

Long Distance BGS Laser Sensor

**FASTUS**

# TOF-DL250 series

• TOF-DL250 □ □

## INSTRUCTION MANUAL

- Thank you for purchasing TOF-DL series. We hope you are satisfied with its performance.
- Please read this manual carefully and keep it for future reference.

### ■ Safety Symbols

The safety symbols and their meanings are as follows.

- 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.

- Locations where dust, salt, iron powders, or vapor (steam) is present.
- Locations subjected to corrosive gases or flammable gases.
- Locations where water, oil, or chemical splashes may occur.
- Locations where heavy vibrations or impacts may occur.
- Locations where the ambient temperature exceeds the rated range.
- Locations subject to rapid temperature changes (or where condensation occurs).
- Locations with strong electric or magnetic fields.
- 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 not be performed by the customer. Contact the Optex FA sales office.

In case water 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

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 when wiring the product for the correct wiring method. Incorrect wiring can damage the product or cause a malfunction. Output cannot be connected with other LED controller in series, nor in parallel.

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 is classified as Class 1 Laser Product by JIS C6802 :2014/IEC60825-1 :2007 and 2014 Laser Safety Standard.

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.

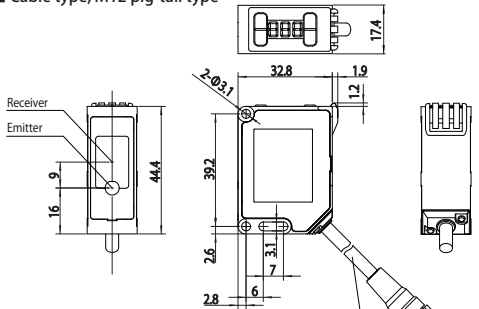


### Dimensions

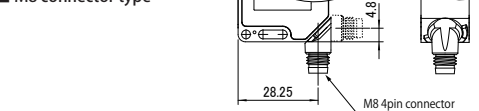
● Without mounting bracket

■ Cable type, M12 pig-tail type

[mm]

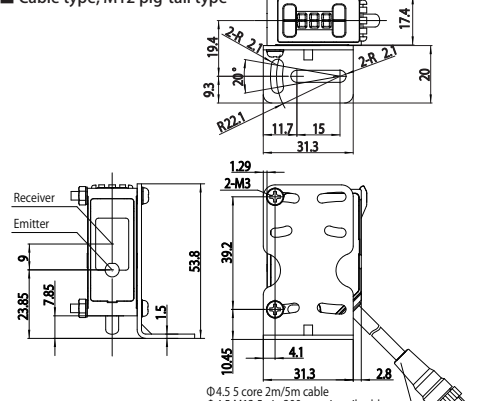


■ M8 connector type

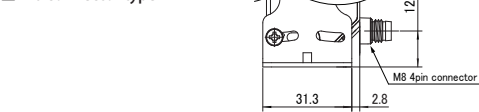


● With mounting bracket

■ Cable type, M12 pig-tail type

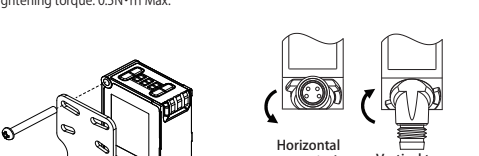


■ M8 connector type



### Installation

Tightening torque: 0.5N·m Max.



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.

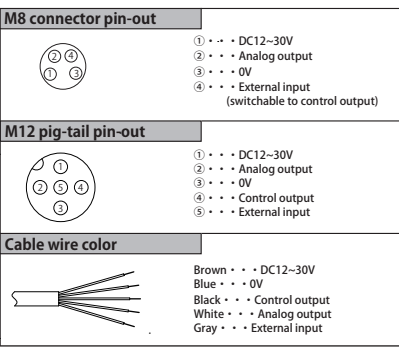
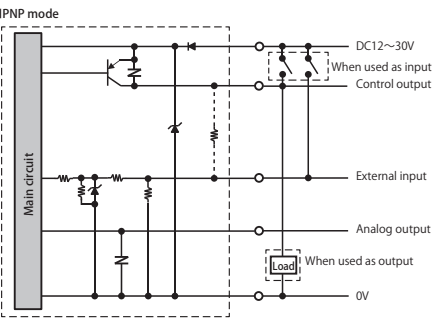
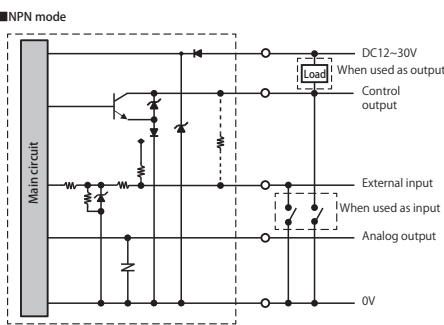
### SPECIFICATIONS

