BT6 SERIES

Digital Temperature Controller

INSTRUCTION MANUAL

INSTALLATION / OPERATION / PARAMETERS / WIRING



BT6-A • BT6-B • BT6-D • BT6-E

APPLICABLE MODELS	BT6-A / BT6-B / BT6-D / BT6-E
DOCUMENT LANGUAGE	English

Read this manual before installation or operation.
Retain this manual for future reference.

A1. Contents

A2. Warnings and Precautions 2

Warnings . . . 2

Precautions . . . 2

A3. Electrical Specifications 3

A4. Model Selection 4

A5. Outline and Panel Cutout Dimensions 4

B1. Front Panel and Key Functions 5

B2. Menu Operation 6

1. User Parameters . . . 6

B2. Menu Operation — 2. Engineering Parameters . . . 7

B3. Factory Parameters 8

Alarm mode reference . . . 9

Timer operation . . . 9

B4. Configuration Parameters 10

Factory options: Code=0040 . . . 10

Factory options: Code=0060 . . . 10

B5. Additional Information 10

Input and output options . . . 10

Wire-routing and mounting options . . . 10

3. Disturbance-Response and Initial-Overshoot Comparison . . . 12

C1. Diagnostic Messages 12

C2. Wiring Diagrams 13

C3. Troubleshooting and Maintenance 13

Configuration and Rating Checks 14

Introduction

Thank you for purchasing a BT6 Series Digital Temperature Controller. This manual describes the product’s functions and performance and explains how to use it effectively. Users must have adequate electrical knowledge. Read and understand this manual before use. Confirm suitability for the intended system, machinery and equipment; observe all specifications and restrictions. Examples in this manual and other technical documents are for reference only and do not guarantee operation. When combining this product with other products, confirm compliance with applicable laws, standards and regulations.

A2. Warnings and Precautions

Warnings

1. Do not touch the AC power terminals while the controller is energized; electric shock may result.

2. Before powering on, confirm that the supply voltage matches the controller rating. An incorrect voltage may damage the controller.

3. Do not disassemble, modify or repair the product, or touch any internal components.

4. If the output relay is used beyond its expected service life, its contacts may melt and burning may occur.

5. Tighten terminal screws to 0.74–0.90 N·m. Loose screws may cause a fire.

6. To prevent damage or failure, install suitable fuses in the power and input/output circuits to protect against current surges.

7. To prevent fire, explosion or instrument damage, do not use the product where flammable or explosive gases or discharged steam are present.

8. Each product is inspected before shipment. A one-year warranty covers product-quality defects. Liability is limited to the product sold and excludes other consequential liability. Unauthorized disassembly and improper use are not covered.

Precautions

1. Allow heat to dissipate. Keep adequate space around the product and do not block ventilation openings.

2. Do not install where exposed to high-frequency interference, corrosive gas, high temperature or humidity, freezing, condensation, or splashing liquids or oil mist.

3. Maintain sufficient distance between the controller and equipment that generates high-frequency interference or surges.

4. Connect each wire to the correct terminal.

5. Use within the rated load and power-supply conditions.

6. Do not clean with paint thinner or similar chemicals. Use standard-grade alcohol.

7. Read and understand the catalog and manual information before connecting the control-output unit.

8. Do not use the controller if the front membrane is peeling or cracked.

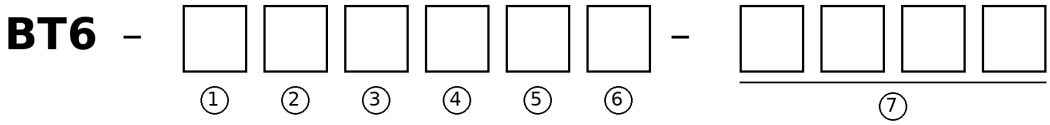
A3. Electrical Specifications

Item	Specification
Rated voltage	100–240 VAC, 50 Hz
Power consumption	≤5 VA
Operating environment	Ambient temperature: 0–50°C; relative humidity: 35–85% RH, non-condensing
Storage temperature	−25–65°C; avoid freezing and condensation
Resolution	1°C or 0.1°C, selectable
Connection	Screw terminals
Measurement accuracy	±0.5% FS
Memory	Non-volatile
Installation environment	Installation category II; pollution degree 2
Relay output	AC 220 V / DC 30 V, 5 A
Logic-level output	ON: DC 12 V; OFF: DC 0.5 V or less; maximum current: 30 mA; load resistance: ≥1 kΩ

A4. Model Selection

Check that the delivered model and options match the ordered configuration. Match each numbered code field to the selection table below.

