

CONTROLLER

CB SERIES

DIGITAL TEMPERATURE CONTROLLER



☒ RoHS compliant

☐ Reinforced Insulation

RKC RKC INSTRUMENT INC.

Launching temperature control into the new Millennium

CB Series

The CB Series combines leading edge temperature control developments with easy-to-use operation in a cost-competitive package. These versatile controllers can be configured for the most demanding applications. With powerful new features such as Active-tuning, digital communications, user-friendly functions, large, bright displays, IP66, and advanced heater and loop break alarm capabilities, these controllers deliver exceptional temperature performance to your process for the new Millennium.

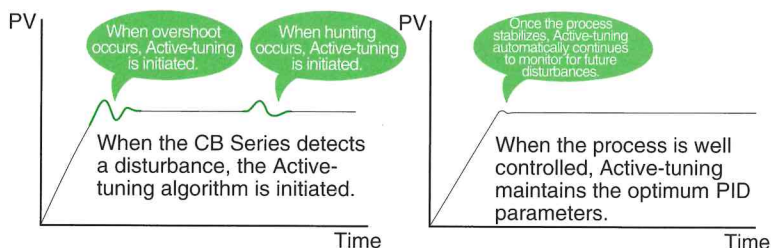


Active-tuning takes control to a new dimension!

Active-tuning (Self-tuning) is initiated at start-up and when process parameters or conditions change. The CB Series monitors your process and automatically sets new PID parameters when needed. Active-tuning can be manually set on or off. The CB Series offers both Active-tuning and our RKC world-renowned auto-tuning algorithm.

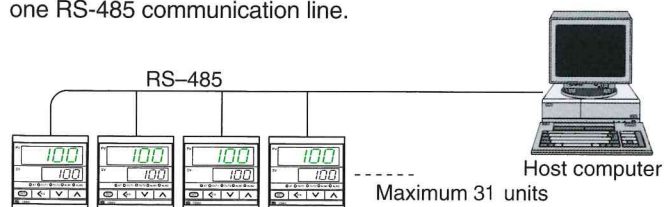
* Active-tuning function is not available with heat/cool PID control type.

Active-Tuning Performance



Digital Communications

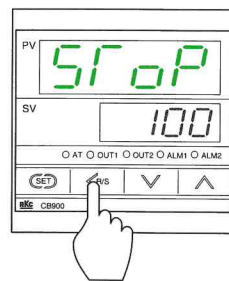
The CB Series offers an optional RS-485 communications interface for networking to computers, PLCs and SCADA software in your plant. Up to 31 units can be interfaced on one RS-485 communication line.



RUN/STOP Mode

To toggle between modes, press the RUN/STOP key for one second.

The instrument monitors the process value even when in STOP mode.



Large, Easy-to-read LED Displays

New CB100/400 display (PV)



New CB700 display (PV)



New CB900 display (PV)



Conventional 1/16, 1/8 DIN controller display



Conventional 3/16 DIN controller display



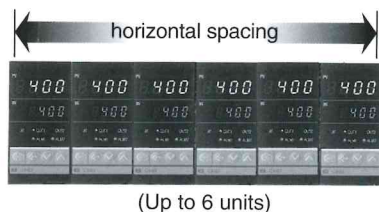
Conventional 1/4 DIN controller display





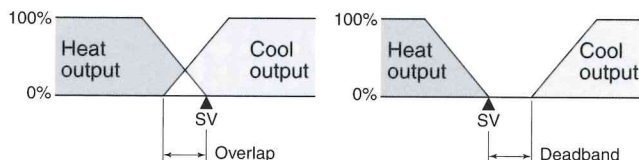
Close horizontal Spacing

The mounting bracket has been redesigned to allow closer placement between instruments to save valuable panel space.



Heat/Cool Control

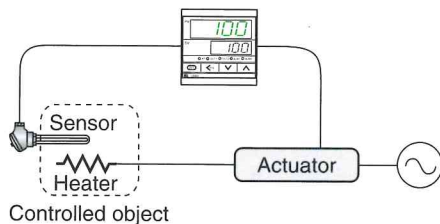
The use of Heat/cool PID control contributes to energy savings in applications where process-generated heat exists. The controller allows the input of overlap or deadband settings.



