CB103
CB403
CB903

General Description

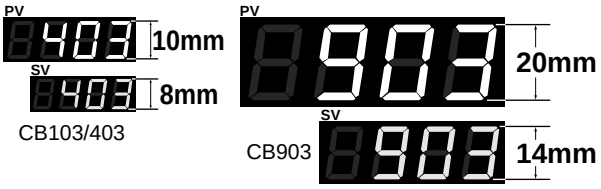
The new CB103/403/903 controllers have been added to the CB series to provide specific features for RUN/STOP and 2 set points, analog retransmission output and additional alarm configuration.

Features

- ☆ Clear and easy-to-read large LED
- ☆ Digital contact input/output
- ☆ Analog output
- ☆ Three alarm flexibility, including HBA and LBA
- ☆ RKC self-tuning
- ☆ 2 set points (Change by DI)
- ☆ Waterproof and dustproof protection

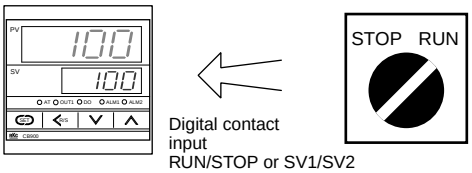
Clear and easy-to-read large LED

It has a very clear and easy-to-read large LED display.



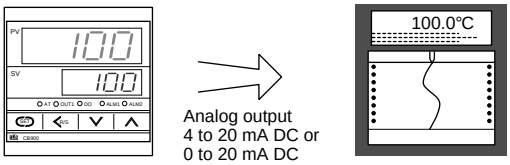
Digital contact input/output (Optional)

These controllers can switch RUN/STOP or SV1/SV2 by contact input. It can also output RUN/STOP status by contact output.



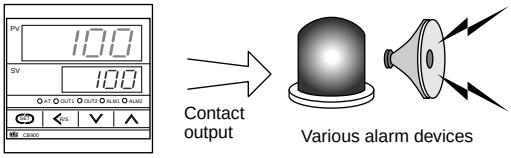
Analog output (Optional)

An analog output is available so that the process value can be retransmitted as an analog current signal (4 to 20 mA or 0 to 20 mA) to a remote instrument such as a recorder or data-logging equipment.



Three alarm flexibility (Optional)

The CB series provides a wide selection of alarm types to configure up to three alarm contacts. A third contact output is available for either temperature alarm function or RUN/STOP status output.



CB series feature comparison

Comparison table of functions

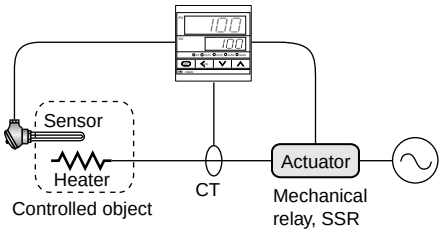
Functions	Series	CB series CB100/400/500/700/900	CB series CB103/403/903
Alarms (2 points) (Select two)	Temperature	☆	☆
	Heater break	☆	☆
	Control loop break	☆	☆
Aux. output (1 point) (Select one)	Temperature alarm	—	☆
	Analog output	—	☆
	RUN/STOP status output	—	☆
Contact input (Select one)	RUN/STOP switching	—	☆
	SV1/SV2 switching	—	☆
Heat/Cool control		☆	—
Communications		☆	—
Water and dust proof protection		☆	☆

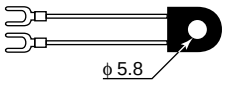
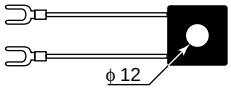
☆: Selectable — : Not selectable

Features

Heater break alarm (HBA) (Optional)

The HBA detects a fault in heating or cooling circuit.
If the measured value becomes lower than the preset value, the alarm is generated.
The HBA function requires a current detector for measuring load current.



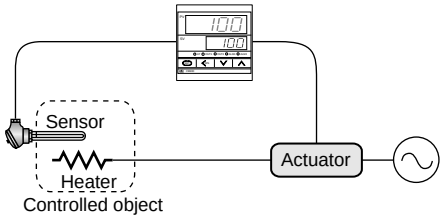
CTL-6-P-N (0 to 30A)	CTL-12-S56-10L-N (0 to 100A)
Length of lead wire : Approx. 130mm (standard)	Length of lead wire : Approx. 100mm (standard)
	

Loop break alarm (LBA) (Optional)

The control loop break alarm (LBA) monitors and protects an entire temperature control system. The LBA detects heater breaks, thermocouple or RTD failures, short circuits, or the failure of an operating device such as a mechanical or solid state relay.

