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TemcoLine®

T50 SERIES PID Controller
User's Manual

HEATING & COOLING
Selectable for All models



T50 series

T52 | T53 | T54 | T57 | T59

Thank you for purchasing the T50 series from TemcoLine.
The T50 series is a precision industrial controller that uses an advanced 2 degree-of-freedom (DOF) algorithm.
The T50 series consists of 5 models, which are T52, T53, T54, T57, and T59.This manual explains the installation, the functions, the operation, and the handling of the products.
Please read the manual thoroughly before using the products. If any difficulties arise while using our products, please call our customer service at +82-1588-5439.

Pay attention to the followings!

- Use the products under the conditions specified in this manual.
- Please heed the cautions and warnings listed in this manual.
- The contents of the manual may be changed without notice.
- The product is designed to be used installed on a control panel.
- This manual is copyrighted, and may not be copied in part or in whole without permission.
- The manufacturer takes no responsibility for direct or indirect damages caused by careless operation or operation under unpredictable or risky environments.

Safety requirements!

Safety requirements are intended to prevent accidents and dangers through the proper use of the products, so please heed them at all times.
The safety requirements are divided into "cautions" and "warnings", which indicate the following.



WARNING

Serious injury or death may be caused if instructions are not observed.



CAUTION

Failure to observe these instructions may cause damage to the instrument or some injury to the user.



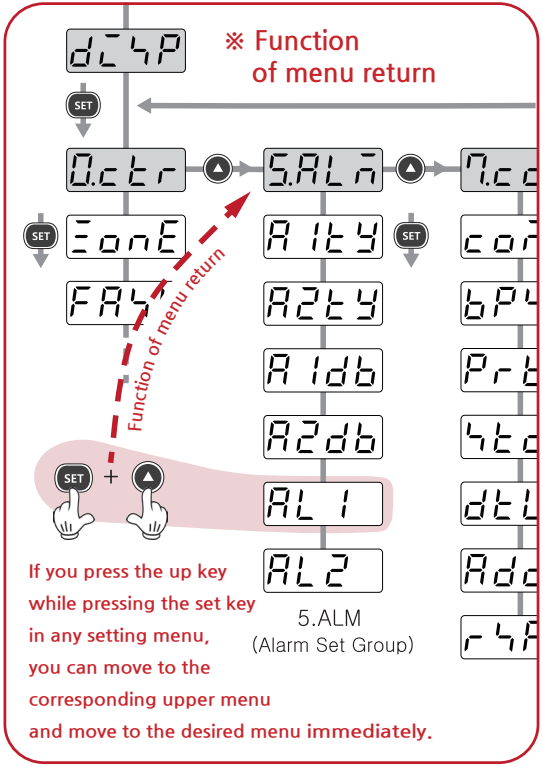
WARNING

1. Use a separate safety device when this product is used to control a device that could harm lives or expensive property in the event of a malfunction or a breakdown. (This may cause fires, deaths, or damage to property.)
2. Do not use this controller at place where there are flammable or explosive gas. (It may cause a fire or explosion.)
3. Before turning the power on, please check that wiring is correct to the number of terminal. (It may cause a fire.)
4. Turn off the power during wiring and maintenance to avoid an electric shock.
5. Do not touch the terminals when it is power on. (It may give an electric shock.)
6. This controller must be mounted on the panel to avoid an electric shock.
7. Do not attempt to disassemble, modify and repair.

CAUTION

1. Please conduct an inspection when water has entered the product. (It may cause short circuits, fires, and malfunction.)
2. This controller should be used indoors.(It may shorten the controller's life or give an electric shock.)
3. Observe the rated voltage and specification.(It may cause a fire or shorten the controller's life.)
4. Be careful that any of foreign materials do not inflow into the controller. (It may cause a fire or malfunction of the controller.)
5. Do not give direct vibration or shock to the controller. (It may cause of malfunction of the controller.)
6. Do not use chemical detergent or solvent, but use a dry towel in cleaning the controller. (It may cause an electric shock or a fire.)
7. Please check the polarity of power before wiring and connecting the sensor.(It may cause an electric shock or explosion.)
8. Power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
9. Altitude max. 2,000m
10. Pollution degree 2
11. Installation overvoltage category II
12. Relay output wires are at least 75 °C of heat resistance and, use Copper wires from 18 AWG to 24 AWG.
13. Tighten the screw of the terminal is torque from 0.74 to 0.90 N·m

Useful Features !

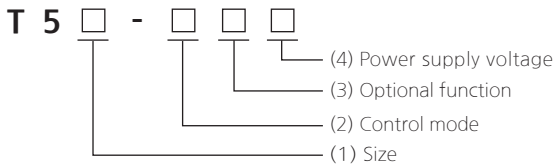


※ Use the menu return function to speed up.
The setting speed becomes very fast.

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1. Ordering Information



(1) Size

Code	Model	Size	Remarks
2	T52-SERIES	48(W) x 96(H) x 77(D)	Option: 0, 1
3	T53-SERIES	96(W) x 48(H) x 77(D)	Option: 0, 1
4	T54-SERIES	48(W) x 48(H) x 77(D)	Option: 0, 1, 2, 3, 4, 5, 6, 7
7	T57-SERIES	72(W) x 72(H) x 77(D)	Option: 0, 1, 2
9	T59-SERIES	96(W) x 96(H) x 77(D)	Option: 0, 1

(2) Control mode

Code	Description	Remarks
S	SINGLE	Heating or Cooling control
C	COMBINE	Normal type (Single) + Heating / cooling type (Dual) integration
L	LIMIT CONTROLLER	Dedicated product for monitoring and controlling the temperature for safety

(4) Power supply voltage

Code	Description	Remarks
0	100 ~ 240V AC	General-purpose usage
1	24V AC or DC	Alternating or Direct current usage

(3) Optional function

Model	Code	Description	Remarks
T52-SERIES T53-SERIES	Basic function	RELAY output 1(MAIN/Alarm 3), Alarm output 2, SCR(4~20mA), SSR(Voltage pulse) 1, RET(4~20mA Retransmission output)	Basic function + (Option code)
	0	D.I (SV1, 2, 3) External digital input	Ex.) T52, T53-C00
	1	Communication RS-485(MODBUS-ASCII, RTU) Heater ammeter & HBA(CT) Heater break alarm	Ex.) T52, T53-C10
T54-SERIES	0	RELAY output 2 (ALARM & MAIN OUTPUT), SCR(4~20mA), SSR(Voltage pulse) 1	Basic function + Option code (0 : No option)
	1	RET(4~20mA Retransmission), Alarm output 2	Ex.) T54-C10
	2	HBA(CT) Heater current & Break Alarm, Alarm output 2	Ex.) T54-C20
	3	D.I(SV2, 3) External input, Alarm output 2	Ex.) T54-C30
	4	RET(4~20mA Retransmission), Communication (RS-485)	Ex.) T54-C40
	5	HBA(CT) Heater current & Break Alarm, Communication (RS-485)	Ex.) T54-C50
	6	D.I(SV2, 3) External input, Communication (RS-485)	Ex.) T54-C60
	7	Communication (RS-485), Alarm output 2	Ex.) T54-C70
T57-SERIES	0	RELAY output 1, Alarm output 2, SCR(4~20mA), SSR(Voltage pulse) 1	Basic function + Option code (0 : No option)
	1	Communication RS-485(MODBUS-ASCII, RTU), RET(4~20mA Retransmission), HBA(CT) Heater current & Break Alarm	Ex.) T57-C10
	2	D.I(SV2, 3), RET(4~20mA Retransmission), HBA(CT) Heater current & Break Alarm	Ex.) T57-C20
T59-SERIES	0	RELAY output 1, Alarm output 2, SCR(4~20mA), SSR(Voltage pulse) 1, RET(4~20mA Retransmission)	Basic function + Option code (0 : No option)
	1	Communication RS-485(MODBUS-ASCII, RTU), HBA(CT) Heater current & Break Alarm	Ex.) T59-C10

1) Example of model building

Ex.) T54-C10

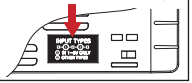
(1) Size : 48(W) x 48(H) x 77(D) ➡ **"4"**
(2) Control mode : COMBINE ➡ **"C"**
(3) Function per option : RET, Alarm output2 ➡ **"1"**
(4) Supply voltage : 100~240V AC ➡ **"0"**

T54-C10

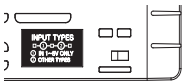
2. Input ranges and Output constitutions

1) Input ranges

※ The T50 series has multiple inputs, which may be set and changed by the user.

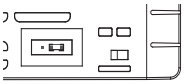
Input type	Input	Code	Temperature range	Accuracy	Remarks
Thermocouple (T.C)	K	1	-200 ~ 1370	±0.3% of FS + 1 Digit	* F.S is max. value to min. value of each range. * Digit is minimum of display.
		2	-199.9 ~ 999.9		
	J	15	-200 ~ 1000		
		3	-199.9 ~ 999.9		
	E	16	-200 ~ 1000		
		4	-199.9 ~ 999.9		
	T	5	-199.9 ~ 400.0		
	R	6	0 ~ 1700		
	B	7	400 ~ 1800		
	S	8	0 ~ 1700		
	L	17	-200 ~ 900		
		9	-199.9 ~ 900.0		
	N	10	-200 ~ 1300		
		14	-199.9 ~ 999.9		
	U	11	-199.9 ~ 400.0		
	C (W5)	12	0 ~ 2300		
	D (W3)	13	0 ~ 2400		
	Platinel Ⅱ	18	-90 ~ 1370		
		19	-90.0 ~ 999.9		
RTD	JPt100Ω (JIS, KS)	20	-199.9 ~ 500.0		
		22	-200 ~ 500		
	Pt100Ω (DIN, IEC)	21	-199.9 ~ 640.0		
		23	-200 ~ 640		
Voltage (V DC/mV DC)	0~100mV DC	33	0 ~ 100mV DC	※ When using 1~5V input (30), the interior jumper switch must be relocated. 	
	-10~20mV DC	32	-10 ~ 20mV DC		
	1~5V DC	30	1~5V DC		
Current	4~20mA DC	30	When using current input, use the resistor 250Ω on input terminal.		

※ How to change the interior switch when using 1~5V input



① Remove plate or take out the main cover.

mult-in mode



② Move and insert the jumper that pulled by tweezers.

in 1~5V only mode

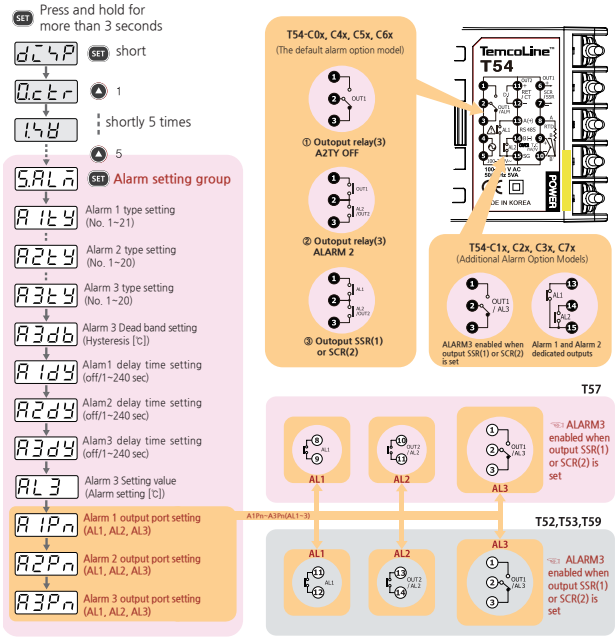


③ Relocated jumper as above and attach plate or mounted cover.

