RKC

REX–D100
REX–D400
REX–D900

Digital Controllers

CE .RU ®SA®

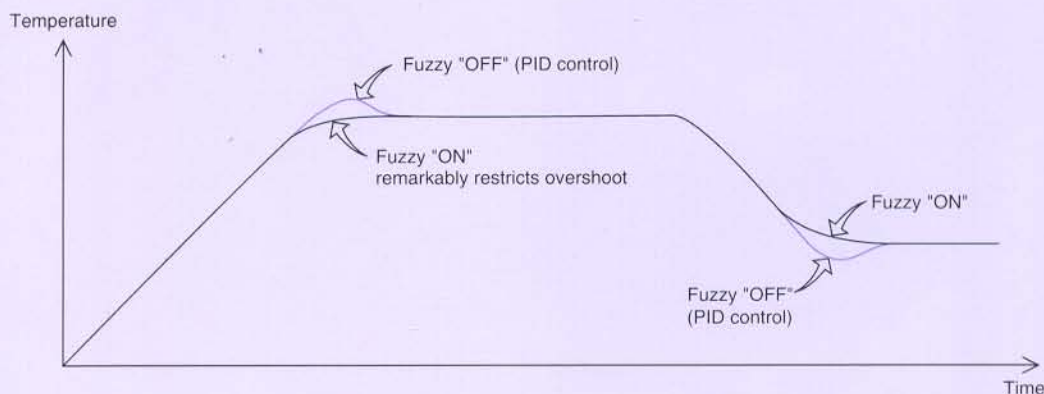## New easy-to-use controller featuring fuzzy logic with universal inputs and outputs

Fuzzy

RKC® RKC INSTRUMENT INC.

New fuzzy logic algorithm eliminates overshoot and undershoot.

A new concept of control has been added to the REX family of digital controllers. This newly-designed series offers a variety of features such as universal input and output, versatile communication options, and IP54 water/dust-proof construction.

1 The new fuzzy logic algorithm eliminates overshoot

The fuzzy logic algoritnm automatically starts during operation or setpoint change to eliminate overshoot and undershoot. The operator can easily turn the fuzzy logic algorithm on or off without advanced training. This controller performs conventional PID control (gain control stability etc) and can be easily operated with automatic autotuning which calculates optimum PID constants. This controller is highly accurate with 0.3% F.S and a sampling time of 0.5 seconds.

Temperature

Fuzzy "OFF" (PID control)

Fuzzy "ON"
remarkably restricts overshoot

Fuzzy "ON"

Fuzzy "OFF"
(PID control)

Time

2 Interface Capability

Up to 31 REX-D series controllers can be connected to one host computer by the RS-485 or RS-422A communication function. In addition, the controller supports the step-function which allows SV1/SV2 to be selected by an external contact.

Host Computer

Up to 31 units

300
300

300
300

300
300

PLC

300
300

DI
(SV1/SV2
select)
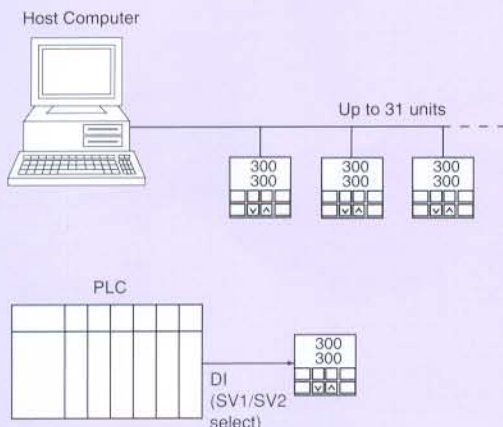
3 Standard universal inputs and outputs

44 range types of thermocouple, RTD, DC voltage and DC current inputs (see Input range table) can be selected simply from the front of the controller. (Slide switches are partially used.) In addition, it employs universal output (except D100 and cooling output on heat/cool type) to allow free selection of the relay contact output, voltage pulse output or 4 to 20mA output.

*For DC current input, a shunt resistor (externally mounted) is required.

4 Easy to operate

All settings can be made simply by pressing the Up ($\triangle$) and Down ($\triangledown$) keys.