Loop Break Alarm (LBA)

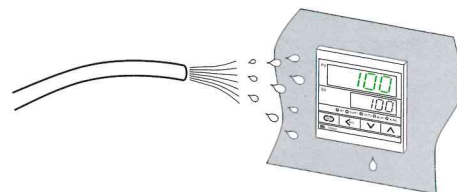
The LBA monitors and protects an entire temperature control loop.

The LBA detects a heater break, an incorrect sensor placement, a sensor break or the failure of output device such as SCR's and SSR's.



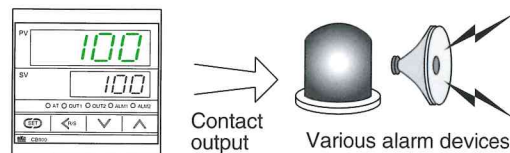
Dustproof and Waterproof Protection

For operation in severe environments or when washdown is required, IP66(65) is available.



Temperature alarms

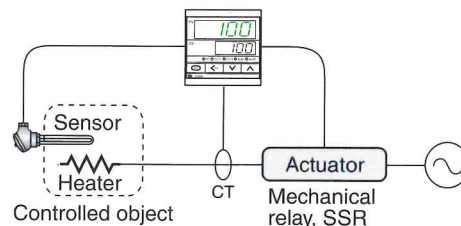
The CB Series provides a wide selection of alarm types to configure up to two alarm contacts. Alarm Hold action is configured in the controller. Upon start-up, alarm action is suppressed by the Hold function until the process value has entered the non-alarm range.



Heater Break Alarm (HBA)

The HBA detects a fault in the heating or cooling circuit and displays actual amperage on the front of the controller. The HBA monitors the load current of a heater by using a dedicated current transformer (CTL-6-P-N: 0 to 30A, CTL-12-S56-10L-N: 0 to 100A).

When the control output is ON and the load current drops below a specified minimum (it is likely that a heater break has occurred), an alarm is turned on. When the control output is OFF and the load current is still present (indicating a short-circuit in the relays or SSR's etc.), the alarm is also turned on.



CTL-6-P-N (0 to 30A)	CTL-12-S56-10L-N (0 to 100A)
Length of lead wire : approx. 130mm (standard)	Length of lead wire : approx. 100mm (standard)
 ø5.8	 ø12

CB Series Lineup

Black



CB100

CB500

CB700

CB400

CB900

White



CB900

CB400

CB700

CB500

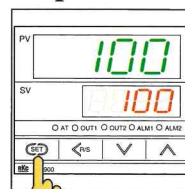
CB100



Easy-to-Use

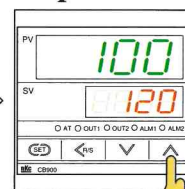
Changing a set point value is as easy as 1, 2, 3...

Step 1



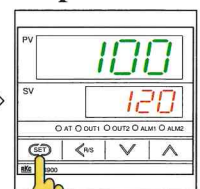
Press SET key to enable set point changes.

Step 2



Change the set point value by using the R/S, and up/down arrow keys.

Step 3



Press the SET key to confirm the new set point.

Specifications



1. Input

Measured Input

- (1) Input : a) Thermocouple : K, J, E, T, R, S, B (JIS/IEC)
U, L (DIN), N, PLII (NBS) W5Re/W26Re (ASTM)
Input impedance : Approx. 1MΩ
b) RTD : Pt100 (JIS/IEC), JPt100 (JIS)
c) DC voltage input : 0 to 5V DC, 1 to 5V DC
d) DC current input : 0 to 20mA DC, 4 to 20mA DC
* A 250 ohm resistor is externally connected at the input terminals for DC current input.
* Refer to the Input and Range Code Table for details.
- (2) Sampling time : 0.5 sec.
- (3) Influence of external resistance : Approx. 0.2μV/Ω (Thermocouple input)
- (4) Influence of lead resistance : Approx. 0.01[%/Ω] of reading (RTD)
* Maximum 10Ω per wire
- (5) Input break action : a) Thermocouple : Up-scale
b) RTD : Up-scale
c) DC voltage/current input : Down-scale
* All alarm outputs are ON.
* Control outputs of both heating and cooling side are OFF for heat/cool PID action type.
* Reading is around zero for 0 to 5VDC input and 0 to 20mADC input.
- (6) Input short action : Down-scale (RTD)
* All alarm outputs are on.
- (7) PV bias : a) Temperature input : -199.9 to 9999°C(°F) or -199.9 to 999.9°C(°F)
b) Voltage, Current input : -span to +span