2) Output configuration

(1) Alarm output configuration

T50 SERIES can use up to three different alarm outputs for 21 different types. In addition, the unique output configuration of the system allows the user to designate the output port freely, and the alarm 1 ~ 3 outputs can be exchanged or used together.



※ Detailed description related to setting of control and alarm output port

① Basically, the T50 series output supports a total of three event outputs, each of which consists of 21 types.

② Basically, alarm 1 is set to AL1 port, alarm 2 is set to AL2 port, and alarm 3 is set to AL3 port. However, if necessary, the output port can be used in combination or a single output port can be used It provides a powerful function that can logical sum or OR the alarms 1 to 3.

☞ When alarms 1 to 3 are set to one port, it is necessary to set only one of the process high and process low, or if the process high and the process low are mixed and the port is specified as one port, process high.

③ When the cooling output is set to RELAY (3) by selecting the heating / cooling dual control mode, the AL2 (OUT2) port is used as the cooling control output.

④ In case of model without alarm option of T54 (48x48mm), the main control output (①, ②, ③) port can be automatically changed to various output contact according to the setting and can be used as maximum 2 relay contact output.

⑤ The alarm delay time is a function that waits for a set delay time before outputting the output immediately when an alarm is occurred. (Alarm LED blinks at 0.5 second intervals while waiting for output under alarm conditions.)

(2) Setting of heating and cooling control PID control mode

T50 SERIES

Press and hold for more than 3 seconds

SET short

dC4P → 0.ctr → 9.cn → 8.out (SET)

out1 (PV) / 1 (SV)

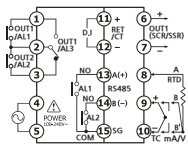
Use ◀ or ▼ , ▲ key to adjust the setting number corresponding to the output type, and then save it using SET key.

Example) Model T54-C10

Output selection number	Heating or cooling control (output 1)	Output terminal
0	RELAY ON/OFF control	①, ②, ③
1	SSR P.I.D control	⑥, ⑦
2	SCR (4~20mA) P.I.D control	⑥, ⑦
3	RELAY P.I.D control	①, ②, ③

※ Press and hold SET key for more than 3 seconds in any menus to return to Normal operation mode. After the auto tuning is completed, the entry of the input and output setting menu is automatically blocked. Please refer to the instruction manual if reset and release are required.

T54



aAct (PV) ← Selecting Output Operation (REV, DIR, DUAL)
REV : Heating control
DIR : Cooling control
Dual : Heating and cooling control

dUAL (SV)

out2 ← Only displayed during dual (heating and cooling) control

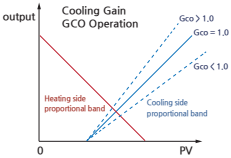
Example) Model T54-C10

Output selection number	Heating or cooling control (output 2)	Output terminal
1	SSR P.I.D control	⑪, ⑫
2	SCR (4~20mA) P.I.D control	⑪, ⑫
3	RELAY P.I.D control	⑭, ⑮

ct ← Cycle time in heating (output 1) SSR or relay
※ It is not used in the SCR (4 to 20 mA) mode, so it will not be displayed.

ctc ← Cycle time in Cooling (output 2) SSR or relay
※ It is not used in the SCR (4 to 20 mA) mode, so it will not be displayed.

Gco ← The cooling gain setting range can be set from 0.1 to 10.0



※ Caution!
In Heating & cooling mode, control output uses alarm 2 output, so must be change to alarm 1 or alarm 3 when using alarms.

(3) Dead band setting

It is used only for heating / cooling control and sets the dead zone area of heating and cooling.

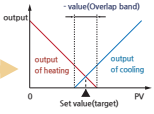
3.Pid → PID group menu

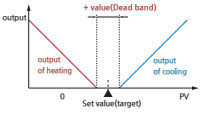
Pid → Select group (default)

1

1.db → Dead band setting (-100 ~ 100%)

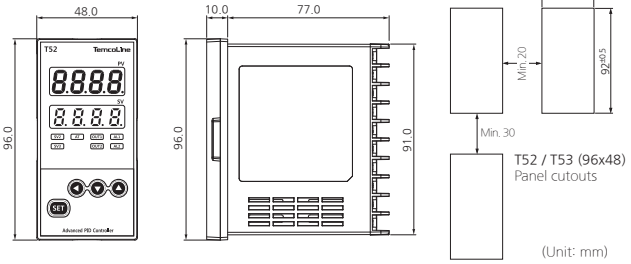
※ Explanation of operation according to dead band value
The default value is set to 0.0% and does not need to be set except in special cases.



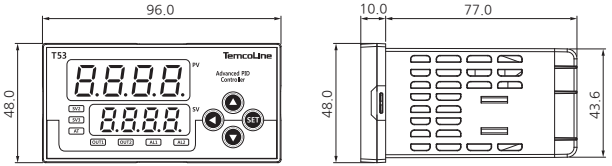


3. Dimensions and Panel cutouts

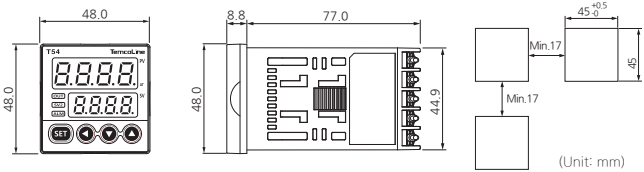
1) T52 (48x96 mm) Dimensions



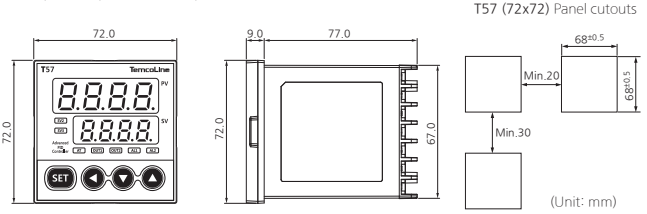
2) T53 (96x48 mm) Dimensions



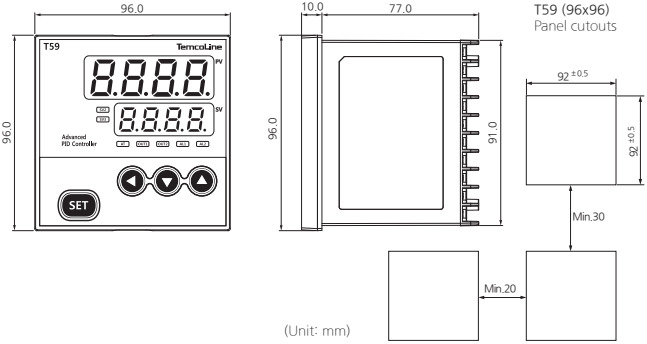
3) T54 (48x48 mm) Dimensions



4) T57 (72x72 mm) Dimensions

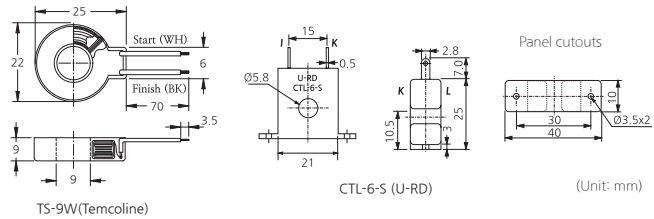


5) T59 (96x96 mm) Dimensions



※ HBA option (Heater break alarm)

Current transformer (CT) : using 800:1 CT of TS-9W or CTL-6-S



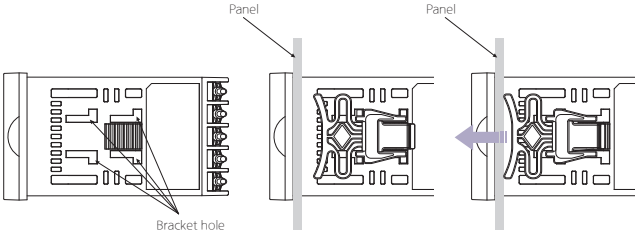
6) Installation

(1) T54-SERIES

① Process the mounting hole referring to the panel machining dimensions of the previous page on the panel.

② Insert this device from the front of the panel.

③ After inserting the two brackets into the holes of the left and right brackets of the device, Slide it until it fits tightly to the panel and secure it.



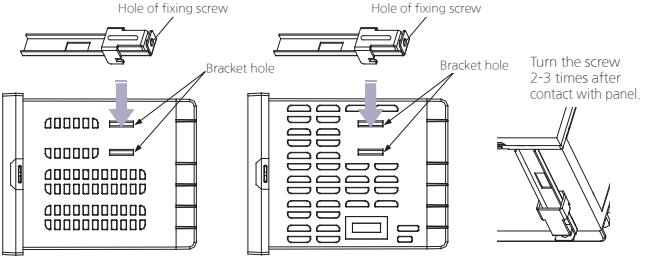
(2) T52/ T53/ T57/ T59-SERIES

① Bore a hole in the panel, referring to the panel cutouts on the previous page.

② Insert this device into the front of the panel.

③ Insert 2 brackets, one each on the bracket holes on the top and the bottom of the device.

④ Secure using screws on the two locations at top and bottom.

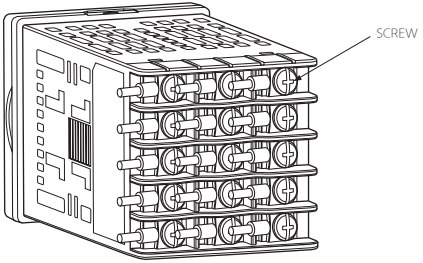


[figure 1] Top side [figure 2] Bottom side [figure 3] Fixing completion

7) Terminal wiring method

(1) SCREW

① When wiring the terminal, tighten the screw with a tightening torque of 0.74 to 0.90 N.m.



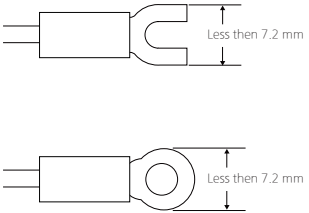
(2) Cautions for terminal wiring

① Signal lines and power lines should be separately wired to avoid the effects of noise

② Use a crimp terminal to wire the terminals.

③ Tighten the terminal screws with a tightening torque of 0.74 to 0.90 N.m.

