



Operating Instructions
capa**NCDT** 6240/6248 PROFINET

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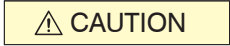


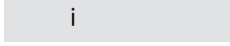
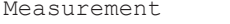
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1 Safety

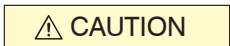

1.1 Symbols used

System operation assumes knowledge of the operating instructions.

The following symbols are used in these operating instructions:

	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
	Indicates a situation that may result in property damage if not avoided.
	Indicates a user action.
	Indicates a tip for users.
	Indicates hardware or a software button/menu.

1.2 Warnings

	<p>Disconnect the power supply before touching the sensor surface.</p> <ul style="list-style-type: none"> • Risk of injury <p>Connect the power supply and the display/output device according to the safety regulations for electrical equipment.</p> <ul style="list-style-type: none"> • Risk of injury • Damage to or destruction of the sensor and/or the controller
	<p>Avoid shocks and impacts to the sensor and the controller.</p> <ul style="list-style-type: none"> • Damage to or destruction of the sensor and/or the controller • The supply voltage must not exceed the specified limits. • Damage to or destruction of the sensor and/or the controller • Protect the sensor cable against damage. • Destruction of the sensor • Failure of the measuring device

1.3 Notes on product marking

1.3.1 CE marking

The following apply to the product:

- Directive 2014/30/EU ("EMC")
- Directive 2011/65/EU ("RoHS")

Products which carry the CE marking satisfy the requirements of the EU Directives cited and the relevant applicable harmonized European standards (EN).

The product is designed for use in industrial and laboratory environments.

The EU Declaration of Conformity and the technical documentation are available to the responsible authorities according to the EU Directives.

1.3.2 UKCA marking

The following apply to the product:

- SI 2016 No. 1091 ("EMC")
- SI 2012 No. 3032 ("RoHS")

Products which carry the UKCA marking satisfy the requirements of the directives cited and the relevant applicable harmonized standards.

The product is designed for use in industrial and laboratory environments.

The UKCA Declaration of Conformity and the technical documentation are available to the responsible authorities according to the UKCA Directives.

1.4 Intended use

The measuring system is designed for use in industrial and laboratory applications.

It is used for

- Displacement, distance and thickness measurements
- Position measurement of parts or machine components

The measuring system must only be operated within the limits specified in the technical data.

- ▶ The system must be used in such a way that no persons are endangered or machines and other material goods are damaged in the event of malfunction or total failure of the system.
- ▶ Take additional precautions for safety and damage prevention in case of safety-related applications.

1.5 Proper environment

Temperature range (sensor)	CSx, CSEx	CSxHP CSEx/Mx	CSHx-CAMx CSHxFL-CRmx	CSGx-CAMx CSFx-CRgx	CSFx
Storage	-50 ... +200 °C			-50 ... +100 °C	-40 ... +100 °C
Continuous operation (connector)	-50 ... +200 °C			-	-40 ... +100 °C
Continuous operation (cable)	-			-50 ... +80 °C	-
Operation, 10,000 h max. (cable)	-			-60 ... +100 °C	-

Temperature range (sensor cable)	CCgx	CCgx/90	CCmx	CCmx/90
Storage	-50 ... +80 °C		-50 ... +200 °C	
Continuous operation	-20 ... +80 °C		-100 ... +200 °C	
Operation, 10,000 h max.	-20 ... +100 °C		-	

Temperature range (controller)	
Storage	-10 ... +75 °C
Operation	+10 ... +60 °C

- Protection class: IP 40
- Humidity: 5 ... 95% (non-condensing)
- Ambient pressure: Atmospheric pressure
- The space between sensor surface and target must have an unchanging dielectric constant.
- The space between the sensor surface and target must not be soiled (e.g. with water, abraded particles, dust, etc.).



2 Functional principle, technical data

2.1 Measuring Principle

The capacitive distance measuring principle of the capaNCDT system is based on the functioning of an ideal plate capacitor. In the case of conductive targets, the sensor and the target located opposite form the two plate electrodes.

If a constant alternating current flows through the sensor capacitor, the amplitude of the alternating voltage on the sensor is proportional to the distance between the capacitor electrodes. The AC voltage is demodulated, amplified and output via the interface(s).

The capaNCDT system evaluates the reactance X_C of the plate capacitor, which changes in strict proportion to the distance.

$$X_C = \frac{1}{j\omega C}; \text{ capacitance } C = \varepsilon_r * \varepsilon_0 * \frac{\text{area}}{\text{distance}}$$

i A small measuring object and curved (uneven) measurement surfaces also result in a non-linear characteristic curve.

This theoretical correlation is reproduced almost perfectly in practice if the sensors are designed as guard ring capacitors.

A linear characteristic curve can be obtained without additional electronic linearization for the measurement signal if targets consisting of electrically conductive materials (metals) are measured. Minor changes in the conductivity or magnetic properties do not affect the sensitivity or linearity.

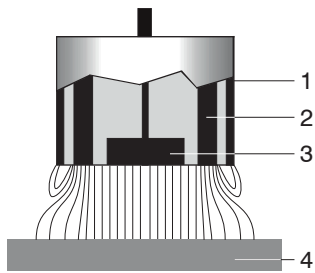


Fig. 2.1: Functional principle of the guard ring capacitor

1	Ground
2	Guard electrode
3	Measuring electrode
4	Electrical conductor

2.2 Structure

2.2.1 Components, block diagram

The non-contact multi-channel measuring system in an aluminum housing consists of:

- Basic module DT6240 or DT6248
- One demodulator module DL6220 or DL6230, each with integrated preamplifier per sensor
- Sensor, sensor cable
- Power supply cable
- Ethernet cable
- Signal output cable

The modular design enables the connection of up to 4 channels (modular system).

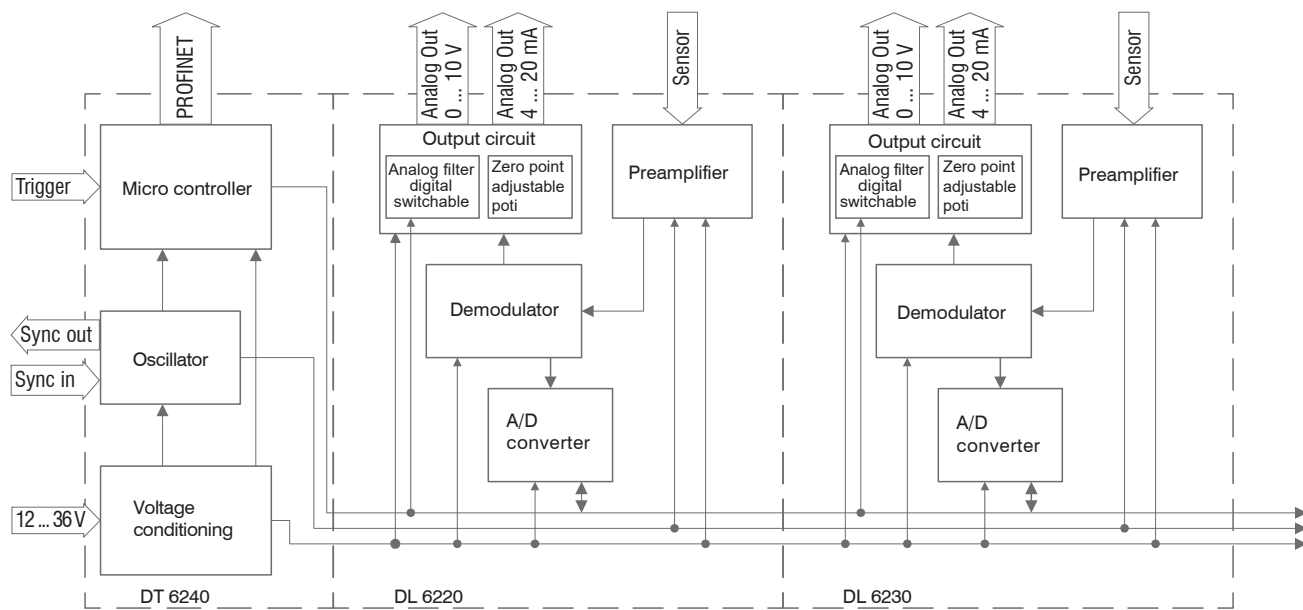


Fig. 2.2: Block diagram capaNCDT 6240 with PROFINET

2.2.2 Sensors

Several sensors can be used for this measuring system.

- i To obtain accurate measurement results, keep the sensor surface clean and free from damage.

The capacitive measuring method is area-based. A minimum area is required depending on the sensor model and measuring range, see table. For insulators, the dielectric constant and the target thickness also play an important role.

Sensor model	Measuring range	Min. target size (flat) / nominal measuring range
CS005	0.05 mm	ø 3 mm
CS02	0.2 mm	ø 5 mm
CS08	0.8 mm	ø 9 mm
CS1HP	1 mm	ø 9 mm
CS-025	0.2 mm	ø 5 mm
CS-05	0.5 mm	ø 7 mm
CS-1	1 mm	ø 9 mm
CS-2	2 mm	ø 17 mm
CS-3	3 mm	ø 27 mm
CS-5	5 mm	ø 37 mm
CS-10	10 mm	ø 57 mm
CSE01	0.1 mm	ø 3 mm
CSE025	0.25 mm	ø 4 mm
CSE05	0.5 mm	ø 6 mm
CSE1	1 mm	ø 8 mm
CSE1,25	1.25 mm	ø 10 mm
CSE2	2 mm	ø 14 mm
CSE3	3 mm	ø 20 mm
CSE05/M8	0.5 mm	ø 6 mm
CSE1/M12	1 mm	ø 10 mm
CSE2/M16	2 mm	ø 14 mm
CSE3/M24	3 mm	ø 20 mm

Sensor model	Measuring range	Min. target size (flat) / nominal measuring range
CSE-1-HT/CA1,0	1 mm	ø 8 mm
CSE-2-HT/CA1,0	2 mm	ø 14 mm
CSE-5-HT/CA1,0	5 mm	ø320 mm
CSE-10-HT/CA1,0	10 mm	ø 50 mm
CSH02-CaM1,4	0.2 mm	ø 7 mm
CSH05-CaM1,4	0.5 mm	ø 7 mm
CSH1-CaM1,4	1 mm	ø 11 mm
CSH1,2-CaM1,4	1.2 mm	ø 11 mm
CSH2-CaM1,4	2 mm	ø 17 mm
CSH02FL-CRm1,4	0.2 mm	ø 7 mm
CSH05FL-CRm1,4	0.5 mm	ø 7 mm
CSH1FL-CRm1,4	1 mm	ø 11 mm
CSH1,2FL-CRm1,4	1.2 mm	ø 11 mm
CSH2FL-CRm1,4	2 mm	ø 17 mm
CSH3FL-CRm1,4	3 mm	ø 24 mm
CSF2 / CSF2-CRg4,0	2 mm	approx. 50 x 13 mm
CSF4 / CSF4-CRg4,0	4 mm	approx. 90 x 17 mm
CSF6 / CSF6-CRg4,0	6 mm	approx 128 x 24 mm
CSG0,5-CaM2,0	0.5 mm	approx. 7 x 8 mm
CSG1,00-CaM2,0	1 mm	approx. 8 x 9 mm
CSG0,5-CRg2,0	0.5 mm	approx. 10 x 10 mm
CSG1-CRg2,0	1 mm	approx. 12 x 12 mm
CSG-1/90/CRg2,0	1 mm	approx. 10 x 10 mm

Tab. 2.1: Sensoren für elektrisch leitende Messobjekte (Metalle)

2.2.3 Sensor Cable

Sensor and controller are connected via a special, double-shielded sensor cable.

A damaged cable cannot be repaired.

- i Switch the device off when plugging in and unplugging plugs.
Do not crush the cable.
Do not shorten or modify the sensor cable.
Loss of functionality!

Model	Cable length	Cable-ø	2 axial connectors	1x axial + 1x 90°	Measuring range Sensors	Bending radius immovably routed	Bending radius flexible
CCgxC	2/4 or 6 m	3.1 mm	•		0.05 - 0.8 mm	10 mm	22 mm
CCgxC/90	2/4 or 6 m	3.1 mm		•	0.05 - 0.8 mm		
CCgxB	2/4 or 6 m	3.1 mm	•		1 ... 10 mm		
CCgxB/90	2/4 or 6 m	3.1 mm		•	1 ... 10 mm		
CCmxC	1.4/2.8 or 4.2 m	2.1 mm	•		0.05 - 0.8 mm	7 mm	15 mm
CCmxC/90	1.4/2.8 or 4.2 m	2.1 mm		•	0.05 - 0.8 mm		
CCmxB	1.4/2.8 or 4.2 m	2.1 mm	•		1 ... 10 mm		
CCmxB/90	1.4/2.8 or 4.2 m	2.1 mm		•	1 ... 10 mm		

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

Other cable lengths are also available on request.

The sensor model CSE1 (measuring range 1 mm) has connector type C.

