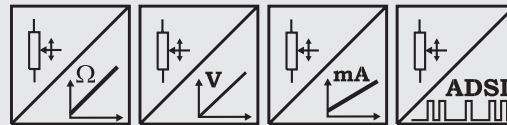


# Model WS10 with analog or SSI output



## Compact sensor for industrial applications

- Protection class IP65
- Measurement ranges:  
0 ... 100 mm to 0 ... 1250 mm
- Analog output 0 ... 10 V, 4 ... 20 mA, potentiometer or A/D converted synchronous serial output (SSI)



<b>Specifications</b>	Outputs	Potentiometer: 1 kΩ Voltage: 0...10 V Current: 4...20 mA, 2 or 3 wire Voltage and current output, adjustable A/D converted synchronous serial 16 bit max. (SSI)
	Resolution	Essentially infinite / ADSI16: max. 16 bit full scale
	Material	Aluminium and stainless steel. Cable: stainless steel
	Sensing Device	Precision potentiometer
	Connector	Male socket 8 pin (M12 or DIN 45326)
	Linearity	Up to ±0.05 % full scale
	Protection Class	IP65 (only when the electrical plug is correctly assembled and connected)
	Weight	800 g approx.
	Environmental	
	EMC	Refer to output specification
Temperature	Refer to output specification	

## Order Code WS10 Analog or SSI

**Model Name**

**Measurement Range (in mm)**

100 / 125 / 375 / 500 / 750 / 1000 / 1250

**Outputs** (see pages 57 ff.)

- R1K = Potentiometer 1 kΩ (other values on request)
- 10V = With 0 ... 10 V signal conditioner
- 420A = With 4 ... 20 mA signal conditioner (2 wire)
- 420T = With 4 ... 20 mA signal conditioner (3 wire)
- PMU = With 0...10 V/4...20 mA signal conditioner, adjustable
- ADSI16 = With A/D converted synchronous serial output 16 bit (option: 12, 14 bit)

**Linearity**

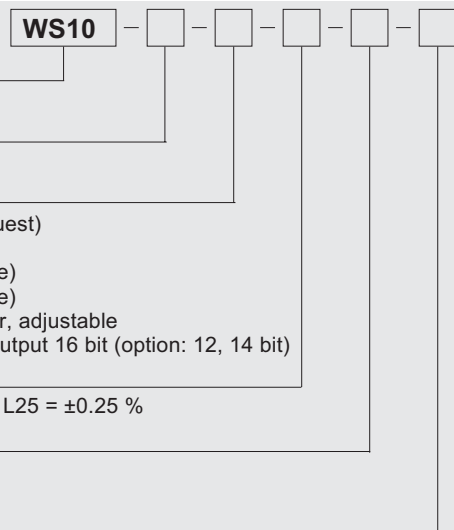
L10 = ±0.10 %    option:    L05 = ±0,05 %    L25 = ±0.25 %

