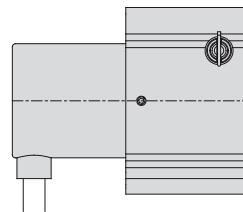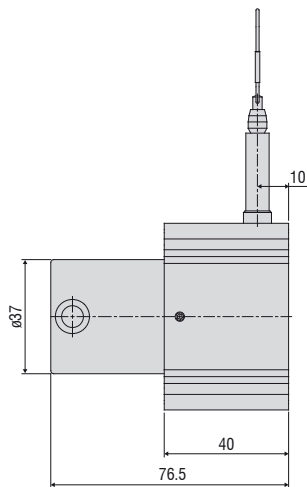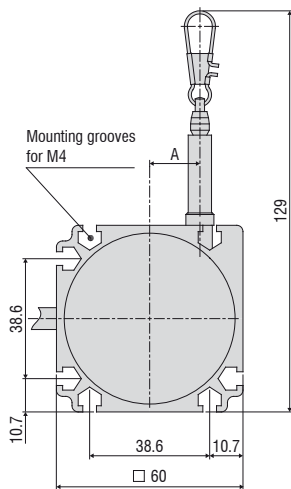# MICRO-EPSILON

More Precision.

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

- Robust aluminum profile housing

- Customer-specific designs

- Potentiometer, current or voltage output

WDS-750-P60-SR-I
Measuring range 750 mm
SN 51184

P60 model   Output P

Mounting grooves for M4

A

129

ø37

38.6

10.7

38.6   10.7

□ 60

10

40

76.5

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

P60 model   Output U/I

Mounting grooves for M4

A

129

ø58

38.6

10.7

38.6   10.7

□ 60

10

40

95
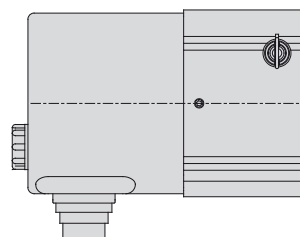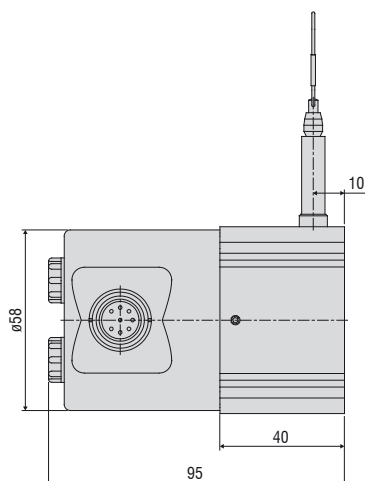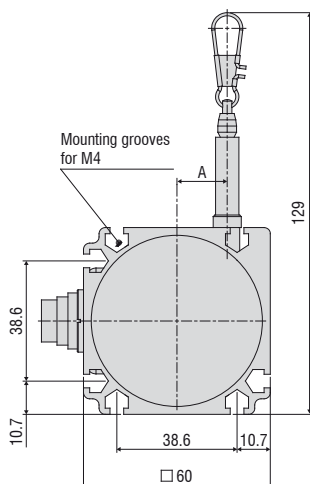
Measuring range (mm)	A (mm)
100 / 300 / 500 / 1000	16.15
150 / 750 / 1500	24.2

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 [1]						
Weight		approx. 370 g						

FSO = Full Scale Output
Specifications for analog outputs from page 54 onwards.
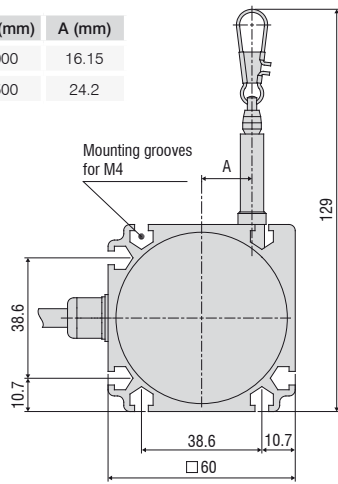[1] Plug connection only with mating plug

