



Galil Motion Control, Inc. Special Agreement Rev 2.0

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Quote Date: August 16, 2010
Short Description: BiSS for DMC-40x0

NRE #: 3470
NRE Price: \$0
Cost per Unit: \$200
Cancellation Fee*: Up to 100% of NRE
Lead Time: 2 weeks
Controller: DMC-4080-I200-I200

Description

The DMC-4080 hardware and firmware will be modified to support a BiSS encoder interface for axes A-D, and an SSI interface for axes E-H.

Pinout/Hardware Information

ICM-42200 Encoder 26 pin HD D-Sub Connector (Female) (Axis A-D)

Pin #	Label	Description	Pin #	Label	Description
1	RES	Reserved	14	FLS	Forward Limit Switch Input
2	AEN	Amplifier Enable	15	AB+	B+ Aux Encoder Input / BiSS Data+ ²
3	DIR	Direction	16	MI-	I- Index Pulse Input
4	HOM	Home	17	MB+	B+ Main Encoder Input
5	LSCOM	Limit Switch Common	18	GND	Digital Ground
6	AA-	A- Aux Encoder Input / BiSS Clock- ¹	19	MCMD	Motor Command
7	MI+	I+ Index Pulse Input	20	ENBL+	Amp Enable Power
8	MA-	A- Main Encoder Input	21	RES	Reserved
9	+5V	+5V	22	RLS	Reverse Limit Switch Input
10	GND	Digital Ground	23	AB-	B- Aux Encoder Input / BiSS Data- ²
11	ENBL-	Amp Enable Return	24	AA+	A+ Aux Encoder Input/ BiSS Clock+ ¹
12	RES	Reserved	25	MB-	B- Main Encoder Input
13	STP	PWM/Step	26	MA+	A+ Main Encoder Input

- 1 Clock +/- is the clock output from the Galil to the BiSS encoder. Often this is referenced as MA+/- for BiSS encoder documentation.
- 2 Data+/- is the data output from the BiSS encoder to the Galil. Often this is referenced as SLO+/- for BiSS encoder documentation.

ICM-42200 Encoder 26 pin HD D-Sub Connector (Female) (Axis E-H)

Pin #	Label	Description	Pin #	Label	Description
1	RES	Reserved	14	FLS	Forward Limit Switch Input
2	AEN	Amplifier Enable	15	AB+	B+ Aux Encoder Input / SSI Data+
3	DIR	Direction	16	MI-	I- Index Pulse Input
4	HOM	Home	17	MB+	B+ Main Encoder Input
5	LSCOM	Limit Switch Common	18	GND	Digital Ground
6	AA-	A- Aux Encoder Input / SSI Clock-	19	MCMD	Motor Command
7	MI+	I+ Index Pulse Input	20	ENBL+	Amp Enable Power
8	MA-	A- Main Encoder Input	21	RES	Reserved
9	+5V	+5V	22	RLS	Reverse Limit Switch Input
10	GND	Digital Ground	23	AB-	B- Aux Encoder Input / SSI Data-
11	ENBL-	Amp Enable Return	24	AA+	A+ Aux Encoder Input/ SSI Clock+
12	RES	Reserved	25	MB-	B- Main Encoder Input
13	STP	PWM/Step	26	MA+	A+ Main Encoder Input

Command Information

SS	Syntax:	Explicit Notation Only
	Operands:	SSn
	Burn:	burnable with BN
Configure the special Galil BiSS feature		

Full Description

BiSS is an open source digital interface for sensors and actuators. BiSS is hardware compatible to the industrial standard SSI (Serial Synchronous Interface). It allows serial transmission of absolute position data from BiSS encoders based on a master clock signal from the controller.

Communication between the controller and encoder is based on two signal lines, clock (MA) and data (SLO), which are differential for increased noise immunity and transmission length.

The standard Galil BiSS implementation is C-mode (unidirectional). Contact Galil for other modes.

Arguments

SSn = ss0, ss1, ss2, ss3 < p

where

n = The axis designator (XYZ or W or ABCDEFG or H). Each axis must be set individually.

ss0 = 0 is for NO BiSS, 1 is for BiSS to replace MAIN encoder data (TP). 2 is for BiSS to replace AUX encoder data (TD).

ss1 = number of single-turn bits. A positive number designates true, absolute, single-turn decoding. A

negative number will cause the controller to internally simulate a multi-turn encoder by counting past the single-turn max/min. This is typically used for a rotary, single-turn encoder to prevent an instantaneous change in position error when the single-turn bits roll over. When the controller loses power, the internal multi-turn state is lost.

ss2 = number of bits before E (error bit). This includes multi-turn bits + single-turn bits + zero padding bits. See Table 1.

ss3 = number of zero padding bits after single turn data and before error bit. See Table 1.

p = clock frequency argument. See Table 2.

