TOHO

DIGITAL TEMPERATURE CONTROLLER

TTM-00 SERIES

Most Superior Controller with Advanced Multiple Functions!
Low Price, Easy Operation & Selectable Input!!

TOHO ELECTRONICS INC.

DIGITAL TEMPERATURE CONTROLLER

Upgraded Digital Temperature Controller with Various Functions, Easy-to-Use & Multiple Inputs

TTM-00 SERIES `TTM-004/005/007/009`

■Features

●Self-Tuning PID
Most appropriate PID constant is automatically reckoned up for control objects. PID constant is calculated when making alteration of setting value, or it is corrected when occuring disturbance/hunting etc.

●Blind Function
At the request, desirable parameter screen is only displayed and set up.

●Simplified Flavor
ON/OFF setting control available after some certain interval. Function of ON/OFF alarm output is independently usable.

●Priority Display
Demanding parameter screens are monitored and set up under operational mode screen (max. 9 screens).

●Multiple Inputs
Thermocouple/R.T.D.(JPt 100 & JPt 100) are selectable by front key.

●Standardization of Conformity
UL, CUL, CE & IP 66 approved.
*Being in process of UL, CUL, CE & IP 66 approval for TTM-005/007/009.

●Compact Size
It is a compact size. The depth is only 77mm!

●Manual Control (Balanceless & Bumpless)
Manual output function is applicable for versatile applications of instrumentation systems.

●Communication Function (RS-485)
The communication distance is extended up to 500 meters, and maximum 31 units of computers can be connected at a time. Centralized supervision is available for collection of the whole data and alteration of setting values at remote location.

●Digital PV Filter
For abrupt alteration of input value, filter effect is operational on software.

●PID Over-Shoot Protection
It is functional to inhibit PID Over-Shoot.

●DI (Digital Input) Functions
The following functions are selective.
① SV/SV2
② Run/Ready
③ Automatic (RUN)/Manual
④ Normal/Reverse Action
⑤ Normal (SV2)/Reverse Action (SV)
⑥ AT (Auto-Tuning) Start
⑦ Timer, Start/Reset

●Heating/Cooling Control
PID control is available on cooling side

●Others
① CT Input (Input Monitor usable)
② Shift setting of ON/OFF position during ON/OFF control, for both output 1 & 2.

■Front Panel

TTM-004

TTM-005

TTM-007

TTM-009

AL1	Output monitor for event output 1
AL2	Output monitor for event output 2
OUT1	Output monitor for output 1
OUT2	Output monitor for output 2
RDY	Lighting while operation ready
ATU	Lighting while operating communication (option)
MODE	Mode key in setting screen
PV	Lighting while operating PV (option)
FUNC	Function key for digit shift, AT/Auto-Tuning), RUN/READY, Timer Start/Reset
PID	Indication of processes value & character display for alarm, PID etc.
SV	Indication of setting value, manipulation value & residual time of timer
▲	Up/Down key for alteration of setting value

▼	Processing 1 ~ 10 sec. 1 digit/100ms
	  11 ~ 30 sec. 10 digits/100ms
	  over 30 sec. 100 digits/100ms

■Size
TTM-004 48 × 48 mm
TTM-005 96 × 48 mm
TTM-007 48 × 96 mm
TTM-009 72 × 72 mm

■Panel Installation

●TTM-004
●TTM-005
TTM-007
TTM-009

For this panel installation, please be careful sufficiently to avoid any of damage.
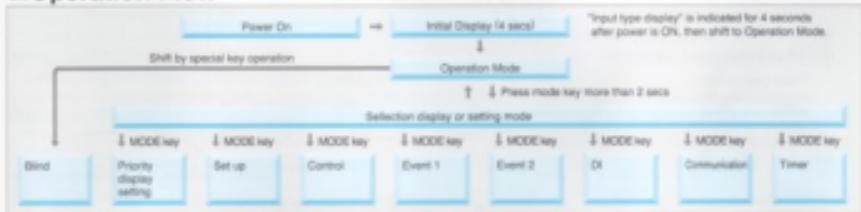
■Standard Specifications

