OPTEX FA

Displacement Sensor
CD33-L SERIES
Specular Laser type

CD33-L30□□
CD33-L50□□

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.

Carefully read and understand the safety precautions before operation. The important information is provided to protect your health and property. Do not apply any other installing or operating procedure other than that

Meanings of Safety Symbol

⚠ WARNING	Indicates a possible hazard that may result in death, serious injury, WARNINGS 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 automatically stop the laser emission when open. Disassembling or modifying at customer's end 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

● 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.
●The product is not designed for outdoor use.
●Do not use the sensor in a transient state at power on（Approx. 15min. Warm up period)
●Do not wire with the high voltage cable or the power lines.
　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.

Precautions for using laser

■Laser label
This product is classified as Class 1 by JIS C6802/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 CDRH (Center for Devices and Radiological Health). For details, contact our customer service.
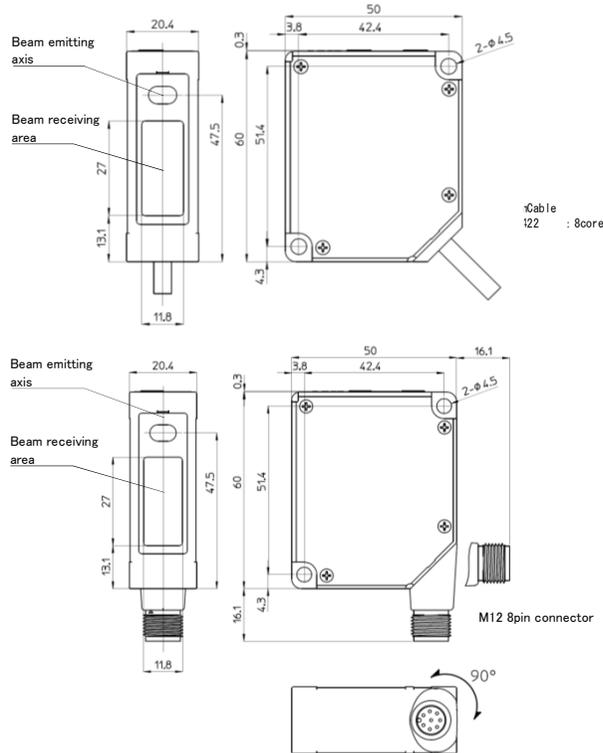
Label-A   Label-B

Label-A   Label-B
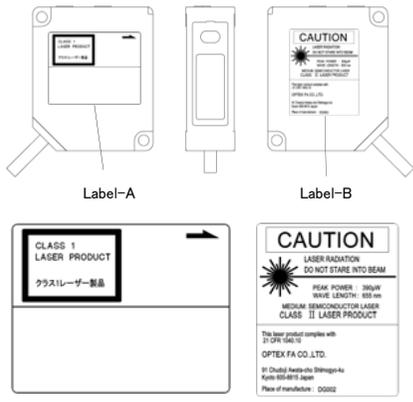
Ramco Innovations

Specifications

●Specifications of Measuring Range

Type	Cable type	CD33-L30N(P)	CD33-L50N(P)	CD33-L85N(P)
	Connector type	CD33-L30CN(P)	CD33-L50CN(P)	CD33-L85CN(P)
Center		26.3mm	47.3mm	82.9mm
Measuring range		±2mm	±5mm	±10mm
Light source		Red laser Diode (wave length 655nm)		
Peak power		Max. output 390μW		
Laser Class	IEC/JIS	CLASS1		
	FDA	CLASSⅡ		
Spot size (approx. volume) *1	Near	0.15×0.15mm	0.15×0.15mm	0.15×0.15mm
	Middle	0.1×0.1mm	0.1×0.1mm	0.1×0.1mm
	Far	0.15×0.15mm	0.15×0.15mm	0.15×0.15mm
Linearity *2		±0.2% F.S. (F.S.=4mm)	±0.2% F.S. (F.S.=10mm)	±0.2% F.S. (F.S.=20mm)
Resolution *3		1μm	2.5μm	5μm
Response time	Fast	averaging: 1 time 5ms max.		
	Standard	averaging: 16 times 12.5ms max.		
	High resolution	averaging: 64 times 36.5ms max.		
Sampling period		500 /1000 /1500 /2000μs		
Temperature Drift		±0.08% F.S./℃		
Indicators	Distance Indicator	Bar graph LED		
	Output Indicator	ON status : Orange		
MF (multi functional) input		Laser off、Remote teaching、Sample Hold (choose one function) Response time：3ms max.		
Circuit protection		Reverse polarity、Over current		
Protection Category		IP67		
Operating temp./humidity		−10～+45℃/35～85%RH (No condensation or freezing)		
Storage temp./humidity		−20～+60℃/35～95%RH (No condensation or freezing)		
Ambient Light		Sun light: 10,000 lx max. / Incandescent lamp: 3,000 lx max.		
Vibration resistance		10 to 55 Hz, Double amplitude 1.5 mm, 2 h for XYZ axes		
Shock resistance		50G (500m/s2)		
Warm up period		15min max.		
Material		PBT (Case) PMMA (Front window)		
Weight	Cable type	Approx. 65g (without cable)		
	Connector type	Approx. 70g		

