



PCQA24

Displacement sensor in square profile for standard industrial applications



- Protection class IP67/IP69
- Also available with guided position magnet
- Wear and maintenance free
- High level of shock resistance up to 50 g (100 shocks)
- Guiding distance of up to 19 mm (depending on magnet/profile)

Product versions



Analog output, 1 channel



Analog output, 2 channels



Digital output SSI



Digital output CANopen



PCQA24 - Magnetostrictive Position Sensor in square profile Version with analog output, 1 channel

Specifications

		Order options, 1 channel	
Measurement range	100 ... 5750 (in 10 mm increments) other lengths upon request	1	100 ... 5750
Output	0 ... 10 V signal conditioner U1 with alarm_HOLD 0.5 ... 10 V signal conditioner U2 with alarm_LOW; U2 with alarm_HOLD 0.5 ... 4.5 V signal conditioner U8 with alarm_LOW; U8 with alarm_HOLD 4 ... 20 mA signal conditioner (3 wire) I1 with alarm_LOW; I1 with alarm_HOLD	2	U1 U1/H U2 U2/U; U2/H U8 U8/U; U8/H I1 I1/U; I1/H
Function and characteristics output	Position magnet 1, increasing Position magnet 1, decreasing Start value, direction & end value adjustable by the customer	3	P1A P1D PMU
Resolution	16 bit f.s., min. 10 µm		
Sampling rate	Up to 1 kHz, depending on the measurement range		
Linearity	Ranges >500 mm: ±0.10 % f.s. ±0.02 % f.s. Ranges ≤500 mm: ±0.5 mm ±0.2 mm	4	L10 L02 L10 L02MM
Repeatability	±3 µm		
Housing material	AlMgSi1 / Zn / V4A		
Protection class	IP67 (optional IP67/IP69; connector version: with mating connector only)		
Mounting	Mounting set PCQA-BFS1		
Connection	Connector M12, 8 pin Cable, standard length 2 m; other lengths upon request	5	M12 KAB2M
Temperature range	-40 ... +85°C		
Shock	DIN EN 60068-2-27:2010, 50 g/11 ms, 100 shocks		
Vibration	DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles		
EMC	DIN EN 61326-1:2013		

Order code

PCQA24 – **1** – **2** – **3** – **4** – **5**

Order example: PCQA24 – 1000 – I1 – P1A – L10 – M12



PCQA24 - Magnetostrictive Position Sensor in square profile

Specifications

		Order options, 2 channels
Measurement range	100 ... 5750 (in 10 mm increments) other lengths upon request	1 100 ... 5750
Output	0 ... 10 V signal conditioner U1 with alarm_HOLD 0.5 ... 10 V signal conditioner U2 with alarm_LOW; U2 with alarm_HOLD 0.5 ... 4.5 V signal conditioner U8 with alarm_LOW; U8 with alarm_HOLD 4 ... 20 mA signal conditioner (3 wire) I1 with alarm_LOW; I1with alarm_HOLD	2 U1 U1/H U2 U2/U; U2/H U8 U8/U; U8/H I1 I1/U; I1/H
Function and characteristics, output 1	Position magnet 1, increasing Position Magnet 1, decreasing Difference magnet 1/2, increasing (2 magnets required) Difference magnet 1/2, decreasing (2 magnets required)	3 P1A P1D DA DD
Function and characteristics, output 2	Position magnet 2, increasing (2 magnets required) Position magnet 2, decreasing (2 magnets required) Difference magnet 1/2, increasing (2 magnets required) Difference magnet 1/2, decreasing (2 magnets required) Velocity with direction detection (with 1 magnet only) Velocity without direction detection (with 1 magnet only)	4 P2A P2D DA DD VZx.x ¹⁾ VAX.x ²⁾
Resolution	16 bit f.s., min. 10 µm	
Sampling rate	Up to 1 kHz, depending on the measurement range	
Linearity	Ranges >500 mm: ±0.10 % f.s. ±0.02 % f.s. Ranges ≤500 mm: ±0.5 mm ±0.2 mm	5 L10 L02 L10 L02MM
Repeatability	±3 µm	
Housing material	AlMgSi1 / Zn / V4A	
Protection class	IP67 (optional IP67/IP69; connector version: with mating connector only)	
Mounting	Mounting set PCQA-BFS1	
Connection	Connector M12, 8 pin Cable, standard length 2 m; other lengths upon request	6 M12 KAB2M
Temperature range	-40 ... +85°C	
Shock	DIN EN 60068-2-27:2010, 50 g/11 ms, 100 shocks	
Vibration	DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles	
EMC	DIN EN 61326-1:2013	

Order code

PCQA24 – 1 – 2 – 3 – 4 – 5 – 6

Order example: PCQA24 – 1000 – I1 – P1A – VZ1.0 – L10 – M12

1) VZx.x = velocity with direction detection (with 1 magnet only), in steps of 0.1 m/s

Example: VZ1.5	towards start position		towards end position
	-1.5 m/s	0	1.5 m/s
Output U2:	0.5 V	5.25 V	10 V
Output I1:	4 mA	12 mA	20 mA

2) VAx.x = velocity without direction detection (with 1 magnet only), in steps of 0.1 m/s

Example: VA1.5	towards start position		towards end position
	-1.5 m/s	0	1.5 m/s
Output U2:	10 V	0.5 V	10 V
Output I1:	20 mA	4 mA	20 mA

Accessories:

Connector cable (see page 23)

Position magnets (see page 12)

Mounting set (see page 11)



PCQA24 - Magnetostrictive Position Sensor in square profile Version with digital output SSI

Specifications

			Order options
Measurement range	100 ... 5750 (in 10 mm increments) other lengths upon request	1	100 ... 5750
Resolution	5 / 10 / 20 / 50 / 100 µm	2	5 / 10 / 20 / 50 / 100
Output	Synchronous serial interface (SSI)	3	SSI
Output code	Gray Dual	4	G D
Number of data bits	24 bit 25 bit	5	24 25
Sampling rate	Up to 1 kHz, depending on the measurement range		
Linearity	Ranges >500 mm: ±0.10 % f.s. ±0.02 % f.s. Ranges ≤500 mm: ±0.5 mm ±0.2 mm	6	L10 L02 L10 L02MM
Repeatability	±3 µm		
Housing material	AlMgSi1 / Zn / V4A		
Protection class	IP67 (optional IP67/IP69; connector version: with mating connector only)		
Mounting	Mounting set PCQA-BFS1		
Connection	Connector M12, 8 pin Cable, standard length 2 m; other lengths upon request	7	M12 KAB2M
Temperature range	-40 ... +85°C		
Shock	DIN EN 60068-2-27:2010, 50 g/11 ms, 100 shocks		
Vibration	DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles		
EMC	DIN EN 61326-1:2013		

Order code

PCQA24 – **1** – **2** – **3** / **4** / **5** – **6** – **7**

Order example: PCQA24 – 1000 – 5 – SSI / G / 24 – L10 – M12

Accessories:

Connector cable (see page 23)

Position magnets (see page 12)

Mounting set (see page 11)



PCQA24 - Magnetostrictive Position Sensor in square profile Version with digital output CANopen

Specifications

			Order options
Measurement range	100 ... 5750 (in 10 mm increments) other lengths upon request	1	100 ... 5750
Output	CANopen-Bus CANopen-Bus with integrated terminating resistance CAN SAE J1939 CAN SAE J1939-Bus with integrated terminating resistance	2	CANOP CANOP/R CANJ1939 CANJ1939/R
Resolution	50 µm		
Sampling rate	Up to 1 kHz, depending on the measurement range		
Linearity	Ranges >500 mm: ±0.10 % f.s. ±0.02 % f.s. Ranges ≤500 mm: ±0.5 mm ±0.2 mm	3	L10 L02 L10 L02MM
Repeatability	±3 µm		
Housing material	AlMgSi1 / Zn / V4A		
Protection class	IP67 (optional IP67/IP69; connector version: with mating connector only)		
Mounting	Mounting set PCQA-BFS1		
Connection	Connector M12, 5 pin	4	M12/CAN
Temperature range	-40 ... +85°C		
Shock	DIN EN 60068-2-27:2010, 50 g/11 ms, 100 shocks		
Vibration	DIN EN 60068-2-6:2008, 20 g 10 Hz-2 kHz, 10 cycles		
EMC	DIN EN 61326-1:2013		

Order code

PCQA24 – 1 – 2 – 3 – 4

Order example: PCQA24 – 1000 – CANOP – L10 – M12/CAN

Accessories:

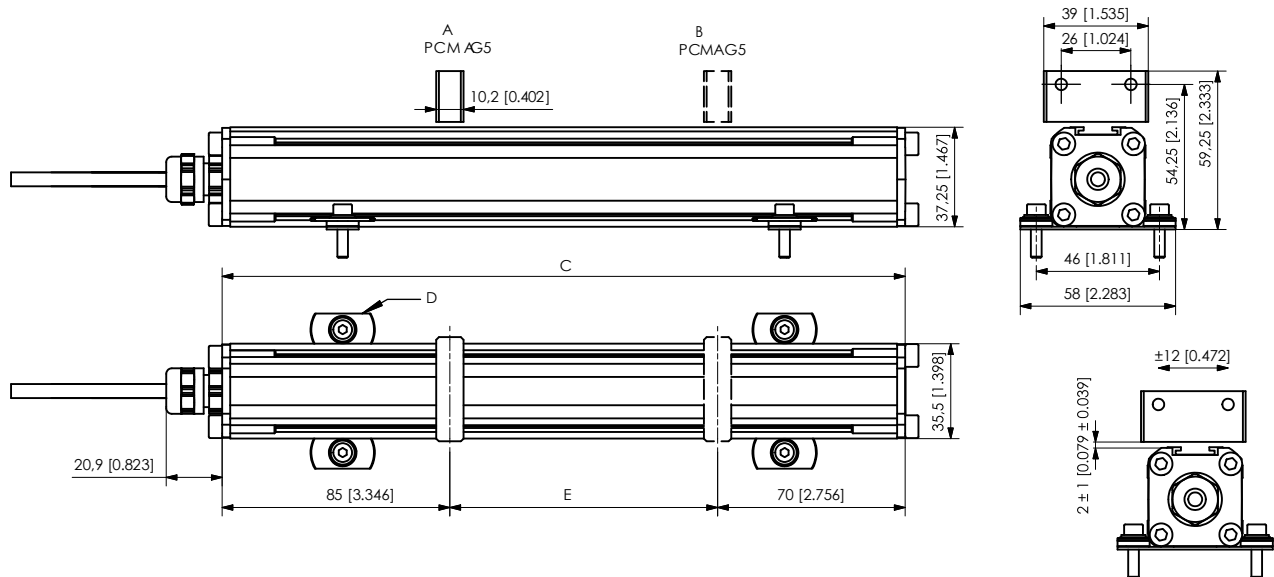
Connector cable (see page 24)

