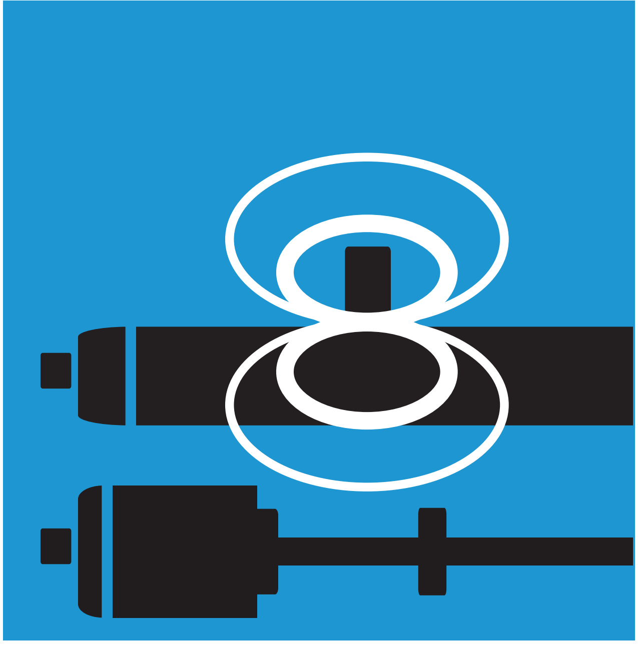
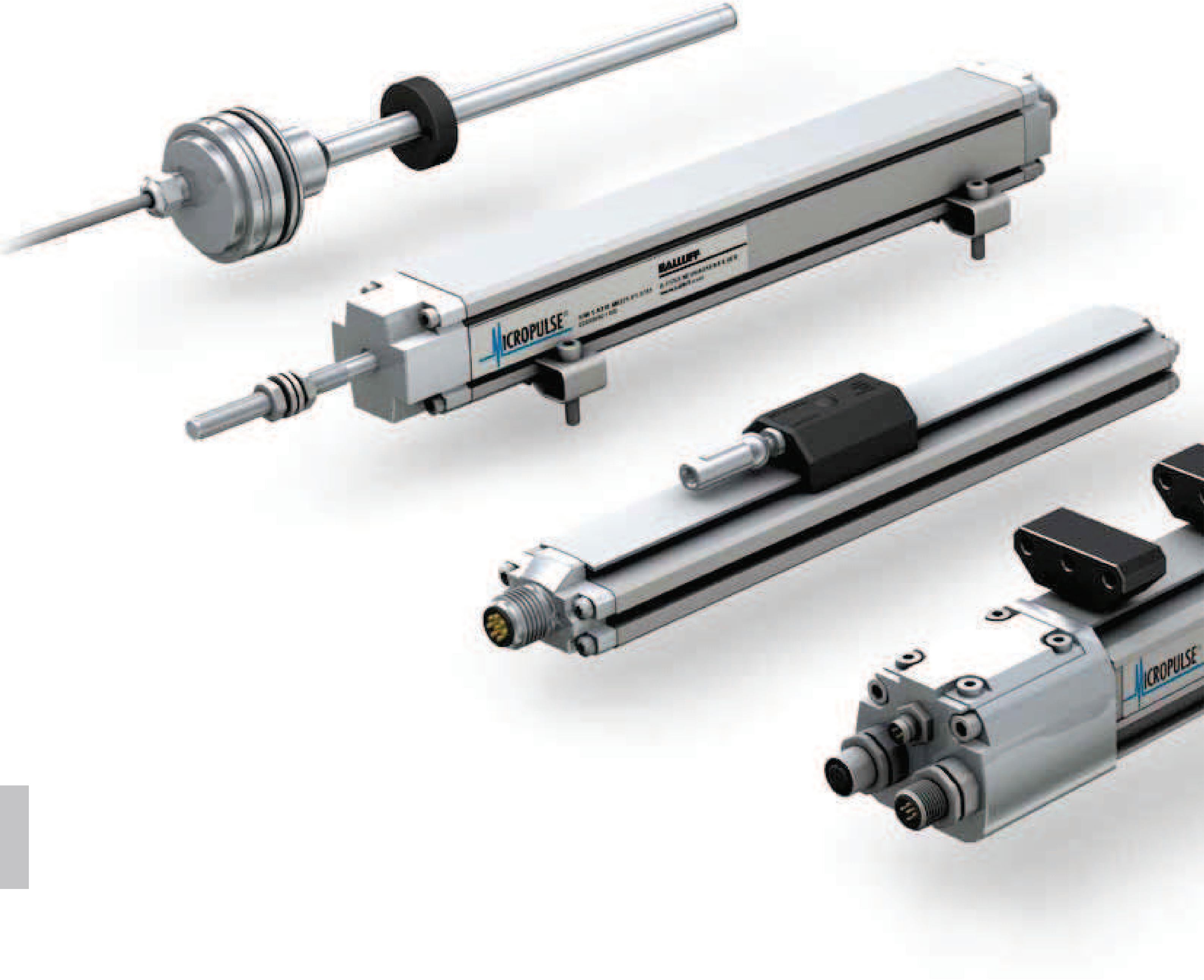


