**Displacement Sensor**

**CD33-L SERIES**

**Specular**

**Laser type**

**INSTRUCTION MANUAL**

- Confirm if the item meets your needs.
- Before the use, you should first thoroughly read this manual and operate correctly as mentioned.
- You should keep this manual at hand for proper use.

**Meanings of Safety Symbol**

| WARNING | Indicates a possible hazard that may result in death, serious injury, WARNING or serious property damage if the product is used without observing the stated instructions. |
| WARNING | Mandatory Requirements |
- 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 blindness.
- Do not disassemble or modify the product since it is not designed to be disassembled or modified at customer's end and it may cause personal injury, fire or electric shock.
- This product is not an explosion-proof construction. Do not use the product under flammable, explosive gas or liquid environment.
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

**WARNING Safety Precautions**

1. It is dangerous to wire or attach/remove the connector with the power on. Make sure to turn off the power before operation.
2. Installing in the following places may result in malfunction:
   - A dusty or steamy place
   - A place generating corrosive gas
   - A place directly receiving scattering water or oil
   - A place suffered from heavy vibration or impact
3. The product is not designated for outdoor use.
4. Do not use the sensor in a transient state at power on (Approx. 15 min).
5. Warm up period
   - Do not wire with the high voltage cable or the power line.
   - Failure to do this will cause malfunction by induction or damage.
   - Do not use the product in water.
   - Operate within the rated range.
   - Wipe off dirt on the emitting/receiving parts to maintain correct detection also avoid direct impact on the product.

**This product cannot be used as a safety device to protect human body.**

**Specifications**

- **CD33-L SERIES**

**CD33-L30**
- Laser Type: CD33-L30N(P)
- Distance Measurement: 26.4mm
- Spot Size: Near 0.15×0.15mm
- Laser Power: Max. output 390μW
- Temperature: -20°C to +60°C
- Humidity: RH 10% to 95%
- Ambient Light: 10,000 lux max.
- Warm-up period: 15 min.

**CD33-L50**
- Laser Type: CD33-L50N(P)
- Distance Measurement: 47.3mm
- Spot Size: Near 0.15×0.15mm
- Laser Power: Max. output 390μW
- Temperature: -20°C to +60°C
- Humidity: RH 10% to 95%
- Ambient Light: 10,000 lux max.
- Warm-up period: 15 min.

**CD33-L85**
- Laser Type: CD33-L85N(P)
- Distance Measurement: 82.9mm
- Spot Size: Near 0.15×0.15mm
- Laser Power: Max. output 390μW
- Temperature: -20°C to +60°C
- Humidity: RH 10% to 95%
- Ambient Light: 10,000 lux max.
- Warm-up period: 15 min.

**Meaning of indicators**

- **Blink Once**: Measures higher peak between 2 peaks
- **Blink Twice**: Measures the higher peak
- **Blink Three Times**: Measures distance

**Laser Diode wavelength 850nm**

**Precautions for using laser**

- **Laser label**
  - This product is classified as Class I by JIS Q6060/IEC and Class II by FDA Laser Product Laser Safety standard.

- **Regulations in the USA**
  - When exporting laser devices to the USA, the USA laser control, FDA (Food and Drug Administration) is applied. This product has been already reported to CDHR (Center for Devices and Radiological Health). For details, contact our customer service.

**Installations**

Install the sensor and adjust the light spot onto the measuring point so that the distance indicator turns ON ( in orange) at the middle of measuring range. Use M4 screw (tightening torque need to be under 0.8N·m).
Functions

Teach mode

- Set the range of Control Output:
  - One point teaching: From the position of the teaching -0.19 (FS) to the middle of the measuring range.
  - Two points teaching: From the position of the first teaching +0.19 (FS) and the position of the second teaching +0.19 (FS).
  - One point reverse teaching: From the position of the teaching +0.19 (FS) to the far side of the measuring range.

- Distance indicator turns ON (orange) at the middle of the measuring range.

