabled by digital input signal.

Input signal:	No-voltage contact, open-collector signal
External contact capacity:	5VDC 2mA
Functions:	<ol style="list-style-type: none"> 1. Selection of pattern No. (6 points) 2. Manual output operation/automatic output operation (2 points) 3. Holding of PV 4. Run/stop 5. Advance 6. Reset 7. Wait 8. Fast 9. Start/reset of timer (4 points) 10. Alarm output cancellation 11. Preset manual/Automatic output operation

● Digital output (DO)

Time signal or status signal can be outputted externally open-collector signal.

Output signal:	Open-collector signal
Capacity:	24VDC, Maximum 50mA
Functions:	<ol style="list-style-type: none"> 1. Time signal (Maximum 8 points) 2. Run/stop 3. Advance 4. Reset 5. Wait 6. End

■ DETAILED SPECIFICATIONS OF ACCURACY RATING

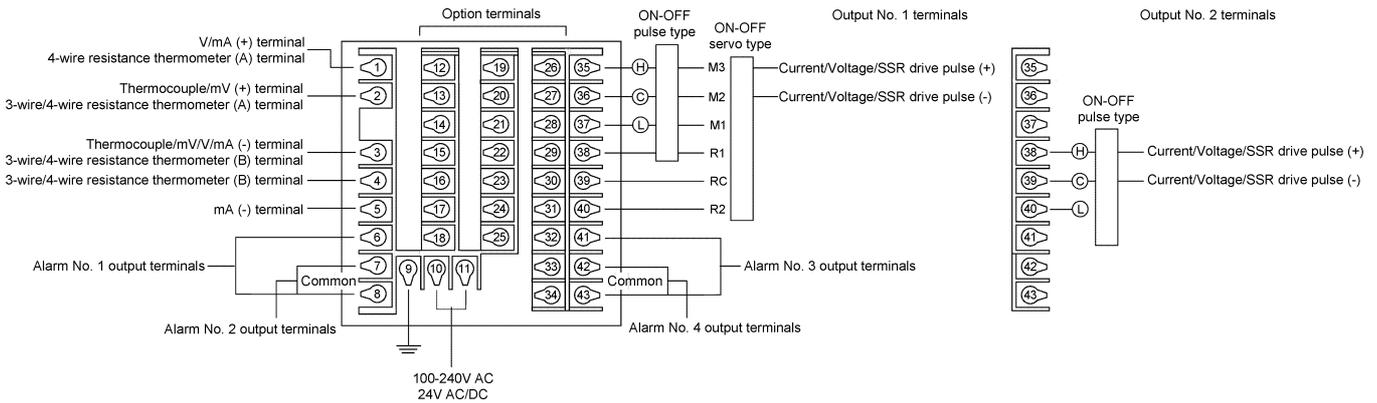
Input type		Accuracy rating	Exceptional specifications
Thermocouple	B	±0.1%±1digit	Less than 400°C: Not specified / 400°C to less than 800°C: ±0.2% ± 1 digit
	R, S		0°C to less than 400°C: ±0.2% ± 1 digit
	N		
	K		-200°C to less than 0°C: ±0.2% ± 1 digit or the value equivalent to ±60 μV, whichever is greater
	E		-270°C to less than 0°C: ±0.2% ± 1 digit or the value equivalent to ±80 μV, whichever is greater
	J		-200°C to less than 0°C: ±0.2% ± 1 digit or the value equivalent to ±80 μV, whichever is greater
	T		-270°C to less than 0°C: ±0.2% ± 1 digit or the value equivalent to ±40 μV, whichever is greater
	U		-200°C to less than 0°C: ±0.2% ± 1 digit or the value equivalent to ±40 μV, whichever is greater
	L		-200°C to less than 0°C: ±0.2% ± 1 digit
	WRe5-WRe26		
	W-WRe26		0°C to less than 400°C ±0.3% ± 1 digit
	NiMo-Ni		
	Platinel II		
	CR-AuFe		±0.2%±1digit
PR5-20	0°C to less than 100°C: Not specified / 100°C to less than 200°C: ±0.5% ± 1 digit		
PtRh40-PtRh20	0°C to less than 400°C: ±1.5% ± 1 digit / 400°C to less than 800°C: ±0.8% ± 1 digit		
DC voltage / DC current		±0.1%±1digit	
Resistance thermometer	Pt100	±0.1%±1digit	For the measuring range of [-100°C to 100°C] only: ±0.15% ± 1 digit
	Old Pt100		
	JPt100		
	JPt50		
	Pt-Co	±0.15%±1digit	4K to less than 20K : ±0.5% ± 1 digit / 20K to less than 50K : ±0.3%± 1 digit

* The above ratings are the measurement range conversion accuracies under the reference operating conditions.

