

POSITAL FRABA



Ahead Through Absolute Position

SYMBOLS

General Symbols



Temperature Range in °C



Protection Class (EN 60529)

Specific Symbols for Encoders



Resolution per Revolution



Revolutions



A gearing is used to measure the revolutions.



A counter is used to measure the revolutions (without battery backup).



Magnetic Measurement Principle



Optic Measurement Principle

Specific Symbols for Inclinometers



Measurement of Two Axes



Measurement of Three Axes



Measurement of 360°

COMPANY



FRABA Group

FRABA AG is a group of enterprises focused on niches in the industrial automation market. FRABA POSITAL GmbH is one of its subsidiaries and has been a leading manufacturer of absolute rotary encoders for 30 years. The FRABA group also includes the VITECTOR and INTACTON subsidiaries, which produce sensors for security applications and sensors for non-contact velocity measurement, respectively.

History

Franz Baumgartner founded the company in Cologne in 1918. Prior to the 1960s, FRABA was mainly involved in the mass production of relays. From this business emerged the company's systems engineering division which installed a total of more than 13,000 machine control systems. FRABA developed one of the first absolute rotary encoders in 1973.



Service

Absolute rotary encoders are highly technical devices, requiring numerous parameter and interface considerations when adapting them to the requirements of a given application. That is why POSITAL's engineers in Cologne and New Jersey take on the dual responsibilities of development and customer support. In addition, a still growing network of national and international partners has been established, helping to provide knowledgeable guidance on location and in the local language.

Production

In the fall of 2006, FRABA Group opened another state-of-the-art production facility to complement its base in Cologne. Located in Slubice, at the German-Polish border, the new plant services all of the FRABA companies.

ENCODERS



Rotary Encoders

All positioning tasks in factory automation and construction require current and precise position values to monitor motion activity. Absolute rotary encoders mark every step of movement by a unique digital signal. This ability to assign distinct and exact values to linear and angular positions at any time has made absolute rotary encoders a pivotal means of connection between the mechanical system and the control system.

Compared to other systems of angle measurement, like inclinometers, rotary encoders provide a comparably high measuring frequency and a constant precision over the full measuring range, which extends beyond 360°.

Encoders determine angle values by scanning the position of a shaft within the sensor unit. Given the diversity of potential applications, there is a need for different mechanical interfaces and coupling systems. Also, various interfaces for connecting encoders to control systems have been established in the market. Considering possible combinations of functional sensor specifications with mechanical and electrical interfaces POSITAL's current product lines are all based on a modular design.

The appropriate choice of a rotary encoder for an application depends on the kind of motion, the form of motion transmission, the operating conditions, the necessary resolution and the electrical interfaces involved.



ENCODERS



Incremental Rotary Encoders

Incremental encoders measure angle values by counting a material with a periodic pattern, starting from an arbitrary origin. This measuring method does not inherently render absolute positions for a measured signal. Initial homing to a reference point is therefore required in all positioning tasks, both upon startup of the control system and whenever power to the encoder has been interrupted.

Absolute Rotary Encoders

Absolute rotary encoders, however, are capable of providing unique position values from the moment they are switched on as well as immediately after a power loss. This is accomplished by scanning the position of a coded material.



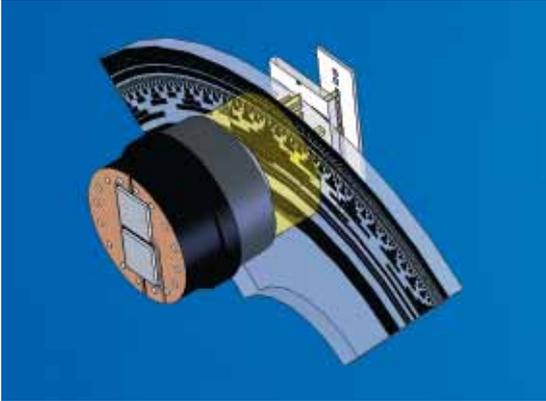
All positions in these systems correspond to a fixed code. Even movements that occur while the system is without power are translated into accurate position values at once when the encoder is powered up again.

