Wachendorff Automation GmbH & Co. KG
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General technical Data absolute encoders WDGA SSI

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.

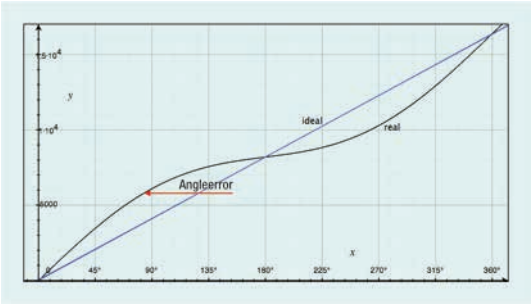
Absolute encoders WDGA:
Every shaftposition of the absolute encoders WDGA has defined a precise value, so that there is a single value for every position between 0° and 360°. Absolute encoders with Multiturn are able to count a number of shaft revolutions, too.
The position value will not get lost if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

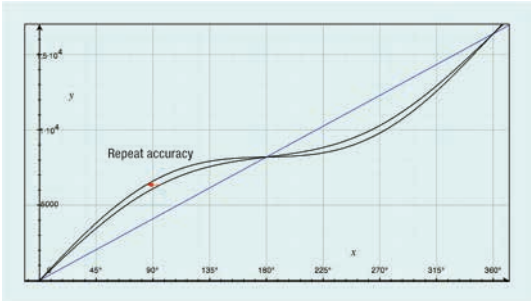
Accuracy of the absolute encoders WDGA
Talking about encoders, you have to differentiate between resolution and accuracy. The Singleturn resolution describes in how many single positions one shaft rotation (360°) is devided. The Multiturn resolution defines how many revolutions can be counted.

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.

Absolute encoder WDGA with SSI
SSI is a serial interface. It is based on a shifting register, which gets permanently loaded with the actual measuring value. The absolute encoders WDGA with SSI are always slaves. The SSI master controls the encoder data output by sending clock sequences to the encoder clock inputs.
The encoder electronics responding to the first falling slope of the clock sequence freeze the actual value and start the serial output of the data bits. On every following rising slope one bit gets transmitted.
The order of the bits within one transmission is MSB to LSB. The SSI Master has to be configured to the data word length. Without slopes the WDGA electronics switches over after the time tp and permits the loading of a new measuring value.
The dataline is pulled to the low level until the point in time tp. After that the high level is set.
If the clock starts before the point of time tp is reached, the old data value is transmitted. This option is called multipath transmission and is meant to achieve a higher transmission security.
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.
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.
Recommentation: After preseting and when not used, connect Preset-Pin to GND.

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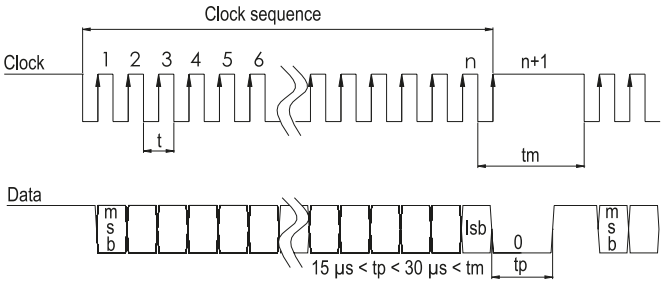
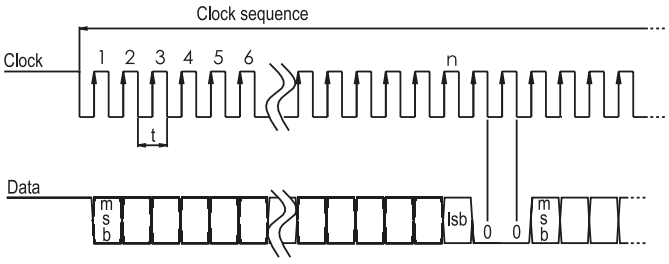
Single transmission SSI



Multipath transmission



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 SSI (specific cable WDGA SSI):

Using SSI the usable cable length falls with the rising of the transmission rate.

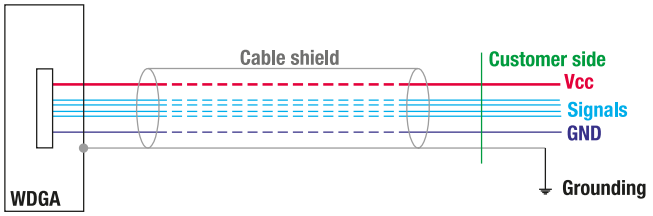
max. cable length *	Transmission rate
20 m **	≤ 500 kHz
*** 5 VDC max. 2 m**	

** > 20 m on request

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 SSI encoder



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.

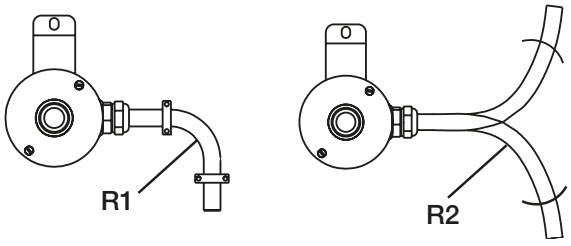
In certain applications it may be necessary to install additional protection against interference, depending on the way the system is earthed and on the noise fields present. Such measures would include: capacitive coupling of the screen, the installation of HF-filters in the encoder cable or the installation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

Environmental Data

Measured mounted and housing grounded.

ESD (DIN EN 61000-4-2):	8 kV
Burst (DIN EN 61000-4-4):	2 kV
Vibration (IEC 68-2-6):	50m/s² (10-2000 Hz)
Shock (IEC 68-2-27):	1000m/s² (6 ms)
Design according to:	DIN VDE 0160

	Cabel for encoders WDGA SSI
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 SSI

cable Ø	R1	R2
≤ 7 mm	31,5 mm	94,5 mm