

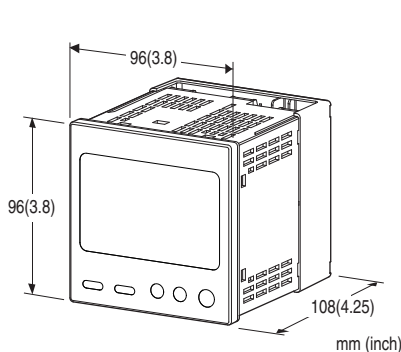
Temperature Controller TC10 Series

TEMPERATURE CONTROLLER

(Modbus use)

Functions & Features

- Two PID controllers
- Universal input x 2 points, control output x 4 points, discrete input x 2 points, clamp-on current sensor input x 2 points
- 2 universal inputs configurable to T/C, RTD, DC current or voltage independently
- Discrete inputs usable to switch PID bank or operation mode
- Control outputs configurable to MV, PV or alarm
- Clamp-on current sensor input enables to detect heater wire break or over current
- Auto tuning function



MODEL: TC10EM-[1]-M2

ORDERING INFORMATION

- Code number: TC10EM-[1]-M2
- Specify a code from below for [1].
(e.g. TC10EM-A-M2)

[1] CONTROL OUTPUT

- A:** 0 - 20 mA DC (Load resistance 500 Ω max.)
Open-collector 2 points
- V:** 0 - 10 V DC (Load resistance 2 k Ω max.)
Open-collector 2 points
- P:** 12 V pulse (Load resistance 600 Ω max.)
Open-collector 2 points

POWER INPUT

AC Power

M2: 100 - 240 V AC (Operational voltage range 85 - 264 V, 47 - 66 Hz)

RELATED PRODUCTS

- PC configurator software (model: TC10CFG)
Downloadable at M-System's web site.
- A dedicated cable is required to connect the module to the PC. Please refer to the internet software download site or the users manual for the PC configurator for applicable cable types.
- Clamp-on current sensor (model: CLSE)
(Used for detecting the heater wire break)

GENERAL SPECIFICATIONS

Construction: Panel flush mounting

Degree of protection: IP65; applicable to the front panel of the unit with single mounting according to the specified panel cutout

Configuration jack: 2.5 dia. miniature jack connector; RS-232-C level

Connection: Separable M3 screw terminals (torque 0.5 N·m)

Solderless terminal: Refer to the drawing at the end of the section.

Recommended manufacturer: Japan Solderless Terminal MFG.Co.Ltd, Nichifu Co.,Ltd

Applicable wire size: 0.25 to 1.65 mm² (AWG 22 to 16)

Screw terminal: Nickel-plated steel

Isolation: Pv1 to Pv2 to CT1 or CT2 to Di1 or Di2 to MV1 or MV2 to Do1 or Do2 to Modbus to power

CT Input waveform

RMS sensing: Up to 15 % of 3rd harmonic content

Control mode: Standard PID, heating and cooling control (ON/OFF, PID)

Proportional band (P): 0.1 to 999.9 (temperature unit)

Integral time (I): 0.0 to 9999.9 sec.

Derivative time (D): 0.0 to 9999.9 sec.

Auto-tuning: Limit cycle method

Alarm: Deviation high & low, absolute high & low, etc.

Sampling cycle: 100 msec.

Control cycle: 0.1 to 99.9 sec.

MV output range: -5 - +105 %

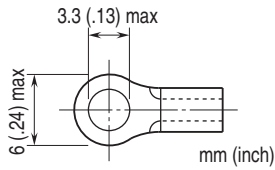
Parameters: Stored in non-volatile memory; write/erase cycle endurance: less than 1 000 000

Parameter setting: With front panel operation buttons or PC configurator software (model: TC10CFG)

- Universal input
- Burnout
- Control output
- Loop
- Bank
- Event input
- CT input
- Auto-tuning

Refer to the instruction manual for detail.

■ Recommended solderless terminal



MODBUS COMMUNICATION

Communication: Half-duplex, asynchronous, no procedure

Standard: Conforms to RS-485

Transmission distance: 500 meters max.

Transmission media: Shielded twisted-pair cable
(CPEV-S 0.9 dia.)

