MICRO-EPSILON

Instruction Manual

capaNCDT 6110/6120

CS02	CSH05FL	CSH1,2	CS3
CSH02	CS08	CSH1,2FL	CS5
CSH02FL	CS1	CSH2FL	CS10
CS05	CSE1	CSH3FL	
CSE05	CSH1	CS2	
CSH05	CSH1FL	CSH2	
	CS1HP	CSE2	

Non-contact Capacitive Displacement Measuring

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Contents

1. Safety

Knowledge of the operating instructions is a prerequisite for equipment operation.

1.1 Symbols Used

The following symbols are used in this instruction manual:

⚠ **CAUTION**   Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE   Indicates a situation which, if not avoided, may lead to property damage.

➡   Indicates a user action.

i   Indicates a user tip.

1.2 Warnings

⚠ **CAUTION**

Disconnect the power supply before touching the sensor surface.
> Danger of injury

> Static discharge

Connect the power supply and the display/output device in accordance with the safety regulations for electrical equipment.
> Danger of injury

> Damage to or destruction of the sensor and/or controller

NOTICE

Avoid shock and vibration to the sensor and controller.
> Damage to or destruction of the sensor and/or controller

The power supply may not exceed or continuously fall below the specified limits.
> Damage to or destruction of the sensor and/or controller

Protect the sensor cable against damage

> Destruction of the sensor

> Failure of the measuring device

1.3 Notes on CE Identification

The following applies to the capaNCDT 6110 / 6120:
- EU directive 2014/30/EU
- EU directive 2011/65/EU, "RoHS" category 9

Products which carry the CE mark satisfy the requirements of the quoted EU directives and the European standards (EN) listed therein.

The EC declaration of conformity is kept available according to EC regulation, article 10 by the authorities responsible at

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94496 Ortenburg / Germany

The system is designed for use in industry and satisfies the requirements.

1.4 Proper Use

- The capaNCDT 6110 / 6120 measuring system is designed for use in industrial areas. It is used for
  - displacement, distance, thickness and movement measurement
  - position measuring of parts or machine components
- The system may only be operated within the limits specified in the technical data, see Chap. 2.3.

➡ The system should only be used in such a way that in case of malfunction or failure personnel or machinery are not endangered.

➡ Additional precautions for safety and damage prevention must be taken for safety-related applications.

1.5 Proper Environment

- Protection class: IP 40
- Operating temperature:
  - Sensor: -50 ... +200 °C (-58 to +392 °F)
  - Sensor cable: -100 ... +200 C (-58 to +392 °F) (CCmx and CCmx/90)
                               -20 ... +80 °C (-4 to 176 °F) (CCgx and CCgx/90 - permanently)
                               -20 ... +100 °C (-4 to 212 °F) (CCgx and CCgx/90 - 10,000 h)
  - Controller: +10 ... +60 °C (-50 to +140 °F)
- Humidity: 5 - 95 % (non-condensing)
- Ambient pressure: Atmospheric pressure
- Storage temperature:
  - Sensor: -50 ... +200 °C (-58 to +392 °F)
  - Sensor cable: -50 ... +200 °C (-58 to +392 °F) (CCmx and CCmx/90)
                               -50 ... +80 °C (-58 to +176 °F) (CCgx and CCgx/90)
  - Controller: -10 ... +75 °C (+14 to +167 °F)
- The space between the sensor surface and the target must have an unvarying dielectric constant.
- The space between the sensor surface and the target may not be contaminated (for example water, rubbed-off parts, dust, etc.).

2. Functional Principle, Technical Data

2.1 Measuring Principle

The principle of capacitive distance measurement with the capaNCDT system is based on the principle of the parallel plate capacitor. For conductive targets, the sensor and the target opposite form the two plate electrodes.

If a constant AC current flows through the sensor capacitor, the amplitude of the AC voltage at the sensor is proportional to the distance between the capacitor electrodes. The AC voltage is demodulated, amplified and output as an analog signal.

The capaNCDT system evaluates the reactance X_c of the plate capacitor which changes strictly in proportion to the distance.

$$X_c = \frac{1}{j\omega C} ; \quad \text{capacitance } C = \varepsilon_r * \varepsilon_o * \frac{area}{distance}$$

i A small target and bent (uneven) surfaces cause a non-linear characteristic.

This theoretical relationship is realized almost ideally in practice by designing the sensors as guard ring capacitors.

The linear characteristic of the measuring signal is achieved for electrically conductive target materials (metals) without any additional electronic linearization. Slight changes in the conductivity or magnetic properties do not affect the sensitivity or linearity.

Ground

Screening electrode

Measuring electrode

Electrical conductor
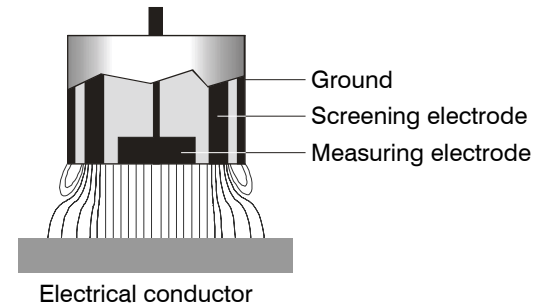
Fig. 1 Functional principle of the guard ring capacitor

2.2 Structure

The non-contact, single-channel measuring system of capaNCDT 6110 / 6120, installed in an aluminum housing, consists of:
- Controller
- Sensor
- Sensor cable
- Power supply and signal cable

The signal processing electronics with oscillator, demodulator, AD converter and integrated preamplifier is in the controller [1].
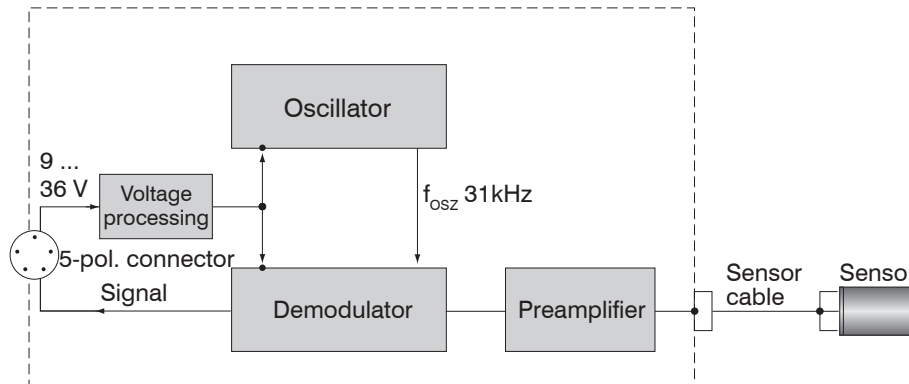