Single and Multi Turn Rotary Encoders

Single turn encoders are systems that measure absolute positions for one turn of the shaft, i.e. for 360° . After one turn the measuring range is exceeded and loops back to the starting value. However, in many applications several turns of the shaft must be distinguished. In these cases, multi turn encoders will keep track of the angle position of the shaft while also providing code information about the number of turns.



OPTOCODE (OCD)



Measuring Principles

Optical encoders are made up of a revolving shaft with a code disc and an optoelectronic scanning unit consisting of a screen and photoreceptors. Infrared light from an LED source passes through the code disc and the screen behind it. At every angle position a different sequence of photoreceptors are blocked from light by dark segments on the code disc.

Functionality

The OPTOCODE (OCD) series uses a highly integrated Opto-ASIC providing a resolution up to 16 bits (65536 steps) per turn, as well as additional incremental signals.

Without backup batteries the measuring range is increased up to 16384 revolutions using mechanical gearing.

Interfaces

All OPTOCODE (OCD) models are available with hollow or solid shaft versions and are IP 65 protected to withstand harsh industrial environments. Special stainless steel or explosion-proof encoders for hazardous areas are also available. All models transmit digital measurement values to control systems either by parallel, serial or any common field bus interface. Standardized interfaces like Profibus-DP, CANopen, DeviceNet or Industrial Ethernet feature simplified connections and stable data transmission while also safeguarding investment assets.



SSI AND BITPARALLEL



SSI

- Preset Input
- Preset Button and LEDs
- Hollow Shaft
- Strobe (Ten Absolute Rotary Encoders Use The Same Data Line)
- Additional Incremental Output
- Transfer Distance up to 1,200m

Bitparallel

- Can Be Connected to Any Control System Via I/O Inputs
- Preset Input
- Over-voltage-peak protection
- Data transmission via two transistors in push-pull circuit
- Transfer Distance up to 50 m

Alternative Solutions

- Compact Magnetic Encoders
See Page 17



PROFIBUS



Specifications

- Accredited by Profibus User Trade Organization
- Programmable According to Class2 Encoder Profile
- Additional Features Including Velocity Output, Software Limit Switches, and a Teach-In Option for On-Site Gear Ratio Determination
- Expanded DPV2 Functionality (Isochronous Mode and Slave-to-Slave Communication)
- Transmission Rates up to 12 Mbaud

Connection Cap

- Connection Cap With Cable Glands or M12 Connectors
- Device Address and Baudrate Is Set Via BCD Rotary Switches
- LEDs for Status Indication
- Integrated T-Distributor
- Switchable Terminating Resistor



CANOPEN



Specifications

- Certified by CiA
- Communication Profile According to DS 301
- Device Profiles DS 406 or DS 417 (for Lift Applications)
- Programmable According to Class 2
- Transmission Mode:
Polled Mode, Cyclic Mode, and Sync Mode

Models with Cable or Connector Exits

- Device Address and Baudrate Is Set Via Software
- Through Hollow Shaft Flange for Singleturn Encoder
- Outdoor version for harsh industrial environments with heavy-duty housing and protection elements against condensation



Models with Connection Cap

- Connection Cap
With Cable Glands or M12 Connectors
- Device Address and Baudrate Is Set Via BCD Rotary Switches
- LEDs for Status Indication
- Integrated T-Distributor
- Switchable Terminating Resistor

Alternative Solutions

- Compact Magnetic Encoders
See Page 17



DEVICENET



Specifications

- Certified by ODVA
- Transmission Rate up to 500 kBaud
- Transmission Mode: Polled Mode, Change of State Mode and Cyclic Mode

Models with Cable or Connector Exits

- Device Address and Baudrate Is Set Via Software
- Outdoor version for harsh industrial environments with heavy-duty housing and protection elements against condensation

Models with Connection Cap

- Device Address and Baudrate Is Set Via BCD Rotary Switches
- LEDs for Status Indication
- Integrated T-Distributor
- Switchable Terminating Resistor
- Connection Cap With Cable Glands or M12 Connectors



ETHERNET



Specifications

- Integrated Web Server
- LEDs for Status Indication
- Connection Cap With M12 Connectors

