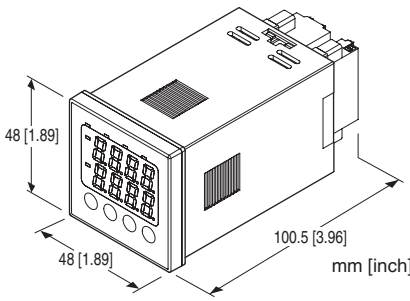
Temperature Controller TC10 Series

TEMPERATURE CONTROLLER

(Modbus, 4 digit, LED display type, size 48 x 48 mm)

Functions & Features

- One PID controller
- Universal input x 1 point, control output x 4 points, clamp-on current sensor input x 1 point
- Universal input configurable to T/C, RTD, DC current or voltage independently
- 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



CE

MODEL: TC10CM–[1]–M2

ORDERING INFORMATION

- Code number: TC10CM-[1]-M2

Specify a code from below for [1].
(e.g. TC10CM-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 kΩ min.)
Open collector 2 points
P: 12 V pulse (Load resistance 600 Ω min.)
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 cable (model: COP-US)
- PC configurator software (model: TC10CFG)

Downloadable at our web site.

- Clamp-on current sensor (model: CLSE)

(Used for detecting the heater wire break)

GENERAL SPECIFICATIONS

Construction: Panel flush mounting
Degree of protection: IP66; applicable to the front of the panel meter mounted according to the specified panel cutout
Configuration jack: 2.5 dia. miniature jack connector; RS-232-C level (bottom of the unit)
Connection: Tension clamp terminal (Separable, 8 pin × 2) (Terminal 9 to 16: 8 pin front twin connection)
Applicable wire size: 0.2 to 1.5 mm^2, stripped length 10 mm
Housing material: Flame-resistant resin (gray)
Isolation: Pv1 to CT1 (clamp-on current sensor) 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 to 3999 sec.
Derivative time (D): 0.0 to 999.9 sec.
Auto-tuning: Limit cycle method
Alarm: Deviation high & low, absolute high & low, etc.
Sampling cycle: 100 msec.
Control cycle: 1.0 to 99.9 sec.
(100 msec. fixed for Mv output 0 - 20 mA DC and 0 - 10 V DC)
Mv output range: -5 - +105 % for output scale
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 on/off
- Control output
- Loop
- Bank
- CT input
- Auto-tuning

Refer to the instruction manual for detail.

MODBUS COMMUNICATION

Communication: Half-duplex, asynchronous, no procedure
Standard: Conforms to TIA/EIA-485-A
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)

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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)
Terminating resistor: When using attached terminating resistor (110Ω), install between terminal 15 and 16.

DISPLAY

PV display: 4 digits 7-segment green LED, 10 mm (.40") height
SP display: 4 digits 7-segment red LED, 10 mm (.40") height, switchable to MV display
Display range: -1999 to 9999
Decimal point position: 10^{-1} to 10^{-3} or none
Zero indication: Higher-digit zeros are suppressed
Loop status indicators
Run: Green LED turns on while loop is in operation
Man: Green LED turns on during manual mode
AT: Green LED turns on during auto-tuning
Alarm: Red LED turns on when alarm is occurring
SP: Red LED turns on when selecting SP
MV: Red LED turns on when selecting MV
Engineering unit indication: Sticker label attached
DC, AC, mV, V, kV, µA, mA, A, kA, mW, W,
kW, var, kvar, Mvar, VA, Hz, Ω, kΩ, MΩ,
cm, mm, m, m/sec, mm/min, cm/min, m/min,
m/h, m/s^2, inch, ℓ, ℓ/s, ℓ/min, ℓ/h, m^3, m^3/sec,
m^3/min, m^3/h, Nm^3/h, N·m, N/m^2, g, kg, kg/h,
N, kN, Pa, kPa, MPa, t, t/h, ℃, °F, %RH, J,
kJ, MJ, rpm, sec, min, min^{-1}, pH, %, ppm, etc.

