

DTB Series Temperature Controller

Instruction Sheet

Thank you very much for purchasing DELTA B Series. Please read this instruction sheet before using your B series to ensure proper operation and please keep this instruction sheet handy for quick reference.

■ Precautions

⚠ DANGER! Caution! Electric Shock!

- Do not touch the AC terminals while the power is supplied to the controller to prevent an electric shock.
- Make sure power is disconnected while checking the unit inside.
- The symbol  indicates that this Delta B Series Temperature Controller is protected throughout by DOUBLE INSULATION or REINFORCED INSULATION (equivalent to Class II of IEC 536).

⚠ WARNING!

This controller is an open-type temperature controller. Make sure to evaluate any dangerous application in which a serious human injury or serious property damage may occur.

- Always use recommended solder-less terminals: Fork terminal with isolation (M3 screw, width is 7.0mm (6.0mm for DTB 4824), hole diameter 3.2mm). Screw size: M3 x 6.5 (With 6.8 x 6.8 square washer). Screw size for DTB4824: M3 x 4.5 (With 6.0 x 6.0 square washer). Recommended tightening torque: 0.4 N.m (4kgf.cm). Applicable wire: Solid/twisted wire of 2 mm², 12AWG to 24AWG. Please be sure to tighten them properly.
- Do not allow dust or foreign objects to fall inside the controller to prevent it from malfunctioning.
- Never modify or disassemble the controller.
- Do not connect anything to the “No used” terminals.
- Make sure all wires are connected to the correct polarity of terminals.
- Do not install and/or use the controller in places subject to:
 - Dust or corrosive gases and liquid.
 - High humidity and high radiation.
 - Vibration and shock.
 - High voltage and high frequency
- Must turn power off when wiring and changing a temperature sensor.
- Be sure to use compensating wires that match the thermocouple types when extending or connecting the thermocouple wires.
- Please use wires with resistance when extending or connecting a platinum resistance thermometer (RTD).
- Please keep the wire as short as possible when wiring a platinum resistance thermometer (RTD) to the controller and please route power wires as far as possible from load wires to prevent interference and induced noise.
- This controller is an open-type unit and must be placed in an enclosure away from high temperature, humidity, dripping water, corrosive materials, airborne dust and electric shock or vibration.
- Please make sure power cables and signals from instruments are all installed properly before energizing the controller, otherwise serious damage may occur.
- Please do not touch the terminals in the controller or try to repair the controller when power is applied to prevent an electric shock.
- Wait at least one minute after power is disconnected to allow capacitors to discharge, and please do not touch any internal circuit within this period.
- Do not use acid or alkaline liquids for cleaning. Please use a soft, dry cloth to clean the controller.
- This instrument is not furnished with a power switch or fuse. Therefore, if a fuse or power switch is required, install the protection close to the instrument. Recommended fuse rating: Rated voltage 250 V, Rated current 1 A. Fuse type: Time-lag fuse
- Note: This controller does not provide overcurrent protection. Use of this product requires that suitable overcurrent protection device(s) must be added to ensure compliance with all relevant electrical standards and codes. (Rated 250 V, 15 Amps max). A suitable disconnecting device should be provided near the controller in the end-use installation.

■ Display, LED & Pushbuttons



PV Display : to display the process value or parameter type.
SV Display : to display the set point, parameter operation read value, manipulated variable or set value of the parameter.
AT : Auto-tuning LED, flashes when the Auto-tuning operation is ON.
OUT1/OUT2 : Output LED, lights when the output is ON.
Function key. Press this key to select the desired function mode and confirm a setting value.
Mode key. Press this key to set parameters within function mode.
°C, °F : **Temperature unit LED**. °C : Celsius °F : Fahrenheit
ALM1 ~ ALM3 : Alarm output LED, lights when ALM1/ALM2/ALM3 is ON.
Down key. Press this key to decrease values displayed on the SV display. Hold down this key to speed up the decrements.
Up key. Press this key to increase values displayed on the SV display. Hold down this key to speed up the incremental action.