5 Flexible features for a variety of applications

Versatile Features

D100	Fuzzy logic function. Universal input. *Temperature alarm 2 points (Include LBA),*Contact input(Step function), *Heater Break Alarm (1-phase,3-phase),*Analog output, *Communication function, *NEMA 4X.
D400	Fuzzy logic function. Universal input, Universal output,**1. Contact input (Step function), *Temperature alarm 2 points (Include LBA). *Heater Break Alarm (1-phase,3-phase) **2. *Analog output, *Communication function.
D900	Fuzzy logic function. Universal input, Universal output, **1. Contact input (Step function), *Temperature alarm 2 points (Include LBA). *Heater Break Alarm (1-phase,3-phase) **2. *Analog output, *Communication function.

*Optional feature
**1: For heat/cool control, output on the cooling side is specified and fixed.
**2: If a 3-phase heater break alarm is added to the D400/D900, no contact input can be provided.

1) Heat/Cool PID control (Option)

Heat/cool PID control is effective for controlling processes which generate heat such as extruders, reactors etc. The controller can conserve energy by using a deadband function or can perform stable temperature control in processes with large time constants by overlapping the heat/cool output.

2) Analog output enhances system performance (Option)

The controller can produce analog output signals which are required when sending measured data to a recorder. Measured value, deviation value, set value or manipulated output value can be selected.

Recorder
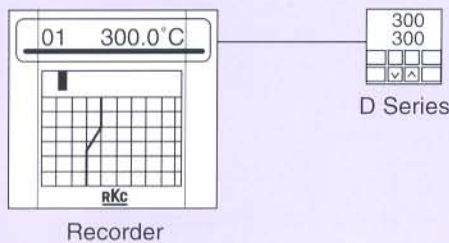
3) Conforms to international safety standards

The models with the CE markings based on the European directives for EMC and LVD, and the models certified by UL / CSA are available.

$C \in$ ®**�** ®CSA®

* Refer to instrument model code instructions on last page to specifiy standards.

4) NEMA 4X (Option)

For operating in severe environments or when wash-down is required, the controller is available with the NEMA 4X water-proof and dust-proofrating(equivalent to IP56). The standard D-Series controller conforms to IP54.

5) Programmable alarm functions (Options)
*New function*
Single or three-phase heater break alarm

Single or three-phase heater break alarm can be built into the controller for heater break detection.

3-phase detection
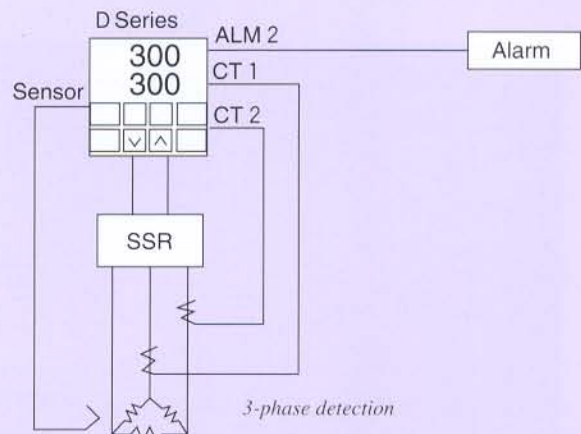
New function
Set value alarm for connection to an auxiliary chiller or heater

In addition to process alarming which alarms on measured value status, a SV alarm has been added which alarms on SV status. This is applicable for auxiliary heater output for constant temperature baths which require a wide, high-low temperature range.

ALM1 : SV low alarm
30°C setting

SV=100°C   →   SV=20°C

ALM1:OFF   ALM1:ON
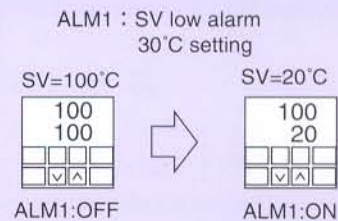
Temperature alarms

Field-programmable alarms such as set value, deviation, process value and FAIL alarms, etc. can be easily selected and set.

LBA

LBA can detect heater breaks, thermocouple or RTD failure, short circuits, or the failure of an operating device such as mechanical relays, SCRs, and SSRs.

