Maple Systems

USER MANUAL

MAPLE MODULAR PLC
RTD & TC Modules

- IO-SA0400
- IO-SA0400T

1010-1155 REV 1.2

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- For your safety and the safe operation of this product, please read this manual before using the product. The manual is subject to change without notice.
- Please review the product specifications in this manual to determine the suitability of this product for its intended use.
- For your safety only qualified persons should perform electrical and wiring attachments to this product.

This manual contains important information on the use and operation of this device. Please read all the information carefully for optimal performance and to prevent any damage or misuse of the device.

To keep products safe, all activities including product installation, wiring operation, and maintenance are required to be treated by trained personnel.

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Safety symbols are classified into two categories: “WARNING” and “CAUTION”.

Warning This symbol describes situations that could cause major or fatal injury to the user.

Caution This symbol describes situations that may cause minor injury or damage to the device.

SAFETY SYMBOLS USED IN THIS PRODUCT MEAN:

This symbol warns the user of potential hazards.

This symbol warns the user of uninsulated voltage within the unit that can cause dangerous electric shock.

Keep this manual near the operating devices so it can be easily checked.

Design Precautions (⚠ Warning)

Please install a safety circuit to protect the entire control system in case of an unexpected power shut-down or PLC module malfunction. Such anomalies may severely compromise the integrity of the overall system.

External to the PLC, please install circuits and switches to safeguard the system from mechanical damages (ex. emergency stop, upper/lower limit switches, forward/reverse direction interlocking circuits, etc).

When the PLC detects either of the following failure conditions, it may stop operation and turn off all outputs.

- The overcurrent protection or overvoltage protection of the power supply module is activated.

- The PLC CPU detected a failure, such as the watchdog timer error or module installation failure, with its self-diagnostic function.

In addition, all outputs may be turned on when there is a failure that the PLC CPU cannot detect, such as in the relay or TR terminal. Build an extra monitoring circuit that will monitor any output signal that could cause serious accidents.

A greater than normal current passed through the PLC for an extended period of time, or a short-circuited load flowing through the output module may cause a fire.

Build a circuit that turns on the external power supply after the PLC power supply is turned on. If the external power supply is turned on first, it could result in output failure or malfunction.

In order to ensure that the system operates safely, please configure an interlock circuit in the scan program for the following situations:

- When exchanging data with a computer or other devices.

- When operated by a computer or other devices.

Not doing so could result in output failure or malfunction.

Precautions for design (⚠ Caution)

Do not bundle the input/output signal or communication cables with the main circuit and power cables. They should be installed at least more than 100 mm (3.94 inches) apart. Not doing so could result in output failure or malfunction.

Precautions for mounting (⚠ Caution)

Use the PLC in an environment that meets the general specifications given in this manual.

Using this PLC in any environment outside the range of the general specifications could result in electric shock, fire, malfunction, or damage to or deterioration of the product.

Please ensure that each module is installed correctly in its place. Loosely or incorrectly installed pieces may result in malfunction, failure, or free-fall.

The PLC power supply should be turned off before mounting the module. Not doing so could cause an electric shock or damage to the device.

Install I/O devices or extension connectors correctly. If they are installed incorrectly, it may result in an input or output failure.

Do not convey direct vibration into the PLC. Doing so could cause electric shock, fire or malfunctions.

After wiring work, please make sure to close the terminal cover before turning on the power for the PLC system.

When using the SP04ETO, be careful not to damage the NTC temperature sensor.

Precautions for wiring (⚠ Warning)

Make sure to check the device's rated voltage and circuit arrangement before wiring. Failure to do so may cause electric shock or damage to the device.

Make sure to close the terminal cover before turning on the power of the PLC system after wiring work. Failure to do so may cause electric shock.

Precautions for wiring (⚠ Caution)

Make sure to check the device's regular voltage and sequence of terminals. Failure to do so may cause fire, electric shock, and malfunctions.

Make sure to tighten the screws with standard torque. Loose connections may cause a short circuit, fire, or malfunctions.

When grounding the FG ground terminals, be sure to conduct the product with at least D type (Class 3) grounding. Not doing so could result in electric shock or malfunctions.

When wiring, make sure that wiring debris does not enter the module. Failure to do so may cause fire, equipment damage or malfunctions.

Precautions for wiring of RTD & TC Module (⚠ Caution)

Cables for module input signals should be separate from AC power to prevent the influence of surge or induction noise occurring from AC.

Select a cable considering the ambient temperature and allowable current. AWG16-28 is recommended.

If the wiring is too close to a heat-generating device, or directly contacted with oil for long periods of time, it may cause a short circuit, breakdown, or malfunction.

In the case of wiring together with a high-voltage cable or power line, a malfunction or breakdown may occur.

Our TC modules are non-isolated between channels and use FG in common.