Ethernet TCP/IP

- Communication Via TCP, IP, HTTP, SMTP, UDP
- Transmission Rate = 100 MBits/s
- Modbus TCP/IP Also Available

Powerlink

- Supports Powerlink V1 and Powerlink V2 Protocols

Profinet

- 2-Port Switch
- RT + IRT (coming soon)

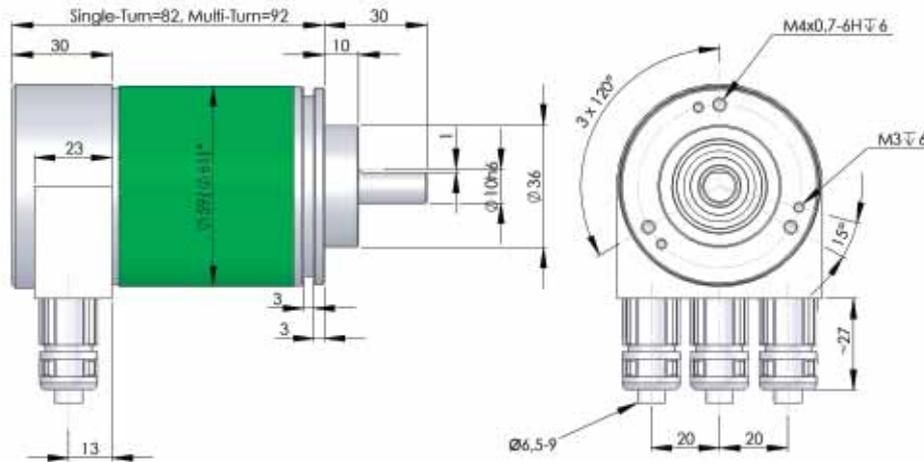
Ethernet IP

- 2-Port Switch
- CIP and CIP Sync (coming soon)

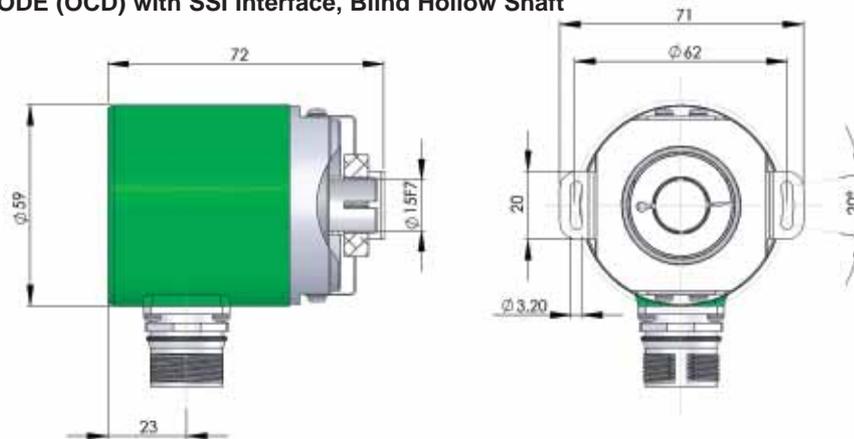


OPTOCODE (OCD) MECHANICS

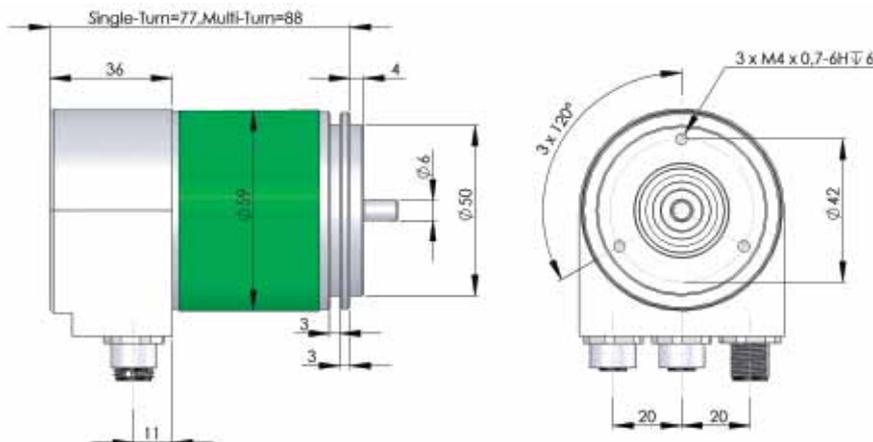
OPTOCODE (OCD) with Fieldbus Interface, Clamp Flange



