Autonics

Multi-channel modular temperature controller
TM2 SERIES
M A N U A L

CE ᶜᴿᵁˢ

Thank you very much for selecting Autonics products.
For your safety, please read the following before using.

▣ Caution for your safety

※Please keep these instructions and review them before using this unit.
※Please observe the cautions that follow;

⚠ **Warning** Serious injury may result if instructions are not followed.
⚠ **Caution** Product may be damaged, or injury may result if instructions are not followed.

※The following is an explanation of the symbols used in the operation manual.
⚠ caution:Injury or danger may occur under special conditions.

⚠ Warning

1. **In case of using this unit with machineries(Nuclear power control, medical equipment, vehicle, train, airplane, combustion apparatus, entertainment or safety device etc) it is required to install fail-safe device, or contact us.**
   It may cause a fire, human injury or property loss.
2. **Install the unit on a panel.**
   It may cause an electric shock.
3. **Do not connect, inspect or repair when power is on.**
   It may cause an electric shock.
4. **Make sure power supply type and terminal polarity when connecting the wires.**
   It may cause a fire.
5. **Do not disassemble the case. Please contact us if it is required.**
   It may cause an electric shock or a fire.

⚠ Caution

1. **This unit shall not be used outdoors.**
   It might shorten the life cycle of the product.
2. **For relay output terminal wire connections, use AWG No. 20(0.50mm²).**
   It may cause fire due to contact failure.
3. **Please observe the rated specifications.**
   It might shorten the life cycle of the product and cause a fire.
4. **Do not use beyond of the rated switching capacity of Relay contact.**
   It may cause insulation failure, contact melt, contact failure, relay broken and fire etc.
5. **In cleaning unit, do not use water or an oil-based detergent and use dry towels.**
   It may cause an electric shock or a fire.
6. **Do not use this unit in place where there are flammable & explosive gas, humidity, direct ray of the light, radiant heat, vibration and impact etc.**
   It may cause a fire or an explosion.
7. **Do not inflow dust or wire dregs into the unit.**
   It may cause a fire or a malfunction.
8. **Please wire properly after check the terminal polarity when connect temperature sensor.**
   It may cause a fire or a malfunction.
9. **In order to install the units with reinforced insulation, use the power supply unit which reinforced insulation level is ensured.**

▣ Ordering information

TM2 – 22 R B

Module type	B	Basic Module (※Power / communication terminal)
	E	Expansion Module (※No power / communication terminal)
Control output	R	Relay
	C	Current or SSR output Selectable(Default:Current Output)
Power supply	2	24VDC
Aux I / O	2	Alarm1+Alarm2 Relay Contact Output
	4	Alarm1+Alarm2+Alarm3+Alarm4 Relay Contact Output
Channel	2	2 Channel
Item	TM	Multi-Channel Modular Temperature Controller

※ Make sure to purchase both expansion module and basic module together since power supply / communication terminals are provided with basic modules only.

▣ Parts description

① Indicating LED

Status		Initial power on (※1)	Control output	Alarm output				Auto tuning (※2)
				N.O		N.C		
Indi-cating LED				Alarm occurred		Alarm occurred		
				OFF(OPEN)	ON(CLOSE)	OFF(CLOSE)	ON(OPEN)	
PWR LED (※3)		Green	Green					Green
CH1 LED		2400bps – Flickering	ON-RED	—	—	—	—	Flickering
CH2 LED		4800bps – Flickering	ON-RED	—	—	—	—	Flickering
AL1 LED		9600bps – Flickering	ON-Yellow(※4)	Light OFF	Light ON	Light OFF	Light ON	Flickering
AL2 LED		19200bps – Flickering	ON-Yellow(※5)	Light OFF	Light ON	Light OFF	Light ON	Flickering
AL3 LED		38400bps – Flickering	—	Light OFF	Light ON	Light OFF	Light ON	—
AL4 LED		—	—	Light OFF	Light ON	Light OFF	Light ON	—

