Autonics

Multi-Channel Modular Type Temperature Controller

TM SERIES

INSTRUCTION MANUAL

Thank you for choosing our Autonics product.
Please read the following safety considerations before use.

▣ Safety Considerations

※Please observe all safety considerations for safe and proper product operation to avoid hazards.
※Safety considerations are categorized as follows.
⚠**Warning** Failure to follow these instructions may result in serious injury or death.
⚠**Caution** Failure to follow these instructions may result in personal injury or product damage.
※The symbols used on the product and instruction circumstances in which hazards may occur.
⚠ symbol represents caution due to special

⚠ Warning

1. **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 fire, personal injury, or economic loss.
2. **Install on a device panel to use.**
   Failure to follow this instruction may result in fire.
3. **Do not connect, repair, or inspect the unit while connected to a power source.**
   Failure to follow this instruction may result in fire.
4. **Check 'Connections' before wiring.**
   Failure to follow this instruction may result in fire.
5. **Do not disassemble or modify the unit.**
   Failure to follow this instruction may result in fire.

⚠ Caution

1. **When connecting the power input and relay output, use AWG 26~12 cable and connecting the sensor input and communication cable without dedicated cable, use AWG 28~14 cable.**
   Failure to follow this instruction may result in fire or malfunction due to contact failure.
2. **Use the unit within the rated specifications.**
   Failure to follow this instruction may result in fire or product damage.
3. **Use dry cloth to clean the unit, and do not use water or organic solvent.**
   Failure to follow this instruction may result in fire.
4. **Do not use the unit in the place where flammable/explosive/corrosive gas, humidity, direct sunlight, radiant heat, vibration, impact, or salinity may be present.**
   Failure to follow this instruction may result in fire or explosion.
5. **Keep metal chip, dust, and wire residue from flowing into the unit.**
   Failure to follow this instruction may result in fire or product damage.

▣ Ordering Information

TM 2 – 2 2 R B

※1: The expansion module does not supply power/comm. terminal. Order it with the basic module.

Module type	**B**		Basic module
	E		Expansion module※1
Control output	**2CH**	**R**	Relay output
		C	Selectable current or SSR drive output
	4CH	**R**	Relay output
		S	SSR drive output
Power supply	**2**		24VDC
Option I/O	**2CH**	**2**	CT input, Digital input (DI-1, DI-2), Alarm output 1+2, RS485 comm. output
		4	CT input, Digital input (DI-1, DI-2), Alarm output 1+2+3+4, RS485 comm. output
	4CH	**N**	RS485 comm. output
Channels	**2**		2 channels
	4		4 channels
tem	**TM**		Multi-Channel Modular Temperature Controller

