



Concept



BiSS Interface

Concept



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OVERVIEW

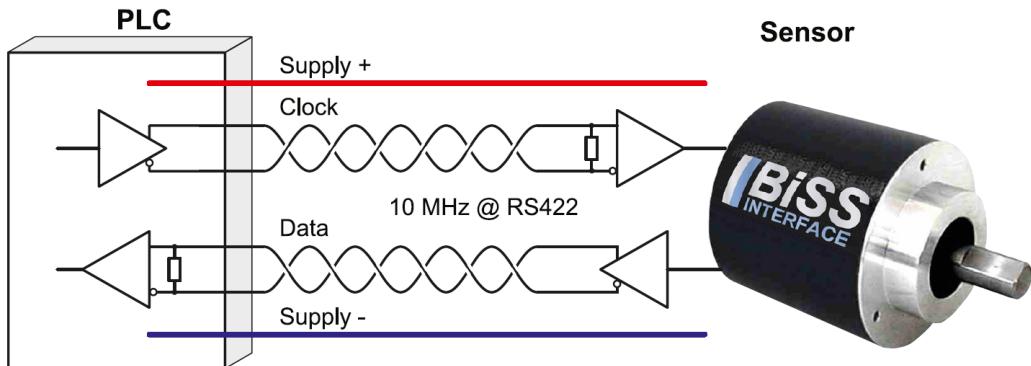


Figure 1: A typical *BiSS* application with encoder and PLC/drive based on the RS422 standard

Introduction

BiSS (**B**idirectional/**S**erial/**S**ynchronous) is a digital, serial interface protocol for fast and safe isochronous process data transmission, particularly used in motor feedback systems. Simultaneous to the reception of sensor process data and the transmission of actuator process data in real-time, the *BiSS* protocol is capable of register data transfers without interrupting the process data stream.

BiSS at a Glance

- Cyclic high-speed data transmission (up to 10 MHz)
- Line delay compensation
- Consideration of sensor processing times
- Safety capabilities (Certified by TÜV Rheinland)
- Daisy-chaining of multiple sensors
- Memory access to slave, e.g. for sensor configuration, calibration, electronic datasheet

BiSS TOPOLOGIES

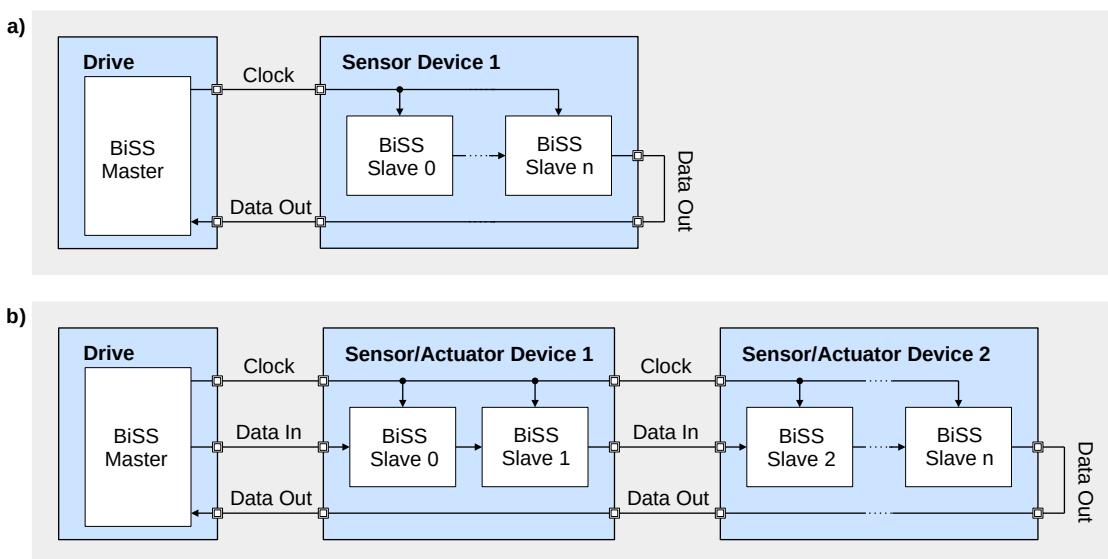


Figure 2: Point-to-point connection (a) and bus connection (b)

Point-to-Point Connection

In the point-to-point connection only one sensor device is connected to the master device using one clock line and one data output line. Within the sensor device, several sensors can be daisy-chained, e.g. to enable redundant data transmission for safety systems, smart sensor applications or condition monitoring.

Bus Connection

For systems with more than one sensor device, the bus connection is used. In contrast to the point-to-point connection, the bus connection also enables data transmission to actuator devices. Therefore, a third line (data input) is connected to the *BiSS* slaves.

