**MICRO-EPSILON**

# More Precision
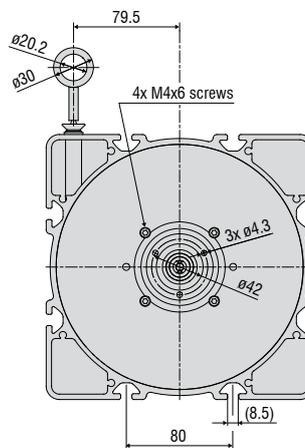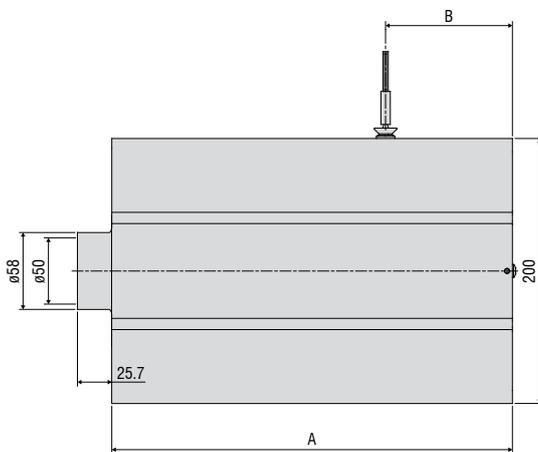
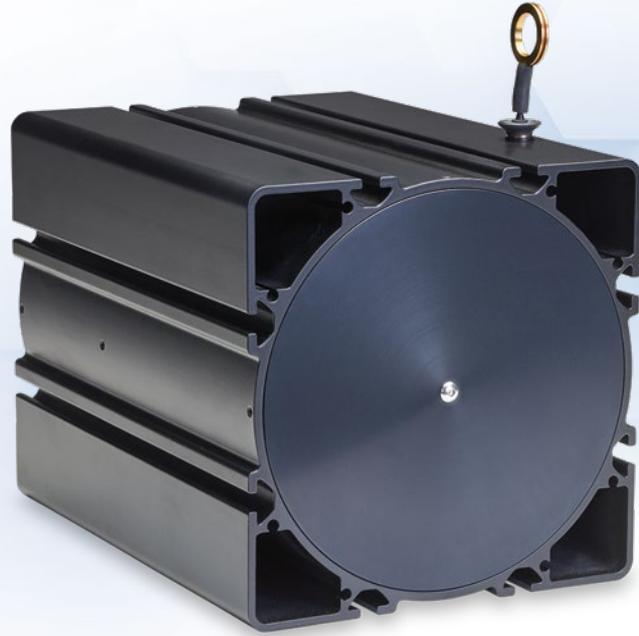**wireSENSOR** // Draw-wire displacement sensors

# Draw-wire long-range sensors
## wireSENSOR P200 digital

Robust aluminum profile housing

Customer-specific designs

Absolute or incremental encoder
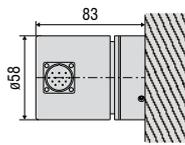
| Measuring range (mm) | A (mm) | B (mm) |
|---|---|---|
| 30000 | 268 | 75 |
| 40000 | 300 | 95 |
| 50000 | 333.5 | 95 |

**HTL/TTL output**
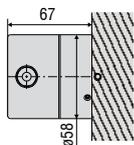
**SSI output**

**CO / PB / PN / ENIP / CAT output**
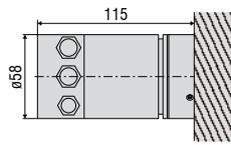
All dimensions in mm, not to scale

| Model | WDS-30000-P200 | WDS-40000-P200 | WDS-50000-P200 |
|---|---|---|---|
| Measuring range | 30000 mm | 40000 mm | 50000 mm |
| Digital interface [1] | PROFINET, Profibus DP, CANopen, EtherNet/IP, EtherCAT | | |
| Digital output [1] | HTL, TTL, SSI | | |
| Resolution      HTL, TTL | 0.167 mm (6 pulses/mm) | | |
| Resolution      SSI, PROFINET, Profibus DP, CANopen, EtherNet/IP, EtherCAT | 0.061 mm | | |
| Linearity      ≤ ±0.01% FSO | ≤ ±3 mm | ≤ ±4 mm | ≤ ±5 mm |
| Sensor element | Incremental/absolute encoder | | |
| Wire extension force (max.) | approx. 22 N | approx. 22 N | approx. 24 N |
| Wire retraction force (min.) | approx. 12 N | approx. 11 N | approx. 11 N |
| Wire acceleration (max.) | approx. 2 g | | |
| Material      Housing | Aluminum | | |
| Material      Measuring wire | Polyamide-coated stainless steel (ø 0.8 mm) | | |
| Wire mounting | Eyelet (ø 20.2 mm) | | |
| Mounting | Mounting grooves on the sensor housing | | |
| Temperature range      Storage | -20 … +80 °C | | |
| Temperature range      Operation | -20 … +80 °C | | |
| Connection      HTL, TTL | integrated cable, radial, length 1 m | | |
| Connection      SSI | 12-pin flange connector, radial | | |
| Connection      PROFINET, Profibus DP, CANopen, EtherNet/IP, EtherCAT | Bus cover | | |
| Shock (DIN EN 60068-2-27) | 50 g / 10 ms in 3 axes, 1000 shocks each | | |
| Vibration (DIN EN 60068-2-6) | 20 g / 20 … 2000 Hz in 3 axes, 10 cycles each | | |
| Protection class (DIN EN 60529) | IP65 [2] | | |
| Weight | Approx. 10 kg | approx. 11 kg | approx. 12 kg |

FSO = Full Scale Output
[1] Specifications for digital outputs from page 59 onwards.
[2] With plug version only when connected

## Article designation

| WDS - | 30000 - | P200 - | CR - | TTL |
|---|---|---|---|---|

Output:
HTL
TTL
CO: CANopen
PB: Profibus DP
SSI: Gray Code
PN: PROFINET
ENIP: EtherNet/IP
CAT: EtherCAT