▣ Specifications

Series		TM2	TM4
No. of channels		2 channels (insulated each channel-dielectric strength 1,000VAC)	4 channels (insulated each channel-dielectric strength 1,000VAC)
Power supply		24VDC⎓	
Permissible voltage range		90 to 110% of rated voltage	
Power consumption		Max. 5W (for max. load)	
Display method		None- parameter setting and monitoring is available at external devices (PC, PLC, etc.)	
Input type	Thermocouple	K(CA), J(IC), E(CR), T(CC), B(PR), R(PR), S(PR), N(NN), C(TT), G, (TT), L(IC), U(CC), Platinel II	
	RTD	JPt100Ω, DPt100Ω (permissible line resistance max. 5Ω)	
Sampling cycle		50ms (2CH synchronous sampling)	100ms (4CH synchronous sampling)
Measured accuracy	Thermocouple※1	(PV ±0.5% or ±1℃, select the higher one) ±1digit max.	
	RTD		
	CT input	±5% F.S. ±1digit max.	—
	Current output	±1.5% F.S. ±1digit max.	—
Influence of temp.※2	Thermocouple	(PV ±0.5% or ±2℃, select the hghter one) ±1digit max. (TC input max. -100℃ is within ±5℃)	
	RTD	• TC B, R, S, C, G, L, U: (PV ±0 5% or ±5℃, select the hghter one) ±1digit max.	
Control output	Relay	250VAC～ 3A 1a	
	SSR	Max. 12VDC⎓±3V 30mA	Max. 22VDC⎓±3V 30mA
	Current	Selectable DC 4-20mA or DC 0-20mA (load resistance max. 500Ω)	—
Control method	Heating, Cooling Heating&Cooling	ON/OFF control, P, PI, PD, P D control	
Option output	Alarm	250VAC～ 3A 1a	—
	Communication	RS485 communication output (Modbus RTU method)	
Option input	CT input	0.0-50 0A (primary current measurement range) ※CT ratio=1/1000	—
	Digital input	• Contact input: ON max. 1kΩ, OFF min. 100kΩ • Solid-state input: ON residual voltage max. 1.5V, OFF leakage current max. 0.1mA • Outflow current: Approx. 0.5mA per input	—
Hysteresis		1 to 100℃/℉ (0.1 to 100.0℃/℉) variable	
Proportional band (P)		0.1 to 999 9℃/℉	
Integral time (I)		0 to 9999 sec.	
Derivative time (D)		0 to 9999 sec.	
Control period (T)		0.1 to 120 0 sec. (only for relay output, SSR drive output)	
Manual reset		0.0 to 100 0%	
Relay life cycle	Mechanical	Min. 10,000,000 operations	
	Electrical	Min. 100,000 operations (250VAC 3A resistance load)	
Insulation resistance		100MΩ (at 500VDC megger)	
Insulation type		Double insulation or reinforced insulation (mark: ⧈, dielectric strength between the measuring input part and the power part: 1kV)	
Dielectric strength		1,000VAC 50/60Hz for 1 min. (between input terminals and power terminals)	
Vibration		0.75mm amplitude at frequency of 5 to 55Hz (for 1 min.) in each X, Y, Z direction for 2 hours	
Noise resistance		±0.5kV the square wave noise (pulse width: 1μs) by the noise simulator	
Environment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH	
Accessories		Expansion connector: 1, Power/Comm. connector: 1 (only for basic module)	
Approval		CE, cULus, KC	
Weight※3	Basic module	Approx. 217g (Approx. 152g)	Approx. 239g (Approx. 174g)
	Expansion module	Approx. 208g (Approx. 143g)	Approx. 231g (Approx. 166g)

※1: In case of thermocouple K, J, E, T, N, it is below -100℃ and L, U, Platinel II, it is below ±2℃ ±1digit.
In case of thermocouple B, display accuracy cannot be ensured under 400℃.
In case of thermocouple R, S, it is below 200℃ and C, G, it is max. 3℃ ±1digit.
※2: Applied when it is for out of room temperature (23±5℃) range.
※3: The weight includes packaging. The weight in parentheses is for unit only.
※Environment resistance is rated at no freezing or condensation.