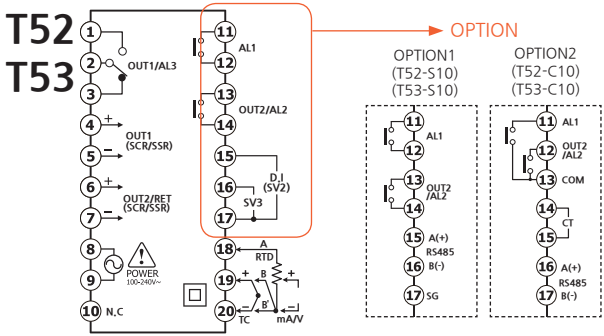
④ Please use the following form of crimp terminal M3.5.



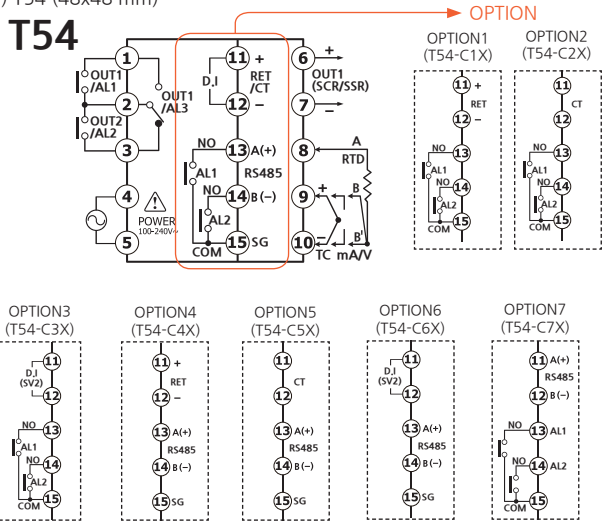
Crimp terminal

4. Terminal Arrangements and Wirings

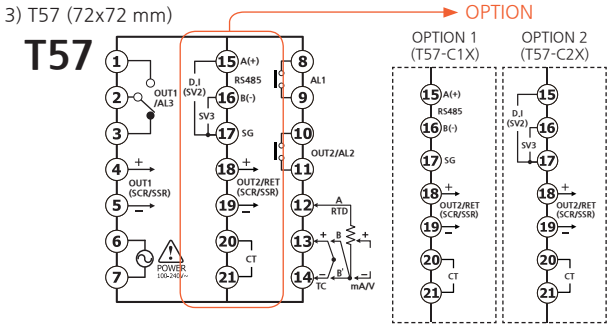
1) T52 (48x96 mm), T53 (96x48 mm)



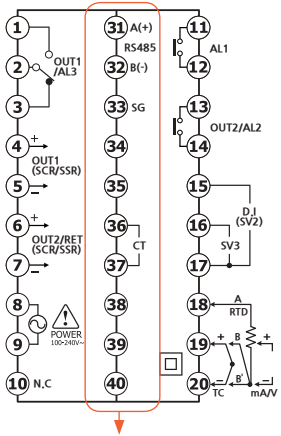
2) T54 (48x48 mm)



3) T57 (72x72 mm)



4) T59 (96x96 mm)



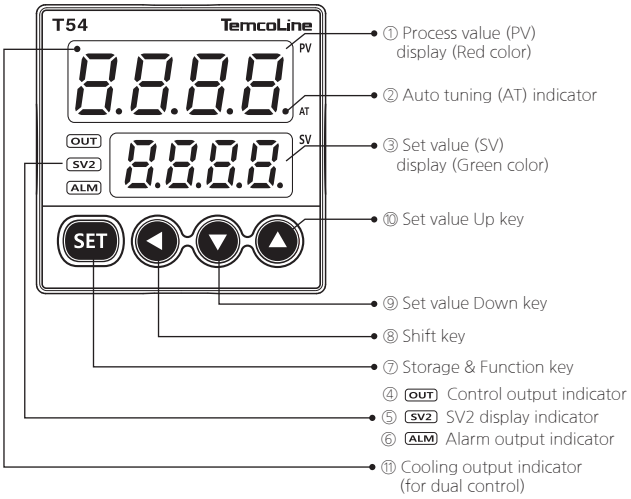
※ Terminal explanation (T59-S10 basis)

- Terminal ① ② ③ : OUT1 only for output selection no. 0, 3 (Relay output) mode.
- Terminal ④ ⑤ : OUT1 only for output. selection no. 1, 2 (SSR, SCR output) mode.
- Terminal ⑥ ⑦ : RET(Retransmission 4~20mA) or for power of sensor SPS. (DC 15V)
- Terminal ⑧ ⑨ : Power supply terminal.
- Terminal ⑪ ⑫ : Alarm1 output terminal.
- Terminal ⑬ ⑭ : Alarm2 output terminal.
- Terminal ⑮ ⑯ ⑰ : It is an external input (DI) terminal. various functions can be set with external switches according to DIS 1-5 (1: OFF, 2: SV 1-3, 3: run/stop, 4: auto/manual, 5: alarm reset).
- Terminal ⑱ ⑲ ⑳ : The input sensor type is changed according to the input setting number with the univeral input terminal.
- Terminal ㉛ ㉜ ㉝ : RS-485 communication terminals completely isolated, Modbus-ASCII, Modbus-RTU, PC-Link, TL-Link basic.
- Terminal ㊱ ㊲ : C.T(800:1) input terminals for Heater break alarm.

5. Ratings and Specifications

Model		T50 SERIES
Power Supply		Rating 100~240V AC 50~60Hz (voltage operating range: 85~265V AC) ※ Option: Rating 24V AC or DC (operating voltage range 20~28V DC)
Power Consumption		8VA(MAX) at AC100~240V 4W at DC 24V
Input Type		TC: K, J, T, E, R, B, S, L, N, U, C(W5), D(W3), PlatinelII Platinum RTD: KPt100(KS), JPt100(JIS), Pt100(DIN) Current input(A): 4~20mA DC Voltage input(V): 1~5V DC, -10~20mV DC, 0~100mV DC
Dispaly Accuracy		±0.3% of FS +1 Digit
Input Impedance		Current input(250Ω), Voltage input(including TC) 1MΩ min. (RTD line resistance: ≤ 10Ω, when 3-line resistance are the same)
Input Sampling Period		50~250ms (variable according to SG-PID algorithm)
Control Output	Relay	1c 250V AC, 3A(resistance load) electric lifespan ≥ 100,000 min. (time proportional PID output or ON/OFF output)
	Voltage (S.S.R)	DC15V 25mA (Built-in short protection circuit) Voltage pulse (time proportional PID output)
	Current (S.C.R)	4~20mA DC, load impedance ≤ 600Ω (continuous PID output)
Control Method		Super 2 degree-of-freedom PID (SG-PID algorithm), S-Fuzzy, Auto-Tuning
Multi SV Input(D.I)		ON: ≤ 1KΩ, OFF: ≥ 100KΩ(external control SV1, 2, 3)
Retransmission Output		4~20mA DC, load impedance ≤ 600Ω resolution 1/4,600 PV(process value), SV(set value), MV(manipulated variable [%]), SPS(sensor module power supply)
Alarm Output	ALARM 1, 2 HBA common (C.T)	1a 250V AC 3A (Resistive load) HBA: 0.1 ~ 38.0 A AC (Resolution 0.1A)
Communication Output		2 wires RS485 totally independent isolation structure Max. speed: 19,200bps/ Max. connect no. 99 devices (32 devices recommended) Support protocol: PC-Link, TL-Link, Modbus-ASCII, Modbus-RTU
Ambient Temperature and Humidity		-10~50℃/ relative humidity 25~85% RH (but with neither condensation nor freezing)
Certification Standards	Approved	c UL us T52-C00, C10, T53-C00, C10, T59-C00, C10 T54-C00, C40, C50, C60, T54-C01, T54-C11~C71
	Conformed	CE
Weight (Bracket, Accessories included)		•T52, T53, T57: 310g •T54: 200g •T59: 420g ※ + 30g, if options are added

6. Features and Function (ex. T54-SERIES)



※ Description

NAME	FUNCTION
① Process value	Display the process value. (red color)
② Auto tuning indicator	Blink every 0.5 second during auto tuning.
③ Set value display	Display the set value, codes, and modes.
④ Control output indicator	Lights when the control output is ON.
⑤ SV2 display indicator	Lights when the SV2 is displayed.
⑥ Alarm output indicator	Lights during the alarm is ON.
⑦ SET Function key	Use to move the menus, to store, and to operate.
⑧ ◀ Shift key	Use to shift the digits.
⑨ ▼ Set value down key	Use to decrease set value and to move the menu.
⑩ ▲ Set value up key	Use to increase set value and to move the menu.
⑪ Cooling output indicator	Displays cooling output during heating/ cooling control.

7. Check points before Using

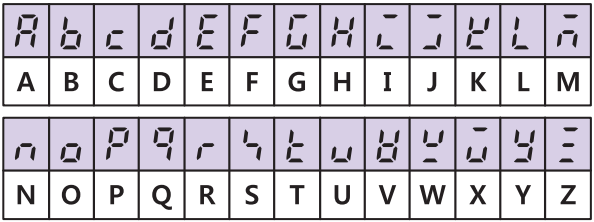
1) Default values at the point of manufacture

The default input and output values of the product at the point of manufacture are as follows.

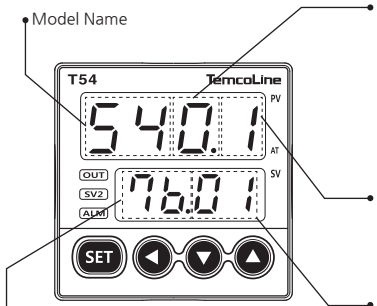
Input : K-Type (Code No. 1) Output : SSR (Code No. 1)

※ The main relay output terminals (terminals 1, 2, 3) can be used as additional alarm outputs (alarm 1 OR alarm 3), if the control output terminals are selected as SSR(1) and SCR(2).

2) 7 Segment display indications



3) Initial display on power supply (T54 SERIES basis)



- Model Name
- Firmware version display

- Option indication
  - 0 : Basic type (No option)
  - 1 : RET, ALARM1, 2
  - 2 : HBA(CT), ALARM1, 2
  - 3 : DI, ALARM1, 2
  - 4 : RET, RS-485
  - 5 : HBA(CT), RS-485
  - 6 : DI(SV1, 2), RS-485
  - 7 : RS-485, ALARM1, 2
- Output type indication
  - 0 : RELAY ON/OFF control
  - 1 : SSR (VOLT-PULSE) PID control
  - 2 : SCR (4~20mA) PID control
  - 3 : RELAY PID control
- Input type indication
  - 01 : K-Type (-200~1370 ℃)
  - 02 : K-Type (-199.9~999.9 ℃)
  - ⋮
  - 33 : mV DC (0~100mV)

8. Initial installation and Minimum operation procedures

The following are the instructions for initial installation and minimum operation procedures. Please read the contents of this manual, including the general functions outlined here, as thoroughly as possible before operating the device.

1) Check the external wiring diagram and specifications.
(power supply and terminal arrangement)

2) Check input and output specifications!
The default setting for the T50 series at the point of manufacturer are as follows.

Input : K-Type (setting code : -200 ~ 1370℃)
Output : SSR mode (setting code 1)

If you wish to change the input or the output type, please select the option you desire on the input group and the output group menus.