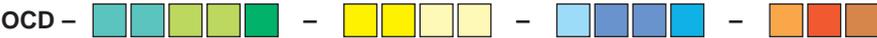
OPTOCODE (OCD) with SSI Interface, Blind Hollow Shaft



OPTOCODE (OCD) with Ethernet Interface, Synchro Flange



TYPE KEY

OCD –  –  – 

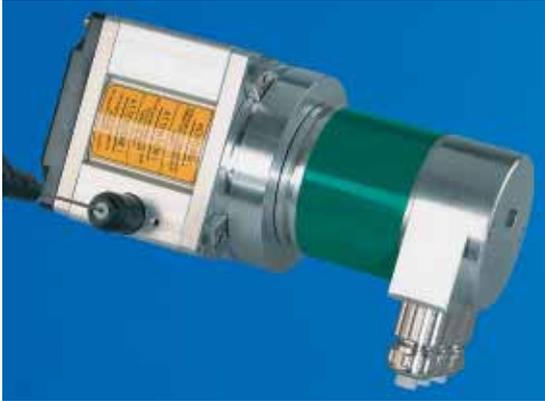
| | | | | | |
|---|--------------------------------|---|-------------------|--|---------------------------|
|  | Interface |  | Flange |  | Electrical connection |
|  | Version number |  | Shaft |  | Orientation of Connection |
|  | Code |  | Mechanical option |  | Connection type |
|  | Multi turn resolution in Bits | | | | |
|  | Single turn resolution in Bits | | | | |

| Interface | Flange | Electrical Connection |
|--|---|---|
|  SSI |  Clamp |  Connector |
|  SSI with preset |  Synchro |  Cable |
|  SSI with incr. outputs |  Blind hollow shaft |  Connection cap |
|  SSI with preset button + LEDs |  Hollow shaft (SSI) | |
|  Profibus | Shaft | Orientation |
|  DeviceNet |  10x20 |  Radial |
|  CANopen |  6x10 |  Axial |
|  Parallel |  12x20 |  Connection cap |
|  Parallel Preset |  15 (Blind hollow shaft) | |
|  Ethernet TCP/IP | Mechanical Option | Connection Type |
|  Ethernet Modbus TCP |  Without |  12 pin round connector (SSI) |
|  POWERLINK V1+V2 |  Shaft sealing |  16 pin round connector (bitparallel) |
| |  Stainless steal |  26 pin round connector (bitparallel) |
| |  Heavy Duty |  5 pin round connector (CANopen, DeviceNet, Ethernet) |
| Code | |  9 pin D-Sub (CANopen, DeviceNet) |
|  Gray | |  Connection cap |
|  Binary | |  Cable |
| | |  2x5 pin round connector male, female with venting element (only Heavy Duty version) |

Advice:

Not all options can be combined (see Data-sheet)

OPTOCODE (OCD) ACCESSORIES



Cable Pull Adapters

For the measurement of linear movements absolute rotary encoders can be combined with cable pull adapters. Low-cost and high-end systems are available for specific applications.

Mechanical Accessories

Clamp discs and clamp half-rings can be utilized for the installation of encoders.

Mounting Device

The MGY58 mounting device provides an easy and inexpensive way to affix any absolute rotary encoder with a synchro flange.



Cables and Connectors

Connectors as well as cables, pre-equipped with connectors, can be purchased for absolute encoders with SSI or Bitparallel interface.

Couplings

A selection of couplings is available for different applications.

Reducing Rings

Reducing rings adapt the hollow shaft of OCD rotary encoders from 15 mm to 12 mm, 10 mm or 8 mm.



