FASTUS
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INSTRUCTION MANUAL

Long Distance BGS Laser Sensor

0809261

TOF-DL250G Series

TOF-DL250GC

IO-Link setting file (IODD file) and Index list can be downloaded from our web site.
https://www.optex-fa.com

IO-Link

OPTEX FA CO., LTD.

- Thank you for purchasing this Long Distance BGS Laser Sensor TOF-DL250G Series.
- Before using this product, please read this manual carefully to ensure proper use.
- Read this manual thoroughly, and then keep this manual at hand so that it can be used whenever necessary.

Safety Precautions

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

Safety Symbols

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

⚠WARNING

- Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product.
  Doing so may cause injury or fire.
- This product is not explosion-proof and should not be used around flammable or explosive gases or liquids.
  Doing so may cause ignition resulting in a 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 water, 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 sun light.
- Do not use this product in a non-industrial environment.
  Doing so may cause induction or radiation interference.
- 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.
- This product cannot be used as safety device for the purpose of protecting the human body.

⚠CAUTION

- Do not drop the product or subject the product to strong impacts. Doing so may damage the product.
- The light source of this product applies the visible light semiconductor laser. Do not allow the laser beam to enter an eye, either directly or reflected from reflective object. If the laser beam enters an eye, it may cause damage or problems of the eye.
- Follow the instructions in this manual or the specified instruction manual to wire the product correctly.
  Incorrect wiring can damage the product or cause a malfunction.
- 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 the product within the rated ranges.
- Install this product and the dedicated controller securely.
  Failure to ensure secure installation can result in the products falling and becoming damaged.
- Make sure to turn the power off before connecting or disconnecting the cable.
  Connecting or disconnecting while energized may damage the product.
- Don't bend the cable when the temperature of the cable or atmosphere is below freezing.
- Don't use the sensor on transient state after power on (approx. 300ms).
- The sensor performance or digital display values may depend on the individual units or the condition of detecting object.

Precautions for using laser

This product emits a visible laser beam and is classified as a Class 1 Laser Product by the JIS C6802:2014/IEC 60825-1:2007 and 2014 Laser Product Safety Standards.
When exporting this product to USA, it's necessary to follow laser regulation of USA FDA. This product has been already reported to CDRH (Center for Devices and Radio-logical Health). For details, contact our customer service.