**Cable fixing**

- M4 = M4 cable fixing
- SB0 = Cable clip

**Connection**

- M12 = 8 pin socket M12
- D8 = 8 pin socket DIN 45326



**Order Code Mating Connector** (see accessories p. 82) D8: **CONN-DIN-8F-W** M12: **CONN-M12-8F-G**

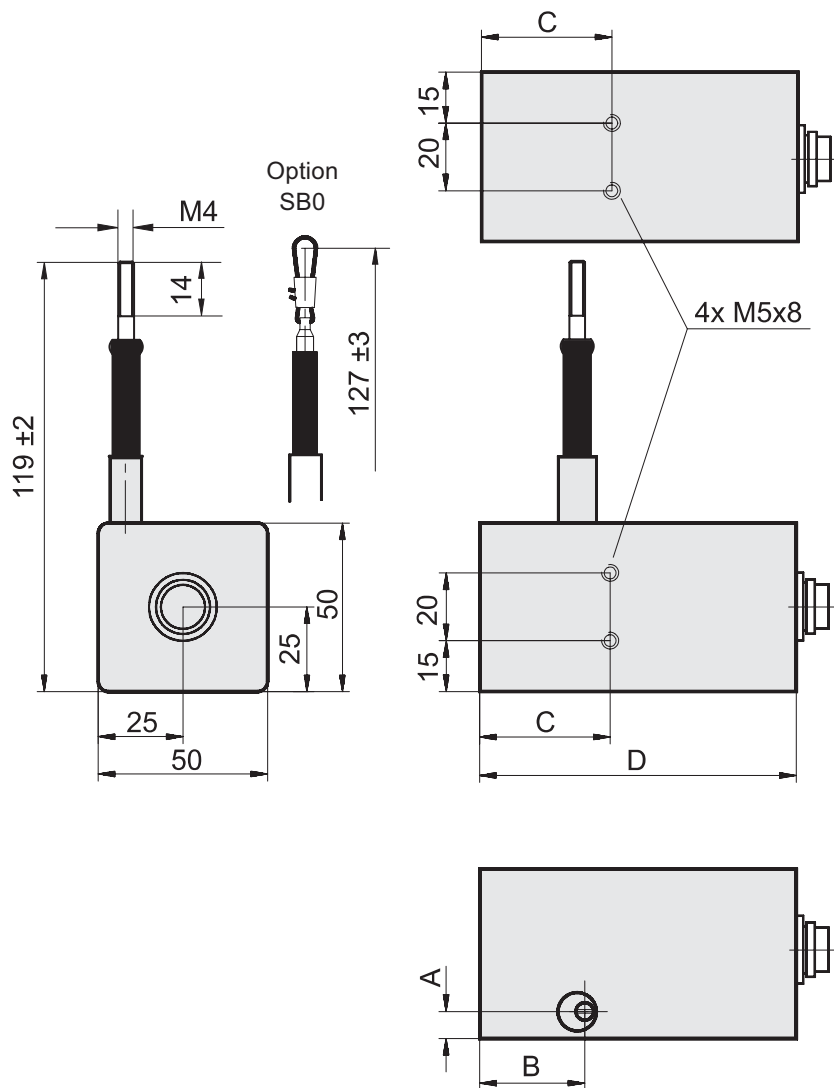
**Order Example: WS10 - 1250 - 10V - L10 - M4 - M12**

# Model WS10 with analog or SSI output



Cable Forces typical at 20 °C	Range	Maximum pull-out force	Minimum pull-in force
	mm	[N]	[N]
	100	4.7	3.0
	125	4.6	2.4
	375	7.4	3.9
	500	5.5	2.8
	750	7.6	3.8
	1000	5.3	2.9
	1250	4.6	2.4

## Outline drawing



Dimensions informative only.  
For guaranteed dimensions consult factory

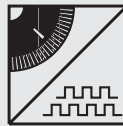
Dimensions (mm)	Range	A	B, C	D (ADS16)
	375; 750	12.5	B=31, C=38.5	93.5 (120.5)
	100; 125; 500	8.0		
1000; 1250	8.0			

# Model WS10 with incremental encoder output



## Compact sensor for industrial applications

- Protection class IP65
- Measurement range:  
0 ... 1250 mm
- With incremental encoder output



Specifications	Outputs	Incremental encoder output with differential push-pull circuit for reliable data transmission. The output is compatible with TTL or HTL.
	Resolution	10 pulses per mm (1/40 mm with external edge counting mode)
	Material	Aluminium and stainless steel. Cable: stainless steel
	Sensing Device	Incremental encoder
	Connector	Male socket 8 pin (M12 or DIN 45326)
	Linearity	±0.05 % full scale
	Protection Class	IP65 (only when the electrical plug is correctly assembled and connected)
	Weight	800 g approx.
	Environmental	
	EMC	Refer to output specification
Temperature	Refer to output specification	

## Order Code WS10 Incremental

WS10 - [ ] - [ ] - [ ] - [ ] - [ ]

### Model Name

### Measurement Range (in mm)

1250 (all smaller measurement ranges included)

### Pulses per mm

10 = 10 pulses per mm

25 = 25 pulses per mm (output PP530 only)

Other numbers of pulses on request

### Output (see page 60)

IE24LI = Incremental output TTL compatible inverted

IE24HI = Incremental output HTL compatible inverted

PP530 = Incremental output TTL and HTL compatible

### Cable fixing

M4 = M4 cable fixing

SB0 = Cable clip

### Connection

M12 = 8 pin socket M12

D8 = 8 pin socket DIN 45326

Order Code Mating Connector (see accessories p. 82) D8: **CONN-DIN-8F-W** M12: **CONN-M12-8F-G**