EXPLOSION PROOF ENCODERS (EXAG)



Specifications

- ATEX certified (EX II 2 G/D Eex d IIC T6)
- Resolution Per Revolution up to 13 Bit (8192 Steps)
- Up to 16384 (14 bit) Revolutions With Mechanical Gearing, No Battery Back Up
- Operating Temperature -40 to +70 °C
- Environmental Protection IP 65, Others on Request
- Interfaces: SSI, Profibus, CANopen and DeviceNet
- Connection and Device Addressing via Connection Cap



Type Key

Model Explosion Proof



| EXAG- | | | | | | |
|----------------------------|---|-----------|--|--|--|--|
| Inter- face | Profibus | DP | | | | |
| | CANopen | C2 | | | | |
| | DeviceNet | D2 | | | | |
| | SSI | SL | | | | |
| Version | | 00 | | | | |
| | | B1 | | | | |
| Code | Binary | B | | | | |
| | Gray | G | | | | |
| Revo- lutions (Bits) | Singleturn | 00 | | | | |
| | Multiturn (4096 Revolutions) | 12 | | | | |
| | Multiturn (16384 Revolutions) | 14 | | | | |
| Resolution per Revolution | 8192 | 13 | | | | |
| Shaft | Solid Shaft | A | | | | |
| Material | Aluminum | AL | | | | |
| Shaft Diameter | 10 mm | 10 | | | | |
| Shaft Length | 20 mm | 20 | | | | |
| Protection Class | IP65 (Others on Request) | 65 | | | | |
| Flange | Clamp Flange | C | | | | |
| Connection | Connection Cap with Radial Cable Glands | FS | | | | |

MAGNETOCODE (MCD)

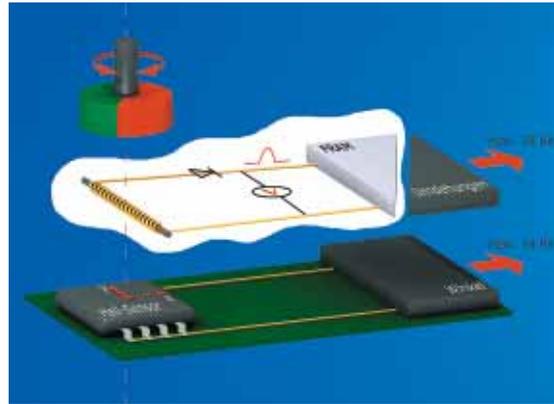


The Singleturn Measuring Principle

Magnetic rotary encoders determine positions using the Hall effect sensor technology developed for the automotive mass market. A permanent magnet fixed to the shaft generates a magnetic field that is sampled by the Hall sensor, which translates the measured value into a unique absolute position value.

The Multiturn Innovation

To register revolutions even when no voltage is applied, energy from the turning of the shaft must suffice for proper operation. An innovative, patented technology makes this feasible even at low rotational speeds and through long standstill periods – a



Wiegand wire ensures that the magnetic field can only follow the turning of the shaft in discrete steps. A coil wound on the Wiegand wire receives only brief, strong voltage spikes, which prompt the reliable recognition of each revolution.

Specifications

Given their small diameter of 36.5 mm, MAGNETOCODE (MCD) encoders with a serial interface can also be used in applications with very limited installation space. They are available as hollow or solid shaft versions with a 12 bit (4096 steps) resolution per revolution. The measurement range of 8192 revolutions can be extended upon request.



MAGNETOCODE (MCD)



MAGNETOCODE with SSI Interface

- Low Cost Compact Design
- 36,5 mm Diameter
- 12Bit Resolution per Revolution
- 13Bit Revolutions, Others upon Request
- Very compact version with cable pull adapter for linear measurement available.