An FG connection is recommended. In particular, FG reinforcement is strongly recommended when the measured values fluctuate quickly.

When the TC sensor is connected to multiple sources at the same time, electrical interference may occur between them. So, it is not recommended to use simultaneous common connections (this is the main cause of abnormal measurements).

If it is necessary to use another company's model, you must connect the FG of our model with that of the other company's model.

Precautions for test run and repair (⚠ Warning)

Please do not touch the terminals when the power is on. Doing so could cause an electric shock or malfunctions.

When cleaning or tightening the screws, turn off the power of the PLC and all other systems. Failure to do so could cause an electric shock or malfunctions.

Do not charge, disassemble, heat up, short, or solder the battery. Doing so could cause the battery to heat up, rupture, or ignite, thereby harming the user.

Precautions for test run and repair (⚠Caution)

Do not dissociate the PCB from the module's casing or make any modifications to the device. Doing so may cause fire, electric shock or malfunction.

When mounting or separating the module, make sure to turn off power to the PLC and all other devices. Failure to do so could cause an electric shock or malfunctions.

Use radio, walkie-talkie or cellphone devices at least 30cm away from the PLC. Not doing so could result in malfunction.

Precautions for disposal (⚠Caution)

When the product is disposed of, it should be done according to your country's regulations for similar types of industrial waste. Not doing so may cause an occurrence of toxic substances or explosions.

General Specifications

<table>
<tr><th>Items</th><th colspan="5">Specification</th><th>Standards</th></tr>
<tr><td>Ambient Temp.</td><td colspan="5">-10℃–65℃</td><td>-</td></tr>
<tr><td>Storage Temp.</td><td colspan="5">-25℃–80℃</td><td>-</td></tr>
<tr><td>Ambient Humidity</td><td colspan="5">5–95% RH, Non-condensing</td><td>-</td></tr>
<tr><td>Storage Humidity</td><td colspan="5">5–95% RH, Non-condensing</td><td>-</td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="4">For discontinuous vibration</td><td rowspan="8">IEC 61131-2</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Times</td></tr>
<tr><td>5 ≤ f < 9 Hz</td><td>-</td><td>3.5 mm</td><td rowspan="2">10 times
in X, Y, Z</td></tr>
<tr><td>9 ≤ f ≤ 150 Hz</td><td>9.8 m/s^2 (1G)</td><td>-</td></tr>
<tr><td colspan="4">Continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Times</td></tr>
<tr><td>5 ≤ f < 9 Hz</td><td>-</td><td>1.75 mm</td><td rowspan="2">10 times
in X, Y, Z</td></tr>
<tr><td>9 ≤ f ≤ 150 Hz</td><td>4.9 m/s^2 (0.5G)</td><td>-</td></tr>
<tr><td>Shocks</td><td colspan="5">• Max. impact acceleration: 147 m/s^2 (15G)
• Authorized time: 11 ms
• Pulse wave: Sign half-wave pulse (3 times each in X, Y, Z)</td><td>IEC 61131-2</td></tr>
<tr><td rowspan="5">Noise</td><td>Square Wave Impulse Noise</td><td colspan="4">±2 kV</td><td>-</td></tr>
<tr><td>Electrostatic Discharge</td><td colspan="4">±4 kV (contact), ±8 kV (air)</td><td>IEC 61131-2
IEC 61000-4-2</td></tr>
<tr><td>Radiated Electromagnetic Field Noise</td><td colspan="4">80–1000 MHz,10 V/m</td><td>IEC 61131-2
IEC 61000-4-3</td></tr>
<tr><td rowspan="4">Fast Transient Burst Noise (Voltage)</td><td colspan="2">CPU, Power</td><td rowspan="2">2 kV</td><td rowspan="4">IEC 61131-2
IEC 61000-4-4</td></tr>
<tr><td colspan="2">Digital/Analog I/O (AC)</td></tr>
<tr><td colspan="2">Digital/Analog I/O (DC)</td><td rowspan="2">1 kV</td></tr>
<tr><td colspan="2">Communication</td></tr>
<tr><td>Ambient Conditions</td><td colspan="6">No corrosive gas or dust</td></tr>
<tr><td>Altitude</td><td colspan="6">2,000m or less</td></tr>
<tr><td>Pollution</td><td colspan="6">Pollution Degree 2 or less</td></tr>
<tr><td>Cooling</td><td colspan="6">Natural air cooling</td></tr>
</table>

Performance Specifications (IO-SA0400)

