Good Thinking, Good Future

FASTUS

*FASTUS is a product brand of OPTEX FA.

Non-contact thermometer stationary type

TI-S Series

User's Manual

Before using this product, read this manual carefully.
Keep this manual at hand so that it can be used whenever necessary.
Store the manual in a secure location.



IO-Link

OPTEX FA CO., LTD.

Introduction

Thank you for purchasing Non-contact thermometer stationary type TI-S Series.

This manual contains the information necessary for operating and setting up the TI-S series sensor head (TI-S30) and controller (TI-SC(E)).

Read this manual thoroughly before using the product to ensure correct use with full understanding of its functions and performance. After you have finished reading this manual, store it safely for future reference.

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

The safety precaution symbols used and their meanings are listed below.

⚠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.

■ Precautions

⚠Warning	
	Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product. Doing so may cause injury or fire.
	This product does not have a function that stops the emission of light from the laser during disassembly. Do not disassemble the product.
	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 a 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 heavy vibrations or impacts may occur. 5. Locations where the ambient temperature exceeds the rated range. 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 sunlight.
	Do not use this product with a voltage exceeding the rated voltage or AC power supply. And do not connect any power source other than the dedicated controller. Doing so may cause a fire or damage the product.

⚠Warning

	Do not use this product in a non-industrial environment. Doing so may cause induction or radiation interference.
	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 look directly at the laser beam or intentionally shine the laser beam in another person's eyes. Doing so may have adverse affects on the eyes, including temporary blindness.
	Do not let the thermometer touch the object that is being measured. This product is a non-contact thermometer. Touching high temperature object may cause deformation of the meter, irreparable damage or incorrect measurement.
	Do not touch the lens in this product. Do not touch the lens with hard or sharp objects. Do not insert foreign objects into the light receiving part. Otherwise incorrect measurement will occur.
	In the event of a malfunction such as smoke comes out from the product. If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the housing becoming very hot, immediately stop operating the product and turn off the power to the controller. Doing so may cause a fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact the OPTEX FA sales office.
	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.
	In case water enters the product If water or any other liquid enters the product or the cable, immediately stop operating the product and turn off the power to the controller. Using the product in this condition may cause a fire.

⚠Caution

	This product is not clinical thermometer and therefore, cannot be used for medical purposes.
	Follow the instructions in this manual or the specified instruction manual when wiring the product for the correct wiring method. Incorrect wiring can damage the product or cause a malfunction.

⚠Caution	
	Use the dedicated cable for connecting the sensor head to the controller. Use of anything other than the dedicated cable may cause a malfunction or damage the product.
	Do not excessively twist or apply stress to the cable. Doing so may damage the cable or the connector.
	When connecting the cable, make sure to hold it by the connector portion, and do not apply excessive force to the cable.
	When disconnecting the connector, be careful not to touch the terminals inside the connector, and do not allow foreign objects to enter the connector.
	Route wiring separately from high-voltage circuits and power circuits. If the wires are routed together, induction may occur, which can cause a malfunction or damage the product. If this is unavoidable, use a conductive object such as a properly grounded conduit as a shield.
	Install this product as far away from high-voltage equipment, power equipment, equipment that generates large switching surges, welders, inverter motors, or any equipment that can be a source of noise.
	Use this product within the rated ranges.
	Install this product securely. Failure to ensure secure installation can result in the products falling and becoming damaged.
	Make sure to turn the power off before wiring the cable or connecting/disconnecting the connector. Performing work while the product is energized may damage it or cause electric shock.
	If this product used in a manner not specified by the manufacturer, the protection provided this product may be impaired.

NOTICE

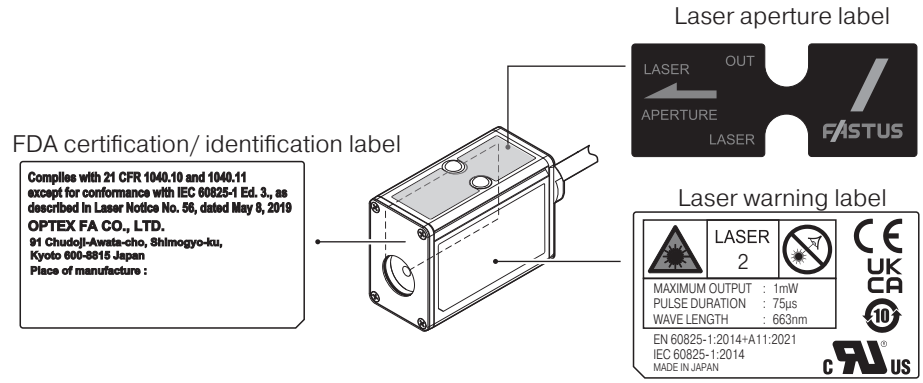
- After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
- All specifications may be changed without notice.
- When using this product, it is the responsibility of the customer to ensure necessary safety designs 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.

- If installing this product in your own equipment, ensure that the product is properly handled according to the laws and regulations of the relevant country or region.
- Detection characteristics values may vary depending on the state of the target object and variations among individual products.
- 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.
- When using this product in a UL-certified environment, do not route cables through the building's wiring. If connecting to the building's wiring, use appropriately certified intermediate devices and cables, and follow certified wiring methods.

Precautions for Laser Use

- This product emits Class 2 visible laser beam that is compliant with JIS C6802 / IEC 60825-1 laser product safety standards. Labels for applicable standards are affixed to the product.
- If this product will be exported to the United States, approval must first be obtained from the FDA (Food and Drug Administration), the laser regulating body of the United States.
- A report for this product has been submitted to the CDRH (Center for Devices and Radiological Health).
- Use of controls or adjustments performance of procedures other than those described here may result in hazardous radiation exposure.

Laser warning label position



Symbol	Meaning
	Laser emission
LASER 2	Class 2 laser product
	Do not stare into beam
	Laser aperture

Type of laser used in this product

Type	Red semiconductor laser
Wavelength	663 nm
Maximum output	1 mW
Pulse duration	75 μs
Repetition Frequency	2.63 kHz

Expressions Used in This Manual

This section explains the expressions used in this manual.

CAUTION
Indicates an item that requires special attention during use.

MEMO
Indicates information that is useful to know during use.

■ Regarding the screen images

The screen images shown in this user's manual are subject to change without prior notice for improvement.

Configuration of this Manual

This manual is composed of the following contents.

1. Read This First	This section describes the TI-S (hereinafter referred to as “this product”) system configuration, features, included items, optional parts, and part names.
2. Installation and Connections	This section describes the installation and wiring methods for this product, as well as the alignment using the ring laser pointer.
3. Display Screens and Operating Procedures	This section describes the screen configuration and basic operations of this product.
4. Emissivity Setting	This section describes the emissivity setting which is required for temperature measurement with this product.
5. Functions	This section explains the items that can be set with this product and the setting procedure for each setting menu.
6. Troubleshooting	This section contains the error/warning display of this product, as well as the correction methods for trouble occurring during product use.
7. Maintenance	This section describes the maintenance procedures for this product.
8. Appendix	This section contains the specifications, external dimensions, and IO-Link index list.

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Using This Product

The following shows the basic setup process for use of this product.

Installation	Controller installation	“2-2-1 Controller Installation” (page 2-4)
	→ Related item: “Disp. Direction direction”	“5-11-2 Disp. Direction” (page 5-42)
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	Connecting the sensor head and controller	“2-3 Connecting the Sensor Head and Controller” (page 2-9)
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	1. Alarm	“5-6 Alarm” (page 5-26)
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IO-Link connection	Application tag/function tag/location tag	“5-13 Application Tag” (page 5-46) “5-14 Function Tag” (page 5-47) “5-15 Location Tag” (page 5-48)
	Index list	“TI-S30-AP” (page 8-9)
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	Replacing only the sensor head	“7-2 When Only the Sensor Head or Controller Was Replaced” (page 7-3)

1

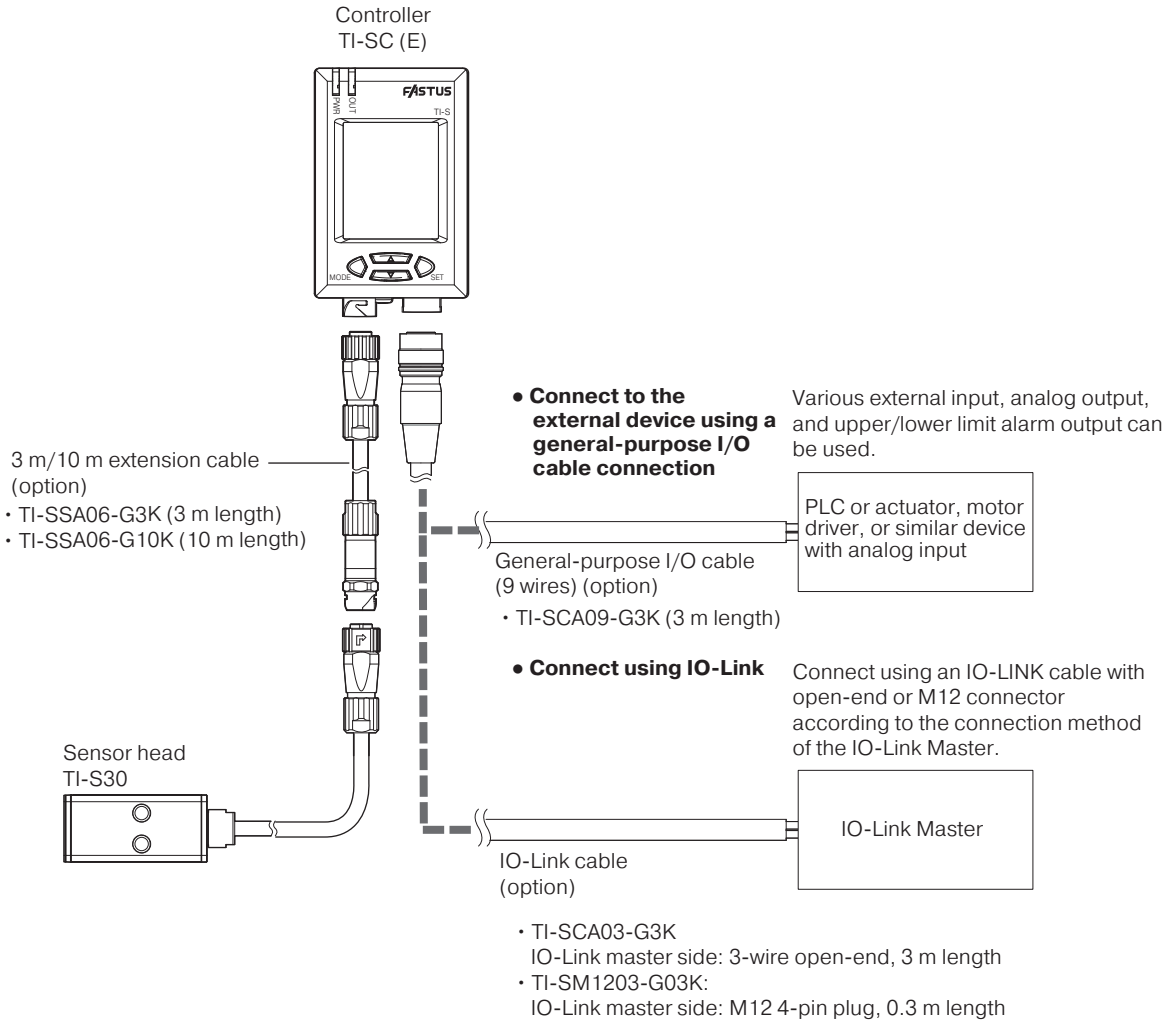
Read This First

This section describes the included items, part names, and system configuration.

1-1 General Description

1-1-1 System Configuration

The TI-S series is composed of three parts: the sensor head, controller, and various connector cables. When a general-purpose I/O cable is connected, the external input, analog output, and upper/lower limit alarm output can be used. When an IO-Link cable is connected, communication using IO-Link is possible.



1-1-2 Main Features

■ High performance

● High speed (Refer to page 5-11.)

Response time: Achieves 50 ms (high speed) / 90% response. Rapid measurement is possible.

● High-accuracy measurement

Measurement can be performed with an accuracy of ±1°C. (At measurement range: 1 to 200°C)

■ Space-saving design allows installation anywhere

● Compact sensor head

The compact (49.5 × 35 × 23 mm) size allows installation even in small spaces.

● The screen display can be rotated (Refer to page 5-42.)

The controller screen display can be rotated 360° in 90° increments, allowing the controller to be installed without worrying about the installation direction.

■ Easy adjustment

● Check the field of view using the ring laser pointer (Refer to page 2-10.)

A ring laser pointer is installed so that the field of view can be checked visually. This allows correct alignment to be performed while checking the field of view.

● Auto emissivity setting (Refer to page 4-5.)

Previously troublesome emissivity can be set automatically simply by setting the temperature of the measurement target.

■ Easy operation

● Information can be displayed in 3 languages (1.8-inch full color TFT LCD)

This makes is possible to display English, Simplified Chinese and Japanese, which could not be reproduced with a conventional 7-segment LED display, and allows settings to be configured easily.

● Status notifications via easy-to-understand indicators (Refer to page 6-2.)

In addition to the output status, errors and warnings are indicated by lighting color and lighting status according to their levels.

■ Wide-ranging interface and measurement functions

● Analog output (Refer to page 5-32.)

For analog output, current output (4 to 20 mA) and voltage output (0 to 10 V) can be selected.
It can be used without selecting an input device.

● Alarm output (upper/lower limit settings) (Refer to page 5-26.)

A designated temperature range can be set as the threshold, and an alarm can be output when the measured temperature is outside of that range.

● Detection of rapid temperature changes (edge detection) (page 5-21)

Edge detection is provided, and detects when rapid temperature changes occurred.
Because slow temperature changes are ignored, it is possible to only detect errors caused by temperature changes occurring within a short period of time.

● Hold display (Refer to page 5-13.)

Instead of displaying the measured temperature in real time, the maximum/minimum temperature displays can be retained (peak hold, valley hold), and the measured value can be held (sample hold) when real-time display is not needed.

■ Various user-friendly functions

● Head internal temperature display (Refer to page 3-3.)

In addition to the temperature of the measurement target, the head internal temperature is also continuously displayed. This allows use while checking the effects of the ambient temperature.

● Saving/selecting (calling) four types of settings (Refer to page 5-6.)

4 ch are installed for the bank function which can select (call) setting contents.
During setup and at other times, it is not necessary to reconfigure the settings when the emissivity or other measurement condition changes. Instead, it can be handled simply by selecting the preconfigured bank.

● Notification of maintenance timing (Refer to page 7-2.)

Notification of maintenance timing can be provided when the preset period has elapsed for the timing of optical system cleaning, calibration, or other maintenance.

● The sensor head and controller can be replaced individually (Refer to page 7-3.)

Because the sensor head and controller are calibrated individually, either can be replaced if a malfunction occurs.
Because the settings are saved separately for the sensor head and controller, operation can be restarted with the minimal necessary reconfiguration after replacement.

● Connection test (Refer to page 5-25.)

A physical test can be performed to determine whether or not signals are actually being output from the input/output cable.

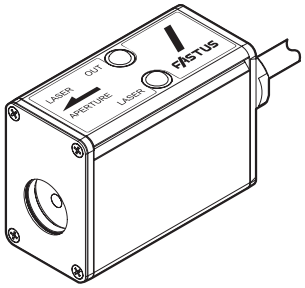
● Trend graph display (Refer to page 3-6.)

A trend graph of the measured temperature can be displayed covering up to 24 hours.

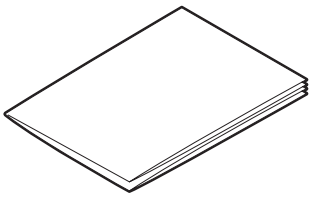
1-2 Checking the Included Items

Before use, check that all items that are included with this product are present.
In the event of a defective or damaged part, contact OPTEX FA (contact information printed at end of manual).

1-2-1 Sensor Head (TI-S Series)

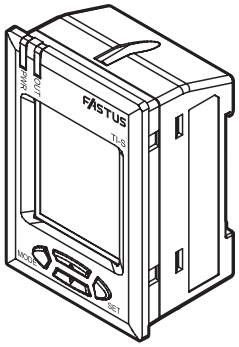


Sensor head

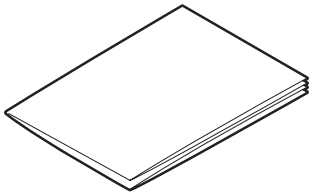


Instruction manual

1-2-2 Controller (TI-SC (E))



Controller



Instruction manual

1-3 Options

1-3-1 Cables

Purchase either the general-purpose I/O cable or the IO-Link connection cable as the optional cable according to the type of connection with the external device.

■ General-purpose I/O cable

Used when connecting to the external device using a general-purpose I/O cable.

Model	Cable length	Remarks
TI-SCA09-G3K	3 m	—

■ IO-Link connection cable

Used when communicating using IO-Link.

Model	Cable length	Remarks
TI-SCA03-G3K	3 m	IO-Link Master side: Open-end cable
TI-SM1203-G03K	0.3 m	IO-Link Master side: M12 4-pin plug

■ Extension cable connecting the sensor head and controller

This is a connection cable that can extend the distance between the sensor head and controller.

Model	Cable length	Remarks
TI-SSA06-G3K	3 m	—
TI-SSA06-G10K	10 m	—

1-3-2 Mounting Bracket

■ Sensor head mounting bracket

Model	Remarks
BEF-TISH-A	Wall mounting bracket
BEF-TISH-B	Floor mounting bracket
BEF-TISH-AB	2-axis mounting bracket

■ Controller mounting bracket

Model	Remarks
BEF-TISC-BKT	Panel mounting bracket

1-3-3 Air purge kit

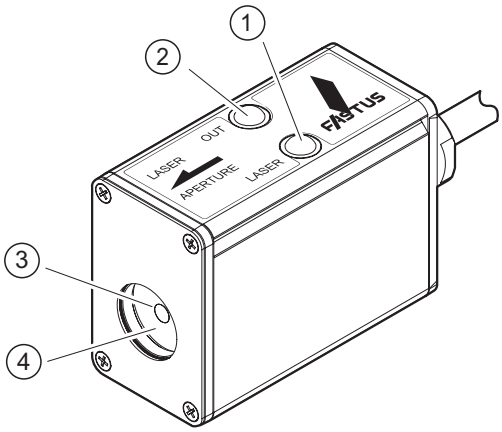
Model	Remarks
TI-S30-AP	Exclusive use with sensor head TI-S30

1-3-4 Black Tape

Model	Remarks
HB-250	Heat resistance temperature: 250°C Tape width: 60 mm, Tape length: 2 m

1-4 Part Names

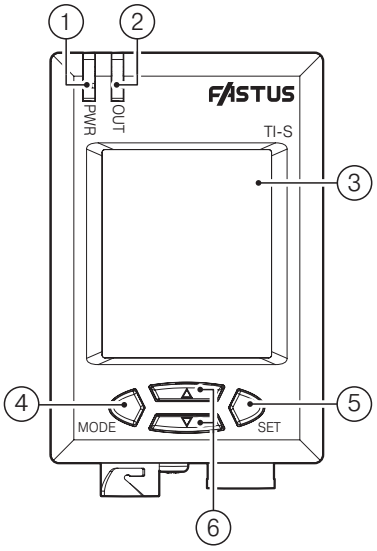
1-4-1 Sensor Head



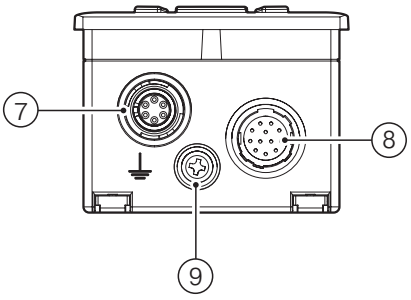
No.	Name	Description
①	Laser emission indicator	Illuminates green when the laser is emitting, and turns off when the laser is OFF.
②	Output indicator	The lighting color and lighting status change according to the output status and the levels of errors and warnings. Illuminated green : Normal measurement Illuminated red : Alarm output ON Blinking green : Minor warning Blinking orange : Major warning Blinking red : Error For details of errors and warnings, refer to “6-1-2 Error/Warning Categories and Order of Priority” (page 6-3).
③	Laser emission outlet	This is the outlet for the ring laser pointer. Do not look into the outlet when the ring laser pointer is ON.
④	Silicon lens	Receives the infrared rays emitted from the measurement target.

1-4-2 Controller

Front view



Bottom view



No.	Name	Description
①	Power indicator	Illuminates in green when the power is turned on, and blinks in green during IOLink communication.
②	Output indicator	The lighting color and lighting status change according to the output status and the levels of errors and warnings. Illuminated green : Illuminates during judgment output and analog output. Illuminated red : Upper/lower limit alarm output Blinking green : Minor warning Blinking orange : Major warning Blinking red : Error For details of errors and warnings, refer to “6-1-2 Error/Warning Categories and Order of Priority” (page 6-3).
③	Display	Displays the measured value, setting menu, and icons.
④	MODE key	Returns to the previous screen when the setting menu is displayed or on a setting screen of the setting menu.
⑤	SET key	Sets parameters, selects options, and confirms selected options.
⑥	Selection keys (▲ and ▼)	Change the selected option.
⑦	Sensor head connector	Connects the TI-S series sensor head.
⑧	Power and I/O connector	Connects the controller to a power supply, inputs and outputs, and an IO-Link Master via an optional cable.
⑨	Function earth ground terminal	Connect the controller and ground wire.

2

Installation and Connections

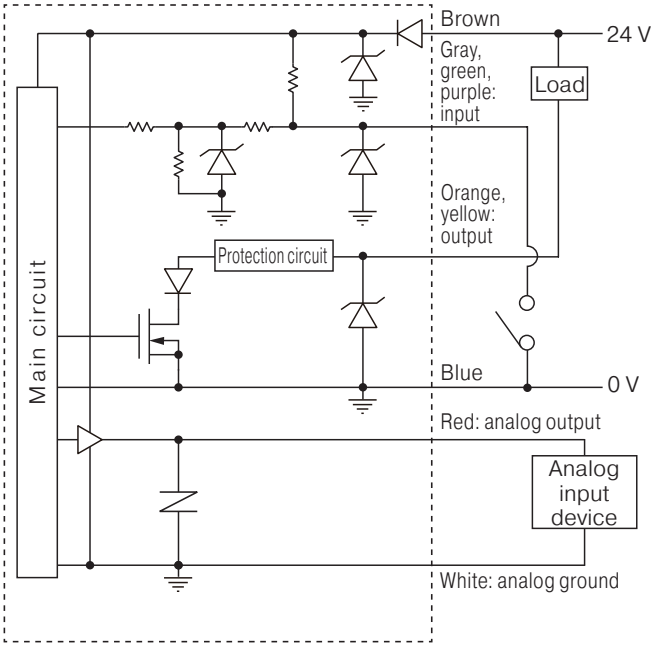
This section describes the installation and wiring methods for this product.

2-1 Controller Wiring

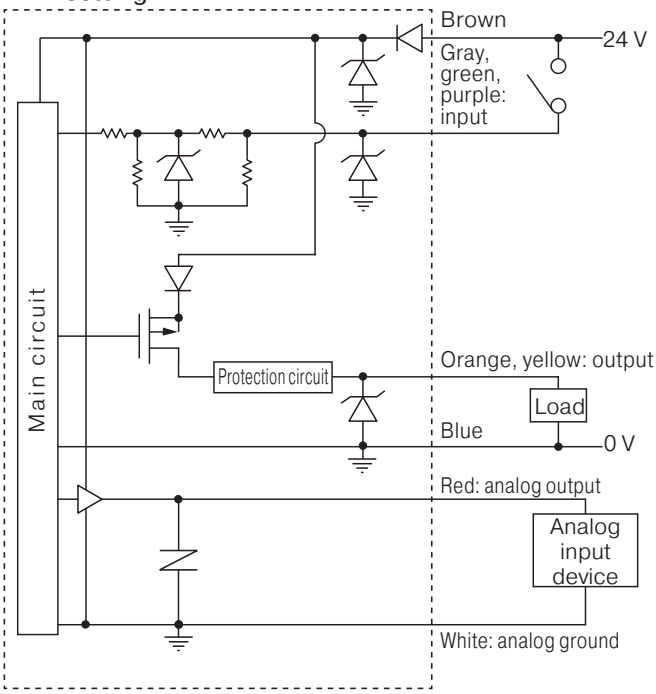
The circuit diagram for each connection type is shown below.

■ I/O connection (when using a general-purpose I/O cable)

NPN setting



PNP setting



Lead wire functions

Wire color	Description
Brown	+V (24 VDC)
Gray	Laser control input
Green	Hold input/bank select*
Purple	Trigger input/bank select*
Orange	Upper limit alarm output
Yellow	Lower limit alarm output
Blue	Ground (0 V)
Red	Analog output
White	Analog ground

* Operates as bank select input when Measurement mode is set to Normal.

Lead wire functions during bank select

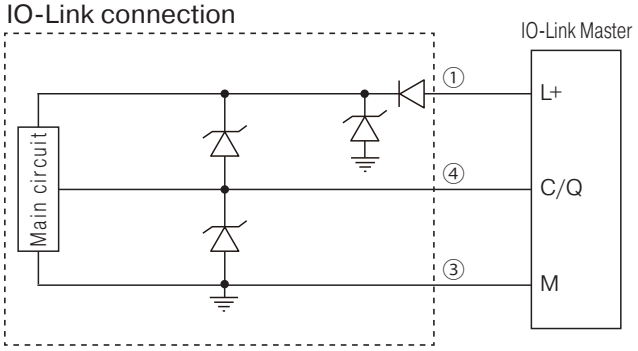
Bank number	Lead wire color	
	Green	Purple
1	OFF	OFF
2	OFF	ON
3	ON	OFF
4	ON	ON

A test can be performed of the input/output status for the connected general-purpose I/O cable.

Refer to “Input/output terminals” in 📖 “5-5-3 Test” (page 5-25).

IO-Link connection (when using an IO-Link cable)

IO-Link connection



IO-Link cable lead wire/
connector pin functions

Wire color	M12 connector pin No.	Description
Brown	①	L+
Black	④	C/Q
Blue	③	M

* The input wire is replaced with process output data.

M12 connector pin No.



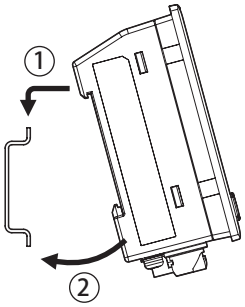
* ② is not used.

2-2 Installation

2-2-1 Controller Installation

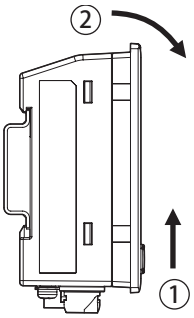
■ Attaching the controller on a DIN rail

① Place the DIN rail mounting hook on the top side (the indicator side) on the DIN rail.
② Press down until the hook locks.



■ Removing the controller from a DIN rail

① Push the controller up (toward the indicator side)
② Lift the indicator side up and to the right to remove the controller.

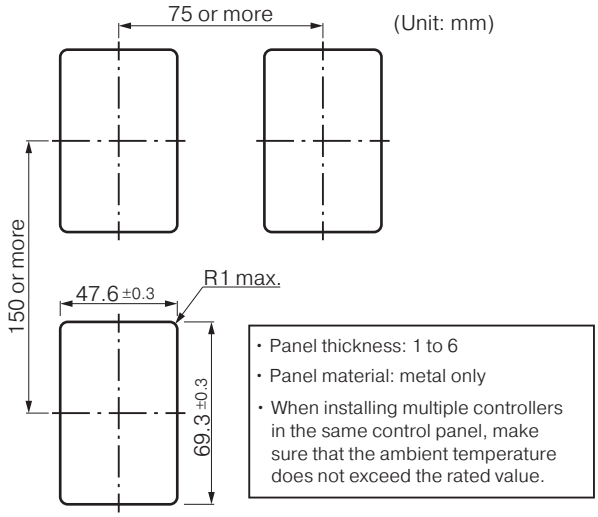


■ Panel installation

● Panel processing

Cut the panel to which the controller will be installed.