※ The input type settings must be configured first before changes to other set values are made.

When the input type is changed, all other parameters (set values) are reverted to their factory default.

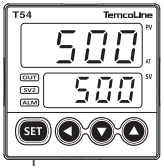
3) Select the desired set value (SV).

4) Please set auto-tuning or P, I, D values to suit the operating environment.
Auto-tuning is recommended except under special circumstances.

※ To ensure safety and prevent wrong operation, once auto-tuning has been completed, "level-2"(setting menu display limit) will be set automatically. At the same time, setting menu output group(8.out) and input group(9.in) are not displayed. If needed reset, please change to "level-3"(setting menu display limit) and operate.
Please refer to the "3) setting menu display limit" at page 28.

9. Entering into "set menu" and Setting method

1) Input & Output type setting



Temcoline products are universalized input and output. Please set up input and output type firstly and use when install our unit.

SET more than 3 sec.

dLYP

SET Press once shortly

0.ctr

Press once shortly

SET

9.Ln → LnP

LEVL 3 — When it is LEVEL 3, input/output set is available.(Refer to p28) Setting menu display limit(LEVEL) function)

① Input type setting : Select the desired input sensor type.
(setting code 1~33 / refer to P9, Input ranges)

i

unLt

SET

b.out

INPUT(T.C)	CODE	TEMP. RANGE
K	1	-200 ~ 1370
	2	-199.9 ~ 999.9
J	15	-200 ~ 1000
	3	-199.9 ~ 999.9
E	16	-200 ~ 1000
	4	-199.9 ~ 999.9
T	5	-199.9 ~ 400.0
R	6	0 ~ 1700
B	7	400 ~ 1800
S	8	0 ~ 1700
L	17	-200 ~ 900
	9	-199.9 ~ 900.0
N	10	-200 ~ 1300
	14	-199.9 ~ 999.9
U	11	-199.9 ~ 400.0
C (W5)	12	0 ~ 2300
D (W3)	13	0 ~ 2400
PlatinelII	18	-90 ~ 1370
	19	-90.0 ~ 999.9

INPUT(RTD)	CODE	TEMP. RANGE
JPt100Ω (JIS, KS)	20	-199.9 ~ 500.0
	22	-200 ~ 500
Pt100Ω (DIN, IEC)	21	-199.9 ~ 640.0
	23	-200 ~ 640

INPUT(V DC/mV DC)	CODE
0~100 mV DC	33
-10~20 mV DC	32
1~5V DC	30
4~20mA DC (Use 250Ω resistor)	

Press once shortly

8.out

SET Press once shortly

out

i

② Output type setting : Select the desired output type.

oAct

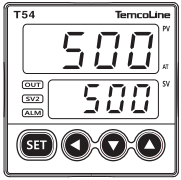
SET

oL-L

SETTING CODE	CONTROL OUTPUT
0	RELAY ON/OFF CONTROL
1	SSR P.I.D CONTROL
2	SCR (4~20mA) P.I.D CONTROL
3	RELAY P.I.D CONTROL

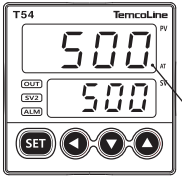
※ If the P value is set to OFF even when the P.I.D control output 1, 2, or 3 is selected, it operates in the ON / OFF mode.

2) Set value(SV) setting [in condition of Mvn = OFF (basic)]



① Enter to setting mode by SET key
② Set a desired value by ◀ ▼ ▲ key
③ Store a value by SET key

3) Quick auto tuning

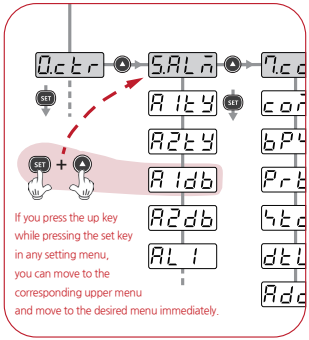


AT operation start : SET + ▲ 0.5 second
AT stop by perforce : SET + ▲ 0.5 second

AT indicator
(Blink every 0.5 second during auto tuning.)

Auto-tuning is required before operating for the first time. Set the target value(SV) in the range mainly used and run auto-tuning. When auto-tuning begins, the "auto-tuning command indicator" will blinks every 0.5 second and will turn off upon completion of the auto-tuning process. Please refrain from operating the keys while auto-tuning is in progress.

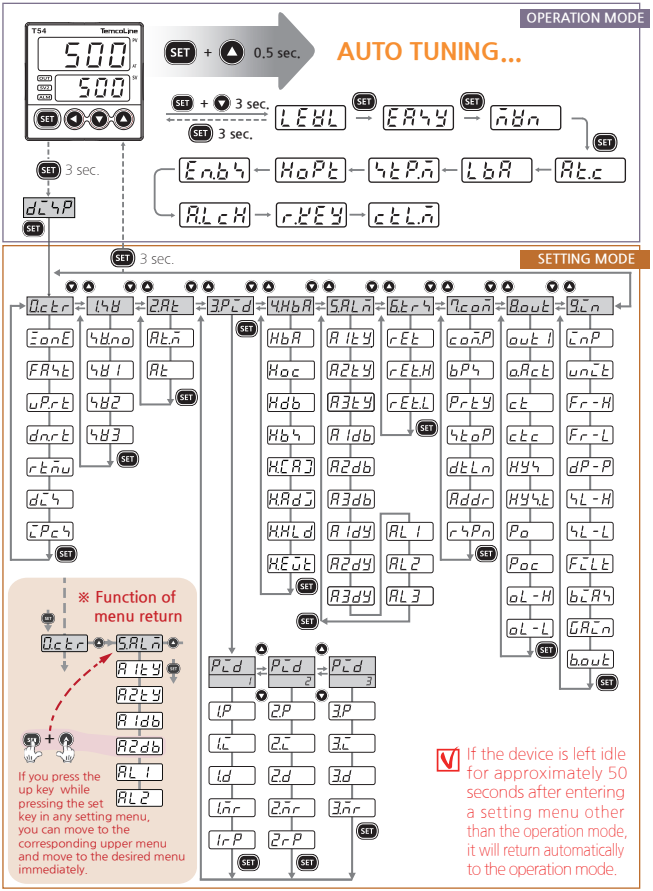
※ Function of menu return



※ Useful Features

Use the menu return function to speed up. The setting speed becomes very fast.

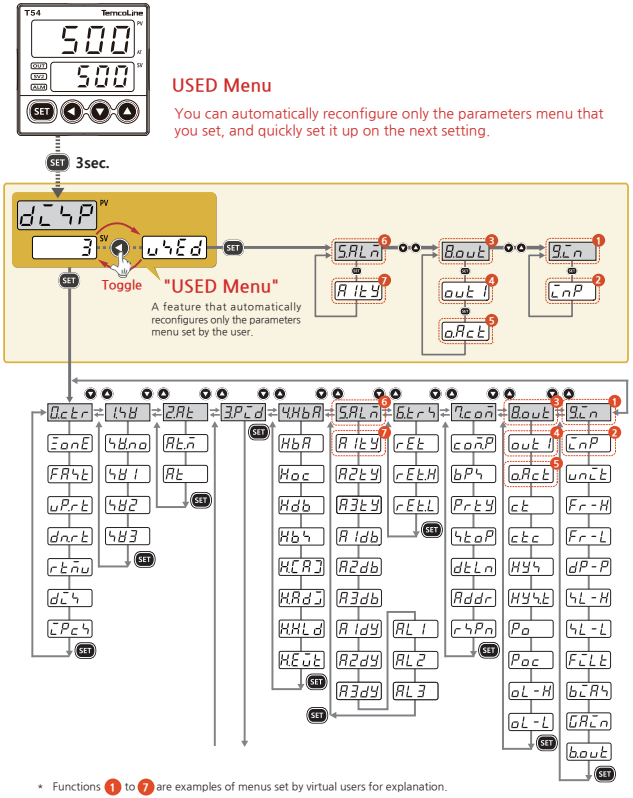
10. Flow Chart (Parameter structure)



※ The full menu diagram above shows all control and setting menus on the T50 series, but during actual operations the menus that are the most relevant to the situation according to the options and the operation mode, providing a simpler user interface while retaining functionality.

1) Menu for Smart Users

It is a convenient function that automatically re-configures only the functions that the user has changed the settings among the entire parameter setting menus, so that only the changed parameter menus can be checked and changed for each function.

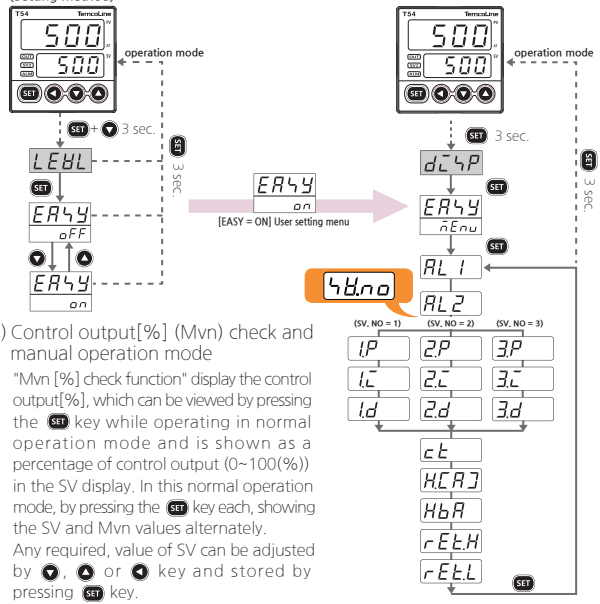


11. Easy function and Safety function

1) Easy Menu

"Easy Menu" is displays the most frequently used functions of the T50 series and hides the others.

〈Setting method〉



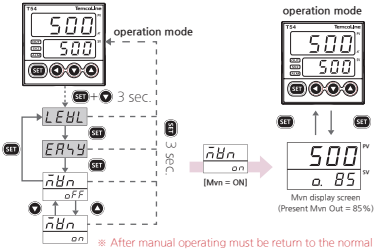
2) Control output[%] (Mvn) check and manual operation mode

"Mvn [%] check function" display the control output[%], which can be viewed by pressing the SET key while operating in normal operation mode and is shown as a percentage of control output (0~100(%)) in the SV display. In this normal operation mode, by pressing the SET key each, showing the SV and Mvn values alternately.

Any required, value of SV can be adjusted by ▼, ▲ or ◀ key and stored by pressing SET key.

〈Setting method〉

〈In condition of Mvn=ON〉



※ After manual operating must be return to the normal operation mode.