※ **1** : In case of initial power on, default communication speed will be flickering for 5 sec(1 sec cycle).
※ **2** : Each CH□ LED will be flickering during auto tuning (1 sec cycle).
※ **3** : Power LED will be flickering while communicating with external units(1 sec cycle).
※ **4** : ON OFF when control type for CH1 is heating & cooling type and cooling output is provided.(Alarm setting not available on AL1)
※ **5** : Light ON when control type for CH2 is heating & cooling type and cooling output is provided.(Alarm setting not available on AL2)

① CT(Current Transformer) input terminal, DI(Digital input) terminal   ③ CH1, CH2 Sensor input terminal
④ OUT2(Control output), AL3 and AL4(Alarm output) terminal   ⑤ OUT1 (Control output), AL1 and AL2(Alarm output) terminal
⑥ Communication address setting switch : Set a communication address
⑦ PC loader port(Port A) : In case of PC parameter setting, use a dedicated loader(SCM–US, sold separately)
⑧ Communication address group change switch : Set a communication address group
⑨ Power supply/communications connector(Port B) : Only Basic module
⑩ END Cover : Remove it when connecting each module.
⑪ Rail Lock : Used for fixing units to DIN Rail or to the wall
⑫ Lock switch : Used for fixing each module when connecting module units.(up/down side)

※The above specifications are subject to change without notice.

▣ Specifications

Series			TM2 series								
			TM2-22RB	TM2-42RB	TM2-22RE	TM2-42RE	TM2-22CB	TM2-42CB	TM2-22CE	TM2-42CE
Channel			2 channels(Each channel insulated – Dielectric strength 1,000VAC)							
Power Supply			24VDC							
Allowable voltage range			90 ~ 110% of rated voltage							
Power consumption			Max. 5W(At maximum load)							
Indicating type			Non—indicating type ☞ Parameter setting & monitoring with external devices (PC or PLC)							
Input type	RTD		DPt100Ω, JPt100Ω 3 wire (Allowable line resistance : Max. 5Ω)							
	Thermocouples		K, J, E, T, L, N, U, R, S, B, C, G, PLII(13types)							
Indicating accuracy (※1)	RTD		(Bigger one either PV ±0.5% or ±1℃) ±1 Digit Max.							
	Thermocouples									
	CT input		(±5% F.S) ±1 Digit Max.							
	Current input		(±1.5% F.S) ±1 Digit Max.							
Influence of Temperature (※2)	RTD		(Bigger one either PV ±0.5% or ±2℃) ±1 Digit Max.(In case of thermocouple input, it is ±5℃ at −100℃ below.)							
	Thermocouples		· Thermocouples L,U,C,G,R,S,B : (Bigger one either PV ±0.5% or ±5℃) ±1 Digit Max.							
Control output	Relay		250VAC 3A 1a							
	SSR		—				12VDC ±3V 30mA Max.			
	Current		—				DC 4~20mA or DC 0~20mA selectable (Load 500Ω Max.)			
Auxiliary output	Relay		250VAC 3A 1a							
communication output			RS485 communication output (Modbus RTU)							
Event Input	Leakage current		Approx. Max. 4mA							
	Contacts		ON : Max. 1KΩ, OFF : Max. 100KΩ							
	Non—contacts		ON : Max. 1.5V residual voltage, OFF : Max. 0.1mA leakage current							
	CT		0.0~50.0A(Primary current meaurement range) / CT ratio 1,000:1							
Control type	heating, cooling		ON/OFF control mode, P, PI, PD, PID control mode							
	heating&cooling									
Hysteresis			Thermocouples/RTD : 1 ~ 100℃/℉(0.1 ~ 100℃/℉) variable							
Proportional band (P)			0.1 ~ 999.9℃							
Integral time (I)			0 ~ 9,999 sec.							
Derivative time (D)			0 ~ 9,999 sec.							
Control period (T)			0.1 ~ 120.0 sec. (Only Relay and SSR output type)							
Manual reset value			0.0 ~ 100.0%							
Sampling period			50ms(2 channel synchronous sampling)							
Dielectric strength			1,000VAC 50/60Hz for 1 min. (between power source terminal and input terminal)							
Vibration resistance			0.75mm amplitude at frequency of 5~55Hz(for 1 min.) in each X, Y, Z direction for 2 hours							
Relay life cycle	Mechanical		Over 1,000,000 times							
	Electrical		Over 100,000 times (250 VAC 3A resistance load)							
Insulation resistance			100MΩ (500VDC megger)							
Noise resistance			Square shaped noise by noise simulator (pulse width 1μs) ±0.5kV							
Ambient temperature			−10 ~ 50℃(at non−freezing status)							
Storage temperature			−20 ~ 60℃ (at non−freezing status)							
Ambient humidity			35 ~ 85%RH							
Accessories			Parallel expansion connector							
			Power / communication connector		Power / communication connector					
Insulation type(※3)			▣							
Approval			CE ᶜᴿᵁˢ							
Unit weight			Approx. 144g	Approx. 152g	Approx. 135g	Approx. 143g	Approx. 139g	Approx. 148g	Approx. 130g	Approx. 139g