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BiSS FRAME & FEATURES

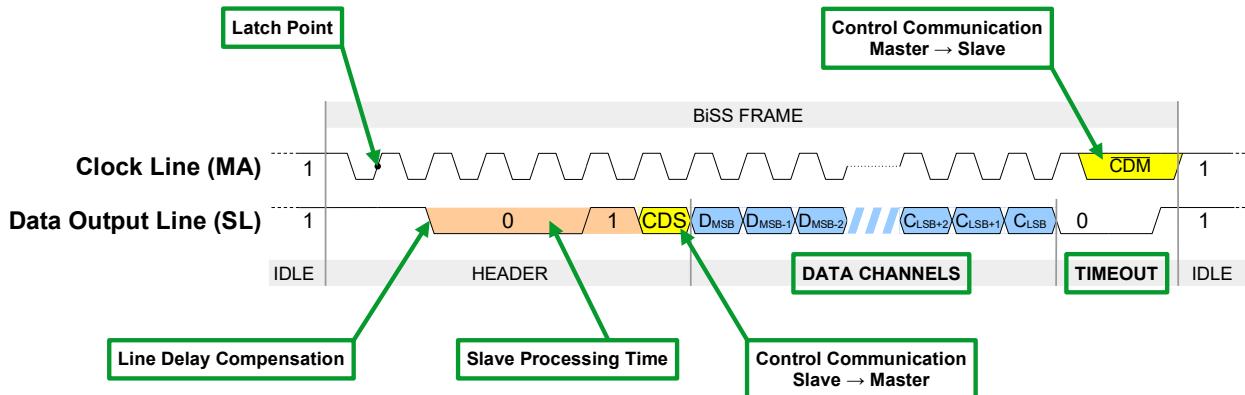


Figure 3: BiSS frame and features

Latch Point

Sensor data is simultaneously captured for all slaves in the daisy chain with the first rising edge of the clock signal (MA).

polynomial (0...16 bit). BiSS can be used for arbitrary sensor and actuator data, e.g. position, torque and rotation speed. For standardization, the data contents are described in application specific BiSS Profiles.

Line Delay Compensation

The BiSS master measures and compensates the total line delay in every frame. The line delay is measured from second rising edge of the clock signal (MA) to falling edge of the data output signal (SL) and takes propagation delays, aging effects and temperature effects into account.

Control Communication

BiSS enables a bidirectional control communication via the unidirectional clock (MA) and data output line (SL). In each frame the master sends one control data bit to the slave (CDM) and the slave responds with its control data bit (CDS). This in-band protocol can be used to perform register accesses to the slave without interrupting the process data transfer. For example, it enables access to a sensor's electronic datasheet, reading a sensor's temperature register or calibration.

Slave Processing Time

In a point-to-point topology the slave can delay the start bit, if it requires time to prepare and provide its sensor data. This feature enables preprocessing of sensor data before transmission.

Timeout

Each BiSS frame is terminated by the slave's timeout. The timeout is either a constant period (typically about 20 µs) or depends on the clock frequency applied to the clock line (adaptive timeout). With the adaptive timeout, the timeout period is reduced significantly at high frequencies enabling short cycle times well below 31.25 µs.

Data Channel

Sensor and actuator data are transmitted as part of a data channel. Each data channel is defined by its communication parameters, e.g. transmission direction (sensor or actuator data), data length (0...64 bit), CRC

BiSS PROFILES



Figure 4: Data channel content according to BiSS Profile BP3

BiSS can be used to transmit arbitrary sensor or actuator data. Standardized communication profiles are defined for different applications. For instance, BiSS Profile BP3 is suitable to describe the process data of rotary encoders which transmit angle position words as shown in Figure 4. The position word may contain multturn information (MT), which is the number of full

mechanical revolutions, and singleturn information (ST), which is the angle information within one mechanical revolution. Validity of the position word is indicated to the BiSS master with error bit (\bar{E}) and warning bit (\bar{W}). The data is protected against transmission errors with a standard 6-bit CRC. Error bit, warning bit and CRC are inverted before transmission (indicated with bar).

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PLUG & PLAY

Control communication enables a *BiSS* master to access the slave's memory. Typically, the sensor/actuator manufacturer stores product specific data, e.g. a manufacturer ID, device ID, serial number and a standardized electronic datasheet (EDS) in the slave's non-volatile memory (e.g. EEPROM). The EDS contains all re-

quired parameters to successfully establish *BiSS* communication between master and slave and additionally provides application specific parameters. On power-up the *BiSS* master can automatically read the EDS and configure itself accordingly for Plug & Play operation.

BiSS CERTIFIED

In order to verify interoperability of *BiSS* products, the user organization BiSS Association e.V. has introduced a certification service. The service includes thorough verification of *BiSS* features and precise documentation of measurements and results in a report. Compliant *BiSS* devices are labeled as *BiSS Certified*.



BiSS SAFETY

BiSS Safety is a profile definition for *BiSS* that has been certified by TÜV Rheinland for safety-critical applications up to SIL3 according to IEC61508:2010. *BiSS Safety* defines the data channel contents in order to ensure failure mode detection as defined in IEC61784-3 using redundant position words, different CRC polynomials and a sign-of-life counter.



BiSS LINE

BiSS Line is a one-cable technology based on *BiSS*. It enables a combined power and data transmission over just two wires based on the RS485 half-duplex transmission standard. *BiSS Line* is fully compatible to *BiSS* and all of its features including low jitter performance and short cycle times. Data availability is ensured by a forward error correction (FEC) which is suitable to repair up to four corrupted bytes.



BiSS ASSOCIATION e.V.

The BiSS Association e.V. operates as an exchange platform concerning *BiSS Interface*, products and solutions. Members have access to the community, share their industrial knowledge and experiences and corporately develop protocol features. At www.biss-interface.com, *BiSS* products and services including ICs, encoders, drives, modules and tools are presented by members and licensees.

