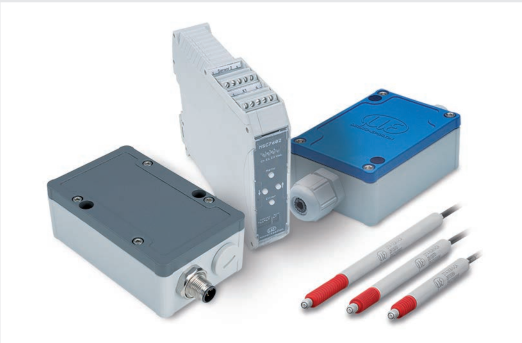
MICRO-EPSILON



Operating Instructions

induSENSOR, MSC7401 / 7802 / 7602

MSC7401
MSC7401(0x0)

MSC7802
MSC7802(0x0)

MSC7602

Miniature sensor controller for inductive displacement sensors

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Contents

Appendix

1. Safety

Sensor operation assumes knowledge of the operating instructions.

1.1 Symbols Used

The following symbols are used in these operating instructions:

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

1.2 Warnings

⚠ CAUTION

Connect the power supply and the display/output device according to the safety regulations for electrical equipment.
> Risk of injury

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

NOTICE

Avoid shocks and impacts to the sensor and controller.
> Damage to or destruction of the controller and/or the sensor

The supply voltage must not exceed the specified limits.
> Damage to or destruction of the controller and/or the sensor

Protect the sensor cable against damage.
> Destruction of the sensor

> Failure of the measuring device

1.3 Notes on CE Marking

The following apply to the induSENSOR MSC7401 / 7802 / 7602 series:
- EU Directive 2014/30/EU
- EU Directive 2011/65/EU

Products which carry the CE mark satisfy the requirements of the EU directives cited and the relevant applicable harmonized European standards (EN). The measuring system is designed for use in industrial environments.

The EU Declaration of Conformity is available to the responsible authorities according to EU Directive, article 10.

1.4 Intended Use

Das induSENSOR MSC7401 / 7802 / 7602 measuring system is designed for use in industrial environments.

It is used to control inductive displacement sensors based on the LVDT principle (Linear Variable Differential Transformer) and for operation with LDR displacement sensors.
- The system must only be operated within the limits specified in the technical data, see 2.3.
- 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

- Protection class:
  - MSC7401 and 7802: IP 67
  - MSC7602: IP 20
- Temperature range:
  - Operation: -40 ... +85 °C (-40 ...185 °F)
  - Storage: -40 ... +85 °C (-40 ...185 °F)
- Humidity: 5 - 95 % (non-condensing)
- Ambient pressure: Atmospheric pressure
- Vibration/Shock: EN 60068-2

2. Functional Principle, Technical Data

2.1 Functional Principle

The MSC 7401 / 7802 / 7602 series are single- and multi-channel miniature sensor controllers for the operation of inductive displacement sensors based on the LVDT principle (full bridge) and for half-bridge sensors.

An electronic oscillator supplies the primary coil with an alternating current of constant frequency and amplitude. For optimal control of the respective sensors, the frequency and the supply voltage can be set, see 5.

The demodulator electronics transforms the signal of the two (secondary) coils into the set output signal. With the setting possibilities for zero point and gain, the user can adapt the equipment to the task to be performed, see 5.

The output signal increases, when the plunger is moved into the sensor. If the reverse effective direction is required (i.e. the signal becomes smaller when the plunger is inserted), replace the connections sec+ and sec-, or make the according setting in the controller, see 5.3.4.

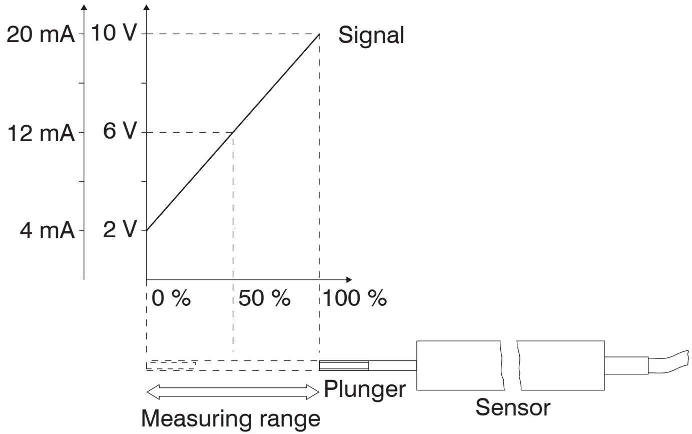


Fig. 1 Measuring principle

2.2 Structure

A complete measuring channel consists of
- Sensor and controller (MSC7401 model)
- Two sensors and controllers (MSC7802 / 7602 models)
- Sensor cable
- Supply and output cable

Any type of half-bridge and full-bridge sensors can be connected to the amplifier electronics. However, if sensors of other manufacturers are used you should check their functionality in conjunction with the controller. MICRO-EPSILON recommends the inductive displacement sensors and gauging sensors of the induSENSOR DTA and LDR series because they are optimally adjusted with the controller.

2.3 Technical Data

Model		MSC7401	MSC7802	MSC7602
Resolution [1]	DTA series	13 bits (0.012 % FSO) with 50 Hz (frequency response) 12 bits (0.024 % FSO) with 300 Hz (frequency response)		
	LDR series	12 bits (0.024 % FSO) with 50 Hz (frequency response) 11 bits (0.048 % FSO) with 300 Hz (frequency response)		
Frequency response (-3 dB)		300 Hz (adjustable only via software)		
Linearity		≤ ± 0.02 % FSO		
Temperature stability	DTA series	≤ 100 ppm FSO/K		
	LDR series	≤ 125 ppm FSO/K		
Supply voltage		14 … 30 VDC (5 … 30 VDC [2])		
Max. current consumption		40 mA	80 mA	
Input impedance [3]		> 100 kOhm		
Analog output [4]		(0)2 … 10 V; 0.5 … 4.5 V; 0 … 5 V (Ra > 1 kOhm) or 0(4) … 20 mA (load < 500 Ohm)		
Connection		Sensor: screw terminal AWG 16 up to AWG 24; with ferrule up to AWG 28 or 5-pin M9 connector (cable see accessories) Supply/signal: screw terminal AWG 16 up to AWG 24; with ferrule up to AWG 28 or 5-pin M12 connector (cable see accessories)		Sensor: screw terminal AWG 16 to AWG 28 Supply/signal: screw terminal AWG 16 to AWG 28 Supply/Sync/RS485: DIN rail bus connector
Installation		2x mounting holes for M4		DIN rail 35 mm
Temperature range	Storage	-40 ... +85 °C (-40 ...185 °F)		
	Operation	-40 ... +85 °C (-40 ...185 °F)		
Shock (DIN-EN 60068-2-29)		40 g / 6 ms in 3 axes, 2 directions and 1000 shocks each 100 g / 5 ms in 3 axes, 2 directions and 9 shocks each		5 g / 6 ms in 6 axes, 1000 shocks each 15 g / 11 ms in 6 axes, 10 shocks

Model	MSC7401	MSC7802	MSC7602
Vibration (DIN-EN 60068-2-6)	± 1.5 mm / 5 … 57 Hz in 3 axes, 10 cycles each ± 20 g / 57 … 500 Hz in 3 axes, 10 cycles each		± 2 mm / 10 … 15.77 Hz in 3 axes, 10 cycles each ± 2 g / 15.77 … 2000 Hz in 3 axes, 10 cycles each
Protection class (DIN-EN 60529)	IP67 (plugged)		IP20
Material	Aluminum die casting		Polyamide
Weight	approx. 200 g	approx. 280 g	approx. 120 g
Compatibility	full-bridge sensor/LVDT (DTA series) and half-bridge sensor (LDR series)		
No. of measurement channels	1	2	2
Protection	reverse polarity protection, overvoltage protection		
Sensor excitation [5]	550 mVSS, 350 mVSS, 150 mVSS, 75 mVSS 1, 2, 5, 10, 13 kHz (DTA) / 9, 13, 16, 21, 23 kHz (LDR)		
Gain	Determination by 2 points of a straight line of the output signal with respect to the target position. The distance between the two points must be greater than 10 % of the measuring range.		
Zero	adjustable via buttons an software		

FSO = Full Scale Output

1) Noise: AC RMS measurement via RC low-pass filter of the 1st order with fc = 5 kHz

2) With technical restrictions of the output signal (load and signal span)

3) Sensor side

4) With controllers including a current output, the output signal is limited to approx. 21 mA

5) Adjustable via buttons; via software, additional steps can be adjusted under frequency

3. Delivery

3.1 Unpacking/Included in Delivery

1 Controller

1 Assembly instruction

2 Sleeve-shaped ferrites (with induSENSOR MSC7602 model)

2 Fastening clips for ferrites for M4 screw

- 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 your supplier.

Optional accessories are listed in the appendix, see A 1.

3.2 Storage

Temperature range (storage):	-40 ... +85 °C (-40 ... +185 °F)
Humidity:	5 - 95% (non-condensing)

4. Installation and Assembly

4.1 Precautions

NOTICE

No sharp or heavy objects should be allowed to affect the sensor cable and the supply/output cable.
> Damage to or destruction of the controller

➡ Check all plug-in connections for firm seating before starting operation.

i Ensure careful handling during installation and operation.

4.2 Controller

4.2.1 MSC7401 Model

➡ Fasten the controller of series MSC7401 by means of two M4 screws.

The position of the mounting holes is shown in the drawing, see Fig. 2.

The tightening torque for the cover screws is 0.9 Nm. The maximum tightening torque for the SW15 (M12) cable gland is 1.5 Nm and for the SW19 (M16) cable gland is 3 Nm.

NOTICE

Please note that less torque should be applied for cable glands with various cable sheath materials.
> Damage to the cable sheath

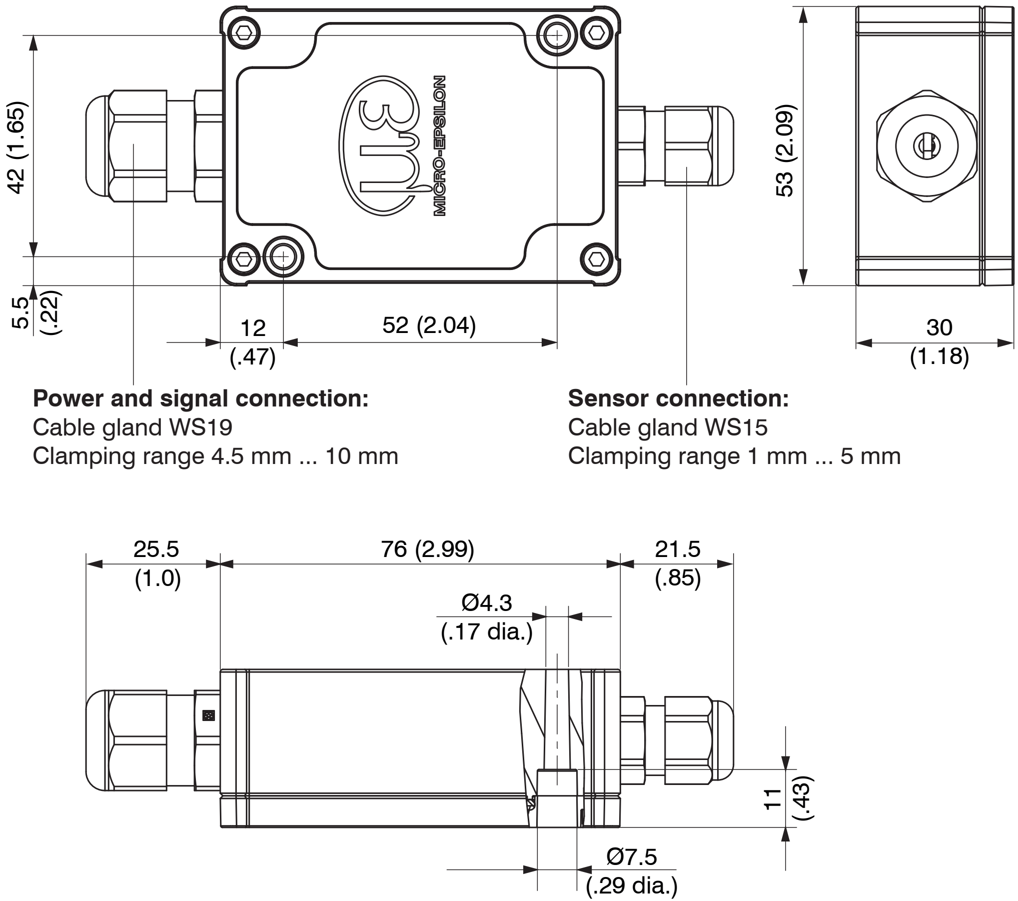


Fig. 2 Dimensions of MSC7401 controller, dimensions in mm, not to scale

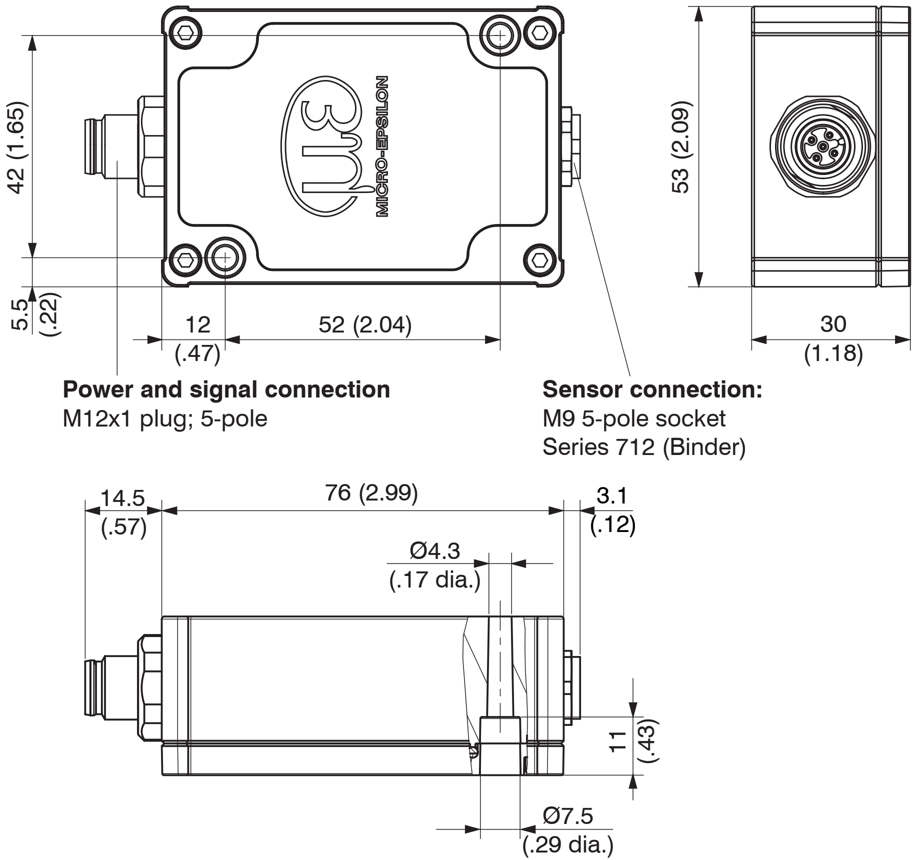


Fig. 3 Dimensions of MSC7401(010) controller, dimensions in mm (inches), not to scale

4.2.2 MSC7802 Model

Fasten the controller of series MSC7802 by means of two M4 screws, see Fig. 4.

The position of the mounting holes is shown in the drawing, see Fig. 4.

The tightening torque for the cover screws is 0.9 Nm. The maximum tightening torque for the SW15 (M12) cable gland is 1.5 Nm and for the SW19 (M16) cable gland is 3 Nm.