Input Switchable	Thermocouple	K, J, T, R, N, S, B LJIS1602 ~ 1986)	
	R.T.D.	Pt100, JPt100 (Load resistance : 10 Ω or less)	
Indication	PV Character	4 digits, 7 segments Green 10mm height (15mm height for TTM-009)	
	SV (Setting Value)	4 digits, 7 segments Red 8mm height	
	Various Function Indication	LED : Red (AL1, AL2, OUT1, OUT2 or RDY), LED : Green (COM, DI)	
Control Method	PID Auto-Tuning	Proportional band (P∙)	0.1 to 200.0% of setting limiter span
	PID Self Tuning	Proportional band (P∙) a Output 2	0.10 to 10.00 times (Times per P)
		Reset time (Integral) (I)	1 to 3600 sec (0 : OFF)
		Rate time (Deviation) (D)	1 to 3600 sec (0 : OFF)
		Cycle time (T1, T2)	1 to 120 sec
		Dead band (DB)	+00.0 to +100.0 or -100 to +100.0℃
	ON/OFF	Control sensitivity (C1, C2)	0 to 999 or 0.0 to 999.9 (℃)
	OFF Point of Output 1 & 2	Position of setting	-199 to 999 or -199.9 to 999.9 (℃)
Control Output	Relay Contact	250VA C, 3A (Load resistance) 1a contact (On heating /cooling operation, output 2 is 250V AC, 2.4A load resistance, 1a contact)	
	SSR Drive Voltage	0 to 12V DC (Load resistance : 600 Ω or more)	
	Current	14 ~ 20mA DC (Load resistance : Max 600 Ω)	
Sampling Time		0.5 sec (Output change period is the same)	
Setting and Indication Accuracy	Thermocouple	±0.3% + 1 digit of process value or ±2℃, either of bigger numeral values is taken. (Ambient temperature : 23℃ ±10℃) (-100 to 0℃ : ±3℃, -200 to 100 ℃ : ±4℃ Thermocouple B under 400℃ is not regulated.	
	R.T.D.	±0.3% + 1 digit of process value or ±0.9℃, either of bigger numeral values is taken. (Ambient temperature : 23℃ ±10℃) (Ambient temperature 0 to 90℃ : ±0.5% + 1 digit or 1.5 ℃, either of bigger numeral values is taken	
Memory Element		EEPROM	
Voltage Source		100V AC to 240V AC (50/60Hz)	
Weight		TTM-004 : less than 180g, TTM-005 : less than 240g, TTM-007 : less than 250g, TTM-009 : less than 310g	
Power Consumption		Less than 10VA (240V AC)	
Accessories		Instruction manual & installation attachment (TTM-004) or installation metal instruments (TTM-005/007/009)	
Operating Condition		0 to 50℃, 20 to 90%RH (under non-condensation)	
Storage Condition		-20 to 70℃, 5 to 95%RH (under non-condensation)	
Functions	Manipulated Variable Limiter (ML1, MH1, ML2, MH2)	0.0 to 100.0%	
	Setting Limiter (SLL, SLH)	See "Input and Range".	
	Selectable Control Mode(CNT)	Auto-Tuning PID Type A ← B, Normal ↔ Reverse, Auto-Tuning PID ↔ ON / OFF	
	PV Correction Setting 1 Point (PVS)	-199 to 999 or -199.9 to 999.9 (℃)	
	PV Correction Setting Gain	0.50 to 2.00 (times)	
	Input Filter	0 to 99 (sec)	
	Manual Reset (PRB)	0.0 to 100.0%, -100.0 to 100.0 (heating & cooling) of proportional band	
	Timer Operation Mode (TME)	0.00 minute to 59.59 minutes, 0.00 hour to 99.59 hours. Accuracy : ±(1.5% + 0.5 sec) of setting time.	
	Decimal Point Shift (DP)	Decimal point display available (up to 999.9)	
	Manual Control	Auto /Manual control can be switched by key.	
	Run Ready	Run and Ready can be switched by key.	
	Blind Function	No indication available for non-required display.	
	Auto-Tuning (AT) Coefficient	After AT, the computed PV band is newly to set up with another coefficient.	
	FUNC Key	"Digit Shift" "AT" "RUN /READY" "Timer Start /Reset"	
	Priority Display	Arbitrary parameter screens are shifted to indication of operation mode by key. (max : 9 screens)	
	Lock Function (LOC)	4 modes (OFF, ALL, Operation Lock, Lock except Operation Mode)	
	Watch Dog Function	Data checked by EEPROM (Err0, A /D converter check (Err1), and Auto-Tuning check (Err2), Built-in watch dog timer.	
	Event Output 1 (AL1)	Function : PV contact output (6 modes). Special contact output (3 modes), additional functions (5 modes)	
		Setting Range : -199.9 to 999.9 or -1999 to 9999 (℃)	
		Sensitivity : 0.0 to 999.9 or 0 to 9999 (℃)	
		Rating : 250V AC 2.4A (Load resistance)1a contact.	
		Contact polarity : selectable either normal open or normal close.	