■ Ordering Information

DTB 1 2 3 4 5 6 7

DTB Series	DTB: Delta B Series Temperature Controller
1 2 3 4 Panel Size (W×H)	4824 : 1/32 DIN W48 × H24mm 4896 : 1/8 DIN W48 × H96mm 4848 : 1/16 DIN W48 × H48mm 9696 : 1/4 DIN W96 × H96mm
5 1st Output Group Selection	R : Relay output, SPDT (SPST: 1/16 DIN and 1/32 DIN size), 250VAC, 5A V : Voltage pulse output, 14V +10% ~ -20% (Max. 40mA) C : DC current output, 4 ~ 20mA L : Linear voltage output, 0~5V, 0~10Vdc
6 2nd Output Group Selection	R : Relay output, SPDT (SPST: 1/16 DIN and 1/32 DIN size), 250VAC, 5A V : Voltage pulse output, 14V +10% ~ -20% (Max. 40mA)
7 EVENT Inputs / CT function (Optional)	None : No EVENT input, No CT (Current transformer) E : EVENT input is provided, No CT (Current transformer) T : CT (Current transformer) is provided, No EVENT input V : Valve control.

Note 1: DTB4824 series: no optional function provided and no extra alarm output supported, but user can set 2nd output as alarm mode.

Note 2: DTB4848 series: only one alarm output when optional function supported, but user can set 2nd output as 2nd alarm output.

Note 3: “Valve control” with feedback selection is only available for DTB4896RRV; DTB9696RRV.

■ Specifications

Input Voltage	100 to 240VAC 50/60Hz
Operation Voltage Range	85% to 110% of rated voltage
Power Consumption	5VA max.
Memory Protection	EEPROM 4K bit (non-volatile memory (number of writes: 100,000))
Display Method	2 line x 4 character 7-segment LED display Process value(PV): Red color, Set point(SV): Green color Thermocouple: K, J, T, E, N, R, S, B, L, U, TXX
Sensor Type	3-wire Platinum RTD: Pt100, JPt100 Analog input: 0 ~ 5V, 0 ~ 10V, 0 ~ 20 mA, 4 ~ 20 mA, 0 ~ 50mV
Control Mode	PID, ON/OFF, Manual or PID program control (Ramp/Soak control) Relay output: SPDT (SPST: 1/16 DIN and 1/32 DIN size), Max. load 250VAC, 5A resistive load
Control Output	Voltage pulse output: DC 14V, Max. output current 40mA Current output: DC 4 ~ 20mA A output (Load resistance: Max. 600Ω) Linear voltage output: 0 ~ 10V
Display Accuracy	0 or 1 digit to the right of the decimal point (selectable)
Sampling Rate	Analog input: 150 msec/ per scan Thermocouple or Platinum RTD: 400 msec/per scan
RS-485 Communication	MODBUS ASCII / RTU communication protocol
Vibration Resistance	10 to 55Hz, 10m/s ² for 10min, each in X, Y and Z directions
Shock Resistance	Max. 300m/ s ² , 3 times in each 3 axes, 6 directions

Ambient Temperature	0 °C to +50 °C
Storage Temperature	-20 °C to +65 °C
Altitude	2000m or less
Relative Humidity	35% to 80% (non-condensing)

■ Temperature Sensor Type & Temperature Range

Input Temperature Sensor Type	Register Value	LED Display	Temperature Range
0 ~ 50mV Analog Input	17		-999 ~ 9999
4 ~ 20mA Analog Input	16		-999 ~ 9999
0 ~ 20mA Analog Input	15		-999 ~ 9999
0V ~ 10V Analog Input	14		-999 ~ 9999
0V ~ 5V Analog Input	13		-999 ~ 9999
Platinum Resistance (Pt100)	12		-200 ~ 600°C
Platinum Resistance (JPt100)	11		-20 ~ 400°C
Thermocouple TXX type	10		-200 ~ 800°C
Thermocouple U type	9		-200 ~ 500°C
Thermocouple L type	8		-200 ~ 850°C
Thermocouple B type	7		100 ~ 1800°C
Thermocouple S type	6		0 ~ 1700°C
Thermocouple R type	5		0 ~ 1700°C
Thermocouple N type	4		-200 ~ 1300°C
Thermocouple E type	3		0 ~ 600°C
Thermocouple T type	2		-200 ~ 400°C
Thermocouple J type	1		-100 ~ 1200°C
Thermocouple K type	0		-200 ~ 1300°C

Note 1: **An internal 249Ω precision resistor for the current input is built-in, please refer to the item “How To Set Up Current Input”.**

Note 2: **SP** (Operation mode) must be set if user wish to specify decimal point position. Except for the thermocouple B, S, R type, the decimal point positions of all the other thermocouple type input sensors can be set.
The default range of analog input is -999 ~ 9999. For example, when a 0 ~ 20mA analog input is selected as the input temperature sensor type, -999 indicates 0mA and 9999 indicates 20mA. If change the input range to 0 ~ 2000, then 0 indicates 0mA and 2000 indicates 20mA. One display scale is equal to 0.01mA.