Connection:
SR (with SSI output): radial plug
CR (with HTL, TTL output): integrated cable, radial, 1 m
BH (with CO, PB, PN, ENIP, CAT output): bus cover
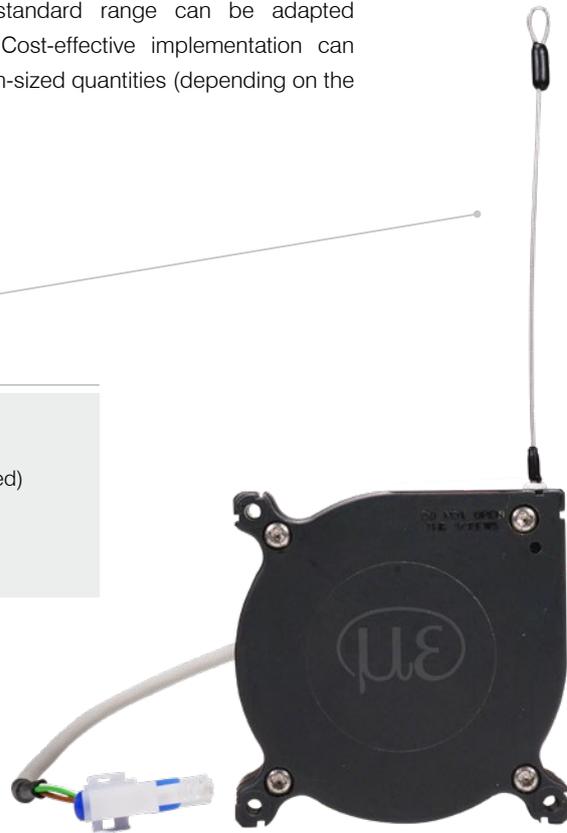
P200 series

Measuring range in mm

# Options
## wireSENSOR

**Customer-specific modifications for your series application**

If the standard models do not meet certain specific requirements, draw-wire sensors from the standard range can be adapted accordingly by Micro-Epsilon. Cost-effective implementation can already be achieved with medium-sized quantities (depending on the type and number of changes).

**Wire attachment**
- Wire clip
- Eyelet
- Thread
- Wire extension

**Measuring wire**
- Plastics
- Stainless steel (coated/uncoated)
- Different diameters
- Thicker wire for improved snap protection

**Connection/Output signal**
- Different cable lengths
- Different plug variants
- Redundant sensor element
- Adaption of supply voltage
- Inverted signal
- Redundant signal outputs
- Alignment cable/connector outlet

**Sensor mounting**
- Mounting bracket
- Mounting plate
- Magnetic holder

**Wire guide**
- Wire wiper
- Different designs of integrated deflection
  pulleys
- Wire outlet socket from ceramics for increased
  diagonal pull up to 15°

**Housing and environment**
- Wire outlet right (standard) / left
- Protection class up to IP69K
- Drainage holes
- Stainless steel spring
- Housing material
- Wire acceleration
- Snap protection

\* Some options cannot be combined with each other;
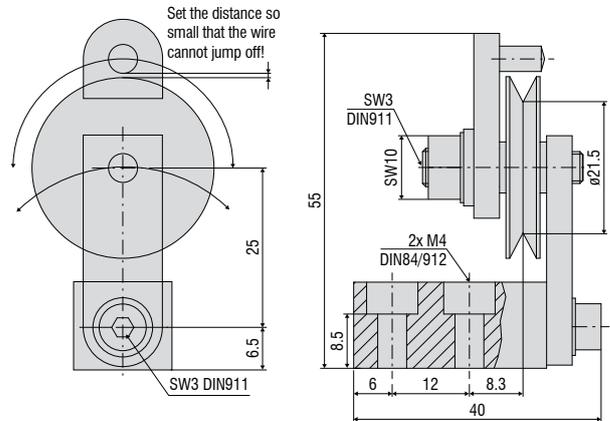  availability of options on request

# Accessories
# wireSENSOR
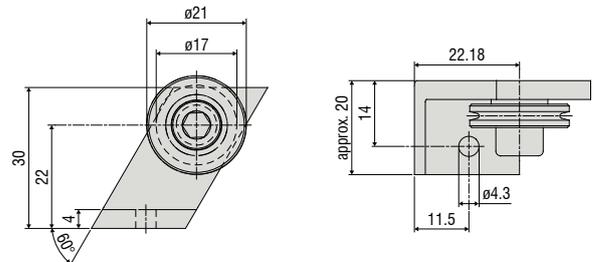
## Wire deflection pulleys for external installation

**TR1-WDS**
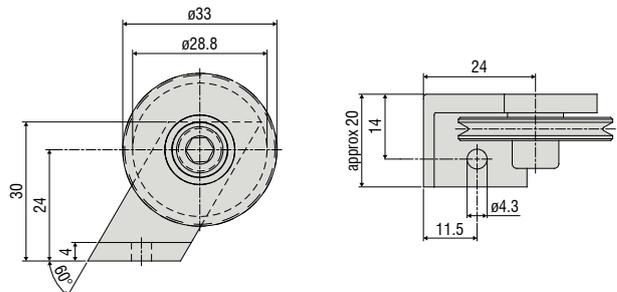Wire deflection pulley, adjustable, for sensors with a wire diameter ≤ 0.45 mm

Set the distance so small that the wire cannot jump off!

