Two-Degree-of-Freedom PID Temperature Controllers

TN Series INSTRUCTION MANUAL

TCD210227AF

Autonics

Thank you for choosing our Autonics product.

Read and understand the instruction manual and manual thoroughly before using the product.

For your safety, read and follow the below safety considerations before using. For your safety, read and follow the considerations written in the instruction manual, other manuals and Autonics website.

Keep this instruction manual in a place where you can find easily.

The specifications, dimensions, etc are subject to change without notice for product improvement Some models may be discontinued without notice. Follow Autonics website for the latest information.

Safety Considerations

• Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.

• Λ symbol indicates caution due to special circumstances in which hazards may occur.

Warning Failure to follow instructions may result in serious injury or death

- 01. Fail-safe device must be installed when using the unit with machinery that may cause serious injury or substantial economic loss.(e.g. nuclear power control, medical equipment, ships, vehicles, railways, aircraft, combustion apparatus, safety equipment, crime/disaster prevention devices, etc.) Failure to follow this instruction may result in personal injury, economic loss or fire.
- 02. Do not use the unit in the place where flammable/explosive/corrosive gas, high humidity, direct sunlight, radiant heat, vibration, impact or salinity may be present.
- Failure to follow this instruction may result in explosion or fire. 03. Install on a device panel to use.

Failure to follow this instruction may result in electric shock.

- 04. Do not connect, repair, or inspect the unit while connected to a power source.
- Failure to follow this instruction may result in fire or electric shock. 05. Check 'Connections' before wiring.
- Failure to follow this instruction may result in fire. 06. Do not disassemble or modify the unit.

Failure to follow this instruction may result in fire or electric shock.

▲ Caution Failure to follow instructions may result in injury or product damage

01. When connecting the power input and relay output, use AWG 20 (0.50 mm²) cable or over, and tighten the terminal screw with a tightening torque of 0.74 to 0.90 N m.

When connecting the sensor input and communication cable without dedicated cable, use AWG 28 to 16 cable and tighten the terminal screw with a tightening torque of 0.74 to 0.90 N m.

Failure to follow this instruction may result in fire or malfunction due to contact

02. Use the unit within the rated specifications.

- Failure to follow this instruction may result in fire or product damage 03. Use a dry cloth to clean the unit, and do not use water or organic solvent.
- Failure to follow this instruction may result in fire or electric shock 04. Keep the product away from metal chip, dust, and wire residue which flow into the unit.

Failure to follow this instruction may result in fire or product damage.

Cautions during Use

• Follow instructions in 'Cautions during Use'. Otherwise, it may cause unexpected accidents.

- Check the polarity of the terminals before wiring the temperature sensor. For RTD temperature sensor, wire it as 3-wire type, using cables in same thickness and length. For thermocouple (TC) temperature sensor, use the designated compensation wire for extending wire.
- Keep away from high voltage lines or power lines to prevent inductive noise. In case installing power line and input signal line closely, use line filter or varistor at power line and shielded wire at input signal line. Do not use near the equipment which generates strong magnetic force or high frequency noise.

· Do not apply excessive power when connecting or disconnecting the connectors of the product.

• Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.

- Do not use the unit for other purpose (e.g. voltmeter, ammeter), but temperature controller.
- When changing the input sensor, turn off the power first before changing. After changing the input sensor, modify the value of the corresponding parameter.
- Do not overlapping communication line and power line. Use twisted pair wire for communication line and connect ferrite bead at each end of line to reduce the effect of external noise. Make a required space around the unit for radiation of heat. For accurate temperature
- measurement, warm up the unit over 20 min after turning on the power.
- Make sure that power supply voltage reaches to the rated voltage within 2 sec after supplying power.
- Do not wire to terminals which are not used.
- This unit may be used in the following environments.
- Indoors (in the environment condition rated in 'Specifications')
- Altitude Max. 2,000 m - Pollution degree 2
- Installation category II

Ordering Information

This is only for reference, the actual product does not support all combinations. For selecting the specified model, follow the Autonics website .

