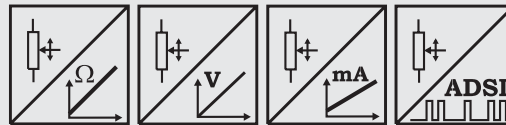


Model WS12 with analog or SSI output



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 |
| | 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

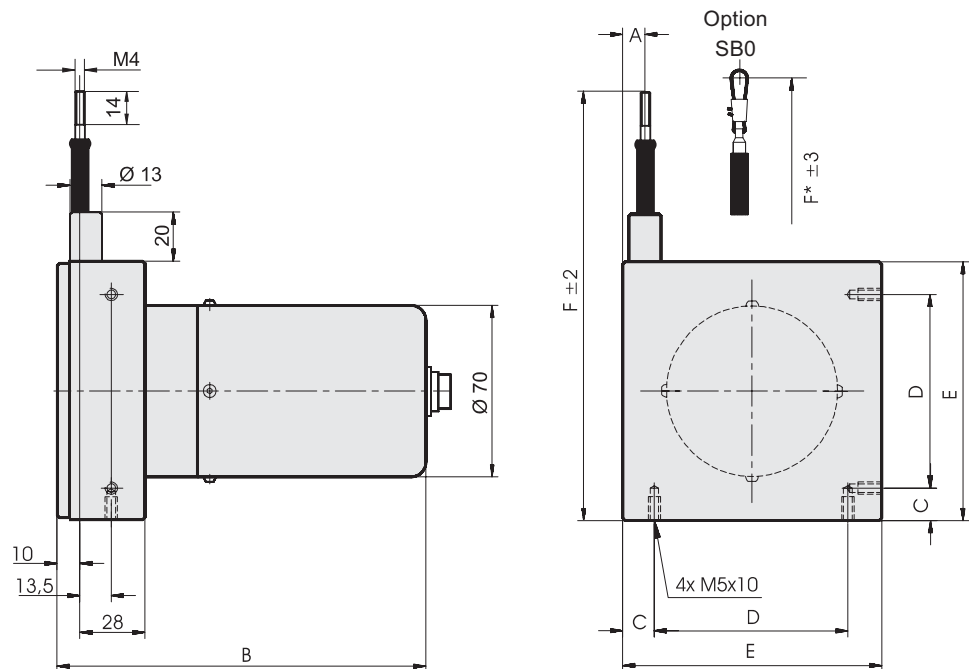
Order Example: WS12 - 2500 - 10V - L10 - M4 - M12

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

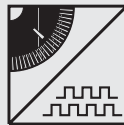
| Dimensions | Range | A | B (ADSI16) | C...E | F (F*) |
|------------|----------------|------|------------|-------------------------------|-----------|
| | [mm] | | | | |
| | 100; 500; 1000 | 18,5 | 112 (137) | C=14, D=43, E=71 | 141 (149) |
| | 125; 1250 | 15,0 | 112 (137) | | |
| | 1500 | 11,0 | 127 (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

WS12 - [] - [] - [] - [] - [] - []

Model Name

Measurement Range (in mm)

1250 (all smaller ranges included) / 1500 / 2000 / 2500 / 3000

Pulses per mm

10 = 10 Pulses per mm (1250, 1500 mm)

5 = 5 Pulses per mm (2000, 2500, 3000 mm)

Output (see page 60)