SW3 DIN911

SW10

SW3 DIN911

2x M4 DIN84/912

ø21.5

55

25

6.5

8.5

6    12    8.3

40

**TR3-WDS**
Wire deflection pulley, fixed, for sensors with a wire diameter ≤ 0.45 mm

ø21
ø17

30
22
4
60°

22.18
14
approx. 20
ø4.3
11.5

**TR4-WDS**
Wire deflection pulley, fixed, for sensors with a wire diameter of 0.8 mm to 1 mm

ø33
ø28.8

30
24
4
60°

24
14
approx. 20
ø4.3
11.5

## Wire deflection pulley for direct installation on the sensor housing

**TR5-WDS**
Integrated wire deflection pulley for P115 sensors with a wire diameter of 0.45 mm

max 105°
ø24

Screw locked with Loctite 638

23

M6

39

6°  3°
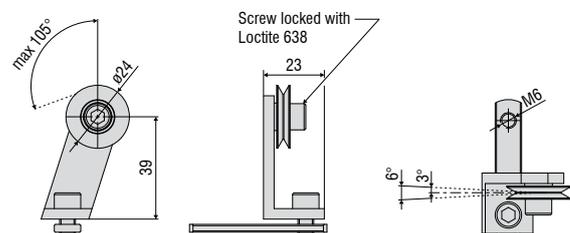
All dimensions in mm, not to scale

**TR5-WDS(03)**
Integrated double deflection pulley for P115 sensors with a wire diameter of 0.45 mm

Screw locked with Loctite 638

2x ø21
77.5±0.5
67
39
40.1±0.5
52
23
approx. 16
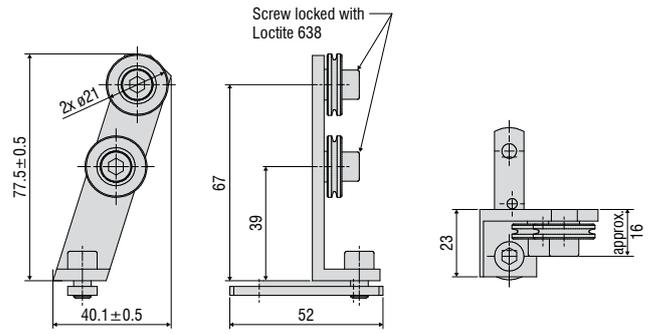
**TR5-WDS(04)**
Integrated double deflection pulley, 90° angled, for P115 sensors with a wire diameter of 0.45 mm
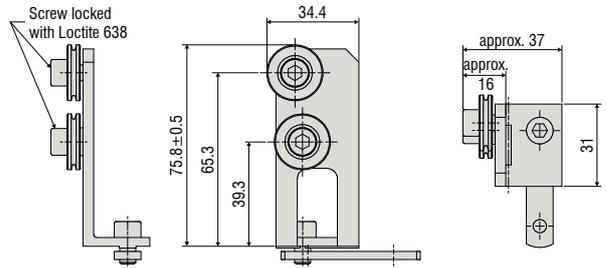
Screw locked with Loctite 638

34.4
75.8±0.5
65.3
39.3
approx. 37
approx. 16
31

**TR6-WDS(01)**
Integrated wire deflection pulley for the P115 sensors with a wire diameter of 1 mm

60°
16
9
Screw DIN912 M6x10
33
15
ø45
ø34.1±0.1
40
20
R0.5
8

## Mounting bracket set

46
39.5
4x ø2.9
57.5
39.5
1.5
(15)
10
35.6
2x ø5.3

WPS-MB46
for the MK46 series
(Output types: P10/P25/E/E830)

77
67
50
86.5
67
50
4x ø3.2
4x ø3.2
101
12.5
(20)
15
85.7
2x ø5.6

WPS-MB77
for the MK77 series

90
78
97
78
4x ø4.2
135
2
(20)
12
120.1
2x ø6.5

WPS-MB88
for the MK88 series
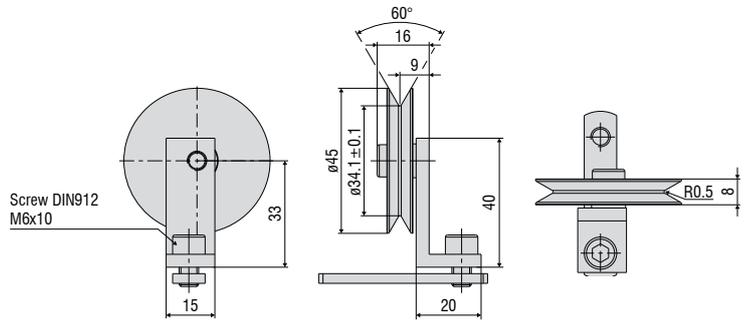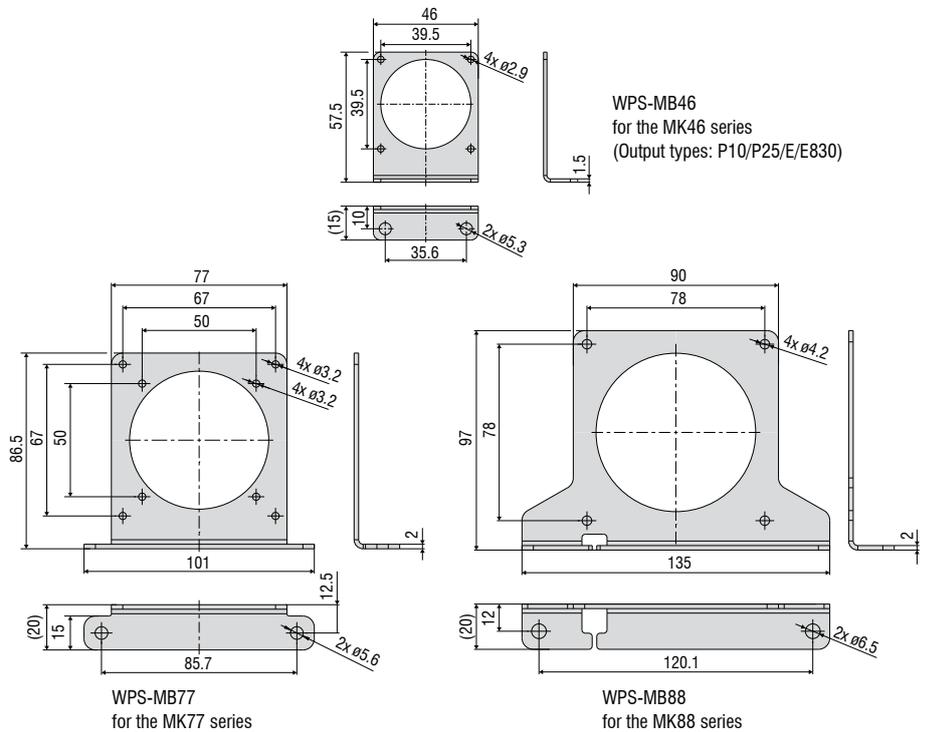
# Accessories & Notes for installation
## wireSENSOR

