BRIEF INFORMATION

Angular position sensors

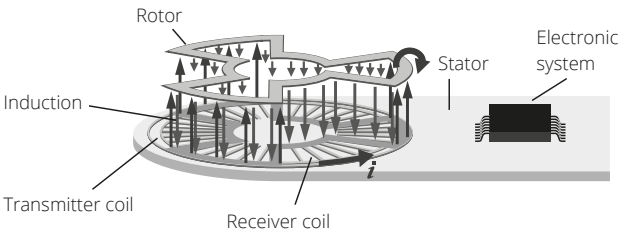
- High precision due to internal 14 bit resolution
- High thermal stability and linearity
- High insensitivity to magnetic fields
- Zero position can be individually programmed
- Various connection elements available

PRODUCT FEATURES

Application

The CIPOS®-type angular position sensors (**c**ontactless **i**nductive **p**osition **s**ensors) are designed for many different applications to measure angles accurately and reliably even in tough environments. Their insensitivity to magnetic fields and their high level of temperature stability in particular are the characteristic qualities of the CIPOS® technology used in all angular position sensors. Angles are measured inductively using a contactless and thus wear-resistant method. This guarantees a high degree of measurement accuracy throughout the entire life of the sensor. The redundant sensors (double sensors) are specially designed for failure detection, thus improving the reliability of the overall system.

Design and function



Inside the laser-welded housing made of polyamide PA66, the lever arm torque above the rotor is determined via the induction method. An ASIC (**A**pplication **S**pecific **I**ntegrated **C**ircuit) calculates the rotor position precisely. Various installation positions are possible via the repetitive characteristic curve of the output signal path (depending on the sensor structure used). This increases the number of flexible application options for the sensor.

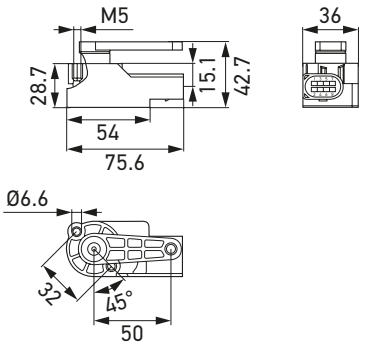
TECHNICAL DETAILS
6PD 009 583-001

Technical Data

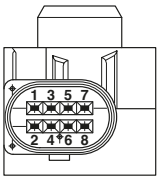
Supply voltage	U_s 5 V ± 10 % or 9 – 32 V
Current consumption	< 15 mA
Max. current (analogue output)	< 2 mA
Angle range	- 30° to + 30°
Mechanical angle range	Unlimited (full 360° circle)
Temperature range	- 40 °C to + 85 °C
„Crossed Scale“ Output signal	**Power Supply** U_s 5 V Output $U_{out\,1}$ 0.5 – 4.5 V ratiometric Output $U_{out\,2}$ 4.5 – 0.5 V ratiometric **Power Supply** U_s 9 – 32 V Output $U_{out\,1}$ 0.5 – 4.5 V Output $U_{out\,2}$ 4.5 – 0.5 V
Pin coating	Tin
Mating connector[1)]	1394416-1
Lifetime	5 million cycles
Resolution	0.06°
Linearity error including temperature drift	± 0.3°
Approved	ECE-R10
Protection class	IP 6K9K
Protection	Polarity reversal protection (mechanical protection only)
Zero position	0° / 120° / 240°
Lever arm	50 mm, socket

[1)] This accessory is not included. Available from TE Connectivity.

Dimensional sketch



Pin assignment / electrical connection



Power supply with 5 V DC[2)]
Pin 1: 5 V DC Sensor 2
Pin 2: Output $U_{out\,1}$ 0.5 – 4.5 V ratiometric
Pin 3: Not assigned
Pin 4: 5 V DC sensor 1
Pin 5: Output $U_{out\,2}$ 4.5 – 0.5 V ratiometric
Pin 6: Not assigned
Pin 7: Ground sensor 2
Pin 8: Ground sensor 1

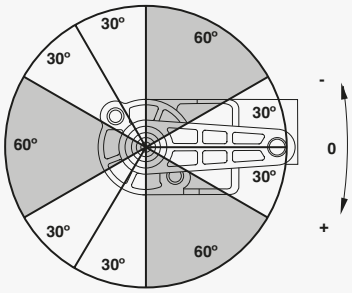
[2)] The power supply (pin 1 and pin 4) and the ground supply (pin 7 and pin 8) can be bridged externally (e. g. in the mating connector) in order to reduce the number of cables.