IE24LI = Incremental output TTL compatible inverted

IE24HI = Incremental output HTL compatible inverted

PP530 = Do not use for further developments

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**

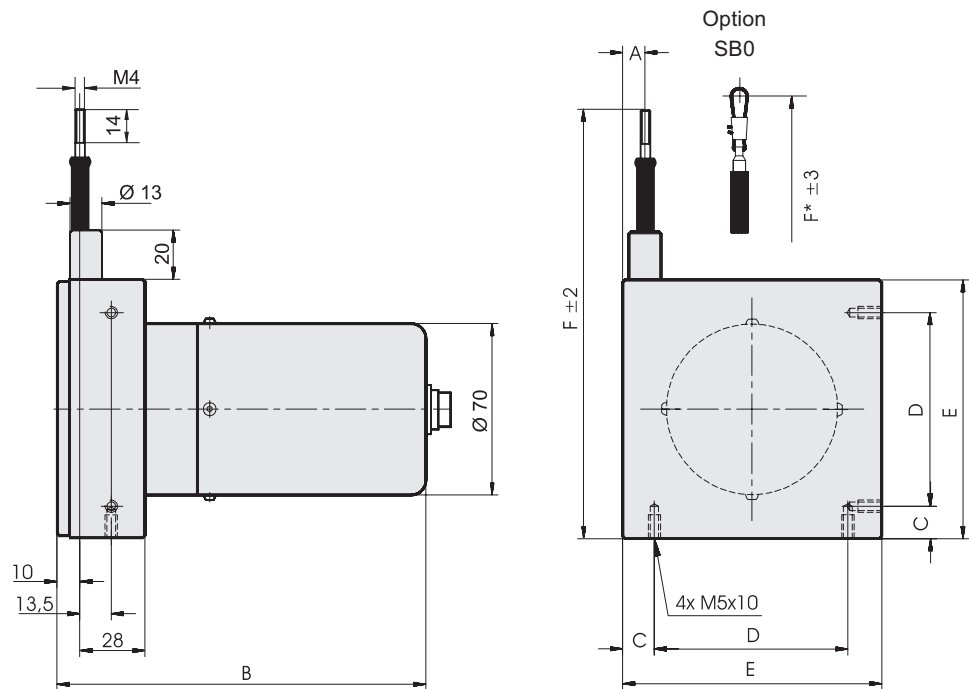
Order Example: **WS12 - 1500 - 10 - IE24HI - M4 - M12**

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) |

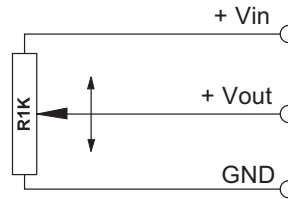
Output Specifications

R1K and 10V for WS position sensors

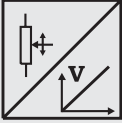


| | | |
|--|-----------------------------------|---|
| Voltage divider R1K Potentiometer  | Excitation Voltage | 32 VDC max. at 1 k Ω (input power 1 W max.) |
| | Potentiometer Impedance | 1 k Ω \pm 10% |
| | Thermal coefficient | \pm 25 x 10 ⁻⁶ / °C full scale |
| | Sensitivity | Depends on measurement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

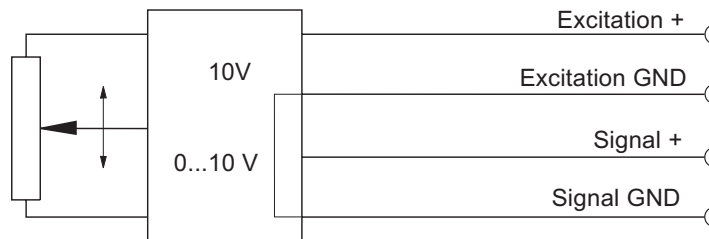
Signal diagram



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

| | | |
|---|----------------------------|---|
| Signal conditioner 10V 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 Ω |
| | Stability (Temperature) | \pm 50 x 10 ⁻⁶ / °C full scale |
| | Protection | Reverse polarity, short circuit |
| | Output Noise | 0,5 mV _{RMS} |
| | Operating Temperature | -20 ... +85 °C |
| EMC | According to EN 61326:2004 | |

Signal diagram

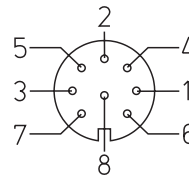


| Signal Wiring | Output signals | | Cable color | Connector pin no. |
|---------------|----------------|----------------|-------------|-------------------|
| | R1K | 10V | | |
| | + Vin | Excitation + | White | 1 |
| | GND | Excitation GND | Brown | 2 |
| | + Vout | Signal + | Green | 3 |
| | | Signal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