2.2.4 Controller

The capaNCdT 6240 multi-channel measuring system consists of a DT6240 basic module and, depending on requirements, one to four DL62xx demodulator modules. The assemblies are built in aluminum housings.



Fig. 2.3: Front view of basic module DT6240 with demodulator module DL6220 and DL6230

1	Basic module
2	4 Demodulator modules max.

Basic module DT624x

The basic module consists of the voltage processor unit, oscillator and digital unit.

The voltage processor generates all required internal voltages from the supply voltage both for the basic module and the demodulator unit. The oscillator supplies the demodulator module with an alternating voltage that has a constant frequency and amplitude. The frequency is 31 kHz. The digital unit controls the A/D converters of the demodulator modules and measures the current measurement values. The measured values can be read out in digital form via the Profinet interface.

Demodulator module DL62xx

The DL6220/DL6230 demodulator module consists of an internal preamplifier, demodulator, output stage and A/D converter for each sensor channel. The internal preamplifier generates and amplifies the distance-dependent measurement signal. The demodulator and output stage transform the measurement signal into a standardized voltage or current signal.

The A/D converter helps process the measurement values digitally.

The Zero trimpot enables a special zero adjustment of the analog output signals.

NOTICE

The output voltage can reach a maximum value of 15 VDC if the sensor is unplugged or if the measuring range is exceeded.

► Observe possible restrictions for the evaluation or display units to be connected.

2.3 Technical data

Model		DT624x	
with demodulator		DL6220	DL6230
Resolution ^[1]	static	0.004 % FSO	0.0005 % FSO
	dynamic	0.02 % FSO	0.005 % FSO
Frequency response (-3 DB)		5 kHz, switchable to 20 Hz	
Measuring rate		max. 3.906 kSa/s	

[1] FSO = Full scale output | RMS noise related to mid of measuring range

Model		DT624x	
Linearity ^[2]		< ±0.05 % FSO	< ±0.025 % FSO
Temperature stability		< 200 ppm FSO / K	
Sensitivity		< ±0.1 % FSO	
Long term stability		< 0.02 % FSO / month	
Synchronization		yes (internal only)	yes
Supply voltage		15 ... 36 VDC	
Power consumption		3.9 W (24 VDC) + 1.9 W / demodulator	
Signal input		TTL (5V)	
Digital interface		PROFINET	
Analog output		0 ... 10 V / 4 ... 20 mA	
Connection	Sensor	pluggable cable via triaxial socket	
	Supply/ signal	Supply/trigger: 4 pin connector; sync: 5 pin connector signal: analog via 4 pin connector, digital via RJ45 connector (for suitable connection cables, see accessories)	
Montage		Table-top device or DIN rail	
Temperature range	Storage	-10 ... +75 °C	
	Operation	+10 ... +60 °C	
Shock (DIN-EN 60068-2-27)		15 g / 6 ms in 3 axis, 2 directions and 1000 shocks each	
Vibration (DIN-EN 60068-2-6)		0.75 mm / 10 ... 500 Hz in 3 axis, 2 directions and 10 cycles each 2 g / 10 ... 500 Hz in 3 axis, 2 directions and 10 cycles each	
Protection class (DIN-EN 60529)		IP40	
Weight		appr. 720 g + 185 g / demodulator	appr. 720 g + 210 g / demodulator
Compatibility		suitable for all sensors	
No. of measurement channels		max. 4	

2.4 Options

Name	Description	Suitable for articles			
		2303018 DL6220	2303022 DL6220/ECL2	2303023 DL6220/ECL3	2303029 DL6220/LC
LC DL62x0 digital, Article 2982044	special calibration of linearity on digital output	○	○	○	●
LC DL62x0 analog, Article 2982045	special calibration of linearity on analog output	○	○	○	●
ECL2 DL6220, Article 2982046	Special tuning for 2x sensor cable length	-	●	-	●
ECL3 DL6220, Article 2982047	Special tuning for 3x sensor cable length	-	-	●	●
EMR2 DL6220, Article 2982048	Extended measuring range (factor: 2)	○	○	○	●
RMR1/2 DL6222, Article 2982 49	Reduced measuring range (factor: 1/2)	○	○	○	●

[2] Applies only to the controller. The total linearity of the measuring channel is composed of the values for controller and sensor.

Name	Description	Suitable for articles			
		2303019 DL6230	2303024 DL6230/ECL2	2303025 DL6230/ECL3	2303030 DL6230/LC
LC DL62x0 digital, Article 2982044	Special calibration of linearity on digital output	○	○	○	●
LC DL62x0 analog, Article 2982045	special calibration of linearity on analog output	○	○	○	●
ECL2 DL6230, Article 2982054	Special tuning for 2x sensor cable length	-	●	-	●
ECL3 DL6230, Article 2982055	Special tuning for 3x sensor cable length	-	-	●	●
EMR2 DL6230, Article 2982051	Extended measuring range (factor: 2)	○	○	○	●
EMR3 DL6230, Article 2982052	Extended measuring range (factor: 3)	○	○	○	●
RMR1/2 DL6230, Article 2982053	Reduced measuring range (factor: 1/2)	○	○	○	●

- Articles already contain the option
- Option available
- Option not available

3 Delivery

3.1 Unpacking, included in delivery

1 basic module DT62x0 with 1 to 4 DL62x0 demodulator modules

1 supply and trigger cable PC6200-3/4, 3 m long, [see Chap. 11](#)

1 Ethernet cable, 3 m long

Optional accessories

1 sensor per measuring channel

1 sensor cable with connector per measuring channel

1 signal output cable, synchronization cable

- ▶ Carefully remove the components of the measuring system from the packaging and ensure that the goods are forwarded in such a way that no damage can occur.
- ▶ Check the delivery for completeness and shipping damage immediately after unpacking.
- ▶ If there is damage or parts are missing, immediately contact the manufacturer or supplier.

Return of packaging

Micro-Epsilon Messtechnik GmbH & Co. KG offers customers the opportunity to return the packaging of products purchased from Micro-Epsilon by prior arrangement so that it can be reused or recycled.

To arrange the return of packaging, for questions about the costs and / or the exact return procedure, please contact us directly at

info@micro-epsilon.de

3.2 Download

GSDML Datei <GSDML-V2.42-MICRO-EPSILON-DT6x40PNET-202x.xml> available at www.micro-epsilon.de/service/download/

TIA function blocks for easier configuration, available at www.micro-epsilon.de/service/download/

3.3 Storage

Sensor	CSx CSxHP CSEx CSEx/Mx	CSHx-CAMx CSHxFL-CRmx	CSGx-CAMx CSFx-CRgx	CSFx
	-50 ... +200 °C		-50 ... +100 °C	-40 ... +100 °C

Sensor Cable	CCgx CCgx/90	CCmx CCmx/90
	-50 ... +80 °C	-50 ... +200 °C

Controller	-10 ... +75 °C
------------	----------------

- Humidity: 5 to 95 % RH (non-condensing)

4 Installation and assembly

4.1 Precautions

No sharp or heavy objects should be allowed to affect the cable sheath.

- Protect the cable from pressure loads in pressurized rooms.
- Avoid folding the cables.
- Check the plug-in connections for firm seating.

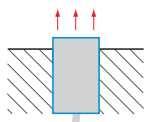
i A damaged cable cannot be repaired.

4.2 Sensor

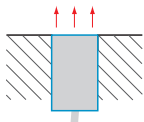
4.2.1 General

The sensors may be mounted free-standing or flush.

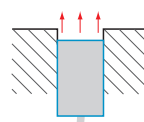
When assembling, ensure that the polished sensor surface is not scratched.



Protruding installation



Flush installation



Recessed installation, not for sensors in the CSE series

4.2.2 Radial spot clamping with set screw, cylindrical sensors

This simple type of fixture is only recommended for installation locations that are free of impact and vibration. The set screw must be made of plastic so that it cannot damage or deform the sensor housing.

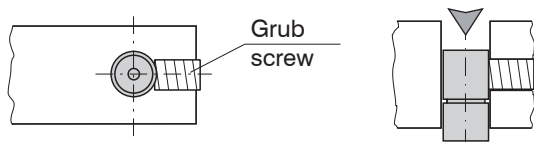


Fig. 4.1: Radial spot clamping with set screw

NOTICE

Risk of damage to the sensor

- Do not use any set screws made of metal.

4.2.3 Circumferential clamping, cylindrical sensor

This type of sensor mounting offers maximum reliability as the sensor is clamped around its cylindrical housing. It is absolutely necessary in difficult installation environments, for example on machines and production plants.

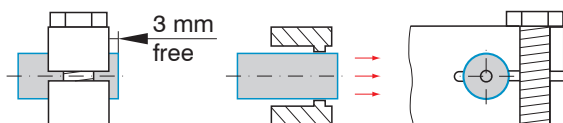
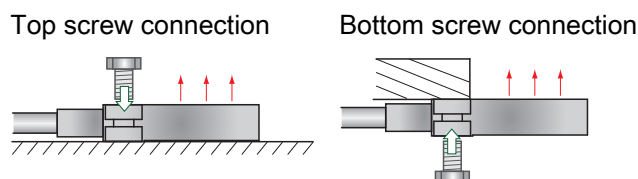


Fig. 4.2: Circumferential clamping with clamping collet

i Tension on the cable is not permitted!

4.2.4 Flat sensors

Flat sensors are mounted by means of a threaded 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 screwed on from above or below.



Tab. 4.1: Flat sensor top/bottom fixture

4.2.5 Dimensional drawings of sensors and sensor cables

The dimensional drawings for the standard sensors of the

- CSx
- CSEx
- CSHx
- CSGx

series and the sensor cables are compiled in one separate document. You will find this online at: <https://www.micro-epsilon.com/download-file/set--capaNCDT-Sensoren--en.pdf>



4.3 Controller

4.3.1 Basic module, demodulator module

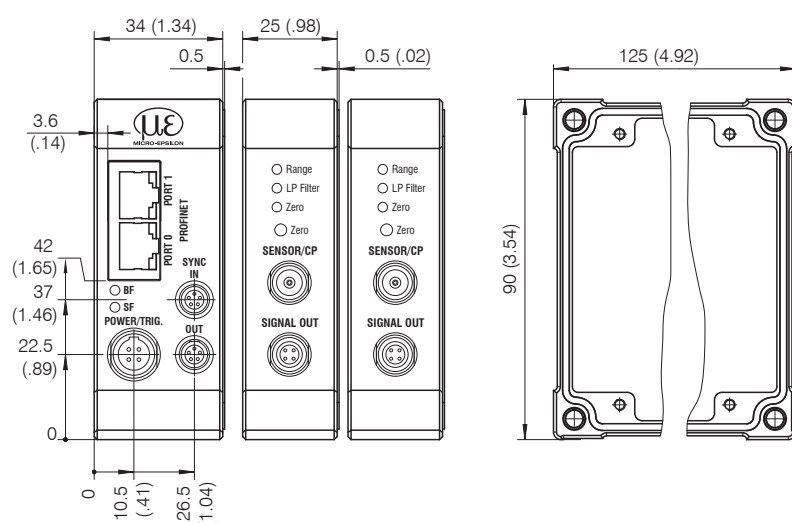


Fig. 4.3: Dimensional drawing of basic module and demodulator

Dimensions in mm (inches rounded off)

The controller is mounted using mounting plates or retaining clips for a DIN rail mounting, which are included in an optional conversion kit.