MODEL CODE STRUCTURE



1 Size 2 Input 3 Supply 4 Main output 5 Alarm 1 6 Alarm 2 7 Function code

Model code: positions 1–6 are single-character option fields; position 7 is the four-character function field.

Code position	Selection	Options
1	Front-panel size	A: 48×48; B: 48×96; D: 72×72; E: 96×96
2	Input signal	K, J, R, S, B, E, N, T, PT, CU, O.K, 0–50, 0–5V, 1–50
3	Power-supply type	L: linear supply; S: switching supply
4	Main output	1: relay; 2: logic-level/solid-state signal; 3: PID 4–20 mA (custom); 4: SCR phase-angle/zero-crossing triggering (custom); 5: 30 A relay (custom); 6: 4–20 mA retransmission (custom)
5–6	Alarm outputs AL1 / AL2	Select the alarm mode below; alarm output 2 uses the same mode list as alarm output 1.
7	Function code	Custom-product serial code; not significant for standard model selection.

INPUT NAME / CONTROLLER DISPLAY CODE

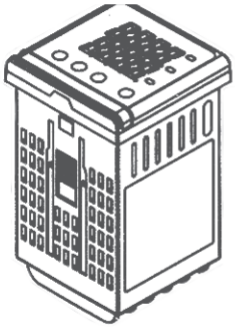
Name	K	J	R	S	B	E	N	T	PT	CU	O.K	0-50	0-5V	1-50
Code														

Input names and matching controller display codes. Match the code glyph shown on the actual instrument.

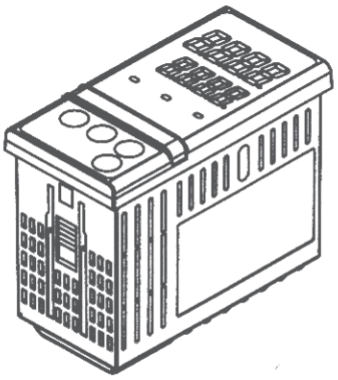
Alarm code	Meaning
0	No alarm; AL1/AL2 menus are hidden by default.
1	High absolute alarm
2	High deviation alarm (alarm-1 default)
3	Low absolute alarm (alarm-2 default)
4	Low deviation alarm
5	Outside-band alarm
6	Inside-band alarm
P1	High absolute alarm with power-on hold
P2	High deviation alarm with power-on hold
P3	Low absolute alarm with power-on hold
P4	Low deviation alarm with power-on hold