MAGNETOCODE with CANopen Interface

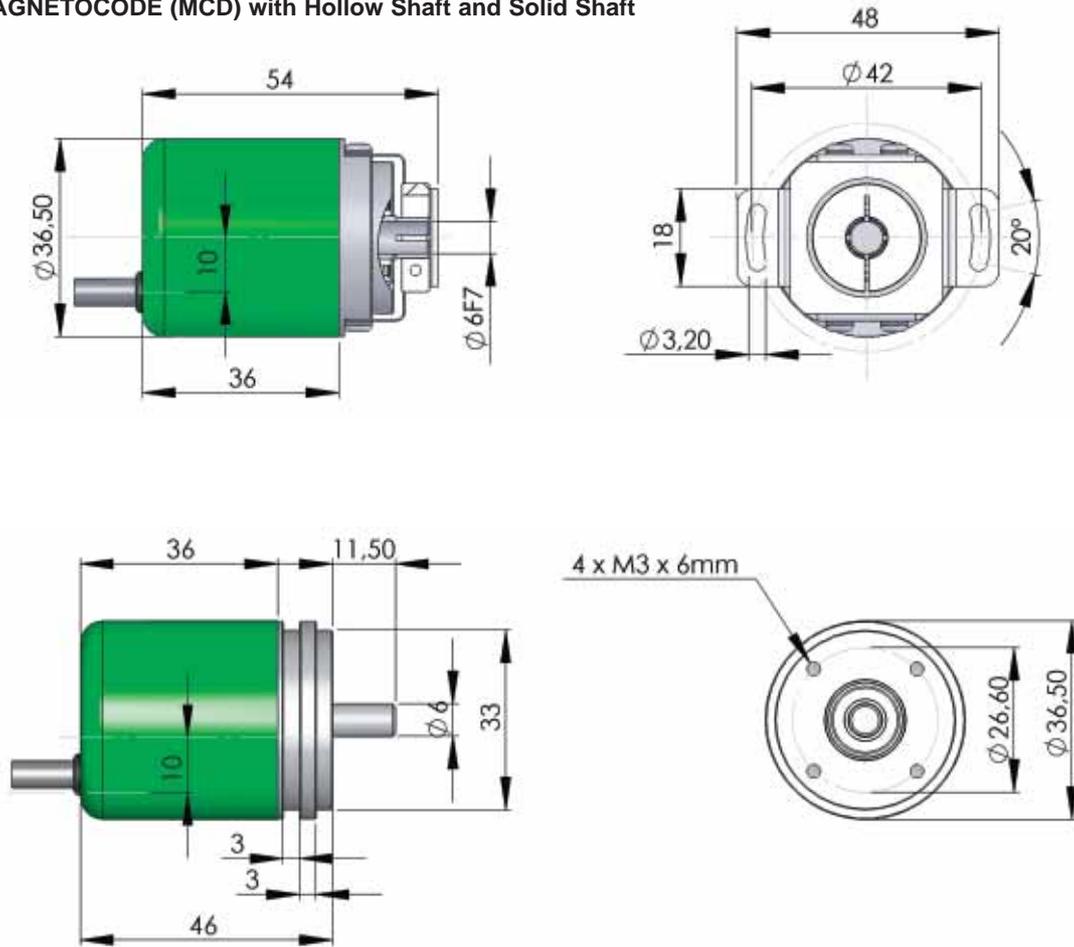
- Low Cost Compact Design
- 36,5 or 58 mm Diameter
- CANopen Communication Profile acc. DS 301
- Device Profile DS 406
- Device Address and Baudrate Is Set Via Software
- Very compact version with cable pull adapter for linear measurement available.