*1 Defined with center strength 1/e2(13.5％). There may be leak light other than the specified spot size.
The sensor may be damaged when there is a highly reflective object around the targets.
*2 Averaging: 64(High resolution), Sampling period:500μs, Object: white ceramic.
*3 Middle of measuring range, Object: white ceramic.
*4 Diameter of min bend cable is 40mm.

Dimension

Beam emitting axis
Beam receiving area

20.4   50   3.8   42.4   0.3   2-φ4.5
47.5   27   13.1   60   51.4   4.3
11.8

Cable
122   : 8core

Beam emitting axis
Beam receiving area

20.4   50   16.1   3.8   42.4   0.3   2-φ4.5
47.5   27   16.1   60   51.4   13.1   4.3
11.8

M12 8pin connector

90°

Installation

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

CD33-L30

60.6
33
27.65
17.5
26.3
15°
30°
2
2
Middle of measuring range

CD33-L50

58.2
32.8
32.45
13.4
47.3
10.39°
20.77°
5.5
Middle of measuring range

CD33-L85

56.5
31.25
35.3
10.75
82.9
7.5°
15.05°
10
10
Middle of measuring range

(unit：mm)

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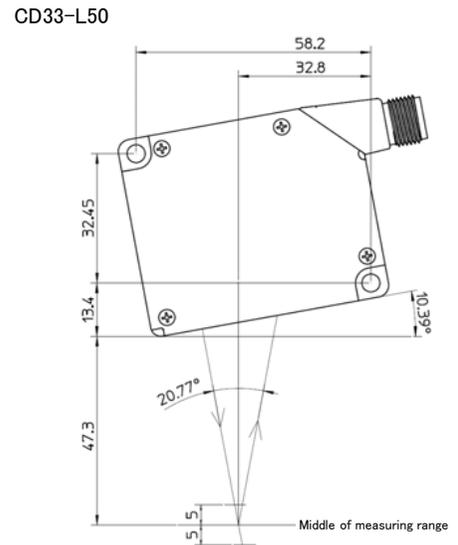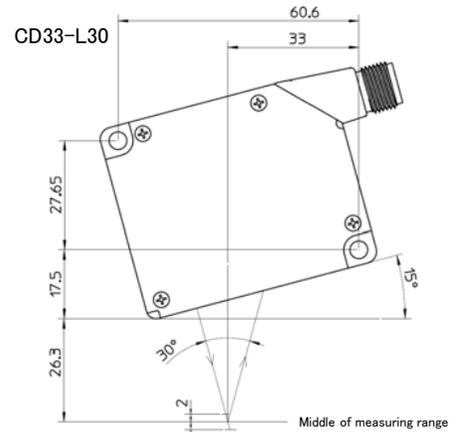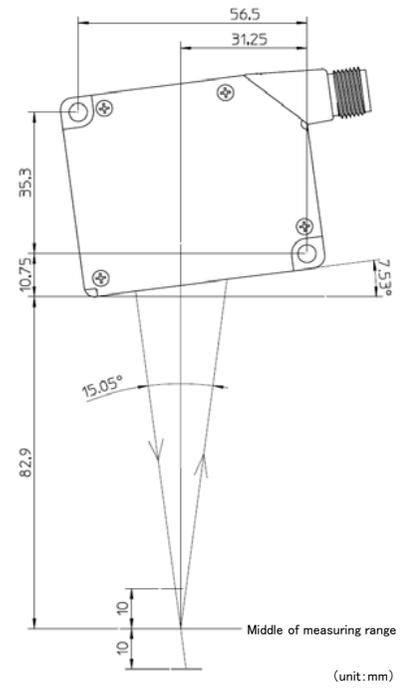
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Functions

