Autonics

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

Safety Considerations

- ▲ 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 failure

- 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.

Two-Degree-of-Freedom PID **Temperature Controllers**



TN Series PRODUCT MANUAL

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

The specifications, dimensions, etc are subject to change without notice for product improvement Some models may be discontinued without notice.

Features

- · 2-DOF PID algorithm optimized for various control environments
- + 50 ms high-speed sampling and \pm 0.2% display accuracy
- Program control and fixed control models available
- Up to 10 patterns X 20 steps program setting (program control model)
- Timer function for preset operation (fixed control model)
- · Simultaneous heating/cooling and automatic/manual control function Control functions: Group PID, Zone PID, Anti Reset Windup (ARW)
- Control status monitoring of up to 10 events
- RS485 communication output model available
- Communication protocols: Modbus RTU/ASCII, PLC ladderless, Sync-Master - Communication speed: up to 115,200bps
- · Heater burnout alarm function (CT input)
- · Parameter setting via PC
- Comprehensive Device Management Software (DAQMaster) provided
- Communication converter connection with front loader port (TNH, TNL only)
- Shortcut key setting with front user key button [U]
- · Easy maintenance with detachable terminal blocks



- 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 - 2 3 3	66	- 0	8 - 6			
● Size S: DIN W 48 × H 48 mm H: DIN W 48 × H 96 mm L: DIN W 96 × H 96 mm	R: Rel S: SSF	ntrol out ay R drive rrent or SS				
 Control method No mark: Fixed control P: Program control 	T Co N: No R: RS4		ation			
3 Power supply 4: 100 - 240 VAC		8 Terminal type S: Screw				
Alarm outputs	() Op	Option input/output				
2: Alarm 1 / 2 4: Alarm 1 / 2 / 3 / 4	No.	Digital input	CT input	Transmission output		
6: Alarm 1 / 2 / 3 / 4 / 5 / 6	006	0	1	0		
Control output 1	008	2	1	0		
R: Relay	009	3	1	0		
S: SSR drive	014	3	2	0		
	026	0	1	1		
C: Current or SSR drive	031	0	2	1		

Manual

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

035 6

Download the manuals from the Autonics website.

Software

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

• Bracket

Instruction manual

Sold Separately

- Communication converter: SCM Series
- Terminal protection cover
- Current transformer (CT) • Front cover

Specif	ications					
Power sup	ply	100 - 240 VAC~, 50/60 Hz ±10%				
Power con		≤ 8 VA				
Display ty	pe	11 segment, LCD type (operating value display part: 7 segment)				
Sampling		50 / 100 / 250 ms (parameter)				
Input specification		Refer to 'Input Type and Using Range'				
Option	СТ	O.0-50.0 A (primary current measurement range) OT ratio: 1/1,000 Measurement accuracy: ±5% F.S. ±1digit				
input	Digital	• Contact - ON: $\leq 2 \text{ k}\Omega$, OFF: $\geq 90 \text{ k}\Omega$ • Non contact - residual voltage $\leq 1.0 \text{ V}$, leakage current $\leq 0.1 \text{ mA}$ • Outflow current: $\approx 0.5 \text{ mA per input}$				
	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				
Control type	Multi SV	\leq 4 SV				
	Group PID	≤ 8 group				
	Zone PID	4 zones				
	ARW (Anti Reset Windup)	50 to 200 %				
Program control	Program	≤ 10 patterns				
	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				
	nal band (P)	0.1 to 999.9 °C (0.1 to 999.9%)				
Integral ti		0 to 9,999 sec				
Derivative	time (D)	0 to 9,999 sec				
Control cy		Relay / SSRP output: 0.1 to 120.0 sec Selectable current or SSR drive output: 1.0 to 120.0 sec				
Manual res		0.0 to 100.0% Between the charging part and the case:				
Vibration		3,000 VAC ~ 50/60 Hz for 1 min 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	≥ 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 retention		pprox 10 years (non-volatile semiconductor memory type)				
Ambient temperature		-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 po	rt	TNS: top side TNH, TNL: front side				
Accessory		Bracket				
Unit weigh	nt (packaged)	$\begin{array}{l} \bullet TNS: \approx 128 \; g \; (\approx \; 156 \; g) \\ \bullet TNL: \approx \; 301 \; g \; (\approx \; 443 \; g) \end{array} \bullet TNH: \approx \; 184 \; g \; (\approx \; 286 \; g)$				
Approval		C € . 91 us 🕅				