■Additional Functions (Option)

Event Output 2 (AL2 or OUT2)	Function : PV contact output (6 modes), Special contact output (3 modes), additional functions (3 modes)
	Setting Range : 199.9 to 999.9 or -1999 to 9999 (°C)
	Sensitivity : 0.2 to 999.9 or 0 to 9999 (°C)
	Relay : 250V AC 3 A/Load resistance/1a contact. When selecting output 2 and control output 2, the output generates on cooling side during heating /cooling. Contact : polarity is selectable, either normal open or normal close.
DI	Function : 5V/SVD switchable OFF: 3V/2: Auto Manual switchable OFF: Manual : Run /Ready switchable OFF: Ready : Normal /Reverse switchable OFF: Normal /Stop OFF: Normal /SV2 switchable OFF: Normal SV0, Then Start /Reset OFF: Counting
	Input Specifications : Minimum input time : 500ms, OFF voltage : 6DC max, ON current : 4mA max, Permissible resistance value at contact conduction : ON 330Ω max, OFF < 900Ω min
C/T input	Setting Range : 1 to 30A AC, Accuracy : 5% (setting resolution 1A)
Heating & Cooling	See "Control Output" in standard specifications.
Communication	RS-485 communication : Multi-Drop 2 line system, 1-31 stations max.
	Communication Parameter : BSC check: Non-BSC check, 7 bits 8 bits. Non-parity /odd number /even number, stop bit 1/2.
	Communication Speed : 1200/2400/4800/9600/19200 BPS
	Communication Address : 1 to 99
	Response Delay Time : 0 to 250m sec.

■Operation Flow

"Input type display" is indicated for 4 seconds
after power is ON, then shift to Operation Mode.

Power On → Initial Display (4 sec)

Shift by special key operation ↓

Operation Mode

↓ Press mode key more than 2 secs

Selection display or setting mode

| Blind | Priority display setting mode | Set up | Control | Event 1 | Event 2 | DI | Communicate | Timer |
| | ↕ MODE key | ↕ MODE key | ↕ MODE key | ↕ MODE key | ↕ MODE key | ↕ MODE key | ↕ MODE key | ↕ MODE key |

■Input and Range (Thermocouple & R.T.D. switchable by key)

■Timer Operation Mode

Start Mode

Thermocouple	Setting Range	Display Range
	Non-decimal point	Decimal point	Non-decimal point	Decimal point
K	°C	-200~1370	-199.9~999.9	-210~1380	-199.9~999.9
K	°C	-200~1370	-199.9~999.9	-210~1380	-199.9~999.9
J	°C	-200~400	-199.9~400.0	-210~410	-199.9~410.0
R	°C	0~1760	—	-10~1770	—
S	°C	0~1760	—	-10~1770	—
B	°C	0~1820	—	-20~1820	—
E	°C	-200~800	-199.9~800.0	-210~810	-199.9~810.0
T	°C	-200~400	-199.9~400.0	-210~410	-199.9~410.0
N	°C	-200~1300	-199.9~999.9	-210~1310	-199.9~999.9
PL-II	°C	0~1390	—	-10~1400	—
C(WRe)	°C	0~2315	—	-20~2320	—

R.T.D.	Setting Range	Display Range
	Non-decimal point	Decimal point	Non-decimal point	Decimal point
Pt100 (JIS·IEC)	°C	-199~500	-199.9~500.0	-199~510	-199.9~510.0
JPt100 (JIS)	°C	-199~500	-199.9~500.0	-199~510	-199.9~510.0

Start Mode

0	Auto start : ON delay
1	Manual start : ON delay
2	Event start : ON delay
3	Auto start : OFF delay
4	Manual start : OFF delay
5	Event start : OFF delay

ON delay : Control start or event output is ON, after time-up
OFF delay : Control stop or event output is OFF, after time-up
*Output is selectable, either event contact output or event output.