Simple design provides easy-to-set operations

REX-D100

REX-D400

REX-D900

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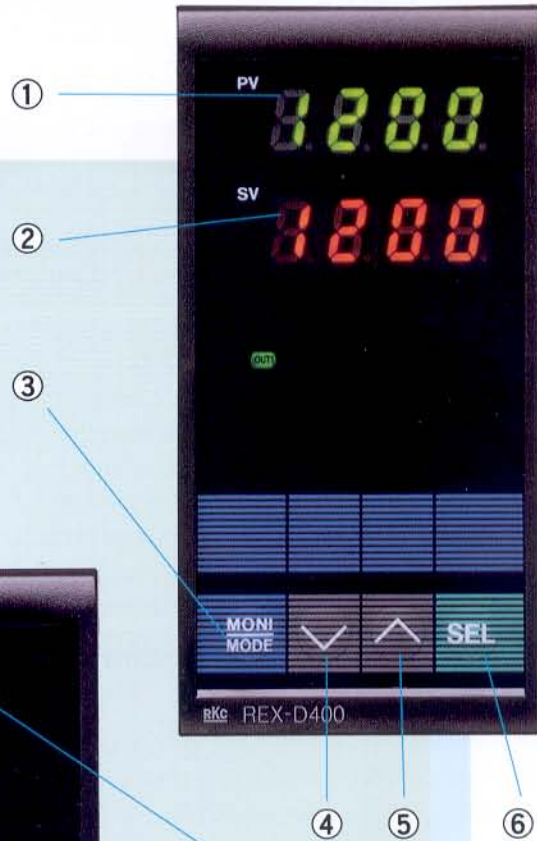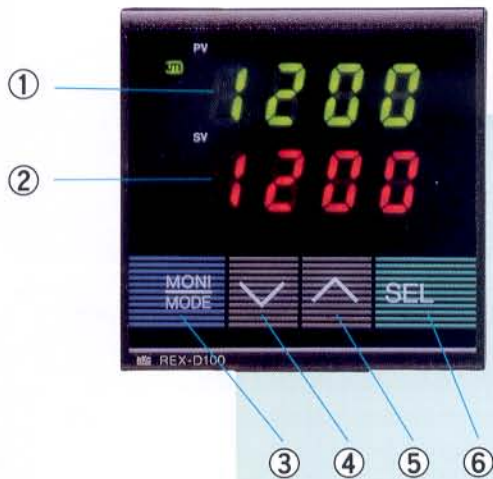
① **Measured-value(PV) display unit**

Measured values from various sensors are displayed on the 4-digit 7-segment LEDs. In addition, setting modes are displayed.

② **Set-value(SV) display unit**

Each set-value is displayed on the 4-digit, 7-segment LEDs. All items which can be set are displayed on this unit.

③ **MODE/MONI key**

Used for calling up the auto/manual or run/stop change screen or for changing from other setting groups to the monitoring screen.

④ **DOWN (▽) key**

Used for lowering the set-value. Hold key to decrease the speed of numeric value change. Also use to select either auto or manual operation.

⑤ **UP (△) key**

Used for raising the set-value. Hold key to increase the speed of numeric value change. Also use to select either auto or manual operation.

⑥ **SEL key**

Use for calling up the engineer's setting group. The controller enters the initial set mode when this key is used together with the MODE/MONI key.

REX D-Series offers low cost, easy-to-use features for a full range of applications.
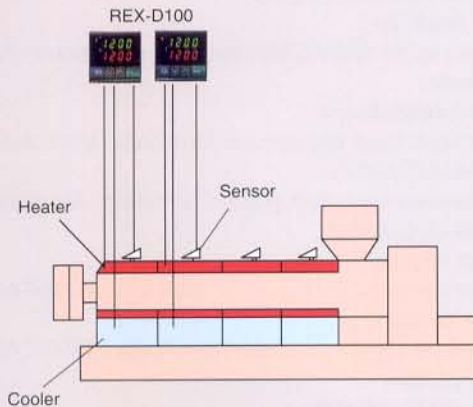
Constant Temperature Bath