Fig. 2 Block diagram capaNCDT 6110

1) The controller 6120: Contains additionally an AD converter for converting to a RS485 interface.
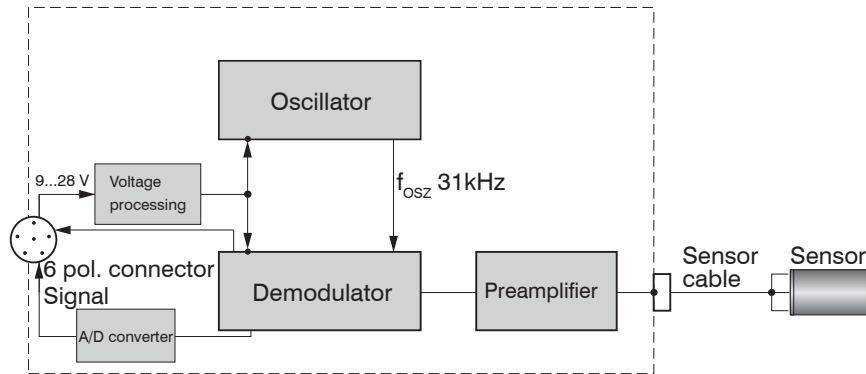
Fig. 3 Block diagram capaNCDT 6120

2.2.1   Sensors

For this measurement system, several sensors can be used.

➡ In order to obtain accurate measuring results, keep the surface of the sensor clean and free from damage.

The capacitive measuring process is area-related. A minimum area (see table) is required depending on the sensor model and measuring range. In the case of insulators the dielectric constant and the target thickness also play an important role.

Sensors for electrical conducting targets (metals)

Sensor model	Measuring range	Min. target diameter
CS02	0.2 mm	5 mm
CSH02	0.2 mm	7 mm
CSH02FL	0.2 mm	7 mm
CS05	0.5 mm	7 mm
CSE05	0.5 mm	6 mm

Sensor model	Measuring range	Min. target diameter
CSH05	0.5 mm	7 mm
CSH05FL	0.5 mm	7 mm
CS08	0.8 mm	9 mm
CS1	1 mm	9 mm
CSE1	1 mm	8 mm
CSH1	1 mm	11 mm
CSH1FL	1 mm	11 mm
CS1HP	1 mm	9 mm
CSH1,2	1.2 mm	11 mm
CSH1.FL	1.2 mm	11 mm
CSH2FL	2 mm	17 mm
CS2	2 mm	17 mm
CSH2	2 mm	17 mm
CSE2	2 mm	14 mm
CS3	3 mm	27 mm
CSH3FL	3 mm	24 mm
CS5	5 mm	37 mm
CS10	10 mm	57 mm

2.2.2   Sensor Cable

Sensor and controller are connected by a special, double screened sensor cable.

Do not shorten or lengthen these special cables.

Usually, a damaged cable can not be repaired.

| NOTICE |

Switch off the device when plugging and removing connectors.
Do not crush the sensor cable.
Do not modify to the sensor cable.
> Lost of functionality

Model	Cable length	Cable ø	2 axial connector	1x axial + 1x 90 ^{0}	For sensors	Min. bending radius once	Min. bending radius permanently
CCgxC	2/4 m	3.1 mm	•		0.05 - 0.8 mm	10 mm	22 mm
CCgxC/90	2/4 m	3.1 mm		•	0.05 - 0.8 mm	10 mm	22 mm
CCgxB	2/4 m	3.1 mm	•		1 ... 10 mm	10 mm	22 mm
CCgxB/90	2/4 m	3.1 mm		•	1 ... 10 mm	10 mm	22 mm
CCmxC	1.4/2.8 m	2.1 mm	•		0.05 - 0.8 mm	7 mm	15 mm
CCmxC/90	1.4/2.8 m	2.1 mm		•	0.05 - 0.8 mm	7 mm	15 mm
CCmxB	1.4/2.8 m	2.1 mm	•		1 ... 10 mm	7 mm	15 mm
CCmxB/90	1.4/2.8 m	2.1 mm		•	1 ... 10 mm	7 mm	15 mm

The sensors of type CSH have integrated a 1.4 long sensor cable. Cable lengths of 2.8 m are available too if required.

Other cable lengths are also available on request.

The sensor model CSE-1 (measuring range 1 mm) has the connector type C.

2.2.3   Controller

The capaNCDT 6110 / 6120 contains a voltage processing, oscillator, integrated preamplifier, demodulator [2] as well as an output level.

The voltage processing produces all necessary internal voltages from the power supply. The oscillator supplies the sensor with frequency and amplitude-stabilized alternating voltage. The frequency is 31 kHz. The internal preamplifier generates the distance-dependent measuring signal and amplifies it. Demodulator and output level convert the measuring signal into a standard voltage signal [3].

| NOTICE |

The output voltage can reach up to a maximum of 13 VDC when sensor is disconnected or measurement is exceeded.

> Damage to downstream devices

Sensor

Fig. 4 Controller DT6110 / 6120

2) The controller 6120: Contains additionally an AD converter.
3) An analog-digital converter converts the measuring signal and outputs it to the RS485 interface.

2.3   Technical Data

Controller model	DT6110	DT6110/ECL2	DT6120	DT6120/ECL2
Resolution static	0,01 % FSO			
Resolution dynamic	0.015 % FSO (1 kHz)			
Bandwidth	1 kHz (-3 dB)			
Linearity (typical)	±0.05 % FSO			
Max. sensitivity deviation	±0.1 % FSO			
Long term stability	< 0.05 % FSO/month			
Synchronous operation	no			
Isolator measurement	no			
Temperature stability	200 ppm			
Operating temperature, sensor	-50 ... +200 °C			
Operating temperature, controller	+10 … +60° C			
Storage temperature	-10 … +75° C			
Power supply	24 VDC/55 mA (9 - 36 V)		24 VDC/60 mA (9 - 28 V)	
Output	0 … 10 V (short-circuit proof), optional: ±5 V, 10 … 0 V			
Sensors	all sensors suitable			
CCm	1.4 m	2.8 m	1.4 m	2.8 m
CCg	2 m	4 m	2 m	4 m
Protection class — Controller	IP 40			
Protection class — Sensors	when plugged in: IP 54			
Weight	165 g			
Interface	-		RS485, 230400 Baud (adjustable), 24 bit measuring values, max. 2kSamples (adjustable)	

FSO = Full Scale Output

3. Delivery

3.1 Unpacking

1 Controller

1 Power supply and output cable SCAC3/5 (DT6110) or SCAC3/6 (DT6120)

1 Instruction Manual

Optional accessories:

1 Sensor

1 Sensor cable with connector

1 IF1032/ETH interface converter from analog (DT6110) or RS485 Ethernet (DT6120) on Ethernet/Ether-CAT

Further optional accessories, see Chap. A 1

➡ Remove the parts of the system carefully from the packaging and transport them in such a way that they are not damaged.

