Advanced Modular 2/4-Channel PID Temperature Controllers

TMH 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

[Common]

- Easy maintenance with detachable body and base terminal
- Power supply and communication with expansion connectors (up to 32 units)
- Screw/screwless connection type models
- Terminal protection cover (sold separately)

[TMH2/4 Series (Control Modules)]

- Multi-channel (2-channel/4-channel) input and output control
  : Expandable up to 32 units (up to 128 channels)50 ms high-speed sampling rate and ±0.3% measurement accuracy
- 50 ms high-speed sampling rate and up to ±0.3% measurement accuracy
- Simultaneous heating and cooling control and auto/manual control mode available

[TMHC (Communication Modules)]

- Allows connection of control modules and option modules to master devices
- Connect up to 32 control/option modules (up to 1,024 channels) per module
- RS422/RS485 (PLC Ladderless, ModbusRTU), Ethernet Communication

[TMHA (Analog Input / Output Option Modules)]

- 4 channels, various input types/temperature ranges/transmission outputs
- 50 ms high-speed sampling rate and up to ±0.3% measurement accuracy

[TMHE (Digital Input / Alarm Output Option Modules)]

- 8 digital inputs / 8 alarm outputs

[TMHCT (CT Input Option Modules)]

- 8 CT inputs

Safety Considerations

- Observe all 'Safety Considerations' for safe and proper operation to avoid hazards.
- ⚠ 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 or store 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 explosion or fire.

03. Install the device in panel to use.
Failure to follow this instruction may result in fire.

04. Do not connect, repair, or inspect the unit while connected to a power source.
Failure to follow this instruction may result in fire.

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.

⚠ 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 mm^2) cable or over and tighten the terminal screw with a tightening torque of 0.74 to 0.90 N·m for screw type.
When connecting the sensor input and communication cable without dedicated cable, use AWG 24 to 12 cable for screwless type , use AWG 28 to 16 cable for screw type, and tighten the terminal screw with a tightening torque of 0.74 to 0.90 N·m for screw type.
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 (CT) temperature sensor, use the designated compensation wire for extending wire.
- The connection of this unit should be separated from the power line and high voltage line in order to prevent inductive noise.
  In case of installing power line and input signal line closely, use line filter or varistor at power line and shielded wire at input signal line.
  The connection of this unit should be separated from the power line and high voltage line in order to prevent inductive noise.
- Do not apply excessive power when connecting or disconnecting the connectors of the product.
- Switch or circuit breaker should be installed nearby users for convenient control.
- 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.
- Power supply should be insulated and limited voltage/current or Class 2, SELV power supply device.
- 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.
- Mounting multiple devices in any way other than the specified mounting method may cause heat to build up inside, which will shorten their service life. If there is a possibility of the ambient temperature rising to a temperature above the specified temperature range, take steps, such as installing fans, to cool the device. Be sure that the cooling method in not cooling just the terminal block. If only the terminal block is cooled, measurement errors may occur.
- 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.
- Install DIN rail vertically from the ground.
- 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.

■ Control module

T M H ❶ - ❷ ❸ ❹ - ❺

❶ Module
2: Control 2 channels
4: Control 4 channels

❷ Option Input/Output
2: Alarm output 1/2 (Module: 2)
4: Alarm output 1/2/3/4 (Module: 2)
N: None (Module: 4)

❸ Power supply
2: 24 VDC

❹ Control output
R: Relay output
S: SSR drive output
C: Selectable current or SSR drive output

❺ Terminal type
None: Screw
L: Screwless

■ Option module

T M H ❶ - ❷ ❸ ❹ - ❺

❶ Module
A: Analog input/output
E: Digital input/Alarm output
CT: CT input

❷ Option Input/Output
4: Analog 1 to 4 (Module: A)
8: Digital input 1 to 8, Alarm output 1 to 8 (Module: E)
8: CT input 1 to 8 (Module: CT)

❸ Power supply
2: 24 VDC

❹ Output
A: Transmission output
R: Relay output
N: None

❺ Terminal type
None: Screw
L: Screwless

■ Communication module

T M H ❶ - ❷ ❸ ❹ - ❺

❶ Module
C: Communication

❷ Option Input/Output
2: Communication output COM1+ COM2

❸ Power supply
2: 24 VDC

❹ Communication
E: Ethernet
L: PLC Ladderless

❺ Terminal type
None: Screw
L: Screwless

Firmware Version and Manual

Additional settings may be required if the firmware version is different between the connected modules.
Please refer to the user manual and the user manual for communication, and be sure to follow cautions written in the technical descriptions.
Visit our website (www.autonics.com) to download manuals.

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)
- Expansion connector × 1
- [Screwless type] 5-pin connector× 4
- Instruction manual
- Module lock connector × 2

Sold Separately

- Current transformer (CT)
- CT connector cable: CICT4-□
- Communication Converters: SCM-USP / SCM-38I / SCM-US48I / SCM-WF48
- Terminal Protection Cover: TMH-COVER

Specifications

■ Control module

Model	TMH2-□□□	TMH2-□□□-L	TMH4-□□□	TMH4-□□□-L
No. of channels	2 channels		4 channels	
Sampling period	50 ms (2 channels or 4 channels synchronous sampling)			
Input specification	Thermocouple, RTD, Analog (refer to 'Input Specification')			
CT input	• 0.0 - 50.0A (primary current measurement range) • CT ratio: 1/1,000, • Measurement accuracy: ±5% F.S. ±1 digit			
Digital input	• Connect input ON: ≤ 1 kΩ, OFF: ≥ 100 kΩ • Solid state input Residual voltage: ≤ 0.9 V, Leakage current: ≤ 0.5 mA • Outflow current: ≈ 0.3 mA per input		-	
Control type	Heating, cooling, heating & cooling: ON/OFF, P, PI, PD, PID control			
Control output	• Relay: 250 VAC~ 3 A 1a mechanical life cycle: ≥ 10,000,000 operations, electrical life cycle: ≥ 100,000 operations • SSR: 12 VDC⎓ ±3 V, ≤ 20 mA • Current[01]: DC 4 - 20 mA or DC 0 - 20 mA (Load: ≤ 500 Ω)			
Alarm output	250 VAC~ 3 A 1a Mechanical life cycle: ≥ 10,000,000 operations Electrical life cycle: ≥ 100,000 operations		-	
Communication	Modbus RTU			
Hysteresis	• Thermocouple / RTD: 1 to 100 (0.1 to 100.0) °C/°F • Analog: 1 to 100 digit			
Proportional band (P)	• Thermocouple / RTD: 0.1 to 999.9 °C/°F • Analog: 0.1 to 999.9 %			
Integral time (I)	0 to 9,999 sec			
Derivative time (D)	0 to 9,999 sec			
Control period (T)	• Relay output, SSR drive output: 0.1 to 120.0 sec • Selectable current or SSR drive output: 1.0 to 120.0 sec			
Manual reset	0 to 100 (0.0 to 100.0) %			
Insulation type	Double insulation or reinforced insulation (mark: ⊡, dielectric strength between the measuring input part and the power part: 1 kV)			
Unit weight (packaged)	≈ 174 g (≈ 249 g)	≈ 162 g (≈ 261 g)	≈ 154 g (≈ 229 g)	≈ 151 g (≈ 250 g)