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
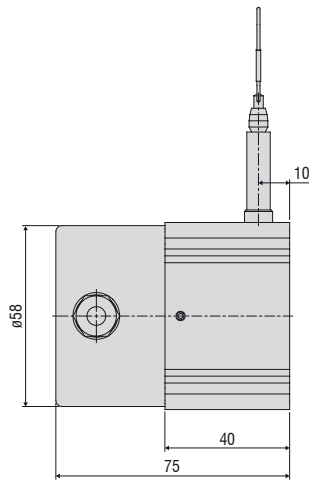
P60 series

Measuring range in mm

- *Robust aluminum profile housing*

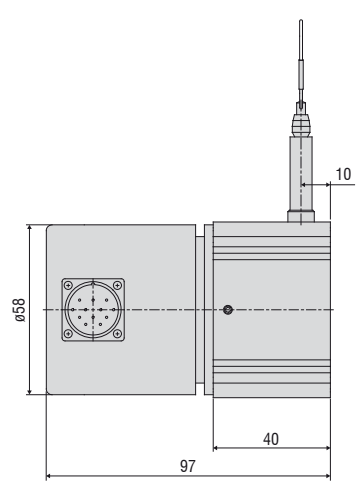- *Customer-specific designs*

- *Absolute or incremental encoder*

WDS-1000-P60-CR-HTL
Measuring range 1000 mm
SN 52306

P60 model

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

Mounting grooves for M4

A

129

38.6

10.7

38.6   10.7

□60

HTL/TTL output

10

ø58

40

75

SSI output

10

ø58

40

97

P60 model   Output CO/PB/PN

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

Mounting grooves for M4

A

129

38.6

10.7

38.6   10.7

□60

81

10

ø58

21.3   40

129
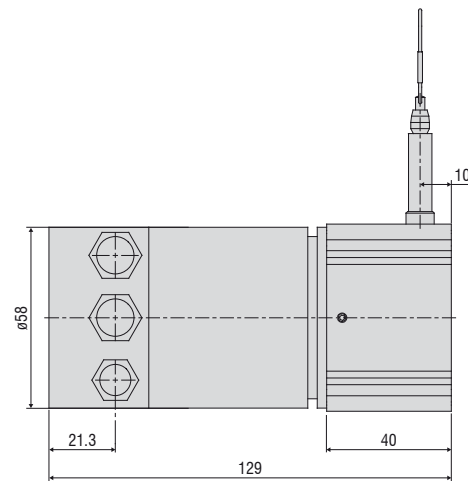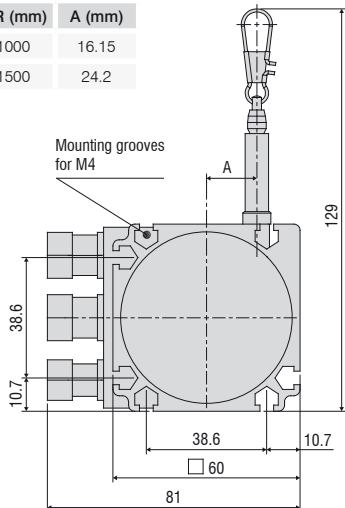
Dimensions in mm, not to scale.

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)
Resolution — SSI, PROFINET, Profibus DP, CANopen	0.012 mm	0.018 mm
Linearity ≤ ±0.02 % FSO	≤ ±0.2 mm	≤ ±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	
Material — 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	
Temperature range — Operation	-20 … +80 °C	
Connection — HTL, TTL	integrated cable, radial, length 1 m	
Connection — SSI	pluggable cable via 12-pin flange connector, radial	
Connection — 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 [1]	
Weight	approx. 1 kg	

FSO = Full Scale Output
Specifications for digital outputs from page 55 onwards.
[1] 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
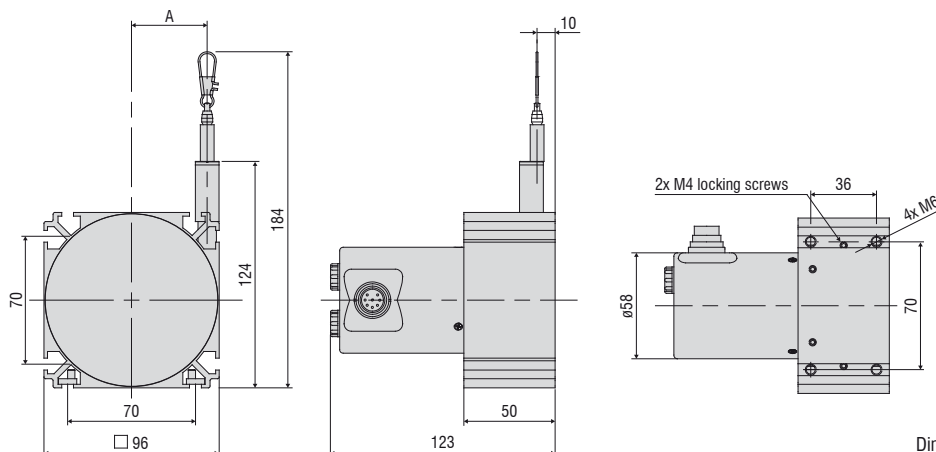
P60 series

