

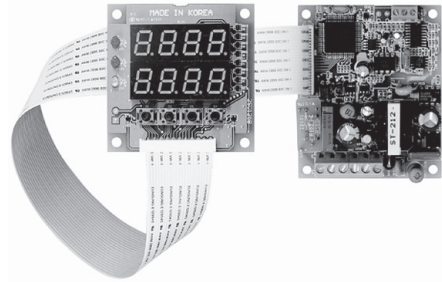
# TB42 Series

## Board Type, Dual PID Control Temperature Controller

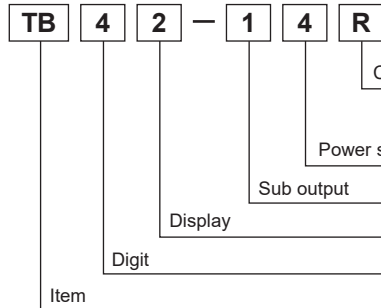
### ■ Features

- High quality and economical product
- Convenient organization of panel to use
- Dual PID control
- Time reservation

**⚠ Please read "Safety Considerations" in operation manual before using.**



### ■ Ordering Information



|    |   |
|----|---|
| R  | Relay output                                    |
| S  | SSR drive output                                |
| C  | Current output (DC4-20mA)                       |
| N  | PV Transmission output (DC4-20mA) <sup>※1</sup> |
| 4  | 100-240VAC 50/60Hz                              |
| 1  | Event 1 output type                             |
| 2  | 2 Display                                       |
| 4  | 9999 (4-digit)                                  |
| TB | Temperature Controller Board                    |

※1: PV transmission output type does not have Event 1 output.

### ■ Specifications

| Model                   | TB42-14R  | TB42-14S   | TB42-14C            | TB42-14N                  |
|-------------------------|---|--|---------------------|---------------------------|
| Power supply            | 100-240VAC~ 50/60Hz   |  |                     |                           |
| Allowable voltage range | 90 to 110 of rated voltage  |  |                     |                           |
| Power consumption       | Max. 5VA  |  |                     |                           |
| Display method          | 7-segment (PV: green, SV: red) LED method   |  |                     |                           |
| Character size (W×H)    | 8×10mm  |  |                     |                           |
| Input type              | RTD   | DPT100Ω, JPt100Ω [Allowable line resistance is max. 5Ω per a wire]                 |                     |                           |
|                         | Thermocouple  | K(CA), J(IC) [Tolerance outer resistance is max. 100Ω]                             |                     |                           |
| Control output          | Relay   | 250VAC~ 3A, 12VDC= 3A, 1a  | —                   | —                         |
|                         | SSR   | —  | 12VDC=±3V 30mA Max. | —                         |
|                         | Current   | —  | —                   | DC4-20mA (max. load 600Ω) |
|                         | Transmission  | —  | —                   | DC4-20mA (Max. load 600Ω) |
| Sub output              | • Event 1 output: Relay output (250VAC~ 0.5A 1a) • Event 2 output: OK monitoring display by LED |  |                     |                           |
| Control method          | ON/OFF control, P, PI, PD, PIDF, PIDS control   |  |                     |                           |
| Setting type            | Front push buttons  |  |                     |                           |
| Display accuracy        | F.S ± 0.3% or 3°C, select the higher one  |  |                     |                           |
| Hysteresis              | 1 to 100°C (0.1 to 100.0°C) variable (at ON/OFF control)  |  |                     |                           |
| Proportional band (P)   | 0.0 to 100.0%   |  |                     |                           |
| Integral time (I)       | 0 to 3600 sec   |  |                     |                           |
| Derivative time (D)     | 0 to 3600 sec   |  |                     |                           |
| Control cycle (T)       | 1 to 120 sec  |  |                     |                           |
| Sampling period         | 0.5 sec   |  |                     |                           |
| Dielectric strength     | 2,000VAC 50/60Hz for 1 minute (Between input and power terminal)                                |  |                     |                           |
| Vibration               | 0.75mm amplitude at frequency of 10 to 55Hz (for 1 min) in each X, Y, Z direction for 2 hours   |  |                     |                           |
| Relay life cycle        | Main output   | Mechanical: Min. 10,000,000, Electrical: Min. 100,000 (250VAC 3A resistive load)   |                     |                           |
|                         | Sub output  | Mechanical: Min. 20,000,000, Electrical: Min. 200,000 (250VAC 0.5A resistive load) |                     |                           |
| Insulation resistance   | Over 100MΩ (at 500VDC megger)   |  |                     |                           |
| Noise immunity          | ±2kV the square wave noise (pulse width: 1μs) by the noise simulator                            |  |                     |                           |
| Memory retention        | Approx. 10 years (when using non-volatile semiconductor memory type)                            |  |                     |                           |
| Environment             | Ambient temperature   | -10 to 50°C, storage: -20 to 60°C  |                     |                           |
|                         | Ambient humidity  | 35 to 85%RH, storage: 35 to 85%RH  |                     |                           |
| Approval                | cULus   |  |                     |                           |
| Unit weight             | Approx. 113.5g  |  |                     |                           |