〈Mvn Manual Operation〉

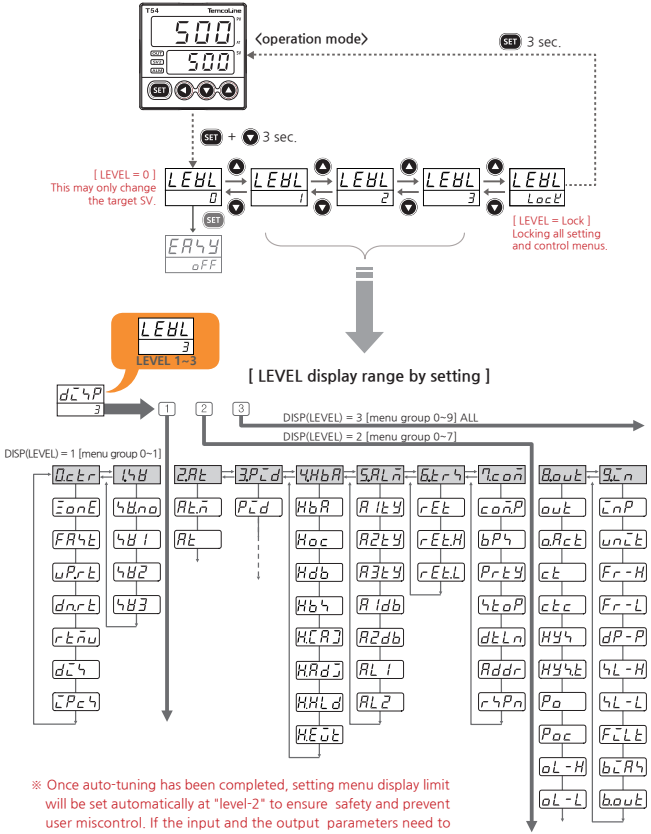
"Mvn [%] Manual Operation" can be used for testing the control output and for the manual control system, Press and hold the ▼ and ▲ keys simultaneously for 2 seconds in the control output (Mvn) display to enter. At this time, you can manipulate value the desired amount of output with the ▼ and ▲ key.



In manual operation mode, press SET key for about 1.5 seconds to return to normal operation (automatic control) mode.

3) Setting menu display limit (LEVEL) function

The setting menu display limit function limits the range displayed according to the level set in the control and the setting menus in the T50 series. This can be used, for example, to prevent user's miscontrol after all settings have been configured.



※ Once auto-tuning has been completed, setting menu display limit will be set automatically at "level-2" to ensure safety and prevent user miscontrol. If the input and the output parameters need to be changed after auto-tuning, set to "level-3" before doing so.

4) How to use other special functions



The T50 series has convenient and powerful functions. You can select whether or not to use the following special function setting menu.

SET + ▼ 3 seconds (Special function setting menu)

Press the SET key a short time to advance to the next function menu.

LEUL ① LEVEL Setting Menu Lock Function (See Page 28)

EASY ② EASY Menu setting function (See Page 27)

nUn ③ Mv(Manipulated variable) Display setting function (see Page 27)

MV [%] Displays the control output.

At.c ④ Setting of Auto Tuning type

There are two modes, FAST and NORMAL, but they are all in the default "FAST mode" except for special cases.

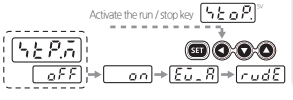
LbA ⑤ LBA(Control Loop Break Alarm) Set control loop break alarm(LBA)

If A 1ty (first alarm output type setting) is set to 21, If you do not use the HBA feature or the model does not have the HBA feature, the LBA feature is automatically enabled. The LBA value is automatically set during auto tuning (enabling the menu only when using LBA).

※ What is the control loop alarm(LBA) ?
LBA is a function that outputs an alarm when the input (sensor) does not change even if the control output is output for a certain time or longer, considering that there is an error in the control loop. That is, it can be used as a substitute for the heater break alarm(HBA) function, and is output when a defect or malfunction of the control device occurs.

StPn ⑥ Run /stop function setting

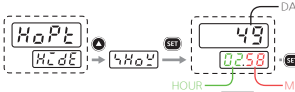
In the normal operation mode, operation or stop control is possible by pressing the ◀ key for more than 1.5 seconds. In other words, this is a menu that activates this function.



■ Stop mode
- Display : stop on the SV StoP
- Output : Control off , Alarm off
- Auto tuning : stop (P.I.D unchanged)
- Eu_A : Except alarm at stop
- rudE : Initialize Integral at Stop

HoPt ⑦ Heater operation time (accumulated) function

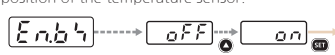
It is a function that can prevent accidents so that the life of the heater can be predicted in advance and prepared in advance. It is accumulated up to 9999 days 23 hours 59 minutes.(about 27 years or more)



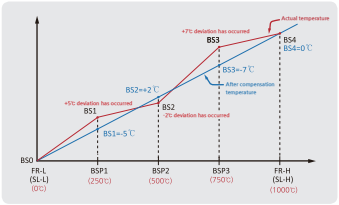
※ It is possible to initialize heater operation time rSEt but if necessary, contact customer support team.

EnbS

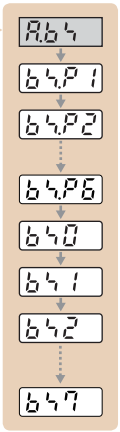
⑧ Setting the input compensation function for each section (4 sections)
This compensation function can be used when there is a mechanical problem such as a heater block, a chamber, etc., and when the present value(PV) does not match the external measured value due to the position of the temperature sensor.



※ When "EnbS" EnbS is turned on in the special function setting menu, the AbS group menu is created in the general setting group menu.



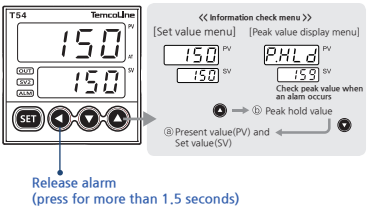
[Input compensation for each section]

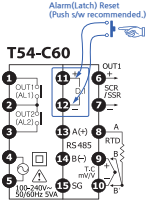


Ex.) The actual temperature of the control object used at
0 ~ 1000 ℃ was measured. Measurements at 250 ℃ are
+ 5 ℃, -2 ℃ at 500 ℃, and + 7 ℃ at 750 ℃,
In this case, the compensation settings are as follows.
FR-L=0℃, BSP1=250℃, BSP2=500℃, BSP3=750℃, FR-H=1000℃
BS0=0℃, BS1=-5℃, BS2=+2℃, BS3=-7℃, BS4=7=0℃

AL.cH

⑨ Alarm latch function setting (OFF-AL1-AL2-AL3-ALL)
This function maintains the alarm status until it is manually released from the outside after an alarm occurs. To disable this feature, press the Shift (◀) button on the front of the product.
Alternatively, you can disable the function by connecting an external switch to the DI (SV2) terminal.
When this function is set, the maximum or minimum value of input (PV) is recorded, until you disable this feature, you can check the maximum or minimum value to identify the problem.





r.KEY

⑩ Disiable function of reset on front (◀)

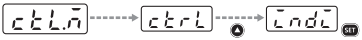
Set whether to use latch function ON or OFF when using alarm function.



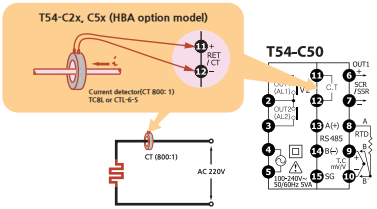
ctLn

⑪ Setting the indicator mode

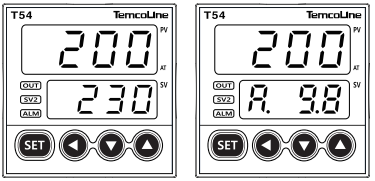
This function is for use only for monitoring without using the control function. When this function is set, all control related functions are not displayed and all parameters and user interface are automatically optimized as monitoring dedicated devices.



※ In the indicator mode, only 4. HBA setting group / 5. ALM setting group / 6. TRS setting group / 7. COM setting group / 9. IN setting group and special function setting menu can be set.



※ In the HBA setup menu, the ammeter function and the overcurrent (HOC) alarm and the HBA alarm are used as the current lower limit alarm function.



ⓐ SV: set temperature of alam ⓑ SV: Heater or other current

※ SV window can be used as a general ammeter. Depending on the alarm and settings.

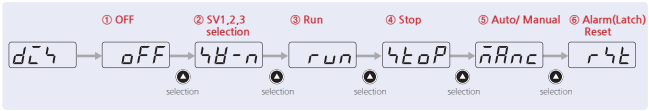
12. Functions of each setting group

1) Control group setting

Control zone, fast function, and ramp function may be selected, and the fast function works only in PID control mode. In addition, as shown in Table 1, the 3 set values (SV1, SV2, SV3) preset by the two external contact inputs may be selected and controlled.

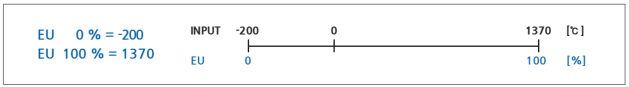
display	description	setting range	condition	initial value
0.ctr	Enter to control group	-	-	-
ZonE	Activate function of zone PID	OFF / ON	Always	OFF
FASt	Activate high speed PID mode	OFF / 1 / 2	PID control	OFF
uP.rt	Initial rising temp. setting (Ramp function)	OFF / EUS (0 ~ 100 %)	Always	OFF
dn.rt	Initial drop temp. setting (Ramp function)	OFF / EUS (0 ~ 100 %)	Always	OFF
rtMu	Time (Hour/Minute) unit selection (Ramp function)	MIN / HOUR	Always	MIN
dCH	Activate external digital input ON/OFF switch	OFF / SV1,2,3 / RUN / STOP / AUTO-MANUAL / ALARM RESET	D I option	OFF

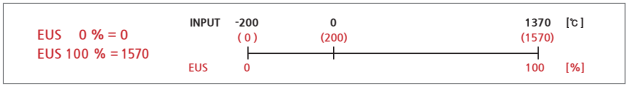
※ Function selection menu of external digital input



※ EU : An engineering unit in compliance with the input range

Ex.) Input selection no. : 01 (K-TYPE)

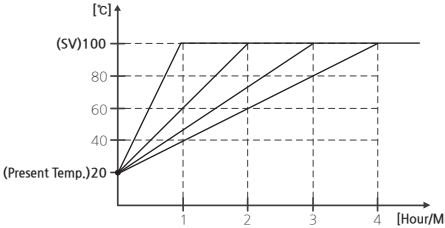




(1) Control zone (ZONE): In an environment with large temperature fluctuations, the optimal PID value may vary according to the temperature range. This function allows 3 separate temperature ranges to be set in order to control the PID value in each of them.

(2) Fast mode :
off : Used for general system control (initial value)
1 : Used in a very fast control system (CT can be set in 0.1 second increments (SSR only) ex.) Pressure, motion, thermoelectric elements, etc
2 : A system that requires fast response characteristics during general control

(3) Ramp function : This controls the incline toward the initial set values (SV1, SV2, SV3). To use this function, set the time at the initial temperature increase and decrease settings, or define the desired initial temperature increase or decrease per hour or minute. Once this has been set, a steady incline from the starting temperature to the set values will be maintained.



For example,when the desired SV is set as 100℃, the initial temperature increase as (UP.RT) 20℃, and the time unit (RTMU) as in minutes, the incline to the SV will be at 20℃ per minute.