- Specifications of Measuring Range:
  - CD33-L30CN(P), CD33-L50CN(P), CD33-L85CN(P)
  - Max. output 390μW

- One point teaching:
  - Push the Select button more than five seconds to enter Teach mode.
  - Push the Select button and let 01/02 indication turn on.
  - Set the object in the position you want to measure and push the Set button.
  - If the adjustment failure, indication flashes five times. Try again getting back to 02 of above.

- Two points teaching:
  - Push the Select button more than five seconds to enter Teach mode.
  - Push the Select button and let 01/02 indication turn on.
  - Set the object at the first point of the range that you want to measure and push the Set button.
  - 01/02 indicator flashes twice. In the case of adjustment failure, the indicator flashes for five seconds. Try again getting back to 02 of above.

- One point reverse teaching:
  - Push the Select button more than five seconds to enter Teach mode.
  - Push the Select button and let 01/02 indication turn on.
  - Set the object in the position you want to measure and push the Set button.
  - 01/02 indication flashes twice. In the case of adjustment failure, the indication flashes for five seconds. Try again getting back to 02 of above.

- Push the Select button more than five seconds to return to Run mode.

- One point reverse teaching:
  - Push the Select button more than five seconds to enter Teach mode.
  - Push the Select button and let 01/02 indication turn on.
  - Set the object at the second point you want to measure and push the Set button.
  - 01/02 indication flashes twice. In the case of adjustment failure, the indication flashes for five seconds. Try again getting back to 02 of above.

- Push the Select button more than five seconds to return to Run mode.

Mandatory Requirements

- Laser label:
  - This product is classified as Class 1 by JIS C6802/IEC and Class II by FDA Laser Product Laser Safety Standard.

- Sun light: 10,000 lx max. / Incandescent lamp: 3,000 lx max.

- Life span: 50,000 hours

- Laser off, Remote teaching, Sample Hold (choose one function)

- Range of sensing:
  - One Point Teaching:
    - Near: 26.3mm
    - Middle: 47.3mm
    - Far: 82.9mm

- Laser OFF:
  - Approx. 65g (without cable)
  - Approx. 70g

- Material:
  - PBT (Case)
  - PMMA (Front window)

- Dimensions:
  - Width: 29.4mm
  - Height: 42.8mm
  - Depth: 15.2mm

- Operating temp./humidity:
  - Temperature: -10~+45℃ / 35~85%RH (No condensation or freezing)
  - Temperature: -20~+60℃ / 35~95%RH (No condensation or freezing)

- Response:
  - Averaging averaging: 16

- Operating environment:
  - Phone 800-280-6933
  - www.optex-ramco.com

Safety Precautions

- It is dangerous to wire or attach/remove the connector with the power on. Make sure to turn off the power before operation.

- Installing in the following places may result in malfunction:
  - 1. A dusty or steamy place
  - 2. A place generating corrosive gas
  - 3. A place directly receiving scattering water or oil
  - 4. A place suffered from heavy vibration or impact.

- Averaging average:
  - Blink once: Fast (averaging 1 time)
  - Blink twice: Standard (averaging 16 times)
  - Blink three times: High Res. (averaging 64 times)

- This product cannot be used as a safety device to protect human body.

- This setting is choice of measurement peak at receiver.
  - Blink once: measures the 2nd peak
  - Blink once: measures higher peak
  - Blink twice: measures the 1st peak
  - Blink three times: measures distance between 2 peaks

- One shot trigger is possible to select through external input.
  - Blink once: One shot trigger
  - Blink once: Laser OFF
  - Blink twice: Remote teaching
  - Blink three times: Sample Hold

- Sampling period setting:
  - Blink once: 500μs
  - Blink twice: 1000μs
  - Blink three times: 1500μs
  - On: 2000μs

- This function does not work when you set the output of Q2. Reset the product when you want to use self-diagnosis again.
Command Table

