

Glossary of Technical Terms

Absolute shaft encoder	Shaft encoder that transmits unique coded data for each increment.
Accuracy	The difference between the actual and measured position.
Alarm signal	Serves to monitor the shaft encoder for malfunctions, such as glass breakage, fouling, short circuit, short circuit of signal line, and supply voltage too low.
Amplitude regulation	Current or voltage amplitude is constant through regulation
Analogue signal	A signal whose level alters continuously.
ASIC	Application specific integrated circuit
Axial loading	Maximum load on the shaft encoder's shaft in the axial direction
Bandwidth	Frequency range for output signals
Baud rate	Rate of data transfer (bits per second).
BCD	Binary-coded decimal; binary representation of a decimal number.
Binary	Two logical states (yes/no); the basis of binary data-processing systems.
Binary code	Code using binary numbering; often used for absolute measuring systems.
Bit	Abbreviation for "binary digit"; the smallest unit of information of a binary system, whose value can be 1 or 0 (yes-or-no decision).
Bus cycle	Time needed for polling every bus slave by the bus master.
Byte	Sequence of 8 Bits.
CAL	Can application layer
CANopen	Layer 7 protocol based on CAN
CCW	Counter clockwise
Change of state	For CAN: Bus node (encoder) sends it's data automatically when a position change occurs.
Channel	Signal track on which 1 or 0 is outputted.
CiA	CAN in automation (CAN users and manufacturers group)
CiA DS	CAN in automation draft standard, communication profile
CiA DSP	CAN in automation draft standard proposal, communication profile
CIM	Computer Integrated Manufacturing; i. e. the linking of different computer-aided processes in production and related fields for general use of the data.
CMD	Software tool for configuration and diagnosis of Interbus networks
COB	Communication object
Code	Format in which data are transmitted.
Code switching frequency	Number of position steps per second. For absolute shaft encoders with parallel interface: The maximum output frequency of the LSB output driver (f_{max}) also limits the maximum permissible code switching frequency: Code switching frequency max. = $2 \cdot f_{max}$ for Binary code Code switching frequency max. = $4 \cdot f_{max}$ for Gray code

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Coefficient of thermal expansion	Material expansion under influence of temperature change [$\mu\text{m}/^\circ\text{K m}$], relevant for linear scales.
Complementary	Output circuit for which also the inverted signals are outputted (e.g. Channel A and Channel A). Electrically, the 1/0 levels are transmitted as voltage differences between two lines. In this way the information signal (the difference) remains pure as in general interferences are interspersed equally on both lines.
CRC	Cyclic redundancy check. Bit error protection method for data communication.
CW	Clockwise
Data bus	System of lines over which data are transferred electronically in parallel or serially.
Data consistency	Intrinsic coherence of data in respect of timing and logical aspects.
Data integrity	Correspondence of data with the reality that they describe.
Datavalid	Output for checking the validity of data.
DC	Direct current (not alternating)
Demodulator	Device that filters the original information out of an altered signal again.
DeviceNet - conformity and interoperability	Confirmation of agreement of a bus node with the DeviceNet specifications and correct interoperability with other DeviceNet nodes.
Differential line driver	Output circuit in which the difference between the two signals A and A is evaluated, thus providing high signal transmission reliability.
DIN	Deutsche Industrie Norm (German Industrial Standard)
Direction	Control input for determining the data sequence (whether ascending for clockwise or counterclockwise rotation).
Dual Code	Natural binary code
EDS - File	Electronic data sheet. This is a file with the device specific parameter description and is provided by the manufacturer of a DeviceNet or CANopen device.
EEPROM	“Electrically Erasable Programmable Read-Only Memory” chip (see EPROM).
EIA	Electronic Industries Association; U.S. umbrella organization of manufacturers of electronic equipment and facilities. It is responsible for maintenance and development of the industrial standards for interfaces between data-processing devices and data communications equipment.
EMC	Electromagnetic compatibility
ENCOM	User group of manufacturers of INTERBUS-S absolute shaft encoders
Encoder monitoring	See “Alarm signal”
Enable	Control input via which the data outputs can be activated.
Encoder power	Supply voltage to be provided for the shaft encoder.
EPROM	“Erasable Programmable Read-Only Memory” chip, which can be erased with ultraviolet light, after which new data can be written into it.
Gray code	A special binary code that changes only one data bit per measuring step at a time. It is used with absolute encoders.