The SV alarm can easily be connected to auxiliary coolers or heaters and is useful for constant temperature bath and test equipment which require a wide range of temperature control.
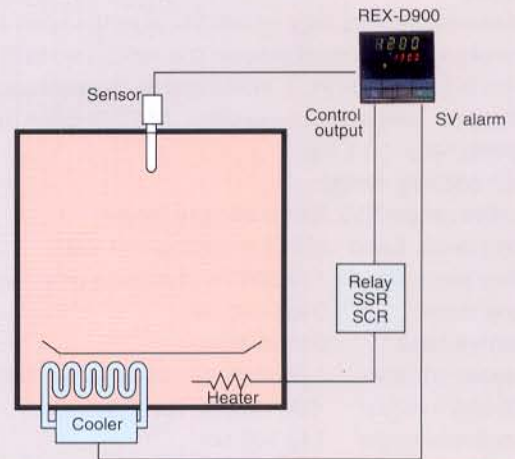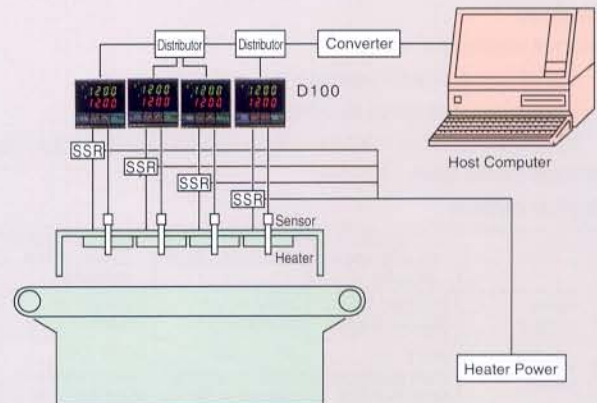

Extruder

The REX-D100 provides superior heat/cool PID control in a compact 1/16 DIN (48mm²) size.

Continuous Furnace

The REX-D100 allows centralized control of up to 31 units by the host computer using the RS-485 communications function.

■Input and range table

Group		Input type and range	Action on input disconnection and spec
Temperature input	Thermocouple		
	K	-199.9~999.9℃, -200~1372℃	Up-scale
		-199.9~999.9°F, -330~2500°F	
	J	-199.9~999.9℃, -200~1200℃	
		-199.9~999.9°F, -330~2192°F	
	T	-199.9~400.0℃	※ Input impedance : Approx.1MΩ
		-199.9~752.0°F	※ Effect by signal source : Approx0.4μV/Ω
	R	0~1769℃	※ Accuracy is not guaranteed less than
		0~3216°F	400℃(752°F) of type B and 32°F of type N,
	S	0~1769℃	PLⅡ, W5Re/W26Re.
		0~3216°F	
	B	0~1820℃	
		0~3308°F	
	E	-200~1000℃	
		-330~1832°F	
	N	0~1300℃	
		0~2372°F	
	PLⅡ	0~1390℃	
		0~2534°F	

Group		Input type and range	Action on input disconnection and spec
Temperature input	Thermocouple	W5Re / W26Re	0~2320℃	Up-scale
			0~4208°F	
		U	0~600℃	※ Input impedance:approx.1MΩ
			0~1100°F	※ Effect by signal source:approx 0.4μV/Ω
		L	0~900℃	
			0~1600°F	
	RTD	JPt100Ω	-199.9~510.0℃	Up-scale
			-199.9~950.0°F	※ Sensor current:approx 300μA
		Pt100Ω	-199.9~660.0℃	※ Leadwire resistance:less than 10Ω
			-199.9~999.9°F	
Voltage input	Voltage input (Low)	mV	0~10mV	Up-scale
			0~100mV	※ Input impedance:approx 1MΩ
			0~1V	※ Allowable input voltage:less than ±5V
	Voltage input (High)	V	0~5V	Down scale
			1~5V	※ Input impedance:approx 1MΩ
			0~10V	※ Allowable input voltage:less than ±15V
Current input		mA	※1 0~20mA	Down scale
			※2 4~20mA	

※1 For 0 to 5V range: A resistor of 250Ω(±0.02% ±10PPM, more than 0.25W) is externally connected.
※2 For 1 to 5V range: A resistor of 250Ω(±0.02% ±10PPM, more than 0.25W) is externally connected.
※ K, J, T, R, S, B, E : J I S／I E C
※ N：I E C

※ P L Ⅱ：N B S
※ W 5 Re／W 2 6 Re：A S T M
※ U, L：D I N

■ Specifications

1. Input
Type of input
: Refer to input and range table(Universal input)

Accuracy
: Measurement accuracy →±(0.3% of range span +1digit)

*Accuracy is not guranteed between 0 to 400℃(0 to 752°F) of type B and 0 to 32°F of type PLⅡ, W5Re/W26Re thermocouple input.