When the PID computed value reaches 100% and the temperature does not respond in a set time, the loop break alarm is activated. Conversely, when the PID value reaches 0% and the temperature does not respond accordingly, the loop break alarm is turned on.

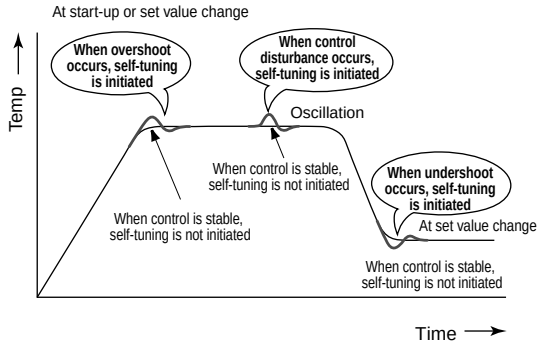
*The above examples are for reverse action.
For direct action. the LBA action becomes reversed.
*LBA deadband is available to suppress the influence by external disturbances.



RKC self-tuning
Advanced algorithm for optimum control

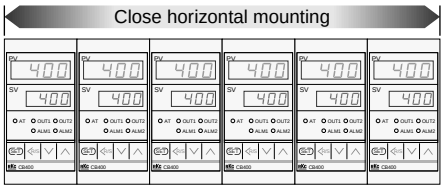
RKC self-tuning offers the most advanced algorithm for precise temperature control. Self-tuning is initiated at start-up and when process parameters or conditions change. At these times, new PID parameters are calculated for the best control performance. With the unique RKC self-tuning, the controller evaluates whether PID parameters should be maintained or replaced, selecting the best setting for the controlled process. If it is determined that the existing PID parameters can achieve the best control for the process, the present PID parameters will be retained and the new PID parameters will be canceled. Self-tuning can be turned on/off in parameter setting mode. Self-tuning is not available with heat/cool control.

In addition to self-tuning, the controller also has autotuning (AT) so that either function can be selected for optimum process control.



Close horizontal mounting

The mounting bracket has been designed to allow close horizontal mounting to save valuable panel space.



Watertproof and dustrproof protection (Optional)

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

Specifications

Input

Input
a) Thermocouple : K, J, R, S, B, E, T, N (JIS/IEC), PLII (NBS)
W5Re/W26Re (ASTM), U, L (DIN)
• Influence of external resistance : Approx. 0.2μV/Ω
• Input break action : Up-scale
b) RTD : Pt100 (JIS/IEC), JPt100 (JIS)
• Influence of input lead resistance : Approx. 0.01[%/Ω] of reading
• Maximum 10Ω per wire
• Input break action : Up-scale
c) DC voltage : 0 to 5V, 1 to 5V (0.0 to 100.0% (Default value))
• Input break action : Down scale
d) DC current : 0 to 20mA, 4 to 20mA (0.0 to 100.0% (Default value))
• For DC current input, connect a 250 Ω resister to the input terminals.
• Input break action : Down-scale

Sampling time
0.5 sec

PV bias
Temperature input : -1999 (-199.9) to 9999 (999.9)℃ [℉]
DC voltage, DC current : - span to +span

Performance

Measuring accuracy
a) Thermocouple
±(0.3% of reading + 1 digit) or ±2℃ (4℉) whichever is larger
• Accuracy is not guaranteed between 0 and 399℃ (0 and 749℉) for type R, S and B.
• Accuracy is not guaranteed between -199.9 and -100.0℃ (-199.9 and -158.0℉) for type T and U.
b) RTD
±(0.3% of reading + 1 digit) or ±0.8℃ (1.6℉) whichever is larger
c) DC voltage and DC current
±(0.3% of span + 1 digit)

Insulation resistance
More than 20MΩ (500V DC) between measured terminals and ground
More than 20MΩ (500V DC) between power terminals and ground

Dielectric strength
1000V AC for one minute between measured terminals and ground
1500V AC for one minute between power terminals and ground

Control

Control method
a) PID control (with autotuning and self-tuning function)
• Available for reverse and direct action. (Specify when ordering.)