Position magnets (see page 12)

Mounting set (see page 11)

Dimensions

Cable output



A – Start position

B – End position

C – Total length = Measurement length + 155 [6.102]

(e.g. 255 [10.039])

D – Mounting set PCQA-BFS1

E – Measurement length (e.g. 100 [3.937])

Cable: outer diameter 5.2 mm ±0.2 mm

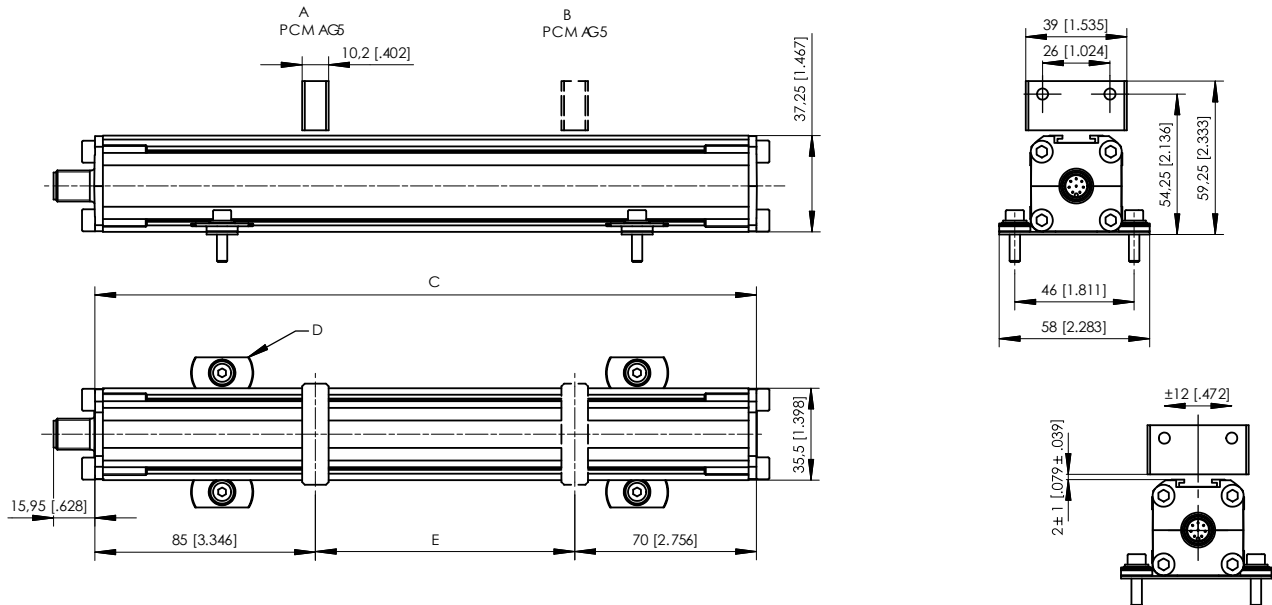
Wire cross sectional area 0.14 mm²

Dimensions in mm [inch]

Dimensions informative only.

For guaranteed dimensions consult factory.

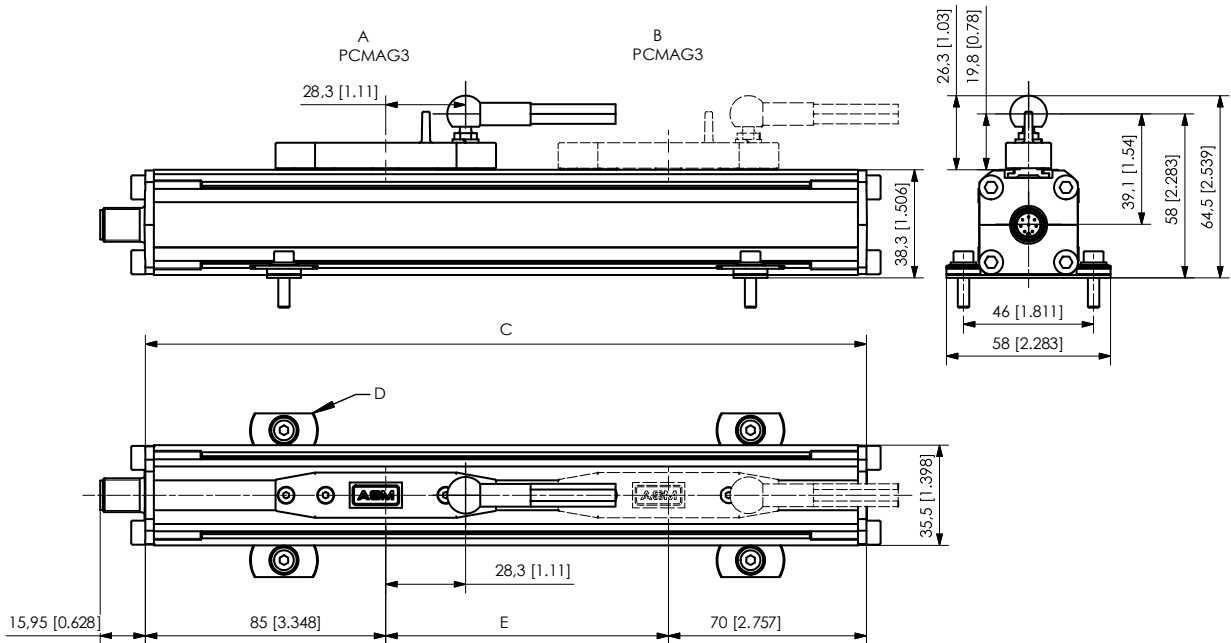
Connector M12 output



- A – Start position
- B – End position
- C – Total length = Measurement length + 155 [6.102]
(e.g. 255 [10.039])
- D – Mounting set PCQA-BFS1
- E – Measurement length (e.g. 100 [3.937])

