Baumer

Passion for Sensors

Manual

Absolute encoders with BiSS C interface

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At any time we should be pleased receiving your comments and proposals for further improvement of the present manual.

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Documentation revision history

Version	Corrections / Additions / Description
V1.00	

1 Introduction

1.1 Product assignment

Product	Description
GBPAH	Multiturn, through-hollow shaft
GBPAS	Multiturn, blind hollow shaft
GBUAH	Singleturn, through-hollow shaft
GBUAS	Singleturn, blind hollow shaft
GBPAW	Multiturn, solid shaft
GBUAW	Singleturn, solid shaft
EFL580	Singleturn, cone shaft

2 Safety and operating instructions

Intended use

- The encoder is a precision measuring device that is used to record positions and speeds. It provides measuring values as electronic output signals for the subsequently connected device. It must not be used for any other purpose. Unless this product is specially labeled, it may not be used for operation in potentially explosive environments.
- Make sure by appropriate safety measures, that in case of error or failure of the encoder, no danger to persons or damage to the system or operating facilities occurs.

Personnel qualification

- Installation and assembly of this product may be performed only by a person qualified in electronics and precision mechanics.

Maintenance

- The encoder is maintenance-free and must not be opened up nor mechanically or electronically modified. Opening up the encoder can lead to injury.

Disposal

- The encoder contains electronic components. At its disposal, local environmental guidelines must be followed.

Mounting

- Solid shaft: Do not connect encoder shaft and drive shaft rigidly. Connect drive and encoder shaft with a suitable coupling.
- Hollow shaft: Open clamping ring completely before mounting the encoder. Foreign objects must be kept at a sufficient distance from the stator coupling. The stator coupling is not allowed to have any contact to the encoder or the machine except at the mounting points.

Electrical commissioning

- Do not proceed any electrical modifications at the encoder.
- Do not proceed any wiring work while encoder is live.
- Do not remove or plug on connector whilst under power supply.
- Ensure that the entire system is installed in line with EMC/EMI requirements. Operating environment and wiring have an impact on the electromagnetic compatibility of the encoder. Install encoder and supply cables separately or far away from sources with high emitted interference (frequency converters, contactors, etc.).
- When working with consumers with high emitted interference provide separate encoder supply voltage.
- Completely shield encoder housing and connecting cables.
- Connect encoder to protective earth (PE) using shielded cables. The braided shield must be connected to the cable gland or connector. Ideally, aim at dual connection to protective earth (PE), i.e. housing by mechanical assembly and cable shield by the downstream devices.

Supplementary information

- The present manual is intended as a supplement to already existing documentation (e.g. catalogues, data sheets or mounting instructions).

3 Introduction

This specification describes a serial interface protocol for isochronous, fast and safe exporting of sensor data and simultaneous accessing of the slave registers.

In the point-to-point configuration, only one device with one slave (sensor) is operated on the master. The BiSS interface is hardware-compatible to the SSI interface in the point-to-point configuration and only requires two unidirectional differential lines.