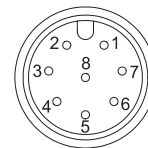
Connection

Mating Connector

View to solder terminals



CONN-DIN-8F-W

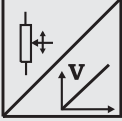


CONN-M12-8F-G

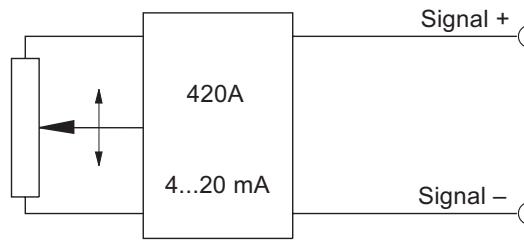
Output Specifications

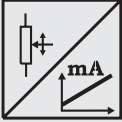
420A and 420T for WS position sensors



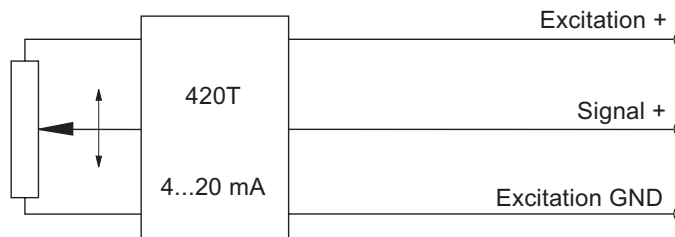
| | | |
|--|-------------------------|---|
| Signal conditioner 420A Current output (2 wire)  | Excitation Voltage | +12 ... 27 VDC non stabilized, measured at the sensor terminals |
| | Excitation Current | 35 mA max. |
| | Output Current | 4 ... 20 mA equivalent to 0 ... 100% range |
| | Stability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

Signal Diagram



| | | |
|--|-------------------------|---|
| Signal Conditioner 420T 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 _{RMS} |
| | Operating Temperature | -20 ... +85 °C |
| | EMC | According to EN 61326:2004 |

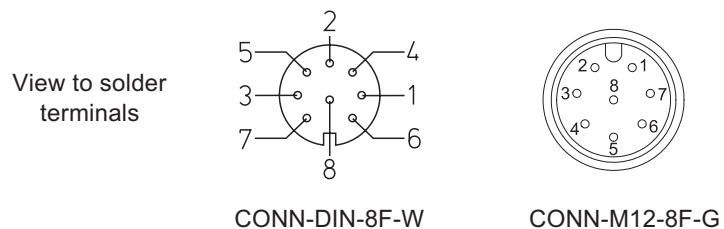
Signal diagram



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

Connection

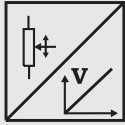
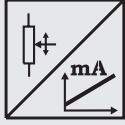
Mating Connector



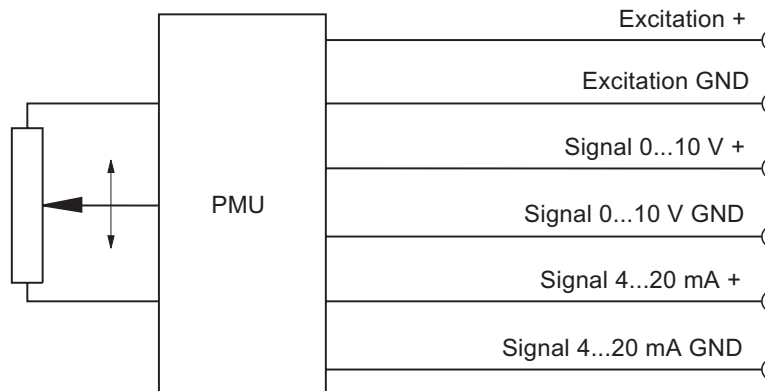
Output Specification

PMU for WS position sensors



| | | |
|---|--------------------------------------|---|
| Signal Conditioner PMU, adjustable 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) | $\pm 50 \times 10^{-6}$ / °C full scale |
| | Protection | Reverse polarity, short circuit |
| | Output noise | 1 mV _{eff} |
| Operating temperature | -20 ... +85 °C | |
| EMC | According to EN 61326:2004 | |

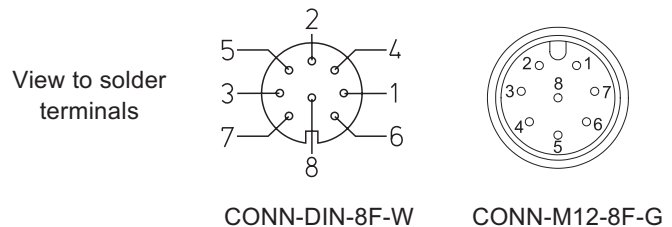
Signal diagram



| 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

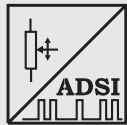
Description

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)

