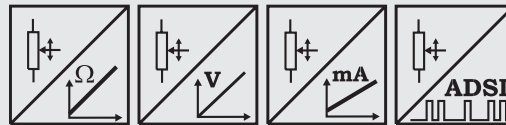


# Model WS12 with analog or SSI output



## Sensor for hostile environments

- Protection class IP67
- Measurement ranges: 0 ... 100 mm to 0 ... 3000 mm
- Analog output 0 ... 10 V, 4 ... 20 mA, potentiometer or A/D converted synchronous serial output (SSI)



Specifications	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 max. 16 bit (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	IP67 (only when the electrical plug is correctly assembled and connected)	
Weight (approx.)	≤1500 mm: 1 kg; ≥2000 mm: 1.5 kg	
Environmental		
EMC	Refer to output specification	
Temperature	Refer to output specification	

**Order Code WS12**

**Analog**

**Model Name** WS12 - [ ] - [ ] - [ ] - [ ] - [ ]

**Measurement Range (in mm)**  
100 / 125 / 375 / 500 / 750 / 1000 / 1250 / 1500 / 2000 / 2500 / 3000

**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...10/4...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**

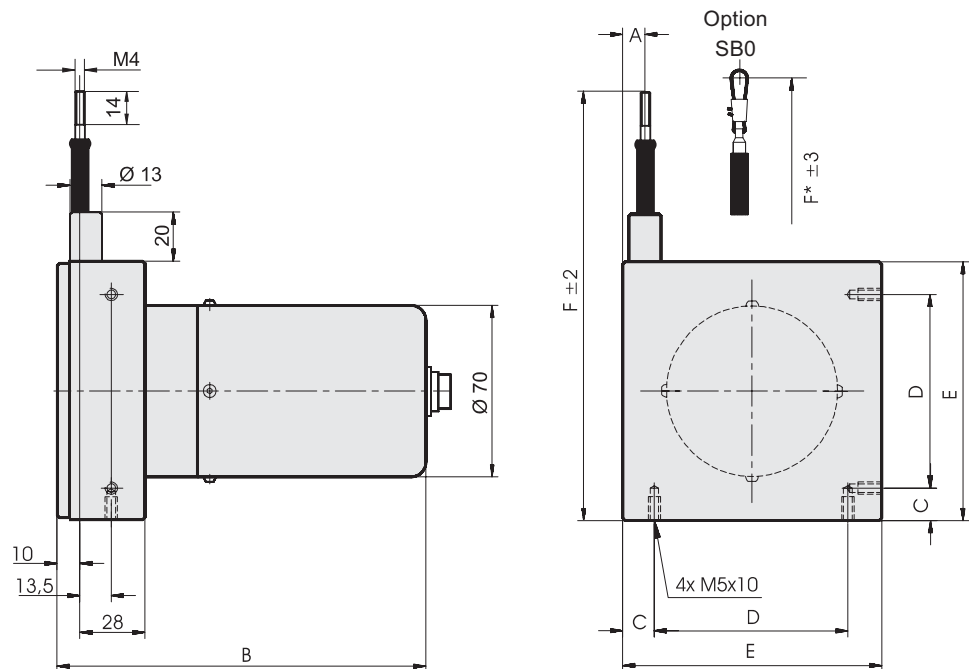
**Order Example: WS12 - 2500 - 10V - L10 - M4 - M12**

# Model WS12 with analog or SSI output



Cable Forces typical at 20 °C	Range	Maximum Pull-out Force	Minimum Pull-in Force
	[mm]	[N]	[N]
	100	5.2	2.8
	125	4.6	2.5
	375	7.5	3.7
	500	5.9	2.6
	750	7.5	3.3
	100	5.5	2.4
	1250	4.8	2.1
	1500	10.4	6.4
	2000	8.1	5.0
	2500	6.7	4.0
	3000	6.2	3.0

## Outline drawing



Dimensions informative only.  
For guaranteed dimensions consult factory

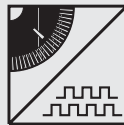
Dimensions	Range	A	B (ADSI16)	C...E	F (F*)
	[mm]				
	100; 500; 1000	18,5	112 (137)	C=14, D=43, E=71	141 (149)
	125; 1250	15,0	112 (137)		
	1500	11,0	127 (152)		
	2000	22,0	127 (152)	C=15, D=79, E=109, F=182±3	179 (187)
	2500	13,5	127 (152)		
	3000	9,5	127 (152)		

# Model WS12 with incremental encoder output



### Sensor for hostile environments

- Protection class IP67
- Measurement ranges:  
0 ... 1250 mm to 0 ... 3000 mm
- Incremental encoder output