| Type                   | Analog Output Type   | Control Output Type |
|------------------------|--|---------------------|
| M8 Connector Type      | TOF-DL250AC  | TOF-DL250DC         |
| 2m Cable Type          | TOF-DL250A   | TOF-DL250T          |
| 5m Cable Type          | TOF-DL250A-5   | TOF-DL250T-5        |
| M12 Pig-tail Type      | TOF-DL250AM12  | TOF-DL250TM12       |
| Sensing distance       | 0.25 ~ 2.5m<br>(Reflectance: 6% Black paper/18% Gray paper/90% White paper)  |                     |
| Light source           | Red laser diode (wave length: 650nm, maximum output: 64mW, pulse duration: 7ns, repetition rate: 11.11MHz), average output: 390 μW Max.                  |                     |
| Laser class            | CLASS 1 (IEC/JIS/FDA*)   |                     |
| Spot size*2            | Φ 10mm /2.5m   |                     |
| Hysteresis             | 15% Max. (Reflectance: 6% Black paper/18% Gray paper/90% White paper)  |                     |
| Sampling period        | 200 μS   |                     |
| Response time          | 0.5ms Max. (averaging number: 1)   |                     |
| Indicator              | Output indicator (Orange LED*)/ Stable indicator (Green LED)/Unstable indicator (Red LED) (All LED will be OFF when Laser is OFF)                        |                     |
| Digital display        | 7 segment 3 digit (unit: cm)   |                     |
| Threshold adjustment   | Teaching and +/- buttons   |                     |
| Output mode            | Light ON / Dark ON selectable by setting   |                     |
| Control output         | NPN/PNP (selectable by setting) open collector DC30V, 100mA max. (Residual 1.8V max)*4   |                     |
| External input         | Laser OFF, External teaching   |                     |
| Analog output          | Current: 4~20mA/<br>Voltage: 0~10V (selectable by setting)   |                     |
| Power supply           | DC12~30V including ripple (P-P)10%*5 DC10~30V including ripple (P-P)10%  |                     |
| Current consumption    | 60mA Max.*6  |                     |
| Applicable regulations | EMC EMC Directive (2014/30/EU)<br>RoHS RoHS Directive (2011/65/EU), China RoHS(MIIT Order No.32)<br>Safety FDA Regulations (21 CFR 1040.10 and 1040.11*) |                     |
| Applicable standards   | EN 60947-5-7 / IEC 60825-1 EN 60947-5-2 / IEC 60825-1  |                     |
| Cross talk prevention  | Up to 2 units  |                     |
| Protection circuit     | Reverse connection protection, Over current protection   |                     |
| Ambient Temp./Humid.   | -10~50°C/35~85%RH (no condensation)  |                     |
| Storage Temp./Humid.   | -40~70°C/35~95%RH (no condensation)  |                     |
| Ambient illuminance    | Sun light 4,000lx Max. at receiving window<br>Incandescent light 3,000lx Max. at receiving window  |                     |
| Vibration resistance   | 10~55Hz amplitude 1.5mm X, Y, Z each 2h  |                     |
| Shock resistance       | 500m/s <sup>2</sup> X, Y, Z each 3 times   |                     |
| Protection category    | IP67   |                     |
| Material               | Case: PC / Lens: PMMA  |                     |
| Weight including cable | M8 connector type: approx. 30g, 2m cable type: approx. 88g,<br>5m cable type: approx. 188g, M12 pig-tail type: approx. 48g                               |                     |
| Accessories            | 1 mounting bracket: BEF-WK190, 2 screws: M3 x 20mm   |                     |

