0812371

OPTEX FA

| INSTRUCTION MANUAL |

Non-Contact Thermometer

SA-80T-4IO

IO-Link

- Thank you for purchasing this SA-80T-4IO.
- Before using this product, please read this manual carefully to ensure proper use.
- Read this manual thoroughly, and then keep this manual at hand so that it can be used whenever necessary.
- The warranty period of this product is one year after delivery. However, any fault attributable to natural disasters or any other similar disasters or modification or repair will be excluded from the scope of the warranty.

Safety Precautions

Safety precautions for ensuring safe operation of this product are displayed as follows with the following symbols.
Precautions listed here describe important information about safety. Make sure to follow them accordingly.

Safety Symbols

⚠ WARNING	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
⚠ CAUTION	Indicates that any improper operation or handling may result in minor injury or property damage.

⚠ WARNING	
🚫	Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product. Doing so may cause injury or fire.
⚠	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
⚠	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in an explosion or fire.
⚠	Do not install this product in any of the following locations. Doing so may cause a fire, damage, or a malfunction. 1. Locations where dust, salt, iron powders, or vapor (steam) is present. 2. Locations subjected to corrosive gases or flammable gases. 3. Locations where oil or chemical splashes may occur. 4. Locations where the ambient temperature exceeds the rated range. 5. Locations where heavy vibrations or impacts may occur. 6. Locations subject to rapid temperature changes (or where condensation occurs). 7. Locations with strong electric or magnetic fields. 8. Outdoor locations or locations subject to direct light.
🚫	This is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.
🚫	This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.
🚫	This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety. Do not use this product as a detection device for protecting the human body.
🚫	Do not let the thermometer touch the measured object. This product is a non-contact thermometer. Touching high-temperature object may cause deformation of the meter, irreparable damage or incorrect measurement.
🚫	Do not let the lens touch with a hard or sharp-edged object. Do not insert foreign objects into the lens. These may cause incorrect measurement.
❗	Keep the thermometer away from sudden change in ambient temperature. Sudden temperature change may cause incorrect measurement. Start measurement when temperature has become stable after leaving the meter for a while.
❗	What to do in the event of a malfunction such as smoke being emitted from the product If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the body becoming very hot, immediately stop operating the product and turn off the product power. Failure to do so may cause a fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact an OPTEX FA sales representative for repairs.

⚠ CAUTION
- Make sure to turn the power off before wiring the cable or connecting/disconnecting the connector. Connecting or disconnecting while energized may damage the product or cause electric shock.
- Avoid using the transient state while the power is on (10 min.). Output could become unstable, causing unexpected operation.
- Do not wire with high voltage cables or power lines. Doing so may cause malfunction or damage by induction.
- Do not bend the cable below the freezing point. This may cause the cable to break.
- Do not drop the product or subject the product to strong impacts. Doing so may damage the product.
- Follow the instructions in this manual or the specified instruction manual when wiring the product or the dedicated controller for the correct wiring method. Incorrect wiring can damage the product or the controller, or cause a malfunction.
- When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.
- Install this product as far away as possible from high-voltage equipment, power equipment, equipment that generates large switching surges, inverter motors, welders, or any equipment that can be a source of noise.
- When connecting or disconnecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.

NOTICE
- After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
- All specifications may be changed without notice.
- When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
- Do not use this product for the development of weapons of mass destruction, for military use, or for any other

military application. Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the "Foreign Exchange and Foreign Trade Act" and the "Export Administration Regulations," and carry out the necessary procedures pursuant to the provisions therein.
- For more details on conformity to the Restriction of Hazardous Substances Directive for this product, please contact an Optex FA sales representative. Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations. Optex FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
- Detection characteristics may vary depending on the state of the target object and variations among individual products.

1. Included Accessories

Included Accessories

SA-80T-4IO unit, Instruction manual (this manual), Mounting bracket, Mounting nut x 2pcs

Options

Black tape for glossy objects HB-250

2. Dimensions

3. Specifications

	SA-80T-4IO
Measurement range	0 to 400℃
Field of view	Φ80 / 500mm
Optics	Silicon lens
Sensing element / spectral response	Thermopile / 8 to 14µm
Response time	100ms / 90%
Accuracy	0 to 200℃: ±2℃, 201 to 400℃: ±1% * Conditions: ε=1.0, Ambient temperature=23±5℃, Work distance=250mm, Measured object=Φ100mm
Repeatability	±1℃
Emissivity	0.1 to 1.2
Supply voltage	DC18 to 30V±10%
Current consumption	50mA or less
Interface	IO-Link
Total cable length	20m
Environmental resistance	Water resistance	IP67
	Ambient temperature	0 to 70℃
	Ambient humidity	35 to 85%RH (no condensation)
	Storage temperature	-20 to 70℃
	Vibration resistance	10 to 55Hz; amplitude 1.5mm; 2hours in each of the X, Y and Z directions
Applicable regulations	EMC	EMC directive (2014/30/EU)
	Environment	RoHS directive (2011/65/EU), China RoHS (MIIT Order No.32)
Applicable standards	EN 61326-1:2013
Material	SUS / Al
Weight	Approx. 180g

