

 **WS21**

Displacement sensor with  
measurement length up to  
20,000 mm



- Protection class up to IP67/IP69
- High-performance aluminum/PBT housing
- With magnetic absolute encoder
- Optional with integrated inclination sensor (WST21)
- Redundant version available

## Product versions



Analog output



Analog output, programmable



Analog output, redundant



Digital output SSI



Digital output CAN Bus



## WS21 - Cable Extension Position Sensor Version with analog output

### Specifications

|                        |                                                                                                                                 | Order options |                                              |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------------|
| Measurement range      | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 mm                                                                                 | <b>1</b>      | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 |
| Resolution             | <0.002% f.s.                                                                                                                    |               |                                              |
| Output                 | Voltage 0.5 ... 10 V<br>Voltage 0.5 ... 4.5 V<br>Current 4 ... 20 mA, 3 wire                                                    | <b>2</b>      | U2<br>U8<br>I1                               |
| Signal characteristics | Increasing signal (e.g. 4 ... 20 mA)<br>Decreasing signal (e.g. 20 ... 4 mA)                                                    | <b>3</b>      | A<br>D                                       |
| Linearity              | ±0.10% f.s. (standard)<br>±0.05% f.s. (optional)                                                                                | <b>4</b>      | L10<br>L05                                   |
| Sensing device         | Magnetic absolute encoder                                                                                                       |               |                                              |
| Material               | Aluminum, PBT<br>measuring cable: stainless steel                                                                               |               |                                              |
| Protection class       | IP67/IP69 (with mating connector only)                                                                                          |               |                                              |
| Cable fixing           | M4 cable fixing<br>Cable clip                                                                                                   | <b>5</b>      | M4<br>SB0                                    |
| Connection             | Connector M12, 5 pin                                                                                                            | <b>6</b>      | M12R5                                        |
| Shock                  | DIN EN 60068-2-27:2010, 100 g/11 ms, 100 shocks                                                                                 |               |                                              |
| Vibration              | DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles                                                                              |               |                                              |
| Temperature range      | -20 ... +85 °C                                                                                                                  |               |                                              |
| Weight                 | WS21-8000: 1.5 kg<br>WS21-10000: 1.5 kg<br>WS21-12500: 2.5 kg<br>WS21-15000: 3.0 kg<br>WS21-17500: 4.2 kg<br>WS21-20000: 4.2 kg |               |                                              |
| EMC                    | DIN EN 61326-1:2013                                                                                                             |               |                                              |

### Order code

|      |   |          |   |          |   |          |   |          |   |          |   |          |
|------|---|----------|---|----------|---|----------|---|----------|---|----------|---|----------|
| WS21 | – | <b>1</b> | – | <b>2</b> | – | <b>3</b> | – | <b>4</b> | – | <b>5</b> | – | <b>6</b> |
|------|---|----------|---|----------|---|----------|---|----------|---|----------|---|----------|

Order example: WS21 – 15000 – U2 – A – L10 – M4 – M12R5

### Accessories:

Connector cable (see page 22)



## WS21 - Cable Extension Position Sensor Version with analog output, programmable

### Specifications

|                        |                                                                                                                                 | Order options |                                              |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------|----------------------------------------------|
| Measurement range      | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 mm                                                                                 | <b>1</b>      | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 |
| Resolution             | <0.002% f.s.                                                                                                                    |               |                                              |
| Output                 | Voltage 0.5 ... 10 V, programmable<br>Voltage 0.5 ... 4.5 V, programmable<br>Current 4 ... 20 mA, 3 wire, programmable          | <b>2</b>      | U2/PMU<br>U8/PMU<br>I1/PMU                   |
| Signal characteristics | Increasing signal (e.g. 4 ... 20 mA)<br>Decreasing signal (e.g. 20 ... 4 mA)                                                    | <b>3</b>      | A<br>D                                       |
| Linearity              | ±0.10% f.s. (standard)<br>±0.05% f.s. (optional)                                                                                | <b>4</b>      | L10<br>L05                                   |
| Sensing device         | Magnetic absolute encoder                                                                                                       |               |                                              |
| Material               | Aluminum, PBT<br>measuring cable: stainless steel                                                                               |               |                                              |
| Protection class       | IP67/IP69 (with mating connector only)                                                                                          |               |                                              |
| Cable fixing           | M4 cable fixing<br>Cable clip                                                                                                   | <b>5</b>      | M4<br>SB0                                    |
| Connection             | Connector M12, 5 pin                                                                                                            | <b>6</b>      | M12R5                                        |
| Shock                  | DIN EN 60068-2-27:2010, 100 g/11 ms, 100 shocks                                                                                 |               |                                              |
| Vibration              | DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles                                                                              |               |                                              |
| Temperature range      | -20 ... +85 °C                                                                                                                  |               |                                              |
| Weight                 | WS21-8000: 1.5 kg<br>WS21-10000: 1.5 kg<br>WS21-12500: 2.5 kg<br>WS21-15000: 3.0 kg<br>WS21-17500: 4.2 kg<br>WS21-20000: 4.2 kg |               |                                              |
| EMC                    | DIN EN 61326-1:2013                                                                                                             |               |                                              |

### Order code

|      |   |          |   |          |   |          |   |          |   |          |   |          |
|------|---|----------|---|----------|---|----------|---|----------|---|----------|---|----------|
| WS21 | – | <b>1</b> | – | <b>2</b> | – | <b>3</b> | – | <b>4</b> | – | <b>5</b> | – | <b>6</b> |
|------|---|----------|---|----------|---|----------|---|----------|---|----------|---|----------|

**Order example:** WS21 – 15000 – U2/PMU – A – L10 – M4 – M12R5

### Accessories:

**Connector cable (see page 23)**



## WS21 - Cable Extension Position Sensor Version with analog output, redundant

### Specifications

|                        |                                                                                                                                  |          | Order options                                |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------|
| Measurement range      | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 mm                                                                                  | <b>1</b> | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 |
| Resolution             | <0.002% f.s.                                                                                                                     |          |                                              |
| Output                 | Voltage 0.5 ... 10 V, redundant<br>Voltage 0.5 ... 4.5 V, redundant<br>Current 4 ... 20 mA, 3 wire, redundant                    | <b>2</b> | U2R<br>U8R<br>I1R                            |
| Signal characteristics | Output 1 increasing, output 2 increasing<br>Output 1 increasing, output 2 decreasing<br>Output 1 decreasing, output 2 decreasing | <b>3</b> | A/A<br>A/D<br>D/D                            |
| Linearity              | ±0.10% f.s. (standard)<br>±0.05% f.s. (optional)                                                                                 | <b>4</b> | L10<br>L05                                   |
| Sensing device         | Magnetic absolute encoder                                                                                                        |          |                                              |
| Material               | Aluminum, PBT<br>measuring cable: stainless steel                                                                                |          |                                              |
| Protection class       | IP67/IP69 (with mating connector only)                                                                                           |          |                                              |
| Cable fixing           | M4 cable fixing<br>Cable clip                                                                                                    | <b>5</b> | M4<br>SB0                                    |
| Connection             | Connector M12, 8 pin                                                                                                             | <b>6</b> | M12R8                                        |
| Shock                  | DIN EN 60068-2-27:2010, 100 g/11 ms, 100 shocks                                                                                  |          |                                              |
| Vibration              | DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles                                                                               |          |                                              |
| Temperature range      | -20 ... +85 °C                                                                                                                   |          |                                              |
| Weight                 | WS21-8000: 1.5 kg<br>WS21-10000: 1.5 kg<br>WS21-12500: 2.5 kg<br>WS21-15000: 3.0 kg<br>WS21-17500: 4.2 kg<br>WS21-20000: 4.2 kg  |          |                                              |
| EMC                    | DIN EN 61326-1:2013                                                                                                              |          |                                              |