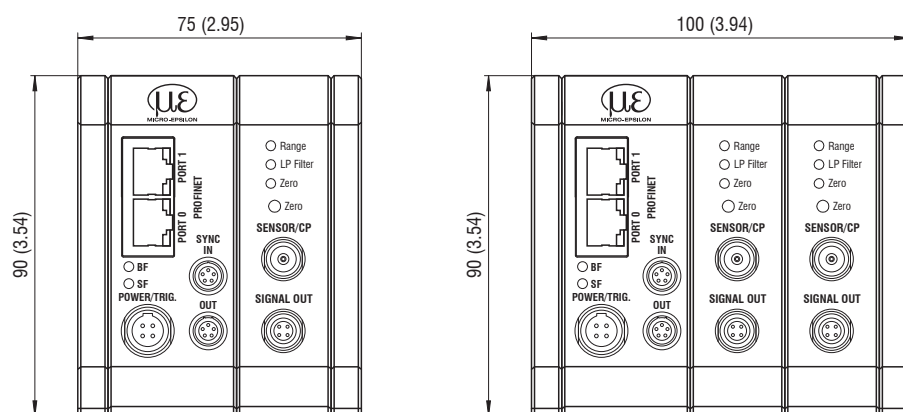


Fig. 4.4: Dimensional drawing of controller with one or two demodulator modules

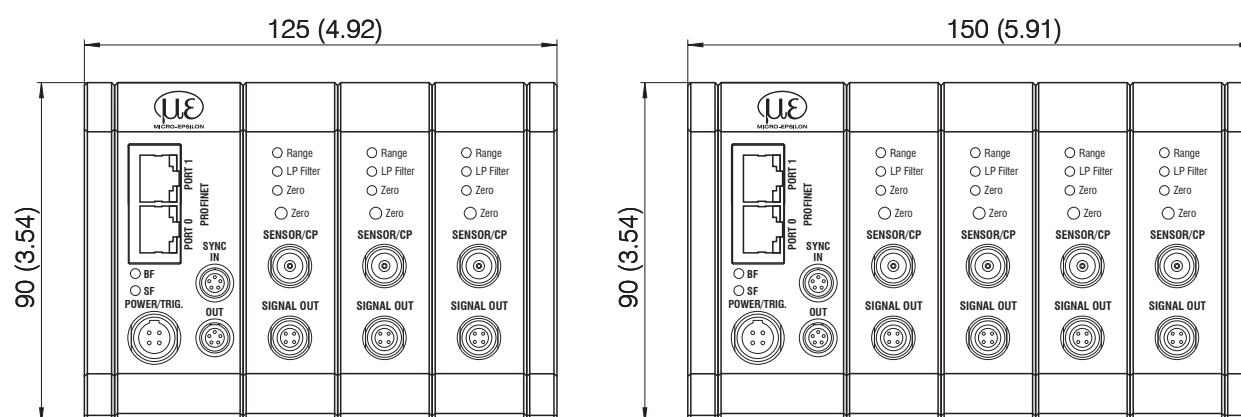


Fig. 4.5: Dimensional drawing of controller with three or four demodulator modules

4.3.2 Housing cover

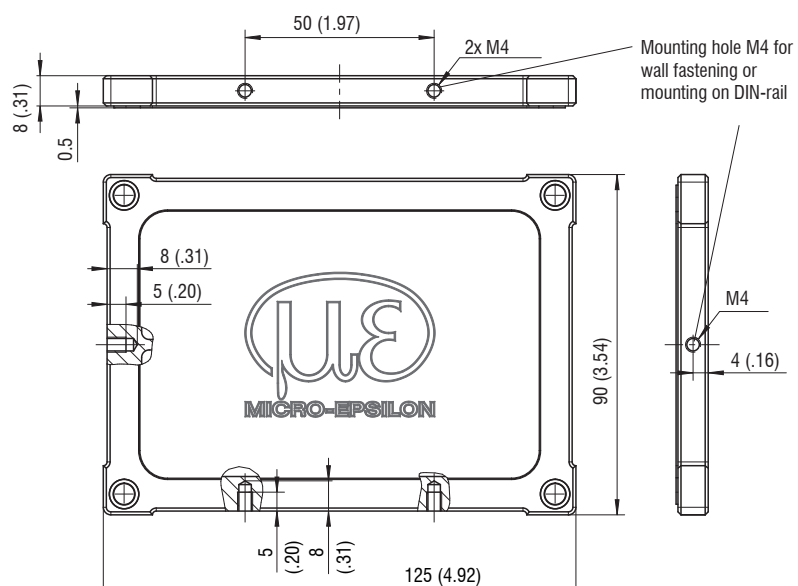


Fig. 4.6: Dimensional drawing of housing cover

Dimensions in mm (inches rounded off)

The controller is mounted using mounting plates or retaining clips for a DIN rail mounting.

4.4 Inserting the demodulator module

- Loosen the sleeve nuts (4b) on the right side of the controller, remove the right housing cover (3).

- ▶ Pull out a sleeve nut (4a) together with the threaded rod (1).
- ▶ Replace the threaded rod (1) with the next-longest threaded rod in the conversion kit supplied. Push the new threaded rod, including sleeve nut (4a), through the modules.
- ▶ Replace the remaining 3 threaded rods in the same way.

i Only touch the demodulator modules on the housing, not on the electronics. This avoids electrostatic discharges onto the electronics.

- ▶ Attach the additional demodulator module.

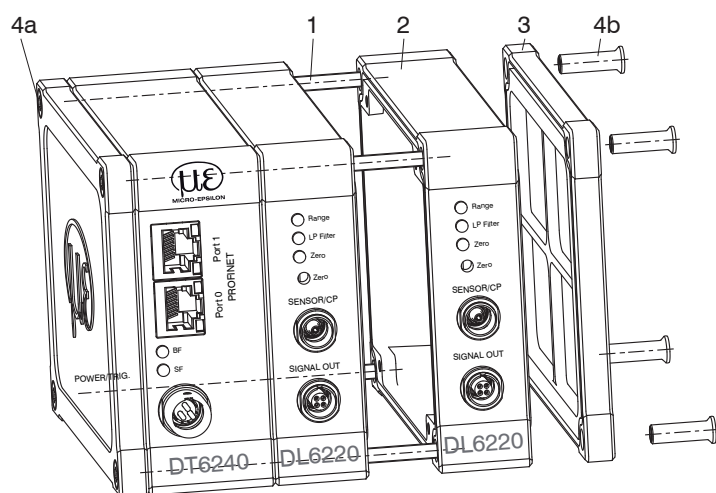


Fig. 4.7: Mechanical controller components

Number of demodulator modules	Length of threaded rod M4
1	59 mm
2	84 mm
3	109 mm
4	134 mm

- ▶ Connect both ribbon cables (5) of the previous demodulator module to the new demodulator module (6).

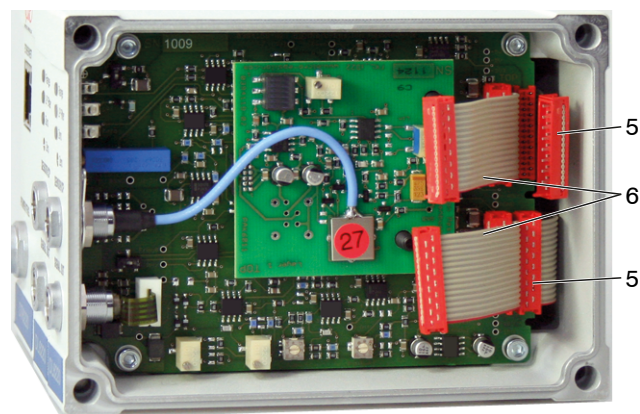


Fig. 4.8: Wiring of demodulator modules

- 5 Wiring of previous demodulator module
- 6 Wiring of next demodulator module

- ▶ Attach the right housing cover (3).
- ▶ Screw the sleeve nuts (4b) onto the threaded rods on the right side of the controller and tighten the sleeve nuts.

The wiring to the previous demodulator module (5) can be disconnected with the supplied unplugging tool, as follows:

- ▶ 1. Press the unplug aid with the recess on the side of the plug connector (5).
- ▶ 2. Release the plug with a lever movement.
- ▶ 3. Release the other side of the plug in the same manner.

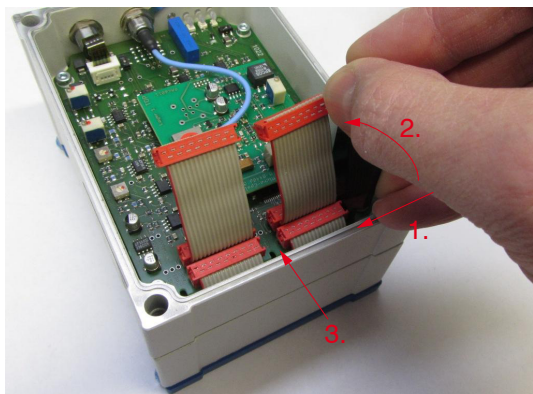


Fig. 4.9: Use of the unplugging tool for wiring of the demodulator elements

4.5 Ground connection, grounding

- ▶ Ensure sufficient grounding of the target, for example, by connecting it to the sensor or the power supply ground.

Non-contact target grounding

In various applications, grounding the target is difficult or even impossible.

Unlike other systems, capaNCDT systems do not require the measuring object to be grounded.

The drawing below shows two synchronized capaNCDT sensors measuring against a roller. Due to Micro-Epsilon's unique synchronization technology, special target grounding is not required in most cases.

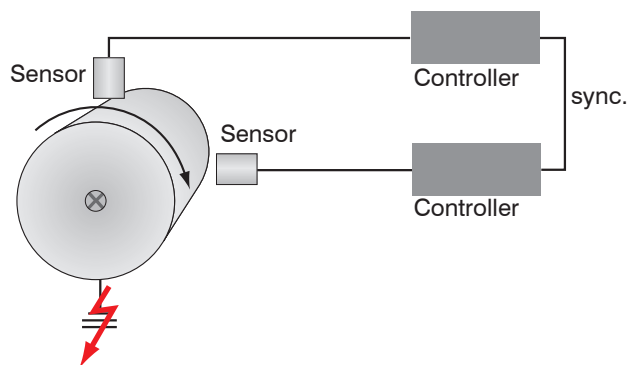


Fig. 4.10: Position and imbalance measurements with two measuring systems

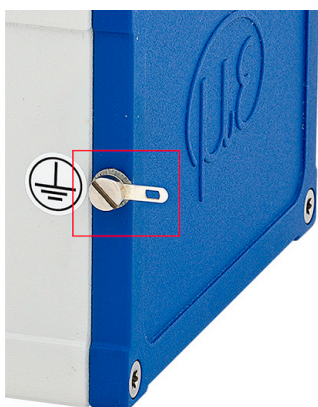


Fig. 4.11: Grounding connection on the housing cover

No target grounding required with synchronized capaNCdT sensors.

If necessary, use the grounding connection on the housing cover.

4.6 Electrical connections

4.6.1 Connection options

Power supply and signal output are on the front of the controller.

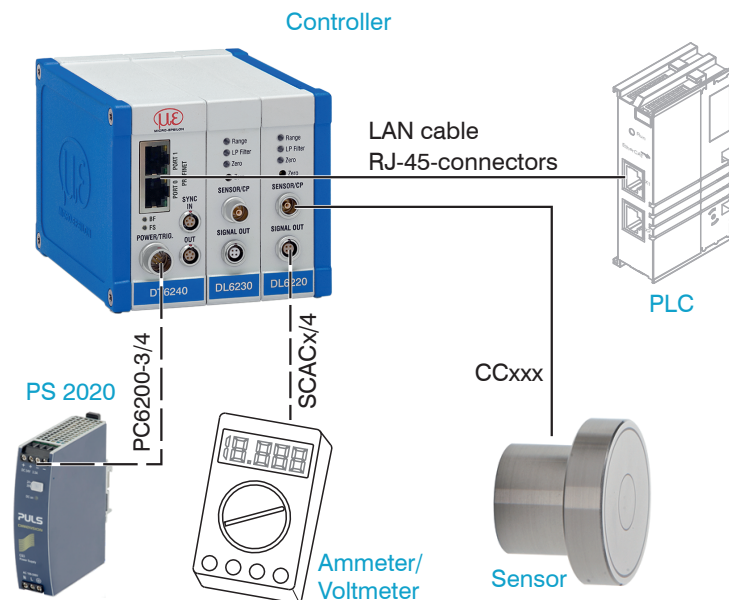
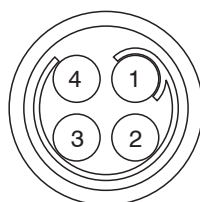
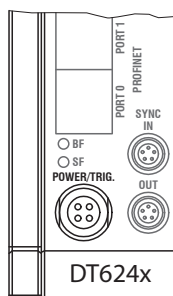


Fig. 4.12: Connection examples DT6240

4.6.2 Supply pin assignment, trigger

PIN	Color PC6200-3/4	Signal	Description
1	Brown	+24VIN	+24 VDC supply
2	White	Zero VIN	GND supply
3	Yellow	TRI_IN+	Trigger IN+, TTL level
4	Green	TRI_IN-	Trigger IN-
Shield			

PC6000-3/4 is an assembled supply and trigger cable that is 3 m long.



4-pin ODU cable socket, view of solder side

Tab. 4.2: Supply voltage input on the controller, 4-pin cable connector

Release the trigger by:

- Connecting Pin 3 to +5V
- Connecting Pin 4 to GND

An input voltage with $U_{IN} \geq 2.0 \text{ V}$ is recognized as HIGH.

An input voltage U_{IN} with $\leq 0.8 \text{ V}$ is recognized as LOW.

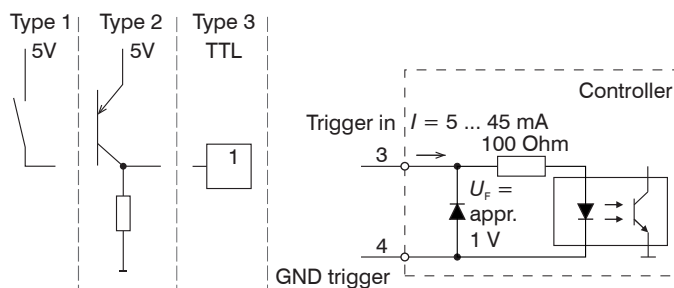
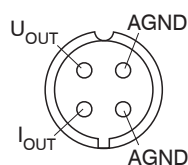
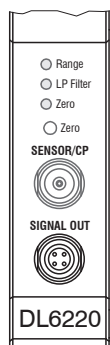


Fig. 4.13: Trigger input circuit

4.6.3 Pin Assignment of Analog Output

Pin	Color SCACx/4	Signal	Description
1	Brown	U_{OUT}	Load at least 10 kOhm
2	Yellow	I_{OUT}	Load at least 500 ohms
3	Gray	AGND	Analog ground
4	White	AGND	Analog ground
Shield			

Analog grounds are connected internally. SCACx/4 is a 4-wire output cable that is 3 m long. It is supplied as an optional accessory.