<For diffuse reflection / specular reflection type>

<table>
<thead>
<tr>
<th>Command</th>
<th>Type*</th>
<th>Initial value</th>
<th>Description</th>
<th>Example of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>READ</td>
<td>CR</td>
<td>–</td>
<td>Start continuous reading of measurements</td>
<td>85.00000[CR]85.00010[CR]85.0---</td>
</tr>
<tr>
<td>READ</td>
<td>R</td>
<td>–</td>
<td>Stop continuous reading of measurements</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>MEASURE</td>
<td>R</td>
<td>–</td>
<td>Read the measurements</td>
<td>[STX]85.0000[ETX]</td>
</tr>
<tr>
<td>START_MEASURE</td>
<td>CR</td>
<td>–</td>
<td>Start continuous reading of measurements and sensitivity</td>
<td>85.00000[121][CR]85.00010[121][CR]85.0---</td>
</tr>
<tr>
<td>MEASURE_S</td>
<td>R</td>
<td>–</td>
<td>Stop continuous reading of measurements and sensitivity</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>Q2</td>
<td>R</td>
<td>–</td>
<td>Read Q2 output</td>
<td>[STX]ON[ETX]</td>
</tr>
<tr>
<td>Q2.HI</td>
<td>R</td>
<td>–</td>
<td>Read actual setting of Q2.HI</td>
<td>[STX]100.0000[ETX]</td>
</tr>
<tr>
<td>Q2.LO</td>
<td>R</td>
<td>–</td>
<td>Read actual setting of Q2.LO</td>
<td>[STX]65.0000[ETX]</td>
</tr>
<tr>
<td>Q2.HI</td>
<td>60.000</td>
<td>W</td>
<td>Set Q2.HI for example to 60mm</td>
<td>[STX] &gt; [ETX] or [STX]?[ETX]</td>
</tr>
<tr>
<td>Q2.LO</td>
<td>40.000</td>
<td>W</td>
<td>Set Q2.LO for example to 40mm</td>
<td>[STX] &gt; [ETX] or [STX]?[ETX]</td>
</tr>
<tr>
<td>Q2 DEFAULT</td>
<td>R</td>
<td>–</td>
<td>Set Q2 to default (Self-diagnostics output)</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>AVG</td>
<td>R</td>
<td>–</td>
<td>Read the setting of the response time</td>
<td>[STX]FAST[ETX]</td>
</tr>
<tr>
<td>AVG</td>
<td>W</td>
<td>–</td>
<td>Set response time to Fast</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>AVG</td>
<td>W</td>
<td>–</td>
<td>Set response time to Standard</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>AVG</td>
<td>W</td>
<td>–</td>
<td>Set response time to High resolution</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>MF</td>
<td>R</td>
<td>–</td>
<td>Read setting of multi-functional inputs</td>
<td>[STX]MF[ETX]</td>
</tr>
<tr>
<td>MF</td>
<td>W</td>
<td>–</td>
<td>Set to Laser off (default)</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>MF</td>
<td>W</td>
<td>–</td>
<td>Set to Sample Hold</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>MF</td>
<td>W</td>
<td>–</td>
<td>Set to external Teach</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>MF</td>
<td>W</td>
<td>–</td>
<td>Set to one shot by trigger or command</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>ALARM</td>
<td>R</td>
<td>–</td>
<td>Read actual setting for Alarm</td>
<td>[STX]ALARM[ETX]</td>
</tr>
<tr>
<td>ALARM.CLAMP</td>
<td>W</td>
<td>–</td>
<td>Set Alarm to clamp</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>ALARM.HOLD</td>
<td>W</td>
<td>–</td>
<td>Set Alarm to Hold</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>RESET</td>
<td>W</td>
<td>–</td>
<td>Reset all settings to default settings</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>ON</td>
<td>W</td>
<td>–</td>
<td>Set MF active</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>OFF</td>
<td>W</td>
<td>–</td>
<td>Set MF inactive</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>ON,1500</td>
<td>W</td>
<td>–</td>
<td>Q2: one point teaching</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>ON,1600</td>
<td>W</td>
<td>–</td>
<td>Q2: one point reverse teaching</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>ON,1700</td>
<td>W</td>
<td>–</td>
<td>Offset +8 +9</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>ON,2500</td>
<td>W</td>
<td>–</td>
<td>Offset cancel</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>SAVE</td>
<td>R</td>
<td>–</td>
<td>Save all setting</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>WRITE</td>
<td>R</td>
<td>–</td>
<td>Write all setting *3</td>
<td>[STX]xxxxxxx[ETX]</td>
</tr>
<tr>
<td>SERIAL.NO</td>
<td>R</td>
<td>–</td>
<td>Read Serial number *4</td>
<td>[STX]xxxxxxx[ETX]</td>
</tr>
<tr>
<td>USER DATA</td>
<td>R</td>
<td>–</td>
<td>Read user Data</td>
<td>[STX]xxxxxxx[ETX]</td>
</tr>
<tr>
<td>USER DATA,1500</td>
<td>W</td>
<td>–</td>
<td>Write user data</td>
<td>[STX]1500[ETX]</td>
</tr>
<tr>
<td>BIT RATE</td>
<td>R</td>
<td>–</td>
<td>Read actual setting for Bit rate</td>
<td>[STX]8[ETX]</td>
</tr>
<tr>
<td>BIT RATE,9.6</td>
<td>W</td>
<td>–</td>
<td>Set baud rate</td>
<td>[STX] &gt; [ETX]</td>
</tr>
<tr>
<td>SAMPLE RATE</td>
<td>R</td>
<td>–</td>
<td>Read actual setting for sampling period</td>
<td>[STX]50000[ETX]</td>
</tr>
<tr>
<td>SAMPLE RATE,500</td>
<td>W</td>
<td>–</td>
<td>Set sampling period *7</td>
<td>[STX] &gt; [ETX]</td>
</tr>
</tbody>
</table>