A5. Outline and Panel Cutout Dimensions

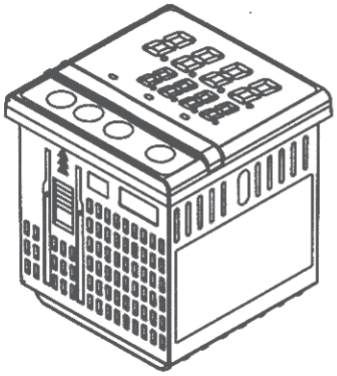
Unit: mm



BT6-A



BT6-B



BT6-D

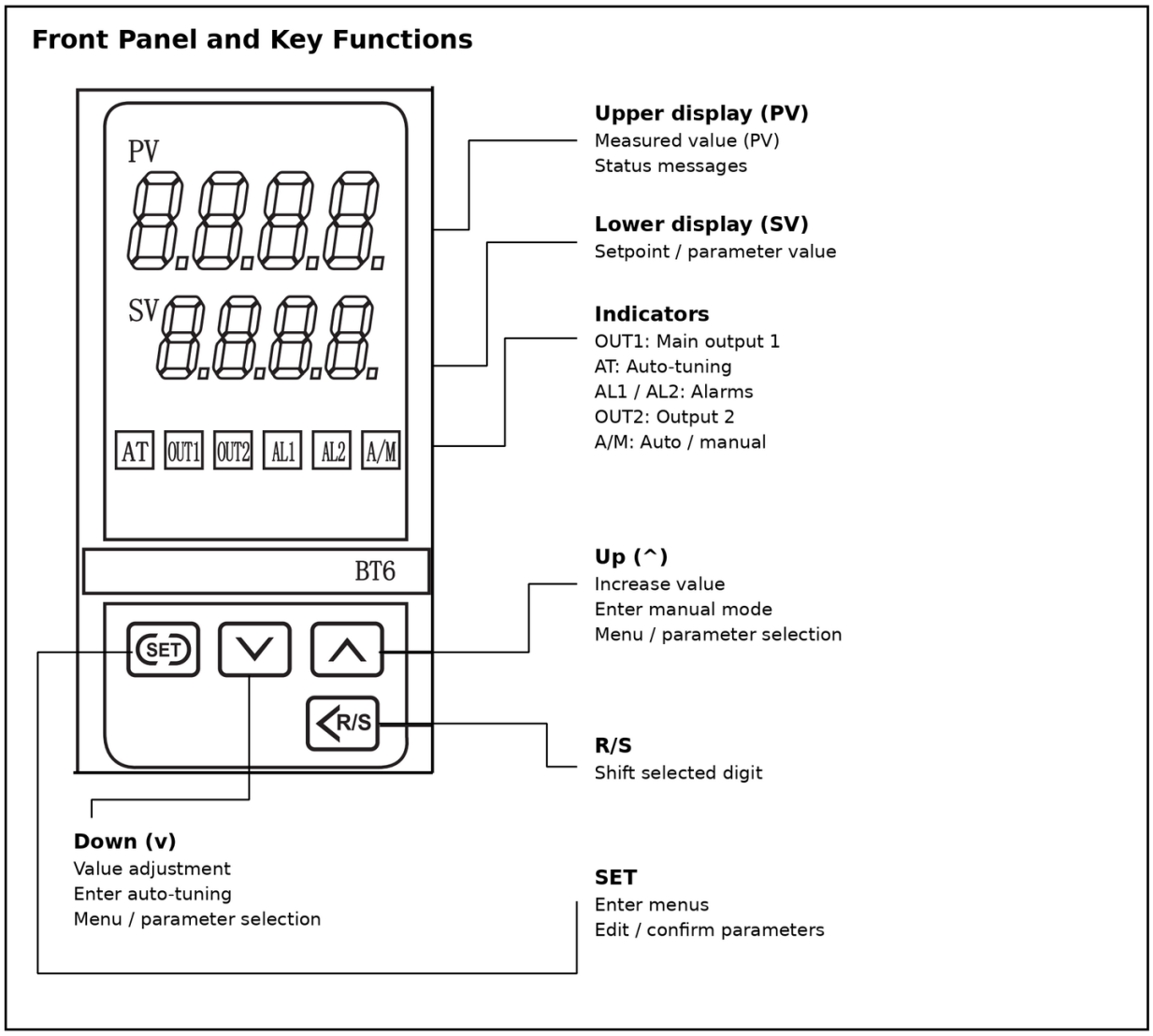


BT6-E

Model	Panel (W×H)	Case (L×W×H)	Panel cutout
BT6-A	48×48	45×45×83	46×46
BT6-B	48×96	45×90×83	45×91
BT6-D	72×72	66×66×83	67×67
BT6-E	96×96	90×90×83	91×91

B1. Front Panel and Key Functions

PV denotes the measured value. For temperature inputs, the measured value is the measured temperature shown in the performance graphs. The target temperature is the setpoint.