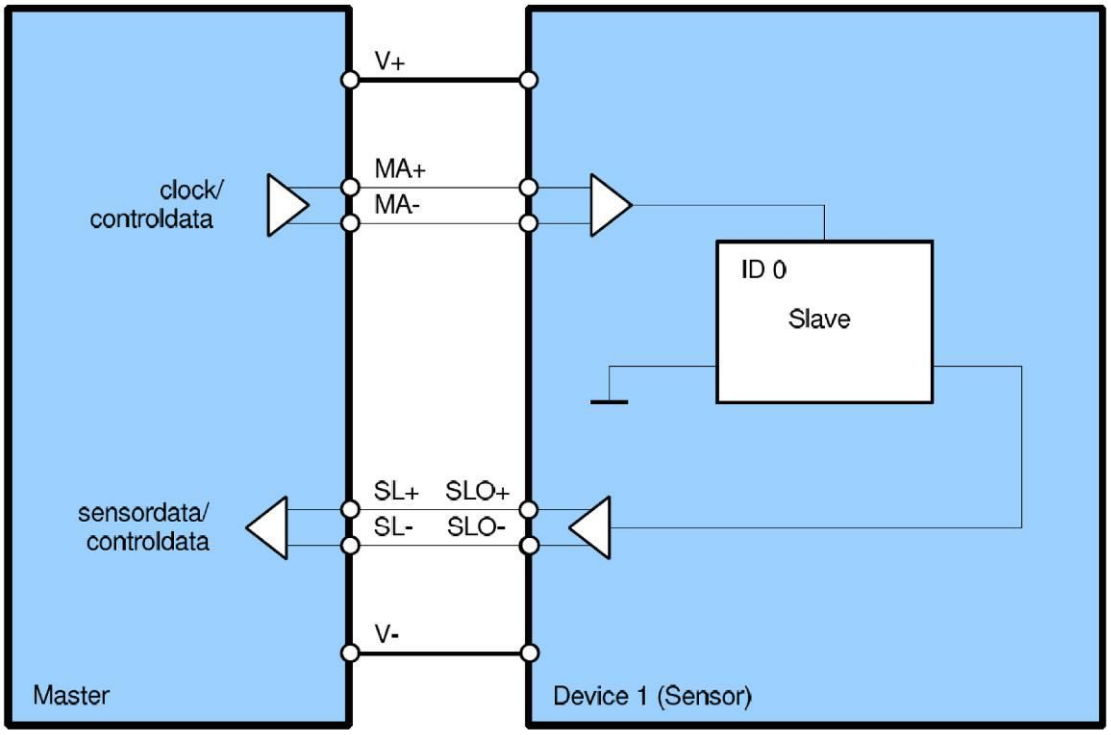

Figure 1

4 Functional description

The BiSS C protocol enables simultaneous transmission of sensor data (SD) from slave to master and control data from master to slave.

4.1 The BiSS-Frame

The isochronous transmission of the BiSS frames is typically used for cyclical scanning systems. Here, each cycle begins with the transmission of a BiSS frame, the interface remains in the idle state up to the beginning of the next cycle. The cycle duration is therefore at least equal to the duration of a BiSS frame, and may be as long as desired.

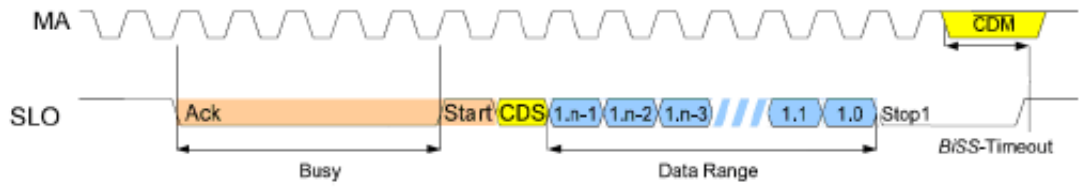

Figure 2

In each BiSS frame, one bit of control data (CD) is transmitted per direction for the command or for register communication. The control data bit of the masters (CDM, Control Data Master) is sent to all slaves via the line MA as an inverse signal level of the BiSS timeout.
The addressed slave responds with the CDS (Control Data Slave) bit which is always transmitted in the first bit after the start bit. The control data bits of several consecutive BiSS frames are combined by the master and by the slaves to form a control frame. It permits the reading and writing of the slave register and the sending of commands to the slave.

4.2 Processing time per request

If a slave requires additional processing time before outputting its sensor data, e.g. for A/D conversion or for memory access, it can request this by delaying the start bit. The master detects the delayed start bit and generates the additionally required MA clock pulses.

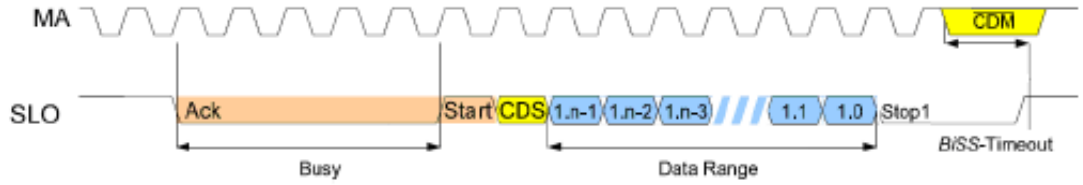

Figure 3

4.3 Bus reset

After switch-on or an error, the master must maintain a break of 40 µs prior to the data transmission. This ensures that the BiSS timeout has expired and all slaves are ready for data transmission.

5 Sensor data communication

The data area

The data area is used to transmit the sensor data from the slaves to the master. The entire data area is divided into logical data channels. The position and length of the individual data channels is described for each slave in its parameters. A slave can have no, one or several data channels for sensor data.
Valid data can only be transmitted with a correct configuration of the data channels in the master. The check bits contained for each data channel are used to detect transmission errors and bit offsets.
The slave data arrive at the master directly after the CDS bit. The further data channels follow without separation by start or stop bits, so the length of the data area is the sum of the length of all data channels.

The slaves can only correctly signal the BiSS timeout in the BiSS frame if all SLO lines have the signal level „0“ at the start of the BiSS timeout. The master sends a leading zero before each packet which is active as a stop bit at the slave output at the end of the cycle. If an error occurs, the BiSS frame can be canceled with a timeout of 40 µs at any time.