### Accessories

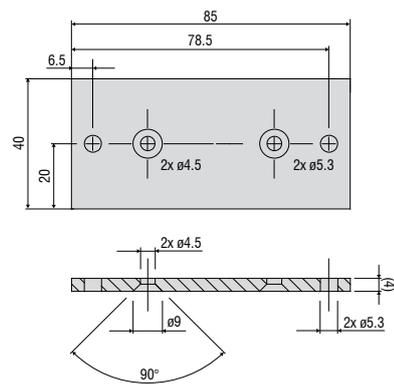| | |
|---|---|
| WE-xxxx-M4 | Wire extension with M4 wire connection, x=wire length |
| WE-xxxx-Clip | Wire extension with eyelet, x = wire length |
| WE-xxx-Clip-WSS | Wire extension with clip and uncoated wire d=0.45 mm |
| WE-xxxx-Ring-PW | Wire extension with plastic ring and para-aramid wire, 1 mm |
| GK1-WDS | Fork head for M4 |
| MH1-WDS | Magnetic holder for wire attachment |
| MH2-WDS | Magnetic holder for sensor mounting |
| MT-60-WDS | Mounting clamps for WDS-P60 |
| FC8 | Mating plug for WDS straight, 8-pin |
| FC8/90 | Mating plug, 90° angled for WDS |
| PC3/8-WDS | Sensor cable, 3 m long, for WDS with 8-pin cable connector |
| WDS-MP60 | Mounting plate for P60 models |
| WPS-MB46 | Mounting bracket set for the MK46 series (output type: P10/P25/E/E830) |
| WPS-MB77 | Mounting bracket set for the MK77 series |
| WPS-MB88 | Mounting bracket set for the MK88 series |
| PC2/10-WDS-A | Cable for SSI encoder, 2 m long |
| PC10/10-WDS-A | Cable for SSI encoder, 10 m long |
| PC5/5-IWT | Sensor cable, 5 m long, M12x1 connector, 5-pin, A-coding |

**Example application with accessories**



**MT-60-WDS**
Mounting clamps

**MH1-WDS**
Magnetic holder

**WE-x-Clip**
Wire Extension

**TR3-WDS**
Deflection pulley, fixed

**TR1-WDS**
Deflection pulley, adjustable

Measurement displacement

---
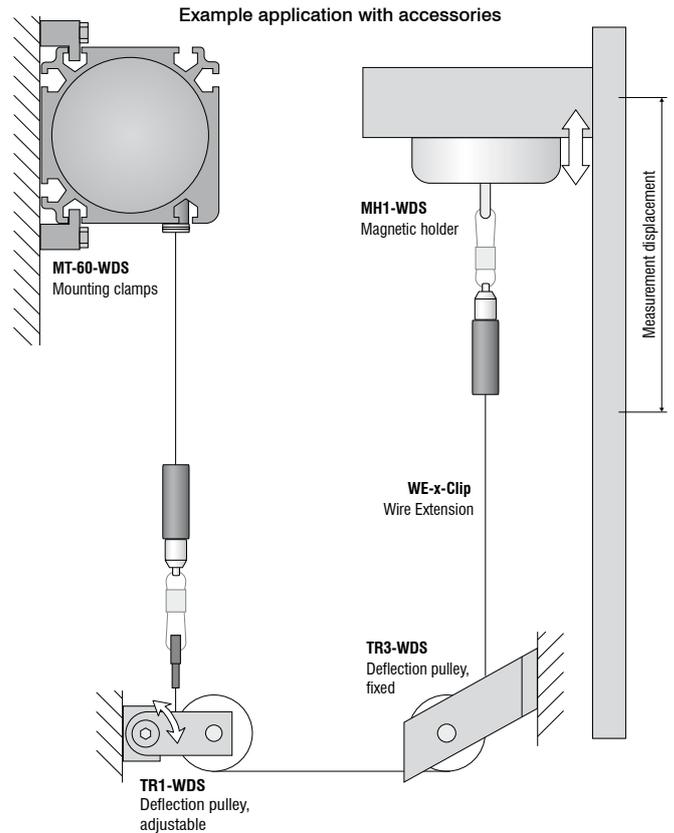
**WDS-MP60**
Mounting plate for P60 models





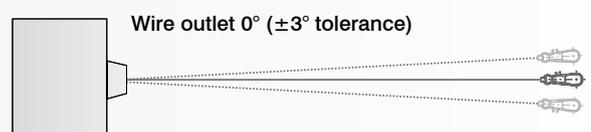All dimensions in mm, not to scale

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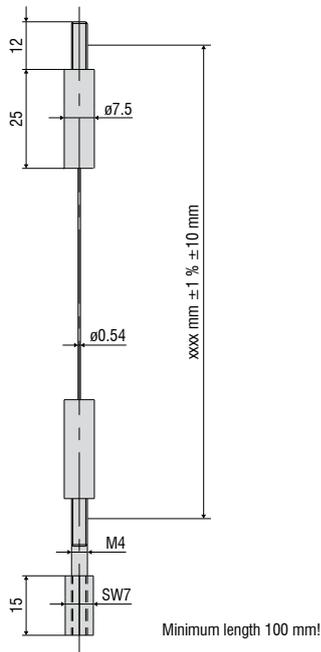**Installation instructions:**

Wire attachment: during installation, do not allow at any time the measuring wire to freely return.

Angle of wire outlet: Make sure during installation that the wire outlet is straight (tolerance of ±3°). Exceeding this tolerance leads to increased wear of the wire material and on the wire outlet.

**Wire outlet 0° (±3° tolerance)**

**WE-xxxx-M4**
Wire extension with M4 wire connection, x=wire length

12

25

ø7.5

ø0.54

xxx mm ±1 % ±10 mm

M4

15

SW7

Minimum length 100 mm!

**WE-xxxx-Clip**
Wire extension with eyelet, x = wire length

9.5

1

40

25

ø7.5

xxxx mm ±1 % ±10 mm

ø0.45

18

ø3

Eyelet
2 mm thick

ø4

9

Minimum length 120 mm!