➡ Check for completeness and shipping damages immediately after unpacking. In case of damage or missing parts, please contact the manufacturer or supplier.

3.2 Storage

- Storage temperature:
  - Sensor: -50 ... +200 °C (-58 to +392 °F)
  - Sensor cable: -50 ... +200 °C (-58 to +392 °F) (CCmx and CCmx/90)
                    -50 ... +80 °C (-58 to +176 °F) (CCgx and CCgx/90)
  - Controller: -10 ... +75 °C (+14 to +167 °F)
- Humidity: 5 - 95 % RH (non-condensing)

4.　　　Installation and Assembly

4.1　　　Precautionary Measures

No sharp-edged or heavy objects may get into contact with the sensor cable sheath.

➡ Protect the cable against pressure loads in pressurised rooms.

➡ Avoid kinks in any case.

➡ Check the connections for tight fit.

i　　A damaged cable cannot be repaired.

4.2　　　Sensor

The sensors may be mounted free-standing or flush.
When assembling, make sure that the polished sensor surface is not scratched.

4.2.1　　　Radial Point Clamping with Grub Screw, Cylindric Sensors

This simple type of fixture is only recommended for a force and vibration-free installation position. The grub screw must be made of plastic so that it cannot damage or deform the sensor housing.
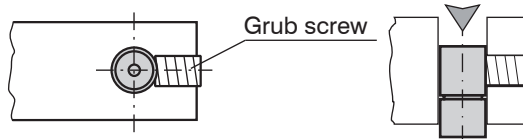
Grub screw

Fig. 5 Radial point clamping with grub screw

NOTICE

Do not use metal grub screws!
> Danger of damaging the sensor

4.2.2 Circumferential Clamping, Cylindric Sensors

This sensor mounting option offers maximum reliability because the sensor is clamped around its cylindrical housing. It is absolutely necessary in difficult installation environments, for example on machines, production plants et cetera.
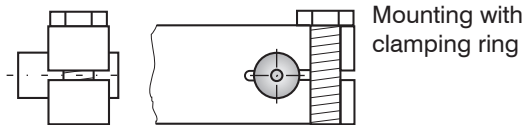
Mounting with clamping ring
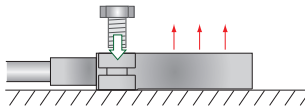
Fig. 6 Circumferential clamping

A circumferential clamping possible from 2 mm behind the front face.
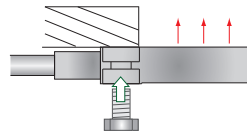
i   Tension at the cable is inadmissible!

4.2.3 Flat Sensors

Flat sensors are mounted by means of a tap hole for M2 (in case of sensors 0.2 and 0.5 mm) or by a through hole for M2 screws. The sensors can be bolted on top or below.
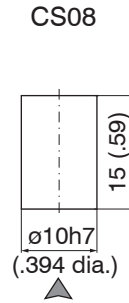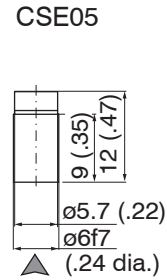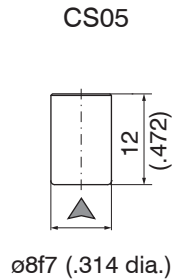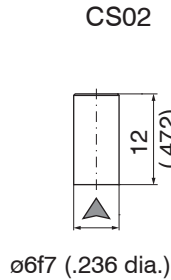
Screwing from above   **Screwing from bottom**

4.2.4 Dimensional Drawings Sensors
Cylindric sensors

CS02

12 (.472)

ø6f7 (.236 dia.)

CS05

12 (.472)

ø8f7 (.314 dia.)

CSE05

9 (.35) 12 (.47)
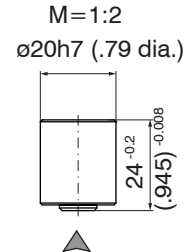
ø5.7 (.22)
ø6f7
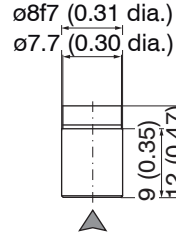(.24 dia.)

CS08

15 (.59)

ø10h7
(.394 dia.)

▲ Connector side

Dimensions in mm (inches)

Circumferential clamping possible from 2 mm behind the front face.

Dimensional drawings of other sensors are available on request.

CS1HP

20 $^{-0.2}$ (.787 $^{-0.008}$)

ø10h7 (.394 dia.)

CS1

ø10h7 (.394 dia)

21 $^{-0.2}$ (o.83 $^{-0.008}$)

CSE1

ø8f7 (0.31 dia.)
ø7.7 (0.30 dia.)

9 (0.35) 12 (0.47)

CS2

M=1:2
ø20h7 (.79 dia.)

24 $^{-0.2}$ (.945) $^{-0.008}$

CSE2

ø14h7 (0.55 dia.)
ø13.7 (0.54 dia.)

18.5 (0.73) 22 (0.87)

CS3

M=1:2

ø30h7 (1.18 dia.)

16.5 (.649)

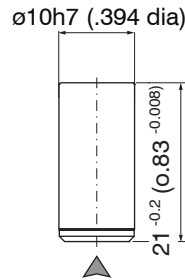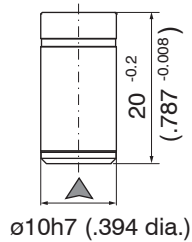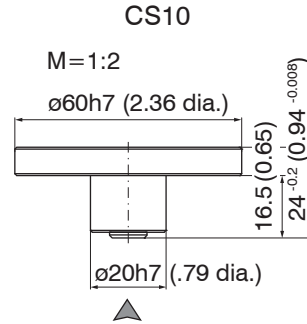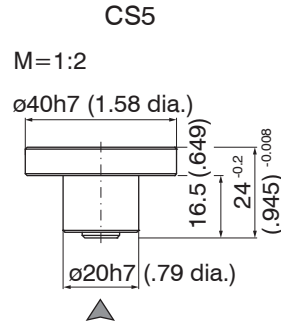$24^{-0.2}$ (.945) $^{-0.008}$
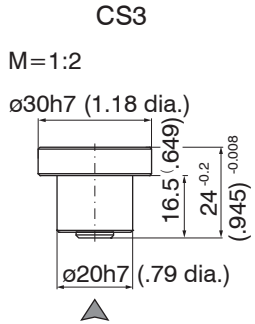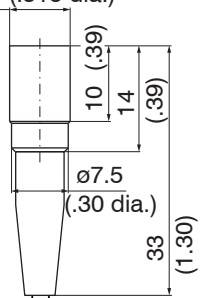
ø20h7 (.79 dia.)

▲ Connector side

Dimensions in mm (inches)

Circumferential clamping possible from 2 mm behind the front face.