If using multiple controllers, cut the panel as shown below.



● BEF-TISC-BKT panel mounting bracket

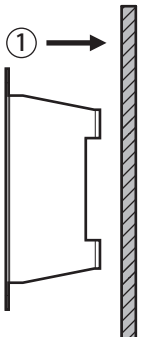
The parts included with the BEF-TISC-BKT panel mounting bracket are the following.

Part	Size	Quantity
Panel mount bracket	85 x 65 x 33.2	1
DIN rail	70 mm	1
Nut Plate	65 × 10 × t3.2, 2-M4 pitch 55 mm	1
Screw	M4 × 40 mm	2

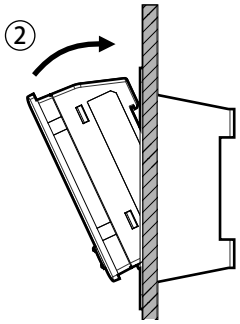
● Panel installation method

The installation method described here uses the optional BEF-TISC-BKT panel mounting bracket.

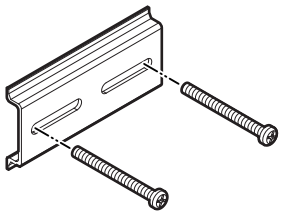
① Attach the Panel Mount Bracket to a panel with an opening.



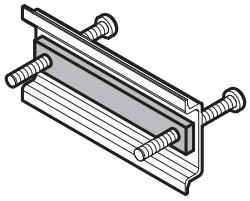
②Attach the controller to the Panel Mount Bracket.



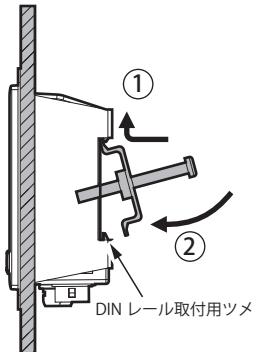
③Insert the screws into the elongated DIN rail mounting holes from the direction shown in the figure.



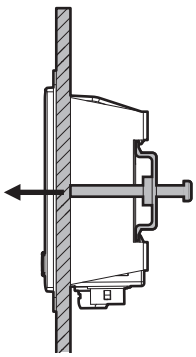
④Insert the screws through the Nut Plate.



⑤Hook the upper hook (indicator side) to the DIN rail (1), push the DIN rail mounting hook up to lock the product in place (2).



⑥Tighten the screws to secure the DIN rail to the panel. The tightening torque should be 0.15N•m or less.

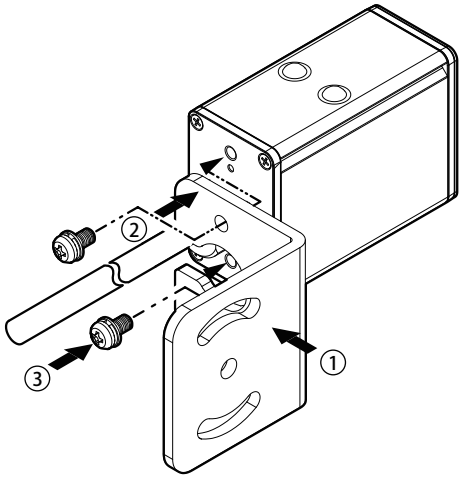


2-2-2 Sensor Head Installation

The installation method described here uses the optional mounting bracket.

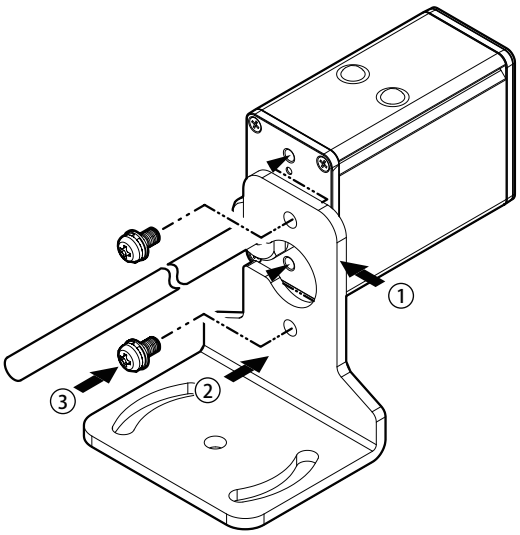
■ Wall mounting bracket (when BEF-TISH-A is used)

① Pass the cable through the groove in the mounting bracket.
② Place the mounting bracket in contact with the head.
③ Fasten using the screws that were provided with the mounting bracket.
Use a tightening torque of 0.6 N·m or less.



■ Floor mounting bracket (when BEF-TISH-B is used)

① Pass the cable through the groove in the mounting bracket.
② Place the mounting bracket in contact with the head.
③ Fasten using the screws that were provided with the mounting bracket.
Use a tightening torque of 0.6 N·m or less.

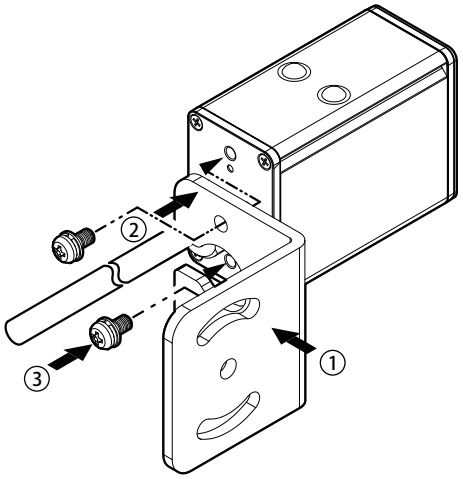


■ 2-axis mounting bracket (when BEF-TISH-AB is used)

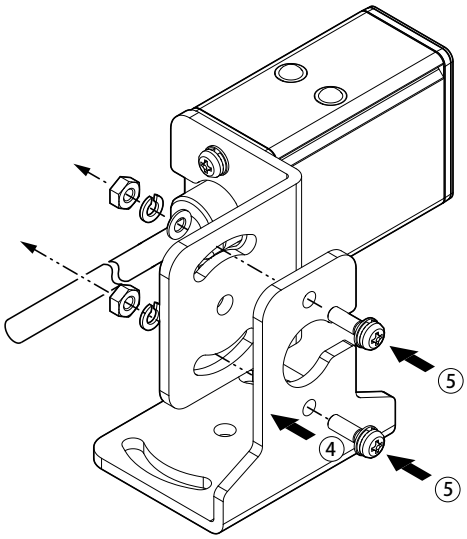
BEF-TISH-AB is a mounting bracket consisting of a set of BEF-TISH-A and BEF-TISH-B.
Combining the two mounting brackets allows fine adjustment of the measurement point in two axes: the vertical direction and horizontal direction.
The typical installation method described here uses BEF-TISH-AB.

In order, first install BEF-TISH-A, then install BEF-TISH-B.
They cannot be installed in the reverse order.

① Pass the cable through the groove in the BEF-TISH-A mounting bracket.
② Place the BEF-TISH-A mounting bracket in contact with the head.
③ Fasten using the screws (M3 × 8) that were provided with the mounting bracket.



④ Place BEF-TISH-B in contact with BEF-TISH-A.
⑤ Fasten using the screws (M3 × 10) and nuts that were provided with the BEF-TISH-B mounting bracket.
Use a tightening torque of 0.6 N·m or less.



2-3 Connecting the Sensor Head and Controller

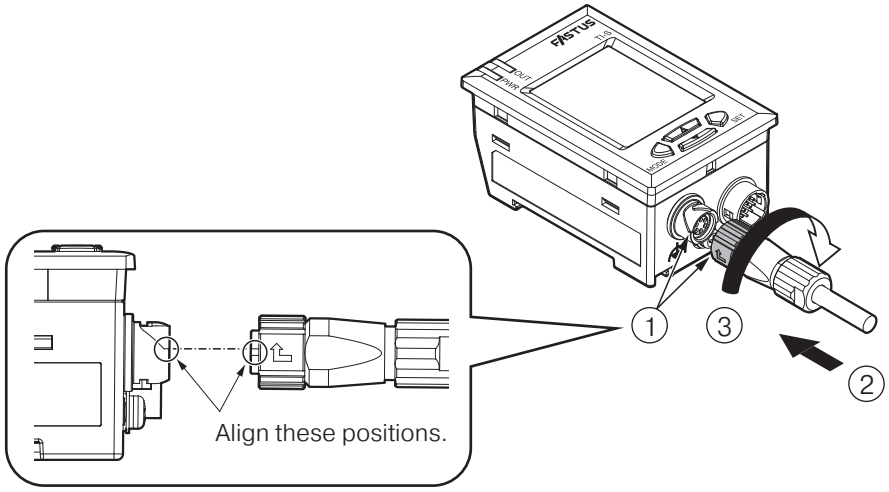
■ Connecting the sensor head cable

Connecting the sensor head cable to the controller.

①Align the connector notch on the sensor head cable with the controller-side groove.

②Insert the socket on the sensor head cable to the back of the controller-side plug.

③Turn the tip of the socket on the sensor head cable to lock the connector.

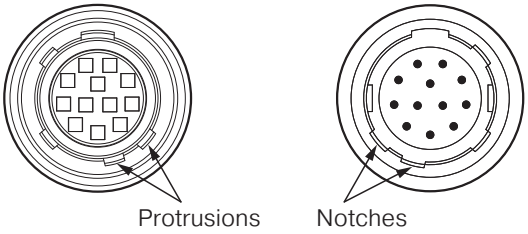


■ Connecting the general-purpose I/O and IO-Link cables

① Visually align the notches on the controller-side plug with the protrusions on the cable-side socket as shown in the figure on the right, and then fit the socket into the plug.

② While pushing the socket on the cable, turn the socket to align the notches and protrusions.

③ After aligning these parts, push the socket in until it clicks.



■ Ground wire connection

There is a functional ground terminal (M3 screw) on the bottom side of the controller.

Attach a terminal to the end of the ground wire and connect it to the functional ground terminal.

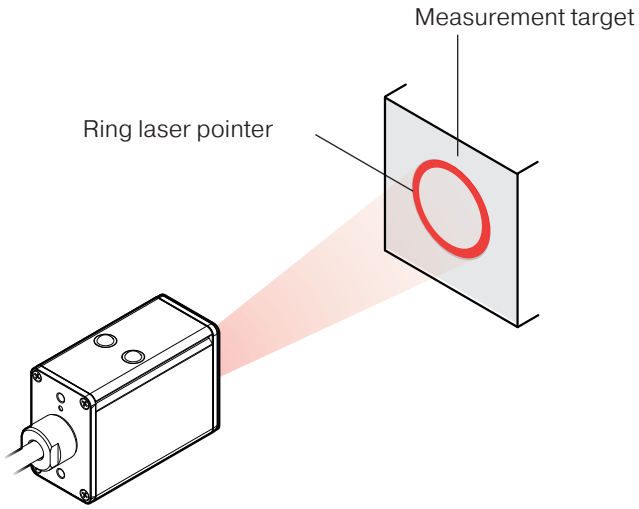
Recommended terminal: R1.25-3

2-4 Alignment Using the Ring Laser Pointer

The sensor head installation position can be easily adjusted by using the ring laser pointer that is emitted from the sensor head. The diameter of the ring laser pointer indicates the field of view. Therefore adjust the sensor head installation position and the measurement target passage position so that the measurement target is larger than the ring laser pointer.

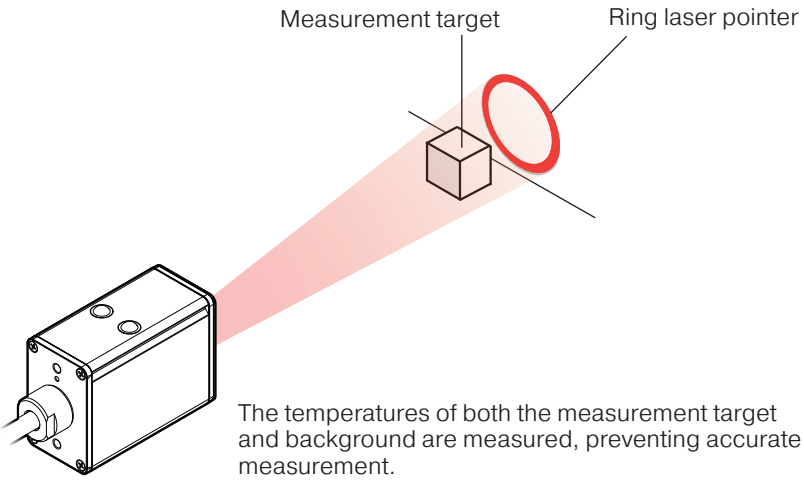
Correct

The ring laser pointer is contained within the measurement target.



Incorrect

The ring laser pointer protrudes from the measurement target.



The temperatures of both the measurement target and background are measured, preventing accurate measurement.

MEMO

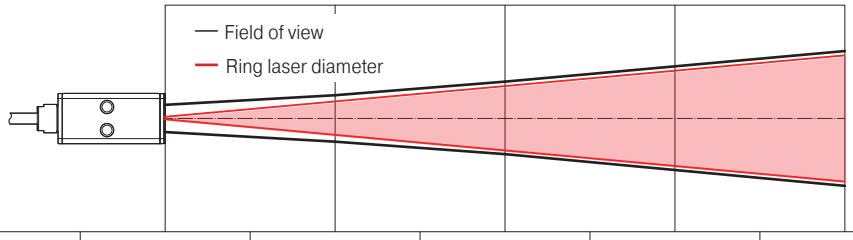
This ring laser pointer visually indicates the measurement position and field of view.
Because the temperature is not actually measured using the ring laser pointer, measurement is possible even when the ring laser pointer is turned OFF.

2-4-1 Relationship between the Field of View and the Ring Laser Pointer

The relationship between the field of view and the laser is shown in the figure below.

- Field of view (TI-S30)

Unit: mm



Distance	0	250	500	750	1000
Field of view	Ø12	Ø21	Ø30	Ø45	Ø60
Ring laser diameter	Ø1	Ø15	Ø30	Ø45	Ø60

- The field of view stated above is for an output response of 90%.
- The measurement target must be fit in the ring laser pointer.

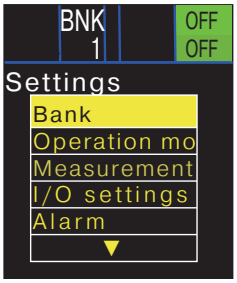
2-4-2 Ring Laser Pointer Lighting Methods

Set the ring laser pointer lighting method.

■ Setting procedure

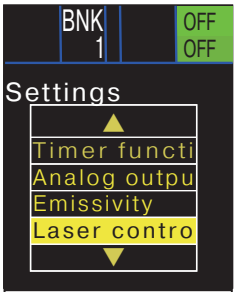
1 **Press** MODE **.**

The screen changes to the settings screen.



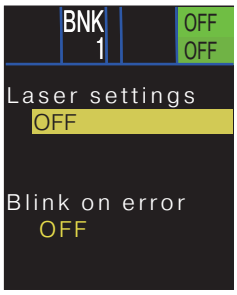
2 **Press the ▲▼ keys and select “Laser control” from the settings menu, and then press** SET**.**

The screen changes to the laser settings screen.



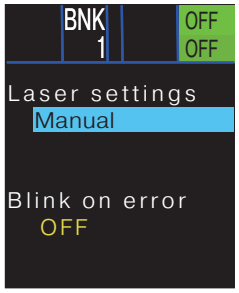
3 **Press the ▲▽ keys and select the “Laser settings” item, and then press SET.**

The location of the lighting method changes from yellow to light blue.

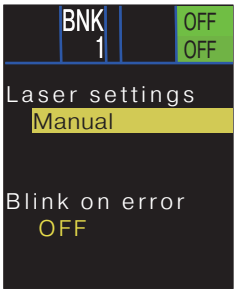


4 **Use the ▲▽ keys to select the lighting status (OFF/Specified period/Manual/Blink/ON).**

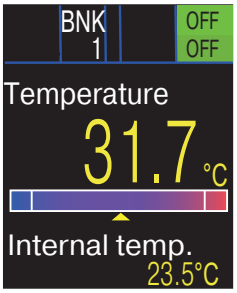
Here, select “Manual.”



5 **When SET is pressed, the display changes from light blue to yellow and “Manual” is confirmed.**

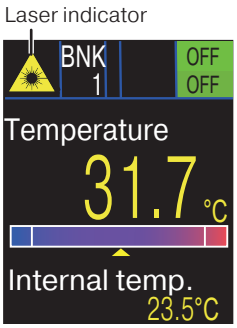


6 **Press MODE twice to return to the measurement screen.**



7 **Press SET to illuminate the ring laser pointer.**

To turn OFF the ring laser pointer, press SET again.



About the ring laser pointer lighting methods

The following types of ring laser pointer lighting methods exist.

For the specifications and setting procedures, refer to “5-10-1 Laser Settings” (page 5-39).

Lighting method	Description
Specified period	When SET is pressed, the ring laser pointer illuminates and then automatically turns OFF after the specified period elapses.
Manual	When SET is pressed, the ring laser pointer changes from ON to OFF.
Blink	The ring laser pointer blinks continually.
ON	The ring laser pointer is continually ON.
Blink on error	When an error occurs, the ring laser pointer blinks at high speed to notify the operator of the error. * “Blink on error” is a separate setting from the lighting method. “5-10-3 Blink on Error” (page 5-40)

MEMO

It is possible to use external input (laser OFF input wire (gray)) to turn OFF the illuminated ring laser pointer.

“2-1 Controller Wiring” (page 2-2)

3

Display Screens and Operating Procedures

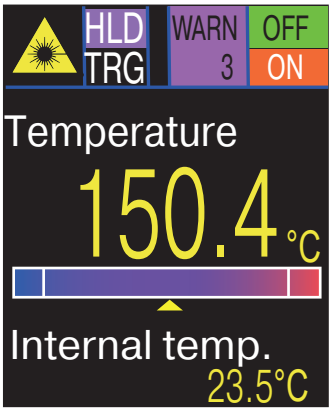
This section describes the display screens and operating procedures of this product.

3-1 Display Screens

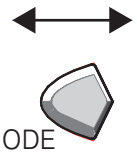
The following two types of display screens exist.

Measurement screen	Displays the temperature of the measurement target, internal temperature of the sensor head, bank number that is in use, alarm output ON/OFF status, and other information.
Settings screen	Changes the setting contents on each setting menu.

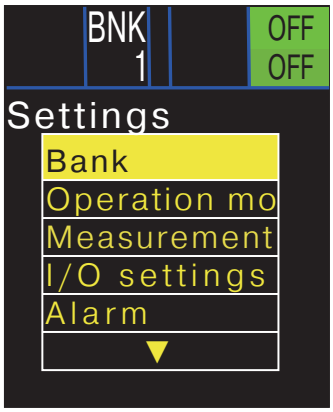
[Measurement screen]



Screen change



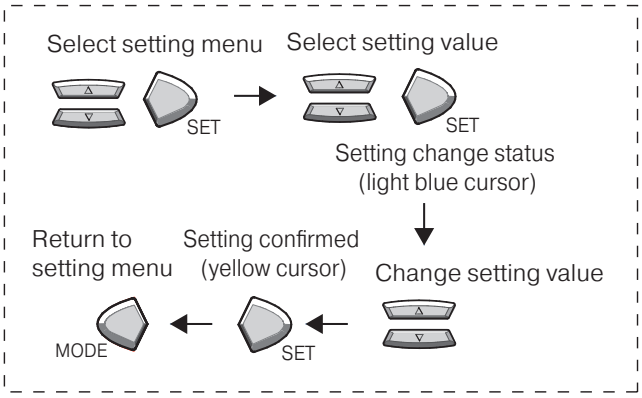
[Settings screen]



The following are displayed.

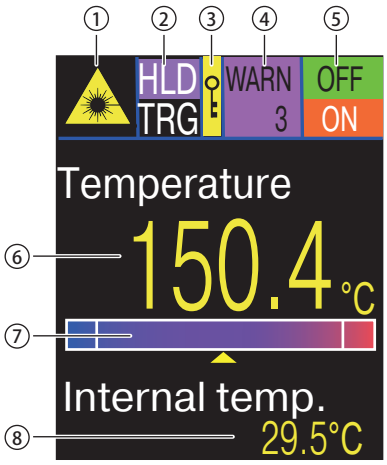
- Temperature of measurement target
- Sensor head internal temperature
- Bank number in use / Control input status
- Status of error/warning occurrence
- Alarm output ON/OFF status

Change the settings on each setting menu.



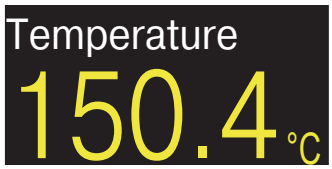
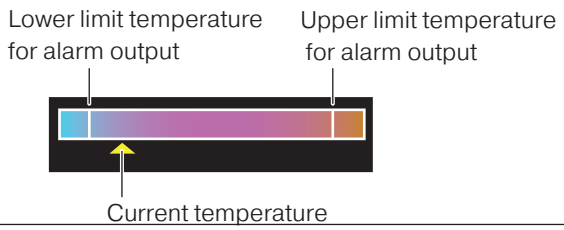
3-1-1 Measurement Screen

Displays the temperature of the measurement target, bank number that is in use, alarm output ON/OFF status, and other information.



● Display

No.	Displayed icon	Description
①	Laser indicator	An icon indicates the laser lighting status.  : Laser emitting  : Laser emission prohibited (Prohibited by external input or IO-Link process output data.) Not displayed: Laser OFF
②	External input status icon	Displays either the current bank number or the external input status. The display contents can be switched as shown below according to the "Measurement mode" 📖 "5-4 Measurement Mode" (page 5-12) setting status. • When "Measurement mode" is set to "Normal": (a) Specified bank number • When "Measurement mode" is set to other than "Normal": (b) External input status (a) Specified bank number Displays the currently specified bank number.  (b) External input (hold input, trigger input) status display Displays the input status of the general-purpose I/O cable green lead wire (hold input) and purple lead wire (trigger input).  The item selected for input is displayed highlighted in purple. When the IO-Link cable is connected, displays the ON/OFF status of hold (bit2) and trigger (bit1) in the IO-Link communication process output data.

No.	Displayed icon	Description
③	Operation lock icon	Displayed when operation lock is activated.  When the operation lock icon (key) is displayed, the setting contents cannot be changed. For details of operation lock, refer to “3-2 Operation Lock” (page 3-9).
④	Error/warning icon	When an error occurs, displays the error type (error/warning) and number.  The timing when the error/warning icon turns OFF varies depending on the error type. For details of the displayed contents for errors and warnings, refer to “6-1-3 Causes and Correction Methods for Errors/Warnings” (page 6-3).
⑤	Upper/lower limit alarm status icon	Displays the status of the upper/lower limit alarm. (Refer to “5-6 Alarm” (page 5-26).)  Upper level: Displays the upper limit alarm ON/OFF status. Lower level: Displays the lower limit alarm ON/OFF status.
⑥	Measured temperature	Displays the current measured temperature. 
⑦	Temperature graph	Displays a graph of the current measured temperature. 
⑧	Head internal temperature (Internal temp.)	Displays the temperature inside the sensor head. 

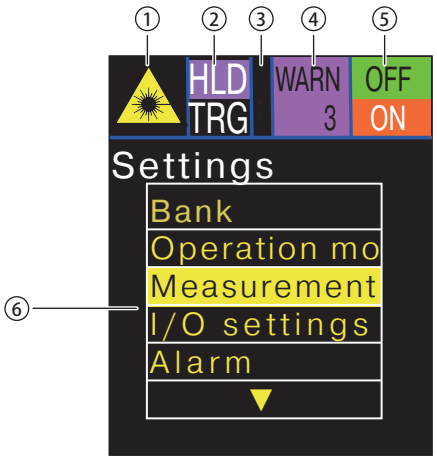
● Operating procedure

The following operations can be performed on the measurement screen.

Operation	Operation key	Description
Laser emission		Turns ON laser emission. (When “Laser settings” is set to “Specified period” or “Manual”)
Screen change		The screen changes to the settings screen.
Display settings	 (Press and hold.)	Switch the screen to “5-11 Display Settings” (page 5-41). The display language, display direction, etc. can be changed.

3-1-2 Settings Screen

Used to configure the setting items.



Display

No.	Displayed icon	Description
① to ⑤	Status icons	Same as those on the measurement screen. (Refer to "3-1-1 Measurement Screen" (page 3-3).)
⑥	Main area	Displays the settings menus and setting items.

Operating procedure

Operation		Operation key	Description
Setting change	Setting item change	SET	Follow the procedure below to change the setting. 1) With the setting item to change selected, press SET to change the cursor color to light blue. 2) Press △▽ to change the setting contents. 3) Press SET to confirm the setting contents. The cursor color changes back to yellow.
	Numeric input	MODE SET	1) Value change Move the cursor to the digit to change and then change the value. • Move cursor (left/right): MODE SET • Value change: △▽ 2) Value confirm To confirm, press MODE when the cursor is at the top digit, or press SET when the cursor is at the bottom digit.
	Character input	MODE SET	1) Character input Move the cursor to the character to change and then change the character. • Move cursor (left/right): MODE SET • Character change: △▽ 2) Character confirm To confirm, press MODE when the cursor is at the left end, or press SET when the cursor is at the right end. * The characters which can be input are the following. Numbers: 0 - 9, Alphabetic characters: A - Z, a - z, Symbols: *+,-./:;<=>?@[¥]^_`{|}~ !"#$%&'()

Operation	Operation key	Description
Cancel setting	MODE (Press and hold.)	To cancel the input contents of the current setting, press and hold MODE (approx. 5 seconds). The input contents are canceled and the screen returns to the settings menu.
Screen change	MODE	Changes to the measurement screen.

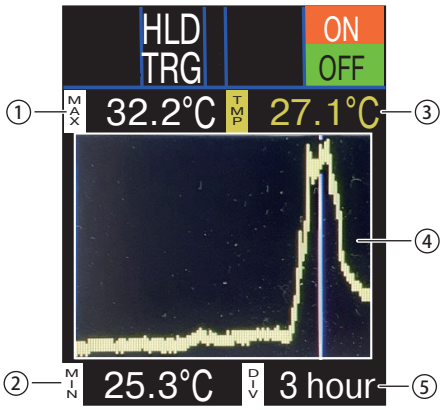
MEMO

It takes about 1 second for the settings to be changed or initialized. Do not turn off the power during this time.

3-1-3 Graph

A graph of the changes in measured temperature can be displayed.

About the graph display



Display

No.	Display	Description
①	Highest temperature	Displays the highest temperature of the temperature range that was set on the graph vertical axis.
②	Lowest temperature	Displays the lowest temperature of the temperature range that was set on the graph vertical axis.
③	Current measured temperature	Displays the current measurement value.
④	Graph	Temperature changes are displayed as a line graph for the time range that was set for the graph horizontal axis.
⑤	Graph horizontal axis time	Displays the time period shown on the graph horizontal axis. It can be changed to the following times. Auto (default value) / 2 min / 10 min / 30 min / 1 hour / 3 hours / 6 hours / 12 hours / 24 hours

Operating procedure

The following operations can be performed for the graph display.

Operation	Operation key	Description
Refresh display	SET	Clears the graph display and displays it again from the beginning.

Operation	Operation key	Description
Back	MODE	Returns to the graph settings screen.
Check temperature at specified position	△ ▽	The display changes, and the temperature at the specified position can be checked. → Refer to “Checking the temperature at a specified position” (page 3-8).

● Changing the graph display

The ranges of temperatures and time which are displayed in the graph can be changed.

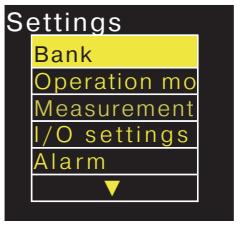
For the setting procedure, refer to “5-12 Graph” (page 5-44).

■ Graph display procedure

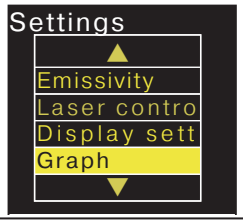
Follow the procedure below to display the graph.