---

**MH1-WDS**
Magnetic holder for wire attachment

6 ±0.5

2 ±1

25 ±2

31 ±2

10.5

ø50

**MH2-WDS**
Magnetic holder for sensor mounting

M4

8

8

ø40

---

**GK1-WDS**
Fork head for M4

21

16

8

M4

4

8

8

4

ø8

**MT-60-WDS**
Mounting clamps for WDS-P60

86

75

10

SW7

20

## Analog

| Output | | Connector M16 -SA / -SR | Integrated cable -CA / -CR | Open contacts |
|---|---|---|---|---|
| **Potentiometer output (P)** | | | | |
| Input voltage | max. 32 VDC with 1 kOhm / max. 1 W | | | |
| Resistance | 1 kOhm ±10 % (resistance divider) | | | |
| Temperature coefficient | ±0.0025 % FSO/°C | Sensor side<br><br>1 = Input +<br>2 = Ground<br>3 = Signal | White = Input +<br>Brown = Ground<br>Green = Signal | 1 = Input +<br>2 = Signal<br>3 = Ground |

| Output | | Connector M16 -SA / -SR | Integrated cable -CA / -CR | Open contacts |
|---|---|---|---|---|
| **Voltage output (U)** | | | | |
| Supply voltage | 14 ... 27 VDC (non-stabilized) | | | |
| Current consumption | max. 30 mA | | | |
| Output voltage | 0 ... 10 VDC<br>Option 0 ... 5 / ±5 V | | | |
| Load resistance | >5 kOhm | | | |
| Output noise | 0.5 mV$_{eff}$ | | | |
| Temperature coefficient | ±0.005 % FSO/°C | | | |
| Electromagnetic compatibility (EMC) | EN 61000-6-4<br>EN 61000-6-2 | Sensor side | | |
| **Adjustment range** (if supported by the model) | | 1 = Power supply<br>2 = Ground<br>3 = Signal<br>4 = Ground | White = Supply<br>Brown = Ground<br>Green = Signal<br>Yellow = Ground | |
| Zero | ±20 % FSO | | | |
| Sensitivity | ±20 % | | | |

| Output | | Connector M16 -SA / -SR | Integrated cable -CA / -CR | Open contacts |
|---|---|---|---|---|
| **Current output (I)** | | | | |
| Supply voltage | 14 ... 27 VDC (non-stabilized) | | | |
| Current consumption | max. 35 mA | | | |
| Output current | 4 ... 20 mA | | | |
| Load | <600 Ohm | | | |
| Output noise | <1.6 μA$_{eff}$ | | | |
| Temperature coefficient | ±0.01 % FSO/°C | | | |
| Electromagnetic compatibility (EMC) | EN 61000-6-4<br>EN 61000-6-2 | Sensor side | | |
| **Adjustment range** (if supported by the model) | | | | |
| Zero | ±18 % FSO | 1 = Power supply<br>2 = Ground | White = Supply<br>Brown = Ground | |
| Sensitivity | ±15 % | | | |
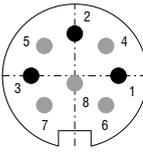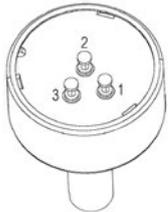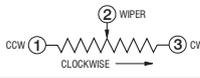
# CANopen
## (for the MK88 and K100 series)

| CANopen features | |
|---|---|
| Profiles | Communication profile CiA 301. Device profile CiA 406 (absolute linear encoder) |
| SDO | 1x SDO server |
| PDO | 2x TxPDO |
| PDO modes | Event/time-triggered, synchronous (cyclic/acyclic) |
| Preset value | The "Preset" parameter can be used to set the current measured value to any value. The difference from the original value is stored in the object. |
| Direction | Via the operating parameter, the counting direction of the measured values can be reversed |
| Diagnosis | Heartbeat, Emergency Message |
| Default setting | AutoBaud(9), Node-ID 1 |

| Setting the baud rate | |
|---|---|
| Baud rate adjustable via LSS or object 0x3001 | |
| 0 | 1000 kBaud |
| 2 | 500 kBaud |
| 3 | 250 kBaud |
| 4 | 125 kBaud |
| 6 | 50 kBaud |
| 9 | AutoBaud (default) |

| Description of the connections | |
|---|---|
| Pin | Assignment |
| 1 | n. c. |
| 2 | V+ (7…32VDC) |
| 3 | GND |
| 4 | CAN-High |
| 5 | CAN-Low |

5-pin
housing connector
View on pin side
A-coded

| Setting the subscriber address (node ID) |
|---|
| Address adjustable via LSS or object 0x3000 (1....127, 1=default) |

# Output specifications
**wireSENSOR**

## CANopen
(for P60, P96, P115 and P200 series)

### CANopen features

| CANopen features | |
|---|---|
| Bus protocol | CANopen |
| Device profile | CANopen - CiA DSP 406, V 3.0 |
| CANopen features | Device class 2, CAN 2.0B |
| Operating modes (with SDO progr.) | Polling mode (asynch, via SDO) Cyclic mode (asynch-cyclic). The encoder cyclically transmits the current actual process value without a request by a master. The cycle time can be parameterized for values between 1 and 65,535 ms. Synch mode (synch-cyclic). The encoder transmits the current actual process value after receiving a synch telegram sent by a master. The synch counter in the encoder can be parameterized such that the position value is transmitted only after a defined number of synch telegrams. Acyclic mode (synch-acyclic) |
| Preset value | With the "Preset" parameter the encoder can be set to a desired actual process value that corresponds to the defined axis position of the system. The offset value between the encoder zero point and the mechanical zero point of the system is saved in the encoder. |
| Rotary direction | With the operating parameter the rotary direction in which the output code is to increase or decrease can be parameterized. |
| Scaling | The steps per rotation and the total revolution can be parameterized. |
| Diagnosis | The encoder supports the following error messages: - Position and parameter errors - Lithium cell voltage at lower limit value (multi-turn) |
| Default setting | 50 kbit/s, node number 1 |