B2. Menu Operation

Press and hold SET for 3 seconds to enter the main menu. During normal operation, press SET to enter user parameters; press again to advance.

1. User Parameters

Code	Parameter	Description	Setting range	Factory default	Displayed when
SV	Temperature setpoint	Temperature setpoint; manual mode displays output percentage.	SLL–SLH	150 °C	In manual mode, the display shows output percentage.
ST	Timer preset	Available for ET=1, 2 or 3. Final-digit decimal point denotes minutes.	0–9999 s/min	60	Cod=40; Ton=1000; ET≠0

B2. Menu Operation — 2. Engineering Parameters

Hold SET for 3 seconds to enter engineering parameters. Hold SET for 1 second to exit. Press SET once to advance.

Code	Parameter	Description	Setting range	Factory default	Displayed when
AL1	Alarm 1 setpoint	Select the alarm mode using the alarm-mode settings.	−1999–9999	30	AL1≠0
AL2	Alarm 2 setpoint	Select the alarm mode using the alarm-mode settings.	−1999–9999	50	AL2≠0
SC	Display offset (Pb)	Displayed value = internal measured value + Pb. Pb may be positive or negative.	−50–50	0	1
P	Proportional band	P=0 selects ON/OFF control. I/D are hidden; the HY switching-differential menu is displayed.	0–9999	30	1
OH	Lower switching differential (OHL)	For ON/OFF control (P = 0), output energizes when PV < SV − OHL.	0–200	2	P=0
OHH	Upper switching differential (OHH)	Output switches off when PV > SV + OHH.	0–200	0	P=0
I	Integral time	Integral time constant; 0 disables integral action.	0–9999	240	P≠0
D	Derivative time	Derivative time constant; 0 disables derivative action.	0–9999	60	P≠0
T	Main output cycle time	Cycle time of the main control output.	0–100	20	P≠0
Pc	Cooling proportional-band ratio	Cooling band as a percentage of the main band.	1–200%	50	Dir=H-C
Tc	Cooling output cycle time	Cooling cycle time; do not set zero.	1–100 s	20	Dir=H-C
db	Deadband	Heating/cooling deadband; negative values create overlap.	−1999–9999	0	Dir=H-C
AR	Integral limit	Integral limit setting.	0–100%	100	P≠0
ATU	Auto-tuning enable	OFF = disabled; ON = enabled. Press and hold the SET key for 3 seconds to access auto-tuning.	OFF/ON	OFF	P≠0
CTH	Current-transformer input scaling	Value 100 corresponds to the 100 A input reference. Verify the current-transformer type and input scaling before adjustment.	0–100	100	CTon=1
ACT	Heater-break alarm	AL2 operates when CT input is below ACT. Verify scaling against CTH.	Relative to CT input value	0	CTon=1
Lck	Parameter lock	0 = unlocked; 1 = user parameters locked; 2 = all parameters locked.	0–2	0	1

Pb is a signed display correction used to compensate for systematic sensor/instrument offset so the display matches a reference. OHL and OHH denote lower and upper switching differentials. These symbols do not change the instrument display codes SC, OH and OHH. The auto-tuning shortcut uses SET.

B3. Factory Parameters

Hold SET and the shift key until Code appears. Enter 010 and press SET to enter this menu. After setting parameters, press SET to return to the Code screen. These parameters are intended for engineers or the manufacturer; ordinary users should not change them.