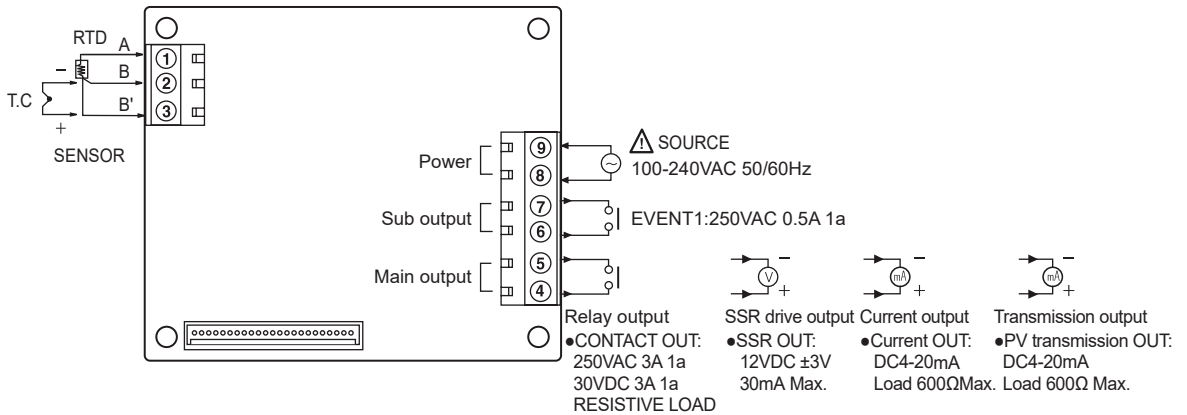
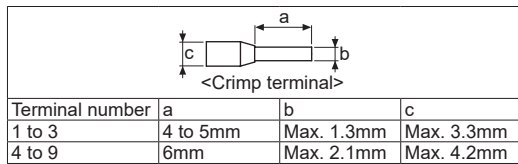
※Environment resistance is rated at no freezing or condensation.

# Board Type, Dual PID Control

## ■ Connections

※RTD: DPT100Ω, JPT100Ω (3-wire type) ※Thermocouple: K(CA), J(IC)

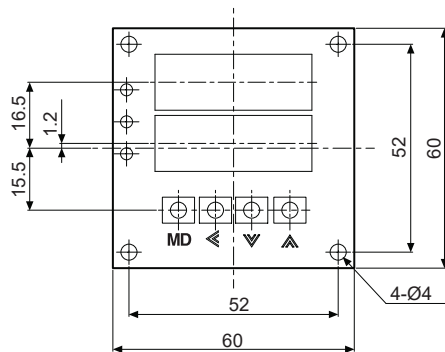
※Use crimp terminals of size specified below.



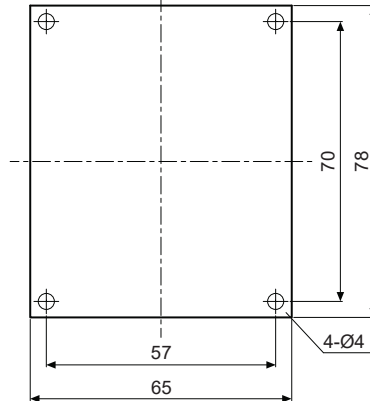
## ■ Dimensions

(unit: mm)

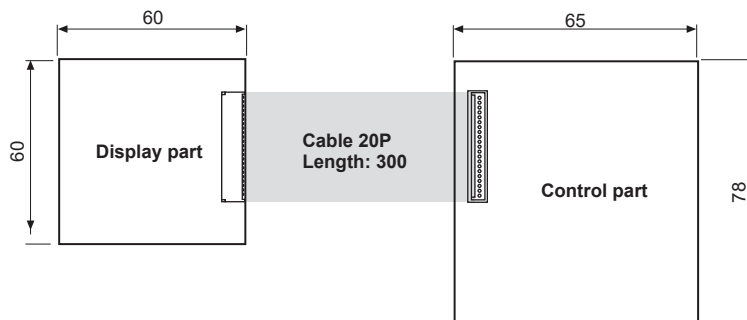
### ● Display part



### ● Control part



### ● Layout



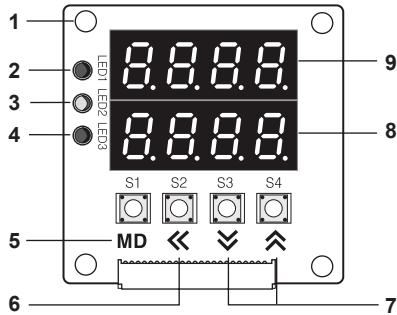
※Cable length is 300mm.