T N O - O O O O	6	- 0	8 - 6	
O Size S: DIN W 48 × H 48 mm H: DIN W 48 × H 96 mm L: DIN W 96 × H 96 mm	nm S: SSR drive			
Control method No mark: Fixed control P: Program control	S: Scr	minal typ ew mmunica		
Power supply 4: 100 - 240 VAC	N: No R: RS4	ne 185		
 Alarm outputs 2: Alarm 1 / 2 4: Alarm 1 / 2 / 3 / 4 	Op No.	tion inpu Digital input	t/output CT input	Transmission output
6: Alarm 1/2/3/4/5/6	006 008	0	1	0
Control output 1 R: Relay	009	3	1	0
S: SSR drive	014 026	3	2	0
C: Current or SSR drive	031 035	0 6	2	1

Manual

For proper use of the product, refer to the manuals and be sure to follow the safety considerations in the manuals.

Download the manuals from the Autonics website.

Software

• Bracket

Download the installation file and the manuals from the Autonics website.

DAQMaster

DAQMaster is comprehensive device management program. It is available for parameter setting, monitoring.

Product Components

Product

Instruction manual

Sold Separately

 Communication converter: SCM Series Current transformer (CT)

Terminal protection cover

Front cover

Specifications

Power sup	ply	100 - 240 VAC~, 50/60 Hz ±10%		
Power consumption		\leq 8 VA		
Display type		11 segment, LCD type (operating value display part: 7 segment)		
Sampling period		50 / 100 / 250 ms (parameter)		
Input spec	ification	Refer to 'Input Type and Using Range'		
Option	СТ	 0.0-50.0 A (primary current measurement range) CT ratio: 1/1,000 Measurement accuracy: ±5% F.S. ±1digit 		
input	Digital	• Contact - ON: ≤ 2 kΩ, OFF: ≥ 90 kΩ • Non contact - residual voltage ≤ 1.0 V, leakage current ≤ 0.1 mA • Outflow current: ≈ 0.5 mA per input		
	Relay	250 VAC~ 3A 1a		
Control	SSR	12 VDC= \pm 2 V, \leq 20 mA		
output	Current	DC 0 - 20 mA or DC 4 - 20 mA (parameter), Load resistance: \leq 500 Ω		
	Alarm	250 VAC~ 3 A 1a		
Option output	Transmission	DC 4 - 20 mA (load resistance: \leq 500 $\Omega,$ output accuracy: $\pm 0.3\%$ F.S.)		
	Communication	RS485		
	Туре	ON/OFF, P, PI, PD, PID		
	Multi SV	\leq 4 SV		
Control	Group PID	≤ 8 group		
type	Zone PID	4 zones		
	ARW (Anti Reset Windup)	50 to 200 %		
Drogram	Program	\leq 10 patterns		
Program control	Step	\leq 200 steps (1 pattern: \leq 20 steps)		
	Setting type	Time setting		
Hysteresis		• Thermocouple, RTD: 1 to 100 (0.1 to 100.0) °C/°F • Analog: 1 to 100 digit		
Proportional band (P)		0.1 to 999.9 °C (0.1 to 999.9%)		
Integral time (I)		0 to 9,999 sec		
Derivative time (D)		0 to 9,999 sec		
Control cy	cle (T)	Relay / SSRP output: 0.1 to 120.0 sec Selectable current or SSR drive output: 1.0 to 120.0 sec		
Manual re	set	0.0 to 100.0%		
Dielectric	strength	Between the charging part and the case: 3,000 VAC \sim 50/60 Hz for 1 min		
Vibration		0.75 mm amplitude at frequency of 5 to 55 Hz in each X, Y, Z direction for 2 hours		
Relay life	Mechanical	OUT1/2: ≥ 5,000,000 operations AL1/2/3/4/5/6: ≥ 20,000,000 operations		
cycle	Electrical	OUT1/2: ≥ 200,000 operations AL1/2/3/4/5/6: ≥ 100,000 operations		
Insulation	resistance	\geq 100 MΩ (500 VDC== megger)		
Insulation type		Double insulation or reinforced insulation (mark: \Box , dielectric strength between the measuring input part and the power part: 3 kV)		
Noise imm	nunity	± 2 kV square shaped noise by noise simulator (pulse width: 1 $\mu s)$ R-phase, S-phase		
Memory re	etention	\approx 10 years (non-volatile semiconductor memory type)		
Ambient t	emperature	-10 to 50 °C, storage: -20 to 60 °C (no freezing or condensation)		
Ambient h	umidity	35 to 85%RH		
Protection structure		IP65 (Front panel, IEC standards)		
Loader port		TNS: top side TNH, TNL: front side		
Accessory		Bracket		
	nt (packaged)	$\begin{array}{ll} \bullet TNS: \approx 128 \ g \ (\approx 156 \ g) & \bullet TNH: \approx 184 \ g \ (\approx 286 \ g) \\ \bullet TNL: \approx 301 \ g \ (\approx 443 \ g) \end{array}$		
Approval				