Specifications	Outputs	Incremental encoder output for reliable data transmission. The output is compatible with TTL and HTL.
	Resolution	5 or 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	IP67 (only when the electrical plug is correctly assembled and connected)
	Weight	Up to 1500 mm: 1 kg approx. 2000 mm and greater: 1.5 kg approx.
	Environmental	
	EMC	Refer to output specification
	Temperature	Refer to output specification

Order Code WS12 Incremental	Model Name	WS12 - [ ] - [ ] - [ ] - [ ] - [ ]
	<b>Measurement Range (in mm)</b>	
	1250 (all smaller ranges included) / 1500 / 2000 / 2500 / 3000	
	<b>Pulses per mm</b>	
	10 = 10 Pulses per mm (1250, 1500 mm)	
	5 = 5 Pulses per mm (2000, 2500, 3000 mm)	
	<b>Output</b> (see page 60)	
	IE24LI = Incremental output TTL compatible inverted	
	IE24HI = Incremental output HTL compatible inverted	
	PP530 = Do not use for further developments	
	<b>Cable fixing</b>	
	M4 = M4 cable fixing	
	SB0 = cable clip	
	<b>Connection</b>	
	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**

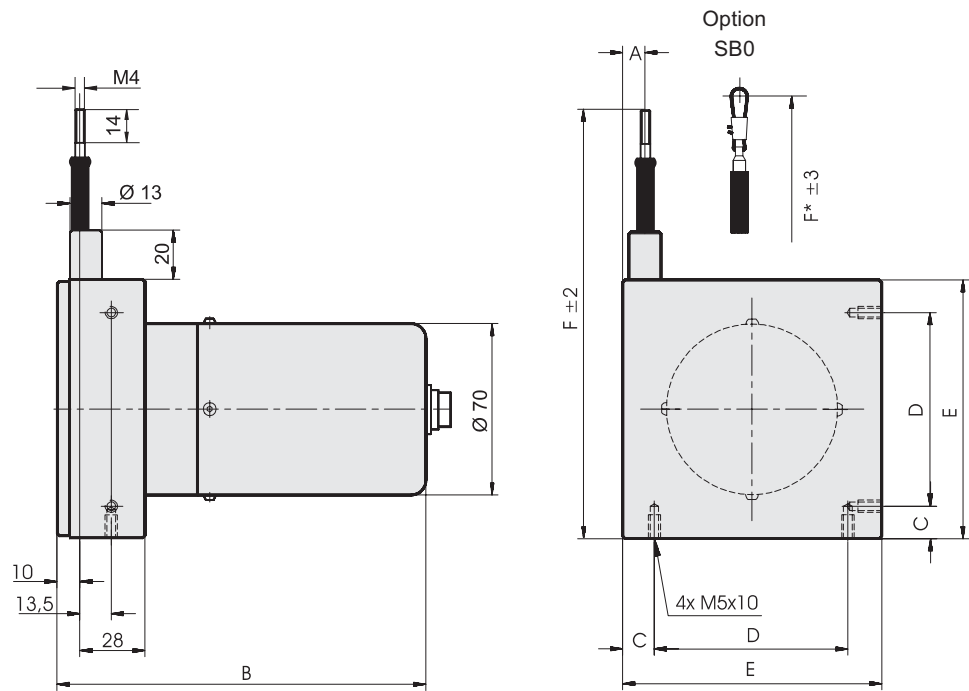
**Order Example: WS12 - 1500 - 10 - IE24HI - M4 - M12**

# Model WS12 with incremental encoder output



Cable Forces typical at 20 °C	Range [mm]	Max. Pull-out Force [N]	Min. Pull-in Force [N]
	1250	6.6	2.7
	1500	10.6	6.5
	2000	5.7	4.1
	2500	5.7	4.1
	3000	5.8	4.0

## Outline drawing



Dimensions informative only.  
For guaranteed dimensions consult factory

Dimensions	Range [mm]	A	B	C	D	E	F (F*)
	1250	18,5	137	14	43	71	141 (149)
	1500	11	152	14	43	71	141 (149)
	2000	9,5	152	15	79	109	179 (187)
	2500	9,5	152	15	79	109	179 (187)
	3000	9,5	152	15	79	109	179 (187)