### Setting the CANopen baud rate

| Baud rate | DIP switch setting | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| 10 kBit/s | OFF | OFF | OFF |
| 20 kBit/s | OFF | OFF | ON |
| 50 kBit/s | OFF | ON | OFF |
| 125 kBit/s | OFF | ON | ON |
| 250 kBit/s | ON | OFF | OFF |
| 500 kBit/s | ON | OFF | ON |
| 800 kBit/s | ON | ON | OFF |
| 1 MBit/s | ON | ON | ON |

### Description of the CANopen connections

| Description of the CANopen connections | |
|---|---|
| CAN_L | CAN bus signal (dominant Low) |
| CAN_H | CAN bus signal (dominant High) |
| V+ | Supply voltage 10 ... 30 VDC |
| GND | Ground connection for V+ |

(Terminals with the same designation are internally interconnected)

### Settings of the CANopen participant address

Address can be set with rotary switch. Example: Participant address 23
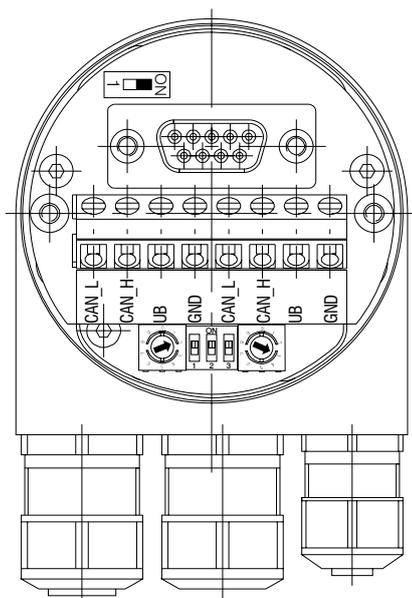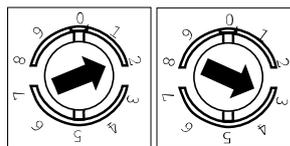




Setting of the terminating resistor CANopen

ON = Last participant

OFF = Participant X

# SSI (Gray Code)

| Connections | |
|---|---|
| 1 V+ | Supply connection of rotary encoder |
| 2 GND | Ground connection of rotary encoder<br>The voltage drawn to GND is V+ |
| 3 Pulses + | Positive SSI clock input. Pulse + forms a current loop with Pulse -. A current of approx. 7 mA in direction of Pulse + input generates a logical 1 in positive logic. |
| 4 data + | Positive, serial data output of the differential line driver. A high level at the output corresponds to logical 1 in positive logic. |
| 5 ZERO | Zero-setting input for setting a zero point at any point within the total resolution.<br>The zeroing process is triggered by a High pulse (pulse duration ≥100 ms) and must take place after the rotating direction selection (F/R).  For maximum interference immunity, the input must be connected to GND after zeroing. |
| 6 Data - | Negative, serial data output of the differential line driver. A high level at the output corresponds to logical 0 in positive logic. |
| 7 Pulses - | Negative SSI clock input. Pulse - forms a current loop with Pulse +. A current of approx. 7 mA in direction of the clock input generates a logical 0 in positive logic. |
| 8 / 10<br>$\overline{\text{DATAVALID}}$<br>$\overline{\text{DATAVALID}}$ $\overline{\text{MT}}$ | Diagnosis outputs DV and DV MT Jumps in data word, e.g., due to defective LED or photo receiver, are displayed via the DV output. In addition, the power supply of the multi-turn sensor unit is monitored and  the DV MT output is set when the voltage falls below a specified level. Both outputs are low-active, i.e. are switched through to GND in the event of an error. |
| 9 F/R | Forward/reverse counting direction input. When not connected, this input is on High. F/R High means increasing output data with a clockwise rotating shaft when looking at the flange. F/R Low means increasing values with a counterclockwise rotating shaft when looking at the flange. |
| 11 / 12 | Not assigned |

| Pin assignment | | |
|---|---|---|
| Connector | Cable color | Assignment |
| 1 | brown | V+ |
| 2 | black | GND |
| 3 | blue | Pulse + |
| 4 | beige | Data + |
| 5 | green | ZERO |
| 6 | yellow | Data - |
| 7 | purple | Pulse - |
| 8 | brown-yellow | $\overline{\text{DATAVALID}}$ |
| 9 | pink | F/R |
| 10 | black-yellow | $\overline{\text{DATAVALID}}$ $\overline{\text{MT}}$ |
| 11 | - | - |
| 12 | - | - |
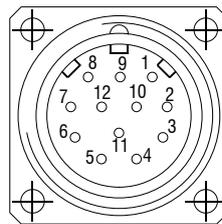


Use twisted-pair cables as extension cables.

| Inputs | |
|---|---|
| Control signals F/$\overline{\text{R}}$ and zero | |
| High level | > 0.7 V+ |
| Low level | < 0.3 V+ |
| Circuitry | F/$\overline{\text{R}}$ input with 10 kOhm against V+,<br>Zero-setting input with 10 kOhm against GND. |
| SSI clock | |
| Optocoupler inputs for galvanic isolation | |

| Outputs | | |
|---|---|---|
| SSI data | RS485 driver | |
| Diagnosis outputs | | |
| Push-pull outputs, short circuit proof | | |
| High level | > V+ -3.5 V | (with I = -20 mA) |
| Low level | ≤ 0.5 V | (with I = 20 mA) |