※ **1** : In case of thermocouple K,T,N,J,E at −100℃ below and L,U, Platinel II, it is ±2℃ ±1Digit Max.
 In case of thermocouple B, indicating accuracy cannot be ensured under 400℃.
 In case of thermocouple R,S at 200℃ below and thermocouple C, G, it is 3℃ ±1Digit Max.
※ **2** : Applied when used out of range 23±5℃.
※ **3** : " ▣ " Mark indicates that equipment protected throughout by double insulation or reinforced insulation.
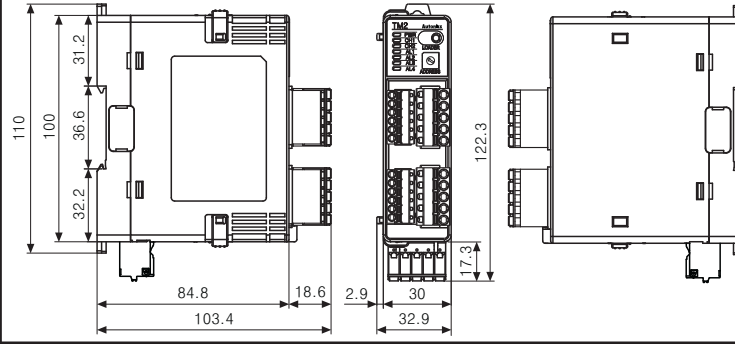
▣ Input Sensor Type and Temperature Range

Input type		No.	Dot	Display	Input range(℃)	Input range(℉)
ThermoCouple	K(CA)	0	1	K(CA).H	−200 ~ 1350	−328 ~ 2462
		1	0.1	K(CA).L	−200.0 ~ 1350.0	−328.0 ~ 2462.0
	J(IC)	2	0	J(IC).H	−200 ~ 800	−328 ~ 1472
		3	0.1	J(IC).L	−200.0 ~ 800.0	−328.0 ~ 1472.0
	E(CR)	4	1	E(CR).H	−200 ~ 800	−328.0 ~ 1472
		5	0.1	E(CR).L	−200.0 ~ 800.0	−328.0 ~1472.0
	T(CC)	6	1	T(CC).H	−200 ~ 400	−328 ~ 752
		7	0.1	T(CC).L	−200.0 ~ 400.0	−328.0 ~ 752.0
	B(PR)	8	1	B(PR)	0 ~ 1800	32 ~ 3272
	R(PR)	9	1	R(PR)	0 ~ 1750	32 ~ 3182
	S(PR)	10	1	S(PR)	0 ~ 1750	32 ~ 3182
	N(NN)	11	1	N(NN)	−200 ~ 1300	−328 ~ 2372
	C(TT)(※1)	12	1	C(TT)	0 ~ 2300	32 ~ 4172
	G(TT)(※2)	13	1	G(TT)	0 ~ 2300	32 ~ 4172
	L(IC)	14	1	L(IC).H	−200 ~ 900	−328 ~ 1652
		15	0.1	L(IC).L	−200.0 ~ 900.0	−328.0 ~ 1652.0
	U(CC)	16	1	U(CC).H	−200 ~ 400	−328 ~ 752
		17	0.1	U(CC).L	−200.0 ~ 400.0	−328.0 ~ 752.0
	Platinel II	18	1	PLII	0 ~ 1400	32 ~ 2552
RTD	JIS Standards	19	1	JPt100.H	−200 ~ 600	−328 ~ 1112
		20	0.1	JPt100.L	−200.0 ~ 600.0	−328.0 ~ 1112.0
	DIN Standards	21	1	DPt100.H	−200 ~ 600	−328 ~ 1112
		22	0.1	DPt100.L	−200.0 ~ 600.0	−328.0 ~ 1112.0

