



# More Precision.

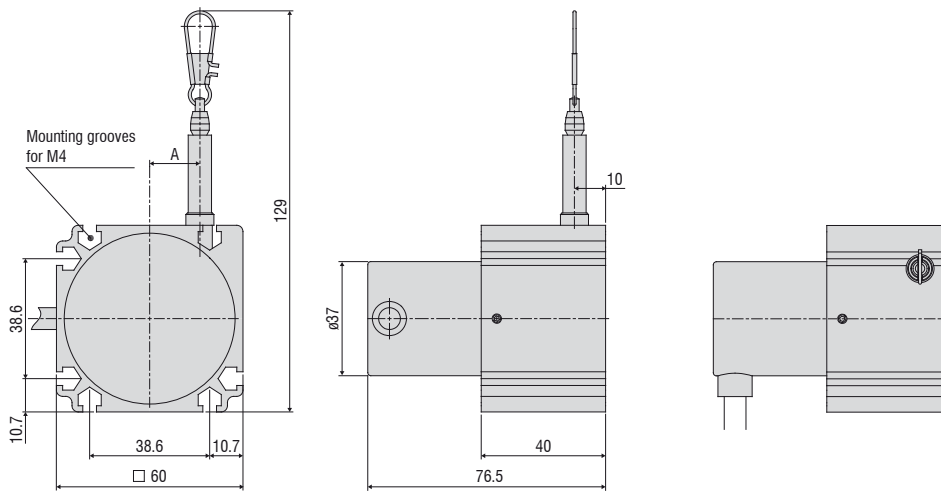
**wireSENSOR** // Draw-wire displacement sensors





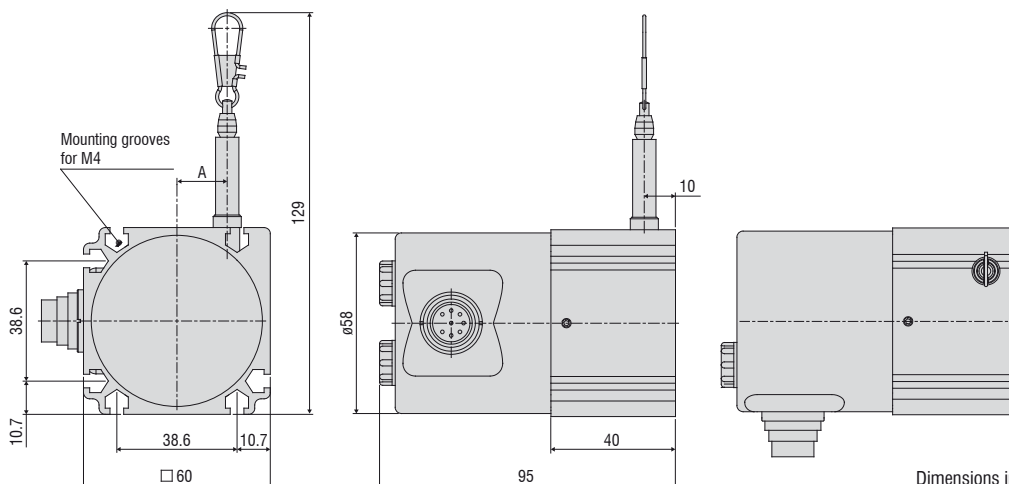
- Robust aluminum profile housing
- Customer-specific designs
- Potentiometer, current or voltage output

P60 model Output P



Measuring range (mm)	A (mm)
100 / 300 / 500 / 1000	16.15
150 / 750 / 1500	24.2

P60 model Output U/I



Measuring range (mm)	A (mm)
100 / 300 / 500 / 1000	16.15
150 / 750 / 1500	24.2

Dimensions in mm, not to scale.

Model		WDS-100-P60	WDS-150-P60	WDS-300-P60	WDS-500-P60	WDS-750-P60	WDS-1000-P60	WDS-1500-P60	
Measuring range		100 mm	150 mm	300 mm	500 mm	750 mm	1000 mm	1500 mm	
Analog output		Potentiometer, current, voltage							
Resolution		towards infinity							
Linearity	Hybrid potentiometer P10	≤ ±0.1 % FSO	-	-	-	≤ ±0.5 mm	≤ ±0.75 mm	≤ ±1 mm	≤ ±1.5 mm
	Hybrid potentiometer P25	≤ ±0.25 % FSO	-	-	≤ ±0.75 mm	-	-	-	-
	Conductive plastic/wire potentiometer P25	≤ ±0.5 % FSO	≤ ±0.5 mm	≤ ±0.75 mm	-	-	-	-	-
Sensor element		Conductive plastic/wire potentiometer		Hybrid potentiometer					
Wire extension force (max.)		approx. 7.5 N	approx. 5.5 N	approx. 7.5 N	approx. 7.5 N	approx. 5.5 N	approx. 7.5 N	approx. 5.5 N	
Wire retraction force (min.)		approx. 6.5 N	approx. 4.5 N	approx. 6 N	approx. 6 N	approx. 4 N	approx. 5 N	approx. 3.5 N	
Wire acceleration (max.)		approx. 10 ... 15 g (depending on measuring range)							
Material	Housing	Aluminum							
	Measuring wire	Polyamide-coated stainless steel (ø 0.45 mm)							
Wire mounting		Wire clip							
Mounting		Mounting grooves on the sensor housing							
Temperature range	Storage	-20 ... +80 °C							
	Operation	-20 ... +80 °C							
Connection	Potentiometer	integrated cable, radial, 1 m long							
	Current, voltage	pluggable cable via 8-pin flange connector (DIN45326), radial							
Shock (DIN EN 60068-2-27)		50 g / 10 ms in 3 axes, 1000 shocks each							
Vibration (DIN EN 60068-2-6)		20 g / 10 ... 2000 Hz in 3 axes, 10 cycles each							
Protection class (DIN EN 60529)		IP65 <sup>1)</sup>							
Weight		approx. 370 g							

FSO = Full Scale Output

Specifications for analog outputs from page 54 onwards.

