Z SERIES **MICRO CONTROLLER S**
(STANDARD TYPE, DUAL TYPE) — 48 × 96mm, 72 × 72mm, 96 × 96mm —

DATA SHEET PYW5,7,9

Micro Controller S (PYW) is a small, economical temperature contoroller containing a microprocessor, and sizing 48 x 96, 72 x 72, or 96 x 96mm according to DIN standard.

It accepts inputs from thermocouples, resistance bulbs, or voltage/current, and provides numerous control functions ranging of on-off control and PID control.
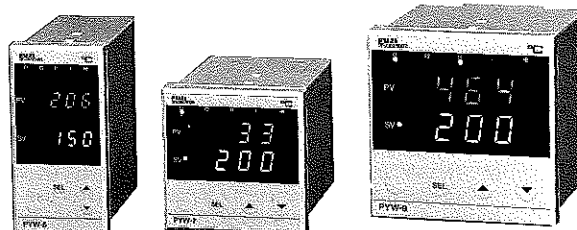
〈PYW5〉 〈PYW7〉 〈PYW9〉

FEATURES

1. **Multiple inputs, easy programmable range**
   The micro controller S accepts inputs from 7 different types of thermocouples, resistance bulb, or voltage/current, and settings and alterations can readily be made easily by user.
2. **Wide range of power supply**
   The micro controller S can be operated on AC voltage ranging from 85 to 265V.
3. **PID auto-tuning function standard equipment**
   Optimum PID parameters can be determined automatically.
4. **Heater break alarm (option)**
   A heater break alarm can be provided. When ramp SV function is used, HB alarm function is not available.
5. **Ramping SV (option)**
   SV can be changed slowly toward the destinated SV. When HB alarm function is used, ramp SV function is not available.
6. **Front panel of drip-proof design**
   Front panel is dust/drip-proof complying with IEC IP55.
7. **Compactness**
   Instrument depth only 100mm saves space.
8. **A simple design and easy operation.**

SPECIFICATIONS

1. Control functions
— Standard type —
(1) PID control: Proportional band (P): 0 to 999.9%
   Integral time (I): 0 to 9999 sec
   Derivative time (D): 0 to 3600 sec
   (2-position control at P,I,D=0, proportional control at I,D=0)
(2) PID auto-tuning
(3) Output cycle: 1 to 150 sec
   (contact; SSR drive output)
(4) Hysteresis width:
   0 to 20% (for 2-position control)

(5) Anti-reset windup zone:
   0 to 100%
(6) Ramp rate: 1 to 999 °C/min or °F/min.
   or 0.1 to 99.9 °C/min or °F/min.
   Power on start of ramping SV is possible

— Dual output type —
(1) Heating/cooling PID control
   Proportional band for heating:

$$P \times \frac{1}{2} \, (P=0 \text{ to } 999.9\%)$$

   Proportional band for cooling:

$$P \times \frac{1}{2} \times COOL \ (COOL=0.1 \text{ to } 99.9 \text{ and 2-position}$$

   action at COOL=0)
   Integration time (I): 0 to 9999 sec ⎰ ⎰for both heating⎱
   Derivative time (D): 0 to 3600 sec ⎰ ⎱and cooling   ⎰
   (2-position control for both heating and cooling at P,I,D=0, and proportional control at I,D=0)
(2) PID auto tuning:
   Only for heating
   (cooling output is OFF during auto tuning)
(3) Output cycle: 1 to 150 sec (contact and SSR drive output)
(4) Hysteresis width:
   0 to 20% for two-position action
(5) Anti-reset windup zone:
   0 to 100%
(6) Ramp rate: Same as standard type
(7) Overlap/dead band:
   ±50% of proportional band for heating

Fuji Electric Co., Ltd.

EDS11-223b
Date | Jul. 31, 1994

2. Input
(1) PV input signal:

Type	Input		Remarks
I	Thermocouple input	J K R S T N (Nichrosil-Nisil) PL-II (Platinel)	• Reference junction compensating function built in • Burnout circuit built in • Influence of external wiring resistance is approx. 0.5µV/Ω
	Resistance bulb input	Pt100 (IEC)	• Burnout circuit built in • Influence of external wiring resistance is 0.015%/Ω (per wire) of reading
II	Voltage input	1 to 5V DC	Input resistance, 400kΩ
	Current input	4 to 20mA DC	Input resistance, 250Ω

Remarks: (1) Selection of thermocouple and resistance bulb for type I is done with internal selector pins.
(2) Resistor of 250Ω will be provided for 4 to 20mA DC input of type II, so connect it to the input terminals for use.
(3) For changeover from 4 to 20mA DC to 1 to 5V DC, detach the 250Ω resistor.