Cold junction compensation error:within ±1.5℃(Between 0 to 50℃)

Sampling time : 0.5 sec

2. Major setting range
Set-value range(SV): Same as input range
Heating prop. band : 0(0.0) to setting limit span
Cooling prop. band : 1 to 3000% of heating prop. band
Integral time : 0 to 3600 sec
Derivative time : 0 to 3600 sec
Anti-reset-windup : 1 to 100% of heating prop. band
Deadband/overlap : -10(-10.0) to 10(10.0)
Proportional cycle : 1 to 100 sec
Output limiter high : -5.0 to 105.0%
Output limiter low : -5.0 to 105.0%
Manual reset : -50.0 to 50.0%(control output value)
Manual control : -5.0 to 105.0%(Heat/cool type:-105.0 to 105.0%)
Set-value (SV) rate limiter (Ramp-to-Setpoint)
: 0(0.0) to setting limit span/min(OFF by setting zero)

3. Control
Control method :

a) PID control with autotuning and fuzzy logic

*Direct/Reverse action selectable by setting

b) Heat/Cool PID control with autotuning and fuzzy logic

Control cycle time : 0.5 sec

Control output :

	D100 Specify when ordering	D400/900 (OUT1) Univeral output	D400/900 (OUT2) Specify when ordering
Relay contact	250V AC 3A (Resistive load)	250V AC 3A (Resistive load)	250V AC 3A (Resistive load)
Voltage pulse	0/12V DC Load resistance : More than 600 Ω	0/12V DC Load resistance : More than 1K Ω	0/12V DC Load resistance : More than 600 Ω
Curent continuous	4 to 20mA DC 0 to 20mA DC Load resistance : Less than 600 Ω	4 to 20mA DC Load resistance : Less than 600 Ω	4 to 20mA DC 0 to 20mA DC Load resistance : Less than 600 Ω
Voltage continuous	0 to 5V DC 0 to 10V DC 1 to 5V DC Load resistance : More than 1K Ω	✕	0 to 5V DC 0 to 10V DC 1 to 5V DC Load resistance : More than 1K Ω

＊OUT1 : Control output for PID control specification.
Heat output for Heat / cool PID control specification.
OUT2 : Cool output for Heat / cool PID control specification.

4. Alarm function(Option)
No. of alarm : 2 points
Alarm action : Programmable (Process,Deviation,SV,FAIL)
Alarm delay : 0 to 600 sec
Output : Relay contact output 250V 0.5A AC

5. Control Loop Break Alarm(Include alarm function)
LBA time setting : 0 to 7200sec
LBA deadband : 0 to 999℃ or 100% of span(OFF by setting zero)
Output : Relay contact output 250V 0.5A AC
(Output from alarm 1, temperature alarm common output)
*Control loop break alarm cannot be added to heat/cool type.

6. External contact input (REX-D100:Option,REX-D400/900:Standard)
Type : SV1/SV2 change (open:SV1,close:SV2)

7. Retransmission output(Option)
Type :
PV for process value, DEV for deviation, SV for set-point, MV for heating or cooling output, CT1 for current transformer

Output signal :
0-5V,0-10V,1-5V DC (Load resistance:More than 1KΩ)
0-20mA,4-20mA DC (Load resistance:Less than 600Ω)

8. Heater break alarm(Option)
No. of input : 1 or 2 points (2 points: For 3-phase heater)
Input : CTL-6-P-N(30A),CTL-12-S56-10L-N(100A)
Display range: 0.0 to 100.0A
Accuracy : ±0.5% of input value or 2A (Whichever is larger)
Output : Relay contact output 250V 0.5A AC
(Output from alarm2, temperature alarm common output)

9. Digital communication(Option)
Communication method : RS-485(2-wire),RS-422A(4-wire)
*REX-D100:RS-485 only

Communication speed : 1200,2400,4800,9600,19200BPS
Bit format: 1)Start bit → 1
2)Data bit → 7 or 8
3)Parity bit → "with" or "without",even or odd in case of "with" parity
4)Stop bit → 1 or 2

Communication code : ASCII(JIS) 7-bit code

10. NEMA 4X: Please specify when ordering (Option)

11. General specifications
Memory back up :
Backed up by EEPROM(Data retaining period : Approx. 10 years)

Insulation resistance :
a)Between input and ground terminals : More than 20MΩ(DC500V)
b)Between power and ground terminals : More than 20MΩ(DC500V)