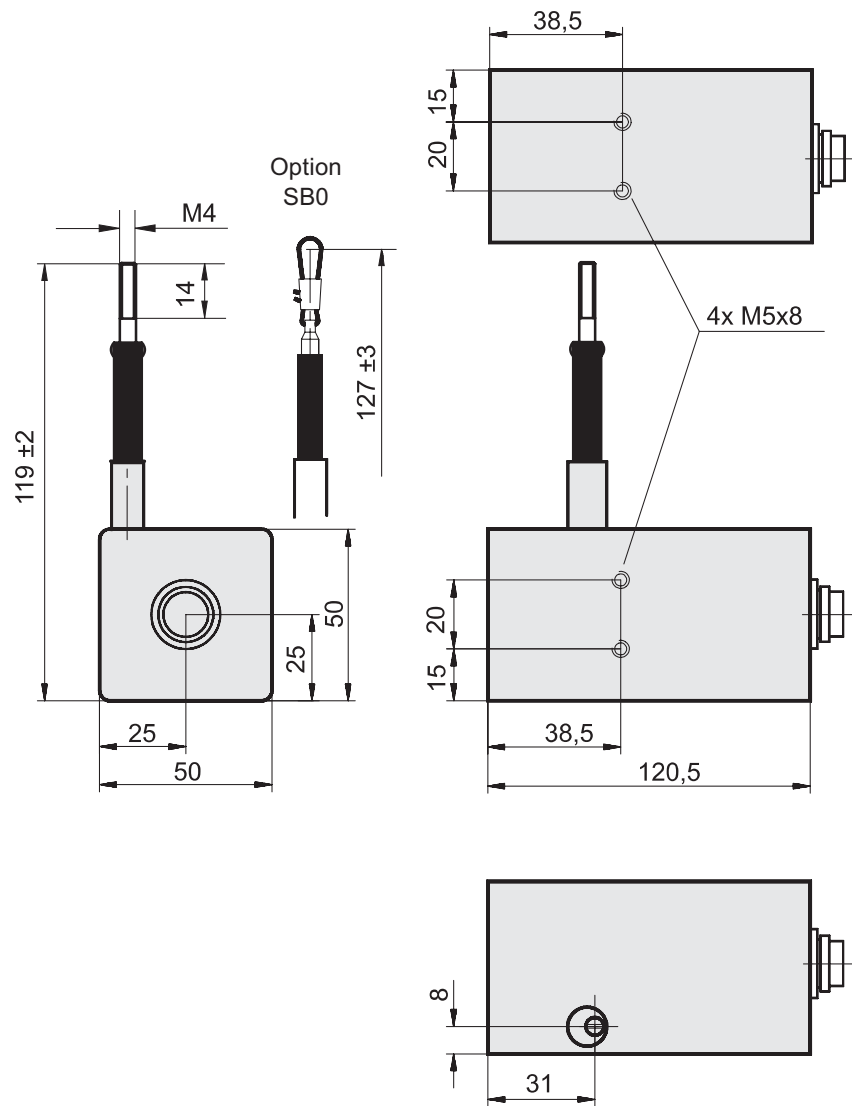
Order Example: **WS10 - 1250 - 10 - IE24HI - M4 - M12**

# Model WS10 with incremental encoder output



Cable Forces typical at 20 °C	Resolution	Maximum Pull-out Force [N]	Minimum Pull-in Force [N]
	Pulses per mm		
	10	5.8	3.0

## Outline drawing



Dimensions informative only.  
For guaranteed dimensions consult factory

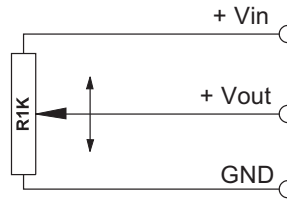
# Output Specifications

## R1K and 10V for WS position sensors

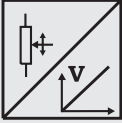


<b>Voltage divider R1K</b> Potentiometer 	Excitation Voltage	32 VDC max. at 1 k $\Omega$ (input power 1 W max.)
	Potentiometer Impedance	1 k $\Omega$ $\pm$ 10%
	Thermal coefficient	$\pm$ 25 x 10 <sup>-6</sup> / °C full scale
	Sensitivity	Depends on measurement range, individual sensitivity of sensor specified on label
	Voltage Divider Utilization Range	Approx. 3% ... 97% of full range
	Operating Temperature	-20 ... +85 °C