(4) Digital input selection(dis): External contact input.It is a function to select whether to use.
① OFF: Stops the external digital input function.
② SV1, 2, 3 selection: Up to three store values can be set as set values(SV).
③ RUN: It can be controlled by connecting a digital signal or by connecting a switch to the external DI (SV2) input terminal. (initial value: Run)
④ STOP: It can be controlled by connecting a digital signal or by connecting a switch to the external DI (SV2) input terminal. (initial value: Stop)
⑤ AUTO/MANUAL : It can be controlled by connecting a digital signal or by connecting a switch to the external DI (SV2) input terminal.

※ In order to use Run / Stop function and Auto / Manual function, 'Mvn' and 'St p.M' function must be activated in special function setting menu, and communication and external input terminal can be controlled.

⑥ Alarm (Latch) Reset: When the Alarm Latch function is turned on in the special function setting menu, you can use the reset function by connecting the push switch to the external DI (SV2) input terminal.

Target set value on External contact input (SV-n)

DIS selection	SV selection mode by external contact signal		
OFF	NO external contact signal		
ON	external signal / display selection	SV2	SV3
	display the SV1	OFF	OFF
	display the SV2	ON	OFF
	display the SV3	ON	ON

※ Please use a non-voltage contact (relays, switches) for direct input. If a non-contact device such as a semiconductor are used, please operate within the ranges
ON = under 1KΩ, OFF = over 100KΩ

2) Set value(SV) group setting

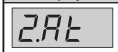
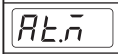
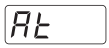
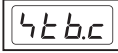
With the SV group, the 3 control set values (SV1, SV2, SV3) must be set before they can be selected and controlled as desired by direct input signal or by the internal menu.

※ When controlling with external contact signal, external contact input switch (DIS) of control setting group must be set to "SV-n". When it is OFF, it is selected by setting value number selection (SV, no).

display	description	setting range	condition	initial value
	Enter to set value setting group	-	-	-
	Target set value NO	1 / 2 / 3	Always	1
	Target set value SV1	EU (0.0 ~ 100.0 %)	Always	EU (0.0%)
	Target set value SV2	EU (0.0 ~ 100.0 %)	Always	EU (0.0%)
	Target set value SV3	EU (0.0 ~ 100.0 %)	Always	EU (0.0%)

3) Auto tuning(AT) group setting

Before the PID temperature controller can be used for the first time, the P, I, D values must be tuned. The auto-tuning function finds the optimal value by tuning automatically according to the load factor and other conditions. Please make sure that the controller is tuned before using it for the first time, by defining the set values in the most frequently used range and running auto-tuning. When auto-tuning begins, the "auto-tuning command lamp" will flash every 0.5 second and will turn off upon completion of the tuning process. Please refrain from operating the keys while auto-tuning is in progress. The T50 series is able to perform several kinds of auto-tuning. To make auto-tuning easier, the Quick-AT function, which allows the command to be executed with a simple external key combination.

display	description	setting range	condition	initial value
	Enter to auto tuning setting group	-	PID control	-
	Auto tuning (AT) type selection	Standard / Low	PID control	STD
	Auto tuning (AT) start selection	OFF / 1 / 2 / 3 / Auto	PID control	OFF
	Improved control stability after convergence	1 ~ 5	PID control	1

This product performs optimally when auto-tuning is executed in the STD mode according to the S-PID algorithm. We recommend that you operate the product in the STD mode.

(1) Types of auto-tuning (AT)

The T50 temperature controller has two tuning methods, standard auto-tuning (STD: based on the set value) and low-SV tuning (LOW: SV - 10%). Under normal conditions, the standard auto-tuning is recommended.

(2) Start auto-tuning

This menu starts the auto-tuning process. Select the number of the SV that you wish to tune (SV1 → " 1 ", SV2 → " 2 ", SV3 → " 3 "), and auto-tuning will begin, making automatic calculations which will be stored under the P, I, D values of the corresponding SV. When set on AUTO, SV1~3 will be auto-tuned consecutively if in the control group ZONE is set as off. If ZONE is on, groups 1, 2, and 3 will be created based on the ranges set in 1RP and 2RP of the PID group, and the results will each be stored under the PID groups 1, 2, and 3.

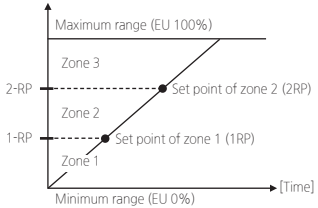
4) P.I.D group setting

This is used to view the PID and ARW values produced by auto-tuning in the auto-tuning groups, and to change the values manually.

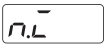
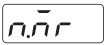
(1) In the PID selection group, press the SET key to set automatically or manually the anti-reset wind-up ARW value. Pressing again the SET key will display the PID selection mode, where you may choose to view the group PID parameters by selecting 0~3. For example, when " 0 " is selected in the PID mode, no PID values will be shown. Use the ▲ key to select " 1 " and then press the SET key to view the PID values for group 1. Selecting " 2 " and " 3 " will display the values for groups 2 and 3 respectively. (This is intended to prevent accidentally mishandling the settings.)

(2) Manual reset (MR) is displayed when the integral value set at OFF, and it is used to manually remove control offsets.

(3) When the control group zone selection mode is on, 2 zone location settings may be made to control 3 zones.



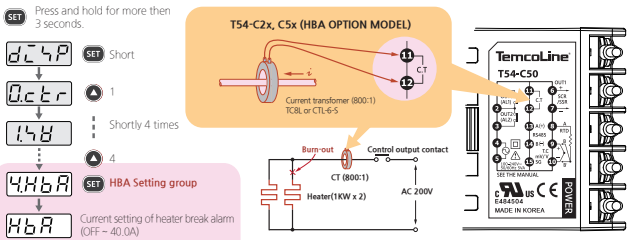
This product provides optimal control when ARW is in automatic mode according to the S-PID algorithm. We recommend that you used the product in the automatic mode. The ARW function is actually seldom required with S-PID.

display	description	setting range	condition	initial value
	Enter to P.I.D setting group	-	PID control	-
	P.I.D group selection	0 / 1 ~ 3	Always	1
	n. Proportional band (P)	OFF / 0.1 ~ 999.9 ℃ (OFF = ON/OFF)	PID group selection	20.0 ℃
	n. Integral time (I)	OFF / 1 ~ 6000 sec.	Always	240 sec.
	n. Derivative time (D)	OFF / 1 ~ 6000 sec.	Always	60 sec.
	n. Manual reset (M.R)	-5.0 ~ 105.0 %	Integral time	50 %
	n. Hysteresis band	-100.0 ~ 100.0 %	Heating and Cooling type	0.0 %
	n. Zone position setting	EU (0) < 1.RP < 2.RP < EU (100.0 %)	ZONE=ON	EU (100.0 %)

The meaning of the n symbol in the table indicates that there are a total of three groups (SV1-3), such as n.P. In other words, you can set the P, I, D parameter values separately applied according to SV number selection. Up to three P, I, and D values can be set and individually controlled to achieve optimal control for each temperature step.

5) Heater Ammeter and HBA (Heater Burnout Alarm) Setting Group

Temcoline's T50 SERIES supports instrument-level precision AC ammeter. It supports real-time AC current monitoring and HBA (heater break alarm) function of 0.1 ~ 38.0 A maximum.In normal operation mode, heater current can be monitored at the same time as current temperature.



① HBA(heater break alarm) current setting procedure is as follows

$$\text{HBA Setting value} = \frac{\text{Normal current value + burn-out current}}{2} = \frac{10A + 5A}{2} = 7.5\ [A]$$

② Hdb(Heater break alarm Dead band or hysteresis): This function is to prevent malfunction when the current change approaches or exceeds the set value.

Hdb Setting value = (maximum current - minimum current) x 1.4

However, it is not applicable when the control output SCR (2) is used.

③ Hbs (setting the start point of the heater break alarm): Displayed only when the control output SCR (2) is used. Set when using a power control device such as TPR.
The Hbs setting can be set from 0 to 95% of the control output (MVn) at convergence (default 90%).
For your information, set "HBS: 90%, A1DY:5 seconds" automatically when using HBA.
* A1TY (Alarm 1 Type Setting) must be set to 21 when using HBA.

④ H.[A](Heater current monitor): The AC current flowing in the current heater is accurately measured and displayed at 0.1 to 38.0 A. When "H.EXT" is turned ON, the SV display window of the normal operation menu is displayed in real time.

⑤ H.Adj(Heater current compensation): Calibration is possible when using a different ratio of CT than the current detector tolerance or 800: 1.

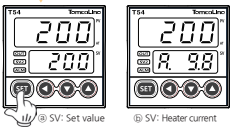
$$\text{H.Adj correction value} = \frac{38\ A}{\text{Measured value}} \times \text{Measurement deviation}$$

For example, assuming a current of 10A is displayed at 9.8A,

$$\text{H.Adj correction value} = \frac{38\ A}{9.8\ A} \times 0.2\ A \approx 0.775 \sim 0.8\ A$$

⑥ H.HLd(Heater current hold): The output when the control output is used by SSR (1) or Relay (3) is output in time division. At this time, it is very difficult to read the instantaneous current value. Therefore, the last measured current value can be temporarily held and the correct current value can be measured at any time.

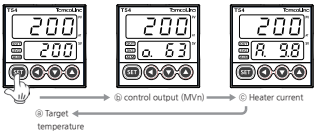
〈 Normal operation menu 〉



ⓐ SV: Set value ⓑ SV: Heater current

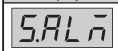
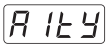
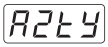
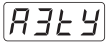
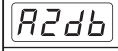
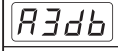
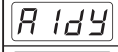
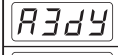
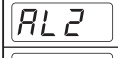
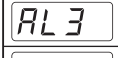
H.Ext When the external current monitoring function is enabled, the heater current can be checked from the normal operation menu in real time, just like the current temperature.

H.Ext Enables current monitoring for normal operation menu.
Hdn Enables control output for normal operation menu.