1 **Press MODE.**

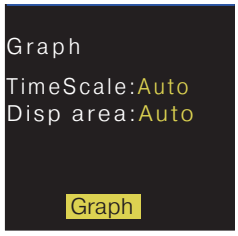
The screen changes to the settings screen.



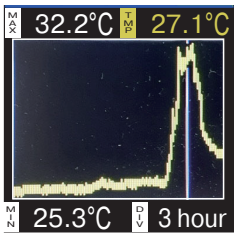
2 **Press the △ ▽ keys and select “Graph,” and then press SET.**



3 **Select “Graph” and press SET.**



4 **The graph is displayed.**



■ Checking the temperature at a specified position

The temperature at the specified position in the graph can be checked.

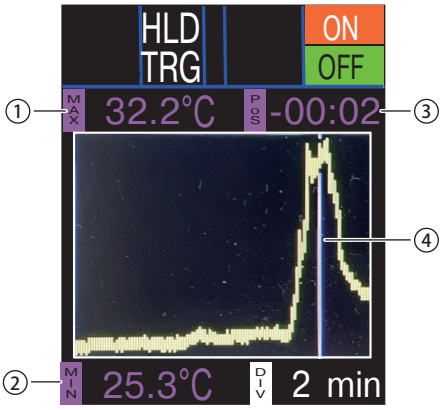
1 **When the graph is displayed, press the keys.**

The cursor (purple line) is displayed.

2 **Press the keys to move the cursor (purple line).**

3 **The measured temperature (highest/lowest) and measurement time for the cursor (purple line) position are displayed.**

If no key operation is performed for a certain period of time (approximately 5 seconds), the operation is automatically canceled.



No.	Display	Description
①	Highest measured temperature at specified position	Displays the highest temperature at the position specified by the cursor.
②	Lowest measured temperature at specified position	Displays the lowest temperature at the position specified by the cursor.
③	Measurement time	Displays the time at the position specified by the cursor as hours and minutes relative to the current time 0.
④	Cursor position	Displays the position for the displayed measured temperature and measurement time.

3-2 Operation Lock

Prohibits changes to the setting contents in order to prevent malfunction.

When operation lock is activated, it is not possible to change any setting items other than the following.

- Manual lighting of the ring laser pointer
- Bank select

MEMO

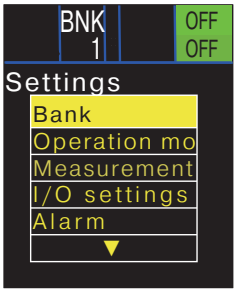
Even when operation lock is activated, it is possible to change settings via the IO-Link Master.

3-2-1 Operating Procedure

■ Activating operation lock

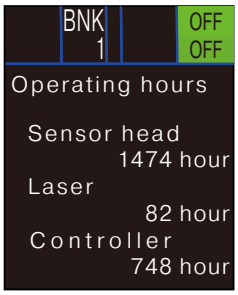
1 **Press MODE.**

The screen changes to the settings screen.

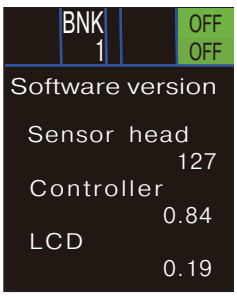


2 **Use ▲▼ to select “Information” and then press SET.**

The information screen is displayed.

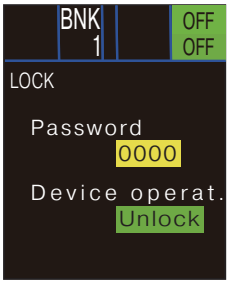


3 **Use ▲▼ and display “Software ver.” on the information screen.**

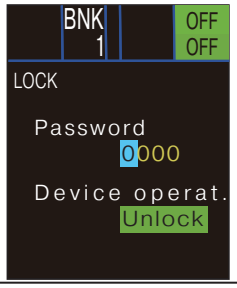


4 **When “Software ver.” is displayed, press SET three times.**

The operation lock screen is displayed.

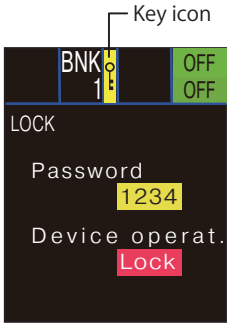


5 **Press SET.**



6 **Use ▲▼ and SET to input the number (4 digits) that will be set as the password.**

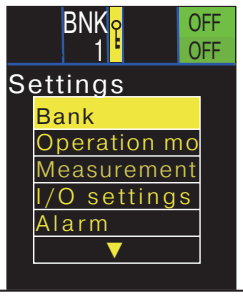
- To confirm the password and activate operation lock, press SET when the cursor is on the 4th digit, or press SET when the cursor is on the 1st digit.
- MODE can be used to return the cursor to the left side.
  Press and hold MODE to cancel password input.
- When operation lock is activated, “Lock” is displayed for device operations, and a key icon is displayed to indicate that operation lock is activated.



■ Canceling operation lock

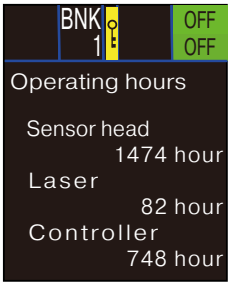
1 **Press MODE.**

The screen changes to the settings screen.

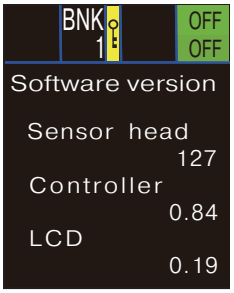


2 **Use ▲▼ to select “Information” and then press SET.**

The information screen is displayed.

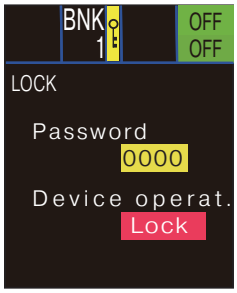


3 **Use ▲▼ and display "Software ver." on the information screen.**

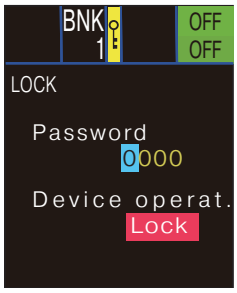


4 **When "Software ver." is displayed, press SET three times.**

The operation lock screen is displayed.

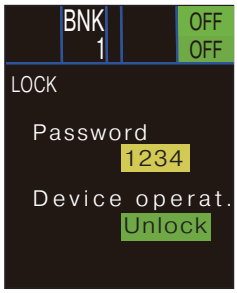


5 **Press SET.**



6 **Use ▲▼ and SET to input the password which was input when operation lock was activated.**

- Press SET when the cursor is on the 4th digit to cancel operation lock.
- "Unlock" is displayed for device operations, and the key icon disappears.



MEMO

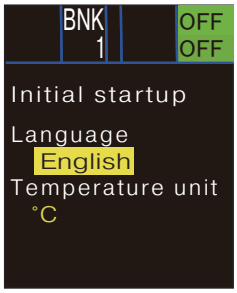
- The password is cleared when operation lock is canceled. Set the password again the next time when activating operation lock.
- If you forgot the password, cancel operation lock using the IO-Link service data (index number 12).

3-3 Setup at Initial Start

When turning ON the power for the first time or after initialization, the following initial settings screen is displayed.

1 **The initial settings screen is displayed.**

The initial settings screen is displayed in English.

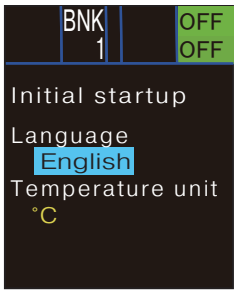


2 **Set the display language.**

① When “Language” is selected, press SET.
The cursor color changes to light blue.

② Press the ▲▼ and select the display language to use (English(Default)/日本語 [Japanese]/简体中文 [Simplified Chinese]), and then press SET.

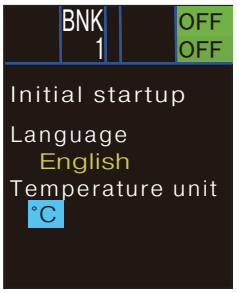
The screen display language changes each time the “Language” item is changed.



3 **Set the temperature units.**

① Press the ▲▼ to select “temperature unit” then press SET.
The cursor color changes to light blue.

② Press the ▲▼ and select the temperature units (°C/°F), and then press SET.



4 **Press MODE.**

The measurement screen is displayed.

4

Emissivity Setting

This section describes the emissivity setting which is required for temperature measurement with this product.

4-1 What Is Emissivity?

Emissivity is the ratio of the infrared ray energy emitted from the surface of the object as a ratio from 0.00 to 1.00.
All objects possess a particular emissivity that changes according to the object's material, surface conditions, and other factors.
With this product, the amount of received infrared energy is converted to a temperature and displayed using the set emissivity.

4-1-1 Setting the Emissivity

Configure the emissivity setting so that it matches the emissivity of the measurement target.
If the emissivity setting and emissivity of the measurement target are different, measurement error may occur.

The emissivity is set using the following methods according to the circumstances.

Circumstances when setting	Setting method	Refer to
When the emissivity of the measurement target is known	Directly input the emissivity of the measurement target.	"4-2 Setting Using the Emissivity (Emissivity Input)" (page 4-3)
When the temperature of the measurement target is known	Input the temperature of the measurement target. The emissivity will be calculated and set automatically based on the input temperature.	"4-3 Setting Using Auto Calculation (Temperature Input)" (page 4-5)
When the emissivity and temperature of the measurement target are not known	Use the black tape and measure the temperature of the measurement target.	"4-4-1 About the Black Tape (Option)" (page 4-7)
If the measurement target is a shiny object such as a metal		

4-2 Setting Using the Emissivity (Emissivity Input)

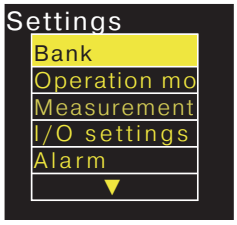
Set by directly inputting the emissivity of the measurement target.

MEMO

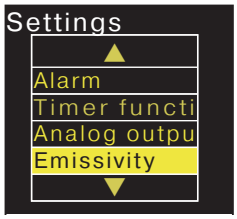
When the emissivity of the measurement target is not known, it is possible to refer to the emissivity listed in the literature. However be aware that the actual emissivity of the measurement target is not the value listed as the physical constant in the literature. The actual emissivity varies depending on the conditions (temperature, surface conditions, wavelength, etc.) at the time of measurement.

■ Setting procedure

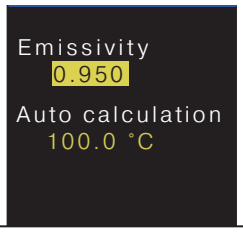
1 **Press** MODE **.**
The screen changes to the settings screen.



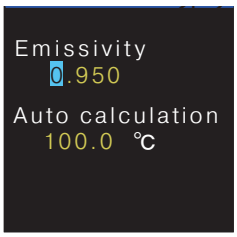
2 **Press the △▽ keys and select "Emissivity" in the settings menu, and then press** SET**.**



3 **Press the △▽ keys and select "Emissivity," and then press** SET**.**
The cursor color changes to light blue.



4 **Input the emissivity value.**



5 **Press** MODE **twice to return to the measurement screen.**

MEMO

The maximum value of emissivity is fundamentally “1.00,” however for convenience when actually using this product, a value of up to “1.20” can be set.

4-3 Setting Using Auto Calculation (Temperature Input)

Input the actual temperature of the measurement target that was measured using a contact-type thermometer or other means.
The emissivity will be calculated and set automatically based on the input temperature.

MEMO

When the temperature of the measurement target cannot be measured, it is possible to perform simplified temperature measurement by affixing the optional black tape to the measurement target.

(Refer to "4-4-1 About the Black Tape (Option)" (page 4-7).)

■ Setting procedure

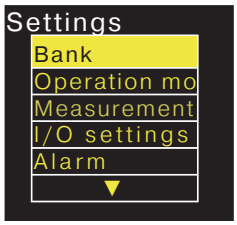
Perform using the measurement target and installation environment that will actually be used for measurement.

1 **Set the measurement target to a state suitable for measurement.**

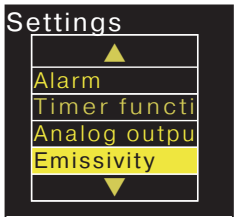
Wait until the ambient temperature has stabilized.
When turning ON the power of this product, it is recommended that you wait for around 10 minutes until the product has stabilized.

2 **Press** MODE **.**

The screen changes to the settings screen.

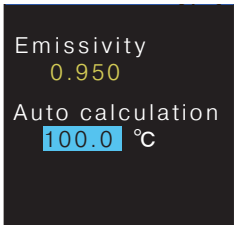


3 **Press the keys and select "Emissivity" in the settings menu, and then press** SET**.**

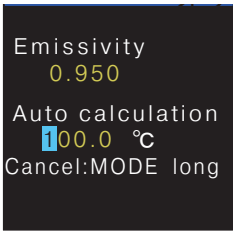


4 **Press the keys and select "Auto calculation," and then press** SET**.**

The cursor color changes to light blue.



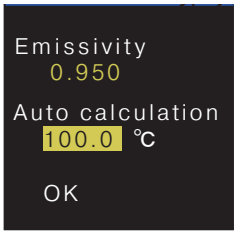
5 **Input the temperature of the measurement target as a numeric value.**



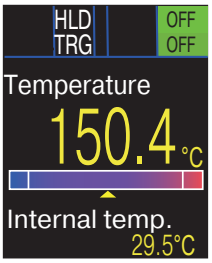
6 **When the emissivity setting has been configured correctly, “OK” is displayed.**

When the emissivity could not be set, an error message is displayed. Refer to the following and correct the error.

“Error messages occurring at auto calculation” (page 4-6)



7 **Press MODE twice to return to the measurement screen.**



■ Error messages occurring at auto calculation

When auto calculation of the emissivity failed, the following error messages are displayed.

Error display	Cause	Correction
Lack of temp.	The difference between the measurement target and the ambient temperature (sensor head internal temperature) is too small.	Set again after either raising the temperature of the measurement target to increase the temperature difference from the ambient temperature, or else distancing the measurement target from the sensor head.
Out of temp.	Calculation of emissivity is not possible because the temperature difference between the temperature input for auto calculation and the temperature of the measurement target is too large.	Input again using a temperature that is closer to that of the measurement target. If an error is displayed again, set by directly inputting the emissivity in the “Emissivity” item.

4-4 Setting Using the Black Tape

When the emissivity and temperature of the measurement target are not known, it is possible to perform simplified temperature measurement of the measurement target using the optional black tape in order to set the emissivity.

4-4-1 About the Black Tape (Option)

Affixing the black tape to the measurement target makes it possible to simply measure even objects with unknown emissivity or shiny objects such as metals, since the emissivity will be 0.95.

- Model :HB-250
- Emissivity :0.95
- Heat resistance temperature :250 °C

4-4-2 Using the Black Tape

1 **Affix the black tape to the measurement target.**

2 **Set "Emissivity" to "0.95."**

3 **Measure the temperature using this product at the location where the black tape was affixed.**
This temperature is the actual temperature of the measurement target.

4 **Measure the temperature close to the black tape.**
Since the emissivity of the measurement target between the black tape is different, the temperature will be different from that in Step 3.

5 **In the "Auto calculation" item, input the temperature which was measured in Step 3.**
For information about auto calculation input, refer to "📖 "4-3 Setting Using Auto Calculation (Temperature Input)" (page 4-5)."

6 **Measure the temperature close to the black tape again, and check that the measured temperature is the same as the temperature that was measured in Step 3.**

MEMO

When measuring a temperature that is 250°C or higher, apply commercially available black body spray before measuring.

5

Functions

This section explains the items that can be set with this product and the setting procedure for each setting menu.

5-1 Setting Menu List

Setting menu	Setting items		Setting value/description	Default value	Bank select	Storage location	Refer to
Bank	Bank select*1		1 to 4	1	-	Sensor Head	Page 5-7
	Initialize bank		CANCEL/ EXECUTE	-	-	-	Page 5-9
Operation mode			High speed/50 ms/100 ms/ 200 ms/500 ms/1 s/2 s/ 5 s/10 s/20 s	100 ms	All banks	Sensor head	Page 5-11
Measure-ment mode	Measurement mode		Normal/Sample hold/Peak hold/Valley hold/Edge detection	Normal	All banks	Sensor head	Page 5-13
	When "edge detection" setting	Edge detect time	0.1 to 10.0 sec	1.0 sec	All banks	Sensor head	Page 5-21
		Edge detect diff	1.0 to 100.0 °C 1.8 to 180.0 °F	Celsius :1.0 °C Fahrenheit : 1.8 °F	All banks	Sensor head	
I/O set-tings	I/O settings		NPN/PNP	NPN	All banks	Controller	Page 5-23
	Output mode		N.O./ N.C.	N.O.	All banks	Controller	Page 5-24
	Test	Input test	Laser: OFF/ON Trigger: OFF/ON Hold: OFF/ON	Laser: OFF Trigger: OFF Hold: OFF	-	-	Page 5-25
		Output test	Upper lim: OFF/ON Lower lim: OFF/ON	Upper lim: OFF Lower lim: OFF	-	-	
Alarm	Alarm select		Upper & lower/Not use/ upper limit only/lower limit only	Upper & lower	Each bank	Sensor head	Page 5-27
	Upper limit		Celsius : -40.0 to 500.0 °C Fahrenheit: -40.0 to 932.0 °F	Celsius : 500.0 °C Fahrenheit: 932.0 °F	Each bank	Sensor head	Page 5-28
	Lower limit		Celsius : -40.0 to 500.0 °C, Fahrenheit: -40.0 to 932.0 °F	Celsius : -40.0 °C Fahrenheit: -40.0 °F	Each bank	Sensor head	Page 5-28
	Hysteresis		Celsius : 0.0 to 10.0 °C Fahrenheit: 0.0 to 18.0 °F	Celsius : 2.0 °C Fahrenheit: 3.6 °F	Each bank	Sensor head	Page 5-28
Timer function	Timer mode		Not use/One shot/Delay	Not use	Each bank	Sensor head	Page 5-29
	When "One shot" setting	One shot time	0.01 to 10 sec	0.10 sec	Each bank	Sensor head	Page 5-30
	When "Delay" setting	On delay time	0.00 to 10 sec	0.10 sec	Each bank	Sensor head	Page 5-31
		Off delay time	0.00 to 10 sec	0.10 sec	Each bank	Sensor head	

Setting menu	Setting items		Setting value/description	Default value	Bank select	Storage location	Refer to
Analog output*2	Analog output		Not use/Current/Voltage	Not use	All banks	Controller	Page 5-34
	Specify temp. (Temperature setting when setting current)	4mA :	Celsius : -40.0 to 500.0 °C, Fahrenheit: -40.0 to 932.0 °F	Celsius : -40.0°C Fahrenheit: -40.0 °F	Each bank	Sensor head	Page 5-34
		20mA :	Celsius : -40.0 to 500.0°C, Fahrenheit: -40.0 to 932.0 °F	Celsius : 500.0°C, Fahrenheit: 932.0 °F	Each bank	Sensor head	
		Test	4mA/12mA/20mA	4mA	-	-	Page 5-35
	Specify temp. (Temperature setting when setting voltage)	0V :	Celsius : -40.0 to 500.0°C, Fahrenheit: -40.0 to 932.0°F	Celsius : -40.0°C Fahrenheit: -40.0 °F	Each bank	Sensor head	Page 5-34
		10V :	Celsius : -40.0 to 500.0°C, Fahrenheit: -40.0 to 932.0°F	Celsius : 500.0°C, Fahrenheit: 932.0 °F	Each bank	Sensor head	
		Test	0V/5V/10V	0V	-	-	Page 5-35
Emissivity	Emissivity		0.100 to 1.200	0.950	Each bank	Sensor head	Page 5-36
	Auto calculation		Celsius : -40.0°C to 500.0°C, Fahrenheit: -40.0 to 932.0°F	Celsius : 100.0°C, Fahrenheit: 212.0 °F	-	-	Page 5-37
Laser control	Laser settings		OFF/Specified period/ Manual/Blink/ON	OFF	All banks	Controller	Page 5-39
	When "Specified period" setting	Lighting period	1 to 90 sec	10 sec	All banks	Controller	Page 5-39
	Blink on error		OFF/ON	OFF	All banks	Controller	Page 5-40
Display settings	Language		English/日本語/简体中文	*3	All banks	Controller	Page 5-41
	Disp. direction		Vertical/Horizontal/Vertical-Rev./HorizontalRev.	Vertical	All banks	Controller	Page 5-42
	Brightness		1 to 15	15	All banks	Controller	Page 5-42
	Temperature unit		°C/°F	*3	All banks	Controller	Page 5-43

Setting menu	Setting items		Setting value/description	Default value	Bank select	Storage location	Refer to
Graph	Graph	Time Scale:	Auto/ 2 min/10 min/ 30 min/ 1 hour/3 hour/ 6 hour/ 12 hour/ 24 hour	Auto	All banks	Controller	Page 5-44
		Disp area:	Auto/ Specify	Auto	All banks	Controller	Page 5-45
	When "Specify" setting	Min:	Celsius : -40.0 to 500.0 °C, Fahrenheit: -40.0 to 932.0 °F	Celsius : -40.0°C Fahrenheit: -40.0°F	All banks	Controller	Page 5-45
		Max:	Celsius : -40.0 to 500.0 °C, Fahrenheit: -40.0 to 932.0 °F	Celsius : 500.0°C, Fahrenheit: 932.0°F	All banks	Controller	
	Graph		Press the "SET" key to display the graph.	-	-	-	Page 5-45
Application tag			"A character string can be entered. Up to 32 characters.*4"	-	All banks	Controller	Page 5-46
Function tag			"A character string can be entered. Up to 32 characters.*4"	-	All banks	Controller	Page 5-47
Location tag			"A character string can be entered. Up to 32 characters.*4"	-	All banks	Controller	Page 5-48
Maintenance	Maintenance **** Hours later		0 to 87672 Hours later	0	All banks	Sensor head	Page 5-49
App. reset			CANCEL/ EXECUTE	-	-	-	Page 5-50
Information	Operating hours	Sensor head	Displays the operation time of the sensor head.	-	-	-	Page 5-51
		Laser	Displays the operation time of the laser.	-	-	-	
		Controller	Displays the operation time of the controller.	-	-	-	
	EEP write count	Sensor head	Displays the number of write operations to sensor head memory.	-	-	-	
		Controller	Displays the number of write operations to controller memory.	-	-	-	
	Serial N0.	Sensor head	Displays the sensor head serial number.	-	-	-	
		Controller	Displays the controller serial number.	-	-	-	
	Software version	Sensor head	Displays the sensor head software version.	-	-	-	
		Controller	Displays the controller software version.	-	-	-	
		LCD	Displays the LCD software version.	-	-	-	

Setting menu	Setting items		Setting value/description	Default value	Bank select	Storage location	Refer to
Informa-tion	Temp. range	Upper limit	Celsius : 500.0 °C Fahrenheit: 932.0 °F	-	-	-	Page 5-51
		Lower limit	Celsius : -40.0 °C Fahrenheit: -40.0 °F	-	-	-	
Errs. warnings			Displays a list of the errors and warnings that have occurred and allows the user to clear the warning status.*5	-	-	-	Page 5-52

*1: This cannot be set when using a general-purpose I/O cable with Measurement mode set to Normal.

*2: This can only be used when a general-purpose I/O cable is connected.

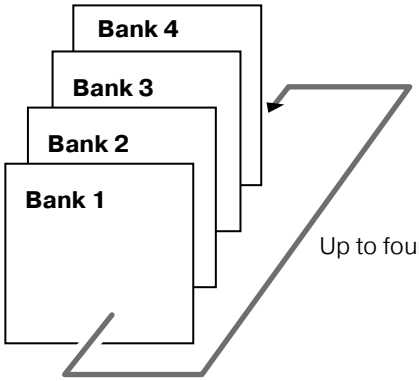
*3: Default value is that selected when the controller starts for the first time.

4: The selectable characters are numbers (0 to 9), alphabet letters (A to Z and a to z), and symbols (+ , - . / : ; < = > ? @ [¥] ^ _ ` { | } ~ ! " # $ % & ' ( )).

*5: Errors and warnings that occur at all times cannot be cleared.

5-2 Bank

Up to 4 patterns of settings can be saved in this product.
If the settings for each measurement target are saved in a bank, the saved settings can be read back when the measurement target is changed. This function reduces the time and effort required to reconfigure the settings each time the measurement target is changed.

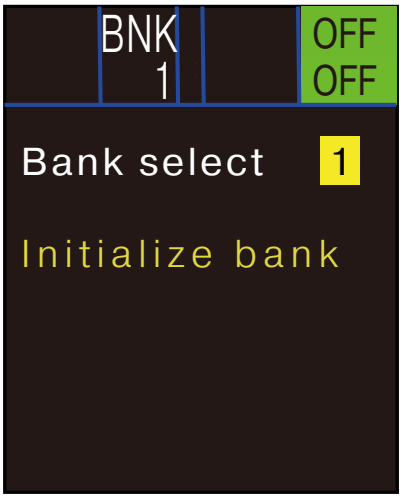


Up to four patterns can be saved for banks 1 to 4.

Changing to the setting menu

MODE >>“Bank” >> SET

Setting items



Setting items	Description of function	Setting range
Bank select	The bank number that is currently in use is displayed. When set to any hold or edge detection in measurement mode (when set to anything other than “Normal”), it is possible to select the bank that is used by directly changing the bank number.	1 to 4
Initialize bank	The setting items of the bank that is currently in use are initialized. Banks which are not currently in use, and setting items that are common to all banks, are not initialized. “5-2-3 Save Bank” (page 5-9)	-

5-2-1 Bank Select

The bank selection methods are as shown below according to the method of connecting to this product and the measurement mode (“5-4 Measurement Mode” (page 5-12)).

Connected cable	Selection method		
	Key operation	External input signal	IO-Link (service data)
General-purpose I/O cable	Possible However only when the following measurement modes are set (*1) • Sample hold • Peak hold • Valley hold • Edge detection	Possible However only when “Normal” is set as the measurement mode (*2)	Not possible
IO-Link cable	Possible	Not possible	Possible

*1: When a measurement mode other than “Normal” is set, bank selection is performed by key operation because priority is given to use of the external input signal for measurement value hold display control.

*2: When the measurement mode is set to “Normal,” bank select cannot be performed by key operation because bank selection is performed using the external input signal.

MEMO

Bank which is displayed when the power is turned ON

When bank selection is performed by controller key operation, the controller starts using the bank number which was used the previous time.

(When starting for the first time, bank 1 is used.)

When bank selection is performed by external input, the controller starts using the bank number which was specified by the ON/OFF status of the hold input wire (green) and trigger input wire (purple) of the general-purpose I/O cable.

■ Bank selection by key operation

Perform from “Bank select” in the ”Bank" settings menu.

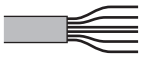
MODE >> “Bank” >> SET >> “Bank select”

MEMO

When the measurement mode is set to “Normal,” bank selection cannot be performed by key operation.

■ Bank selection using the external input signal

Bank selection is performed according to the hold input wire (green) and trigger input wire (purple) of the general-purpose I/O cable.



Green: Hold input wire
Purple: Trigger input wire

Specify the bank number to use as shown below using the ON/OFF status of the hold input wire and trigger input wire.

Changes to	Input status	
	Hold input wire (green)	Trigger input wire (purple)
Bank number: 1	OFF	OFF
Bank number: 2	OFF	ON
Bank number: 3	ON	OFF
Bank number: 4	ON	ON

MEMO

When the measurement mode is set to anything other than “Normal,” the hold input wire (green) and trigger input wire (purple) of the general-purpose I/O cable become the input wires for hold display input. As a result, bank selection by external input is not possible.

■ Bank selection using IO-Link (service data)

Select the bank number using the IO-Link service data.

For details, refer to 🕮 “TI-S30-AP” (page 8-9).

MEMO

When selecting the bank using IO-Link service data, bank selection is possible regardless of the measurement mode setting.

5-2-2 Initialize Bank

When  is pressed, the setting items of the bank that is currently in use are initialized.

MEMO

Setting items where bank selection is not possible are not initialized.

“5-2-3 Save Bank” (page 5-9)

5-2-3 Save Bank

■ Saving a bank

When settings are changed, they are automatically applied to the bank that is currently in use.

