Autonics

Multi-channel modular temperature controller
TM2 SERIES

M A N U A L

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 or 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 an explosion.
9. **In order to install the units with reinforced insulation, use the power supply unit which reinforced insulation level is ensured.**

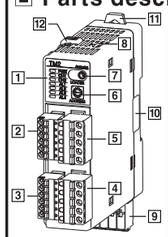
▣ Ordering information

TM 2 – 2 2 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



Status / Indicating LED	Initial power on (※1)	Control output	Alarm output N.O Alarm occurred OFF(OPEN)	Alarm output N.O Alarm occurred ON(CLOSE)	Alarm output N.C Alarm occurred OFF(CLOSE)	Alarm output N.C Alarm occurred ON(OPEN)	Auto tuning (※2)
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	Light OFF
AL2 LED	19200bps – Flickering	ON-Yellow(※5)	Light OFF	Light ON	Light OFF	Light ON	Light OFF
AL3 LED	38400bps – Flickering	—	Light OFF	Light ON	Light OFF	Light ON	Light OFF
AL4 LED	—	—	Light OFF	Light ON	Light OFF	Light ON	Light OFF

1 Indicating LED

※**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**: Light ON 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)

2 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 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 and some models may be discontinued 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	RTD	(Bigger one either PV ±0.5% or ±1℃) ±1 Digit Max.							
	Thermocouples (※1)								
	CT input	(±5% F.S) ±1 Digit Max.							
	Current output	(±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 1㎲) ±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 cULus							
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, PlatinelⅡ, 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 JPt 100Ω	19	1	JPt100.H	−200 ~ 600	−328 ~ 1112
	JIS Standards JPt 100Ω	20	0.1	JPt100.L	−200.0 ~ 600.0	−328.0 ~ 1112.0
	DIN Standards DPt 100Ω	21	1	DPt100.H	−200 ~ 600	−328 ~ 1112
	DIN Standards DPt 100Ω	22	0.1	DPt100.L	−200.0 ~ 600.0	−328.0 ~ 1112.0

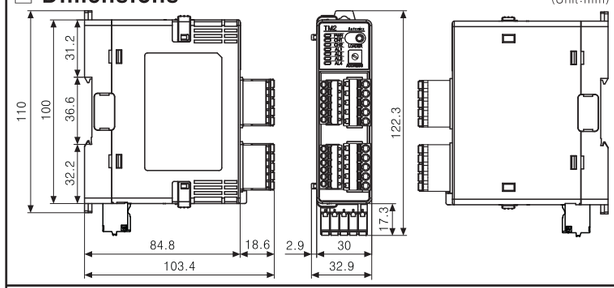
※**1**: C(TT)– Same as existing W5(TT)
※**2**: G(TT)– Same as existing W(TT)
※ Default: K(CA).H

▣ 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

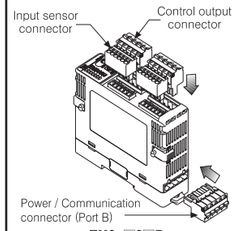
▣ Dimensions

(Unit:mm)



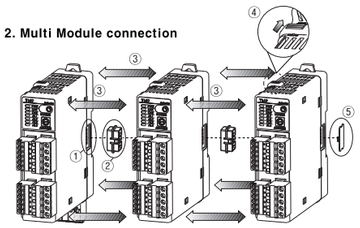
▣ Installation

1. Connector connection



TM2-□2□B

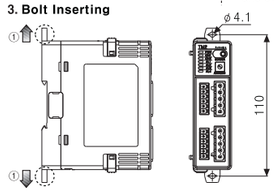
2. Multi Module connection



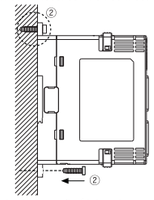
TM2-□2□B TM2-□2□E TM2-□2□E

※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



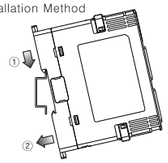
①Pull each Rail Lock switch up and down.



② Insert the bolts to fix (tightening torque: 0.5 to 0.9 N · m).

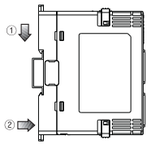
4. DIN Rail Installation

4.1 Installation Method



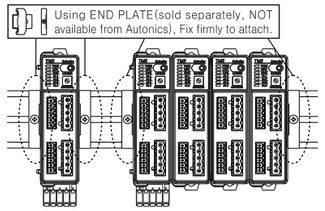
① Put the top edge of the rail lock on the top edge of the DIN rail.
② Push the module body in while pressing down.

4.2 Removal Method



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.



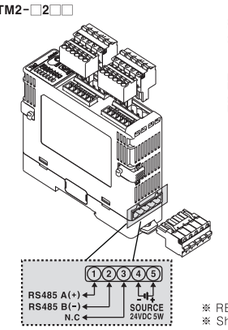
※**Make sure to install the unit vertically to the ground.**

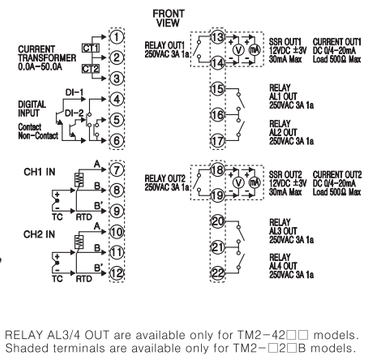
Vertical Installation (O)

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

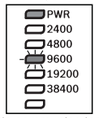
◎A function for external parameter setting using PC or PLC.

●**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.)

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

※ Default: SW1 : 1, SW2 : +0

▣ 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

■ 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/soldering system
■ Temperature controllers
■ Temperature/Humidity transducers
■ SSR/Power controllers
■ Counters
■ Timers
■ Panel meters
■ Tachometer/Pulse(Rate)meters
■ Display units
■ Sensor controllers

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