Displacement sensor

FASTUS

CD22 Series

CD22-15-485□□ **CD22M-15-485□□**
CD22-35-485□□ **CD22M-35-485□□**
CD22-100-485□□ **CD22M-100-485□□**

Instruction manual

- Thank you for purchasing CD22 series. We hope you are satisfied with its performance.
- Please read this manual carefully and keep it for future reference.

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 refected from refrective object. If the laser beam enters an eye, it may cause blindness.
- This product is not an explosion proof construction. Do not use the product under flammable , explosive gas or liquid environment.
- 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.
- Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

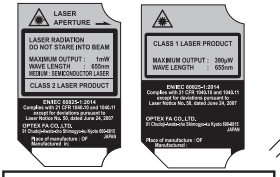
Warning Safety Precautions

- It is dangerous to wire or attach/remove the connector while the power is 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.
- Don't bend the cable when the temperature of the cable or atmosphere is below freezing.

Precautions for using laser

- 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.

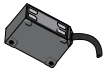


Laser diode
Wave length:655nm, Max output:10mW.//9 degree type.

Included items

Before using this product, confirm that the following items are contained in the package.

・CD22□-□□□□



・This instruction manual

・Screws
M3 x 15 2 pieces

・Laser label

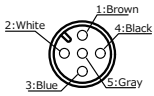
Pins configuration and cable color

Pins configuration of the connector and cable color are as follows.

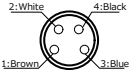
Pin No.	Color	Description
1	Brown	DC12-24V ± 10%
3	Blue	0V
5	Gray	(N.C.)
4	Black	RS-485(A)
2	White	RS-485(B)

■ Pins configuration (sensor side)

・M12 type

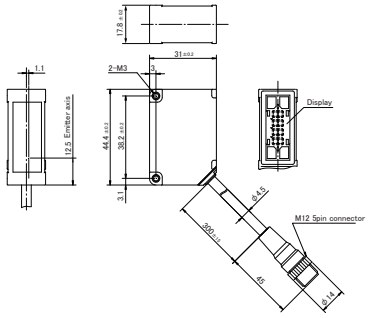


・M8 type

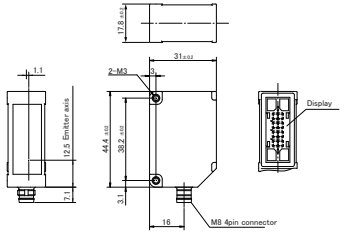


Dimensions

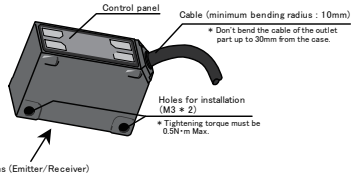
■ M12 type [mm]