NOTICE

Please note that less torque should be applied for cable glands with various cable sheath materials.
> Damage to the cable sheath

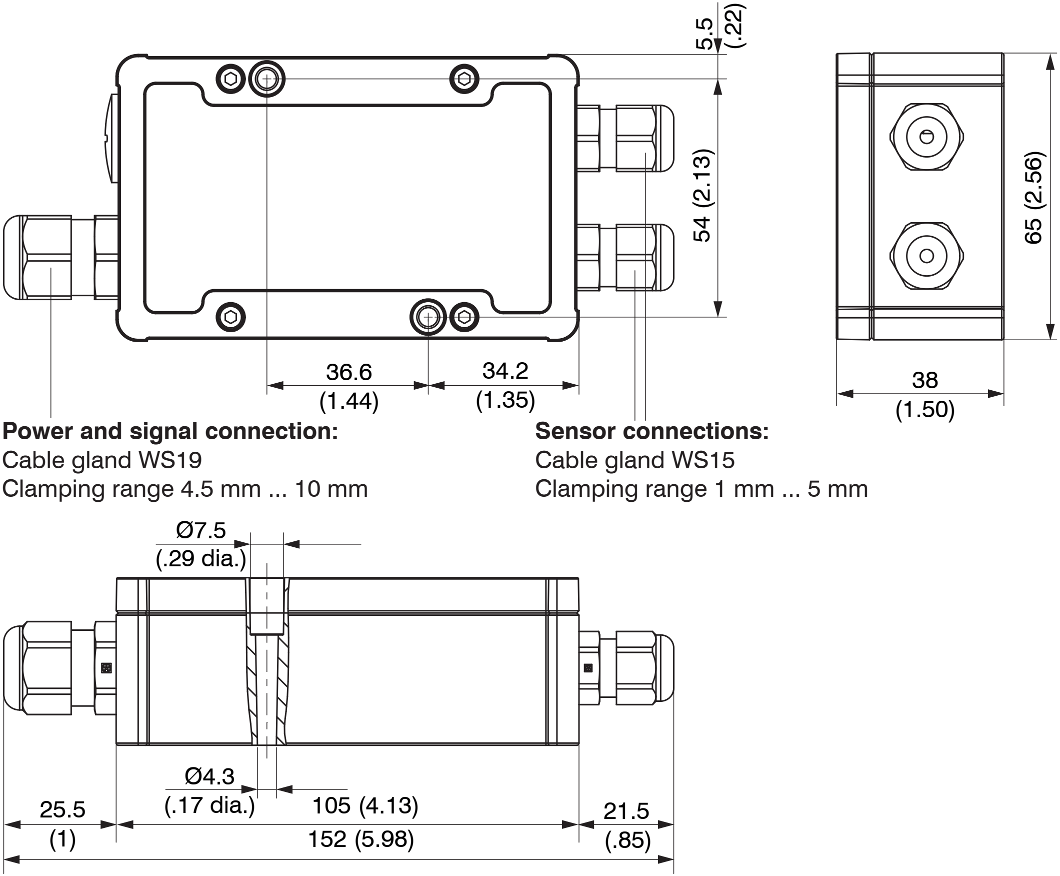


Fig. 4 Dimensions of MSC7802 controller, dimensions in mm, not to scale

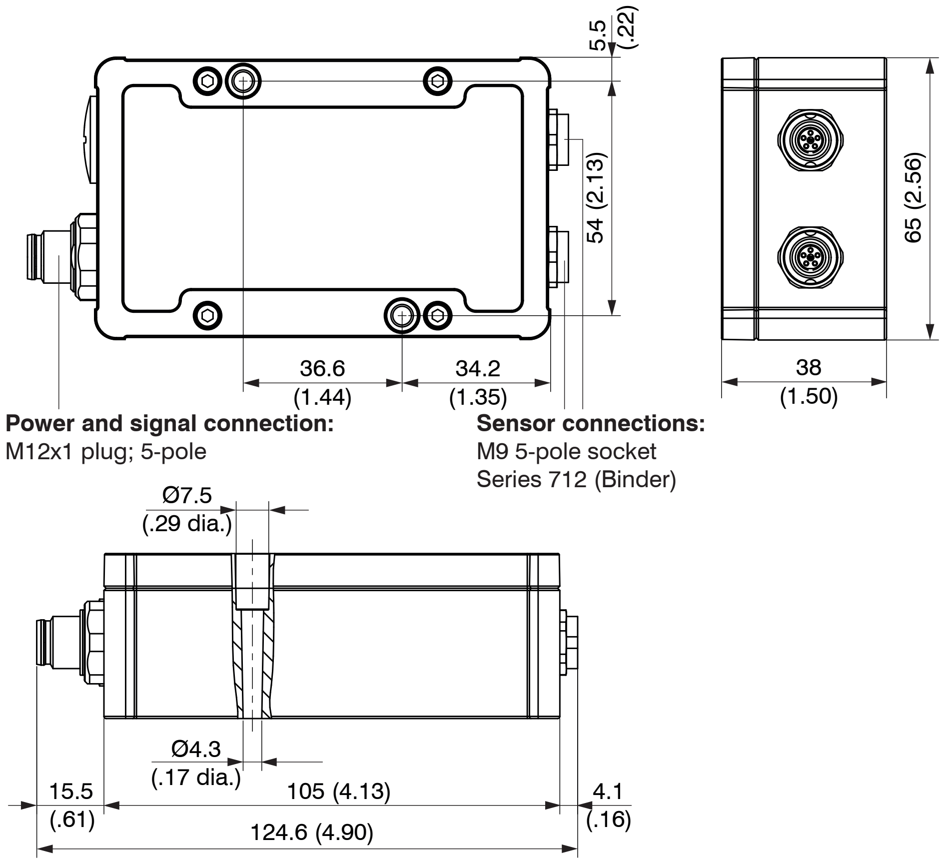


Fig. 5 Dimensions of MSC7802(010) controller, dimensions in mm (inches), not to scale

4.2.3 MSC7602 Model

- If required, install a DIN rail bus connector, e.g., ME22,5 TBUS 1,5/4P1S KMGY (Phoenix: 2201732), see A 1, onto the DIN rail.
- If required, connect the mating plug, e.g., MCVR 1.5/5-ST-3.81 (Phoenix: 1827156), see A 1, with the bus connector.
- Position the MSC7602 controller on the DIN rail and press it down until it snaps in, see Fig. 6.

Fig. 6 Installation of controller

Fig. 7 Dismantling of controller

Dismantling

- For dismantling, pull the locking element on the controller forwards, e.g., using a screwdriver (1), see Fig. 7.
- Tilt the controller in order to remove it from the DIN rail (2), see Fig. 7

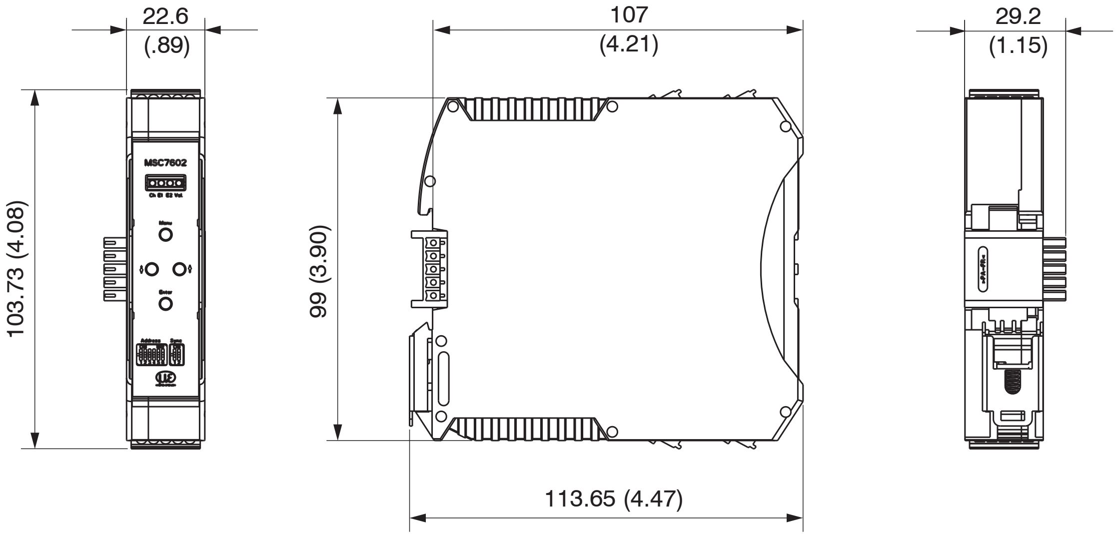


Fig. 8 Dimensions of MSC7602 controller model, dimensions in mm (inches), not to scale

Installation with ferrite

To stabilize the output signal against EMC interferences, you may in addition guide the sensor cables through a sleeve-shaped ferrite included in the scope of supply, see 3.1. This ferrite must be mounted as close as possible to the input terminals.

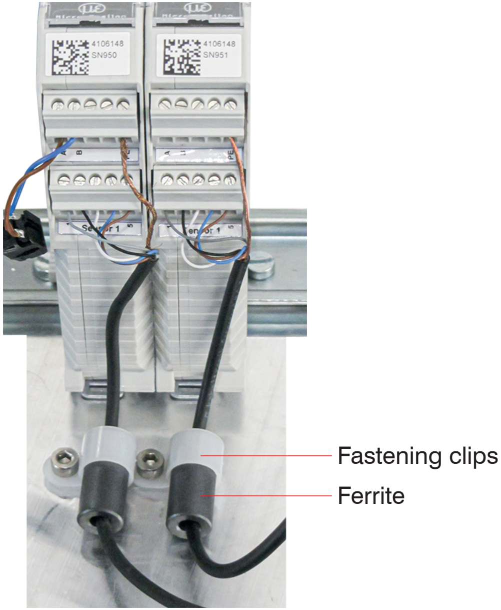


Fig. 9 Installation example of induSENSOR MSC7602 with ferrite

NOTICE

Avoid applying force on the terminals and the sensor cables.
> Damage to the sensor cables and/or the controller

4.3 Power Supply, Sensor and Signal Output MSC7401

The minimum bending radius of the PC7400-6/4 and PC5/5-IWT power supply and output cables (available as optional accessories, see A 1) is ten times the cable diameter. All of the connections for the power supply/ sensors/signal output are on the controller, see Fig. 10, see Fig. 11.

Connections

- Power supply/output side:
  - Cable gland: SW19; clamping range 4.5 mm ... 10 mm
    Screw terminal connection; AWG 16 up to AWG 24; up to AWG 28 with ferrule
  - Alternatively: connector M12x1, 5-pole, A-coded
- Sensor side:
  - Cable gland: SW15; clamping range 1 mm ... 5 mm
    Screw terminal connection; AWG 16 up to AWG 24; up to AWG 28 with ferrule
  - Alternatively: female connector M9; 5-pole, series 712, Co. Binder

Fig. 10 View with cable gland, MSC 7401

Fig. 11 View with plug-in connectors, MSC 7401(010)

Wiring

The housing must be open to connect the sensors, see 4.3.3 and wire the output and power supply cable, see 4.3.1.

- Loosen the screws.
- Pass the sensor and signal cables through the cable glands.
- Connect the cables to the terminals according to the pin assignments.

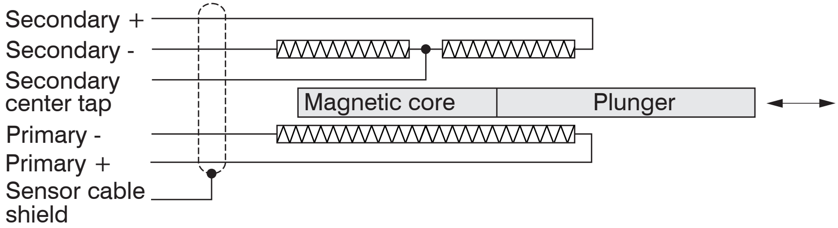


Fig. 12 Pin assignment for the sensor at terminal block X2, full bridge

Terminal block X2	Pin	Cable [1] DTA-x-CA-x DTA-x-CR-x C701-x	Braid [1] DTA-x-LA-x	Solder pin [1] DTA-x-TA-x	Cable [1] DTA-xG8-x
Shield (sensor cable)	1	Shield	-	-	Shield
Secondary center tap	2	Gray	Gray	5	Gray
Secondary +	3	White	White	1	Black
Secondary -	4	Brown	Black	2	White
Primary +	5	Green	Green	3	Blue
Primary -	6	Yellow	Yellow	4	Brown

Fig. 13 Table of the pin assignment for the sensor at terminal block X2, full bridge

1) The colors and pins listed refer to the sensors from MICRO-EPSILON MESSTECHNIK GmbH & Co. KG.

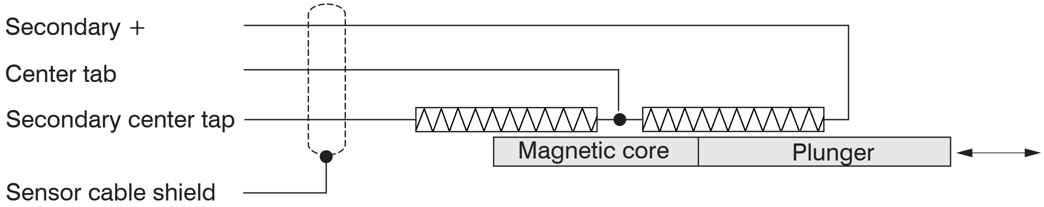


Fig. 14 Pin assignment for the sensor at terminal block X2, half bridge

Terminal block X2	**Pin**	**Cable** [1] **LDR-x-CA LVP-25-20-x**	**Connector LDR-x-SA**	**Sensor cable** [1] **C7210-x**
Shield (sensor cable)	1	-	-	-
Secondary center tap	2	Green	4	Black
Secondary +	3	White	1	Brown
Secondary -	4	Brown	3	Blue
Primary +	5	-	-	-
Primary -	6	-	-	-

Fig. 15 Table of the pin assignment for the sensor at terminal block X2, half bridge

The pin assignment for the terminal blocks can also be found in the graphic and the tables, see Fig. 16 ff.

1) The colors and pins listed refer to the sensors from MICRO-EPSILON & Co. KG.

4.3.1 Power Supply and Signal

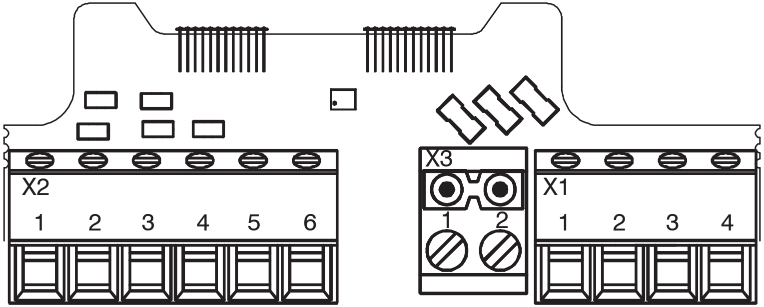


Fig. 16 Pin assignment for supply and signal on the terminal blocks X2, X3, X1

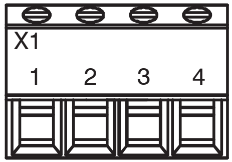
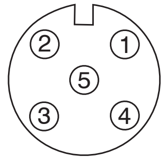
<table>
<tr><td>Pin assignment of supply and analog output</td><td>Variant with cable gland
</td><td></td><td colspan="2">Connector variant

5-pin M12x1 housing connector (A-coded; view on pin side)</td></tr>
<tr><td>Assignment</td><td>Pin X1</td><td>Color (cable: PC7400-6/4)</td><td>5-pin</td><td>Color (cable: PC5/5-IWT)</td></tr>
<tr><td>Analog output</td><td>1</td><td>Yellow</td><td>4</td><td>Black</td></tr>
<tr><td>Supply voltage</td><td>2</td><td>White</td><td>1</td><td>Brown</td></tr>
<tr><td>GND supply/signal ground</td><td>3</td><td>Brown</td><td>3</td><td>Blue</td></tr>
<tr><td>Shield (housing)</td><td>4</td><td>Cable shield</td><td>-</td><td>Cable shield guided over connector</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>2</td><td>White</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>5</td><td>Gray</td></tr>
</table>

Fig. 17 Table for pin assignment of supply and analog output

4.3.2 Digital Interface

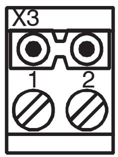
<table>
<tr><td>Assignment</td><td>Pin X3</td><td rowspan="4"></td></tr>
<tr><td>RS485 A</td><td>1</td></tr>
<tr><td>RS485 B</td><td>2</td></tr>
<tr><td></td><td></td></tr>
</table>

Fig. 18 Table for pin assignment of digital interface RS485

4.3.3 Sensor

The output signal increases, when the plunger is moved into the sensor. If the reverse effective direction is required (i.e. the signal becomes smaller when the plunger is inserted), replace the connections sec+ and sec-.

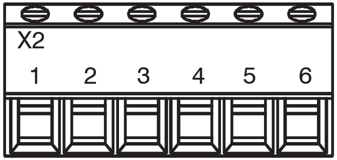
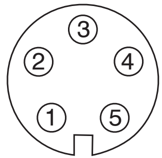
Sensor pin assignment (DTA/LVDT)	**Variant with cable gland** 				**Connector**  5-pin housing socket M9 (Binder, series 712) View on pin side
Assignment	**Pin X2**	**DTA-x-CA-x DTA-x-CR-x Cable C701-x**	**DTA-x-CA-x**	**DTA-xG8-x**	**5-pin**
Shield	1	Shield	-	Shield	Housing
Secondary center tap	2	Gray	Gray	Gray	5
Secondary +	3	White	White	Black	1
Secondary -	4	Brown	Black	White	2
Primary +	5	Green	Green	Blue	3
Primary -	6	Yellow	Yellow	Brown	4

Fig. 19 Table for pin assignment of sensor (DTA/LVDT)

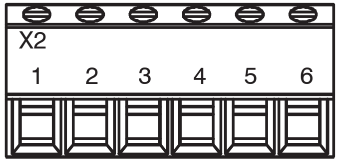
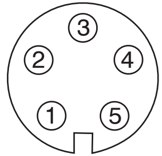
<table>
<tr><td>Sensor pin assignment (LDR)</td><td colspan="3">Variant with cable gland
</td><td>Connector

5-pin housing socket M9
(Binder, series 712)
View on pin side</td></tr>
<tr><td>Assignment</td><td>Pin X2</td><td>LDR-x-CA
LVP-25-Z20-x</td><td>Cable
C7210-x</td><td>5-pin</td></tr>
<tr><td>Shield</td><td>1</td><td>-</td><td>-</td><td>Housing</td></tr>
<tr><td>Secondary center tap</td><td>2</td><td>Green</td><td>Black</td><td>5</td></tr>
<tr><td>Secondary +</td><td>3</td><td>White</td><td>Brown</td><td>1</td></tr>
<tr><td>Secondary -</td><td>4</td><td>Brown</td><td>Blue</td><td>2</td></tr>
<tr><td>Primary +</td><td>5</td><td>-</td><td>-</td><td>3</td></tr>
<tr><td>Primary -</td><td>6</td><td>-</td><td>-</td><td>4</td></tr>
</table>

Fig. 20 Table for pin assignment of sensor (LDR)

4.4 Power Supply, Sensor and Signal Output MSC7802

The minimum bending radius of the PC7400-6/4and PC5/5-IWT power supply and output cables (available as optional accessories), see A 1, is ten times the cable diameter. All of the connections for the power supply/ sensors/signal output are on the controller, see Fig. 4.