Dimensional drawings of other sensors are available on request.

CS5

M=1:2

ø40h7 (1.58 dia.)

16.5 (.649)

$24^{-0.2}$ (.945) $^{-0.008}$

ø20h7 (.79 dia.)

CS10

M=1:2

ø60h7 (2.36 dia.)

16.5 (0.65)

$24^{-0.2}$ (0.94) $^{-0.008}$

ø20h7 (.79 dia.)

CSH02-CAmx,
CSH05-CAmx

ca. 9.4 (.37)

ø8g6 (.315 dia.)

10 (.39)

14 (.39)

ø7.5 (.30 dia.)

33 (1.30)

ca. 37 (1.46)
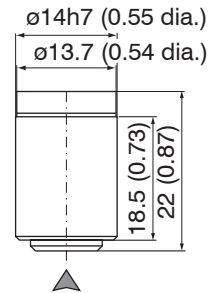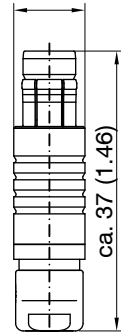
ø2.2 (.09 dia.)

CSH1-CAmx,
CSH1.2-CAmx

ca. 9.4 (.37)

ø12g6 (.473 dia.)

10 (.39)

14 (.39)

ø11.5 (.45 dia.)

33 (1.30)

ca. 37 (1.46)
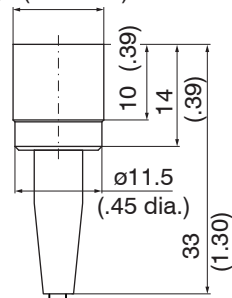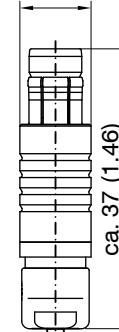
ø2.2 (.09 dia.)

Circumferential clamping possible from 2 mm behind the front face.

Dimensions in mm (inches), not to scale

CSH2-CAmx

ø20g6 (.79)

appr. 9.4 (.37)

10 (.39)

14 (.55)

33 (1.3)

ø19.5 (.77)

appr. 37 (1.5)

ø2.2 (.09)

Dimensions in mm (inches), not to scale

Flat sensors

CSH02FL-CRmx,
CSH05FL-CRmx

CSH1FL-CRmx,
CSH1.2FL-CRmx
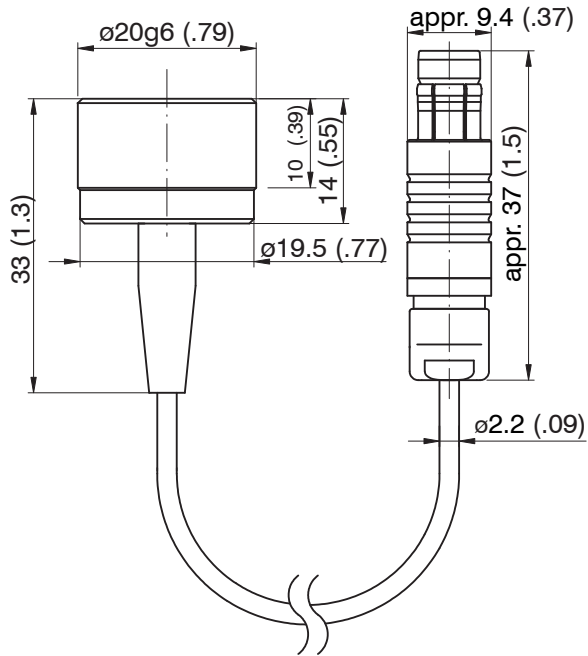
Dimensions in mm (inches), not to scale

CSH2FL-CRmx

CSH3FL-CRmx
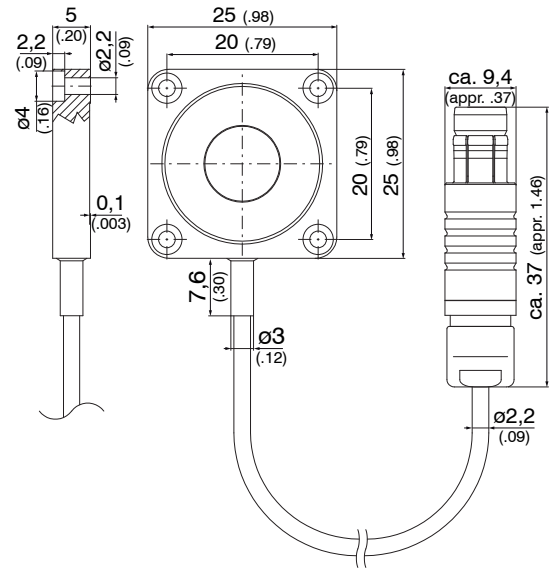
Cable length 1.4 m visible (incl. crimp sleeve)

Dimensions in mm (inches), not to scale

4.3   Sensor Cable

The sensor is connected to the controller by the sensor cable. The connection is made by simple plugging. The connector locks automatically. The tight fit can be checked by pulling the connector housing (cable bushing). The lock can be released and the connector can be opened by pulling the knurled housing sleeve of the cable bushing.
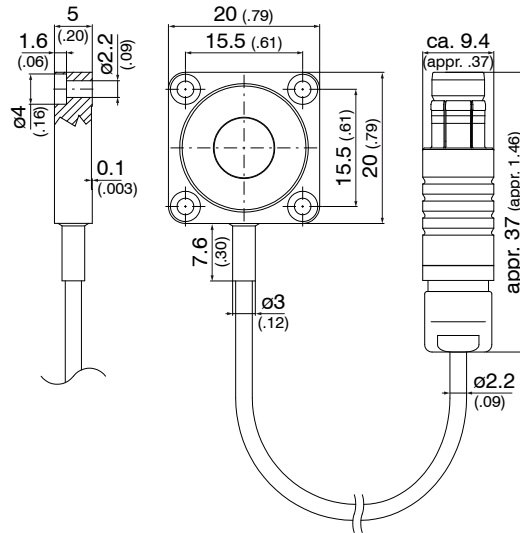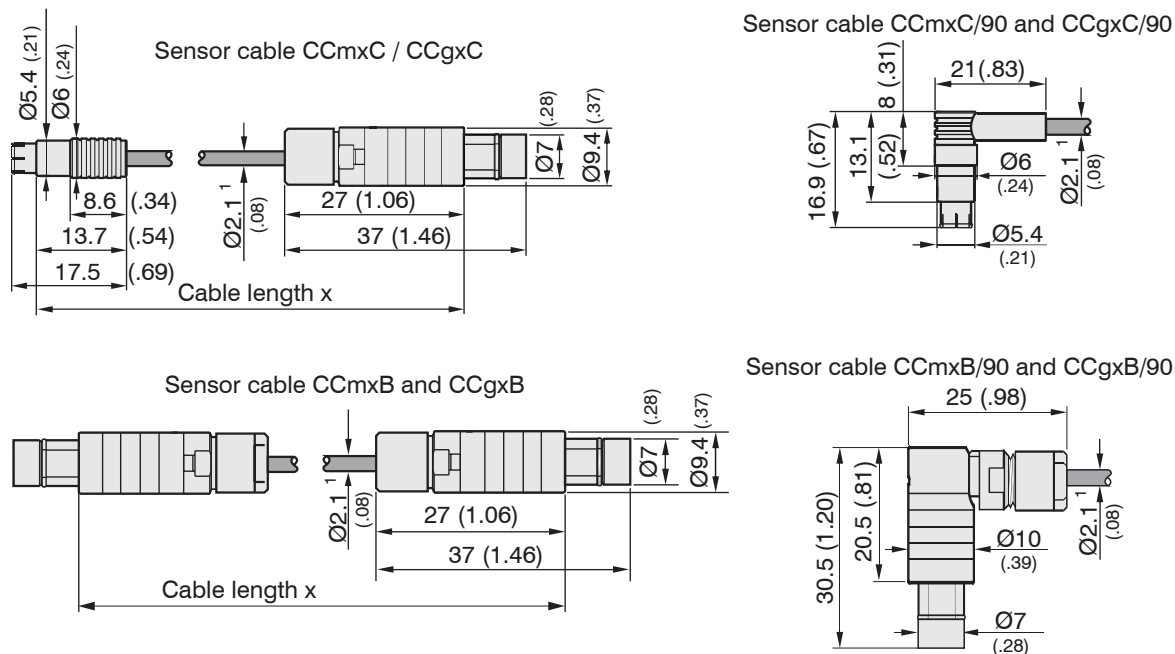