Dielectric strength :
a)Between input and ground terminals : 1000V AC for one minute
b)Between input and ground terminals : 1500V AC for one minute

Power supply voltage :
a)90 to 264V AC (including voltage variation), 50/60Hz, [Rating : 100 to 240V AC]
b)21.6 to 26.4V AC (including voltage variation), 50/60Hz, [Rating : 24V AC]
c)21.6 to 26.4V DC (ripple rate 10% p-p or less) [Rating : 24V DC]

Power consumption :
a)100 to 240V AC (D100 : Less than 11VA, D400/900 : Less than 12VA)
b)24V AC (D100 : Less than 7.0VA, D400/900 : Less than 7.5VA)
c)24V DC (D100 : Less than 180mA, D400/900 : Less than 200mA)

Effect by power failure :
No influence even under power failure of less than 20m sec

Ambient temperature : 0 to 50℃(32 to 122 °F)
Ambient humidity : 20 to 80%RH
Net weight : REX-D100 → Approx 180g
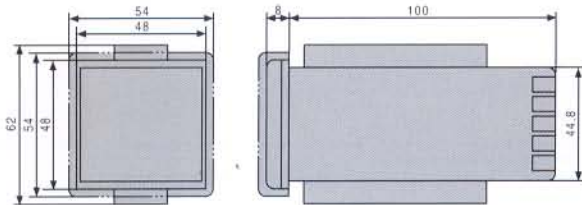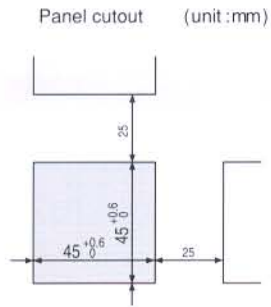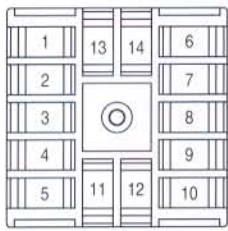REX-D400 → Approx 250g
REX-D900 → Approx 360g
External dimension : REX-D100 → 48×48×100mm
REX-D400 → 96×48×100mm
REX-D900 → 96×96×100mm

REX-D100

Panel cutout   (unit : mm)

*Double-dotted lines show the front cover conforming to NEMA 4X.
The panel thickness shall be 1 to 10mm.

No.	Functions		No.	Functions	
1		Alarm output	6	L 100~240V	Power
2	ALM1 NO		7	N	
3	ALM2 NO		8	T C R T D DC V, mA	Input
4	Relay NO	DC V, mV, mA	Control output 1	9	A B
5				10	B

No.	Functions	
11	CTL input	Option
12	C T 1	

No.	Functions					
13	Control output 2	A O	C T 2	RS-485	Step	Option
	NO ① ② +			T/R(B)	−	
14				T/R(A)	+	
	① Relay					
	② DC V, mA					

REX-D400

Panel cutout   (unit : mm)

*The panel thickness shall be 1 to 8mm.

No.	Function	
1	L 100~240V	Power
2	N	
3	Relay C	Control output 1
4	NO	
5	NC	
6		Alarm output
7	ALM1 NO	
8	ALM2 NO	
9	T C R T D DC V, mA A	Input
10	B	
11	B	

REX-D900

Panel cutout   (unit : mm)
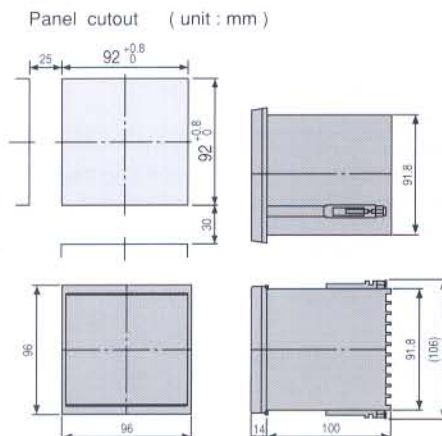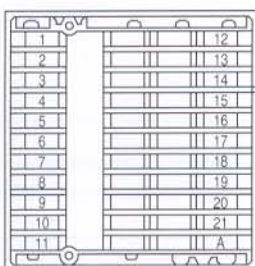
*The panel thickness shall be 1 to 8mm.