INPUT SPECIFICATIONS

■ **Universal input (Pv1)**
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 kΩ (-1000 to +1000 mV DC)
Input resistance: ≥ 1 MΩ (-10 to +10 V DC)
• **Thermocouple**
Input resistance: ≥ 10 kΩ
Input range: Refer to the table 1
Burnout sensing: ≤ 4 µA
Conformance range: Refer to the table 1
• **RTD (2-wire or 3-wire)**
Excitation: ≤ 0.33 mA
Input range: Refer to the table 1
Allowable leadwire resistance: 20 Ω per wire
• **Resistor (2-wire or 3-wire)**
Excitation: ≤ 0.33 mA
Input range: 0 - 4000 Ω
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)**
(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 (45 - 65 Hz)
Max. working voltage: 480 V AC (primary side)
Overload capacity:
CLSE-R5: 10 A continuous, x40 (1 sec.)
CLSE-05: 60 A continuous, x40 (1 sec.)
CLSE-10: 120 A continuous, x40 (1 sec.)
CLSE-20: 240 A continuous, x40 (1 sec.)
CLSE-40: 480 A continuous, x40 (1 sec.)
CLSE-60: 720 A continuous, x40 (1 sec.)
Operational range
CLSE-R5: ≤ 5 A
CLSE-05: ≤ 50 A
CLSE-10: ≤ 100 A
CLSE-20: ≤ 200 A
CLSE-40: ≤ 400 A
CLSE-60: ≤ 600 A
Caution 1: The output values may vary depending on the accuracy of engagement at the clamp connection.
Caution 2: The sensor's mechanical construction may cause it to generate resonance sound. However, it does not affect the perfomance of the sensor.

OUTPUT SPECIFICATIONS

Four control outputs are configurable to Mv, Ao or Do.
■ **Control Output (Mv1, Mv2)**
Specify one type of output with the code number from 4 types shown below.
• **DC Current**: 0 – 20 mA DC
Operational range: 0 – 23 mA DC
Load resistance: ≤ 500 Ω
• **DC Voltage**: 0 – 10 V DC
Operational range: 0 – 11.5 V DC
Load resistance: ≥ 2 kΩ
• **12 V Voltage pulse**
Maximum frequency: 1 Hz

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Minimum pulse width: 1 msec.
Hi level: 12 V ±15 %
Lo level: ≤ 0.5 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

INSTALLATION

Power Consumption
•**AC**:
Approx. 4.5 VA at 100 V
Approx. 5.5 VA at 200 V
Approx. 6.5 VA at 240 V
Operating temperature: -10 to +55°C (14 to 131°F)
Operating humidity: 30 to 90 %RH (non-condensing)
Atmosphere: No corrosive gas or heavy dust
Mounting: Panel flush mounting
Weight: 200 g (0.44 lb)

PERFORMANCE in percentage of span

Accuracy
• **Pv1**: Refer to "Input type, range & conversion accuracy" section.
• **CT1**: ±2 % (sensor error margin not included)
• **Mv1 or Mv2**: ±0.5 %
Cold junction compensation error (thermocouple input): ±2.0°C at -10 – +55°C (±3.6°F at 14 – 131°F)
CJC sensor is adjacently attached to the input terminals.
Temp. coefficient
• **Pv1**: ±0.03 %/°C (± 0.02 %/°F)
• **CT1**: ±0.03 %/°C (± 0.02 %/°F)
Response time
• **CT1**: ≤ 2 sec. (0 – 90 %)
• **Mv1 or Mv2**: ≤ 1 sec. (0 – 90 %, DC output)
Burnout response (thermocouple, RTD, resistor, potentiometer input): ≤ 10 sec.
Insulation resistance: ≥ 100 MΩ with 500 V DC
Dielectric strength: 1500 V AC @1 minute (Pv1 to CT1 to Mv1 or Mv2 to Do1 or Do2 to Modbus)
2000 V AC @1 minute (Input or output or Modbus to power to ground)