Connections

- Power supply/output side:
  - Cable gland: SW19; clamping range 4.5 mm ... 10 mm
    Screw terminal connection; AWG 16 up to AWG 24; up to AWG 28 with ferrule
  - Alternatively: Connector M12x1, 5-pole, A-coded
- Sensor side:
  - Cable gland: SW15; clamping range 1 mm ... 5 mm
    Screw terminal connection; AWG 16 up to AWG 24; up to AWG 28 with ferrule
  - Alternatively: female connector M9; 5-pole, series 712, Co. Binder

Fig. 21 View with cable gland, MSC7802

Fig. 22 View with plug-in connectors, MSC7802(010)

Wiring

The housing must be open, see 4.4.3, to connect the sensors and wire the output and power supply cable, see 4.4.1.

- Loosen the screws.
- Pass the sensor and signal cables through the cable glands.
- Connect the cables to the terminals according to the pin assignments.

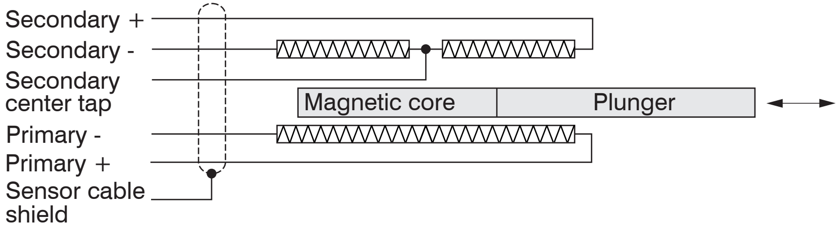


Fig. 23 Pin assignment for the sensor at terminal block X2, full bridge

Terminal block X2	Pin	Cable [1] DTA-x-CA-x DTA-x-CR-x C701-x	Braid [1] DTA-x-LA-x	Solder pin [1] DTA-x-TA-x	Cable [1] DTA-xG8-x
Shield (sensor cable)	1	Shield	-	-	Shield
Secondary center tap	2	Gray	Gray	5	Gray
Secondary +	3	White	White	1	Black
Secondary -	4	Brown	Black	2	White
Primary +	5	Green	Green	3	Blue
Primary -	6	Yellow	Yellow	4	Brown

Fig. 24 Table of the pin assignment for the sensor at terminal block X2, full bridge

1) The colors and pins listed refer to the sensors from MICRO-EPSILON MESSTECHNIK GmbH & Co. KG.

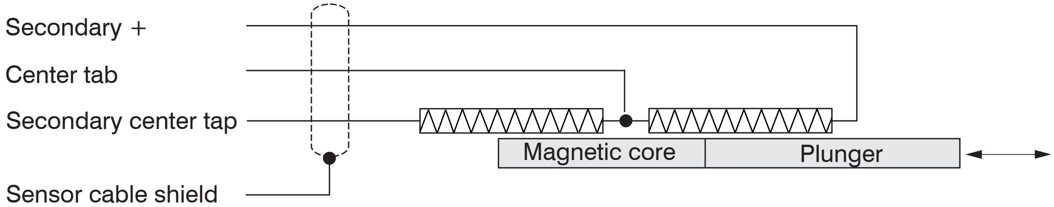


Fig. 25 Pin assignment for the sensor at terminal block X2, half bridge

Terminal block X2	**Pin**	**Cable [1] LDR-x-CA LVP-25-20-x**	**Connector LDR-x-SA**	**Sensor cable [1] C7210-x**
Shield (sensor cable)	1	-	-	-
Secondary center tap	2	Green	4	Black
Secondary +	3	White	1	Brown
Secondary -	4	Brown	3	Blue
Primary +	5	-	-	-
Primary -	6	-	-	-

Fig. 26 Table of the pin assignment for the sensor at terminal block X2, half bridge

The pin assignment for the terminal blocks can also be found in the graphic and the tables, see Fig. 27 ff.

1) The colors and pins listed refer to the sensors from MICRO-EPSILON MESSTECHNIK GmbH & Co. KG.

4.4.1 Power Supply and Signal

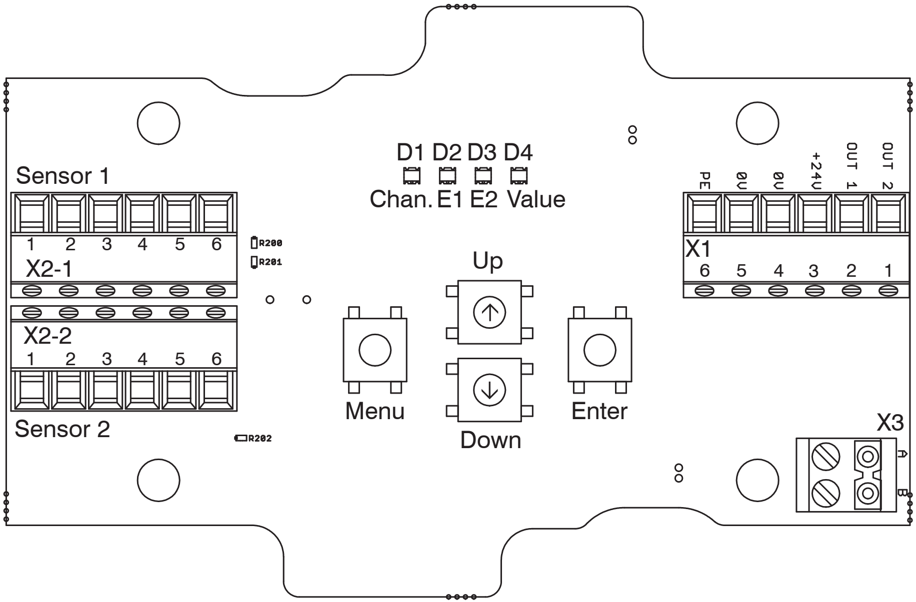


Fig. 27 Pin assignment for power supply and signal on the terminal blocks X2, X3, X1

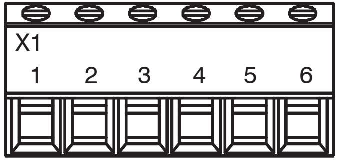
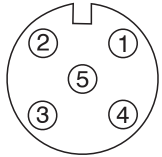
Pin assignment of supply and analog output	**Variant with cable gland** 		**Connector variant**  5-pin M12x1 (A-coded); view on pin side	
Assignment	**Pin X1**	**Color (cable: PC7400-6/4)**	**5-pin**	**Color (cable: PC5/5-IWT)**
Analog output for channel 2	1	Green	2	White
Analog output for channel 1	2	Yellow	4	Black
Supply voltage	3	White	1	Brown
GND supply/signal ground	4	Brown	3	Blue
-	5	-	5	Gray
Shield (housing)	6	Cable shield	-	Cable shield guided over connector

Fig. 28 Table for pin assignment of supply and analog output

4.4.2 Digital Interface

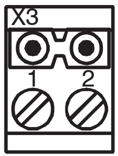
Assignment	**Pin X3**	
RS485 A	1	
RS485 B	2	

Fig. 29 Table for pin assignment of digital interface RS485

4.4.3 Sensor

The output signal increases, when the plunger is moved into the sensor. If the reverse effective direction is required (i.e. the signal becomes smaller when the plunger is inserted), replace the connections sec+ and sec-.

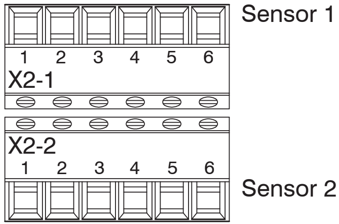
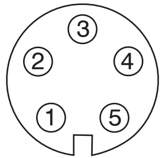
<table>
<tr><td>Pin assignment
Sensor 1 + 2
(DTA/LVDT)</td><td colspan="4">Variant with cable gland
</td><td>Connector

5-pin housing socket M9
(Binder, series 712)
View on pin side</td></tr>
<tr><td>Assignment</td><td>Pin X2-x</td><td>DTA-x-CA-x
DTA-x-CR-x
Cable C701-x</td><td>DTA-x-
CA-x</td><td>DTA-xG8-x</td><td>5-pin</td></tr>
<tr><td>Shield</td><td>1</td><td>Shield</td><td>-</td><td>Shield</td><td>Housing</td></tr>
<tr><td>Secondary center tap</td><td>2</td><td>Gray</td><td>Gray</td><td>Gray</td><td>5</td></tr>
<tr><td>Secondary +</td><td>3</td><td>White</td><td>White</td><td>Black</td><td>1</td></tr>
<tr><td>Secondary -</td><td>4</td><td>Brown</td><td>Black</td><td>White</td><td>2</td></tr>
<tr><td>Primary +</td><td>5</td><td>Green</td><td>Green</td><td>Blue</td><td>3</td></tr>
<tr><td>Primary -</td><td>6</td><td>Yellow</td><td>Yellow</td><td>Brown</td><td>4</td></tr>
</table>

Fig. 30 Table for pin assignment of sensor (DTA/LVDT)

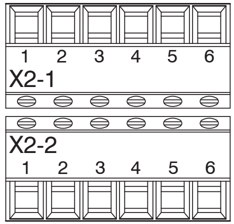
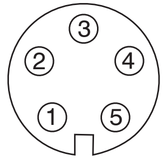
Pin assignment Sensor 1 + 2 (LDR)	**Variant with cable gland** Sensor 1  Sensor 2			**Connector**  5-pin housing socket M9 (Binder, series 712) View on pin side
Assignment	**Pin X2-x**	**LDR-x-CA LVP-25-Z20-x**	**Cable C7210-x**	**5-pin**
Shield	1	-	-	Housing
Secondary center tap	2	Green	Black	5
Secondary +	3	White	Brown	1
Secondary -	4	Brown	Blue	2
Primary +	5	-	-	3
Primary -	6	-	-	4

Fig. 31 Table for pin assignment of sensor (LDR)

4.5 Power Supply, Sensor and Signal Output MSC7602

The MSC7602 is designed for multi-channel operation. Therefore, power supply and RS485 must therefore be applied only to one controller and can then be transmitted to the adjacent controller via a DIN rail bus connector on the rear side.

The Sync signal is only available on the DIN rail bus connector and executed in series, i.e., it is not daisy-chained in the bus connector.

All of the connections for the power supply/sensors/signal output are on the controller, see Fig. 32 ff.

Connections:

Screw terminal connection; AWG 16 up to AWG 24; up to AWG 28 with ferrule

Fig. 32 View MSC7602

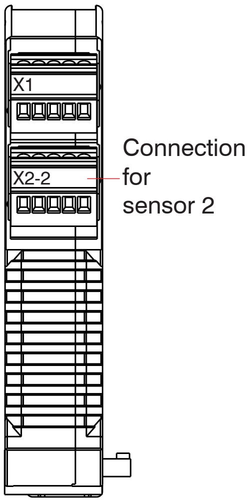


Fig. 33 Upper view, MSC7602

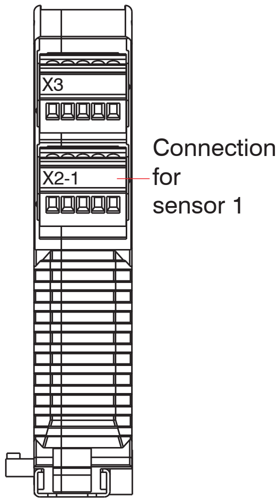


Fig. 34 Lower view, MSC7602

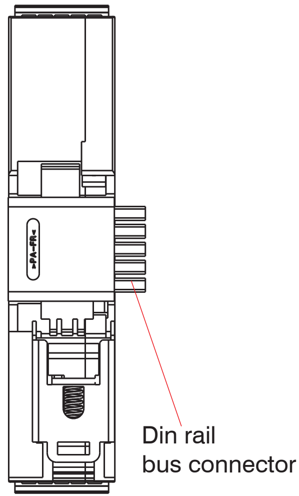


Fig. 35 View rear side, MSC7602 inclusive DIN rail bus connector

4.5.1 Power Supply and Signal

Assignment	Pin X1	Color (cable: PC7400-6/4)
Supply voltage +24 V	1	White
GND supply/signal ground	2	Brown
Output signal 1	3	Yellow
Output signal 2	4	Green
Cable shield sensor 2 (direct connection to DIN rail)	5	-

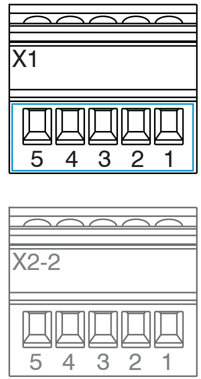


Fig. 36 Table for pin assignment of supply and analog output

Assignment	Pin
Supply voltage +24 V	1
Ground 0 V	2
RS485 A	3
RS485 B	4
Sync-signal	5
ME22,5 TBUS 1,5/4P1S KMGY (Phoenix: 2201732) Suitable mating plug: MCVR 1.5/5-ST-3.81 (Phoenix: 1827156)	

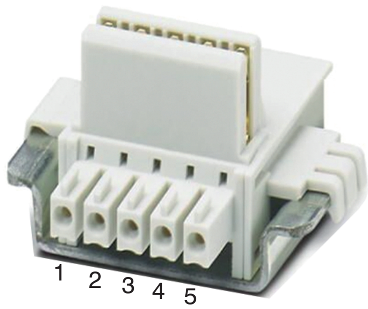


Fig. 37 Table for pin assignment of DIN rail bus connector

4.5.2 Sensor

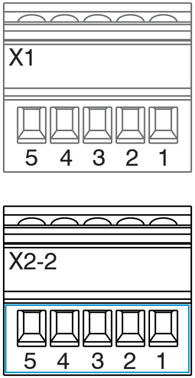


Fig. 38 Terminal block X2-2

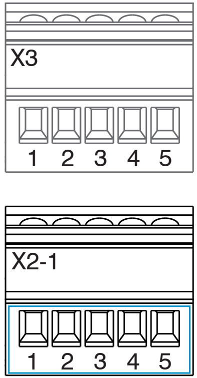


Fig. 39 Terminal block X2-1

Assignment	**Pin X2-x**	**DTA-x-CA-x DTA-x-CR-x Cable C701-x**	**DTA-x-CA-x**	**DTA-xG8-x**
Secondary center tap	1	Gray	Gray	Gray
Secondary +	2	White	White	Black
Secondary -	3	Brown	Black	White
Primary +	4	Green	Green	Blue
Primary -	5	Yellow	Yellow	Brown
Cable shield sensor 1 + 2, see X1 and X3				

Fig. 40 Table for pin assignment sensor 1 + 2 (DTA/LVDT)

Assignment	Pin X2-x	LDR-x-CA LVP-25-Z20-x	Cable C7210-x
Secondary center tap	1	White	White
Secondary +	2	Brown	Black
Secondary -	3	Green	Green
Primary +	4	Yellow	Yellow
Primary -	5	Gray	Gray
Cable shield sensor 1 + 2, see X1 and X3			

Fig. 41 Table for pin assignment sensor 1 + 2 (LDR)

4.5.3 Digital Interface

Assignment	Pin X3	Color (IF7001)
A (RS485)	1	Brown
B (RS485)	2	White
-	3	-
-	4	-
Cable shield sensor 1 (direct connection to DIN rail)	5	-

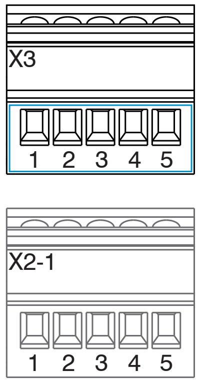


Fig. 42 Table for pin assignment of digital interface X3

5. Operation

➡ Before starting the measurement or making settings, let the controller with connected sensor warm up for approx. 2 minutes while supply voltage is switched on.

i Observe the operating instructions of the sensors used.

i If a sensor is replaced, the channel must be re-parameterized and readjusted.

The parameter setup of the controller may either be performed via keys on the controller or via the sensorTOOL, see A 3. The output is then via the analog outputs or the RS485 interface, see A 4 or the sensorTOOL.

5.1 Initial Operation

- Connect the sensor before starting the controller, see 4.3.3, see 4.4.3, see 4.5.2.
- Ensure that the wiring of the sensor connections, signal cable and power supply connections are correct before connecting the controller to the power supply and turning it on, see 4.
- Then switch on the power supply.
- Set the controller to its basic setting, see 5.3.