### Order code

|      |   |          |   |          |   |          |   |          |   |          |   |          |
|------|---|----------|---|----------|---|----------|---|----------|---|----------|---|----------|
| WS21 | – | <b>1</b> | – | <b>2</b> | – | <b>3</b> | – | <b>4</b> | – | <b>5</b> | – | <b>6</b> |
|------|---|----------|---|----------|---|----------|---|----------|---|----------|---|----------|

Order example: WS21 – 15000 – I1R – A – L10 – M4 – M12R8

### Accessories:

Connector cable (see page 24)



## WS21 - Cable Extension Position Sensor Version with digital output SSI

### Specifications

|                   |                                                                                                                                 |          | Order options                                |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------|
| Measurement range | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 mm                                                                                 | <b>1</b> | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 |
| Resolution        | 50 µm<br>100 µm                                                                                                                 | <b>2</b> | 50<br>100                                    |
| Output            | SSI synchronous serial interface                                                                                                | <b>3</b> | MSSI                                         |
| Linearity         | ±0.10% f.s. (standard)<br>±0.05% f.s. (optional)                                                                                | <b>4</b> | L10<br>L05                                   |
| Sensing device    | Magnetic absolute encoder                                                                                                       |          |                                              |
| Material          | Aluminum, PBT<br>measuring cable: stainless steel                                                                               |          |                                              |
| Protection class  | IP67/IP69 (with mating connector only)                                                                                          |          |                                              |
| Cable fixing      | M4 cable fixing<br>Cable clip                                                                                                   | <b>5</b> | M4<br>SB0                                    |
| Connection        | Connector M12, 8 pin                                                                                                            | <b>6</b> | M12R8                                        |
| Shock             | DIN EN 60068-2-27:2010, 100 g/11 ms, 100 shocks                                                                                 |          |                                              |
| Vibration         | DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles                                                                              |          |                                              |
| Temperature range | -20 ... +85 °C                                                                                                                  |          |                                              |
| Weight            | WS21-8000: 1.5 kg<br>WS21-10000: 1.5 kg<br>WS21-12500: 2.5 kg<br>WS21-15000: 3.0 kg<br>WS21-17500: 4.2 kg<br>WS21-20000: 4.2 kg |          |                                              |
| EMC               | DIN EN 61326-1:2013                                                                                                             |          |                                              |

### Order code

|      |   |          |   |          |   |          |   |          |   |          |   |          |
|------|---|----------|---|----------|---|----------|---|----------|---|----------|---|----------|
| WS21 | – | <b>1</b> | – | <b>2</b> | – | <b>3</b> | – | <b>4</b> | – | <b>5</b> | – | <b>6</b> |
|------|---|----------|---|----------|---|----------|---|----------|---|----------|---|----------|

Order example: WS21 – 15000 – 50 – MSSI – L10 – M4 – M12R8

### Accessories:

Connector cable (see page 24)



## WS21 - Cable Extension Position Sensor Version with digital output CAN Bus

### Specifications

|                   |                                                                                                                                 |          | Order options                                |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------|
| Measurement range | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 mm                                                                                 | <b>1</b> | 8000 / 10000 / 12500 / 15000 / 17500 / 20000 |
| Resolution        | setting via CAN Bus                                                                                                             |          |                                              |
| Output            | CANopen<br>CAN SAE J1939<br>CANopen redundant<br>CAN SAE J1939 redundant                                                        | <b>2</b> | MCANOP<br>MCANJ1939<br>MCANOPR<br>MCANJ1939R |
| Linearity         | ±0.10% f.s. (standard)<br>±0.05% f.s. (optional)                                                                                | <b>3</b> | L10<br>L05                                   |
| Sensing device    | Magnetic absolute encoder                                                                                                       |          |                                              |
| Material          | Aluminum, PBT<br>measuring cable: stainless steel                                                                               |          |                                              |
| Protection class  | IP67/IP69 (with mating connector only)                                                                                          |          |                                              |
| Cable fixing      | M4 cable fixing<br>Cable clip                                                                                                   | <b>4</b> | M4<br>SB0                                    |
| Connection        | Connector M12, 5 pin                                                                                                            | <b>5</b> | M12/CAN                                      |
| Shock             | DIN EN 60068-2-27:2010, 100 g/11 ms, 100 shocks                                                                                 |          |                                              |
| Vibration         | DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles                                                                              |          |                                              |
| Temperature range | -20 ... +85 °C                                                                                                                  |          |                                              |
| Weight            | WS21-8000: 1.5 kg<br>WS21-10000: 1.5 kg<br>WS21-12500: 2.5 kg<br>WS21-15000: 3.0 kg<br>WS21-17500: 4.2 kg<br>WS21-20000: 4.2 kg |          |                                              |
| EMC               | DIN EN 61326-1:2013                                                                                                             |          |                                              |