(2) Input range   ( ): Decimal point acceptable range

Input	Range [°C]	Range [°F]
Pt100 (IEC)	0 to 50, ... 400 (0.0 to 100.0, ... 300.0) −150, ...−100 to 50, ... 200 (−150.0 ...−100.0 to 50.0, ... 200.0)	32 to 122, ... 752 −238, ...−148 to 122, ... 392
J	0 to 200, ... 1000 (0.0 to 200.0, ... 300.0)	32 to 392, ... 1832
K	0 to 200, ... 1200 (0.0 to 200.0, ... 300.0)	32 to 392, ... 2192
R, S	0 to 1000, ... 1600	32 to 1832, ...2912
T	0 to 200, ... 400 (0.0 to 200.0, ... 300.0) −200, ...−100 to 200, ... 400 (−199.9, ...−100.0 to 200.0, ... 300.0)	32 to 392, ...752 −328, ... −148 to 392, ...752
N	0 to 200, ... 1300 (0.0 to 200.0, ... 300.0)	32 to 392, ... 2372
PL-II	0 to 200, ... 1300 (0.0 to 200.0, ... 300.0)	32 to 392, ... 2372
4 to 20mA DC	−1999 to 3000 (engineering unit value)	
1 to 5V DC	Decimal point acceptable optionary	

(3) Burnout
Control output is held at upper/lower maximum value when temperature sensor open.

3. Output
— Standard type —
Control output: One point specifiable from the following.

Current output	4 to 20mA DC	Allowable load resistance 600 Ωor less. Ripple approx. 1.5%FS*/2Hz
Contact output	SPDT contact	Electrical expect. life 220V AC, 3A, resistive load 10⁵ cycle Mechanical expect. life 10⁷ cycle
SSR driver output	Voltage	ON 18 to 34V DC/20mA max. (100V AC) /60mA max. (200V AC) OFF 0.3V max.

Note : *FS: Full scale

— Dual output type —
Control output signal:
One point specifiable from the following for both heating and cooling

Current output	4 to 20mA DC	Allowable load resistance 600Ω or less. Ripple approx. 1.5%FS/2Hz
Contact output	SPDT contact	Electrical expect. life 220V AC, 3A, resistive load 10⁵ cycle Mechanical expect. life 10⁷ cycle
SSR driver output	Voltage	ON 18 to 34V DC/20mA max. (100V AC) /60mA max. (200V AC) (Note 1) OFF 0.3V max.

Note 1: When both outputs are SSR driver output, total of both output-current should be less than 60mA (200V AC) or 20mA (100V AC)

4. Setting and indication
(1) Accuracy: ±0.5% full scale (FS) ±1 digit
±5% FS ±1 digit
(R. thermocouple 0 to 400°C)

(2) Setting method:
Key operation

(3) Indicator: Dual 4 digit 7 segment LED (red and green)

(4) Status indication:
Control output
High alarm
Low alarm
Heater break alarm

5. Alarm (option)
(1) High/low alarm:
Alarm type is programmable (Refer to Fig. 1)
Alarm output: 2 contacts

Relay contact output	Contact (N.O)	Resistive load; 220V AC, 1A

(2) Heater break alarm:
• Heater break can be detected only on single-phase heater
• Current transformer (CT)* primary input: 1 to 50A
• Output:

Relay contact output	Contact (N.O)	Resistive load; 220V AC, 1A

Heater power voltage compensating function is provided.
(This function is effective when the heater and the instrument operate with the same power source.)

Note: * Current transformer (CT) is required separately from the instrument (CT is mounted on the outside of the instrument.)

6. Power failure processing
Set values, PID parameters are retained in nonvoratile memory and restarts automatically.

7. Self-diagnosis function

8. Operating and storage conditions
(1) Ambient temperature:
-10 to +50°C
(2) Ambient humidity:
90%RH or less (no condensation is required)
(3) Storage temperature:
-20 to +60°C

9. General specifications
(1) Power supply: 85 to 265V AC
(2) Power consumption:
Approx. 10VA/100V AC, approx. 18VA/220V AC
(3) Dielectric strength:
1500V AC (1min.)
(earth to power source, earth to relay output, earth to alarm output)
500V AC (other)
(4) Insulation resistance:
50MΩ or more (500V DC)

10. Structure
(1) Mounting method:
Panel flush mounting
(2) Enclosure: Plastic housing
(3) External dimensions:
96 (H) x 96 (W) x 100 (D) mm (PYW9)
72 (H) x 72 (W) x 100 (D) mm (PYW7)
96 (H) x 48 (W) x 100 (D) mm (PYW5)
(4) Mass (weight):Approx. 400g (PYW9)
Approx. 300g (PYW7,PYW5)
(5) Finish color: Munsell 5Y 8/1 (front panel frame, case)