Measuring range in mm

- *Robust aluminum profile housing*

- *Customer-specific designs*

- *Potentiometer, current or voltage output*

P96 model   Output P
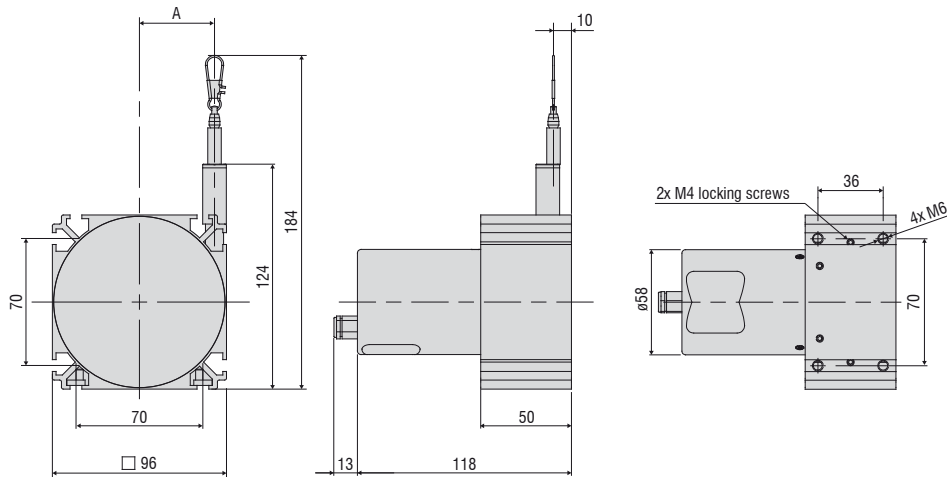
MR (mm)	A (mm)
2000	32
2500	41.4

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	≤ ±0.1 % FSO	≤ ±2 mm	≤ ±2.5 mm
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 (ø 0.8 mm)	
Wire mounting		Wire clip	
Mounting		Mounting grooves on the sensor housing	
Temperature range	Storage	-20 … +80 ℃	
	Operation	-20 … +80 ℃	
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 [1]	
Weight		approx. 1.1 kg	

FSO = Full Scale Output
Specifications for analog outputs from page 54 onwards.
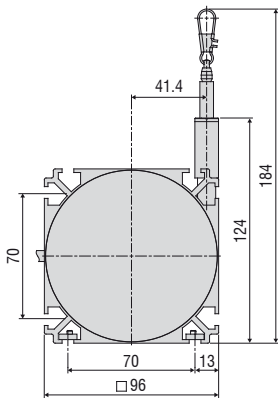[1] Plug connection only with mating plug

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
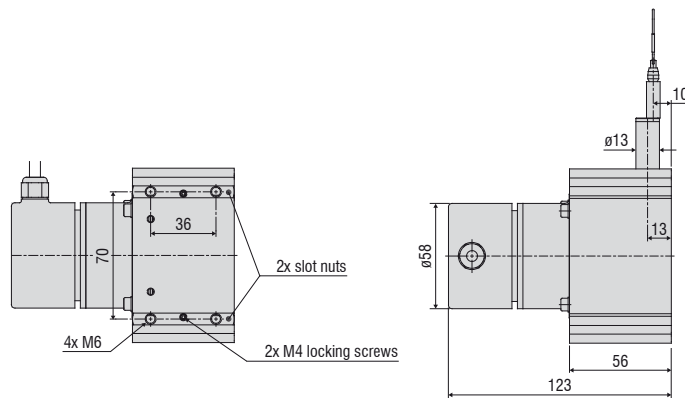CA: integrated cable, axial, 1 m