● Teach mode

Functions	Functions indicated	Details	Settings and Adjustments	Factory Setting
Output setting	Q1 ◯ Q2 ◯	set the range of Control Output. One point teaching : From the position of the teaching − 0.15%(FS) to the Near side of the sensing range. Two points teaching : Between the position of the first point teaching +0.15%(FS) and the position of the second point teaching −0.15%(FS). One point reverse teaching: From the position of the teaching +0.15%(FS) to the Far side of the sensing range. Range of sensing of One Point Teaching Near　　　　One point Two points　Far Range of sensing of Two Points Teaching Range of sensing of One Point Reverse teaching	● One point teaching ①Push the Select button more than five seconds to enter Teach mode. ②Push the Select button and let Q1(Q2) indication turn on. ③Set the object in the position that you want to measure and push the Set button ④ Q1(Q2) indication flashes one time. 　In the case of adjustment failure, indication flashes for five seconds. Try again getting back to ② of above. ● Two points teaching ①Push the Select button more than five seconds to enter Teach mode. ②Push the Select button and let Q1(Q2) indication turn on. ③Set up the object at the first point of the range that you want to measure and push the Set button ④ Q1(Q2) indication flashes one time. In the case of adjustment failure, the indication flashes 　for five seconds. Try again getting back to ② of above. ⑤Q1(Q2)) which you Set up the object to the second point you want to measure, and push the Set button. 　Q1(Q2) indication flashes two times. In the case of the adjustment failure that the indication flashes 　for five seconds. Try again getting back to ② of above. ⑥Push the Select button more than five seconds to return to Run mode. ● One point Reverse teaching ①Push the Select button more than five seconds to enter Teach mode. ②Push the Select button and let Q1(Q2) indication turn on. ③Set the object in the position that you want to measure and push the Set button more than five seconds . ④ Q1(Q2) indication flashes one time. 　In the case of adjustment failure, the indication flashes five seconds. 　Try again getting back to ② of above. ⑤Push the Select button more than five seconds to return to Run mode.	The output in the measurement range & Self−diagnosis *1
External input	MF ◯	Select the function of the external input. Blink Once : Laser OFF Blink twice : Remote teaching Blink three times : Sample Hold MF input Laser output Remote teaching ◀ T ▶　Input time (refer to Remote Teaching) Sample Hold Analog output　Hold the output during inputs. One Shot Trigger Analog output　Update the output by edge of the input 　and hold the output until next input ＊Possible to choose One Shot Trigger by Special setting mode.	①Push the Select button more than five seconds to enter Teach mode. ②Push the Select button and let MF indication turn on. ③Choose the function you need by pushing Set button. ④Push the Select button more than five seconds to return to Run mode.	Laser OFF
Averaging	Avg ◯	Average count setting Blink Once : Fast (averaging 1 time) Blink twice : Standard (averaging 16 times) Blink three times : High Res. (averaging 64 times)	①Push the Select button more than five seconds to enter Teach mode. ②Push the Select button and let Avg. indication turn on. ③Choose the function by pushing Set button. ④Push the Select button more than five seconds to return to Run mode.	averaging: 16