11. Scope of delivery
Controller, and mounting bracket
(Item to prepare separately: current detector (CT) for heater disconnection alarm)

CODE SYMBOLS

```
1 2 3 4 5 6 7 8  9 10
P Y W       1 -   V
```

	Description
	Front panel dimensions [mm]
5	48 x 96
7	72 x 72
9	96 x 96
	Input signal
T	Thermocouple [°C]
R	Thermocouple [°F]
N	Resistance bulb, Pt100, 3-wire type [°C]
S	Resistance bulb, Pt100, 3-wire type [°F]
B	4 to 20mA DC (Note 1)
	Control output 1
A	Relay contact reverse action output
B	Relay contact direct action output
C	SSR or SSC drive reverse action output
D	SSR or SSC drive direct action output
E	4 to 20mA DC reverse action output
F	4 to 20mA DC direct action output
	Control output 2 (with dual output type)
Y	None
A	Relay contact reverse action output
B	Relay contact direct action output
C	SSR or SSC drive reverse action output
D	SSR or SSC drive direct action output
E	4 to 20mA DC reverse action output
F	4 to 20mA DC direct action output
	Additional functions
0	None
1	With high/low alarm
2	With heater break alarm (Note 2)
3	With high/low alarm and heater break alarm (Note 2)
4	Ramp SV
5	Ramp SV and high/low alarm

Notes: (1) By removing 250Ω resistor, 1 to 5V DC input is available.
(2) Heater break alarm cannot be provided with current output type.

Fig. 1 Kinds of alarms:

	Function	Action
Deviation alarm	High/low alarm, (*) without low hold	AL SV AH
	High alarm	SV AH
	Low alarm without low hold	AL SV
	High/low alarm, with low hold	AL SV AH
	Low alarm, with low hold	AL SV
Absolute value alarm	High/low alarm without low hold	AL AH
	High alarm	AH
	Low alarm without low hold	AL
	High/low alarm, with low hold	AL AH
	Low alarm, with low hold	AL
	High/two high	SV AL AH
	Low/two low (without low hold)	AL AH SV

	Function		Action
Absolute value+Deviation alarm	Absolute value	Deviation	
	High alarm	Low alarm	AL SV AH
	Low alarm	High alarm	AL SV AH
	Low alarm	High alarm	AL SV AH
	High alarm	Low alarm	AL SV AH
	High alarm	High alarm	SV AL AH
Zone alarm	Low alarm	High alarm	AL AH
	Absolute value	Absolute value	AL AH
	Deviation	Absolute value	AL SV AH
	Absolute value	Deviation	AL SV AH
	Deviation	Deviation	AL SV AH

Remarks: (1) Low alarm hold is a function to turn ON the lower alarm; temperature of furnace, etc. is below the set value at ON of instrument power source. Since this phenomenon is not abnormal, the lower alarm is set in hold mode and when the temperature rises above the set value of AL and then lower again, the lower alarm is turned ON.
(2) Alarm output in the shaded area ▨▨▨ turns ON.
(3) Two high or two low alarms can be provided on request.
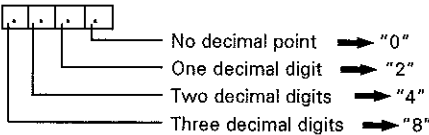(4) Alarm type at shipping is deviation high/low alarm with low alarm hold.

Parameter function

- This instrument is provided with No.1 to No. 3 block parameters. The parameters are settable with keys on the front panel in accordance with the operating conditions.
- SV indication ➡ No. 1 block parameter: Selectable by pressing the ⟨SEL⟩ key for 5 seconds (Press the ⟨SEL⟩ key for 5 seconds to return to SV indication.)
- SV indication ➡ No. 2 block parameter: Selectable by pressing the ⟨◯⟩ key for 5 seconds. (Press the ⟨◯⟩ key for 5 seconds to return to SV indication.)
- SV indication ➡ No. 3 block parameter: Selectable by pressing the ⟨◯⟩ key for 10 seconds. (Press the ⟨◯⟩ key for 5 seconds to return to SV indication.)
- By waiting for 30 seconds after key operation, the parameter indication will return to setpoint (SV) indication automatically.

