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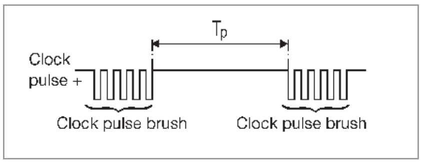
Basics of Absolute Encoders ACURO

Synchronous-Serial Interface (SSI)

GENERAL INFORMATION

In many cases, absolute shaft encoders are subject to severe mechanical stresses and to electrical and magnetic fields that contaminate the site.
Therefore, special design measures are needed to combat dirt, dust and liquids in industrial environments.
Our absolute shaft encoders are of state-of-the-art rugged mechanical construction, and the electronic components are very compact.
A main consideration for immunity to interference is the data transfer from the shaft encoder to the control system. The control system must be able to read the readings from the shaft encoder without errors. Under no circumstances should undefined data be transmitted, for example at the changeover point.



The major differences between the concept of synchronous-serial data transfer for absolute shaft encoders described here and parallel and asynchronous serial forms of data transfer are:

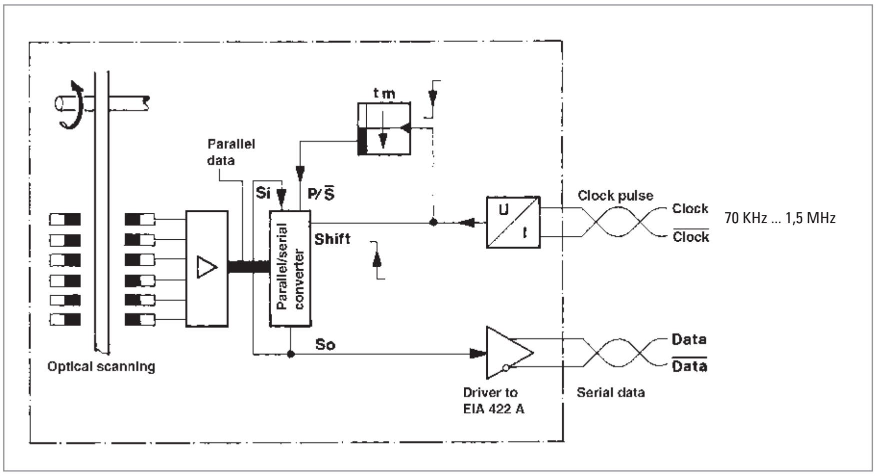
- less electronic components
- less cabling for data transfer
- the same interface hardware, regardless of the absolute shaft encoder's resolution (word length)
- electrical insulation of the shaft encoder from the control system by optocouplers
- open-circuit monitoring by constant current
- data transfer rates up to 1.5 megabits per second (depending on the length of line)
- ring-register operating possible.

TRANSFER SEQUENCE

For correct transfer of the data a defined number of pulses (clock pulse brush) must be applied to the clock input of the absolute shaft encoder. Next, a pause T_P must be observed. As long as no clock signal is applied to the shaft encoder, its internal parallel/serial shift register remains switched to parallel. The data change continuously, corresponding to the current position of the shaft encoder's shaft.

As soon as a clock pulse brush is applied to the clock input again, the instantaneous angular data is recorded.
The first shift of the clock signal from high to low ① actuates the shaft encoder's internal retriggerable mono-stable element, whose storage time tm must be greater than the clock signal's period T.
The output of the monostable element controls the parallel/serial register via terminal P/S (parallel/serial).

Block diagram of an absolute shaft encoder



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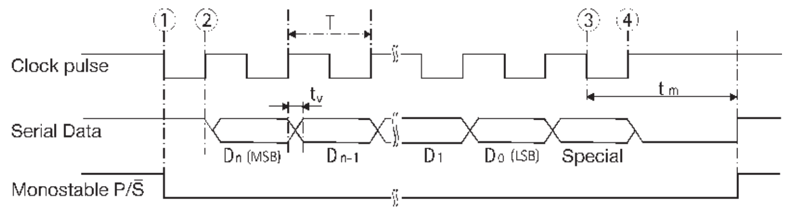

T = clock pulse period
t_m = storage time of monostable element
t_m ranging from 10 µs to 30 µs
t_v = 100 ns

The number of clock pulses necessary for data transfer is independent of the resolution of the absolute shaft encoder.

The clock signal can be interrupted at any point, or continued in ring-register mode for repeated polling.

With the first shift of the clock signal from low to high ② the most significant bit (MSB) of the angular data is applied to the shaft encoder's serial output.
With each succeeding rising edge, the next less significant bit is shifted to the data output.
After transmission of the least significant bit (LSB) the Alarm bit or other special bits are transferred, depending on configuration. Then the data line switches to low ③ until the time t_m has passed.

A further transfer of data cannot be started until the data line switches to high ④ again. If the clock pulse sequence is not interrupted at point ③, the ring-register mode is activated automatically. This means that the data stored at the first clock pulse transition ① are returned to the serial input S_i via the terminal S_0. As long as the clock pulse is not interrupted at ③, the data can be read out as often as wanted (multiple transfer).

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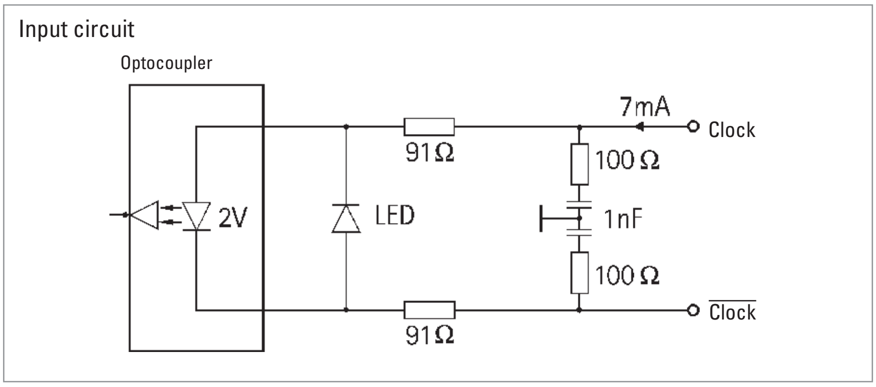

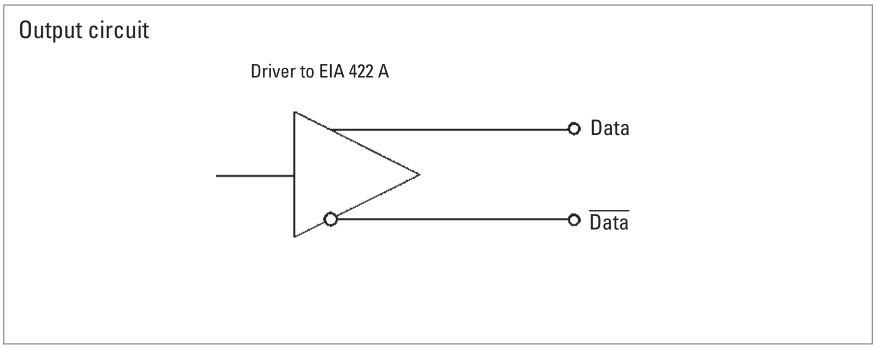

RECOMMENDED DATA TRANSMISSION RATE

The maximum data transmission rate depends on the length of cable:

Cable length	Baud rate
< 50 m	< 400 kHz
< 100 m	< 300 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz