WACHENDORFF
The Encoder Experts

Wachendorff Automation GmbH & Co. KG
Industriestraße 7 • D-65366 Geisenheim
Tel.: +49 (0) 67 22 / 99 65 -25 • E-Mail: support-wa@wachendorff.de
www.wachendorff-automation.com

General technical Data absolute encoders WDGA RS485

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.

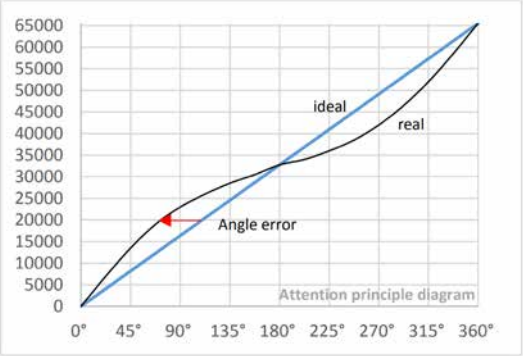
Absolute encoders WDGA:
Every shaftposition of the absolute encoders WDGA has defined a precise value, so that there is a single value for every position between 0° and 360°. Absolute encoders with Multiturn are able to count a number of shaft revolutions, too.
The position value will not get lost if 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. The Singleturn and Multiturn information were combined to a position value and regarding to the interface transmitted.

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 43 bit revolutions.
The absolute encoders WDGA are finely-tuned measuring systems, combining precision mechanics, efficient sensor technology and high-performance electronics.

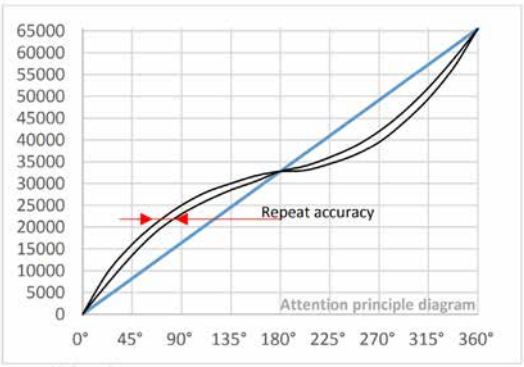
Accuracy of the absolute encoders WDGA
Talking about encoders, you have to differentiate between resolution and accuracy. The Singleturn resolution describes in how many single positions one shaft rotation (360°) is devided. The Multiturn resolution defines how many revolutions can be counted.

You can differentiate between Singleturn accuracy and Singleturn repeat accuracy.

Singleturn accuracy:
The Singleturn accuracy defines the tolerance of the position of every transmitted position value 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 0.0878° at ambient tempeature.



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



Signal Conditioning
The absolute encoders WDGA with a singleturn resolution up to 16 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.

Absolute encoder WDGA with RS485
RS485 is a serial interface. It is based on a shifting register, which gets permanently loaded with the actual measuring value. The data output of the encoder is time controlled, so that a transmission is sent out automatically and continuously. This polling cycle is configurable with us while ordering the product. There are cycles between 1 ms up to 1000 ms possible (Standard = 20 ms).

The baudrate is open for free choice, too. There are baudrate between 500 bit/s and 1 Mbit/s possible, standard is e.g. 9600 bit/s .
The encoder electronics starts the data transmission immediately after turning power on.
In the Wachendorff Standard the data word consists of 2 byte preamble, 2 byte Data in Singleturnversion, 4 byte Data in Multiturnversion an d2 byte CRC. Any byte has a start- and Stopbit. The Startbit is logically 0 and the Stopbit is logically 1. The bytes are big-Endian and LSB first coded. There are no Paritybits included.
The preamble consists of a block 0xABCD and shell be used for Start recognition and for static data transmission intro. The data is binary coded.

The CRC Code in the end is a standard code of the type CRC-CCITT with 16 bit(X^16+X^12+X^5+1). The start value is 0x1021. The CRC does not include start and Stopbits in its calculation. The preamble is used in calculation.
If an error occurs and the encoder diagnoses a problem which makes it impossible to send out a right value (e.g. magnet loss), then the data of the telegram were set to the max value. Baudrate and polling cycle stay constant.

The absolute encoders WDGA have two further options. There‘s the Preset wire, which defines the actual shaft position as zero position, if it Is set to supply voltage level more than two seconds.
The direction wire defines the positive direction of counting when shaft rotates. The standard is defined in that way that the position value is counted up if the shaft rotates CW (view on the shaft). Therefore the direction wire has to be set to GND.

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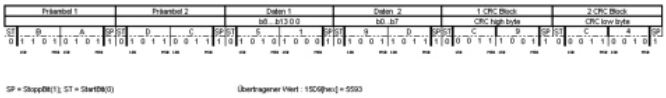
If the direction wire is set to supply voltage the direction of counting changes to CCW. A change of counting direction needs a reset of the encoder. After changing the direction of counting, it is possible that the preset has to be done again.



Value:
AB CD 15 D9 9C 4C | calculation CRC {%AB%CD%15%D9} = 9C4C

Further CRC example
Value:
AB CD 00 00 3A 9E | calculation CRC {%AB%CD%00%00} = 3A9E

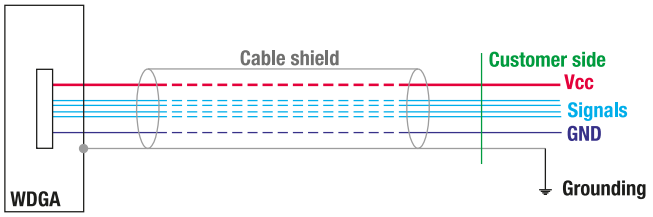
LED and status signalling WDGA SSI:
The status LED in the housing shows the working status of the encoder.

Green LED = encoder is fully functional
Red LED = error has occurred / no transmission possible

Cable length WDGA RS485:
Using RS485 the usable cable length falls with the rising of the transmission rate.

clock rate / kHz	max. cable length/m
< 600	< 12
< 500	< 25
< 400	< 50
< 300	< 100
< 200	< 200
< 100	< 400

Typical shielding concepts for WDGA RS485 encoders

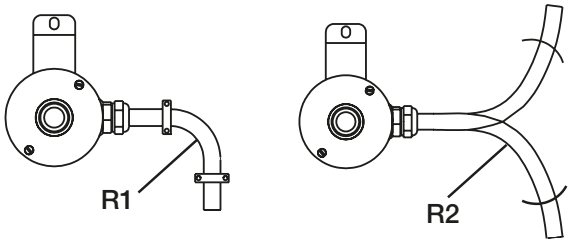


Protection from Noise Interference
For efficient protection of the entire system we recommend the following measures:
For normal applications it is sufficient to connect the shield of the encoder cable to the earth potential. The entire system, consisting of the encoder and the signal processing equipment 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.

	Cabel for encoders WDGA RS485
Core	stranded copper wire
Cross-section for singnal lines power lines	 0.14 mm² 0.14 mm²
Cable cross-section	6 mm
Shield	Tinned braided copper Stranded filter wire for simple connection
Outer sheath	light-grey PVC, 0.6 mm
Line resistance for 0.14 mm²:	 max. 148 Ohm/km
Plant capacity Core/Core: Core/Shield:	 140 nF/km approx. 155 nF/km



For encoders WDGA RS485

cable Ø	R1	R2
≤ 7 mm	31,5 mm	94,5 mm