For thermocouple inputs, the reference junction compensation accuracy is added.

* K, E, J, T, R, S, B, N : IEC584 (1977, 1982), JIS C 1602-1995, JIS C 1605-1995
 WRe5-WRe26, W-WRe26, NiMo-Ni, Platinel II, CR-AuFe, PtRh40-PtRh20 : ASTM Vol.14.03
 U, L : DIN43710-1985
 Pt100 : IEC751 (1995), JIS C 1604-1997
 Old dPt100 : IEC751 (1983), JIS C 1604-1989, JIS C 1606-1989
 JPt100 : JIS C 1604-1981, JIS C 1606-1986
 JPt50 : JIS C 1604-1981

■ TERMINAL ARRANGEMENT



● Option terminals

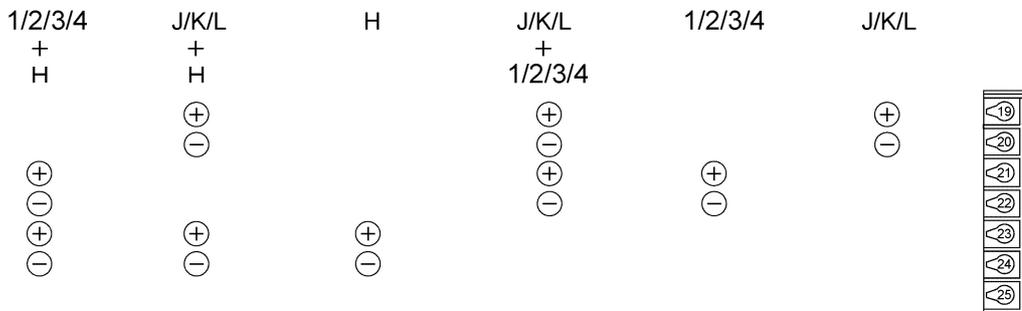
Options common to each zone

9	P	M	T	N	1st ← 2nd ← 3rd zone
CT	DI	CT	DO	CT	12
CT	DI	CT	DO	CT	13
	DI	DI	DO	DO	14
	DI	DI	DO	DO	15
	DI	DI	DO	DO	16
	DI	DI	DO	DO	17
	COM	COM	COM	COM	18
					19
					20
					21
					22
					23
					24
					25
					26
					27
					28
					29
					30
					31
					32
					33
					34

9: Heater disconnection alarm P: 6 Digital inputs
M: 4 Digital inputs + Heater disconnection alarm
T: 6 Digital outputs N: 4 Digital outputs + Heater disconnection alarm

Based on combination with other options, assign the zone in the above order.

Transmission signal output (2nd zone)



1/2/3/4: High-precision type J/K/L: General type H: Transmitter power supply

Communications interface + Digital input (3rd zone)

R	A	S	B	C	D	E	F	G
RD	RDA	SA	RD1	RD1	RD1	SA1	SA1	SA1
SD	RDB	SB	SD1	SD1	SD1	SB1	SB1	SB1
SG	SDA	SG	SG1	SG1	SG1	SG1	SG1	SG1
DI	SDB	DI	RD2	RDA2	SA2	RD2	RDA2	SA2
DI	SG	DI	SD2	RDB2	SB2	SD2	RDB2	SB2
DI	DI	DI	SG2	SDA2	SG2	SG2	SDA2	SG2
COM	COM	COM		SDB2			SDB2	
			DI	DI	DI	DI	DI	DI
			COM	COM	COM	COM	COM	COM

R: Communications RS232C + 3 Digital inputs
A: Communications RS422A + 1 Digital input
S: Communications RS485 + 3 Digital inputs
B: Communications RS232C + Communications RS232C + 1 Digital input
C: Communications RS232C + Communications RS422A + 1 Digital input

