



The pressure-proof linear scale GEL 176 - made of stainless steel - was conceived for the direct use in a hydraulic cylinder. It is furthermore suited for the external installation into industrial automation lines. This linear scale offers the user the following important advantages:

- a long service life due to the contactless and wearless measuring of position magnets
- direct, digital synchronous serial output (SSI) or direct analogue current or voltage output
- there is a homogeneous supply voltage of 24 V
- for lengths up to 7,600 mm
- resolution up to 5  $\mu\text{m}$  (SSI) and 16 bits (analogue)

### Output signals

The absolute information on the travelled path is supplied either digitally or analogue. The digital transmission is performed in Gray-Code, so that a simple cabling is ensured and the transmission security rises. Various current/voltage outputs are available as analogue output signals.

### Measuring principles

The tried and tested measuring principle was further improved. It is the running time of the torsion pulse that is measured and which is proportional to the distance between an internal start signal and a stop signal. The torsion emerges from the interaction of two magnetic fields under the position magnet. The running time is the absolute measure up to the position of the magnet and is transformed into a digital or analogue output signal.

# Technical Data

| sensor  | analogue   | SSI  |
|---|--|--|
| sensor head   | aluminium die casting  |  |
| protection class  | IP 65  |  |
| sensor tube with flange   | stainless steel  |  |
| pressure resistance   | 350 bar  |  |
| protection class  | IP 67  |  |
| installation thread   | M18 x 1,5  |  |
| assembly fitting position   | any  |  |
| connection type   | plug or cable connection   |  |
| measuring length  | 50 ... 7600 mm in 50 mm steps  |  |
| resolution  | 25 µm or 16 Bit  | 5 µm   |
| linear tolerance (non-corrected)  | < ± 0,02 %*, min. ± 50 µm<br>(independent of influences of temperature from outside) | < ± 0,01 %*, min. ± 40 µm<br>(independent of influences of temperature from outside) |
| repeatability   | < ± 0,001 %*, min. ± 2,5 µm  |  |
| hysteresis  | < 4 µm   |  |
| voltage supply  | 24 V DC (+20 % /-15%)  |  |
| power consumption   | 100 mA typ.  | 70 mA typ.   |
| temperature coefficient   | < 40 ppm/°C  | < 15 ppm/°C  |
| voltage sustaining capability   | 500 V  |  |
| operating temperature   | -40 °C ... +75 °C  |  |
| EMC (if the assembly instructions are observed)   |  |  |
| electromagnetic emissions   | EN 50081-1   |  |
| electromagnetic immunity  | EN 50082-2   |  |
| The linear scale GEL 176 is in strict conformity with Directive EMC 89/336/EEC of the European Union which is certified by the CE mark. |  |  |
| shock protection  | 100 g (single shock) as per IEC 68-2-27  |  |
| vibration protection  | 5 g /10 ... 150 Hz as per IEC 68-2-6   |  |
| <b>SSI</b>  |  |  |
| data format   | -  | Gray   |
| data length   | -  | 25 bits  |
| <b>output signal</b>  |  |  |
| voltage   | 0 ... + 10 V or + 10 ... 0 V, $R_L \geq 5 \text{ k}\Omega$                           | -  |
| current   | 0 ... +20 mA or +20 ... 0 mA<br>4 ... +20 mA or +20 ... 4 mA<br>burden 0 ... 500 Ω   | -  |

\* referring to the measuring length

# Synchronous serial interface, Pin layouts

## Synchronous serial interface

**Principles of serial data transmission**  
Gray code (25 bits)

clock +  
data +

MSB LSB

$f \geq 100 \text{ kHz}$   
ci = clock pulse space min. 16  $\mu\text{s}$   
T = cycle duration of the clock signal

### Number of distance measurements per second

| measuring length | 150   | 300  | 500  | 750  | 1000 | 2000 |
|------------------|-------|------|------|------|------|------|
| measurements     | 10000 | 6600 | 4500 | 3300 | 2500 | 1400 |

### Baud rate

The transmission rate depends on the line length and reaches a maximum of 1.5 Mbaud. Use screened cables with paired wires.

| cable length          | <50  | <100 | <200 | <400 |
|-----------------------|------|------|------|------|
| clock frequency [kHz] | <400 | <300 | <200 | <100 |