### Order code

WS21 – **1** – **2** – **3** – **4** – **5**

**Order example:** WS21 – 15000 – MCANOP – L10 – M4 – M12/CAN

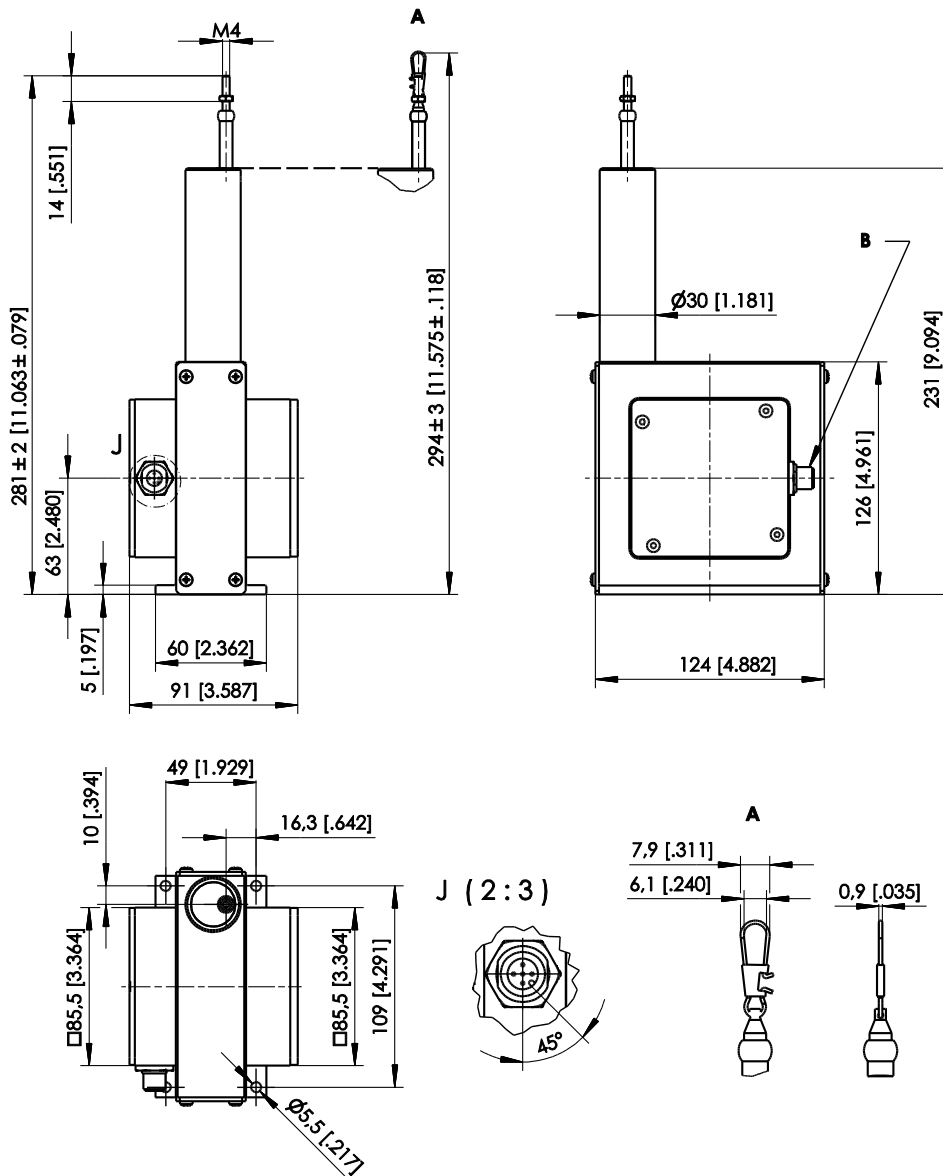
### Accessories:

Connector cable (see page 25)

| Cable forces<br>typical at = 20 °C | Measurement<br>range [mm] | Weight<br>[kg] | Maximum pull-out<br>force [N] | Minimum pull-in<br>force [N] |
|------------------------------------|---------------------------|----------------|-------------------------------|------------------------------|
|                                    | 8000                      | 1.5            | 4.3                           | 2.9                          |
|                                    | 10000                     | 1.5            | 4.3                           | 2.9                          |
|                                    | 12500                     | 2.5            | 11.3                          | 7.9                          |
|                                    | 15000                     | 3.0            | 8.8                           | 4.4                          |
|                                    | 17500                     | 4.2            | 6.8                           | 4.5                          |
|                                    | 20000                     | 4.2            | 6.8                           | 4.5                          |

## Dimensions

## WS21-8000, WS21-10000



A – Option SB0

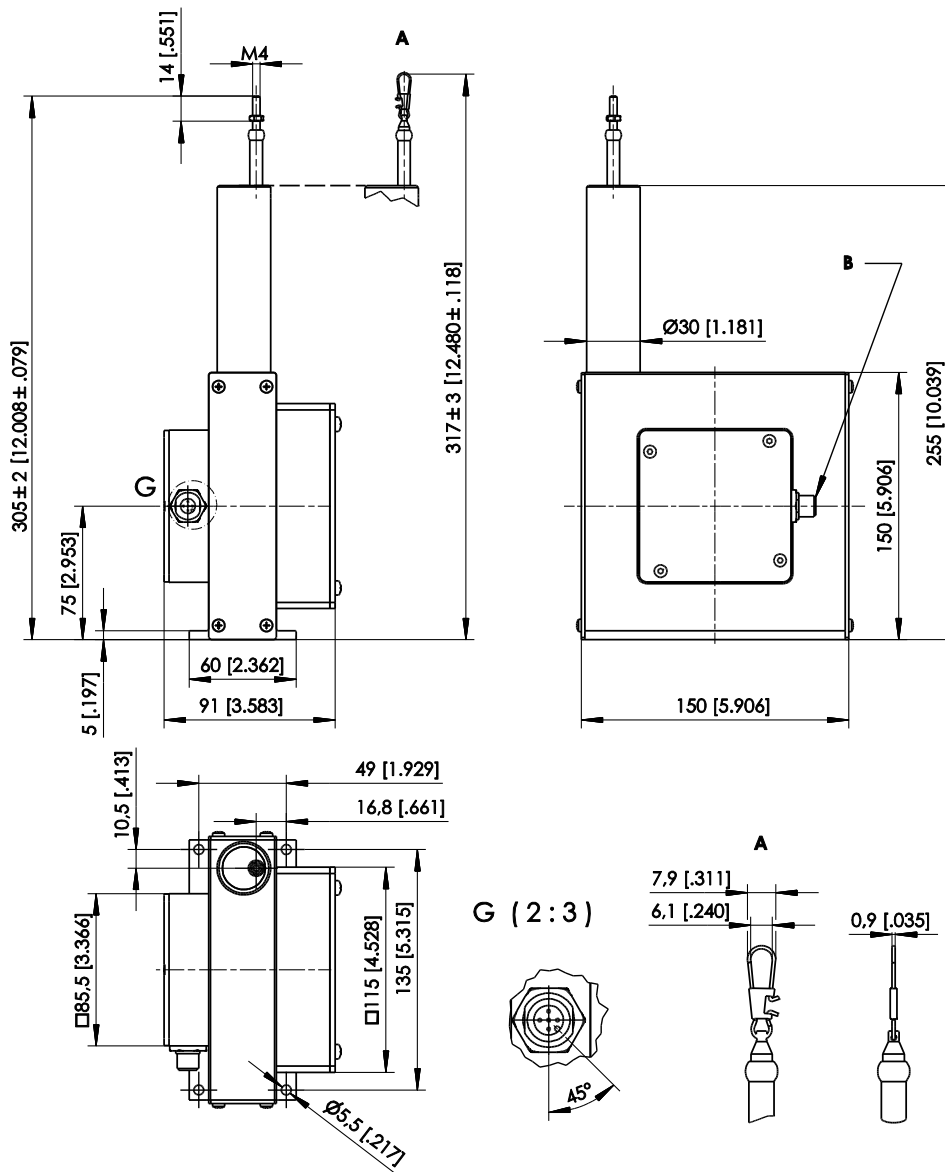
### B – Connector M12

Dimensions in mm [inch]. Weight approx. 1.5 kg.

Dimensions informative only.

For guaranteed dimensions consult factory.

WS21-12500



A - Option SB0

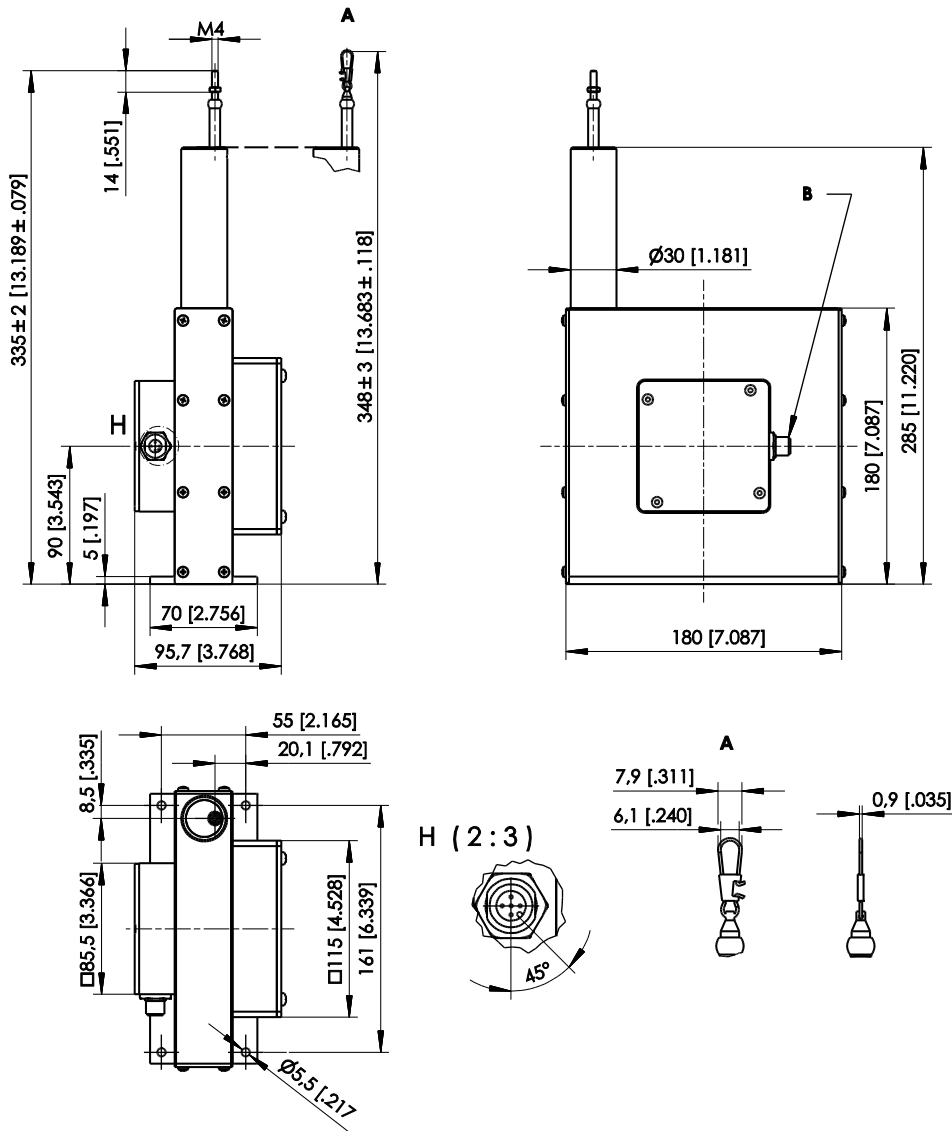
B - Connector M12

Dimensions in mm [inch]. Weight approx. 2.5 kg.

Dimensions informative only.

For guaranteed dimensions consult factory.

Measurement range 15000 mm, magnetic encoder output



A – Option SB0

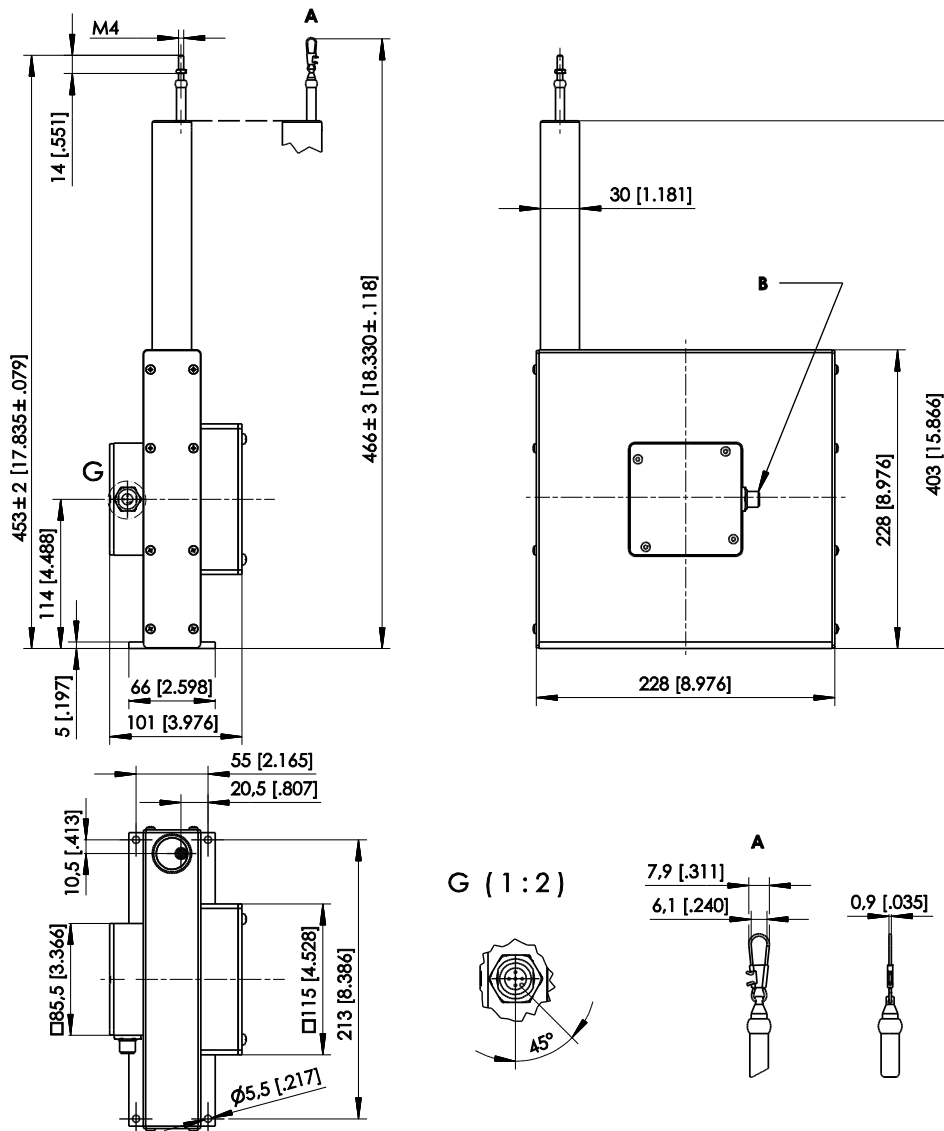
B – Connector M12

Dimensions in mm [inch]. Weight approx. 3.0 kg.

Dimensions informative only.

For guaranteed dimensions consult factory.

Measurement range 17500 ... 20000 mm, magnetic encoder output



A – Option SB0

B – Connector M12

Dimensions in mm [inch]. Weight approx. 4.2 kg.

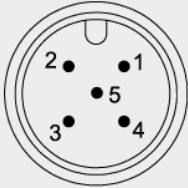
Dimensions informative only.

For guaranteed dimensions consult factory.

## Output specification

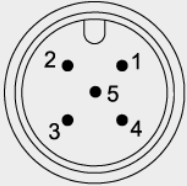
### Analog output

|                                                                                                                                            |                         |                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------|
| <b>U2</b><br>Voltage output<br>0.5 ... 10 V<br>           | Excitation voltage      | 8 ... 36 V DC                                                       |
|                                                                                                                                            | Excitation current      | 20 mA typical at 24 V DC<br>38 mA typical at 12 V DC<br>max. 50 mA  |
|                                                                                                                                            | Output voltage          | 0.5 ... 10 V DC                                                     |
|                                                                                                                                            | Output current          | 2 mA max.                                                           |
|                                                                                                                                            | Measuring rate          | 1 kHz standard                                                      |
|                                                                                                                                            | Stability (temperature) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                         |
|                                                                                                                                            | Protection              | Reverse polarity, short circuit                                     |
|                                                                                                                                            | Operating temperature   | See specification of the respective sensor                          |
|                                                                                                                                            | EMC                     | DIN EN 61326-1:2013                                                 |
| <b>U8</b><br>Voltage output<br>0.5 ... 4.5 V<br>         | Excitation voltage      | 8 ... 36 V DC                                                       |
|                                                                                                                                            | Excitation current      | 17 mA typical at 24 V DC<br>32 mA typical at 12 V DC<br>50 mA max.  |
|                                                                                                                                            | Output voltage          | 0.5 ... 4.5 V DC                                                    |
|                                                                                                                                            | Output current          | 2 mA max.                                                           |
|                                                                                                                                            | Measuring rate          | 1 kHz standard                                                      |
|                                                                                                                                            | Stability (temperature) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                         |
|                                                                                                                                            | Protection              | Reverse polarity, short circuit                                     |
|                                                                                                                                            | Operating temperature   | See specification of the respective sensor                          |
|                                                                                                                                            | EMC                     | DIN EN 61326-1:2013                                                 |
| <b>I1</b><br>Current output<br>4 ... 20 mA, 3 wires<br> | Excitation voltage      | 8 ... 36 V DC                                                       |
|                                                                                                                                            | Excitation current      | typical 36 mA at 24 V DC<br>typical 70 mA at 12 V DC<br>120 mA max. |
|                                                                                                                                            | Load $R_L$              | 500 $\Omega$ max.                                                   |
|                                                                                                                                            | Output current          | 4 ... 20 mA                                                         |
|                                                                                                                                            | Measuring rate          | 1 kHz standard                                                      |
|                                                                                                                                            | Stability (temperature) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                         |
|                                                                                                                                            | Protection              | Reverse polarity, short circuit                                     |
|                                                                                                                                            | Operating temperature   | See specification of the respective sensor                          |
|                                                                                                                                            | EMC                     | DIN EN 61326-1:2013                                                 |

| Signal wiring                                                                                                                                    | Output signals  | Connector pin no. | Cable color |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------|-------------|
| <b>Connector M12, 5 pin</b><br><br>View to the sensor connector | Excitation +    | 1                 | brown       |
|                                                                                                                                                  | Signal          | 2                 | white       |
|                                                                                                                                                  | GND             | 3                 | blue        |
|                                                                                                                                                  | Do not connect! | 4                 | black       |
|                                                                                                                                                  | Do not connect! | 5                 | (grey)      |
|                                                                                                                                                  |                 |                   |             |

## Analog output, programmable

|                                                                                                                                                |                         |                                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------|
| <b>U2/PMU</b><br>Voltage output<br>0.5 ... 10 V<br>           | Excitation voltage      | 8 ... 36 V DC                                                       |
|                                                                                                                                                | Excitation current      | 20 mA typical at 24 V DC<br>38 mA typical at 12 V DC<br>max. 50 mA  |
|                                                                                                                                                | Output voltage          | 0,5 ... 10 V DC                                                     |
|                                                                                                                                                | Output current          | 2 mA max.                                                           |
|                                                                                                                                                | Measuring rate          | 1 kHz standard                                                      |
|                                                                                                                                                | Stability (temperature) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                         |
|                                                                                                                                                | Protection              | Reverse polarity, short circuit                                     |
|                                                                                                                                                | Operating temperature   | See specification of the respective sensor                          |
|                                                                                                                                                | EMC                     | EN 61326-1:2013                                                     |
| <b>U8/PMU</b><br>Voltage output<br>0.5 ... 4.5 V<br>         | Excitation voltage      | 8 ... 36 V DC                                                       |
|                                                                                                                                                | Excitation current      | 17 mA typical at 24 V DC<br>32 mA typical at 12 V DC<br>max. 50 mA  |
|                                                                                                                                                | Output voltage          | 0.5 ... 4.5 V DC                                                    |
|                                                                                                                                                | Output current          | 2 mA max.                                                           |
|                                                                                                                                                | Measuring rate          | 1 kHz standard                                                      |
|                                                                                                                                                | Stabilität (Temperatur) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                         |
|                                                                                                                                                | Protection              | Reverse polarity, short circuit                                     |
|                                                                                                                                                | Operating temperature   | See specification of the respective sensor                          |
|                                                                                                                                                | EMC                     | DIN EN 61326-1:2013                                                 |
| <b>I1/PMU</b><br>Current output<br>4 ... 20 mA, 3 wires<br> | Excitation voltage      | 8 ... 36 V DC                                                       |
|                                                                                                                                                | Excitation current      | typical 36 mA at 24 V DC<br>typical 70 mA at 12 V DC<br>max. 120 mA |
|                                                                                                                                                | Load R <sub>L</sub>     | 500 Ω max.                                                          |
|                                                                                                                                                | Output current          | 4 ... 20 mA                                                         |
|                                                                                                                                                | Measuring rate          | 1 kHz standard                                                      |
|                                                                                                                                                | Stability (temperature) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                         |
|                                                                                                                                                | Protection              | Reverse polarity, short circuit                                     |
|                                                                                                                                                | Operating temperature   | See specification of the respective sensor                          |
|                                                                                                                                                | EMC                     | DIN EN 61326-1:2013                                                 |

| Signal wiring                                                                                                                                    | Output signals  | Connector pin no. | Cable color |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------|-------------|
| <b>Connector M12, 5 pin</b><br><br>View to the sensor connector | Excitation +    | 1                 | brown       |
|                                                                                                                                                  | Signal          | 2                 | white       |
|                                                                                                                                                  | GND             | 3                 | blue        |
|                                                                                                                                                  | Do not connect! | 4                 | black       |
|                                                                                                                                                  | SPAN/ZERO       | 5                 | grey        |

## Output .../PMU

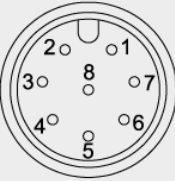
### Programming of the start and end value by the customer (programmable)

Teach-In of start and end value for the analog outputs U2/PMU, U8/PMU, I1/PMU is provided by a binary signal SPAN/ZERO. At the start position connect signal SPAN/ZERO for a period of 2 ... 3 seconds to GND via push button. At the end position connect signal SPAN/ZERO for a period of 5 ... 6 seconds to GND via a push button. The scaling range will be stored non-volatile.