<sup>1)</sup> Plug connection only with mating plug

## Article designation

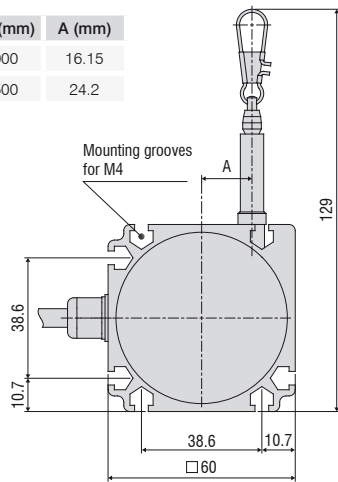
WDS -	100 -	P60 -	CR -	P
				Output type: P: potentiometer (with connection CR) U: voltage (with connection SR) I: current (with connection SR)
				Connection: SR: radial plug CR: integrated cable, radial, 1 m
				P60 series
				Measuring range in mm



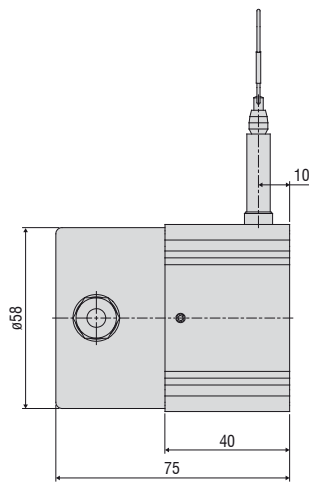
- Robust aluminum profile housing
- Customer-specific designs
- Absolute or incremental encoder

P60 model

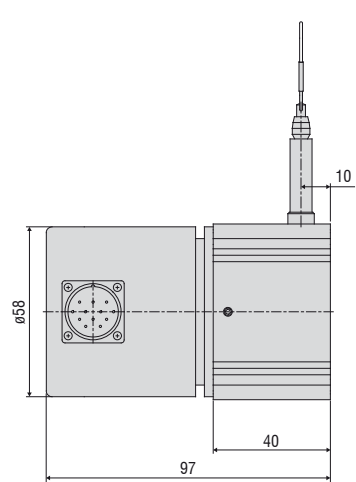
MR (mm)	A (mm)
1000	16.15
1500	24.2



HTL/TTL output

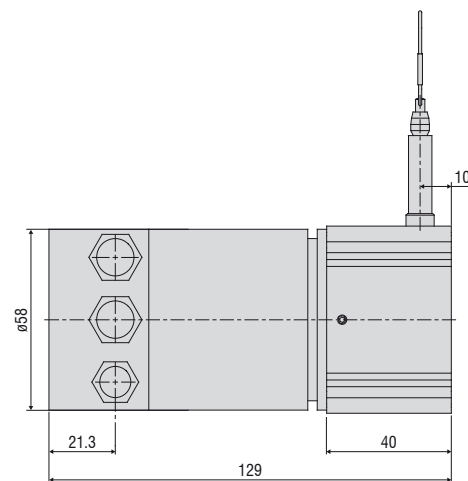
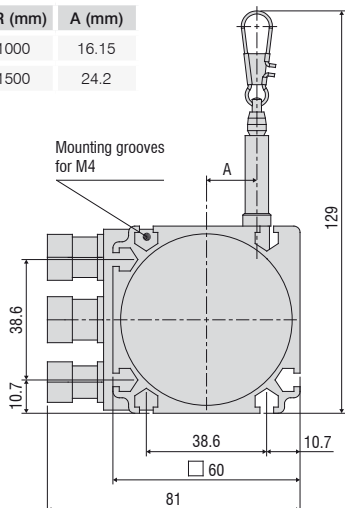


SSI output



P60 model Output CO/PB/PN

MR (mm)	A (mm)
1000	16.15
1500	24.2



Dimensions in mm, not to scale.