Code	Parameter	Description	Setting range	Factory default	Displayed when
AL1T	Alarm 1 mode	Selects the alarm mode; see alarm mode list.	0–6, P1–P4	2	1
AL2T	Alarm 2 mode	AL2 mode selection. Ordinary alarm action is unavailable when current alarm or timing uses AL2.	0–6, P1–P4	3	1
AH1	Alarm 1 hysteresis	Alarm 1 relay switching hysteresis.	0–200	1	1
AH2	Alarm 2 hysteresis	Alarm 2 relay switching hysteresis.	0–200	1	1
AH	Over-temperature cut-off differential	Output switches off when PV > SP + AH.	0–999	30	—
FP	Proportional-band advance	Shifts the proportional band down FP degrees to reduce initial overshoot.	0–100	5	1
SLL	Lower setpoint limit	Lowest permitted setpoint.	Full scale	0	1
SLH	Upper setpoint limit	Highest permitted setpoint.	Full scale	1370	1
PL	Minimum output limit	Limits minimum output power.	0–30%	0%	1
PH	Maximum output limit	OUT=0: limit applies after entry into the proportional band. For OUT=1 or 2, limits maximum instrument output power.	30–100%	100%	1
DLY	Compressor switching delay	Minimum cooling switching interval to prevent rapid cycling.	0–200 s	0	1
PSL	Linear-input zero display value	Display value at linear-input zero.	−1999–9999	0	1
PSH	Linear-input full-scale display value	Display value at linear-input full scale.	−1999–9999	1370	1
dP	Decimal-point position	Linear-input decimal position; not for thermocouple or RTD signals.	0–3	0	1
DF	Input filter coefficient	Larger values provide stronger filtering and a steadier display.	0–250	200	1
TSL	Retransmission lower range value	Lower scaling point for retransmission.	0–9999	00	1
TSH	Retransmission upper range value	Upper scaling point for retransmission.	0–9999	400	1
Addr	Communication address	Controller communication address.	1–250	1	Con=100
bps	Communication baud rate	Sets communication baud rate.	300–38400	19200	Con=100
ET	Timing mode	0 off; 1 main-output timing; 2 single timing; 3 repeating timing; 4 delayed start.	0, 1, 2, 3, 4	0	Ton=1000
TIE	Time unit	0 = seconds; 1 = minutes.	0, 1	0	Ton=1000
ALT	Timer-start lower deviation	For ET=1, 2 or 3, countdown starts when temperature reaches SP − ALT. A sufficiently large ALT setting may allow the countdown to start immediately at power-up.	0–9999°C	1 °C	Ton=1000
BL	Alarm 2 ON duration	After completion: 0 = off; 250 = stays on; 1–249 = ON duration in seconds.	0–250 s	5 s	Ton=1000

Alarm mode reference

Code	Meaning	Code	Meaning
0	No alarm	4	Low deviation
1	High absolute	5	Outside-band
2	High deviation (AL1 default)	6	Inside-band
3	Low absolute (AL2 default)	P1	High absolute with power-on hold
P2	High deviation with power-on hold	P3	Low absolute with power-on hold
P4	Low deviation with power-on hold		

Timer operation

ET	Timing operation
0	Timing disabled.
1	Start at the temperature trigger. At completion, turn the main output off and wait for operator action. The four decimal points flash at 0.5-second intervals. AL2 operates according to BL.
2	Single timing. Completion does not switch the main output off; AL2 provides the BL reminder. Timing stops after the AL2 interval. Verify mode-2 heating behavior.
3	Repeating timing. Main output is not switched off at completion. AL2 operates according to BL; after AL2 ends, timing may start again when the trigger temperature is reached.
4	Delayed start. Main output starts after ST time from power-up.

When timing is enabled, press shift and down together to view timer status on SV. Before timing starts, the preset is shown; a final-digit decimal point denotes minutes. During countdown, the point flashes at 0.5-second intervals in minute mode. Completion shows 0000. Outside the menu, hold shift and up to reset running or completed timing. Changing timing parameters also resets timing. Confirm mode-2 heating behavior before use: its operating description and the statement that heating starts after completion are inconsistent.

B4. Configuration Parameters

Hold SET and the shift key until Code appears. Enter 020 with the increment/decrement keys. These parameters are intended for factory adjustment before shipment; do not change them after delivery.

