Autonics

Multi-Channel Modular Type High Performance Temperature Controller [Control Module]

TMH2/TMH4 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.
※⚠ symbol represents caution due to special circumstances in which hazards may occur.

⚠**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.

⚠ 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 20 (0.50mm²) cable or over and tighten the terminal screw with a tightening torque of 0.74 to 0.90N·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 0.90N·m.
   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

TMH 2 – 4 2 R B

※1: Since the expansion module is not supplied with power/comm. terminal. Order it with the basic module.

Module type	**B**		Basic module
	E		Expansion module※1
Control output	**R**		Relay output
	C		Selectable current or SSR drive output
Power supply	**2**		24VDC
Input/Output option	**2CH**	**2**	CT input, digital input (DI-1/2), alarm output 1/2, RS485 comm. output
		4	CT input, digital input (DI-1/2), alarm output 1/2/3/4, RS485 comm. output
	4CH	**N**	CT input, RS485 comm. output
Channels	**2**		2 channels
	4		4 channels
Item	**TMH**		Advanced Multi-Channel Modular Temperature Controller

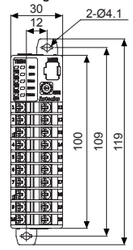
▣ Specifications

Series		TMH2	TMH4
No. of channels		2 channels	4 channels
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	DPt100Ω, JPt100Ω, DPt50Ω, Cu100Ω, Cu50Ω, Nikel 120Ω 3-wire type (permissible line resistance max. 5Ω)	
	Analog	• Voltage: 0-100mVDC⎓, 0-5VDC⎓, 1-5VDC⎓, 0-10VDC⎓ • Current: 0-20mA, 4-20mA	
Sampling cycle		50ms (2CH or 4CH synchronous sampling)	
Measured accuracy	Thermocouple※1	• At room temperature (23℃±5℃): (PV ±0.3% or ±1℃, higher one) ±1-digit※2 • Out of room temperature range: (PV ±0.5% or ±2℃, higher one) ±1-digit	
	RTD		
	Analog	• At room temperature (23℃±5℃): ±0.3% F.S. ±1-digit • Out of room temperature range: ±0.5% F.S. ±1-digit	
Option input	CT input	0.0-50.0A (primary current measurement range) ※CT ratio=1/1000 Measured accuracy: ±5% F.S. ±1-digit	
	Digital input	• Connect input: ON - max. 1kΩ, OFF - min. 100kΩ • Solid-state input: ON - max. residual voltage 0.9V, OFF - max. leakage current 0.5mA • Outflow current : approx. 0.3mA per input	—
Control method	Heating, Cooling	ON/OFF control, P, PI, PD, PID control	
	Heating&Cooling		
Control output	Relay	250VAC～ 3A 1a	
	SSR	Max. 12VDC⎓ ±3V 20mA	
	Current	Selectable DC 4-20mA or DC 0-20mA (load resistance max. 500Ω)	
Option output	Alarm	250VAC～ 3A 1a	—
Comm-unication	Master	RS485 communication output (Modbus RTU)	
	PC loader	Serial (TTL Level), half duplex	
Hysteresis		RTD/Thermocouples: 1 to 100℃/℉ (0.1 to 100.0℃/℉), analog: 1 to 100 digit	
Proportional band (P)		RTD/Thermocouples: 1 to 999℃/℉ (0.1 to 999.9℃/℉), analog: 0.1 to 999.9 digit	
Integral time (I)		0 to 9999 sec	
Derivative time (D)		0 to 9999 sec	
Control period (T)		Relay output: 0.1 to 120.0 sec, SSR output: 1.0 to 120.0 sec	
Manual reset		0 to 100% (0.0 to 100.0%)	
Relay life cycle	Mechanical	Min. 10,000,000 operations	
	Electrical	Min. 100,000 operations (250VAC 3A resistance load)	
Memory retention		Approx. 10 years (non-volatile semiconductor memory type)	
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 immunity		±0.5kV the square wave noise (pulse width: 1μs) by the noise simulator	
Environ-ment	Ambient temp.	-10 to 50℃, storage: -20 to 60℃	
	Ambient humi.	35 to 85%RH, storage: 35 to 85%RH	
Protection structure		IP20 (IEC standard)	
Accessories		Expansion connector: 1, module lock connector: 2	
Approval		CE, cULus, KC	
Weight※3	Basic module	Approx. 250.8g (approx. 177.7g)	Approx. 250.4g (approx. 177.3g)
	Expansion module	Approx. 245.7(approx. 172.6g)	Approx. 245.1g(approx. 172.2g)