Model	WDS-1000-P60	WDS-1500-P60	
Measuring range	1000 mm	1500 mm	
Digital interface	PROFINET, Profibus DP, CANopen		
Digital output	HTL, TTL, SSI		
Resolution	HTL, TTL	0.067 mm (15 pulses/mm)	0.1 mm (10 pulses/mm)
	SSI, PROFINET, Profibus DP, CANopen	0.012 mm	0.018 mm
Linearity	$\leq \pm 0.02\%$ FSO	$\leq \pm 0.2$ mm	$\leq \pm 0.3$ mm
Sensor element	Incremental encoder		
Wire extension force (max.)	approx. 7.5 N	approx. 5.5 N	
Wire retraction force (min.)	approx. 5 N	approx. 3.5 N	
Wire acceleration (max.)	approx. 10 g	approx. 15 g	
Material	Housing	Aluminum	
	Measuring wire	Polyamide-coated stainless steel ( $\phi$ 0.45 mm)	
Wire mounting	Wire clip		
Mounting	Mounting grooves on the sensor housing		
Temperature range	Storage	-20 ... +80 °C	
	Operation	-20 ... +80 °C	
Connection	HTL, TTL	integrated cable, radial, length 1 m	
	SSI	pluggable cable via 12-pin flange connector, radial	
	PROFINET, Profibus DP, CANopen	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 / 10 ... 2000 Hz in 3 axes, 10 cycles each		
Protection class (DIN EN 60529)	IP65 <sup>1)</sup>		
Weight	approx. 1 kg		

FSO = Full Scale Output

Specifications for digital outputs from page 55 onwards.

<sup>1)</sup> Plug connection only with mating plug

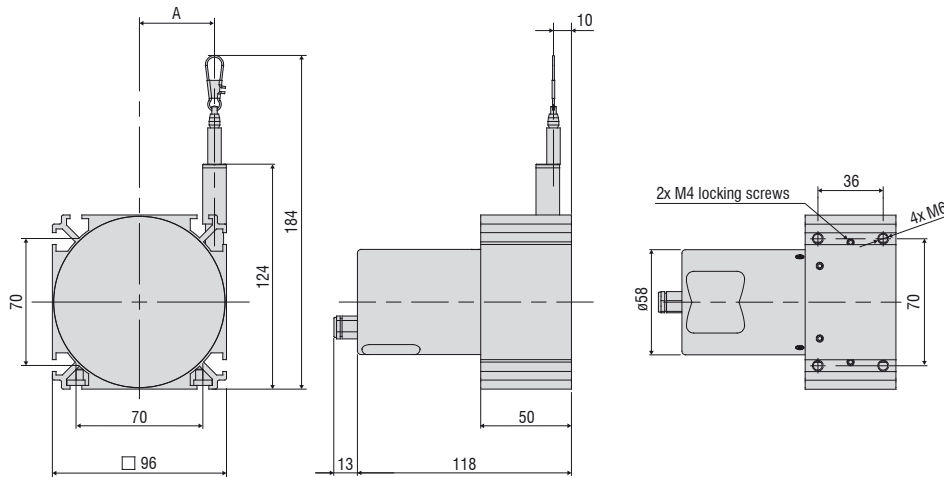
## Article designation

WDS -	1000 -	P60 -	CR -	TTL
				Output: HTL TTL CO: CANopen PB: Profibus DP SSI: Gray Code PN: PROFINET
				Connection: SR (with SSI output): plug, radial CR (with HTL, TTL output): integrated cable, radial, 1 m BH (with CO, PB, PN output): bus cover
				P60 series
				Measuring range in mm



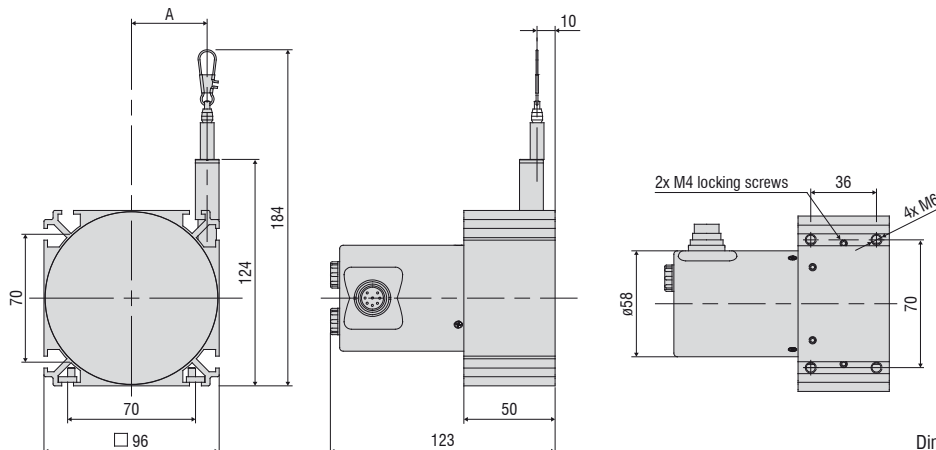
- Robust aluminum profile housing
- Customer-specific designs
- Potentiometer, current or voltage output

P96 model Output P



MR (mm)	A (mm)
2000	32
2500	41.4

P96 model Output U/I



MR (mm)	A (mm)
2000	32
2500	41.4

Dimensions in mm, not to scale.

Model	WDS-2000-P96	WDS-2500-P96
Measuring range	2000 mm	2500 mm
Analog output	Potentiometer, current, voltage	
Resolution	towards infinity	
Linearity	$\leq \pm 0.1\%$ FSO	$\leq \pm 2.5\%$ FSO
Sensor element	Hybrid potentiometer	
Wire extension force (max.)	approx. 11 N	approx. 9 N
Wire retraction force (min.)	approx. 7.5 N	approx. 5.5 N
Wire acceleration (max.)	approx. 8 g	
Material	Housing	Aluminum
	Measuring wire	Polyamide-coated stainless steel ( $\phi$ 0.8 mm)
Wire mounting	Wire clip	
Mounting	Mounting grooves on the sensor housing	
Temperature range	Storage	-20 ... +80 °C
	Operation	-20 ... +80 °C
Connection	Potentiometer	integrated cable, axial, length 1 m
	Current, voltage	pluggable cable via 8-pin flange connector (DIN45326), radial
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 <sup>1)</sup>	
Weight	approx. 1.1 kg	

FSO = Full Scale Output

Specifications for analog outputs from page 54 onwards.