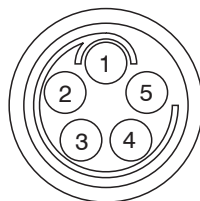
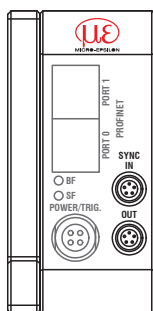
4-pin cable connector, view solder side

Tab. 4.3: Signal output on controller, 4-pin male cable connector

4.6.4 Synchronization pin assignment

PIN	Assignment	Insulation	Color
1	n.c	-	-
2	Twisted pair 1	1	White 1
3	Twisted pair 1	Blue	Blue
4	Twisted pair 2	2	White 2
5	Twisted pair 2	Orange	Orange

SC6000-x is an assembled synchronization cable which is 0.3 or 1 m long



5-pin ODU cable connector, view solder side

Tab. 4.4: Sync IN/OUT on controller, 5-pin female cable connector

Several capaNCDT 6240 series measuring systems can be operated simultaneously as a multi-channel system. Synchronizing the systems prevents the sensors from influencing each other.

- ▶ Plug the SC6000-x, [see Chap. 11](#) synchronization cable into the SYNC OUT socket (synchronization output) on controller 1.
- ▶ Insert the plug from the SC6000-x into the SYNC IN socket (synchronization input) on controller 2.

The oscillator of controller 2 automatically switches to synchronization mode, i.e. depending on the oscillator in controller 1.

Interference from a poorly grounded target is excluded.

If necessary, synchronize several measuring systems with one SC6000-x.

i Automatic synchronization. One controller synchronizes further controllers.



Fig. 4.14: Synchronization of a second controller

4.7 Fieldbus cabling

- ▶ When wiring, connect channel 0 of the IO controller to a port of the first IO device (slave device). Connect the second port of the first slave device to the input port of the next slave device, etc. One port of the last slave device and channel 1 of the master device remain unused.



Fig. 4.15: Cabling in the PROFINET IO network

Optional: You achieve greater failsafe network performance if you implement an additional redundant connection (MRP = Media Redundancy Protocol) between the output port of the last slave device and channel 1 of the IO controller. DT6240 can participate in an MRP ring as a client; however, it cannot manage the ring. To achieve ring functionality, all participants must be configured as ring participants.

5 Operation

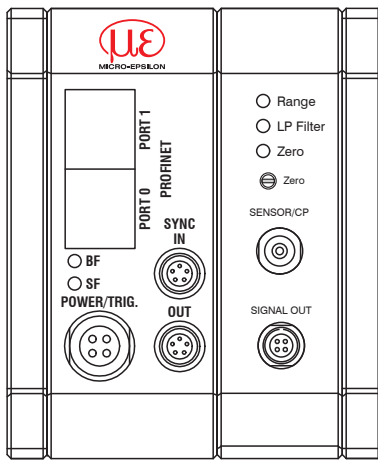
5.1 Initial operation

- ▶ Connect the display/output devices via the signal output socket, [see Chap. 4.6](#) before the device is connected to the supply voltage and switched on.

- i Allow the measuring system to warm up for about 15 minutes before the first measurement or calibration.

5.2 Control and indicator elements

5.2.1 LEDs



LED	Color	Function
Range		Green Measuring object in measuring range
	Red	Measuring range exceeded
LP filter ^[3]		Default strip width active
		20 Hz low-pass filter at analog outputs enabled
Zero		Zero potentiometer in base position (right-hand stop)
		Zero potentiometer adjusted
BF		Red Bus failure
SF		Red System failure
BF, SF		No failure

5.2.2 Potentiometer

The zero potentiometer on the demodulator modules is used to zero the analog outputs.

The end positions on the left or right stop are indicated by a slight click.

The electrical zero point can be set over the entire measuring range using the **Zero** potentiometer. The start of the measuring range (= mechanical zero point) is located at the front of the sensor.

A tilted sensor or a tilted measuring object causes a reduced measuring range and a zero point shift corresponding to the tilt angle.

The potentiometer is factory-set to the right stop (maximum level).

[3] LP filter can only be switched via Ethernet.

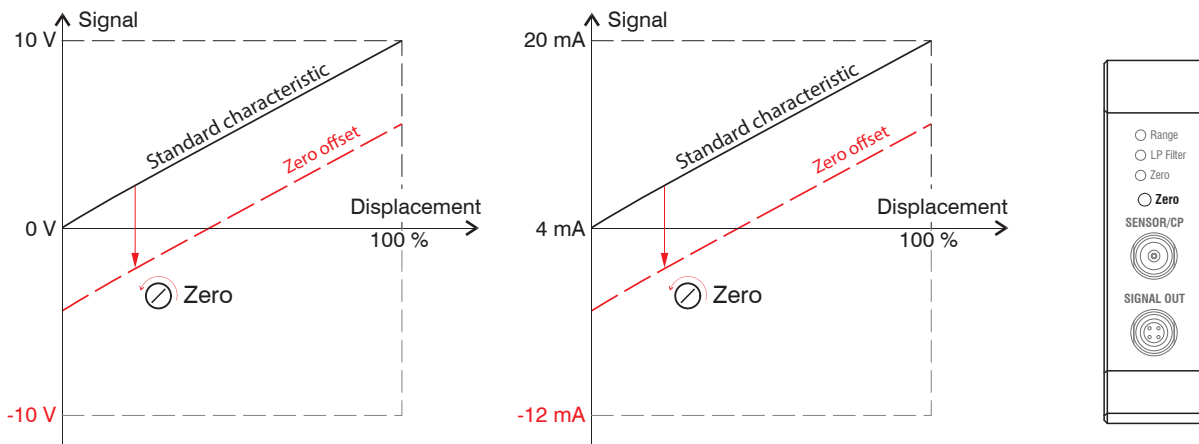


Fig. 5.1: Zero offset using the potentiometer $Zero$

5.3 Triggering

The output of measurement values can be controlled by an external electrical trigger signal. This only affects the digital output.

The trigger type is determined by the cparameters of the PROFINET device used.

Level triggering (High level). Continuous measured value output with set data rate for as long as the selected level is active. The controller outputs the last measured value. The measured value counter is not incremented any further.

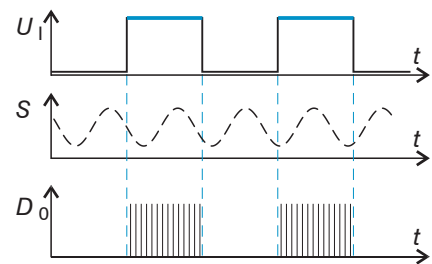


Fig. 5.2: Active high level trigger (U_I), relevant digital signal (D_0)

Edge triggering. Starts measured value output as soon as the selected edge is present at the trigger input. If the trigger condition is met, the controller outputs a measured value. The set data rate must be greater than the maximum trigger frequency. If triggering is faster than the set data rate, individual measured values are sent twice because no new measured values are available internally from the AD converter.

The duration of the pulse must be at least 5 μ s.

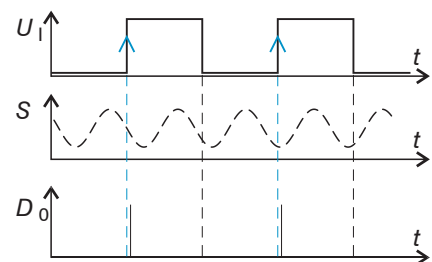


Fig. 5.3: Rising edge trigger (U_I), relevant digital signal (D_0)

Rising edge (gate). Starts measured value output with set data rate as soon as the rising edge is present at the trigger input. Another rising edge stops the output of measured values or switches it on again.

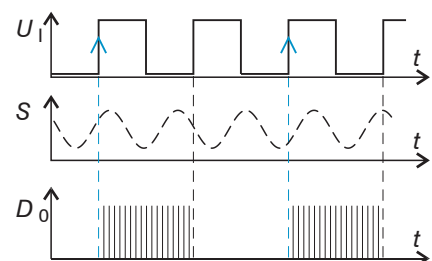


Fig. 5.4: Gating with rising edge trigger (U_I), relevant digital signal (D_0)

No trigger is set at the factory. The controller starts data transmission immediately after it is switched on.

5.4 Measurement averaging

5.4.1 Introduction

Measurement averaging is performed after measured values have been calculated, and before they are issued or processed through the relevant interfaces.

Measurement averaging

- improves the resolution,
- allows the masking of individual interference points, or
- “smooths” the measurement result.

i Linearity is not affected by averaging. Averaging has no effect on measuring rate and output rate.

Averaging is disabled by default on the sensor.

5.4.2 Moving average

The arithmetic average value M_{mov} is formed via the selectable filter width N of successive measurement values and then output. Each new measured value is added, and the first (oldest) value is removed from the averaging (from the window).

$M_{\text{mov}} = \frac{\sum_{k=1}^N MV(k)}{N}$	MV = measured value
	N = averaging value
	k = continuous index (in the window)
	M_{mov} = average value or output value

This produces short settling times in case of measurement jumps.

Example: N=4

... 0, 1, <u>2, 2, 1, 3</u>	... 1, 2, <u>2, 1, 3, 4</u>	Measured values
↓	↓	
$\frac{2, 2, 1, 3}{4} = M_{\text{mov}}(n)$	$\frac{2, 1, 3, 4}{4} = M_{\text{mov}}(n+1)$	Output value

5.4.3 Arithmetic average

The arithmetic average M is formed and output via the selectable number N of successive measured values.

Measured values are collected based on which the mean value is calculated. This method reduces the amount of data generated as an average value is only output after every N th measured value.

Example: N=3

... 0, 1, <u>2, 3, 4</u>	... 1, 2, 3, 4, <u>5, 6, 7</u>	Measured values
↓	↓	
$\frac{2, 3, 4}{3} = M_{\text{mov}}(n)$	$\frac{5, 6, 7}{3} = M_{\text{mov}}(n+1)$	Output value

5.4.4 Median

A median value is formed from a preselected number of measured values.

When forming the median in the sensor, the incoming measured values are re-sorted after each measurement. The middle value is then output as the median.

If an even value is selected for median N , the two median measurement values are added and divided by two.

Example: N=5

... 0 1 2 4 5 1 3 → Sorted measurements: 1 2 3 4 5 Median_(n) = 3
 ... 1 2 4 5 1 3 5 → Sorted measurements: 1 3 4 5 5 Median_(n+1) = 4

5.4.5 Dynamic noise suppression

This filter entirely eliminates the noise of the measured values but maintains the original bandwidth of the measuring signal.

For this purpose, the noise is calculated dynamically and changes in the measured values are only accepted if they are greater than this calculated noise. However, this can cause small hysteresis effects in the order of magnitude of the calculated noise when the direction of the measurement signal changes.

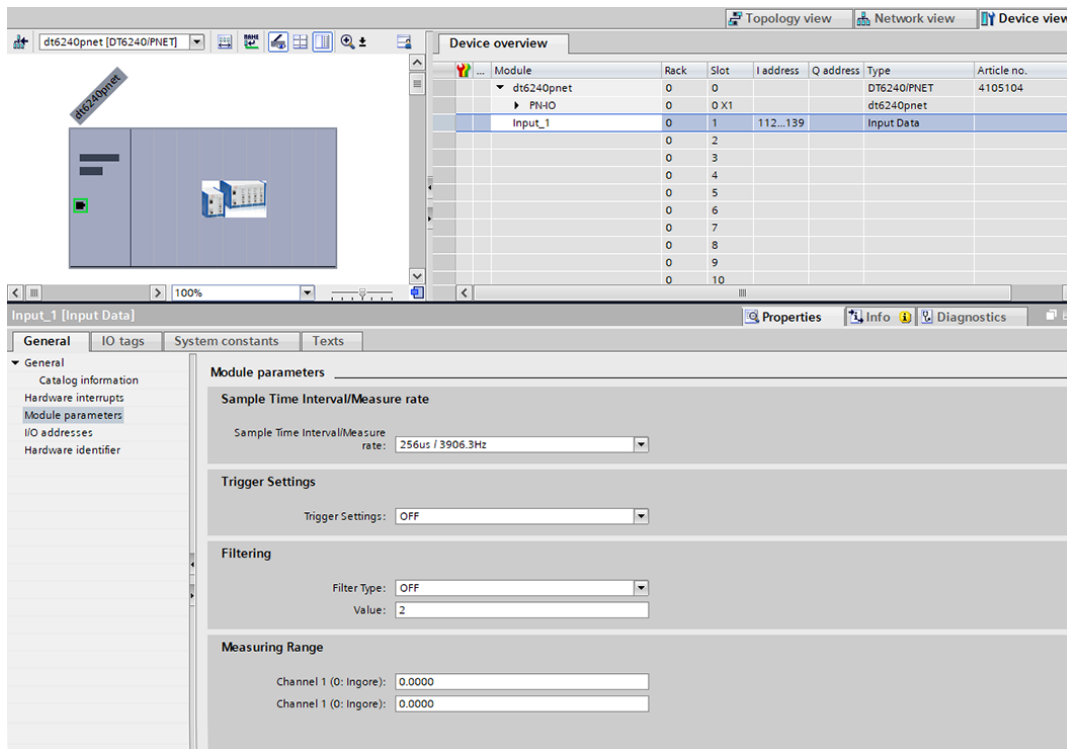
6 PROFINET - Documentation

6.1 General

This section describes how to use a SIMATIC S7 controller with Micro-Epsilon sensors (controller).