■Timer Drive Setting

0	Non-use timer function
1	Control output
2	Event 1 output

■Event Contact Output Mode (Alarm)

Abnormal PV/heater code

0	None
1	Abnormal PV contact output
2	Abnormal heater contact output
3	Abnormal PV contact output + abnormal heater contact output

Only 2 or 3 available, when re-selecting C/T input.

Additional Functions

0	None
1	Holding
2	Awaiting sequence
3	Holding + awaiting sequence
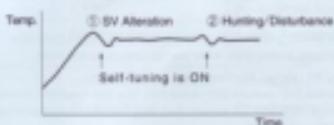
When special function is 2 , only code (1 or 1 selectable)

PV Event Code (Alarm)
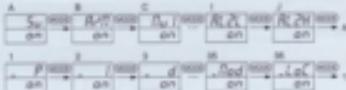
0	Deviation high limit
1	Deviation low limit
2	Deviation high and limit
3	Deviation low limit
4	Deviation high and low range
5	Deviation low and limit range
6	Absolute value high and low limit
7	Absolute value low limit
8	Absolute value high limit
9	Absolute value high and low range

■Advanced Features

●Self-Tuning PID (Standard)
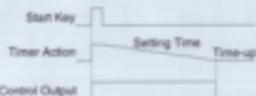
Temp.

○ Alteration   ○ Hunting・Disturbance

Self-tuning is ON

Time

The mode screen or the parameter screen whichever you demand can be displayed by merely pressing a key, at the request. When the SV screen is erased, the set value is normally not indicated but the measured value (PV) is only shown.

●Blind Function (Standard)

The mode screen or the parameter screen whichever you demand can be displayed by merely pressing a key, at the request. When the SV screen is erased, the set value is normally not indicated but the measured value (PV) is only shown.

●Timer Function (Standard)

1.Bread Oven Machine
● Put dough into oven and press the timer start key.
● While setting timer, temperature in oven is controlled by heater.
● After timer counts up, control of oven is stopped automatically. (This example is for control stop after the timer counts up.)

Start Key

Timer Action

Control Output

Setting Time
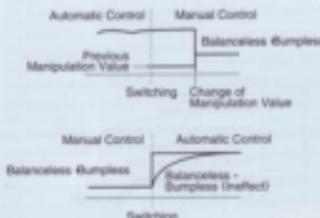
2.Package Machine and Industry Machineries
For case of start of control after the relative equipments are prepared!
● When power is "ON", the timer starts to count.
● While setting timer, control output is stopped.
● After the timer counts up, control is started automatically. (For control start after the timer counts up.)

Power

Timer Action

Control Output

Setting Time

## ●Automatic/Manual Control (Standard)
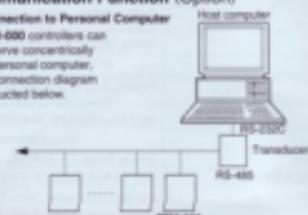
Automatic Manual control can be switched by front key for DI or communication. When checking the manipulation action for valve and heater during a system test run, or when normal control is not operational due to sensor failure, the system can be operated manually in its movie.

Automatic Control → Manual Control
Previous Manipulation Value → Balanceless・Bumpless
Switching / Change of Manipulation Value

Manual Control → Automatic Control
Balanceless・Bumpless → Balanceless → Bumpless (Indirect)
Switching

●Communication Function (Option)
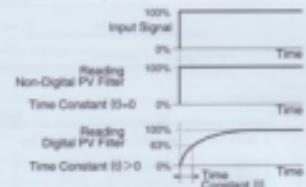
●Connection to Personal Computer
TTM-000 controllers can observe concentratedly by personal computer, as connection diagram instructed below.


●Digital PV Filter (Standard)
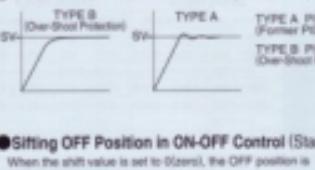
This is a function to realize a CR filter effect on software by means of primary delay estimate on the measured value (PV). The filter effect can be set by time constant (t). (The time constant is a period to reach 63% of PV value, when the input changes stepwise.)

Digital PV filter with the following uses
1) To eliminate high frequency noise : When electric noise is added to the input, the adverse effect is reduced.
2) When input changes abruptly, the response delay is possibly made.
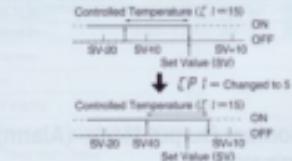
●Over-Shoot Protection PID (Standard)

●Sifting OFF Position in ON-OFF Control (Standard)

When the shift value is set to 0(zero), the OFF position is the set value position.