<sup>1)</sup> Plug connection only with mating plug

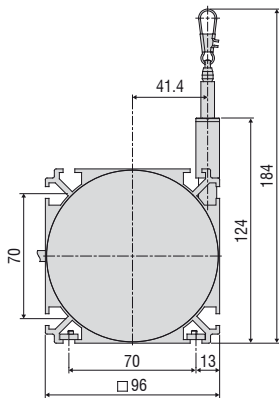
#### Article designation

WDS -	2000 -	P96 -	CA -	P
				Output type: P: potentiometer (with CA connection) U: voltage (with connection SR) I: current (with connection SR)
				Connection: SR: radial plug CA: integrated cable, axial, 1 m
				P96 series
				Measuring range in mm

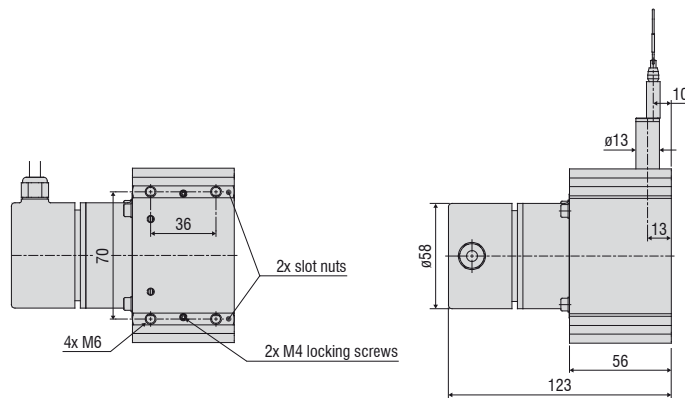


- Robust aluminum profile housing
- Absolute or incremental encoder

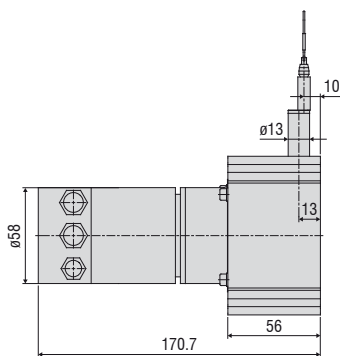
P96 model



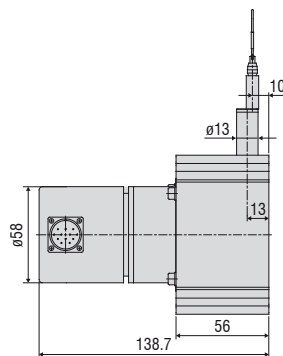
HTL/TTL output



CO/PB/PN output



SSI output



Dimensions in mm, not to scale.



Model	WDS-3000-P96	
Measuring range	3000 mm	
Digital interface	PROFINET, Profibus DP, CANopen	
Digital output	HTL, TTL, SSI	
Resolution	HTL, TTL	0.087 mm (11.53 pulses/mm)
	SSI, PROFINET Profibus DP, CANopen	0.032 mm
Linearity	$\leq \pm 0.02\%$ FSO	$\leq \pm 0.6$ mm
Sensor element	Incremental/absolute encoder	
Wire extension force (max.)	approx. 9 N	
Wire retraction force (min.)	approx. 5.5 N	
Wire acceleration (max.)	approx. 7 g	
Material	Housing	Aluminum
	Measuring wire	Polyamide-coated stainless steel ( $\phi$ 0.8 mm)
Wire mounting	Wire clip	
Mounting	Mounting grooves on the sensor housing	
Temperature range	Storage	-20 ... +80 °C
	Operation	-20 ... +80 °C
Connection	HTL, TTL	integrated cable, radial, length 1 m
	SSI	pluggable cable via 12-pin flange connector, radial
	PROFINET, Profibus DP, CANopen	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 <sup>1)</sup>	
Weight	approx. 1.7 kg	

FSO = Full Scale Output

Specifications for digital outputs from page 55 onwards.

<sup>1)</sup> Plug connection only with mating plug

### Article designation

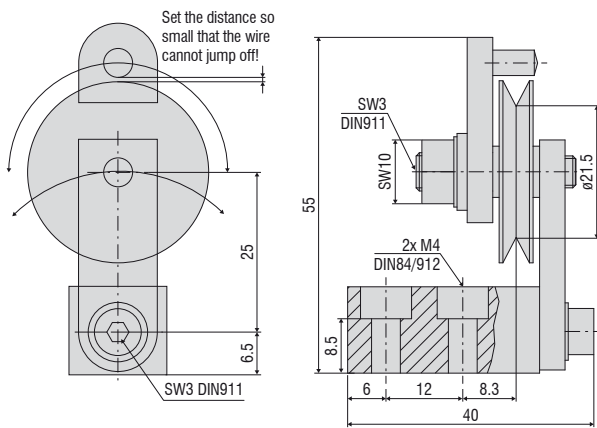
WDS -	3000 -	P96 -	CR -	TTL
				Output: HTL TTL CO: CANopen PB: Profibus DP SSI: Gray Code PN: PROFINET
				Connection: SR (with SSI output): plug, radial CR (with HTL, TTL output): integrated cable, radial, 1 m BH (with CO, PB, PN output): bus cover
				P96 series
				Measuring range in mm