6.2 Basic settings module

After setting up the DT6240, see [Chap. 13](#) in the TIA Portal, the *Input_1* module is an easy way to make the necessary settings



6.3 Output data, data format

All configuration parameters and data are transmitted in little-endian format.

1		LSB	17		LSB
2	Timestamp (ms)	...	18	Channel 2 (μm)	...
3	DWord, Little Endian	...	19	Real 32bit, Little Endian	...
4		MSB	20		MSB
5		LSB	21		LSB
6	Error Code	...	22	Channel 3 (μm)	...
7	DWord, Little Endian	...	23	Real 32bit, Little Endian	...
8		MSB	24		MSB
9	Sensor Counter	LSB	25		LSB
10	Word, Little Endian	MSB	26	Channel 4 (μm)	...
11	Number of Values, Byte	...	27	Real 32bit, Little Endian	...
12	Reserved		28		MSB
13		LSB			
14	Channel 1 (μm)	...			
15	Real 32bit, Little Endian	...			
16		MSB			

Name	Data type	Address	Retain	Access...	Write...	Visible
timestamp	DWord	%D0				
lasterror	DWord	%D4				
a	DWord	%D8				
c1	DWord	%D12				
c2	DWord	%D16				
c3	DWord	%D20				
c4	DWord	%D24				
c1_le	Real	%D28				
c2_le	Real	%D32				
c3_le	Real	%D36				
c4_le	Real	%D40				
<hold new>						


```

9  #tmp_dword.1B0 := "c1".1B3;
10 #tmp_dword.1B1 := "c1".1B2;
11 #tmp_dword.1B2 := "c1".1B1;
12 #tmp_dword.1B3 := "c1".1B0;
13 "c1_le" := DWORD_TO_REAL(#tmp_dword);
14

```

Fig. 6.1: Data format and conversion of a DWORD to REAL

The IO-Area contains the data as shown, see [Fig. 6.1](#):

Timestamp	Milliseconds since the device was switched on
Error code	Status code of the communication module
Sensor counter	Sequential number of the currently transferred sample
Number of values	Sensor values detected since the last communication cycle
Reserved	Reserved
Channel 1	Distance in μm , calculated on the basis of channel measuring range and offset

6.4 Object directory

6.4.1 Error log

Index	Sub-index	Data type		Name	Description
0x2010	0	Uint32[64]	R	device error log	Reads out the last 32 error codes with time stamp

6.4.2 Device reset

Index	Sub-index	Data type		Name	Description
0x2026	0	Uint8	W	reset device	One byte performs reset

6.4.3 Triggering

Index	Sub-index	Data type		Name	Description
0x2031	1	Uint16	RW	Trigger settings	0: No trigger 1: Rising edge, a measured value is output 2: Falling edge, a measured value is output 4: High level, value output as long as the level is active 8: Low level, value output as long as the level is active 16: Gate trigger with rising edge, starts or stops the output of measured values alternatively 32: Gate trigger with falling edge, starts or stops the output of measured values alternatively

6.4.4 Filter settings

Index	Sub-index	Data type		Name	Description
0x2032		8 bytes	RW	Filter settings	
	1	Uint16		Filter type	0: No filter 1: Moving average 2: Arithmetic average 4: Median
		Uint16		Reserved	
		Uint32		Filter value	Filter length: 2 / 3 / 4 / 5 / 6 / 7 / 8

6.4.5 Measuring range

Index	Sub-index	Data type		Name	Description
0x2033	1	Float[4]	RW	MeasRange	Measuring range per sensor

6.4.6 Mathematical functions

Index	Sub-index	Data type		Name	Description
0x2035	1	112 bytes		Mathematical functions	
		UInt8	RW	MF Channel 1 active	
		UInt8	RW	MF Channel 2 active	
		UInt8	RW	MF Channel 3 active	
		UInt8	RW	MF Channel 4 active	
		UInt8	RW	MF Channel 5 active	
		UInt8	RW	MF Channel 6 active / reserved	
		UInt8	RW	MF Channel 7 active / reserved	
		UInt8	RW	MF Channel 8 active / reserved	
		UInt8	RW	Reserved	
		Int8	RW	Channel 1 Factor 1	[-99..+99] => -9.9..+9.9
		Int8	RW	Channel 1 Factor 2	
		Int8	RW	Channel 1 Factor 3	
		Int8	RW	Channel 1 Factor 4	
		Int8	RW	Channel 1 Factor 5 / reserved	
		Int8	RW	Channel 1 Factor 6 / reserved	
		Int8	RW	Channel 1 Factor 7 / reserved	
		Int8	RW	Channel 1 Factor 8 / reserved	
		UInt8	RW	Reserved	
		Int8	RW	Channel 2 Factor 1	[-99..+99] => -9.9..+9.9
		Int8	RW	Channel 2 Factor 2	
		Int8	RW	Channel 2 Factor 3	
		Int8	RW	Channel 2 Factor 4	
		Int8	RW	Channel 2 Factor 5 / reserved	
		Int8	RW	Channel 2 Factor 6 / reserved	
		Int8	RW	Channel 2 Factor 7 / reserved	
		Int8	RW	Channel 2 Factor 8 / reserved	
		UInt8	RW	Reserved	
		Channel 3...7	
		Int8	RW	Channel 8 Factor 1 / reserved	[-99..+99] => -9.9..+9.9
		Int8	RW	Channel 8 Factor 2 / reserved	
		Int8	RW	Channel 8 Factor 3 / reserved	
		Int8	RW	Channel 8 Factor 4 / reserved	
		Int8	RW	Channel 8 Factor 5 / reserved	
		Int8	RW	Channel 8 Factor 6 / reserved	
		Int8	RW	Channel 8 Factor 7 / reserved	
		Int8	RW	Channel 8 Factor 8 / reserved	
		Int32	RW	Channel 1 Constant Factor	
		Int32	RW	Channel 2 Constant Factor	
		Int32	RW	Channel 3 Constant Factor	
		Int32	RW	Channel 4 Constant Factor	
		Int32	RW	Channel 5 Constant Factor / reserved	
		Int32	RW	Channel 6 Constant Factor / reserved	
		Int32	RW	Channel 7 Constant Factor / reserved	
		Int32	RW	Channel 8 Constant Factor / reserved	

6.4.7 Sample time

Index	Sub-index	Data type		Name	Description
0x2036	1	Uint32	RW	Sample time interval	256: 3906.3 Hz 480: 2083.3 Hz 960: 1041.7 Hz 1920: 520.8 Hz 9600: 104.2 Hz 16000: 62.5 Hz 19200: 52.1 Hz 32000: 31.3 Hz 38400: 26 Hz

6.4.8 Device info

Index	Sub-index	Data type		Name	Description
0x2210				Device Info	Read out the block of the current sensor
	0	Uint8	R	NrOfObjects	
	1	Uint8	R	Block version	Block version
	2	Uint8	R	Endianness	Endian
	3	Uint16	R	Software version	Software version
	4	Int32	R	Article number	Article number
	5	Int32	R	Option	Option
	6	Int32	R	Batch	Batch
	7	Int32	R	Serial number	Serial number
	8	Uint8	R	Change index	Change index
	9	Uint8	R	Calibration day	Day of calibration
	10	Uint8	R	Calibration month	Month of calibration
	11	Uint8	R	Calibration year	Year of calibration
	12	Uint16	R	Calibration software version	Version of calibration software
	13	Uint16	R	Test software version	
	14	Uint8	R	Test hour	
	15	Uint8	R	Test day	
	16	Uint8	R	Test month	
	17	Uint8	R	Test year	
	18	Int32	R	Article number circuit board	
	19	Int32	R	Serial number circuit board	
	20	Uint8[32]	R	Name	
	21	Uint8	R	Sensor/channel count	
	22	Uint8	R	Protocol block count	
	23	Uint8[164]	R	Protocol blocks	

6.4.9 Sensor information

Index	Sub-index	Data type		Name	Description
0x2220				Sensor block	Request sensor information
	0	UInt8	R	NrOfObjects	
	1	UInt8	RW	Block index offset	The offset lets you scroll through existing sensor blocks [0 - 0x1F]
	2	UInt8	RW	Page index to read	Specifying an index lets you scroll through existing pages
	3	UInt8	R	Number of pages	Max. number of pages
	4	UInt8	R	Measurement unit	Signal unit
	5	Int32	R	Article number	Article number
	6	Int32	R	Option	Option
	7	Int32	R	Batch	Batch
	8	Int32	R	Serial number	Serial number
	9	Float	R	Nominal measuring range	Nominal measuring range
	10	Float	R	Nominal offset	Nominal offset
	11	Float	R	Current measuring range	Actual measuring range
	12	Float	R	Current offset	Actual offset
	13	UInt8[32]	R	Target material	Target material
	14	UInt8[32]	R	Sensor/channel name	Sensor/channel name
	15	UInt8	R	extension length	Length of block extension
	16	UInt8[138]	R	extension	

6.4.10 Parameter info

Index	Sub-index	Data type		Name	Description
0x2501				Parameter Info	Request configuration parameters, request via subindex 1, configure interface with objects 0x2510 to 0x2540
	0	UInt8	R	NrOfObjects	
	1	UInt16	RW	Parameter ID	Please refer to the sensor documentation for the available parameter IDs and their type.
	2	UInt8[14]	RW	Name	
	3	UInt8[8]	R	Unit	
	4	UInt8[8]	R	Type	

6.4.11 Float parameters

Index	Sub-index	Data type		Name	Description
0x2510				Float Parameter	Read or write float parameters
	0	UInt8		NrOfObjects	
	1	UInt16	RW	Parameter ID	Please refer to the sensor documentation for the available parameter IDs and their type.
	2	UInt8	RW	Reserved	
	3	Float	RW	Value	Value
	4	UInt8[14]	R	Name	Name
	5	UInt8[8]	R	Unit	Unit as a string
	6	Float	R	Min	
	7	Float	R	Max	

6.4.12 Integer parameters

Index	Sub-index	Data type		Name	Description
0x2520				Int Parameter	Reading or writing integer parameters
	0	UInt8		NrOfObjects	
	1	UInt16	RW	Parameter ID	Please refer to the sensor documentation for the available parameter IDs and their type.
	2	UInt8	RW	Reserved	
	3	Int32	RW	Value	Value
	4	UInt8[14]	R	Name	Name
	5	UInt8[8]	R	Unit	Unit as a string
	6	Int32	R	Min	
	7	Int32	R	Max	

6.4.13 Unsigned integer parameters

Index	Sub-index	Data type		Name	Description
0x2530				UInt Parameter	Reading or writing unsigned integer parameters
	0	UInt8		NrOfObjects	
	1	UInt16	RW	Parameter ID	Please refer to the sensor documentation for the available parameter IDs and their type.
	2	UInt8	RW	Reserved	
	3	Int32	RW	Value	Value
	4	UInt8[14]	R	Name	Name
	5	UInt8[8]	R	Unit	Unit as a string
	6	Int32	R	Min	
	7	Int32	R	Max	

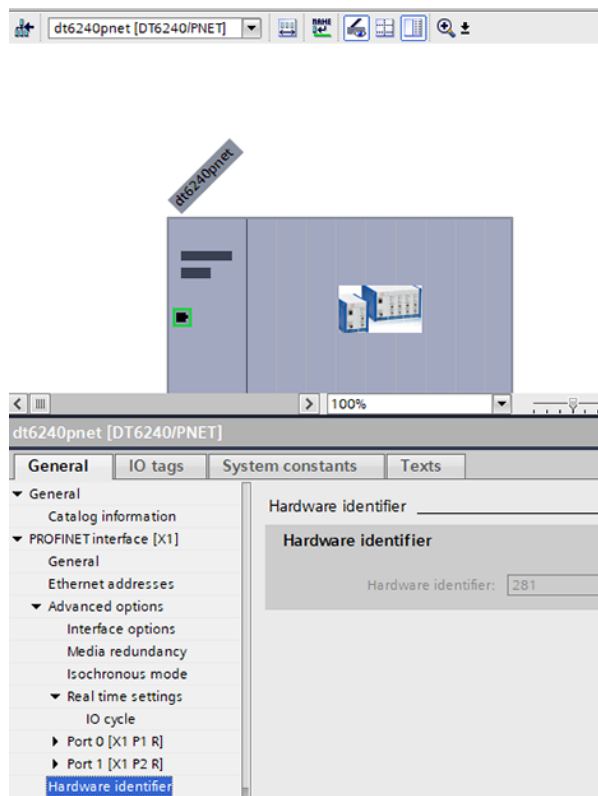
6.4.14 String parameters

Index	Sub-index	Data type		Name	Description
0x2540				String Parameter	Reading or writing string parameters
	0	UInt8		NrOfObjects	
	1	UInt16	RW	Parameter ID	Please refer to the sensor documentation for the available parameter IDs and their type.
	2	UInt8	RW	Reserved	
	3	UInt8[246]	RW	Value	Value
	4	UInt8[14]	R	Name	Name

6.5 Sequence when writing and reading acyclical data

- Determine the hardware identification (ID) of the module. To do this, switch to the **General > PROFINET interface > Advanced options** tab.