Dimensions in mm [inch]
Dimensions informative only.
For guaranteed dimensions consult factory.

With magnet PCMAG3



A – Start position

B – End position

C – Total length = Measurement length + 155 [6.102]

(e.g. 255 [10.039])

D – Mounting set PCQA-BFS1

E – Measurement length (e.g. 100 [3.937])

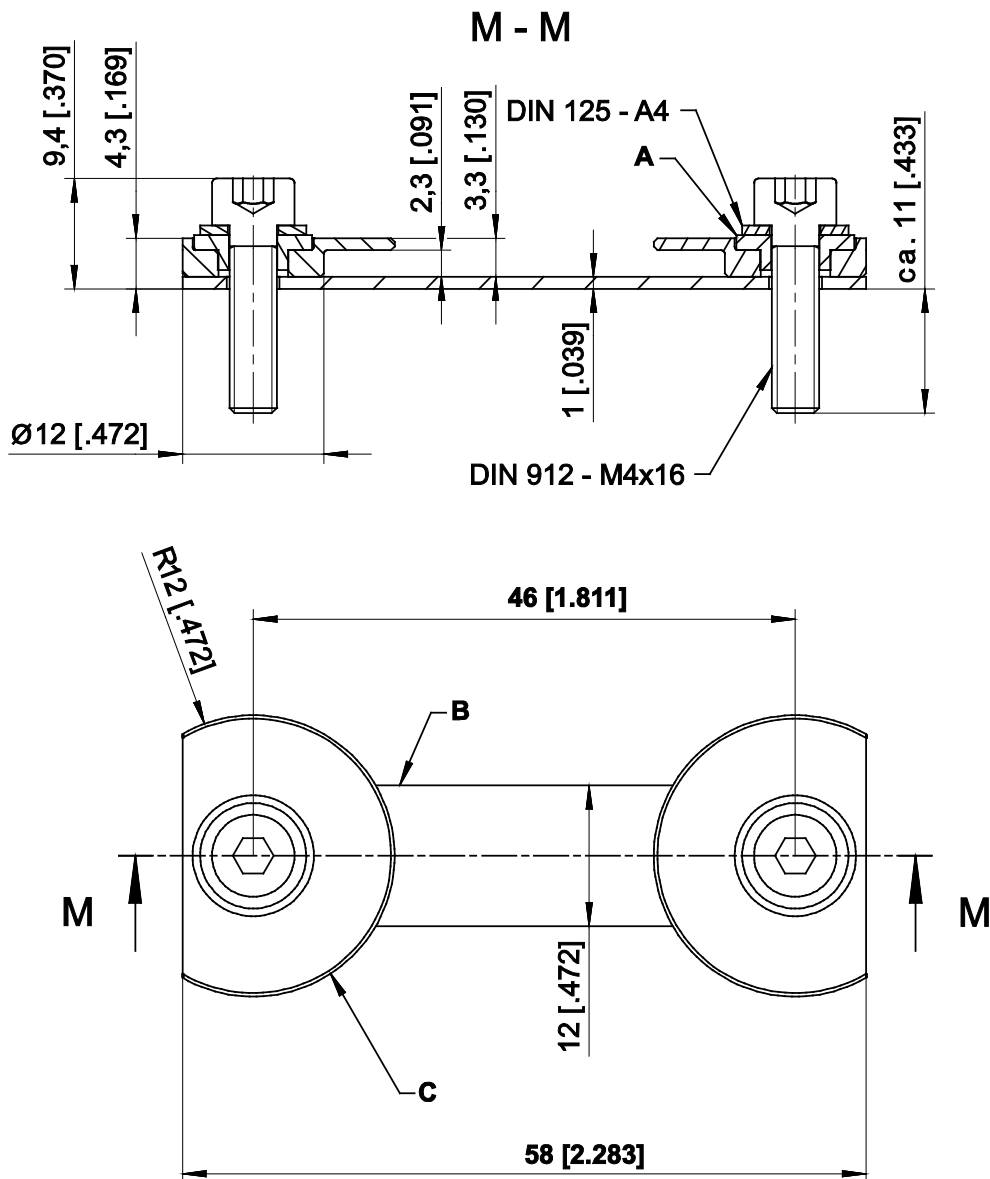
Dimensions in mm [inch]

Dimensions informative only.

For guaranteed dimensions consult factory.