STANDARDS & APPROVALS

EU conformity:
EMC Directive
EMI EN 61000-6-4
EMS EN 61000-6-2
Low Voltage Directive
EN 61010-1
Installation Category II
Pollution Degree 2
Input or output or Modbus to power – Reinforced insulation (300 V)
Input to output to Modbus – Basic insulation (300 V)
RoHS Directive

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INPUT TYPE, RANGE & CONVERSION ACCURACY

INPUT TYPE	INPUT RANGE	ACCURACY
DC CURRENT	0 to 20mA DC	±20μA*4
DC VOLTAGE	-1000 to +1000mV DC	When max. range*2 is ≥60mV ±20μV*4 When max. range*2 is ≤120mV ±30μV*4 When max. range*2 is ≥120mV ±200μV*5
	-10 to +10V DC	±10mV*4
POTENTIOMETER	Total resistance up to 4000Ω*3	±0.1Ω or ±0.1%, whichever is greater*5
RESISTOR	0 to 4000Ω	±0.1Ω or ±0.1%, whichever is greater*5

Thermocouple	°C			°F		
	INPUT RANGE	ACCURACY*1	CONFORMANCE RANGE	INPUT RANGE	ACCURACY*1	CONFORMANCE RANGE
(PR)	0 to 1760	±1.80	0 to 1760	32 to 3200	±3.24	32 to 3200
K (CA)	-270 to +1370	±0.40	-150 to +1370	-454 to +2498	±0.72	-238 to +2498
E (CRC)	-270 to +1000	±0.60	-170 to +1000	-454 to +1832	±1.08	-274 to +1832
J (IC)	-210 to +1200	±0.70	-180 to +1200	-346 to +2192	±1.26	-292 to +2192
T (CC)	-270 to +400	±0.50	-170 to +400	-454 to +752	±0.90	-274 to +752
B (RH)	100 to 1820	±2.00	400 to 1760	212 to 3308	±3.60	752 to 3200
R	-50 to +1760	±1.00	200 to 1760	-58 to +3200	±1.80	392 to 3200
S	-50 to +1760	±1.00	0 to 1760	-58 to +3200	±1.80	32 to 3200
C (WRe 5-26)	0 to 2315	±1.00	0 to 2315	32 to 4199	±1.80	32 to 4199
N	-270 to +1300	±0.50	-130 to +1300	-454 to +2372	±0.90	-202 to +2372
U	-200 to +600	±0.50	-100 to +600	-328 to +1112	±0.90	-148 to +1112
L	-200 to +900	±0.30	-100 to +900	-328 to +1652	±0.54	-148 to +1652
P (Platinel II)	0 to 1395	±0.30	0 to 1395	32 to 2543	±0.54	32 to 2543

RTD	°C		°F	
	INPUT RANGE	ACCURACY*1	INPUT RANGE	ACCURACY*1
Pt 100 (JIS '97, IEC)	-200 to +850	±0.40	-328 to +1562	±0.72
Pt 500	-200 to +850	±0.40	-328 to +1562	±0.72
Pt 1000	-200 to +850	±0.40	-328 to +1562	±0.72
Pt 50Ω (JIS'81)	-200 to +649	±0.60	-328 to +1200	±1.08
JPt 100 (JIS'89)	-200 to +510	±0.40	-328 to +950	±0.72
Ni 508.4Ω	-50 to +200	±0.60	-58 to +392	±1.08
Cu 10 (25℃)	-50 to +250	±2.00	-58 to +482	±3.60

*1. Thermocouple: Add 2.0°C of cold-junction-compensation error. If the digits after decimal point are not displayed, round up the all decimal places.

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

*3. Refer to the operating manual for details.

*4. If the digits after first decimal place are not displayed, described value ±1 digit.

*5. If the digits after decimal point are not displayed, described value ±1 digit.