Communication Interface

-

RS485	
Comm. protocol	Modbus RTU/ASCII, Sync-Master, PLC ladderless
Connection type	RS-485, RS-422A
Application standard	EIA RS485 compliance with
Maximum connection	32 units (address: 01 to 99)
Synchronous method	Asynchronous
Comm. Method	Two-wire half duplex
Comm. effective range	≤ 800 m
Comm. speed	\leq 115,200 bps
Response time	5 to 99 ms (default: 20 ms)
Start bit	1 bit (fixed)
Data bit	8 bit (fixed)
Parity bit	None (default), Odd, Even
Stop bit	1 bit, 2 bit (default)
EEPROM life cycle	pprox 1,000,000 operations (Erase / Write)
1 deserves of March Reve BTU is fixed	

• 1 character of ModBus RTU is fixed at 11 bit.

Input Type and Using Range

The setting range of some parameters is limited when using the decimal point display.

Input typ	e	Decimal point	Display	Using range (°C)	Using range (°F)		
	14 (04)	1	K E R.H	-200 to 1,350	-328 to 2,462		
	K (CA)	0.1	K E AL	-199.9 to 999.9	-199.9 to 999.9		
	J (IC)	1	JI E.H	-200 to 800	-328 to 1,472		
	J (IC)	0.1	JI E.L	-199.9 to 800.0	-199.9 to 999.9		
	E (CR)	1	E C R.H	-200 to 800	-328 to 1,472		
	E (CR)	0.1	E C R.L	-199.9 to 800.0	-199.9 to 999.9		
	T (CC)	1	E C C.H	-200 to 400	-328 to 752		
		0.1	E E E.L	-199.9 to 400.0	-199.9 to 752.0		
	B (PR)	1	ь PR	0 to 1,800	32 to 3,272		
Thermo	R (PR)	1	R PR	0 to 1,750	32 to 3,182		
-couple	S (PR)	1	S PR	0 to 1,750	32 to 3,182		
-coupie	N (NN)	1	N NN	-200 to 1,300	-328 to 2,372		
	C (TT) ⁰¹⁾	1	C EE	0 to 2,300	32 to 4,172		
	G (TT) 02)	1	G EE	0 to 2,300	32 to 4,172		
	L (IC)	1	LI E.H	-200 to 900	-328 to 1,652		
	L (IC)	0.1	LIE.L	-199.9 to 900.0	-199.9 to 999.9		
	L (RUS)	1	L R.H	-200 to 800	-328 to 1,472		
		0.1	L R.L	-199.9 to 800.0	-199.9 to 999.9		
	U (CC)	1	U С С.Н	-200 to 400	-328 to 752		
		0.1	U C C.L	-199.9 to 400.0	-199.9 to 752.0		
	Platinel II	1	PLII	0 to 1,390	32 to 2,534		
	Cu50 Ω	0.1	CU S	-199.9 to 200.0	-199.9 to 392.0		
	Cu100 Ω	0.1	C U 10	-199.9 to 200.0	-199.9 to 392.0		
	JPt100 Ω	1	JPE.H	-200 to 650	-328 to 1,202		
RTD		0.1	JPE.L	-199.9 to 650.0	-199.9 to 999.9		
RID	DPt50 Ω	0.1	d P E S	-199.9 to 600.0	-199.9 to 999.9		
	DPt100 Ω	1	dPE.H	-200 to 650	-328 to 1,202		
	DFLIOU 12	0.1	dPE.L	-199.9 to 650.0	-199.9 to 999.9		
	Nickel120 Ω	1	NI 12	-80 to 260	-112 to 500		
	0 to 10 V	-	AV I	0 to 10 V			
	0 to 5 V	-	812	0 to 5 V			
Analog	1 to 5 V	-	AK 3	1 to 5 V			
Analog	0 to 100 mV	-	AMV I	0 to 100 mV			
	0 to 20 mA	-	8 1 8 1	0 to 20 mA			
	4 to 20 mA	-	8882	4 to 20 mA			

