

Non-contact thermometer stationary type

TI-S Series Controller

TI-SC

TI-SC(E)



- Thank you for purchasing "TI-S Series" non-contact thermometer stationary type.
- This product is a dedicated controller for the TI-S series sensor head.
- For TI-SC(E) only, the temperature unit is selectable between Celsius (°C) and Fahrenheit (°F).
- TI-SC is a Japanese domestic model and is not sold overseas.
- Before using this product, read this manual carefully to ensure proper use.
- Read this manual thoroughly, and then keep this manual at hand so that it can be used whenever necessary.

Download the TI-S user's manual, IO-Link configuration file (IODD), and index list from OPTEX FA website.
<https://www.optex-fa.jp>

Click here for online manual→



Safety Precautions

Safety precautions for ensuring safe operation of this product are displayed as follows with the following symbols.

Precautions listed here describe important information about safety. Make sure to follow them accordingly.

Safety Symbols

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

WARNING	
	Do not disassemble, repair, modify, deform under pressure, or incinerate this product. Doing so may cause injury or fire.
	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in an explosion or fire.
	Do not install this product in any of the following locations. Doing so may cause a fire, damage, or a malfunction. <ol style="list-style-type: none"> 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.
	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 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.
	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 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.
	In case water enters the product. If water or any other liquid enters the product, 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 the sensor head or cause a malfunction.
	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 and disconnecting the cable from controller, 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.

CAUTION	
	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 and the sensor head 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.

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.

1. Included Items and Options

Included Items

- Controller
- Instruction manual:
1x English, 1x Japanese

Options

General-purpose I/O cable

- TI-SCA09-G3K
(not terminated, open-end)

IO-Link cable

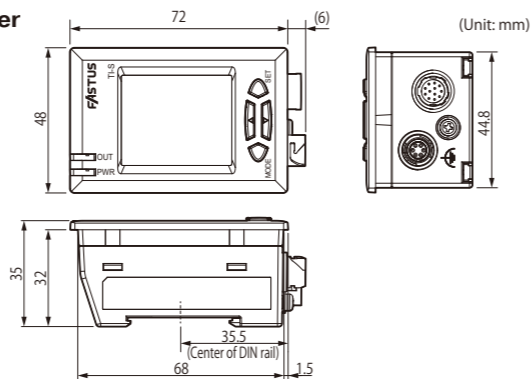
- TI-SCA03-G3K
(not terminated, open-end)
- TI-SM1203-G03K
(not terminated, M12 connector)

Extension cable between controller and sensor head

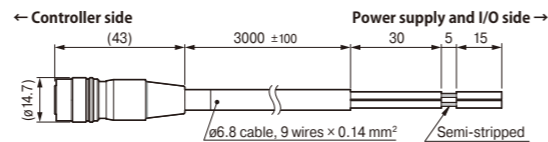
- TI-SSA06-G3K
(extension cable, 3m)
- TI-SSA06-G10K
(extension cable, 10m)

2. Dimensions

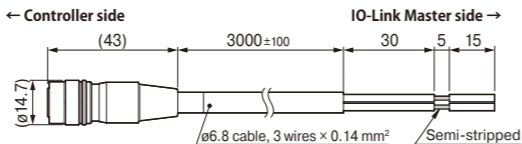
Controller



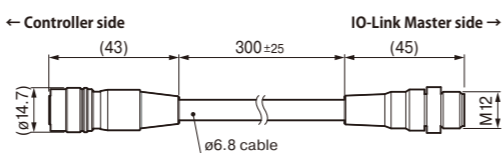
General-purpose I/O cable: TI-SCA09-G3K



IO-Link cable: TI-SCA03-G3K



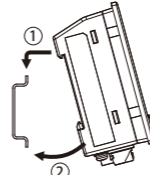
IO-Link cable: TI-SM1203-G03K



3. Installation

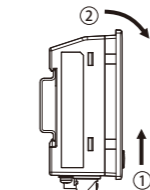
Attaching the controller on a DIN rail

- 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.