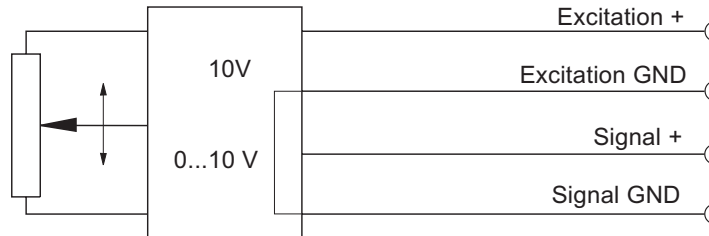
### Signal diagram



Note: The potentiometer must be connected as a voltage divider. The input impedance of the following processing circuit should be 10 M $\Omega$  min.

<b>Signal conditioner 10V</b> Voltage output 	Excitation Voltage	+18 ... +27 V DC non stabilized
	Excitation Current	20 mA max.
	Output Voltage	0 ... +10 V DC
	Output Current	2 mA max.
	Output Load	> 5 k $\Omega$
	Stability (Temperature)	$\pm$ 50 x 10 <sup>-6</sup> / °C full scale
	Protection	Reverse polarity, short circuit
	Output Noise	0,5 mV <sub>RMS</sub>
	Operating Temperature	-20 ... +85 °C
	EMC	According to EN 61326:2004

### Signal diagram

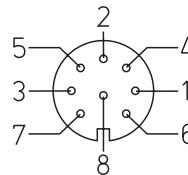


Signal Wiring	Output signals		Cable color	Connector pin no.
	R1K	10V		
	+ Vin	Excitation +	White	1
	GND	Excitation GND	Brown	2
	+ Vout	Signal +	Green	3
		Signal GND	Yellow	4

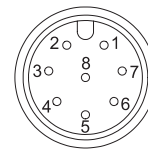
### Connection

#### Mating Connector

View to solder terminals



CONN-DIN-8F-W

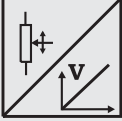


CONN-M12-8F-G

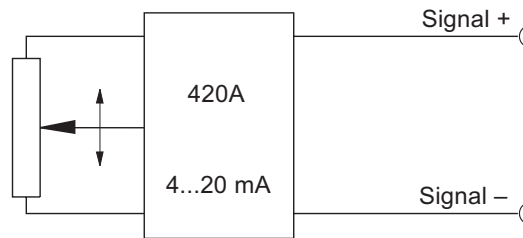
# Output Specifications

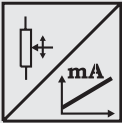
## 420A and 420T for WS position sensors



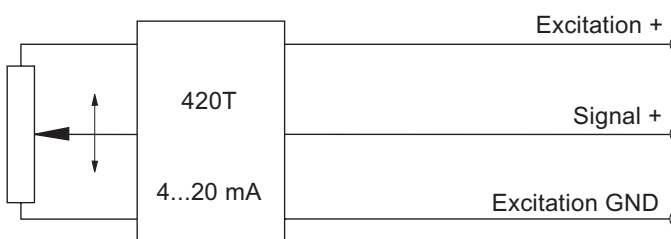
<b>Signal conditioner</b> <b>420A</b> Current output (2 wire) 	Excitation Voltage	+12 ... 27 VDC non stabilized, measured at the sensor terminals
	Excitation Current	35 mA max.
	Output Current	4 ... 20 mA equivalent to 0 ... 100% range
	Stability (Temperature)	$\pm 100 \times 10^{-6} / ^\circ\text{C}$ full scale
	Protection	Reverse polarity, short circuit
	Output Noise	0.5 mV <sub>RMS</sub>
	Operating Temperature	-20 ... +85 °C
	EMC	According to EN 61326:2004