2. Performance

- (1) Measuring accuracy : a) Thermocouple : $\pm 0.3\%$ of reading + 1 digit) or $\pm 2^\circ\text{C}$ (4°F)
(Within the range of whichever is larger)
Accuracy is not guaranteed between 0 to 399°C (0 to 749°F) for type R, S and B.
Accuracy is $\pm 3^\circ\text{C}$ between -199.9 to -100.0°C (-199.9 to -158.0°F) for type T and U.
b) RTD : $\pm 0.3\%$ of reading + 1 digit) or $\pm 0.8^\circ\text{C}$ (1.6°F)
(Within the range of whichever is larger)
c) Voltage, Current input : $\pm 0.3\%$ of reading + 1 digit)
- (2) Insulation resistance : More than 20MΩ(500VDC) between measured terminals and ground
More than 20MΩ(500VDC) between power terminals and ground
- (3) Dielectric Voltage : 1000 VAC for one minute between measured terminals and ground
1500 VAC for one minute between power terminals and ground



3. Control

- (1) Control method : a) PID control (with autotuning and Active-tuning (self-tuning) function)
• Reverse and direct action are available. (Specify when ordering.)
• ON/OFF, P, PI and PD control is also settable.
ON/OFF action differential gap : 2°C (°F) (Temperature input)
0.2% (Voltage, current input)
b) Heat/Cool PID control (with autotuning function)
Air cooling and water cooling type are available.
(Specify when ordering.)
- (2) Setting range : a) Set value (SV) : Same as input range.
b) Heat side proportional band (P)
: 1 to span or 0.1 to span (Temperature input)
(ON/OFF action when P=0)
(When 0.1°C (°F) resolution, within 999.9°C(°F))
0.1 to 100.0% of span (voltage, current input)
c) Cool side proportional band (Pc)
: 1 to 1000% of heat side proportional band (P)
d) Integral time (I) : 1 to 3600 sec. (PD action when I=0)
e) Derivative time (D) : 1 to 3600 sec. (PI action when D=0)
f) Anti-reset windup (ARW)
: 1 to 100% of heat side proportional band (P)
(Integral action is OFF when ARW=0)
g) Heat side proportional cycle : 1 to 100 sec.
(No cycle setting for current output)
h) Cool side proportional cycle : 1 to 100 sec.
(No cycle setting for current output)
i) Deadband/Overlap : -10 to 10 or -10.0 to +10.0°C(°F)
(Temperature input)
-10.0 to +10.0% of span (Voltage, current input)
* Deadband is set below zero for overlap.
- (3) Control output : a) Relay contact output : 250VAC 3A (resistive load), Form C contact
* Both heat output and cool output are Form A contact for heat/cool PID action.
* Electrical life : 300,000 cycles or more (rated load)
b) Voltage pulse output : 0/12V DC
(Load resistance : more than 600Ω)
c) Current output : 4 to 20mA DC
(Load resistance : less than 600Ω)
d) Triac trigger output : Zero-cross method for medium capacity triac drive
(less than 100A)
1) Load voltage : 100VAC type 200VAC type
2) Load : Resistive load
e) Triac output : rating : 0.5A (ambient temperature is less than 40°C)
* Triac trigger output is not available for heat/cool PID control type.