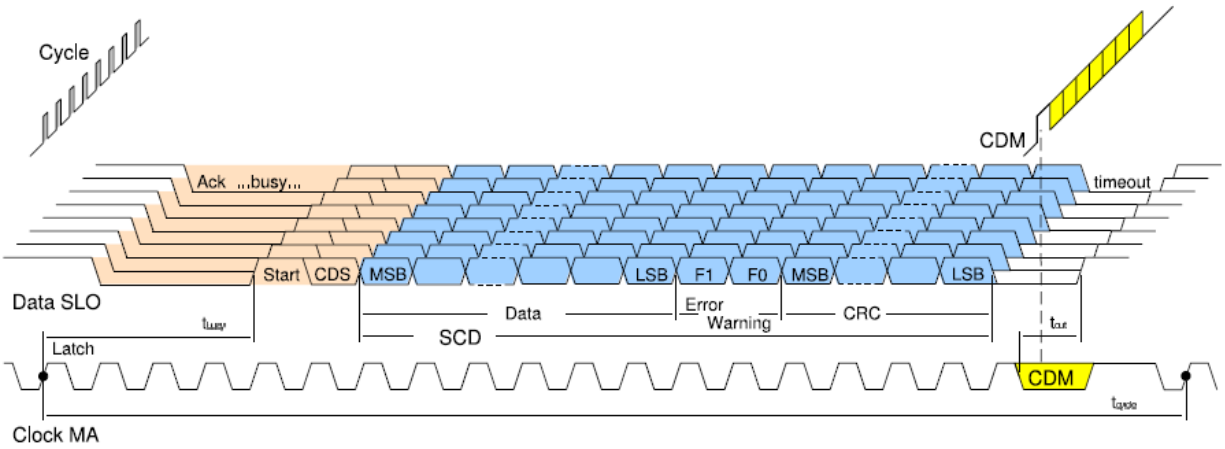

Figure 4

CRC checking

Each data channel can use transmission checking with CRC in addition to its data value. The properties of the CRC checking are specified in the parameters of the data channel. The CRC polynomial also indicates the transmitted CRC bits. Calculation is carried out via the data bits and starting with the most significant bit. There is no start bit. The CRC check bits are always transmitted inversely first with the most significant bit.
The starting value for the CRC calculation is generally zero.

Output format BiSS-C protocol:

CDS 0/1 bit	MT 12 bit	ST 9-19 bit	ERR/NERR	WARN/NWARN	CRCPOS 6 bit (inverted)

Figure 5

6 Control communication

The control frame

The control frame enables the protected and confirmed reading and writing of the register of a slave and the protected and confirmed sending of commands to the slave. The control frame results from a count of BiSS frames generating and transmitting sensor data.

The register access or the command is always carried out at the end of the cycle of the last DCM bit, i.e. with the expiration of the BiSS timeout in the slave. The control frame can be canceled at any time with the transmission of 14 “0“ bits. The start bit of a control frame must be preceded by at least 14 cycles with CDM = “0“.

CRC checking

Control communication also uses a checksum for transmission checking. The CRC polynomial used is the same as in protected SCD data transmission:

X^(6) + X^(1) + 1

With it, 6 CRC bits are available which are transmitted inverted. Calculation is carried out with the starting value zero via the addressing sequence or the data bits beginning with the most significant bit, always excluding the start bit.

Note: Before each control frame at least 14 bits with CDM=“0“ must be transmitted.

7 Register communication

Writing of the registers calls for utmost care and attention. Writing only of the registers listed in this document. Incorrect register writing may cause the encoder outputting incorrect values.

Writing only of the command register (0x60).
Do not write in any other register.

Soft preset (0x60 = 0x02)
Writing 0x02 in register 0x60 will execute preset. (zero set as default).
Any other preset value requires the corresponding default parameter predefined at Baumer.

The error register
Register 0x68 is reading the encoder error status. 0x00 mains no error present.
Bit “0” is the only one to signal error ERR_L (infrared LED current limit error) in the BiSS C frame.
The warning bit is not used.

Transmission current error:

ERR_L	0x68; bit 0
Code	Function
0	no control error present
1	amplitude exceeded, or outside control range*

Figure 6
* EFL580 – outside temperature limit

Error bit transmission is usually inverted (low active).

Error Reset
The error reset is automatically executed at position data reading.

BiSS encoders are programmable to allow for customer-specific parameterization. Should you require another different from default, you may approach your Baumer contact for support to ensure proper encoder functionality by the correct configuration. We gladly will be of help.