### Signal Diagram



<b>Signal Conditioner</b> <b>420T</b> Current output (3 wire) 	Excitation Voltage	+18...+27 V DC non stabilized
	Excitation Current	40 mA max.
	Load Resistor	350 Ω max.
	Output Current	4 ... 20 mA equivalent to 0 ... 100% range
	Stability (Temperature)	$\pm 50 \times 10^{-6} / ^\circ\text{C}$ full scale
	Protection	Reverse polarity, short circuit
	Output Noise	0.5 mV <sub>RMS</sub>
	Operating Temperature	-20 ... +85 °C
	EMC	According to EN 61326:2004

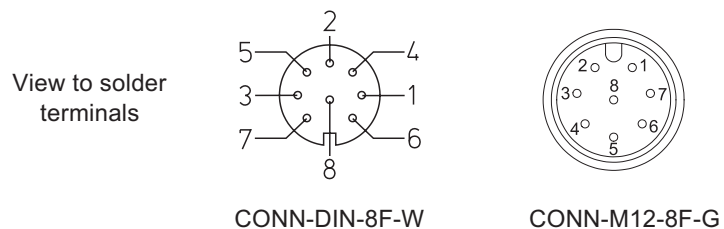
### Signal diagram



Signal Wiring	Output signals		Cable color	Connector pin no.
	420A	420T		
Signal +		Excitation +	White	1
Signal -		Excitation GND	Brown	2
		Signal +	Green	3

### Connection

Mating Connector

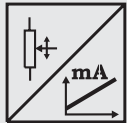
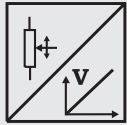


# Output Specification

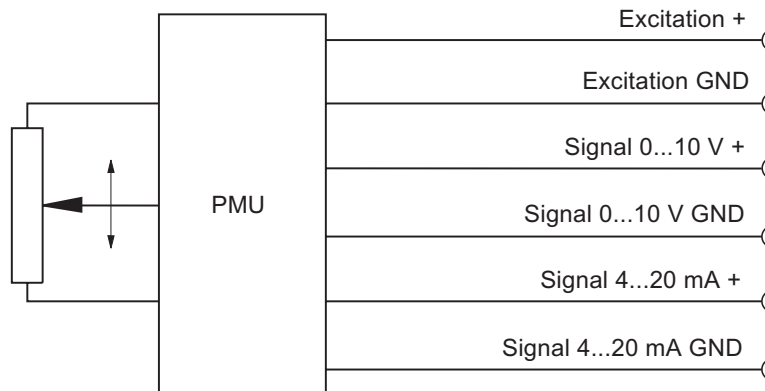
## PMU for WS position sensors



<b>Signal Conditioner PMU, adjustable</b> Voltage output and current output (3 wire)	Excitation voltage	+18 ... 27 V DC
	Excitation current	50 mA max.
	Voltage output	0 ... 10 V
	Output current	10 mA max.
	Output load	1 kΩ min.
	Current output	4 ... 20 mA (3 wire)
	Load resistor	500 Ω max.
	Adjustment	
	Activation of offset and gain adjust	Connect with excitation GND (0 V)
	Scalable range	90 % max. full scale
	Stability (Temperature)	$\pm 50 \times 10^{-6} / ^\circ\text{C}$ full scale
	Protection	Reverse polarity, short circuit
	Output noise	1 mV <sub>eff</sub>
Operating temperature	-20 ... +85 °C	
EMC	According to EN 61326:2004	



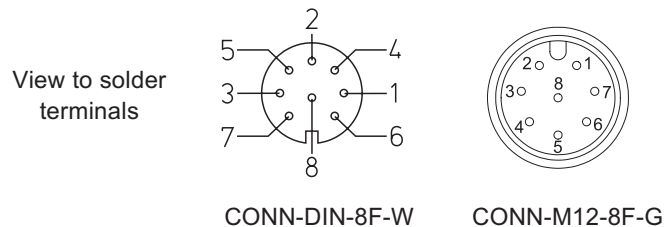
### Signal diagram



Signal wiring	Output signals	Connector pin no.
	Excitation +	1
	Excitation GND	2
	Signal 0...10 V +	3
	Signal 0...10 V GND	4
	Signal 4...20 mA +	5
	Signal 4...20 mA GND	6
	Offset	7
	Gain	8