Node address: 1 to 247

Data mode: RTU (Binary)

Parity: None, even or odd

Baud rate: 4800, 9600, 19.2 k, 38.4 k, 57.6 k (bps)

Stop bit: 1 or 2

Node address, parity, baud rate setting: With front panel operation buttons or PC configurator software (model: TC10CFG)

DISPLAY

PV display: 5 digits 7-segment green LED, 19.5 mm (.77") height

SP display: 5 digits 7-segment red LED, 12.5 mm (.49") height, switchable to MV display

Display range: -32000 to 32000

Decimal point position: 10^{-1} to 10^{-4} or none

Zero indication: Higher-digit zeros are suppressed.

Loop status indicators

- Loop1: Amber LED turns on when loop 1 chosen
- Loop2: Amber LED turns on when loop 2 chosen
- Bank1: Green LED turns on when bank 1 chosen
- Bank2: Green LED turns on when bank 2 chosen
- Bank3: Green LED turns on when bank 3 chosen
- Bank4: Green LED turns on when bank 4 chosen
- Alarm1: Red LED turns on at alarm 1
- Alarm2: Red LED turns on at alarm 2
- Alarm3: Red LED turns on at alarm 3
- Alarm4: Red LED turns on while setting is saving to the non-volatile memory.
- Run: Green LED turns on while loop is in operation.
- Man: Green LED turns on during manual mode
- Local: Green LED turns on when local SP chosen
- At: Green LED turns on during auto-tuning
- Out1: Green LED turns on when MV1 output
- Out2: Green LED turns on when MV2 output

INPUT SPECIFICATIONS

■ Universal input 1, 2 (Pv1, Pv2)

For type and range configuration, refer to the instruction manual.

DC Current:

Input range: 0 - 20 mA DC

Input resistance: 49.9 Ω resistor incorporated

• **DC voltage input**

Input resistance: ≥ 10 k Ω (-1000 to +1000 mV DC)

Input resistance: ≥ 1 M Ω (-10 to + 10 V DC)

• **Thermocouple**

Input resistance: ≥ 10 k Ω

Burnout sensing: ≤ 4 μ A

• **RTD (2-wire or 3-wire)**

Excitation: ≤ 0.33 mA

Allowable leadwire resistance: 20 Ω per wire

• **Resistance**

Excitation: ≤ 0.33 mA

Allowable leadwire resistance: 20 Ω per wire

• **Potentiometer**

Excitation: ≤ 0.33 mA

Input range: 0 to 4000 Ω

Allowable leadwire resistance: 20 Ω per wire

■ Clamp-on current sensor (CT1, CT2)

(Sensor model No.: AC input)

CLSE-R5: 0 - 5 A

CLSE-05: 0 - 50 A

CLSE-10: 0 - 100 A

CLSE-20: 0 - 200 A

CLSE-40: 0 - 400 A

CLSE-60: 0 - 600 A

Frequency: 50 / 60 Hz

Operational range: 0 - 120 % of rating

Overload capacity:

CLSE-R5: 10 A continuous

CLSE-05: 60 A continuous

CLSE-10: 120 A continuous

CLSE-20: 240 A continuous

CLSE-40: 480 A continuous

CLSE-60: 720 A continuous

Be sure that the input voltage is of 480 V or less.

■ Discrete Input (Di1, Di2)

Contact rating: 3.3 V @1 mA

Detection levels:

≤ 15 k Ω / 0.5 V at close

≥ 350 k Ω / 2.5 V at open

OUTPUT SPECIFICATIONS

Four control outputs are configurable to Mv, Ao or Do.

■ Control Output (Mv1, Mv2)

Specify the type of output with the code number.

■ **DC Current:** 0 - 20 mA DC

Operational range: 0 – 23 mA DC

Load resistance: $\leq 500 \Omega$

■ **DC Voltage:** 0 – 10 V DC

Operational range: 0 – +11.5 V DC

Load resistance: $\geq 2 \text{ k}\Omega$

■ **Voltage Pulse**

Maximum frequency: 1 Hz

Minimum pulse width: 1 msec.

Hi level: 12 V $\pm 15 \%$

Lo level: $\leq 0.5 \text{ V}$

Load resistance: 600 Ω min.

■ **Control Output (Do1, Do2)**

• **Open collector**

Maximum frequency: 1 Hz

Minimum pulse width: 1 msec.