D: Communications RS232C + Communications RS485 + 1 Digital input
E: Communications RS485 + Communications RS232C + 1 Digital input
F: Communications RS485 + Communications RS422A + 1 Digital input
G: Communications RS485 + Communications RS485 + 1 Digital input

● Option terminals (continued)

Digital input/output + Heater disconnection alarm (3rd zone)

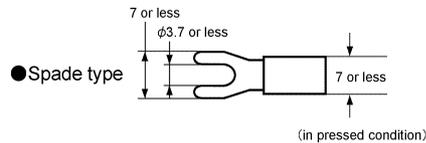
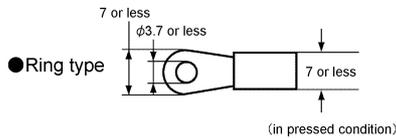
U	V	W	X	Y	Z
DI	CT	DO	CT	DO	DO
DI	CT	DO	CT	DO	DO
DI	DI	DO	DO	DO	DO
DI	DI	DO	DO	DO	DO
DI	DI	DO	DO	DO	DI
DI	DI	DO	DO	DI	DI
DI	DI	DO	DO	DI	DI
DI	DI	DO	DO	DI	DI
COM	COM	COM	COM	COM	COM



U: 8 Digital inputs
V: 6 Digital inputs + Heater disconnection alarm
W: 8 Digital outputs

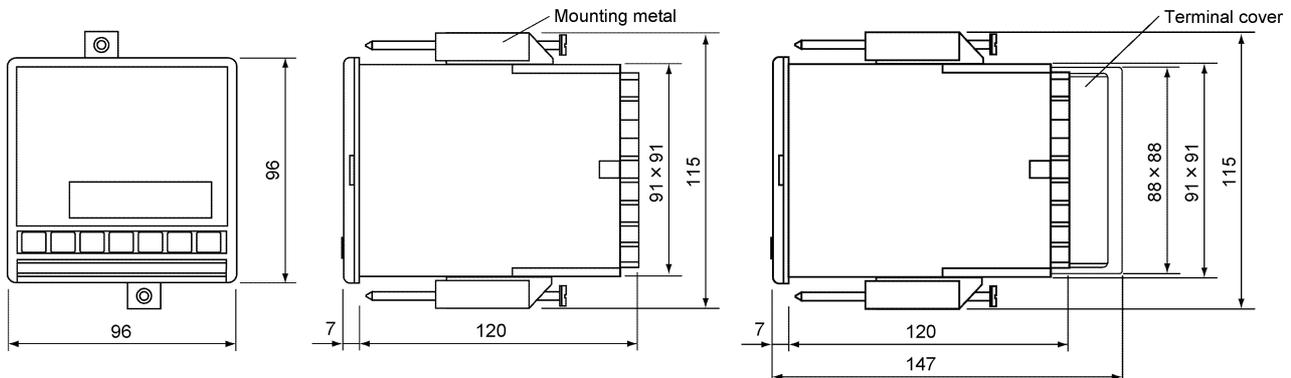
X: 6 Digital outputs + Heater disconnection alarm
Y: 3 Digital inputs + 5 Digital outputs
Z: 4 Digital inputs + 4 Digital outputs

● ABOUT CRIMP STYLE TERMINALS

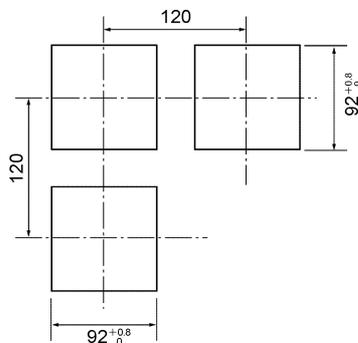


*Use terminal with insulation

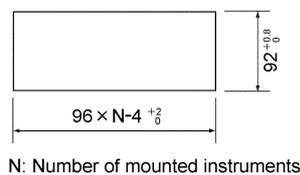
■ EXTENAL DIMENSIONES



● PANEL CUTOUT



● Closed mounting panel dimensions



Unit: mm

Specifications subject to change without notice. Printed in Japan (I) 2008. 2 Recycled Paper

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