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General technical Data absolute encoders WDGA CANopen

Safety instructions:
a. If a riskless operation can no longer be assured, the unit has to be shut down immediately and be secured against unintended start up.
b. In any case of possible hazard of people or possible damage of equipment if the encoder fail, precautions have to be taken to prevent it before start.

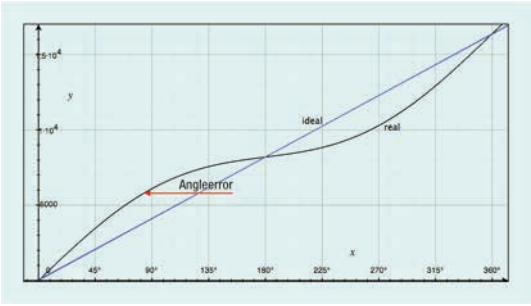
Absolute encoders WDGA:
Every shaftposition of the absolute encoders WDGA has defined a precise value, so that there is a single value for every position between 0° and 360°. Absolute encoders with Multiturn are able to count a number of shaft revolutions, too.
The position value will not get lost if the supply voltage breaks down and is immediately pollable after recovery of the supply voltage.
Therefore no reference run is needed. At absolute encoders the angle-values were transmitted by an interface.

Magnetic principle
The absolute encoders WDGA work on a non-contact magnetic scanning principle. A diametral magnetised magnet is mounted in the stainless-steel shaft with its backlash-free bearings. If the shaft is rotated, the magnet and the magnetic field rotate with it. This change in the magnetic field is detected and processed by a sensor chip on the PCB opposite. The evaluation enables the IC to generate a precise singleturn-information with a resolution up to 16 Bit per 360°.
For counting the number of revolutions the WDGA doesn‘t need a mechanic gear. The information about the number of revolutions is detected by the EnDra®-Technology Principle:
The diametral magnetised magnet accumulates enough energy in the EnDra® wire, so that on one single position the information about revolution and direction of rotation is generated. EnDra® accumulates so much energy that calculation and safeing electronics can work safely and all processes can be accomplished.
An external supply (e.g. battery) isn‘t needed. So the patented system works fully autarkic and is able to count up to 10^12 (40 bit) revolutions.
The Singleturn and Multiturn information were combined to a position-word and regarding to the interface transmitted.
The absolute encoders WDGA are finely-tuned measuring systems, combining precision mechanics, efficient sensor technology and high-performance electronics.

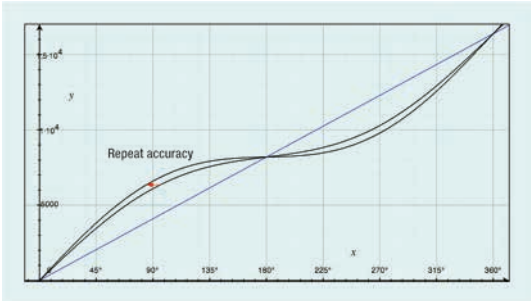
Accuracy of the absolute encoders WDGA
Talking about encoders, you have to differentiate between resolution and accuracy. The Singleturn resolution describes in how many single positions one shaft rotation (360°) is devided. The Multiturn resolution defines how many revolutions can be counted.

You can differentiate between Singleturn accuracy and Singleturn repeat accuracy.

Singleturn accuracy:
The Singleturn accuracy defines the tolerance of the position of every transmitted positionword to the real mechanic shaft position (Singular run to one point and measurement at ambient temperature).
There is no summation of angle errors about some or more revolutions.
The shown drawing shows exemplary the angle error progress.
In the real application the maximum of this error is 0.35°



Singleturn repeat accuracy:
The Singleturn repeat accuracy describes the tolerances of the measured position and the transmitted positionword to a reference position or in repeating actions.
That means at repeated runs to one position the transmitted position word varies a smaller range of tolerance to the real position.



Signal Conditioning
The absolute encoders WDGA with a singleturn resolution up to 12 bits are equipped with signal conversion noise caused by the magnetic sensors.
The position value is conditioned before it is transmitted. A digital filter is followed by an internal hysteresis at rotation reversing. The conditioning is configured in that way, that no visible negative effect occurs for the position value.
These measures have the effect that the position value doesn´t change at shaft standstill in spite of the sensor noise of the magnetic field.

CAN physical and transport layer
CAN is a field bus. It operates with the CSMA/CA (Carrier Sense Multiple Access/Collision Avoidance) method. It means that collisions during bus access are avoided by a so called bitwise arbitration. The bits are coded NRZ-L (Non Return To Zero - Low).

A cyclic redundancy check (CRC) and other safety mechanisms provide a secure transmission. For synchronisation a mechanism called „bit stuffing“ is used. CAN is a multimaster system, i.e. several equal bus nodes can be connected without a bus master supervising the communication. In principle a CAN bus can be realized with copper wire or in fiber optic cable.