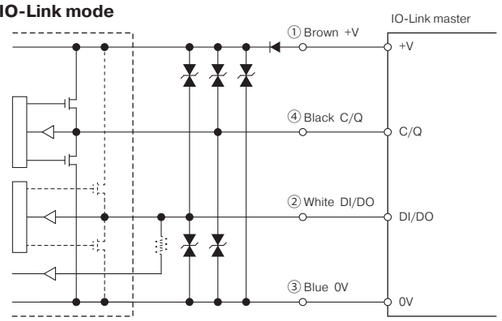
1. Specifications

Type		IO-Link type
Model		TOF-DL250GC
Measurement range*1		0.25 to 2.5 m
Light source	Medium/ Wavelength	Red semiconductor laser, Wavelength: 650 nm
	Output	Average: 390 µW or less, Maximum: 64mW
	Pulse width/ Frequency	7ns, 11.11MHz
Laser class		CLASS 1 (IEC/JIS/FDA*2)
Spot size*3		ø10 mm (At a distance of 2.5 m)
Sampling period / Response time		200 µs / 0.5 ms or less (When performing moving average once)
Hysteresis		Typical value: 3% or less (Moving average performed: 64 or 256 times, Distance: 1 to 2.5 m)
Sensitivity adjustment		Teaching (Manual adjustment possible after teaching)
Indicators		Light receiving 1 (Orange), Light receiving 2 (Orange), Power/IO-Link (Green)
Digital display		7-segment, 3-digit LED display (Display unit: cm)
External input		Laser OFF input / Teaching input (Selectable by setting)
Control output		Push/Pull*4, NPN/PNP open collector (Selectable by setting) Max. 100 mA / 30 VDC, Residual voltage 1.8 V Max.
No. of outputs		2*5
Output mode		Invertable by setting
IO-Link	Specification	Rev. 1.1
	Transmission rate	COM 3 (230.4 kbps)
	Process data length	4 byte
	Min. cycle time	1.0 ms
Connection type		Connector type: M8, 4-pin
Protection circuit		Reverse connection protection, Overcurrent protection
Supply voltage		IO-Link: 18 to 30 VDC, SIO: 10 to 30 VDC, Including 10% ripple (p-p)
Current consumption		60 mA or less*6
Applicable regulations	EMC	EMC directive (2014/30/EU)
	RoHS	RoHS directive (2011/65/EU), China RoHS (Directive 32)
	Safety	FDA regulations (21 CFR 1040.10 and 1040.11*7)
Applicable standards		EN 60947-5-2/IEC 60825-1
NRTL Certification		UL Listed Proximity Switch Certified for US and Canada
Cross-talk prevention		Up to 2 units
Ambient temperature/ humidity		–10 to +50°C (No freezing) / 35 to 85% RH (No condensation)
Storage temperature/ humidity		–40 to +70°C (No freezing) / 35 to 95% RH (No condensation)
Ambient illuminance		Sunlight: 4,000 lx or less, Fluorescent lamp: 3,000 lx or less (at receiving window)
Vibration resistance		10 to 55 Hz, double amplitude 1.5 mm, 2 hours in each of the XY and Z directions
Shock resistance		500 m/s² (Approx. 50 G), 3 times in each of the XY and Z directions
Degree of protection		IP67
Material		Housing: PC, Front cover: PMMA
Weight		Approx. 30 g
Included accessories		Mounting bracket: BEF-WK-190, Mounting screws (M3 × 20 mm)

*1. For black paper (6% reflectance), gray paper (18% reflectance), and white paper (90% reflectance).
*2. In accordance with the FDA provisions of Laser Notice No. 50, the laser is classified as Class 1 per the IEC 60825-1:2007 standard.
*3. Defined with $1/e^2$ (13.5%) of the center strength at the maximum detection distance. The sensor may be affected by light leakage at spot sizes other than the default and when there is a highly reflective object close to the detection area.
*4. Default state of IO-Link type is Push/Pull.
*5. Default state of Output 2 is not assigned.
*6. Not including control output load current.
*7. Excluding differences per Laser Notice No. 50.

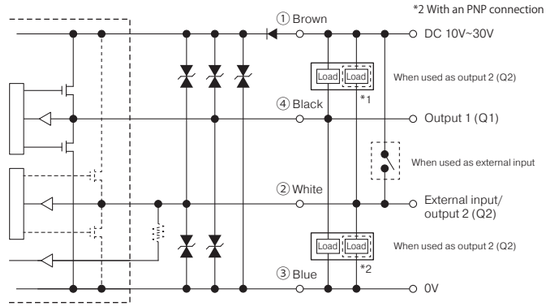
2. Circuit diagram

IO-Link mode

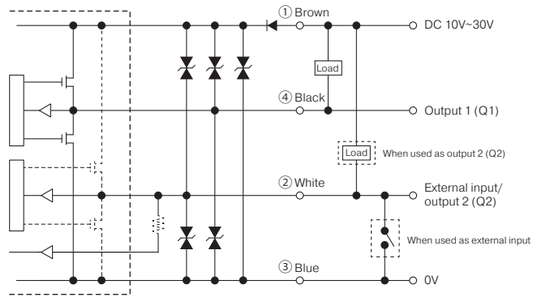


SIO mode (standard I/O mode) with the push-pull/PNP setting

*1 With an NPN connection
*2 With an PNP connection



SIO mode (standard I/O mode) with the NPN setting



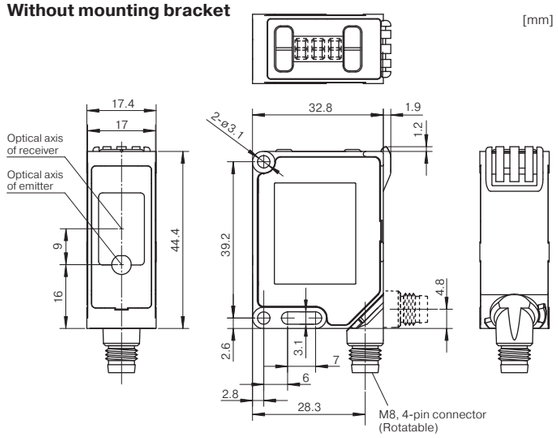
M8 connector pin-out

① IO-Link: 18 to 30 VDC, SIO: 10 to 30 VDC
② External input/output 2 (Q2)
③ 0V
④ Output 1 (Q1)/IO-Link