SSn=? Returns the configuration parameters

Table 1. SS Example for Hengstler 12 bit MT 10 bit ST

Bit sequence:	T-2	T-1 (Delay)	T0	T1... T12	T13... T22	T23... T26	T27	T28	T29... T34	T35
Data (Data/SLO line):	1	0	1	M11... M0	S9... S0	0	E	W	C5... C0	MCD
Data Description:	Idle	Encoder acquiring	Start Bit	Multi-turn data	Single-turn data	Zero padding	Error Bit	Warning Bit	CRC	Multi-Cycle Data
SS command details:	-	-	-	-	ss1=10	ss3=4	ss2=26, E bit read in _SSn	W read in _SSn	CRC valid bit read in _SSn	Ignored by default

'BiSS setup command for the Hengstler 12 bit MT 10 bit ST

'Data will be available in TP and for servo feedback

SSA=1,10,26,4<13

BiSS clock (MA) frequency is set with the p argument and has the following form:

MA freq= 20 MHz / (2 * (p+1))

20 MHz frequency is hardware dependent with a range of 18Mhz to 26Mhz. Contact Galil if tolerances must be tighter for a particular application (this is rare).

Table 2. Popular Master Clock Frequencies (MA)

p argument	Clock Frequency (kHz)
4	2000
8	1111
10	909
12	769
13	714
24	400
26	370

Operands

_SSn Returns 4 bits of axis status data where n is the axis ABCDEFG or H.

SSn Bit Map

Bit Position	Description
0	Multi-turn
1	CRC valid = 0, invalid = 1
2	Warning bit
3	Alarm bit

Note: To verify the integrity of the _SSn bits, ensure that TC1 does not return "140 serial encoder missing". 140 supersedes the _SSn bits as it indicates that an encoder is not available for BiSS transactions.

Usage

Usage and Default Details

Usage	Value
While Moving	No
In a Program	Yes
Command Line	Yes
Default Value	SSn=0

Related Commands

TP - Tell Position

TD - Tell Dual Encoder

SI - Configure the special Galil SSI feature

Examples

```
'Configuration for 26 bit Renishaw Resolute single-turn encoder
SSA=1,26,27,0<20
'The 27 includes the Resolute single leading zero bit
'Configuration for 36 bit Hengstler multi-turn encoder
'19 bits single turn, 12 bits multi turn, 5 zero padding bits
SSB=1,19,36,5<14
```

SI	Syntax:	Explicit Notation Only
	Operands:	none
	Burn:	burnable with BN
Configure the special Galil SSI feature		

Full Description

Synchronous Serial Interface (SSI) allows for serial transmission of absolute position data (either binary or Gray code) from the encoder based on a timed clock pulse train from the controller. Connection between the controller and encoder is based on two signal lines, clock and data, which are usually differential for increased noise immunity. For each sequential clock pulse of the controller, the encoder transmits one data bit from shift registers on the encoder.

There are two items required when connecting an SSI encoder to a DMC-40x0: special SSI firmware and the controller -SSI option.

Arguments

SIn = si0, si1, si2, si3 <p>q

where

n = The axis designator (XYZW or ABCDEFGH). Each axis must be set individually

si0 = 0 is for NO SSI, 1 is for SSI to replace MAIN encoder data. 2 is for SSI to replace AUX encoder data

si1 = Total # of Bits of SSI. A positive number designates No Rollover. A negative number will cause the controller to act as an incremental encoder, allowing the encoder to count past the max value of the

encoder. (Note: when the controller is powered down, the rollover values are lost)

si2 = # of Single Turn Bits

si3 = # of Status Bits (ie: Error Bits)

Positive # designates status bits as trailing the SSI data

Negative # designates status bits as leading the SSI data

p is an integer in the range of 4-26 and indicates the clock frequency given the following formula

SSI Clock Freq = CLK / 2^(p-1)

CLK = 20Mhz

q = 1 For Binary encoding, 2 for Gray Code

SIn=? Returns the configuration parameters (where n is the axis)

See Application Note 2438 for more information, and a Clock frequency table.

Usage

Usage and Default Details

Usage	Value
While Moving	No
In a Program	Yes
Command Line	Yes
Default Value	SIn=0

SSI Hardware Upgrade Required

Related Commands

TP - Tell Position

TD - Tell Dual Encoder

SS - Configure the special Galil BiSS feature

DF - Dual Feedback (DV feedback swap)

Examples

```
SIA=1,25,25,0<10>1;' Encoder on axis A replaces main encoder (TP), 25  
bits total, all single turn, no status  
SIA=0;' Disable SSI on axis A
```

NRE Price and Lead Time is valid for 30 days after Quote Date.

Thank you for allowing Galil Motion Control, Inc. the opportunity to serve your needs.

Andy Herum

Authorized Employee

Galil Applications Engineer

Name (print): _____

X _____

X _____

Date: _____

Date: _____

*A cancellation fee will be charged if special is cancelled after a PO is placed.