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	≤ 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 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)
	K (CA)	1	к E Я.Н	-200 to 1,350	-328 to 2,462
-	IN (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
	L (CIV)	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
	T (CC)	0.1	E C C.L	-199.9 to 400.0	-199.9 to 752.0
	B (PR)	1	ь PR	0 to 1,800	32 to 3,272
	R (PR)	1	R PR	0 to 1,750	32 to 3,182
Thermo	S (PR)	1	S PR	0 to 1,750	32 to 3,182
-couple	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	ն եե	0 to 2,300	32 to 4,172
	L (IC)	1	LIE.H	-200 to 900	-328 to 1,652
		0.1	LI E.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 (CC)	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	CU 10	-199.9 to 200.0	-199.9 to 392.0
	JPt100 Ω	1	JPE.H	-200 to 650	-328 to 1,202
RTD	JPt100 Ω	0.1	JPE.L	-199.9 to 650.0	-199.9 to 999.9
RID	DPt50 Ω	0.1	dPt5	-199.9 to 600.0	-199.9 to 999.9
	DPt100 Ω	1	dPE.H	-200 to 650	-328 to 1,202
	DPt100 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 1	0 to	10 V
	0 to 5 V	-	8v2	0 to	
Analag	1 to 5 V	-	A¥3	1 to	5 V
Analog	0 to 100 mV	-	AMV I	0 to	100 mV
	0 to 20 mA	-	AMA I	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 RTD	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 below -100^\circ\text{C}\text{ and L, U, PLII,} \\ \text{RTD Cu50}\Omega, \text{DPt50}\Omega; (\text{PV}\pm0.3\% \text{ or }\pm2^\circ\text{C}\text{ higher one}) \\ \pm1\text{-digit} \\ \bullet\text{Thermocouple C, G and R, S 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 below 400^\circ\text{C}:} \\ \text{Thermocouple B below 400^\circ\text{C}:} \\ \end{array} $
	Out of room temperature range	$\begin{array}{l} (\text{PV}\pm0.5\% \text{ or }\pm2\ ^\circ\text{C} \text{ higher one})\pm1\text{-digit}\\ \bullet\text{ RTD Cu50 }\Omega, \text{ DPt50 }\Omega; (\text{PV}\pm0.5\% \text{ or }\pm3\ ^\circ\text{C} \text{ higher one})\\ \pm1\text{-digit}\\ \bullet\text{ Thermocouple R, S, B, C, G:}\\ (\text{PV}\pm0.5\% \text{ or }\pm5\ ^\circ\text{C} \text{ higher one})\pm1\text{-digit}\\ \bullet\text{ Other sensors: }\leq\pm5\ ^\circ\text{C}\ (\leq\text{-100\ }^\circ\text{C})\end{array}$
Apolog	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

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€目

• Below is based on TNL Series.

1

2

3

<u>00000</u>

• 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. PV display part (White)

• RUN mode: Displays PV (Present value) and unit. • Setting mode: Displays parameter name

2. SV display part (Green)

• Setting mode: Displays parameter setting value. 3. Operating value display part (Yellow)

(Manipulated output value), CT, TIME with unit.

based on SV

Program control: Displays temperature control

5. Operation status indicator

Display	Name	Description
LOCK	Lock	Turns ON during key lock status.
PROG	Program	Turns ON during program control.
WAIT	Wait	Turns ON during waiting status.
HBA1/2	Heater break alarm	Turns ON when the heater break alarm output is ON.

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.
	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.
0000	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
LLLL	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.
	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	-	Flashes at 0.5 sec interval if there is error for setting and it returns to the error-before screen.	-	Check setting method.