※The size of board is based on user's application. (customizable)

- (A) Photoelectric Sensors
- (B) Fiber Optic Sensors
- (C) Door/Area Sensors
- (D) Proximity Sensors
- (E) Pressure Sensors
- (F) Rotary Encoders
- (G) Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets
- (H) Temperature Controllers
- (I) SSRs / Power Controllers
- (J) Counters
- (K) Timers
- (L) Panel Meters
- (M) Tacho / Speed / Pulse Meters
- (N) Display Units
- (O) Sensor Controllers
- (P) Switching Mode Power Supplies
- (Q) Stepper Motors & Drivers & Controllers
- (R) Graphic/ Logic Panels
- (S) Field Network Devices
- (T) Software

# TB42 Series

## ■ Unit Description



### 1. Mounting hole (Ø4.0mm)

### 2. Main output operation display LED (LED 1)

It indicates the operation status of control output and displayed on "LED 1".  
But when it is current output or retransmission output "LED 1" does not operate. (LED indication is OFF)

### 3. Event 1 output operation display LED (LED 2)

It indicates the operating status of alarm output and displayed on "LED 2".

### 4. O.K monitor operation display LED (LED 3)

It indicates the operating status of alarm output and displayed on "LED 3".  
After setting alarm output in Event 2, if execute Auto-tuning, O.K monitor operation will be displayed after AT function.  
(it flashes during AT function, and turns OFF after completing AT function)

### 5. Mode key (S1)

It is used to enter into every parameter group or move to other parameters. It is "S1" on this PCB.

### 6. Shift key (S2)

It is used when change the setting value or move to digit at the parameter. It is "S2" on this PCB.

### 7. Up / Down key (S3/S4)

It is used when change the setting value or select setting function.  
Up key is "S4" and Down key is "S3" on this PCB.

### 8. SV display part

The setting temperature is displayed in red LED.  
But when timer function is used, the setting time will be displayed at  $t - 50$ .  
If time function is OFF, it will return to the setting temperature.

### 9. PV display part

It displays measured temperature in green LED.

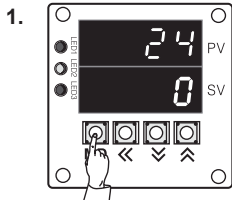
## ■ Input Type and Range

| Input sensor |       | Display                                  | Temperature range (°C) | Temperature range (°F) |
|--------------|-------|--|------------------------|------------------------|
| Thermocouple | K(CA) | $\text{E } \square \text{ R}$            | -100 to 1300           | -148 to 2372           |
|              | J(IC) | $\text{J } \text{I } \square$            | 0 to 800               | 32 to 1472             |
| RTD          | JPt H | $\text{J } \text{P } \text{E } \text{H}$ | 0 to 500               | 32 to 932              |
|              | JPt L | $\text{J } \text{P } \text{E } \text{L}$ | -199.9 to 199.9        | -199.9 to 392.0        |
|              | DPt H | $\text{P } \text{E } \text{H}$           | 0 to 500               | 32 to 932              |
|              | DPt L | $\text{P } \text{E } \text{L}$           | -199.9 to 199.9        | -199.9 to 392.0        |

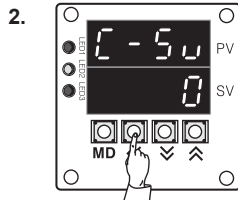
# Board Type, Dual PID Control

## SV Setting

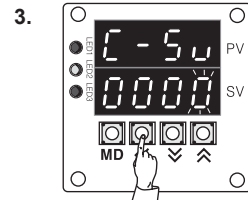
Example of setting 100°C



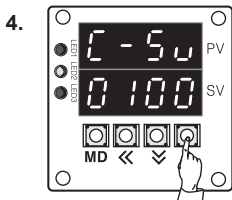
When PV and SV are displayed, press the MD key (S1).



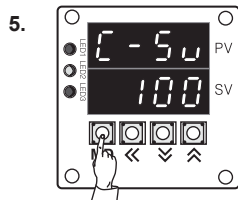
E-5u is displayed in the PV display part, 0 is displayed in the SV display part. Press the left arrow key (S2).



10<sup>0</sup> digit flashes in the SV display part. Move the digit by pressing the right arrow key (S2) twice.