### Connection

#### Mating Connector



# Output Specification

## ADSI16 for WS position sensors



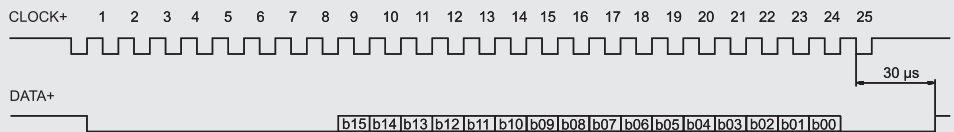
- Resolution 16 bit, data transmission synchronous serial/SSI
- Optional available with 12 bit (ADSI) or 14 bit (ADSI14) resolution
- No loss of data at power-down
- Easy to connect to PLC's with SSI input circuit

### Description

The sensing device of the ADSI is a precision potentiometer. The position information is given by an analog/digital converter output serialized as a data word. Data transmission takes place by means of the signals CLOCK and DATA. The processing unit (PLC, Micro-computer) sends pulse sequences which clock the data transmission with the required transfer rate. With the first falling edge of a pulse sequence the position of the sensor is recorded and stored. The following rising edges control the bit-by-bit A/D conversion, encoding and output of the data word. After a delay time the next new position information will be transmitted.

### Data Format

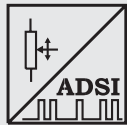
(Train of 26 Pulses)



### Signal Conditioner

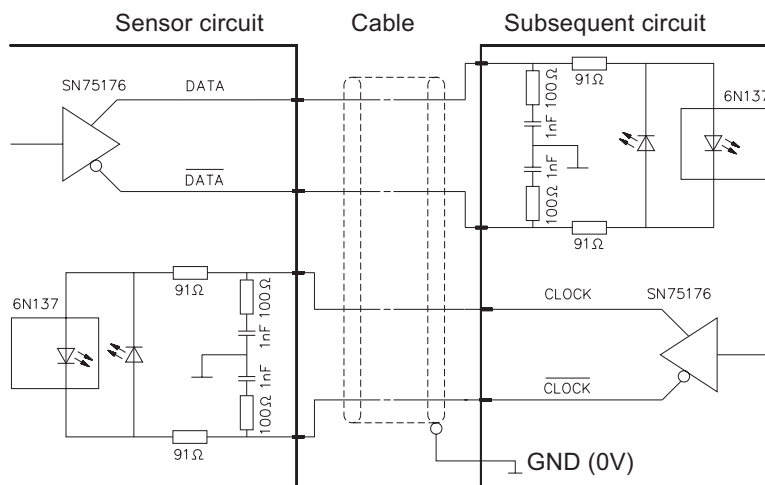
#### ADSI

A/D converted synchronous serial



Output	EIA RS-422, RS-485, short-circuit proof
Excitation voltage	11 ... 27 VDC
Excitation current	200 mA max.
Clock frequency	70 ... 500 kHz
Code	Gray code, continuous progression
Delay between pulse trains	T=30 μs min.
Resolution	16 bit (65536 counts) full scale; optional 12 bit or 14 bit
Stability (temperature)	±50 x 10 <sup>-6</sup> / °C full scale
Operation temperature	-20 ... +85 °C
EMC	According to EN 61326:2004

### Recommended Processing Input Circuit



### Transmission rate

Cable length	Baud rate
< 50 m	< 300 kHz
< 100 m	< 100 kHz

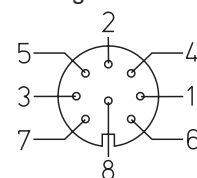
### Note:

Extension of the cable length will reduce the maximum transmission rate. The signals CLOCK/CLOCK and DATA/DATA must be connected in a twisted pair cable, shielded per pair and common.

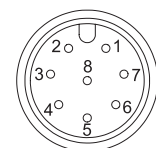
### Signal Wiring

Signal names	Connector pin no.
Excitation +	1
Excitation GND (0V)	2
CLOCK	3
CLOCK	4
DATA	5
DATA	6
Screen	not connected