Mounting sets

Mounting set PCQA-BFS1 with mounting clamps



- A – Isolation sleeve
- B – Isolation strip
- C – Mounting clamp

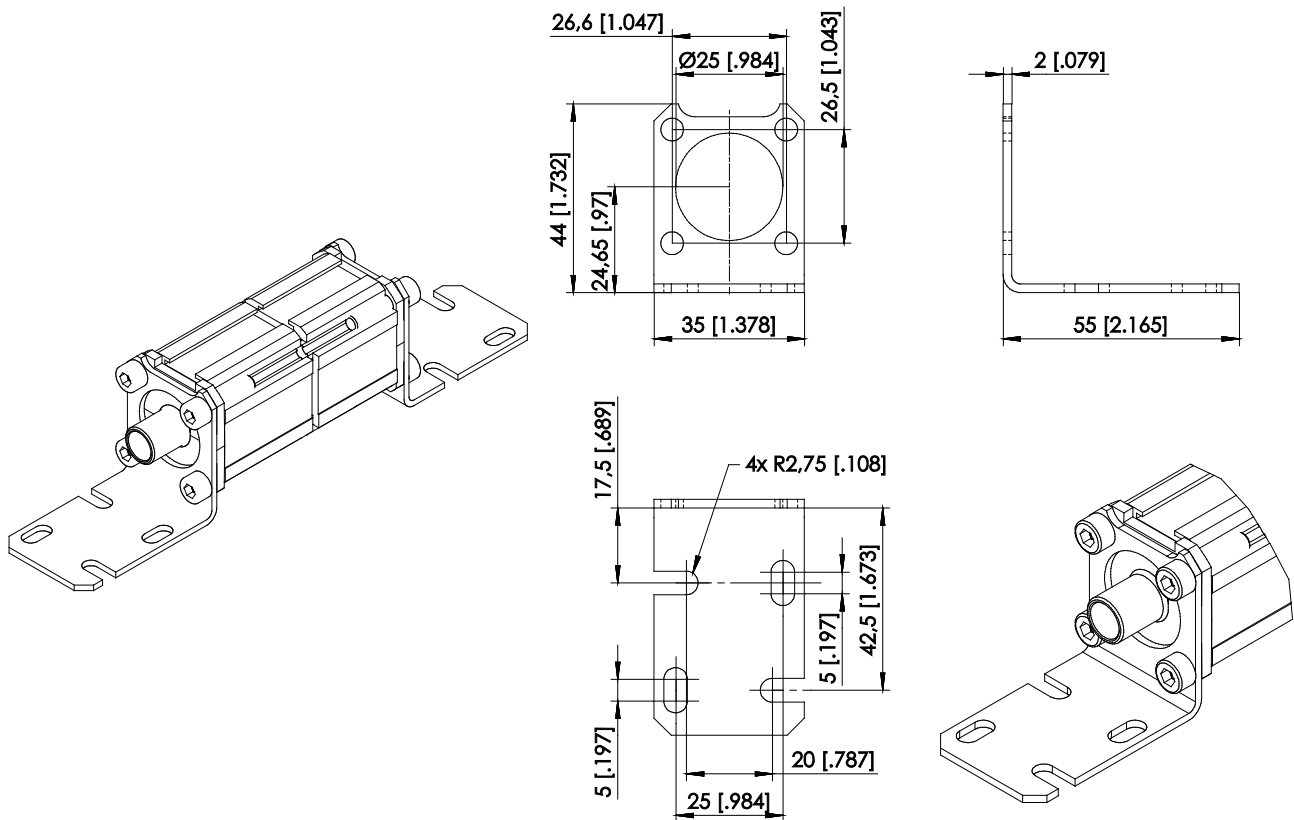
Dimensions in mm [inch]

Dimensions informative only.

For guaranteed dimensions consult factory.

Option -BFW

Mounting brackets for PCQA22 and PCQA24



Note: The option -BFW can only be ordered with a new sensor, not separately! Applicable for sensor lengths up to 1000 mm. Not to be combined with PCQA-BFS1.

Dimensions in mm [inch]

Dimensions informative only.

For guaranteed dimensions consult factory.