01) When the control output is set to the current output, the heater current value monitoring function through the CT input terminals is not available.

■ Option module

Model	TMHA-42A	TMHA-42A-L
No. of channels	4 channels	
Sampling period	50 ms (4 channels synchronous sampling)	
Input specification	Thermocouple, RTD, analog (refer to 'Input Specification')	
Transmission output	DC 4 - 20 mA or DC 0 - 20 mA (Load: ≤ 500 Ω)	
Communication	Modbus RTU	
Insulation type	Double insulation or reinforced insulation (mark: ⊡, dielectric strength between the measuring input part and the power part: 1 kV)	
Unit weight (packaged)	≈ 160 g (≈ 235 g)	≈ 148 g (≈ 247 g)

Model	TMHE-82R	TMHE-82R-L	TMHCT-82N	TMHCT-82N-L
No. of I/O points	8 points		8 points	
Input specification	- Digital input • Connect input ON: ≤ 1 kΩ, OFF: ≥ 100 kΩ • Solid state input Residual voltage: ≤ 0.9 V, Leakage current: ≤ 0.5 mA • Outflow current: ≈ 0.3 mA per input		- CT input • 0.0-50.0 A (primary current measurement range) • CT ratio: 1/1,000 • Measurement accuracy: ±5% F.S. ±1 digit	
Alarm output	250 VAC~ 3 A 1a, • Mechanical life cycle: ≤ 10,000,000 operations • Electrical life cycle: ≤ 100,000 operations		-	
Communication	Modbus RTU			
Insulation type	Double insulation or reinforced insulation (mark: ⊡, dielectric strength between the measuring input part and the power part: 1 kV)		-	
Unit weight (packaged)	≈ 163 g (≈ 239 g)	≈ 151 g (≈ 250 g)	≈ 144 g (≈ 219 g)	≈ 133 g (≈ 232 g)

■ Communication module

Model		TMHC-22L	TMHC-22L-L	TMHC-22E
Communi-cation	COM1	• Connection type: RS422 / RS485 • Protocol: Modbus RTU, PLC Ladderless communication		• Connection type: Ethernet (10/100BaseT) • Protocol: Modbus TCP
	COM2			
Insulation type		Double insulation or reinforced insulation (mark: ⊡, dielectric strength between the measuring input part and the power part: 1 kV)		
Unit weight (packaged)		≈ 147 g (≈ 222 g)	≈ 137 g (≈ 236 g)	≈ 129 g (≈ 204 g)

■ Common

Power supply	24 VDC⎓
Permissible voltage range	90 to 110% of rated voltage
Power Consumption	≤ 5 W (for max. load)
Display type	None- parameter setting and monitoring is available at external devices
Memory retention	≈ 10 years (non-volatile semiconductor memory type)
Insulation resistance	100 MΩ (500 VDC⎓ megger)
Dielectric strength	Between the charging part and the case: 1,000 VAC~ 50/60 Hz for 1 min
Vibration	0.75mm amplitude at frequency of 5 to 55Hz in each X, Y, Z direction for 2 hours
Noise immunity	Square shaped noise by noise simulator (pulse width 1 μs) ±0.5 kV
Ambient temperature	-10 to 50 °C, storage: -20 to 60 °C (no freezing or condensation)
Ambient humidity	35 to 85%RH, Storage: 35 to 85%RH (no freezing or condensation)
Protection structure	IP20 (IEC standard)
Certification	CE UK CA c UL us

Input Specifications

■ Input type and range

The setting range of some parameters is limited when using the decimal point display.

Input type		Decimal point	Display Method	Input range (°C)	Input range (°F)
Thermo -couple	K (CA)	1	K (CA) .H	-200 to 1,350	-328 to 2,462
		0.1	K (CA) .L	-200.0 to 1,350.0	-328.0 to 2462.0
	J (IC)	1	J (IC) .H	-200 to 800	-328 to 1,472
		0.1	J (IC) .L	-200.0 to 800.0	-328.0 to 1472.0
	E (CR)	1	E (CR) .H	-200 to 800	-328 to 1,472
		0.1	E (CR) .L	-200.0 to 800.0	-328.0 to 1,472.0
	T (CC)	1	T (CC) .H	-200 to 400	-328 to 752
		0.1	T (CC) .L	-200.0 to 400.0	-328.0 to 752.0
	B (PR)	1	B (PR)	0 to 1,800	32 to 3,272
	R (PR)	1	R (PR)	0 to 1,750	32 to 3,182
	S (PR)	1	S (PR)	0 to 1,750	32 to 3,182
	N (NN)	1	N (NN)	-200 to 1,300	-328 to 2,372
	C (TT)	1	C (TT)	0 to 2,300	32 to 4,172
	G (TT)	1	G (TT)	0 to 2,300	32 to 4,172
	L (IC)	1	L (IC) .H	-200 to 900	-328 to 1,652
		0.1	L (IC) .L	-200.0 to 900.0	-328.0 to 1,652.0
	U (CC)	1	U (CC) .H	-200 to 400	-328 to 752
		0.1	U (CC) .L	-200.0 to 400.0	-328.0 to 752.0
	Platinel II	1	PLII	0 to 1,390	32 to 2,534
RTD	Cu50 Ω	0.1	CU 50	-200.0 to 200.0	-328.0 to 392.0
	Cu100 Ω	0.1	CU 100	-200.0 to 200.0	-328.0 to 392.0
	JPt100 Ω	1	JPt100.H	-200 to 650	-328 to 1,202
		0.1	JPt100.L	-200.0 to 650.0	-328.0 to 1,202.0
	DPt50 Ω	0.1	DPt50.L	-200.0 to 600.0	-328.0 to 1,112.0
	DPt100 Ω	1	DPt100.H	-200 to 650	-328 to 1,202
		0.1	DPt100.L	-200.0 to 650.0	-328.0 to 1,202.0
	Nickel120 Ω	1	NI12	-80 to 260	-112 to 500
Analog	0 to 10 V	-	AV1	0 ~ 10 V	
	0 to 5 V	-	AV2	0 ~ 5 V	
	1 to 5 V	-	AV3	1 ~ 5 V	
	0 to 100 mV	-	AMV1	0 ~ 100 mV	
	0 to 20 mA	-	AMA1	0 ~ 20 mA	
	4 to 20 mA	-	AMA2	4 ~ 20 mA	