Mating connector: view to solder terminals



CONN-DIN-8F-W



CONN-M12-8F-G



# Output Specifications

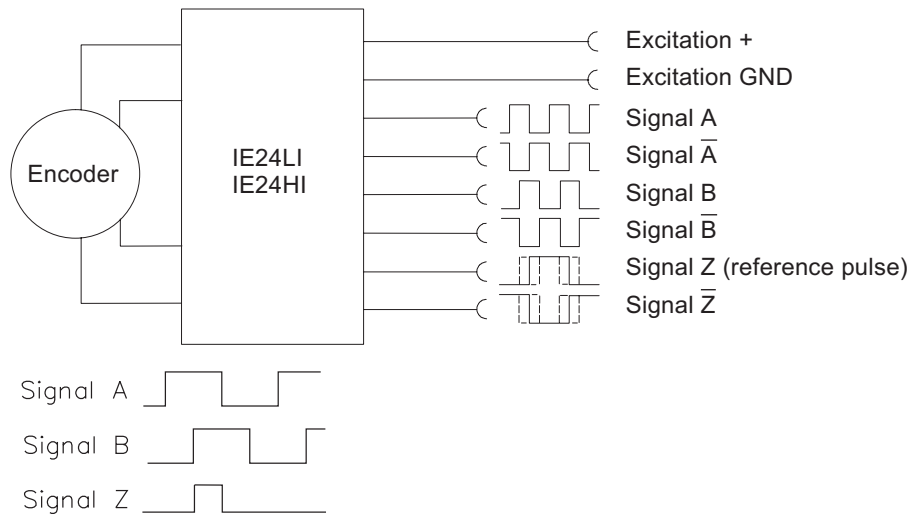
## IE24LI and IE24HI for WS position sensors



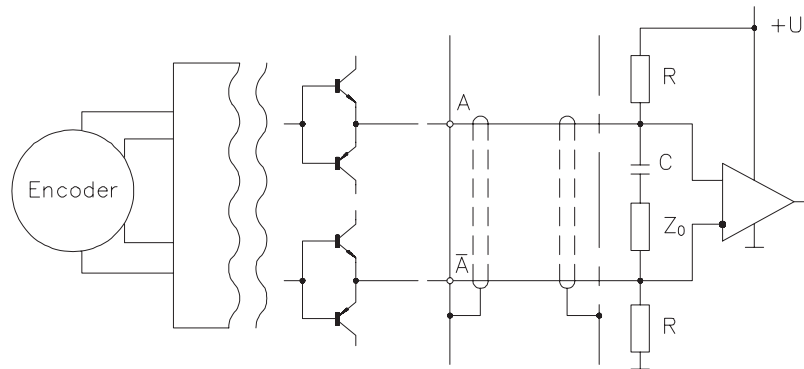
IE24LI and IE24HI incremental	IE24LI		IE24HI
	Excitation voltage	5 V DC $\pm 10\%$	10 ... 30 V DC
Excitation current	100 mA max.		
Output frequency	200 kHz		
Output	Push-pull and inverted signals		
Output current	10 mA max.		
Output voltage	Depending on the excitation voltage		
Stability (temperature)	$\pm 20 \times 10^{-6} / ^\circ\text{C}$ f.s. (sensor mechanism)		
Operation temperature	-20 ... +85 $^\circ\text{C}$		
Protection	Short circuit		
EMC	According to EN 61326:2004		



### Output signals



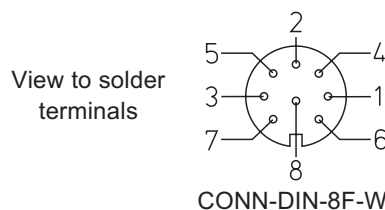
### Output circuit and recommended processing input circuit



Signal wiring	Output signals	Cable color	Connector pin no.
	Excitation +	Brown	1
	Excitation GND	White	2
	Signal B (A + 90°)	Grey	3
	Signal A	Green	4
	Signal $\bar{B}$	Pink	5
	Signal $\bar{A}$	Yellow	6
	Signal Z (reference pulse)	Blue	7
	Signal $\bar{Z}$	Red	8