4. Field of View

The optical resolution values stated in "Field of View" are at minimum 90% energy. The size of measuring object should be sufficiently lager than the field of view (spot size) shown in the above illustration.

5. Usage

Installation

The outside diameter of the screw is M18 x P1.0. Fix the screw to a hole of not less then Φ18mm with the provided nut. L-shaped bracket provided would help easy adjustment of angle.

Installation Warnings

- The thermometer should be installed perpendicular to the measured object.
- Avoid mechanical shock to the thermometer.
- Make sure if there is not any head source around the location of the thermometer. Highly reflective objects may cause discrepancies in measurement.
- Do not expose thermometer to direct hot air, nor operate/store in the room of which temperature exceed its ambient temperature range (see "Specifications").

Connection

Connect the wires as shown in the figure below.

Measurement

1. Turn the thermometer on after checking to see there are no mistakes in connection.
2. Confirm that the thermometer is working properly with IO-Link master.
* When the thermometer's temperature is unstable (such as just after installation), measurement error may occur.

Emissivity setting

Emissivity (ε) refers to the ratio of infrared energy emitted from all the object surfaces. All objects has their own emissivity, which changes depending on the surface conditions and object temperature. This thermometer can be set to emissivity from 0.1 to 1.2. Refer to the following examples: 095 ... Food, rubber, plastic, paintwork, etc.
The displayed temperature could differ from the actual temperature of objects that have difference emissivity. In such cases, regard the displayed temperature as a rough standard. When you wish to measure shiny metal surfaces, put a piece of optional blackbody tape (ε=0.95) on the suface of the measured object.

6. Maintenance

Lens

Dust or dirt adhering to the lens and flaws on the lens may cause incorrect measurement. When the lens is dirty, remove the adhering objects from the lens using a blower for lens cleaning, etc.

Body

When the thermometer is dirty, wipe it off using a cloth moistened with a small amount of ethyl alcohol.

Calibration

Yearly calibration is recommended. Please contact our sales office for more information.

7. Troubleshooting

Problems	Cause	Solution
Unmeasurable	The power source is not connected perperly.	Check the lead wires and the connection.
	The power voltage is lower than 24V.	Check the power voltage and adjust it from DC 12V to DC24V.
The measured object is odd.	The lens is dirty.	Clean the lens reterring to the lens section under "Maintenance".
	The measurement area is off center.	Aim the measured object which should be within the area of view field of the thermometer.
	There is a heat source near the measured object and the measurement is affected.	Block the head source using a board, etc.
The measured object is not stable.	The thermometer is vibrated.	Prevent the vibration.
	The ambient temperature has suddenly changed.	Put the thermometer aside for a while to stabilize the thermometer's temperature.

- Support for the China RoHS directive
  For details on the support for the China RoHS directive (the Administrative Measure on the Control of Pollution Caused by Electronic Information Products), see the following website.
  http://www.optex-fa.com/rohs_cn/

OPTEX FA CO.,LTD.

IO-Link

Specifications

Cycle time	3ms
Transmission rate	COM2 (38.4kbps)
M-Sequence code in Preoperate mode	0
M-Sequence code in Operate mode	0
ISDU support	Support
IO-Link Revision	Ver1.1
Length of Process input data	4 Byte
Length of Process output data	0 Byte
Vender ID	1076 (HEX: 0x0434)
Device ID	98305 (HEX: 0x018001)

Process Data

Bit position	Type	Description
bit 31 - bit 16	int16	Measured temperature. The unit is 0.1℃ or 0.1℉.
bit 15 - bit 1	int16	Follow the description of the index 192 [Process data selection] .
bit 0	boolean	Alarm Output. Off: within bounds, On: out of bounds.