• RUN mode: Displays SV (Setting value) and unit.

• RUN mode: Displays selected value among MV

4. Temperature control indicator

• Fixed control: Relative PV value status display

 $PV > SV (\nearrow)$, $PV = SV (\rightarrow)$, $PV < SV (\searrow)$

status of up (\nearrow), hold (\rightarrow), down (\searrow).

7. Input key

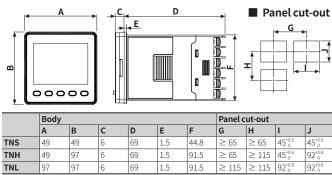
Display	Name		
[U]	User key		
[M]	Mode key		
[◀], [▼], [▲]	Setting value control key		

8. PC loader port

For connecting communication converter (SCM-USP).

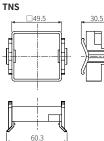
Dimensions

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



INS	49	49	6	69	1.5	44.8	≥ 65	≥ 65	45.0	45 0
TNH	49	97	6	69	1.5	91.5	≥ 65	≥ 115	45 ^{+0.6}	92 ^{+0.8}
TNL	97	97	6	69	1.5	91.5	≥ 115	\geq 115	92 ^{+0.8}	92 ^{+0.8}

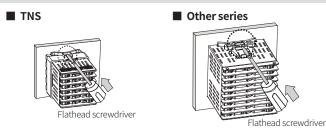
Bracket







Installation Method

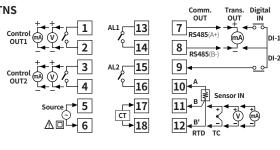


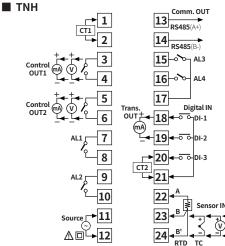
Insert the unit into a panel, fasten the bracket by pushing with tools with a flathead screwdriver.

Connections

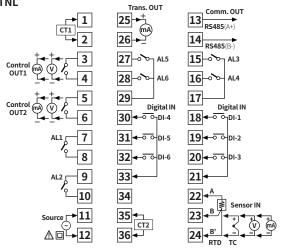
• Digital input is not electrically insulated from internal circuits, so it should be insulated when connecting other circuits.

TNS





TNL



Crimp Terminal Specifications

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

≤5.8 ≥3.0

≥3.0 ≤5.8

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	ЕЧРЕ	oPEN
SV	42RR	006	K E A.H	٥

Mode Setting

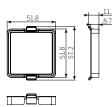
	Auto before entering to mode (when using password) →		Password input	Password Pass Fail	Key input Auto [◀], [▲], [▼] [MODE]	Selected mod], [▼] Password inp		
	[◀], [▲], [▼] (in manual control)	\rightarrow	MV setting	Move digits: [◀] Change value: [▲], [▼]			\bigcap	
	[◀], [▲], [▼] (in auto control)	\rightarrow	SV setting	Save: [MOI over 3 sec	DE] or no key i	nput 🕇		
	[▼] + [▲] 3 sec	\rightarrow	Control output run/stop	Auto	\rightarrow			
RUN	[M] + [▲]	→	Operating value display part (MV/CT/TIME) setting	Auto	\rightarrow	RUN		
	[U] + [◀] / [▼] / [▲] 2 sec	\rightarrow	Shortcut key 1/2/3	Auto		\rightarrow		
	[◀] + [♥] 3 sec	\rightarrow	Key lock	[◀] + [▼] 3	3 sec	\rightarrow		
	[M] 2 sec	\rightarrow	Parameter group	[◀] 2 sec		\rightarrow		
	[U] 2 sec	\rightarrow	User customized parameter group	[U]		\rightarrow		
	[◀] + [▲] + [▼] 5 sec	→	Parameter reset			→		

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

Sold Separately: Front cover

• Unit: mm, For the detailed drawings, follow the Autonics website.

TNS: FSA-COVER





TNL: FLA-COVER