- Permissible line resistance per line: ≤ 5 Ω

■ Measurement accuracy

Input type	Using temperature	Teriminal type	Measurement accuracy
Thermo -couple RTD	At room temperature (23 ±5 °C)	Screw	(PV ±0.3% or ±1 °C higher one) ±1-digit • Thermocouple K, J, T, N, E below -100 °C and L, U, PLII, RTD Cu50 Ω, DPt50 Ω: (PV ±0.3% or ±2 °C higher one) ±1-digit • Thermocouple C, G and R, S below 200 °C: (PV ±0.3% or ±3 °C higher one) ±1-digit • Thermocouple B below 400°C: there is no accuracy standards
		Screwless	(PV ±0.5% or ±1 °C higher one) ±1-digit • Thermocouple K, J, T, N, E below -100 °C and L, U, PLII, RTD Cu50 Ω, DPt50 Ω: (PV ±0.5% or ±2 °C higher one) ±1-digit • Thermocouple C, G and R, S below 200 °C: (PV ±0.5% or ±3 °C higher one) ±1-digit • Thermocouple B below 400°C: there is no accuracy standards
	Out of room temperature range		(PV ±0.5% or ±2 °C higher one) ±1-digit • RTD Cu50 Ω, DPt50 Ω: (PV ±0.5% or ±3 °C higher one) ±1-digit • Thermocouple R, S, B, C, G: (PV ±0.5% or ±5 °C higher one) ±1-digit • Other sensors: ≤ ±5 °C (≤-100 °C)
Analog	At room temperature (23 ±5 °C)		±0.3% F.S. ±1-digit
	Out of room temperature range		±0.5% F.S. ±1-digit

- Connecting 1 or more module can vary measurement accuracy about ±1°C, regardless of the number of connected module.

Communication Setting

■ Interface

Module	Control	Option	Communication	
Series	**TMH2/4**	**TMHA, TMHE, TMHCT**	**TMHC-22L**	**TMHC-22E**
Protocol	Modbus RTU		Modbus RTU, PLC Ladderless communication	Modbus TCP
Comm. method	RS485		RS422, RS485	Ethernet (10/100BaseT)
PC loader	TTL (Protocol: Modbus RTU)			
Maximum connection	32 units (address: 01 to 32) • 16 units in case of connecting TMHC module (address: 01 to 16)	16 units per each module	Control module 16 units, option module 16 units per each module (32 units in total)	
Synchronization	Asynchronous			-
Connection method	Two-wire half duplex			-
Comm. effective range	≤ 800 m			-
Comm. speed	4,800 / 9,600 (default) / 19,200 / 38,400 / 115,200 bps (parameter)			10/100 Mbps
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	≈ 1,000,000 operations (Erase / Write)			

- When changing the setting value related to communication interface, reboot the device for normal operation.
- It is recommended to use Autonics communication converter. Please use twisted pair wire, which is suitable for RS485 communication.

■ Address

Set the communication address with the communication address setting switch (SW1, default: 1) and communication address group switch (SW2, default: +0, TMH2/4 Series).

Series \ SW1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
TMH2/4 +0 +16	16	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
TMH2/4 +0 +16	32	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
TMHC	16	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
TMHA	48	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
TMHE	64	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
TMHCT	80	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79

- When connecting TMHC and TMH2/4 to master separately, communication address can be duplicated, but if they communicate with master at the same time, communication address must not be duplicated to avoid error. (use address TMHC: 1 to 16, TMH2/4: 17 to 32)

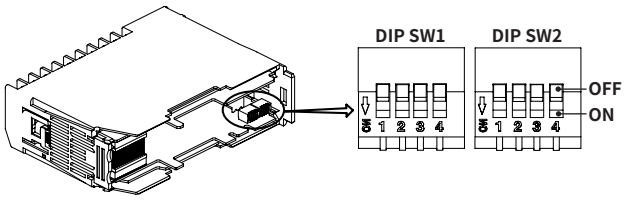
■ Mac address [Ethernet communication module]

It is possible to check Mac address for Ethernet communication at DAQMaster.
Refer to the manual for the details.

■ DIP switch setting [Ladderless communication module]

After separating base terminal block, set communication speed, stop bit, PLC connection and protocol by using a internal DIP switch.

- Setting values are applied to COM1 only, default: All switches OFF (following parameter setting)



DIP SW1

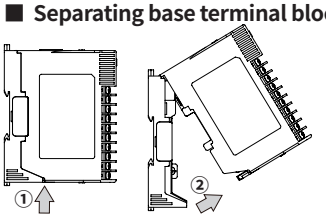
1	2	Communication speed	3	4	Stop bit
OFF	OFF	Following parameter setting	OFF	OFF	Following parameter setting
OFF	ON	19,200 bps	OFF	ON	Stop bit: 1 bit
ON	OFF	38,400 bps	ON	OFF	Stop bit: 2 bit
ON	ON	115,200 bps	ON	ON	-