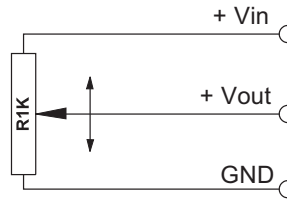
# Output Specifications

## R1K and 10V for WS position sensors

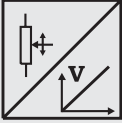


<b>Voltage divider R1K</b> Potentiometer 	Excitation Voltage	32 VDC max. at 1 kΩ (input power 1 W max.)
	Potentiometer Impedance	1 kΩ ±10%
	Thermal coefficient	±25 x 10 <sup>-6</sup> / °C full scale
	Sensitivity	Depends on measurement range, individual sensitivity of sensor specified on label
	Voltage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

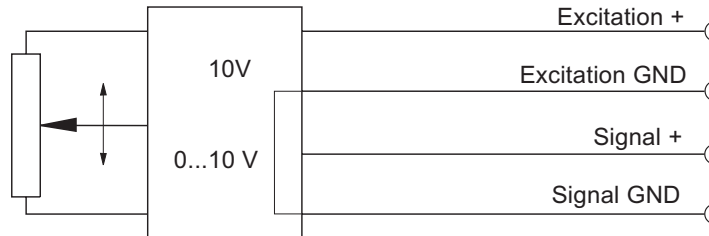
### Signal diagram



Note: The potentiometer must be connected as a voltage divider. The input impedance of the following processing circuit should be 10 MΩ 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 kΩ
	Stability (Temperature)	±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

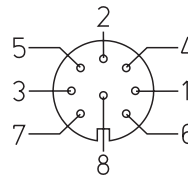


Signal Wiring	Output signals		Cable color	Connector pin no.
	R1K	10V		
	+ Vin	Excitation +	White	1
	GND	Excitation GND	Brown	2
	+ Vout	Signal +	Green	3
		Signal GND	Yellow	4

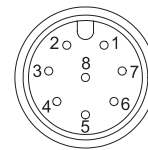
### Connection

#### Mating Connector

View to solder terminals



CONN-DIN-8F-W

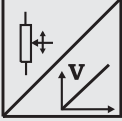


CONN-M12-8F-G

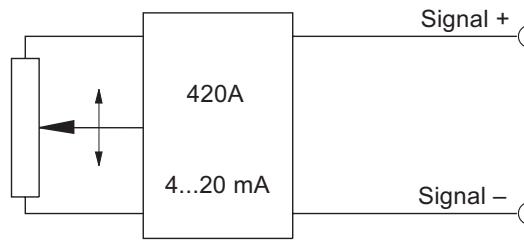
# Output Specifications

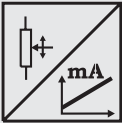
## 420A and 420T for WS position sensors



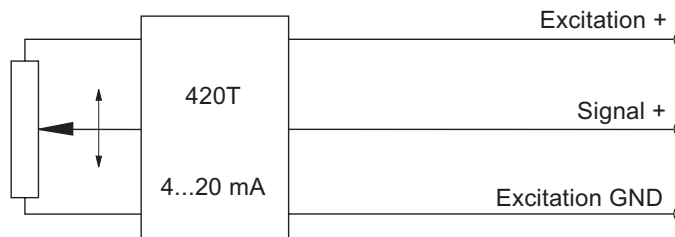
<b>Signal conditioner</b> <b>420A</b> Current output (2 wire) 	Excitation Voltage	+12 ... 27 VDC non stabilized, measured at the sensor terminals
	Excitation Current	35 mA max.
	Output Current	4 ... 20 mA equivalent to 0 ... 100% range
	Stability (Temperature)	$\pm 100 \times 10^{-6} / ^\circ\text{C}$ 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

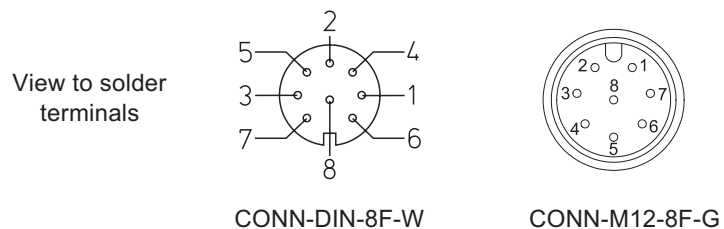
### Signal diagram



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

### Connection

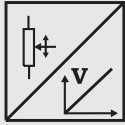
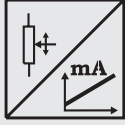
Mating Connector