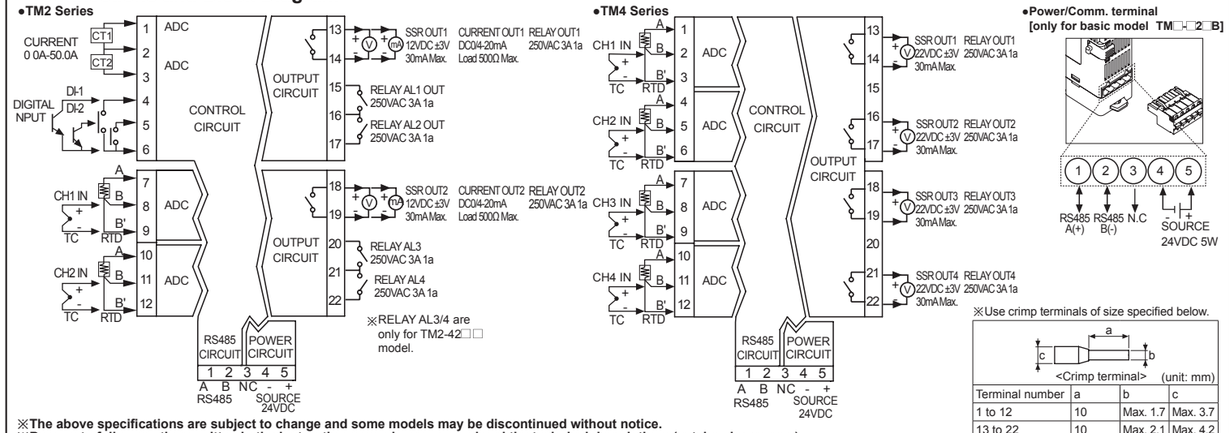
▣ Input Type and Range

※Factory default: K(CA) H

Input type		No.	Dot	Display	Temperature range (℃)	Temperature range (℉)
Thermocouple	K(CA)	0	1	K(CA).H	-200 to 1350	-328 to 2462
		1	0.1	K(CA).L	-200 0 to 1350.0	-328 0 to 2462.0
	J(IC)	2	1	J(IC).H	-200 to 800	-328 to 1472
		3	0.1	J(IC).L	-200 0 to 800.0	-328 0 to 1472.0
	E(CR)	4	1	E(CR).H	-200 to 800	-328 0 to 1472
		5	0.1	E(CR).L	-200 0 to 800.0	-328 0 to 1472 0
	T(CC)	6	1	T(CC).H	-200 to 400	-328 to 752
		7	0.1	T(CC).L	-200 0 to 400.0	-328 0 to 752.0
	B(PR)	8	1	B(PR)	0 to 1800	32 to 3272
	R(PR)	9	1	R(PR)	0 to 1750	32 to 3182
	S(PR)	10	1	S(PR)	0 to 1750	32 to 3182
	N(NN)	11	1	N(NN)	-200 to 1300	-328 to 2372
	C(TT)※1	12	1	C(TT)	0 to 2300	32 to 4172
	G(TT)※2	13	1	G(TT)	0 to 2300	32 to 4172
	L(IC)	14	1	L(IC).H	-200 to 900	-328 to 1652
		15	0.1	L(IC).L	-200 0 to 900.0	-328 0 to 1652.0
	U(CC)	16	1	U(CC) H	-200 to 400	-328 to 752
		17	0.1	U(CC) L	-200 0 to 400.0	-328 0 to 752.0
	Platinel II	18	1	PLII	0 to 1400	32 to 2552
RTD	JPt 100Ω	19	1	JPt100.H	-200 to 600	-328 to 1112
		20	0.1	JPt100.L	-200 0 to 600.0	-328 0 to 1112.0
	DPt 100Ω	21	1	DPt100 H	-200 to 600	-328 to 1112
		22	0.1	DPt100 L	-200 0 to 600.0	-328 0 to 1112.0

※1: C(TT) is same as existing W5 (TT). ※2: G(TT) is same as existing W (TT).

▣ Connections and Block Diagram



※Use crimp terminals of size specified below.

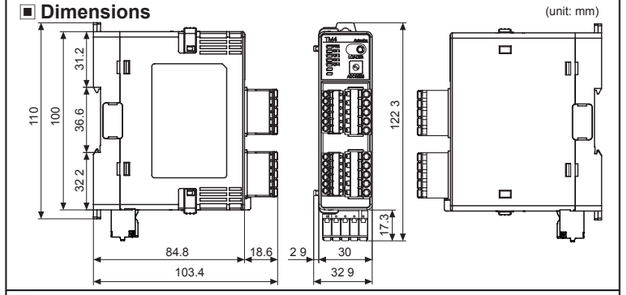
<Crimp terminal> (unit: mm)

Terminal number	a	b	c
1 to 12	10	Max. 1.7	Max. 3.7
13 to 22	10	Max. 2.1	Max. 4.2

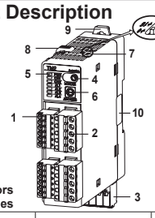
※The above specifications are subject to change and some models may be discontinued without notice.
※Be sure to follow cautions written in the instruction manual, user manual and the technical descriptions (catalog, homepage).

▣ Dimensions

(unit: mm)



▣ Unit Description



1. Sensor input connector
2. Control output connector
3. Power/Comm. terminal
[only for basic module (TM□□2□B)]
Suppling power to basic/expansion modules and communicating with over 1 module (s).
4. PC loader port
It is the PC loader port for serial communication between one module and PC to set parameter and monitoring by DAQMaster. Use this for connecting SCM-US (USB to serial converter, sold separately).
※When using PC loader port (connecting SCM-US), communication via power/comm. terminal is blocked and monitoring is not available.
5. Indicators

●TM2 Series

Indicator \ Status	Initial power ON※1	Control output	Alarm output N.O. (Normally Open) OFF (OPEN)	Alarm output N.O. (Normally Open) ON (CLOSE)	Alarm output N.C. (Normally Closed) OFF (CLOSE)	Alarm output N.C. (Normally Closed) ON (OPEN)	Auto-tuning※2
PWR (green)※3	ON	ON	—	—	—	—	ON
CH1 (red)	Flash (2,400bps)	ON	—	—	—	—	Flash
CH2 (red)	Flash (4,800bps)	ON	—	—	—	—	Flash
AL1 (yellow)	Flash (9,600bps)	ON※4	OFF	ON	OFF	ON	OFF
AL2 (yellow)	Flash (19,200bps)	ON※5	OFF	ON	OFF	ON	OFF
AL3	Flash (38,400bps)	—	OFF	ON	OFF	ON	OFF
AL4	—	—	OFF	ON	OFF	ON	OFF

※1: When power is supplied initially, the set communication speed LED flashes for 5 sec.