DIP SW2

1	2	3	4	PLC connection and protocol
OFF	OFF	OFF	OFF	Following parameter setting
OFF	OFF	OFF	ON	Modbus RTU
OFF	OFF	ON	OFF	LS MASTER-K Series special protocol
OFF	OFF	ON	ON	LS GLOFA-GM Series special protocol
OFF	ON	OFF	OFF	LS XGT/XGB Series special protocol
OFF	ON	OFF	ON	MITSUBISHI MELSEC Series special protocol Q/QnACPU common command (1401/0401)
OFF	ON	ON	OFF	MITSUBISHI MELSEC Series special protocol ACPU common command (WW/WR)
OFF	ON	ON	ON	OMRON SYSMAC Series special protocol
ON	OFF	OFF	OFF	MITSUBISHI MELSEC3 Series special protocol

Installation Method

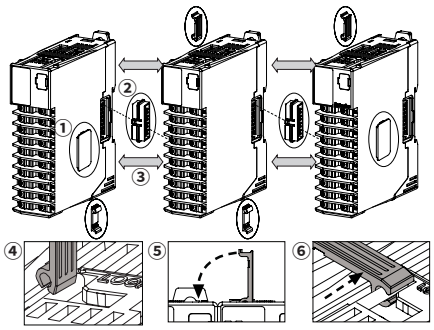
■ Separating base terminal block



1. Push the lock lever at ①.
2. Pull the body of the module to ② direction.

- When connecting base terminal block, align the upper concave part (凹) of the body and the upper convex part (凸) of the base, then lower it vertically to connect it. If the upper parts are not align correctly, it may damage to the inner connector.

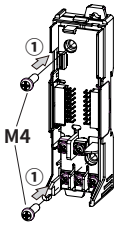
■ Connection between modules



1. Remove END cover (①) of each module (except END cover of the first and last module).
2. ② Insert expansion connector (②) and connect them tightly to ③ direction (max. 31 units).
3. Insert module lock connector (④) to lock connector hole (⑤).
4. Push module lock connector to the lock direction (⑥).

- Supply power to the rear power terminal of only one of the connected modules. Supply adequate power for power input specifications and overall capacity. (Max. power when connecting 32 modules: 32 × 5 W = 160 W)

■ Mounting with bolts

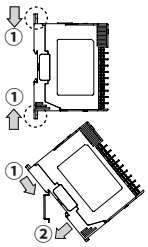


1. Refer to 'Separating base terminal block' to separate base terminal block.
2. Install the module by using M4 screws to the ① direction of the inside mounting hole.

- Refer to the 'Dimensions' to check hall positions and dimensions of inside mounting hole.

■ Mounting on DIN rail

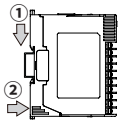
- Installation



1. Press the rail lock at the top / bottom of the module to the ① direction.

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

- Separation



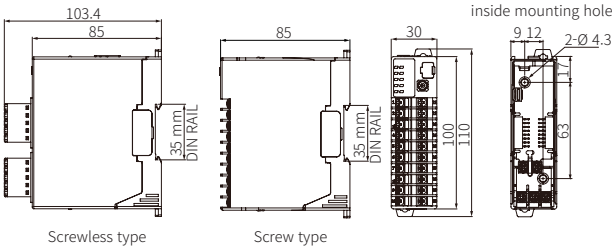
1. Press the module to ① direction.
2. Keep it pressed and pull it to ② direction.

■ Precautions

- Install the module vertically.
- Use end plates (sold separately, not available from Autonics) to fix firmly.

Dimensions

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

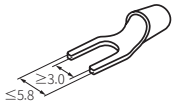


Screwless type Screw type

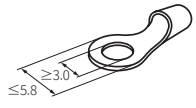
Terminal

- Unit: mm, Use the terminal of follow shape.

■ Screw: Crimp terminal

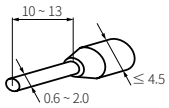


Fork crimp terminal



Round crimp terminal

■ Screwless: Wire ferrule

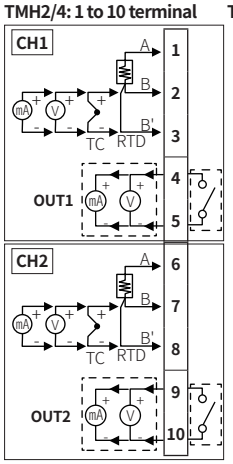


Connections

⚠ Do not arbitrarily remove the terminal screws, and use them after fully tightening them.
Failure to follow this instruction may result in malfunction due to contact failure.

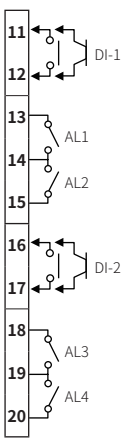
■ Control module

TMH2/4: 1 to 10 terminal



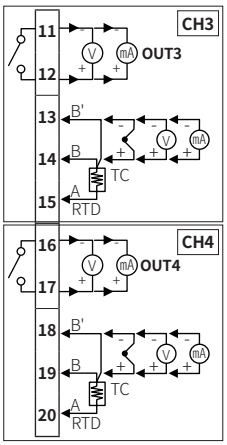
Terminal		Function 1		Function 2	
1	CH1 input	RTD	A	-	
2			B	TC, current, voltage	+
3			B'		−
4	CH1 output	Relay, current, SSR	+	-	
5			−		
6	CH2 input	RTD	A	-	
7			B	TC, current, voltage	+
8			B'		−
9	CH2 output	Relay, current, SSR	+	-	
10			−		

TMH2: 11 to 20 terminal



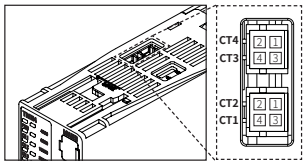
Terminal	Function
11	Digital input 1
12	
13	Alarm output 1
14	Ground
15	Alarm output 2
16	Digital input 2
17	
18	Alarm output 3
19	Ground
20	Alarm output 4

TMH4: 11 to 20 terminal

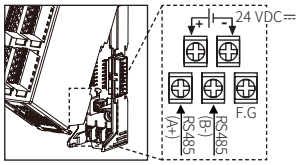


Terminal		Function 1		Function 2	
11	CH3 output	Relay, current, SSR	−	-	
12			+		
13	CH3 input	RTD	B'	TC, current, voltage	−
14			B		+
15			A	-	
16	CH4 output	Relay, current, SSR	−	-	
17			+		
18	CH4 input	RTD	B'	TC, current, voltage	−
19			B		+
20			A	-	