■ Setting items which can be saved in a bank

The setting items which can be saved in a bank are the following.

For details of setting items, refer to each of the setting items.

Setting menu	Setting items
Alarm	Alarm select
	Upper limit
	Lower limit
	Hysteresis
Timer function	Timer mode
	One shot time
	On delay time
	Off delay time
Analog output*1	Specify temp.
Emissivity	Emissivity

*1: The analog output setting (Not use/Current/Voltage) is a setting that is common to all banks.

● Setting items where bank selection is not possible (common settings for all banks)

The following setting items are common settings for all banks and therefore the setting cannot be changed by selecting a bank.

Change the setting as necessary after selecting the bank.

Setting menu	Setting items
Operation mode	High speed/50 ms/100 ms/200 ms/500 ms/1 s/2 s/5 s/10 s/20 s
Measurement mode	Measurement mode(Normal/Sample hold/Peak hold/Valley hold/Edge detection)
	Edge detect time
	Edge detect diff
I/O settings	I/O settings (NPN/PNP)
	Output mode
Analog output	Analog output (Current/Voltage)
Laser control	Laser settings (OFF/Specified period/Manual/Blink/ON)
	Lighting period
	Blink on error
Display settings	Language
	Disp. direction
	Brightness
	Temperature unit
Graph	Time Scale:
	Disp area:

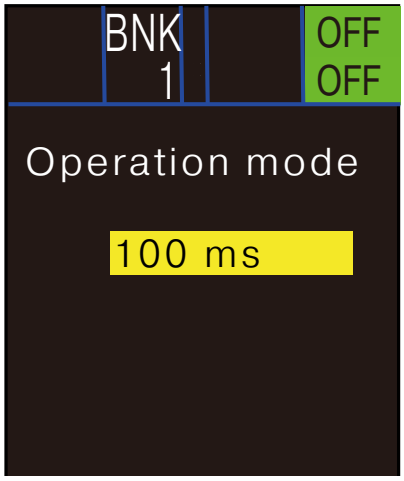
5-3 Operation Mode

Reduces variation in the measured value by applying a moving average process to the measured temperature.
A longer set time for the operation mode slows down the response time, but the measured value will be more stable.

■ Changing to the setting menu

MODE >> “Operation mode” >> SET

■ Setting items



Selected item	Description of function
High speed	Reduces the response time by reducing the number of times that measured temperature is collected in order to perform the moving average process.
50 ms	Specifies the response time.
100 ms (default value) *1	
200 ms	
500 ms	
1 s	
2 s	
5 s	
10 s	
20 s	

*1: A shorter set time will enable a faster response, however accuracy will decrease and variation becomes more likely. To use the full measurement accuracy of this product, set the response time to 100 ms or more.

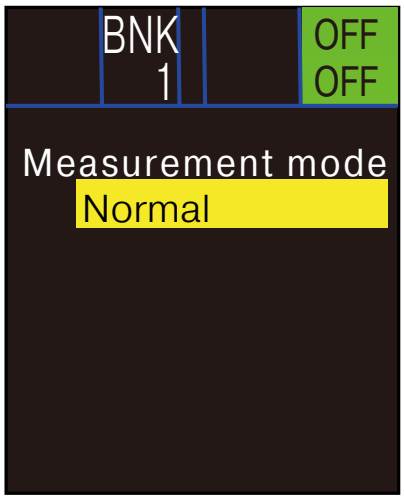
5-4 Measurement Mode

This configures the basic measurement method and the hold functions.
It also can set edge detection which detects only rapid temperature changes.

■ Changing to the setting menu

MODE >> “Measurement mode” >> SET

■ Setting items



Setting items		Description of function	Setting range
Measure-ment mode	Normal	Selects the measurement mode.	- (Default value: Normal)
	Sample hold		
	Peak hold		
	Valley hold		
	Edge detection		
Edge detect time		This sets the cycle to use for comparison when identifying temperature changes for edge detection. Set when “Edge detection” is selected.	0.1 to 10.0 sec (Default value: 1.0 sec)
Edge detect diff		Sets the temperature difference for detection as edge detection. Set when “Edge detection” is selected.	001.0°C to 100.0°C (Default value: 1.0°C)

5-4-1 Types of Measurement Modes

The temperature measurement method can be selected by means of the measurement mode.

✓: Possible ×: Not possible

Measurement mode	Overview of function	Hold display	Refer to
Normal (Default setting)	Continually updates the temperature during measurement.	×	(Page 5-15)
Sample hold	Continually updates the temperature during measurement.	✓	(Page 5-15)
Peak hold	Detects the highest temperature (peak hold value) during measurement.	✓	(Page 5-17)
Valley hold	Detects the lowest temperature (valley hold value) during measurement.	✓	(Page 5-19)
Edge detection	Detects rapid temperature changes.	✓	(Page 5-21)

5-4-2 Control of Measurement Values

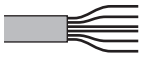
The measurement values can be controlled as shown below.

■ Hold the measured value (hold display).

Any measurement value can be held during measurement. (Hold display)

Hold display starts/cancels hold based on the ON/OFF of the trigger input wire (green).

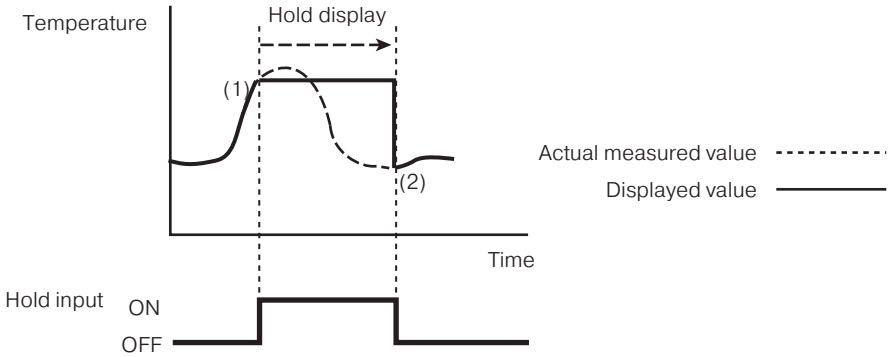
- Hold input wire (green)



ON: Hold start

OFF: Hold cancel

Example: Holding the measured value based on hold input



(1) Holds display at current value.
(2) Cancels hold display.
Returns to real-time display.

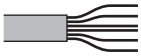
■ Update of current value

When hold display of the measurement value, or the highest value (peak value) *1 or lowest value (valley value) *1, is displayed, each of these displays is updated to the current value.

*1: Only when “Peak hold” or “Valley hold” is set for the measurement mode

Current value update can be performed by either of the methods below.

- Updating by external input (trigger input)
  The display is updated to the current value when the trigger input wire (purple) turns ON.
  - Trigger input wire (purple)



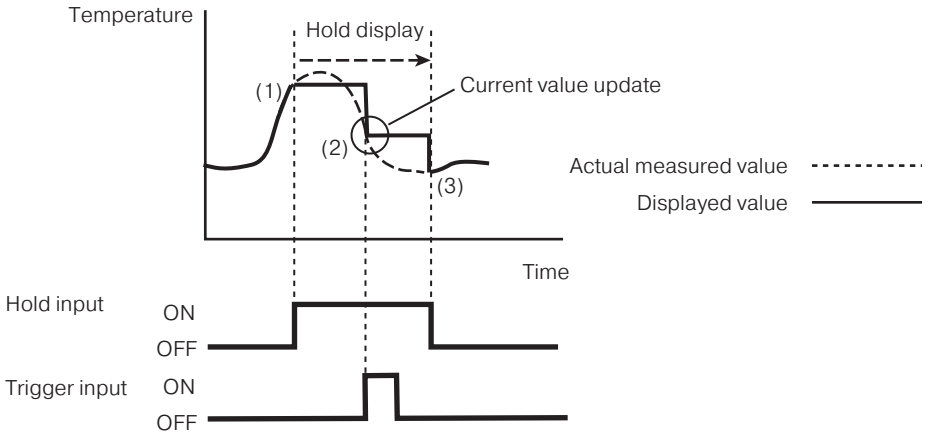
ON: Update using the current value

- Updating using the 

key
  Pressing and holding the 

MODE key updates the display to the current value.

Example: When “Sample hold” is set for the measurement mode and hold display is updated based on the trigger input

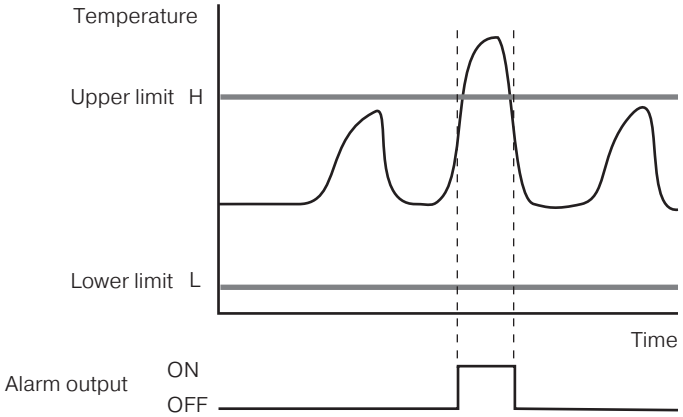


(1) Holds display at current value.
(2) Resets hold display.
Hold display is updated to the actual measured value.
(3) Cancels hold display.
Returns to real-time display.

5-4-3 “Normal” Measurement Mode

Continually updates the temperature during measurement.

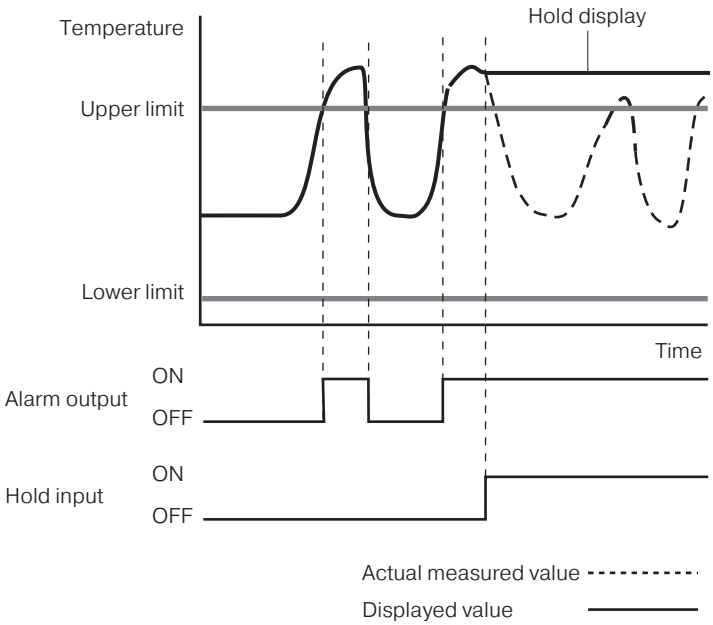
When “Alarm” is set (refer to “5-6 Alarm” (page 5-26)), and a temperature exceeding the upper/lower limit settings is measured, an alarm is output during that time.



5-4-4 “Sample Hold” Measurement Mode

The temperature is continuously updated during measurement, however it is possible to hold the measurement value (hold display) based on external input. (Refer to “5-4-2 Control of Measurement Values” (page 5-13).)

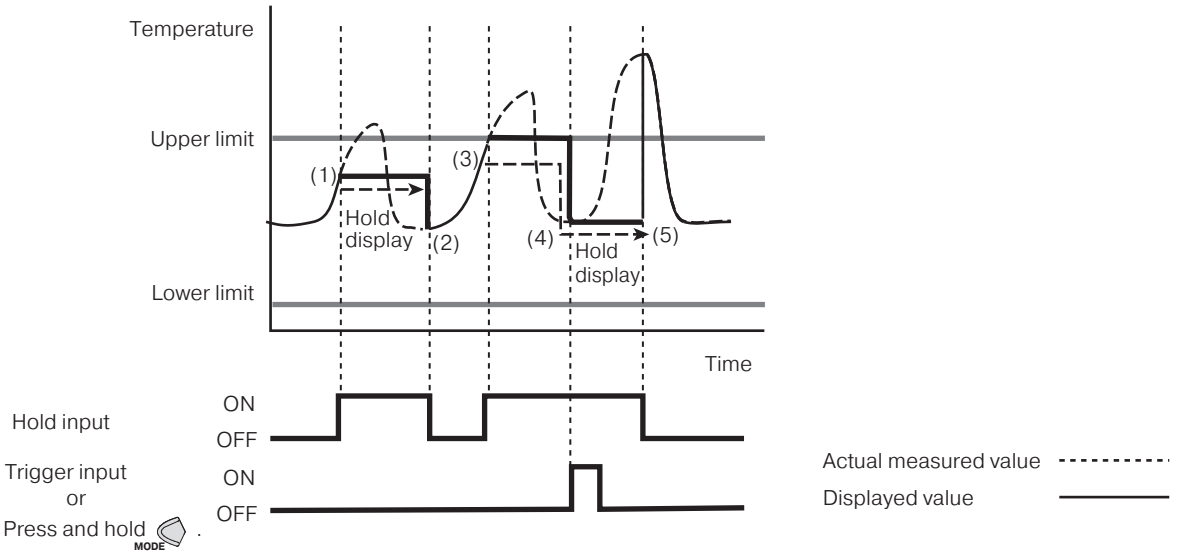
When “Alarm” is set (refer to “5-6 Alarm” (page 5-26)), and a temperature exceeding the upper/lower limit settings is measured, an alarm is output during that time.



■ Operation control during sample hold

When sample hold is selected, the following control is performed.

Operation type	Trigger
Hold display start	When the hold input wire turns ON, the current value at the time when the hold input wire turns ON is stored.
Hold display cancel	When the hold input wire turns OFF, hold display is canceled and the current measurement value is displayed.
Hold display reset	When the MODE key is pressed and held or when the trigger input wire turns ON, the hold display is updated to the current measurement value. The hold display is maintained.



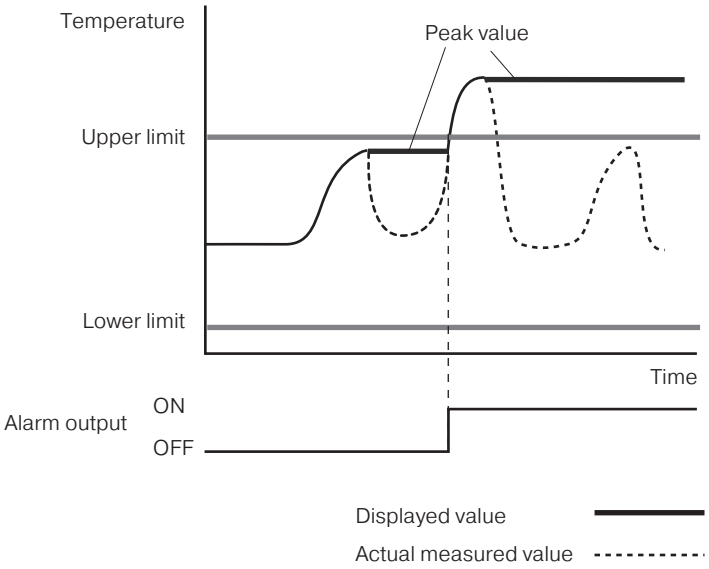
(1) Holds display at current value.
(2) Cancels hold display.
Returns to real-time display.
(3) Holds display at current value.
(4) Resets hold display.
Hold display is updated to the actual measured value.
(5) Cancels hold display.
Returns to real-time display.

5-4-5 “Peak Hold” Measurement Mode

The highest temperature (peak value) is displayed continuously during measurement.

It is also possible to hold the measurement value based on external input (hold display). (Refer to “5-4-2 Control of Measurement Values” (page 5-13).)

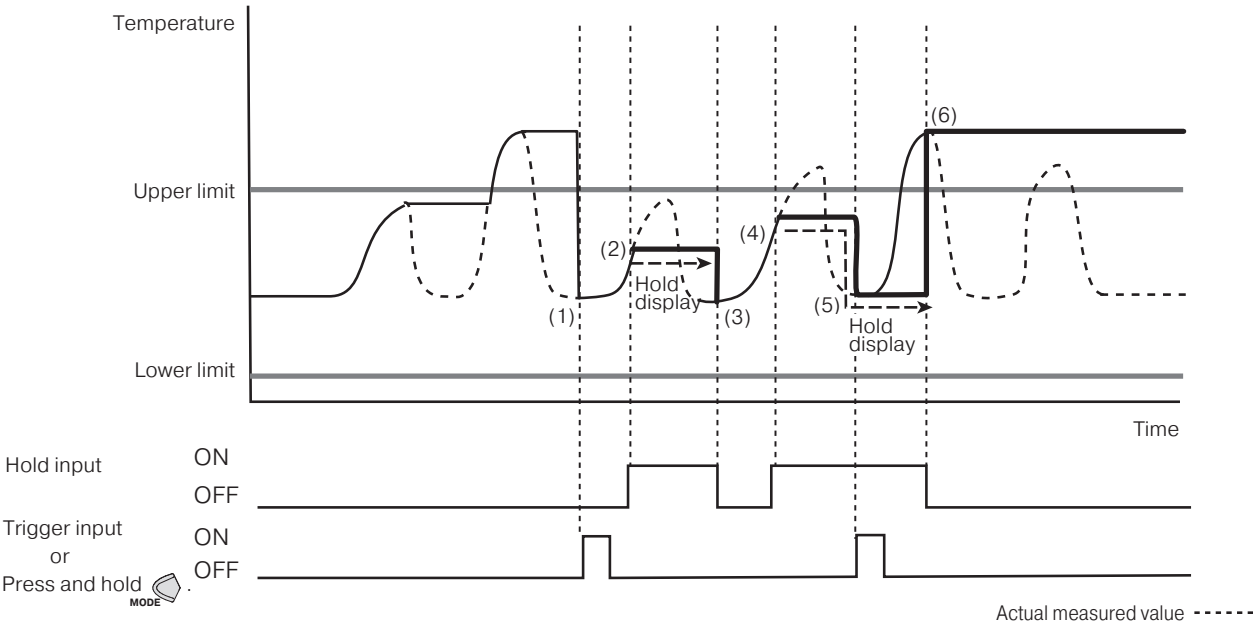
When “Alarm” is set (refer to “5-6 Alarm” (page 5-26)) and the peak display value or hold display value exceeds the range of the upper/lower limit settings, an alarm is output.



■ Operation control during peak hold

When peak hold is selected, the following control is performed.

Operation type	Trigger
Hold display start	When the hold input wire turns ON, the current value at the time when the hold input wire turns ON is stored.
Hold display cancel	When the hold input wire turns OFF, hold display is canceled and the current measurement value is displayed.
Display reset	When the MODE key is pressed and held, or when the trigger input wire turns ON, the peak display is updated to the current measurement value. During hold display, the actual measurement value at the update time is shown in the hold display.



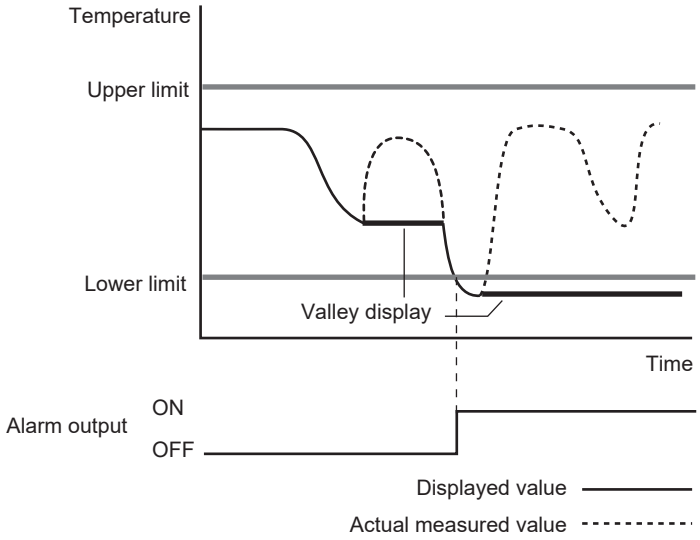
(1) Resets peak value.
Peak display is updated to the actual measured value.
(2) Holds display using current value.
(3) Cancels hold display.
Returns to peak display.
(4) Holds display using current value.
(5) Resets hold display.
Hold display is updated to the actual measured value.
(6) Cancels hold display.
Returns to peak display.

5-4-6 “Valley Hold” Measurement Mode

The lowest temperature (valley value) is displayed continuously during measurement.

It is also possible to hold the measurement value based on external input (hold display). (Refer to “5-4-2 Control of Measurement Values” (page 5-13).)

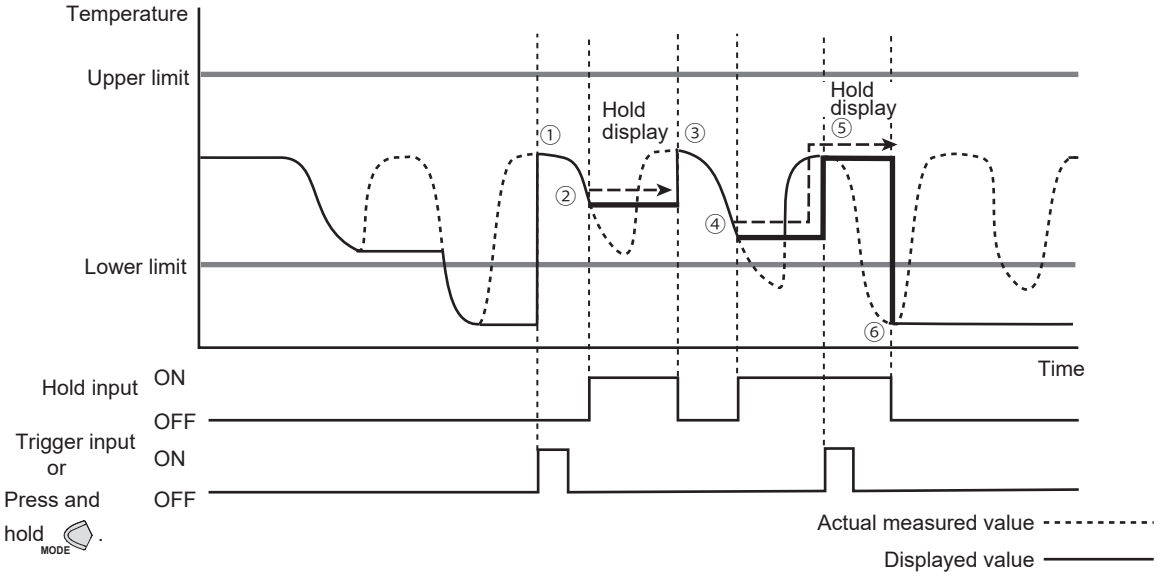
When “Alarm” is set (refer to “5-6 Alarm” (page 5-26)), when the valley display value or hold display value exceeds the range of the upper/lower limit settings, an alarm is output.



■ Operation control during valley hold

When valley hold is selected, the following control is performed.

Operation type	Trigger
Hold display start	When the hold input wire turns ON, the current value at the time when the hold input wire turns ON is stored.
Hold display cancel	When the hold input wire turns OFF, hold display is canceled and the current measurement value is displayed.
Display reset	When the MODE key is pressed and held, or when the trigger input wire turns ON, the valley display is updated to the current measurement value. During hold display, the actual measurement value at the update time is shown in the hold display.



① Resets valley display.
Valley display is updated to the actual measured value.
② Holds display using current value.
③ Cancels hold display.
Returns to valley display.
④ Holds display using current value.
⑤ Resets hold display.
Hold display is updated to the actual measured value.
⑥ Cancels hold display.
Returns to valley display.

5-4-7 “Edge Detection” Measurement Mode

The temperatures during measurement are compared during a predetermined time period, and if a temperature difference at or above the set value occurs, the alarm output turns ON.

It is also possible to hold the measurement value based on external input (hold display). (Refer to “5-4-2 Control of Measurement Values” (page 5-13).)

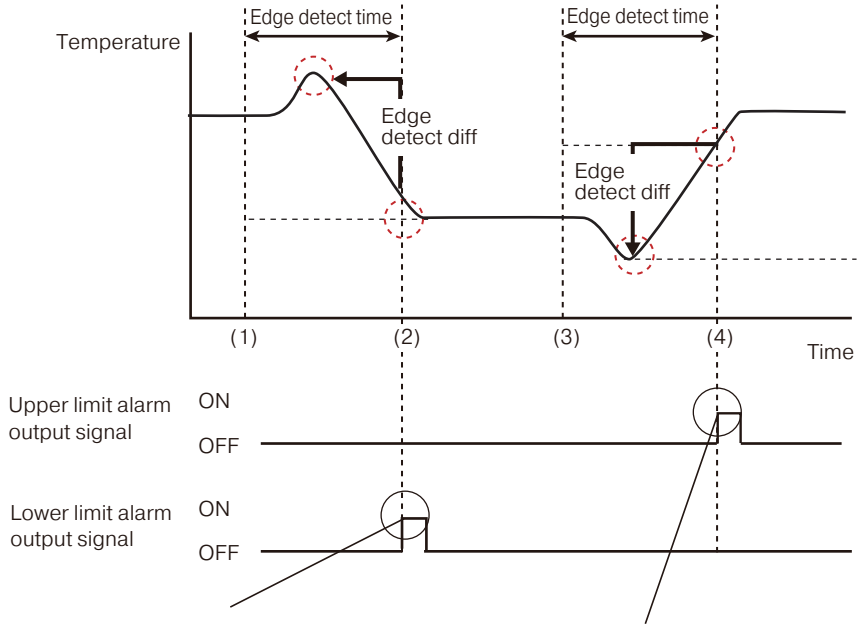
■ Settings when edge detection is selected

The following items are set when edge detection is selected.

Setting items	Description of function	Setting range
Edge detect time	This sets the cycle to use for comparison when identifying temperature changes for edge detection.	0.01 to 10.0 sec (Default value: 1.0 sec)
Edge detect diff	Sets the temperature difference for detection as edge detection.	001.0°C to 100.0°C (Default value: 1.0°C)

■ Operation when edge detection occurs

The operation principle for edge detection is differential detection. The temperature is monitored within the time that was set for “Edge detect time,” and if a difference with the current temperature which is at or above the temperature set for “Edge detect diff” occurs, an edge is detected and an alarm is output.



When a temperature difference (temperature drop) of “Edge detect diff” or larger is recognized within the most recent time (within edge detect time: (1) to (2)) from the current temperature (2), the lower limit alarm turns ON.

When a temperature difference (temperature rise) of “Edge detect diff” or larger is recognized within the most recent time (within edge detect time: (3) to (4)) from the current temperature (4), the upper limit alarm turns ON.

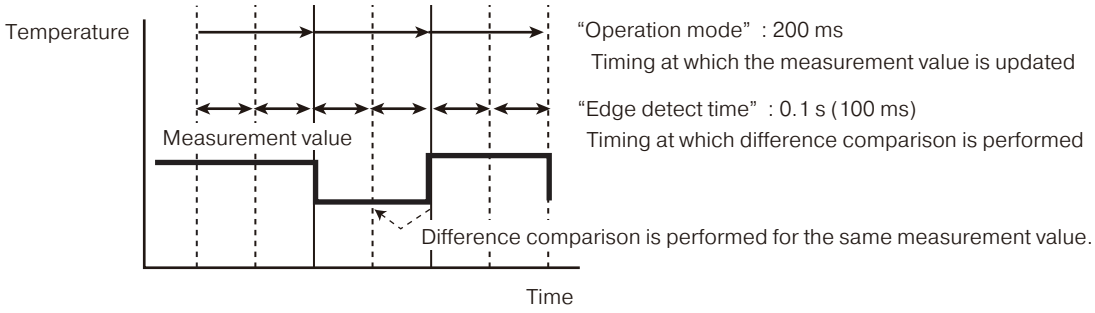
MEMO

After the power is turned ON or after a bank is selected, measurement data equivalent to the edge detect time has not yet been accumulated. Therefore, edge detection is performed by extracting the highest temperature and lowest temperature within the range of the accumulated measurement data.