P96 series

Measuring range in mm

- Robust aluminum profile housing
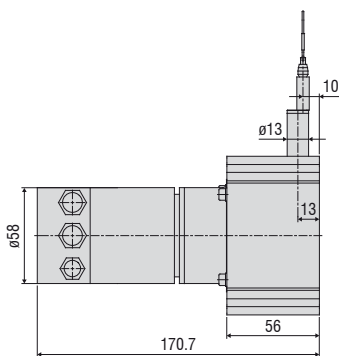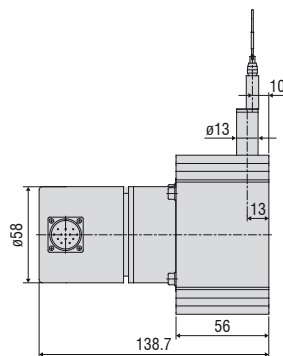
- Absolute or incremental encoder

P96 model

HTL/TTL output

41.4
184
124
70
70
13
□ 96

70
36
2x slot nuts
4x M6
2x M4 locking screws

ø58
10
ø13
13
56
123

CO/PB/PN output

SSI output

10
ø13
13
ø58
56
170.7

10
ø13
13
ø58
56
138.7

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)
Resolution — SSI, PROFINET Profibus DP, CANopen	0.032 mm
Linearity ≤ ±0.02 % FSO	≤ ±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
Material — Measuring wire	Polyamide-coated stainless steel (ø 0.8 mm)
Wire mounting	Wire clip
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	pluggable cable via 12-pin flange connector, radial
Connection — 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 [1]
Weight	approx. 1.7 kg

FSO = Full Scale Output
Specifications for digital outputs from page 55 onwards.
[1] 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

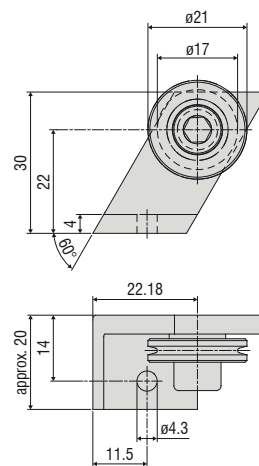|	
TR1-WDS	Wire deflection pulley, adjustable, for sensors with a wire diameter ≤ 0.45 mm
TR3-WDS	Wire deflection pulley, fixed, for sensors with a wire diameter ≤ 0.45 mm
TR4-WDS	Wire deflection pulley, fixed, for sensors with a wire diameter of 0.8 mm to 1 mm

