Control of DC Motors

Absolute Encoder

Rotalink
Miniature Motors,Transmission and Control

Absolute encoder options with and without RS422 interface.

The Rotalink absolute encoder is a contactless magnetic rotary encoder for accurate angular measurement over a full turn of 360 degrees. The sensor determines the orientation of a magnet attached to the output shaft and calculates a binary code (10 – 16 Bit as required). The absolute encoder is tolerant of stray magnetic fields due to a local measurement technique and Hall sensor conditioning circuitry.

The encoder can be programmed at Rotalink to provide either:

- Options with and without RS422 interface.
- SSI interface (3-wire or 2-wire).
- PWM output (with non RS422 version).
- Quadrature output for incremental encoding is optional upon request (with non RS422 version).
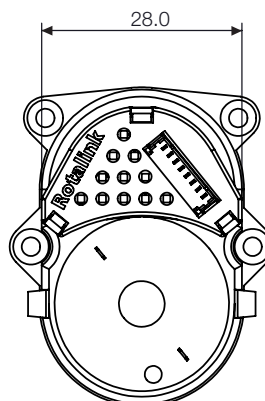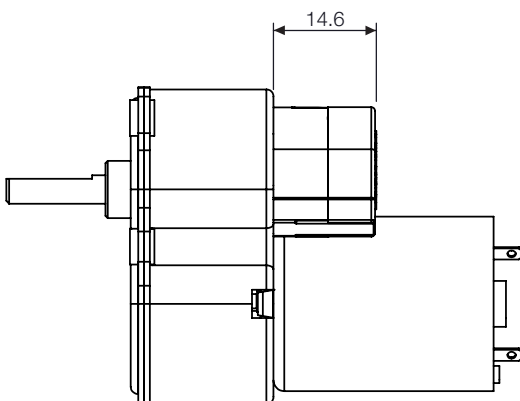
Option 1: Non RS422 Version

The non RS422 version provides an SSI interface with the possibility to include PWM output of the absolute position and AB quadrature output.
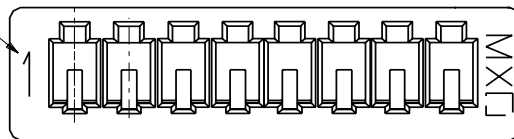
General Specification

Supply Voltage	5Vdc
Output	SSI or PWM
Max. Rev. Count	1rev.
Position retention	no limit
Angle Resolution	10/12/14/16 bit
Accuracy	0.9° @ 25ºC
Maximum SSI frequency	1Mhz
Connector	8 Way Molex

Circuit number

Units: mm

14.6

28.0

Pin Outs to 8 Way Connector

Circuit 1	5V power
Circuit 2	0V
Circuit 3	PWM Out
Circuit 4	Serial Chip_Select
Circuit 5	Serial Clock
Circuit 6	Serial Data Out
Circuit 7	Quadrature B
Circuit 8	Quadrature A

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Option 2: With RS422 Version

The RS422 version has the benefit of a robust communication layer for the SSi interface. RS-422 is a serial communication standard that is used for transmitting digital data over long distances between devices. Advantages of RS-422 include:

- Differential Signalling: RS-422 uses differential signalling to transmit data, which means that it sends two complementary signals on separate wires. This technique allows for noise immunity, making it suitable for long-distance transmission and high-speed communication.
- Long-Distance Communication: RS-422 is designed to operate over longer distances than RS-232. RS-422 can communicate up to 4000 feet (1220 meters) at speeds up to 10 Mbps, whereas RS-232 can only communicate up to 50 feet (15 meters).
- Multiple Receivers: RS-422 allows for multiple receivers to be connected to a single transmitter, which makes it suitable for communication in a networked environment. This feature also reduces the number of transmitters required, which reduces the cost of the system.
- Simple Implementation: RS-422 is relatively easy to implement and does not require any complex hardware or software. This simplicity reduces the cost and complexity of the system, making it an attractive option for many applications.

Overall, RS-422 is a robust and reliable standard that offers many advantages for long-distance communication and high-speed data transmission.
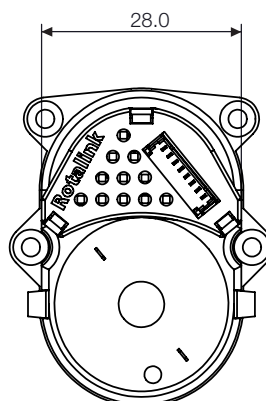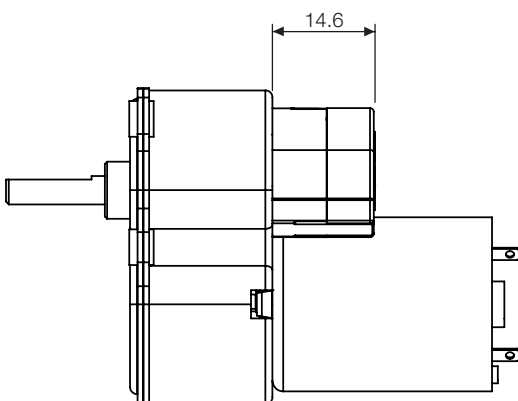
General Specification