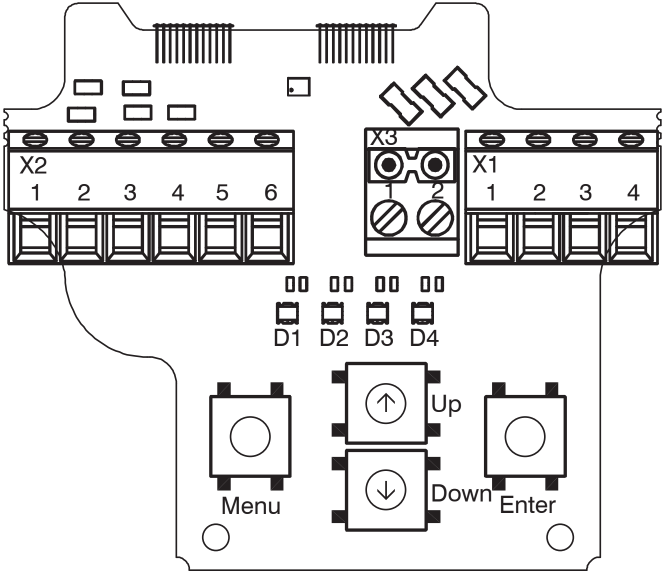


Fig. 43 Controller induSENSOR MSC7401

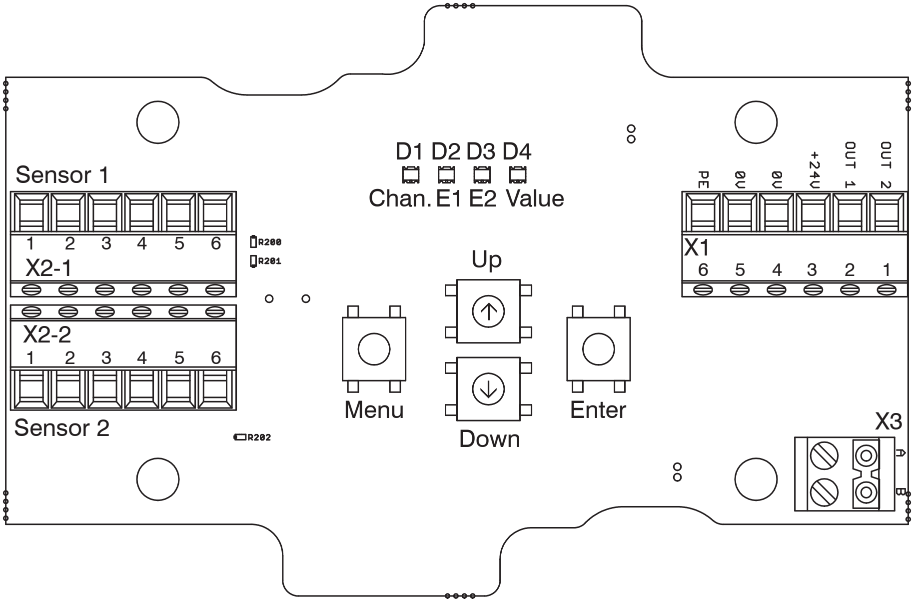


Fig. 44 Controller induSENSOR MSC7802

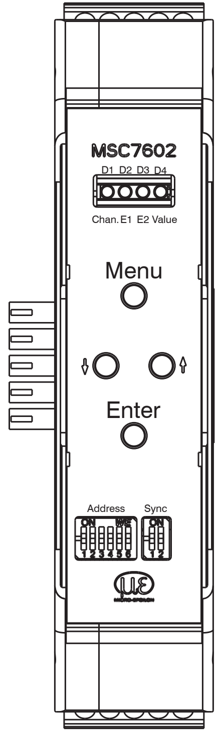


Fig. 45 Controller induSENSOR MSC7602

5.2 Control and Display Elements

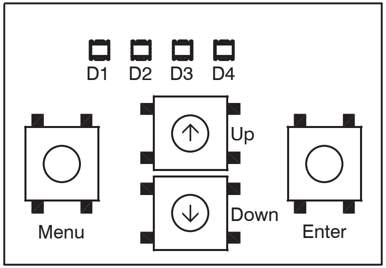


Fig. 46 Control and display elements MSC7401 [1]

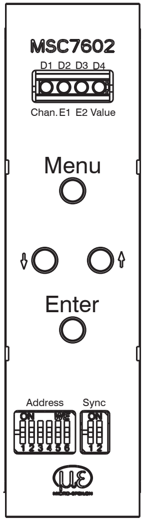


Fig. 47 Control and display elements MSC7602

Button/LED	Function	Description
`Menu` button	Enter the menu level	-
`Enter` button	Confirmation	-
↑ and ↓ buttons	Parameter selection	-
LED `D1 / Ch`	`Channel` display	The LED `Channel` indicates the current channel, with ↑ and ↓ the channel can be changed (red and green). Channel 1: green, channel 2: red It flashes in corresponding color, if the channel is not parametrized.
LED `D2 / E1`	`E1` menu level display	The `E1` and `E2` LEDs show the current position in the menu or the corresponding settings.
LED `D3 / E2`	`E2` menu level display	
LED `D4 / Value`	`Value` display	The `Value` LED indicates the current value of the selected parameters.

1) Description also applies for MSC7802 model.

5.3 Setting

The menu of the *MSC7401 / 7802 / 7602* is designed for fast, mainly automated commissioning as well as for individual application-specific settings. It is divided into four function blocks, see Fig. 48. The 4 LEDs show the current position in the menu and the corresponding setting value at any time, see 5.4. Alternatively, the software sensorTOOL, can be used, see A 3.

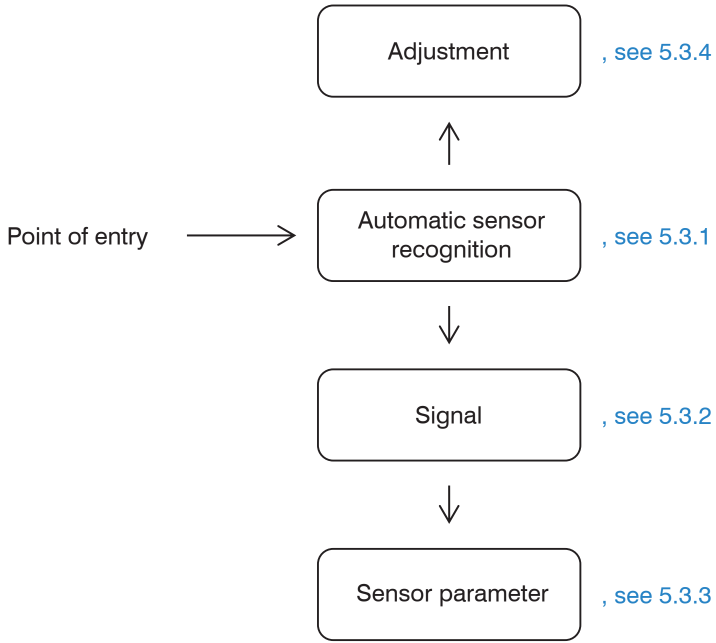


Fig. 48 Menu structure (simple), details, see 5.4

5.3.1 Automatic Sensor Recognition

The first menu item is the automatic sensor recognition.

LED D2 = red

The automatic sensor recognition checks the connected sensor and determines the parameters for the common MICRO-EPSILON sensors:
- Sensor type (half bridge or full bridge (LVDT))
- Supply frequency and
- Excitation voltage

After the automatic sensor recognition has been completed, the LEDs confirm the status.

D3/D4 = green	Sensor recognition successful	After successful recognition, the system is ready for use. The output signal is preset according to the factory setting, as well as a rough adjustment of the measuring signal.
D3/D4 = red	Automatic recognition is not successful	The parameters must now be set manually according to the respective instruction manuals of the sensor used. An automatic jump to the menu item `Sensor parameter` is done, see 5.3.3.

5.3.2 Signal

LED D2 = orange

This function allows you to adjust the type of output signal, e.g., 2 ... 10 V or 4 ... 20 mA.

Automatic recognition is available. For a load at the output of:

> 1 kOhm, voltage output 2 ... 10 V is set,

< 1 kOhm, current output 4 ... 20 mA is set.

5.3.3 Sensor Parameters

LED D2 = red flashing

With this function, you can set the parameters
- sensor type,
- supply frequency and
- excitation voltage

if the automatic recognition is not successful, or for special areas of use other settings may be necessary. These depend on the sensor model used. After manual setting of the sensor parameters, the adjustment of the system, see 5.3.4, is recommended.

Sensor model		Measuring range	Sensor type	Supply frequency	Excitation voltage
DTA-1x		±1 mm	LVDT	5 kHz	550 mV
DTA-3x		±3 mm		5 kHz	
DTA-5x		±5 mm		5 kHz	
DTA-10x		±10 mm		2 kHz	
DTA-15x		±15 mm		1 kHz	
DTA-25x		±25 mm		1 kHz	
LDR-10		10 mm	LDR	21 kHz	
LDR-25		25 mm		13 kHz	
LDR-50		50 mm		9 kHz	
LVP-3		3 mm		18 kHz	
LDR-14	With 8 mm drawbar	14 mm		23 kHz	
	With 10 mm drawbar			23 kHz	
LVP-25	With 8 mm drawbar	25 mm		16 kHz	
	With 10 mm drawbar			16 kHz	

Fig. 49 Sensor models and sensor parameters

5.3.4 Adjustment

LED D2 = green

At the menu item adjustment, you can use either a 2-point adjustment or a zero point search. In this menu, the controller can also be reset to the factory settings.

2-point adjustment	Here you can set any 2 points within the measuring range and the corresponding signal values.
Factory settings	The controller can be reset to the parameters stored by default, see A 2.
Zero point search	This is a special case of a 2-point adjustment and provides the best performance for the measuring system. The first of the two points is the electrical zero point at which a differential sensor shows the highest stability on principle.

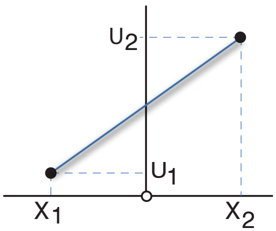


Fig. 50 Graphic 2-point adjustment

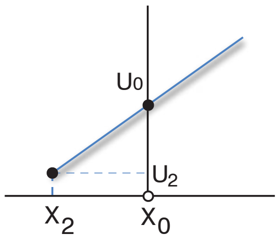


Fig. 51 Graphic Zero point search

5.4 Menu Structure

Legend of the menu structure [1]	
	LED orange
	LED orange flashing
	LED green
	LED green flashing
	LED red
	LED red flashing
	LED off
SMR	Start of measuring range
MMR	Mid of measuring range
EMR	End of measuring range

Fig. 52 Legend of the menu structure

1) For pages 51 to 58

D1: Channel		D2: E1			D3: E2			D4: Value			Next menu
		G	Adjustment	ENTER	↑ ↓	R	2-point adjustment	ENTER	Go to the adjustment modes 2-point adjustment, see Fig. 54 or zero-point search, see Fig. 55.	ENTER	E1 level
						G	Factory settings				
						O	Zero-point search				
		↑									
G	MENU (3 sec.)	R	Automatic sensor reco-gnition	ENTER		G	Successful		G Successful		E1 level
↑ ↓						R	Failed		R Failed		Sensor parameter
R						G	Manually set		□ Manually set		Display only
		↓									
		O	Signal	ENTER	↑ ↓	G	Automatic	ENTER	O Voltage; R Current	ENTER	E1 level
						O	Voltage		Voltage ↑ ↓: G 0 ... 10 V; O 2 ... 10 V; R 0 ... 5 V; R (flashing) 0.5 ... 4.5 V		
						R	Current		Current ↑ ↓: G 4 ... 20 mA; O 0 ... 20 mA; R 0 ... 10 mA		

Continuation of menu structure of page 51

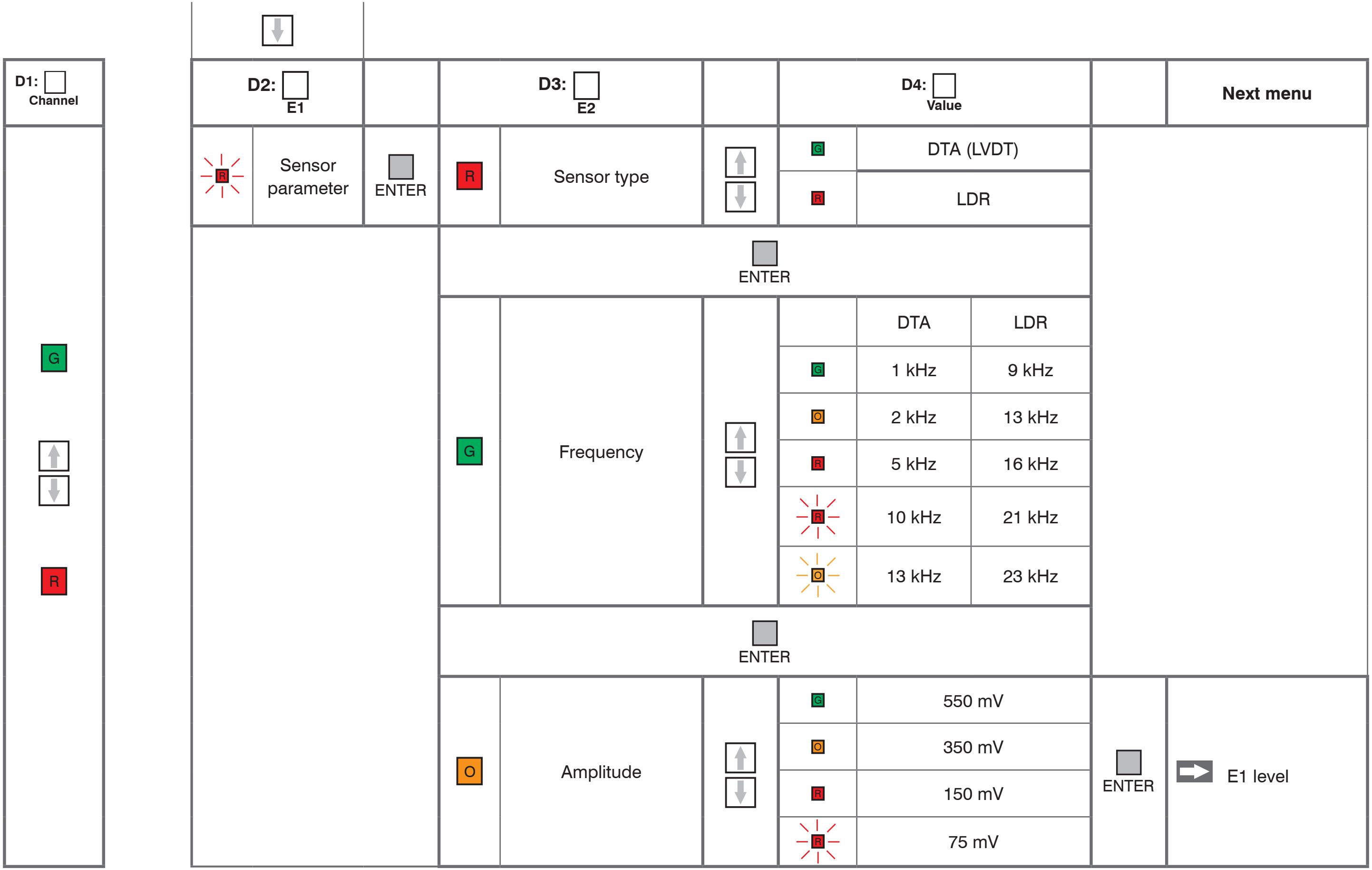
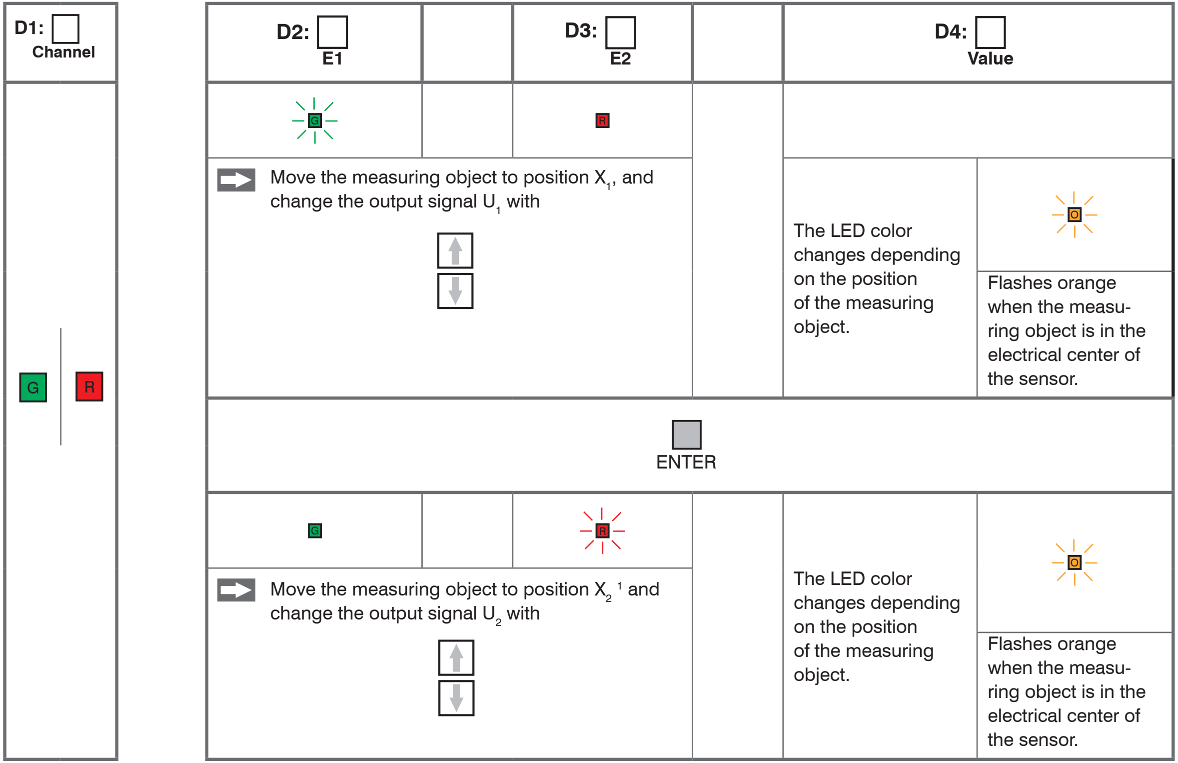