Power supply with 9 – 32 V DC[3)]
Pin 1: Bridge to pin 4 (external)
Pin 2: Output $U_{out\,1}$ 0.5 – 4.5 V
Pin 3: 9 – 32 V DC sensor 1 and 2
Pin 4: Bridge to pin 1 (external)
Pin 5: Output $U_{out\,2}$ 4.5 – 0.5 V
Pin 6: Not assigned
Pin 7: Ground sensor 2
Pin 8: Ground sensor 1

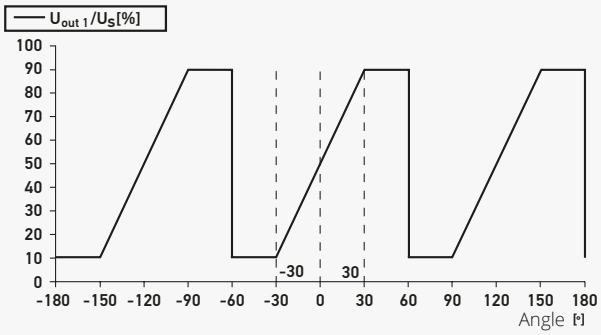
[3)] The bridge between pin 1 and pin 4 must be set up externally (e. g. in the mating connector). The power supply (pin 7 and pin 8) can be bridged externally (e. g. in the mating connector) in order to reduce the number of cables.

CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR

The characteristic curve of the angular position sensor repeats itself every 120°. This results in freedom for the mounting of the sensor, which enables it to be placed not only in the position shown but also to be staggered at a multiple of 120°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 60°. If it is exceeded by up to 30°, the output signal remains limited to the measuring range final value. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions can be seen on the graphic representation. The segments of the circle shown in grey represent the angle range that cannot be measured.

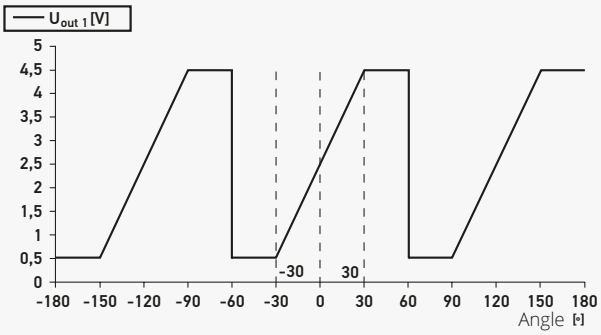


Ratiometric output signal $U_{out\ 1}$ with 5 V power supply



Output signal $U_{out\ 2}$ = 100 % – $U_{out\ 1}/U_s$ [%] (opposite curves)

Absolute output signal $U_{out\ 1}$ with 9 – 32 V power supply



Output signal $U_{out\ 2}$ = 5 V – $U_{out\ 1}$ [V] (opposite curve)