※**1** : C(TT) — Same as existing W5(TT)
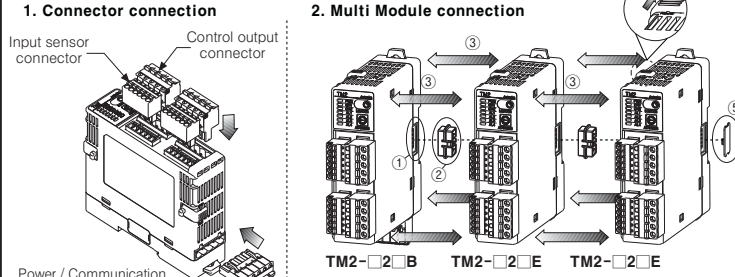※**2** : G(TT) — Same as existing W(TT)
※ Default: K(CA).H

▣ Error Indication

	Input Sensor Open Error	Over Temperature Range
PWR LED		RED ON
CH1 LED	RED Flickering (for 0.5 sec)	
CH2 LED	RED Flickering (for 0.5 sec)	
Communication Output (decimal)	'31000' output	'30000 (upper limit)' output, '−30000 (lower limit)' output
Dedicated program	'OPEN' indication	'HHHH (upper limit)' indication , 'LLLL (lower limit)' indication

▣ Dimensions

(Unit:mm)

▣ Installation

1. Connector connection

Input sensor connector Control output connector

Power / Communication connector (Port B)

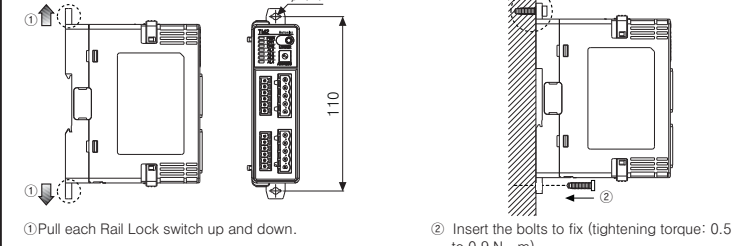TM2-□2□B

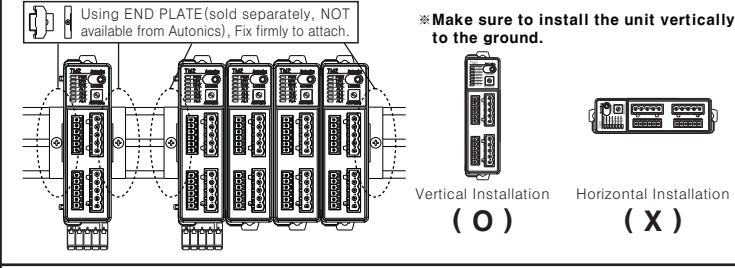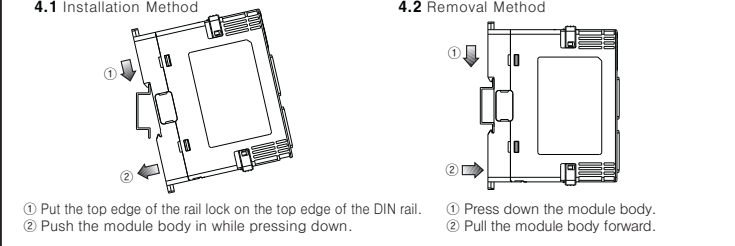### 2. Multi Module connection

TM2-□2□B   TM2-□2□E   TM2-□2□E

① Remove END cover for both basic modules and expansion modules.
② Insert expansion module connection connectors.
③ Connect an expansion module without space.
④ Fix the LOCK switch by pushing it in the LOCK direction.
⑤ Mount the END cover at each side.