●TM4 Series

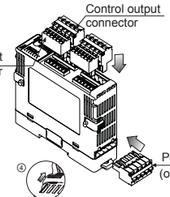
Indicator \ Status	Initial power ON※1	Control output	Auto-tuning※2
PWR (green)※3	ON	ON	ON
CH1 (red)	Flash (2,400bps)	ON	Flash
CH2 (red)	Flash (4,800bps)	ON	Flash
CH3 (red)	Flash (9,600bps)	ON	Flash
CH4 (red)	Flash (19,200bps)	ON	Flash
	Flash (38,400bps)	—	—

※2: The auto-tuning CH LED flashes for 1 sec in turn.
※3: The PWR LED flashes during communication for 1 sec in turn.
※4: Turns ON when CH1 control method is heating & cooling control and cooling output occurs. (disable AL1 setting)
※5: Turns ON when CH2 control method is heating & cooling control and cooling output occurs. (disable AL2 setting)

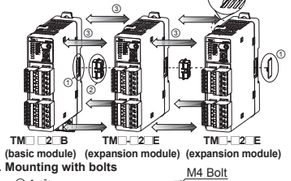
6. Communication address setting switch (SW1)
Set the communication address.
7. Communication address group switch (SW2)
When setting the communication address over 16, select +16. If changing the communication address by setting switch, use the flat head driver which is 2mm size or plastic driver. If not, it may cause product damage.
8. Lock switch Used for fixing modules at top and bottom.
9. Rail Lock Used for installing at DIN rail or using bolts.
10. END cover: Remove it when connecting each module to connect an expansion connector.

▣ Installation

1. Connector Connection

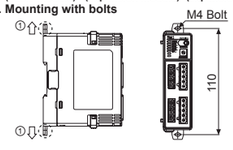


2. Connection between modules

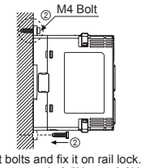


①Remove each module's END covers. (do not remove at the ends of END covers)
②Connect expansion connectors between modules.
③Push each modules. (max. 30 units)
④Push the lock switch to lock direction.
※Supply adequate power for power input specifications and overall capacity. (Max. power when connecting 31 modules: 31 units×5W=155W)

2. Mounting with bolts



①Pull each rail lock to up and down.



②Insert bolts and fix it on rail lock. (fixing torque is 0.5N m to 0 9N·m.)

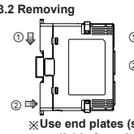
3. Mounting on DIN Rail

3.1 Installing

①Hang the top rail lock to D N rail.
②Push and press the module to down direction.

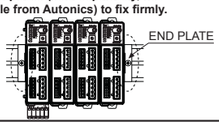
※**Install the units vertically.**

3.2 Removing



①Press the module to down direction.
②Pull the module body forward.

※**Use end plates (sold separately, not available from Autonics) to fix firmly.**



▣ Communication Setting

It is for parameter setting and monitoring via external devices (PC, PLC, etc.).

● Interface

Comm. protocol	Modbus RTU	Comm. distance	Max. 800m
Connection type	RS485	Comm. speed	2400, 4800, 9600 (default), 19200, 38400dps
Application standard	Compliance with EIA RS485	Start bit	1-bit (fixed)
Max. connection	31 units (address: 01 to 31)	Data bit	8-bit (fixed)
Synchronous method	Asynchronous	Parity bit	None (default), Odd, Even
Comm. method	Two-wire half duplex	Stop bit	1-bit, 2-bit (default)

※ t is not allowed to set overlapping communication address at the same communication line.
Use twisted pair wire for RS485 communication.