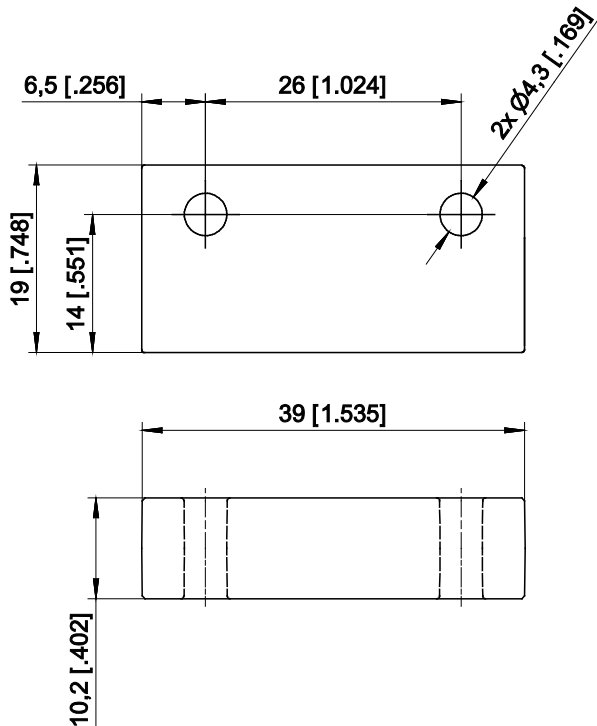
Order example

PCQA24 – 1000 – U2 – P1A – L10 – M12 – BFW

Magnets

PCMAG5

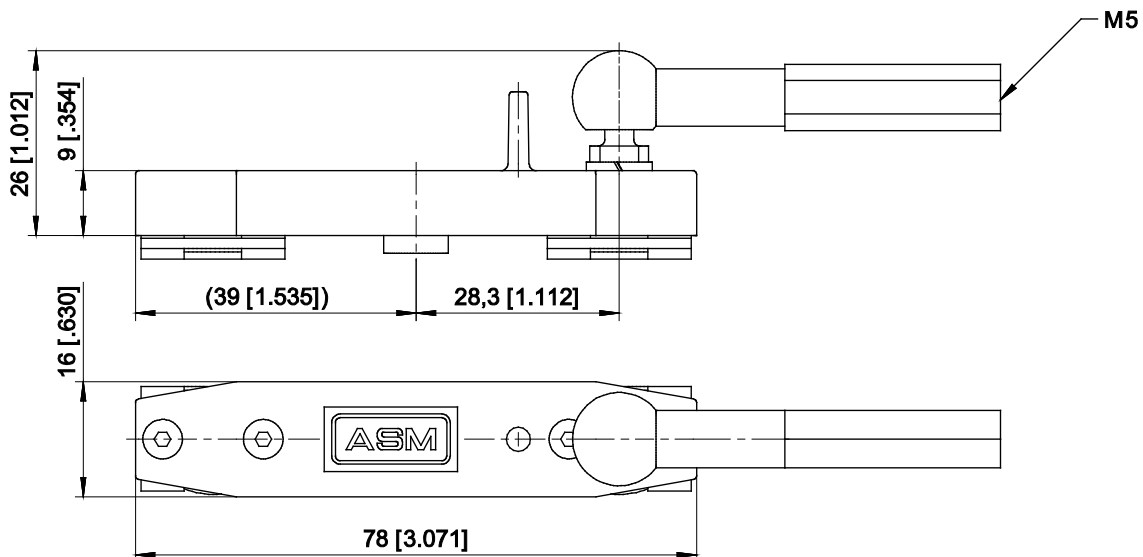
Standard magnet



Dimensions in mm [inch]
Dimensions informative only.
For guaranteed dimensions consult factory.

PCMAG3

Guided magnet slider with internal position magnet



Dimensions in mm [inch]
Dimensions informative only.
For guaranteed dimensions consult factory.

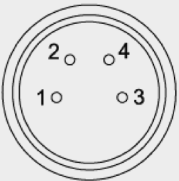
Output specification

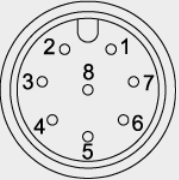
Analog output

U1 Voltage output 0 ... 10 V 	Excitation voltage	18 ... 36 V DC
	Excitation current	typical 23 mA at 24 V DC typical 46 mA at 12 V DC max. 80 mA
	Output voltage	0 ... 10 V DC
	Output current	2 mA max.
	Output load	>5kΩ
	Resolution	16 bit f.s. min. 10 μm
	Stability (temperature)	±50 x 10 ⁻⁶ / °C f.s.
	Protection	Reverse polarity, short circuit
	Output noise	0,5 mV _{RMS}
	Operating temperature	-40 ... +85°C
	EMC	DIN EN 61326-1:2013
U2 Voltage output 0,5 ... 10 V 	Excitation voltage	18 ... 36 V DC
	Excitation current	typical 23 mA at 24 V DC typical 46 mA at 12 V DC max. 80 mA
	Output voltage	0,5 ... 10 V DC
	Output current	2 mA max.
	Output load	>5kΩ
	Resolution	16 bit f.s., min. 10 μm
	Stability (temperature)	±50 x 10 ⁻⁶ / °C f.s.
	Protection	Reverse polarity, short circuit
	Output noise	0,5 mV _{RMS}
	Operating temperature	-40 ... +85°C
	EMC	DIN EN 61326-1:2013

U8 Voltage output 0.5 ... 4.5 V 	Excitation voltage	10 ... 36 V DC
	Excitation current	typical 23 at 24 V DC typical 46 mA at 12 V DC max. 80 mA
	Output voltage	0.5 ... 4.5 V DC
	Output current	2 mA max.
	Output load	>5kΩ
	Resolution	16 bit f.s., min. 10 μm
	Stability (temperature)	±50 x 10 ⁻⁶ / °C f.s.
	Protection	Reverse polarity, short circuit
	Output noise	0,5 mV _{RMS}
	Operating temperature	-40 ... +85°C
	EMC	DIN EN 61326-1:2013

I1 Current output 4 ... 20 mA, 3 wire 	Excitation voltage	18 ... 36 V DC (10 ... 36 V for R _L ≤ 250Ω)
	Excitation current	Typical 36 mA at 24 V DC Typical 66 mA at 12 V DC 100 mA max.
	Load resistor R _L	350 Ω max.
	Output current	4 ... 20 mA (max. 30 mA at failure)
	Resolution	16 bit f.s. min. 10 μm
	Stability (temperature)	±50 x 10 ⁻⁶ / °C f.s.
	Protection	Reverse polarity, short circuit
	Output noise	0,5 mV _{RMS}
	Operating temperature	-40 ... +85°C
	EMC	DIN EN 61326-1:2013

Signal wiring	Output signals	Connector pin no.
Connector M8, 4 pin  View to the sensor connector	Excitation +	1
	Excitation GND	2
	Signal +	3
	PMU (optional)	4

Signal wiring	Output signals	Connector pin no.	Cable color
Connector M12, 8 pin  View to the sensor connector	Excitation +	1	white
	Excitation GND	2	brown
	Signal 1 +	3	green
	Signal GND	4	yellow
	Signal 2 + (optional*)	5	grey
	SPAN/ZERO (PMU only, optional)	6	pink
	-	7	do not connect
	-	8	do not connect

* When using two magnets, the distance between the magnets must be min. 70 mm to identify the single magnets definitely.