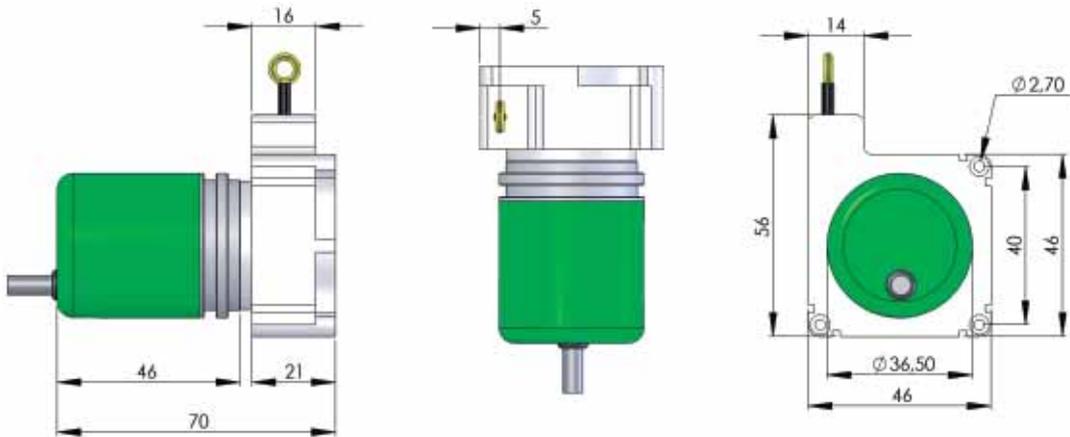
| Description | Type Key | | | | | | | | | | |
|---------------------------------|---|----|-----------|---|----|-----------|---|---|----|---|----|
| MAGNETOCODE | MCD- | __ | 00 | - | __ | __ | - | - | __ | - | __ |
| Interface | SSI S1 CANopen CA | | | | | | | | | | |
| Version | | | 00 | | | | | | | | |
| Code | Gray G Binary B | | | | | | | | | | |
| Revolutions (Bit) | Singleturn 00 Multiturn (4096 turns) 12 Multiturn (8192 turns) 13 | | | | | | | | | | |
| Resolution per Revolution (Bit) | 4096 (0,09°, 12 Bit) | | | | | 12 | | | | | |
| | Standard (8 Bit Accuracy) S Calibrated (10 Bit Accuracy) C | | | | | | | | | | |
| Flange | Synchro Flange S 06 Clamp Flange C 10 Blind Hollow Shaft B 06 | | | | | | | | | | |
| Shaft diameter | 06 mm or 10 mm | | | | | | | | | | |
| Mechanical options | Without 0 | | | | | | | | | | |
| Connection | Cable exit, axial 1 m CAW | | | | | | | | | | |

MAGNETOCODE (MCD) MECHANICS

MAGNETOCODE (MCD) with Hollow Shaft and Solid Shaft



MAGNETOCODE (MCD) with Cable Pull Adapter



INCLINOMETERS



Inclinometers

Angles and inclines must be measured in many applications to ensure safe operation or to control automatic movements. An incline is defined as any deviation from the vertical or horizontal axis within the reference system. Inclinometers allow an easy and efficient way to measure position values without direct coupling to the actuators. This fact and a high protection class allow them to be placed almost anywhere, providing more flexibility for design engineers. Inclinometers also allow simultaneous measurement of two axes with a single sensor, which can also reduce the design and engineering effort compared to other sensor systems.

ANGUSENS Product Line

ANGUSENS inclinometers measure incline angles with a multi-electrode array, which determines the conductivity of a fluid-filled cell. This sensor technology supports three different measuring ranges: from ± 2 up to ± 30 degrees. Besides this flexible choice of range, the sensor technology also ensures a high resolution of up to $0,001^\circ$. A rugged three-point mounting on the sensor housing simplifies installation, particularly on uneven surfaces.



The sensor housing's IP protection class guarantees safe outdoor use. Besides analog interfaces like voltage, current, PWM or switching outputs ANGUSENS inclinometers support RS232 and CANopen.

ACCELENS Series

The ACCELENS series of inclinometers is based on the groundbreaking MEMS - Micro-Electro-Mechanical-Systems technology. These capacitive sensor cells feature a measuring range of up to $\pm 80^\circ$ with an approximate resolution of 0.03° . Besides measuring X-Y angle inclinations, they are also capable of 360° axis measurements. The sensor cells are extremely shock-resistant (up to 20000 g) and provide consistent precision across the full temperature range ($-40^\circ\text{C} - +85^\circ$). Their integrated A/D converter yields up to 150 reading points per second, which enables an effective filtering of vibrations and shocks and also limits the settling time to a minimum. ACCELENS sensor systems can be supplied in different tried and tested aluminum housings. All ACCELENS series sensors are generally equipped with a certified CANopen interface.