To reset the sensor to factory default ZERO/END must be connected to ground while powering up the sensor for 2 ... 3 seconds.

## Analog output, redundant

|                                                                                                                                             |                         |                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------------------------------------------------|
| <b>U2R</b><br>Voltage output<br>0.5 ... 10 V<br>           | Excitation voltage      | 8 ... 36 V DC                                                                   |
|                                                                                                                                             | Excitation current      | 20 mA typical at 24 V DC<br>38 mA typical at 12 V DC<br>max. 50 mA per channel  |
|                                                                                                                                             | Output voltage          | 0.5 ... 10 V DC                                                                 |
|                                                                                                                                             | Output current          | 2 mA max.                                                                       |
|                                                                                                                                             | Measuring rate          | 1 kHz standard                                                                  |
|                                                                                                                                             | Stability (temperature) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                                     |
|                                                                                                                                             | Protection              | Reverse polarity, short circuit                                                 |
|                                                                                                                                             | Operating temperature   | See specification of the respective sensor                                      |
|                                                                                                                                             | EMC                     | DIN EN 61326-1:2013                                                             |
| <b>U8R</b><br>Voltage output<br>0.5 ... 4.5 V<br>         | Excitation voltage      | 8 ... 36 V DC                                                                   |
|                                                                                                                                             | Excitation current      | 17 mA typical at 24 V DC<br>32 mA typical at 12 V DC<br>max. 50 mA per channel  |
|                                                                                                                                             | Output voltage          | 0.5 ... 4.5 V DC                                                                |
|                                                                                                                                             | Output current          | 2 mA max.                                                                       |
|                                                                                                                                             | Measuring rate          | 1 kHz standard                                                                  |
|                                                                                                                                             | Stability (temperature) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                                     |
|                                                                                                                                             | Protection              | Reverse polarity, short circuit                                                 |
|                                                                                                                                             | Operating temperature   | See specification of the respective sensor                                      |
|                                                                                                                                             | EMC                     | DIN EN 61326-1:2013                                                             |
| <b>I1R</b><br>Current output<br>4 ... 20 mA, 3 wires<br> | Excitation voltage      | 8 ... 36 V DC                                                                   |
|                                                                                                                                             | Excitation current      | 36 mA typical at 24 V DC<br>76 mA typical at 12 V DC<br>max. 120 mA per channel |
|                                                                                                                                             | Load R <sub>L</sub>     | 500 Ω max.                                                                      |
|                                                                                                                                             | Output current          | 4 ... 20 mA                                                                     |
|                                                                                                                                             | Measuring rate          | 1 kHz standard                                                                  |
|                                                                                                                                             | Stability (temperature) | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                                     |
|                                                                                                                                             | Protection              | Reverse polarity, short circuit                                                 |
|                                                                                                                                             | Operating temperature   | See specification of the respective sensor                                      |
|                                                                                                                                             | EMC                     | DIN EN 61326-1:2013                                                             |

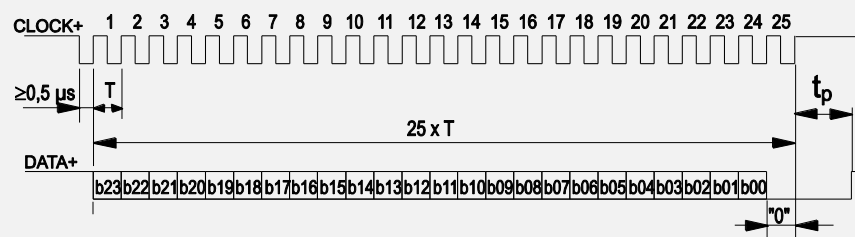
| Signal wiring                                                                                                                                           | Channel | Output signals  | Connector pin no. | Cable color |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------|-------------------|-------------|
| <b>Connector M12, 8 pin</b><br><br><br>View to the sensor<br>connector | 1       | Excitation +    | 1                 | white       |
|                                                                                                                                                         |         | Signal          | 2                 | brown       |
|                                                                                                                                                         |         | GND             | 3                 | green       |
|                                                                                                                                                         |         | Do not connect! | 4                 | yellow      |
|                                                                                                                                                         | 2       | Excitation +    | 5                 | grey        |
|                                                                                                                                                         |         | Signal          | 6                 | pink        |
|                                                                                                                                                         |         | GND             | 7                 | blue        |
|                                                                                                                                                         |         | Do not connect! | 8                 | red         |

## Digital output

|                                                                                                                            |                                      |                                                                    |
|----------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------|
| <b>MSSI</b><br>Synchronous serial SSI<br> | Interface                            | EIA RS-422                                                         |
|                                                                                                                            | Excitation voltage                   | 8 ... 36 V DC                                                      |
|                                                                                                                            | Excitation current                   | 19 mA typical at 24 V DC<br>35 mA typical at 12 V DC<br>max. 80 mA |
|                                                                                                                            | Clock frequency                      | 100 kHz ... 500 kHz                                                |
|                                                                                                                            | Code                                 | Gray-Code, continuous progression                                  |
|                                                                                                                            | Delay between pulse trains ( $t_p$ ) | 30 $\mu$ s min.                                                    |
|                                                                                                                            | Stability (temperature)              | $\pm 50 \times 10^{-6}$ / °C f.s. (typical)                        |
|                                                                                                                            | Operating temperature                | See specification of the respective sensor                         |
|                                                                                                                            | Protection                           | Reverse polarity, short circuit                                    |
|                                                                                                                            | EMC                                  | DIN EN 61326-1:2013                                                |

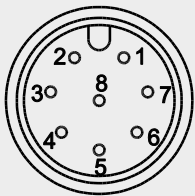
### Data format

(Train of 26 pulses)



| Transmission rate | Cable length | Baud rate   | Note:                                                                    |
|-------------------|--------------|-------------|--------------------------------------------------------------------------|
|                   | 50 m         | 100-400 kHz | Extension of the cable length will reduce the maximum transmission rate. |
|                   | 100 m        | 100-300 kHz |                                                                          |