### Connection


Mating connector



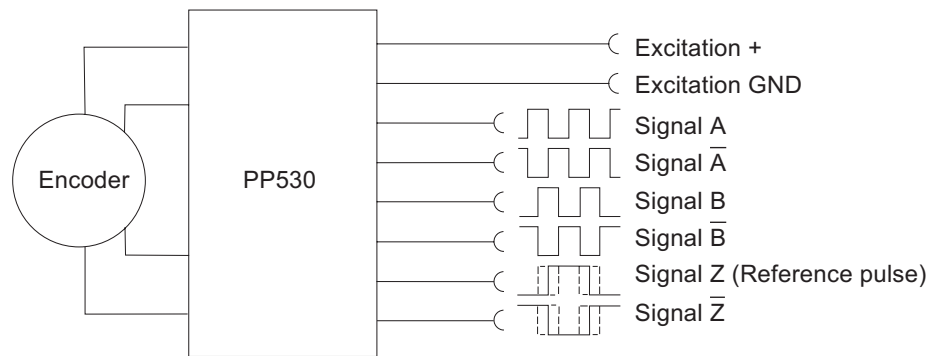
# Output Specification

## PP530 for WS position sensors

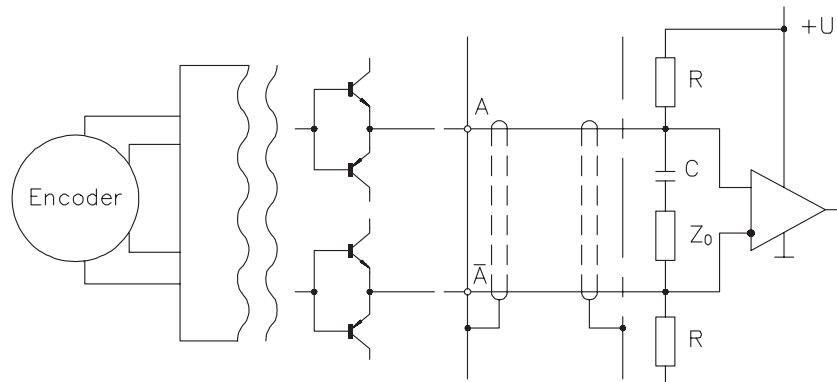


<b>Signal Conditioner</b> <b>PP530</b> Incremental 	Excitation Voltage	+5 ... +30 VDC
	Excitation Current	200 mA max.
	Output Frequency	200 kHz max.
	Output	Linedriver, Push-Pull, CMOS, TTL and HTL compatible
	Output Current	30 mA max., short circuit protection
	Output Voltage	Depends on the excitation voltage (e.g. to obtain TTL-signals the excitation must be 5 V.) Compatible to EIA RS-422/RS-485
	Stability (Temperature)	$\pm 20 \times 10^{-6}$ / K full scale (sensor mechanism)
	Operation Temperature	-10 ... +70 °C
	Storage Temperature	-30 ... +80 °C
	Transition Time Positive Edge	250 ns
	Transition Time Negative Edge	250 ns
	Protection	Reverse polarity, short circuit
	EMC	According to EN61326:2004

### Signal Diagram



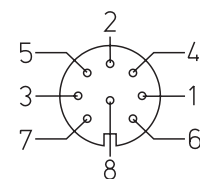
### Recommended Processing Circuit



Signal Levels	Excitation	Level	$I_a \leq 5 \text{ mA}$	$I_a \leq 25 \text{ mA}$	$-I_a \leq 5 \text{ mA}$	$-I_a \leq 25 \text{ mA}$
	5 V	$U_{aHigh}$	$>4.2 \text{ V}$	$>4.2 \text{ V}$	$>4.1 \text{ V}$	$>3.8 \text{ V}$
5 V	$U_{aLow}$	$<0.5 \text{ V}$	$<1.2 \text{ V}$	$<0.4 \text{ V}$	$<0.4 \text{ V}$	
24 V	$U_{aHigh}$	$>23.5 \text{ V}$	$>23.5 \text{ V}$	$>23.5 \text{ V}$	$>22.5 \text{ V}$	
24 V	$U_{aLow}$	$<0.5 \text{ V}$	$<1.2 \text{ V}$	$<0.4 \text{ V}$	$<0.4 \text{ V}$	

Signal Wiring / Connection	Output signals	Connector CONN-DIN-8F
	Excitation +	1
Excitation GND (0V)	2	
Signal B (A + 90°)	3	
Signal A	4	
Signal B-bar	5	
Signal A-bar	6	
Signal Z (reference pulse)	7	
Signal Z-bar	8	

Mating connector  
View to solder terminals



CONN-DIN-8F-W