CT input terminals on the top



Power/Comm. terminal on the back

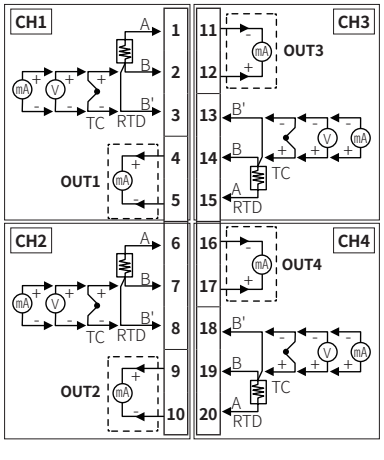


CT connector cable(CICT4-□, sold separately)

Pin	Cable color	CT connection
1	Brown	CT 2 / CT 4
2	Blue	CT 2 / CT 4
3	White	CT 1 / CT 3
4	Black	CT 1 / CT 3

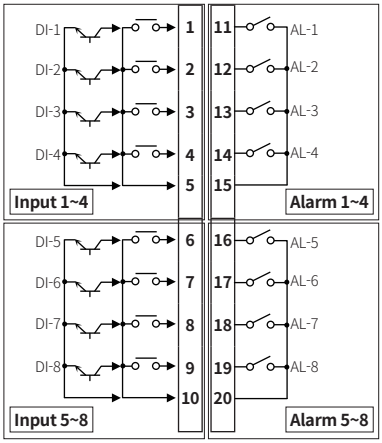
■ Option module

TMHA [Analog input / output]



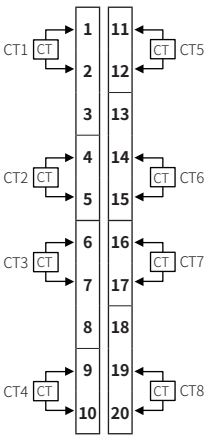
Terminal		Function 1		Function 2	
1	CH1 input	RTD	A	-	
2			B	TC, current, voltage	+
3			B'		−
4	CH1 output	Current	+	-	
5			−		
6	CH2 input	RTD	A	-	
7			B	TC, current, voltage	+
8			B'		−
9	CH2 output	Current	+	-	
10			−		
11	CH3 output	Current	−	-	
12			+		
13	CH3 input	RTD	B'	TC, current, voltage	−
14			B		+
15			A	-	
16	CH4 output	Current	−	-	
17			+		
18	CH4 input	RTD	B'	TC, current, voltage	−
19			B		+
20			A	-	

TMHE [Digital input / Alarm output]



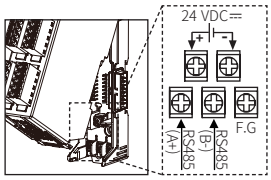
Terminal		Function
1	Input 1 to 4	Digital input 1
2		Digital input 2
3		Digital input 3
4		Digital input 4
5		Ground
6	Input 5 to 8	Digital input 5
7		Digital input 6
8		Digital input 7
9		Digital input 8
10		Ground
11	Output 1 to 4	Alarm output 1
12		Alarm output 2
13		Alarm output 3
14		Alarm output 4
15		Ground
16	Output 5 to 8	Alarm output 5
17		Alarm output 6
18		Alarm output 7
19		Alarm output 8
20		Ground

TMHCT [CT input]



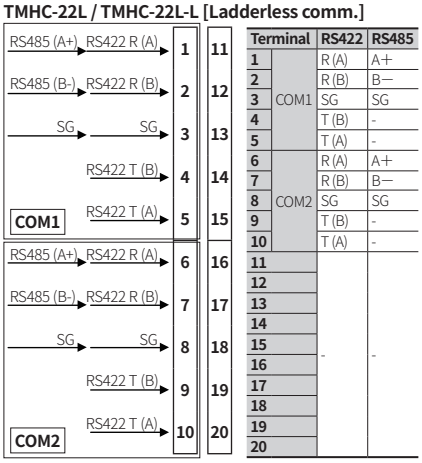
Terminal	Function
1	CT input 1
2	
3	-
4	CT input 2
5	
6	CT input 3
7	
8	-
9	CT input 4
10	
11	CT input 5
12	
13	-
14	CT input 6
15	
16	CT input 7
17	
18	-
19	CT input 8
20	

Power/Comm. terminal on the back



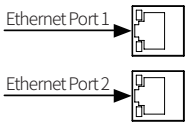
■ Communication module

TMHC-22L / TMHC-22L-L [Ladderless comm.]

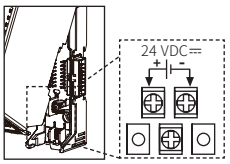


Terminal		RS422	RS485
1	COM1	R (A)	A+
2		R (B)	B−
3		SG	SG
4		T (B)	-
5		T (A)	-
6	COM2	R (A)	A+
7		R (B)	B−
8		SG	SG
9		T (B)	-
10		T (A)	-
11	-	-	-
12			
13			
14			
15			
16			
17			
18			
19			
20			

TMHC-22E [Ethernet comm.]



Power/Comm. terminal on the back



Errors

■ Indicator

Name	Status	Color	Description	Troubleshooting
PWR	ON	Red	□ channel error: Input < Input range, Input > Input range, Input sensor is open or not connected	When the error factor is resolved, it automatically returns to normal operation.
CH□	Flash[01]	Red		

01) Cycle: 0.5 sec

■ Communication output, DAQMaster

Communication output (decimal)	DAQMaster	Description	Troubleshooting
'31000'	Display 'OPEN'	Input sensor is open or not connected	When the error factor is resolved, it automatically returns to normal operation.
'30000'	Display 'HHHH'[01]	Input > Input range	
'-30000'	Display 'LLLL'[01]	Input < Input range	
'31500'	Display '31500'	Sensor internal communication error	Check the power supply (24VDC⎓).[02]

01) When HHHH / LLLL error occurs, the control output may occur by recognizing the maximum or minimum input depending on the control type. Please be careful.

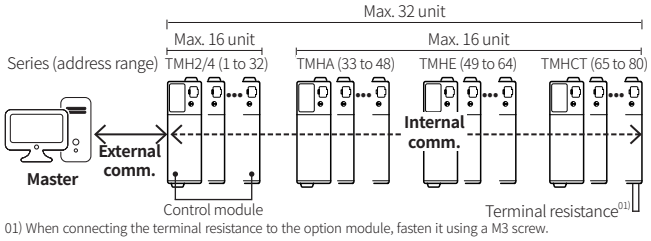
02) This error may occur when connecting only the loader port.