● Special setting mode function

Functions	Functions indicated	Details	Settings and Adjustments	Factory Setting
Measurement settings	Q2 ◯	This setting is choice of measurement peak at receiver. On : measures the 2nd peak Blink Once : measures higher peak Blink twice : measures the 1st peak Blink three times : measures distance between 2 peaks On　measures the 2nd peak Blink Once　measures higher peak Blink twice　measures the 1st peak Blink three times　measures distance between 2 peaks	①Push the Select and set button at same time for more than five seconds to enter Special setting mode ②Push the Select button and let MF indication turn on. ③Choose the function by pushing Set button. ④Push the Select and set button more than five seconds to return to Run mode.	measures higher peak
One shot trigger	MF ◯	One shot trigger is possible to select through external input. On : One shot trigger Blink Once : Laser OFF Blink twice : Remote teaching Blink three times : Sample Hold	①Push the Select and set button at same time for more than five seconds to enter Special setting mode ②Push the Select button and let MF indication turn on. ③Choose the function by pushing Set button. ④Push the Select and set button more than five seconds to return to Run mode.	Laser OFF
Sampling period	Avg ◯	Sampling period setting Blink Once : 500 μs Blink twice : 1000 μs Blink three times : 1500 μs On : 2000 μs High response　↑　Shorter sampling period increases the response and longer sampling period enhances the sensitivity. ↓ High sensitivity	①Push the Select button more than five seconds to enter Teach mode. ②Push the Select button and let Avg. indication turn on. ③Choose the function by pushing Set button. ④Push the Select and set button more than five seconds to return to Run mode.	500 μs

(Remarks)
When the Teach mode / special setting mode it returns to RUN if no operation in given for 60 seconds.
*1 Self-diagnosis output comes at the time of (1) laser stop (2) saturation by mirror−like object or (3) low sensitivity.
 This function does not work when you set the output of Q2. Reset the product when you want to use self-diagnosis again.
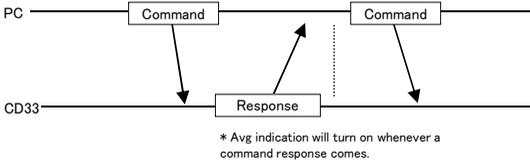
Communication

●Specification

Communication method	RS422
Synchro system	Asynchronous
Baud rate	9600/19200/38400/76800 bps ＊
Transmission code	ASCII
Data length	8 bit
Stop bit length	1 bit
Parity check	Nil
Data classification	STX・ETX

＊ Baud rate :9600bps at factory set

●Communication Procedure

When PC sends a command to CD33 it sends back a response to the PC.
In principle one response is given to one command. When sending a command,
make sure if you receive the response to the previous command.

```
PC ────┌─────────┐──────────────┌─────────┐────
        │ Command │               │ Command │
        └─────────┘               └─────────┘
                    ↘         ↗
CD33 ──────────────┌──────────┐────────────────
                    │ Response │
                    └──────────┘
```

＊ Avg indication will turn on whenever a
command response comes.

●Transmission Data Format (Command)

Reading out Setting/Measurement Value/Output Status

02H		03H
STX	COMMAND	ETX
1	2	3

1 The code showing the head of transmit data (02H).
2 Selects the command to transmit.

Writing the setting

02H		20H		03H
STX	COMMAND	SPACE	COMMAND	ETX
1	2	3	4	5

1 The code showing the head of transmit data (02H).
2 Selects the command to transmit.
3 Shows the separation between Command and Command (20H).
4 Set the Setting/Measurement Value/Output Status.

●Incoming Data Format (Response)

02H		03H
STX	RESPONSE	ETX
1	2	3

1 The code showing the head of incoming data (02H).
2 The response data is set to the transmitted command.
3 The code showing the completion of incoming data (03H).

The following four responses are for the written commands:
＞(3EH)　　　　　:Writings completed
? (3FH)　　　　　:Writings rejected due to wrong command, etc.
(Numerical value) : Measurements or settings

Continuous readout of measurement value
Readout the measurements continuously at "START_MEASURE"
command. The response of this case never has STX, ETX.　CR(0DH) is
inserted between the measurements.
(ex.)
85.0000＜CR＞85.0001＜CR＞85.0…

Sure to use the command "STOP_MEASURE" to stop the continuous
reading. Any other command will be valid until the stop command is set.
Continuous reading will not be activated simultaneously.