No. 1 block parameter

Indication	Item	Description	
AL lamp (*1)	Low alarm	The low operating point of alarm.	Settable within input range (option)
AH lamp (*1)	High alarm	The high operating point of alarm.	
Hb lamp (*2)	Heater disconnection alarm	Sets the operating value for detecting heater disconnection (option) (Setting range. 0 to 50A) (Hb=0, alarm OFF)	
AT	Auto tuning	Used for setting P,I,D constants via auto tuning. 0: Auto tuning off (released or not executed) 1: Auto tuning on (standard type, SV) 2: Auto tuning on (low PV type, SV — 10% full scale) } See page 6	
LOC	Key lock	Specify whether or not to change the parameters set in this table. 0: All parameters changeable 1: All parameters not changeable (locked) 2: Only SV changeable	

No. 2 block parameter

Indication	Item	Description
P	Proportional band	Proportional band (P) setting when proportional control is performed (Setting range: 0.0 to 999.9% versus input range). Setting P to 0 provides the two-point (ON-OFF) control.
I	Integration time	Serves to eliminate offset (residual deviation) produced in proportional control (Setting range: 0 to 9999 sec). Setting I to 0 (zero) provides no integral operation.
D	Derivative time	Improves the stability of control by judgement from the variation of input (Setting range: 0 to 3600 sec). Setting D to 0 (zero) provides no derivative operation.
TC (*4)	Proportional cycle of control output 1	Sets the proportional cycle of control output (Setting range: 1 to 150 sec).
HYS	Hysteresis width of 2-position action	Sets the hysteresis width in 2-position action (Setting range: 0.0 to 20.0% FS).
Srr	Ramp rate	1 to 999 Engineering unit (E.U)/min 0.1 to 99.9 E.U/min when set 0 or 0.0, ramping SV is off.
TC2 (*3)(*4)	Proportional cycle of control output 2	Sets the proportional cycle of cooling control output (Setting range: 1 to 150 sec) (option).
COOL (*3)	Proportional band coefficient for cooling	Sets the proportional band for cooling (option) (Setting range: 0.1 to 99.9). ON-OFF action when 0 set.
db (*3)	Proportional band shift for cooling	Shifts the cooling output value (option) (Setting range: −50.0 to +50.0).
BAL	Output convergence value	A function to suppress overshoot, and the value is automatically set by auto tuning (Setting range: 0 to 201 (code)) (200 corresponds to 100%.)
AR	Anti-reset windup	Suppress overshoot by integral action (Setting range: 0 to 100%).
rs	Power on start of ramping SV	0: off 1: on
P-n2	Input type setting	Sets the type of input.
P-SL	Range lower limit setting	Sets the lower limit of input range.
P-SU	Range high limit setting	Sets the high limit of input range.
P-dP	Decimal point position setting	Selects the decimal point position for PV/SV indication. No decimal point ➡ "0" One decimal digit ➡ "2" Two decimal digits ➡ "4" Three decimal digits ➡ "8"
P-Ab	Alarm type setting	Sets the type of alarm action.
P-CT (*2)	Heater rated voltage setting	Set the rated power voltage for this instrument when using the heater broken-wire alarm (Setting range: 85 to 265V) (option).
PVOF	PV offset	Shifts the indication of input value (PV). Does not affect control computation (Setting range: −1999 to +2000).
SVOF	SV offset	Shifts the setpoint (SV). The SV indication doesn't change (Setting range: −1999 to +2000).
P-F	°C/°F selection for measured input	°C indication: "0" °F indication: "1"

Internal parameters are selected by ◯ key, and data is indicated by (SEL) key.
Notes: *(1) 1 is indicated when alarm is equipped.
(2) When heater break alarm is equipped.
(3) With dual output type.
(4) 0 (zero) set when current output is provided.

No. 3 block parameter

Indication	Item	Description
P-n1	Control action setting	Used for setting direct or reverse action of control output and for setting burnout.
P-dF	Input filter constant	Half of setpoint becomes time constant (sec) (Setting range: 0 to 201).
P-An (*¹)	Alarm hysteresis setting	Sets the ON-OFF hysteresis width of alarm output (Setting range: 0 to 255 Engineering unit).
P-48	—	Not to be changed
PLC1	Minimum ON pulse output	Setting range: 0 to 100 (100 corresponds to 50%)
PHC1	Minimum OFF pulse output	Setting range: 101 to 201 (200 corresponds to 100%)
PLC2 (*³)	Minimum ON pulse output for output 2	Setting range: 0 to 100 (100 corresponds to 50%)
PHC2 (*³)	Minimum OFF pulse output for output 2	Setting range: 101 to 201 (200 corresponds to 100%)
PCUT	—	Not to be changed
dSP1	Parameter skip	L alarm (1), H alarm (2), HB alarm (4)
dSP2		Sets whether or not to indicate any of parameters: P (1), I (2), D (4), TC (8), HYS (16), Srr (32), TC2 (64), COOL (128) / P (1), I (2), D (4), TC (8), HYS (16), TC2 (32), COOL (64), DB (128) . . . 9th code 2 or 3
dSP3		DB (1), BAL (2), AR (4) / BAL (1), AR (2) . . . 9th code 2 or 3

Internal parameters are selected by ⬭ key, and data is indicated by (SEL) key.