4. Alarm (Up to 2 points) (Option)

- (1) Temperature alarm : a) Type : Deviation (High, Low, High/Low, Band)
Process (High, Low), Set Value (High, Low)
* Hold action can be added to any type except set value alarm.
b) Differential gap : 2°C (°F) or 2.0°C (°F) (Temperature input)
0.2% (Voltage, current input)
c) Output : Relay contact output 250VAC 1A
(resistive load) Form A contact
- (2) Control loop break alarm (LBA)
: a) LBA setting time : 0.1 to 200.0 min.
* 0.0 min. can not be set.
b) LBA deadband : 0 to 9999°C(°F) (Temperature input)
0 to 100% of span (Voltage, current input)
c) Output : Relay contact output 250VAC 1A (resistive load) Form A contact
* Output of control loop break alarm is output from Alarm 1 or Alarm 2 terminals.
- (3) Heater break alarm (HBA) (For single phase)
: a) Input : Current transformer output
CTL-6-P-N (0 to 30A)
CTL-12-S56-10L-N (0 to 100A)
(Specify when ordering)
b) Heater current display range : 0.0 to 100.0A
c) Heater current display accuracy : $\pm 5\%$ of input value or $\pm 2\text{A}$
(within the range of whichever is larger)
d) Output : Relay contact output
250VAC 1A (resistive load) Form A contact
* Output of heater break alarm is output from Alarm 2 terminals.
* Heater break alarm is not available, when control output is a current output.



5. Communications Function (Option)

- (1) Communication method : RS-485 (two-wire)
- (2) Synchronous method : Start/stop synchronous type
- (3) Communication speed : 2400bps, 4800bps, 9600bps, 19200bps
- (4) Bit format : Start bit : 1
Data bit : 7 or 8
Parity bit : "with", or "without", even or odd in case of "with" parity
Stop bit : 1 or 2
- (5) Maximum connection : 31 (Address can be set from 0 to 99.)



6. Dustproof and waterproof (Option)

Dustproof and waterproof protection

CB 100 : IP 66
CB 400/500/700/900 : IP 65

* Dustproof and waterproof are effective only to the front direction when installed on a panel.

* Dustproof and waterproof are not effective when controllers are closely spaced.



7. General Specifications

- (1) Supply voltage : a) AC type : 85 to 264VAC (50/60Hz common)
(Including supply voltage variation)
(Rating : 100 to 240VAC)
b) 24VAC type : 21.6 to 26.4VAC
(Including supply voltage variation)
(Rating : 24VAC)
c) 24VDC type : 21.6 to 26.4V DC
(Including supply voltage variation)
(Rating : 24VDC)
- (2) Power consumption : a) AC type : Maximum 7VA at 100VAC
Maximum 10VA at 240VAC
b) 24VAC type : Maximum 5VA
c) 24VDC type : Maximum 160mA
- (3) Effect of power failure : Not affected by power failure less than 20 msec., otherwise reset to the initial status.
- (4) Memory backup : Backed up by non-volatile memory.
Data retaining period : Approx. 10 years
- (5) Ambient temperature : 0 to 50°C (32 to 122°F)
- (6) Ambient humidity : 45 to 85%RH
- (7) Weight and external dimensions
CB 900 : Approx. 340g, 96(H) X 96(W) X 100(D) mm (1/4 DIN)
CB 700 : Approx. 290g, 72(H) X 72(W) X 100(D) mm (3/16 DIN)
CB 500 : Approx. 250g, 48(H) X 96(W) X 100(D) mm (1/8 DIN)
CB 400 : Approx. 250g, 96(H) X 48(W) X 100(D) mm (1/8 DIN)
CB 100 : Approx. 170g, 48(H) X 48(W) X 100(D) mm (1/16 DIN)
- (8) Operating environment : Free from corrosive and flammable gas and dust.
- (9) Other conditions : Free from external noise, vibration, shock and exposure to direct sunlight.



8. Compliance with standards

• CE marked • UL recognized • CSA certified

* Triac trigger output type and triac output type are not CE marked, UL recognized and CSA certified.

Model and Suffix Code

Specifications		Model and Suffix Code									
Size	48x48mm (1/16 DIN) size 96x48mm (1/8 DIN Vertical) size 48x96mm (1/8 DIN Horizontal) size 72x72mm (3/16 DIN) size 96x96mm (1/4 DIN) size	CB100 CB400 CB500 CB700 CB900	☐	☐	☐	☐	☐	☐	☐	☐	☐
Control method	PID control with AT (reverse action) PID control with AT (direct action) Heat/cool PID control with AT (water cooling) Heat/cool PID control with AT (air cooling)	F D W A									
Input and Range	See Input and Range Code Table		☐	☐	☐						
Control output (OUT1)	Relay contact output Voltage pulse output Current output Triac trigger output Triac output										
Control output (OUT2)	No output (control action is F or D) Relay contact output Voltage pulse output Current output Triac output										
Alarm 1	No alarm See Alarm Code Table										
Alarm 2	No Alarm See Alarm Code Table										
Digital Communications	Not supplied RS-485										
Waterproof and dustproof	Not supplied Waterproof and dustproof										
Body color	Black White										
Instrument version	Version symbol										Y