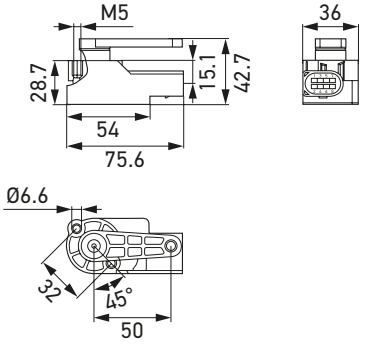
TECHNICAL DETAILS
6PD 009 583-011

Technical Data

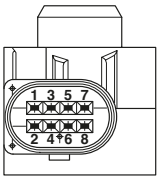
Supply voltage	U_s 5 V ± 10 % or 9 – 32 V
Current consumption	< 15 mA
Max. current (analogue output)	< 2 mA
Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° circle)
Temperature range	- 40 °C to + 85 °C
„Crossed Scale“ Output signal	**Power Supply** U_s 5 V Output $U_{out\,1}$ 0.5 – 4.5 V ratiometric Output $U_{out\,2}$ 4.5 – 0.5 V ratiometric **Power Supply** U_s 9 – 32 V Output $U_{out\,1}$ 0.5 – 4.5 V Output $U_{out\,2}$ 4.5 – 0.5 V
Pin coating	Tin
Mating connector[1)]	1394416-1
Lifetime	5 million cycles
Resolution	0.06°
Linearity error including temperature drift	± 0.3°
Approved	ECE-R10
Protection class	IP 6K9K
Protection	Polarity reversal protection (mechanical protection only)
Zero position	0° / 120° / 240°
Lever arm	50 mm, socket

[1)] This accessory is not included. Available from TE Connectivity.

Dimensional sketch



Pin assignment / electrical connection



Power supply with 5 V DC[2)]
Pin 1: 5 V DC sensor 2
Pin 2: Output $U_{out\,1}$ 0.5 – 4.5 V ratiometric
Pin 3: Not assigned
Pin 4: 5 V DC sensor 1
Pin 5: Output $U_{out\,2}$ 4.5 – 0.5 V ratiometric
Pin 6: Not assigned
Pin 7: Ground sensor 2
Pin 8: Ground sensor 1

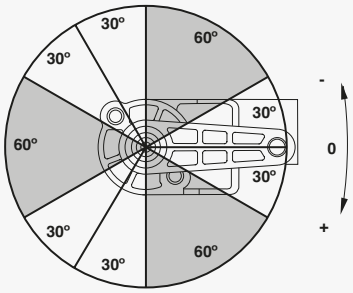
[2)] The power supply (pin 1 and pin 4) and the ground supply (pin 7 and pin 8) can be bridged externally (e. g. in the mating connector) in order to reduce the number of cables.

Power supply with 9 – 32 V DC[3)]
Pin 1: Bridge to pin 4 (external)
Pin 2: Output $U_{out\,1}$ 0.5 – 4.5 V
Pin 3: 9 – 32 V DC sensor 1 and 2
Pin 4: Bridge to pin 1 (external)
Pin 5: Output $U_{out\,2}$ 4.5 – 0.5 V
Pin 6: Not assigned
Pin 7: Ground sensor 2
Pin 8: Ground sensor 1

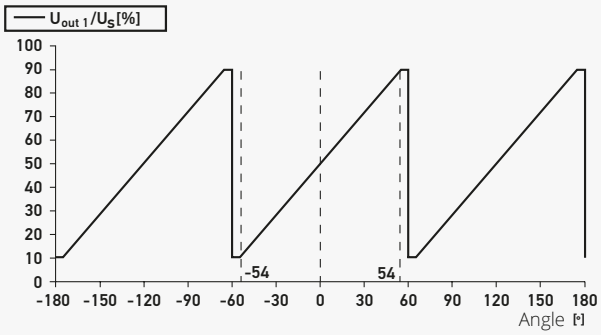
[3)] The bridge between pin 1 and pin 4 must be set up externally (e. g. in the mating connector). The power supply (pin 7 and pin 8) can be bridged externally (e. g. in the mating connector) in order to reduce the number of cables.

CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR

The characteristic curve of the angular position sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is a multiple of 120°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 108°. If it is exceeded by up to 6°, the output signal remains at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.

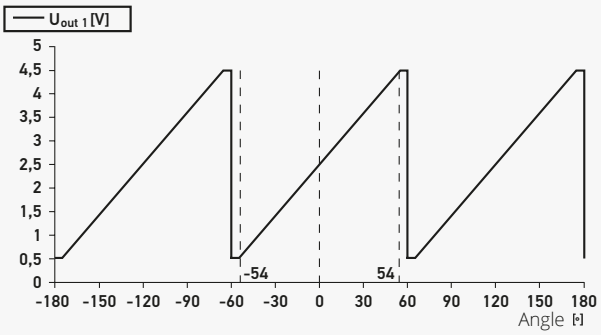


Ratiometric output signal $U_{out\ 1}$ with power supply 5 V



Output signal $U_{out\ 2}$ = 100 % – $U_{out\ 1}/U_s$ [%] (opposite curve)