In the example to the right, you get the value 281.



WRREC_DB is called up on the PLC with the input parameters (:=).

REQ // Start execution

ID // Hardware ID of the target device addressed

INDEX // Target address in the object directory

LEN // Length of the binary data block to be written

RECORD // Usable data for writing

RECORD, VALID, BUSY, ERROR, STATUS and LEN contain return parameters (=>) which can be used to determine the success or progress of the write command.

6.6 Sequence when writing structured data

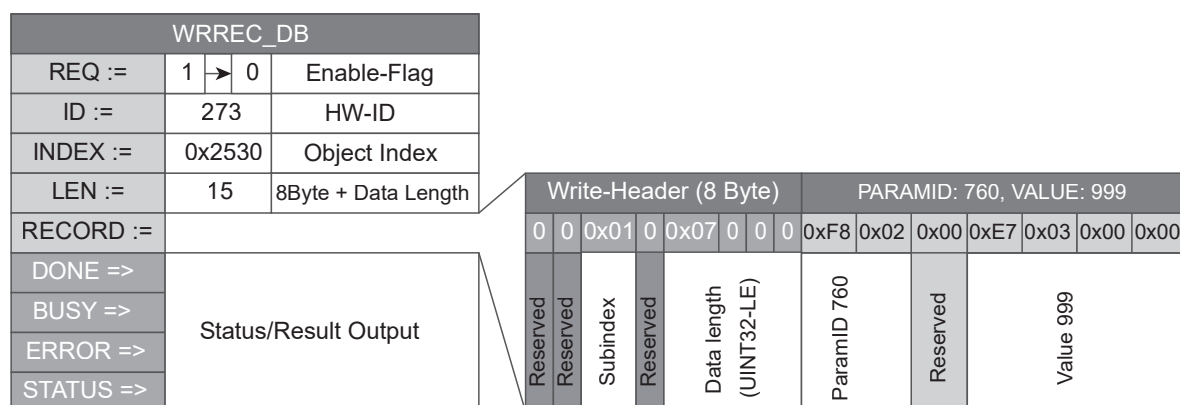


Fig. 6.2: Write command with data from PLC to capaNCDT

7 Operation and maintenance

Please note the following:

- ▶ Make sure that the sensor surface is always clean.
- ▶ Before cleaning, turn off the supply voltage.
- ▶ Clean with a damp cloth and then rub the sensor surface dry.

Changes to the measuring object or very long operating times can slightly impair the operating quality (long-term errors). These can be eliminated by recalibration.



CAUTION

Static discharge, risk of injury

- ▶ Disconnect the power supply before touching the sensor surface.

8 Disclaimer

All components of the device have been checked and tested for functionality in the factory. However, should any defects occur despite careful quality control, these shall be reported immediately to Micro-Epsilon or to your distributor / retailer.

Micro-Epsilon undertakes no liability whatsoever for damage, loss or costs caused by or related in any way to the product, in particular consequential damage, e.g., due to

- non-observance of these instructions/this manual,
- improper use or improper handling (in particular due to improper installation, commissioning, operation and maintenance) of the product,
- repairs or modifications by third parties,
- the use of force or other handling by unqualified persons.

This limitation of liability also applies to defects resulting from normal wear and tear (e.g., to wearing parts) and in the event of non-compliance with the specified maintenance intervals (if applicable).

Micro-Epsilon is exclusively responsible for repairs. It is not permitted to make unauthorized structural and / or technical modifications or alterations to the product. In the interest of further development, Micro-Epsilon reserves the right to modify the design and the firmware.

In addition, the General Terms of Business of Micro-Epsilon shall apply, which can be accessed under

Legal details | Micro-Epsilon <https://www.micro-epsilon.com/legal-details/>.

9 Service, repair

If the measuring system is defective:

- If possible, save the current settings in the PLC but not in the sensor/controller. When the PLC starts up, it distributes the settings to the sensor/controller again.
- Please send us the affected parts for repair or exchange.

If the cause of a fault cannot be clearly identified, please send the entire system incl. cables to:

MICRO-EPSILON MESSTECHNIK
GmbH & Co. KG
Koenigbacher Str. 15
94496 Ortenburg / Germany

Tel: +49 (0) 8542 / 168-0
Fax: +49 (0) 8542 / 168-90
info@micro-epsilon.com
www.micro-epsilon.com/contact/worldwide/
<https://www.micro-epsilon.com>

10 Decommissioning, disposal

In order to avoid the release of environmentally harmful substances and to ensure the reuse of valuable raw materials, we draw your attention to the following regulations and obligations:

- Remove all cables from the sensor and/or controller.
- Dispose of the sensor and/or the controller, 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.
- You are obliged to comply with all relevant national laws and regulations.

For Germany / the EU, the following (disposal) instructions apply in particular:

- Waste equipment marked with a crossed garbage can must not be disposed of with normal industrial waste (e.g. residual waste can or the yellow recycling bin) and must be disposed of separately. This avoids hazards to the environment due to incorrect disposal and ensures proper recycling of the old appliances.



- A list of national laws and contacts in the EU member states can be found at https://ec.europa.eu/environment/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en. Here you can inform yourself about the respective national collection and return points.

- Old devices can also be returned for disposal to Micro-Epsilon at the address given in the legal details at <https://www.micro-epsilon.com/legal-details>.

- We would like to point out that you are responsible for deleting the measurement-specific and personal data on the old devices to be disposed of.

- Under the registration number WEEE-Reg.-Nr. DE28605721, we are registered at the foundation Elektro-Altgeräte Register, Nordostpark 72, 90411 Nuremberg, as a manufacturer of electrical and/or electronic equipment.

11 Optional accessories, service

PC6200-3/4



Supply and trigger cable, 3 m long

MC2.5



Micrometer calibration fixture

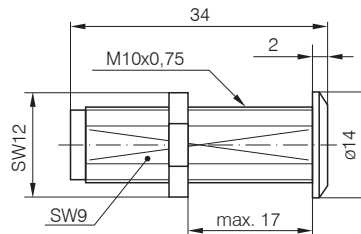
Adjustment range 0 - 2.5 mm, reading 0.1 μm , for sensors CS005 to CS2

MC25D



Digital micrometer for sensor calibration, adjustment range 0 - 25 mm, adjustable zero for all sensors

SWH.OS.650.CTMSV

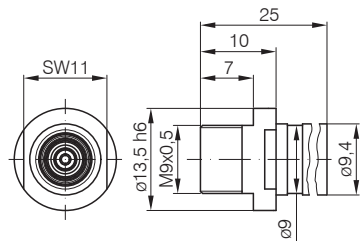


Vacuum feedthrough

Maximum leakage rate 1×10^{-7} mbar - l s⁻¹

Compatible with type B plug

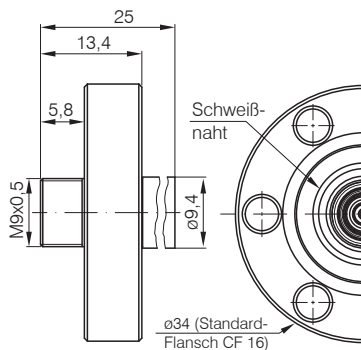
UHV/B



Vacuum feedthrough triax weldable

Maximum leakage rate 1×10^{-9} mbar - l s⁻¹

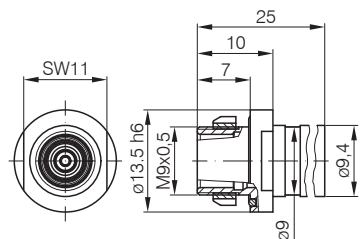
Compatible with type B plug



Vacuum feedthrough triax with CF16 flange

Maximum leakage rate 1×10^{-9} mbar - l s⁻¹

Compatible with type B plug



Vacuum feedthrough triax screwable

Maximum leakage rate 1×10^{-9} mbar - l s⁻¹

Compatible with type B plug

SCACx/4



Analog signal output cable, x m long (necessary for multi-channel operation)

SC6000-x



Synchronization cable

PS2020



Power supply unit for DIN rail mounting
Input 230 VAC, output 24 VDC/2.5 A

Service

Function and linearity test, including 11-point protocol with graphic and recalibration.

12 Factory settings

Analog

Zero potentiometer = Off (right-stop)

LP filter 20 Hz = Off

Digital

Data rate = 3906 Sa/s

Filters = Off

Linearization = Off

Trigger mode = Off

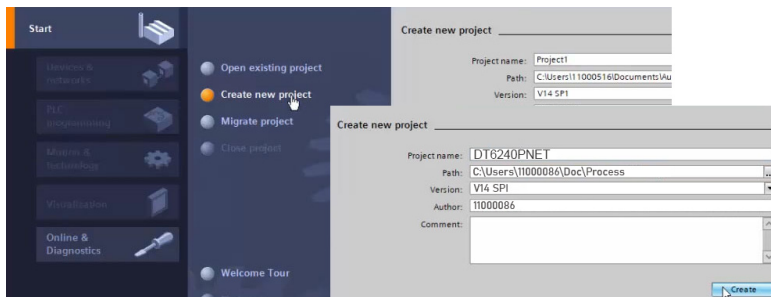
Mathematical functions = Off

13 Integration into TIA-portal

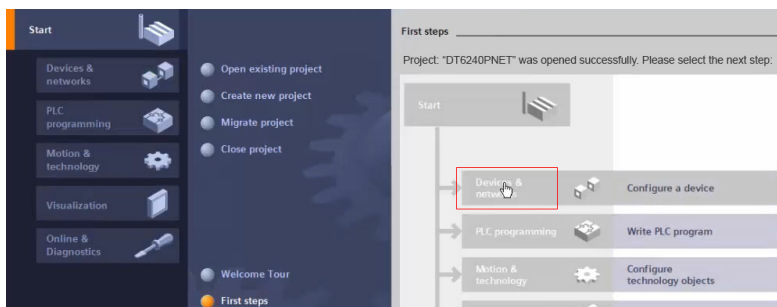
13.1 Importing capaNCDT 6240 into the software

This section describes how to connect capaNCDT 6240 to SIMATIC S7 controllers.

- ▶ Start TIA (Totally Integrated Automation) Portal. Therefore, either double-click on the TIA Portal icon on your desktop or call up the framework via the start menu.
- ▶ Click on the Create new project button at the top left of the Start view. Enter a project name and confirm by clicking on the Create button.

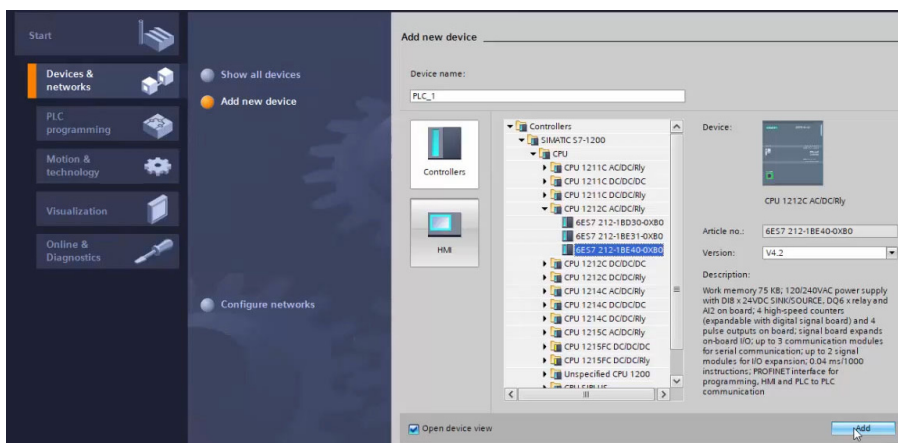


- ▶ Switch to the Devices & networks portal.



- ▶ Click on Add new device. Select the S7 CPU series you are using in the device list and click on the Add button. Make sure that the Open device view checkbox at the bottom left of the window is activated.

- Identify your CPU module using the order number on the S7 device, the packaging or the delivery note. Also select the correct firmware version.