The common CAN implementation with copper wire operates with differential signals, transmitted via two wires:
CANHIGH, CANLOW.

Therefore CAN has a good common mode rejection ratio.
Data is transmitted with bits that can either be dominant or recessive. The dominant (0) always overwrites the recessiv (1).

The network always has to be terminated on both ends with 120 Ohms each (between CANHIGH und CANLOW). Other locations or values are not allowed.

Due to the arbitration there is a ranking of the messages. The message with the lowest ID has the highest priority and therefore it has almost instant access on the bus. The exception is that an ongoing transmission will not be interrupted. So time critical messages should be asigned to the high priority CAN-IDs, but even then there is no determination in the time of transmission (non-deterministic transmission).

A CAN network can operate with baudrates up to 1 Mbit/s. Due to the neccessary synchronisation of the nodes, the maximum delay caused by the length of the cable has to be limited. The limitation corresponds with the baudrate. There is a common recomendation of the maximum cable length at several baudrates.

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Possible Baud rates	Max. cable length
10 kBit/s	6,7 km
20 kBit/s	3,3 km
50 kBit/s	1,3 km
100 kBit/s	700 m
125 kBit/s	530 m
250 kBit/s	270 m
500 kBit/s	130 m
800 kBit/s	75 m
1 MBit/s	<40 m

Absolute encoders CANopen
CANopen is a specified higher protocol (layer 7 protocol).
With CANopen it is possible to transfer larger amounts of data, emergency telegrams and process data. CANopen describes how the comminication is performed. That means that parameters to configure a device are transmitted in a defined form (profile).
A CANopen profile defines objects representing the different functions of a device. These objects form a table called object dictionary.
The communication profile defines the basic services and parameters of a CANopen device (i.g. service data objects SDOs, process data objects PDOs, used CAN-IDs, etc.).
The device profile defines the specific functions of a device family (i.g. encoders, i/o devices,...). For encoders the device profile is the encoder profile CiA 406.

LED and status signalling WDGA CANopen:
A bicolour status LED at the top indicates the different states of the encoder during use and helps with configuration and troubleshooting.

The indication of operating conditions and trouble codes are following the CiA 303-3. Therefor two colours are provided:

green glewing LED = Information about NMT-Status
red glewing LED = Information about Errors
see also: **http://www.wachendorff-automation.com/ledcan-en**

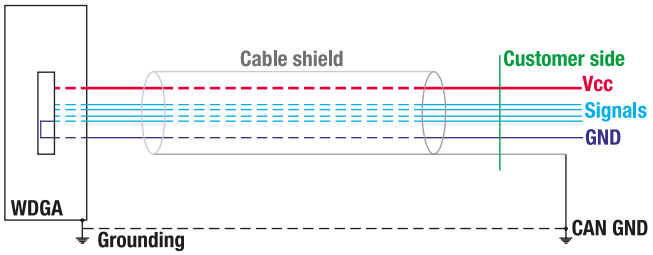
Environmental data
With grounded housing and against trouchable parts when implemented.

ESD (DIN EN 61000-4-2):	8 kV
Burst (DIN EN 61000-4-4):	2 kV
includes EMC:	DIN EN 61000-6-2 DIN EN 61000-6-3
Vibration: (DIN EN 60068-2-6)	50 m/s² (10-2000 Hz)
Shock: (DIN EN 60068-2-27)	1000 m/s² (6 ms)
Design:	appropriate DIN VDE 0160

Abbreviations for cable colours

BK = black	PK = pink
BN = brown	RD = red
BU = blue	TQ = turquoise
GN = green	VT = violet
GY = grey	WH = white
OG = orange	YE = yellow

Typical shielding concepts for WDGA CANopen encoders
Cable shield connection to pin 3.
Encoder housing has to be grounded separately.



Protection from Noise Interference
For efficient protection of the entire system we recommend the following measures:
For normal applications it is sufficient to connect the shield of the encoder cable to the earth potential. The entire system, consisting of the encoder and the signal processing equipment should be grounded at one single location by using a low resistance connection (e.g. braided copper).

- In all cases the connecting cables should be shielded and should be locally kept away from power lines and other noise-generating equipment.
- Sources of interference such as motors, solenoid valves, frequency converters etc. should always have their noise suppressed at source.
- Encoders should not be powered from the same mains supply as solenoid valves or contactors, as this may cause interference.

In certain applications it may be necessary to install additional protection against interference, depending on the way the system is earthed and on the noise fields present. Such measures would include: capacitive coupling of the screen, the installation of HF-filters in the encoder cable or the installation of transient protection diodes. If these or any other measures are necessary, please contact us.