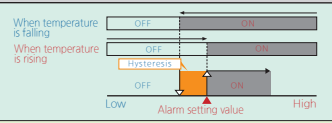
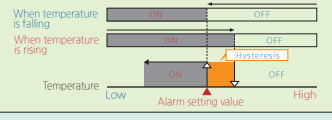
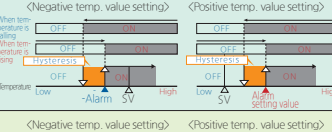
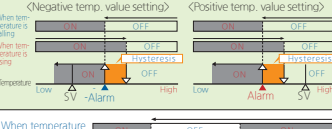
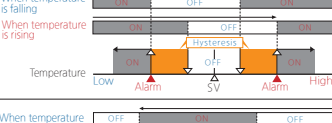
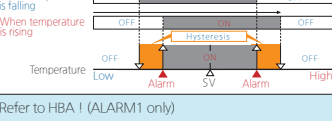
6) Alarm (Alarm1,2,3) group setting

The T50 series has three separate alarm outputs, and in the setting group, alarms may be chosen among 21 types, and the dead band(Hysteresis) for the alarm output may be set. Please find alarm code with the desired function in the 'Alarm output type and Selection code' on the next page and use it to set the alarm output in the settings mode.

display	description	setting range	condition	initial value
	Enter to alarm setting group	-	Always	-
	Type of alarm 1	OFF / 1~21	Always	3
	Type of alarm 2	OFF / 1~20	Always	OFF
	Type of alarm 3		Always	OFF
	Hysteresis of alarm 1	EUS (0.0~100.0%)	When using Alarm 1	1 ℃
	Hysteresis of alarm 2		When using Alarm 2	1 ℃
	Hysteresis of alarm 3		When using Alarm 3	1 ℃
	Delay time of alam1	OFF / 1~240 sec.	When using Alarm 1	OFF
	Delay time of alam2		When using Alarm 2	OFF
	Delay time of alam3		When using Alarm 3	OFF
	Value of alarm 1	PV alarm, Deviation alarm EU (-100.0 ~ 100.0 %)	When using Alarm 1	EU(100.0%)
	Value of alarm 2		When using Alarm 2	0 ℃
	Value of alarm 3		When using Alarm 3	0 ℃
	Output port of alarm 1	AL1/ AL2/ AL3	When using Alarm 1	AL 1
	Output port of alarm 2		When using Alarm 2	AL2
	Output port of alarm 3		When using Alarm 3	AL3

The HBA will be generated through alarm output #1 (when A1TY = 21). This means that HBA may be set only through alarm output #1.

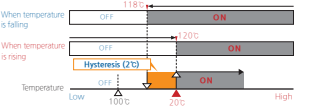
(1) Alarm output type and Selection code

CODE NO.	ALARM TYPE	ALARM OUTPUT OPERATION
01	Absolute value upper-limit	
09	Process low	
11	with hold function	
19	with hold function (Inverted)	
02	Absolute value lower-limit	
10	Process low	
12	with hold function	
20	with hold function (Inverted)	
03	Upper-limit deviation	
05	Process low	
13	with hold function	
15	with hold function (Inverted)	
04	Lower-limit deviation	
06	Process low	
14	with hold function	
16	with hold function (Inverted)	
07	Upper & Lower-limit deviation	
17	Upper & Lower-limit deviation with hold	
08	Upper & Lower-limit deviation in range	
18	Upper & Lower-limit deviation in range with hold	
21	Heater break alarm (HBA)	Refer to HBA ! (ALARM1 only)
	Control Loop break alarm	LBA operation when heater break alarm(HBA) is not used (ALARM1 only)
22	Heater break alarm (Inverted, HBA)	Refer to HBA ! (ALARM1 only)
	Control Loop break alarm (Inverted)	LBA operation when heater break alarm(HBA) is not used (ALARM1 only)

When alarm type reverse-correspondence is selected for alarm type and code, please be aware that when the alarm lamp turns on, the contact output will be off.

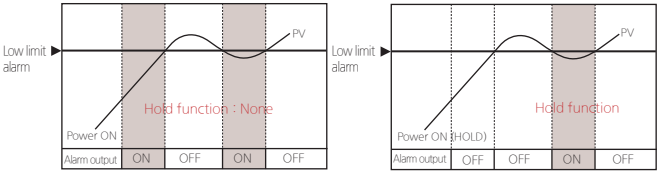
〈 example of Alarm output 1 setting 〉

- Alarm type (Upper-limit deviation) = **03**
- Hysteresis (Dead band) = **2 ℃**
- Alarm setting value = **20 ℃**



(2) Hold function

When the low limit alarm is used, when the power is turned on and the temperature rises, unnecessary low limit alarm occurs during the rise. When the hold function is enabled, the low alarm can be ignored until the alarm set value is released once the initial power is turned on.

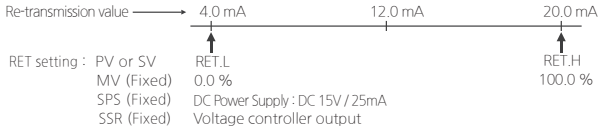


7) Re-transmission group setting

In the re-transmission output mode, process value (PV), set value (SV), manipulated variable(MV) or sensor power supply (SPS) may be chosen, and the output will be generated in direct current of 4~20mA. (SPS is DC15V/25mA)

display	description	setting range	condition	initial value
G.trn	Enter to re-transmission setting group	-	Option	-
rEt	Re-transmission type or SPS selection	PV / SV / MV / SPS / SSR	Option	PV
rEt.H	Upper limit of re-transmission	TC or RTD : Fr-H ~ Fr-L Voltage : SL-H ~ SL-L (But, RET.H > RET.L)	PV or SV selection	EU(100.0%)
rEt.L	Lower limit of re-transmission			EU(0.0%)
rEt.d	Hysteresis of re-transmission	0.0 ~ 100.0	Option	1.0

PV(Process Value) / SV(Set Value) / MV(Manipulated Variable) / SPS(Power supply for external sensor)



※ Method for correcting re-transmission output

When re-transmitting output (4 to 20 mA) is used, tolerance may occur due to the conversion resistance and peripheral equipment error. When necessary, you can easily perform high-precision calibration as described below.

① If the re-transmission output upper limit (RET.H) is set to 100.0 and the lower limit (RET.L) is set to 0.0.

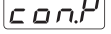
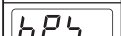
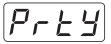
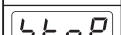
② Change RET to SV transfer mode, change the SV as the current RET.H (100.0) value, check the transferred value of the recorder or receiver (ex. 99.6) next note that the RET. L (0.0) value is also changed by transferring the SV(ex. 0.3). (This must be the same as the setting on the receiving side input range.)

③ Change the transmitted value upper limit (RET.H) to 99.6, and change the transmission output lower limit (RET.L) to 0.3.

④ When the re-transmission output mode (RET) is changed back to the PV re-transmission output mode, the correction is completed.

8) Communication group setting

The communication system of the T50 series is based on RS-485, and is a two-wire half- duplex type, capable of connecting to a maximum of 32 devices. In particular, it is a totally independent isolation structure, which very safe and reliable, and is compatible with most communication protocols used in the market (PC-Link, TL-Link, Modbus-ASCII, Modbus-RTU, Sync-Master/Slave).

display	description	setting range	condition	initial value
	Enter to communication setting group	-	Optional	-
	Protocol selection (PC/TL-Link, Modbus-ASCII/ RTU, Sync-Master/Slave)	HSTD / HSUM / H-TL MODA / MODB SYNM / SYNS		H-TL
	Baud rate selection (B.P.S)	2400 / 4800 / 9600 / 19200 [BPS]		9600 BPS
	Parity check selection	NONE / EVEN / ODD		NONE
	Stop bit selection	1-bt(bit) / 2-bt(bit)		1-bt
	Data Length selection	7-bt(bit) / 8-bt(bit)		8-bt
	Address selection	1 ~ 99		1
	Response time selection	0 ~ 10 (Response time = Handling time + Response time) x 10ms		1

The T50 series has a totally isolated input-output structure. A maximum of 32 devices may be connected to it, but this number may vary according to the site and the line conditions.

(1) Communication protocols in detail

① HSTD / HSUM

PC-Link is used by some in Korea, developed by 2 corporations.

② H-TL (TL-Link)

This is Temcoline's own protocol. The multi-remote surveillance program, which is included in the optional communications package for the T50 series, uses this protocol.(For the reference, this program has advanced recording functions)

③ MODA (Modbus-ASCII)

This ASCII-based protocol is commonly used in the industry, and is easy to use.

④ MODB (Modbus-RTU)

This binary-based protocol is the most widely used standard protocol in the industry, and has a high speed.

⑤ Sync-Master/Slave

A system of Sync communication is configured with a master controller and a number of slave controllers(up to 200 units). The slave controllers are set to operate in the same way as the master controller, this time running information (SV1, SV2, SV3, SV No.) is transmitting to slave controllers from master controller.

(2) Modbus protocol and T50 series

The Modbus communication protocol function code in the T50 series is comprised of a function code that reads and writes D-REGISTER, and another that searches for Loop-Back. For more information, please refer to the separately distributed Temcoline protocol, or contact us by our website or our customer service center.

[Modbus protocol support code]

Code	Description	
03	D-REGISTER consecutive READ	The device is capable of reading up to 32 consecutive D-Register contents.
06	Single D-REGISTER WRITE	The D-Register contents can be edited one at a time.
16	D-REGISTER consecutive WRITE	The device is capable of writing up to 25 consecutive D-Register contents.

The Modbus support device uses as address #400001~400999 in the 16-bit holding register range, which includes 400001~465536.

When using a touchscreen for interface, the read/write addresses must be set at 400001 (D-Reg. 000) ~ 400700 (D-Reg. 699) for Pro-Face products.

For EasyView products, the device setting must be at 4x (16-bit), and the address at 001 (D-Reg. 000) ~ 700 (D-Reg. 699).

In Modbus communication, the address will be designated as the real communication frame address +1. This is because the user may choose addresses from #400001 onward. (Example: #400001 = D-Reg. 000)

(3) Modbus communication setting

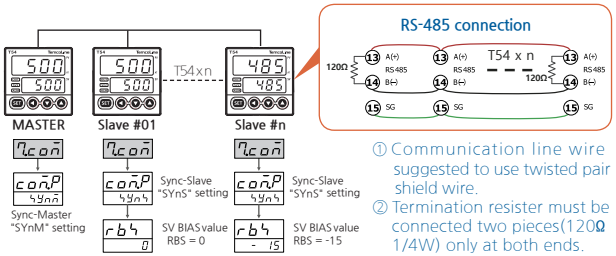
① Modbus-ASCII

COM.P : MODA, BPS : 9600, PRTY : EVEN, STOP : 1-BT(bit), DTLN : 7-BT(bit)

② Modbus-RTU

COM.P : MODB, BPS : 9600, PRTY : EVEN, STOP : 1-BT(bit), DTLN : 8-BT(bit)

(4) Sync-Master/Slave Communication set



① Communication line wire suggested to use twisted pair shield wire.

② Termination resister must be connected two pieces(120Ω 1/4W) only at both ends.

Master controller can be set only one and others should be set as Slave. In Sync communication, no need to set Address and communication option. When set in Slave (Syns), it works RBS menu.