Fig. 53 Menu structure for the MSC7401 / 7802 / 7602 controllers

5.4.1 2-Point Adjustment

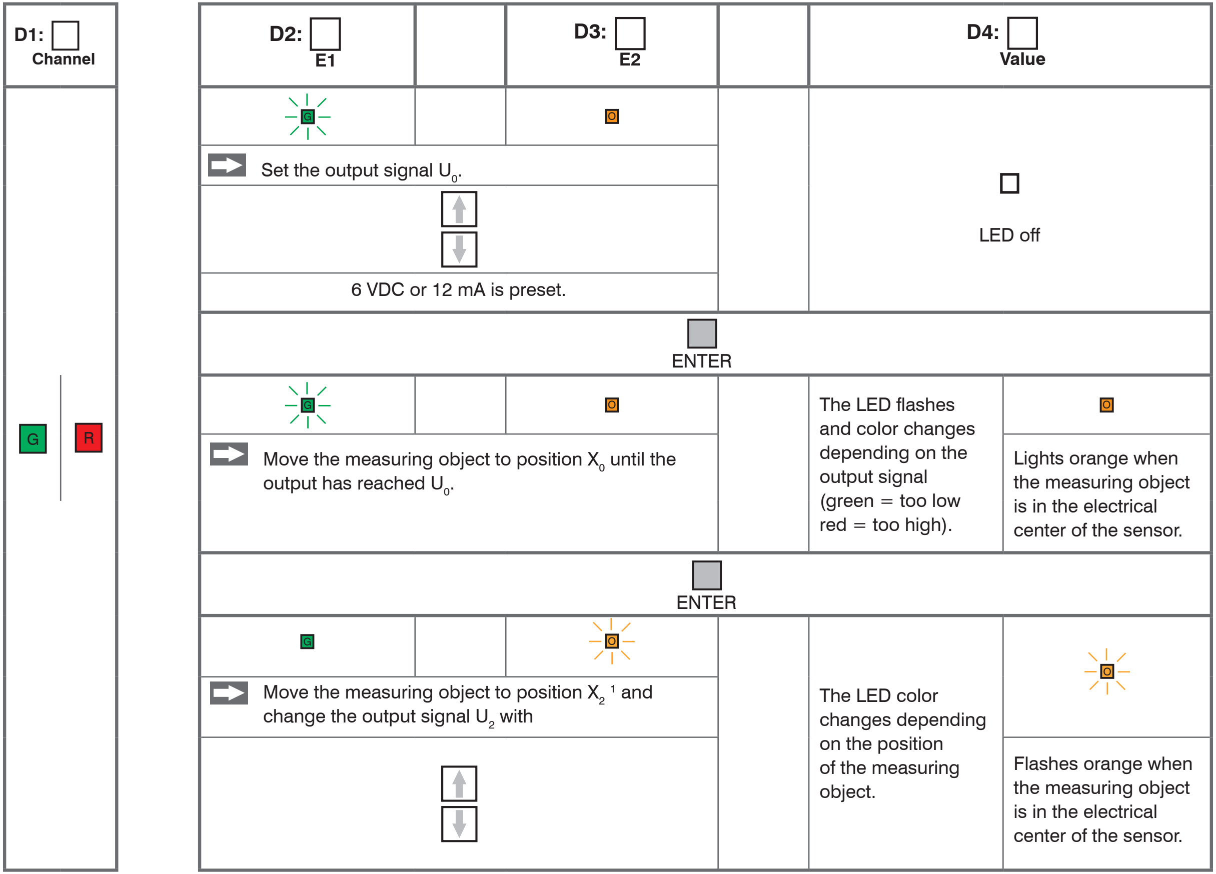


1) Position X_2 must be > 10 % of the measuring range away from X_1.

Fig. 54 Menu structure for the MSC7401 / 7802 / 7602 controllers, adjustment mode: 2-point adjustment

1) Position X_2 must be > 10 % of the measuring range away from X_1.

5.4.2 Zero-Point Search



1) Position X_2 must be > 10 % of the measuring range away from X_1.

Fig. 55 Menu structure for the MSC 7401 / 7802 / 7602 controllers, adjustment mode: Zero-point search

5.4.3 Example A: Sensor Parameter Adjustment: DTA-5G8, Channel 1

D1	D2	D3	D4	
G	□	□	□	
MENU				Press the `MENU` button for 3 sec.
G	R	G	G	After switching on, the sensor is automatically identified. If the recognition was successful, this color code is displayed and you can skip example A.
G	R	R	R	Output situation: sensor is not automatically recognized.
↓				Press button `2x`.
G	R (blinking)	□	□	Menu point `Sensor Parameter`, see 5.3.3
ENTER				Confirm by pressing the `ENTER` button.
G	R (blinking)	R	G	Sensor type: LVDT; with ↑ ↓ the selection can be changed here.
ENTER				Confirm by pressing the `ENTER` button.
G	R (blinking)	G	R	Frequency: 5 KHz; with ↑ ↓ the selection can be changed here.
ENTER				Confirm by pressing the `ENTER` button.
G	R (blinking)	O	G	Excitation voltage: 550 mV; with ↑ ↓ the selection can be changed here.
ENTER				Confirm by pressing the `ENTER` button.
G	R	G	□	

5.4.4 Example B: Signal Output Adjustment: 2 ... 10 V, Channel 1

D1	D2	D3	D4	
G	□	□	□	
■ MENU				➡ Press the `MENU` button for 3 seconds, if you are not yet in the menu.
G	R	G		Output situation: The sensor parameters are already set; depending on the approach, LED `D4` is green or switched off.
↓				
G	O	G		Menu point: `Signal`, see 5.3.2; in delivery state, the electronics works with automatic load recognition; depending on the output load, the LED D4 is red (4 ... 20 mA) or orange (2 ... 10 V). If the automatic settings suits you, you can cancel example B here.
■ ENTER				➡ Confirm by pressing the `ENTER` button.
G	O	G	□	
↓				
G	O	O	□	Voltage output
■ ENTER				➡ Confirm by pressing the `ENTER` button.
G	O	O	O	2 ... 10 V; with ↑ ↓ the selection can be changed here.
■ ENTER				➡ Confirm by pressing the `ENTER` button.
G	R	G		Output situation: The sensor parameters are already set; depending on the approach, LED D4 is green or switched off.

5.4.5 Example C: Adjustment via Zero Point Search, Channel 1

D1	D2	D3	D4
G	☐	☐	☐
☐ MENU			
G	R	G	
↑			
G	G	☐	☐
☐ ENTER			
G	G	G	☐
↓			
G	G	O	☐
☐ ENTER			
G	G (flashing)	O	☐
↓ ↑			
☐ ENTER			
G	G (flashing)	O	
☐ ENTER			
G	G	O (flashing)	
↓ ↑			
☐ ENTER			

- Set the sensor parameters according to example A and connect the output signal according to example B.
- Press the `MENU` button for 3 seconds, if you are not yet in the menu.

Output situation: The sensor parameters are already set; depending on the approach, LED `D4` is green or switched off.

- Go to the menu `Adjustment`, see 5.3.4.
- Confirm by pressing the `ENTER` button.
- Select `Zero point search.`
- Confirm by pressing the `ENTER` button.

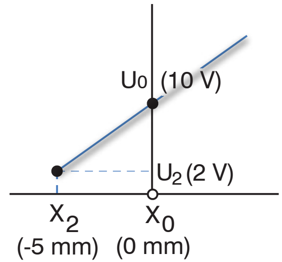


Fig. 56 Example point search

- Now use the arrow keys to set the voltage in such a way that the measuring device displays 6.00 V (U_0)).
- Confirm by pressing the `ENTER` button.
- Now move the measuring object to the zero point (X_0, MMR), where the measuring device again displays the above set 6.00 V (U_0).

For better orientation, LED `D4` changes the color depending on the plunger position. Near the zero point, LED `D4` flashes orange.

- Confirm by pressing the `ENTER` button.
- Now move the measuring object from X0 5.000 mm towards the start of the measuring range (X2) and use the arrow keys to set 2.00 V (U_2).

For better orientation, LED `D4` changes the color depending on the plunger position. Near the zero point, LED `D4` flashes orange.

- Confirm by pressing the `ENTER` button.

5.4.6 Example D: Adjustment via 2-Point Adjustment, Channel 1

D1	D2	D3	D4
G	□	□	□
MENU			
G	R	G	
↑			
G	G	□	□
ENTER			
G	G	G	□
↑			
G	G	R	□
ENTER			
G	G (flashing)	R	
↓ ↑			
ENTER			
G	G	R (flashing)	
↓ ↑			
ENTER			
G	R	G	

➡ Set the sensor parameters according to example A and connect the output signal according to example B.

➡ Press the `MENU` button for 3 seconds, if you are not yet in the menu.

Output situation: The sensor parameters are already set; depending on the approach, LED D4 is green or switched off.

➡ Go to the menu `Adjustment`, see 5.3.4.

➡ Confirm by pressing the `ENTER` button.

➡ Select `2-point adjustment.`

➡ Confirm by pressing the `ENTER` button.

➡ Now move the measuring object to the desired position start of measuring range (X_1).

➡ Use the arrow buttons to set 2.00 V (U_1).

➡ Confirm by pressing the `ENTER` button.

➡ Now move the measuring object 6.000 mm towards the end of the measuring range (X_2).

➡ Use the arrow buttons to set 10.000 V (U_2).

➡ Confirm by pressing the `ENTER` button.

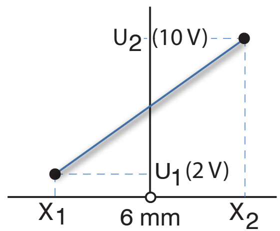


Fig. 57 Example 2-point adjustment

5.5 Multi-Channel Operation

When operating the MSC7401 / MSC7602 / MSC7802 models, multi-channel operation is possible.

i For multi-channel operation, a distance of at least 100 mm between the respective sensors is recommended.

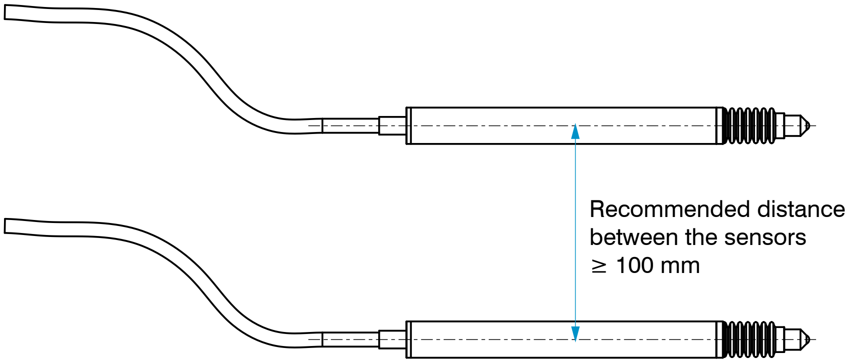


Fig. 58 Multi-channel operation of 2 sensors

5.5.1 Operation on the RS485 Bus with Multiple Channels

The connection to the RS485 bus enables to directly read out the measurement values, see A 4.

The respective addresses can be individually set from 1 ... 126.

NOTICE

Please avoid in each operating mode using the same addresses multiple times on the bus.
> Data collision / System crash

With the MSC7401 and MSC7802 models, the addresses can exclusively be set via software, see A 3. The MSC7602 model in addition enables to set the address via a DIP switch, see Fig. 59.

The MSC7602 and MSC7802 2-channel variants hold a special status.

When the addresses are firmly assigned via DIP switch, see Fig. 60, always both addresses are set, e.g., channel 1 = address 100 → channel 2 = address 99.

However, if the addresses are assigned via the sensorTOOL, see Fig. 60, the addresses can be set individually. But channel 1 only allows even address values while channel 2 only allows odd address values. If an entry is incorrect, the addresses are automatically set to the next higher even address or the next lower address.

i Please note that the transmission frequency per channel is reduced as the number of participants on the bus increases, as all channels have to be queried in series. Per channel, the duration of a message (query and response) is approx. 3 ms with 256,000 baud.

Fig. 59 DIP switch on the MSC7602 for multi-channel operation

Address		Switch setting						
Sensor 1	Sensor 2	S1	S2	S3	S4	S5	S6	Value binary
126 [1 2]	125 [1 2]	OFF	OFF	OFF	OFF	OFF	OFF	000000
2	1	ON	OFF	OFF	OFF	OFF	OFF	000001
4	3	OFF	ON	OFF	OFF	OFF	OFF	000010
6	5	ON	ON	OFF	OFF	OFF	OFF	000011
8	7	OFF	OFF	ON	OFF	OFF	OFF	000100
...	...	...	...	...	...	...	...	...
118	117	ON	ON	OFF	ON	ON	ON	111011
120	119	OFF	OFF	ON	ON	ON	ON	111100
122	121	ON	OFF	ON	ON	ON	ON	111101
124	123	OFF	ON	ON	ON	ON	ON	111110
126	125	ON	ON	ON	ON	ON	ON	111111

Fig. 60 Address assignment on the induSENSOR MSC7602

1) Factory settings

2) The address can be set using the sensorTOOL, see A 3.

i Please note that the bus master requires an individual address. With the bus master from MICRO-EPSILON MESSTECHNIK (e.g., sensorTOOL, IF1032 or IF2030), this address is always 1.

This is how max. 62 single-channel or 31 dual-channel controllers can be operated on the RS485 bus.

5.5.2 Synchronization and Installation of Multiple Channels

MSC7602 model

If the minimum distance of ≥ 100 mm, see 5.3, is impossible, the MSC7602 model in addition offers the possibility to synchronize the supply frequency of the sensors. This significantly reduces or eliminates cross-talking between the channels, which strongly depends on the sensor used and the distance or arrangement to one another.

The following prerequisites/restrictions apply for sync operation:

- All synchronized sensors must be operable with the supply frequency of the master sensor, see 5.3.3.
- In sync mode, no automatic sensor recognition is possible with the slave.
- In sync mode, the slave channel must be set to the frequency of the master.
- The synchronization settings are not possible via the sensorTOOL, see A 3.
- Synchronization is only possible with a frequency response set to ≥ 50 Hz.

The respective synchronization modes can be set via DIP switches:

Switch setting		Operation	
S1	S2	Sensor 1	Sensor 2
off [1]	off [1]	independent	independent
off	on	Master	Slave
on	off	Slave	independent
on	on	Slave	Slave

Fig. 61 DIP switch on the induSENSOR MSC7602 for synchronization

1) Factory settings

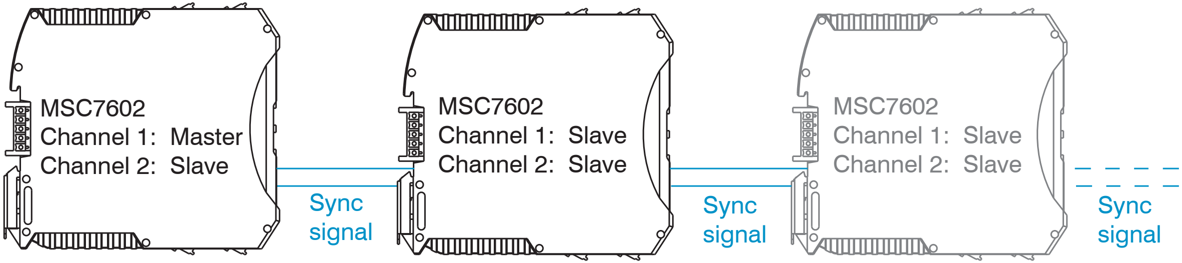


Fig. 62 Example of synchronization induSENSOR MSC7602

MSC7802 model

The MSC7802 offers restricted synchronization possibilities. If these are necessary in the application, please contact Micro-Epsilon Messtechnik GmbH & Co. KG.