### Wire deflection pulleys for external installation

TR1-WDS	Wire deflection pulley, adjustable, for sensors with a wire diameter $\leq 0.45$ mm
TR3-WDS	Wire deflection pulley, fixed, for sensors with a wire diameter $\leq 0.45$ mm
TR4-WDS	Wire deflection pulley, fixed, for sensors with a wire diameter of 0.8 mm to 1 mm

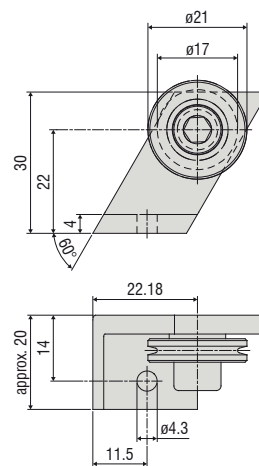
#### TR1-WDS

Wire deflection pulley, adjustable, for sensors with a wire diameter  $\leq 0.45$  mm



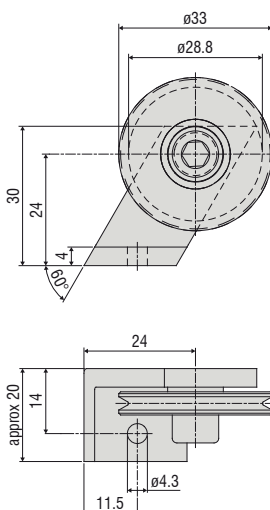
#### TR3-WDS

Wire deflection pulley, fixed, for sensors with a wire diameter  $\leq 0.45$  mm



#### TR4-WDS

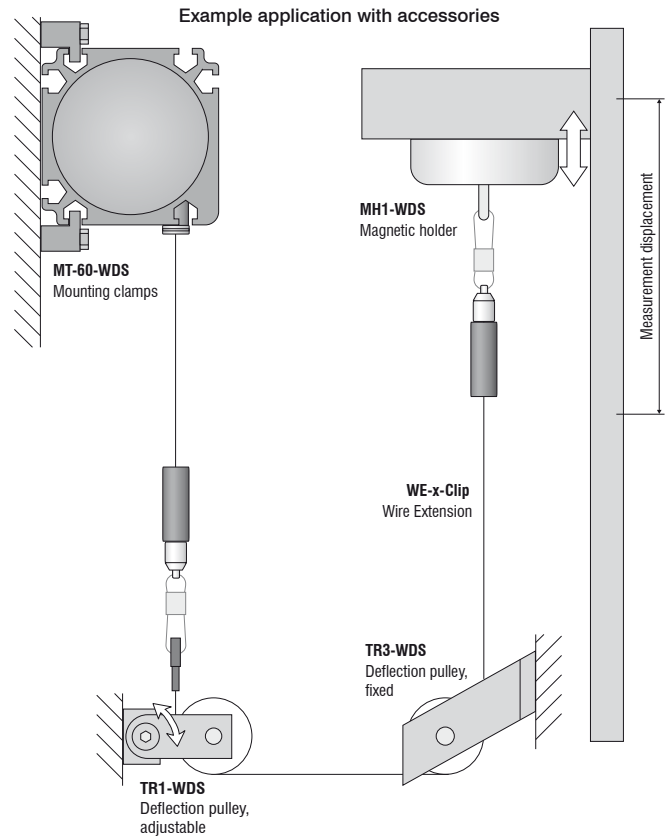
Wire deflection pulley, fixed, for sensors with a wire diameter of 0.8 mm to 1 mm



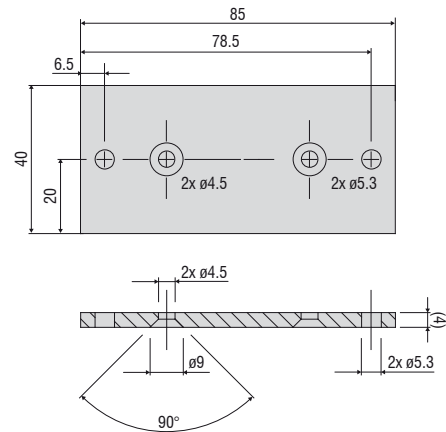
Dimensions in mm, not to scale.

**Accessories**

WE-xxx-M4	Wire extension with M4 wire connection, x=wire length
WE-xxx-Clip	Wire extension with eyelet, x = wire length
WE-xxx-Clip-WSS	Wire extension with clip and uncoated wire d=0.45 mm
WE-xxx-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
PS2020	Power supply unit 24 V / 2.5 A; input 100-240 VAC, output 24 VDC / 2.5 A; mounting onto symmetrical standard rail 35 mm x 7.5 mm, DIN 50022)
WDS-MP60	Mounting plate for P60 models
PC2/10-WDS-A	Cable for SSI encoder, 2 m long
PC2/10-WDS-E	Cable for incremental encoder, 2 m long
PC10/10-WDS-A	Cable for SSI encoder, 10 m long
PC10/10-WDS-E	Cable for incremental encoder, 10 m long