Supply Voltage	5Vdc
Output	SSI
Max. Rev. Count	1rev.
Position retention	no limit
Angle Resolution	10/12/14/16 bit
Accuracy	0.9º @ 25ºC
Maximum SSI frequency	1Mhz
Connector	8 Way Molex

Circuit number

Units: mm

14.6

28.0
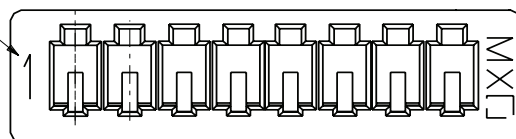
Pin Outs to 8 Way Connector

Circuit 1	5V power
Circuit 2	0V
Circuit 3	Serial Chip_Select A
Circuit 4	Serial Chip_Select B
Circuit 5	Serial Clock A
Circuit 6	Serial Clock B
Circuit 7	Serial Data Out A
Circuit 8	Serial Data Out B

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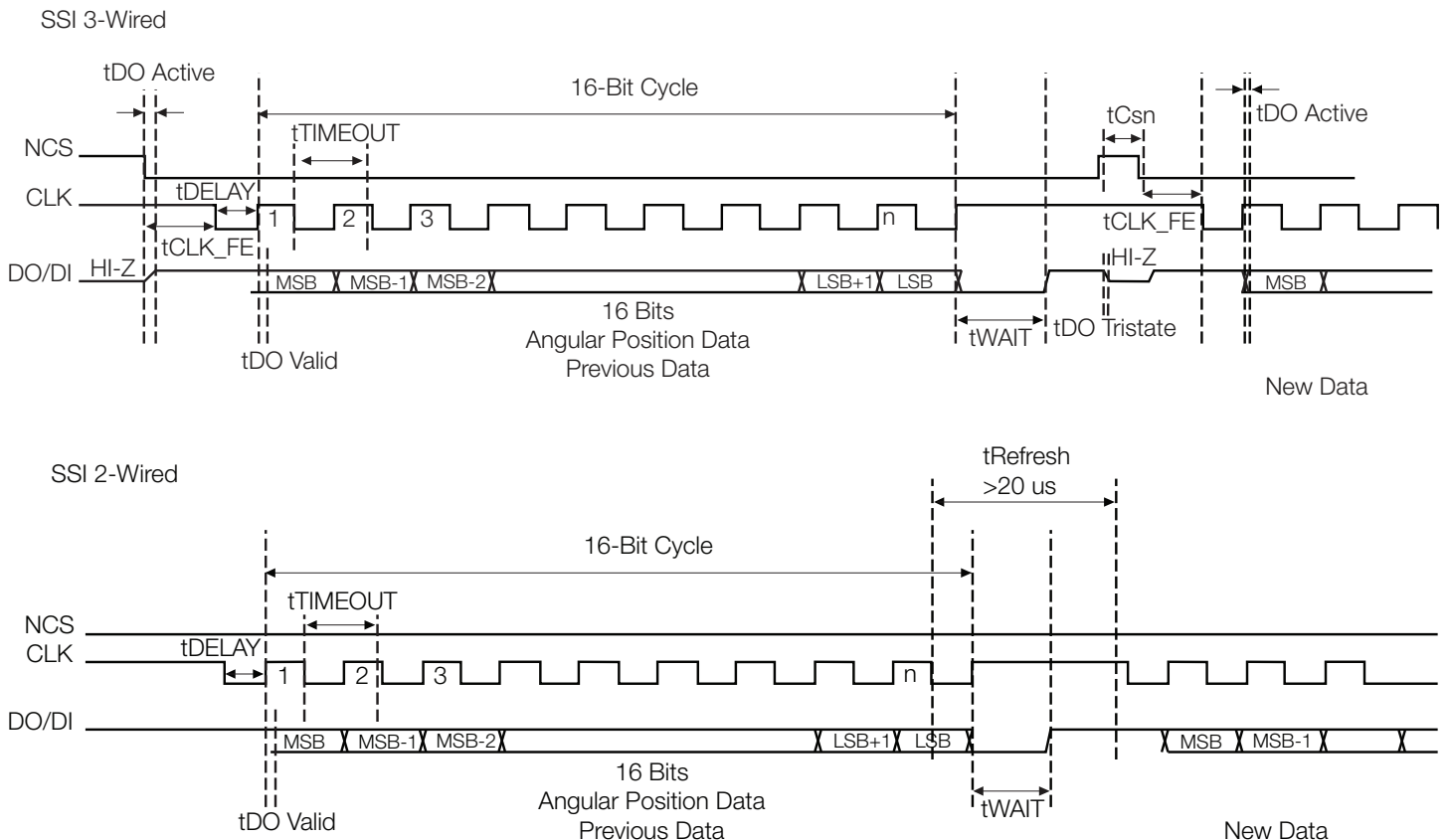
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Zero Position

The physical angle of the output shaft in relation to the electrical 'zero position' is factory set by Rotalink. Whilst we can set this angle to a flat or other shaft feature, this involves additional setting time and due to tolerances of the interface between output shaft and customer parts, may not provide the required accuracy. If the encoder is being used with a microprocessor the following method can be used to maximise accuracy: Use an absolute encoder with a 'random' zero position. Physically move the customer part to the required 'zero position' and fix to Rotalink unit. Read absolute position from the encoder with the microprocessor and save value to nonvolatile memory. A simple subtraction (current position - save position) will then result in the required absolute position.