Diagnostic on analog outputs

Behaviour of the analog signal output in case of error

In case of error (magnet missing or outside the measuring range) the analog output signal will assume a state according to the following options:

Alarm_HIGH

The output voltage resp. the output current is at HIGH level (overrange).

Alarm_LOW

The output voltage resp. the output current is at LOW level (underrange).

Alarm_HOLD

The output voltage resp. the output current will keep the last valid state.

	Alarm_HIGH (Standard)	Alarm_LOW (.../U)	Alarm_HOLD (.../H)
U1	$U_{out} \geq 10.5 \text{ V}$	—	keeps last valid state (Order code U1/H)
U2	$U_{out} \geq 10.5 \text{ V}$	$U_{out} < 0.25 \text{ V}$ (Order code U2/U)	keeps last valid state (Order code U2/H)
U8	$U_{out} \geq 10 \text{ V}$	$U_{out} < 0,25 \text{ V}$ (Order code U8/U)	keeps last valid state (Order code U8/H)
I1	$I_{out} \geq 21 \text{ mA}$	$1.5 \dots 2 \text{ mA}$ (Order code I1/U)	keeps last valid state (Order code I1/H)

Error signal for SSI output

If the sensor cannot detect a magnet, the position value will take the maximum value (0xFFFFF) for 24 bits and (0x1FFFFFF) for 25 bits.

Option - PMU for analog output U1, U2, U8 and I1

Programming of the start and end value by the customer:

The option PMU allows to program the start value and the end value of the output range by a programming signal SPAN/ZERO available at the connector. This Signal SPAN/ZERO must be connected with GND via a push button, then position magnet of the sensor must be moved to the start resp. end position. Pushing the button between 2 and 4 seconds sets the actual position as start position, pushing the button more than 5 seconds sets the actual position as end position. The values will be stored and are available after switching off the sensor.

To reset the sensor to the factory values the button must be pushed for longer than two seconds when the sensor is switched on.

Digital output

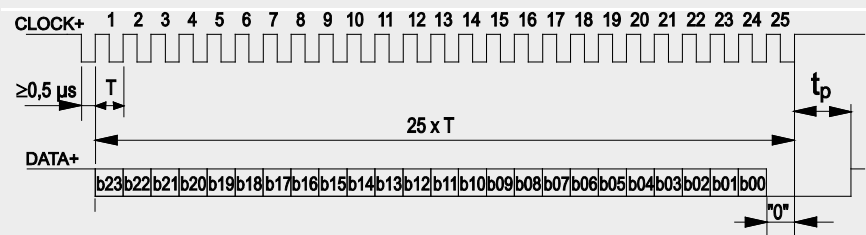
SSI Synchronous serial interface SSI 	Interface	EIA RS-422
	Excitation voltage	10 ... 36 V DC, residual ripple 10 mV _{ss}
	Excitation current	typical 22 mA at 24 V DC typical 46 mA at 12 V DC 150 mA max.
	Clock frequency	100 kHz ... 1 MHz
	Code	Gray-Code, Dual-Code
	Delay between pulse trains (tp)	>25 µs
	Stability (temperature)	±50 x 10 ⁻⁶ / °C f.s.
	Operating temperature	-40 ... +85°C
	EMC	DIN EN 61326-1:2013

Description

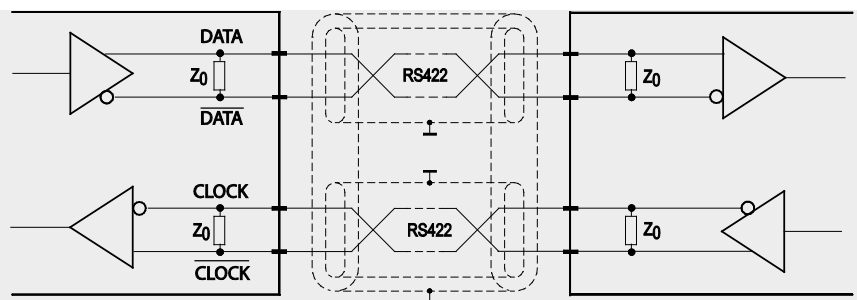
The data transmission takes place by means of the two signals CLOCK and DATA. The processing unit (PLC, microcomputer) sends pulse sequences which clock the data transmission at the required transfer rate. With the first falling edge of the pulse sequence the position of the sensor is recorded and stored. The following rising edges control the bit-by-bit transfer of the data word. After a delay time the next new position information can be transmitted.