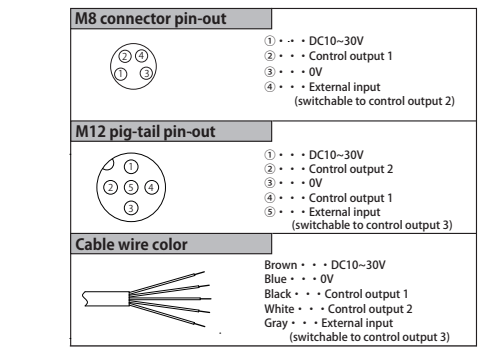
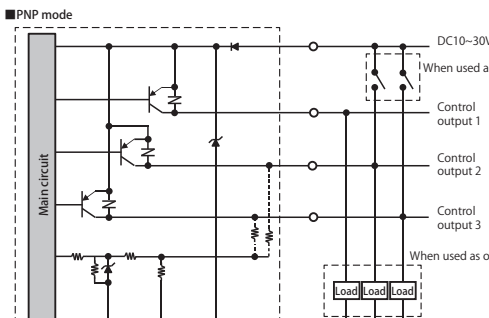
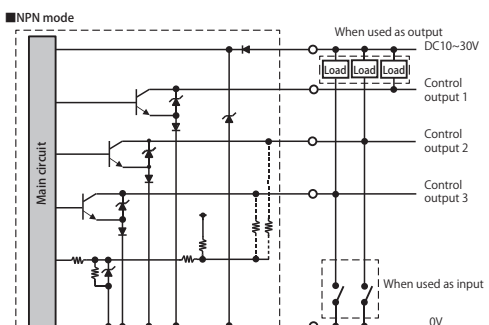
- \*1 These products are Classified as CLASS 1 by IEC 60825-1:2007 according to Laser Notice No.50, FDA Guidance Document.
- \*2 Defined with center strength 1/e<sup>2</sup>(13.5%) at the center. There may be leak light other than the specified spot size. The sensor may be affected when there is a highly reflective object close to the detection area.
- \*3 Analog output type have 2 I/O at same time. M8 connector type (TOF-DL250DC) has 2 for 2 control outputs.
- \*4 Analog output type have 1. M8 connector type (TOF-DL250DC) has 2. Other types have 3 control outputs.
- \*5 Use power supply with DC12.0V Min. to get sufficient output for analog output.
- \*6 Excluding load current for control output.
- \*7 Except for deviations pursuant to laser notice No.50.

### Circuit diagram

■ Analog output type

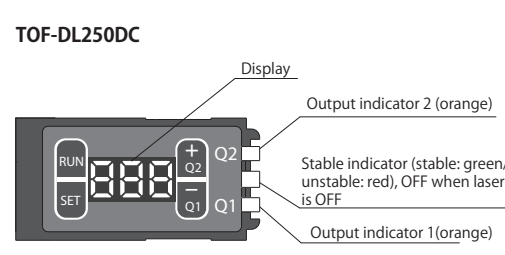
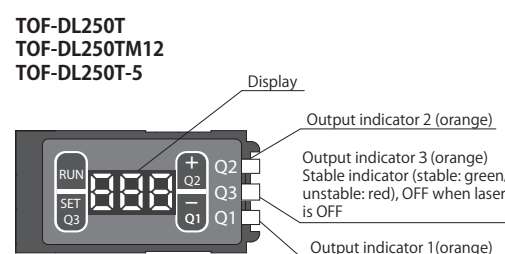
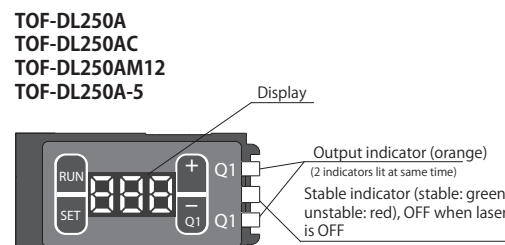


■ Control output type



### Name of the parts and setup

Name and function of buttons and indicators vary depends on the model.



| Button | Function while sensing  | Function while setting       |
|--------|---|------------------------------|
| +      | Increase setting value  | Increase setting value       |
| -/Q1   | Decrease setting value  | Decrease setting value       |
| 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 "Lc".       | Back to "RUN" (sensing) mode |
| SET    | Go to setting mode. By pressing 1 second or more, Teaching of Output 2 will be done for current distance. Then, the display shows "tc2" and the threshold level. * For TOF-DL250DC, external input to be set "out". | Fix the setting value        |
| Q2(*)  | By pressing 1 second or more, Teaching of Output 1 will be done for current distance. Then, the display shows "tc1" and the threshold level. * For TOF-DL250AC, external input to be set "out".                     |                              |
| Q3(*)  | By pressing 1 second or more, Teaching of Output 3 will be done for current distance. Then, the display shows "tc3" and the threshold level. * External input to be set "out".                                      |                              |

\* Valid only for the model that has "Q2" and "Q3" shown on the panel.