Notes: *(¹) 1 is indicated when alarm is equipped.
　　　　(²) When heater disconnection alarm is equipped.
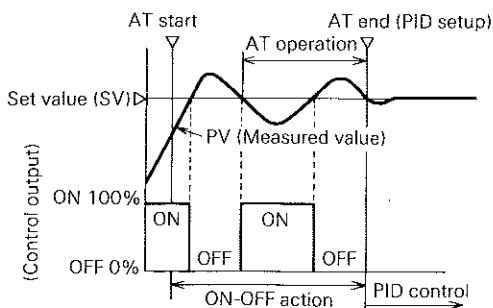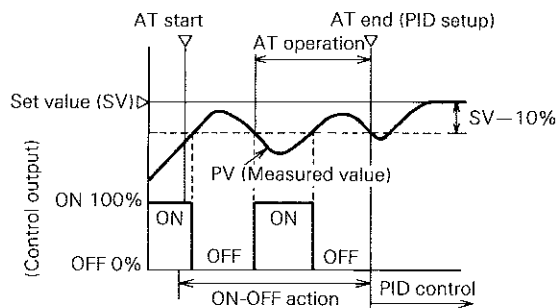　　　　(³) With dual output type.

Functions

(1) Auto tuning

PID parameters are automatically set by controller's measurement and operation function.

This instrument provides 2 types of auto tuning functions; the standard type (auto tuning, with SV used as reference) and the low SV type (auto tuning, with the value 10% below SV used as reference).

(a) Standard type

(b) Low PV type


Remarks:　(1) PID parameter which has been automatically set at the completion of auto tuning is saved even when the power is turned OFF, eliminating the need for auto tuning for succeeding operations.

　　　　　(2) During auto tuning, control output turns ON and OFF, which largely changes the value of PV depending on process. Do not use the auto tuning function if such a phenomenon is not allowed.

　　　　　(3) Do not use the auto tuning function for a process having a quick response, such as pressure control, flow control, etc.
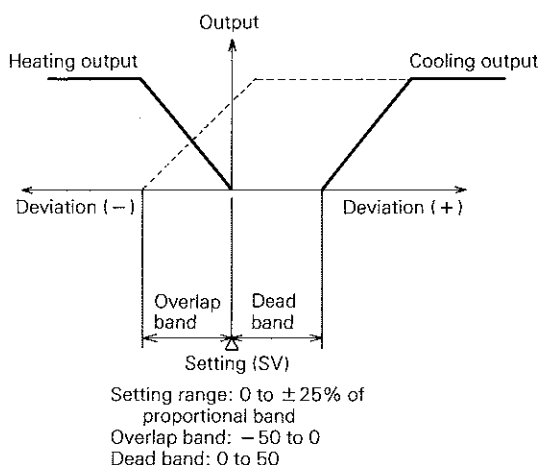
(2) Dual output (option)

The controller incorporates both the heating output and the cooling output for setting "cooling proportional cycle", "cooling proportional band" and "cooling side proportional band shift".

(a) Setting of cooling proportional band

In cooling side proportional band, coefficient is set with respect to heating side proportional band. (ON-OFF action at coefficient 0)
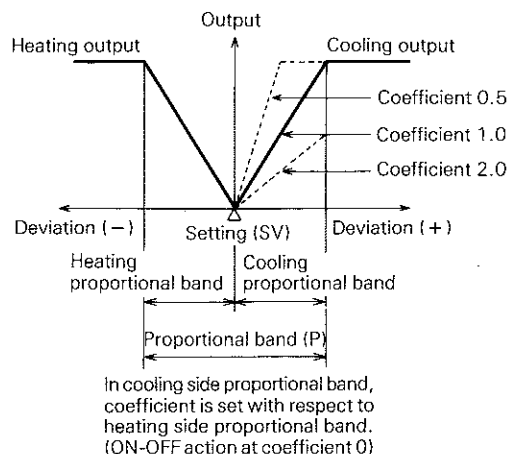
(b) Setting of cooling side proportional band shift

Setting range: 0 to ±25% of proportional band
Overlap band: −50 to 0
Dead band: 0 to 50

Remarks: (1) P,I,D auto tuning is performed only for heating. The cooling output is OFF at this time. Both heating and cooling are performed at the same P,I,D values after auto tuning.
(2) I and D settings are the same for heating and cooling. They are not settable individually.

(3) Heater break alarm (option)

- Broken-wire of heater is detected and an alarm is output immediately.
- A separately installed current detector (CT) specified by Fuji should be used.
- The "power supply voltage" and "alarm operating point" are settable by keys on the front panel.
- Detection is possible only for a single-phase heater.
- This alarm is not usable when controlling the heater by thyristor phase-angle control method.