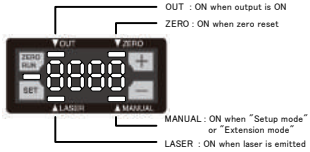
■ M8 type



Functions of components

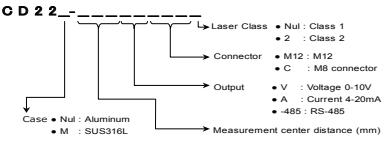


● Control panel



Specifications

● Part number legend



● Specifications per measurement range

Part number	Aluminum housing	CD22-15-485□□	CD22-35-485□□	CD22-100-485□□
	SUS housing	CD22M-15-485□□	CD22M-35-485□□	CD22M-100-485□□
Center of measurement range		15mm	35mm	100mm
Measurement range		±5mm	±15mm	±50mm
Light source		Red laser Diode (wave length 655nm)		
		Max. output: 390 μW		Max. output: 1mW ※3
Laser class	IEC/JIS	Suffix nul: CLASS 1 / 2: CLASS 2 (Laser Notice No.50)		
Spot size ※1		500 * 700μm	450 * 800μm	600 * 700μm
Linearity		0.1% of F.S.	0.1% of F.S.	0.1% of F.S.
Repeatability ※2		1μm	6μm	20μm
Sampling period		500μs / 1000μs / 2000μs / 4000μs / AUTO		
Temperature drift (typical value)		±0.02% / ℃ of F.S.	±0.02% / ℃ of F.S.	±0.05% / ℃ of F.S.
Indicator		Laser indicator: Green / Zero reset indicator: Red Output indicator: Orange / Mode indicator: Red		
Communication I/F		RS-485 Half Duplex (Multi-drop I/F is not supported)		
Power supply		12-24VDC ± 10%		
Current consumption		70mA max.		
Protection circuit		Reverse connection protection, Over current protection		
Protection category		IP67 including connection part		
Operating Temp./Humid.		-10 ~ 50℃ / 35 ~ 85% RH without freasing or condensation		
Storage Temp./Humid.		-20 ~ 60℃ / 35 ~ 85%/RH		
Ambient illuminance		Incandescent lamp: 3,000 lx max.		
Vibration resistance		10 ~ 55Hz, Double amplitude 1.5mm, X,Y,Z for 2 hours		
Shock resistance		500mm/s² (approx. 50G) X,Y,Z 3 times each		
Material		Case: Aluminum/SUS316L, Front lens: PPSU, Display: PET		
Weight		Aluminum case with M12 connector : Approx. 60g including 300mm cable with connector SUS case with M12 connector type : Approx. 90g including 300mm cable with connector Aluminum case with M8 connector : Approx. 40g SUS case with M8 connector : Approx. 70g		

The specifications are based on the condition unless otherwise designated: Ambient temperature: 23℃ , Supply voltage: 24VDC, Sampling period: 500μs, Averaging: 64, Measuring distance: Center of the range, Testing object: White ceramic

※1 Defined with center strength $1/e^2$(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.

※2 512 averaging time

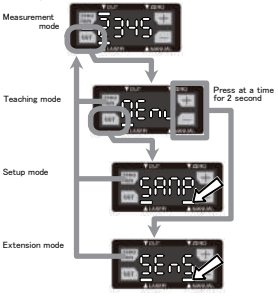
※3 Laser Class 2 type (Model: CD22-100-485M122 ,CD22-100-485C2)

Setup

● Changing mode

While it's "Teach mode", "Setup mode" or "Extension mode", you can change the mode to "Measurement mode" by pressing "ZERO/RUN" button.

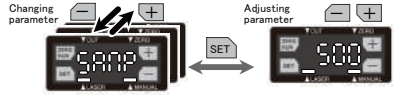
While it's "Setup mode" or "Extension mode", the LED "MANUAL" is lit.



● Changing parameters

You can choose and adjust the parameters by pressing "+" and "-" buttons.

The mode will be changed to "Measurement mode" by pressing "ZERO/RUN" button.



Teach mode

■ 1: Setup mode → To Setup mode

■ 2: Teaching mode → 1 point Teaching / FGS2 / 2 point Teaching (switching)

■ 3: Calibration(Far end of the range) → Teaching current position

■ 4: Calibration(Near end of range) → Teaching current position

■ 5: FGS2 threshold → Teaching current position

■ 6: Near side threshold → Teaching current position

■ 7: 1 point Teaching - Far side threshold → Teaching current position

Measurement mode

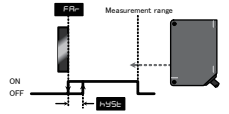
CD22 has 3 measurement mode. The mode is chosen by "Teach mode".

Output can be reversed by setting "Output polarity".

Following output shows its ON/OFF status as "Light ON".

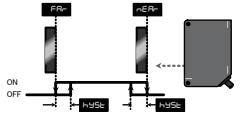
●1 point Teaching

Teaching is done at a position. When the measurement distance is closer than that position, the output will be ON.



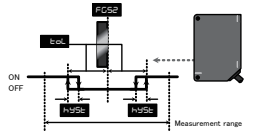
●2 point Teaching

Teaching is done at 2 positions. While the measurement distance is between those positions, the output will be ON.



●FGS2

Teaching is done at a position. When the measurement distance is closer than the distance set by "Hysteresis" from the position that Teaching is done, the output will be ON. It works as FGS sensor.