• Permissible line resistance per line: $\leq 5 \Omega$

01) C (TT): Same as existing W5 (TT) type sensor

02) G (TT): Same as existing W (TT) type sensor

Display accuracy

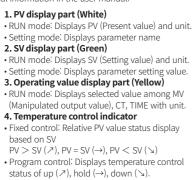
Input type	Using temperature	Display accuracy
Thermo -couple	At room temperature (23°C ±5 °C)	$ \begin{array}{l} (\text{PV}\pm0.2\% \text{ or }\pm1\ ^\circ\text{C}\ \text{higher one})\pm1\text{-digit} \\ \bullet\ \text{Thermocouple K, J, T, N, E}\ \text{below -100\ ^\circ\text{C}}\ \text{and L, U, PLII,} \\ \text{RTD}\ \text{CuSD}\ \Omega, \text{DPtSD}\ \Omega:\ (\text{PV}\pm0.3\% \text{ or }\pm2\ ^\circ\text{C}\ \text{higher one})\pm1\text{-digit} \\ \bullet\ \text{Thermocouple C, G}\ \text{and R, S}\ \text{below 200\ ^\circ\text{C}:} \\ (\text{PV}\pm0.3\% \text{ or }\pm3\ ^\circ\text{C}\ \text{higher one})\pm1\text{-digit} \\ \bullet\ \text{Thermocouple B}\ \text{below 400\ ^\circ\text{C}:}\ \text{There is no accuracy} \\ \text{standards} \end{array} $
RTD	Out of room temperature range	$\begin{array}{l} (\text{PV}\pm0.5\% \text{ or }\pm2\ ^\circ\text{C} \text{ higher one}) \pm1\text{-digit} \\ \cdot \text{RTD Cu50}\ \Omega,\ \text{DPt50}\ \Omega; (\text{PV}\pm0.5\% \text{ or }\pm3\ ^\circ\text{C} \text{ higher one}) \\ \pm1\text{-digit} \\ \cdot \text{Thermocouple R, S, B, C, G:} \\ (\text{PV}\pm0.5\% \text{ or }\pm5\ ^\circ\text{C} \text{ higher one}) \pm1\text{-digit} \\ \cdot \text{Other sensors:} \leq \pm5\ ^\circ\text{C} (\leq-100\ ^\circ\text{C}) \end{array}$
Analog	At room temperature (23°C ±5°C)	±0.2% F.S. ±1-digit
Analog	Out of room temperature range	±0.5% F.S. ±1-digit

Unit Descriptions

• Below is based on TNL Series.

• The shape and function of each part may be different depending on the series, and it is possible to check the additional information in the user manual.