Fig. 7 Dimensional drawings sensor cables
Dimensions in mm (inches), not to scale
Features of the sensor cable, see Chap. 2.2.2.
1) Sensor cable CCgxC/ CCgxB/ CCgxC/90 and CCgxB/90: Ø3.1 ±0.10 (.12 ±0.004 dia.)

4.4 Controller

Fig. 8 Dimensional drawing controller

Dimensions in mm (inches), not to scale

4.5 Ground Connection, Earthing

➡ Make sure you have a sufficient grounding of the measuring object, for example connect it with the sensor or the supply ground.

4.6 Power Supply, Display/Output Device DT6110

The power supply and signal output occur via the 5-pin connector on the front side of the controller.

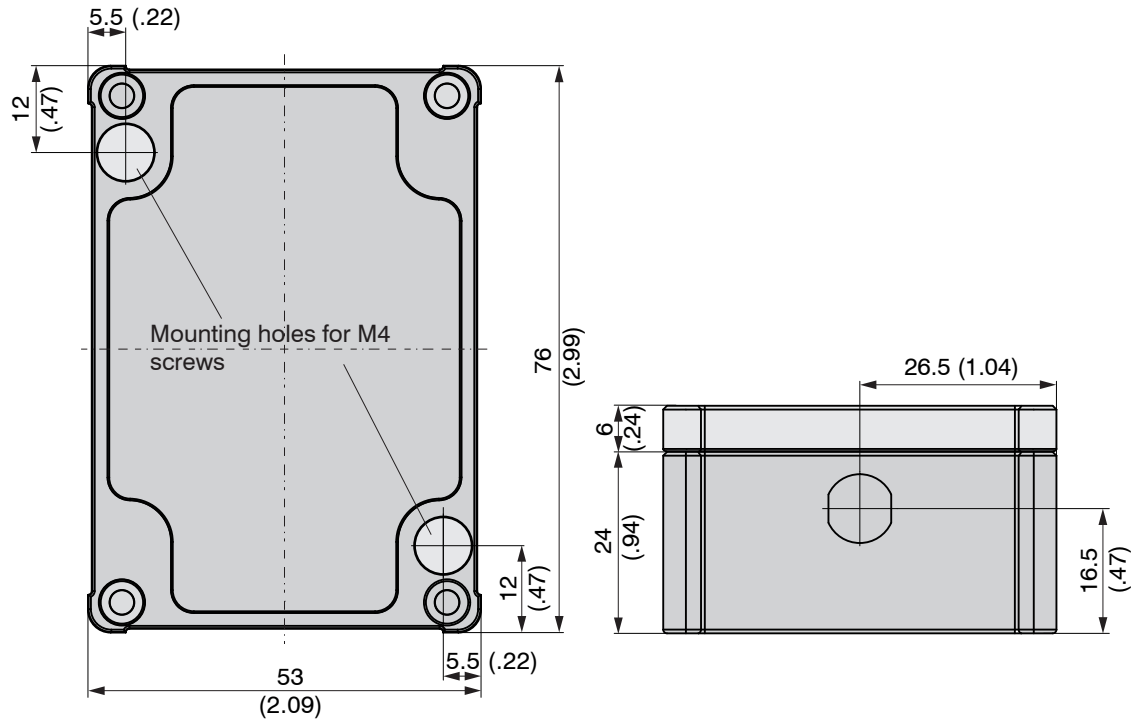| Pin	Color SCAC3/5	Signal	Description		
1	white	+24 V	+24 V power supply		
2	gray	GND	Supply ground		
3	yellow	-	not used	View on solder pin side, 5-pin. female cable connector	*Fig. 9 Connection Power supply*
4	green	AGND	Analog ground (for signal output)		
5	brown	U-out	Signal output (load, min 10 kOhm)		
Shield			Cable shield, housing		
SCAC3/5 is a 3 m long, pre-assembled power supply and output cable.					*Fig. 10 SCAC3/5 power supply and output cable*

4.7 Power Supply, Display/Output Device DT6120

Pin	Color SCAC3/6	Signal	Description		
1	white	+24 V	+24 V power supply		
2	gray	GND	Supply ground		
3	pink	RS485-A	RS485 interface		
4	green	AGND	Analog ground (for signal output)		
5	brown	U-out	Signal output (Last, min 10 kOhm)	View on solder pin side, 6-pin. female cable connector	Fig. 11 Connection power supply
6	blue	RS485_B	RS485 interface		
Shield			Cable shield, housing		
SCAC3/6 is a 3 m long, pre-assembled power supply and output cable.					Fig. 12 SCAC3/6 power supply and output cable

4.8 Sensor Connection

Fig. 13 Connection sensor cable

5. RS485 Interface

The RS485 interface is only present with the DT6120.

You can read the measuring values in digital form via the RS485 interface.

MICRO-EPSILON supports you with the driver MEDAQLib, which contains all commands for the capaNCDT 6120. You can download the driver directly under the link http://www.micro-epsilon.de/link/soft-ware/medaqlib.

You can also use the IF1032/ETH interface converter, see Chap. A 1, for the configuration and reading of the measuring values via Ethernet.