Output rating: 50 V DC 100 mA (resistive load)

Saturation voltage: 0.5 V DC

STANDARDS & APPROVALS

CE conformity:

EMC Directive (2004/108/EC)

EMI EN 61000-6-4: 2007

EMS EN 61000-6-2: 2005

Low Voltage Directive (2006/95/EC)

EN 61010-1: 2001

Installation Category II

Pollution Degree 2

Input to output to power – Reinforced insulation (300 V)

Input or output to power to Modbus – Basic insulation (300 V)

INSTALLATION

Power Consumption

• **AC:**

Approx. 6 VA at 100 V

Approx. 7 VA at 200 V

Approx. 8 VA at 240 V

Operating temperature: -10 to +55°C (14 to 131°F)

Operating humidity: 5 to 90 %RH (non-condensing)

Atmosphere: No corrosive gas or heavy dust

Mounting: Panel flush mounting

Weight: 450 g (0.99 lb)

PERFORMANCE in percentage of span

Accuracy

• **Pv1 or Pv2:** Refer to "Input type, range & conversion accuracy" section.

• **CT1 or CT2:** $\pm 2 \%$ (sensor error margin not included)

• **MV1 or MV2:** $\pm 0.5 \%$ (added to the input accuracy)

Cold junction compensation error (thermocouple input):

$\pm 2.0^\circ\text{C}$ at 0 – 50°C ($\pm 3.6^\circ\text{F}$ at 32 – 122°F)

CJC sensor is adjacently attached to the input terminals.

CJC is available for each universal input 1 and 2.

Temp. coefficient

• **Pv1 or Pv2:** $\pm 0.03 \%/^\circ\text{C}$ ($\pm 0.02 \%/^\circ\text{F}$)

• **CT1 or CT2:** $\pm 0.03 \%/^\circ\text{C}$ ($\pm 0.02 \%/^\circ\text{F}$)

Response time

• **CT1 or CT2:** $\leq 2 \text{ sec.}$ (0 – 90 %)

• **Mv1 or Mv2:** $\leq 1 \text{ sec.}$ (0 – 90 %, DC output)

Burnout response (thermocouple, RTD input): $\leq 10 \text{ s}$

Insulation resistance: $\geq 100 \text{ M}\Omega$ with 500 V DC

Dielectric strength: 2000 V AC @1 minute (Pv1 to Pv2 to

CT1 or CT2 to Di1 or Di2 to MV1 or MV2 to Do1 or Do2 to

Modbus to power to ground)

INPUT TYPE, RANGE & CONVERSION ACCURACY

INPUT TYPE		INPUT RANGE		ACCURACY			
DC CURRENT		0 to 20mA DC		±20μA			
DC VOLTAGE		-1000 to +1000mV DC		When max. range*2 is ≤60mV ±20μV When max. range*2 is ≤120mV ±30μV When max. range*2 is ≥120mV ±200μV			
		-10 to +10V DC		±10mV ±0.1%			
POTENTIOMETER		0 to 4000Ω		±0.1Ω or ±0.1%, whichever is greater			
RESISTOR		0 to 4000Ω		±0.1Ω or ±0.1%, whichever is greater			
Thermocouple (PR) K (CA) E (CRC) J (IC) T (CC) B (RH) R S C (WRe 5-26) N U L P (Platinel II)	°C			°F			
	INPUT RANGE	ACCURACY*1	CONFORMANCE RANGE	INPUT RANGE	ACCURACY*1	CONFORMANCE RANGE	
	0 to 1760	±1.80	0 to 1760	32 to 3200	±3.24	32 to 3200	
	-270 to +1370	±0.40	-150 to +1370	-454 to +2498	±0.72	-238 to +2498	
	-270 to +1000	±0.60	-170 to +1000	-454 to +1832	±1.08	-274 to +1832	
	-210 to +1200	±0.70	-180 to +1200	-346 to +2192	±1.26	-292 to +2192	
	-270 to +400	±0.50	-170 to +400	-454 to +752	±0.90	-274 to +752	
	100 to 1820	±2.00	400 to 1760	212 to 3308	±3.60	752 to 3200	
	-50 to +1760	±1.00	200 to 1760	-58 to +3200	±1.80	392 to 3200	
	-50 to +1760	±1.00	0 to 1760	-58 to +3200	±1.80	32 to 3200	
	0 to 2315	±1.00	0 to 2315	32 to 4199	±1.80	32 to 4199	
	-270 to +1300	±0.50	-130 to +1300	-454 to +2372	±0.90	-202 to +2372	
	-200 to +600	±0.50	-200 to +600	-328 to +1112	±0.90	-328 to +1112	
	-200 to +900	±0.30	-200 to +900	-328 to +1652	±0.54	-328 to +1652	
	0 to 1395	±0.30	0 to 1395	32 to 2543	±0.54	32 to 2543	
	RTD	°C			°F		
		INPUT RANGE	ACCURACY		INPUT RANGE	ACCURACY	
-200 to +850		±0.40		-328 to +1562	±0.72		
-200 to +850		±0.40		-328 to +1562	±0.72		
-200 to +850		±0.40		-328 to +1562	±0.72		
-200 to +649		±0.60		-328 to +1200	±1.08		
-200 to +510		±0.40		-328 to +950	±0.72		
-50 to +200		±0.60		-58 to +392	±1.08		
-50 to +250		±2.00		-58 to +482	±3.60		