Configuration Example

TMHA, TMHE and TMHCT are should be used with TMH2/4 control module.
Each module is available to monitoring at DAQMatser via PC loader.

- Internal comm.: Receiving/Sending data between TMH2/4 and TMHA/E/CT
- External comm.: Communication with master for controlling

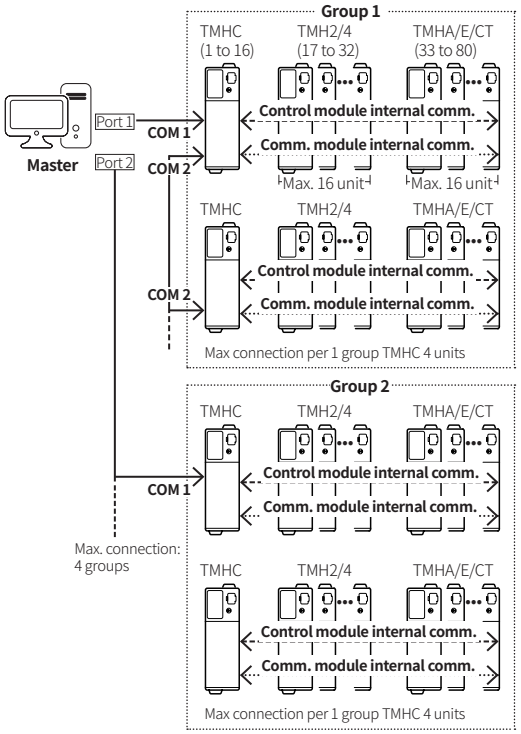
■ Control module: TMH2/4, Option module: TMHA/E/CT inter-working



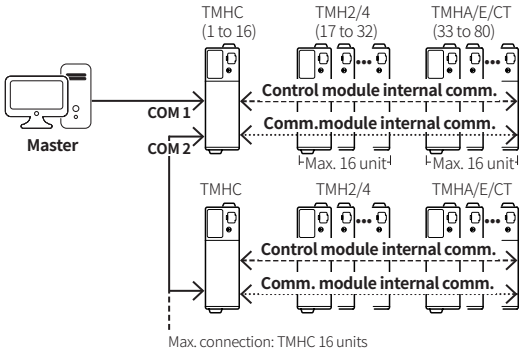
01) When connecting the terminal resistance to the option module, fasten it using a M3 screw.

■ Communication module: TMHC

Ladderless communication

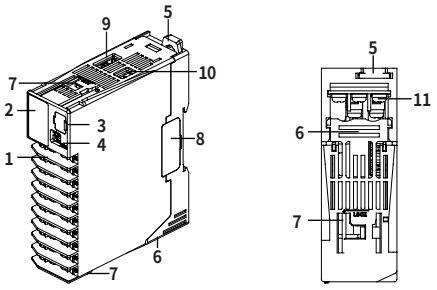


Ethernet communication



Unit Descriptions

- The below is based on screw type.



[Front / Side / Top] [Bottom]

1. Input / Output Terminal

Refer to 'Connection' for the details about terminal description.For specifications of crimp terminals for Screw type or wire ferrule for Screwless type, please refer to 'Terminals'.

2. Indicator

- Control module: TMH2

Indicator		Status	Initial power ON [01]	Control output	Auto tuning [02]	Alarm output N.O. OFF	N.O. ON	N.C OFF	N.C ON
LED 1 LED 2	LED 1	PWR (green) [03]	-	ON	ON	-			
PWR		CH1 (red)		ON	Flash				
CH 1		CH2 (red)		ON	Flash				
AL 1		(red)		ON [04]	OFF				
CH 2		(red)		ON [05]	OFF				
AL 2	LED 2	(yellow)	Flash (4,800 bps)	Module communication status [06]					
		AL1 (yellow)	Flash (9,600 bps)	-	-	OFF	ON	OFF	ON
AL 3		AL2 (yellow)	Flash (19,200 bps)	-	-	OFF	ON	OFF	ON
		AL3 (yellow)	Flash (38,400 bps)	-	-	OFF	ON	OFF	ON
AL 4		AL4 (yellow)	Flash (115,200 bps)	-	-	OFF	ON	OFF	ON

- Control module: TMH4

Indicator		Status	Initial power ON [01]	Control output	Auto tunning [02]
LED 1 LED 2	LED 1	PWR (green) [03]	-	ON	ON
PWR		CH1 (red)		ON	Flash
CH 1		CH2 (red)		ON	Flash
CH 2		CH3 (red)		ON	Flash
CH 3		CH4 (red)		ON	Flash
CH 4	LED 2	(yellow)	Flash (4,800 bps)	Module communication status [06]	
		(yellow)	Flash (9,600 bps)	-	-
		(yellow)	Flash (19,200 bps)	-	-
		(yellow)	Flash (38,400 bps)	-	-
		(yellow)	Flash (115,200 bps)	-	-

- Option module: TMHA [Analog input / output]

Indicator		Status	Initial power ON [01]	Internal comm.	Transmission output
LED 1 LED 2	LED 1	PWR (green) [07]	-	ON	ON
PWR		CH1 (red)		-	ON
CH 1		CH2 (red)		-	ON
CH 2		CH3 (red)		-	ON
CH 3		CH4 (red)		-	ON
CH 4	LED 2	(yellow)	Flash (4,800 bps)	Module communication status [06]	
		(yellow)	Flash (9,600 bps)	ON (CH1)	-
		(yellow)	Flash (19,200 bps)	ON (CH2)	-
		(yellow)	Flash (38,400 bps)	ON (CH3)	-
		(yellow)	Flash (115,200 bps)	ON (CH4)	-

- Option module: TMHE [Digital input, Alarm output]