Command type = CR: Continuous reading command, R: Reading command, W: writing command
The space (20H) is shown as ( ) for convenience.

*1 Sensitivity is automatically adjusted between the value of 0 and 223. (0 as Low limit, 223 as HI limit).
*2 Manual setting of sensitivity is not available.
*3 Input the distance to set by mm. Possible to input decimal four columns, but the setting distance over the detection performance becomes invalid.
*4 Write the values in turn as they have been read out in the SAVE.
*5 Reads out the serial numbers (11 digit) that is printed in the product label on the back.
*6 Up to 16byte by ASCII code
*7 500µs is the factory set value. Choose sampling period among (500/1000/1500/2000µs)
*8 If Offset is activated, it will output displacement data including minus sign for the data smaller than zero.
*9 Please set MF input as “Remote teaching” when you activate Offset.
## Command Table

### Asynchronous Communication

<table>
<thead>
<tr>
<th>Command</th>
<th>Type</th>
<th>Initial Value</th>
<th>Description</th>
<th>Example of Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODE</td>
<td>R</td>
<td>HIGHEST</td>
<td>Read out measurement settings</td>
<td>STX HIGHEST [ETX]</td>
</tr>
<tr>
<td>MODE(HIGHEST)</td>
<td>W</td>
<td>●</td>
<td>Measures higher peak</td>
<td>STX [ETX]</td>
</tr>
<tr>
<td>MODE(FIRST)</td>
<td>W</td>
<td>●</td>
<td>Measures the 1st peak</td>
<td>STX [ETX]</td>
</tr>
<tr>
<td>MODE(LAST)</td>
<td>W</td>
<td>●</td>
<td>Measures the 2nd peak</td>
<td>STX [ETX]</td>
</tr>
<tr>
<td>MODE(GLASS)</td>
<td>W</td>
<td>●</td>
<td>Measures distance between 2 peaks</td>
<td>STX &gt; [ETX]</td>
</tr>
<tr>
<td>PIXEL_DATA</td>
<td>R</td>
<td>●</td>
<td>Read out pixel level (1024byte) and header (11byte) data from receiver</td>
<td>See below.</td>
</tr>
<tr>
<td>SENSE</td>
<td>R</td>
<td>●</td>
<td>Read out sensitivity value (0-223). The bigger, the higher sensitivity.</td>
<td>AUTO,XXX / FX,XXX</td>
</tr>
<tr>
<td>SENSE(AUTO)</td>
<td>W</td>
<td>AUTO</td>
<td>Change the sensitivity mode to automatic. Use fixed auto sensitivity usually.</td>
<td>STX [ETX]</td>
</tr>
<tr>
<td>SENSE(xxx)</td>
<td>W</td>
<td>●</td>
<td>Set sensitivity value, if use fixed sensitivity mode. If send the sensitivity value, sensor return response by 4 digit (current receiving level).</td>
<td>STX XXXX [ETX]</td>
</tr>
<tr>
<td>ZSUPPRESS</td>
<td>R</td>
<td>●</td>
<td>Read out the current zero suppress setting (Zero suppress: Rejecting “0” at the forefront of the data.)</td>
<td>STX ON [ETX] / [STX] OFF [ETX]</td>