Index List

r/w: read/write, ro: read only

Index	Sub-index	Access	Description
12 (0x0C)	0	r/w	Device Lock 0:Off, 1:Parameters only, 2:Storage, 3:All
14 (0x0E)	0	ro	Process Input Format 3,16,16, 3,15,1, 1,1,0, 0,0
15 (0x0F)	0	ro	Process Output Format 0,0,0: No output
16 (0x10)	0	ro	Vendor name: "OPTEX FA"
17 (0x11)	0	ro	Vendor text: "www.optex-fa.com"
18 (0x12)	0	ro	Device name: "SA-80T-4IO"
19 (0x13)	0	ro	Device code: "SA-80T-4IO"
20 (0x14)	0	ro	Device description: "IO-Link thermometer"
21 (0x15)	0	ro	Serial Number
22 (0x16)	0	ro	Hardware Version
23 (0x17)	0	ro	Firmware Version
24 (0x18)	0	r/w	Application Tag. Max.16 characters
32 (0x20)	0	ro	Error Count. Max.65535
36 (0x24)	0	ro	Device Status
40 (0x28)	0	ro	Process Data
64 (0x40)	0	r/w	Emissivity (2Byte) Set the emissivity of the measured object. The range is from 0.100 to 1.200. The unit is 0.001. The initial value is 0.950.
65 (0x41)	0	r/w	Response Time (1Byte) Specify the moving average times. The longer the response time, the slower the response of the measured temperature, but the more stable the measured temperature. The range is from 0.1 sec to 10 sec. The unit is 0.1 sec. The initial value is 1.0 sec.
66 (0x42)	0	r/w	Emissivity Teaching (2Byte) The emissivity is calculated so that the measured temperature will be the set temperature. Return measured temperature with calculated emissivity.
67 (0x43)	0	r/w	Upper Limit (2Byte) [Alarm Output] turn on if measured temperature is upper than this parameter. Once [Alarm Output] is turned on, it will stay on until the temperature drops below "[Upper Limit] - [Alarm Hysteresis]". Enabled when [Alarm Selection] are [Upper Limit Only] or [Upper+Lower Limit]. The unit is 0.1℃. Initial value is 0℃.
68 (0x44)	0	r/w	Lower Limit (2Byte) [Alarm Output] turn on if measured temperature is lower than than this parameter. Once [Alarm Output] is turned on, it will stay on until the temperature exceeds "[Lower Limit] + [Alarm Hysteresis]". Enabled when [Alarm Selection] are [Lower Limit Only] or [Upper+Lower Limit]. The unit is 0.1℃. The initial value is 0℃.
128 (0x80)	0	r/w	Timer Function (1Byte) Specify the output method of [Alarm Output]. Off (Initial) On+Off Delay One-Shot
129 (0x81)	0	r/w	One-Shot Timer (1Byte) Specify the on-delay timer for [Alarm Output]. Enabled when [Timer Function] is [One-Shot]. The range is from 0 to 10 sec. The unit is 0.1 sec. The initial value is 1.0 sec.
130 (0x82)	0	r/w	On Delay Timer (1Byte) Specify the on-delay timer for [Alarm Output]. Enabled when [Timer Function] is [On+Off delay] The range is from 0 to 10 sec. The unit is 0.1 sec. The initial value is 1.0 sec.
131 (0x83)	0	r/w	Off Delay Timer (1Byte) Specify the off-delay timer for [Alarm Output]. Enabled when [Timer Function] is [On+Off delay] The range is from 0 to 10 sec. The unit is 0.1 sec. The initial value is 1.0 sec.
132 (0x84)	0	r/w	Alarm Selection (1Byte) None: [Alarm Output] is off. Upper Limit Only: Enable [Upper Limit] Lower Limit Only: Enable [Lower Limit] Upper+Lower Limit (Initial): Enable [Upper Limit] and [Lower Limit].
133 (0x85)	0	r/w	Alarm Hysteresis (1Byte) The range is from 0 to 20℃. The unit is 0.1℃. The initial value is 2.0℃.
160 (0xA0)	0	ro	Predicted Maintenance Days (2Byte) Returns the predicted maintenance days.
161 (0xA1)	0	r/w	Maintenance Event Hours (4Byte) Returns the time remaining until the event occurs. The unit is hour.
162 (0xA2)	0	ro	Operating Time (4Byte) Returns the operating time. The unit is hour.
192 (0xC0)	0	r/w	Process Data Selection (1Byte) Specify the output data with measured temperature. Peak Hold (℃) (Initial) Valley Hold (℃) Internal Temperature (℃) Peak Hold (℉) Valley Hold (℉) Internal Temperature (℉) The unit is 0.1℃ or 0.1℉.
193 (0xC1)	0	ro	Teaching Status (1Byte) bit0: Emissivity is out of range bit1: Emissivity cannot be calculated. The internal temperature and the temperature of the measured object are too close.