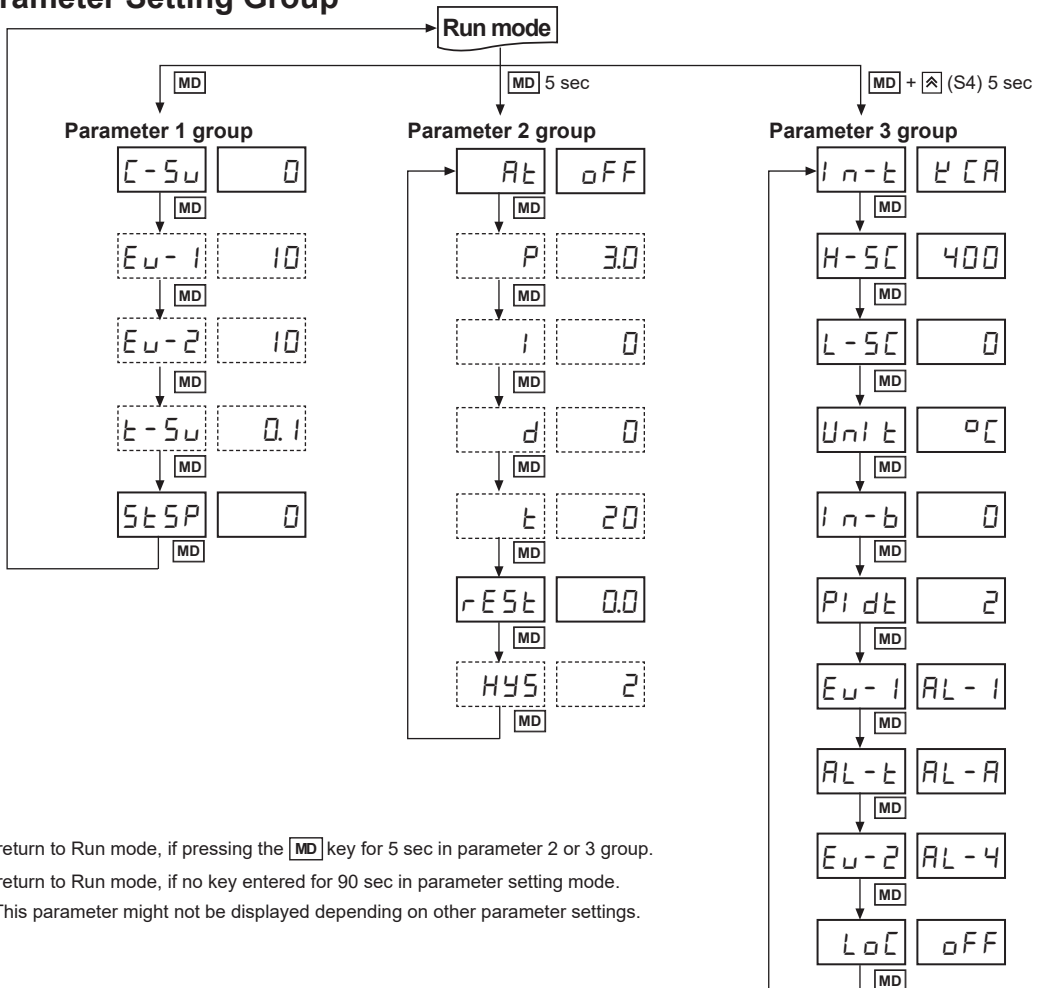
Press the up arrow key (S4) and set 1 at 10<sup>2</sup> digit and press the MD key.



Now SV value is set, then move to E-5 u by pressing the MD key once.

※S1, S2, S3, S4 are on this PCB Board.