</tr>
<tr>
<td>ZSUPPRESS</td>
<td>W</td>
<td>ON</td>
<td>Use zero suppress (default setting).</td>
<td>[ETX]</td>
</tr>
<tr>
<td>LOGIC</td>
<td>R</td>
<td>●</td>
<td>Change the current multi function input (MF: gray scale) status.</td>
<td>STX NORMAL [ETX] / [STX] INVERTED [ETX]</td>
</tr>
<tr>
<td>LOGIC(NORMAL)</td>
<td>W</td>
<td>NORMAL</td>
<td>Change the logic of the multi function input to &quot;Normal mode&quot;. (NPN: connect +V to active / PNP: connect +V to active)</td>
<td>[STX] [ETX]</td>
</tr>
<tr>
<td>LOGIC(INVERTED)</td>
<td>W</td>
<td>INVERTED</td>
<td>Change the logic of the multi function input to &quot;Inverted mode&quot;. (NPN: connect +V to active / PNP: connect -V to active)</td>
<td>[STX] [ETX]</td>
</tr>
<tr>
<td>GLASS,T</td>
<td>R</td>
<td>●</td>
<td>Read out the refractive index for correction value for measurement of the glass thickness</td>
<td>STX XXX [ETX]</td>
</tr>
<tr>
<td>GLASS,T xxx</td>
<td>W</td>
<td>●</td>
<td>Teaching the refractive index using gauge glass, measure the glass thickness and send its know thickness.</td>
<td>[STX] [ETX]</td>
</tr>
</tbody>
</table>

### Reading format of PIXEL_DATA

Response is 1040byte data including header and pixel data (No STX and ETX)

**Header data**: 1Byte at the forefront of the data.

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>Header</td>
</tr>
<tr>
<td>03</td>
<td>Pixel data</td>
</tr>
<tr>
<td>01</td>
<td>Pixel data</td>
</tr>
<tr>
<td>02</td>
<td>Pixel data</td>
</tr>
</tbody>
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<td>02</td>
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<td>Pixel data (Pixel data)</td>
</tr>
<tr>
<td>02</td>
<td>Pixel data (Pixel data)</td>
</tr>
</tbody>
</table>

**Pixel data**: 1024byte data after header data

<table>
<thead>
<tr>
<th>Byte</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>Pixel data (Pixel data)</td>
</tr>
<tr>
<td>03</td>
<td>Pixel data (Pixel data)</td>
</tr>
<tr>
<td>01</td>
<td>Pixel data (Pixel data)</td>
</tr>
<tr>
<td>02</td>
<td>Pixel data (Pixel data)</td>
</tr>
</tbody>
</table>

### Notes

- Reading format of PIXEL_DATA

- Header data: 1Byte at the forefront of the data.

- Pixel data: 1024byte data after header data

- One pixel is 2byte (16bit)

- Part of reserve data is response by 00 00

Manufactured and sold by:

OPTEX FA CO., LTD.
600-8815 Kyoto, Shimogyo, Awata Chudoji 91, Japan

For more information, questions and comments regarding products, please contact us.

Ramco Innovations
Phone 800-280-6933
www.optex-ramco.com