■ Operation

There are three modes of operation: operation, regulation and initial setting. When power is applied, controller gets into the operation mode. Press the  key to switch to regulation mode. If the  key is pressed for more than 3 seconds, controller will switch to the initial setting mode. Pressing the  key while in the regulation mode or initial setting mode, forces the controller to return to the operation mode. PV/SV: Sets the temperature set point and displays the temperature process value. Use   keys to set the temperature set point.

Setting method: While in any function mode, press the  key to select the desired function and use the   keys to change settings. Press  key to save the changes. The next flow chart shows how to switch for settings and internal functions:

Regulation Mode	Operation Mode	Initial Setting Mode
RL Auto-tuning (Set in PID control and RUN mode) Press  	1234 Use   key to set temperature set point Press  	CanPE Set input type Press  
PIdon 4 groups PID modes (n=0~3). When n=4, PID control is auto regulated. Press  	r-S Control setting RUN or STOP Press  	EPun Set temperature unit do not display when analog input Press  
PdoF PD control offset setting (When PID control is ON and Ti=0, set the value of PdoF. Press  	Ptern Start pattern setting (PID program control and Time setting. Press  	EP-H Set upper-limit of temperature range Press  
HEs Heating hystereisls setting (Set in ON/OFF control mode) Press  	SP Decimal point position selection (except for B, S, R type, all the other types can be set) Press  	EP-L Set lower-limit of temperature range Press  
CEs Cooling hystereisls setting (Set in ON/OFF control mode) Press  	RL-H Upper-limit alarm 1 (This parameter is available only when ALA1 function enables) Press  	CE-L Select control mode (See “Pattern and set Editing selection” for detail) Press  
HEPd or ELPd Heating/Cooling control cycle setting (Set in PID control mode) Press  	RL-L Lower-limit alarm 1 (This parameter is available only when ALA1 function enables) Press  	S-HC Select heating/cooling control or dual loop output control Press  
HEPd Control cycle setting of 2nd output group (Set in PID control and Dual Loop output control mode) Press  	RL-H Upper-limit alarm 2 (This parameter is available only when ALA2 function enables) Press  	AL-A Alarm 1 mode setting Press  
CEEF P value of 1st & 2nd output group during dual loop output control P value of 2nd output group = (P value of 1st output group) x CEEF Press  	RL-L Lower-limit alarm 2 (This parameter is available only when ALA2 function enables) Press  	AL-A Alarm 2 mode setting Press  
DEBd Dead Band (Set in Dual Loop output control mode) Press  	RL-H Upper-limit alarm 3 (This parameter is available only when ALA3 function enables) Press  	AL-A Alarm 3 mode setting Press  
V-FB Switch setting for feedback signal of valve. (Display when valve control is ON) Press  	RL-L Lower-limit alarm 3 (This parameter is available only when ALA3 function enables) Press  	SRLR Set system alarm Press  
V-RE Automatically regulate feedback value. (Display when valve control is ON) Press  	LoC Setting lock mode Press  	CoSH Communication write function enable/disable Press  
UREP Time setting for valve from full close to full open. (Display when valve control is ON) Press  	ouE1 Display and adjust output value of 1st output group (Display in PID control mode and manual RUN mode) Press  	C-SL ASCII, RTU communication format selection Press  
V-dB Valve Dead Band setting. (Display when valve control is ON) Press  	ouE2 Display and adjust output value of 2nd output group (Display in dual loop PID control mode and manual RUN mode) Press  	C-aa Communication address setting Press  

U-HC Upper-limit regulation of valve output with feedback to controller. (Display when valve signal feedback function is ON)
Press  

U-Lo Lower-limit regulation of valve output with feedback to controller. (Display when valve signal feedback function is ON)
Press  

EPoF Regulate temperature deviation value
Press  

C-HC Regulate upper-limit of analog output value
(The setting display when analog output)
Press  

C-Lo Regulate lower-limit of analog output value
(The setting display when analog output)
Press   to return to auto-tuning mode

1 Scale = 2.8uA = 1.3mV for tuning output value
PID mode selection: any one of 4 groups PID modes (n = 0 ~ 3) can be selected. When n = 4, program will automatically select 1 group PID that is most useful for target temperature.