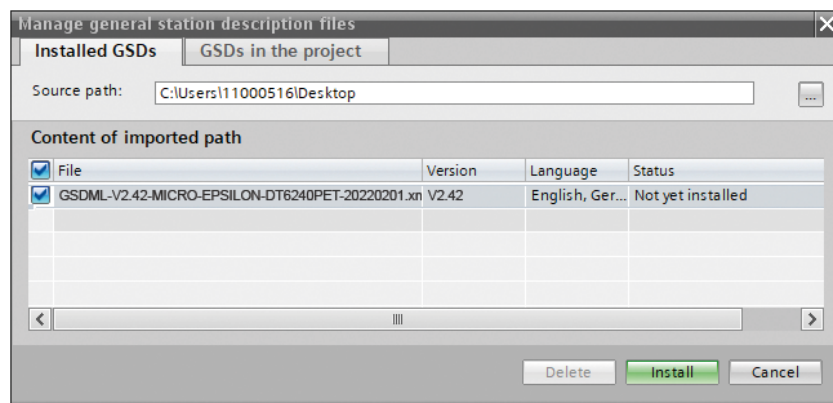


The software automatically switches to the Project view and displays the Working window (in the center of the screen) in the Device view. Below this is the Inspector window, which displays the parameterization options of the selected PLC in the Properties tab.

- i The TIA Portal automatically assigns the IP address and subnet mask. You can adjust this data manually here (General > PROFINET interface > Ethernet addresses) if necessary, and save it by clicking the **Save project** button, see top left in the toolbar.

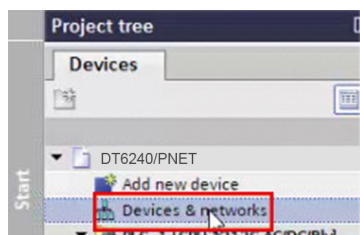
The GSDML file contains information about a PROFINET device. This file is needed for the PROFINET controller and must be integrated into the corresponding configuration software. You get the GSDML file from Micro-Epsilon.

- Import the GSDML file. To do this, select the path for the file <GSDML-Vx-MICRO-EPSILON-DT6240PNET-202x.xml> in the menu Extras > Manage device description files (GSD).
- Click the **Install** button.



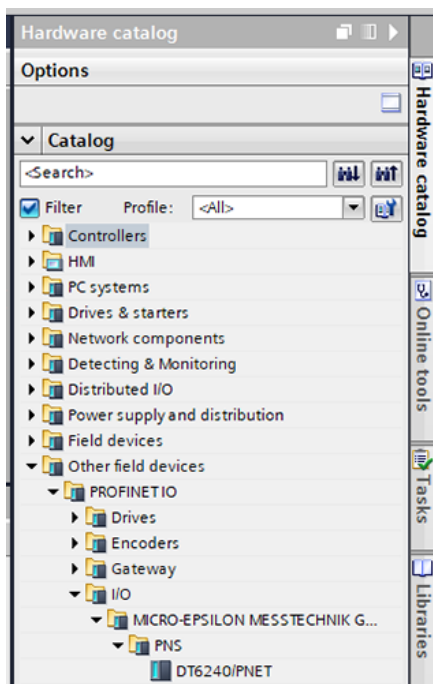
After installation, switch to the project view.

- In **Project** navigation, click **Devices & networks**.



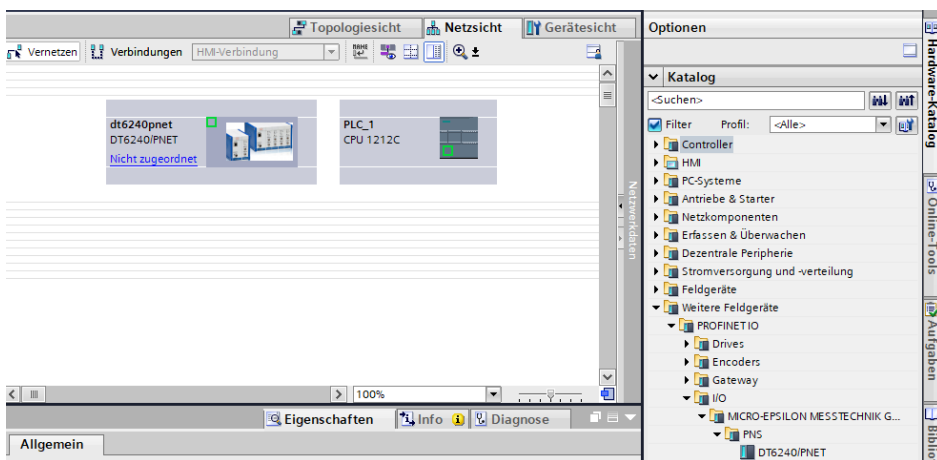
Add capaNCDDT 6240 to the project. Make sure that capaNCDDT 6240 has been integrated correctly.

- Switch to the **Hardware Catalog** tab.
- In the menu, select **Other field devices > PROFINET IO > I/O > MICRO-EPSILON MESSTECHNIK GmbH > PNS > DT6240/PNET**.



13.2 Unique integration of capaNCDT 6240 into the PROFINET network

- Switch to the network view of the Working window and add the DT6240/PNET from the hardware catalog using drag & drop.



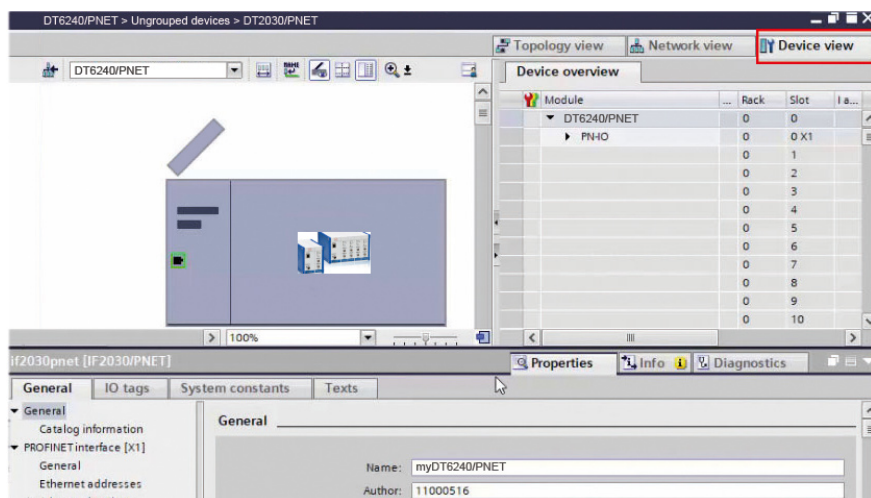
- Connect the Port 0 LAN socket of the capaNCDT 6240 to that of the PLC by clicking on one of the green boxes with the left mouse button. Hold the button and draw the resulting line to the other green box in order to create a PROFINET subsystem.



Enter the device name for identification in the PN network.

- Switch to the Device view, double-click your DT6240/PNET and set its device name in the Inspection window (Properties > General tab).

- i This is one of several possibilities to change the device name.

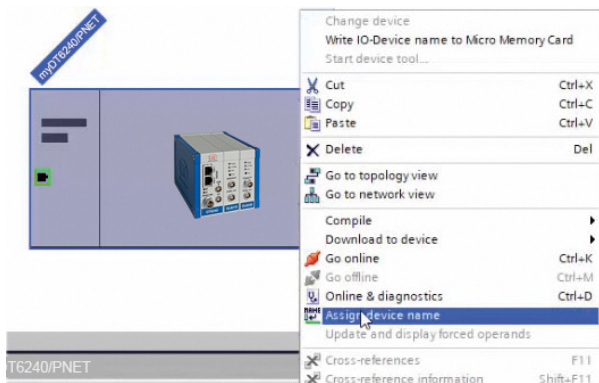


- i The device name is used to identify the device on the PN network and as an address; it must be unique across the entire system.

The change of name must be communicated to the PN network.

- ▶ Right-click the DT6240/PNET.

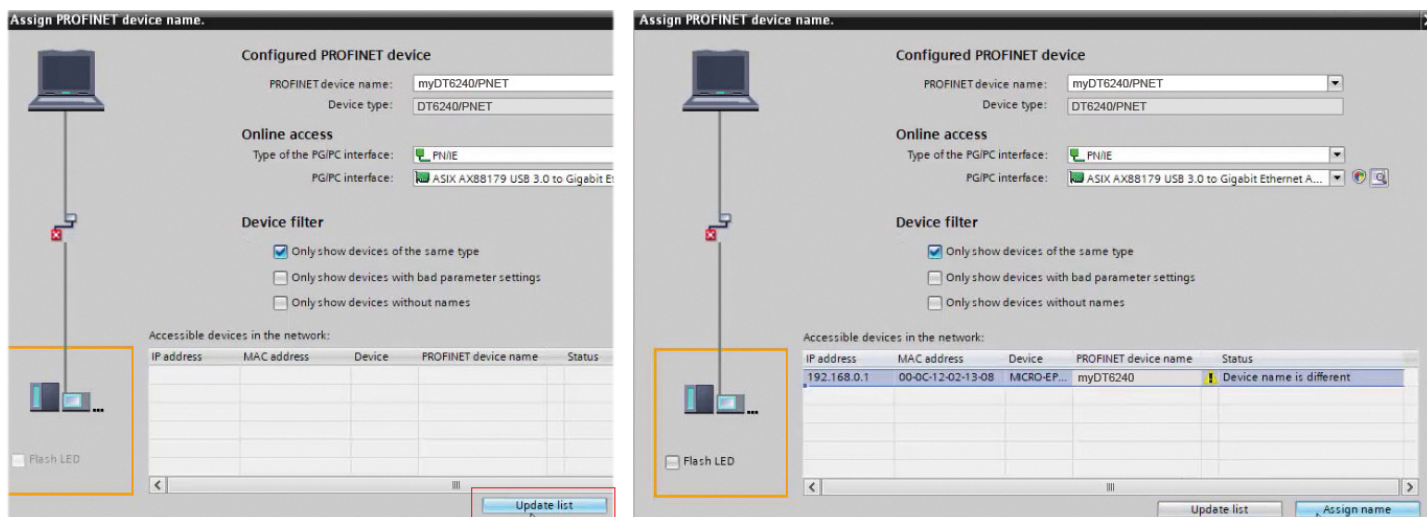
You now reach the context menu shown.



- ▶ Select the Assign device name entry.
- ▶ In the open dialog window, click the Update list button.

Potential devices on the PN network are displayed.

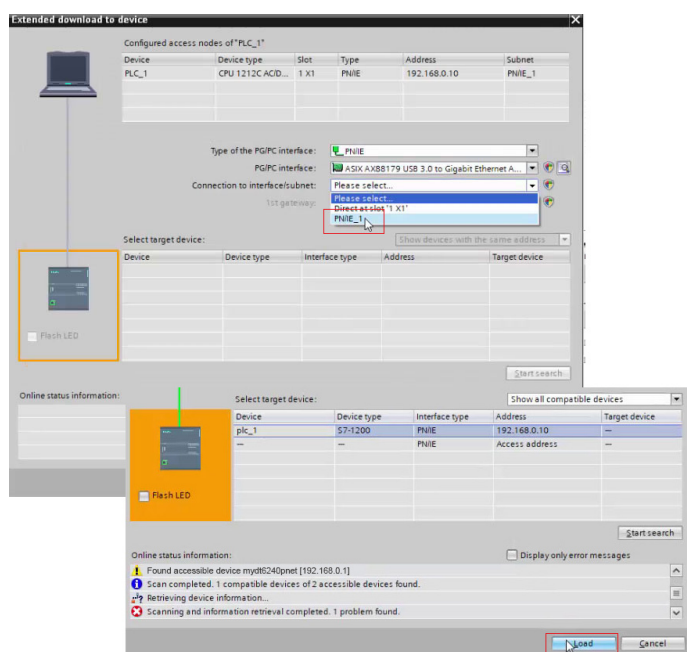
- ▶ In the list that is now displayed, mark the row with your DT6240/PNET that is to be renamed; field Status, Device name is different. Finally, click the Assign name button.



- i If you activate the `Flash LED` checkbox in the orange highlighted area, you can verify which device you are currently addressing. This is especially helpful in larger networks.

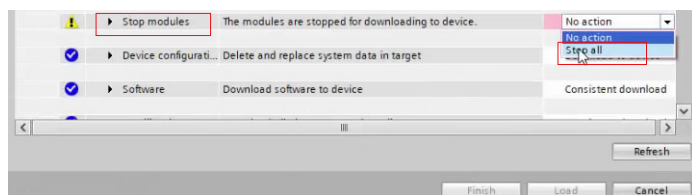
13.3 Loading the configuration into the PLC

- Click the `Download to device` symbol button in the `Toolbar`. Alternatively, you can also right-click on the image of your `S7` in the `Network view` and select the function in the `Context menu`.
- In the `Dialog window` that opens, select the option `PN/IE_1` (the previously created PROFINET subsystem) under `Connection to interface/subnet`. Then click on the `Start search` button. Next, select your target PLC in the displayed list. Click on the `Load` button to transfer the hardware configuration.



The `Load preview` dialog box opens.