Alarm Code Table

A	Deviation High	B	Deviation Low	C	Deviation High-Low	D	Deviation Band
E	Deviation High with hold	F	Deviation Low with hold	G	Deviation High-Low with hold	H	Process High
J	Process Low	K	Process High with hold	L	Process Low with hold	R	Loop break alarm *1
P	Heater break alarm (CTL-6-P-N) *2	S	Heater break alarm (CTL-12-S56-10L-N) *2				
V	Set value High	W	Set value Low				

*1: Loop break alarm is not available for heat/cool PID control type.

*2: Heater break alarm is allocated to Alarm2. Heater break alarm is not be available for current output.

Power supply voltage (Please specify when ordering.)

100 to 240V AC	24V AC	24V DC
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Accessary

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

CB series Input and Range Code Table

Thermocouple Input

Input	Code	Range
K (JIS/IEC)	K 01	0 to 200°C
	K 02	0 to 400°C
	K 03	0 to 600°C
	K 04	0 to 800°C
	K 05	0 to 1000°C
	K 06	0 to 1200°C
	K 07	0 to 1372°C
	K 13	0 to 100°C
	K 14	0 to 300°C
	K 20	0 to 500°C
	K A1	0 to 800°F
	K A2	0 to 1600°F
	K A3	0 to 2502°F
	K A9	20 to 70°F
J (JIS/IEC)	J 01	0 to 200°C
	J 02	0 to 400°C
	J 03	0 to 600°C
	J 04	0 to 800°C
	J 05	0 to 1000°C
	J 06	0 to 1200°C
R *1 (JIS/IEC)	J A1	0 to 800°F
	J A2	0 to 1600°F
	J A3	0 to 2192°F
	J A6	0 to 400°F
	R 01	0 to 1600°C
	R 02	0 to 1769°C
S *1 (JIS/IEC)	R 04	0 to 1350°C
	R A1	0 to 3200°F
	R A2	0 to 3216°F
	S 01	0 to 1600°C
	S 02	0 to 1769°C
	S A1	0 to 3200°F
B *1 (JIS/IEC)	S A2	0 to 3216°F
	B 01	400 to 1800°C
	B 02	0 to 1820°C
	B A1	800 to 3200°F
	B A2	0 to 3308°F

RTD Input

Input	Code	Range
Pt100 (JIS/IEC)	D 01	-199.9 to 649.0°C
	D 02	-199.9 to 200.0°C
	D 03	-100.0 to 50.0°C
	D 04	-100.0 to 100.0°C
	D 05	-100.0 to 200.0°C
	D 06	0.0 to 50.0°C
	D 07	0.0 to 100.0°C
	D 08	0.0 to 200.0°C
	D 09	0.0 to 300.0°C
	D 10	0.0 to 500.0°C
Pt100 (JIS)	D A1	-199.9 to 999.9°F
	D A2	-199.9 to 400.0°F
	D A3	-199.9 to 200.0°F
	D A4	-100.0 to 100.0°F
	D A5	-100.0 to 300.0°F
	D A6	0.0 to 100.0°F
	D A7	0.0 to 200.0°F
	D A8	0.0 to 400.0°F
	D A9	0.0 to 500.0°F
	P 01	-199.9 to 649.0°C
Pt100 (JIS)	P 02	-199.9 to 200.0°C
	P 03	-100.0 to 50.0°C
	P 04	-100.0 to 100.0°C
	P 05	-100.0 to 200.0°C
	P 06	0.0 to 50.0°C
	P 07	0.0 to 100.0°C
	P 08	0.0 to 200.0°C
	P 09	0.0 to 300.0°C
	P 10	0.0 to 500.0°C

Voltage/Current DC Input

Input	Code	Range
0 to 5V	4 01	0.0 to 100.0
1 to 5V	6 01	0.0 to 100.0
0 to 20mA *3	7 01	0.0 to 100.0
4 to 20mA *3	8 01	0.0 to 100.0

*1 : Accuracy is not guaranteed between 0 to 399°C (0 to 799°F).