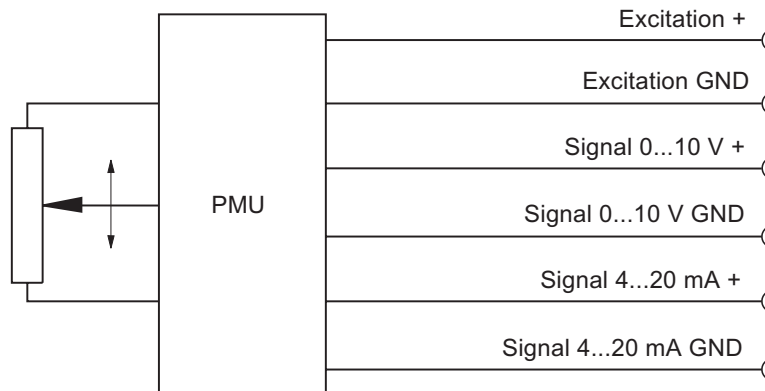
# Output Specification

## 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	

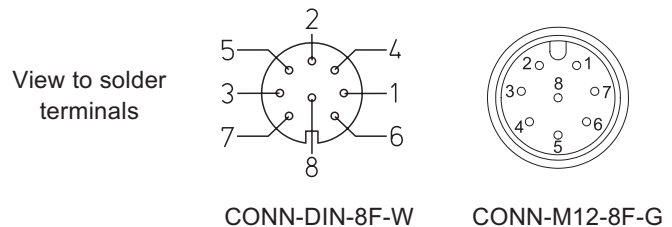
### Signal diagram



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

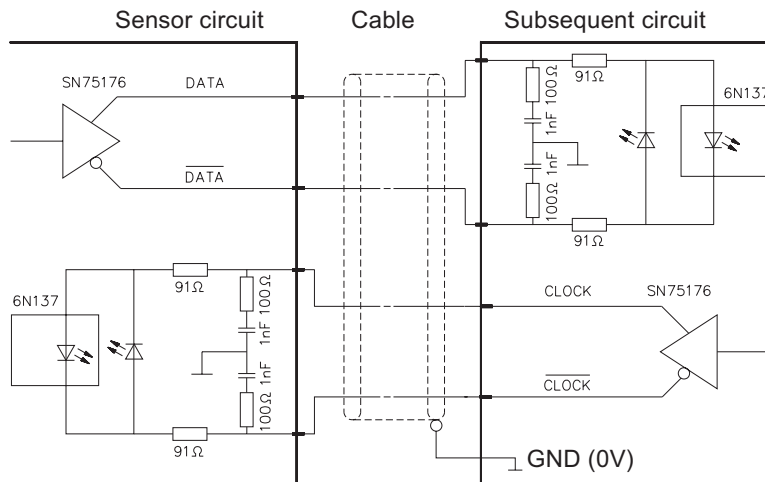
#### ADSI

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

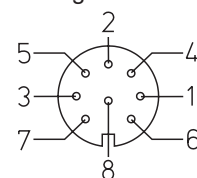
### Note:

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.