• Example of connection of heater break alarm (PYW5, PYW9)

Power source 85 to 265V AC 50/60Hz

Electric furnace
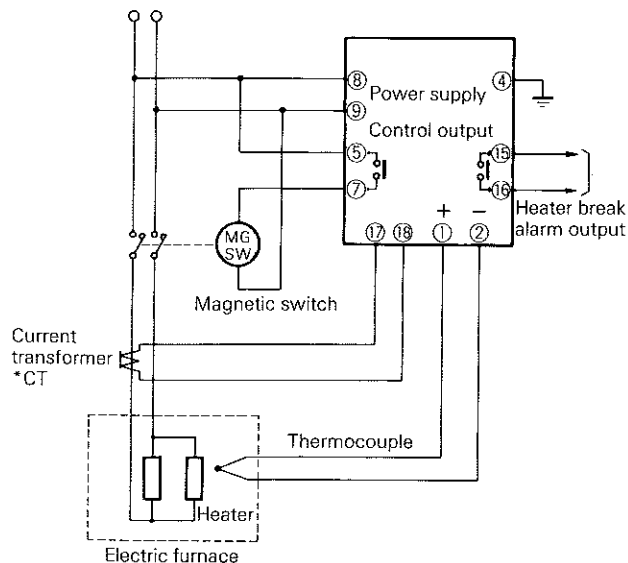
(4) Fault display

This instrument provides fault display functions.

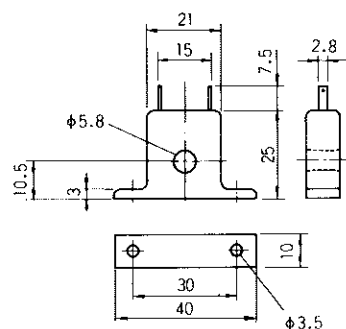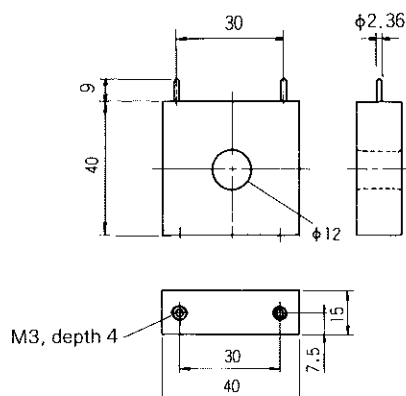| Display	Cause
⊔ ⊔ ⊔ ⊔	(1) Thermocouple sensor burnout (when burnout direction is upscale) (2) Resistance bulb sensor burnout (when burnout direction is upscale) (3) PV display value in excess of 30%FS above the max. value in measurement range
L L L L	(1) Thermocouple sensor burnout (when burnout direction is downscale) (2) Resistance bulb sensor burnout (when burnout direction is downscale) (3) Resistance bulb sensor short-circuit (4) PV display value declined 30%FS below the min. value in measurement range

7

OUTLINE DIAGRAM (Unit: mm)

Type	External dimensions	Panel cutout
PYW5	
Mounting of 1 unit / Mounting of "n" units (2 ≦ n ≦ 6)

Quantity	2	3	4	5	6
a	93	141	189	237	285

Note: For close mounting of instruments with 200V system power source, it is recommended to install a fan for dissipating heat. |
| PYW7 | | |
| PYW9 | | |

Option device

Heater break alarm current transformer (CT)