※Up to 30 expansion modules can be connected to a basic module.
Use an adequate power supply system for the power input specifications and overall capacity.(Maximum power required when connecting 31 units)
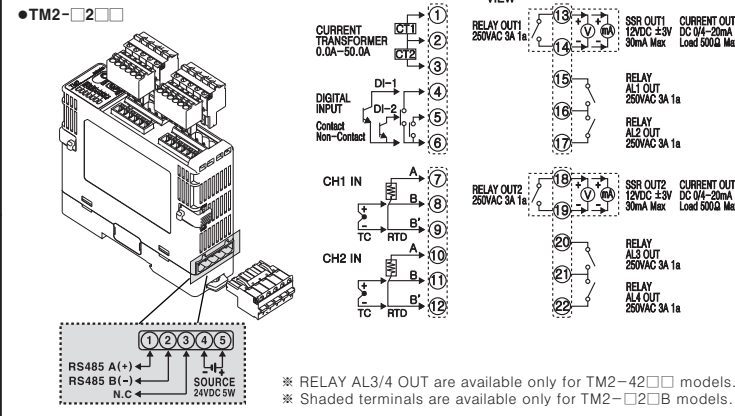
3. Bolt Inserting

① Pull each Rail Lock switch up and down.
② Insert the bolts to fix (tightening torque: 0.5 to 0.9 N·m).

4. DIN Rail Installation

4.1 Installation Method   **4.2** Removal Method

① Put the top edge of the rail lock on the top edge of the DIN rail.
② Push the module body in while pressing down.

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

Using END PLATE(sold separately, NOT available from Autonics), Fix firmly to attach.

※**Make sure to install the unit vertically to the ground.**

Vertical Installation (O)   Horizontal Installation (X)

▣ Connections

●TM2-□2□□

※ RELAY AL3/4 OUT are available only for TM2−42□□ models.
※ Shaded terminals are available only for TM2−□2□B models.

▣ Communication Setting

○A function for external parameter setting using PC or PLC.

●Interface

Application Standard	Compliance with EIA RS 485
Max. connection	31 units(communication address setting: 01 ~ 31)
Communication type	Two wire, Half Duplex
Synchronization method	Asynchronous
Communication distance	Max. 800m
Communication speed(bps)	2400, 4800, 9600(default),19200, 38400
Communication response time	5 ~ 99ms
Start Bit	1bit(fixed)
Stop Bit	1bit, 2bit(default)
Parity Bit	None(default), Odd, Even
Data Bit	8bit(fixed)
Protocol	Modbus RTU

※ Overlapped address setting is not allowed on the same communication line.
 Twist Pair wires(for RS485 communication) must be used for communication cable.

●Communication speed indication

· Current communication speed will be flickering in case of initial power ON for 5 sec (1 sec cycle).

※One module communication is allowed for Port A. Communication speed is fixed to 9600bps.
※Multiple communication is allowed for Port B. It is required to reset controller's Power(Power OFF → Power ON) after changing communication speed.
※Simultaneous monitoring can not be done for port A and B since Port A is for parameter setting only.

●Communication Address Setting

· Set the communication address using SW1 and SW2.
 Setting range is 01 ~ 31. (※ In case setting 00, communication is not available.)

※ Default: SW1 : 1, SW2 : +0

		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

▣ Simple Failure Diagnosis

1. When indicating LED is flickering every 0.5 sec or when error message is indicated on external units
· It represents input sensor open error. Cut off the power of controller and check input sensor connection. If sensor is properly connected, disconnect sensor line from the controller and short the input terminal (+) / (−). Then, make sure that current indoor temperature is indicated. If current indoor temperature is properly indicated, it represents no errors detected. If external unit displays 'HHHH' or 'LLLL', please contact our A/S center.
 (Current indoor temperature checking is available only if selecting thermocouple type.)
· Make sure proper input sensors are selected.