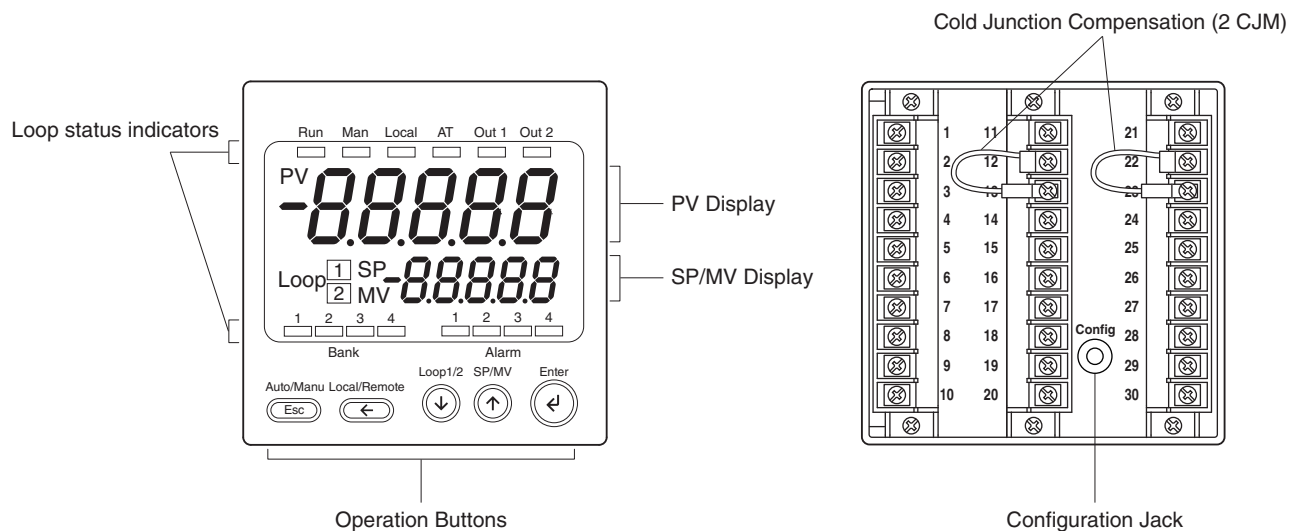
*1. Thermocouple: Add 2.0 $^{\circ}\text{C}$ of cold-junction-compensation error.

*2. Max. range: absolute range (greater of 0% and 100% range values), whichever is greater.