- Rating: 20 to 50A
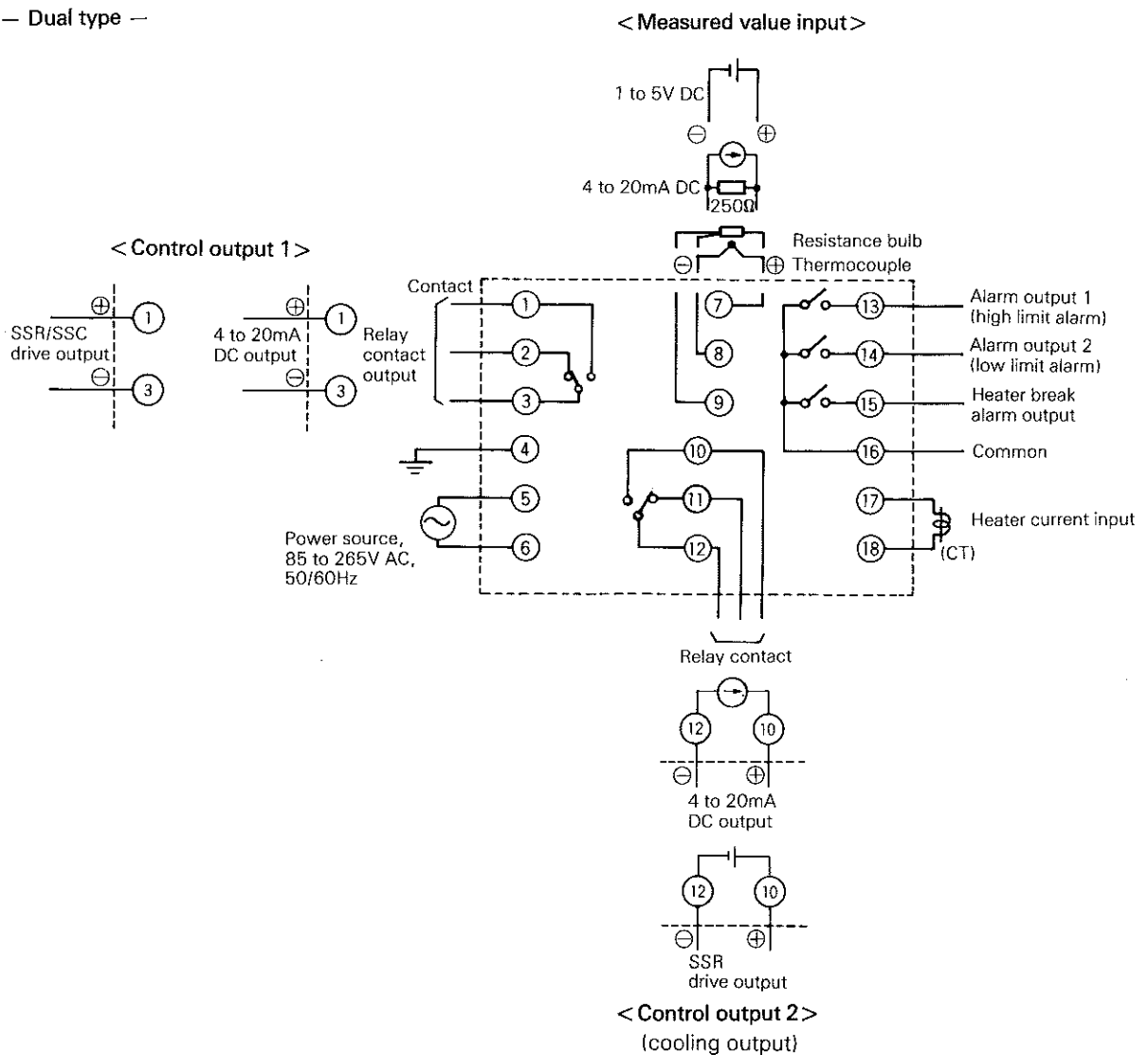- Type: CTL-12-S36-8F

- Rating: 1 to 30A
- Type: CTL-6-SF

CONNECTION DIAGRAM

PYW7

— Standard type —

< Measured value input >

1 to 5V DC

4 to 20mA DC 250Ω

Resistance bulb
⊖ ⊕ Thermocouple

< Control output 1 >

SSR/SSC
drive output
⊕ — ①
⊖ — ③

4 to 20mA
DC output
⊕ — ①
⊖ — ③

Relay
contact
output

Contact

① ② ③ ④
⑤ ⑥

⑦ ⑧ ⑨
⑩ ⑪ ⑫

⑬ Alarm output 1 (high limit alarm)
⑭ Alarm output 2 (low limit alarm)
⑮ Heater break alarm output
⑯ Common
⑰ ⑱ Heater current input (CT)

Power source,
85 to 265V AC,
50/60Hz

— Dual type —

< Measured value input >

1 to 5V DC

4 to 20mA DC 250Ω

Resistance bulb
⊖ ⊕ Thermocouple

< Control output 1 >

SSR/SSC
drive output
⊕ — ①
⊖ — ③

4 to 20mA
DC output
⊕ — ①
⊖ — ③

Relay
contact
output

Contact

① ② ③ ④
⑤ ⑥

⑦ ⑧ ⑨
⑩ ⑪ ⑫

⑬ Alarm output 1 (high limit alarm)
⑭ Alarm output 2 (low limit alarm)
⑮ Heater break alarm output
⑯ Common
⑰ ⑱ Heater current input (CT)