PIdon Select n=0~4 to decide PID mode.
Press   0~3 groups PID

Su0 PID setting: n=0. Press  

P0 Proportion band setting: n=0.
Press  

ti0 Ti setting: n=0. Press  

td0 Td setting: n=0. Press  

CoF0 Integral deviation setting: n=0. AT setting.
Press   back to PID deviation setting

Pattern and step editing selection: edit **Pro0** in **Ctrl** parameter. The following display is the example operation of pattern No. 0.
PRLen Select desired editing pattern number
select OFF
Press    select number

Exit pattern and step editing selection
Switch to **S-HC** and continue setting

SP00 Edit temperature of step No. 0 of pattern No. 0
Press  

ti00 Edit time of step No. 0 of pattern No. 0, unit is hh:mm
Press  

Set step No. 07 in order
SP07 Edit temperature of step No. 7 of pattern No. 0
Press  

ti07 Edit time of step No. 7 of pattern No. 0, unit is hh:mm
Press   to set actual step No.

■ Dual Loop Output Control (Heating/Cooling Control)

Temperature control can be achieved either by heating or cooling. In DTB series, heating and cooling can be operated simultaneously (Dual Loop output control) to perform temperature control. When Dual Loop output control are used, two control outputs must be connected to the heating and cooling devices. Please refer to the following for the operation:

S-HC : This parameter is used to select heating or cooling action if operate either heating or cooling function in this controller. When selecting **H-HC**, 1st output group is heating (reverse) control, and when selecting **C-HC**, 1st output group is cooling (forward) control. At this moment, 2nd output group is regarded as an alarm output. If user select **H-HC** or **C-HC**, it indicates that user can operate Dual Loop output control function in this controller. When selecting **H-HC**, 1st output group is heating (reverse) control and 2nd output group is cooling (forward) control. When selecting **C-HC**, 1st output group is cooling (forward) control and 2nd output group is heating (reverse) control.

In DTB series, P (Proportional Band), I (Integral Time) and D (Derivative Time) parameters are automatically set by using the Auto-tuning (AT) function.

CEEF : This parameter is for the control mode that must be Dual Loop output control with PID control method configured. The value of P, I and D of 1st output group can be set immediately. The P value of 2nd output group is equal to (P value of 1st output group) x **CEEF** and the value of I and D of 2nd output group are the same as the value of I and D of 1st output group.

DEBd : Dead Band, shown as the following figure 1, 2 and 3. This parameter sets an area in which the heating and cooling control output is 0 centering around the set point in a Dual Loop output control mode.

LoC : **Settings lock**. To avoid incorrect operation, two key lock functions are provided. **LoC1** : Lock 1 can lock all settings. All parameters and temperature settings can be locked to disable changes. **LoC2** : Lock 2 can lock settings except the SV (Set point) value. All parameters and temperature settings can be locked with the exception of the SV value. Press  and  key simultaneously, the “Lock” status can be released.

■ Alarm Outputs

There are up to three groups of alarm outputs and each group allows thirteen alarm types in the initial setting mode. The alarm output is activated whenever the process temperature value (PV) is getting higher or lower than the set point of alarm limit.

Set Value	Alarm Type	Alarm Output Operation
0	Alarm function disabled	Output is OFF
1	Deviation upper- and lower-limit: This alarm output operates when PV value is higher than the setting value SV+(AL-H) or lower than the setting value SV-(AL-L).	ON OFF SV-(AL-L) SV SV+(AL-H)
2	Deviation upper-limit: This alarm output operates when PV value is higher than the setting value SV+(AL-H).	ON OFF SV SV+(AL-H)
3	Deviation lower-limit: This alarm output operates when PV value is lower than the setting value SV-(AL-L).	ON OFF SV-(AL-L) SV

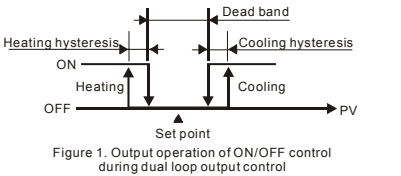


Figure 1. Output operation of ON/OFF control during dual loop output control

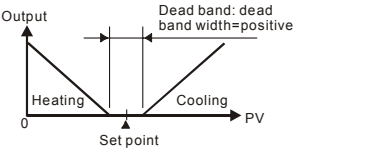


Figure 2. PID control, Dead Band is positive