Indicator		Status	Initial power ON [01]	Internal comm.	Alarm output N.O. Open	N.O. Closed	N.C. Open	N.C. Closed
LED 1 LED 2	LED 1	PWR (green) [07]	-	ON	ON			
PWR		AL1 (red)		-	OFF	ON	OFF	ON
AL 1		AL2 (red)		-	OFF	ON	OFF	ON
AL 2		AL3 (red)		-	OFF	ON	OFF	ON
AL 3		AL4 (red)		-	OFF	ON	OFF	ON
AL 4	LED 2	(yellow)	Flash (4,800 bps)	Module communication status [06]				
		AL5 (yellow)	Flash (9,600 bps)	-	OFF	ON	OFF	ON
		AL6 (yellow)	Flash (19,200 bps)	-	OFF	ON	OFF	ON
		AL7 (yellow)	Flash (38,400 bps)	-	OFF	ON	OFF	ON
		AL8 (yellow)	Flash (115,200 bps)	-	OFF	ON	OFF	ON

- Option module: TMHCT [CT input]

Indicator		Status	Initial power ON [01]	CT input [08]	Internal comm.
LED 1 LED 2	LED 1	PWR (green) [07]	-	ON	ON
PWR		(red)		ON (40.0 to 50.0 A)	-
		(red)		ON (30.0 to 39.9 A)	-
		(red)		ON (20.0 to 29.9 A)	-
		(red)		ON (10.0 to 19.9 A)	-
	LED 2	(yellow)	Flash (4,800 bps)	Module communication status [06]	
		(yellow)	Flash (9,600 bps)	ON (40.0 to 50.0 A)	-
		(yellow)	Flash (19,200 bps)	ON (30.0 to 39.9 A)	-
		(yellow)	Flash (38,400 bps)	ON (20.0 to 29.9 A)	-
		(yellow)	Flash (115,200 bps)	ON (10.0 to 19.9 A)	-

- Communication module: TMHC-22L / TMHC-22L-L [Ladderless communication]

Indicator		Status	Initial power ON [09]	Internal comm.	Connection	Ladderless communication
LED 1 LED 2	LED 1	PWR (green)	Flash (4,800 bps)	Flash	-	Flash (red, read operation)
PWR		(red)	Flash (9,600 bps)	Flash (TMH2/4)		-
		(red)	Flash (19,200 bps)	Flash (TMHA)		-
		(red)	Flash (38,400 bps)	Flash (TMHE)		-
		(red)	Flash (115,200 bps)	Flash (TMHCT)		-
	LED 2	(yellow)	Flash (4,800 bps)	-	ON	Flash (send operation)
		(yellow)	Flash (9,600 bps)		ON (TMH2/4)	-
		(yellow)	Flash (19,200 bps)		ON (TMHA)	-
		(yellow)	Flash (38,400 bps)		ON (TMHE)	-
		(yellow)	Flash (115,200 bps)		ON (TMHCT)	-

- Communication module: TMHC-22E [Ethernet communication]

Indicator		Status	Initial power ON	Internal comm.	Connection
LED 1 LED 2	LED 1	PWR (green)	ON	Flash (external device)	-
PWR		(red)	-	Flash (TMH2/4)	
		(red)	-	Flash (TMHA)	
		(red)	-	Flash (TMHE)	
		(red)	-	Flash (TMHCT)	
	LED 2	(yellow)	-	ON	Flash (Ethernet comm.)
		(yellow)	Sequence-flashing vertically for 5 sec	-	ON (TMH2/4)
		(yellow)		-	ON (TMHA)
		(yellow)		-	ON (TMHE)
		(yellow)		-	ON (TMHCT)

01) At the moment when power is on, the indicator of set communication speed flashes for 5 sec.

02) Indicator of the channel, which is in the process of auto-tuning, flashes at 1 sec interval.

03) When communicating with external device, PWR indicator flashes.

04) Turns on, when CH1 outputs cooling control in the heating&cooling control method.

05) Turns on, when CH2 outputs cooling control in the heating&cooling control method.

06) • ON: Internal comm. (normal) • Flash: Internal comm. (abnormal) • OFF: not communicating

07) • 1 sec interval flash: external comm. (normal) • ON: Internal comm. (normal) • Flash: Internal comm. (abnormal) • OFF: not Internal communicating

08) The indicator corresponding to the certain setting value of CT input flashes according to the parameter.
• LED 1: CT Input Value Indication Lamp1 • LED 2: CT Input Value Indication Lamp2

09) At the moment when power is ON, the indicator of communication speed flashes for 5 sec at 1 sec interval.
• LED 1: HOST 1 • LED 2: HOST 2

3. PC loader port

PC loader port supports serial communication between single module and PC. It needs communication converter(SCM-USP) for communicating.

4. 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.

5. Rail lock

Rail lock helps installing the device. Refer to 'Installation Method' for the details.

6. Lock lever

Lock lever holds module body and base tightly.

7. Module lock connector hole

When connecting modules, insert module lock connector in the hole in order to enhance coherence between them.

8. END Cover

When connecting modules, remove END cover in order to connect expansion connector.

9. CT input Terminal [Control module]

Refer to 'Connection' for the details.

9. Communication mode switch (SW2) [Ladderless communication module]

Select communication mode between RS485 and RS422.

10. Communication address group switch (SW2) [Control module]

When setting the communication address over 16, select +16.

11. Power / Communication terminal

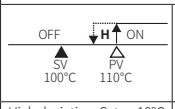
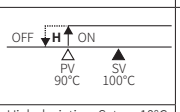
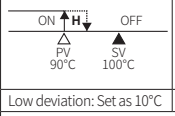
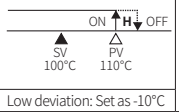
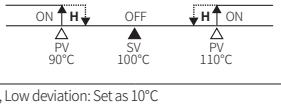
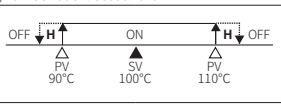
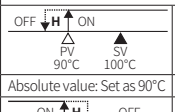
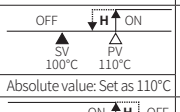
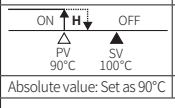
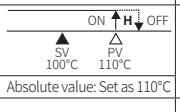
Supplies power to module and communicates with one or more module.

Function: Alarm

Alarm output sets alarm operation and alarm option.
Each alarm operates individually in two alarm output models.
When the current temperature is out of alarm range, alarm clears automatically.