Power source,
85 to 265V AC,
50/60Hz

Relay contact

⑫ ⑩
⊖ ⊕
4 to 20mA
DC output

⑫ ⑩
⊖ ⊕
SSR
drive output
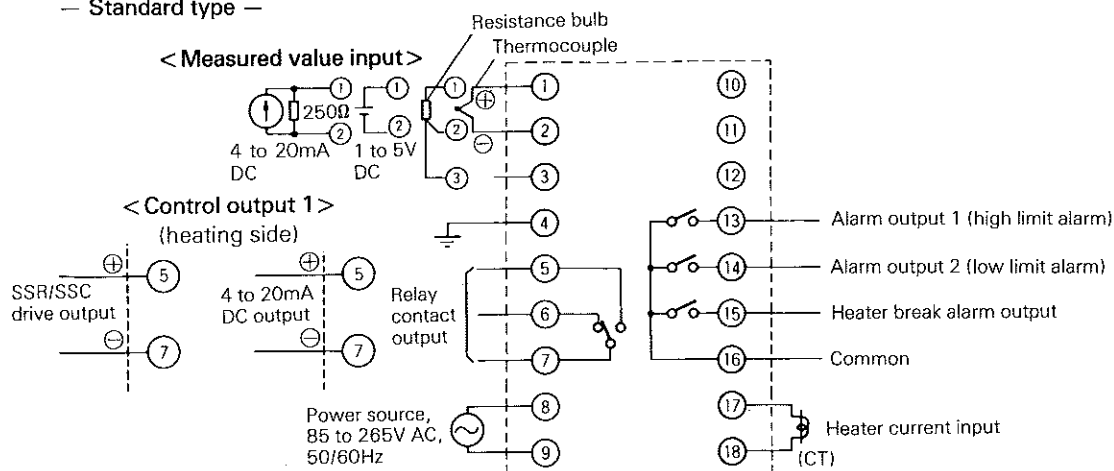
< Control output 2 >
(cooling output)

Remark: SSR drive output and 4 to 20mA DC output are not electrically isolated
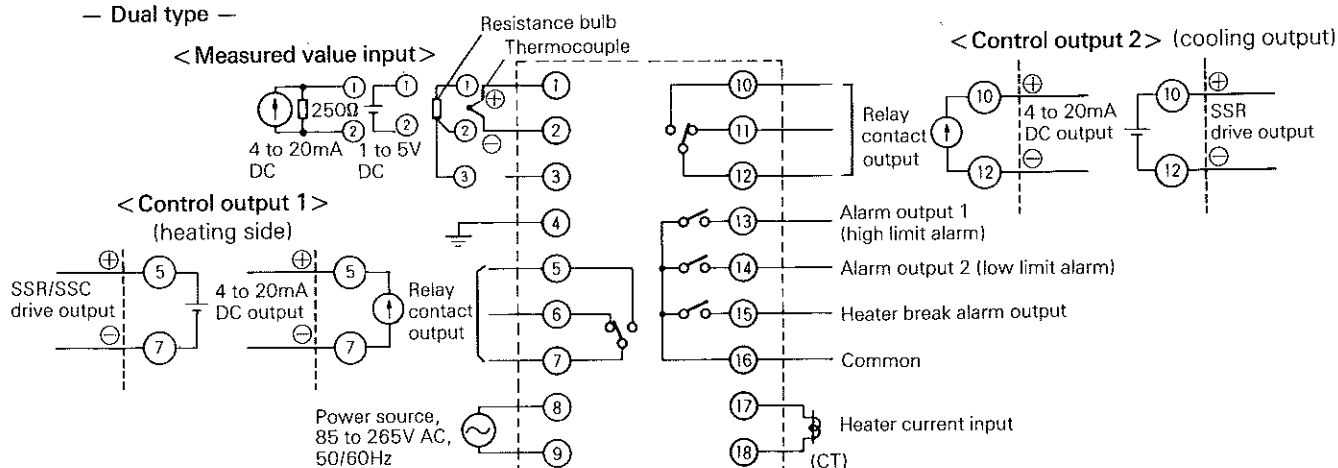from the internal circuit. Be sure to use non-grounded type sensor.

PYW5　**PYW9**

— Standard type —

<Measured value input>

Resistance bulb
Thermocouple

4 to 20mA DC 　 1 to 5V DC

<Control output 1>
(heating side)

SSR/SSC drive output

4 to 20mA DC output

Relay contact output

Power source, 85 to 265V AC, 50/60Hz

Alarm output 1 (high limit alarm)
Alarm output 2 (low limit alarm)
Heater break alarm output
Common
Heater current input (CT)

— Dual type —

Resistance bulb
Thermocouple

<Measured value input>

<Control output 2> (cooling output)

4 to 20mA DC 　 1 to 5V DC

Relay contact output

4 to 20mA DC output

SSR drive output

<Control output 1>
(heating side)

SSR/SSC drive output

4 to 20mA DC output

Relay contact output

Alarm output 1 (high limit alarm)
Alarm output 2 (low limit alarm)
Heater break alarm output
Common

Power source, 85 to 265V AC, 50/60Hz

Heater current input (CT)

The above terminals Nos. ① to ⑱ are for the terminals provided in two rows at the center of the case rear. (in case of PYW9)

Remark: SSR drive output and 4 to 20mA DC output are not electrically isolated from the internal circuit. Be sure to use non-grounded type sensor.

Fuji Electric Co.,Ltd.