TR1-WDS
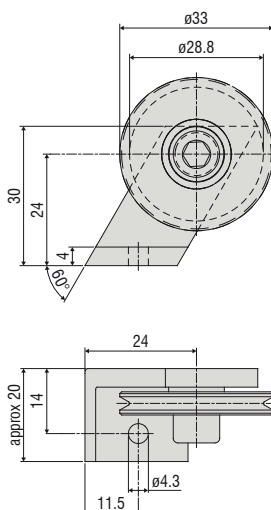Wire deflection pulley, adjustable, for sensors with a wire diameter ≤ 0.45 mm
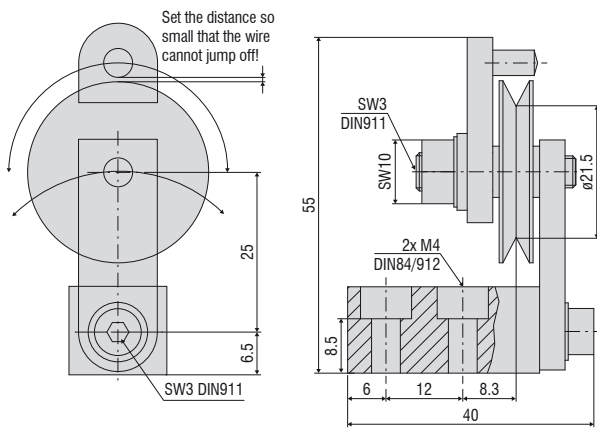
TR3-WDS
Wire deflection pulley, fixed, for sensors with a wire diameter ≤ 0.45 mm
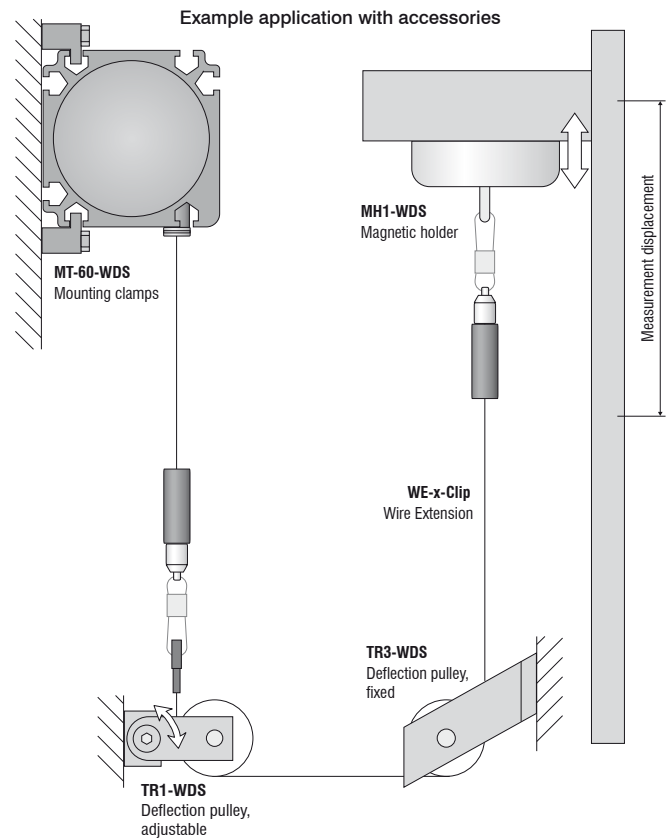
TR4-WDS
Wire deflection pulley, fixed, for sensors with a wire diameter of 0.8 mm to 1 mm
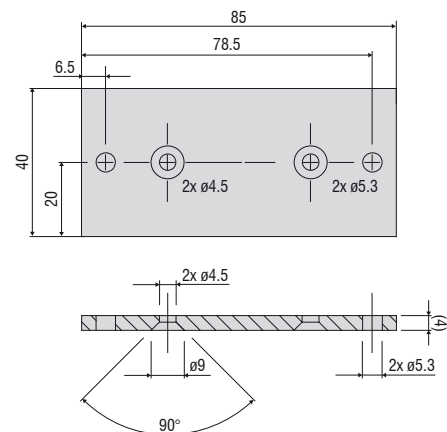
Dimensions in mm, not to scale.

Accessories

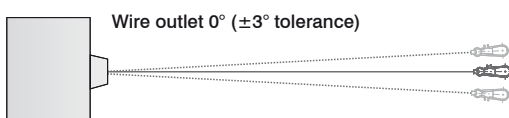|	
WE-xxxx-M4	Wire extension with M4 wire connection, x=wire length
WE-xxxx-Clip	Wire extension with eyelet, x = wire length
WE-xxx-Clip-WSS	Wire extension with clip and uncoated wire d=0.45 mm
WE-xxxx-Ring-PW	Wire extension with plastic ring and para-aramid wire, 1 mm
GK1-WDS	Fork head for M4
MH1-WDS	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
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

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

85
78.5
6.5
40
20
2x ø4.5
2x ø5.3
2x ø4.5
ø9
90°
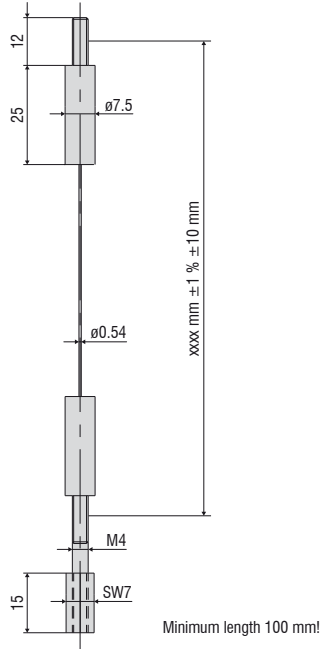2x ø5.3

