

Content

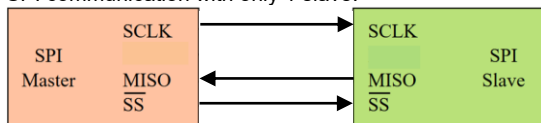
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1. SPI Protocol

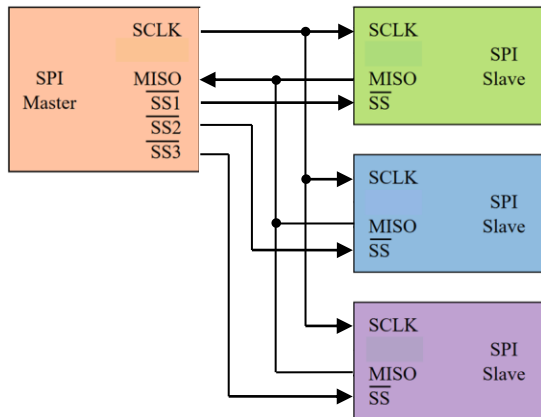
This document reflects the Novotechnik sensor protocol implementation of the standard SPI protocol. A basic knowledge of the SPI Bus is required for a proper understanding of this document.

1.1 Bus Topology

SPI communication with only 1 slave:



SPI communication with more than 1 slave:

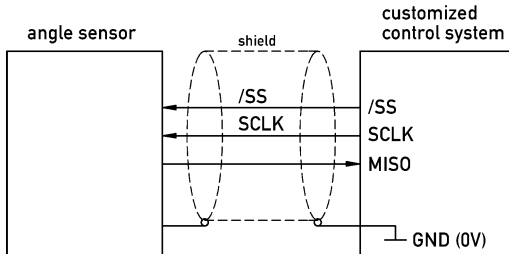


1.2 Electrical Characteristics

The serial protocol of Novotechnik Multi turn sensors is a three wires protocol (/SS, SCLK, MISO).

The rotary sensor is considered as a slave mode:

- /SS pin is a 3.3 V (5V tolerant) digital input
- SCLK pin is a 3.3 V (5V tolerant) digital input
- MISO pin is a 5V digital output



1.3 SPI Mode

Clock phase CPHA = 1 even clock changes are used to sample the data
Clock polarity CPOL = 0 active high clock

The positive going edge shifts a bit to the slave's output stage and the negative going edge samples the bit at the master's input stage.

1.4 MISO (Master In, Slave Out)

The MISO of the slave is a tri state output.

1.5 /SS Slave Select

The /SS pin enables a frame transfer (if CPHA = 1). It allows a re-synchronisation between slave and master in case of communication error.

1.6 Master Start-up

/SS, SCLK, MISO can be undefined during the master start-up as long as the slave is re-synchronized before the first frame transfer.

1.7 Slave Start-up

The slave start-up (after power-up or an internal failure) takes 15 ms. Within this time /SS and SCLK is ignored by the slave. The first frame can therefore be sent after 15 ms. MISO is high-impedant until the slave is selected by its /SS input.

1.8 Timing

To synchronize communication, the master deactivates /SS high for at least 10 μ s.

In this case, the slave will be ready to receive a new frame.

The master can re-synchronize at any time, even in the middle of a byte transfer.

1.9 Slave Reset

In case of internal failures the slave shows 0 for all bits. Power off / on is necessary for a slave reset.

1.10 Data Frame Structure

A data frame consists of 2 data bytes (Data 16 – most significant byte first).

1.11 Data Structure

Data 16: Angle A [15:0] with (Angle Span) /2¹⁶

Most Significant Byte								Less Significant Byte							
MSB							LSB	MSB							LSB
A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0

Data 16: Error

In case of internal failures the slave shows 0 for all bits

Most Significant Byte								Less Significant Byte							
MSB							LSB	MSB							LSB
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1.12 Angle Calculation

All communication timing is independent (asynchronous) of the angle data processing.

The angle is calculated continuously by the slave every 1 ms.

The last angle calculated is hold to be read by the master at any time.

1.13 Document Changes

Revision	Changes	Date	Who
V_00	First edition	23.04.19	VM/mm
V_01	1.1 Bus Topology: chart modified. 1.8 Timing 10 µs instead of 1 µs	12.09.22	VM/mm