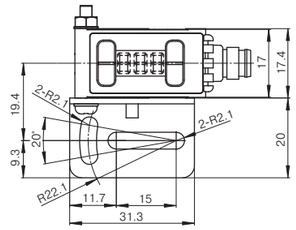
3. Dimensions

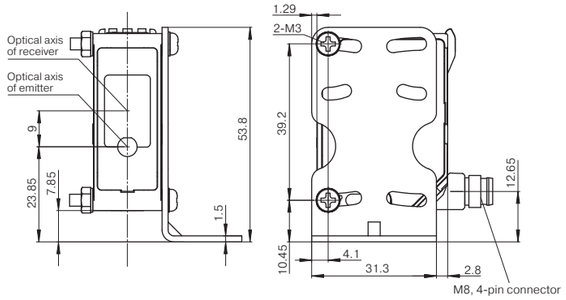
Without mounting bracket

[mm]



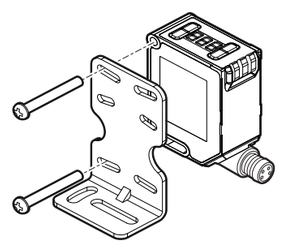
With mounting bracket (horizontal)



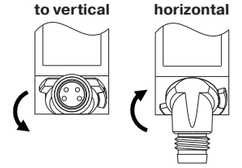


4. Installation

Tightening torque: 0.5N・m Max.

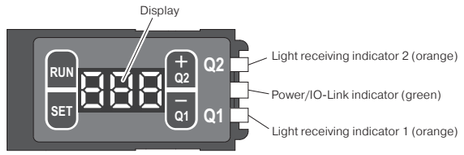


Horizontal to vertical / **Vertical to horizontal**



M8 connector can be rotate from horizontal position to vertical or vertical position to horizontal as picture above. Don't rotate exceeding stopper. Doing so will cause breakage.

5. Name of the parts and setup



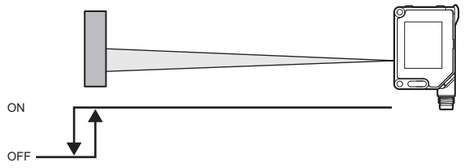
Button	Function while sensing	Function while setting
RUN	Go to setting mode By pressing 1 second or more, Keys will be locked and the display shows “Loc”. While keys are locked, by pressing 1 second or more, key-lock will be released and the display shows “uLc”.	Back to “RUN” (sensing) mode
SET	Go to setting mode	Fix the setting value
+Q2	Holding down this button for 1 second or more teaches the current measured value to output 2 (Q2) as the threshold. (When this is finished, the display shows “t21” or “t22” followed by the threshold.)	Increase setting value
-Q1	Holding down this button for 1 second or more teaches the current measured value to output 1 (Q1) as the threshold. (When this is finished, the display shows “t11” or “t12” followed by the threshold.)	Decrease setting value

6. Teaching

There are three types of teaching: “1-point teaching”, “window teaching”, and “2-point teaching”. Use the type of teaching that matches your application.

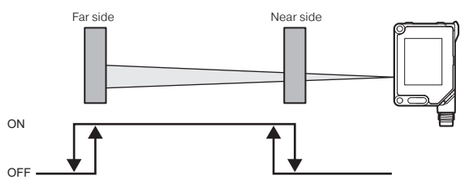
Output operation in 1-point teaching

Place the object for detection and perform teaching to set the threshold to the distance at which it is barely possible to detect the object.