Code	Parameter	Description / options	Range / options	Factory default
SN	Input signal type	Different input types require matching input resistors. Select the code for the fitted sensor and input circuit. Verify RE3/RE5 and the O.K, 0–50, 0–5V and 1–50 mappings before changing the input.	K, J, R, S, B, E, N, T, PT, CU, O.K, 0–50, 0–5V, 1–50	K
Unit	Unit selection	°C = Celsius; °F = Fahrenheit.	°C, °F	°C
OUT	Output type	RLY: relay, 12 V pulse or SCR zero-crossing output; 1–5: 1–5 V / 4–20 mA control signal; MPO: SCR phase-angle output. Matching hardware required.	RLY, 1–5, MPO	RLY
Dir	Control direction	HOT heating/reverse; COL cooling/direct; H-C combined. HOT/COL use OUT1; H-C uses OUT1 heating and OUT2 cooling. COL/H-C require RLY.	HOT, COL, H-C	HOT
Tt	Display tracking	Pulls the display toward the setpoint within the setpoint ±Tt band.	0–10	6
Hnd	Manual control enable	0 = manual control disabled; 1 = enabled. Shift enters/exits; up/down adjusts output percentage.	0, 1	0
FAC	Over-temperature display compression	0 = disabled. Otherwise: display = SV + (PV − SV) / FAC.	0–100	0

Factory options: Code=0040

1. CTON=1000: Change SU directly using up/down; SU is not shown on the upper display. =0001: CT function enabled. Confirm the SU/SV designation on the actual unit.

2. TON=0000: Alarm 1 energized alarm operation; 0001: de-energized alarm operation. =0000: Alarm 2 energized alarm operation; 0010: de-energized alarm operation. =1000: ET timing enabled.

3. CON=0001: Manual output on/off permitted; output off at power-up. Press shift to turn output on. 0100: communication enabled. 1000: adaptive function may be enabled.

Factory options: Code=0060

1. LBAT: Heating-output fault monitoring time, in seconds.

2. LBAB: Heating-output fault monitoring band, in PV units. After full-cycle heating or full-cycle output-off continues for LBAT seconds, PV change below LBAB indicates heating fault. Change above LBAB does not. SV=EER1 indicates a heating fault. The equality case is unspecified.

3. RLRS / SrrL: Heating output type selection. SrrL=0: relay heating; SrrL=1: solid-state signal heating.

B5. Additional Information

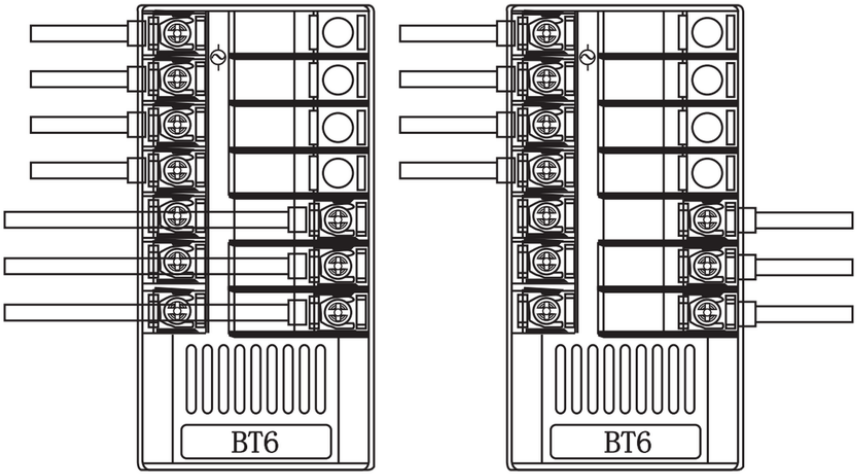
Input and output options

Inputs: K, J, R, S, B, E, N, T, PT, CU, O.K, 0–50, 0–5V and 1–50. Confirm input-code mapping before setup. Outputs: relay; logic-level/solid-state signal; PID 4–20 mA (custom); SCR phase-angle/zero-crossing (custom); 30 A relay (custom); 4–20 mA retransmission (custom).

