BiSS Interface

BP1: STANDARD ROTARY ENCODER

preliminary

FEATURES

- Grouping of rotary encoder
- Compatibility within a group
- Standardized data format
- Simple control configuration

APPLICATIONS

- Fast and simple motion controller configuration
- Intelligent absolute rotary encoder

DESCRIPTION

The *BiSS* standard rotary encoder profile defines a standardized interface configuration set for encoders and their identification.

An absolute encoder is a sensor that detects the angular position of a rotary axis and supplies the position as a measurement. The sensor needs to be able to measure even after a loss of energy supply and a moved axis.

The *BiSS* standard rotary encoder profile is only standardized for *BiSS* C encoders.

The *BiSS* interface is primary used for communication of measurement and control information between sensors, actuators and control. The specification (see *BiSS* C protocol description) defines the enviroment of data exchange without limiting any data lengths and content. This permits powerful, flexible and cost efficient solutions that are required by the automation industry. Whithin the XML file extensive device attributes are described. The two bytes of the standard rotary encoder profile identification refer to the basic configuration of the communication protocol.

With the definition of an application specific profile, using a standardized communication, it is possible to communicate idenitcally and manufacturerindependendly with devices. It defines the data channel parameter and the device attributes. This information does not need to be stored in a general format like it is used in an electronic data sheet, so it is easier to implement on the control side.

CLASSIFICATION

Absolute encoders separate into two groups:

- **Multiturn encoder**
  are capable to capture complete revolutions.
- **Singleturn encoder**
  are not capable to capture complete revolutions.

Depending on the resolution this profile classifies:

- **1 . . . 12 bit**
- **13 . . . 24 bit**
- **25 . . . 31 bit**

BiSS PROFILE IDENTIFICATION

To define a flexible standard with the "*BiSS* Standard Rotary Encoder Profile", this classification is applied with. For profile identification 2 bytes are provided on register adress 0x42 and 0x43 as are ***BiSS* Profile Identification** .

The measurement data transfered with the *BiSS* interface is assembled with the number of complete revolutions (multiturn) and the angular information within a revolution (singleturn) and additional information about error and warning. The name of the profile variant is defined by the portion of multiturn and singleturn data length (e.g. 12-24).

Multiturn
The data length of multiturn is 24 bit or 12 bit (0 bit for singleturn encoder). Does the encoder use a different bit count, the measurement value is placed right-aligned and filled with "0".

Singleturn
The data length of singleturn is 24 bit or 12 bit. Does the encoder use a different bit count, the measurement value is placed right-aligned and filled with "0". Resolutions exceeding 24 bit use the actual data length. This is the "24++" variant.

Error and warning
Modern encoder monitor the enviromental changes and error. Typical examples are for instance: monitoring aging LED attributes or monitoring angular values to plausibility. Both bits are transmitted low active, error and warning are indicated with "0". The measurement is considered vaild with warning and void with error.

CRC
To increase the transmission safety a CRC is extending the data. The CRC value is generated with the start value "0" and the generator polynomial $X^6 + X^1 + X^0$ and the bits are transfered inverted. The data length (containing data, error and warning bits) does not exceed a maximum length of 57 bit. The transfered data (measurement data + CRC) carry a hamming distance of 3 and permit a 2-bit-error detection and a 1-bit-error correction.

The sequence of the data is multiturn, singleturn, error, warning and CRC and is transfered completely within a single cycle. Furhter measurement values e.g. revolution speed, accelleration or temperature are not covered with this profile. They can be transfered with separate data channels and individual profiles. This profile does also not cover incremental encoder nor encoder with safety features.

DEFINITIONS

MT	**Multiturn data** 0, 12 or 24 bit, right aligned, unused bits are set to "0"
ST	**Singleturn data** 0, 12 or 24 bit . . . 31 bit, left-aligned, unused bits are set to "0"
R_MT	**Multiturn resolution** 1 to 24 bit, available multiturn information (without fill bits)
R_ST	**Singleturn resolution** 1 to 31 bit, available singleturn information (without fill bits)
DL_MT	**Multiturn data length** 0, 12 to 24 bit
DL_ST	**Singleturn data length** 0, 12 to 24 . . . 31 bit
nE	**Error bit** 1 bit, inverted transmissionposition data is void on error
nW	**Warning bit** 1 bit, inverted transmissionposition data is valid on warning
DL	**Data length** DL_MT + DL_ST + 2 , total data length of the data channel

DATA CHANNEL PARAMETER

The data channel parameter need to be set for the configuration of the *BiSS* master.