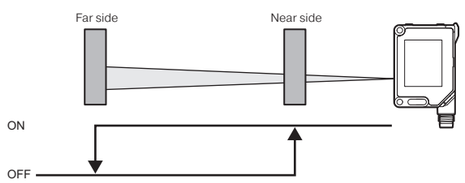
Output operation in window teaching

Place the object for detection at the near side and at the far side and perform teaching with the object at each side to set the sensor so that the object is detected while it is within this range.



Output operation in 2-point teaching

Place the object for detection at the near side and at the far side and perform teaching with the object at each side to set the sensor so that the signal turns ON with the object at the near side when the object comes close to the sensor and the signal turns OFF with the object at the far side when the object moves away from the sensor.



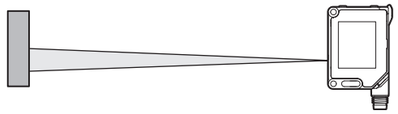
Output 1 (Q1) teaching operation

* To teach output 2 (Q2), press the [+ Q2] button, and then perform the same operation as described here.

Procedure for 1-point teaching

As shown under “8. Function details” on the right, select “SPt” for “qc1” to enable 1-point teaching.
* “SPt” is selected in the factory default settings.
* To perform 1-point teaching for output 2 (Q2), select “SPt” for “qc2”.

1. Place the object for detection at the position where you want to detect it.



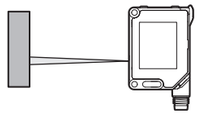
2. Hold down the [- Q1] button for 1 second or longer. The display shows “t11” followed by the threshold, at which point teaching is complete.

* You can also use a numeric value to specify the threshold with “qF1” under “8. Function details” on the right. (For output 2 (Q2), use “qF2”.)

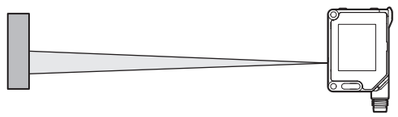
Procedure for window teaching and 2-point teaching

As shown under “8. Function details” on the right, select “WdW” for “qc1” to enable window teaching or “2Pt” for “qc1” to enable 2-point teaching.
* “SPt” is selected in the factory default settings.
* To perform teaching for output 2 (Q2), select “WdW” or “2Pt” for “qc2”.

1. Place the object for detection at the near-side (or far-side) position.



2. Hold down the [- Q1] button for 1 second or longer. The display shows “t11” (or “t21” for output 2 (Q2)) followed by the threshold, at which point the first threshold has been registered.
3. Place the object for detection at the far-side (or near-side) position.



4. Hold down the [- Q1] button for 1 second or longer. The display shows “t12” (or “t22” for output 2 (Q2)) followed by the threshold, at which point the second threshold has been registered and teaching is complete.

* You can also use numeric values to specify the thresholds with “qn1” and “qF1” under “8. Function details” on the right. (For output 2 (Q2), use “qn2” and “qF2”.)

7. Locking button operations

■ Button lock

Hold down the RUN button for 1 second or longer to lock (Loc) or unlock (uLc) button operations.

Loc	Button operations are locked
uLc	Button operations are unlocked (*)

8. Function details

You can get to “Function details” by clicking “RUN” button or “SET” button.

(“*” means default value)

■ 1. Pin ② external I/O setting

[SET] Press “SET” to get to setting menu

Set the pin ② (white lead wire) external I/O

oFF	Do not use pin ② as external I/O
E-in	Make it possible to use the external input function in IO-Link communication
LSr	Set to laser OFF input
tch	Set to teaching input for output 1 (Q1)
qFA	Set to measurement quality alarm output. The receiving light level decreases due to the conditions of the object for detection, causing the measurement quality to decrease. The alarm is output when the measurement quality falls to or below the threshold.
qL2	Set to output 2 (Q2; to generate output, setting with IO-Link Index is required) (*)
qn1	Output internal output Qint1 to an external device
qn2	Output internal output Qint2 to an external device
qLA	Generate output with the same operation as output 1 (Q1)
qbt	Inverted output of output 1 (Q1)

■ 2. Output selection

Set the electrical output characteristic

nPn	Set the control output to NPN.
P_P	Set the control output to PUSH/PULL. (*)
PnP	Set the control output to PNP.