6. Service, Repair

If the controller or the sensor are defective, please send in the affected parts for repair or replacement.

If the cause of a fault cannot be clearly identified, please send the entire measuring system 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

7. Liability for Material Defects

All components of the device have been checked and tested for functionality at the factory. However, if defects occur despite our careful quality control, MICRO-EPSILON or your dealer must be notified immediately.

The liability for material defects is 12 months from delivery. Within this period, defective parts, except for wearing parts, will be repaired or replaced free of charge, if the device is returned to MICRO-EPSILON with shipping costs prepaid.

Any damage that is caused by improper handling, the use of force or by repairs or modifications by third parties is not covered by the liability for material defects.

Repairs are carried out exclusively by MICRO-EPSILON. Further claims can not be made. Claims arising from the purchase contract remain unaffected.

In particular, MICRO-EPSILON shall not be liable for any consequential, special, indirect or incidental damage.

In the interest of further development, MICRO-EPSILON reserves the right to make design changes without notification. For translations into other languages, the German version shall prevail.

8. Decommissioning, Disposal

➡ Remove all sensor cables as well as the power and output cables from the controller.

Incorrect disposal may cause harm to the environment.

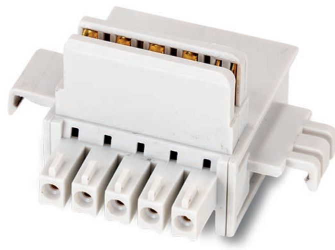
➡ Dispose of the device, its components and accessories, as well as the packaging materials in compliance with the applicable country-specific waste treatment and disposal regulations of the region of use.

Appendix

A 1 Optional Accessories

Designation	Photo	Description
PC7400-6/4		Power and output cable; length: 6 m, 4-core, open ends with ferrules, shielded, OD: 5.6 mm
PC5/5-IWT		Power and output cable; connector M12x1, 5 pin, A-coding, length: 5 m, 5-core, open ends, OD: 5.6 mm, IP 67
IF7001		Single-channel USB/RS485 converter for MSC7xxx
You will find further information on IF7001 under: https://www.micro-epsilon.com/download/manuals/ass--IF-7001--de-en.pdf#zoom=Fit		

Description	Photo	Description
IF2030/PNET		Interface component to con-nect Micro-Epsilon sensors to Profinet via RS422/RS485 interface, single-channel system with DIN-rail housing; software integration into PLC with GSDML file, certified according to PNIO V2.33
IF1032/ETH		Multi-channel analog/Ether-net-EtherCAT converter - three analog inputs - one RS485 in addition with trigger input

Description	Photo	Description
MSC7602 connector kit	 	3 x DIN rail bus connector; ME22,5 TBUS 1,5/4P1S KMGY connector (Phoenix: 2201732) 1x suitable mate plug for DIN rail mounting: MCVR 1.5/5-ST-3.81 (Phoenix: 1827156)

A 2 Factory Settings

The controller is assigned with the following parameters by default:

- Frequency response: 50 Hz, only adjustable via sensorTOOL software, see A 3.
- Language: German
- Automatic recognition of customer signals
- Automatic sensor recognition

Upon successful recognition:

- Start of measuring range (plunger pulled-out): ~2 V or 4 mA
- Mid of measuring range (electric zero): ~6 V or 12 mA

A 3 Software

The sensorTOOL offers you a documented software.
You will find them on www.micro-epsilon.com.

A 3.1 Controller Search

- Connect the controller to a free USB port on your PC (e.g. via IF7001) and connect the power supply.
- Activate the sensorTOOL.

The following view appears:

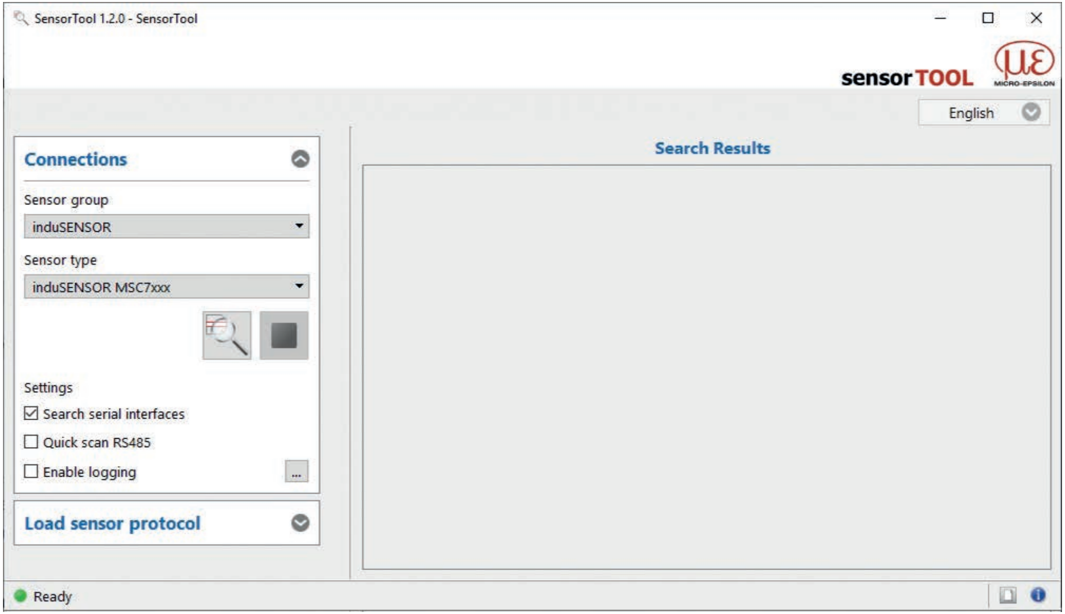


Fig. 63 First interactive site after calling the sensorTOOL

- In the drop down menu, set the sensor group `induSENSOR`, and with the sensor type `induSENSOR MSC7xxx` and activate the other settings, see Fig. 63.
- Then click the  button.

Now the `Search Results (x)` view displays the number of channels (or controllers) found.

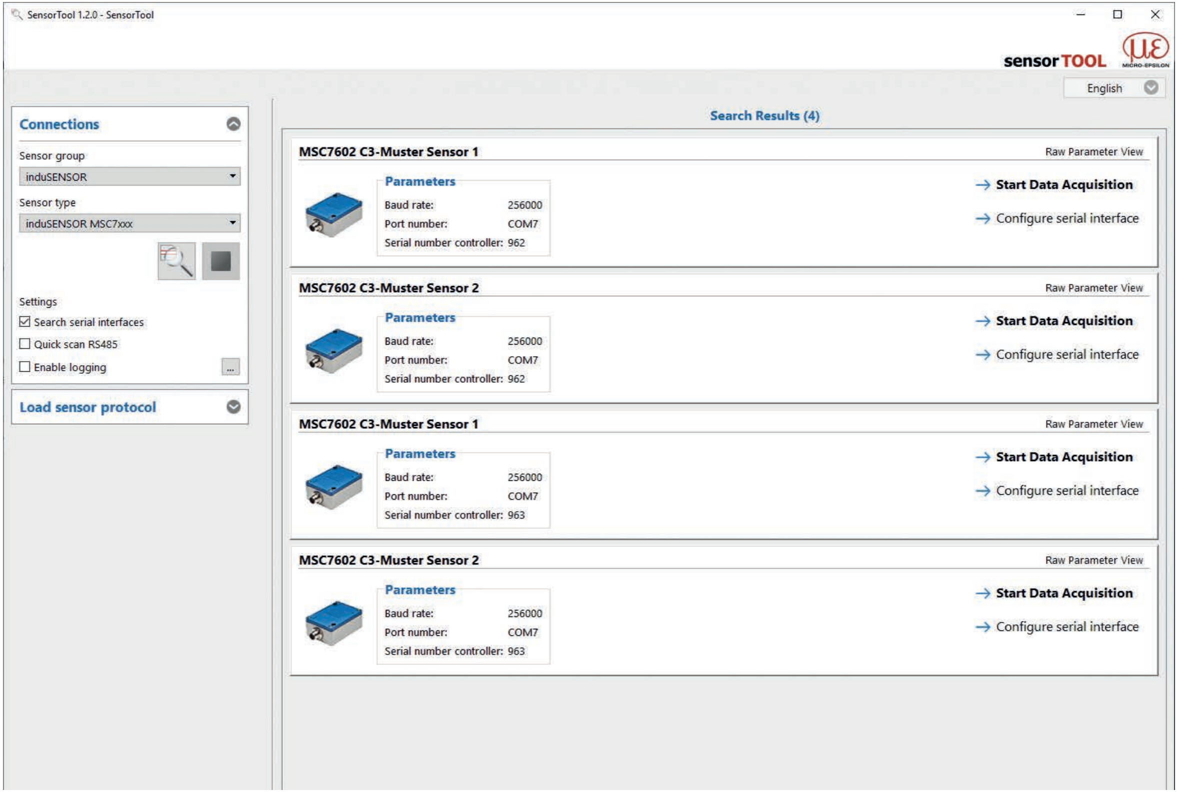


Fig. 64 Main view

The channels found are now listed in the overview.

➡ Click the `Configure serial interface` button to set the basic settings for the serial interface.

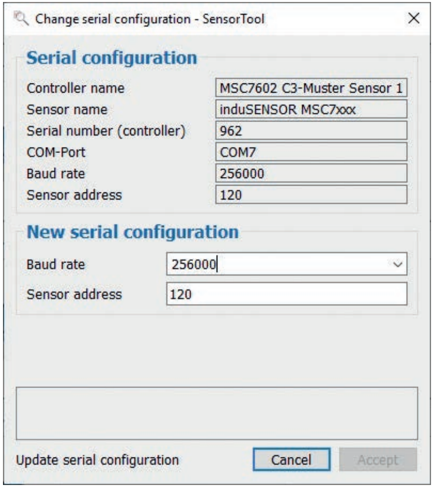


Fig. 65 Window Change serial configuration - sensorTOOL

i Set the baud rate to 256,000.

A sensor address can be assigned for the sensor.

i Please observe the DIP settings of MSC7602, see Fig. 60.

➡ Start the data acquisition/configuration by clicking `Start Data Acquisition` or the controller picture, see Fig. 64.

The following window appears, see Fig. 66.

A 3.2 Measurement Menu

To check your measurements, a simple data acquisition is available.

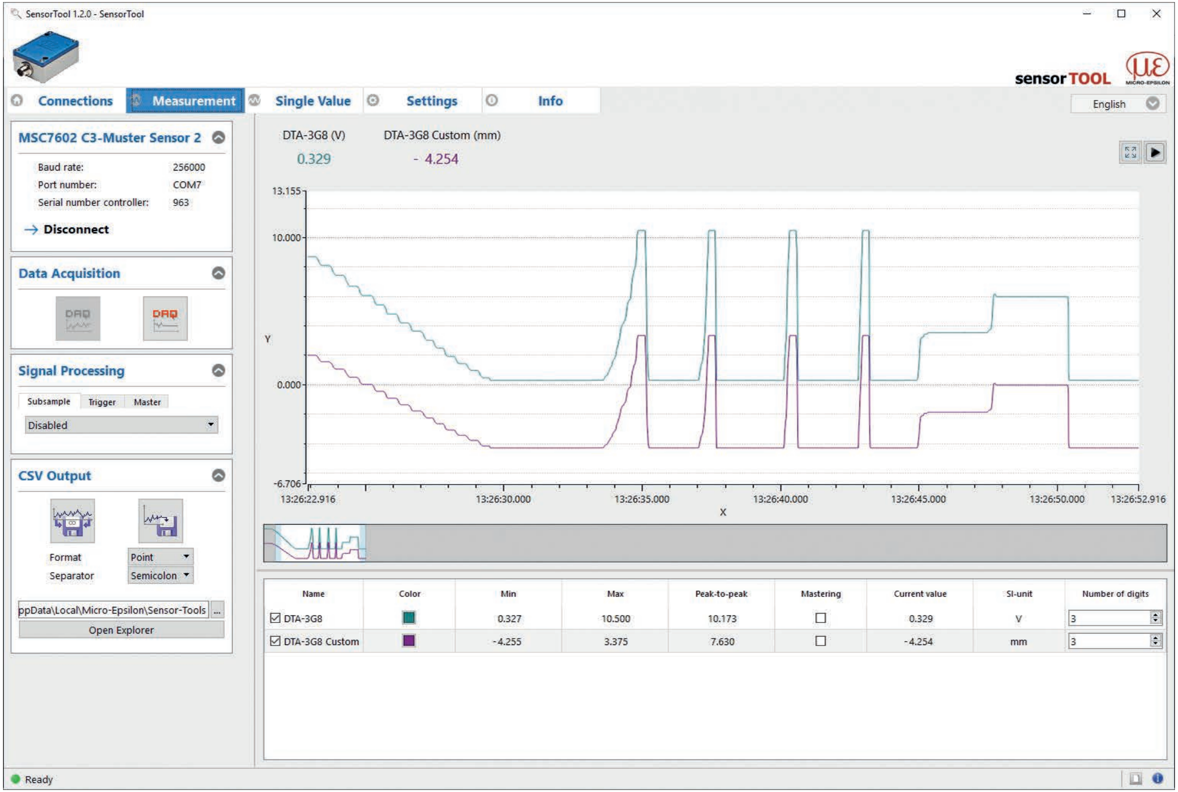


Fig. 66 View Measurement menu

A 3.2.1 Main View

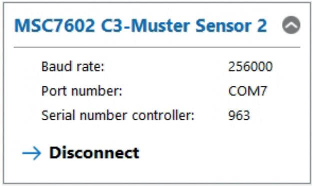
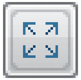
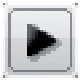


Fig. 67 Disconnect

By clicking the `Disconnect` button you return to the controller search, see Fig. 63.

	Click the `Reset Y-Scale` button to reset the Y-scale to initial settings (e.g. after zooming).
	Click the `Jump to Head` button to display the current signal course.

A 3.2.2 Start / Stop

Start the data acquisition by clicking the `Start` button, see Fig. 68.

The acquisition is completely restarted and the record stopped before is deleted.

Stop the data acquisition by clicking the `Stop` button, see Fig. 69.

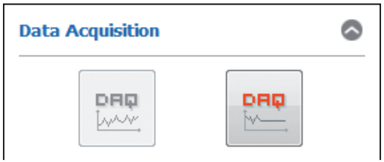


Fig. 68 Start *Fig. 69 Stop*

A 3.2.3 Signal Processing

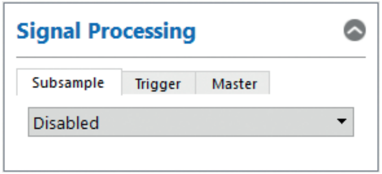


Fig. 70 Signal processing

You can select the following options for signal processing:

Data acquisition	Signal processing	*Subsample*	*Disabled*	*Deactivated; basic settings*
			Sample-based	*Number of samples is adjustable, every xth measurement is recorded.*
			Time-based	*Time-based; time can be set in milliseconds* [1]
		Trigger	*Disabled*	*Deactivated; basic settings*
			Continuous	*Manual trigger*
			One-shot (sample-based)	*Sample can be set; records the signal course according to the set samples; the more samples, the longer the course*
			One-shot (time-based)	*Milliseconds can be set; records the signal course according to the time set*
		Master	*Master now*	*Sets the master*, see Fig. 73.
			Reset	*Resets the master*

1) For example every 5000 ms: The signal course displayed is updated after this period has elapsed.

A 3.2.4 CSV Output

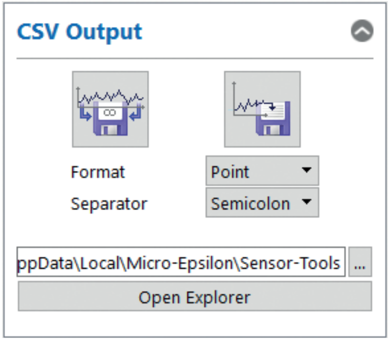


Fig. 71 CSV output

	➡ Click this button to start acquiring the measurement data.
Stop Protocol	➡ Click this button to stop recording.
	➡ Click this button to save the currently selected measurement value.
Cancel Snap	➡ Click this button to cancel the recording.

Measurement	CSV output	*Format*	*Point / Comma*
		Separator	*Comma / Semicolon / Tabulator*

	Fields with gray background require a selection.
	Fields with dark border require entry of a value.

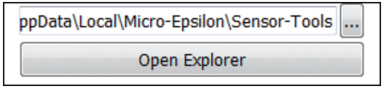


Fig. 72 Open explorer

Name	Color	Min	Max	Peak-to-peak	Mastering	Current Value	SI-Unit	Number of Digits
☑ DTA-5G8	■	4.149	9.442	5.294	☐	**1.480**	V	3
☑ DTA-5G8 Custom	■	-8.606	4.628	13.234	☐	**11.300**	mm	3

Name	Show or hide signal curves of the sensors used.
Color	Change the color settings of the single signal courses.
Mastering	By activating the `Mastering` checkbox you can manually enter the master value. `Master now` in the `Data Acquisition > Signal Processing` menu in the Master tab menu sets the master value, see Fig. 70.