■ Relationship between “Edge detect time” and “Operation mode”

For edge detection, set an “Operation mode” time (“5-3 Operation Mode” (page 5-11)) that is shorter than the edge detect time.
If an “Operation mode” time that is longer than the edge detect time is set, data will not be updated at the timing necessary for edge detection, and edge detection may not function correctly.

Example: When an “Operation mode” time that is longer than the edge detect time is set



■ Hold operation when edge detection is selected

It is possible to hold the display of the measurement value even when edge detection is selected.

The hold display control method is as described below.

Operation type	Trigger
Hold display start	When the hold input wire turns ON, the current value at the time when the hold input wire turns ON is stored.
Hold display cancel	When the hold input wire turns OFF, hold display is canceled and the current measurement value is displayed.
Display reset	When the MODE key is pressed and held or when the trigger input wire turns ON, the hold display is updated to the current measurement value. The hold display is maintained.

MEMO

- Because the measurement value does not change during hold display, edge detection is not performed.
- When hold display is canceled, if the temperature difference from the current measurement value is at or above “Edge detect diff,” then an alarm occurs.

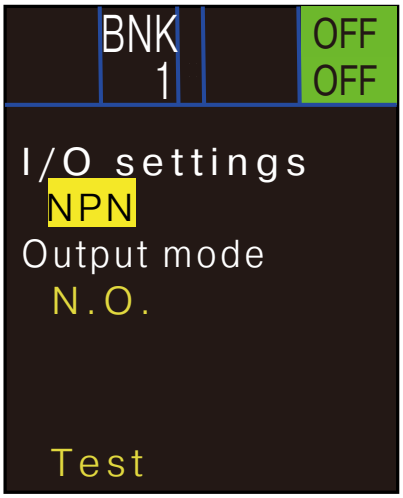
5-5 I/O Settings

Performs a test of general-purpose I/O cable output setting and the input/output status.

Changing to the setting menu

MODE >> “I/O settings” >> SET

Setting items



Setting items	Description of function
I/O settings	Sets NPN/PNP.
Output mode	Sets alarm output to either normally open or normally closed.
Test	A test can be performed of the input/output status using the general-purpose I/O cable.

5-5-1 I/O Settings

Select the I/O settings for the general purpose I/O cable.

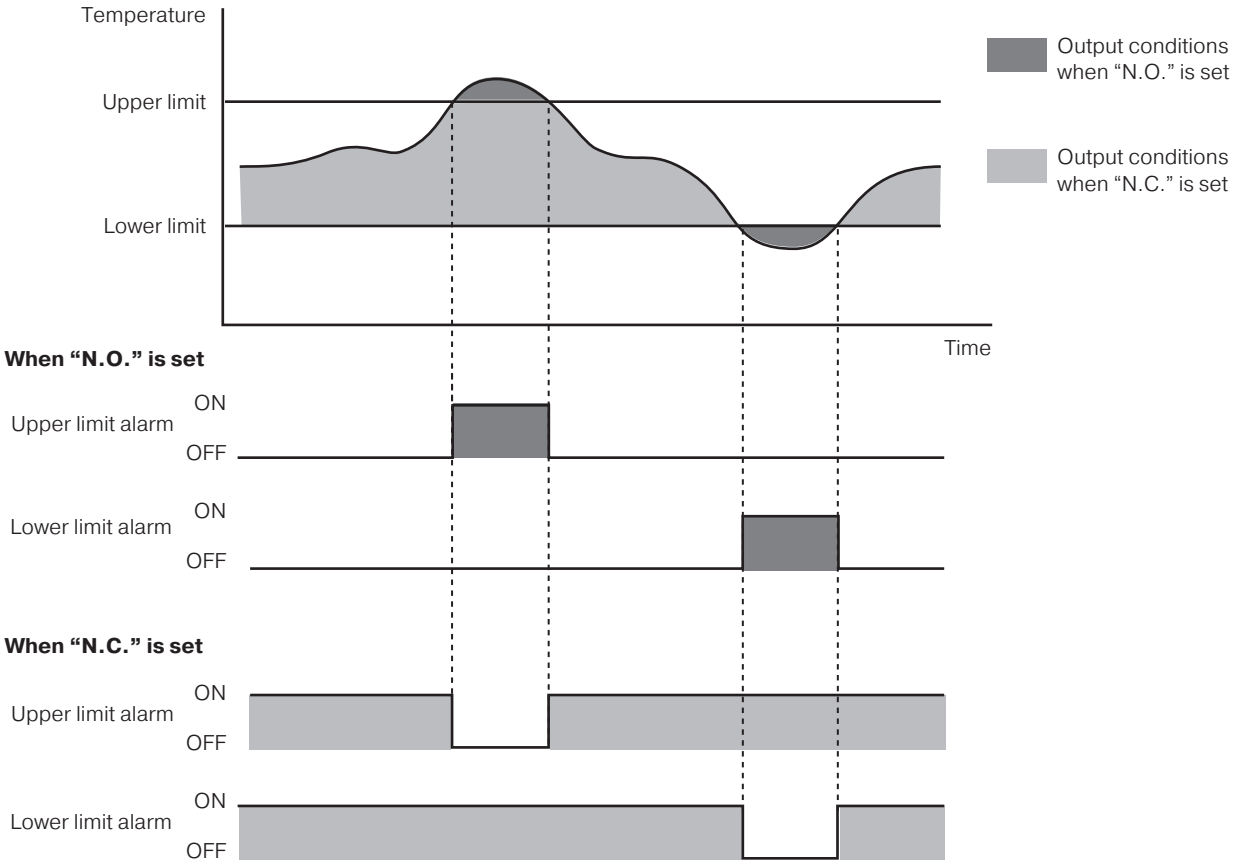
Selected item	Description of function	Setting range
NPN	Sets to NPN.	- (Default value: NPN)
PNP	Sets to PNP.	

5-5-2 Output Mode

Sets the output condition for alarm output to either N.O (normally open) or N.C. (normally closed). Changing the output mode setting selects the alarm output signal status when the measured temperature is outside the specified temperature range (upper/lower limit settings).

Selected item	Description of function	Setting range
N.O.	Sets the output mode to normally open. The alarm output signal turns ON when the measured temperature exceeds the specified temperature range (upper/lower limit settings).	- (Default value: N.O.)
N.C.	Sets the output mode to normally closed. The alarm output signal turns OFF when the measured temperature exceeds the specified temperature range (upper/lower limit settings).	

The differences in alarm output operation when “N.O” and “N.C.” are set are shown below.

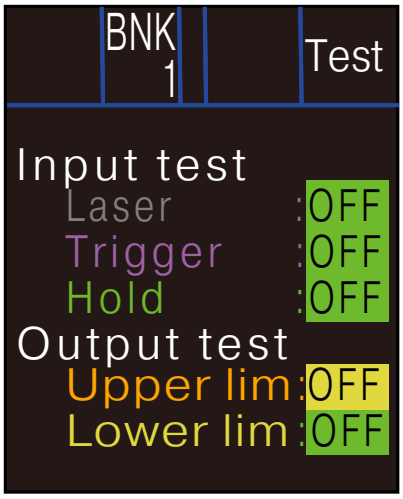


5-5-3 Test

A test can be performed of the input/output status using the general-purpose I/O cable.
This makes it possible to check the external signal input status and check for miswiring or open circuits from the direct output of alarm output.

MEMO

This setting item is only displayed when this product is connected using a general-purpose I/O cable.



Input test

Check the status changes when a signal from an external source is input.

Test item	Description
Laser	“ON” is displayed when a signal is input to the laser OFF input wire (gray).
Trigger	“ON” is displayed when a signal is input to the trigger input wire (purple).
Hold	“ON” is displayed when a signal is input to the hold input wire (green).

Output test

Operate this setting item to directly output the upper/lower limit alarm output.

Test item	Description
Upper limit output	When this setting item is set to “ON,” the upper limit alarm output is output from the upper limit alarm output wire (orange).
Lower limit output	When this setting item is set to “ON,” the lower limit alarm output is output from the lower limit alarm output wire (yellow).

5-6 Alarm

Sets the detection range for the temperature to output as alarm output.
Alarm output can be checked from the status display on the controller screen and the output signal of the general-purpose I/O cable.

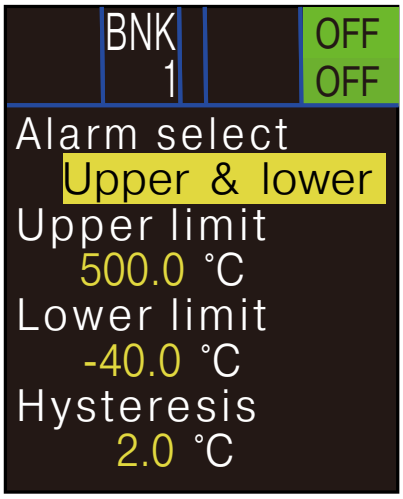
MEMO

The timing for output of the alarm output can be adjusted using the “Timer” setting. (“5-7 Timer Function” (page 5-29))

Changing to the setting menu

MODE >> “Alarm” >> SET

Setting items



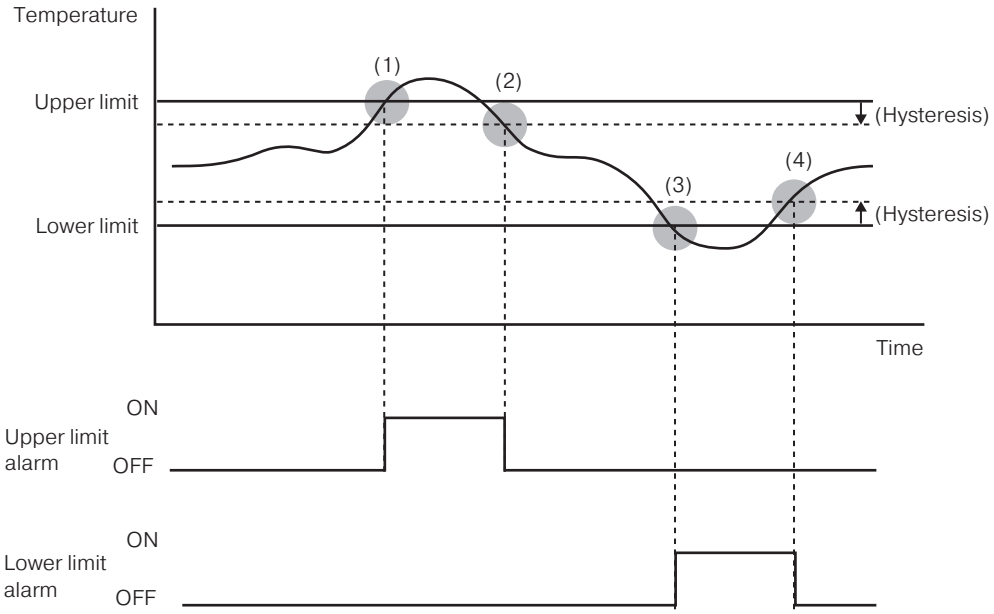
Setting items	Description of function
Alarm select	Sets the temperature output condition (Upper & lower, Not use, Upper limit only, Lower limit only) for alarm output.
Upper limit	Sets the upper limit temperature for alarm output.
Lower limit	Sets the lower limit temperature for alarm output.
Hysteresis	Sets the hysteresis applied to the temperature for alarm output OFF → ON and the temperature for alarm output ON → OFF.

5-6-1 Alarm Output

This function detects when the temperature deviates from a certain range.

The upper limit temperature (Upper limit) and lower limit temperature (Lower limit) can be set individually.

Example: Alarm select settings: “Upper & lower”



(1) Turns ON when temperature rises above the upper limit.

(2) Turns OFF when temperature drops below the temperature of “Upper limit - Hysteresis.”

(3) Turns ON when temperature drops below the lower limit.

(4) Turns OFF when temperature rises above the temperature of “Lower limit + Hysteresis.”

5-6-2 Alarm Select

Selects the temperature output condition for alarm output.

Selected item	Description of function
Upper & lower	When the measured temperature exceeds either the specified upper or lower limit, the upper limit alarm output or lower limit alarm output turns ON.
Not use	Alarm output is not used.
Upper limit only	When the measured temperature exceeds the specified upper limit, the upper limit alarm output turns ON.
Lower limit only	When the measured temperature exceeds the specified lower limit, the lower limit alarm output turns ON.

MEMO

The alarm output can be reversed using “Output mode” (“5-5 I/O Settings” (page 5-23)).

5-6-3 Upper Limit

Sets the upper limit temperature for alarm output.

Setting items	Description of function	Setting range
Upper limit	When the measured temperature exceeds the temperate that is set for this setting, the upper limit alarm output turns ON. This is displayed when the alarm select settings are set to “Upper & lower” or “Upper limit only.”	-40°C to 500°C (Default value: 500°C)

MEMO

The alarm output can be reversed using “Output mode” (“5-5 I/O Settings” (page 5-23)).

5-6-4 Lower Limit

Sets the lower limit temperature for alarm output.

Setting items	Description of function	Setting range
Lower limit	When the measured temperature exceeds the temperate that is set for this setting, the lower limit alarm output turns ON. This is displayed when the alarm select settings are set to “Upper & lower” or “Lower limit only.”	-40°C to 500°C (Default value: -40°C)

MEMO

The alarm output can be reversed using “Output mode” (“5-5 I/O Settings” (page 5-23)).

5-6-5 Hysteresis

Sets the hysteresis for upper limit alarm output and lower limit alarm output.

Setting items	Description of function	Setting range
Hysteresis	When alarm output chattering occurs as a result of small temperature changes, large variation in the measured temperature, or other cause, setting the hysteresis can prevent the chattering. (Refer to “5-6-1 Alarm Output” (page 5-27).) This is displayed when the alarm select settings are set to “Upper & lower,” “Upper limit only,” or “Lower limit only.”	0°C to 10°C (Default value: 2°C)

5-7 Timer Function

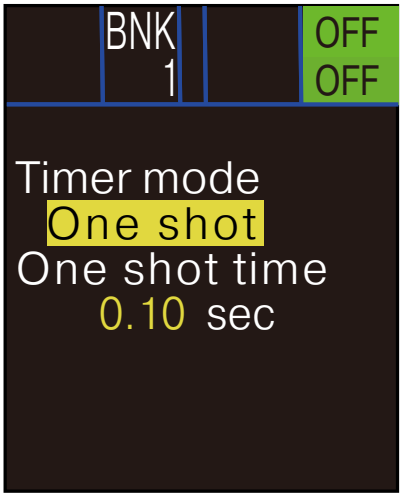
It is possible to apply a timer to alarm output in order to delay the ON or OFF timing, or to turn output ON only for a certain time.

Timer mode	Overview of function	Refer to
Not use	Timer function is not used. Alarm output continues for as long as the measured temperature exceeds the upper or lower limit.	-
One shot	Alarm output turns ON only for the set length of time. Set when you want to output alarm output for a specified length of time regardless of how long the measured temperature exceeds the upper or lower limit.	“5-7-1 Operation When One Shot Is Selected” (page 5-30)
Delay	It is possible to delay the alarm output ON timing or OFF timing. When “On delay time” is set, alarm output turns ON after a delay of the set length of time. When “Off delay time” is set, alarm output turns OFF after a delay of the set length of time. When both “On delay time” and “Off delay time” are set, it is possible to use ON + OFF delay.	“5-7-2 Operation When Delay Is Set” (page 5-31)

Changing to the setting menu

MODE >> “Timer function” >> SET

Setting items



Setting items		Description of function	Setting range
Timer mode	Not use	Selects the timer function type.	- (Default value: Not use)
	One shot		
	Delay		
One shot time		Displayed when “One shot” is selected. Sets the time when outputting alarm output for a specified length of time.	0.01 sec to 10.00 sec (Default value: 0.10 sec)

Setting items	Description of function	Setting range
On delay time	Displayed when “Delay” is selected. Sets the length of time for delay before turning alarm output ON.	0.00 sec (*1) to 10.00 sec (Default value: 0.10 sec)
Off delay time	Displayed when “Delay” is selected. Sets the length of time for delay before turning alarm output OFF.	0.00 sec (*1) to 10.00 sec (Default value: 0.10 sec)

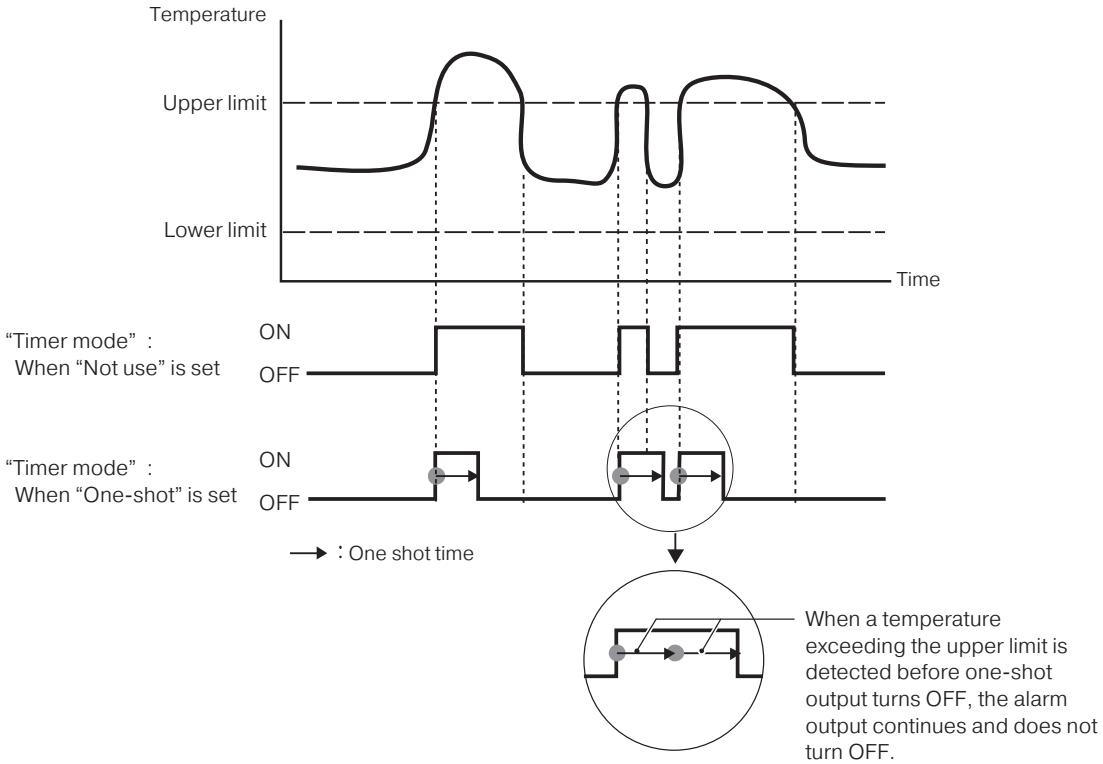
*1: When “0 sec” is set, the delay operation is not performed.

To use only the ON delay or OFF delay, set the delay which is not used to “0 sec.”

5-7-1 Operation When One Shot Is Selected

When the measured temperature exceeds the upper or lower limit, alarm output turns ON for the specified length of time that was set for “One shot time.”

Example: When the measured temperature exceeded the upper limit



5-7-2 Operation When Delay Is Set

It is possible to delay the alarm output ON/OFF timing when the measured temperature exceeds the upper or lower limit.
The time for delaying alarm output ON (On delay time) and time for delaying alarm output OFF (Off delay time) can be set individually.

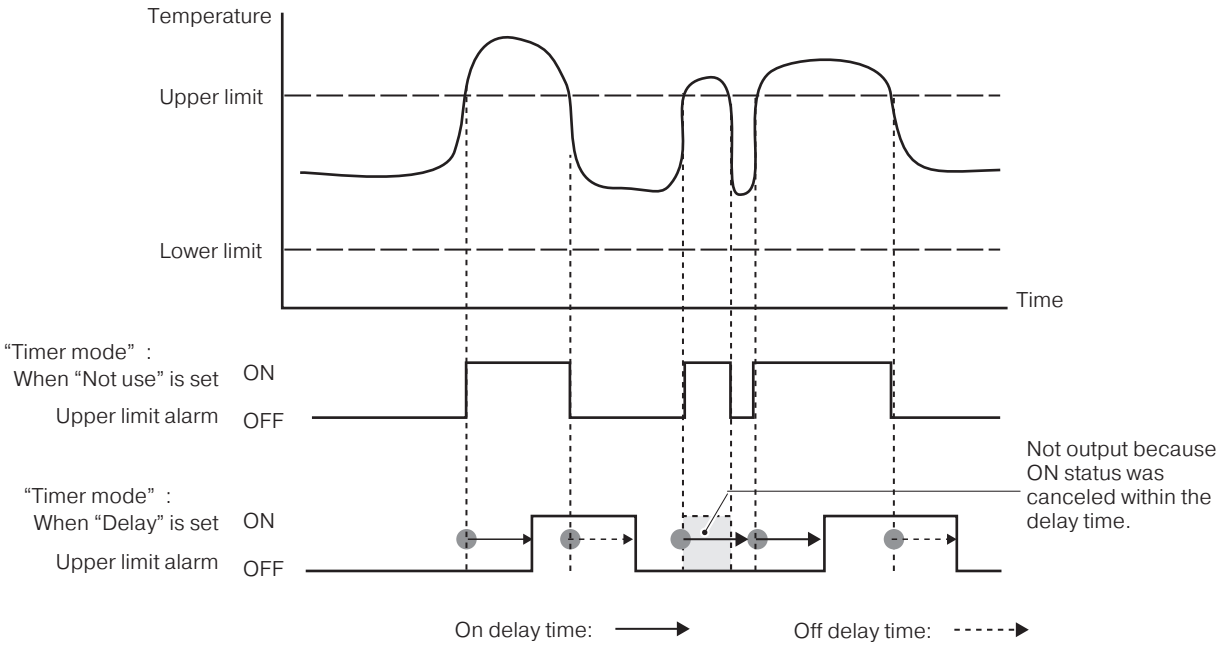
■ On delay time

Alarm output does not occur immediately when the measured temperature exceeds the upper or lower limit, and turns ON after the set “On delay time” has elapsed.
Because alarm output does not turn ON unless the time during which the upper or lower limit is exceeded is at or more than the On delay time, this can prevent chattering caused by momentary noise or other cause.

■ Off delay time

Alarm output does remains ON when the measured temperature returns to within the upper or lower limit, and turns OFF after the set “Off delay time” has elapsed.
Because alarm output does not turn OFF unless the time during which the temperature was within the upper or lower limit is at or more than the Off delay time, it is possible to acquire momentary changes even with a low-speed PLC.

Example: When the measured temperature exceeded the upper limit temperature



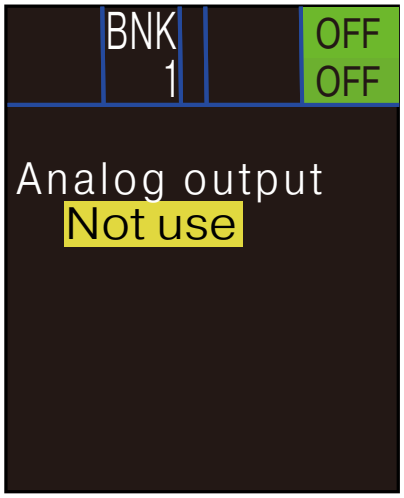
5-8 Analog Output

When the measured temperature is within the set analog output range, a voltage/current value is output according to the temperature.

■ Changing to the setting menu

MODE >> “Analog output” >> SET

■ Setting items



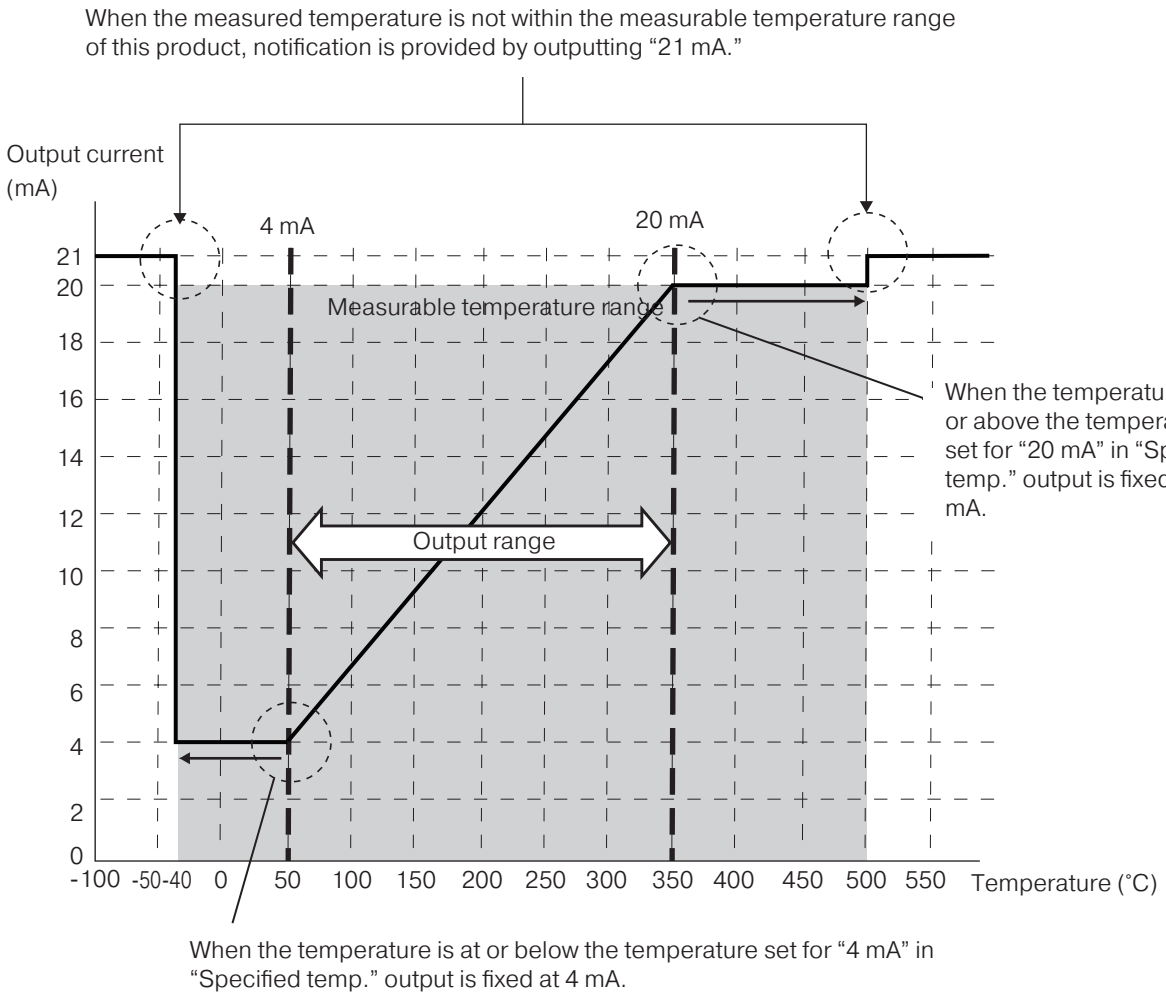
Setting items	Description of function
Analog output	Selects the analog output type (Current/Voltage).
Specified temp.	Sets the temperature range for analog output.
Test	It is possible to test analog output by outputting the specified current value or voltage value.

5-8-1 Example of Setting the Analog Output Range

Sets the temperature range for analog output.
When the measured temperature is within the output temperature range, a current/voltage value is output according to the temperature.
Shortening the distance between the output range lower limit and upper limit can make it easier to detect finer temperature changes.

Example: Analog output: “Current,” Specified temperature: “4 mA: 50°C,” “20 mA: 350°C”

When the measured temperature is within the analog output temperature range specified for “Specified temp.” (50 to 350°C), a current value of 4 to 20 mA is output according to the measured temperature.



MEMO

When a temperature outside the measurement range of this product (-40 to 500°C) is detected, notification is provided by means of the following analog output.
With analog current output (4 to 20 mA): 21 mA
With analog voltage output (0 to 10 V): 11 V

5-8-2 Analog Output

Selects the type of analog output (Current/Voltage).

Selected item	Description of function	Setting range
Not use	Analog output is not used.	- (Default value: Not use)
Current	Output as an analog current of 4 to 20 mA.	
Voltage	Output as an analog voltage of 0 to 10 V.	