ANGUSENS



Current Output

- 4-20mA
- Independent of Cable Length, Therefore Adaptable for Longer Transmission Lines
- Reliable Against Electronic Interference



Switching Output

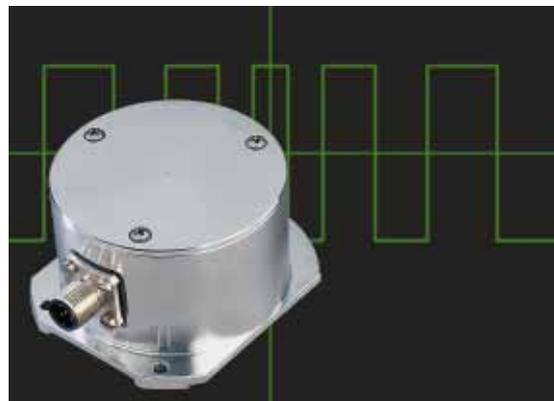
- Directly Usable as Limit Value Switch
- Free Configuration of Switching Output

Voltage Output

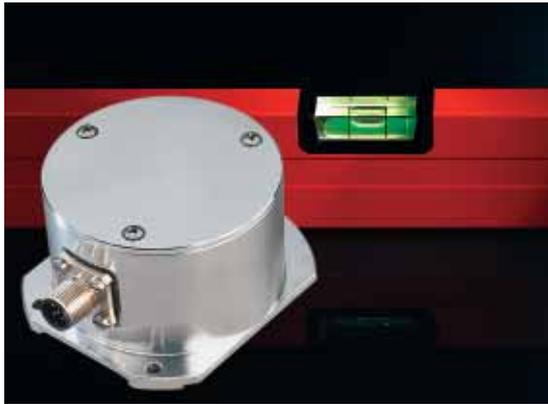
- 0-5 V
- Easy to Read Analog Inputs of Control Systems and I/O Modules
- Intended for Short Transmission Lines

Pulse Width Modulation (PWM)

Combines the advantages of digital signal transmission with a simple conversion to analog signals.



ANGUSENS



CANopen

- Programmable Parameters: Resolution, Preset Value, Baud Rate, Heartbeat, CAN Identifier
- Transmission Mode: Polled, Cyclic and Sync Mode

Profibus

- Measuring Range +/- 15°, +/- 30°
- Resolution up to 0,001°
- Compact and Robust Industrial Design
- Fully Programmable
- Protection Class IP66

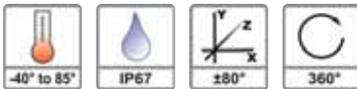
| Description | Type Key | | | |
|-----------------------|---|-------------------------------------|--|--------------------------|
| Absolute Inclinometer | AGS- | | | |
| Measuring Range | | 05 15 30 | | |
| Number of Axes | | 2 | | |
| Interface | Current PWM Switching Output CANopen | | SC SP SS CA | |
| Mechanical Design | Horizontal Vertical Rotational | | H V R | |
| Dynamic | 2 m Pas | | | 0 |
| Connection | 8 pin Round Connector M12 Cable | | | P8M CRW |

ACCELENS



Specifications

- Inclinometer Uses a MEMS Acceleration Sensor
- CANopen Interface acc. to DS 410 and DS 301
- Measuring Range of +/- 80° and 360°
- Horizontal and Vertical Mounting
- Aluminum Housing
- Connector or Cable Exit
- Heavy-Duty Version with Protection Element and M12 Connectors Available



| Description | Type Key | | | | |
|--------------------|---|-----|----|----|----|
| ACCELENS | ACS- | | | | |
| Measuring Range | | 080 | | | |
| | | 360 | | | |
| Number of Axes | | 1 | | | |
| | | 2 | | | |
| Interface | CANopen | | CA | | |
| Version | | | | 00 | |
| Mounting (Housing) | Horizontal | | | | H |
| | Vertical | | | | V |
| Material Housing | Aluminium | | | | A |
| Model | High End | | | | H |
| | Customer Specific | | | | C |
| Connection | Cable Exit 1m | | | | CW |
| | 1x 5 pin. M12 Male Connector + 1x 5 pin. M12 Female Connector | | | | TM |

PARTNERS

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POSITAL

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