5.1 Hardware Interface

The interface is a half-duplex RS485 interface (1 common line pair for Rx and Tx).

Baud rate: 230400 (other baud rates adjustable)

Data format: 1 start bit, 8 data bits, 1 parity bit (straight), 1 stop bit

RS485 Address: 126 (1 … 126 adjustable)

In controller there is no RS485 terminal resistance. For RS485 cables longer than 5 meters a terminal resistance of 120 Ohm between the A and the B line both at the bus start and end is necessary.

5.2 Protocol

The capaNCDT 6120 behaves like a RS485-Slave. Since it is a halfduplex protocol, only the Master can initiate a communication. Each device on the RS485 bus requires a RS485 address. The master sends a request with address on the bus and only the Slave with the address then responds to the request.

5.2.1   Reading Measuring Values

Master: Request Data					
Byte:	SD	DA	SA	FC	FCS	ED
Value:	0x10	x	x	0x4C	x	0x16
		FCS				

Slave: Response Data									
Byte:	SD	LE	LE rep	SD rep	DA	SA	FC	Data[]	FCS	ED
Value:	0x68	x	x	0x68	x	x	0x08	x	x	0x16
					FCS					

Abbreviations:	
SD	StartDelimiter (0x10: telegram without data; 0x68 telegram with variable length)
LE	Length (number of bytes without SD, LE, LErep, SDrep, FCS, ED)
LErep	LE repeated
SDrep	SD repeated
DA	Destination Address /default 0x7E)
SA	Source Address (e.g. 0x01)
FC	Function Code
FCS	Checksum (sum of all bytes without SD, LE, LErep, SDrep, FCS, ED; without overflow, only 8 bits)
ED	EndDelimiter

Data[] - Measuring data (little endian)

The measuring data consists of a counter, the packet length m and the measuring values. The packet length m determines how many measuring values are transmitted. The packet length m is the number of measuring values sampled from the electronic, since the last request of measuring data, but is limited to the last 20 measuring values. The first measuring value in the data[] packet is the oldest value sampled, the last is the newest value sampled.

Data[0]	Counter [7:0]	unsigned short
Data[1]	Counter [15:8]	
Data[2]	Packet length m [7:0]	unsigned char
Data[3]	Filler byte [7:0]	unsigned char
Data[4]	Measuring value 1 [7:0]	signed integer
Data[5]	Measuring value 1 [15:8]	
Data[6]	Measuring value 1 [23:16]	
Data[7]	Measuring value 1 [31:24]	
Data[8]	Measuring value 2 [7:0]	signed integer
Data[9]	Measuring value 2 [15:8]	
Data[10]	Measuring value 2 [23:16]	
Data[11]	Measuring value 2 [31:24]	
	. . .	
Data[..]	Measuring value m [7:0]	signed integer
Data[..]	Measuring value m [15:8]	
Data[..]	Measuring value m [23:16]	
Data[..]	Measuring value m [31:24]	

5.2.2   Scaling the Measuring Values

By default, 24-bit measuring values are transmitted. That is why:

0x0   = 0 % of sensor measuring value

0xFFFFFF   = 100 % of sensor measuring value

If the sensor is out of measuring range, so correspondingly larger measuring values are output.

5.2.3 Example of the Measuring Value Transmission

Master: Request Data						
Byte:	SD	DA	SA	FC	FCS	ED
Value:	0x10	x	x	0x4C	x	0x16
		FCS				

DA = Destination address = slave address = 0x7E

SA = Source address = master address = 0x01

FCS = Checksum = 0x7E+0x01+0x43 = 0xC2

Slave: Response Data									
Byte:	SD	LE	LE rep	SD rep	DA	SA	FC	Data	FCS	ED
Value:	0x68	0x13	0x13	0x68	0x01	0x7E	0x08	e.g. 16 bytes	x	0x16
					FCS				

LE = Length = 16 data bytes + 3 bytes (DA, SA, FC) = 19 bytes = 0x13
DA = Destination address = master address = 0x01
SA = Source address = slave address = 0x7E
FCS = Checksum = 0x01 + 0x7E + ….

	Value	Name	Explanation
Data[0]	0x22	Counter [7:0]	Measuring value counter = 0x0122
Data[1]	0x01	Counter [15:8]	= 290
Data[2]	0x03	Packet length m [7:0]	m = 3 -> 3 meas. values
Data[3]	0x00	Filler byte [7:0]	filler, can be ignored
Data[4]	0xB1	Measuring value 1 [7:0]	meas. value = 0x003244B1
Data[5]	0x44	Measuring value 1 [15:8]	(0x00FFFFFF = 100 %)
Data[6]	0x32	Measuring value 1 [23:16]	-> 0x003244B1 = 19 %
Data[7]	0x00	Measuring value 1 [31:24]	e.g. 200 μm sensor -> 38,0 μm
Data[8]	0xAC	Measuring value 2 [7:0]	
Data[9]	0x44	Measuring value 2 [15:8]	
Data[10]	0x32	Measuring value 2 [23:16]	Next measurement value, see above
Data[11]	0x00	Measuring value 2 [31:24]	
Data[12]	0xB9	Measuring value 3 [7:0]	
Data[13]	0x44	Measuring value 3 [15:8]	
Data[14]	0x32	Measuring value 3 [23:16]	Next measurement value, see above
Data[15]	0x00	Measuring value 3 [31:24]	

A total of 3 measurement values (= m) were added since the last measuring value request in controller and transferred thereby.

5.2.4   Setting the RS485 Address

The RS485 address of controller can be changed with this telegram:

Master:													
SD	LE	LE	SD	DA	SA	FC	DSAP	SSAP	new_addr	ID_Hi	ID_Lo	Lock	FCS	ED
0x68	0x09	rep	rep	x	x	0x43	0x37	0x3E	x	0x0	0x0	0x0	x	0x16

DA   Destination Address (= old Slave address)

SA   Source Address = Master Address (e.g. 0x01)

FCS   Checksum (sum of all bytes without SD, LE, LErep, SDrep, FCS, ED; without overflow, only 8 bits)

New_addr   New address (in range 1…126)

Answer Slave (short acknowledgement), on success:

SC
0xE5

No response:
No response indicates that an error has occurred in the address alignment. The controller still has the old address.

The new address is valid only after a reboot of the controller.

5.3 Commands and Settings

It can be made even more settings via the RS485 interface:
- Filter:
  - off
  - moving average (about 2 to 8 values)
  - arithmetic average (about 2 to 8 values)
  - Median (about 2 to 8 values)
  - dynamic noise reduction
- Data rate at which the measuring values can be added:
  - 5, 10, 20, 40, 80, 160, 320, 640, 1000 or 2000 Samples/s
- Baud rate of RS485 interface:
  - 9600, 115200, 230400, 460800 or 921600 Baud
- RS485 address of controller: 1 … 126
- Firmware Update of controller

i   Use for these settings either our MEDAQLib driver or the IF1032/ETH interface converter to Ethernet with the appropriate configuration option via web interface.