Absolute output signal $U_{out\ 1}$ with power supply 9 – 32 V



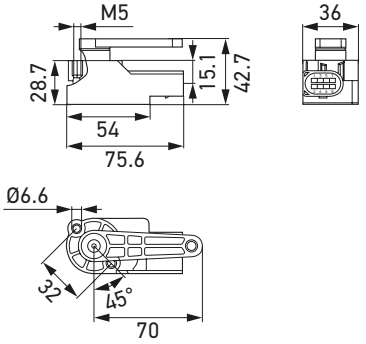
Output signal $U_{out\ 2}$ = 5 V – $U_{out\ 1}$ [V] (opposite curve)

TECHNICAL DETAILS
6PD 009 580-017

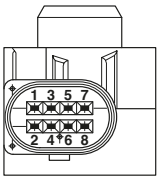
Technical Data	
Supply voltage	U_s 5 V ± 10 %
Current consumption	< 15 mA
Max. current (analogue output)	< 2 mA
Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° circle)
Temperature range	- 40 °C to + 85 °C
„Crossed Scale“ Output signal	**Power Supply** U_s 5 V Output $U_{out\,1}$ 0.5 – 4.5 V ratiometric Output $U_{out\,2}$ 4.5 – 0.5 V ratiometric **Power Supply** U_s 9 – 32 V Output $U_{out\,1}$ 0.5 – 4.5 V Output $U_{out\,2}$ 4.5 – 0.5 V
Pin coating	Tin
Mating connector[1)]	1394416-1
Lifetime	5 million cycles
Resolution	0.06°
Linearity error including temperature drift	± 0.3°
Approved	ECE-R10
Protection class	IP 6K9K
Protection	Polarity reversal protection (mechanical protection only)
Zero position	0° / 120° / 240°
Lever arm	70 mm, socket

[1)] This accessory is not included. Available from TE Connectivity.

Dimensional sketch



Pin assignment / electrical connection

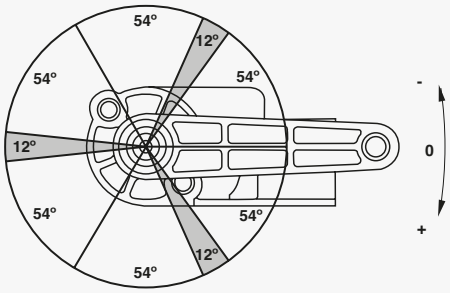


Power supply with 5 V DC[2)]
Pin 1: 5 V DC sensor 2
Pin 2: Output $U_{out\,1}$ 0.5 – 4.5 V ratiometric
Pin 3: Not assigned
Pin 4: 5 V DC sensor 1
Pin 5: Output $U_{out\,2}$ 4.5 – 0.5 V ratiometric
Pin 6: Not assigned
Pin 7: Ground sensor 2
Pin 8: Ground sensor 1

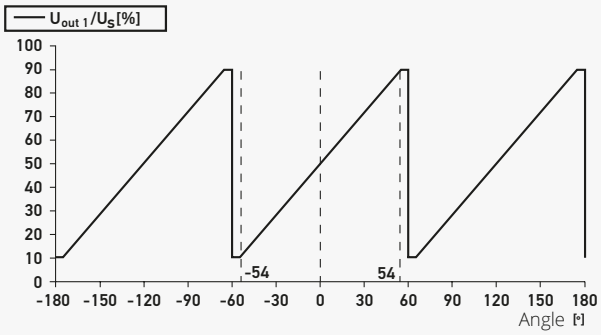
[2)] The power supply (pin 1 and pin 4) and the ground supply (pin 7 and pin 8) can be bridged externally (e. g. in the mating connector) in order to reduce the number of cables.

CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR

The characteristic curve of the angular position sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is a multiple of 120°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 108°. If it is exceeded by up to 6°, the output signal remains at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.