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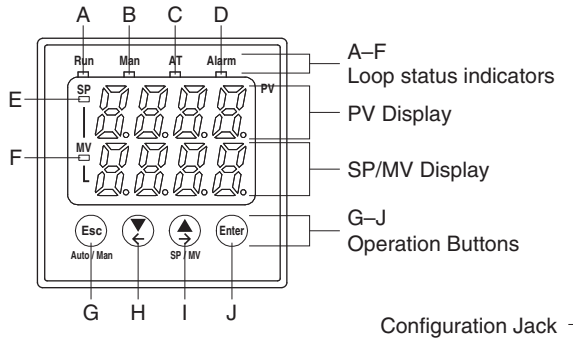
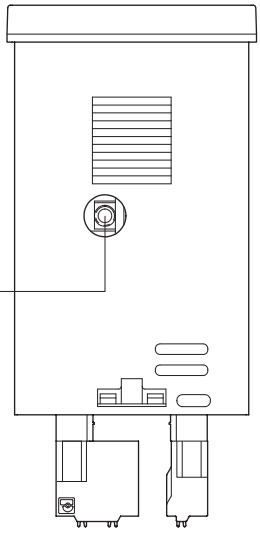
EXTERNAL VIEW

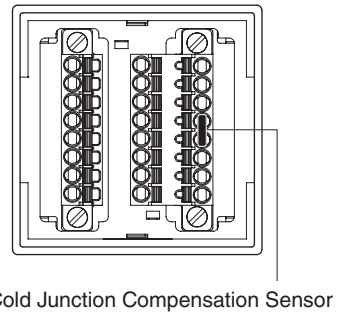
■ FRONT VIEW



■ BOTTOM VIEW



■ REAR VIEW



■ LOOP STATUS INDICATOR

No.	ITEM	FUNCTION
A	Run	Green LED turns on while loop is in operation.
B	Man	Green LED turns on during manual mode.
C	AT	Green LED turns on during auto-tuning.
D	Alarm	Red LED turns on while alarm is occurring.
E	SP	Red LED turns on while displaying SP value.
F	MV	Red LED turns on while displaying MV value.

■ OPERATION BUTTON

No.	ITEM		FUNCTION
G	Esc	Auto/Man	Long-press during setting to return to the normal state. Press in the normal state to switch between auto and manual.
H	▼←		Press and release quickly to move down through numbers or settings. Long-press to move to the lower digit.
I	▲→	SP/MV	Press and release quickly to move up through numbers or settings. Long-press to move to the upper digit. Press in the normal state to switch between SP value and MV value.
J	Enter		Determine the setting value, and at the same time write the setting value to non-volatile memory.

■ PV display

PV value is displayed in the normal state, and setting item is displayed during setting.

■ SP/MV display

SP value and MV value are switched in the normal state, and setting item is displayed during setting.

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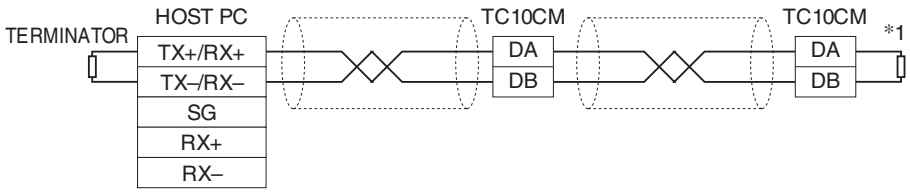
MODBUS WIRING CONNECTION

■ **MASTER CONNECTION**

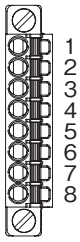


NO.	ID	FUNCTION
15	DA	DA
16	DB	DB

*1. For using attached terminator, mount it between terminals 15 and 16.

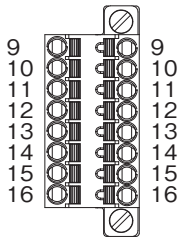
CONNECTION DIAGRAMS

■ **Connector for power input, CT input 1, control output 3, 4**



No.	ID	FUNCTION
1	Do1	Control output 3
2	Do2	Control output 4
3	COM	Control output 3, 4 COM
4	k	Clamp-on current sensor
5	I	Clamp-on current sensor
6	NC	Unused
7	U	Power input
8	V	Power input