*2 : Accuracy is +/-3°C between -199.9 to -100.0°C (-199.9 to -158.0°F).

*3 : A 250Ω resistor is externally connected at the input terminals.

A	Deviation High	B	Deviation Low	C	Deviation High-Low	D	Deviation Band
E	Deviation High with hold	F	Deviation Low with hold	G	Deviation High-Low with hold	H	Process High
J	Process Low	K	Process High with hold	L	Process Low with hold	R	Loop break alarm *1
P	Heater break alarm (CTL-6-P-N) *2	S	Heater break alarm (CTL-12-S56-10L-N) *2				
V	Set value High	W	Set value Low				

*2: Heater break alarm is allocated to Alarm2. Heater break alarm is not be available for current output.

100 to 240V AC	24V AC	24V DC
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Name	Model code
Current transformer for heater break alarm	CTL-6-P-N (0 to 30A)
	CTL-12-S56-10L-N (0 to 100A)
Shunt resistor for DC current input	KD100-55

Thermocouple Input

Input	Code	Range
E (JIS/IEC)	E 01	0 to 800°C
	E 02	0 to 1000°C
	E A1	0 to 1600°F
	E A2	0 to 1832°F
N (JIS/IEC)	N 01	0 to 1200°C
	N 02	0 to 1300°C
	N A1	0 to 2300°F
T *2 (JIS/IEC)	N A2	0 to 2372°F
	T 01	-199.9 to 400.0°C
	T 02	-199.9 to 100.0°C
	T 03	-100.0 to 200.0°C
	T 04	0.0 to 350.0°C
	T A1	-199.9 to 752.0°F
	T A2	-100.0 to 200.0°F
	T A3	-100.0 to 400.0°F
W5Re/ W26Re (ASTM)	T A4	0.0 to 450.0°F
	T A5	0.0 to 752.0°F
	W 01	0 to 2000°C
	W 02	0 to 2320°C
PL II (NBS)	W A1	0 to 4000°F
	A 01	0 to 1300°C
	A 02	0 to 1390°C
	A 03	0 to 1200°C
U *2 (DIN)	A A1	0 to 2400°F
	A A2	0 to 2534°F
	U 01	-199.9 to 600.0°C
	U 02	-199.9 to 100.0°C
	U 03	0.0 to 400.0°C
	U A1	-199.9 to 999.9°F
L (DIN)	U A2	-100.0 to 200.0°F
	U A3	0.0 to 999.9°F
	L 01	0 to 400°C
	L 02	0 to 800°C
	L A1	0 to 800°F
	L A2	0 to 1600°F

Input	Code	Range
Pt100 (JIS/IEC)	D 01	-199.9 to 649.0°C
	D 02	-199.9 to 200.0°C
	D 03	-100.0 to 50.0°C
	D 04	-100.0 to 100.0°C
	D 05	-100.0 to 200.0°C
	D 06	0.0 to 50.0°C
	D 07	0.0 to 100.0°C
	D 08	0.0 to 200.0°C
	D 09	0.0 to 300.0°C
	D 10	0.0 to 500.0°C
	D A1	-199.9 to 999.9°F
	D A2	-199.9 to 400.0°F
	D A3	-199.9 to 200.0°F
	D A4	-100.0 to 100.0°F
	D A5	-100.0 to 300.0°F
	D A6	0.0 to 100.0°F
	D A7	0.0 to 200.0°F
	D A8	0.0 to 400.0°F
D A9	0.0 to 500.0°F	
Pt100 (JIS)	P 01	-199.9 to 649.0°C
	P 02	-199.9 to 200.0°C
	P 03	-100.0 to 50.0°C
	P 04	-100.0 to 100.0°C
	P 05	-100.0 to 200.0°C
	P 06	0.0 to 50.0°C
	P 07	0.0 to 100.0°C
	P 08	0.0 to 200.0°C
	P 09	0.0 to 300.0°C
	P 10	0.0 to 500.0°C

Input	Code	Range
0 to 5V	4 01	0.0 to 100.0
1 to 5V	6 01	0.0 to 100.0
0 to 20mA *3	7 01	0.0 to 100.0
4 to 20mA *3	8 01	0.0 to 100.0

*3 : A 250Ω resistor is externally connected at the input terminals.