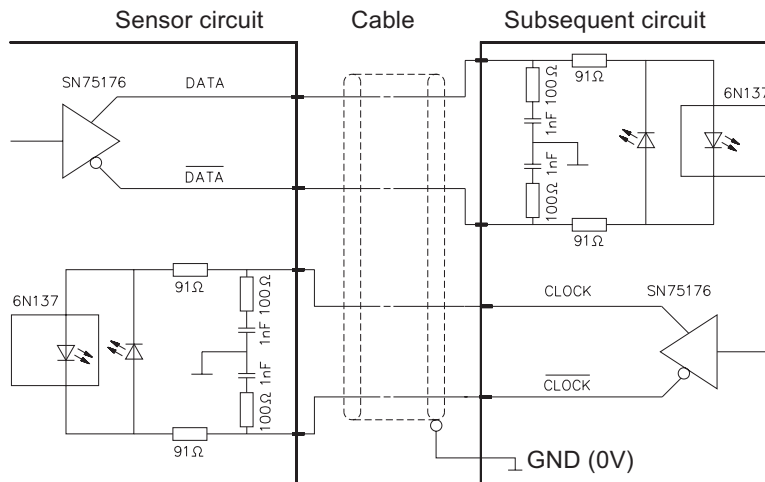


Signal Conditioner ADSI A/D converted synchronous serial



| | |
|----------------------------|---|
| 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 ⁻⁶ / °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 |

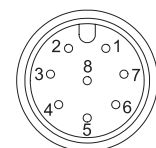
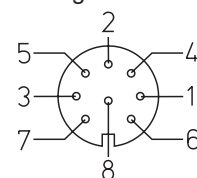
Note:

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

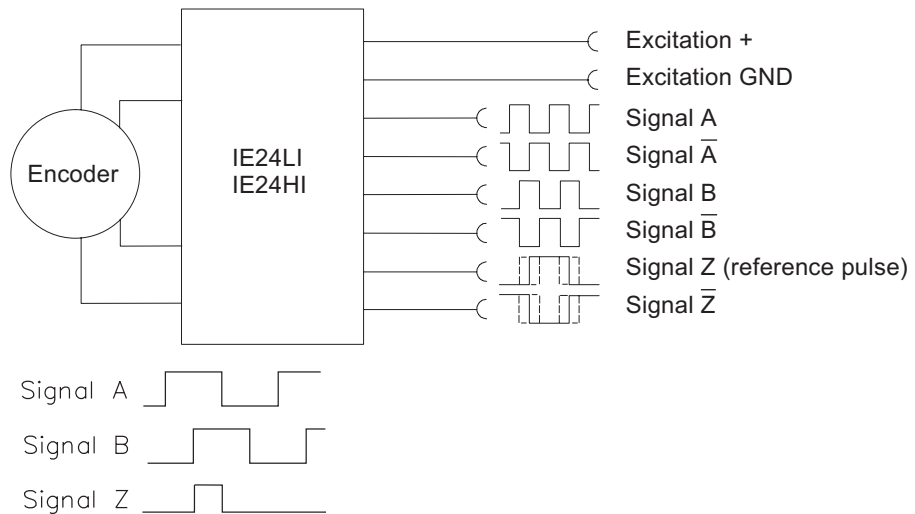
IE24LI and IE24HI for WS position sensors



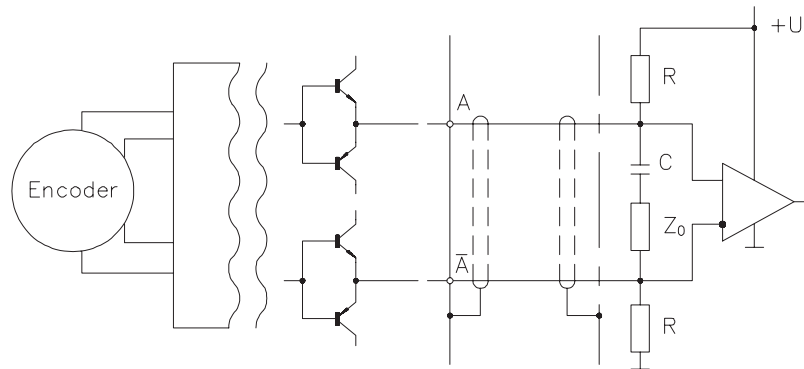
| IE24LI and IE24HI incremental | IE24LI | | IE24HI |
|-------------------------------|--|-------------------|--------|
| | Excitation voltage | 5 V DC $\pm 10\%$ | |
| Excitation current | 100 mA max. | | |
| Output frequency | 200 kHz | | |
| Output | Push-pull and inverted signals | | |
| Output current | 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