■ 3. Averaging

Set the number of times over which to average the measured values (moving average)

001 … 512	Settable values: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512 Default: 64 (*)

■ 4. Initializing

Initialize the settings ※“2. Output selection” will not be initialized.

no	Do not initialize the settings (*)
YES	Initialize the settings to return the sensor to the factory default settings

■ 5. Display

Select the display’s brightness

on	Keep the display bright at all times (*)
oFF	Darken the display if there are no button operations for 30 seconds

■ 6. Output 1 (Q1) setting

Enable/disable output 1 (Q1) and set its teaching mode

no	Do not use output 1 (Q1)
SPt	Set the teaching mode of output 1 (Q1) to 1-point teaching (*)
WdW	Set the teaching mode of output 1 (Q1) to window teaching
2Pt	Set the teaching mode of output 1 (Q1) to 2-point teaching

■ 7. Output 2 (Q2) setting

Enable/disable output 2 (Q2) and set its teaching mode

no	Do not use output 2 (Q2)
SPt	Set the teaching mode of output 2 (Q2) to 1-point teaching (*)
WdW	Set the teaching mode of output 2 (Q2) to window teaching
2Pt	Set the teaching mode of output 2 (Q2) to 2-point teaching

■ 8. Output 1 (Q1) output mode setting

Set the output mode of output 1 (Q1) ※This is not linked with the detection indicator.

no	Do not invert output 1 (Q1; light ON operation) (*)
inv	Invert output 1 (Q1; dark ON operation)

■ 9. Output 2 (Q2) output mode setting

Set the output mode of output 2 (Q2) ※This is not linked with the detection indicator.

no	Do not invert output 2 (Q2; light ON operation) (*)
inv	Invert output 2 (Q2; dark ON operation)

■ 10. Output 1 (Q1) timer function setting

Set the timer function of output 1 (Q1) (Unit: 10ms)
※Time delay is not linked with the detection indicator.

no	Do not use the timer function (*)
ond	Output 1 (Q1) operates with an ON delay
oFd	Output 1 (Q1) operates with an OFF delay
onF	Output 1 (Q1) operates with an ON delay + OFF delay
Sht	Output 1 (Q1) operates with a one shot timer

■ 11. Output 2 (Q2) timer function setting

Set the timer function of output 2 (Q2) (Unit: 10ms)
※Time delay is not linked with the detection indicator.

no	Do not use the timer function (*)
ond	Output 2 (Q2) operates with an ON delay
oFd	Output 2 (Q2) operates with an OFF delay
onF	Output 2 (Q2) operates with an ON delay and an OFF delay
Sht	Output 2 (Q2) operates with a one shot timer

■ 12. Offset

Teach to the value obtained by offsetting the current value by this setting value (Unit: mm)

-99 … 100	Setting range: -99 to 100 Default: 0 (*)

■ 13. Output 1 (Q1) threshold level

Specify the output 1 (Q1) threshold with a numeric value (unit: cm)

000 … 330	Setting range: 0 to 330 Default: 300 (*)

■ 14. Output 1 (Q1) near-side threshold setting

Specify the output 1 (Q1) near-side threshold with a numeric value
This can be set when “qc1” is set to “WdW” or “2Pt” (Unit: cm)

000 … 330	Setting range: 0 to 330 Default: 0 (*)

■ 15. Output 2 (Q2) threshold level

Specify the output 2 (Q2) threshold with a numeric value (unit: cm)

000 … 330	Setting range: 0 to 330 Default: 300 (*)

■ 16. Output 2 (Q2) near-side threshold setting

Specify the output 2 (Q2) near-side threshold with a numeric value
This can be set when “qc2” is set to “WdW” or “2Pt” (Unit: cm)

000 … 330	Setting range: 0 to 330 Default: 0 (*)

After finishing the settings, press the “RUN” button to return to the normal measurement display.
Also, the sensor will automatically return to the measurement display if no operations are performed on the setting menu for approx. 30 seconds.

※When the sensor is set to a value that only exists in IO-Link, the display shows ---.

- Support for the China RoHS directive

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

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