Data transfer direction and type	SCDS (Single Cycle Data Sensor)
Bit count	DL_MT + DL_ST + 2
Processing time	Defined in the EDS (see *BiSS Interface* - Electronic Data Sheet Definition)
Data alignment	Left aligned
CRC polynomial	$X^6 + X^1 + X^0$ = 0x43
CRC start value	0x00

DATA FORMAT

The following variants are standard applications with maximum singleturn resolutions up to 24 bit. The data length is determined by the bits 3 and 2 in adress 0x42. The multiturn resolution is defined by the bits 1 and 0 in adress 0x42 and the bits 7 to 5 in adress 0x43. The single turn resolution results from the bits 4 to 0 in adress 0x43 (see examples).

Variant 24-24

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	0	0	M	M	M	M	M	S	S	S	S	S	
Data Format	MT(24)								ST(24)								nE(1)	nW(1)	CRC(6)

R_MT = MMMMM, DL_MT = 24
R_ST = SSSSS, DL_ST = 24

Variant 12-24

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	0	1	0	M	M	M	M	S	S	S	S	S	
Data Format	MT(12)								ST(24)								nE(1)	nW(1)	CRC(6)

R_MT = MMMM, MTDL = 12
R_ST = SSSSS, DL_ST = 24

Variant 24-12

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	0	1	M	M	M	M	M	0	S	S	S	S	
Data Format	MT(24)								ST(12)								nE(1)	nW(1)	CRC(6)

R_MT = MMMMM, DL_MT = 24
R_ST = SSSS, DL_ST = 12

Variant 0-24

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	1	0	0	0	0	0	0	S	S	S	S	S	
Data Format	ST(24)								nE(1)								nW(1)	CRC(6)	

R_ST = SSSSS, DL_ST = 24

Variant 12-12

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	1	0	0	M	M	M	M	0	S	S	S	S	
Data Format	MT(12)								ST(12)								nE(1)	nW(1)	CRC(6)

R_MT = MMMM, DL_MT = 12
R_ST = SSSS, DL_ST = 12

Variant 24-0

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	1	0	M	M	M	M	M	0	0	0	0	0	
Data Format	MT(24)								nE(1)								nW(1)	CRC(6)	

R_MT = MMMMM, DL_MT = 24

Variant 0-12

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	1	1	0	0	0	0	0	0	S	S	S	S	
Data Format	ST(12)								nE(1)								nW(1)	CRC(6)	

R_ST = SSSS, DL_ST = 12

Variant 12-0

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	1	1	0	M	M	M	M	0	0	0	0	0	
Data Format	MT(12)								nE(1)								nW(1)	CRC(6)	

R_MT = MMMM, DL_MT = 12

The following variants are used for special applications with single turn resolutions bigger than 24 bit. Differing to the first variants the data length results from the bits 3 and 2 in adress 0x42 plus the bits 2 to 0 in adress 0x43.

Variant 24-24++

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	0	0	M	M	M	M	M	S	S	S	S	S	R_MT = MMMMM, DL_MT = 24
Data Format	MT(24)						ST(DL_ST)		nE(1)		nW(1)		CRC(6)				R_ST = DL_ST = SSSSS

Variant 12-24++

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	0	1	0	M	M	M	M	S	S	S	S	S	R_MT = MMMM, DL_MT = 12
Data Format	MT(12)						ST(DL_ST)		nE(1)		nW(1)		CRC(6)				R_ST = DL_ST = SSSSS

Variant 0-24++

	Adr. 0x42								Adr. 0x43								
Electrical Identifier	0	0	1	0	1	0	0	0	0	0	0	S	S	S	S	S	
Data Format	ST(DL_ST)						nE(1)		nW(1)		CRC(6)						R_ST = DL_ST = SSSSS

CALCULATION OF DATA LENGTHS

Calculation of DL (DataLength)

```
if ((REG[66] & 0xF0) == 0x20) {
  DL = 12 * (4 - ((REG[66] & 0x0C) >> 2)) + 2;
  if ((REG[67] & 0x1F) >= 0x018) {
    DL += (REG[67] & 0x07);
  }
}
```

Calculation of R_ST and R_MT (single- and multiturn resolutions)

```
if ((REG[66] & 0xF0) == 0x20) {
  R_ST = REG[67] & 0x1F;
  R_MT = ((REG[66] & 0x03) << 3) +
         ((REG[67] & 0xE0) >> 5);
}
```

ELECTRONIC DATA SHEET DEFINITION BP1

The profile EDS contains, depending on the *BiSS* profile, required information about data transmission, product and process relevant information for the motion control system. Hereto belong mechanica data, accuracy, structure of position words and product attributes. The specification of the first part of the EDS, the *BiSS* EDS (common) part, is located in the applied *BiSS* EDS (common part) document.