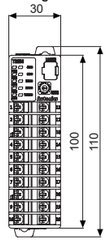
※1: Connecting 1 or more expansion module can vary measurement accuracy about ±1℃, regardless of the number of connected expansion module.
※2: ◎**At room temperature (23℃±5℃)**
• Thermocouple K, J, N, E below -100℃, L, U, PLII and RTD Cu50Ω, DPt50Ω : (PV ±0.3% or ±2℃, higher one) ±1-digit
• Thermocouple C, G and R, S below 200℃: (PV ±0.3% or ±3℃, higher one) ±1-digit
• Thermocouple B below 400℃: there is no accuracy standards.
◎**Out of room temperature range**
• RTD Cu50Ω, DPt50Ω: (PV ±0.5% or ±3℃, higher one) ±1-digit
• Thermocouple R, S, B, C, G: (PV ±0.5% or ±5℃, higher one) ±1-digit • Others blow -100℃: within ±5℃
※3: The weight includes packaging. The weight in parenthesis is for unit only.
※Environment resistance is rated at no freezing or condensation.

▣ Dimensions

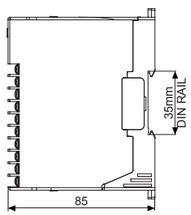
●**Rail Lock position: mounting with bolts**



●**Rail Lock position: mounting on DIN rail**

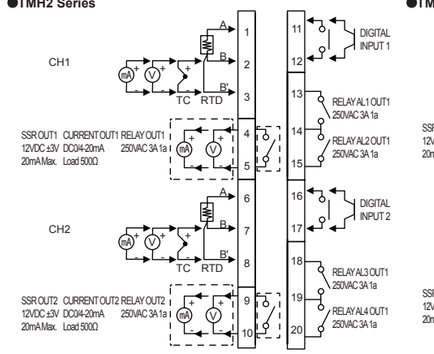


(unit: mm)

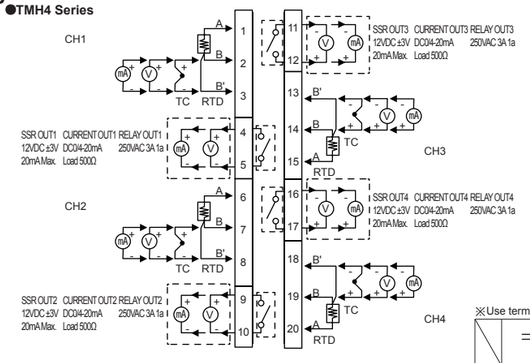


▣ Connections and Isolated Block Diagram

●**TMH2 Series**

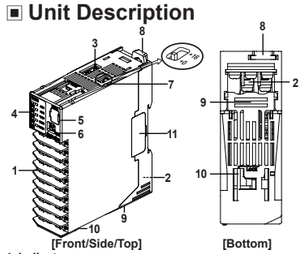


●**TMH4 Series**

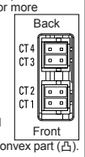


※**The above specifications are subject to change and some models may be discontinued without notice.**
※**Be sure to follow cautions written in the instruction manual, user manual and the technical description (catalog, homepage).**

▣ Unit Description



1. Input/Output terminal
For specific information about terminal formation, please refer to '▣ Connections and Isolated Block Diagram'.
2. Power/Comm. terminal
[basic module only]
Supplies power to both basic control/expansion module and communicates with one or more module.
3. CT input terminal
When using the CT input terminal, remove the rubber cap and connect CT in the same direction with right image.
Connect CT with CICT4-□ (CT connector cable, sold separately).
※When connecting CT connector and CT input terminal, align the concave part (凹) and the convex part (凸).