■ **Connector for universal input 1, control output 1, 2, Modbus**



No.	ID	FUNCTION
9	Mv1	Control output 1
10	Mv2	Control output 2
11	COM	Control output 1, 2 COM
12	Pv1	Universal input 1
13	Pv2	Universal input 1
14	Pv3	Universal input 1
15	DA	Modbus
16	DB	Modbus

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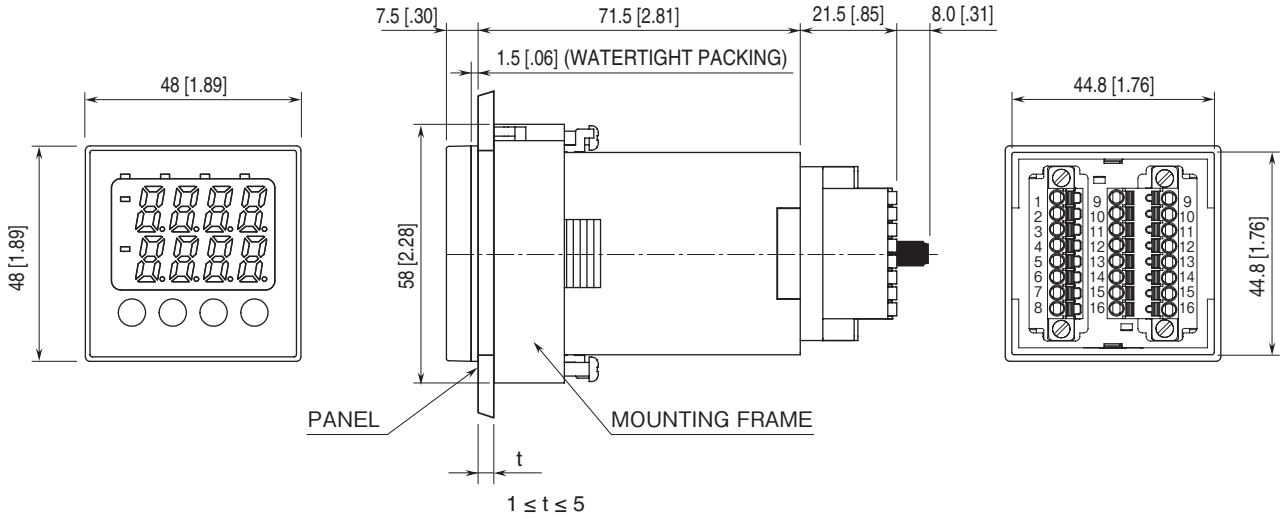
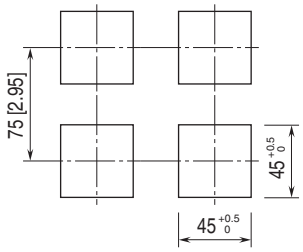
EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm [inch]



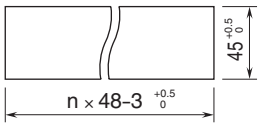
■ **Single Mounting**

(Conform to degree of protection IP66)



■ **Clustered Mounting**

(Not conform to degree of protection IP66)



(n：number of the units)

Panel thickness: 1 to 8 [0.04 to 0.31]