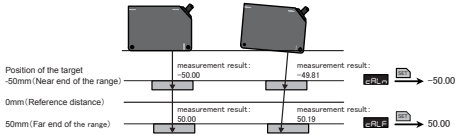


●Calibration (Far end of the range/ Near end of range)

The sensor can be calibrated by "Calibration" mode at both far and near end of the measurement range. This feature is very useful especially when you can't mount the sensor head parallel to the object surface.

● Example of Calibration of CD22-100

A) Calibration condition at the factory B) When the sensor is mounted tilted



Just calibrate the sensor by "Calibration" mode at far end and near end of the measurement range. Then, you will get calibrated result if the sensor head is tilted.

Setup mode

Setup mode is chosen by pressing "SET" button from "Menu". (* means default value)

■ 1: Buad rate

96	9,600bps *
192	19,200bps
384	38,400bps
576	57,600bps
1152	115,200bps
2304	230,400bps
3125	312,500bps
4688	468,750bps
5000	500,000bps
6250	625,000bps
8333	833,333bps
9376	937,500bps
1250	1,250,000bps

■ 2: Near side threshold

0.123 Set the value

Default : CD22-15□□ -1.000
CD22-35□□ -03.00
CD22-100□□ -10.00

■ 3: 1 point Teaching - Far side threshold

0.123 Set the value

Default : CD22-15□□ 1.000
CD22-35□□ 03.00
CD22-100□□ 10.00

■ 4: FGS2 threshold

0.123 Set the value

Default : CD22-15□□ 0.000
CD22-35□□ 00.00
CD22-100□□ 00.00

■ 5: Teaching mode

1Pt	1 point Teaching
FGS2	FGS2
2Pt	2 point Teaching *

■ 6: FGS2 hysteresis

0.123 Set the value

Default : CD22-15□□ 1.000
CD22-35□□ 03.00
CD22-100□□ 10.00

■ 7: Sampling period

500	500μs (2kHz) *
1000	1000μs (1kHz)
2000	2000μs (500Hz)
4000	4000μs (250Hz)
Auto	**AUTO (Sensor will optimize automatically)**

■ 8: Output polarity

L on	Light ON: ON when exceeds the threshold *
d on	Dark ON: ON when less than the threshold

■ 9: Averaging number

1	Once
8	8 times
64	64 times *
512	512 times

■ 10: Alam setting

CLMP	Clamp : display "9999" *
Hold	Hold : Keep previous value

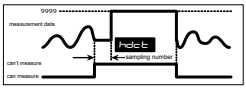
■ 10-2: Alam-Hold and Clamp

0000

When Alam is set as Hold measurement data will be as follows for Alam

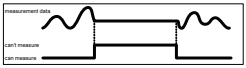
● "Hold and Clamp" is active

※ Keep the previous data for the period and clamp to "9999" after that.



● "Hold and Clamp" is not active
(When it's set "0000")

※ Keep the previous data while it's Alam status.



■ 11: Reset (Initializing)

YES	Initialize the parameters to default setting
no	Do nothing

■ 12: Display setting

on	Activate the display while "Key lock" *
oFF	Desable the display while "Key lock"

Extension mode

Extension mode is chosen by pressing "+" and "-" buttons at a time for 2 second in teach mode top page.
Parameters in Extension mode must be set correctly otherwise it might not work correctly.
Please use with default setting when changing parameters is not needed. (" * " means default setting)

■ 1: Hysteresis

0.123 Set the value

Default: CD22□-15□□ 0.050
CD22□-35□□ 00.15
CD22□-100□□ 00.50

■ 2: Measurement point

Choose measurement point when it receives multiple reflection from the object.

MAX	MAX : Maximum distance *
Pt5	Pt5 : 5th point from sensor side
Pt4	Pt4 : 4th point from sensor side
Pt3	Pt3 : 3rd point from sensor side
Pt2	Pt2 : 2nd point from sensor side
Pt1	Pt1 : Closest point from sensor side

■ 3: Threshold

Set threshold level to recognize as measurement point.