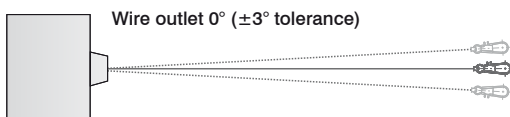
**WDS-MP60**  
Mounting plate for P60 models



**Installation instructions:**

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

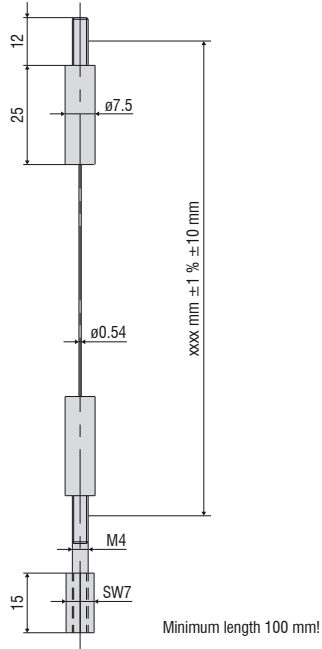
Angle of wire outlet: Make sure during installation that the wire outlet is straight (tolerance of  $\pm 3^\circ$ ). Exceeding this tolerance leads to increased wear of the wire material and on the wire outlet.



Dimensions in mm, not to scale.