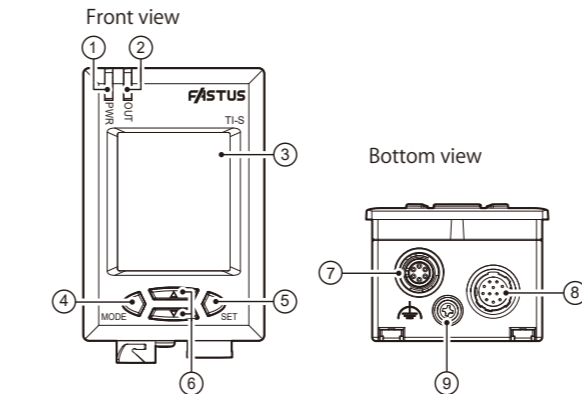


Removing the controller from a DIN rail

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



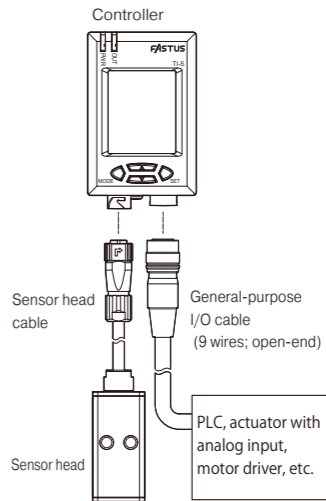
4. Part Names



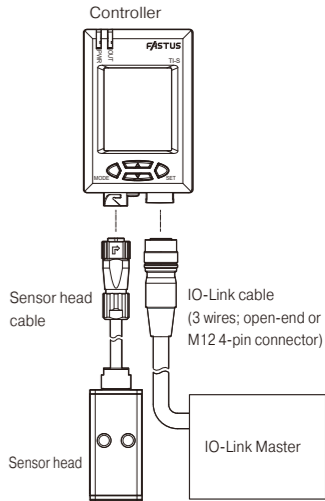
No.	Name	Description
①	Power indicator	Illuminates in green when the power is turned on, and blinks in green during IO-Link communication.
②	Output indicator	Illuminates in green during judgment output and analog output and illuminates in red during upper/lower limit alarm output. Blinks in green when a minor warning occurs, blinks in orange when a major warning occurs, and blinks in red when an error occurs.
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.

5. System Configuration Diagrams

When using a general-purpose I/O cable



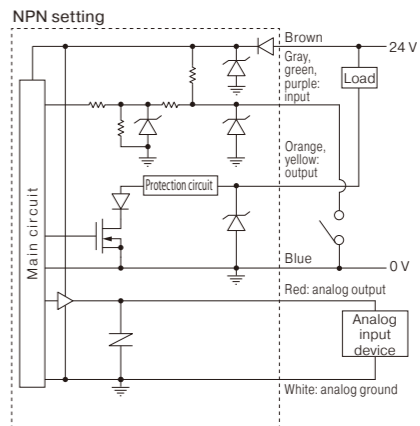
When using an IO-Link cable



* 3m or 10m extension cables (optional) are available between the controller and the sensor head.

6. I/O Circuit Diagrams

General-purpose I/O cable



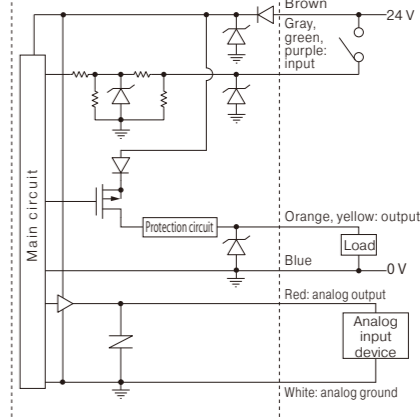
Wire color	Description
Brown	+V (24 VDC)
Gray	Laser control input
Green	Hold input/bank select*
Purple	Trigger input/bank select*
Orange	Upper limit alarm output
Yellow	Lower limit alarm output
Blue	Ground (0 V)
Red	Analog output
White	Analog ground