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Hamming distance	Measure for data security in a data transmission. The higher the number the better the ability to detect data errors.																												
Harmonic Distortion	Measure for the signal quality of sinewave encoder [%]. It describes the content of harmonics in analogue signals. The lower the number the better the signal.																												
Hysteresis error	Measurement deviation for a position approached from opposite directions.																												
Identifier	Address of a message in a CAN network.																												
IEC	International Electrotechnical Commission; organization promoting international standardization of electrical components.																												
Immunity to interference	<p>Test procedure according to IEC 801, Part 4</p> <p>– A test of susceptibility to fast electrical transients (bursts) causing interference on lines.</p> <p>The test values are divided into 5 levels:</p> <table border="1"> <thead> <tr> <th>Level</th> <th>Mains line</th> <th>Data and control lines</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0.5 kV</td> <td>0.25 kV</td> </tr> <tr> <td>2</td> <td>1.0 kV</td> <td>0.5 kV</td> </tr> <tr> <td>3</td> <td>2.0 kV</td> <td>1.0 kV</td> </tr> <tr> <td>4</td> <td>4.0 kV</td> <td>2.0 kV</td> </tr> <tr> <td>X</td> <td>special</td> <td>special</td> </tr> </tbody> </table> <p>– Test procedure according to IEC 801, Part 2</p> <p>Discharge of static electricity on the surface and in the surroundings of the specimen. The test values are divided into 4 classes:</p> <table border="1"> <thead> <tr> <th>Class</th> <th>test voltage</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2 kV</td> </tr> <tr> <td>2</td> <td>4 kV</td> </tr> <tr> <td>3</td> <td>8 kV</td> </tr> <tr> <td>4</td> <td>15 kV</td> </tr> </tbody> </table> <p>– Radio interference voltage test to VDE 0871.</p>	Level	Mains line	Data and control lines	1	0.5 kV	0.25 kV	2	1.0 kV	0.5 kV	3	2.0 kV	1.0 kV	4	4.0 kV	2.0 kV	X	special	special	Class	test voltage	1	2 kV	2	4 kV	3	8 kV	4	15 kV
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Incremental measuring system	Measuring method in which the variable is formed by counting increments (measuring steps).																												
Incremental shaft encoder	Shaft encoder which transmits an electrical signal (yes/no) for each increment, determined by the marked disc.																												
Integer	Integral values; range of values at n bit: 0 ... (2 ⁿ -1)																												
Integrated coupling	Flexible coupling built into shaft encoders																												
INTERBUS	Real time bus for the sensor-actor-level																												
Interbus-Loop	Two wire version of Interbus, transmitting data over the power supply lines and using Phoenix Contact "Quickon" cable plugs.																												
Interface	Transfer point with certain terminals, signals, or signal sequences. The interface serves for communication of the shaft encoder with other systems.																												
Interpolation	Scanning of a sinewave signal to increase resolution by generating intermediate position values.																												
IP	See "Protection class"																												
Jitter	Change in the phase angle between Channel A and B within one revolution (360°).																												
Latch	Control input for storing ("freezing") the data before they are read out.																												