# PROFIBUS

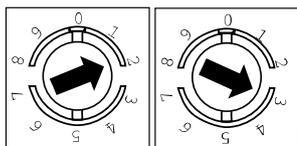| Profibus DP features | |
| --- | --- |
| Bus protocol | Profibus DP |
| Profibus features | Device class 1 and 2 |
| Data Exch. Functions | Input: Position value<br>Additional configurable speed signal<br>(output of the current rotary speed)<br>Output: Preset value |
| Preset value | With the "Preset" parameter the encoder can be set to a desired actual value that corresponds to the defined axis position of the system. |
| Parameter functions | Rotary direction: With the operating parameter the rotary direction for which the output code is to increase or decrease can be parameterized.<br>Scaling: The steps per rotation and the total revolution can be parameterized. |
| Diagnosis | The encoder supports the following error messages:<br>- Position error<br>- Lithium cell voltage at lower limit value<br>  (multi-turn) |
| Default setting | Participant address 00 |
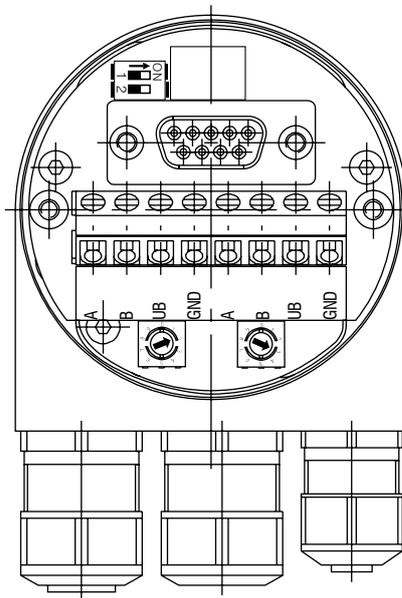


Setting of the terminating resistor Profibus DP



ON = Last participant
OFF = Participant X

| Settings of the Profibus participant address |
| --- |
| Address can be set with rotary switch. Example: Participant address 23 |



| Profibus DP connections |
| --- |
| A Negative serial data line |
| B Positive serial data line |
| V+ supply voltage 10 ... 30 VDC |
| GND ground connection for V+ |
| (Terminals with the same designation are internally interconnected) |

# PROFINET

**PROFINET features**

| Bus protocol | PROFINET |
|---|---|
| Device profile | Encoder profile PNO 3.162 Version 4.1 |
| Features | - 100 MBaud Fast Ethernet<br>- Automatic address assignment<br>- Real-time (RT) Class 1, IRT Class 2, IRT Class 3 |
| Process data | - Position value 32-Bit input data<br>  with/without rotational speed 16/32 Bit<br>- Telegram 81-83 of the Profidrive profile |
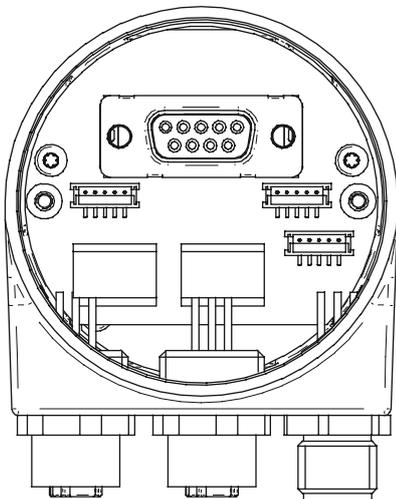
**Pin assignment**

Supply voltage

| Connector | Connection | Description |
|---|---|---|
| Pin 1 | V+ | Supply voltage |
| Pin 2 | N.C. | Not assigned |
| Pin 3 | GND | Ground connection |
| Pin 4 | N.C. | Not assigned |
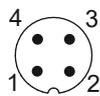
1x M12 connector (pin), A-coded

**PROFINET (data line)**

| Connector | Connection | Description |
|---|---|---|
| Pin 1 | TxD+ | Transmitted data+ |
| Pin 2 | RxD+ | Received data+ |
| Pin 3 | TxD- | Transmitted data- |
| Pin 4 | RxD- | Received data- |
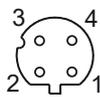
1x M12 connector (pin), A-coded

# Output specifications
**wireSENSOR**

## EtherNet/IP

| Characteristics - EtherNet/IP | |
|---|---|
| Bus protocol | EtherNet/IP |
| Device profile | Encoder Device, Type22hex, according to CIP specification |
| Features | - 100 MBaud Fast Ethernet<br>- Programmable IP address<br>- Automatic IP address assignment (DHCP)<br>- Direction of rotation, resolution, total resolution and preset programmable according to CIP specification |
| Process data | Position value, warning flag, alert flag<br>Assembly Instances 1 and 2 according to CIP specification |
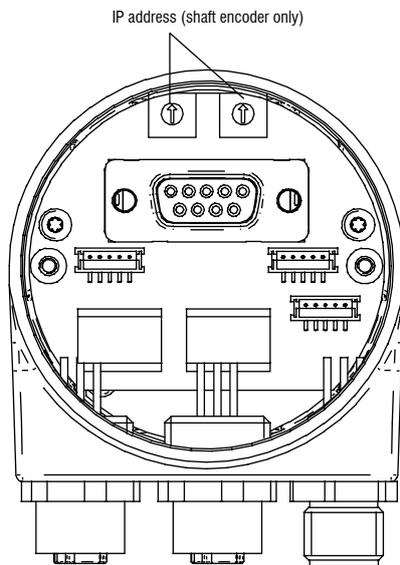
IP address (shaft encoder only)



### Pin assignment

**Supply voltage**

| Connector | Connection | Description |
|---|---|---|
| Pin 1 | UB | Supply voltage |
| Pin 2 | N.C. | Not assigned |
| Pin 3 | GND | Ground connection |
| Pin 4 | N.C. | Not assigned |



1x M12 connector (pin), A-coded

**EtherNet/IP (data line)**

| Connector | Connection | Description |
|---|---|---|
| Pin 1 | TxD+ | Transmitted data+ |
| Pin 2 | RxD+ | Received data+ |
| Pin 3 | TxD- | Transmitted data- |
| Pin 4 | RxD- | Received data- |



2x M12 connectors (socket), D-coded

### IP address

Adjustable via HEX rotary switch. Example: IP address B5$_{hex}$
Configuration via DHCP: 00hex
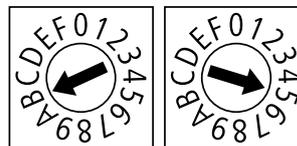
# EtherCAT

| Characteristics - EtherCAT | |
|---|---|
| Bus protocol | EtherCAT |
| Device profile | CoE (CANopen over EtherCAT) DSP406 |
| Features | - 100 MBaud Ethernet<br>- Automatic address assignment<br>- Distributed-Clock for precise synchronization.<br>  Device can be configured as „Reference Clock"<br>- Default 10 byte PDO, configurable<br>  4 byte PDO / 2 byte PDO for shorter cycle times |
| Process data | Position value<br>Warnings<br>System time |
| Cycle times | Depending on sensor type, activated scaling function and PDO length.<br>Min. cycle time: 62.5 $\mu$s |
| Synchronization | 0x00 Free Run, not synchronized<br>0x03 Distributed clocks DC, synchronized with SYNCO/SYNC1 event |