(5) T50 D-REGISTER MAPPING

READ ONLY | READ/WRITE
PROHIBIT(READ ONLY) | RESERVED

ADDRESS		PROCESS	CONTROL	PROGRAM	PID AUTO	ALM & HBA	RET/COM/RSP	OUT & IN
Modbus	Absolute	0	100	200	300	400	500	600
400 001	0				SVNO	HBA1	RET	OUT
400 002	1	N.PV			SV1	H1DB	RET.H	O.ACT
400 003	2	N.SV	ZONE		SV2	HBS	RET.L	CT
400 004	3	N.SVNO	FAST		SV3	H.ADJ		CTC
400 005	4	DP.I	ARW			H.HLD		HYS
400 006	5	M.OUT			AT.M	H.EXT		PO
400 007	6	H.OUT	DIS		AT	HOC		POC
400 008	7	C.OUT			STB.C			OL-H
400 009	8	PID.NO	UP.RT					OL-L
400 010	9	ALM.STS	DN.RT					
400 011	10		RTMU		1.P	A1TY	COM.P	INP
400 012	11		RIFT		1.I	A2TY	BPS	UNIT
400 013	12				1.D	A3TY	PRTY	FR-H
400 014	13				1.MR	A1DB	STOP	FR-L
400 015	14	HCM1			1.Pc	A2DB	DTLN	DP-P
400 016	15				1.Ic	A3DB	ADDR	SL-H
400 017	16	ADE.STS			1.Dc	AL-1	RSPN	SL-L
400 018	17	ERR.STS	RST/(ALM)		1.DB	AL-2		FILT
400 019	18	MOD.STS	Run/Stop		1.RP	AL-3		BIAS
400 020	19		Auto/Man			A1Pn		B.OUT
400 021	20		M.MVn		2.P	A2Pn		
400 022	21				2.I	A3Pn		BS.P1
400 023	22	Limit Controller			2.D	A1DY		BS.P2
400 024	23				2.MR	A2DY		BS.P3
400 025	24		Hi.Lo		2.Pc	A3DY		BS0
400 026	25		RS.Md		2.Ic			BS1
400 027	26		HoLd		2.Dc			BS2
400 028	27	Peak Hold			2.DB			BS3
400 029	28	Keep Time			2.RP			BS4
400 030	29							BS.P4
400 031	30	HoPt(DAY)			3.P			BS.P5
400 032	31	HoPt(MINUTE)			3.I			BS.P6
400 033	32				3.D			BS5
400 034	33				3.MR			BS6
400 035	34				3.Pc			BS7
400 036	35				3.Ic			
400 037	36				3.Dc			
400 038	37				3.DB			
..	..							
..	..							
400 099	98							

※ CAUTION :
Modbus communication!
1. The T50 series supports feature codes 03, 06, and 16. This means that the mode bus-supported device is a 16 bit Holding Register area, 4x 00001 to 00999 (DEC). Alternatively, use the 4x0001 to 03E7 (HEX) address.

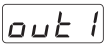
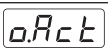
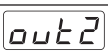
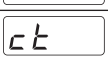
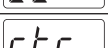
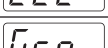
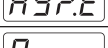
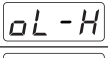
2. Modbus communication address mode
※ If you read absolute number 001 (N.PV),
1-Base mode(Master)
Ex.) 400001 + 001(N.PV)
N.PV = 400002(40002h)
0-Base mode(Master)
Ex.) 400000 + 001(N.PV)
N.PV = 400001(40001h)

3. T50 D-REG. The address is expressed in decimal(DEC). It may be used in hexadecimal (HEX) depending on PLC.
Ex.) 301 (SV1) → 0x12D (hexadecimal)

When using the communication options, please refer to the separately provided T50 series communication protocol manual. Only the basics are outlined here.

9) Output group setting

The T50 series consists of universal outputs, allowing the user to select and use the control outputs either as a relay or as an SSR (15V, DC) or SCR (4-20 mA, DC).

display	description	setting range	condition	initial value
	Enter to output setting group	-	-	-
	Device type of output1	0(ON/OFF)/ 1(SSR)/ 2(SCR)/ 3(Relay) (Refer to P12)	Always	1(SSR)
	Action type of control	REV (Reverse action) DIR (Direct action) Dual (Heating & Cooling)	Always	REV
	Device type of output2 (cooling)	1 (SSR) /2 (SCR) /3 (Relay) (P12, refer to the Output configuration)	Heating & Cooling Model	1(SSR)
	Cycle time	1 ~ 1000 sec.	SSR / RELAY control	2 sec.
	Cycle time of cooling output	1 ~ 1000 sec.	Heating & Cooling Model	2 sec.
	Cooling gain	0.1 ~10.0	Heating & Cooling Model	1.0
	Hysteresis (ON/OFF control mode)	EUS (0.0 ~ 100.0%)	ON/ OFF control	2 ℃
	Type of Hysteresis action (ON/OFF control mode)	Half / Normal	ON/ OFF control	NORM
	Output1 volume when input disconnected (OUT1)	-0.5 ~ 105.0%	Always	0.0%
	Output2 volume when input disconnected (OUT2)	-0.0 ~ 105.0%	Heating & Cooling Model	0.0%
	Upper limit of output	OL-L ~ 105.0%	PID control	100.0%
	Lower limit of output	-0.5% ~ OL-H	PID control	0.0%

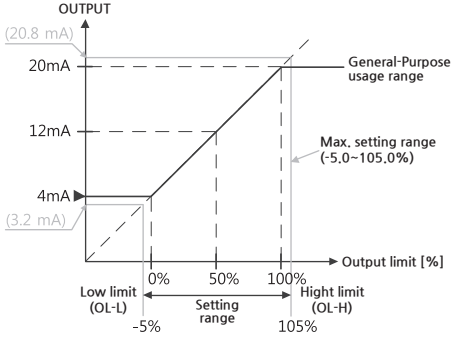
When PID control is set to Relay output code 3, the output cycle (Ct) is set to 20 seconds and the voltage pulse (SSR) output code is set to 1, the output cycle (Ct) is automatically set to 2 seconds. When changing the setting, set it separately.

(1) Setting output amount for the event that input has been cut off (Po)

If there is a problem with the input sensors or if for any reason the temperature controller does not function properly, this safety function shuts off internally controlled output or maintains steady output at a desired level.

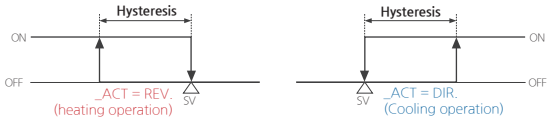
(2) Output limitation in high/low (OL-H, OL-L)

Since the T50 series uses the S-PID algorithm, this function is not necessary in most cases. This function may be used when special circumstances require limiting the output. Using the default value (0~100.0%) is recommended.

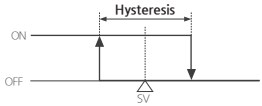


(3) Selection function for Hysteresis(ON/OFF control mode OUT=0)

(1) HYS.T = "NORM" selection



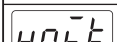
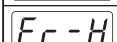
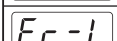
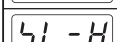
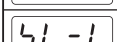
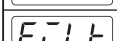
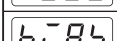
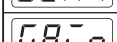
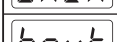
(2) HYS.T = "HALF" selection



※ While Hysteresis operation in "HALF" mode, the operation of Heating and cooling is same, and "NORM" is factory default.

10) Input group setting

The T50 series supports a wide range of specifications, including 13 types of thermocouples (TC), 2 types of platinum resistance thermometers (RTD), and 3 types of current and voltage inputs.

display	description	setting range	condition	initial value
	Enter to input setting group	-	-	-
	Type of Input sensor	1 ~ 33 (refer to P9)	Always	1
	Temperature unit for the input	℃ / ℉	TC or RTD input	℃
	Input range of upper limit	Within input range (refer to next page) but, Fr-H > Fr-L	Always	1370
	Input range of lower limit		Always	-200
	Position of decimal point (Voltage input mode)	0 / 1 / 2 / 3 (On voltage input)	Voltage input mode (mV, V)	1
	Scale of upper limit (Voltage input mode)	-1999 ~ 9999 But , SL-H > SL-L Decimal point positioning by DP-P	Voltage input mode (mV, V)	100.0
	Scale of lower limit (Voltage input mode)			0.0
	Input digital filter	OFF / 1~120 sec.	Always	OFF
	Input value compensation at the lower limit	EUS (-100.0~100.0 %)	Always	EUS (0.0%)
	Input value compensation at upper limit only voltage input	EUS (-100.0~100.0 %)	Voltage input mode (mV, V)	EUS (0.0%)
	Direction of input value during input burn-out	OFF / UP / DOWN	Always	UP

When the input type is changed, all parameters are reverted to their factory default. This means that before using the T50, the input type needs to be set first, after which other parameters can be configured. If the input settings are changed while in use, auto-tuning and other parameters need to be reconfigured.

(1) Input type selection

This is the first thing that needs to be checked and set before using the T50, as the settings here will cause other parameters to be reset to their typically optimal values for that specific type.

(2) Input unit selection (℃ / ℉)

This selects the unit of temperature measurement to be displayed when using temperature sensors. The Celsius degree is set as the default, but it may be changed to the Fahrenheit degree. On products sold in Korea, the units are fixed to the Celsius degree in compliance with the regulations.

(3) Setting decimal point position (DP-P), and free scale high and low limits (SL-H, SL-L)

This applies only when using voltage inputs (DC V, mV) or currents between 4 to 20mA (1~5V). The user may set ranges, units and decimal point position as desired. This can be used not only for temperatures but also for a number of other measurements, including humidity, pressure, and weight.

(4) Digital input filter (FILT)

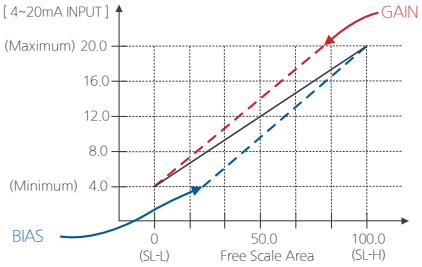
This function is useful when suboptimal environments cause noises or severe fluctuations, enabling a digital software filter. The filter's sensitivity may be set from off to 1~120 seconds. Please be careful when using this function, as it may affect the control-related algorithms.

(5) Input value bias (BIAS)

This function allows the input values to be compensated. This function is useful, for example, when sensors can not be placed at desired locations, or when several different thermometers are used in conjunction. The values may be compensated to extent desired by the user.

(6) Compensation upper limit of input value(GAIN)

It is used only in the voltage input (current 4 to 20 mA) mode, and can accurately correct the indication deviation due to the output tolerance of the sensor modulus and the tolerance of the conversion resistance (250Ω). It is used with BIAS, BIAS adjusts the offset and GAIN adjusts the slope. For example, when using the current (4 ~ 20mA) input, the tolerance is corrected by BIAS when the minimum value (4mA) is input and the tolerance is compensated by GAIN when the maximum value (20mA) is input.



※ For reference, compensation BIAS before compensation GAIN must be done first. The T50 series also offers a powerful compensation function that allows accurate measurement even without using a high-precision (± 0.1%) class with a 4 to 20 mA conversion resistance (250Ω).

11) Error indication during operation

(1) B.OUT : INPUT SENSOR error or burn out etc.
(2) +OVR : Out of maximum input range (refer to input group setting) or overheating
(3) -OVR : Out of minimum input range (refer to input group setting) or overcooling
(4) SYS.E : SYSTEM setting error or Memory damage (request for repair)
(5) RJC.E : RJC Sensor damage or PCB burn (request for repair)
(6) EEP.E : EEPROM damage (request for repair)
(7) COM.E : Communication ERROR (request for repair)
(8) AT.E : Auto Tuning Error, Checking heater break or controller

Rev. 501905-10

TemcoLine®

www.temcoline.com

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