4. Indicator

●**TMH2 Series**

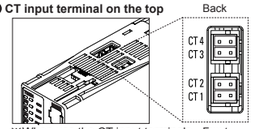
Indicator		Status	Initial power ON※1	Control output	Auto tuning※2	Alarm output			
						N.O.(Normally Open)		N.C. (Normally Closed)	
						OFF (OPEN)	ON (CLOSE)	OFF (CLOSE)	ON (OPEN)
LED 1 LED 2		PWR (green)※3		ON	ON				
PWR	LED 1	CH1 (red)		ON	Flash				
CH 1 AL1		CH2 (red)	—	ON	Flash	—			
		(red)		ON※4	OFF				
CH 2 AL2		(red)		ON※5	OFF				
		(yellow)	Flash (4,800bps)	Module comm. status※6					
AL3	LED 2	AL1 (yellow)	Flash (9,600bps)	—	—	OFF	ON	OFF	ON
		AL2 (yellow)	Flash (19,200bps)	—	—	OFF	ON	OFF	ON
AL4		AL3 (yellow)	Flash (38,400bps)	—	—	OFF	ON	OFF	ON
		AL4 (yellow)	Flash (115,200bps)	—	—	OFF	ON	OFF	ON

●**TMH4 Series**

Indicator		Status	Initial power ON※1	Control output	Auto tuning※2
LED 1 LED 2		PWR (green)※3		ON	ON
PWR	LED 1	CH1 (red)		ON	Flash
CH 1		CH2 (red)	—	ON	Flash
		CH3 (red)		ON	Flash
CH 2		CH4 (red)		ON	Flash
		(yellow)	Flash (4,800bps)	Module comm. status※6	
CH 3	LED 2	(yellow)	Flash (9,600bps)	—	—
		(yellow)	Flash (19,200bps)	—	—
CH 4		(yellow)	Flash (38,400bps)	—	—
		(yellow)	Flash (115,200bps)	—	—

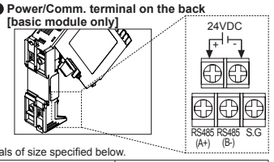
※1: At the moment when power is on, the indicator of set communication speed flashes for 5 sec.
※2: Indicator of the channel, which is in the process of auto-tuning, flashes at 1 sec interval.
※3: When communicating with external device, PWR indicator flashes.
※4: Turns on, when CH1 outputs cooling control in the heating&cooling control method.
※5: Turns on, when CH2 outputs cooling control in the heating&cooling control method.
※6: Displays communication status in control output, auto-tuning or operating RUN mode.
ON: normal / flash: abnormal / OFF: not communicating
5. PC loader port: PC loader port supports serial communication between single module and PC.
It needs EXT-US (converter cable)+SCM-US (USB/Serial converter, sold separately) for communicating.
6. Communication address setting switch (SW1): Set the communication address.
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.
7. Communication address group switch (SW2): When setting the communication address over 16, select +16.
8. Rail lock: Rail lock helps installing the device to DIN rail or with bolts.
9. Lock lever: Lock lever holds module body and base tightly.
10. Module lock connecter hole: When connect modules, insert module lock connector in the hole in order to enhance coherence between modules.
11. END cover: When connect modules, remove END cover in order to connect expansion connector.

●**CT input terminal on the top**



※When use the CT input terminals, remove the robber cap.
※Connect CT with CICT4-□(CT connector cable, sold separately).

●**Power/Comm. terminal on the back [basic module only]**



※Use terminals of size specified below.

	<Round>	<Forked>
a	Min. 3.0mm	Min. 3.0mm
b	Max.5.8mm	Max.5.8mm

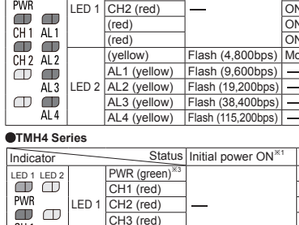
▣ Installation

1. Separating base terminal block

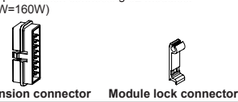
① Push the lock lever at the bottom of the module.
② Pull the body of the module and open up.
※When connecting base terminal block, align the upper concave part (凹) of the body and the upper convex part (凸) of the base. If the upper parts are not align correctly, it may damage to the inner connector.