Micropulse Transducers



Contents

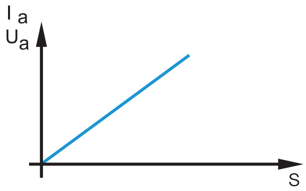
Basic information and definitions

Output signal, characteristic curve, resolution, sensitivity

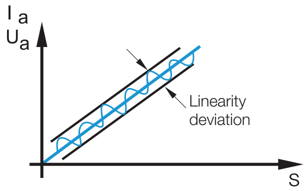
The characteristic curve describes the relationship between the output signal and the input signal. The slope of the curve represents the sensitivity of the device.
The sensitivity (resolution) is the quotient of the input signal change and the change in the output signal. On Micropulse transducers, the input signal change is the change in the position of the magnet and the output signal change is the change in the electrical output signal.

Linearity

A measuring device has a linear characteristic curve and a constant sensitivity when the relationship between the input and output variable is represented by a straight line (linear function). Linear scales are assumed for the X and Y-axes. A characteristic curve is not linear if it is not a straight line.



Linear function



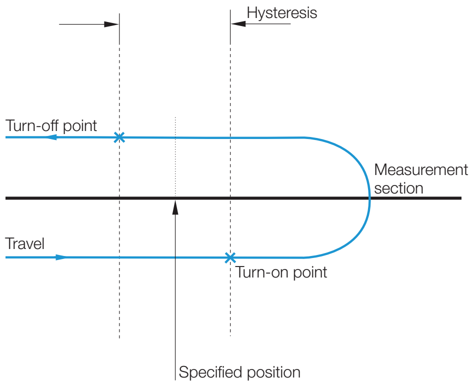
Linearity deviation from a linear function

Linearity deviation

A linearity deviation is the maximum deviation from a straight line that connects the zero point of a measuring range with the end point (full scale). There is a linear relationship between the position or path to be measured and the output signal for a voltage, current or digitized output information. The linearity characteristic curve of magnetostrictive transducers does not change during the life of the system. The curve, however, can be corrected.

Hysteresis

Hysteresis is the signal difference resulting when arriving at a certain position, traveling beyond it and then returning to this position from the other direction.

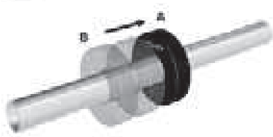


Reproducibility

Reproducibility is moving to a certain position from different directions. Reproducibility is the sum of the hysteresis and the resolution.

Repeat accuracy

Repeat accuracy is the value resulting when moving to the same position from the same direction under unchanging ambient conditions.



SYNC mode

The absolute positioning information of the position measuring system is determined and transmitted synchronously to the read cycle of the electronic evaluation unit, e.g. an axis controller or a regulating controller.