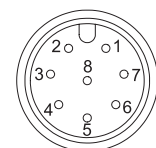
### Signal Wiring

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

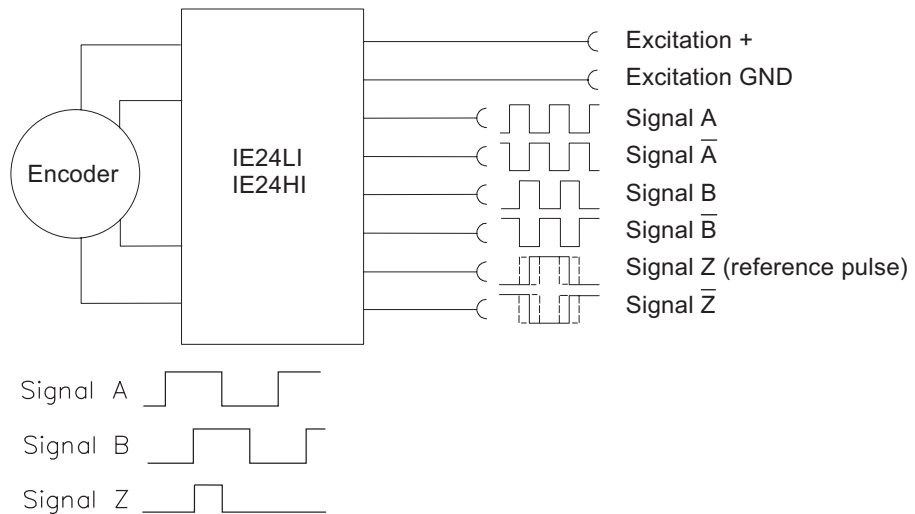
# Output Specifications

## IE24LI and IE24HI for WS position sensors

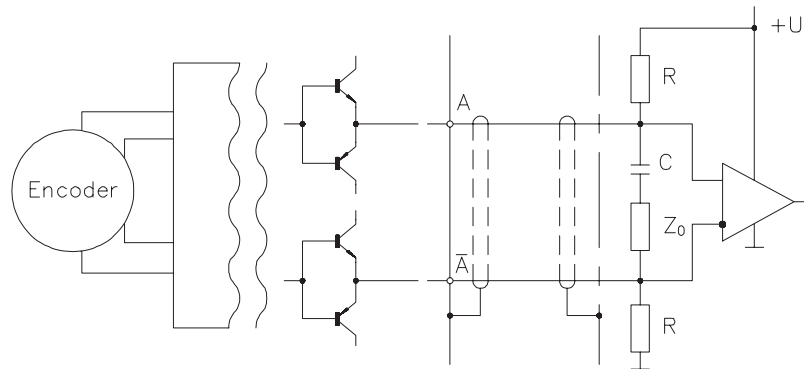


IE24LI and IE24HI incremental	IE24LI		IE24HI
		Excitation voltage	5 V DC $\pm 10\%$
	Excitation current	100 mA max.	
	Output frequency	200 kHz	
	Output	Push-pull and inverted signals	
	Output current	10 mA max.	
	Output voltage	Depending on the excitation voltage	
	Stability (temperature)	$\pm 20 \times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

### Output signals



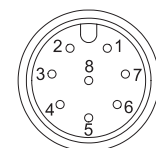
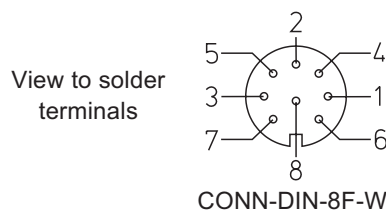
### Output circuit and recommended processing input circuit



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



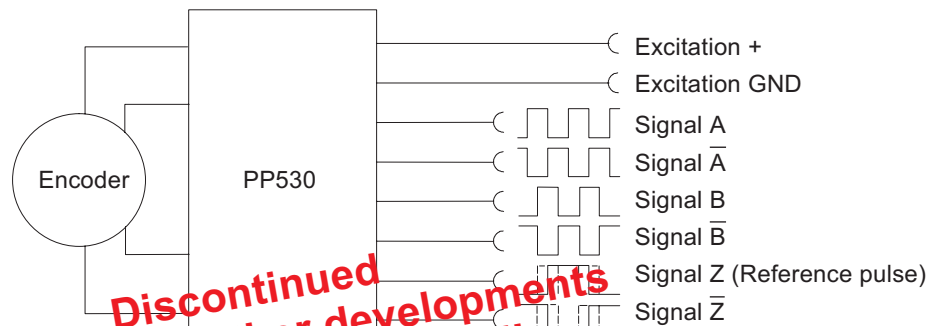
# Output Specification

## PP530 for WS position sensors



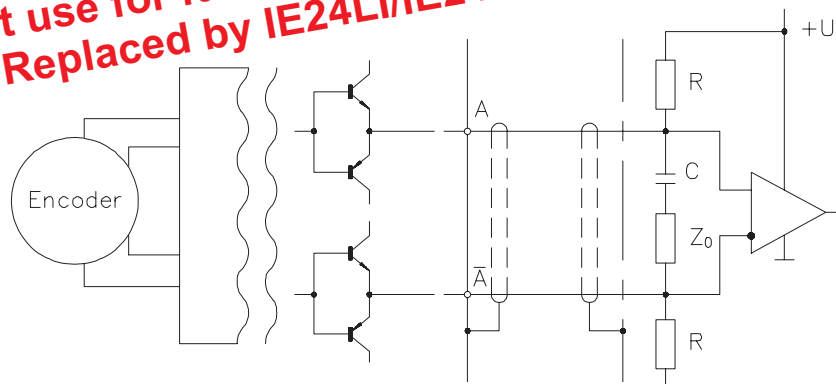
<b>Signal Conditioner</b> <b>PP530</b> Incremental 	Excitation Voltage	+5 ... +30 VDC
	Excitation Current	200 mA max.
	Output Frequency	200 kHz max.
	Output	Linedriver, Push-Pull, CMOS, TTL and HTL compatible
	Output Current	30 mA max., short circuit protection
	Output Voltage	Depends on the excitation 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

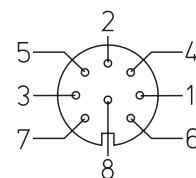
Discontinued  
 Don't use for further developments  
 Replaced by IE24LI/IE24HI



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