Events

| Event code	Event No.	Type	Description
65425 (0xFF91)	0	Notify	IO-Link system event.
6144 (0x1800)	1	Notify	Maintenance time reached.
6145 (0x1801)	2	Error	Write Count Exceeded. Recommended to replace the device because the device is too old.
20497 (0x5011)	3	Error	Cannot read correct calibration values. Please consider calibration or repair if the error occurs after rebooting.
16912 (0x4210)	4	Warning	The internal temperature has exceeded 70℃.
16928 (0x4220)	5	Warning	The internal temperature has dropped below 0℃.

System Commands

wo: write only

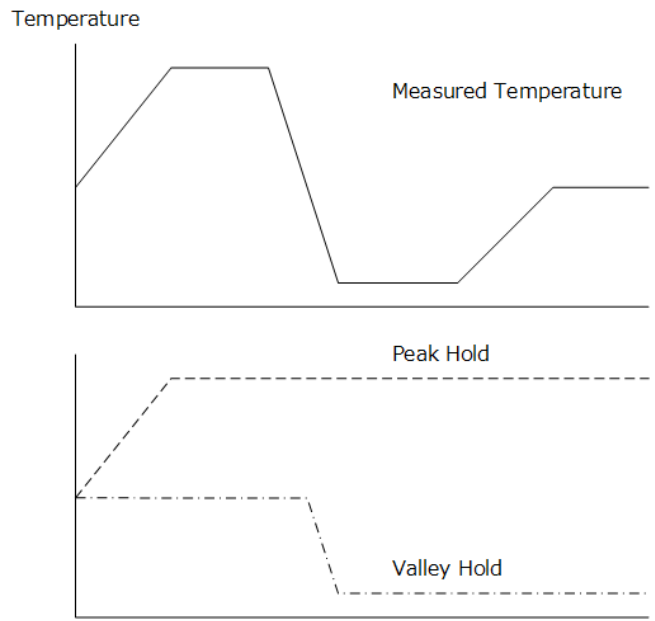| Index	Access	Code	Description
2 (0x02)	wo	130 (0x82)	Initialize parameters
		160 (0xA0)	Reset holding temperatures.

Alarm Output

Upper limit/Lower limit for alarm
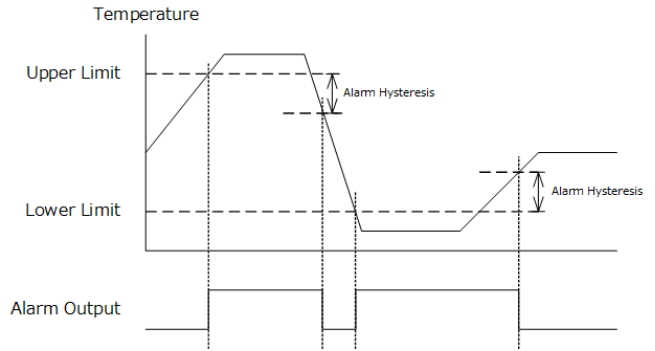
Alarm timer
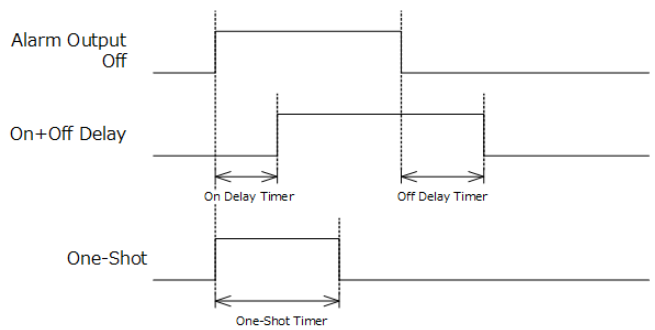
Hold temperature

Additional functions

Maintenance Event

By using Index 161 [Maintenance Event Hours], you can receive the event when maintenance time comes.

Emissivity Teaching

You can calculate and set the emissivity when the emissivity of the measured object is unknown and the temperature of measured object is known.
Follow the steps below.
1. Measure the measured object. Avoid using the transient state while the power is on (10 min.).
2. Write the temperature of measured object to Index 66 [Emissivity Teaching].
3. Wait for 100 ms.
4. Read Index 66 [Emissivity Teaching], and it is successful if the measured temperature is around the temperature of measured object.

If the emissivity teaching is failed, you can read the reason from index 59 [Teaching Status]. There are the following reasons:
- Calculated emissivity is not in the range of 0.1 to 1.2.
- The temperature of measured object is close to the ambient temperature. e.g. Emissivity=0.95, Ambient temperature=25℃, A difference of temperature between the measured object and the ambient is required at least 5℃.