### Extension mode

You can get to "Extension mode" by clicking "RUN" button or "SET" button. (\* means default value)

- External input (MF input)**
  - Press "SET" to get to setting menu
  - Set function of external input
 

| Model                    | Target output  |
|--------------------------|----------------|
| TOF-DL250A TOF-DL250AM12 | Not applicable |
| TOF-DL250AC              | Output 1       |
| TOF-DL250T TOF-DL250TM12 | Output 3       |
| TOF-DL250DC              | Output 2       |
  - teach Analog output type: Teaching Output 1  
Control output type: Less than 1 second: Teaching Output 1  
More than 1 second less than 2 seconds: Teaching Output 2  
More than 2 seconds: Invalid
  - LSA Laser OFF: Kill the laser power (\*)  
LSA Laser ON: Activate the laser power
- NPN/PNP selection**
  - Won't be changed by initializing
  - nan Set input/output as NPN (\*)
  - PNP Set input/output as PNP
- Analog output Current/Voltage selection** \* Only for Analog output type
  - 4.0 Set as current output 4~20mA (\*)
  - 10.0 Set as voltage output 0~10V
- Operating mode Light ON/Dark ON (stability output) selection**
  - tan Light ON: Turns ON when the distance exceeds threshold (\*)
  - dan Dark ON: Turns ON when the distance is less than threshold
  - Stability-Light ON: Output 1 turns ON when stable (Other output: Light ON)
  - Stability-Dark ON: Output 1 turns ON when unstable (Other output: Dark ON)
- Averaging**
  - Set number of averaging
 

|     |              |
|-----|--------------|
| 1   | 1 time       |
| 4   | 4 times      |
| 16  | 16 times     |
| 64  | 64 times (*) |
| 256 | 256 times    |
- Behavior when Alarm** \* Only for Analog output type
  - Set behavior of Analog output when it's out of sensing
 

|     |  |
|-----|--|
| alp | Output Maximum current /voltage (*)        |
| hld | Hold: Keep the value just before the alarm |
- Initializing**
  - Initialize settings to the value set when shipped except NPN/PNP setting
 

|     |                    |
|-----|--------------------|
| nan | Not initialize     |
| yes | Execute initialize |

- Display**
  - Select ON/OFF of the display
 

|     |   |
|-----|---|
| on  | ON: Activate the display (unit: cm) (*)                                   |
| off | OFF: Darken the display when there is no button operation over 30 seconds |
- Delay**
  - Set delay function for output on detection
 

|     |  |
|-----|--|
| off | Not use delay function (*)                   |
| ofd | OFF delay: Delays output timing of ON to OFF |
| ond | ON delay: Delays output timing of OFF to ON  |
| shs | One shot: Output ON for the period set       |

 Input value Range: 0~999 Default: 0 Unit: 10ms
- Near side setting** \* Only for Analog output type
  - Set the distance to output 4mA (current output)/0V (voltage output)
 

|     |             |
|-----|-------------|
| 888 | Input value |
|-----|-------------|

 Range: 0~400, Default: 0, Unit: cm
- Far side setting** \* Only for Analog output type
  - Set the distance to output 20mA (current output)/10V (voltage output)
 

|     |             |
|-----|-------------|
| 888 | Input value |
|-----|-------------|

 Range: 0~400, Default: 300, Unit: cm
- Output 1 threshold level**
  - Set the threshold level of Output 1
 

|     |             |
|-----|-------------|
| 888 | Input value |
|-----|-------------|

 Range: 0~400, Default: 300, Unit: cm
- Output 2 threshold level** \* Only for control output type
  - Set the threshold level of Output 2
 

|     |             |
|-----|-------------|
| 888 | Input value |
|-----|-------------|

 Range: 0~400, Default: 300, Unit: cm
- Output 3 threshold level** \* Only for control output type
  - Set the threshold level of Output 3
 

|     |             |
|-----|-------------|
| 888 | Input value |
|-----|-------------|

 Range: 0~400, Default: 300, Unit: cm
- Offset** \* Only for control output type
  - Set the offset value to add on the Teaching level (Offset value is valid from 2nd time of Teaching)
 

|     |             |
|-----|-------------|
| 888 | Input value |
|-----|-------------|

 Range: -50~+50, Default: 0, Unit: cm

By clicking "RUN" button or leave the setting mode for 30 seconds, it will go back to "RUN" (sensing) mode.

- Support for the China RoHS directive
  - For details on the support for the China RoHS directive, see the following website. [http://www.optex-fa.com/rohs\\_cn/](http://www.optex-fa.com/rohs_cn/)
- Specifications are subject to change without notice
- For more information, questions and comments regarding products, please contact us below.

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