## Parameter Setting Group



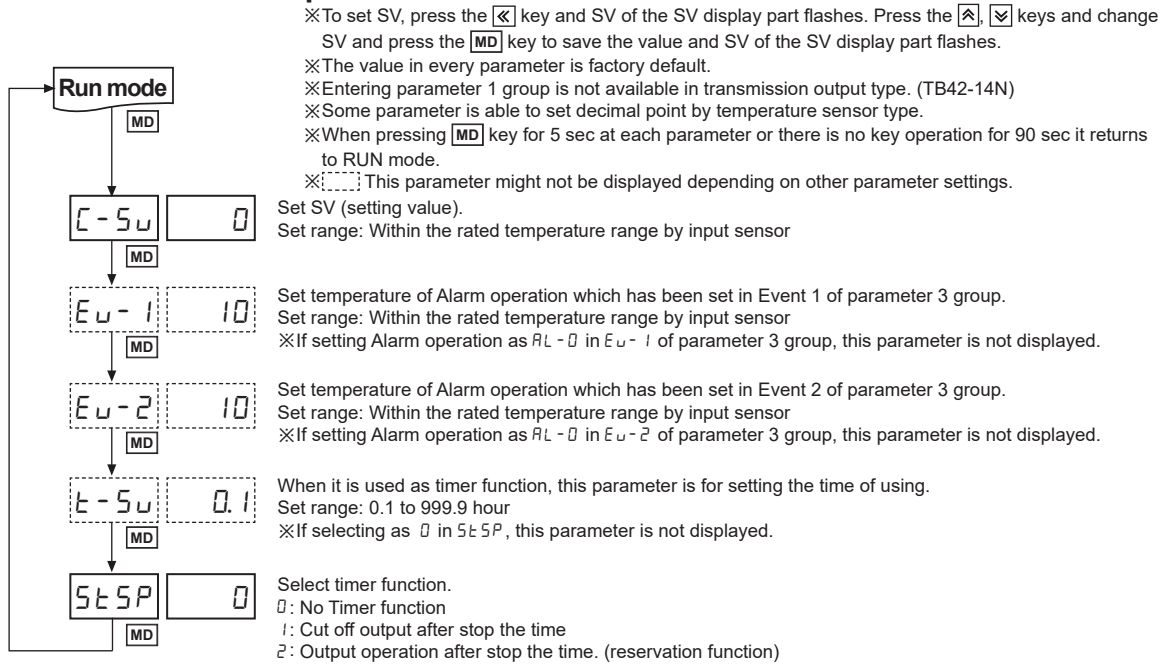
※It will return to Run mode, if pressing the MD key for 5 sec in parameter 2 or 3 group.

※It will return to Run mode, if no key entered for 90 sec in parameter setting mode.

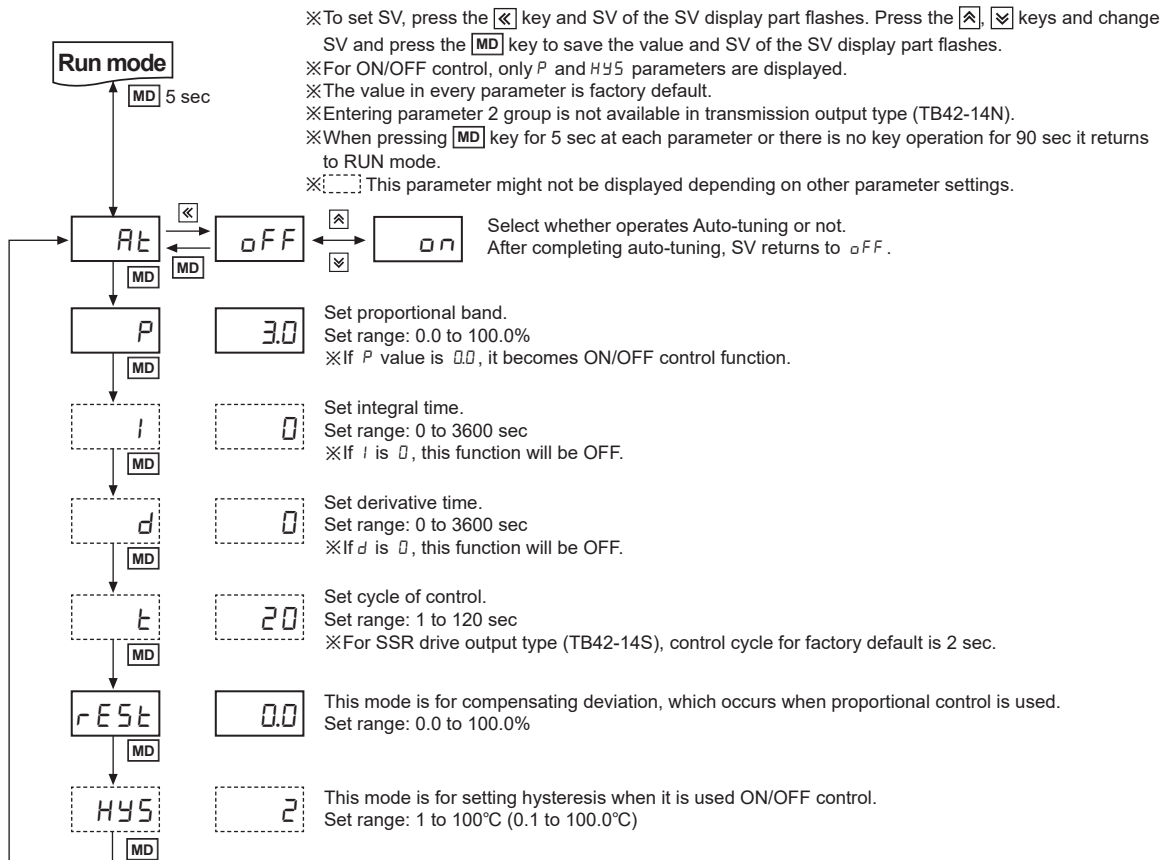
※[ ]: This parameter might not be displayed depending on other parameter settings.