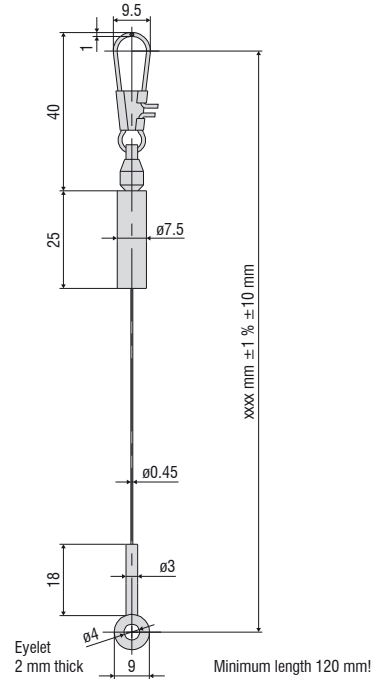
**WE-xxxx-M4**

Wire extension with M4 wire connection, x=wire length



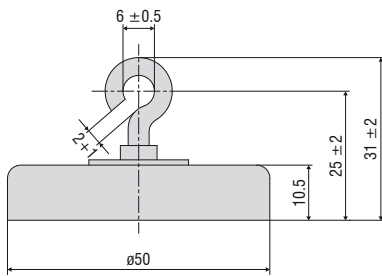
**WE-xxxx-Clip**

Wire extension with eyelet, x = wire length



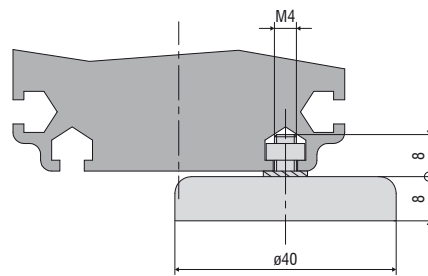
**MH1-WDS**

Magnetic holder for wire attachment



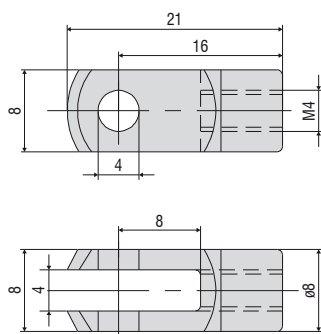
**MH2-WDS**

Magnetic holder for sensor mounting



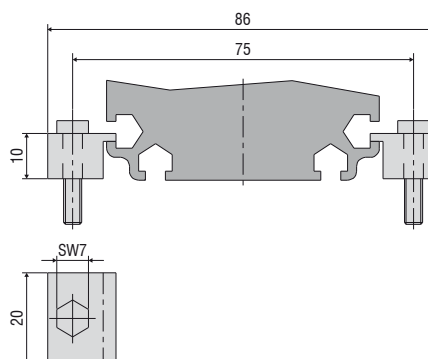
**GK1-WDS**

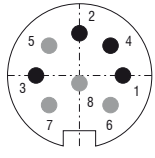
Fork head for M4



**MT-60-WDS**

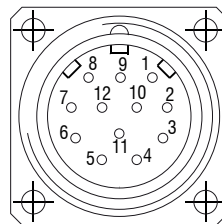
Mounting clamps for WDS-P60



Output		Connector M16 -SA / -SR	Integrated cable -CA / -CR	Open contacts
<b>Potentiometer output (P)</b>		 <p>Sensor side</p> <p>1 = Input + 2 = Ground 3 = Signal</p>	<p>White = Input + Brown = Ground Green = Signal</p>	 <p>1 = Input + 2 = Signal 3 = Ground</p> <p>② WIPER CCW ① → → → ③ CW CLOCKWISE →</p>
Input voltage	max. 32 VDC with 1 kOhm / max. 1 W			
Resistance	1 kOhm $\pm 10\%$ (resistance divider)			
Temperature coefficient	$\pm 0.0025\%$ FSO/ $^{\circ}$ C			
<b>Voltage output (U)</b>		 <p>Sensor side</p> <p>1 = Power supply 2 = Ground 3 = Signal 4 = Ground</p>	<p>White = Supply Brown = Ground Green = Signal Yellow = Ground</p>	
Supply voltage	14 ... 27 VDC (non-stabilized)			
Current consumption	max. 30 mA			
Output voltage	0 ... 10 VDC Option 0 ... 5 / $\pm 5$ V			
Load resistance	$> 5$ kOhm			
Output noise	0.5 mV <sub>eff</sub>			
Temperature coefficient	$\pm 0.005\%$ FSO/ $^{\circ}$ C			
Electromagnetic compatibility (EMC)	EN 61000-6-4 EN 61000-6-2			
<b>Adjustment range</b> (if supported by the model)				
Zero	$\pm 20\%$ FSO			
Sensitivity	$\pm 20\%$			
<b>Current output (I)</b>		 <p>Sensor side</p> <p>1 = Power supply 2 = Ground</p>	<p>White = Supply Brown = Ground</p>	
Supply voltage	14 ... 27 VDC (non-stabilized)			
Current consumption	max. 35 mA			
Output current	4 ... 20 mA			
Load	$< 600$ Ohm			
Output noise	$< 1.6 \mu\text{A}_{\text{eff}}$			
Temperature coefficient	$\pm 0.01\%$ FSO/ $^{\circ}$ C			
Electromagnetic compatibility (EMC)	EN 61000-6-4 EN 61000-6-2			
<b>Adjustment range</b> (if supported by the model)				
Zero	$\pm 18\%$ FSO			
Sensitivity	$\pm 15\%$			

Connections	
1 V+	Supply connection of rotary encoder
2 GND	Ground connection of rotary encoder 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. The zeroing process is triggered by a High pulse (pulse duration $\geq 100$ 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 DATAVALID DATAVALID 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 used

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	DATAVALID
9	Pink	F/R
10	Black-yellow	DATAVALID MT
11	-	-
12	-	-



Use twisted-pair cables as extension cables.

Inputs	
Control signals F/R and zero	
High level	$> 0.7 V+$
Low level	$< 0.3 V+$
Circuitry	F/R input with 10 kOhm against V+, 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	$\leq 0.5 V$	(with I = 20 mA)

**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.)	<p>Polling mode (asynch, via SDO)</p> <p>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.</p> <p>Synch mode (synch-cyclic). The encoder transmits the current actual process value after receiving a synch telegram sent by a master.</p> <p>The synch counter in the encoder can be parameterized such that the position value is transmitted only after a defined number of synch telegrams.</p> <p>Acyclic mode (synch-acyclic)</p>
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

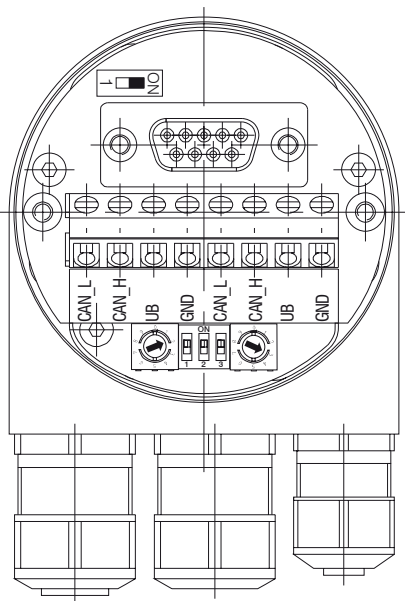
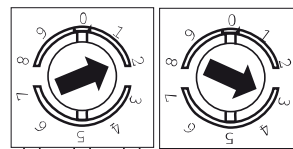
**Description of the CANopen connections**

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

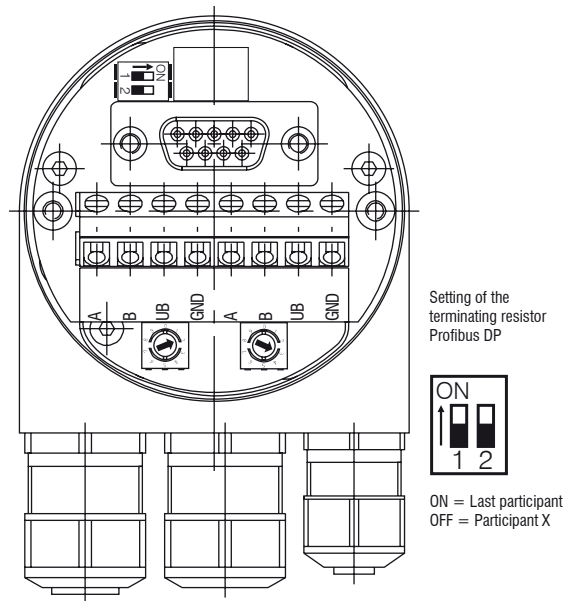


Setting of the terminating resistor CANopen



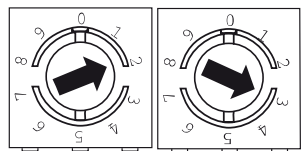
ON = Last participant  
 OFF = Participant X

Profibus DP features	
Bus protocol	Profibus DP
Profibus features	Device class 1 and 2
Data exchange features	Input: Position value Additional configurable speed signal (output of the current rotary speed) 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. Scaling: The steps per rotation and the total revolution can be parameterized.
Diagnosis	The encoder supports the following error messages: - Position error - Lithium cell voltage at lower limit value (multi-turn)
Default setting	Participant address 00