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

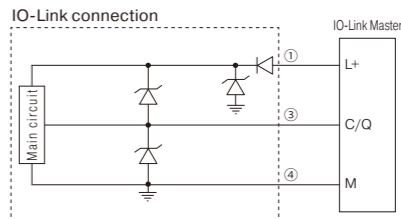
Lead wire functions during bank select

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

PNP setting



IO-Link cable



IO-Link cable lead wire/connector pin functions

No.	Wire color	M12 connector pin No.	Description
①	Brown	①	L+
②	—	—	*
③	Black	④	C/Q
④	Blue	③	M

* The input line is replaced with process output data.

M12 connector pin No.

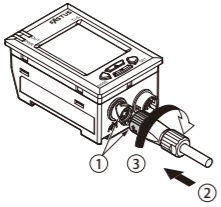
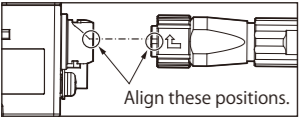


* ② is not used.

7. Connection

Connecting the sensor head cable

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



- Insert the socket on the sensor head cable to the back of the controller-side plug.
- Turn the tip of the socket on the sensor head cable to lock the connector.

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

- 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.
- While pushing the socket on the cable, turn the socket to align the notches and protrusions.
- After aligning these parts, push the socket in until it clicks.



I/O cable-side socket



Controller-side plug

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

8. Menu List

The following items are displayed when "English" is selected for "Language". Fahrenheit can only be displayed on the TI-SC (E).

Setting menu	Setting items		Setting value/description	Default value
Bank	Bank select ^{*1}		1 to 4	1
	Initialize bank		CANCEL/ EXECUTE	-
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	
	When "edge detection" setting	Edge detect time Edge detect diff	0.1 to 10.0 sec 1.0 to 100.0 °C 1.8 to 180.0 °F	1.0 sec 1.0 °C 1.8 °F
I/O settings	I/O settings		NPN/PNP	NPN
	Output mode		N.O./N.C.	N.O.
	Test	Input test	Laser: OFF/ON Trigger: OFF/ON Hold: OFF/ON	OFF OFF OFF
		Output test	Upper lim: OFF/ON Lower lim: OFF/ON	OFF OFF
Alarm	Alarm select		Upper & lower/Not use/upper limit only/lower limit only	Upper & lower
	Upper limit		Celsius: -40.0 to 500.0 °C Fahrenheit: -40.0 to 932.0 °F	Celsius: 500.0 °C Fahrenheit: 932.0 °F
	Lower limit		Celsius: -40.0 to 500.0 °C Fahrenheit: -40.0 to 932.0 °F	Celsius: -40.0 °C Fahrenheit: -40.0 °F
	Hysteresis		Celsius: 0 to 10.0 °C Fahrenheit: 0 to 18.0 °F	Celsius: 2.0 °C Fahrenheit: 3.6 °F
Timer function	Timer mode		Not use/One shot/Delay	Not use
	When "One shot" setting	One shot time	0.01 to 10 sec	0.10 sec
	When "Delay" setting	On delay time Off delay time	0.00 to 10 sec 0.00 to 10 sec	0.10 sec 0.10 sec
Analog output ^{*2}	Analog output		Not use/Current/Voltage	Not use
	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
		20mA:	Celsius: -40.0 to 500.0 °C Fahrenheit: -40.0 to 932.0 °F	Celsius: 500.0 °C Fahrenheit: 932.0 °F
	Specify temp. (Temperature setting when setting voltage)	Test	4mA/12mA/20mA	4mA
		0V:	Celsius: -40.0 to 500.0 °C Fahrenheit: -40.0 to 932.0 °F	Celsius: -40.0 °C Fahrenheit: -40.0 °F
		10V:	Celsius: -40.0 to 500.0 °C Fahrenheit: -40.0 to 932.0 °F	Celsius: 500.0 °C Fahrenheit: 932.0 °F
Emissivity			0V/5V/10V	0V
	Emissivity		0.100 to 1.200	0.950
	Auto calculation		Celsius: -40.0 to 500.0 °C Fahrenheit: -40.0 to 932.0 °F	Celsius: 100.0 °C Fahrenheit: 212.0 °F
Laser control	Laser settings		OFF/Specified period/Manual/Blink/ON	OFF
	When "Specified period" setting	Lighting period	1 to 90 sec	10 sec
	Blink on error		OFF/ON	OFF
Display settings	Language		日本語/简体中文/English	*3
	Disp. direction		Vertical/Horizontal/VerticalRev./HorizontalRev.	Vertical
	Brightness		1 to 15	15
	Temperature unit		TI-SC: °C, TI-SC(E): °C/°F	*3