EXTERNAL VIEW

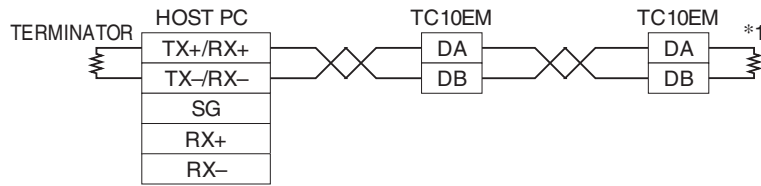
■ FRONT VIEW

■ REAR VIEW



CONNECTION DIAGRAMS

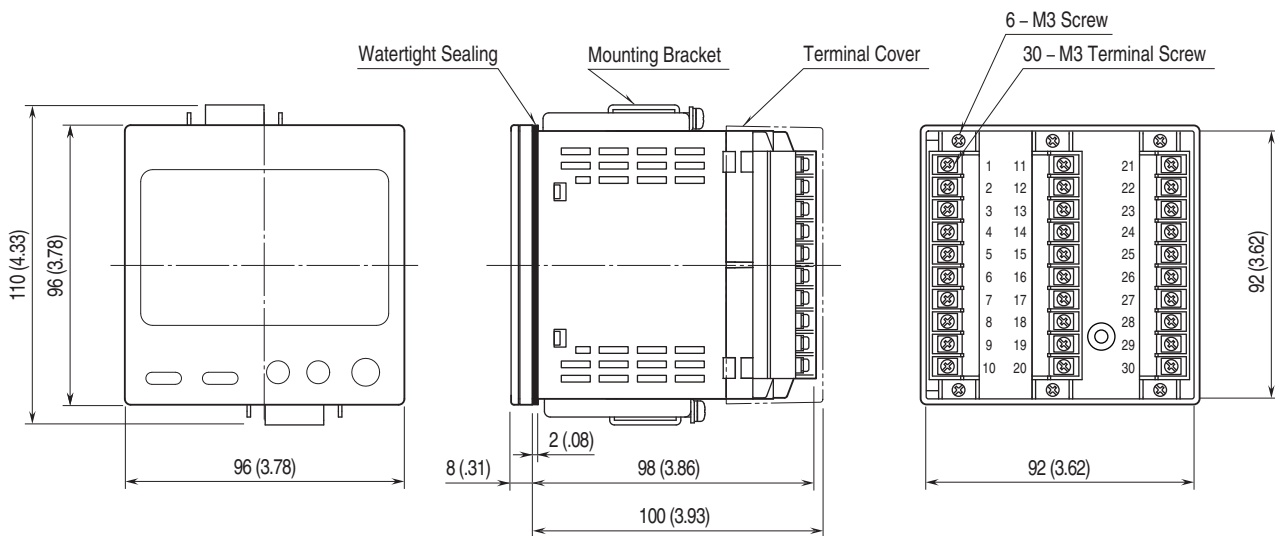
■ MASTER CONNECTION



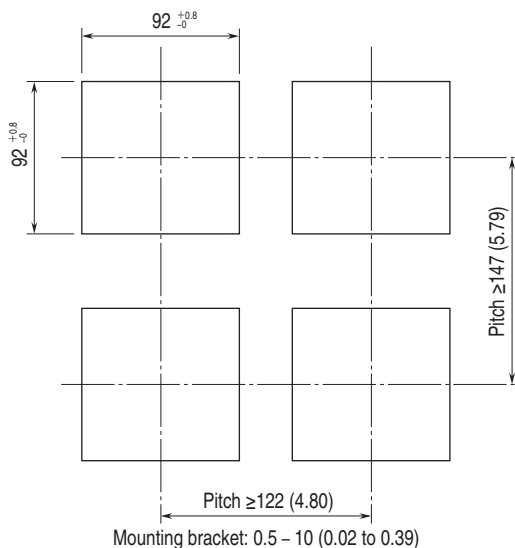
NO.	ID	FUNCTION
6	DA	DA
7	DB	DB

*1. For using internal terminator, short-across terminals 4 and 5.