Command Table

〈For diffuse reflection /specular reflection type〉

	Command	type*	Initial value	Description	Example of Response
Read the measurements	START_MEASURE	CR	–	Start continuous reading of measurements	85.0000[CR]85.0001[CR]85.0…
	STOP_MEASURE	–	–	Stop continuous reading of measurements	[STX]＞[ETX]
	MEASURE	R	–	Read the measurements	[STX] 85.0000 [ETX]
	START_MEASURE_S	CR	–	Start continuous reading of measurements and sensitivity *1	85.0000 121[CR]85.0001 121[CR]85.0…
	STOP_MEASURE_S	–	–	Stop continuous reading of measurements and sensitivity *1	[STX]＞[ETX]
	MEASURE_S	R	–	Read the measurements and sensitivity	[STX]85.0000 121[ETX]
START_Q2		CR	–	Start continuous Q2 output	ON[CR]ON[CR]OFF[CR]OFF…
STOP_Q2		–	–	Stop continuous Q2 output	[STX]＞[ETX]
Q2 setting	Q2	R	–	Read Q2 output	[STX]ON[ETX]
	Q2_HI	R	–	Read actual setting of Q2 Hi	[STX]105.0000[ETX]
	Q2_LO	R	–	Read actual setting of Q2 Lo	[STX]65.0000[ETX]
	Q2_HI（）60.000	W	–	Set Q2 Hi for example to 60mm *2	[STX]＞[ETX] or [STX]?[ETX]
	Q2_LO（）40.000	W	–	Set Q2 Lo for example to 40mm *2	[STX]＞[ETX] or [STX]?[ETX]
	Q2 DEFAULT	R	●	Set Q2 to default (Self-diagnosis output)	[STX]＞[ETX]
Avg. setting	AVG	R	–	Read setting of the response time	[STX]FAST[ETX]
	AVG（）FAST	W	–	Set response time to Fast	[STX]＞[ETX]
	AVG（）MEDIUM	W	●	Set response time to Standard	[STX]＞[ETX]
	AVG（）SLOW	W	–	Set response time to High resolution	[STX]＞[ETX]
Multi functional input	MF	R	–	Read setting of multi functional inputs	[STX]LSR_OFF[ETX]
	MF（）LSR_OFF	W	●	Set to Laser off (default)	[STX]＞[ETX]
	MF（）SH	W	–	Set to Sample Hold	[STX]＞[ETX]
	MF（）TEACH	W	–	Set to external Teach	[STX]＞[ETX]
	MF（）OS	W	–	Set to one shot by trigger or command	[STX]＞[ETX]
Alarm setting	ALARM	R	–	Read actual setting for Alarm	[STX]CLAMP[ETX]
	ALARM（）CLAMP	W	●	Set Alarm to clamp	[STX]＞[ETX]
	ALARM（）HOLD	W	–	Set Alarm to Hold	[STX]＞[ETX]
RESET		W	–	Reset all settings to default settings	[STX]＞[ETX]
ON		W	–	Set MF active	[STX]＞[ETX]
OFF		–	–	Set MF inactive	[STX]＞[ETX]
External Teach	ON（）500	W	–	Q2：One point teaching The second point of two points of teaching ; Complete input of the same command within one minute.	[STX]＞[ETX]
	ON（）600	W	–	Q2：One Point Reverse teaching	[STX]＞[ETX]
	ON（）700	W	–	Offset *8 *9	[STX]＞[ETX]
	ON（）5000	W	–	Offset cancel	[STX]＞[ETX]
SAVE		R	–	Save all setting	
WRITE（）xxxx		W	–	Write all setting *3	
SERIAL_NO		R	–	Read Serial number *4	[STX]xxxxxxxxxxF[ETX]
USER DATA		R	–	Read user Data	[STX]xxxxxxxxxxxxxxxx[ETX]
USER_DATA（）xxx		W	–	Write user data (max. 16 byte ASCII) *5	[STX]＞[ETX]
BIT_RATE		R	–	Read actual setting for Bit rate	[STX]9.6K[ETX]
BIT_RATE（）9.6		W	9.6	Set baud rate *6	[STX]＞[ETX]
SAMPLE_RATE		R	–	Read actual setting for sampling period	[STX]500US[ETX]
SAMPLE_RATE（）500		W	500	Set sampling period *7	[STX]＞[ETX]

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 HIGH limit).
　 Manual setting of sensitivity is not available.
*2 Input the distance to set by mm. Possible to input decimal four columns, but the setting distance
　 over the detection performance becomes invalid.
*3 Write the values in turn as they have been read out in the SAVE.
*4 Reads out the serial numbers (11 digit) that is printed in the product label on the back.
*5 Up to 16byte by ASCII code
*6 Baud rate is 9.6kbps at factory set. Choose baud rate among
　 (9.6/19.2/38.4/57.6/76.8/115.2/128/256kbps)
*7 Sampling period is 500 μs at factory set. Choose sampling period among (500/1000/1500/2000 μs)
*8 While 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.