Wire-routing and mounting options

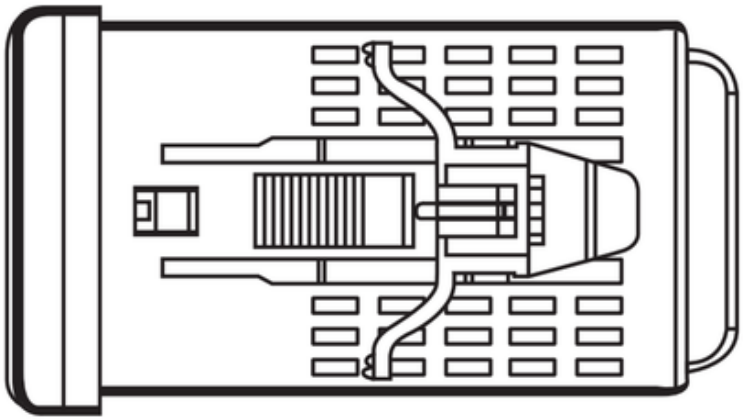
Single-side and double-side wire routing are available. The mounting clip uses a guide groove.

Single-side and double-side wire routing



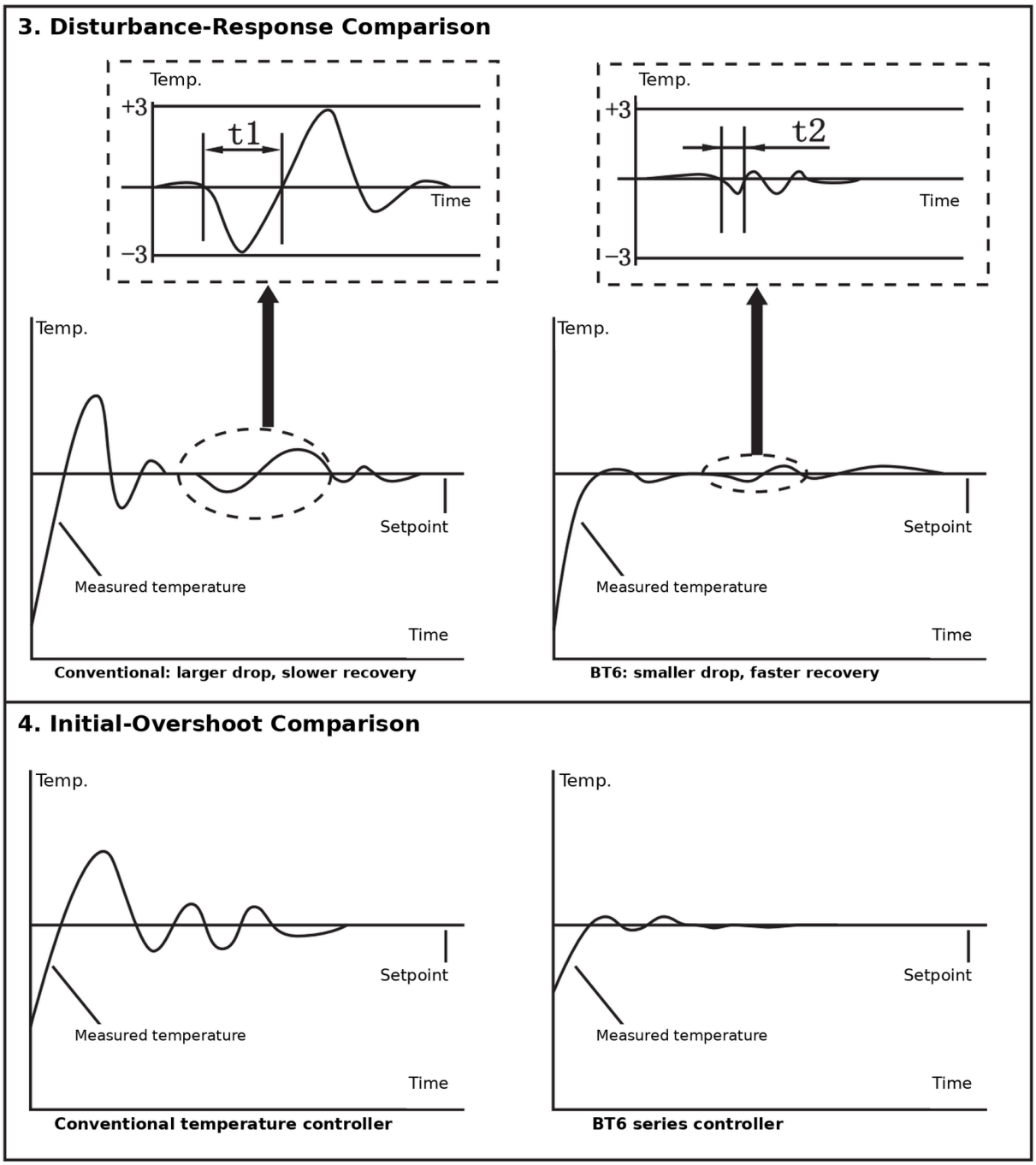
Single-side wire routing **Double-side wire routing**