Major setting range

Set value :	Same as input range.
Proportional band :	1 to span or 0.1 to span (Temperature input) When 0.1℃ (℉) resolution, within 999.9℃ (℉) or 0.1 to 100.0% of span (voltage, current input) (ON/OFF action when P=0)
*Differential gap at ON/OFF action is 2℃ (℉).	
Integral time :	0 to 3600sec.(P + D action when I=0)
Derivative time :	0 to 3600sec.(P + I action when D=0)
Anti-Reset Windup(ARW) :	1 to 100% of proportional band
Proportional cycle time :	1 to 100 sec.

Control output

Relay output :	Form A contact, 250V AC 3A (resistive load)
Voltage pulse output :	0/12V DC (Load resistance : More than 600Ω)
Current output :	4 to 20mA DC (Load resistance : Less than 600Ω)
Triac trigger output :	Zero-corss method for medium capacity triac drive (less than 100A)
Triac output :	Rating : 0.5A (An ambient temperature is less than 40℃)

Waterproof and dustproof (Optional)

CB103 : IP66
CB403/903 : IP65
• 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 mounted.

Alarm (Up to 2 points) (Optional)

Temperature alarm

a) Type :	Deviation High, Low, High/Low, Band, Process High, Low, Set value High, Low
b) Differential gap :	2℃ (℉) or 2.0℃ (℉) (Temperature input) 0.2% (Voltage, current input)

Heater break alarm (For single phase)

a) CT type :	CTL-6-P-N(30A), CTL-12-S56-10L-N(100A)
b) Display range :	0.0 to 100.0A
c) Accuracy :	± 5% of input value or ± 2A (whichever is larger)

• Output from alarm 2 terminal.

Control loop break alarm (LBA)

a) LBA time setting :	0.1 to 200.0 min.
b) LBA deadband :	0 to 9999 ℃[℉] or 100% of span (OFF by setting zero)

Alarm output
Relay output, Form A contact 250V AC 1A (resistive load)

Auxiliary output (Up to 1 point) (Optional)

Temperature alarm

a) Type :	Deviation High, Low, High/Low, Band, Process High, Low
b) Differential gap :	2℃ (℉) or 2.0℃ (℉) (Temperature input) 0.2% (Voltage, current input)
c) Alarm output :	Relay output, Form A contact 250V AC 3A (resistive load)

Analog output

a) Type :	Process value, Set value, Deviation, Manipulation value
b) Output type :	DC current : 0 to 20mA, 4 to 20mA (Load resistance : Less than 600Ω)
c) Accuracy :	± 0.3% of span (Output ripple : ± 0.1% of span)
d) Output resolution :	More than 10bits

RUN/STOP status output

a) Status :	RUN : Close STOP : Open
b) Output :	Relay output, Form A contact 250V AC 3A (resistive load)

Contact input (Optional)

Number of input : 1 point

Contact input type
a) RUN/STOP switching (OPEN : STOP, CLOSE : RUN)
b) STEP function (OPEN : SV1, CLOSE : SV2)

Input rating
Non-voltage contact input (OPEN : 500kΩ or more, CLOSE : 10Ω or less)

General specifications

Supply voltage
a) 85 to 264V AC (Including supply voltage variation)
[Rating : 100 to 240V AC] (50/60Hz common)
b) 21.6 to 26.4V AC (Including supply voltage variation)
[Rating : 24V AC] (50/60Hz common)
c) 21.6 to 26.4V DC (Ripple rate 10% p-p or less) [Rating : 24V DC]

Power consumption
Less than 10VA for standard AC type
Less than 5VA for 24V AC type
Less than 160mA for 24V DC type

Effect by power failure
A power failure of 20ms or less will not affect the control action.
If power failure of more than 20ms occurs, controller will restart.

Operating environments : 0 to 50℃ [32 to 122℉] , 45 to 85% RH

Memory backup : Backed up by non-volatile memory.