BASE	Base : Set threshold to lowest level *
P400	P400 : Set threshold to upper level
P200	P200 : Set threshold to middle level
P100	P100 : Set threshold to lower level

■ 4: Zero reset value

Set display value for Zero reset .

0.123 Set the value

■ 5: Sensitivity

Set Sensitivity of the sensor.

Auto	**Auto** : Adjust automatically *
n_6	6 : Maximum sensitivity
≀	
n_1	1 : Minimum sensitivity

Miscellaneous function

■ Zero reset function

● Set Zero reset

While it's measurement mode, press ZERO RUN for 2 seconds.
Then, 0.000 will be shown. The position of decimal point varies by sensor type.
When setting Zero reset, the red indicator LED "ZERO" will be ON.

● Release zero reset

While it's measurement mode, press ZERO RUN for 4 seconds to release Zero reset.

■ Key lock function

● Activate Key lock

While it's measurement mode, press + - at a time for 2 second. Then, Loc will be shown.
While Loc is shown, any access except "Releasing Key lock" will be neglected.

● Release Key lock

While Key lock is activated, it will be released by pressing + - at a time for 3 seconds. Then, uLoc will be shown.
After this process, every access will be accepted.

Communication

Specifications are as follows.

Communication method	RS-485 Half Duplex (Multi-drop I/F is not supported)
Transmission code	Binary
Data length	8bit
Stop length	1bit
Parity check	Nil
Baud rate (bps)	9.6k/19.2k/38.4k/57.6k/115.2k/230.4k/312k/460k/500k/625k/833k/920k/1.25M
Data classification	STX / ETX

■ Data Format

Transmission data :	STX	COMMAND	DATA1	DATA2	ETX	BCC
Incoming data :	STX	ACK	RESPONSE1	RESPONSE2	ETX	BCC
Incoming data (error) :	STX	NAK	ERROR CODE	00H	ETX	BCC

STX = 02H , ETX = 03H , ACK = 06H , NAK = 15H , BCC = XOR of values hatched

Basic commands :

C(43H)	Individual function commands
W(57H)	Writing the setting
R(52H)	Reading out setting

Error code table :

02H	Address is invalid
04H	BCC value is invalid
05H	Invalid command is issued except "C", "W", "R"
06H	Setting value is invalid (out of specifications)
07H	Setting value is invalid (out of range)

■ C(43H) parameter table

Command	Type	DATA1 (upper)	DATA2 (lower)	Description
Reading out Measurement value	Write	B0h	01h	
	Read	Upper data	Lower data	Response in 2 bytes *1
Reading out Output status	Write	B0h	02h	
	Read	00h	Output status	bit:0 = 1 (ON) bit:4 = 0 (the status has been read)
Writing the setting	Write	A0h	00h	Write the setting into EEPROM.
	Read	00h	00h	
Teaching FGS2	Write	11h	05h	
	Read	00h	00h	
Teaching near side point	Write	11h	06h	
	Read	00h	00h	
Teaching far side point	Write	11h	07h	
	Read	00h	00h	
Laser ON	Write	A0h	03h	
	Read	00h	00h	10ms be required until the laser power stable.
Laser OFF	Write	A0h	02h	
	Read	00h	00h	
Execute Zero reset	Write	A1h	00h	
	Read	00h	00h	
Release Zero reset	Write	A1h	01h	
	Read	00h	00h	
Execute Key lock	Write	A1h	04h	
	Read	00h	00h	
Release Key lock	Write	A1h	05h	
	Read	00h	00h	
Initializing	Write	40h	00h	Initialize all parameters except communication speed and re-boot. The communication won't worrk while initializing.
	Read	00h	00h	

*1 : Measurement and setting value are deacribed as signed hexadecimal .

Model	CD22□-15-485-□		CD22□-35-485-□		CD22□-100-485-□	
Range	±5mm		±15mm		±50mm	
Unit	1µm		10µm		10µm	
Data (Hex)	EC78h	1388h	FA24h	05DCh	EC78h	1388h
Data (Decimal)	-5000	+5000	-1500	+1500	-5000	+5000

■ Writing Data

Writing is done as following proceedure.