5-8-3 Specified Temperature

Specifies the temperature for the analog output minimum value (0 V/4 mA) and the temperature for the analog output maximum value (10 V/20 mA) in order to specify the temperature range for output.

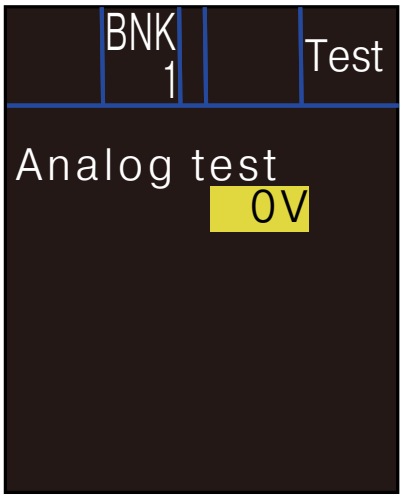
Selected item	Description of function	Setting range
4 mA	Displayed when “Current” is set for “Analog output.” Sets the temperatures for output of the minimum current value (4 mA) and maximum current value (20 mA).	-40.0 to 500.0°C (Default value: -40.0°C)
20 mA		-40.0 to 500.0°C (Default value: 500.0°C)
0 V	Displayed when “Voltage” is set for “Analog output.” Sets the temperatures for output of the minimum voltage value (0 V) and maximum voltage value (10 V).	-40.0 to 500.0°C (Default value: -40.0°C)
10 V		-40.0 to 500.0°C (Default value: 500.0°C)

5-8-4 Test

It is possible to test the analog output when using a general-purpose I/O cable.
It is possible to check for miswiring or open circuits by outputting the specified current value or voltage value.

MEMO

This setting item is only displayed when this product is connected using a general-purpose I/O cable.



Operate this setting item to output the specified current value or voltage value.

Test	Description
0 V/5 V/10 V (When “Voltage” is set for “Analog output”)	The voltage value selected in this item is output between the analog output wire (red) and the analog GND wire (white).
4 mA/12 mA/20 mA (When “Current” is set for “Analog output”)	The current value selected in this item is output between the analog output wire (red) and the analog GND wire (white).

5-9 Emissivity

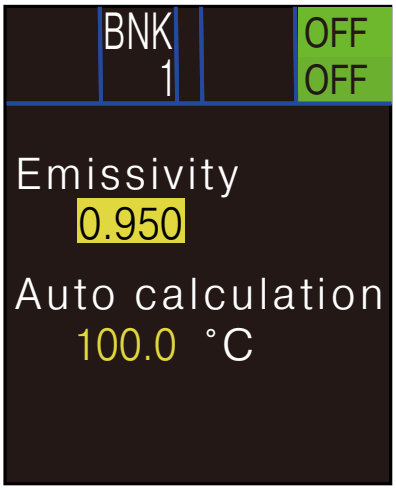
Sets the emissivity of the measurement target.

For details of the emissivity setting procedure, refer to “Emissivity Setting” (page 4-1).

■ Changing to the setting menu

MODE >> “Emissivity” >> SET

■ Setting items



Setting items	Description of function
Emissivity	Set by directly inputting the emissivity of the measurement target.
Auto calculation	The emissivity is calculated and set automatically when the temperature of the measurement target is input.

5-9-1 Emissivity

Directly input and set the emissivity.

Emissivity can be specified in the range of 0.100 to 1.200.

Setting items	Description of function	Setting range
Emissivity	Directly input the emissivity.	0.100 to 1.200 (Default value: 0.950)

5-9-2 Auto Calculation

Input the actual temperature of the measurement target.

The emissivity will be calculated and set automatically based on the input temperature.

Setting items	Description of function	Setting range
Auto calculation	Input the temperature of the measurement target.	-40.0°C to 500.0°C (Default value: 100.0°C)

MEMO

When auto calculation of the emissivity failed, an “Lack of temp.” or “Out of range” error is displayed.

For details of each error and the correction procedures, refer to “Error messages occurring at auto calculation” (page 4-6).

5-10 Laser Settings

Set the lighting method of the ring laser pointer that is emitted from the sensor head.

For the relationship between the ring laser pointer and the field of view, refer to “2-4-1 Relationship between the Field of View and the Ring Laser Pointer” (page 2-11).

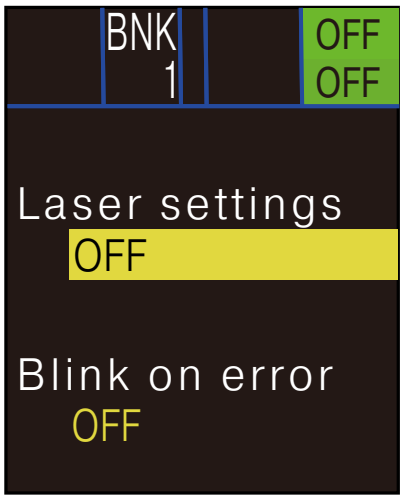
MEMO

- This ring laser pointer visually indicates the measurement position and field of view. Because the ring laser pointer is not used for temperature measurement, measurement is possible even when it is turned OFF.
- If the ring laser pointer is illuminated for a prolonged time, error may occur due to a decline in brightness or due to heating. Therefore, when the ring laser pointer is used, use this setting to specify the lighting method according to the purpose of use.

Changing to the setting menu

MODE >> “Laser control” >> SET

Setting items



Setting items	Description of function
Laser settings	Select the ring laser pointer lighting method from the available four types.
Lighting period	Set the time for lighting of the ring laser pointer.
Blink on error	It is possible to blink the ring laser pointer when an error occurs.

5-10-1 Laser Settings

The following types of ring laser pointer lighting methods exist.

Selected item	General Description	ON/OFF timing	
		ON	OFF
OFF	The ring laser pointer is not used.	-	Continually OFF
Specified period	The ring laser pointer is turned OFF automatically. Set the time for lighting OFF with “Lighting period.”	Press the SET key on the measurement screen.	Turns OFF automatically.
Manual	The ring laser pointer is turned ON/OFF manually.	Press the SET key on the measurement screen.*1	Press the SET key on the measurement screen.
Blink	The ring laser pointer blinks. Compared to “ON” (continuously ON), the effects of heating are reduced and the lifetime of the laser diode can be extended.	Continuously blinking*1	-
ON	The ring laser pointer is continually ON. Because doing so will shorten the laser diode lifetime, do not use under these conditions for prolonged periods.	Continuously ON*1	-

*1: An operation can be added which will blink the ring laser pointer at high speed when an error occurs.
(“5-10-3 Blink on Error” (page 5-40))

MEMO

It is possible to use external input (laser OFF input wire (gray)) to turn OFF the ring laser pointer.
(Refer to “2-1 Controller Wiring” (page 2-2).)

5-10-2 Lighting Period

Sets the lighting time of the ring laser pointer after manual lighting.
This is displayed only when using with “Specified period” selected.

Setting items	Description of function	Setting range
Lighting period	When the set time elapses, the ring laser pointer automatically turns OFF.	1 to 90 sec (Default value: 10 sec)

5-10-3 Blink on Error

When an error occurs while the ring laser pointer is illuminated, the ring laser pointer blinks at high speed to notify the operator of the error.

Selected item	Description of function	Setting range
ON	If the ring laser pointer is ON when an error occurs, the ring laser pointer blinks at high speed.	- (Default value: OFF)
OFF	The ring laser pointer does not blink at high speed when an error occurs.	

■ Conditions permitting “Blink on error”

The only time when it is possible for the ring laser pointer to blink at high speed when an error occurs is when the ring laser pointer is ON.
Therefore in order to cause the ring laser pointer to blink using this function, set “Laser settings” to “Manual,” “Blink,” or “ON” and illuminate the ring laser pointer prior to use.

■ Types of errors and warnings supporting “Blink on error”

The only time when the ring laser pointer blinks is when an error occurs. It does not blink when a warning occurs.
For the differences between errors and warnings, refer to “6-1-3 Causes and Correction Methods for Errors/Warnings” (page 6-3).

5-11 Display Settings

Sets the display direction, display language, and other display settings.

■ Changing to the setting menu

MODE >> “Display settings” >> SET

■ Setting items



Setting items	Description of function
Language	Selects the language for display on the controller screens.
Disp. direction	Selects the controller screen display direction.
Brightness	Sets the brightness of the controller screens.
Temperature unit	Selects the temperature units that are used on the controller screens.

5-11-1 Language

The language to display on the screens can be changed.

Selected item	Description of function	Setting range
English	Displayed in English.	*1
日本語	Displayed in Japanese.	
简体中文	Displayed in Chinese (simplified Chinese).	

*1: This is set on the setting screen that is displayed when the product is started for the first time or when the application reset is executed.

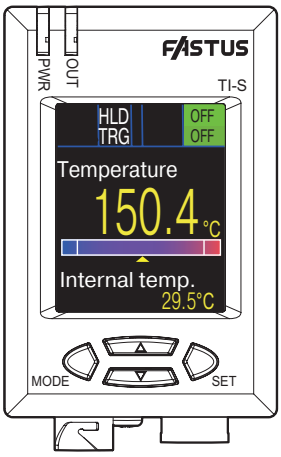
5-11-2 Disp. Direction

The display can be rotated in increments of 90°.

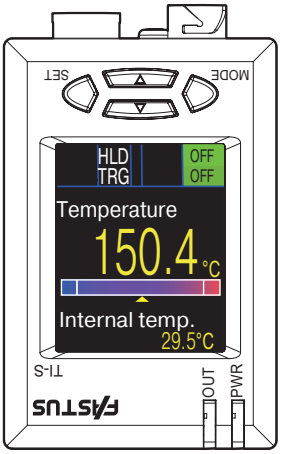
Set to match the installation direction of the controller.

Selected item	Description of function	Setting range
Vertical	This is the normal display.	- (Default value: Vertical)
Horizontal	Displayed horizontal, rotated 90° to the right from “Vertical.”	
VerticalRev.	Displayed inverted, rotated 180° from “Vertical.”	
HorizontalRev.	Displayed horizontal, rotated 90° to the left from “Vertical.”	

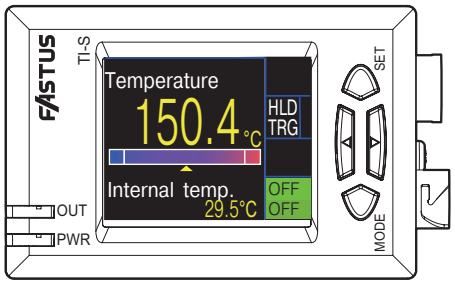
“Vertical”



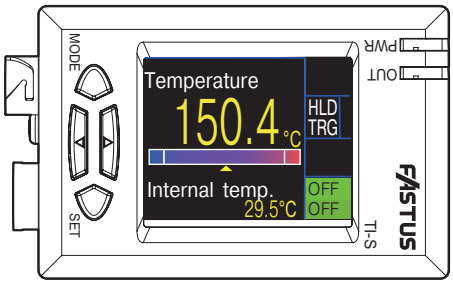
“VerticalRev.”



“Horizontal”



“HorizontalRev.”



5-11-3 Brightness

The screen brightness can be set.

Setting items	Description of function	Setting range
Brightness	The screen brightness can be adjusted in 15 stages.	1 to 15 (Default value: 15)

5-11-4 Temperature Unit

Specify the temperature display units.

Setting items	Description of function	Setting range
Temperature unit	Select either Fahrenheit or Celsius for the temperature display units.	°C, °F (Default value: °C)

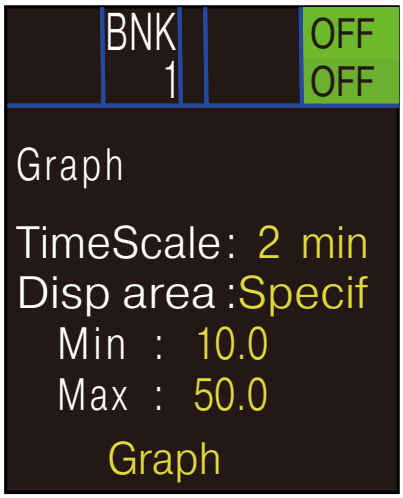
5-12 Graph

Changes in the measured temperature are displayed in a graph at fixed intervals.

■ Changing to the setting menu

MODE >> “Graph” >> SET

■ Setting items



Setting items	Description of function
Time Scale	Sets the time range (graph horizontal axis) for display in the graph.
Disp area	Sets the temperature range (graph vertical axis) for display in the graph.
Graph	Actually displays the graph.

5-12-1 Time Scale

The time range for display in the graph can be set up to 24 hours.
When the set time scale has elapsed, the graph display scrolls to display the most recent measurement value.

Selected item	Description of function	Setting range
Auto	The time range for display in the graph is automatically expanded (up to 24 hours) according to the measured time period.	- (Default value: Auto)
2 min / 10 min / 30 min / 1 hour / 3 hours / 6 hours / 12 hours / 24 hours	Sets the time range for display in the graph in the range of 2 minutes to 24 hours.	2 min / 10 min / 30 min / 1 hour / 3 hours / 6 hours / 12 hours / 24 hours (Default value: Auto)

5-12-2 Disp Area

Sets the temperature range for display in the graph.

Setting items		Description of function	Setting range
Auto		The temperature range for display in the graph is automatically adjusted (-40.0 to 500.0°C) according to the measured temperature.	- (Default value: Auto)
Specify		Specifies the temperature range for display in the graph. The graph temperature display can be fixed at the specified temperature range.	
	Min	Displayed when “Specify” is selected. Specify the minimum value and maximum value of the temperature range for display in the graph.	-40.0 to 500.0°C (Default value: -40.0°C)
	Max		-40.0 to 500.0°C (Default value: 500.0°C)

5-12-3 Graph

A graph is displayed based on the specified conditions.

For a description of graph display, refer to “3-1-3 Graph” (page 3-6).

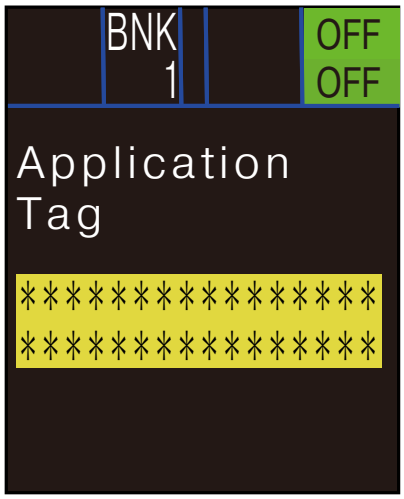
5-13 Application Tag

Registers a string for identifying this product from the IO-Link Master.
The application tag can be read/written via IO-Link.
For the application tag allocation destination, refer to “TI-S30-AP” (page 8-9).

Changing to the setting menu

MODE >> “Application tag” >> SET

Setting items



Setting items	Description of function	Setting range
Application tag	Up to 32 alphanumeric and symbol characters can be entered. The characters which can be input are the following. Numbers: 0 - 9, Alphabetic characters: A - Z, a - z, Symbols: *+,-./:;<=>?@[¥]^_`{|}~ !"#$%&'()	- (Default value: ***...***)

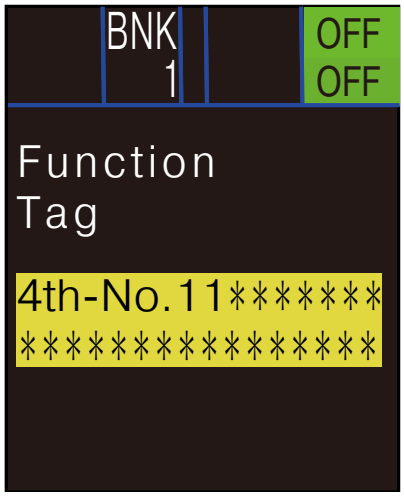
5-14 Function Tag

Registers a string for checking the functions and roles of this product from the IO-Link Master.
The function tag can be read/written via IO-Link.
For the function tag allocation destination, refer to “TI-S30-AP” (page 8-9).

Changing to the setting menu

MODE >> “Function tag” >> SET

Setting items



Setting items	Description of function	Setting range
Function tag	Up to 32 alphanumeric and symbol characters can be entered. The characters which can be input are the following. Numbers: 0 - 9, Alphabetic characters: A - Z, a - z, Symbols: *+,-./:;<=>?@[¥]^_`{|}~ !"#$%&'()	- (Default value: ***...***)

5-15 Location Tag

Registers a string for checking the installation location and other information for this product from the IO-Link Master.

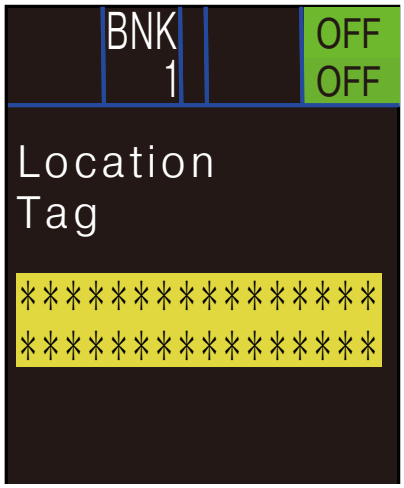
The location tag can be read/written via IO-Link.

For the location tag allocation destination, refer to “TI-S30-AP” (page 8-9).

Changing to the setting menu

MODE >> “Location tag” >> SET

Setting items



Setting items	Description of function	Setting range
Location tag	Up to 32 alphanumeric and symbol characters can be entered. The characters which can be input are the following. Numbers: 0 - 9, Alphabetic characters: A - Z, a - z, Symbols: *+,-./:;<=>?@[¥]^_`{|}~ !"#$%&'()	- (Default value: ***...***)

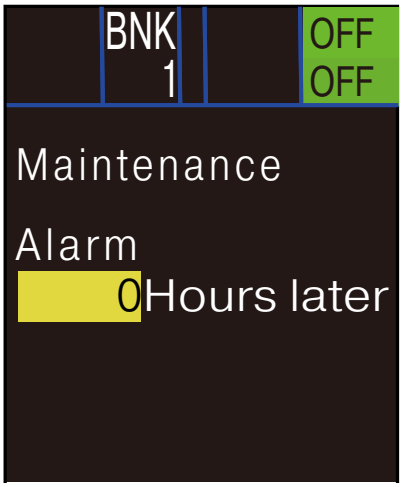
5-16 Maintenance

The timing for calibration, cleaning, and other maintenance can be set in advance.
When the time set for this item has elapsed, notification can be provided in the form of an alarm display on the screen.
For the maintenance timing notification method, refer to “7-1 Notification of Maintenance Timing” (page 7-2).

Changing to the setting menu

MODE >> “Maintenance” >> SET

Setting items



Setting items	Description of function	Setting range
Alarm	Sets the time units for maintenance timing. When a maintenance timing is set, the screen displays the remaining time before notification by alarm display. When “0” is set, the maintenance timing is reset.	0 to 87672 Hours later (Default value: 0 Hours later)

5-17 App. Reset

Reset the all settings of this product to the factory defaults.

■ Changing to the setting menu

MODE >> “App. reset” >> SET >> ▽ >> “EXECUTE” >> SET

When application reset is executed, the setting screen which appears at initial start is displayed.

For the setting operations on the setting screen for initial start, refer to “3-3 Setup at Initial Start” (page 3-12).

MEMO

- The contents which were set for each bank are all initialized.
- It takes about 1 second for the settings to be changed or initialized. Do not turn off the power during this time.

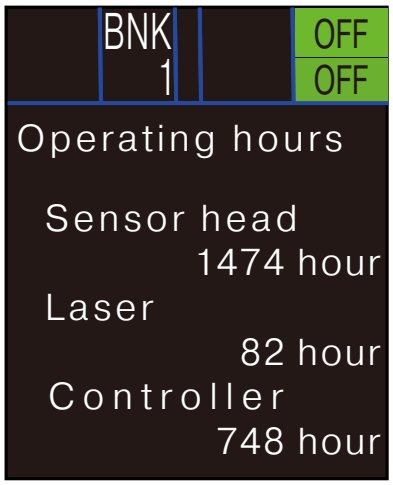
5-18 Information

Various information for this product can be checked.
Use this information as a standard for judgment of replacement timing and other maintenance of this product.

Changing to the setting menu

MODE >> “Information” >> SET >>

Display items



Setting items		Description of function
Operating hours	Sensor head	Displays the operation time for each sensor head/controller, as well as the emitting time for the ring laser pointer.
	Laser	
	Controller	
EEP write count	Sensor head	Displays the number of times that writing to EEPROM was performed for each sensor head/controller.
	Controller	
Serial No.	Sensor head	Displays the unique serial number assigned to each sensor head/controller.
	Controller	
Software version	Sensor head	Displays the software version of the sensor head/controller/LCD (CPU which performs display processing).
	Controller	
	LCD	
Temp. range	Upper limit	Displays the temperature range that can be measured with the connected head.
	Lower limit	

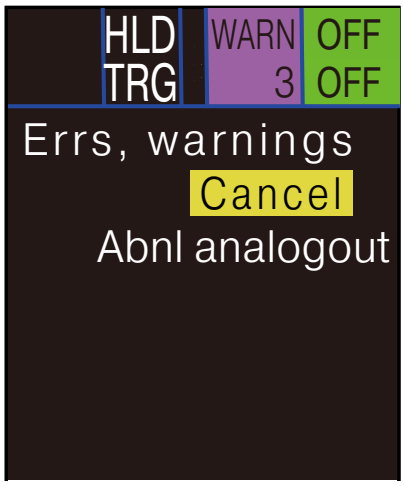
5-19 Errors and Warnings (Errs, Warnings)

The names of errors and warnings can be displayed, and the warning status can be canceled.

■ Changing to the setting menu

MODE >> “Errs, warnings” >> SET

■ Display items



Setting items	Description of function	Setting range
Errs, warnings	A maximum of six error and warning names are displayed in the order of priority (*1). Errors and warnings are displayed as shown below. Errors: The names of the currently occurring errors are displayed. When the cause of an error is corrected, the display automatically disappears. Warnings: The names of the currently occurring warnings are displayed. However, the warning display continues even after the cause of the warning has been corrected. Select “Cancel” on this screen to clear the warning display.	-
Cancel	Clears the display of warnings that occurred. However, the warning display cannot be cleared if the cause of the warning has not been corrected.	

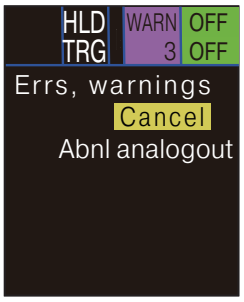
*1: The order of priority for errors is as shown below.
“Error (Error 1 to 6)” → “Major warning (Warning 1 to 4)” → “Minor warning (Warning 5 to 10)”
For the categories and order of priority for errors/warnings, refer to “6-1-1 Displays When an Error or Warning Occurs” (page 6-2).

5-19-1 Clearing the Warning Display

This clears the warning display.
Check the display contents for the displayed warnings, and if the causes of the warnings have been corrected, use this operation to clear the warning display.

● Operating procedure

1 **Confirm that "Cancel" has been selected and then press SET.**



2 **The warning is canceled.**

- Only warnings can be canceled. Errors cannot be canceled.
- The warning display cannot be cleared if the cause of the warning has not been corrected.



6

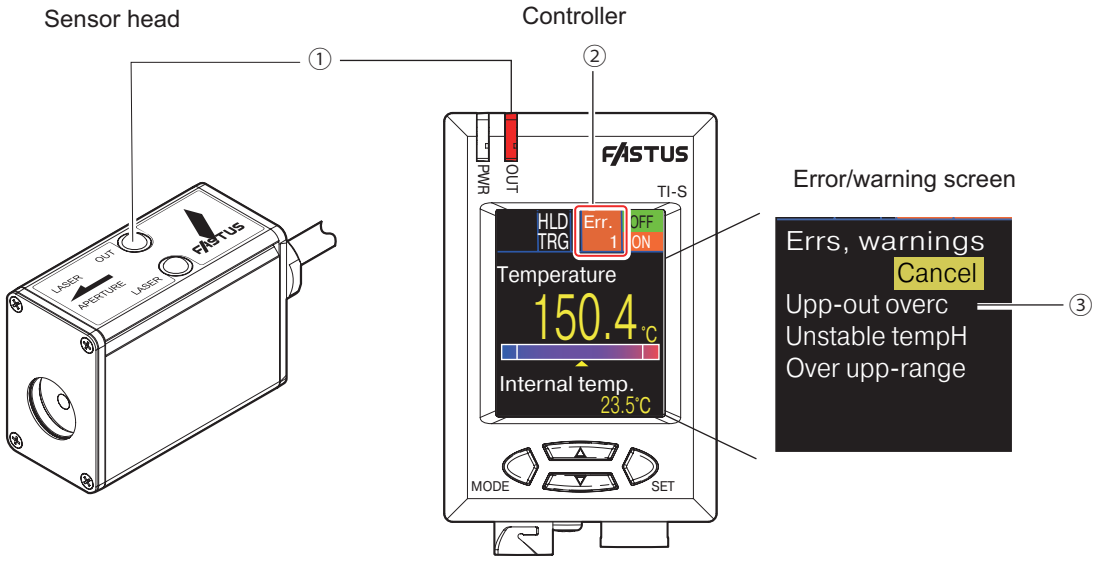
Troubleshooting

This section contains the error/warning display of this product, as well as the correction methods for trouble occurring during product use.

6-1 Error/Warning Display

6-1-1 Displays When an Error or Warning Occurs

When an error or warning occurs with this product, the error/warning is displayed via the output indicator on the sensor head, the output indicator on the controller, and on the display screen.



No.	Error/warning display	Description
①	Output indicator	Blinks as follows for each error or warning. Blinking red: Error (Error 1 to 6) has occurred. Blinking orange: Major warning (Warning 1 to 4) has occurred. Blinking green: Minor warning (Warning 5 to 10) has occurred.
②	Error/warning icon	Displays the error type (Error/Warning/Information) and number. When multiple errors or warnings have occurred, only the item with the highest priority among them is displayed.
③	Error/warning screen	Displays the name of the error (error/warning). When multiple errors or warnings have occurred, maximum six are displayed in the order of priority. For details of the error/warning screen, refer to “5-19 Errors and Warnings (Errs, Warnings)” (page 5-52).

MEMO

When an error occurs, the ring laser pointer in lit can be switched to blink.
This is useful when the output indicator light of the sensor head cannot be checked.

For details, see “5-10-3 Blink on Error” (page 5-40)

6-1-2 Error/Warning Categories and Order of Priority

The errors detected by this product are displayed classified into the following categories.
When alarms occur at the same time, the alarm with the highest order of priority is displayed.

Category	Number	Order of priority
Error	1 to 6	High
Warning	1 to 4	↓
	5 to 10	
Information	1	Low

6-1-3 Causes and Correction Methods for Errors/Warnings

The causes and correction methods for each error/warning type are shown below.

Error/warning display			Cause	Correction
Output indicator	Display	Error/ warning screen		
Blinking red	Errors 1	Abnl voltage_C	Low input voltage was detected at the controller.	Is the input voltage lower than the rated power supply voltage range? If the above problem is not the cause, there is the possibility of an error on the controller side. Please contact an OPTEX FA sales representative.
		Abnl voltage_c	An error was detected in the power supply circuit inside the controller.	There is the possibility of an error on the controller side. Please contact an OPTEX FA sales representative.
		Abnl voltage C	Both types of errors (above “Abnl voltage_C” and “Abnl voltage_c”) were detected.	
	Errors 2	Abnl voltage_H	An error was detected in the power supply voltage inside the sensor head.	Is the optional extension cable used to connect the sensor head and controller not longer than prescribed? If the above problem is not the cause, there is the possibility of an error on the controller side. Please contact an OPTEX FA sales representative.
		Abnl voltage_h	An error was detected in the circuit which supplies power from the controller to the sensor head.	There is the possibility of an error on the controller side. Please contact an OPTEX FA sales representative.
		Abnl voltage H	Both types of errors (above “Abnl voltage_H“ and “Abnl voltage_h”) were detected.	There is the possibility of an error in the controller or sensor head. Please contact an OPTEX FA sales representative.