2. When no output is operated
· Check output indicating LED at the front. In case output indicating LED does not work properly, please check each parameter setting again. In case output indicating LED works properly, disconnect the output terminal and check controller's output type (relay contact, SSR, Current) again.

3. When external units receive no response or error data
· Check communication converter first. (RS−485 to serial converter (SCM−381, sold separately), serial to USB converter (SCM−US, sold separately))
· Do not install the unit with overlapping communication converter lines and AC power supply lines.
· Use separate power supply (24VDC) for communication converter if possible.
· Strong external noise could be a possible cause for this symptom. Please contact our A/S center. In addition, analyze the main cause that triggers strong noise and take measures to prevent it. Even though this unit complies with proper noise resistance standards, consistent noise induction could affect internal circuit break.

4. When communication does not work properly
· Check converter's power supply and connection.
· Check communication setting.
· Check main body's connections to external units.

▣ User Manual

●Visit our website (www.autonics.com) to download user manual and PC loader program.
●Function setting, Control method, parameter group and PC loader program explanations available.

▣ Caution for using

1. Use DC power only.
2. Keep the ambient temperature −10℃ ~ 50℃.
3. For more accurate controlling, start temperature controlling approx. 20 minutes later after connecting input sensors and supplying power.
4. In case indicating accuracy does not meet the specification, check Input Bias parameter first.
5. Power switch or a circuit breaker must be installed for proper application.
6. Make sure that the power switch or a circuit breaker installed near operators.
7. This unit is solely allowed for temperature controlling application. Do not apply this unit as a voltage meter or current meter.
8. When line extension is required, please use specified compensation line. If not, there occurs temperature difference at the joint part between thermocouples and extension lines.
9. In case of using RTD, line connection must be done with 3 wires. When line extension is required, use the same wire with material, thickness and length. Different line resistance may cause temperature difference.
10. Make sure controller's line connection must be separated from high voltage line or power supply line in order to prevent induced noise.
11. If it is required that power supply line should be connected near input signal line, use line filter on controller's power supply line and input signal line must be shielded.
12. Avoid installing controllers adjacent to high frequency noise generating units including high frequency soldering machine, high frequency sewing machine, and high capacity SCR controllers and motors.
13. Avoid using the unit near radio, TV or wireless machines that may cause high frequency interference.
14. When changing input sensors, power off the controller first. Connect input sensors as specified and supply the power again. Then, change & download related parameters using PC loader program.
15. Use (−) driver screws (2mm) or use plastic driver screws. If not, it might cause product damage.
16. Twist Pair wires must be used for communication cable. Connect Ferrite Bead at each end of line in order to reduce the effect of external noise.
17. Avoid installing the unit with overlapping communication line and AC power line together.
18. Draw a draft while using the controllers. In case of installing at a closed area, please take measures for ventilation.
19. Installation environment
 ①It shall be used indoor.   ②Altitude Max. 2000m.
 ③Pollution Degree 2   ④Installation Category II.

※**Please keep the above precautions to avoid malfunction and damages.**

▣ Major products

- Proximity sensors
- Area sensors
- Door/Door side sensors
- Counters
- Rotary encoders
- Power controllers
- Panel meters
- Graphic/Logic panels
- Temperature controllers
- Tachometer/Pulse(Rate) meters
- Temperature/Humidity transducers
- Stepping motors/drivers/motion controllers
- Laser marking system(CO2, Nd:YAG)
- Laser welding/soldering system
- Photoelectric sensors
- Fiber optic sensors
- Pressure sensors
- Timers
- Display units
- Sensor controllers

Autonics Corporation
http://www.autonics.com
Satisfiable Partner For Factory Automation

■HEAD QUARTERS
41−5, Yongdang−dong, Yangsan−si, Gyeongnam, 626−847, Korea
■OVERSEAS SALES
Bldg. 402 3rd Fl., Bucheon Techno Park, 193, Yakdae−dong, Wonmi−gu, Bucheon−si, Gyeonggi−do, 420−734, Korea
TEL:82−32−610−2730 / FAX:82−32−329−0728
■E−mail : sales@autonics.com

The proposal of a product improvement and development : product@autonics.com

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