RENISHAW
apply innovation™

BiSS® C-mode (unidirectional) for EVOLUTE™ encoders

About EVOLUTE™ with BiSS interface

Renishaw EVOLUTE BiSS encoders use the C-mode (unidirectional) BiSS serial interface, (**www.renishaw.com/biss-serial-interface-support**).

EVOLUTE Linear encoders are available with a range of different resolutions (and maximum measuring lengths) as specified in the *EVOLUTE™ absolute optical encoder system* data sheet (Renishaw part no. L-9518-0027) which can be downloaded from **www.renishaw.com/evolutedownloads**.

More information on BiSS serial interfaces is available on the BiSS website: **www.biss-interface.com**.

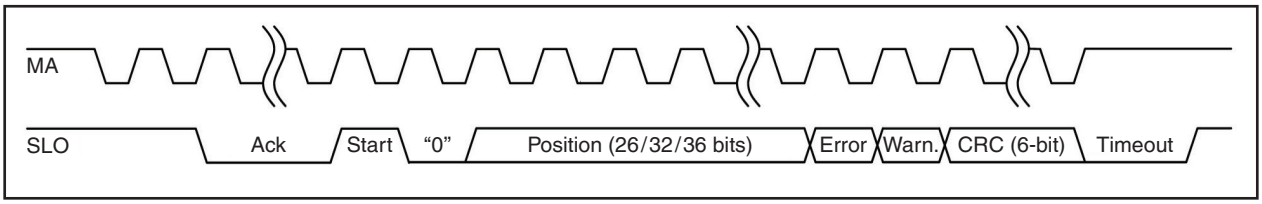
Description of the BiSS interface

BiSS C-mode (unidirectional) is a fast synchronous serial interface for acquiring position data from an encoder.
It is a master-slave interface. The master controls the timing of position acquisition and the data transmission speed, and the encoder is the slave. The interface consists of two unidirectional differential pairs of lines:

- MA transmits position acquisition requests and timing information (clock) from master to encoder.
- SLO transfers position data from encoder to master, synchronised to MA.

The diagram below shows the data transmitted.

Data format



The master-slave signal communication format is RS485/RS422 differential line-driven.

A typical request cycle proceeds as follows:

1. When idle, the master holds MA high. The encoder indicates it is ready by holding SLO high.
2. The master requests position acquisition by starting to transmit clock pulses on MA.
3. The encoder responds by setting SLO low on the second rising edge on MA.
4. After the Ack period is complete, the encoder transmits data to the master synchronised with the clock as shown in the Data format diagram.
5. When all data has been transferred, the master stops the clock and sets MA high.
6. If the encoder is not yet ready for the next request cycle, it sets SLO low (the Timeout period).
7. When the encoder is ready for the next request cycle, it indicates this to the master by setting SLO high.

Description of data

Ack

This is the period during which the readhead calculates the absolute position. See the timing information table on the next page.

Start and “0” (1 bit each)

The encoder transmits the start bit to signal to the master that it is starting to transmit data. The start bit is always high and the “0” bit is always low.

Position (26, 32 or 36 bits)

The absolute position data is sent MSB first in binary format. Lower resolutions may be achieved by ignoring the least significant bit(s) of the position data.

Error (1 bit)

The error bit is active low: “1” indicates that the transmitted position information has been verified by the readhead’s internal safety checking algorithm and is correct; “0” indicates that the internal check has failed and the position information should not be trusted. The error bit is also set to “0” if the temperature exceeds the maximum specified for the product. The operating temperature limits of EVOLUTE systems are specified in the *EVOLUTE™ absolute optical encoder system* data sheet (Renishaw part no. L-9518-0027) which can be downloaded from **www.renishaw.com/evolutedownloads**.

Warning (1 bit)

The warning bit is active low: “0” indicates that the encoder scale (and/or reading window) should be cleaned.

NOTE: The warning bit is not an indication of the trustworthiness of the position data. Only the error bit should be used for this purpose.

CRC for position data (6 bit)

The CRC polynomial for position, error and warning data is: $x^6 + x^1 + x^0$. The CRC start value is 0x00. It is transmitted MSB first and inverted. The start bit and “0” bit are omitted from the CRC calculation.