Incremental

After the system is switched on, the measured value currently available is not defined. A reference run to a defined point, a reference point, is necessary in order to obtain a position value. The position value is calculated by adding or subtracting individual, equal increments from the reference point.

Absolute

The measured value for the current position is available immediately after the system is switched on. An absolute coded digital signal or an analog value is assigned to each position, e.g. along a measurement section. A reference run is not required.

Temperature coefficient, formula

The temperature coefficient is the relative change of a physical variable with changing temperature. The temperature dependency of variable y can be approximated at least for a limited temperature range by using temperature coefficient α with linear relationship $y = y0 (1 + \alpha \times \Delta T)$.

Temperature coefficient

The temperature coefficient indicates the relative change in length as temperature changes. This means that temperature factors change the output value by the indicated amount.

Zero point

The zero point is the position with the lowest output value along the measuring range. The zero point can be set by the user for some transducer models. The zero point must lie within the measuring range.

Sampling rate

The sampling rate is the frequency at which the output information is updated. It can be the same as the number of measurements per second. A high sampling rate for rapidly changing positions is important if a process is time-critical.

Rated length

The rated length is the usable area, i.e. the available path/length measurement range (also see the characteristic curve). The rated length is always shorter than the overall length of the transducer.

Damping zone

The damping zone is the area in which the second (undesired) magnetostrictive wave is damped. This area is always outside of the measuring range. Depending on the transducer model, either an erroneous output signal or an error signal will be output if the magnet is allowed to travel into this zone, which must not be considered valid information.

Intrinsically safe "i"
Coding "Ex i"

A circuit is intrinsically safe if it does not permit a spark or thermal effect that could ignite an explosive atmosphere as defined by Group IIA, IIB or IIC, whereby the test conditions prescribed in the standard must be applied. The test conditions take into account normal operation and certain fault conditions.
The implementation of intrinsically safe circuits results in certain restrictions pertaining to the selection of components for electrical and electronic circuits.
In addition, the permissible load on the components as compared with normal industrial applications must be reduced:

- **for the voltage in terms of electrical stability, and**
- **for the current in terms of heating**

Flameproof encapsulation "d"
Coding "Ex d"

Parts that could ignite a potentially explosive atmosphere must be housed in an enclosure:

- **that can withstand the pressure resulting from the explosion of an explosive mixture inside the housing, and**
- **that prevents the internal explosion from igniting the potentially explosive atmosphere surrounding the housing.**

Non-incendive "n"
Coding "Ex n"

Devices in this category are intended for use in areas where an explosive atmosphere is not expected. Even if the atmosphere were to become explosive, in all probability it would be infrequent and only for a short period of time.
A manufacturer's certificate is provided, confirming that the product satisfies requirements for the use of electrical equipment in potentially explosive areas according to EN 60079-15.
This designation combines multiple methods of ignition protection.

e1 type approval

e1 type approval is granted by the German Federal Motor Transport Authority (KBA) and confirms that special motor vehicle standards have been maintained.
The devices may be mounted on vehicles that travel on public roads. The standards describe EMC conditions under which the devices must operate without failure. e1 approved Micropulse transducers are indicated by "-SA265-" in the part designation.

e1

FDA

The FDA (Food and Drug Administration) oversees the U.S. food and drug industries and certifies devices, materials as well as systems in these industries. A product designation of this kind makes your system eligible for FDA approval.

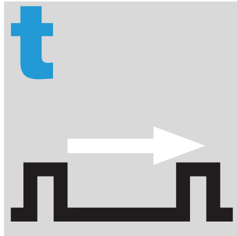
Filling level sensor

The magnetostrictive working principle is also ideal for the continuous high-precision measurement of fluid filling levels. The measuring section and electronic evaluation unit are enclosed inside a housing made from stainless steel. Stainless steel floats with permanent integrated magnets mark the current filling level in the tank or vessel. The design of the sensors meets international hygiene standards.