Mounting clip guide groove



Mounting clip guide groove

3. Disturbance-Response and Initial-Overshoot Comparison



C1. Diagnostic Messages

If abnormal operation is detected, self-diagnostics display a diagnostic message.

Display	Meaning	Corrective action
uuuu	Input wiring is open, polarity is reversed, or the input is outside its range.	Check the input signal and wiring.
oooo	Input wiring is open, polarity is reversed, or the input is outside its range.	Check the input signal and wiring.

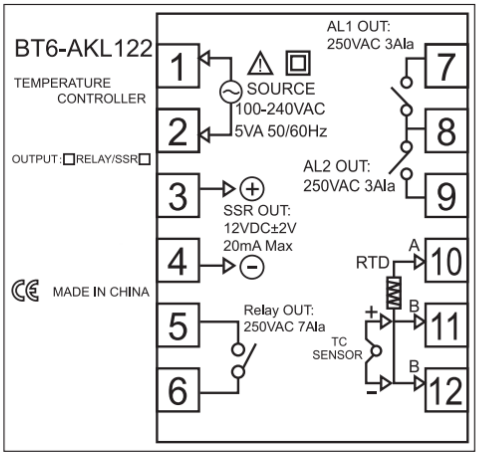
C2. Wiring Diagrams

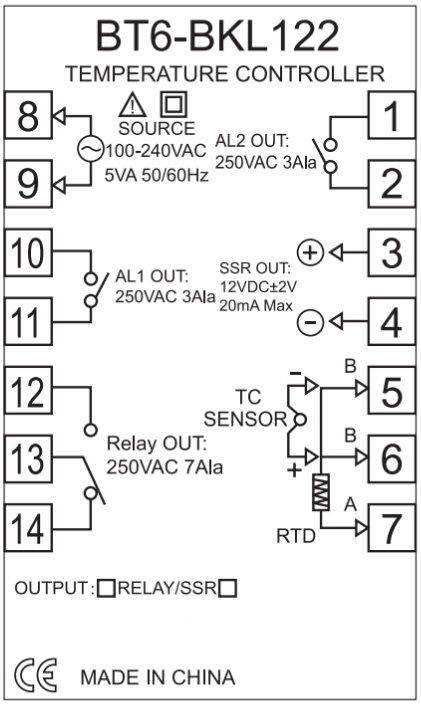
The diagrams are connection examples. The terminal diagram on the actual instrument housing takes precedence.

C2 Wiring Examples

The diagrams below are for wiring reference only.

For actual wiring, follow the diagram on the controller housing.





C3. Troubleshooting and Maintenance

1. Apply power only after checking all wiring. PV displays the measured value; SV displays the control value appropriate to the operating mode.

2. No display and no output after power-up:
① Check supply wiring.
② Check that the applied supply matches the instrument rating.
③ Measure the applied supply.

3. PV displays “uuuu” or “oooo” after power-up:
① Check input wiring.

② Check sensor/input compatibility.
③ Check sensor polarity, damage and open or short circuits.

4. No control output, but the corresponding output indicator is normal:
① Check output wiring.
② Check output-type/load compatibility.
③ Check load damage and open or short circuits.

5. Abnormal display or control:
① Check instrument wiring.
② Check whether parameter settings are appropriate.