### Signal wiring Connector M12, 8 pin

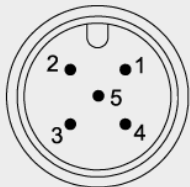


View to the sensor  
connector

| Output signals            | Connector pin no. | Cable color |
|---------------------------|-------------------|-------------|
| Excitation +              | 1                 | white       |
| Excitation GND            | 2                 | brown       |
| CLOCK                     | 3                 | green       |
| $\overline{\text{CLOCK}}$ | 4                 | yellow      |
| DATA                      | 5                 | grey        |
| $\overline{\text{DATA}}$  | 6                 | pink        |
| -                         | 7                 | blue        |
| -                         | 8                 | red         |

|                                                                                                                       |                                     |                                                                  |
|-----------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------------------------------------------------|
| <b>MCANOP, CANOPR</b><br>CANopen<br> | CAN specification                   | ISO 11898, Basic and Full CAN 2.0 B                              |
|                                                                                                                       | Communication profile               | CANopen CiA 301 V 4.02, Slave                                    |
|                                                                                                                       | Encoder profile                     | Encoder CiA 406 V 3.2                                            |
|                                                                                                                       | Error Control                       | Node Guarding, Heartbeat, Emergency Message                      |
|                                                                                                                       | Node ID                             | Adjustable via LSS or SDO, default: 127                          |
|                                                                                                                       | PDO                                 | 3 TxPDO, 0 RxPDO, no linking, static mapping                     |
|                                                                                                                       | PDO Modes                           | Event-/Time triggered, Remote-request, Sync cyclic/acyclic       |
|                                                                                                                       | SDO                                 | 1 Server, 0 Client                                               |
|                                                                                                                       | CAM                                 | 8 cams                                                           |
|                                                                                                                       | Certified                           | Yes                                                              |
|                                                                                                                       | Transmission rate                   | 50 kBit bis 1 Mbit, adjustable via LSS or SDO, default: 125 kBit |
|                                                                                                                       | Bus connection                      | M12 connector, 5 pin                                             |
|                                                                                                                       | Integrated bus terminating resistor | 120Ω adjustable by the customer                                  |
|                                                                                                                       | Bus, galvanic isolated              | no                                                               |

|                       |                         |                                                                    |
|-----------------------|-------------------------|--------------------------------------------------------------------|
| <b>Specifications</b> | Excitation voltage      | 8 ... 36 V DC                                                      |
|                       | Excitation current      | 20 mA typical at 24 V DC<br>40 mA typical at 12 V DC<br>80 mA max. |
|                       | Measuring rate          | 1 kHz (asynchronous)                                               |
|                       | Stability (temperature) | ±50 x 10 <sup>-6</sup> /°C f.s. (typical)                          |
|                       | Repeatability           | 1 LSB                                                              |
|                       | Operating temperature   | See specification of the respective sensor                         |
|                       | Protection              | Reverse polarity, short circuit                                    |
|                       | Dielectric strength     | 1 kV (V AC, 50 Hz, 1 min.)                                         |
|                       | EMC                     | EN 61326-1:2013                                                    |

| Signal wiring                                                                                                      | Output signals | Connector pin no. | Cable color |
|--------------------------------------------------------------------------------------------------------------------|----------------|-------------------|-------------|
| <b>Connector M12, 5 pin</b><br> | Shield         | 1                 | brown       |
|                                                                                                                    | Excitation +   | 2                 | white       |
|                                                                                                                    | GND            | 3                 | blue        |
|                                                                                                                    | CAN-H          | 4                 | black       |
|                                                                                                                    | CAN-L          | 5                 | grey        |
|                                                                                                                    |                |                   |             |

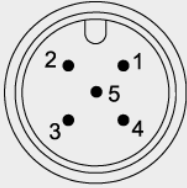
View to the sensor connector

|                                                                                                                                    |                               |                                     |
|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------|
| <b>MCANJ1939,<br/>MCANJ1939R</b><br>SAE J1939<br> | CAN Specification             | ISO 11898, Basic and Full CAN 2.0 B |
|                                                                                                                                    | Transceiver                   | 24V-compliant, not isolated         |
|                                                                                                                                    | Communication profile         | SAE J1939                           |
|                                                                                                                                    | Baud Rate                     | 250 kbit/s                          |
|                                                                                                                                    | Internal termination resistor | 120 Ω adjustable by the customer    |
|                                                                                                                                    | Address                       | Default 247d, configurable          |

|                    |                           |             |                      |
|--------------------|---------------------------|-------------|----------------------|
| <b>NAME Fields</b> | Arbitrary address capable | 1           | Yes                  |
|                    | Industry group            | 0           | Global               |
|                    | Vehicle system            | 7Fh (127d)  | Non specific         |
|                    | Vehicle system instance   | 0           |                      |
|                    | Function                  | FFh (255d)  | Non specific         |
|                    | Function instance         | 0           |                      |
|                    | ECU instance              | 0           |                      |
|                    | Manufacturer              | 145h (325d) | Manufacturer ID      |
|                    | Identity number           | 0nnn        | Serial number 21 bit |

|                                          |                    |           |                                                                               |
|------------------------------------------|--------------------|-----------|-------------------------------------------------------------------------------|
| <b>Parameter Group<br/>Numbers (PGN)</b> | Configuration data | PGN EF00h | Proprietary-A<br>(PDU1 peer-to-peer)                                          |
|                                          | Process data       | PGN FFnnh | Proprietary-B<br>(PDU2 broadcast);<br>nn Group Extension (PS)<br>configurable |

|                       |                         |                                                                    |
|-----------------------|-------------------------|--------------------------------------------------------------------|
| <b>Specifications</b> | Excitation voltage      | 8 ... 36 V DC                                                      |
|                       | Excitation current      | 20 mA typical at 24 V DC<br>40 mA typical at 12 V DC<br>max. 80 mA |
|                       | Measuring rate          | 1 kHz (asynchronous)                                               |
|                       | Stability (temperature) | ±50 x 10 <sup>-6</sup> /°C f.s. (typical)                          |
|                       | Repeatability           | 1 LSB                                                              |
|                       | Operating temperature   | See specification of the respective sensor                         |
|                       | Protection              | Reverse polarity, short circuit                                    |
|                       | Dielectric strength     | 1 kV (V AC, 50 Hz, 1 min.)                                         |
|                       | EMV                     | EN 61326-1:2013                                                    |

| Signal wiring                                                                                                                                    | Output signals | Connector pin no. | Cable color |
|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------------|-------------|
| <b>Connector M12, 5 pin</b><br><br>View to the sensor connector | Shield         | 1                 | brown       |
|                                                                                                                                                  | Excitation +   | 2                 | white       |
|                                                                                                                                                  | GND            | 3                 | blue        |
|                                                                                                                                                  | CAN-H          | 4                 | black       |
|                                                                                                                                                  | CAN-L          | 5                 | grey        |

## Accessories

### Connector cable M12, 4 pin

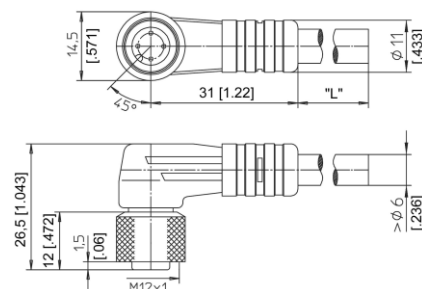
#### (angular coupling)

shielded connector

Suitable for 5-pin

sensor connectors

The 4-core screened cable is supplied with a mating 4-pin 90° M12 connector at one end and 4 wires at the other end. Available lengths are 2 m, 5 m and 10 m.  
Wire: cross sectional area 0.34 mm²  
Cable diameter: 5.6 ±0.2 mm



#### Order code

KAB - xM - M12/4F/W - LITZE

IP69: KAB - xM - M12/4F/W/69K - LITZE

xM = length in m

### Connector cable M12, 4 pin

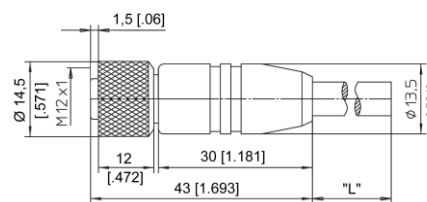
#### (straight coupling)

shielded connector

Suitable for 5-pin

sensor connectors

The 4-core screened cable is supplied with a mating 4-pin M12 connector at one end and 4 wires at the other end. Available lengths are 2 m, 5 m and 10 m.  
Wire: cross sectional area 0.34 mm²  
Cable diameter: 5.6 ±0.2 mm