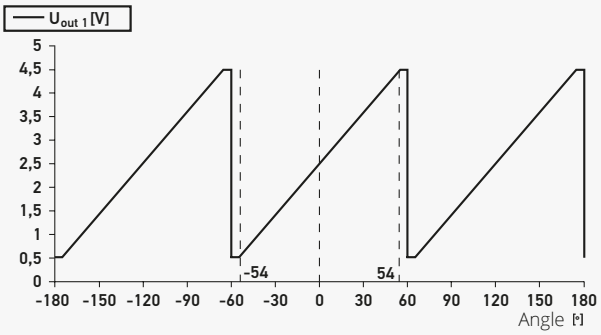


Ratiometric output signal $U_{out\ 1}$ with power supply 5 V



Output signal $U_{out\ 2}$ = 100 % – $U_{out\ 1}/U_s$ [%] (opposite curve)

Absolute output signal $U_{out\ 1}$ with power supply 9 – 32 V



Output signal $U_{out\ 2}$ = 5 V – $U_{out\ 1}$ [V] (opposite curve)

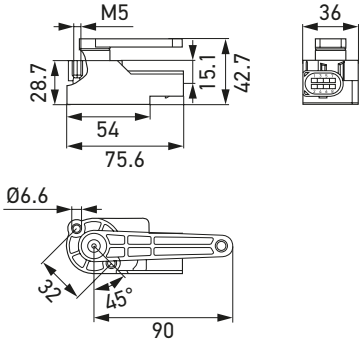
TECHNISCHE DETAILS
6PD 009 584-017

Technical Data

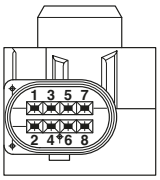
Supply voltage	U_s 5 V ± 10 % or 9 – 32 V
Current consumption	< 15 mA
Max. current (analogue output)	< 2 mA
Angle range	- 54° to + 54°
Mechanical angle range	Unlimited (full 360° circle)
Temperature range	- 40 °C to + 85 °C
„Crossed Scale“ Output signal	**Power Supply** U_s 5 V Output $U_{out\,1}$ 0.5 – 4.5 V ratiometric Output $U_{out\,2}$ 4.5 – 0.5 V ratiometric **Power Supply** U_s 9 – 32 V Output $U_{out\,1}$ 0.5 – 4.5 V Output $U_{out\,2}$ 4.5 – 0.5 V
Pin coating	Tin
Mating connector[1)]	1394416-1
Lifetime	5 million cycles
Resolution	0.06°
Linearity error including temperature drift	± 0.3°
Approved	ECE-R10
Protection class	IP 6K9K
Protection	Polarity reversal protection (mechanical protection only)
Zero position	0° / 120° / 240°
Lever arm	90 mm, ball top

[1)] This accessory is not included. Available from TE Connectivity.

Dimensional sketch



Pin assignment / electrical connection



Power supply with 5 V DC[2)]
Pin 1: 5 V DC sensor 2
Pin 2: Output $U_{out\,1}$ 0.5 – 4.5 V ratiometric
Pin 3: Not assigned
Pin 4: 5 V DC sensor 1
Pin 5: Output $U_{out\,2}$ 4.5 – 0.5 V ratiometric
Pin 6: Not assigned
Pin 7: Ground sensor 2
Pin 8: Ground sensor 1

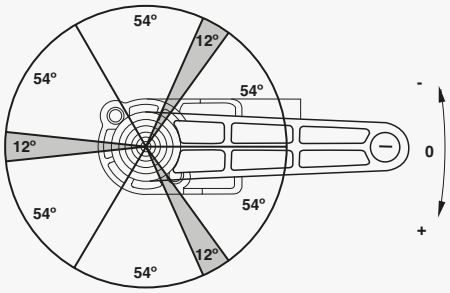
[2)] The power supply (pin 1 and pin 4) and the ground supply (pin 7 and pin 8) can be bridged externally (e. g. in the mating connector) in order to reduce the number of cables.