6.   Operation

➡ Connect the display/output devices through the signal output socket, see Chap. 4.6, before connecting the device to the power supply and switching on the power supply.

The measuring system is delivered calibrated. Calibration by the user is not necessary.

i Allow the measuring system to warm up for about 10 minutes before the first measurement.

NOTICE

The power supply may not exceed or continuously fall below the specified limits.
> Damage to or destruction of the sensor and/or controller
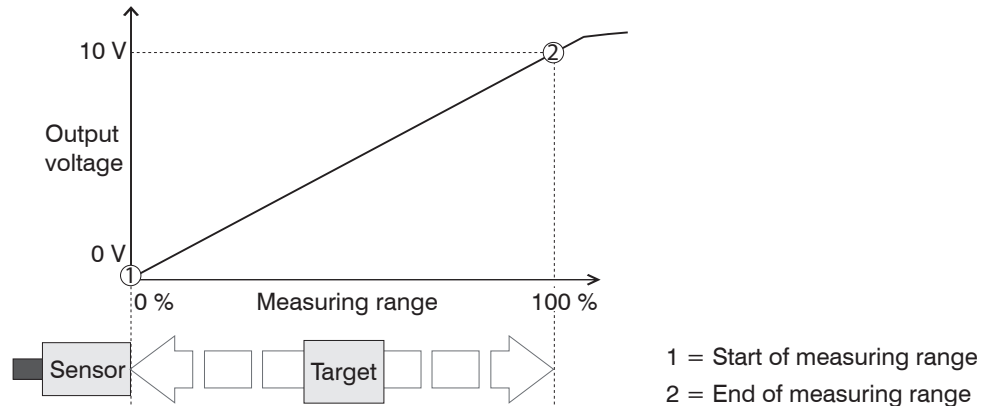
Fig. 14 Signal characteristic in the measuring range

1 = Start of measuring range
2 = End of measuring range

⚠ CAUTION

Disconnect the power supply before touching the sensor surface.
> Static discharge

> Danger of injury

7. Maintenance

Make sure that the sensor surface is always clean.

➡ Switch off the power supply before cleaning.

➡ Clean with a clamp cloth; then rub the sensor surface dry.

⚠ CAUTION

Disconnect the power supply before touching the sensor surface.
> Static discharge

> Danger of injury

In the event of a defect on the controller, the sensor or the sensor cable please send us the effected parts for repair or exchange. In the case of faults the cause of which is not clearly identifiable, send the whole measuring system back to

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Fax +49 (0) 8542 / 168-90
info@micro-epsilon.de
www.micro-epsilon.com

Sensors of the same type can be replaced without calibrating the controller.

8.   Warranty

All components of the device have been checked and tested for perfect function in the factory. In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to MICRO-EPSILON.

The warranty period lasts 12 months following the day of shipment. Defective parts, except wear parts, will be repaired or replaced free of charge within this period if you return the device free of cost to MICRO-EPSILON.

This warranty does not apply to damage resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties.

No other claims, except as warranted, are accepted.

MICRO-EPSILON will specifically not be responsible for eventual consequential damage. The terms of the purchasing contract apply in full.

MICRO-EPSILON always strives to supply the customers with the finest and most advanced equipment.

Development and refinement is therefore performed continuously and the right to design changes without prior notice is accordingly reserved.

For translations in other languages, the data and statements in the German language operation manual are to be taken as authoritative.

9.   Decommissioning, Disposal

➡️ Disconnect the cable for electrical power and output signal on the controller.
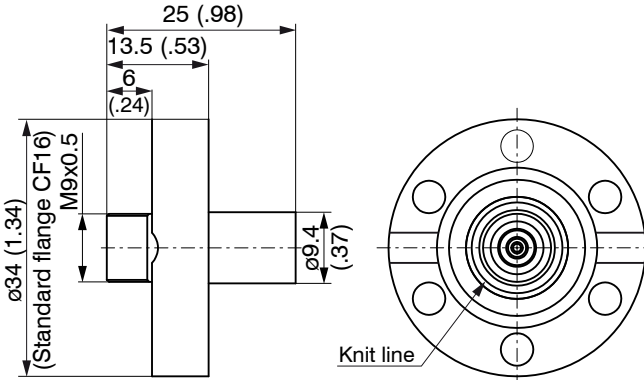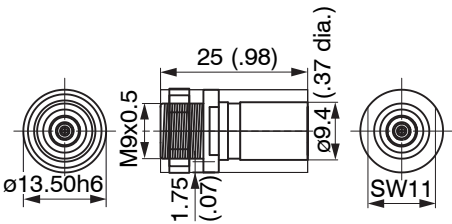
Incorrect disposal may cause harm to the environment.
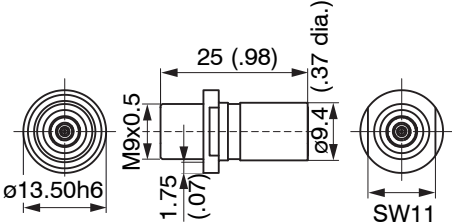
➡️ Dispose of the device, its components and accessories, as well as the packaging materials in compliance with the applicable country-specific waste treatment and disposal regulations of the region of use.

Appendix

A 1   Optional Accessories

PS2020		Power supply for DIN rail mounting Input 100 - 240 VAC Output 24 VDC / 2.5 A; L/W/H 120 x 120 x 40 mm Built-in type; mounting on symmetrical DIN-rail 35 mm x 7.5 mm, DIN 50022
PS2401/100-240/24V/1A		Wall power supply; universal power supply open ends; changeable inserts; internationally usable
IF1032/ETH		Interface module Ethernet/EtherCAT - at DT6120: RS485 to Ethernet/Ether-CAT (24-bit resolution) - at DT6110: Analog output to Ethernet/ EtherCAT (only 14-bit resolution)

SWH.OS.650.CTMSV		Vakuumdurchführung Maximale Leckrate 1x10e-7 mbar · l s^{-1} Kompatibel zu Stecker Typ B
	34 (1.34) M10x0.75 (M10x0.03) 2 (0.08) SW12 ø8.8 (0.35 dia.) ø14 (0.55 dia.) 9 (0.35) max. 17 (max. 0.67) Leak rate <1 * 10e-7 mbar * l / s	

UHV/B		Vakuumdurchführung triax schweißbar Maximale Leckrate 1x10e-9 mbar · l s-¹ Kompatibel zu Stecker Typ B
		Vakuumdurchführung triax mit CF16 Flansch Maximale Leckrate 1x10e-9 mbar · l s-¹ Kompatibel zu Stecker Typ B
		Vakuumdurchführung triax schraubbar Maximale Leckrate 1x10e-9 mbar · l s-1 Kompatibel zu Stecker Typ B