When the OFF position setting is shifted to +5, ON・OFF position shifts to that of +5 minutes upper than the original position. Proviso that the value is not changed. When the OFF position setting is shifted toward the minus direction, the OFF position shifts in the reverse direction.

●Heating/Cooling PID Control (Standard)

Low Cost Type

Heating PID   Cooling PID
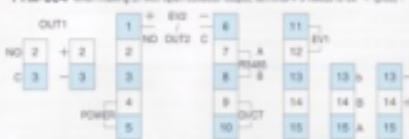
■Ordering Information

```
         Model  Output 1
TTM-00 □ - □ - A
```

※1 Input is selectable either thermocouple (K, J, R, T, S, N, B) or R.T.D. (Pt100, JPt100), with front key.
※2 R:EV1, Alarm 1/ " provided for in the standard specifications.
※3 You may select a maximum of 3 options for TTM-004; 4 options for TTM-005/007/009.

Model	004	48×48mm
	005	48×96mm
	007	72×72mm
	009	96×96mm

Output 1	R	Relay contact
	P	SSR drive voltage 12 VDC
	I	Current 4 ~ 20mA

| Options | | None | | |
	S	Output 2	Relay contact or EV2	B or P selectable
	P	Output 2	SSR drive voltage	
	R	EV2	Relay contact TTM-004 : Not selected	
			TTM-005/007/009 : Not available when DI is selected.	
	D	CT input	TTM-004 : Not provided	
	E	DI(Digital Input)	TTM-004 : Not usable when CT is selected.	
			TTM-005/007/009 : Not obtained when EV2 is selected.	
	M	Communication RS-485		
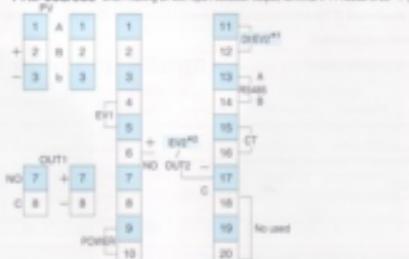
Please refer to this table for appropriate specifications when placing order.

■Wiring
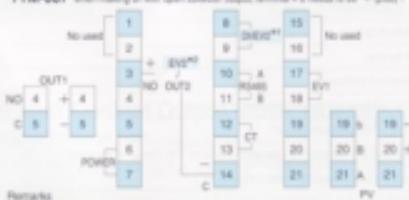
TTM-004 when routing DI with open collector output, terminal is "o" (plus)

TTM-005/009 when routing DI with open collector output, terminal ⑪ terminal is "o" ~ (plus)"

TTM-007 when routing DI with open collector output, terminal ⑭ terminal is "o" ~ (plus)"
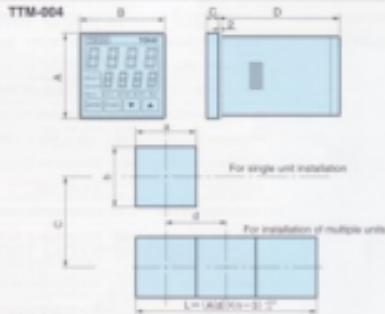
Remarks
※1: EV2 for option S selected.
※2: EV2 for option of either B or P selected.

■Terminals

DI	No 9 + side
Communication	Connect T (R (A) and T (R (B). (Use transducer, except RS-485 in use)
Relay Output	C : Common; NO : Normal open
SSR Drive Output	Connect directly to + & – input of SSR
EV 1, 2	Changeable normal open & normal close
CT	Connect specific current transformer (CTL)
R.T.D. Input	Connect to A, B and b
Thermocouple Input	Connect to (+ polarity (+o, –o)

※ When OUT 2 is "P", connect directly to & – on input of SSR side.

■Dimensions

TTM-004

For single unit installation

For installation of multiple units

Dimensions	A	B	C	D	E
TTM-004	44.7	44.7	139	48	48
TTM-005	44.7	91.7	125	48	96
TTM-007	68.7	68.7	120	72	72
TTM-009	92.7	92.7	120	96	96

For installation of multiple units, L= (N×B)+(N-1)×C
When you use compressed lead wire to install multiple units, please be careful sufficiently not to touch the other lead wires.