|     |   |
|-----|---|
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| (E) | Pressure Sensors  |
| (F) | Rotary Encoders   |
| (G) | Connectors/ Connector Cables/ Sensor Distribution Boxes/Sockets |
| (H) | Temperature Controllers   |
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| (M) | Tacho / Speed / Pulse Meters                                    |
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## Parameter 1 Group



## Parameter 2 Group



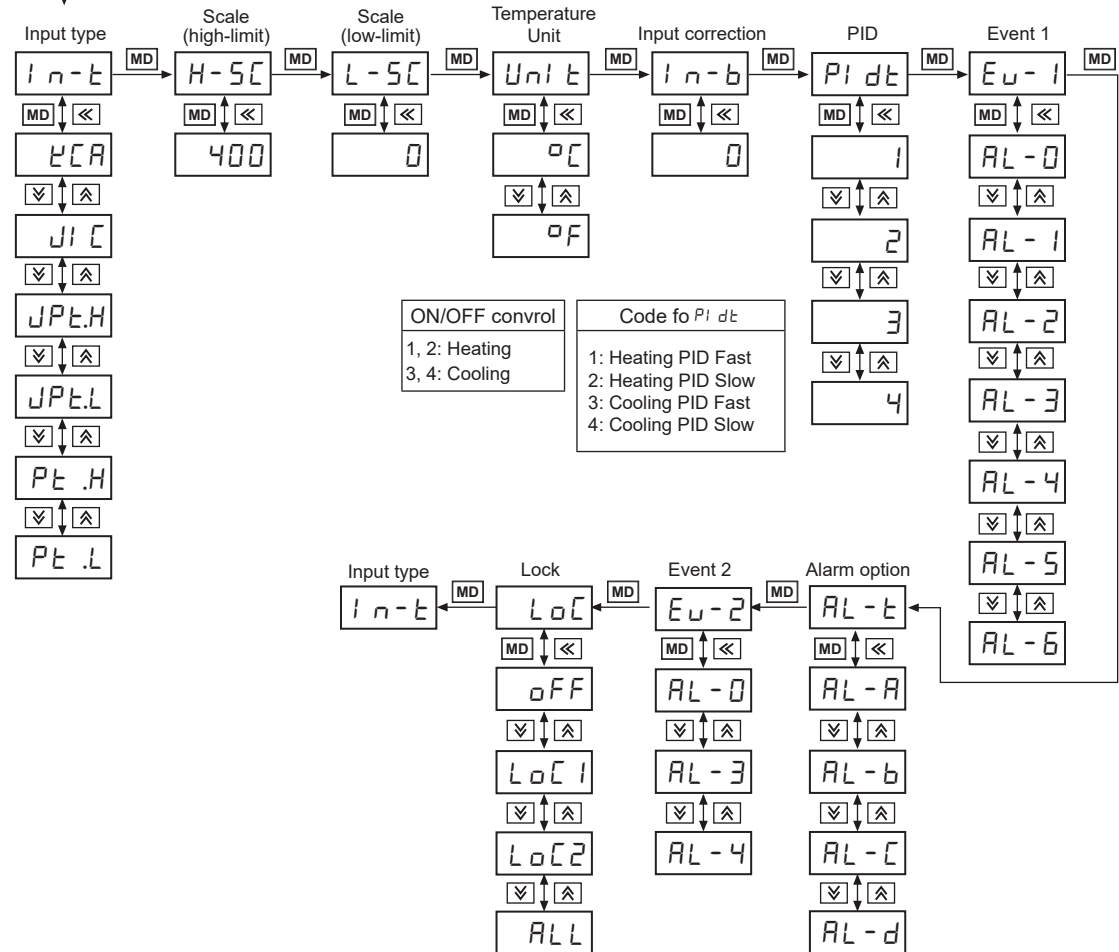
# Board Type, Dual PID Control

## Parameter 3 Group

Run mode

MD +  $\Delta$  5 sec

- ※To set SV, press the  $\Delta$  key and SV of the SV display part flashes. Press the  $\Delta$ ,  $\nabla$  keys and change SV and press the MD key to save the value and SV of the SV display part flashes.
- ※The value in every parameter is factory default.
- ※Entering parameter 2 group is not available in transmission output type (TB42-14N).
- ※When pressing MD key for 5 sec at each parameter or there is no key operation for 90 sec it returns to RUN mode.