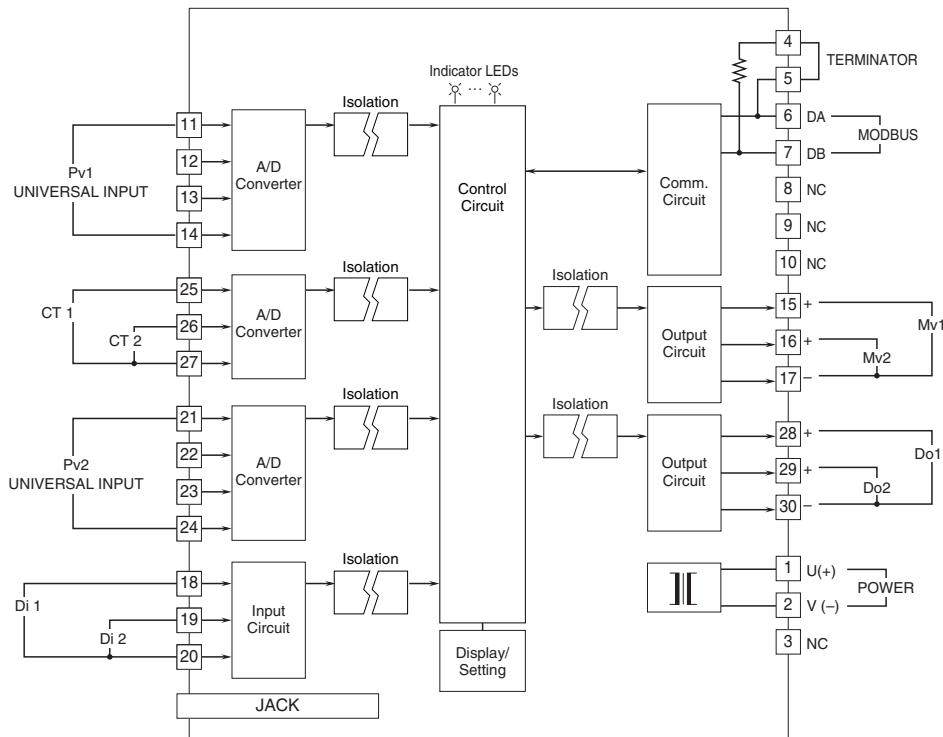
DIMENSIONS unit: mm (inch)



■ PANEL CUTOUT unit: mm (inch)

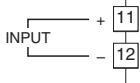


SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

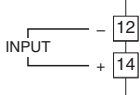


■ UNIVERSAL INPUT CONNECTION (Pv1) e.g.

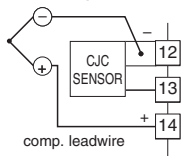
- DC Voltage (-10 ~ +10V DC)
- DC Current (0 ~ 20mA DC)



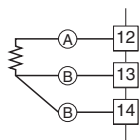
- DC Voltage (-1000 ~ +1000mV DC)



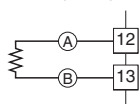
•Thermocouple



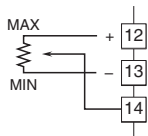
•RTD/Resistor (3-wire)



•RTD/Resistor (2-wire)

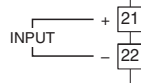


•Potentiometer

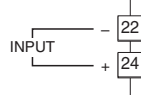


■ UNIVERSAL INPUT CONNECTION (Pv2) e.g.

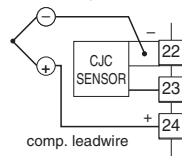
- DC Voltage (-10 ~ +10V DC)
- DC Current (0 ~ 20mA DC)



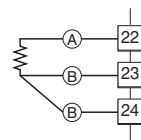
- DC Voltage (-1000 ~ +1000mV DC)



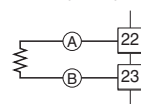
•Thermocouple



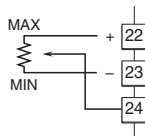
•RTD/Resistor (3-wire)



•RTD/Resistor (2-wire)

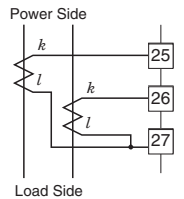


•Potentiometer

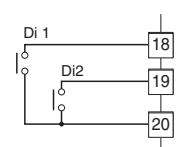


■ CT 1 / CT 2 CONNECTION e.g.

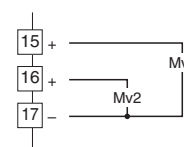
- Clamp-on current Sensor



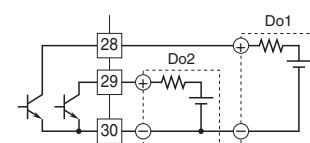
■ DISCRETE INPUT CONNECTION e.g.



■ CONTROL OUTPUT 1 & 2 CONNECTION e.g.



■ CONTROL OUTPUT 3 & 4 CONNECTION e.g.





Specifications are subject to change without notice.