Power supply with 9 – 32 V DC[3)]
Pin 1: Bridge to pin 4 (external)
Pin 2: Output $U_{out\,1}$ 0.5 – 4.5 V
Pin 3: 9 – 32 V DC sensor 1 and 2
Pin 4: Bridge to pin 1 (external)
Pin 5: Output $U_{out\,2}$ 4.5 – 0.5 V
Pin 6: Not assigned
Pin 7: Ground sensor 2
Pin 8: Ground sensor 1

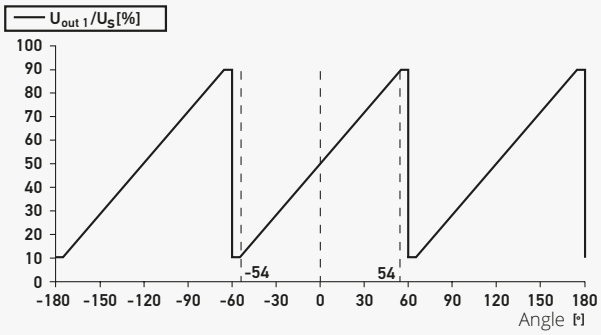
[3)] The bridge between pin 1 und pin 4 must be set up externally (e. g. in the mating connector). The power supply (pin 7 and pin 8) can be bridged externally (e. g. in the mating connector) in order to reduce the number of cables.

CHARACTERISTIC CURVE OF THE ANGULAR POSITION SENSOR

The characteristic curve of the angular position sensor repeats every 120°. The sensor does not therefore have to be installed in the mounting position shown, but can be installed at any offset angle that is a multiple of 120°. This will not affect the behaviour of the connected system in any way. The measuring angle range is 108°. If it is exceeded by up to 6°, the output signal remains at the limit value of the measuring range. If exceeded further, the next section of the characteristic curve is applied. The resulting measuring ranges and zero positions are shown on the graph. The segments of the circle shown in grey represent the angles that cannot be measured.

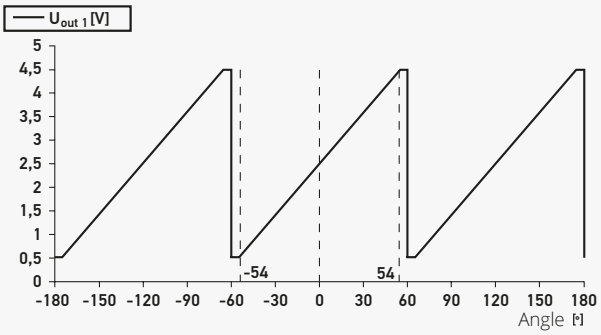


Ratiometric output signal $U_{out\ 1}$ with power supply 5 V



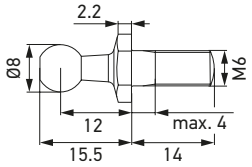
Output signal $U_{out\ 2}$ = 100 % – $U_{out\ 1}$ / U_s [%] (opposite curve)

Absolute output signal $U_{out\ 1}$ with power supply 9 – 32 V

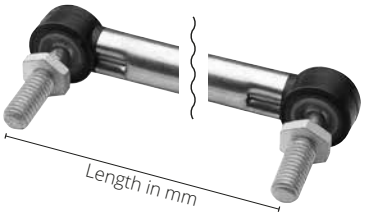


Output signal $U_{out\ 2}$ = 5 V – $U_{out\ 1}$ [V] (opposite curve)

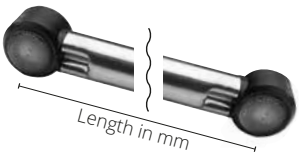
PROGRAM OVERVIEW
CONNECTING ELEMENTS

Product picture	Dimensional sketch	Fitting	Length	Part number	VPE*
		M6	29.5 mm ± 0.6 (total) 14 mm ± 0.3 (screw)	**9NS 740 413-317**	1

Head section, left – Type A – ball head screw
Rotated 180°



Head section, left – Typ A – ball head screw
Head section, right – Typ A – ball head screw



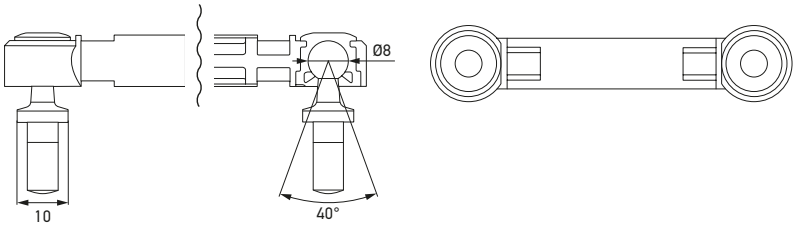
Head section, left – Typ B – cover cap
Head section, right – Typ B – cover cap