|      |      |   |
|------|------|---|
| In-t | ECR  | Select one input sensor among 6 types.  |
| H-Sc | 400  | Set high-limit of temperature (20mA output value for transmission output).<br>Set range: Within the rated range |
| L-Sc | 0    | Set low-limit of temperature (4mA output value for transmission output).<br>Set range: Within the rated range   |
| Unit | °C   | Set the unit of temperature between °C or °F.   |
| In-b | 0    | Set the correction value for error from input sensor.<br>Set range: -50 to 50°C ( -50.0 to 50.0°C).             |
| Pidt | 1    | Select PID control type among 4 kinds.  |
| Ev-1 | AL-1 | Select Alarm output function of Event 1 among 7 kinds.  |
| AL-t | AL-A | Select Alarm output option function among 4 kinds.  |
| Ev-2 | AL-4 | Select Alarm output function of Event 2 among 3 kinds.  |
| LoC  | oFF  | Set whether it is locked or not of setting value among 4 kinds.   |

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# TB42 Series

## Alarm

### Alarm operation

| Mode   | Name                                   | Alarm operation  | Description   |
|--------|--|--|---|
| RL - 0 | —                                      | —  | No alarm output   |
| RL - 1 | Deviation high-limit alarm             | <p>High deviation: Set as 10°C</p>   | If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.      |
| RL - 2 | Deviation low-limit alarm              | <p>Low deviation: Set as 10°C</p>  | If deviation between PV and SV as low-limit is higher than set value of deviation temperature, the alarm output will be ON.       |
| RL - 3 | Deviation high/low-limit alarm         | <p>High/Low deviation: Set as 10°C</p>   | If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.  |
| RL - 4 | Deviation high/low-limit reserve alarm | <p>High/Low deviation: Set as 10°C</p>   | If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be OFF. |
| RL - 5 | Absolute value high limit alarm        | <p>Absolute-value Alarm: Set as 90°C</p> <p>Absolute-value Alarm: Set as 110°C</p> | If PV is higher than the absolute value, the output will be ON.   |
| RL - 6 | Absolute value low limit alarm         | <p>Absolute-value Alarm: Set as 90°C</p> <p>Absolute-value Alarm: Set as 110°C</p> | If PV is lower than the absolute value, the output will be ON.  |

※ H: means fixed 2°C as interval between ON and OFF when alarm output is operating.

### Alarm option

| Mode   | Name                             | Description   |
|--------|----------------------------------|---|
| RL - R | Standard alarm                   | If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.   |
| RL - b | Alarm latch                      | If it is an alarm condition, alarm output is ON and maintains ON status.  |
| RL - C | Standby sequence                 | First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates. |
| RL - d | Alarm latch and standby sequence | If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, alarm latch operates.               |

# Board Type, Dual PID Control

## ■ Functions

### ◎ Event

This function can execute as main control output and sub function.

#### ● Event 1 output

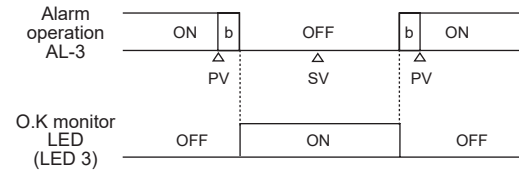
Event 1 output is relay contact and contact capacity is 250VAC 0.5A 1a. Event 1 output is alarm output and there are 7 modes including deviation and absolute alarm. The operation of Event 1 output is displayed on LED 2 at front.

#### ● Event 2 output

There is no terminals for Event 2 output but front LED 3 lamp displays the input range as O.K monitor.

Event 2 output operates as O.K monitor by setting Event 2 [E<sub>2</sub>-2] as RL-3 or RL-4 in Parameter 3 group and set the deviation temperature at E<sub>2</sub>-2 in Parameter 1 group.

< Example of O.K monitor >



### ◎ Auto-tuning [At]

PID Auto-tuning function is automatically to measure thermal characteristics and response of the control object and then execute its value under high response & stability after calculating the time constant of PID required to control optimum temperature.

When AT function is started, LED 3 will flash and when LED 3 is OFF this operation will stop.

**(Note) For ON/OFF control, AT function does not operate.**

### ◎ Dual PID function

One is that PV is reached at SV with fast response speed, but a little of overshoot occurs, the other is that PV is reached at SV with slow response speed, but overshoot will be minimized.

#### ● PID Fast

This mode is applied at the machines or systems which require stop fast response speed, and allowable a little overshoot which require.

#### ● PID Slow

This mode is applied at the machine which overshoot must not occur, because the fire can be and allowable low response time.

### ◎ Error

If error occurs while the controller is operating, it will be displayed as follow.

#### ● LLLL flashes

when measured input temperature is lower than input range of the sensor.

#### ● HHHH flashes

when measured input temperature is higher than input range of the sensor.

#### ● oPE<sub>n</sub> flashes

when the input sensor is not connected or its wire is cut.