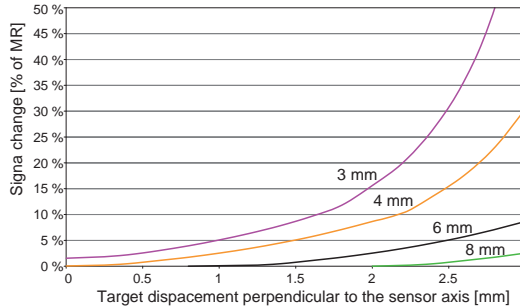## A 2   Tilt Angle Influence on the Capacitive Sensor
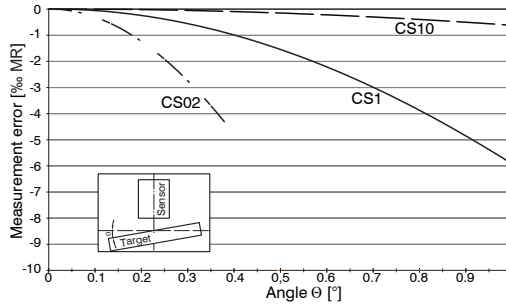
Fig. 15 Example of measuring range deviation in the case of a sensor distance of 10 % of the measuring range
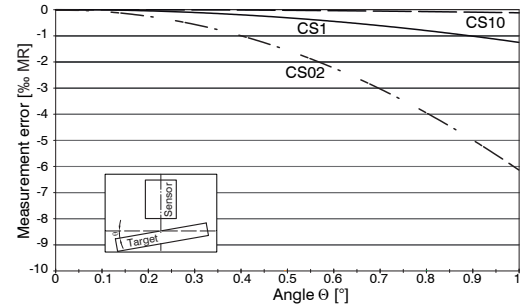
Fig. 16 Example of measuring range deviation in the case of a sensor distance of 50 % of the measuring range
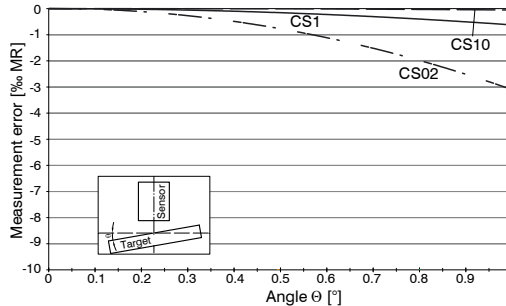
Fig. 17 Example of measuring range deviation in the case of a sensor distance of 100 % of the measuring range

i   Figures give an influence example shown on the sensors CS02/CS1 and CS10 in the case of different sensor distances to the target. As this results from internal simulations and calculations, please request for detailed information.

A 3   Measurement on Narrow Targets

Fig. 18 Example of measuring range deviation in the case of a sensor distance of 10 % of the measuring range
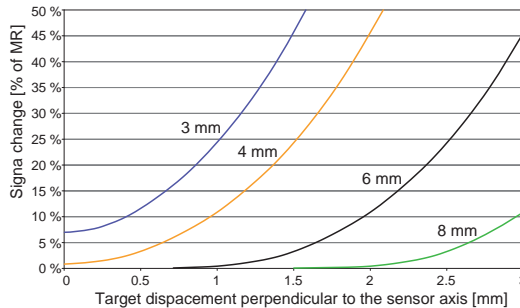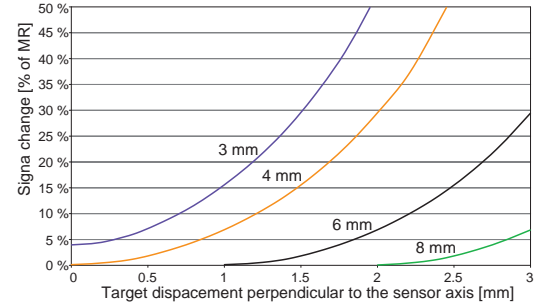

Fig. 19 Example of measuring range deviation in the case of a sensor distance of 50 % of the measuring range
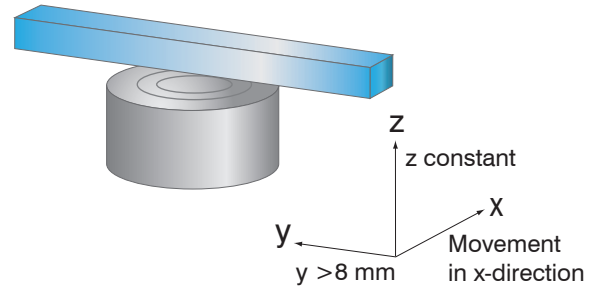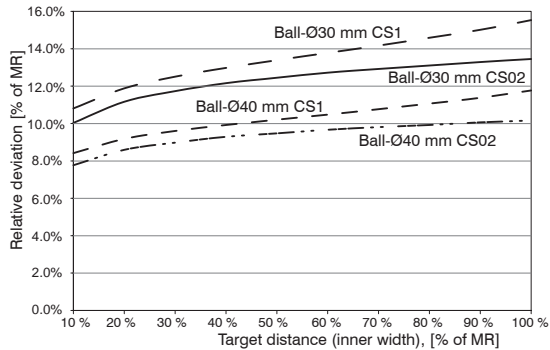

Fig. 20 Example of measuring range deviation in the case of a sensor distance of 100 % of the measuring range


Fig. 21 Signal change in the case of displacement of thin targets in the opposite direction to the measurement direction

i   Figures give an influence example shown on the sensors CS05 in the case of different sensor distances to the target as well as target widths. As this results from internal simulations and calculations, please request for detailed information.

A 4   Measurements on Balls and Shafts

Fig. 22 Measuring value deviation in the case of measurement on ball-shaped targets
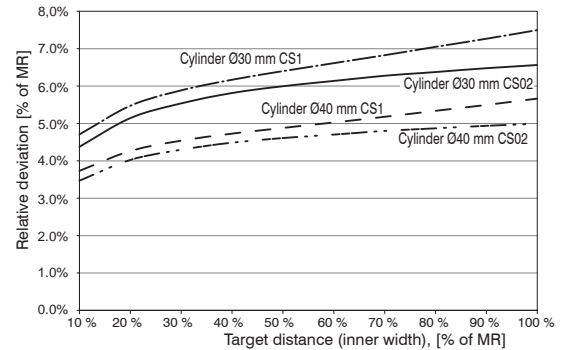
Fig. 23 Measuring value deviation in the case of measurement on cylindrical targets

i   Figures give an influence example shown on the sensors CS05 and CS1 in the case of different sensor distances to the target as well as target diameters. As this results from internal simulations and calculations, please request for detailed information.

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