1 髩 5 2 3 100000



7. Input key

(SCM-USP).

communication converter

5. Operation status indicator

Display	Name	Description	Display	Name
LOCK	Lock	Turns ON during key lock status.	[U]	User key
PROG	Program	Turns ON during program	[M]	Mode key
1100	Tiogram	control.	[◀], [▼], [▲]	Setting value
WAIT	Wait	Turns ON during waiting status.	[], [V], []	control key
HBA1/2	Heater break alarm	Turns ON when the heater break alarm output is ON.	8. PC loader	•
			For connectir	Ig

6. Output status indicator

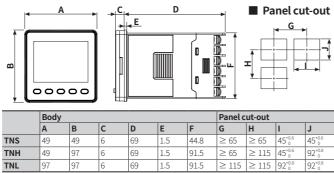
Display	Name	Description
OUT1/2	Control output	Turns ON when the control output is ON
AT	Auto tuning	Flashes during auto tuning every 1 sec
MAN	Manual control	Turns ON during manual control mode
STOP Control output stop		Turns ON during control output stop mode
HOLD Program control hold		Turns ON when program control is hold status
AL1 to 6	Alarm output	Turns ON when the alarm output is ON

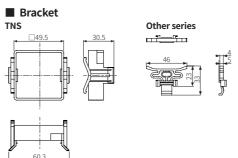
Errors

Display	Input	Description	Output	Troubleshooting
oPEN	Temperature sensor	Flashes at 0.5 sec interval when input sensor is disconnected or sensor is not connected.	'Sensor error, MV' parameter setting value	Check input sensor status.
OFCN	Analog	Flashes at 0.5 sec interval when input is over F.S. $\pm 10\%$.	'Sensor error, MV' parameter setting value	Check analog input status.
нннн	Temperature sensor	Flashes at 0.5 sec interval if the input value is above the input range.	Heating: 0%, Cooling: 100%	
нннн	Analog	Flashes at 0.5 sec interval if the input value is over 5 to 10% of high limit or low limit value.	Normal output	When input is within the rated
	Temperature sensor	Flashes at 0.5 sec. interval if the input value is below the input range.	Heating: 100%, Cooling: 0%	input range, this display disappears.
LLLL	Analog	Flashes at 0.5 sec interval if the input value is over 5 to 10% of low limit or high limit value.	Normal output	
ERR - is error fo		Flashes at 0.5 sec interval if there is error for setting and it returns to the error-before screen.	-	Check setting method.

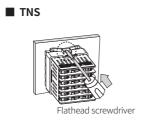
Dimensions

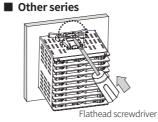
- Unit: mm, For the detailed drawings, follow the Autonics website.
- Below is based on TNS Series.





Installation Method

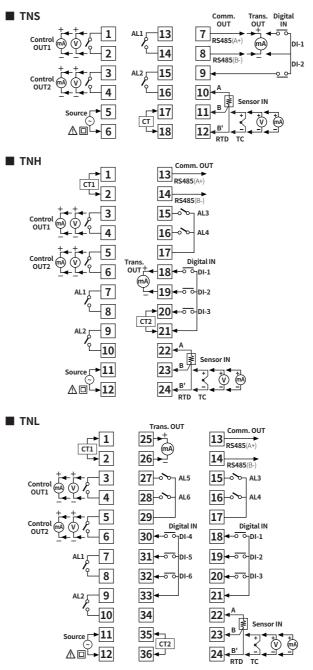




Insert the unit into a panel, fasten the bracket by pushing with tools with a flathead screwdriver.

Connections

 Digital input is not electrically insulated from internal circuits, so it should be insulated when connecting other circuits.



Crimp Terminal Specifications

• Unit: mm, Use the crimp terminal of follow shape





Fork crimp terminal

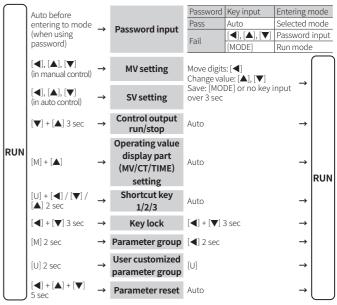
Round crimp terminal

Initial Display When Power is ON

When power is supplied, after all display will flash for 1 sec, model name is displayed sequentially. After input sensor type will flash twice, enter into RUN mode.

Display part	1. Model	2. Model	3. Input specification	4. RUN mode
PV	E N 5.P	RS	FAbe	oPEN
SV	42RR	006	к с я.н	٥

Mode Setting



• TNS series does not support 'MV setting', 'Operation value display part setting' mode. For the details, refer to the user manual.