Adr.	Symbol	Description	Group	Format	Unit	Values
0x00	BP_VER	Version	Orga	U8	-	1 . . . 254
0x01	BP_LEN	Length of this profile	Orga	U8	Banks	1 . . . 254
0x02 0x03	BP_ID	Profile ID BP1 (same content in adresses 0x42 and 0x43)	Orga	U8 U8	- -	1 . . . 254 1 . . . 254
0x04	FB1	Feedback bit 1 = error = 1	Orga	U8	Table B	1
0x05	FB2	Feedback bit 2 = warning = 2	Orga	U8	Table B	2
0x06	PON_PDL	Maximum power on delay until process data available	Timing	U8	ms	1 . . . 254
0x07		Reserved	Prot	U8	-	0
0x08	EN_TYP	Encoder type = rotary = 0	Orga	U8	Table T	0
0x09	POS_NUM	Position value = position value 1 = 0	Safety	U8	Table N	0
0x0A	MT_LEN	Data length MULTITURN (0, 12, 24 bit)	Orga	U8	bit	0 . . . 24
0x0B	MT_FMT	Data format MULTITURN = right aligned = 0	Meas	U8	Table F	0
0x0C	CO_LEN	Data length COARSE (0, 12, 24, . . . 31 bit)	Orga	U8	bit	0 . . . 31
0x0D	CO_FMT	Data format COARSE = left aligned = 1	Meas	U8	Table F	1
0x0E	FI_LEN	Data length FINE = not used = 0	Orga	U8	bit	0 . . . 31
0x0F	FI_FMT	Data format FINE = not used = 1	Meas	U8	Table F	1
0x10 0x11 0x12 0x13	MT_CNT	Number of distinguishable revolutions / multi turn	Meas	U32[1]	-	1 . . . 2^{32}-2
0x14 0x15 0x16 0x17	SIP_CNT	Number of signal periods per revolution / length of a signal period	Meas	U32[1]	PPR (rotary) nm (linear)	1 . . . 2^{32}-2
0x18 0x19 0x1A 0x1B	SIP_RES	Resolution per signal period (LSB of interpolation)	Meas	U32[1]	bit	1 . . . 2^{32}-2
0x1C 0x1D 0x1E 0x1F	CPOLY	CRC polynome (32:1) [3] = $X^6 + X^1 + X^0$ = 0x43(32:1) = 0x21 [3]	Orga	U32[1]	-	0x00 0x00 0x00 0x21
0x20 0x21 0x22 0x23	CSTART	CRC start value = 0	Orga	U32[1]	-	0x00 0x00 0x00 0x00

0x24 0x25	ABS_ACU	Absolute accuracy	Meas	U16[1]	LSB/2	1 . . . 2^{16}-2
0x26 0x27	REL_ACU	Relative accuracy	Meas	U16[1]	LSB/2	1 . . . 2^{16}-2
0x28 0x29	SPD_ACU	Accuracy depending on rotational speed	Meas	U16[1]	LSB/2	1 . . . 2^{16}-2
0x2A 0x2B	HYST	Hysteresis	Meas	U16[1]	LSB/2	1 . . . 2^{16}-2
0x2C 0x2D	SPD_MAX	Maximum rotational speed / maximum speed	Mech	U16[1]	1/min m/min	1 . . . 2^{16}-2
0x2E 0x2F	ACC_MAX	Maximum angular acceleration / maximum acceleration	Mech	U16[1]	$1/min^2$ m/min^2	1 . . . 2^{16}-2
0x30 0x31	TMP_MIN	Minimum operating temperature	Mech	U16[1]	K	1 . . . 2^{16}-2
0x32 0x33	TMP_MAX	Maximum operating temperature	Mech	U16[1]	K	1 . . . 2^{16}-2
0x34 0x35	VLT_MIN	Minimum supply voltage	Elec	U16[1]	mV	1 . . . 2^{16}-2
0x36 0x37	VLT_MAX	Maximum supply voltage	Elec	U16[1]	mV	1 . . . 2^{16}-2
0x38 0x39	CUR_MAX	Maximum supply current	Elec	U16[1]	mA	1 . . . 2^{16}-2
0x3A		Reserved	Prot	U8	-	0
0x3B		Reserved	Prot	U8	-	0
0x3C		Reserved	Prot	U8	-	0
0x3D		Reserved	Prot	U8	-	0
0x3E		Reserved	Prot	U8	-	0
0x3F	CHKSUM	Check sum (additon of all bytes in this bank)	Orga	U8	-	0x