Error/warning display			Cause	Correction
Output indicator	Display	Error/ warning screen		
Blinking red	Errors 3	Abnl laser	Laser error	Laser operation may be abnormal as a result of the laser lifetime, use under high-temperature conditions, or other reason. Immediately discontinue use of the sensor head, and contact an OPTEX FA sales representative.
	Errors 4	EEP read err_C	Failed to read from controller memory.	Please restart the product. If restarting does not correct the trouble, there is the possibility of an error in the controller. Please contact an OPTEX FA sales representative.
	Errors 5	EEP read err_H	Failed to read from sensor head memory.	Please restart the product. If restarting does not correct the trouble, there is the possibility of an error in the sensor head. Please contact an OPTEX FA sales representative.
	Errors 6	EEPwrite lmt_C	Failed to write to controller memory.	There is the possibility of an error in the controller. Please contact an OPTEX FA sales representative. * If the number of write operations exceeds the guaranteed count, an error will be output even if writing was successful.
	Errors 7	EEPwrite lmt_H	Failed to write to sensor head memory.	There is the possibility of an error in the sensor head. Please contact an OPTEX FA sales representative. * If the number of write operations exceeds the guaranteed count, an error will be output even if writing was successful.
	Errors 8	System error_H	Sensor head system error was detected.	Please restart the product. If restarting does not correct the trouble, there is the possibility of an error in the sensor head. Please contact an OPTEX FA sales representative.
Blinking orange (major warning)	Warning 1	Upp-out overc	Overcurrent was detected in the upper limit alarm output.	Is current exceeding 100 mA flowing to the output? Check the load resistance and voltage of the upper limit alarm output.
	Warning 2	Low-out overc	Overcurrent was detected in the lower limit alarm output.	Is current exceeding 100 mA flowing to the output? Check the load resistance and voltage of the lower limit alarm output.
	Warning 3	Abnl analogout	An error (open, short circuit) was detected in the analog output.	Check that a load is correctly connected at the analog output destination.
	Warning 4	Output protect	Voltage exceeding the controller rated voltage was detected, and output was stopped.	Check that use is within the range of the rated power supply voltage. Also check whether the product is installed in an environment that is susceptible to ambient noise, such as the same wiring being used for a high-voltage circuit or motor circuit.

Error/warning display			Cause	Correction
Output indicator	Display	Error/ warning screen		
Blinking green (minor warning)	Warning 5	Abnl temp_H	Sensor head internal temperature error	Is the product used in an environment with a high ambient temperature? Check the guaranteed operation temperature of the product before use. If the above is not the problem, there is the possibility of an error in the sensor head. Please contact an OPTEX FA sales representative.
	Warning 6	Unstable temp_H	Sensor head internal temperature is unstable. (Displayed when the change in sensor head internal temperature exceeds ±1°C/min.)	Is the product being used in an environment where there are large changes in ambient temperature? When there are large changes in ambient temperature, the measured temperature will become unstable. Use in an environment with a stable ambient temperature.
	Warning 7	Over upp-range	Measured temperature exceeded the upper limit of the measurement range. (*1)	Was a temperature measured that is outside the measurement range? Use within the measurement range.
	Warning 8	Over low-range	Measured temperature exceeded the lower limit of the measurement range. (*1)	Was a temperature measured that is outside the measurement range? Use within the measurement range.
	Warning 9	Over runtime_L	Laser use time exceeding the estimated lifetime was detected.	Is the laser being used beyond its estimated lifetime (10,000 hours)? From the menu “Information” screen, check the laser operation time. If the above is not the problem, restart the controller.
	Warning 10	Over runtime_C	Controller use time exceeding the estimated lifetime was detected.	Is the controller being used beyond its estimated lifetime (175,200 hours)? From the menu “Information” screen, check the controller operation time. If the above is not the problem, restart the controller.
-	Information 1	-	Maintenance timing (Time specified by the user was exceeded.)	The alarm time which was specified by the user on the “Maintenance” screen was exceeded. Perform the maintenance that was decided in advance by the user. “Information 1” where notification was provided is cleared when the alarm time is reset on the “Maintenance” screen. For details, refer to “5-16 Maintenance” (page 5-49).

*1: During analog output, when a temperature outside the measurement range of this product (-40 to 500°C) is detected, notification is provided by means of the following analog output.
With analog current output (4 to 20 mA): 21 mA
With analog voltage output (0 to 10 V): 11 V

6-1-4 Timing of Error/Warning Clear

■ Canceling an error

When the cause of an error is corrected, the error is automatically cleared.

■ Canceling a warning

The warning display continues even after the cause of the warning has been corrected.
To clear the warning display, clear it manually on the “Error/warning screen.”
(📖 “5-19-1 Clearing the Warning Display” (page 5-53))

6-2 Troubleshooting

This section contains the correction methods for trouble occurring during use.

During installation and setup

Trouble	Check	Correction
Cannot perform measurement. (Nothing is displayed.)	Is the power supply voltage not being applied?	Check that the lead wire and connector are securely connected.
	Is the power supply voltage low?	Check that the power supply voltage range is within the rated range of 24 VDC±10% (18 to 30 VDC±10% when connected using IO-Link).
Emissivity cannot be set automatically.	Is the “Lack of temp.” error displayed?	Calculation of emissivity is not possible because the temperature difference between the measurement target and the ambient temperature (sensor head internal temperature) is too small. Set again after either raising the temperature of the measurement target to increase the temperature difference from the ambient temperature, or else distancing the measurement target from the sensor head.
	Is the “Out of range” error displayed?	Calculation of emissivity was not possible because the temperature difference between the temperature input for auto calculation and the temperature of the measurement target was too large. Input again using a temperature that is closer to that of the measurement target. If an error is displayed again, set by directly inputting the emissivity in the “Emissivity” item.
The ring laser pointer does not turn ON.	Is “Laser settings” from the settings menu set correctly?	Refer to “5-10-1 Laser Settings” (page 5-39) and set correctly.
	Is the laser beam outlet dirty?	Clean the laser beam outlet. For details of the laser emission outlet, refer to “1-4-1 Sensor Head” (page 1-8).
	Is the laser beam outlet blocked?	Remove any dirt and foreign substances from the laser beam outlet.
	Is the laser OFF input wire (gray) being used?	Set the input signal to OFF.
	After waiting for a time and turning the ring laser pointer ON again, does it illuminate?	It is possible that lighting has stopped due to electrical noise from an external source. If this is the cause, press the SET key or add signal to the external input after some time, then the ring laser pointer will be emitted.
Communication with external devices is not possible.	Are the sensor head, controller, and each cable connected correctly? Is "Not connected." displayed on the controller screen?	If the sensor head and controller are disconnected, I/O output and IO-Link communication are not possible. Securely connect the sensor head and controller.
Setting contents cannot be changed.	Is a key icon displayed at the top of the screen?	Operation lock is activated in order to mis-operation. Input the password and cancel operation lock. “3-2 Operation Lock” (page 3-9)

Trouble	Check	Correction
Settings are not changed even if the settings are changed.	Did you turn off the power to the product immediately after changing the settings or initializing the set values?	It takes about 1 second for the settings to be changed or initialized. Do not turn off the power during this time.
Settings are not initialized to their initial state.		
I have forgotten the operation lock password.	Did you use the default password?	If you have not changed the password for operation lock, enter the default value ("0000") to unlock. If you have changed the password for the operation lock but have forgotten the password, please use the service data of IO-Link (index number 12) to unlock. if IO-Link is not used, contact OPTEX FA and return this product.
The display language has been incorrectly set.	-	Display the measurement screen and press and hold the  key. The display switches to the “Display Settings” screen, and then change to the correct language in the “Language”.

During measurement

Trouble	Check	Correction
Measurement values are high.	Is the emissivity value of this product set too low?	Change the emissivity to the optimal value. Refer to “4-1-1 Setting the Emissivity” (page 4-2).
	Is the temperature monitored by a thermocouple or similar means lower than the actual surface temperature?	Change the monitoring method.
	Is there a high-temperature object located close to the sensor head?	There is the possibility that heat radiated from the high-temperature object may be affecting measurement. Block the heat source using a board, etc.
Measurement values are low.	Is the emissivity value of this product set too high?	Change the emissivity to the optimal value. Refer to “4-1-1 Setting the Emissivity” (page 4-2).
	Is the lens dirty?	Clean the lens.
	Is the measurement target too small?	Check that the measurement target is 1.5 × confirmation required the diameter of the field of view. Change the measurement distance so it is at or above this size. For details of the measurement distance, refer to “2-4-1 Relationship between the Field of View and the Ring Laser Pointer” (page 2-11).
	Are the field of view and measurement target displaced from each other?	Adjust the installation position of this product while checking the measured value. The ring laser pointer makes it easy to position the center of the measurement target as the field of view. For details of the ring laser pointer, refer to “2-4 Alignment Using the Ring Laser Pointer” (page 2-10).
	Is there an obstruction between the measurement target and lens?	Remove any obstructions between the measurement target and lens.
The temperature value is not stable.	Is there a fan or similar device located close to the product?	The air from a fan or similar device may produce instability in the temperature of the product or measurement target. Block airflow to the sensor head and measurement target.

Trouble	Check	Correction
The measured value is not stable.	Is the sensor head moving due to vibration?	Install in a location that is free of vibration, or install vibration damping countermeasures.
	Is the sensor head subjected to sudden temperature changes?	Leave the sensor head with the power on for a while to stabilize the internal temperature.
	Is a shiny metallic surface being measured as the measurement target?	There is the possibility of error occurring. Affix the optional black tape to the measurement target before performing measurement.
	Is there noise present in the analog signal?	Reduce the distance from the analog input device, and shorten the wiring length for the analog signal.
		Because analog voltage output is susceptible to noise, use analog current output.
		Increase the averaging time setting for the analog input device within the allowable range.
		Attach a ferrite core to the analog output wire (red) and the analog GND wire (white).
		If analog output wire (red) and analog GND wire (white) are wired in the same pipe or parallel to the power line, they should not be in the same pipe or parallel wiring.

7

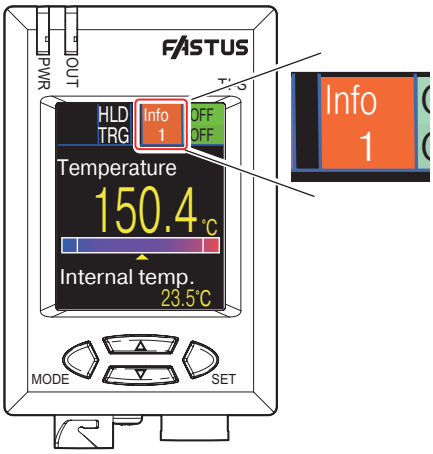
Maintenance

This section describes the maintenance procedures for this product.

7-1 Notification of Maintenance Timing

With this product, notification of the preset calibration or cleaning timing is provided as an error or warning display on the screen.

For details of the maintenance timing settings, refer to “5-16 Maintenance” (page 5-49).



● Maintenance timing settings

Sets how many hours (range: 0 to 87672 hours) to provide notification after the current time when the setting is made.

● Clearing the maintenance timing

To reset/clear the maintenance timing, set the “Maintenance” timing to “0.”

The maintenance events displayed on the screen are also cleared.

7-2 When Only the Sensor Head or Controller Was Replaced

Because the sensor head and controller are calibrated individually, it is possible to replace and use either the sensor head or controller separately.
When only the sensor head or controller was replaced, reconfigure the following setting items.

MEMO

When an IO-Link connection is used, it is possible to use the IO-Link restore function to restore the conditions prior to replacement at both the sensor head and controller side.

Items that must be reconfigured when the sensor head was replaced

Setting items	
Bank	Current bank number
Operation mode	Operation mode
Measurement mode	Measurement mode
	Edge detect time "edge detection" setting"
	Edge detect diff "edge detection" setting"
Alarm	Alarm select
	Upper limit
	Lower limit
	Hysteresis
Timer function	Timer mode
	One shot time
	On delay time
	Off delay time
Analog output*1	Specify temp.
Emissivity	Emissivity
Maintenance	Maintenance

*1: Analog output settings “Not use,” “Current,” and “Voltage” are items on the controller side.

● Items that must be reconfigured when the controller was replaced

Setting items	
I/O settings	I/O settings
	Output mode
Analog output*1	Analog output
Laser control	Laser settings
	Lighting period
	Blink on error
Display settings	Language
	Disp. direction
	Brightness
	Temperature unit
Graph	TimeScale:
	Disp area:
Application tag	Application tag
Function tag	Function tag
Location tag	Location tag

*1: The analog output setting “Specify temp.” is an item on the sensor head side.

7-3 Maintenance Procedures

This section describes the cleaning and calibration procedures for this product.

Cleaning procedures

Subject part	Procedure
Lens	Dust, dirt, and scratches on the lens can cause incorrect measurements. In case of dirty lenses, remove the dust on the lens with a lens cleaning blower or other means. If the dust or dirt cannot be removed with a blower, lightly wipe the lens with a cotton swab or special lens cleaning cloth using a small quantity of ethyl alcohol.
Sensor head	Wipe the sensor head with water to wipe off any dirt. Water droplets on the lens part may cause temperature errors, so be sure to wipe it off with a soft cloth or blow it off with air before use.
Controller	If dirt on the controller is stubborn, wipe gently with a moist cloth. Do not use alcohol. It may penetrate the surface or erase the printing. If the controller is heavily soiled, wipe it with a cloth lightly dampened with diluted neutral detergent. Do not use alcohol or similar substances, as they may damage the surface and erase the printing.

Calibration

OPTEX FA recommends calibrating the sensor head annually.

Contact the dealer where you purchased the product or contact OPTEX FA.

8

Appendix

This section contains the specifications, external dimensions, and IO-Link index list.

8-1 Specifications

8-1-1 Sensor Head Specifications

TI-S30

Model		TI-S30
Measurement range*1		-40 to +500 °C
Display range*1		-50 to +510 °C
Field of view		Ø30 mm at 500 mm
Optics		Silicon lens
Sensing element/spectral response		Thermopile/8 to 14 µm
Response time (operating mode)		High speed response, 50 ms, 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s Output response 90%*2
Accuracy*3		-40 to 0 °C: ±1.5 °C +1 to +200 °C: ±1 °C +201 to +500°C:±0.5 % of reading value
Repeatability		±0.5 °C (operating mode: 100 ms)
Temperature drift		±0.25°C/°C or less
Emissivity adjustment		0.100 to 1.200
Supply voltage		4.4 to 5 VDC (Supplied from controller)
Current consumption		30 mA or less/ 5 VDC
Connection		Pigtail cable 3 m Minimum bending radius: 31 mm
Total cable length		Maximum 13 m (pigtail cable 3m + extension cable 10m)
Laser pointer	Medium	Red semiconductor laser
	Waveleng	663 nm
	Maximum output	1 mW
Laser class (JIS/IEC/FDA)*4		CLASS 2
Environmental resistance	Degree of protection	IP67 (IEC 60529)
	Ambient temperature	0 to +80 °C (up to +70 °C during laser emission)
	Ambient humidity	35 to 85% RH (no condensation)
	Storage temperature	-20 to +80 °C
	Vibration resistance	10 to 55 Hz Double amplitude 1.5 mm 2 hours in each of the X,Y and Z directions
	Shock resistance	500 m/s² (Approx. 50 G) 3 times in each of the X,Y and Z directions
	Atmosphere	No corrosive gas
	Operating altitude	0 to 2000 m
	Installation location	In door use
Pollution degree		2
Applicable regulations	EMC	EMC Directive (2014/30/EU) UK EMC (The Electromagnetic Compatibility Regulations 2016) FCC Part 15 subpart B
	Environment	RoHS Directive (2011/65/EU), China RoHS (MIIT Order No. 32) UK RoHS (The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012)
	Safety	FDA Regulation (21 CFR 1040.10 and 1040.11*5)
Applicable standards		EN / IEC 61326-1
NRTL Certification		UL Recognized Component certification for the US and Canada.
Material		Case: aluminium, Front plate: stainless steel
Weight		Approx. 180 g

*1: If the measured temperature is below -50°C (lower limit display temperature), the displayed temperature is -50°C.
If the measured temperature is above 510°C (upper limit display temperature), the displayed temperature is 510°C.

*2: The response time is the time it takes for the output change to reach 90%.

*3: Measurement conditions: Emissivity; 1.000, Ambient temperature; 23 ±5 °C, Size of the measurement target; sufficiently larger than the field of view.

*4: In accordance with the FDA provisions of Laser Notice No. 56, the laser is classified per the IEC 60825-1:2014 standard.

*5: Excluding differences per Laser Notice No. 56.

8-1-2 Controller Specifications

TI-SC(E)

Model			TI-SC(E)
Rating	Supply voltage		24 VDC ±10 %*1 (when using general-purpose I/O cable) 18 to 30 VDC (when using IO-Link cable)*2
	Current consumption		180 mA (when using general-purpose I/O cable)*3 50 mA (when using IO-Link cable)
Display resolution			0.1 °C/°F
Temperature unit			Celsius "°C"/Fahrenheit "°F"
Measurement mode			Normal/Sample hold/Peak hold/Valley hold/Edge detection
Response time (operating mode)			High speed/50 ms/100 ms/200 ms/500 ms 1 s/2 s/5 s /10 s/20 s Output response 90 %*4
Analog output/IO-Link update time			High speed: 2.5 ms 50 ms to 2 s: 5.0 ms 5s to 20 s: 100 ms
Analog output	Resolution		10,801 steps
	Accuracy	Voltage	± 0.2 % of F.S. (at ambient temperature of 25 °C) Temperature coefficient (typical): ± 22 ppm/°C (± 0.0022 %/°C)
		Current	± 0.2 % of F.S. (at ambient temperature of 25 °C) Temperature coefficient (typical): ± 4 ppm/°C (± 0.0004 %/°C)
Indicator	Display		1.8 inch TFT LCD Display language: English, Japanese, Simplified Chinese
	Power indicator		When power is ON: lights in green, IO-Link communication: blinks in green
	Output indicator		Normal measurement alarm output OFF : lights green Normal measurement alarm output ON : lights red When minor warning occurs : blinks green When major warning occurs : blinks orange When an error occurs : blinks red
Interface	Alarm output		NPN/PNP open collector (selectable by setting) 1 output: Max. 100 mA, 2 outputs: Max. 100 mA Residual voltage NPN: 1.6 V or less, PNP: 3.4 V or less
	Output mode		N.O./N.C.
	External input		Laser off, Hold, Trigger
	Analog output	Current	4 to 20 mA load impedance: 150 to 500 ohm
		Voltage	0 to 10 V output impedance 200 ohm or less
Timer mode			One shot/delay (ON delay, Off delay) one shot: 0.01 to 10.00 sec, delay: 0.00 to 10.00 sec
IO-Link	Revision		1.1.3
	Baud rate		COM3 (230.4 kbps)
	Number of process input data bytes		4 bytes
	Number of process Output data bytes		1 byte
	Minimum cycle time		0.5 ms
	Data storage class		Data Storage class 1:automatic DS

Model			TI-SC(E)
Connection type	General-purpose I/O cable		3 m cable 9 wires, Minimum bending radius: R 42 mm
	IO-Link cable	Open-end	3 m cable 3 wires, Minimum bending radius: R 42 mm
		M12 4 pin connector	0.3 m cable with M12 4-pin connector, Minimum bending radius: R 42 mm
Environmental resistance	Degree of protection		IP40 (IEC 60529)
	Ambient temperature		0 to +50 °C
	Ambient humidity		35 to 85%RH (no condensation)
	Storage temperature		-20 to +70 °C
	Vibration resistance		10 to 55 Hz Double amplitude1.5 mm 2 hours in each of the X, Y and Z directions
	Shock resistance		500 m/s^2 (Approx. 50 G) 3 times in each of the X,Y and Z directions
	Atmosphere		No corrosive gas
	Operating altitude		0 to 2000 m
	Installation location		In door use
Pollution degree			2
Applicable regulations	EMC		EMC Directive (2014/30/EU) UK EMC (The Electromagnetic Compatibility Regulations 2016) FCC Part 15 subpart B
	Environment		RoHS Directive (2011/65/EU) UK RoHS (The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012) China RoHS (MIIT Order No.32))
Applicable standards			EN/IEC 61326-1
NRTL Certification			UL Recognized Component certification for the US and Canada.
Material			Case:ABS
Weight			Approx. 80 g

*1: Use a Class 2 Power Supply or a power supply compliant with the LIM (Limited Energy Circuit) circuit standards.

*2: The IO-Link master used for IO-Link connection must be compatible with a Class 2 Power Supply or LIM (Limited Energy Circuit) circuit standards.

*3: Includes alarm output load current and analog output current.

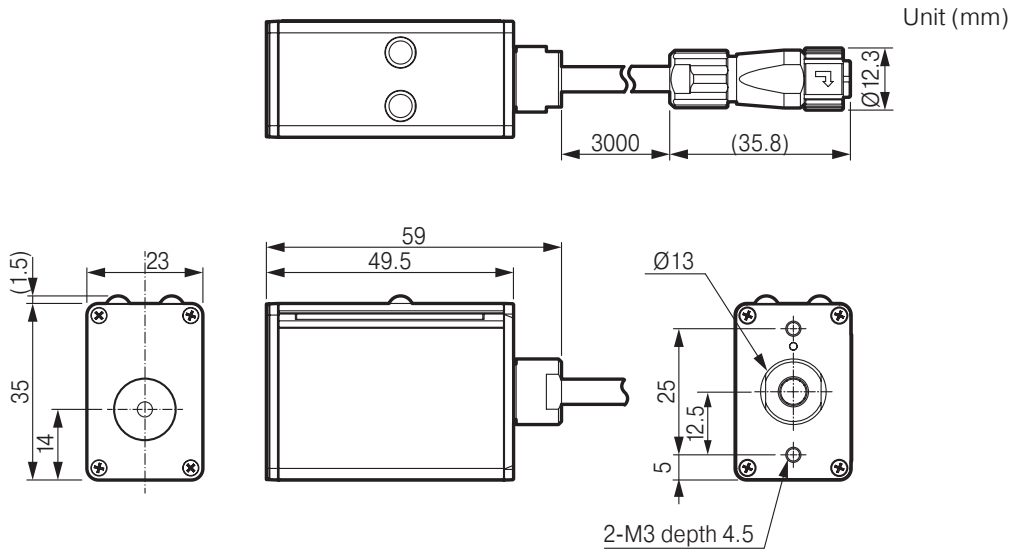
*4: The response time is the time it takes for the output change to reach 90%.

8-1-3 Dimensions

Sensor head

TI-S30

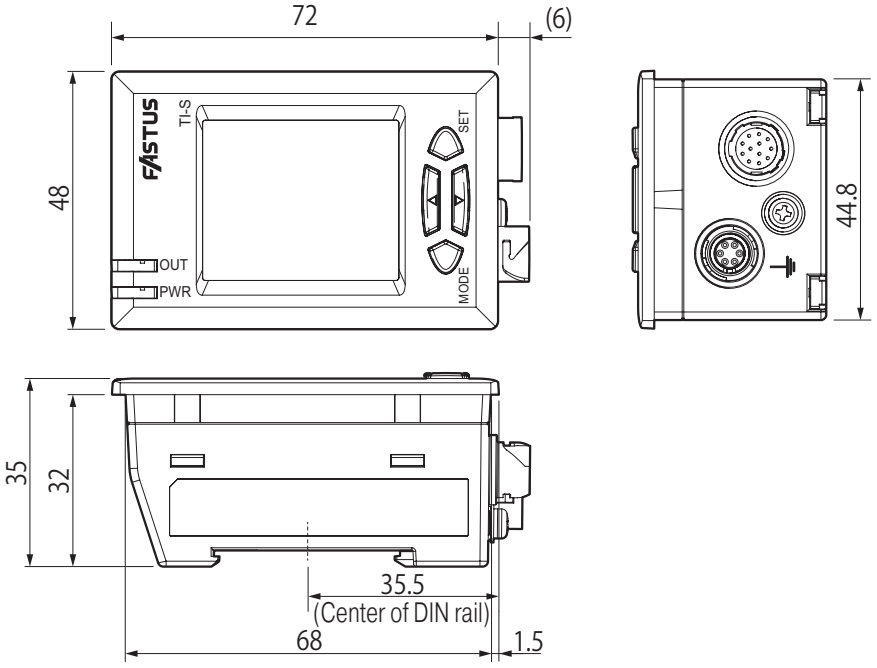
Unit (mm)



Controller

TI-SC (E)

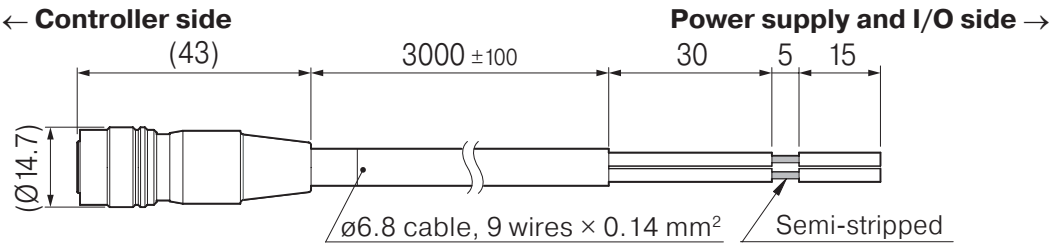
(Unit: mm)



■ General-purpose I/O cable (Option)

● TI-SCA09-G3K (open-end)

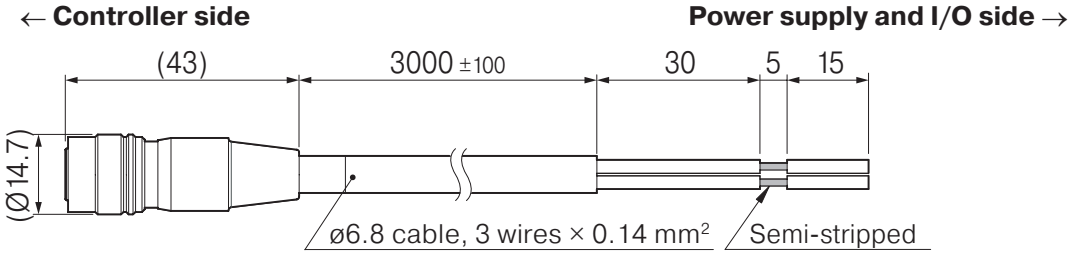
(Unit: mm)



■ IO-Link cable (Option)

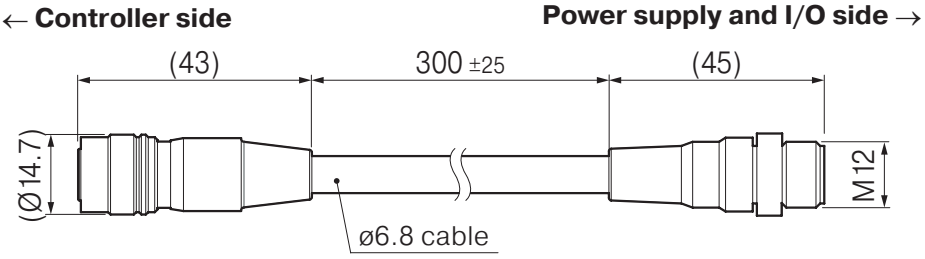
● TI-SCA03-G3K (open-end)

(Unit: mm)



● TI-SM1203-G03K (M12 connector on end)

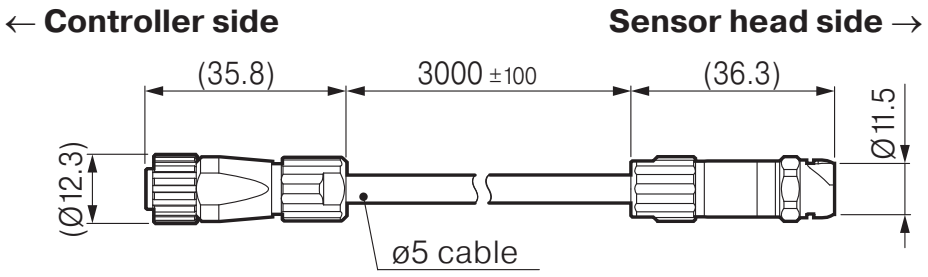
(Unit: mm)



Extension cable connecting the sensor head and controller (Option)