Fig. 73 Depiction and description of data acquisition table

A 3.3 Single Value Menu

Fig. 74 Single value menu

Single value	Font size	*1 ... 30*		-
	Decimal places	*0 ... 6*		-
	Channel	*Sensor x user-defined scaled*	*V* / *mA*	*Selection of the output to be displayed. The outputs are set before in the* `Settings` *menu under* `Output / Output range` *and* `Adjustment`*.*
		Sensor x user-defined custom scaled	*mm*	

The following channel selection can be set:

- Output: Analog output (Output 1 / Channel), see Fig. 77.
- Adjustment: Two-point adjustment, see A 3.4.3.1 and zero point, see A 3.4.3.2

	Fields with gray background require a selection.
	Fields with dark border require entry of a value.

A 3.4 Menu Settings

A 3.4.1 General

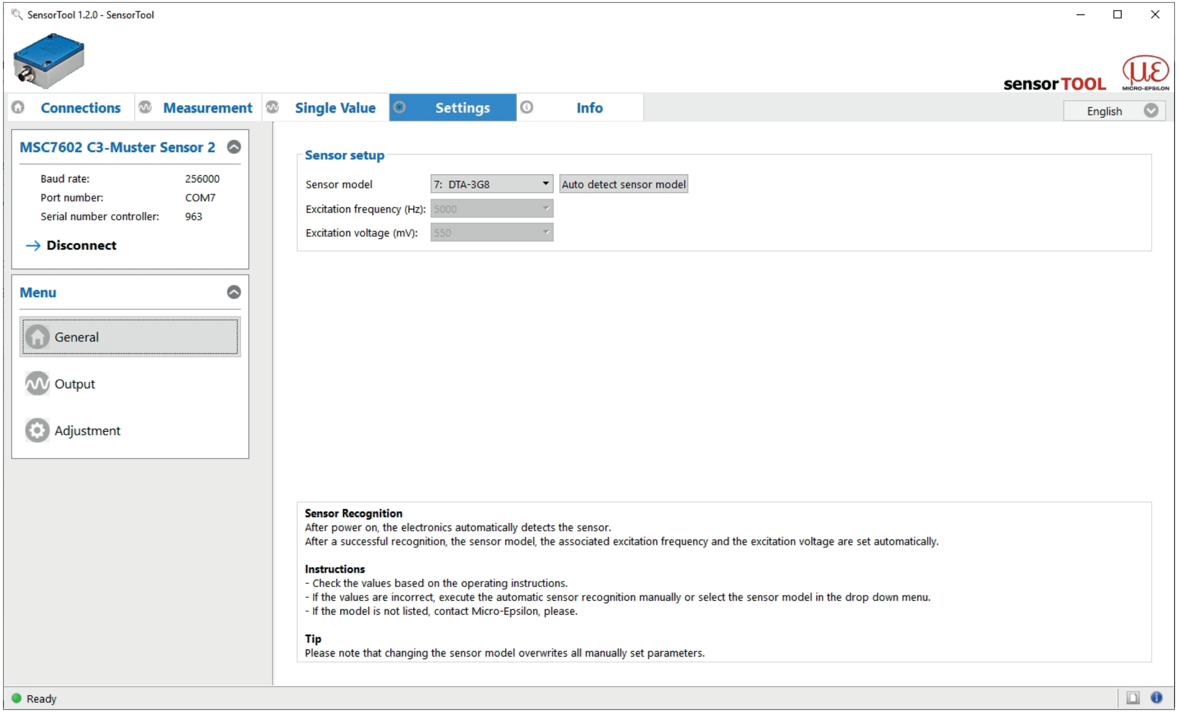


Fig. 75 View Settings - General

Sensor configu-ration	Sensor model	*1 - 6: DTA-xD oder 7 - 10: DTA-xG8* *127: user defined DTA* *129 - 131, 133: LDR-x* *132: LVP-25* *255: user defined LDR* *0: unknown sensor*	
		Automatic recognition of sensor model	
	Excitation frequency (Hz)	*1000 / 2000 / 5000 / 8000 / 9000 / 10000 / 12000 / 13000 / 16000 / 18000 / 21000 / 23000 / 25000*	*Only with user-defined sensor setting*
	Excitation voltage (mV)	*550 / 350 / 150 / 75*	

Three options for sensor recognition:
- Automatic sensor recognition
- Model setting
- User-specific sensor setting

Sensor recognition

After switching on, the controller automatically identifies the sensor.

After successful recognition, the sensor model, the associated excitation frequency and the excitation voltage are automatically set.

Check the values based on the operating instructions.

If the values are not correct, carry out the automatic sensor recognition manually or select the sensor model in the drop down menu.

If the sensor model is not listed in the drop down menu, please contact Micro-Epsilon.

i Please note that changing the sensor model overwrites all manually set parameters.

Fields with gray background require a selection.

Fields with dark border require entry of a value.

A 3.4.2 Output

After switching on, the controller automatically analyzes the output load.
Depending on the result, 4…20 mA or 2…10 V are automatically selected.
You can also set the output range manually via the drop down menu, see Fig. 77.

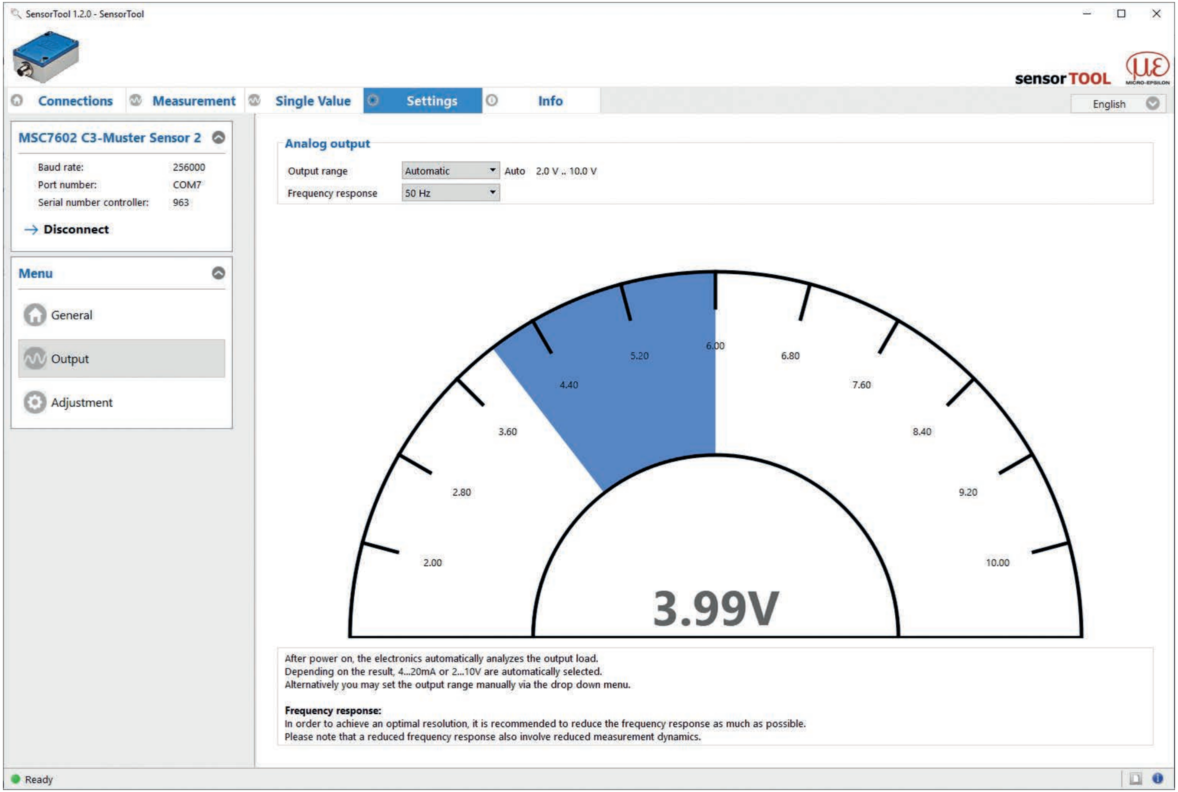


Fig. 76 View Settings - Output

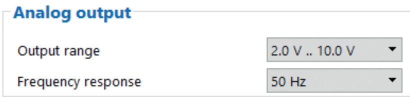


Fig. 77 Settings - Analog output

Analog output	Output range	*Automatic / 0.0 V .. 10.0 V / 2.0 V .. 10.0 V / 0.0 V .. 5.0 V / 0.5 V .. 4.5 V / 4.0 mA .. 20.0 mA / 0.0 mA .. 20.0 mA / 0.0 mA .. 10.0 mA*	Description, see 5.3.2
	Frequency response	*20 Hz / 50 Hz / 100 Hz / 200 Hz / 300 Hz*	-

Frequency response:

In order to achieve an optimal resolution, it is recommended to reduce the frequency response as much as possible.

i Please note that a reduced frequency response also involves a reduced measurement dynamic.

A 3.4.3 Adjustment

There are two possible settings in the `Adjustment` menu:

- Two-point
- Zero

(gray)	Fields with gray background require a selection.
(dark border)	Fields with dark border require entry of a value.

A 3.4.3.1 Two-Point

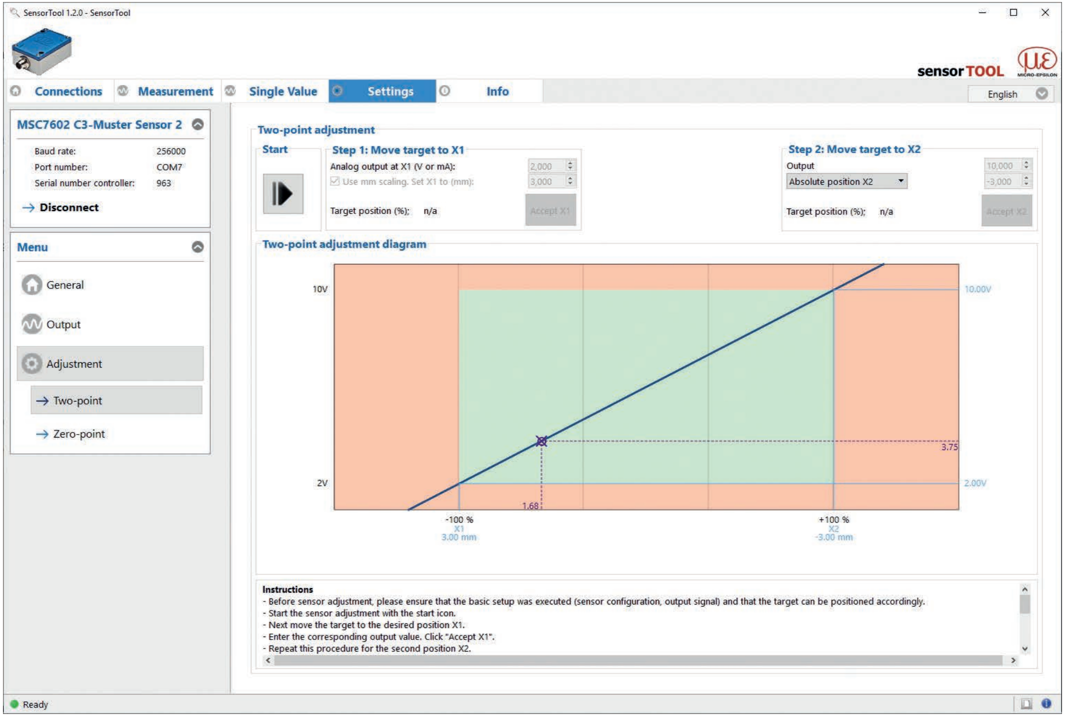


Fig. 78 View 1 Two-point adjustment

- Please make sure before the adjustment that the basic settings were carried out (sensor configuration, output signal) and that the target can be positioned accordingly.
- Start the sensor adjustment via the `Start` button.
- Then move the target to the desired position X_1.
- Enter the corresponding output value. Click `Accept` $_{X1}$.

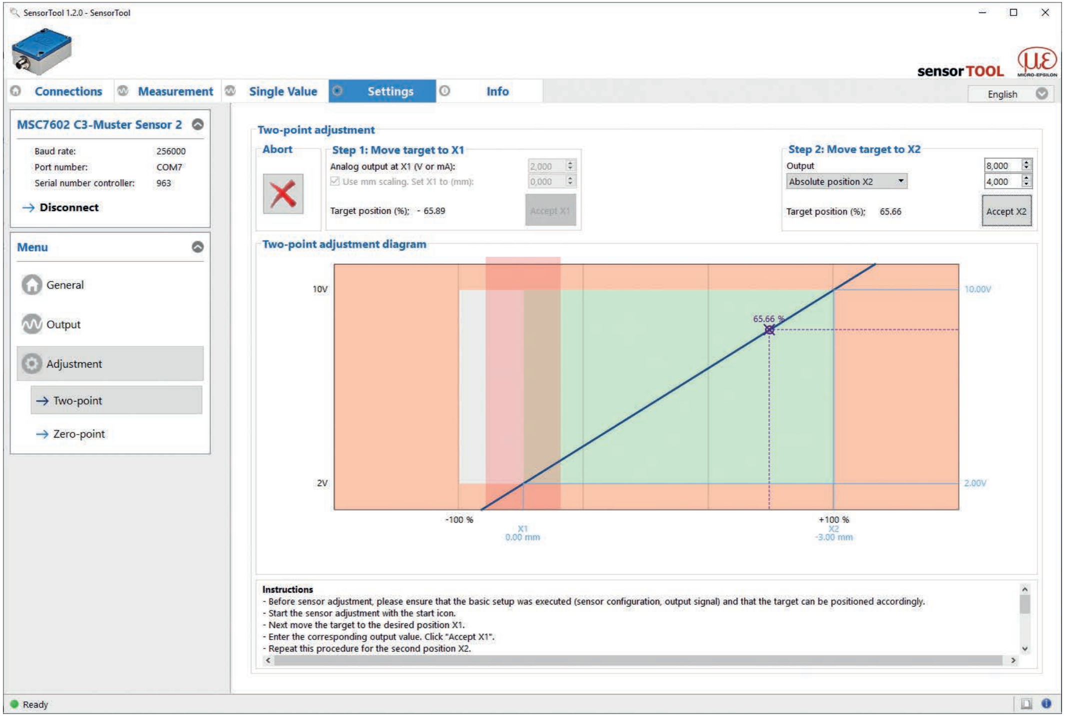


Fig. 79 View 2 Two-point adjustment

Repeat this process for the second position X_2.

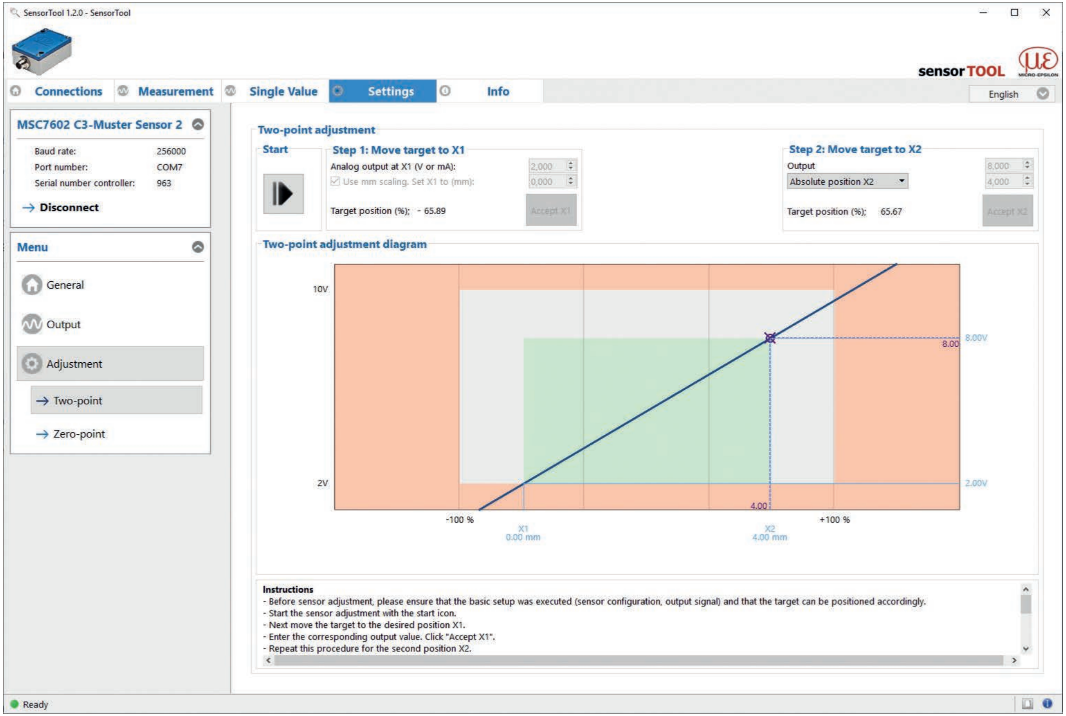


Fig. 80 View 3 Two-point adjustment

Optionally, you can enter the associated millimeter values which can be found under `Measurement` and the additional designation `Custom` [1].