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Linearity	Deviation of the reading from the actual value within one revolution (360°).																												
Line driver	Output circuit that makes a larger current possible.																												
LSB	Least Significant Bit																												
Measuring wheel	A wheel that, mounted on a shaft encoder, converts a linear motion into a rotary motion.																												
MSB	Most Significant Bit																												
MTBF	"Mean Time Between Failures", a measure of average service life.																												
Multi-turn shaft encoder	Shaft encoder which transmits the number of shaft revolutions as well as the angular position of the shaft.																												
NC machinery	Numerically Controlled machinery; their movements are programmed.																												
NPN input/output	Transistor input/output circuit implemented with an npn transistor, and thus negative switching.																												
Offset	For programmable absolute shaft encoders: the offset value is added to the value of physical position. As a result you get a relative shift of the output value (output value = position value + offset value).																												
Parallel interface	Transfer point at which the data are transferred in parallel over several lines.																												
Parity	Checkbit for error detection in data transfer																												
PDO	Process data object (in CAN networks)																												
P.L.C.	Programmable Logic Controller: control system whose program is stored in a program memory and can be changed.																												
Phase discriminator	Sense-of-direction detector that functions by evaluating the phase angle between Signal A and Signal B.																												
Phase tolerance	Deviation of the pulse-edge from Channel A to B, relative to the phase angle 90°.																												
PNP input/output	Transistor input/output circuit implemented with a pnp transistor, and thus positive switching.																												
Preset	For programmable absolute shaft encoders: The programmed numerical value is accepted as output value (output value = preset value).																												
Protection class	<p>The enclosure class is designated according to DIN 40050, by IP and a two-figure code number.</p> <table> <tr> <td>1st digit</td> <td>Degree of protection against ingress of solid bodies:</td> </tr> <tr> <td>0</td> <td>no special protection</td> </tr> <tr> <td>1</td> <td>solid bodies with dia. > 50 mm, no protection against intentional penetration</td> </tr> <tr> <td>2</td> <td>solid bodies with dia. > 12 mm, warding off fingers etc.</td> </tr> <tr> <td>3</td> <td>solid bodies with dia. > 2.5 mm, warding off tools, wires, etc. (thickness > 2.5 mm)</td> </tr> <tr> <td>4</td> <td>solid bodies with dia. > 1 mm, warding off tools, wires, etc. (thickness > 1 mm)</td> </tr> <tr> <td>5</td> <td>dust in harmful quantities, complete shock-hazard protection</td> </tr> <tr> <td>6</td> <td>dust (dust-tight), complete shock-hazard protection</td> </tr> <tr> <td>2nd digit</td> <td>Degree of protection against water</td> </tr> <tr> <td>0</td> <td>no special protection</td> </tr> <tr> <td>1</td> <td>water dripping vertically</td> </tr> <tr> <td>2</td> <td>water dripping at angles up to 15° from vertical</td> </tr> <tr> <td>3</td> <td>water dripping at angles up to 60° from vertical (spraying water)</td> </tr> <tr> <td>4</td> <td>water from all directions (splashing water)</td> </tr> </table>	1st digit	Degree of protection against ingress of solid bodies:	0	no special protection	1	solid bodies with dia. > 50 mm, no protection against intentional penetration	2	solid bodies with dia. > 12 mm, warding off fingers etc.	3	solid bodies with dia. > 2.5 mm, warding off tools, wires, etc. (thickness > 2.5 mm)	4	solid bodies with dia. > 1 mm, warding off tools, wires, etc. (thickness > 1 mm)	5	dust in harmful quantities, complete shock-hazard protection	6	dust (dust-tight), complete shock-hazard protection	2nd digit	Degree of protection against water	0	no special protection	1	water dripping vertically	2	water dripping at angles up to 15° from vertical	3	water dripping at angles up to 60° from vertical (spraying water)	4	water from all directions (splashing water)
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Protection class (continued)	<p>2nd digit Degree of protection against water</p> <p>5 water from a nozzle from all directions (hose-water)</p> <p>6 heavy seas or strong jet of water (flooding)</p> <p>7 water, if the device is immersed in water under specified conditions of pressure and time (immersion)</p> <p>8 water, if the device is submerged constantly. The manufacturer must describe the conditions (submersion)</p> <p>(For numbers 1 to 8, water must not penetrate in harmful quantities.)</p> <p>Example: IP65 A device thus designated is dust-tight, and protected against hose-water.</p>
PVC	Polyvinylchloride; plastic coating of device cable
PTB approval	Approval for use by the Physikalisch-Technische Bundesanstalt, the German government materials testing institute.
Pulse (repetition) frequency, max. speed	The maximum signal frequency achievable by the shaft encoder, the product of rotary and number of markings.
Radial load, max.	Maximum loading of shaft encoder shaft in radial direction.
Quickon	Connector with self contacting cable cutting contacts from Phoenix Contact used with Interbus Loop
RAM	"Random Access Memory" chip; this memory can be read from, written to, and erased freely. When the power goes off, it loses its information.
Reference mark	Irregular gradation pattern that generates a single signal peak, to provide an absolute reference for an incremental shaft encoder.
Reference pulse	Square-wave signal generated by a reference mark, usually only one increment wide, to provide an absolute reference for an incremental shaft encoder.
Repeatability	Degree of deviation for a point approached repeatedly under identical operating conditions.
Resolution	Number of increments per revolution (rotary) or distance between two increments (linear)
Resolver	Inductive angular measuring device that generates two alternating voltages, with amplitude a function of the angle.
Reversal error	Deviation in reading of a position when approached from different directions (hysteresis).
ROM	"Read-Only-Memory" chip, whose memory can only be read out.
RS 422	Standardized interface for unidirectional point-to-point connections (for description refer to "Complementary"); voltage difference 7 V DC max.
RS 422/485	Interfaces for serial data transfer with specifications to EIA standards.
RS 485	Like RS 422, however as a bidirectional bus interface
Sampling frequency	Number of signal periods per second. The maximum sampling frequency limits the speed of incremental measuring systems.
SDO	Service data object (in CAN networks)
Sense	The Sense lines (Sense VCC and Sense GND) enable measurement of the factual encoder voltage without adulteration by voltage drop due to supply current and cable resistivity. With that e.g. supply voltage can automatically be adjusted.

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Scaling	For programmable absolute shaft encoders the encoder actual value is multiplied by a scaling factor. Thus the resolution (increments per measuring distance or increments per revolution) is adaptable to the respective application.
SSI	Synchronous-serial Interface; standardized interface for serial data transfer
TPE	Thermo-plastic polyester elastomer; plastic coating of device cable
Tristate	Control input; switches the outputs either to active or to high impedance.
Two's complement	Number format for the representation of negative numbers; range of values at n bit: $-(2^n - 1) \dots 0 \dots (2^{n-1} - 1)$