No.	Functions				
12	+ DC mA, DC V pulse				Control output 1
13					
14	RS-422A T(A)	RS-485	Analog output +	Control output NO ① ② +	
15	T(B)		−		
16	R(A)	T/R(A)	*RS-485 is available	① Relay	
17	R(B)	T/R(B)		② DC V, mA and DC V pulse *RS-485 is available	
18	SG	SG			Option
19	Step			C T 2	
20	+				
21	CTL input				
A	C T 1				

■ REX-D100 Model and Suffix Code

		Model code	Suffix Code							
		D100	□	–	□	□	*	□	□	–
Control action *2	PID control with AT		F							
	Heat/Cool PID control with AT		W							
Control output(OUT1)	Relay contact output			M						
	Voltage pulse output			V						
	DC mA, output(Nos.4-8)			□						
Control output(OUT2)	No output (Control action F)				N					
	Relay contact output				M					
	Voltage pulse output				V					
	DC mA, V output (Nos.4-8)				□					
Alarm	No alarm					N				
	Dual alarm					D				
Heater break alarm (HBA) *1, 3	Not supplied						N			
	1-phase heater break alarm						S			
	3-phase heater break alarm						D			
Contact input(Step) *1	Not supplied							N		
	Contact input 1 point							1		
Analog output *1	Not supplied								N	
	See signal code (Nos.4-8)								□	
Digital communication *1	Not supplied									N
	RS-485 (2-wire system)									5
Water proof / Dust proof (NEMA4X)	Not supplied									
	Water proof / Dust proof spec									

*1 : Select one from the following : Contact input, Analog output, 3-phase heater break alarm and communication function.
*2 : If the heat / cool PID control with the AT is selected, contact input, analog output, 3-phase heater break alarm or communication function cannot be added.
*3 : If continuous voltage / current output is specified, no heater break alarm can be added.
*4 : When used for current input, the controller requires a shunt resistor (external resistor sold separately).

■REX-D400/900 model and suffix code

		Model code	Suffix code						
		D400 / D900	□	–	□	*	□	□	–
Control action *1, 2	PID control with AT		F						
	Heat/Cool PID with AT		W						
Control output (OUT2)	No output			N					
	Relay contact output			M					
	Voltage pulse output			V					
	DC mA,V(Nos.4-8) output			□					
Alarm	No alarm				N				
	Dual alarm				D				
Heater break alarm *3 / Step function	No heater break alarm/with step function					N			
	1-phase heater break alarm/with step function					S			
	3-phase heater break alarm/no step function					D			
Analog output *1, 2	Not supplied						N		
	See signal code (Nos.4-8)						□		
Digital communication *2	Not supplied							N	
	RS-422A (4-wire)							4	
	RS-485 (2-wire)							5	

*1 : If the heat / cool PID control with AT is selected, no analog output can be added.
*2 : If the heat / cool PID control with AT or analog output is selected, the communication function becomes RS-485.
*3 : If continuous voltage/current output is specified,no heater break alarm can be added.
*4 : When used for current input, the controller requires a shunt resistor (external resistor sold separately).
*5 : Control output 1 is a universal output which be set as a relay contact, voltage pulse, or continuous current (4 to 20mA)

■Output signal code

4.	DC 0~5 V	5.	DC 0~10 V	6.	DC 1~5 V	7.	DC 0~20mA	8.	DC 4~20mA

■Accesary

Name	Model code
CT(Current transformer) for heater break alarm	CTL-6-P-N (0 ~30A)
	CTL-12-S56-10L-N (0~100A)
Shunt resistor for DC current input	KD100-55

* For the 3-phase heater break alarm, two CTs (current transformers) with the same rating are required.
Due to continuous product improvement product specifications are subject to change whthout notice

■Power Supply Voltage

AC 100~240V	AC 24V	DC 24V

■How to specify safety standard

When you specify the models with CE mark·UL / CSA certification, please add the suffix of " / CE " to the model code.

⚠ Caution for your safety	● For proper operation of this precision instrument, please read the instruction manual carefully
	● This instrument is intended for use with industrial machines, test and measuring equipment. It is not designed for use with medical equipment affecting human life
	● If there is a possiblity of an accident occuring to the system due to breakdown or abnormality of this instrument, please prepare an appropriate independent protection device.
	● Delate line above as it is already addressed in first bullet.