2. Connection between modules

TMH□-□2□B (basic module) TMH□-□-2□E (expansion unit) TMH□-□-2□E (expansion unit)



①Remove END cover of each module (except END cover of the first and last module).
②Insert expansion connector.
③Put all together tightly (max. 31 units).
④Insert module lock connector.
⑤Push module lock connector and insert in lock connector hole of another module on the side.
⑥Push module lock connector to the lock direction.
※Supply adequate power for power input specifications and overall capacity.
(Max. power when connecting 32 modules: 32×5W=160W)

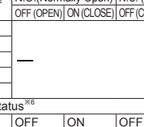


3. Mounting with bolts

①Pull the rail lock at the top and bottom of the module.
②Insert bolts and fix it on rail lock.
(fixing torque is 0.5 to 0.9N·m.)

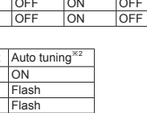
4. Mounting on DIN rail

4.4.1 Installing



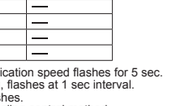
①Hang the top rail lock to DIN rail.
②Push and press the module to down direction.

4.2 Removing

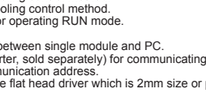


①Press the module down.
②Pull the module body forward.

※**Install the module vertically.**



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



▣ Communication Setting

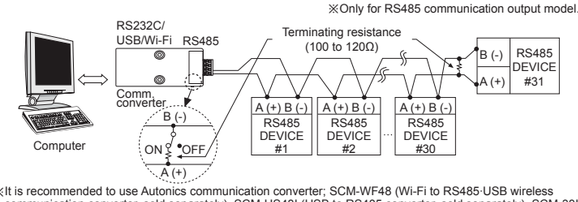
It is for parameter setting and monitoring via external devices (PC, PLC, etc.).

● **Interface**

Comm. protocol	Modbus RTU	Comm. speed	4800, 9600 (default), 19200, 38400, 115200 bps
Connection type	RS485	Response waiting time	5 to 99ms (default: 20ms)
Application standard	EIA RS485 Compliance with	Start bit	1-bit (fixed)
Max. connection	32 units (address: 01 to 32) (in case connecting TMHC module: 16 units (address: 01 to 16))	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)
Comm. effective range	Max. 800m		

● **Application of system organization**

※Only for RS485 communication output model.



※It is recommended to use Autonics communication converter; SCM-WF48 (Wi-Fi to RS485·USB wireless communication converter, sold separately), SCM-US48I (USB to RS485 converter, sold separately), SCM-38I (RS232C to RS485 converter, sold separately), SCM-US (USB to Serial converter, sold separately).
Please use twisted pair wire, which is suitable for RS485 communication, for SCM-WF48, SCM-US48I and SCM-38I.

● **Communication address setting**
Set the communication address with the communication address setting switch (SW1) and communication address group switch (SW2) (default: [SW1] 1, [SW2] +0).

SW2 \ SW1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
+0	16	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
+16	32	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

● **Caution for communication address setting**
After changing communication address via the power/comm. terminal, reboot the device.

▣ Comprehensive Device Management Program[DAQMaster]

DAQMaster is a comprehensive device management software for setting parameters and monitoring processes. DAQMaster can be downloaded from our website at www.autonics.com.

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

▣ Error Display

Indicator \ Status	Input error※1	Remote SV error※2
PRW	ON (red)	ON (green)
CH□※3	Flash (red)	Flash (red)

※1: Input error: input value is below the input range (LLLL) / input value exceeds input range (HHHH) / input sensor wire is down or input sensor is disconnected (OPEN).
※2: Remote SV error: communication error of Remote SV master and internal communication / input of master channel is LLLL/HHHH/OPEN when the channel is subjected to display PV.
※3: An indicator of relative channel flashes.
After main cause of the error is solved, error status is cleared and the device is returned to the normal operation automatically

▣ Manuals

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 description (catalog, homepage).
Visit our homepage (www.autonics.com) to download manuals.

▣ 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. 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 DIN 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

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