Items		Specification
RTD Type		PT100, JPT100, PT1000, Ni1000 (DIN43760),Ni1000 (TCR5000)
Range of Temperature Input		PT100: -200.0–600°C (18.52–313.71 Ω) JPT100: -200.0–600°C (17.14–317.31 Ω) PT1000:-200.0–600°C (185.2–3137.1 Ω) Ni1000 (DIN 43760): -50.0–160°C (742.6–2065.9 Ω) Ni1000 (TCR5000):-50.0–160°C(790.9–1863.6 Ω)
Digital Conversion		Digital converted value (14-bit): -192–16191 (-8192–8191, 0–16000, -8000–8000) Digital converted value (16-bit): 0–65000 (-32768–32767, 0–64000, -32000–32000) Detected Temp. value: -2000–6000 (First decimal place value * 10) or -500–1600 (First decimal place value * 10)
Detecting of Wires Disconnection		3 wires available from each channel
Accuracy		±0.1% (full scale)
Max Conversion Rate		40 ms/4 Channels
Temperature Input points		4 Channels/1 Module
Insulation Type		Between input terminal and PLC: photo coupler insulation between channels: no insulation
Terminal Block		12 points Terminal Block
Current Consumption (mA)	+3.3 V	40
	+24 V	10

Performance Specification (IO-SA0400T)

<table>
<tr><th colspan="2">Items</th><th colspan="4">Specification</th></tr>
<tr><td colspan="2">Thermocouple Type</td><td colspan="4">K, J, E, T, B, R, S, N type</td></tr>
<tr><td colspan="2">Digital Conversion</td><td colspan="4">Digitally converted value: 0–16000 (-8000–8000)/
- 192–16191 (-8192–8191)
Converted temperature value: Range of measured temperature
(one digit after the decimal point * 10)</td></tr>
<tr><td colspan="2" rowspan="10">Range of Temperature Input</td><td>Thermocouple Types</td><td>DIN Code</td><td>Range of measured Temp. (℃)</td><td>Range of measured Voltage (μV)</td></tr>
<tr><td>K</td><td rowspan="9">ITS-90</td><td>-200.0–1200.0</td><td>-5891–48838</td></tr>
<tr><td>J</td><td>-200.0–800.0</td><td>-7890–48494</td></tr>
<tr><td>E</td><td>-200.0–600.0</td><td>-8825–45093</td></tr>
<tr><td>T</td><td>-200.0–400.0</td><td>-5603–20872</td></tr>
<tr><td>B</td><td>400.0–1800.0</td><td>787–13591</td></tr>
<tr><td>R</td><td>-0.0–1750.0</td><td>0–20877</td></tr>
<tr><td>S</td><td>-0.0–1750.0</td><td>0–18503</td></tr>
<tr><td>N</td><td>-200.0–1250.0</td><td>-3990–45694</td></tr>
<tr><td colspan="2">RJC</td><td colspan="4">Automatic</td></tr>
<tr><td colspan="2">Detecting the Breaking of Wires</td><td colspan="4">Per channel</td></tr>
<tr><td colspan="2">Accuracy</td><td colspan="4">±[(Full Scale) x 0.3% + 1°C (RJC Error)]</td></tr>
<tr><td colspan="2">Max Converted Tate</td><td colspan="4">50 ms/4 Channels</td></tr>
<tr><td colspan="2">No. of Input Channels</td><td colspan="4">4 Channels/Module</td></tr>
<tr><td colspan="2">Type of Insulation</td><td colspan="4">Between input terminal and PLC: photo coupler
Insulation between channels: no insulation</td></tr>
<tr><td colspan="2">Connection Terminal</td><td colspan="4">9-point terminal</td></tr>
<tr><td rowspan="2">Current Consumption (mA)</td><td>+3.3 V</td><td colspan="4">40</td></tr>
<tr><td>+24 V</td><td colspan="4">10</td></tr>
</table>

Features of RTD Module (IO-SA0400)

RTD conversion module converts temperatures of PT100, JPT100, PT1000, NI1000 into (℃, °F) or 14-bit (or 16-bit) digital value.

1) Used to convert temperature from PT100, JPT100, PT1000, or Ni1000 into a decimal value (℃, °F) with one decimal place of accuracy. It can output a digital value in the range of -192–16191 (0–65000), -8192–8191 (-32768–32767), 0–16000 (0–64000), -8000–8000 (-32000–32000).

2) RTD module converts temperature from -200–600℃ (PT100/PT1000/JPT100) or -50–160℃ (Ni1000) into a digital value in the range of -192–16191 (0–65000), -8192–8191 (-32768–32767), 0–16000 (0–64000), -8000–8000 (-32000–32000).

3) If the measured temperature exceeds the range of -200–600℃ (PT100/PT1000/JPT100) or -50–160℃ (Ni1000), the temperature will be always displayed within the range of -250–650℃ (PT100/PT1000/JPT100) or -60–170℃ (Ni1000).