Head section – left / right	Rotation	Length of connection element	Part number	VPE*
A / A	0°	56 mm	**9XB 732 588-207**	50
A / A	0°	90 mm	**9XB 732 588-167**	176
B / A	0°	120 mm	**9XX 732 588-237**	176
B / A	180°	56 mm	**9XX 736 603-167**	176
A / A	180°	70 mm	**9XX 736 603-107**	176
A / B	180°	90 mm	**9XX 736 603-117**	176

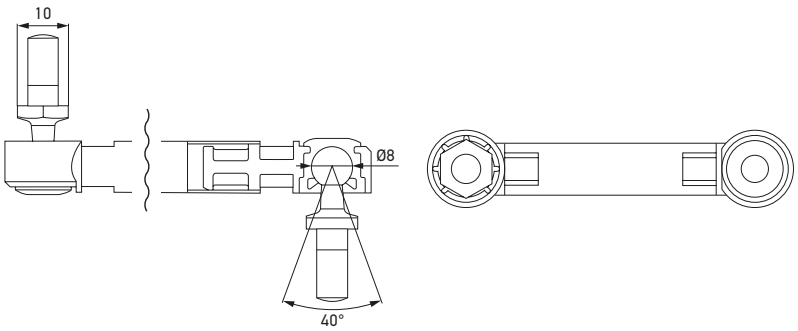
* Packaging unit

CONNECTING ELEMENTS
CONFIGURATION EXAMPLES

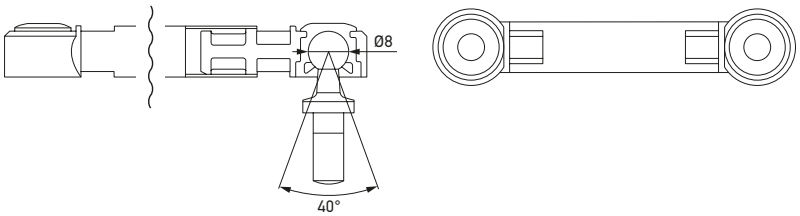
Connecting element with two ball head screws



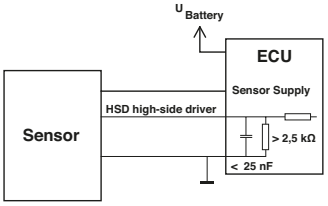
Connecting element with two ball head screws, one of which turned by 180°



Connecting element with a cover cap and a ball head screw



OUTPUT SIGNAL



Analogue
At a supply voltage of 5 V DC, the measured angle is reflected through the ratio of the output voltage (U_{out}) to the operating voltage (U_S) (ratiometrically to the supply voltage). This signal is output via a high side driver (HSD). At a supply voltage of 9 V to 32 V (multi-voltage), the measured angle is reflected through a voltage of 0.5 V to 4.5 V.

Circuit for ratiometric (10 % to 90 %) or fixed voltage output (0,5 – 4,5 V)
An external pull-down resistor is required for this variant. For a 5 V supply, 2.7 kΩ to 10 kΩ must be selected for example. The maximum output current of the analogue output should not exceed 2 mA. Since the high side driver (HSD) is used as an analogue output, the output voltage is set relative to the supply voltage.

PROGRAM OVERVIEW
ANGULAR POSITION SENSORS (DOUBLE SENSORS)

Product picture	Mechanical connection	Angle range	Lever arm	Part number	VPE*
	Socket	- 30° to + 30°	50 mm	**6PD 009 583-001**	1
	Socket	- 54 to + 54°	50 mm	**6PD 009 583-011**	1
	Socket	- 54 to + 54°	70 mm	**6PD 009 580-017**	88
	Ball, top	- 54 to + 54°	90 mm	**6PD 009 584-017**	88

* Packaging unit