### Pin layout (analogue)

6-pole plug or cable outlet

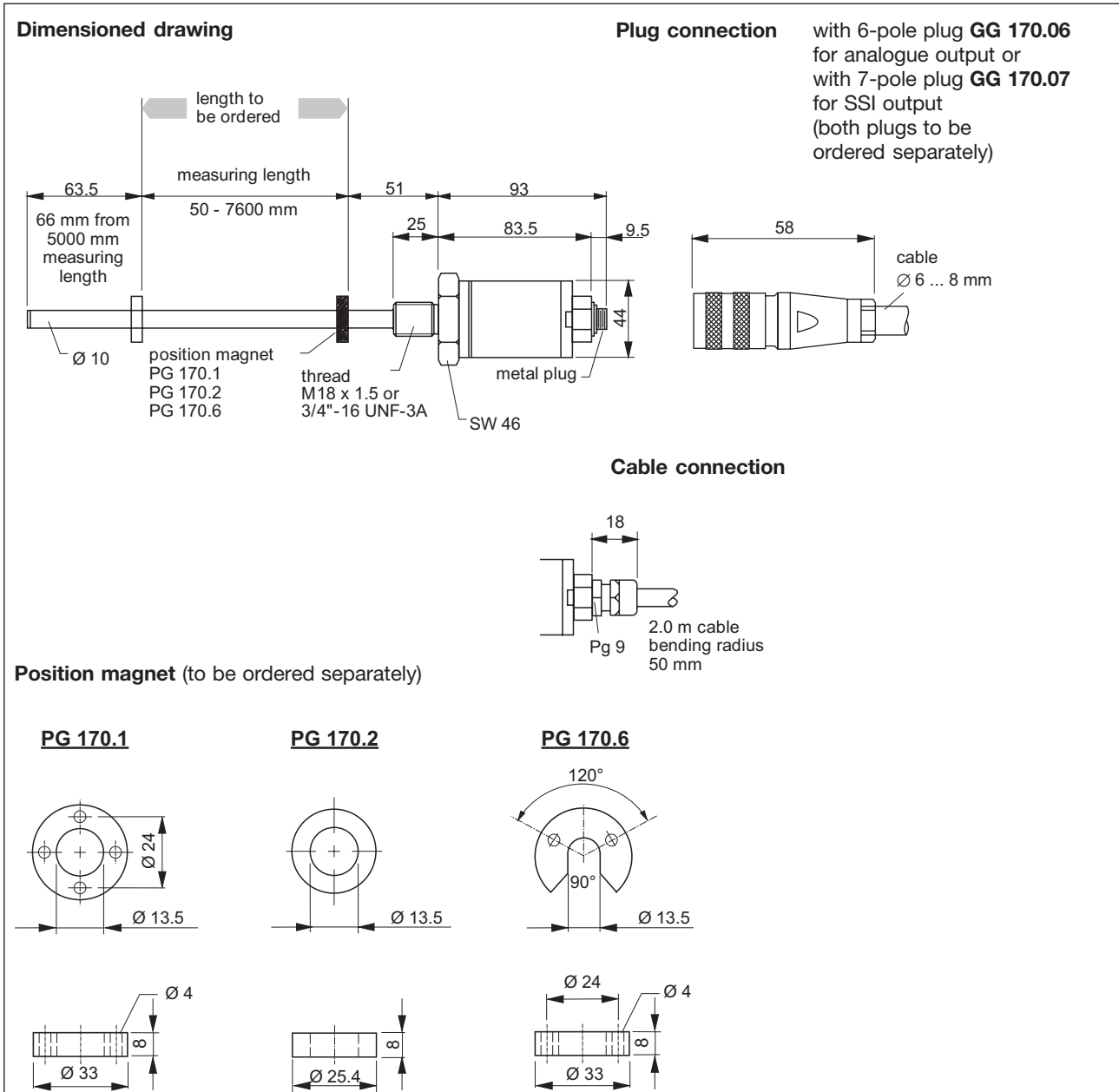
| <p>soldered side</p> | pin | cable  | 0 ... 20 mA                | 20 ... 0 mA | 4 ... 20 mA | 20 ... 4 mA | 0 ... 10 V | 10 ... 0 V |
|----------------------|-----|--------|----------------------------|-------------|-------------|-------------|------------|------------|
|                      | 1   | grey   | 0 ... 20 mA                | 20 ... 0 mA | 4 ... 20 mA | 20 ... 0 mA | 0 ... 10 V | 10 ... 0 V |
|                      | 2   | pink   | DC GND                     |             |             |             |            |            |
|                      | 3   | yellow | nc                         | nc          | nc          | nc          | 10 ... 0 V | nc         |
|                      | 4   | green  | nc                         |             |             |             |            |            |
|                      | 5   | brown  | + 24 V DC (+ 20 % / -15 %) |             |             |             |            |            |
|                      | 6   | white  | DC GND                     |             |             |             |            |            |

### Pin layout (SSI)

7-pole plug or cable outlet

| <p>soldered side</p> | pin | cable  | signal    |
|----------------------|-----|--------|-----------|
|                      | 1   | grey   | data (-)  |
|                      | 2   | pink   | data (+)  |
|                      | 3   | yellow | clock (+) |
|                      | 4   | green  | clock (-) |
|                      | 5   | brown  | +24 V DC  |
|                      | 6   | white  | 0 V       |
| 7                    | -   | nc     |           |

# Dimensioned drawings, Type code



## Type code

| 176 | X | XXXX        | X        | Description  |
|-----|---|-------------|----------|--|
|     |   |             | <b>A</b> | <b>connection</b><br>plug output                                   |
|     |   |             | <b>F</b> | cable output without plug, 2 m                                     |
|     |   | <b>0050</b> |          | <b>measuring length</b><br>e.g. 50 mm, please state in 50-mm steps |
|     |   |             | <b>A</b> | <b>current</b><br>0 ... 10 V                                       |
|     |   |             | <b>Z</b> | 10 ... 0 V   |
|     |   |             | <b>B</b> | 0 ... 20 mA  |
|     |   |             | <b>C</b> | 4 ... 20 mA  |
|     |   |             | <b>D</b> | 20 ... 0 mA  |
|     |   |             | <b>E</b> | 20 ... 4 mA  |
|     |   |             | <b>S</b> | SSI output (Gray-Code, 25 bits)                                    |

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