Data format

(Train of 26 pulses)

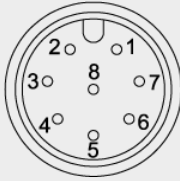


Recommended processing circuit



Transmission rate

Cable length	Baud rate	Note: Extension of the cable length will reduce the maximum transmission rate. The signals $\overline{\text{CLOCK}}$ and $\overline{\text{DATA}}$ must be connected in a twisted pair cable, shielded in pairs, the pairs also commonly shielded.
50 m	100-400 kHz	
100 m	100-300 kHz	

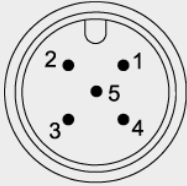
Signal wiring Connector M12, 8 pin	Signal	Connector pin no.	Cable color
 View to the sensor connector	Excitation +	1	white
	Excitation GND	2	brown
	CLOCK	3	green
	$\overline{\text{CLOCK}}$	4	yellow
	DATA	5	grey
	$\overline{\text{DATA}}$	6	pink
	-	7	blue
	-	8	red

Description

CANopen interface with process data for position and cam functions, programmable are preset, resolution, filtering and cam switching points.

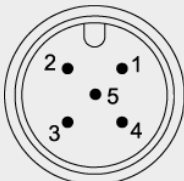
CANOP CANOP/R CANopen 	CAN specification	ISO 11898, Basic and Full CAN 2.0 B
	Communication profile	CANopen CiA 301 V 4.02, Slave
	Encoder profile	Encoder CiA 406 V 3.2
	Error Control	Node Guarding, Heartbeat, Emergency Message
	Node ID	Adjustable via LSS or via object dictionary
	PDO	4 TxPDO, 0 RxPDO, 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 to 1 MBit, adjustable via LSS or via object dictionary
	Nodes	127 max.
	Bus-Anschluss	M12 connector, 5 pin
	Integrated bus terminating resistor (optional)	120 Ω
	Bus, galvanic isolated	no

Specifications	Excitation voltage	18 ... 36 V DC 11 ... 36 V DC for measurement length <1m
	Excitation current	typical 20 mA at 24 V DC typical 40 mA at 12 V DC max. 80 mA
	Number of position magnets	1 ... 4
	Resolution	50 µm
	Measuring rate	1 kHz (asynchronous)
	Stability (temperature)	±50 x 10 ⁻⁶ / °C f.s.
	Repeatability	1 LSB
	Operating temperature	-40 ... +85 °C
	Protection	Reverse polarity, short circuit
	Dielectric strength	500 V (V AC, 50 Hz, 1 min.)
	EMC	DIN EN 61326-1:2013

Signal wiring	Output signals	Connector pin no.
Connector M12, 5 pin  View to the sensor connector	Shield	1
	Excitation +	2
	GND	3
	CAN-H	4
	CAN-L	5

When using multiple magnets, the distance between two magnets must be min. 70 mm to identify the single magnets definitely.

CANJ1939 CANJ1939/R SAE J1939 	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 (optional)	120 Ω	
	Address	Default 247d, configurable	
	NAME Fields	Arbitrary address capable	1
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
Parameter Group Numbers (PGN)	Configuration data	PGN EF00h	Proprietary-A (PDU1 peer-to-peer)
	Process data	PGN FFnnh	Proprietary-B (PDU2 broadcast); nn Group Extension (PS) configurable
Specifications	Excitation voltage	18 ... 36 V DC 11 ... 36 V DC for measurement length <1m	
	Excitation current	20 mA typical at 24 V DC 40 mA typical at 12 V DC, max. 80 mA	
	Measuring rate	1 kHz (asynchronous)	
	Stability (temperature)	±50 x 10 ⁻⁶ /°C f.s. (typical)	
	Repeatability	1 LSB	
	Operating temperature	-40 ... 85°C	
	Protection	Reverse polarity, short circuit	
	Dielectric strength	500 V (V AC, 50 Hz, 1 min.)	
	EMV	DIN EN 61326-1:2013	

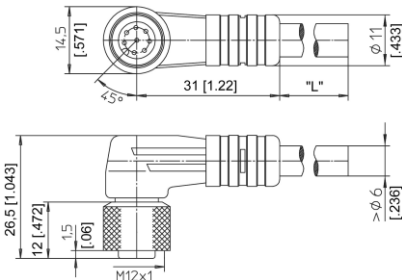
Signal wiring	Output signals	Connector pin no.
Connector M12, 5 pin  View to the sensor connector	Shield	1
	Excitation +	2
	GND	3
	CAN-H	4
	CAN-L	5

When using multiple magnets, the distance between two magnets must be min. 70 mm to identify the single magnets definitely.

Connector cables
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

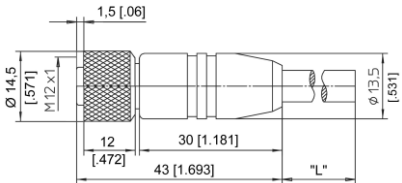
IP69: **KAB - xM - M12/8F/W/69K - LITZE**

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 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

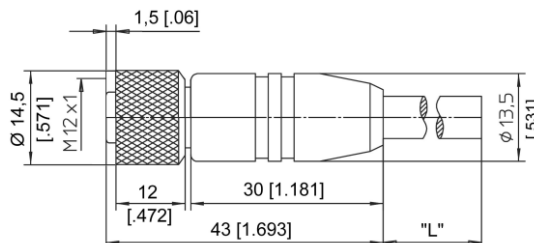
Maximum movement speed	3 m/s
Maximum acceleration	5 m/s²
Minimum bending radius	10 x cable diameter

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 ± 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 ²
Minimum bending radius	10 x cable diameter