● Communication Address Setting

Set the communication address by the communication address setting switch (SW1) and Communication address group switch (SW2). When setting as 0, it does not operate communication.
(setting range: 01 to 31, factory default: [SW1] 1, [SW2] +0)

SW2 \ SW1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
+0	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
+16	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

● Caution for Communication Address Setting
When changing communication address via the Power/Comm. terminal, resupply the power.

▣ Comprehensive Device Management Program[DAQMaster]

DAQMaster is a comprehensive device management software for setting parameters and monitoring processes.

Item	Minimum specifications
System	IBM PC compatible computer with Pentium III or above
Operations	Windows 98/NT/XP/Vista/7/8/10
Memory	256MB+
Hard disk	1GB+ of available hard disk space
VGA	Resolution: 1024×768 or higher
Others	RS232C serial port (9-pin), USB port

▣ Manual

For the detail information and instructions, please refer to user manual and user manual for communication, and be sure to follow cautions written in the technical descriptions (catalog, homepage).

▣ Error Display

※1: The applied CH LED indicator flashes.

Indicator \ Status	Disconnected input sensors	Out of temperature range
PWR (red)	ON	
CH□ (red)※1	Flash (for 0 5 sec. in turn)	
Comm. output (decimal)	Outputs '31000'	Outputs '30000 (high-limit)', '-30000 (low-limit)'
DAQMaster	Displays 'OPEN'	Displays 'HHHH (high-limit)', 'LLLL (low-limit)'

▣ Troubleshooting

Status	Troubleshooting
LED indicators flash (for 0.5 sec. in turn), or external device displays OPEN.	· Check input sensor setting. · Disconnect the power and check the input connection. · If input is connected, disconnect the input wiring from the temperature controller and short the + and - terminals. Power the temperature controller and check if the external device displays the room temperature. If it does not display the room temperature and continues to display HHHH or LLLL, the controller is broken. Please contact our technical support. (input type is thermocouple)
Output does not operate normally.	· Check that CH indicators for control output operates normally. · If CH indicators for control output does not operates, check the parameter settings. · If CH indicators for control output operates, remove the control output connector and check the output.
External device receives no-response or abnormal data.	· Check the communication converter (SCM-WF48, SCM-48I, SCM-38I or SCM-US, sold separately). · Do not install communication converter line and AC power supply lines. · Use different communication converter power and temperature controller power. · Indicates damage to internal chip by strong noise. Please contact our technical support. Locate the source of the noise device countermeasures.
Communication does not work between TM and external device.	· Check the communication converter power and connections. · Check the communication settings. · Check the temperature controller and external device connections.

▣ Cautions during Use

1. Follow instructions in 'Cautions during Use'. Otherwise, It may cause unexpected accidents.
2. 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 (CT) temperature sensor, use the designated compensation wire for extending wire.
3. 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.
4. Do not apply excessive power when connecting or disconnecting the connectors of the product.
5. Install a power switch or circuit breaker in the easily accessible place for supplying or disconnecting the power.
6. Do not use the unit for other purpose (e g. voltmeter, ammeter), but temperature controller.
7. When changing the input sensor, turn off the power first before changing.
   After changing the input sensor, modify the value of the corresponding parameter.
8. 24VDC power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
9. 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.
10. 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.
11. Make sure that power supply voltage reaches to the rated voltage within 2 sec after supplying power.
12. Do not wire to terminals which are not used.
13. Install D N rail vertically from the ground.
14. This unit may be used in the following environments.
    ①Indoors (in the environment condition rated in 'Specifications')
    ②Altitude max. 2,000m
    ③Pollution degree 2
    ④Installation category II

▣ Major Products

■ Photoelectric Sensors
■ Fiber Optic Sensors
■ Door Sensors
■ Door Side Sensors
■ Area Sensors
■ Proximity Sensors
■ Pressure Sensors
■ Rotary Encoders
■ Connector/Sockets
■ Switching Mode Power Supplies
■ Control Switches/Lamps/Buzzers
■ I/O Terminal Blocks & Cables
■ Stepper Motors/Drivers/Motion Controllers
■ Graphic/Logic Panels
■ Field Network Devices
■ Laser Marking System (Fiber, Co_2, Nd: YAG)
■ Laser Welding/Cutting System
■ Temperature Controllers
■ Temperature/Humidity Transducers
■ SSRs/Power Controllers
■ Counters
■ Timers
■ Panel Meters
■ Tachometer/Pulse (Rate) Meters
■ Display Units
■ Sensor Controllers