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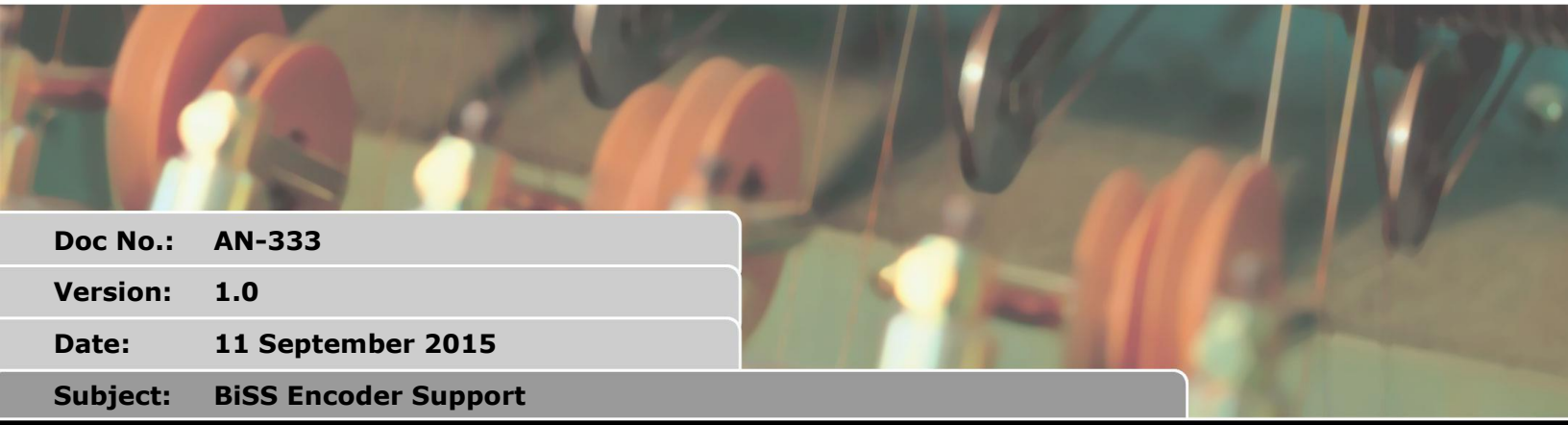

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APPLICATION NOTE

1. Introduction

A BiSS implementation has been added to some Trio controllers to support reading of encoder position from devices fitted with a BiSS interface. This adds to the existing range of absolute encoder protocols already supported on many Trio controllers, allowing the user to work with the solution most suitable for their application.

2. BiSS Implementation

The BiSS protocol allows for a fully featured, bi-directional, multi-drop network capable of device configuration, reading data from sensors and operating actuators. As the intended use of the BiSS interface on Trio controllers is to read position data from sensors or encoders, the point-to-point configuration has been used, requiring a clock output from the controller and a data input to receive the position information. This is identical to the SSI physical layer already supported, so products can be updated with a new FPGA and firmware version.

3. Products with BiSS Interface

The first products to include a BiSS interface are the MC664 (P861), MC664-X (P862) and a special version of the 4 axis FlexAxis module, the FlexAxis4 BiSS (P883). The P883 will also work with the MC464 (P860) when suitable firmware is installed, but the built-in encoder port of the MC464 will not support BiSS.

3.1. Minimum requirements for BiSS support

PRODUCT	FIRMWARE	FPGA	No. of BiSS AXES	NOTES
P860 (MC464)	2.0257	n/a	0	Requires P883 to add BiSS Axis
P861 (MC664)	2.0257	0C	1	Add extra axes with P883
P862 (MC664-X)	2.0257	0C	1	Add extra axes with P883
P883	n/a	002	4	Must be used with P860, P861 or P862

4. Connecting a BiSS Encoder

4.1. P861 & P862

Connections are made to the flexible encoder port on the 9 way D-type socket. The 5V supply can be used to power the encoder providing the encoder requires less than 150mA. If an external 5V supply has to be used, the 0V from the encoder and the external supply must be connected to pin 5 and pin 8 is left disconnected.

Pin	Signal
1	Clock
2	/Clock
3	n/c
4	n/c
5	0V
6	Data
7	/Data
8	5V supply (150mA max)
9	-
Shell	Screen

4.2. P883

Connections are made to the flexible encoder port on the 15 way high density D-type socket. The 5V supply can be used to power the encoder providing the encoder requires less than 250mA. If an external 5V supply has to be used, the 0V from the encoder and the external supply must be connected to pin 5 or pin 15 and pin 8 is left disconnected.

Pin	Signal
1	Clock
2	/Clock
3	n/c
4	n/c
5	0V
6	Data
7	/Data
8	5V supply (250mA max)
9	n/c
10	n/c
11	n/c
12	n/c
13	n/c
14	n/c
15	0V
Shell	Screen

4.3. Cable length

The clock output is running at 1MHz and a cable compensation circuit is implemented on the data input allowing the full clock speed to be run over cable lengths up to 100m. To achieve reliable operation at longer cable lengths it is essential to fit a 120Ω resistor at the receiving end of each line, i.e. the resistor should be fitted at the encoder end of the clock and at the controller end of the data. The cable selected should be matched to the 120Ω terminating impedance and be of sufficient gauge to minimise voltage drops on the 5V and 0V connections.

5. Software Configuration

To use a BiSS encoder the ATYPE and ENCODER_BITS axis parameters need to be correctly set for each axis.

ATYPE	Description
92	BiSS absolute encoder with servo control
93	BiSS absolute encoder input

ENCODER_BITS		
Bits	**Value**	**Function**
Bits 0-5	0-32	Number of bits of data to be clocked out of the encoder
Bit 6	64	0 = Gray Code data from encoder (Default) 64 = Binary data from encoder
Bit 7	128	0 = No data inversion (Default) 128 = Data from encoder is iinverted

5.1. Example configuration for Renishaw Resolute Encoder with BiSS Interface

Assume a 32bit linear Renishaw Resolute encoder connected to axis 4:

```
'Clear the current axis type
ATYPE AXIS(4)=0
'Clear any previous setting and disables encoder
ENCODER_BITS AXIS(4)=0
'Set to 32 bits, Binary data
ENCODER_BITS AXIS(4)=64+32
'BiSS Encoder Input (92 = BiSS Servo)
ATYPE AXIS(4)=93
'Short delay to allow encoder to initialise and return valid data
WA(10)
```

5.2. Position and Error Reporting

The encoder position can be checked using the ENCODER axis parameter, which will return the raw encoder position. MPOS will also return the encoder position but this will be modified by the settings of the REP_DIST and REP_OPTION axis parameters. If used with ATYPE=92, in servo mode, the encoder value is used for servo control in the same way as any other supported encoder type.

Encoder errors are indicated through the AXISSTATUS axis parameter. Two bits are used to indicate an error and a warning condition. In event of an error will all motion will also be stopped.

AXISSTATUS		
Bits	**Value**	**Function**
Bit 2	4	BiSS Encoder Error: • Encoder flagged last data as unreliable • Encoder over temperature • CRC check on received data failed
Bit 22	4194304	BiSS Encoder Warning: • Encoder scale or read head need cleaning on Resolute encoders