74-03

Micropulse transducers
Profile P
Profile PF
Profile AT
Profile BIW
Rod
Compact rod and AR rod
Rod EX, T redundant and CD
SF filling level sensor
Accessories
Basic Information and Definitions
Definitions
Designs
Interfaces

MICROPULSE®



Analog voltage output

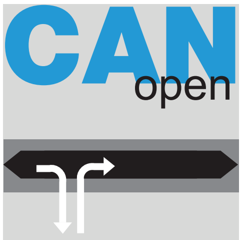
The output voltage is directly proportional to the position of the magnet along the measurement section.
The most important parameter for analog outputs is the refresh rate and residual ripple of the output signal.
Many transducers on the market attain the specified values for output ripple only by means of low-pass filtering. This always carries with it an undesirable time delay of the output signal.
Micropulse transducers attain the specified signal quality without low-pass filters, instead using an improved circuit design. This means fast update times with low levels of ripple and noise in the output signal.
Micropulse transducers with voltage output have 2 outputs, one rising characteristic and one falling.
Versions can be provided with 0...10 V (10...0 V) and –10...10 V (10...–10 V).

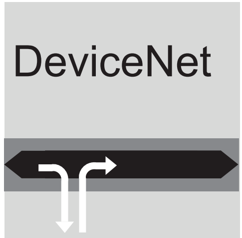
Analog current output

The output current is directly proportional to the position of the magnet along the measurement section.
Analog current interfaces of 0...20 mA and 4...20 mA are standard in numerous applications and in many industries. Current interfaces are substantially less sensitive than analog voltage interfaces with respect to scattered interference voltages. A 500 Ω resistor can be used to convert the 0...20 mA signal into a voltage of 0...10 V.
The 4...20 mA signal provides a simple form of cable break monitoring, since a current of 4 mA has to flow even at the measuring range zero point.
Micropulse transducers with current output are available with rising or falling signals.

Pulse interface

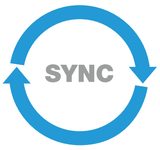
The time between a query and reply signal is directly proportional to the position of the magnet along the measuring section.
These pulses are transmitted using RS485/422 differential line drivers, guaranteeing noise-free signal transmission over distances of up to 500 m.
The great advantage of these interfaces is noise-free signal transmission using a simple and economical interface. Interfaces with tristate outputs allow multiplexing of several Micropulse transducers.
Appropriate control cards are available.





Synchronous serial interface (SSI)

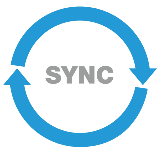
The position of the magnet along the measurement section is sent to the controller serially in a data word.
Micropulse transducers with an SSI interface can be connected directly to controllers or to axis control cards with an SSI interface. The transmission of data from the sensor to the controller is synchronized by the controller's clock. Transducers with 16, 24 or 25-bit data words are available depending on the required resolution.
The ±30 µm maximum linearity deviation of the SSI Micropulse transducer over the entire length, the max. 5 kHz update frequency and a resolution of 1 µm make SSI Micropulse transducers an ideal feedback sensor – even in the most demanding positioning and control applications.



CANopen

The position of the magnet along the measuring section is sent over the CAN bus to the controller in what are known as **P**rocess **D**ata **O**bjects or PDOs.
Micropulse transducers work with standard CANopen protocols as per CiA DS 301 and with the standard device profile as per DS406. CANopen offers greater flexibility because of the large number of configuration options for the transducer.
For example, the resolution is programmable for 5, 10, 20 or 100 µm – depending on your application. Alternatively you can select whether both position and velocity information is to be sent to your controller. Cyclically or on-demand.
And there's more: Up to 4 so-called software cams can be defined in the active measuring range. Each status change to one of these cams is transmitted to the controller using high-priority emergency messages.