Net weight
CB103 : Approx. 170g, CB403 : Approx. 250g, CB903 : Approx. 340g

External Dimensions (W x H x D)
CB103 : 48 x 48 x 100mm, CB403 : 48 x 96 x 100mm
CB903 : 96 x 96 x 100mm

Compliance with standards

• CE marked
• UL recognized
• CSA certified

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

Model and Suffix Code

Specifications	Model and Suffix Code
Size	CB103 (1/16 DIN size) CB403 (1/8 DIN Vertical size) CB903 (1/4 DIN size)
Control method	PID control with AT (reverse action) F PID control with AT (direct action) D
Input type	See range and input code table
Range	See range and input code table
Control output	Relay output M Voltage pulse V DC current : 4 to 20mA 8 Triac trigger G Triac output T
Alarm 1	No alarm N See alarm code
Alarm 2	No alarm N See alarm code
Auxiliary output *1	No auxiliary output N See alarm code (Code : A to L) RUN/STOP status output Y Analog output : 0 to 20mA 7 Analog output : 4 to 20mA 8
Contact output (DI)	Not supplied N STEP function (Select SV1/SV2) 1 RUN/STOP transfer 2
Waterproof and dustproof	Not supplied N Waterproof and dustproof protection 1
Body color	Black A White N
Instrument version	Version symbol Y

*1: The auxiliary output is not available for the triac trigger output.

Range and input code table

Thermocouple

Input	Code	Range
K	01	0 – 200℃
	02	0 – 400℃
	03	0 – 600℃
	04	0 – 800℃
	05	0 – 1000℃
	06	0 – 1200℃
	07	0 – 1372℃
	13	0 – 100℃
	14	0 – 300℃
	20	0 – 500℃
	A1	0 – 800℉
	A2	0 – 1600℉
	A3	0 – 2502℉
	A9	20 – 70℉
J	01	0 – 200℃
	02	0 – 400℃
	03	0 – 600℃
	04	0 – 800℃
	05	0 – 1000℃
	06	0 – 1200℃
	A1	0 – 800℉
	A2	0 – 1600℉
	A3	0 – 2192℉
	A6	0 – 400℉
R	01	0 – 1600℃
	02	0 – 1769℃
	04	0 – 1350℃
	A1	0 – 3200℉
	A2	0 – 3216℉
S	01	0 – 1600℃
	02	0 – 1769℃
	A1	0 – 3200℉
	A2	0 – 3216℉
B	01	400 – 1800℃
	02	0 – 1820℃
	A1	800 – 3200℉
	A2	0 – 3308℉

Input	Code	Range
E	01	0 – 800℃
	02	0 – 1000℃
	A1	0 – 1600℉
	A2	0 – 1832℉
N	01	0 – 1200℃
	02	0 – 1300℃
	A1	0 – 2300℉
	A2	0 – 2372℉
T	01	-199.9 – 400.0℃
	02	-199.9 – 100.0℃
	03	-100.0 – 200.0℃
	04	0.0 – 350.0℃
	A1	-199.9 – 752.0℉
	A2	-100.0 – 200.0℉
	A3	-100.0 – 400.0℉
	A4	0.0 – 450.0℉
	A5	0.0 – 752.0℉
W5Re /W26Re	01	0 – 2000℃
	02	0 – 2320℃
	A1	0 – 4000℉
PL II	01	0 – 1300℃
	02	0 – 1390℃
	03	0 – 1200℃
	A1	0 – 2400℉
	A2	0 – 2534℉
U	01	-199.9 – 600.0℃
	02	-199.9 – 100.0℃
	03	0.0 – 400.0℃
	A1	-199.9 – 999.9℉
	A2	-100.0 – 200.0℉
	A3	0.0 – 999.9℉
L	01	0 – 400℃
	02	0 – 800℃
	A1	0 – 800℉
	A2	0 – 1600℉