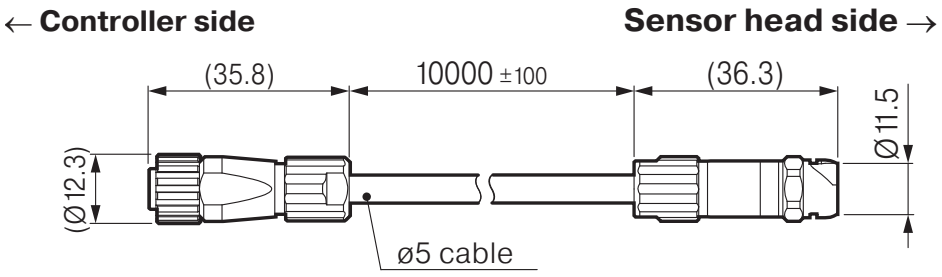
TI-SSA06-G3K(3m length)

(Unit: mm)



TI-SSA06-G10K(10m length)

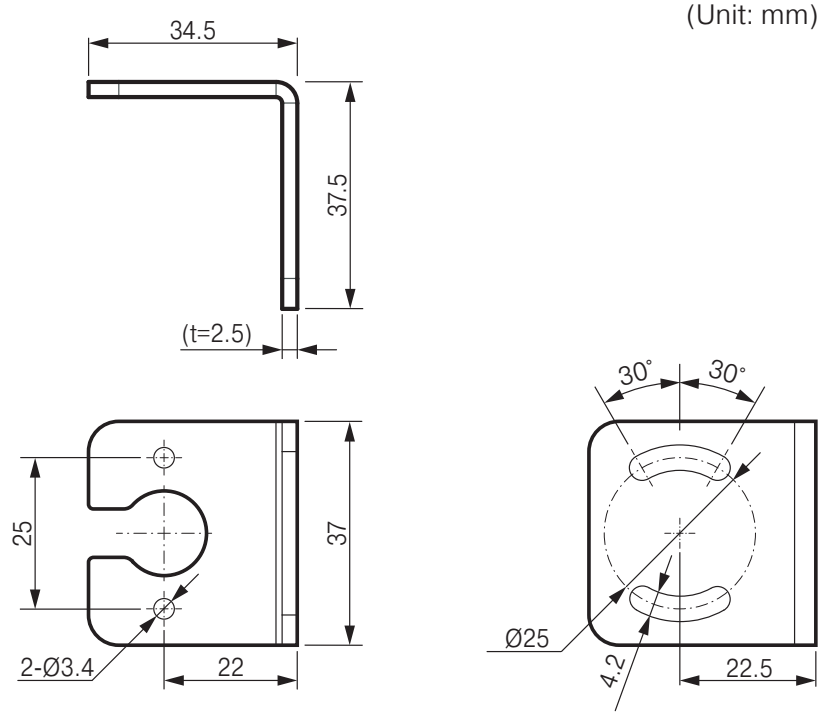
(Unit: mm)



Sensor head mounting bracket (Option)

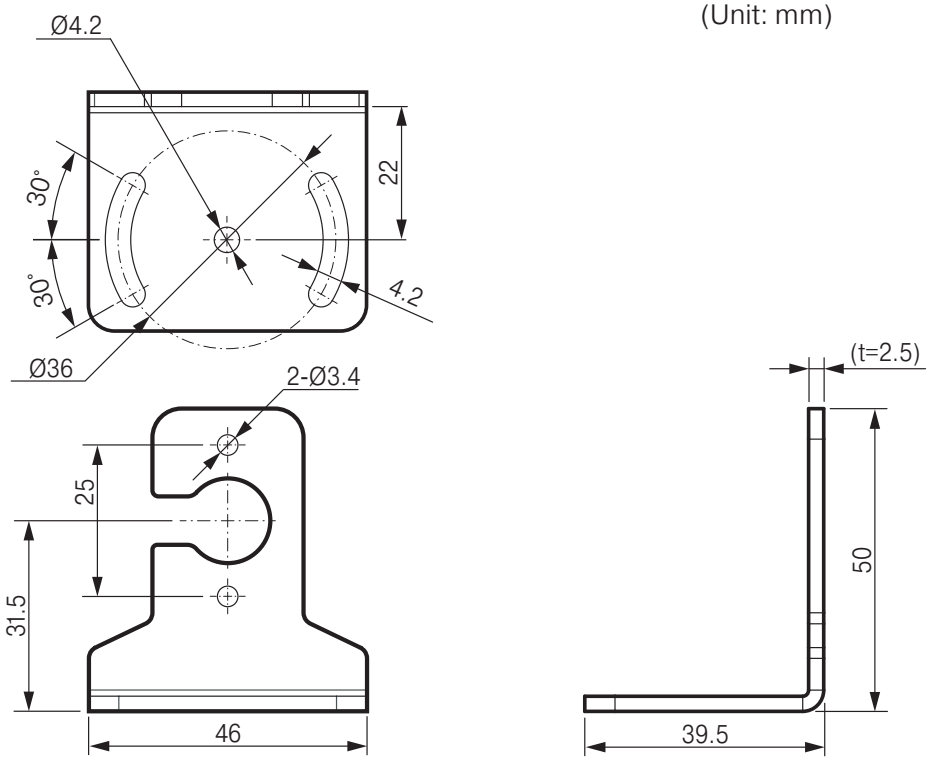
BEF-TISH-A (Wall mounting bracket)

(Unit: mm)



● BEF-TISH-B (Floor mounting bracket)

(Unit: mm)



● BEF-TISH-AB (2-axis mounting bracket)

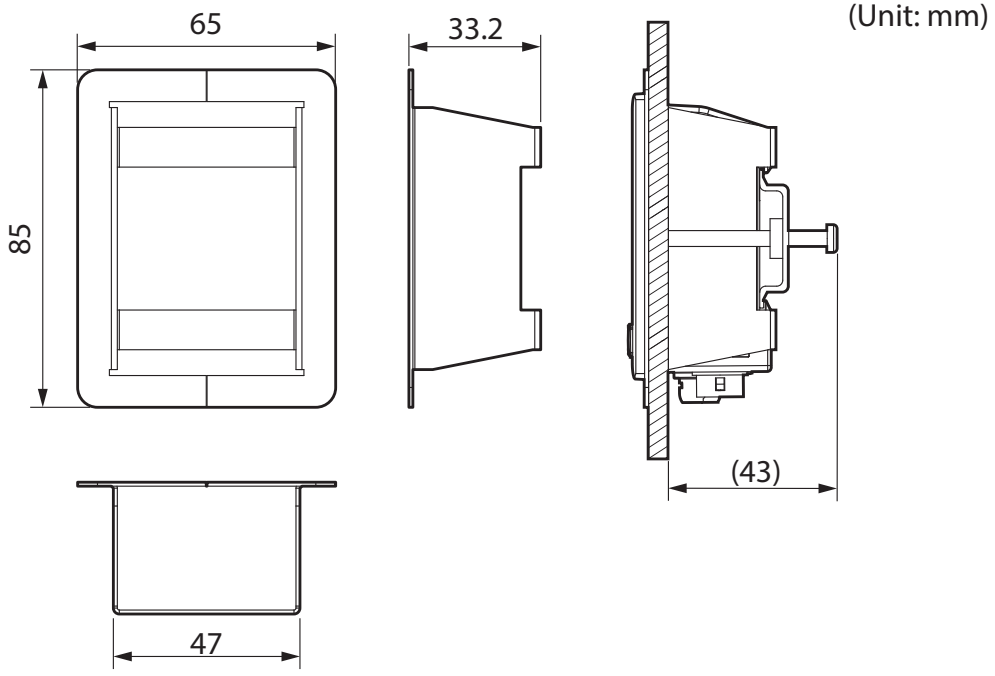
This is composed of BEF-TISH-A and BEF-TISH-B in the same product.

For the outer diameter dimensions, refer to the figures for BEF-TISH-A and BEF-TISH-B.

■ Controller panel mounting bracket (Option)

● BEF-TISC-BKT

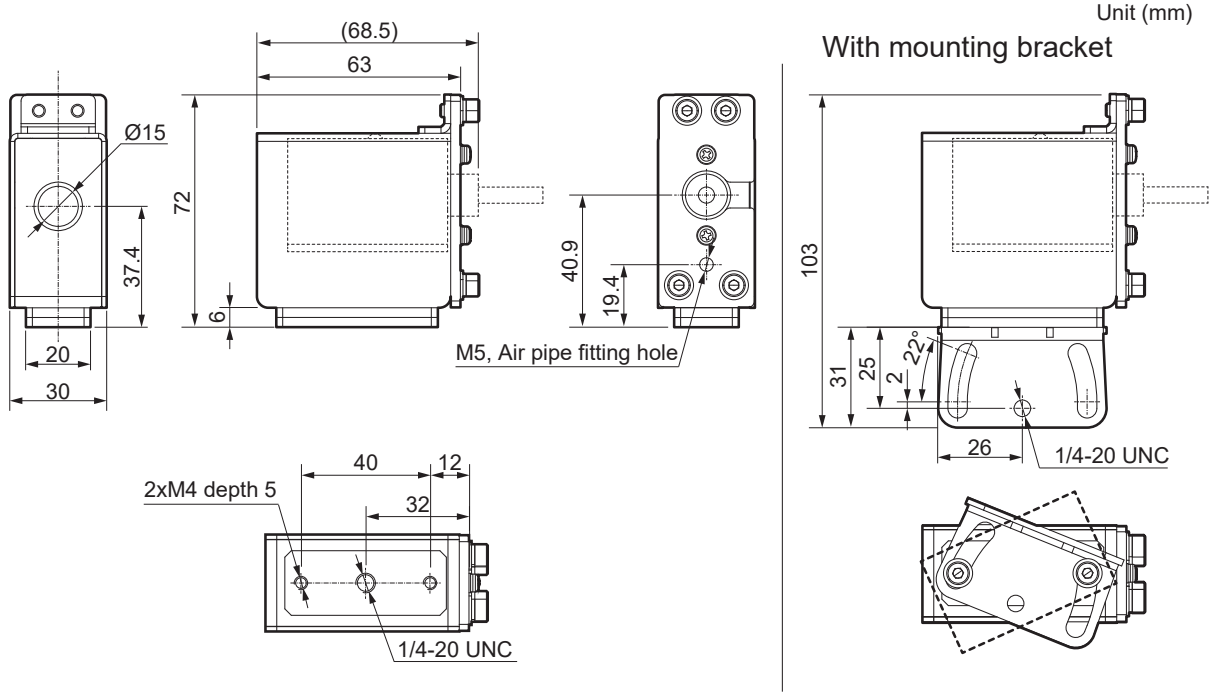
(Unit: mm)



Air purge kit (Option)

TI-S30-AP

Unit (mm)



8-2 Index List

Information on using this product as an IO-Link device.

8-2-1 Communication Specifications

Minimum cycle time	0.5 ms	
Baud rate	COM 3 (230.4 kbps)	
M-Sequence code in Pre-operate mode	0	
M-Sequence code in Operate mode	4	
ISDU support	Yes	
IO-Link revision	1.1.3	
Number of process input data bytes	4 bytes	
Number of process output data bytes	1 bytes	
Vender ID	DEC: 1076	HE: 0434
Device ID	DEC: 98306	HE: 18002
Data storage class	Data Storage class 1:automatic DS	
Profile	ProfileID : 10(0x000a) Measuring Sensor ProfileID : 16384(0x4000) Common Profile	

8-2-2 Process Data Format

■ Input data (IO-Link Master ← TI-SC controller)

Byte number	Bit							
	7	6	5	4	3	2	1	0
n+0	Upper eight bits of the measured temperature *1							
n+1	Lower eight bits of the measured temperature *1							
n+2	Scale eight bits *2							
n+3	Not used (fixed at 0)					Laser output	Upper limit alarm	Lower limit alarm

*1: The measured temperature is sent as an integer multiplied by 10. When the data is 1000, this indicates 100°C.

*2: The scale is fixed at -1. This indicates that the measured temperature data must be multiplied by 10 to the power of -1.

■ Word allocation

(Example) When an OPTEX FA IO-Link UR Master is used (Default value: Lower sequence (little-endian))

Word number	Byte	
	Upper	Lower
N+0	Process data n+2	Process data n+3
N+1	Process data n+0	Process data n+1

Word number	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+0	n+2 (scale eight bits)								Reserved					Laser output	Upper limit alarm	Lower limit alarm
N+1	n+0 (upper eight bits of the measured temperature)								n+1 (lower eight bits of the measured temperature)							

■ Output data (IO-Link Master → TI-SC controller)

The functions are the same as the external input when a general-purpose I/O cable connection is used.

Byte number	Bit							
	7	6	5	4	3	2	1	0
n+0	Not used					Hold	Trigger	Laser control

■ Word allocation

(Example) When an OPTEX FA IO-Link UR Master is used (Default value: Lower sequence (little-endian))

Word number	Byte	
	Upper	Lower
N+0	Not used	Process data n+0

Word number	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+0	Not used								Not used					Hold	Trigger	Laser control

8-2-3 Service Data

Category	Item	Index number DEC (HEX)	Sub index number	Read/write *1	Subject to backup	Format	Data byte count	Default value	Setting (monitor) value	Remarks [units]	
Aapplica-tion reset	Aapplication reset	2 (0x02)	0	W	-	UINT	1	-	129: Returns the settings to their initial status. 160: Resets the graph display and displays it again from the beginning. 161: Initializes bank 1. 162: Initializes bank 2. 163: Initializes bank 3. 164: Initializes bank 4. 165: Error (warning) cancel		
Unit interface	Device lock	12 (0x0C)	0	RW	○	UINT	2	0	bit 02: 1 Device lock activated		
Device information	Serial number (Sensor head)	21 (0x0E)	0	R		UINT	14	—			
	Application tag	24 (0x18)	0	RW	○	STRING	32	**…**			
	Function tag	25 (0x19)	0	RW	○	STRING	32	**…**			
	Location tag	26 (0x1A)	0	RW	○	STRING	32	**…**			
Operation mode	Operation mode	64 (0x40)	0	RW	○	UINT	2	100	40:High speed 50:50ms 100:100ms 200:200ms 500:500ms 1000:1 s 2000:2 s 5000:5 s 10000:10 s 20000:20 s		
Alarm	Alarm select	65 (0x41) *2	0	RW	○	UINT	1	3	0:Not use 1:upper limit only 2:lower limit only 3:Upper & lower		
	Upper limit	66 (0x42) *2	0	RW	○	INT	2	5000	-400 to 5000	Units: °C	* The upper/ lower limit settings are sent/re-ceived as integers multiplied by 10. Specify 250 for 25.0°C.
								9320	-400 to 9320	Units: °F	
	Lower limit	67 (0x43) *2	0	RW	○	INT	2	-400	-400 to 5000	Units: °C	
								-400	-400 to 9320	Units: °F	
	Hysteresis	68 (0x44) *2	0	RW	○	UINT	1	20	0 to 100	Units: °C	
								36	0 to 180	Units: °F	
Bank	Selected bank number	69 (0x45)	0	RW		UINT	1	1	1 to 4		

Category	Item	Index number DEC (HEX)	Sub index number	Read/write *1	Subject to backup	Format	Data byte count	Default value	Setting (monitor) value	Remarks [units]	
Emissivity	Emissivity	70 (0x46) *2	0	RW	○	UINT	2	950	100 to 1200	* Emissivity is sent/ received as an integer multiplied by 1000. Specify 850 for 0.850.	
	Auto calculation	71 (0x47)	0	RW		INT	2	-	-400 to 5000	Units: °C	If the emissivity of the measurement target is not known and the target temperature is known, emissivity is calculated automatically. *3
									-400 to 9320	Units: °F	
	Result of auto calculation	72 (0x48)	0	R		UINT	1	-	0: Successful 1: Calculation result was not within the valid range. 2: Calculation is not possible because the target temperature and head temperature are too close.		
Display	Sensor head internal temperature	73 (0x49)	0	R		INT	2	-	-400 to 5000	Units: °C	* Temperature is received as an integer multiplied by 10. When the data is 1000, this indicates 100.0°C.
									-400 to 9320	Units: °F	
Measurement mode	Measurement mode	96 (0x60)	0	RW	○	UINT	1	0	0 : Normal 1 : Sample hold 2 : Peak hold 3 : Valley hold 4 : Edge detection		
	Edge detect time	97 (0x61)	0	RW	○	UINT	1	10	1 to 100	Units: Seconds * Enabled only when index number 96 (measurement mode) is “4” (edge detection mode). * Edge detect time is sent/ received as an integer multiplied by 10. Specify 80 for 8.0 seconds.	
	Edge detect diff	98 (0x62)	0	RW	○	UINT	2	10	10 to 1000	Units: °C	* Enabled only when index number 96 (measurement mode) is “4” (edge detection mode). * Edge detect diff is sent/ received as an integer multiplied by 10. Specify 250 for 25.0°C.
								18	10 to 1800	Units: °F	

Category	Item	Index number DEC (HEX)	Sub index number	Read/write *1	Subject to backup	Format	Data byte count	Default value	Setting (monitor) value	Remarks [units]
I/O settings	I/O settings	128 (0x80)	0	RW	○	UINT	1	0	0:NPN 1:PNP	* Setting is only possible when an IO-Link cable connection is used. In order to enable the setting value, only a general-purpose I/O cable connection can be used.
	Output mode	129 (0x81)	0	RW	○	UINT	1	0	0:N.O. 1:N.C.	
Timer function	Timer mode	130 (0x82) *2	0	RW	○	UINT	1	0	0:Not use (real time) 1:One shot 2:/Delay	
	One shot time	131 (0x83) *2	0	RW	○	UINT	2	10	1 to 1000	Units: Seconds * Enabled only when index number 130 (timer mode) is “1” (one-shot). * One shot time is sent/received as an integer multiplied by 100. Specify 100 for 1.00 seconds.
	On delay time	132 (0x84) *2	0	RW	○	UINT	2	10	1 to 1000	Units: Seconds * Enabled only when index number 130 (timer mode) is “2” (delay). * When the specified value is 0.00, delay operation is not performed. * To use only one side (ON or OFF), set 0.00 for the side that is not used. * ON/OFF delay time is sent/received as an integer multiplied by 100. Specify 100 for 1.00 seconds.
	Off delay time	133 (0x85) *2	0	RW	○	UINT	2	10	1 to 1000	
Analog output	Analog output	134 (0x86)	0	RW	○	UINT	1	0	0:Not use 1:Current 2:Voltage	* Setting is only possible when an IO-Link cable connection is used. In order to enable the setting value, only a general-purpose I/O cable connection can be used.
	Specified temperature at analog output maximum value (20 mA/10 V)	135 (0x87) *2	0	RW	○	INT	2	5000	-400 to 5000	Units: °C * Temperature is sent/received as an integer multiplied by 10. Specify 1000 for 100.0°C.
								9320	-400 to 9320	Units: °F
	Specified temperature at analog output minimum value (4 mA/0 V)	136 (0x88) *2	0	RW	○	INT	2	-400	-400 to 5000	Units: °C
								-400	-400 to 9320	Units: °F

Category	Item	Index number DEC (HEX)	Sub index number	Read/write *1	Subject to backup	Format	Data byte count	Default value	Setting (monitor) value	Remarks [units]
Maintenance	Estimated days until maintenance is required	160 (0x89)	0	R		UINT	2	-	0 to 7305	Units: Days
	Time until maintenance event	161 (0xA1)	0	RW	○	UINT	4	0	0 to 88000	Units: Hours • Set in units of 1 hour. (Internally converted to units of seconds.) • When read, the remaining time is returned (rounded up when 30 minutes or more).
Information	Operation time (sensor head)	162 (0xA2)	0	R		UINT	4	—		Units: Hours
	Operation time (laser)	163 (0xA3)	0	R		UINT	4	—		Units: Hours
	Operation time (controller)	164 (0xA4)	0	R		UINT	4	—		Units: Hours
	EEPROM update count (sensor head)	165 (0xA5)	0	R		UINT	4	—		
	EEP update count (Controller)	166 (0xA6)	0	R		UINT	4	—		
	Software version (Sensor head)	167 (0xA7)	0	R		UINT	2	—		
	Software version (Controller)	168 (0xA8)	0	R		UINT	2	—		
	Software version (LCD)	169 (0xA9)	0	R		UINT	2	—		
	Serial number (Controller)	170 (0xAA)	0	R		UINT	14	—		
Display	Process data selection	192 (0xC0)	0	RW		UINT	1	-	Temperature display units. The temperature display units for other items also change according to this setting. 0: °C (Celsius) 1: °F (Fahrenheit)	According to the contents of this setting, the temperature units (°C/°F) are set for sending the measured temperature to IO-Link Master.
Laser control	Laser settings	193 (0xC1)	0	RW	○	UINT	1	0	0: OFF 1: Specified period 2: Manual 3: Blink 4: ON	
	Lighting period	194 (0xC2)	0	RW	○	UINT	1	10	1 to 90 (sec)	Enabled only when index number 193 (laser control) is “1” (specified period).
	Blink on error	195 (0xC3)	0	RW	○	UINT	1	0	0: Laser blinks when an error occurs. 1: Laser does not turn ON when an error occurs.	

Category	Item	Index number DEC (HEX)	Sub index number	Read/write *1	Subject to backup	Format	Data byte count	Default value	Setting (monitor) value	Remarks [units]
Graph	Time Scale	196 (0xC4)	0	RW	○	UINT	1	0	0: Auto 1: 2 min 2: 10 min 3: 30 min 4: 1 hour 5: 3 hour 6: 6 hour 7: 12 hour 8: 24 hour	
	Disply area:	197 (0xC5)	0	RW	○	UINT	1	0	0: Auto 1: Specify	
	Specify temperature (Max)	198 (0xC6)	0	RW	○	INT	2	5000	-400 to 5000 (°C)	• Enabled only when index number 197 (graph temperature display range) is “1” (specify). • Temperature is sent/received as an integer multiplied by 10. Specify 1000 for 100.0°C.
								9320	-400 to 9320 (°F)	
	Specify temperature (Min)	199 (0xC7)	0	RW	○	INT	2	-400	-400 to 5000 (°C)	
								-400	-400 to 9320 (°F)	
Display settings	Brightness	200 (0xC8)	0	RW	○	UINT	1	15	1 to 15	
	Display direction	201 (0xC9)	0	RW	○	UINT	1	3	0: Horizontal 1: VerticalRev. 2: HorizontalRev. 3: Vertical	
	Language	234 (0xEA)	0	RW	○	UINT	2	17	9: English 2052: Simplified Chinese 17: Japanese	When a language other than “17” or “2052” is specified, it is handled as English.
Diagnosis: device parameter	Batch reading	16512 (0x4080)	0	R		—	11	-		For the batch reading locations at the time of read-all, refer to *4.
	Minimum measurable temperature		1	R		INT	4	-		• The measurable temperatures are sent as integers multiplied by 10. When the data is 1000, this indicates 100°C.
	Maximum measurable temperature		2	R		INT	4	-		• The measurable temperatures are sent as integers multiplied by 10. When the data is 1000, this indicates 100°C.
	Unit code		3	R		UINT	2	-	1001: °C (Celsius) 1002: °F (Fahrenheit)	
	Scale		4	R		UINT	1	-		• The scale is fixed at -1. This indicates that the measured temperature data must be multiplied by 10 to the power of -1.

*1: R: Read only, W: Write only, R/W: Read/Write

*2: Reading and writing settings for each bank

When an index number in the table above is specified, the settings of the bank that is currently in use are read from or written to.

To read/write settings for setting items that have different settings in each bank, use the calculation

formula below and calculate the index number of the bank that you want to read from or write to.
Index number = Index number in table above + (256 × Bank number (1 to 4))

Example: For index number: 65 (alarm)

Specify using the following index number for each bank number.

Bank 1: 321 (0x141)

Bank 2: 577 (0x241)

Bank 3: 833 (0x341)

Bank 4: 1089 (0x441)

*3: When automatically calculating emissivity via IO-Link, perform using the following procedure.

1. Configure the measurement target for measurement conditions.
   Wait until the ambient temperature has also stabilized. (Wait approximately 10 minutes after power ON.)
2. Write the target temperature (value multiplied by 10) in index number 71 (auto calculation).
3. Allow 100 ms to pass.
4. Read index number 71 (auto calculation). If the measured temperature is close to the target temperature, then calculation was successful.

*4: Batch reading locations at the time of read-all

Data is stored in the following sequence when read-all is performed. (Big-endian)

Device parameter	Location	Description
Device parameter	n+0	Upper eight bits of lowest measurable temperature
	n+1	2nd digit upper eight bits of lowest measurable temperature
	n+2	3rd digit upper eight bits of lowest measurable temperature
	n+3	Lower eight bits of lowest measurable temperature
	n+4	Upper eight bits of highest measurable temperature
	n+5	2nd digit upper eight bits of highest measurable temperature
	n+6	3rd digit upper eight bits of highest measurable temperature
	n+7	Lower eight bits of highest measurable temperature
	n+8	Upper eight bits of units code
	n+9	Lower eight bits of units code
	n+10	Scale

Word allocation

(Example) When an OPTEX FA IO-Link Master is used (Default value: Lower sequence (little-endian))

Word number	Byte	
	Upper	Lower
N+0	n+9	n+10
N+1	n+7	n+8
N+2	n+5	n+6
N+3	n+3	n+4
N+4	n+1	n+2
N+5	Reserved	n+0

Word number	Bit															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
N+0	n+9 (lower eight bits of units code)								n+10 (scale eight bits)							
N+1	n+7 (lower eight bits of highest measurable temperature)								n+8 (upper eight bits of units code)							
N+2	n+5 (2nd digit upper eight bits of highest measurable temperature)								n+6 (3rd digit upper eight bits of highest measurable temperature)							
N+3	n+3 (lower eight bits of lowest measurable temperature)								n+4 (upper eight bits of highest measurable temperature)							
N+4	n+1 (2nd digit upper eight bits of lowest measurable temperature)								n+2 (3rd digit upper eight bits of lowest measurable temperature)							
N+5	Reserved								n+0 (upper eight bits of lowest measurable temperature)							

8-2-4 Event Functions

Code		Type	Event name	Description
DEC	HEX			
6144	0x1800	Notice	Maintenance timing	The referential time for calibration or the user-specified time for cleaning has been reached.
6145	0x1801	Fault	Memory rewrite lifetime	Setting value memory has exceeded the limit of write cycle. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
6149	0x1805	Fault	Laser error	An error was detected at the laser. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
6150	0x1806	Warning	Unstable head internal temperature	The head internal temperature is changing. Temperature measurement is possible, however the error will be large.
6151	0x1807	Warning	Laser lifetime	The laser lighting period has exceeded the prescribed time. We recommend you replace it as soon as possible.
6153	0x1809	Warning	Controller lifetime	The controller use time has exceeded the prescribed time. We recommend you replace it as soon as possible.
6154	0x180A	Warning	Measured temperature upper limit exceeded	The upper limit for measurable temperature has been exceeded.
6155	0x180B	Warning	Measured temperature lower limit exceeded	The lower limit for measurable temperature has been exceeded.
6156	0x180C	Fault	Memory rewrite lifetime (head)	Setting value memory has exceeded the limit of write cycle. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
6157	0x180D	Fault	Memory read invalid (head)	Information could not be read correctly from the settings memory. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
16912	0x4210	Warning	Head internal temperature exceeded	Head internal temperature exceeded the prescribed temperature.
20480	0x5000	Fault	Head system error	An error was detected inside the head. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
20497	0x5011	Fault	Memory read invalid	Information could not be read correctly from the settings memory. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.
20736	0x5100	Fault	Power supply trouble	An error was detected in the power supply. This indicates the end of this product's service life, so we recommend you replace it as soon as possible.

FASTUS

Attention: Not to be Used for Personnel Protection.

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.
These sensors do not include the self-checking redundant circuitry necessary to allow their use in personnel safety applications.
A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.
Please consult our distributors about safety products which meet OSHA, ANSI and IEC standards for personnel protection.

- Specifications are subject to change without prior notice.
- Specifications and technical information not mentioned here are written in Instruction Manual. Or visit our website for details.
- All the warnings and cautions to know prior to use are given in Instruction Manual.

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The information in this user's manual is correct as of January 2026

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