Setting menu	Setting items		Setting value/description	Default value
Graph	Graph	Time Scale:	Auto/ 2 min/10 min/ 30 min/ 1 hour/ 3 hour/ 6 hour/ 12 hour/ 24 hour	Auto
		Disp area:	Auto/ Specify	Auto
	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
		Max:	Celsius: -40.0 to 500.0 °C Fahrenheit: -40.0 to 932.0 °F	Celsius: 500.0 °C Fahrenheit: 932.0 °F
Application tag	Graph		Press the "SET" button to display the graph.	-
Function tag			*A character string can be entered. Up to 32 characters. *4	-
Location tag			*A character string can be entered. Up to 32 characters. *4	-
Maintenance	Maintenance		0 to 87672 Hours later	0
	App. reset		CANCEL/ EXECUTE	
Information	Operation time	Sensor head	Displays the operation time of the sensor head.	
		Laser	Displays the operation time of the laser.	
		Controller	Displays the operation time of the controller.	
	EEP update count	Sensor head	Displays the number of write operations to sensor head memory.	
		Controller	Displays the number of write operations to controller memory.	
	Serial number	Sensor head	Displays the sensor head serial number.	
		Controller	Displays the controller serial number.	
	Software ver.	Sensor head	Displays the sensor head software version.	
		Controller	Displays the controller software version.	
		LCD	Displays the LCD software version.	
	Measurement range	Upper limit	Celsius: 500.0 °C Fahrenheit: 932.0 °F	
		Lower limit	Celsius: -40.0 °C Fahrenheit: -40.0 °F	
Errors and warnings			Displays a list of the errors and warnings that have occurred and allows the user to clear the warning status. ^{*5}	

*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: Only for the TI-SC(E), the 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.

9. Emissivity (ε)

The emissivity is the rate of the infrared ray energy emitted from the surface of the object. All objects possess a particular emissivity that changes according to the object's material and surface conditions.

Setting the emissivity of the measurement target on this product allows for more precise measurements.

Objects with a low emissivity (e.g. the surfaces of shiny metallic objects) reflect the surrounding temperature since they are highly reflective. For such targets, nearby heat sources other than the measurement target will lead to incorrect measurements due to these temperatures being reflected. In these situations, countermeasures such as blocking all heat sources other than the measurement target should be implemented.

Also, accurate temperature measurements can be obtained by affixing optional HB-250 black tape to the measurement target and setting the emissivity to 0.95.

Setting configuration

The emissivity can be set automatically and with manual numeric input.

Manual :Set the emissivity of the measurement target by entering a value from 0.100 to 1.200.

Automatic :If the temperature of the measurement target is known, enter that temperature to automatically calculate the emissivity.

It may not be possible to automatically calculate the emissivity if the difference between the temperatures of the measurement target and sensor head is small.

An error will occur if the calculated emissivity is outside the range of 0.100 to 1.200.