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.
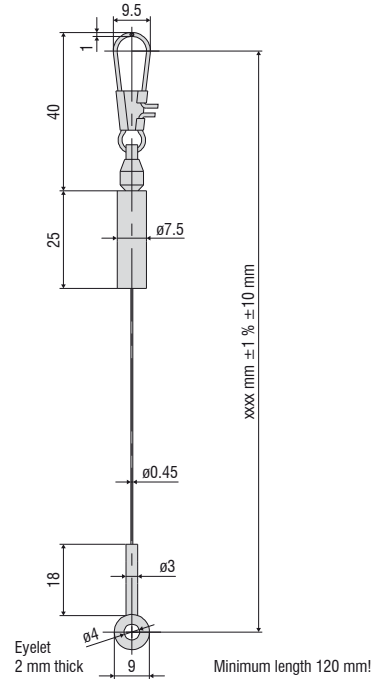

Wire outlet 0° (±3° tolerance)

Dimensions in mm, not to scale.

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

12
25
ø7.5
xxxx mm ±1 % ±10 mm
ø0.54
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
31 ±2
25 ±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

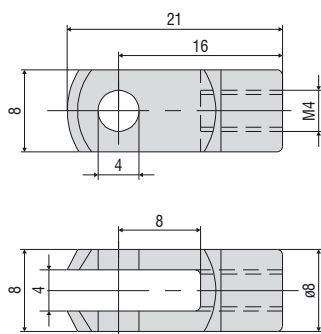| Output	Connector M16 -SA / -SR	Integrated cable -CA / -CR	Open contacts

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

1 = Input +
2 = Ground
3 = Signal

White = Input +
Brown = Ground
Green = Signal

1 = Input +
2 = Signal
3 = Ground

Voltage output (U)

Supply voltage	14 ... 27 VDC (non-stabilized)
Current consumption	max. 30 mA
Output voltage	0 ... 10 VDC 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 EN 61000-6-2
Adjustment range (if supported by the model)	
Zero	±20 % FSO
Sensitivity	±20 %

Sensor side

1 = Power supply
2 = Ground
3 = Signal
4 = Ground

White = Supply
Brown = Ground
Green = Signal
Yellow = Ground

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 EN 61000-6-2
Adjustment range (if supported by the model)	
Zero	±18 % FSO
Sensitivity	±15 %

Sensor side

1 = Power supply
2 = Ground

White = Supply
Brown = Ground

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 ≥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 $\overline{\text{DATAVALID}}$ $\overline{\text{DATAVALID}}$ $\overline{\text{MT}}$	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 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	$\overline{\text{DATAVALID}}$
9	Pink	F/R
10	Black-yellow	$\overline{\text{DATAVALID}}$ $\overline{\text{MT}}$
11	-	-
12	-	-
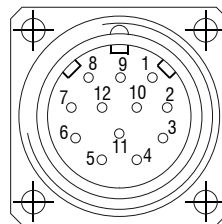
Use twisted-pair cables as extension cables.

Inputs

Control signals $F/\overline{R}$ and zero	
High level	> 0.7 V+
Low level	< 0.3 V+
Circuitry	$F/\overline{R}$ 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	≤ 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.)	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 para- meterized 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

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
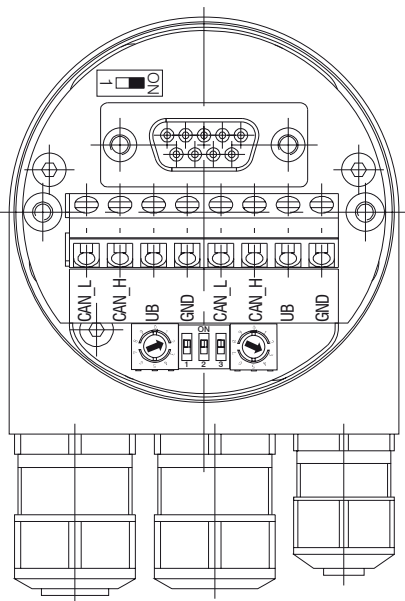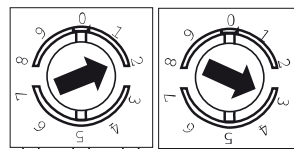