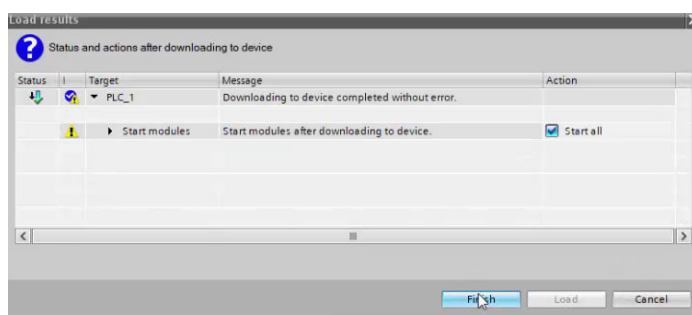
- Select the `Stop all` option under `Stop modules`. The device configuration can only be loaded when the CPU is in the operating state `STOP`.



- i Depending on whether you created a new project or opened an existing one, it might be necessary to overwrite the so-called additional information. The latter is recommended to ensure an up-to-date data pool. To do this, you must scroll down in the same dialog box and activate the `Overwrite all` checkbox under `Additional information`.

- Click the `Load` button. The PLC is thereby introduced to its environment for the first time. The loading process is indicated visually by a red flashing LED of the S7 device.

The results of the loading process are displayed in the following Dialog box. If the process was completed successful, start your S7. If necessary, activate the `Start all` checkbox and click on the `Finish` button.

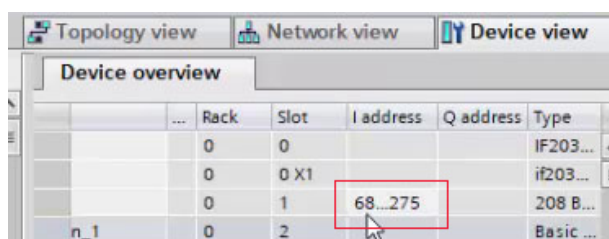


If no error occurs, the S7 changes to the operating state `RUN` which is indicated by the green `RUN`-LED.

13.4 Accessing Input and Output data

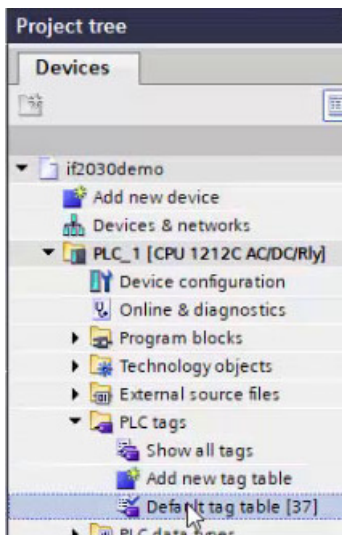
- Switch to the `Device view` and view the `Device overview` of the DT6240. Memorize the start address of the input module as an example.

Depending on the module, the address space (memory address bytes) is visible in the `I address` or `Q address` columns. These addresses are automatically assigned to the respective module depending on the slot.



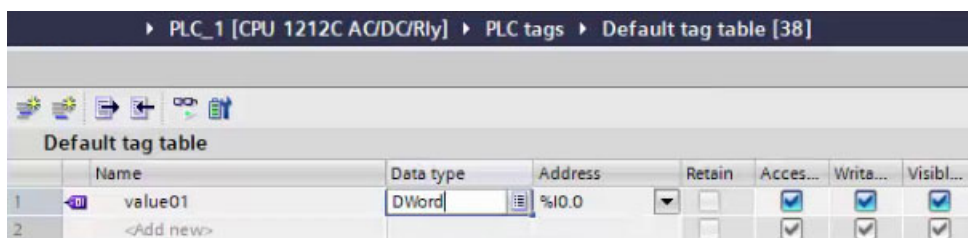
- Go to the `Project tree`. Follow this path in your PLC: `PLC tags > Default tag table`. The latter opens in the `Working window` by double-clicking.

You can now define variables in the Tag register to read out the desired memory locations. Each PLC tag is assigned a name, a data type, and an address.

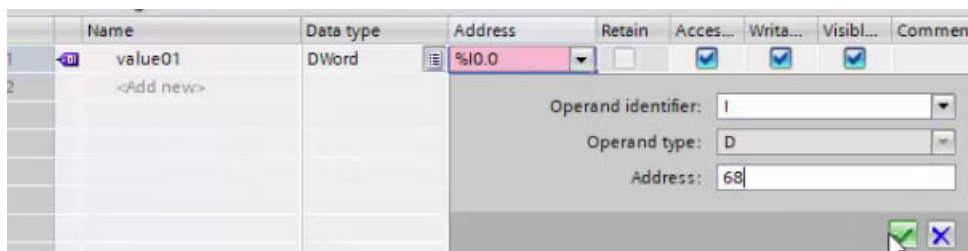


Proceed as follows to read out the content of the input module at its start address:

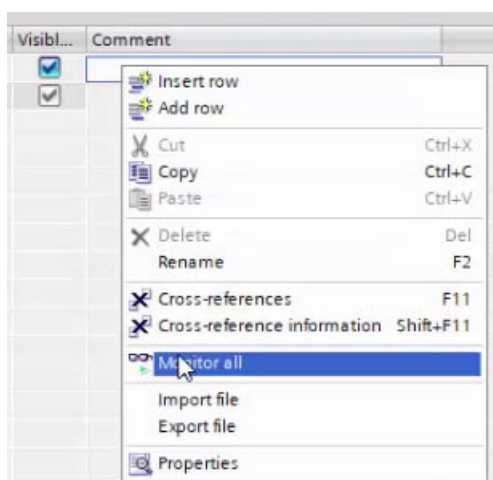
- ▶ Assign a (tag) name and select the **DWord** data type.



- ▶ Open the extended view of the **Address** definition. This facilitates the correct specification of operand and memory space. Enter the start address from **Point 1** and confirm the entry by clicking the symbol button with the **Green** check mark.



- ▶ You can monitor the values of the PLC variables in online mode directly via the **Default tag table** (default variables). Either click on the **Monitor all** button in the **Toolbar** or select this function by right-clicking in the tag table.



This leads to the online mode and the column `Monitor` value is displayed in the table. Clicking the symbol button once again quits the monitor mode.

if2030demo ▸ PLC_1 [CPU 1212C AC/DC/Rty] ▸ PLC tags ▸ Default tag table [38]

	Name	Data type	Address	Retain	Acces...	Writa...	Visibl...	Monitor value
1	value01	DWord	%ID68	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	16#7638_1000
2	<Add new>			<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

14 Influence of tilted capacitive sensor

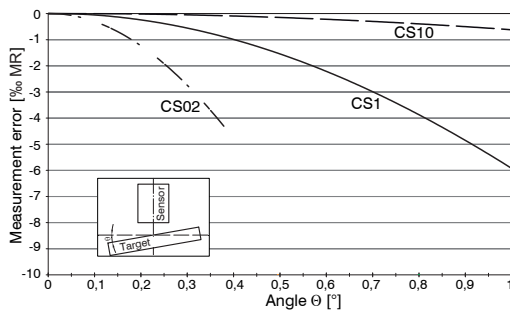


Fig. 14.1: Example of measuring range deviation at a sensor distance of 10 % FSO

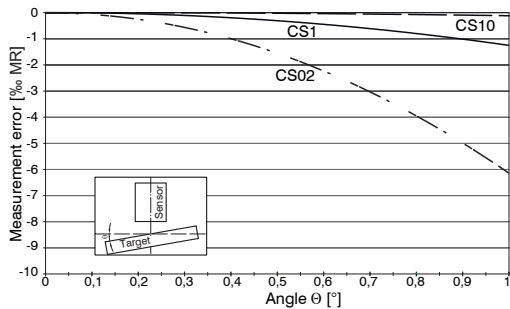


Fig. 14.2: Example measuring range deviation at a sensor distance of 50 % FSO

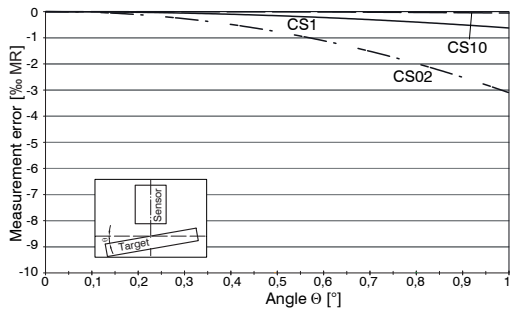


Fig. 14.3: Example measuring range deviation at a sensor distance of 100 % FSO

- i The figures show an example of the influence using the CS02/CS1 and CS10 sensors at different sensor distances from the measuring object. The results are based on our own simulations and calculations; please contact us for more detailed information.

15 Measurement on narrow measuring objects

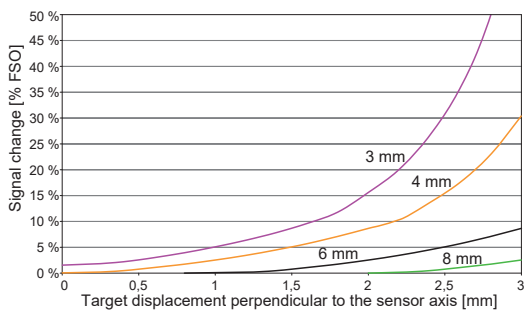


Fig. 15.1: Example of measuring range deviation at a sensor distance of 10 % FSO

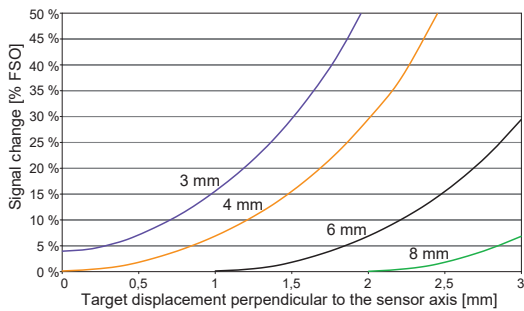


Fig. 15.2: Example of measuring range deviation at a sensor distance of 50 % FSO

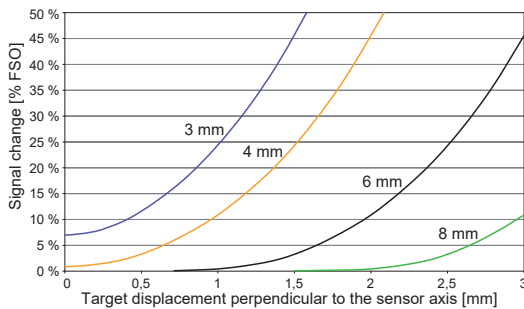


Fig. 15.3: Example of measuring range deviation at a sensor distance of 100 % FSO

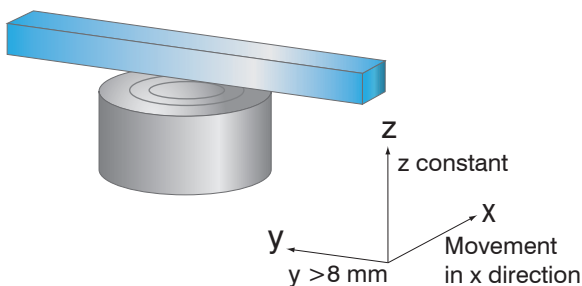


Fig. 15.4: Signal change with displacement of thin measuring objects perpendicular to the measurement direction

- i The figures show an example of the influence of the CS05 sensors at different sensor distances to the target and at target widths. The results are based on our own simulations and calculations; please contact us for more detailed information.

16 Measurements of balls and shafts

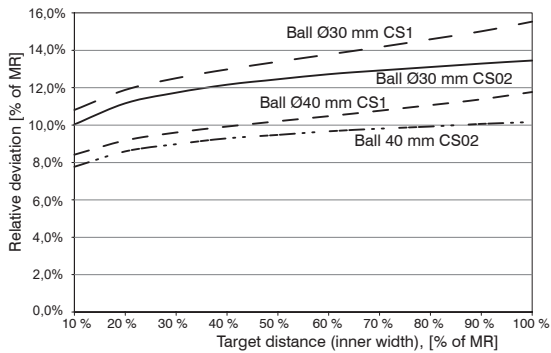


Fig. 16.1: Measurement value deviation when measuring on spherical measuring objects

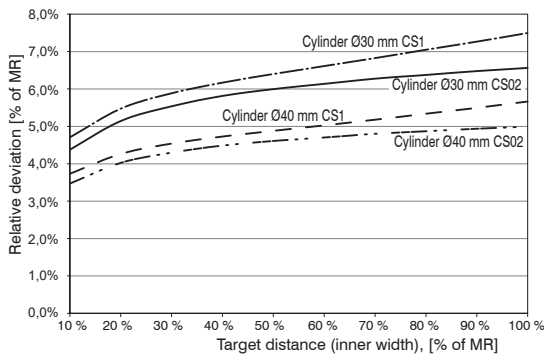


Fig. 16.2: Measurement value deviation when measuring on cylindrical measuring objects

- i The figures show an example of the influence of the CS02 and CS1 sensors at different sensor distances from the target and target diameters. The results are based on our own simulations and calculations; please contact us for more detailed information.

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