#### Order code

KAB - xM - M12/4F/G - LITZE

IP69: KAB - xM - M12/4F/G/69K - LITZE

xM = length in m

| Signal wiring<br>M12, 4 pin | Plug connection / cable color |       |      |       |
|-----------------------------|-------------------------------|-------|------|-------|
|                             | 1                             | 2     | 3    | 4     |
|                             | brown                         | white | blue | black |

### Applicable for cable carriers

|                        |                     |
|------------------------|---------------------|
| Maximum movement speed | 3 m/s               |
| Maximum acceleration   | 5 m/s²              |
| Minimum bending radius | 10 x cable diameter |

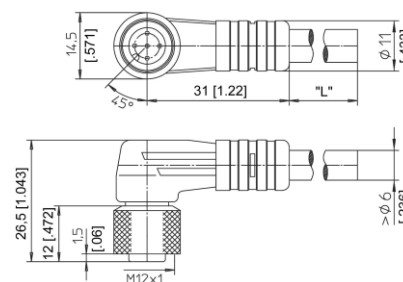
## Connector cable M12, 5 pin (angular coupling)

shielded connector

The 5-core screened cable is supplied with a mating 5-pin 90° M12 connector at one end and 4 wires at the other end. Available lengths are 2 m, 5 m and 10 m.

Wire: cross sectional area 0.34 mm<sup>2</sup>

Cable diameter: 5.6 ±0.2 mm



### Order code

KAB - xM - M12/5F/W - LITZE

IP69: KAB - xM - M12/5F/W/69K - LITZE

xM = length in m

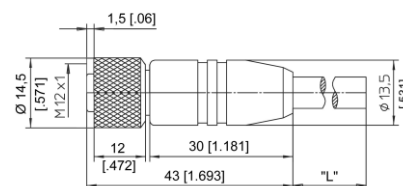
## Connector cable M12, 5 pin (straight coupling)

shielded connector

The 5-core screened cable is supplied with a mating 5-pin M12 connector at one end and 4 wires at the other end. Available lengths are 2 m, 5 m and 10 m.

Wire: cross sectional area 0.34 mm<sup>2</sup>

Cable diameter: 5.6 ±0.2 mm



### Order code

KAB - xM - M12/5F/G - LITZE

IP69: KAB - xM - M12/5F/G/69K - LITZE

xM = length in m

| Signal wiring<br>M12, 5 pin | Plug connection / Cable color |       |      |       |      |
|-----------------------------|-------------------------------|-------|------|-------|------|
|                             | 1                             | 2     | 3    | 4     | 5    |
|                             | brown                         | white | blue | black | grey |

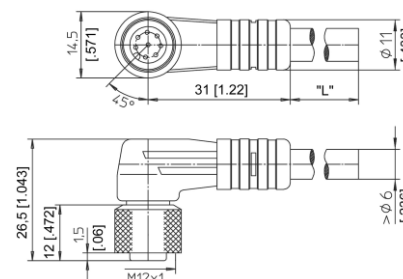
### Applicable for cable carriers

|                        |                     |
|------------------------|---------------------|
| Maximum movement speed | 3 m/s               |
| Maximum acceleration   | 5 m/s <sup>2</sup>  |
| Minimum bending radius | 10 x cable diameter |

## Connector cable M12, 8 pin (angular coupling)

shielded connector

The 8-lead shielded cable is supplied with a mating 8-pin 90° M12 connector at one end and 8 wires at the other end.  
Available lengths are 2 m, 5 m and 10 m.  
Wire: cross sectional area 0.25 mm²  
Cable diameter: 6.3 ±0.2 mm



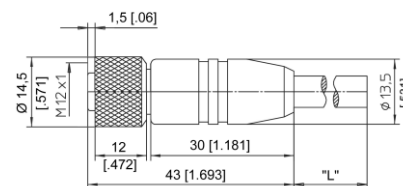
### Order code

|                  |                                 |
|------------------|---------------------------------|
|                  | KAB - xM - M12/8F/W - LITZE     |
| IP69:            | KAB - xM - M12/8F/W/69K - LITZE |
| xM = length in m |                                 |

## Connector cable M12, 8 pin (straight coupling)

shielded connector

The 8-lead shielded cable is supplied with a mating 8-pin M12 connector at one end and 8 wires at the other end.  
Available lengths are 2 m, 5 m and 10 m.  
Wire: cross sectional area 0.25 mm²  
Cable diameter: 6.3 ±0.2 mm



### Order code

|                  |                                 |
|------------------|---------------------------------|
|                  | KAB - xM - M12/8F/G - LITZE     |
| IP69:            | KAB - xM - M12/8F/G/69K - LITZE |
| xM = length in m |                                 |

| Signal wiring<br>M12, 8 pin | Plug connection / cable color |       |       |        |      |      |      |     |
|-----------------------------|-------------------------------|-------|-------|--------|------|------|------|-----|
|                             | 1                             | 2     | 3     | 4      | 5    | 6    | 7    | 8   |
|                             | white                         | brown | green | yellow | grey | pink | blue | red |

### Applicable for cable carriers

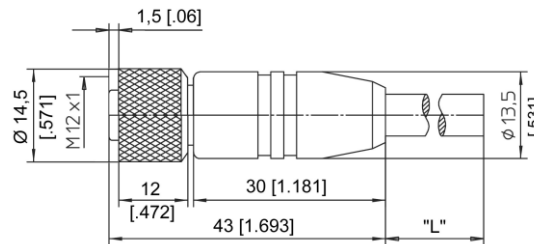
|                        |                     |
|------------------------|---------------------|
| Maximum movement speed | 3 m/s               |
| Maximum acceleration   | 5 m/s²              |
| Minimum bending radius | 10 x cable diameter |

## Connector/bus cable M12, 5 pin CAN-Bus

The 5-lead shielded cable is supplied with a female 5 pin M12 connector at one end and a male 5 pin M12 connector at the other end.

Available lengths are 0.3 m, 2 m, 5 and 10 m.

Cable diameter:  $6.7 \pm 0.2$  mm



### Order code

**KAB - xM - M12/5F/G - M12/5M/G - CAN**

IP69: **KAB - xM - M12/5F/G/69K - M12/5M/G/69K - CAN**

xM = length in m

## T-connector for bus cable M12, 5 pin CAN-Bus

### Order code

**KAB - TCONN - M12/5M - 2M12/5F - CAN**



## Terminating resistor M12, 5 pin CAN-Bus

### Order code

**KAB - RTERM - M12/5M/G - CAN**



### Applicable for cable carriers

|                        |                     |
|------------------------|---------------------|
| Maximum movement speed | 3 m/s               |
| Maximum acceleration   | 5 m/s <sup>2</sup>  |
| Minimum bending radius | 10 x cable diameter |