Table 4: EDS adress mapping for BP1

[1)] The U16 and U32 values are saved as a Big Endian, i.e. with the highest-value byte at the lowest-value address.
[3)] The CRC polynome is stored as a bit pattern (32:1). The ”least significant” bit of the CRC polynome is -on active CRC verification- always 1 and is not stored. So that a CRC check sum with a maximul length of 32 bit is possible. On a deactivated CRC verification the CRC polynome 0x00000000 is used.

Table B	Addr. . . . ; bit . . .	R
0x00	Not present	
0x01	Error bit	
0x02	Warning bit	

Table 5: Bit Function Of Feedback Bits

Table F	Addr. . . . ; bit . . .	R
0x00	Right aligned	
0x01	Left aligned	

Table 6: Data Format

Table T	Addr. . . . ; bit . . .	R
0x00	Angular encoder	
0x01	Linear encoder	

Table 7: Encoder Type

Table N	Addr. . . . ; bit . . .	R
0x00	Position value number not defined	
0x01	Position value 1	
0x02	Position value 2	

Table 8: Position Value Number

EXAMPLE I: 12-24

Multiturn Encoder
This example of a multiturn encoder uses 8 bit multiturn and 17 bit singleturn. The variant 12-24 is applied.

The multiturn component is extended on the left by 4 zero bits. The singleturn component is extended on the right by 7 zero bits. The total data length is 38 bit.

Data format: POS(36) + nE(1) + nW(1) + CRC(6)

DL_MT = 12 bit
R_MT = 8 bit = 0b1000, due to right aligned the unused leftmost bits are filled with ”0”.

DL_ST = 24 Bit
R_ST = 17 Bit = 0b10001, due to left aligned the unused rightmost bits are filled with ”0”.

Separated into 11 bit COARSE as match to the 2048 signal periods and 6 bit FINE for the matching 64 interpolation steps each signal period.

The master does verify the CRC and transfers only the received data without CRC.

BiSS Profile Idenitifier

***BiSS* PROFILE IDENTIFIER**								
Addr	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x42	0	0	1	0	0	1	0	R_MT(3) 1
0x43	R_MT(2) 0	R_MT(1) 0	R_MT(0) 0	R_ST(4) 1	R_ST(3) 0	R_ST(2) 0	R_ST(1) 0	R_ST(0) 1