**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)



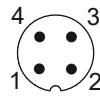
**PROFINET features**

Bus protocol	PROFINET
Device profile	Encoder profile PNO 3.162 Version 4.1
Features	<ul style="list-style-type: none"> <li>- 100 Mbaud Fast Ethernet</li> <li>- Automatic address assignment</li> <li>- Real-time (RT) Class 1, IRT Class 2, IRT Class 3</li> </ul>
Process data	<ul style="list-style-type: none"> <li>- Position value 32-Bit input data with/without rotational speed 16/32 Bit</li> <li>- Telegram 81-83 of the Profidrive profile</li> </ul>

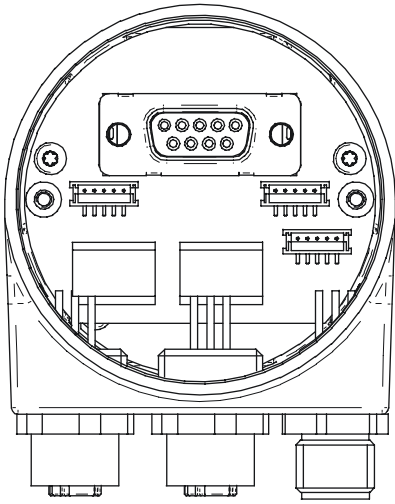
**Pin assignment**

## Supply voltage

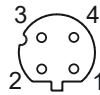
Connector	Connection	Description
Pin 1	V+	Supply voltage
Pin 2	N.C.	Not assigned
Pin 3	GND	Ground connection
Pin 4	N.C.	Not assigned



1x M12 connector (pin), A-coded

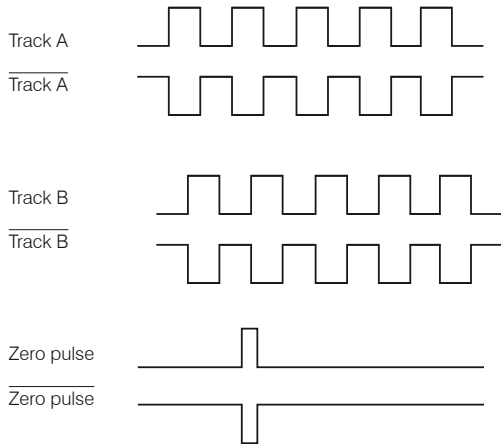
**PROFINET (data line)**

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 signals**



TTL Output	Line driver (5 VDC)	
High level	$\geq 2.5 \text{ V}$	(with $I = -20 \text{ mA}$ )
Low level	$\leq 0.5 \text{ V}$	(with $I = 20 \text{ mA}$ )
Load High	$\leq 20 \text{ mA}$	
Tracks	A, $\bar{A}$ , B, $\bar{B}$ , 0	

Output TTL01/ TTL02	NPN (5 VDC $\pm 5 \%$ )	
High level	$> 4.5 \text{ V}$	
Low level	$< 1.0 \text{ V}$	
Load High	$\leq 3 \text{ mA}$	
Tracks (TTL01)	A, B, 0	
Tracks (TTL02)	A, $\bar{A}$ , B, $\bar{B}$ , 0	

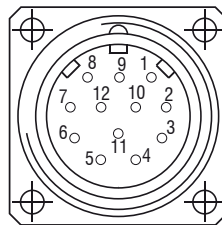
Output HTL	Push-pull (10 ... 30 VDC)	
High level	$\geq V+ - 3 \text{ V}$	(with $I = -20 \text{ mA}$ )
Low level	$\leq 1.5 \text{ V}$	(with $I = 20 \text{ mA}$ )
Load High	$\leq 40 \text{ mA}$	
Tracks	A, $\bar{A}$ , B, $\bar{B}$ , 0	

Output E	Push-pull (5 VDC)	
High level	$\geq V+ - 2.5 \text{ V}$	
Low level	$\leq 0.5 \text{ V}$	
Load High	$\leq 50 \text{ mA}$	
Tracks	A, B, 0	

Output E830	Push-pull (8 ... 30 VDC)	
High level	$\geq V+ - 3 \text{ V}$	
Low level	$\leq 2.5 \text{ V}$	
Load High	$\leq 50 \text{ mA}$	
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	0V
Brown	V+
Green	A
-	$\bar{A}$
Yellow	B
-	$\bar{B}$
Gray	0

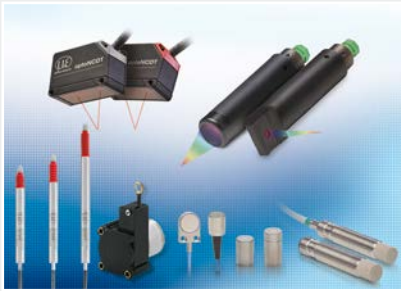
**Pin assignment TTL01**

Cable color	Assignment
Brown	0V
Gray	V+
White	A
Green	B
Yellow	0

**Pin assignment TTL02**

Cable color	Assignment
Red	V+
Black	0V
Brown	A
Black	$\bar{A}$
Orange	B
Black	$\bar{B}$
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



Color recognition sensors, LED analyzers and inline color spectrometers



3D measurement technology for dimensional testing and surface inspection