Timeout

EVOLUTE encoders are capable of acquiring a new position reading every 31.25 µs (a maximum request cycle rate of 32 kHz). Therefore 31.25 µs must elapse between the start of one request cycle and the start of the next.

Nominal timeout is 1.5 x MA clock period.

However, it is possible for data transmission to be complete before 31.25 µs have elapsed. In this case, the encoder signals this to the master by holding the SLO line low until 31.25 µs have elapsed. This extends the timeout period.

Resetting the encoder

The master may reset the encoder at any time during a request cycle by stopping the clock and setting MA high. MA must be held high for the remaining duration of the full request cycle, including timeout period if applicable.

NOTE: SLO may be high or low during resetting (typically depending on the state of the last bit transmitted).

Line delay compensation

Signals travelling between master and encoder experience a time delay due to the cable length and signal propagation delays within the master and encoder. The time delay has no effect at low clock speeds (where the time delay is much shorter than the clock period). However, for high clock speeds, it is necessary for the master to implement line delay compensation.

The master determines the round-trip time delay by measuring the time between transmitting the second rising edge on MA and receiving the falling edge of “Ack” on SLO.

MA clock speed	Maximum cable length	
	Without line-delay compensation	With line-delay compensation
250 kHz	95 m	100 m
1 MHz	20 m	100 m
2 MHz	8 m	100 m
5 MHz	0.5 m	100 m
10 MHz	-	50 m

NOTES:

- All figures relate to installations using EVOUTE readhead with original Renishaw cable up to 10 m in length, with the remainder cable length consisting of Renishaw 14-core extension cable (A-9531-0238),
- Care should be taken to ensure supply voltage is maintained within 5 V ±10% at the readhead connector.

  For extension cable lengths greater than 50 m, it is recommended that the spare 8 × 26 AWG cores are also used for power supply and the EVOLUTE readhead cable should be limited to 5 m to minimise voltage drop.
- This table makes no allowance for propagation delays within the master.

Timing information

	Minimum	Typical	Maximum	Units	Notes
Ack time	-	-	20	µs	The Ack period always ends on a rising edge of MA. Therefore at low MA clock frequencies, the Ack time may exceed 20 µs.
MA clock frequency	0.25	-	10	MHz	Within any one request cycle, the MA clock frequency must be constant. The duty cycle should be 1:1.
Request cycle rate	-	-	32	kHz	32 kHz is not achievable for all MA clock frequencies (because data transmission takes too long).
Sampling moment	3.225	3.250	3.275	µs	Timed from the first rising edge on MA.
EVOLUTE internal line-delay	-	-	42.5	ns	This is the internal propagation delay (MA-SLO) within EVOLUTE encoders.
Line-delay due to cable length	-	10	-	ns/m	This is the round-trip delay experienced by signal travelling through the cable (that is, from master to encoder and back to master again).

+44 (0) 1453 524524 uk@renishaw.com

© 2015–2026 Renishaw plc. All rights reserved. This document may not be copied or reproduced in whole or in part, or transferred to any other media or language by any means, without the prior written permission of Renishaw.
RENISHAW® and the probe symbol are registered trade marks of Renishaw plc. Renishaw product names, designations and the mark ‘apply innovation’ are trade marks of Renishaw plc or its subsidiaries. BiSS® is a registered trademark of iC-Haus GmbH. Other brand, product or company names are trade marks of their respective owners.
WHILE CONSIDERABLE EFFORT WAS MADE TO VERIFY THE ACCURACY OF THIS DOCUMENT AT PUBLICATION, ALL WARRANTIES, CONDITIONS, REPRESENTATIONS AND LIABILITY, HOWSOEVER ARISING, ARE EXCLUDED TO THE EXTENT PERMITTED BY LAW.
RENISHAW RESERVES THE RIGHT TO MAKE CHANGES TO THIS DOCUMENT AND TO THE EQUIPMENT, AND/OR SOFTWARE AND THE SPECIFICATION DESCRIBED HEREIN WITHOUT OBLIGATION TO PROVIDE NOTICE OF SUCH CHANGES.
Renishaw plc. Registered in England and Wales. Company no: 1106260. Registered office: New Mills, Wotton-under-Edge, Glos, GL12 8JR, UK.

Part no.: L-9517-9665-02-A
Issued: 11.2026