■ Rear terminal layout

■ Rear terminal configuration

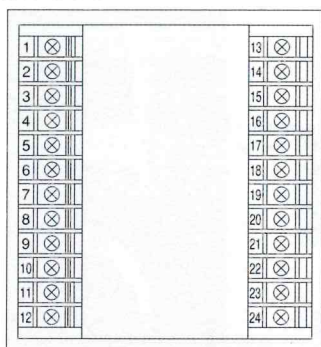
CB 400



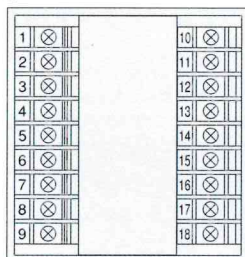
CB 500



CB 900



CB 700



CB100



No.	Description
1	AC 100 to 240V
2	AC 24V
3	DC + 24V
4	DC - 24V
5	Power Supply
6	PID Control
7	Heat/cool PID control
8	Control Output
9	(1) Relay contact output
10	(2) Voltage DC /Current DC output
11	(3) Triac output
12	(4) Triac trigger output
13	Alarm2
14	Alarm1
15	Alarm output
16	Relay contact output
17	Measured input
18	(1) Thermocouple
19	(2) RTD
20	(3) Voltage /Current

No.	Description
13	SG
14	T/R(A)
15	T/R(B)
16	RS-485
17	Communications
18	
19	
20	
21	
22	
23	CT input for heater break alarm
24	Current transformer input

No.	Description
1	AC 100 to 240V
2	AC 24V
3	DC + 24V
4	DC - 24V
5	Power Supply
6	PID Control
7	Heat/cool PID control
8	Control Output
9	(1) Relay contact output
10	(2) Voltage DC /Current DC output
11	(3) Triac output
12	(4) Triac trigger output
13	Alarm2
14	Alarm1
15	Alarm output
16	Relay contact output
17	Measured input
18	(1) Thermocouple
19	(2) RTD
20	(3) Voltage /Current

No.	Description
10	SG
11	T/R(A)
12	T/R(B)
13	RS-485
14	Communications
15	
16	
17	
18	
19	
20	
21	
22	
23	CT input for heater break alarm
24	Current transformer input

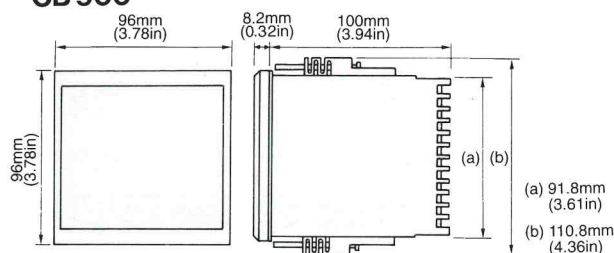
No.	Description
1	AC 100 to 240V
2	AC 24V
3	DC + 24V
4	DC - 24V
5	Power Supply
6	PID Control
7	Heat/cool PID control
8	Control Output
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12	(4) Triac trigger output
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19	(2) RTD
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16	RS-485
17	Communications
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20	
21	
22	
23	CT input for heater break alarm
24	Current transformer input