### ◎ Transmission output (PV)

This function is to transmit the current value (PV) to external equipment such as PC or recorder etc. the output is DC 4-20mA and cannot be used with control output at the same time.

It will output 20mA, when PV reaches to the temperature in H-5C and output 4mA, when PV reaches to the temperature in L-5C.

Min. resolutions are 16,000 divisions available. (TB42-14N)

### ◎ Manual reset [rESt]

Proportional control has an offset because rising time is not the same as falling time, even if the unit operates normally. This function is to correct offset.

### ◎ Lock

Setting value cannot be changed by unauthorized person. There are 4 types of lock mode in this unit.

- oFF : Unlocks for all parameters
- LoC 1 : Locks parameter 2, 3 groups
- LoC 2 : Locks parameter groups except L-5<sub>U</sub> parameter
- RL L : Locks all parameters

### ◎ Timer [StSP]

There is no output terminal in this function, it controls main output by setting of Timer function.

#### ● Timer operation

- When StSP parameter is set as 0.

No timer function. t-5<sub>U</sub> parameter is not displayed.

- When StSP parameter is set as 1.

This unit controls temperature for the set time of t-5<sub>U</sub>.

E.g.)When t-5<sub>U</sub> is set as 5.0, this unit controls temperature for 5 hours and completes to control.

- When StSP parameter is set as 2.

This unit controls temperature after the set time of t-5<sub>U</sub>.

E.g.)When t-5<sub>U</sub> is set as 5.0, this unit controls temperature after 5 hours.

- To stop timer function, enter StSP parameter and set 0.
- During timer function, the set time at t-5<sub>U</sub> is displayed on the SV display part in RUN mode. If not using the timer function, it displays SV.

|     |   |
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# TB42 Series

## ■ Proper Usage

### ◎ Front part

Front part is able to customized for user's application.

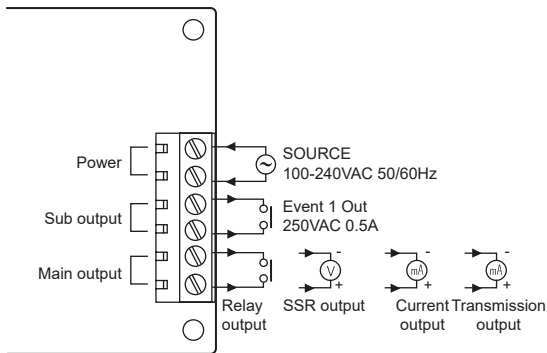
The length of connector cable connected the front part and control part is basically 300mm and also 100mm.

### ◎ Output

This unit has main output terminals and sub output terminals.

Main output terminals is for relay, SSR, current, transmission output and sub output terminals are fixed for Event 1 output.

Be sure that output terminals are as below.



※Relay output: 1a contact output. Contact capacity is 250VAC 3A.

※SSR drive output: It outputs Max. 12VDC  $\pm$ 3V 30mA max. voltage to drive SSR. For using SSR drive voltage to other applications, use this within the rated current.

※Current output: It outputs DC4-20mA within the hysteresis.

※Transmission output: It outputs DC4-20mA within the set range at  $H-5\%$  and  $L-5\%$  parameters. (resolutions: 16,000 divisions)

### ◎ When changing the sensor type

Be sure that when changing the sensor type during operation, the set SV is cleared.

### ◎ Caution for when mounting on Panel

This unit does not have an additional external case but has only a PCB. When mounting this unit on panel, maintain insulation between iron plates. If dust, oil, or water is enter to inside of panel, inner may be short.

Be sure that interval between terminals is narrow to wire cables. The cable (20P) connected control PCB and front PCB is sensitive signal line.

Be careful when wiring this cable not to enter noise or affect to high voltage line.

### ◎ Cautions during use

- Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
- Check the polarity of the terminals before wiring the temperature sensor.  
For RTD temperature sensor, wire it as 3-wire type, using cables in same thickness and length.  
For thermocouple (CT) temperature sensor, use the designated compensation wire for extending wire.
- Keep away from high voltage lines or power lines to prevent inductive noise.  
In case installing power line and input signal line closely, use line filter or varistor at power line and shielded wire at input signal line.  
Do not use near the equipment which generates strong magnetic force or high frequency noise.
- Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.
- Do not use the unit for other purpose (e.g. voltmeter, ammeter), but temperature controller.
- Make a required space around the unit for radiation of heat.  
For accurate temperature measurement, warm up the unit over 20 min after turning on the power.
- Make sure that power supply voltage reaches to the rated voltage within 2 sec after supplying power.
- Do not wire to terminals which are not used.
- This unit may be used in the following environments.
  - ①Indoors  
(in the environment condition rated in 'Specifications')
  - ②Altitude max. 2,000m
  - ③Pollution degree 2
  - ④Installation category II