1) Sensor designation, e.g., DTA-3G8 Custom

The chart is divided into 3 areas:

Green	Taught-in range, limited by X_1, X_2 and the associated output signals.
White	Usable range outside the taught-in range
Red	Unavailable range

A 3.4.3.2 Zero Point

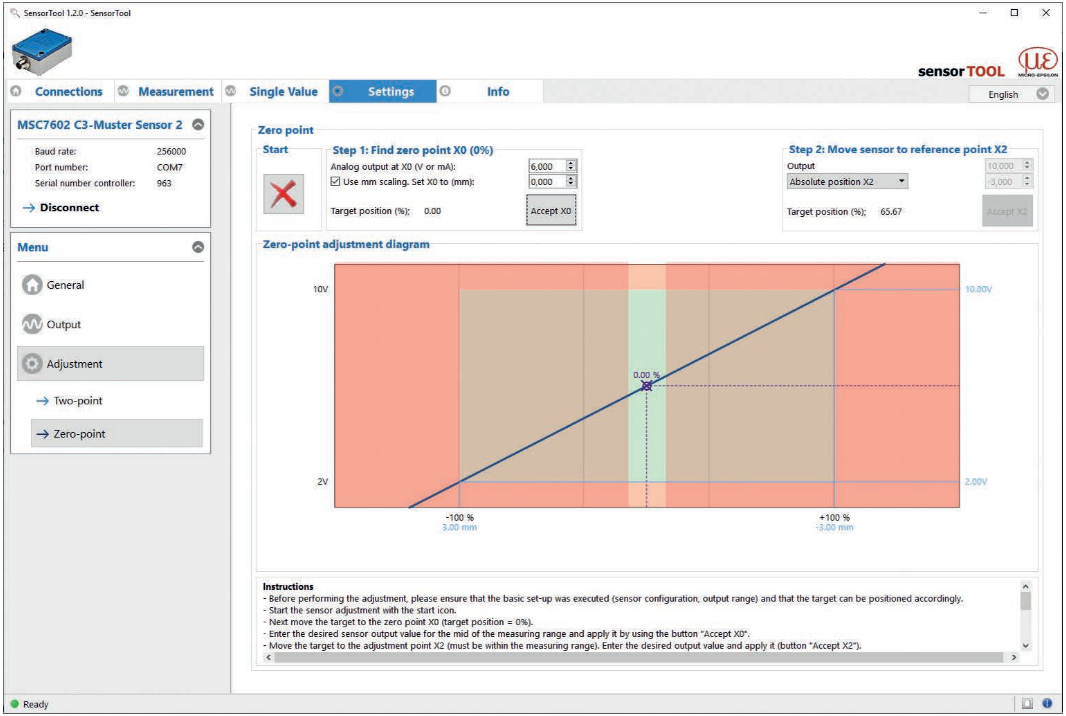


Fig. 81 View 1 Zero-point adjustment

- Please make sure before the adjustment that the basic settings were carried out (sensor configuration, output signal) and that the target can be positioned accordingly.
- Start the sensor adjustment via the `Start` button.
- Then move the target to the zero point X0 (target position = 0 %)
- Enter the desired output value for the midrange and accept it by clicking the button `Accept` X_0.

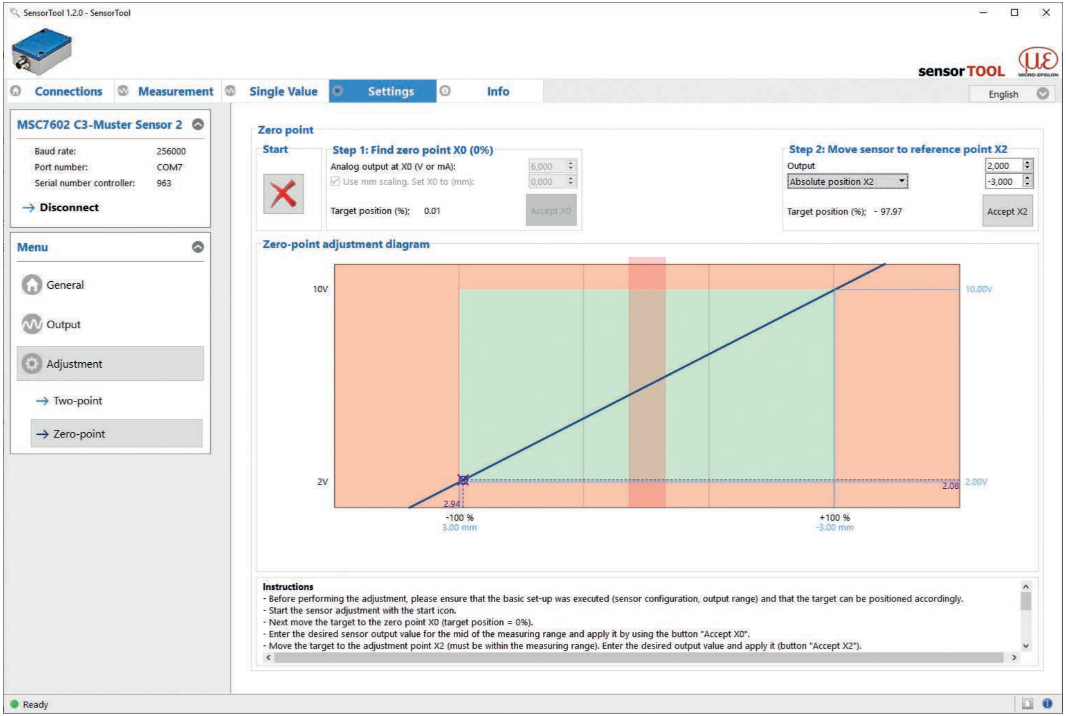


Fig. 82 View 2 Zero-point adjustment

➡ Now move the target inside the midrange to point X_2.

➡ Also enter the desired output value there and accept it by pressing the button `Accept X2`.

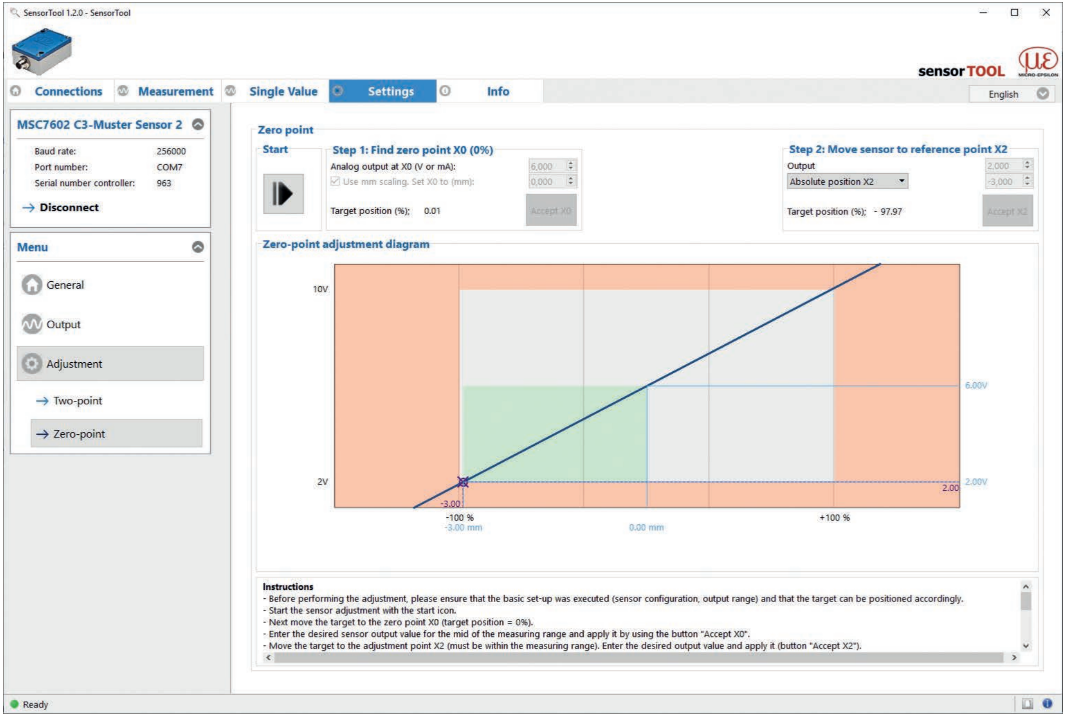


Fig. 83 View 3 Zero-point adjustment

The entire measuring range is now symmetrically arranged around the zero point.

i Optionally, you can enter the associated millimeter values which can be found under `Measurement` and the additional designation `Custom` [1].

The chart is divided into 3 areas:

Green	Taught-in range, limited by X_0, X_2 and the associated output signals.
White	Usable range outside the taught-in range
Red	Unavailable range

1) Sensor designation, e.g., DTA-3G8 Custom

A 3.5 Info Menu

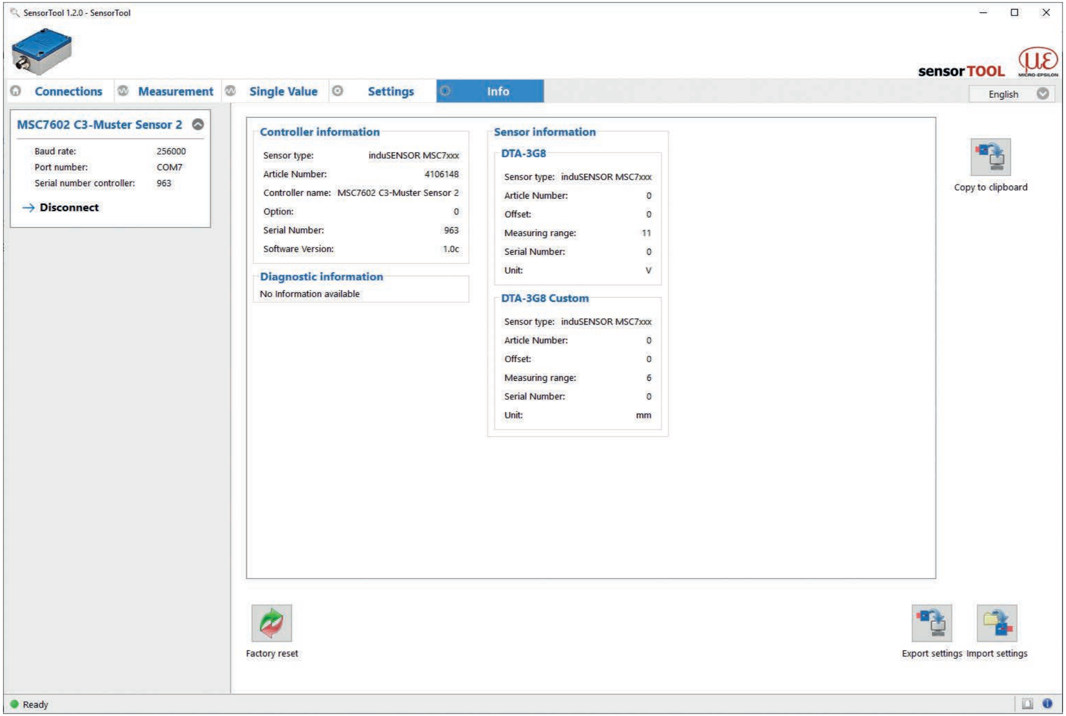


Fig. 84 View Info

This window provides the current overview of the controller information, sensor information, diagnostic information and the currently connected sensor.

By clicking the `Disconnect button` you return to the channel search.

Clicking the `Copy to clipboard` button copies the information and settings for the selected controller to the clipboard.

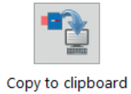


Fig. 85 Copy to clipboard button

By pressing the `Factory reset` button, you can restore the factory settings.

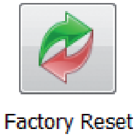


Fig. 86 Factory reset button

`Export settings` opens the explorer to store the setting values in a default file `*.csv` on the PC.

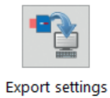


Fig. 87 Export settings button

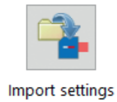


Fig. 88 Import settings button

`Import settings` opens the explorer to import the setting values from a default file *.csv on the PC.

A 4 Communication via RS485 Digital Interface

A 4.1 General

This manual describes how to obtain the digital measurement values from the induSENSOR MSC7xxx controller without using the MICRO-EPSILON sensorTOOL. Direct digital communication requires that the controller was set up before according to the manual.

To do so, you can use, e.g., the PC sensorTOOL and the IF7001/USB single-channel RS485/USB converter.

A 4.2 Hardware Configuration

Transmission technology: UART

Electrical level: RS485

Baud rate: 256,000 baud (optional: 9600 baud)

Data framing: Startbits: 1; Databits: 8; Parity: Even; Stopbits: 1

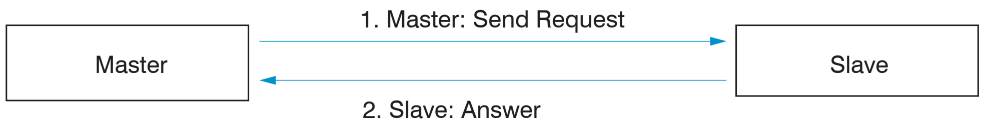


Fig. 89 Hardware configuration

A 4.3 Protocol

Name	Description	Format	Example
DA	Destination Address	1 byte	0x7E = Address: 126
SA	Source Address	1 byte	0x01 = Address: 1
New_Adr	New Address	1 byte	0x7C = Address: 124
FSC	Checksum	Sum without arithmetic overflow; mod 256	

Fig. 90 Protocol example

i DA and SA have to be different!

A 4.4 Commands

A 4.4.1 Identification

Send:	0x68	0x09	0x09	0x68	0x7E [1]	0x01 [2]	0x4C	0x30	0x33	0x5E	0x10	0x0	0x4A
	0xE6 [3]	0x16											
Receive:	0x68	0x53	0x53	0x68	0x01 [2]	0x7E [1]	0x08	0x33	0x30	0x5E	0x10	0x00	0x4A
	0x01	0x00	0x63	0x10	0xA1	0xA7	0x3E	0x00	0x00	0x00	0x00	0x00	0x00
	0x00	0x00	0x00	0xE8	0x03	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
	0x00	0x00	0x00	0x00	0x00	0x00	0x2E	0xB2	0x21	0x00	0x00	0x00	0x00
	0x00	0x4D	0x53	0x43	0x37	0x34	0x30	0x31	0x20	0x20	0x20	0x20	0x20
	0x20	0x20	0x20	0x20	0x20	0x20	0x20	0x20	0x20	0x20	0x20	0x20	0x20
	0x20	0x20	0x20	0x20	0x20	0x20	0x20	0x01	0x16	0x6E [4]	0x16		

Result:	**Description**	**Format**	**Example**
	Article number	Bytes 18 - 21: 4 bytes, uint32, little endian	4106145
	Serial number	Bytes 30 - 33: 4 bytes, uint32, little endian	1000
	Article description	Bytes 54 - 85: 32 bytes, ASCII	MSC7401

1) DA: 126
2) SA: 1
3) CH: Checksum Send: Bytes 5 - 13
4) CH: Checksum Receive: Bytes 5 - 87

A 4.4.2 Assign New Address

Send:	0x68	0x09	0x09	0x68	0x7E [1]	0x01 [2]	0x43	0x37	0x3E	0x7C [5]	0x00	0x00	0x00
	0xB3 [3]	0x16											
Receive:	0xE5												

Afterwards a reset is necessary. This can be done by sending the reset message or by disconnecting the controller from power supply.

1) DA: 126 → 5) DA new: 124
2) SA: 1
3) CH: Checksum Send: Bytes 5 - 13
4) -

A 4.4.3 Reset

Send:	0x68	0x09	0x09	0x68	0x7E [1]	0x01 [2]	0x4C	0x30	0x33	0x5E	0xB0	0x00	0x01
	0x3D [3]	0x16											
Receive:	0x68	0x0A	0x0A	0x68	0x01 [2]	0x7E [1]	0x08	0x33	0x30	0x5E	0xB0	0x00	0x01
	0x02 [4]	0xFB	0x16										

1) DA: 126
2) SA: 1
3) CH: Checksum Send: Bytes 5 - 13
4) CH: Checksum Receive: Bytes 5 - 13

A 4.4.4 Get Measuring Value

Send:	0x10	0x7E [1]	0x01 [2]	0x4C	0xCB [3]	0x16							
Receive:	0x68	0x0B	0x0B	0x68	0x01 [2]	0x7E [1]	0x08	0xAE	0x47	0x61	0x3F	0x00	0x00
	0x00	0x00	0x1C [4]	0x16									

Result:	**Description**	**Format**	**Example**
	Unscaled value	Bytes 8 - 11: 4 bytes, float, little endian	0x3F6147AE (float) = 0.88 V
	Scaled value	Bytes 12 - 15: 4 bytes, float, little endian	If this value is 0, the controller was not set up. Otherwise, the digital counterpart of the analog output will be sent according the setting you have done in the controller before.
	Maximum speed for data transmission (1x send + 1x receive): ~3 ms @ 256.000 Baud		

1) DA: 126
2) SA: 1
3) CH: Checksum Send: Bytes 2 - 4
4) CH: Checksum Receive: Bytes 5 - 15

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