RTD

Input	Code	Range
Pt100	D 01	-199.9 – 649.0℃
	D 02	-199.9 – 200.0℃
	D 03	-100.0 – 50.0℃
	D 04	-100.0 – 100.0℃
	D 05	-100.0 – 100.0℃
	D 06	0.0 – 50.0℃
	D 07	0.0 – 100.0℃
	D 08	0.0 – 200.0℃
	D 09	0.0 – 300.0℃
	D 10	0.0 – 500.0℃
	D A1	-199.9 – 999.9℉
	D A2	-199.9 – 400.0℉
	D A3	-199.9 – 200.0℉
	D A4	-199.9 – 100.0℉
	D A5	-100.0 – 300.0℉
	D A6	0.0 – 100.0℉
	D A7	0.0 – 200.0℉
	D A8	0.0 – 400.0℉
	D A9	0.0 – 500.0℉
JPt100	P 01	-199.9 – 649.0℃
	P 02	-199.9 – 200.0℃
	P 03	-100.0 – 50.0℃
	P 04	-100.0 – 100.0℃
	P 05	-100.0 – 200.0℃
	P 06	0.0 – 50.0℃
	P 07	0.0 – 100.0℃
	P 08	0.0 – 200.0℃
	P 09	0.0 – 300.0℃
	P 10	0.0 – 500.0℃

Voltage and Current

Input	Code	Range
0 – 5V DC	4 01	0.0 – 100.0
1 – 5V DC	6 02	0.0 – 100.0
0 – 20mA DC	7 03	0.0 – 100.0
4 – 20mA DC	8 04	0.0 – 100.0

* Type R, S and B input : Accuracy is not guaranteed between 0 to 399℃ (0 to 799℉)
* Type T and U input : Accuracy is not guaranteed between -199.9 to -100.0℃ (-199.9 to -158.0℉)
* DC current input : A 250 Ω resistor is externally connected at the input terminals.

Alarm code

Code	Type
A	Deviation High
B	Deviation Low
C	Deviation High/Low
D	Band Alarm
E	Deviation High with Alarm Hold
F	Deviation Low with Alarm Hold
G	Deviation High/Low with Alarm Hold
H	Process High

Code	Type
J	Process Low
K	Process High with Alarm Hold
L	Process Low with Alarm Hold
R *1	Loop break alarm (LBA)
P *2	Heater break alarm (CTL-6-P-N [30A])
S *2	Heater break alarm (CTL-12-S56-10L-N [100A])
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 can only be assigned to Alarm 2. Heater break alarm is not available for current output.

Supply voltage

100 - 240V AC	24V AC	24V DC

Accessory

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

Shunt resistor for DC current input
KD100-55

Terminal cover
KCA100-517 (CB103) KCA400-513 (CB403)
KCA900-58 (CB903)