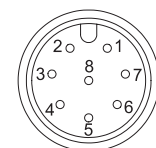
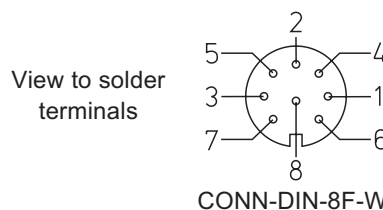
Output circuit and recommended processing input circuit



| 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 B-bar | Pink | 5 |
| | Signal A-bar | Yellow | 6 |
| | Signal Z (reference pulse) | Blue | 7 |
| | Signal Z-bar | Red | 8 |

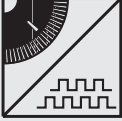
Connection

Mating connector

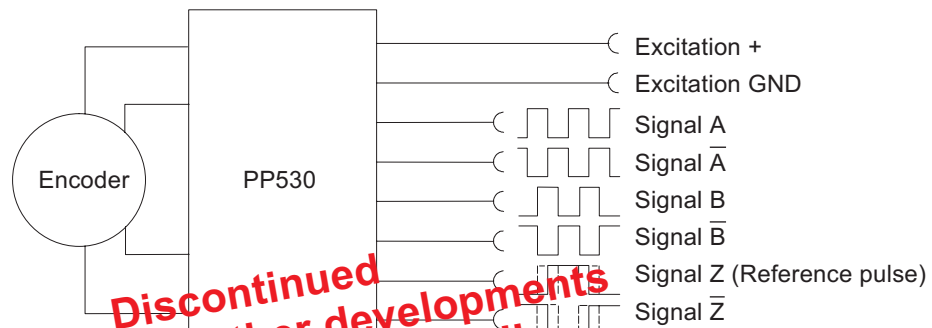


Output Specification PP530 for WS position sensors



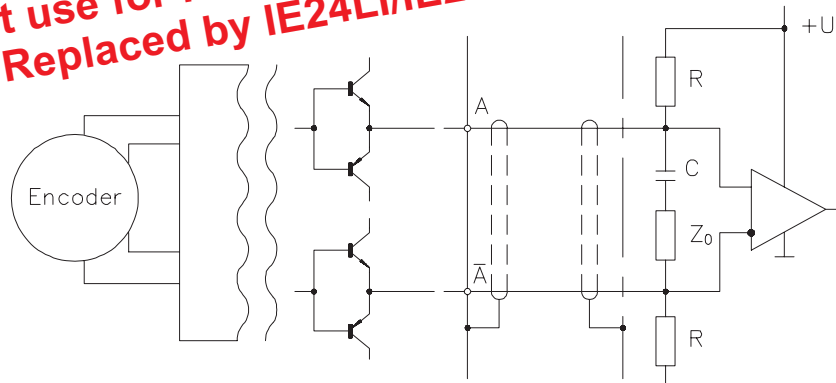
| | | |
|---|-------------------------------|---|
| Signal Conditioner PP530 Incremental  | Excitation Voltage | +5 ... +30 VDC |
| | Excitation Current | 200 mA max. |
| | Output Frequency | 200 kHz max. |
| | Output | Linedriver, Push-Pull, CMOS, TTL and HTL compatible |
| | Output Current | 30 mA 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

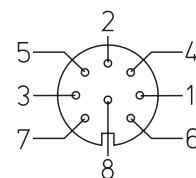
Discontinued
 Don't use for further developments
 Replaced by IE24LI/IE24HI



| 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 V | >4.2 V | >4.1 V | >3.8 V |
| | 5 V | U_{aLow} | <0.5 V | <1.2 V | <0.4 V | <0.4 V |
| | 24 V | U_{aHigh} | >23.5 V | >23.5 V | >23.5 V | >22.5 V |
| 24 V | U_{aLow} | <0.5 V | <1.2 V | <0.4 V | <0.4 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