SSI Output

SSI 3-Wired

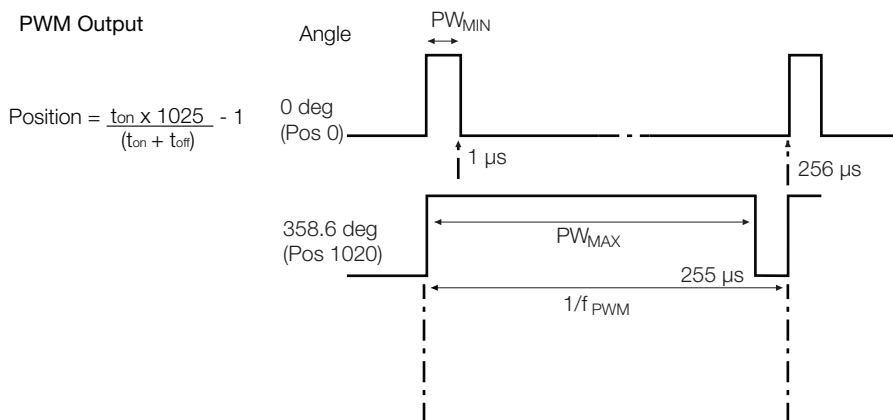SSI 2-Wired

Rotalink
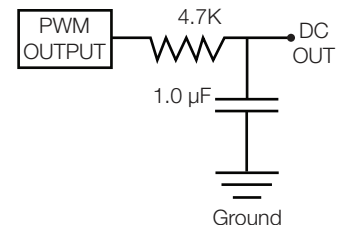Miniature Motors, Transmission and Control

PWM Output

PWM output is considered as another absolute output besides SSI. In PWM mode, the duty cycle is proportional to the measured angle. For full rotation angle, 360 degrees is equivalent to position 0 to 1023. For instance, an angle position of 358.6° generates a pulse width t_{on} = 255 µs and a pause t_{off} of 1 µs, resulting in Position = 1020 after the calculation:
255 x 1025 / (255 + 1) - 1 = 1020.

To convert the PWM output to an analogue voltage use a low pass filter if desired. For example an R = 4.7K and C = 1.0µF; see PWM RC filter diagram. The load on the filter should be kept as low as possible and use of a voltage follower buffer amplifier may be required in some applications.

PWM Output

$$\text{Position} = \frac{t_{on} \times 1025}{(t_{on} + t_{off})} - 1$$

Angle

PW$_{MIN}$

0 deg (Pos 0)

1 µs

256 µs

358.6 deg (Pos 1020)

PW$_{MAX}$

255 µs

1/f $_{PWM}$

PWM RC Filter

PWM OUTPUT — 4.7K — DC OUT

1.0 µF

Ground

EMC Information

EMC Compliance:

- EN55022 Radiated emissions Class A – residential
- EN61000-4-3 Radiated immunity Level 3 (10V/m)
- EN 61000¬4¬6 Conducted Radio Frequency (RF) immunity Level 3 (10V/m) 150kHz to 80MHz
- Fast transient burst / Electrical fast transient

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Programming Options		
	Non RS422 Version	With RS422 Version
Absolute Settings	10 Bit (default)	10 Bit (default)
	12 Bit (optional)	12 Bit (optional)
	14 Bit (optional)	14 Bit (optional)
	16 Bit (optional)	16 Bit (optional)
Direction	Matched default gearbox output unless bi-directional, then on customer request.	Matched default gearbox output unless bi-directional, then on customer request.
Position Averaging	On by default. (off is an option)	On by default. (off is an option)
PWM	Enabled	Disabled
PWM Period	1µs by default. (2µs is an option)	Disabled
Zero Position	Set based on angle (degrees) by default. (Hex code is an option)	Set based on angle (degrees) by default. (Hex code is an option)
Index Logic Output	Active High by default. (Active Low is an option)	Active High by default. (Active Low is an option)
Incremental Output Only	Default is off. (From 8cpr to 1024cpr AB mode is an option)	Not available

Note:
1. Absolute and incremental output is available as an option for non-RS422 version but zeroing device becomes unavailable.
2. Position averaging is available for 10 Bit, 12 Bit, 14 Bit, 16 Bit. With position averaging turned off 16 Bit is not available.

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