■ Operation

• **H**: Alarm output hysteresis

Mode	Name	Alarm operation		Description
OFF	-	-		No alarm output
AL-1	Deviation high limit			If deviation between PV and SV as high-limit is higher than set value of deviation temperature, the alarm output will be ON.
		High deviation: Set as 10°C	High deviation: Set as -10°C	
AL-2	Deviation low limit			If deviation between PV and SV as low limit is higher than set value of deviation temperature, the alarm output will be ON.
		Low deviation: Set as 10°C	Low deviation: Set as -10°C	
AL-3	Deviation high, low limit			If deviation between PV and SV as high/low-limit is higher than set value of deviation temperature, the alarm output will be ON.
		High, Low deviation: Set as 10°C		
AL-4	Deviation high, low limit reverse			If deviation between PV and SV is higher than the lower limit deviation set value and less than the upper limit deviation set value, the alarm output will be ON.
		High, Low deviation: Set as 10°C		
AL-5	Absolute value high limit			If PV is higher than the absolute value, the output will be ON.
		Absolute value: Set as 90°C	Absolute value: Set as 110°C	
AL-6	Absolute value low limit			If PV is lower than the absolute value, the output will be ON.
		Absolute value: Set as 90°C	Absolute value: Set as 110°C	
LBA	Loop break	-		It will be ON when it detects loop disconnection.
SBA	Sensor break	-		It will be ON when it detects sensor disconnection.
HBA	Heater break	-		It will be ON when CT detects heater break.

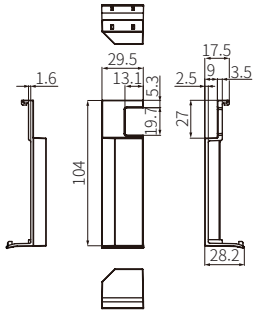
■ Option

Mode	Name	Description	Condition of re-apply
AL-A	Standard alarm	If it is an alarm condition, alarm output is ON. If it is a clear alarm condition, alarm output is OFF.	-
AL-B	Alarm latch	If it is an alarm condition, alarm output is ON and maintains ON status.	-
AL-C	Standby sequence 1	First alarm condition is ignored and from second alarm condition, standard alarm operates. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second alarm condition, standard alarm operates.	Power ON
AL-D	Alarm latch and standby sequence 1	If it is an alarm condition, it operates both alarm latch and standby sequence. When power is supplied and it is an alarm condition, this first alarm condition is ignored and from the second 1alarm condition, alarm latch operates.	
AL-E	Standby sequence 2	First alarm condition is ignored and from second alarm condition, standard alarm operates. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, standard alarm operates.	Power ON, change SV, change alarm temperature / operation or change STOP to RUN mode
AL-F	Alarm latch and standby sequence 2	Basic operation is same as alarm latch and standby sequence1. It operates not only by power ON/OFF, but also alarm set value, or alarm option changing. When re-applied standby sequence and if it is alarm condition, alarm output does not turn ON. After clearing alarm condition, alarm latch operates.	

Sold Separately: Terminal Protection Cover

• Unit: mm, Only available for screw type modules.

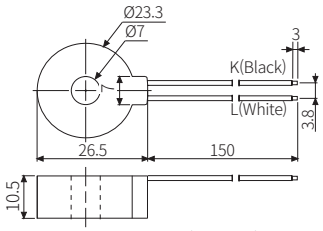
TMH-COVER



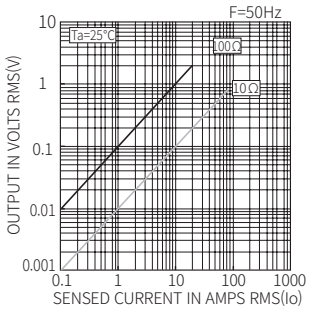
Sold Separately: Current Transformer (CT)

• Unit: mm
• The current for above CTs is 50A same but inner hole sizes are different. Please use this for your environment.
• Do not supply primary current in case that CT output is open. High voltage will be generated in CT output.

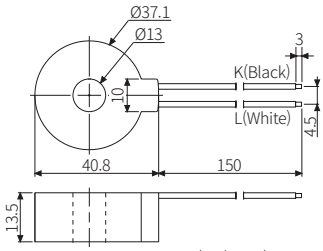
CSTC-E80LN



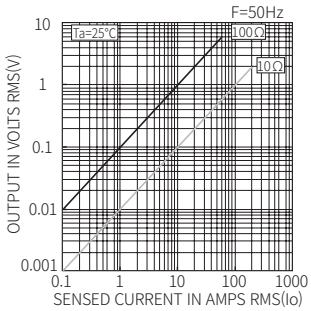
• Max. load current: 80A (50/60Hz)
• Current ratio: 1/1000
• Wire wounded resistance: 31Ω ±10%



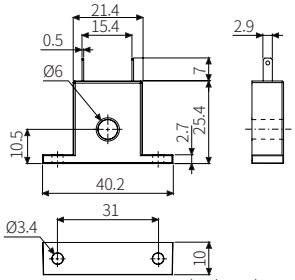
CSTC-E200LN



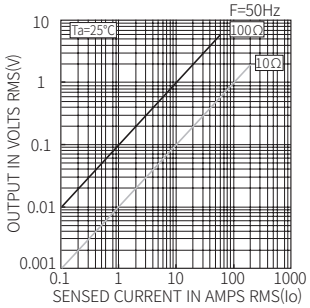
• Max. load current: 200A (50/60Hz)
• Current ratio: 1/1000
• Wire wounded resistance: 20Ω ±10%



CSTS-E80PP

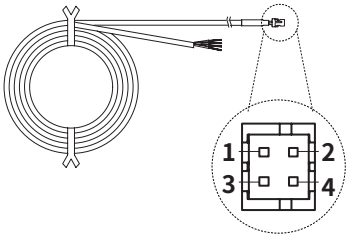


• Max. load current: 80A (50/60Hz)
• Current ratio: 1/1000
• Wire wounded resistance 31Ω ±10%



Sold Separately: CT Connector Cable

• When connecting CT connector and CT input terminal, align the concave part and the convex part .



Model	Cable length
CICT4-1	1 m
CICT4-3	3 m

Pin	Cable color	CT connection
1	Brown	CT 2 / CT 4
2	Blue	CT 2 / CT 4
3	White	CT 1 / CT 3
4	Black	CT 1 / CT 3

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