If the emissivity cannot be set automatically, enter the emissivity value that brings the measured value close to the temperature of the measurement target.

10. Errors and warnings

Errors and warnings expressed by the output indicator

This product's output indicator displays not only the output status but errors and warnings as well.

Display details are shown below.

Output indicator	Status
Green	Normal measurement, alarm output off
Red	Normal measurement, alarm output on
Blinking in green	Minor warning
Blinking in orange	Major warning
Blinking in red	Error

The numbers and descriptions of errors and warnings are shown below.

Category	No.	Contents
Error	1	Abnl voltage C
	2	Abnl voltage H
	3	Abnl laser
	4	EEP read err C
	5	EEP read err H
	6	EEPwrite lmt C
	7	EEPwrite lmt H
	8	System error H
Major warning	1	Upp-out overc
	2	Low-out overc
	3	Abnl analogout
	4	Output protect
Minor warning	5	Abnl temp H
	6	Unstable tempH
	7	Over upp-range
	8	Over low-range
	9	Over runtime L
	10	Over runtime H
Information	11	Over runtime C
	1	Maintenance timing (elapsed time specified by user)

*: If the number of write operations exceeds the guaranteed count, an error will occur even if writing is successful.

11. Specifications

Model		TI-SC ^{*1}	TI-SC(E)
Rating	Supply voltage	24 VDC ± 10 % (when using general-purpose I/O cable) 18 to 30 VDC (when using IO-Link cable)	
	Current consumption	180 mA (when using general-purpose I/O cable)* ² 50 mA (when using IO-Link cable)	
Display resolution		0.1 °C	0.1 °C/°F
Temperature unit		Celsius "°C"	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 % ^{*3}	
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	± 0.2 % of F.S. (at ambient temperature of 25 °C) Temperature coefficient (typical): ± 22 ppm/°C (± 0.0022 %/°C) ± 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: Japanese, Simplified Chinese, English
	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, delay: 0.00 to 10.00 sec
IO-Link	Revision		1.1.3
	Baud rate		COM3 (230.4kbps)
	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 ¹	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 amplitude 1.5 mm 2 hours in each X, Y, Z directions	
Applicable regulations	Shock resistance		500 m/s ² (Approx. 50 G) 3 times in each X, Y, Z directions	
	EMC	EMC Directive (2014/30/EU)		
		UK EMC (The Electromagnetic Compatibility Regulations 2016)		
	Environment	FCC Part 15 subpart B		
		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	
Material			Case: ABS	
Weight			Approx. 80 g	

*1: TI-SC is a Japanese domestic model and id not sold oversea.

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

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

12. Operation Lock/Unlock

When operations are locked, settings can be checked but not changed.

* Bank select via external signals and setting changes via IO-Link are still possible.

Operation lock procedure

- On the Information screen, press the SET key 3 times while the software version is displayed, and a special screen for entering the password will be displayed.
- Enter a password (any 4-digit number).
- The "Device operat." display changes from "Unlock" to "Lock" and the key icon appears at the same time, indicating that the operation lock is complete. Press the MODE key to return to the measurement screen.

* The password is not reset by "App. Reset", so make a note of it and manage it so you don't forget it.

Operation unlock procedure

- On the Information screen, press the SET key 3 times while the software version is displayed, and a special screen for entering the password will be displayed.
- Enter the password (4-digit number).
- The "Device operat." display changes from "Lock" to "Unlock" and the key icon disappears at the same time, indicating that the operation unlock is complete. Press the MODE key to return to the measurement screen.


* The password entered when the operation is locked will be cleared when the operation is unlocked, so a different password can be set when locking the operation again.

This device complies with part 15 of the FCC Rules.

Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

* This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

- Support for the China RoHS directive

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

- Specifications are subject to change without notice
- For more information, questions and comments regarding product, please contact us at the information below.

OPTEX FA CO., LTD.

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