〈Only for specular reflection type〉

	Command	type*	Initial value	Description	Example of Response
Measurement settings	MODE	R	HIGHEST	Read out measurement settings	[STX] HIGHEST [ETX]
	MODE()HIGHEST	W	●	measures higher peak	[STX] > [ETX]
	MODE()FIRST	W	–	measures the 1st peak	[STX] > [ETX]
	MODE()LAST	W	–	measures the 2nd peak	[STX] > [ETX]
	MODE()GLASS	W	–	measures distance between 2 peaks	[STX] > [ETX]
	PIXEL_DATA	R	–	Read out pixel level (1024byte) and header (16byte) data from receiver	See below.
Sensitivity setting	SENSE	R	–	Read out sensitivity value (0–223). The bigger higher sensitivity.	AUTO_XXX / FIX_XXX
	SENSE()AUTO	W	AUTO	Change the sensitivity mode to automatic. Use fixed auto sensitivity usually.	[STX] > [ETX]
	SENSE()xxx	W	–	Set sensitivity value , if use fixed sensitivity mode. If send the sensitivity value , sensor return response by 4 digit (current receiving level).	[STX] XXXX [ETX]
Zero suppress setting	ZSUPPRESS	R	–	Read out the current zero suppress setting. (Zero suppress : Rejecting "0" at the forefront of the data.)	[STX] ON [ETX] / [STX] OFF [ETX]
	ZSUPPRESS()ON	W	ON	Use zero suppress（default setting）.	[STX] > [ETX]
	ZSUPPRESS()OFF	W	–	Does not use zero suppress.	[STX] > [ETX]
Multi functional input logic setting	LOGIC	R	–	Read out the current multi function input (MF : gray cable) status.	[STX] NORMAL [ETX] / [STX] INVERTED [ETX]
	LOGIC()NORMAL	W	NORMAL	Change the logic of the multi function input to "Normal mode".(NPN：connect 0V to active ／ PNP：connect +V to active)	[STX] > [ETX]
	LOGIC()INVERTED	W	–	Change the logic of the multi function input to " Inverted mode".(NPN：connect +V or open to active ／ PNP：connect 0V or open to active)	[STX] > [ETX]
	GLASS_T	R	–	Read out the refractive index for correction value for measurement of the glass thickness.	[STX] XXX [ETX]
	GLASS_T xxx	W	–	Teaching the refractive index using gauge glass. Measure the glass thickness and send its know thickness.	[STX] > [ETX]

●Reading format of PIXEL_DATA

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

Header 16byte	Pixel deta : 512pixcel 1pixel = 2byte 1024byte

Header data
16byte at the forefront of the data.

bit data	0byte	1byte	2byte	3byte	4byte	5byte	6byte	7byte	8byte	9byte	10byte	11byte	12byte	13byte	14byte	15byte
lower/higher	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H

read the measurement settings		read the first peak pixel	read the second peak pixel	reading threshold	reserve	reserve	reserve	reserve
0	Highest	response by 0–511 (number is pixel position)	response by 0–511 (number is pixel position)	response threshold				
1	First							
2	Glass							
3	Last							

example

Hex	02	00	42	01	00	00	1C	04	00	00	00	00	00	00	00	00
Dec	2		322		0		1052		0		0		0		0	

※One data is 2byte(16bit)
※Part of reserve data is response by 00 00

Pixel data
1024byte data after header data

bit data	0byte	1byte	2byte	3byte	4byte	5byte		1018byte	1019byte	1020byte	1021byte	1022byte	1023byte
lower/higher	L	H	L	H	L	H		L	H	L	H	L	H

pixel 0 receiver level	pixel 1 receiver level	pixel 2receiver level		pixel 509 receiver level	pixel 510receiver level	pixel 511receiver level
response by 0–4095	response by 0–4095	response by 0–4095		response by 0–4095	response by 0–4095	response by 0–4095

example

Hex	20	00	22	00	25	00		40	03	42	03	1F	02
Dec	20		22		25			832		834		543	

Manufactured and sold by :

OPTEX FA CO.,LTD.

600−8815 Kyoto, Shimogyo, Awata Chudoji 91, Japan

●Specifications and equipment are subject to change without any notice.
●For more information, questions and comments regarding products, please contact us.

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