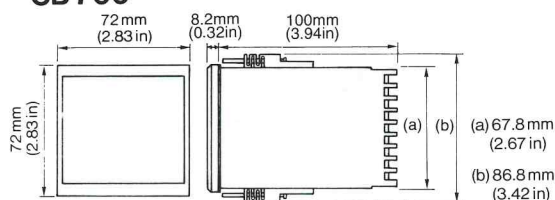
External Dimensions, Panel Cutouts

External dimensions

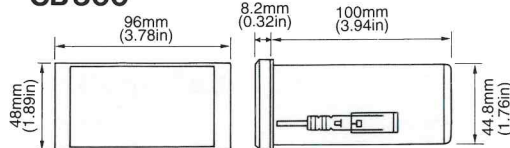
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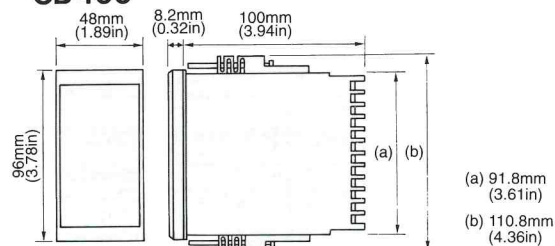
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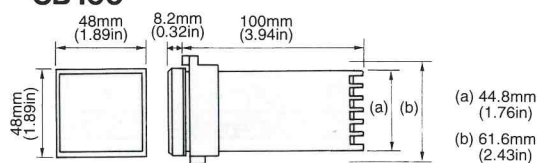
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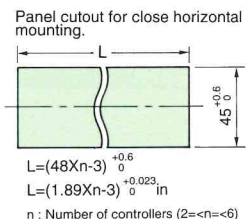
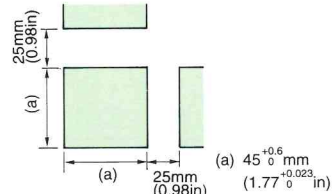
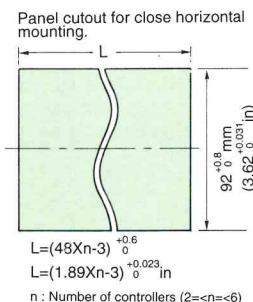
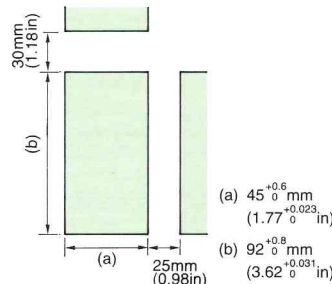
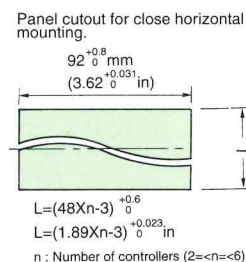
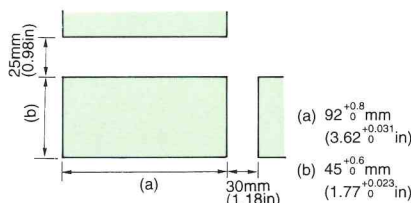
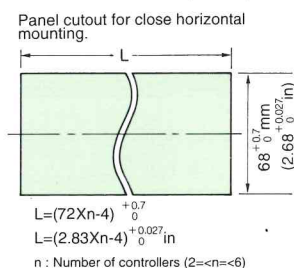
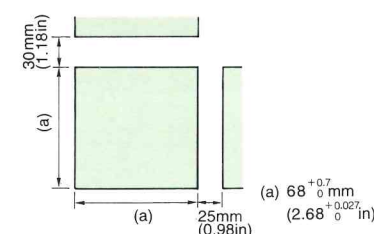
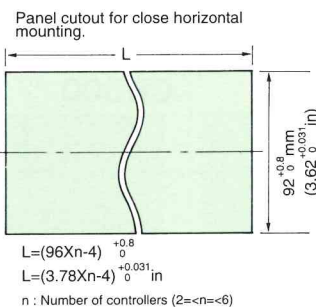
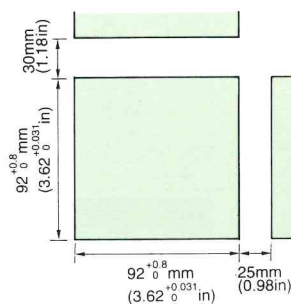
CB400



CB100



Panel cutouts



- Before operating this product, read the instruction manual carefully to aid proper operation.
- This product is intended for use with industrial machines, test and measuring equipment. It is not designed for use with medical equipment.
- Do not install this product in the following locations :
 - Where ambient temperature is lower than 0°C or higher than 50°C.

- Where dew is formed. Ambient humidity should not be lower than 45% or higher than 85% RH.
- Where water, oil, chemicals splashes directly on the product.
- Where inductive interference, static, electricity, magnetism or noise is generated.
- Where corrosive or flammable gas generated.

Subject to change without notice due to design changes.

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