Setting of the terminating resistor CANopen

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

Setting of the terminating resistor Profibus DP

ON = Last participant
OFF = Participant X
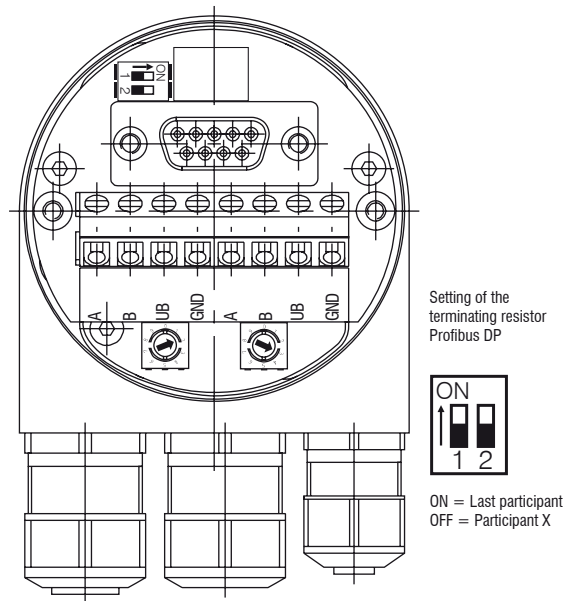
Settings of the Profibus participant address

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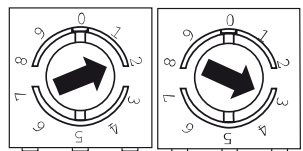
Profibus DP connections

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 features

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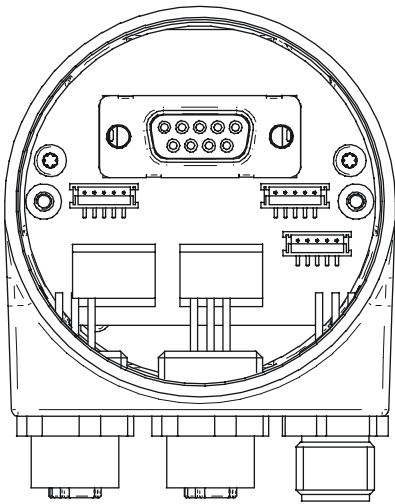
Pin assignment

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
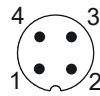
1x M12 connector (pin), A-coded

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-
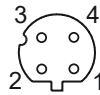
1x M12 connector (pin), A-coded

Output signals

Track A

$\overline{\text{Track A}}$

Track B

$\overline{\text{Track B}}$

Zero pulse

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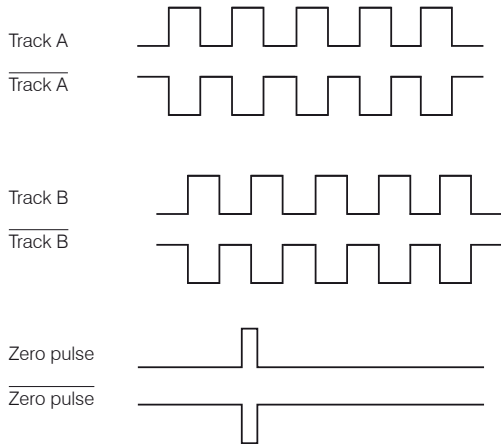
TTL Output	Line driver (5 VDC)	
High level	≥ 2.5 V	(with I = -20 mA)
Low level	≤ 0.5 V	(with I = 20 mA)
Load High	≤ 20 mA	
Tracks	A, $\overline{A}$, B, $\overline{B}$, 0	

Output TTL01/ TTL02	NPN (5 VDC ±5 %)
High level	> 4.5 V
Low level	< 1.0 V
Load High	≤ 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)
Load High	≤ 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
Load High	≤ 50 mA
Tracks	A, B, 0

Output E830	Push-pull (8 ... 30 VDC)
High level	≥ V+ -3 V
Low level	≤ 2.5 V
Load High	≤ 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+
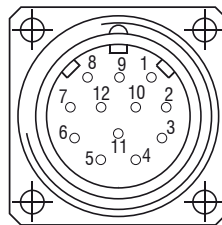
V+ Sense and GND Sense are directly connected to V+ or GND. Recommendation: Use twisted-pair cables (e.g. A/A inv.) from a cable length of 10 m.

Pin assignment E, E830

Cable color	Assignment
White	0V
Brown	V+
Green	A
-	$\overline{A}$
Yellow	B
-	$\overline{B}$
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	$\overline{A}$
Orange	B
Black	$\overline{B}$
Yellow	0
Black	n. c.

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