1. Read out setting
   Execute Command "R" (Reading out setting) on the target parameter.
   Set "Address" at "DATA1" and "DATA2".

2. Write setting
   Execute Command "W" (Writing the setting) on the target parameter.
   Writing data is done to the address set at "1. Read setting".

Example: Setting "Sampling period" to "AUTO"

1. Read out "Sampling period"

Transmission command :	STX (02h)	R (52h)	40h	06h	ETX (03h)	BCC (14h)
Incoming data :	STX (02h)	ACK (06h)	00h	00h	ETX (03h)	BCC (06h)

2. Write the setting

Transmission command :	STX (02h)	W (57h)	00h	04h	ETX (03h)	BCC (53h)
Incoming data :	STX (02h)	ACK (06h)	00h	00h	ETX (03h)	BCC (06h)

* Incoming data of command "W" (Writing the setting) will be "00h" and "00h".

■ Setting parameter table

Setting	Address/ Parameter	DATA1 (upper)	DATA2 (lower)	Description
Model type	Address	01h	00h	Return center value of measurement range (only for checking model type)
	Parameter	00h	0Fh	15mm type
		00h	23h	30mm type
		00h	64h	100mm type
Measurement mode	Address	40h	04h	
	Parameter	00h	00h	2 point Teaching
		00h	01h	1 point Teaching
		00h	02h	FGS2 Teaching
Near side threshold	Address	41h	00h	
	Parameter	Upper data	Lower data	
Far side threshold	Address	41h	02h	
	Parameter	Upper data	Lower data	
FGS2 threshold	Address	41h	04h	
	Parameter	Upper data	Lower data	
FGS2 hysteresis	Address	41h	06h	
	Parameter	Upper data	Lower data	
Output polarity	Address	40h	08h	
	Parameter	00h	00h	Light ON: ON when exceeds the threshold
		00h	01h	Dark ON: ON when less than the threshold
Sampling period	Address	40h	06h	
	Parameter	00h	00h	500µs
		00h	01h	1,000µs
		00h	02h	2,000µs
		00h	03h	4,000µs
		00h	04h	AUTO
Averaging number	Address	40h	0Ah	
	Parameter	00h	00h	Once
		00h	01h	8 times
		00h	02h	64 times
		00h	03h	512 times
Alarm setting	Address	40h	0Ch	
	Parameter	00h	00h	Clamp
		00h	01h	Hold
Alarm - Hold and Clamp	Address	41h	08h	
	Parameter	Upper data	Lower data	
Display setting	Address	40h	0Eh	
	Parameter	00h	00h	ON
		00h	01h	OFF
Hysteresis	Address	41h	10h	
	Parameter	Upper data	Lower data	
Measurement point	Address	40h	10h	
	Parameter	00h	00h	MAX. : Maximum distance
		00h	01h	Pt1 : Closest point from sensor side
		00h	02h	Pt2 : 2nd point from sensor side
		00h	03h	Pt3 : 3rd point from sensor side
		00h	04h	Pt4 : 4th point from sensor side
		00h	05h	Pt5 : 5th point from sensor side
Threshold	Address	40h	12h	
	Parameter	00h	00h	Base : Lowest level
		00h	01h	Level 100 : lower level
		00h	02h	Level 200 : middle level
		00h	03h	Level 400 : upper level
Zero reset value	Address	41h	12h	
	Parameter	Upper data	Lower data	
Sensitivity	Address	40h	14h	
	Parameter	00h	00h	AUTO
		00h	01h	1 : Minimum sensitivity
		00h	02h	2
		00h	03h	3
		00h	04h	4
		00h	05h	5
		00h	06h	6 : Maximum sensitivity

* Execute the command "R" (Read out) before executing command "W" (Write).

Attention: Not to be Used for Personnel Protection.
Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death. These sensors do not include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized senso r output condition.
Please consult our distributors about safety products which meet OSHA, ANSI and IEC standards for personnel protection.

→ http://www.optex-fa.com/rohs_cn/

- Specifications and equipment are subject to change without any obligations on the part of manufacture.
- For more information, questions and comments regarding products, please contact us below.

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