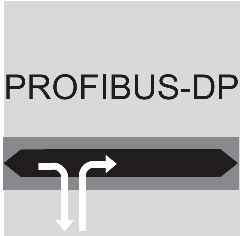
CANopen certified by

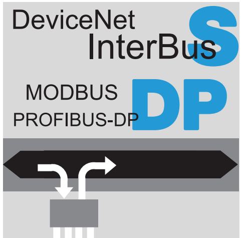


DeviceNet

DeviceNet is a fieldbus network that permits communication between basic sensors/ actuators as well as programmable logic controllers.
Micropulse transducers transmit the absolute position and the velocity to the controller in the form of a 4-byte value with a maximum cycle time of 1 ms.
The communication parameters and the objects available to the Micropulse transducer can be parameterized using the electronic device data sheet (EDS file).

DeviceNet™





Profibus DP

The **P**rocess **D**ata **U**nit sends position and velocity information for the transducer to the controller via the Profibus DP. Micropulse transducers operate according to EN 50170 and support the Profibus DP encoder profile and multi-magnet operation.
Micropulse transducers can be parameterized using the GSD file. The position resolution can be adjusted at 5 µm increments and the velocity resolution at 0.1 mm/s increments.
A zero point and working ranges can be configured individually for each magnet.

WAGO/Phoenix Contact BUS interface modules

One flexible way of connecting Micropulse transducers to various bus systems is to use interface modules available from WAGO and Phoenix Contact. These provide the option of transmitting the positioning information from several transducers through a single bus interface to the supervisory controller within a single bus cycle.
The resolution and zero point of the transducers with the pulse interface can be programmed using the respective bus interface. For further technical data and ordering bus interface modules, contact WAGO and Phoenix Contact.

VARAN bus

VARAN is an open, real time Ethernet bus system. Micropulse AT VARAN position measuring systems detect the movements of highly dynamic axes in complex applications.
The real time Ethernet system is extremely economical, easy to implement and simple to program. VARAN networks in combination with controllers, such as from Sigmatek, are widespread on the market.
VARAN is fully integrated in hardware and designed according to IEEE 802.3 for standard Ethernet physics.
The simple design guarantees extremely rapid cycle times while achieving maximum data security and reducing implementation costs.

IO-Link

IO-Link is a point-to-point connection within any network. An IO-Link system consists of an IO-Link device such as a sensor or actuator, an IO-Link master and wiring. The IO-Link master is either an integrated/modular IP 20 module for central operation in the control cabinet or as a remote IO module in IP 65/67 form of protection for tough applications directly in the field.
Master modules are available with all current field bus protocols. The Micropulse PF IO-Link device is coupled to the master via a maximum 20 m long standard sensor/actuator line. The Micropulse PF IO-Link works at COM3 communication speed (230kB), which can achieve a process data cycle of 1 ms with a 1.1 master.
Data transmission between the master and the device utilizes three-conductor physics well-known in the world of standard sensor/actuators. A standard UART protocol is used. The exact nature of the data packets defines the IO-Link protocol. Via IO-Link, the user interface can be mapped based on an IODD (IO Device Description) in the engineering system. Due to the continuous flow of information, all data is centrally and permanently saved, so that configuration is possible and reproducible at any time. More information about IO-Link:
www.io-link.com.

EtherCAT

Micropulse position measuring systems with an EtherCAT interface are the ideal nodes in an EtherCAT network when dealing with controlling and positioning with precision down to the micrometer.
Multi-position capable up to 16 axes, path and speed, monitored working ranges with diagnostics: These characteristics are used in automation and drive technology.
EtherCAT is an Ethernet-based bus system. The protocol is disclosed as the IEC61188 type 12 (EtherCAT) IEC standard and is suitable for hard and soft real time requirements. The structure of the standard Ethernet frame sent by the master is structured according to IEEE 802.3. EtherCAT slave devices take the data intended for them while the telegram goes through the device. Likewise, input data is inserted into the telegram as it goes through the device. This results in short cycle times that can be significantly below 100 µs, making them ideal for application areas in drive and automation technology. EtherCAT offers extensive diagnostic options with precise and quick error detection.