4) Using the digital value range -192–16191 (0–65000) and -8192–8191 (-32768–32767) will display the temperature of -200–600℃ (PT100/PT1000/JPT100) or -50–160℃ (Ni1000) as 0–16000 (0–64000), -8000–8000 (-32000–32000). The temperature that exceeds the range will be displayed within -192–16191 (0–65000) or -8192–8191 (-32768–32767).

5) If the user customizes maximum and minimum temperature values, the minimum values will be displayed as 0 (0) or -8000 (-32000). The maximum values will be displayed as 16000 (64000) or 8000 (32000). The temperature that exceeds the custom temperature range will be displayed within the range of -192–16191 (0–65000) or -8192–8191 (-32768–32767).

6) Detection of thermocouple errors, broken cables, and values outside of the measurement range.

7) There are 4 channels (PT100, JPT100, PT1000, Ni1000) per RTD module.

8) In case of normal status, the LED is on. In case of error, LED will blink at 0.3 s intervals.

9) PT100, JPT100: 0℃ → 100.0 Ω output
PT1000: 0℃ → 1000.00 Ω output
Ni1000: 0℃ → 1000.00 Ω output

Features of TC Module (IO-SA0400T)

TC is the conversion module that measures temperature from a thermocouple (K, J, E, T, B, R, S, N) and converts temperatures into (℃, °F), or a 14-bit digital value.

1) Can show minimum -200℃ and maximum +1200℃ temperature value, or digital value
   -192–16191 (-8192–8191).
2) If the maximum and minimum temperature values are set, values outside of the range are rounded to the minimum 0 (-8000) or maximum 16000 (8000) each.
3) Detection of thermocouple errors, broken cables, and values outside of the measurement range.
4) There are 4 thermocouple points to use.
5) The reference junction compensation is made automatically by the temperature sensor in the terminal.
6) User can calibrate temperature in 0.1℃ increments (buffer memory 75).

Wiring of RTD (IO-SA0400)

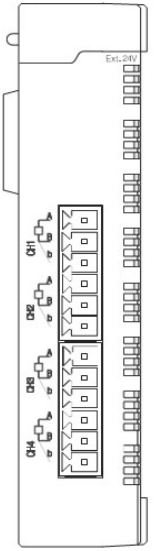
Channel	A Terminal	B Terminal	b Terminal
CH 1	Terminal 1	Terminal 2	Terminal 3
CH 2	Terminal 4	Terminal 5	Terminal 6
CH 3	Terminal 7	Terminal 8	Terminal 9
CH 4	Terminal 10	Terminal 11	Terminal 12
24 V External	Connection: bottom of module		

Wiring of TC (IO-SA0400T)

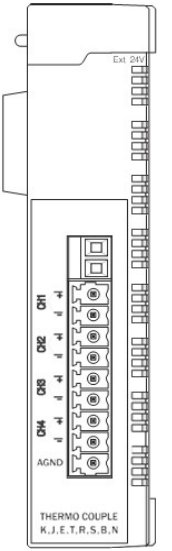
Channel	+ Terminal	- Terminal
CH 1	Terminal 1	Terminal 2
CH 2	Terminal 3	Terminal 4
CH 3	Terminal 5	Terminal 6
CH 4	Terminal 7	Terminal 8
AGND	Terminal 9	
24 V External	Connection: bottom of module	

Appearance

IO-SA0400



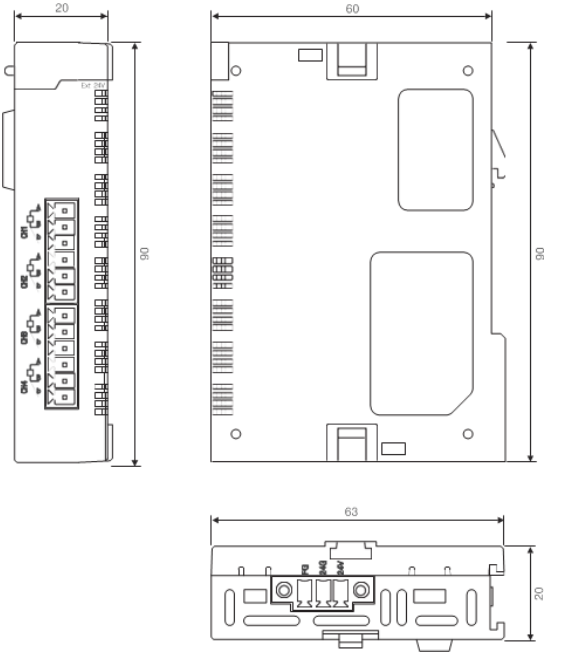
IO-SA0400T



Dimensions

► Both IO-SA0400 and IO-SA0400T have the same dimensions.

(Unit: mm)



Product Warranty

Warranty Statements are included with each unit at the time of purchase and are available at www.maplesystems.com.

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