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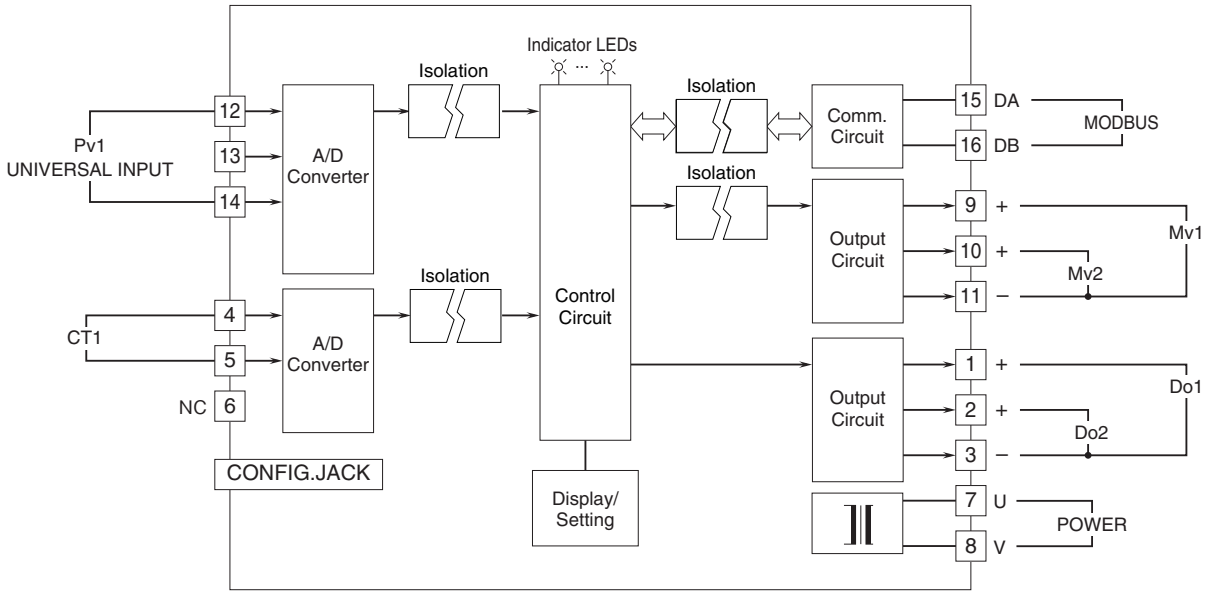
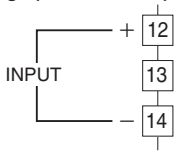
SCHEMATIC CIRCUITRY & CONNECTION DIAGRAM

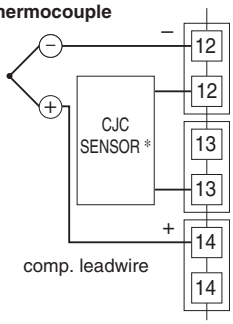


■ UNIVERSAL INPUT CONNECTION (Pv1) e.g.

- **DC Current (0 – 20mA DC)**
- **DC Voltage (-1000 – +1000mV DC)**
- **DC Voltage (-10 – +10V DC)**

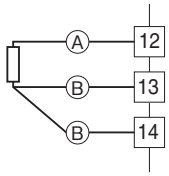


- **Thermocouple**

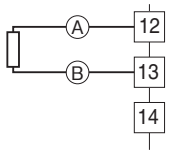


* The CJC sensor does not have polarity. Install compensation leadwire inside the t-branch connector, and CJC sensor on the outside.

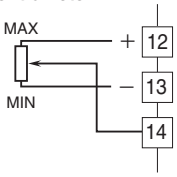
- **RTD/Resistor (3-wire)**



- **RTD/Resistor (2-wire)**

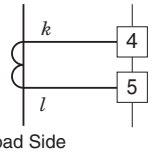


- **Potentiometer**

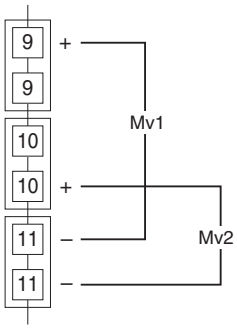


■ CT1 CONNECTION e.g.

- **Clamp-on Current Sensor (model : CLSE)**

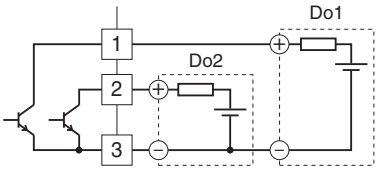


■ CONTROL OUTPUT Mv1, Mv2 CONNECTION e.g.

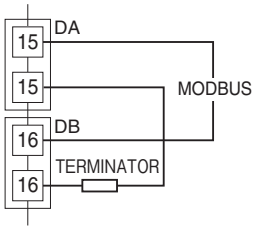


■ CONTROL OUTPUT Do1, Do2 CONNECTION e.g.

- **Open Collector**



■ MODBUS CONNECTION e.g.



⚠ Specifications are subject to change without notice.

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