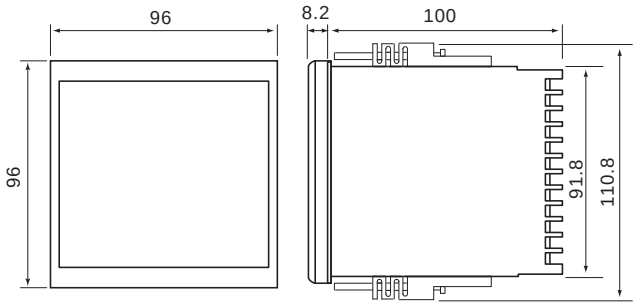
External Dimensions

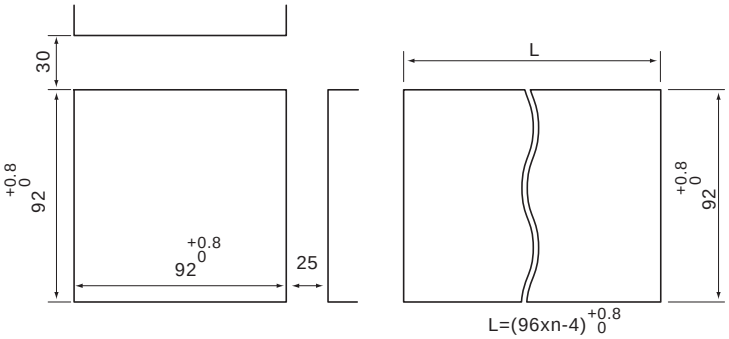
Units : mm

•External dimensions

•Panel cutouts

CB903

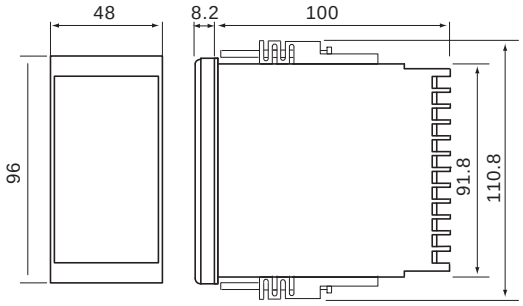


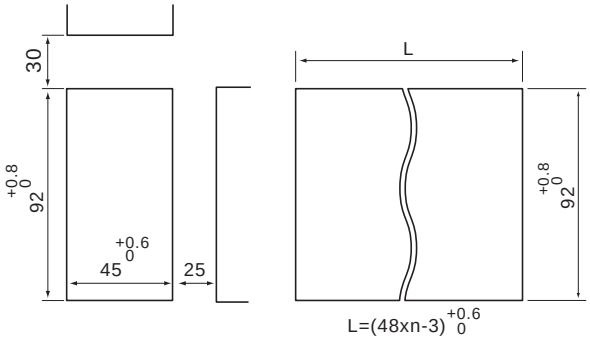


$L=(96xn-4)^{+0.8}_{0}$

n : Number of controllers (2=<n=<6)

CB403

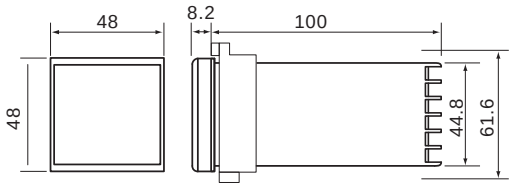


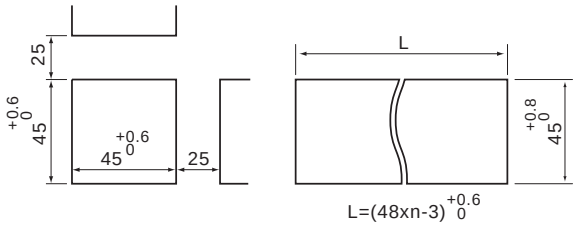


$L=(48xn-3)^{+0.6}_{0}$

n : Number of controllers (2=<n=<6)

CB103



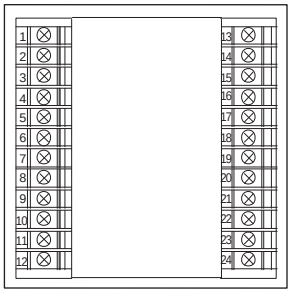


$L=(48xn-3)^{+0.6}_{0}$

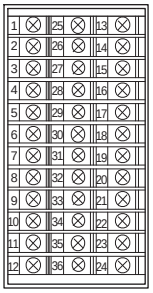
n : Number of controllers (2=<n=<6)

Rear Terminals

CB903



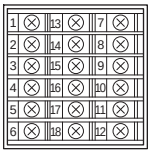
CB403



No.	Description	
1 2	AC 100 to 240V AC 24V DC+ 24V −	Power supply
3 4	(1) NO (2) + − (4) T2	Aux. output (1) Relay contact output (2) Analog output
5 6	(1) NO (2) + − (3) SSR T1 G	Control output (1) Relay contact output (2) Voltage DC/Current DC (3) Triac output (4) Triac trigger output
7 8 9	NO Alarm 2 NO Alarm 1	Alarm output Relay contact output
10 11 12	A B B + T + (1) (2) (3)	Measured input (1) Thermocouple (2) RTD (3) Voltage/Current

No.	Description	
13 14 15	− DI + DI	Contact input
16 17 18 19 20 21 22		
23 24	CT CT input for heater break alarm	Current transformer input

CB103



No.	Description	
1 2	AC 100 to 240V AC 24V DC+ 24V −	Power supply
3 4	(1) NO (2) + − (4) T2	Aux. output (1) Relay contact output (2) Analog output
5 6	(1) NO (2) + − (3) SSR T1 G	Control output (1) Relay contact output (2) Voltage DC/Current DC (3) Triac output (4) Triac trigger output
7 8 9	NO Alarm 2 NO Alarm 1	Alarm output Relay contact output
10 11 12	A B B + T + (1) (2) (3)	Measured input (1) Thermocouple (2) RTD (3) Voltage/Current

No.	Description	
13 14 15	− DI + DI	Contact input
16		
17 18	CT CT input for heater break alarm	Current transformer input