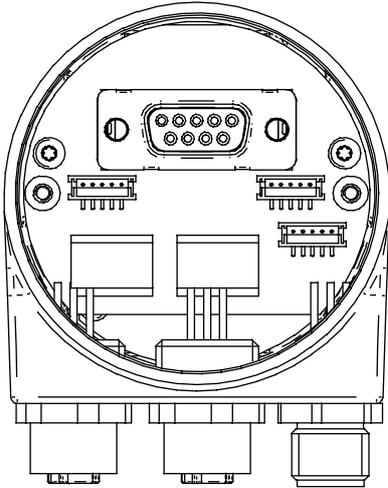| Pin assignment | | |
|---|---|---|
| **Supply voltage** | | |
| Connector | Connection | Description |
| Pin 1 | UB | Supply voltage |
| Pin 2 | N.C. | Not assigned |
| Pin 3 | GND | Ground connection |
| Pin 4 | N.C. | Not assigned |

1x M12 connector (pin), A-coded

| EtherCAT (data line) | | |
|---|---|---|
| Connector | Connection | Description |
| Pin 1 | TxD+ | Transmitted data+ |
| Pin 2 | RxD+ | Received data+ |
| Pin 3 | TxD- | Transmitted data- |
| Pin 4 | RxD- | Received data- |

2x M12 connectors (socket), D-coded

# Output specifications
## wireSENSOR

## Incremental encoder
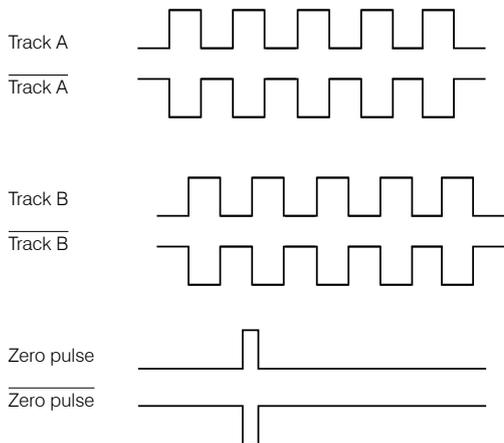
| | |
|---|---|
| Track A | |
| Track A‾ | |
| Track B | |
| Track B‾ | |
| Zero pulse | |
| Zero pulse‾ | |

| TTL Output | Line driver (5 VDC) | |
|---|---|---|
| High level | ≥ 2.5 V | (with I = -20 mA) |
| Low level | ≤ 0.5 V | (with I = 20 mA) |
| High load | ≤ 20 mA | |
| Tracks | A, $\overline{A}$, B, $\overline{B}$, 0 | |

| Output TTL01/ TTL02 | NPN (5 VDC ±5 %) |
|---|---|
| High level | > 4.5 V |
| Low level | < 1.0 V |
| High load | ≤ 3 mA |
| Tracks (TTL01) | A, B, 0 |
| Tracks (TTL02) | A, $\overline{A}$, B, $\overline{B}$, 0 |

| Output HTL | Push-pull (10 ... 30 VDC) | |
|---|---|---|
| High level | ≥ V+ -3 V | (with I = -20 mA) |
| Low level | ≤ 1.5 V | (with I = 20 mA) |
| High load | ≤ 40 mA | |
| Tracks | A, $\overline{A}$, B, $\overline{B}$, 0 | |

| Output E | Push-pull (5 VDC) |
|---|---|
| High level | ≥ V+ -2.5 V |
| Low level | ≤ 0.5 V |
| High load | ≤ 50 mA |
| Tracks | A, B, 0 |

| Output E830 | Push-pull (8 ... 30 VDC) |
|---|---|
| High level | ≥ V+ -3 V |
| Low level | ≤ 2.5 V |
| High load | ≤ 50 mA |
| Tracks | A, B, 0 |

**Pin assignment TTL, HTL**

| Connector | Cable color | Assignment |
|---|---|---|
| Pin 1 | pink | Track B inv. |
| Pin 2 | blue | V+ Sense |
| Pin 3 | red | Track N (zero pulse) |
| Pin 4 | black | Track N inv. (zero pulse inv.) |
| Pin 5 | brown | Track A |
| Pin 6 | green | Track inv. |
| Pin 7 | - | - |
| Pin 8 | gray | Track B |
| Pin 9 | - | - |
| Pin 10 | white-green | GND |
| Pin 11 | white | GND Sense |
| Pin 12 | brown-green | V+ |
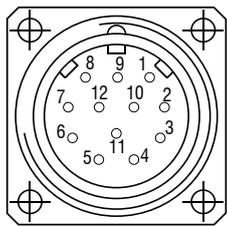


V+ Sense and GND Sense are directly connected to V+ or GND. Recommendation: Use twisted-pair cables (e.g. A/A inv.) from a cable length of 10 m.

**Pin assignment E, E830**

| Cable color | Assignment |
|---|---|
| white | 0 V |
| brown | V+ |
| green | A |
| - | $\overline{A}$ |
| yellow | B |
| - | $\overline{B}$ |
| gray | 0 |

**Pin assignment TTL01**

| Cable color | Assignment |
|---|---|
| brown | 0 V |
| gray | V+ |
| white | A |
| green | B |
| yellow | 0 |

**Pin assignment TTL02**

| Cable color | Assignment |
|---|---|
| red | V+ |
| black | 0 V |
| brown | A |
| black | $\overline{A}$ |
| orange | B |
| black | $\overline{B}$ |
| yellow | 0 |
| black | n. c. |

# Sensors and Systems from Micro-Epsilon



Sensors and systems for displacement, distance and position



Sensors and measurement devices for non-contact temperature measurement



Measuring and inspection systems for metal strips, plastics and rubber



Optical micrometers and fiber optics, measuring and test amplifiers



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3D measurement technology for dimensional testing and surface inspection