Table 9: Register layout

BiSS EDS BP1

Adr.	Symbol	Description	Group	Format	Unit	Values
0x00	BP_VER	Version	Orga	U8	-	1
0x01	BP_LEN	Length of this profile	Orga	U8	Banks	1
0x02 0x03	BP_ID	Profile ID BP1 (same content in adresses 0x42 and 0x43)	Orga	U8 U8	- -	0x25 0x11
0x04	FB1	Feedback bit 1 = error nE = 1	Orga	U8	Table B	1
0x05	FB2	Feedback bit 2 = warning nW = 2	Orga	U8	Table B	2
0x06	PON_PDL	Maximum power on delay until process data available	Timing	U8	ms	10
0x07		Reserved	Prot	U8	-	0
0x08	EN_TYP	Encoder type = rotary = 0	Orga	U8	Table T	0
0x09	POS_NUM	Position value = position value 1 = 0	Safety	U8	Table N	0
0x0A	MT_LEN	Data length MULTITURN 12 bit	Orga	U8	bit	12
0x0B	MT_FMT	Data format MULTITURN = right aligned = 0	Meas	U8	Table F	0
0x0C	CO_LEN	Data length COARSE = 11 bit	Orga	U8	bit	11
0x0D	CO_FMT	Data format COARSE = left aligned = 1	Meas	U8	Table F	1
0x0E	FI_LEN	Data length FINE = 6 bit	Orga	U8	bit	6
0x0F	FI_FMT	Data format FINE = left aligned = 1	Meas	U8	Table F	1
0x10 0x11 0x12 0x13	MT_CNT	Number of distinguishable revolutions = 256	Meas	U32[1]	-	0x00 0x00 0x01 0x00
0x14 0x15 0x16 0x17	SIP_CNT	2048 signal periods per revolution	Meas	U32[1]	PPR (rotary)	0x00 0x00 0x08 0x00
0x18 0x19 0x1A 0x1B	SIP_RES	6 bit resolution per signal period (LSB of interpolation)	Meas	U32[1]	bit	0x00 0x00 0x00 0x20
0x1C 0x1D 0x1E 0x1F	CPOLY	CRC polynome = $X^6 + X^1 + X^0$ = 0x43(32:1) = 0x21	Orga	U32[1]	-	0x00 0x00 0x00 0x21
0x20 0x21 0x22 0x23	CSTART	CRC start value = 0	Orga	U32[1]	-	0x00 0x00 0x00 0x00
0x24 0x25	ABS_ACU	Absolute accuracy	Meas	U16[1]	LSB/2	0x00 0x08

0x26 0x27	REL_ACU	Relative accuracy	Meas	U16[1]	LSB/2	0x00 0x06
0x28 0x29	SPD_ACU	Accuracy depending on rotational speed	Meas	U16[1]	LSB/2	0x00 0x0C
0x2A 0x2B	HYST	Hysteresis	Meas	U16[1]	LSB/2	0x00 0x04
0x2C 0x2D	SPD_MAX	Maximum rotational speed	Mech	U16[1]	1/min m/min	0x17 0x70
0x2E 0x2F	ACC_MAX	Maximum angular acceleration	Mech	U16[1]	1/min^2 m/min^2	0x09 0xC4
0x30 0x31	TMP_MIN	Minimum operating temperature -10 °C = 263 °K	Mech	U16[1]	K	0x01 0x07
0x32 0x33	TMP_MAX	Maximum operating temperature +85 °C = 358 °K	Mech	U16[1]	K	0x01 0x66
0x34 0x35	VLT_MIN	Minimum supply voltage 9 V	Elec	U16[1]	mV	0x23 0x28
0x36 0x37	VLT_MAX	Maximum supply voltage 30 V	Elec	U16[1]	mV	0x75 0x30
0x38 0x39	CUR_MAX	Maximum supply current 250 mA	Elec	U16[1]	mA	0x00 0xFA
0x3A		Reserved	Prot	U8	-	0
0x3B		Reserved	Prot	U8	-	0
0x3C		Reserved	Prot	U8	-	0
0x3D		Reserved	Prot	U8	-	0
0x3E		Reserved	Prot	U8	-	0
0x3F	CHKSUM	Check sum (additon of all bytes in this bank)	Orga	U8	-	0x

Table 11: EDS for BP1 12-24

[1)] The U16 and U32 values are saved as a Big Endian, i.e. with the highest-value byte at the lowest-value address.

EXAMPLE II: 0-12

Singleturn encoder
Example for a typical singleturn encoder configuration. The device uses the Variant 0-12 and has a data length of 14 bit.

	Adr. 0x42								Adr. 0x43							
Electrical Identifier	0	0	1	0	1	1	0	0	0	0	0	0	1	1	0	0

Data Format	ST(11:0)	nE	nW	CRC(5:0)

Data format: POS(12) + nE(1) + nW(1) + CRC(6)

DL_MT = 0 bit
R_MT = 0 bit = 0b0000.

DL_ST = 12 bit
R_ST = 12 bit = 0b01100.
Partitioned into 0 bit COARSE at one 1 signal periode and 12 bit FINE at 4096 interpolation steps each signal periode.

The master does verify the CRC and transfers only the received data without CRC.

BiSS Profile Idenitifier

***BiSS* PROFILE IDENTIFIER**								
Addr	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x42	0	0	1	0	1	1	0	0
0x43	R_MT(2) 0	R_MT(1) 0	R_MT(0) 0	R_ST(4) 0	R_ST(3) 1	R_ST(2) 1	R_ST(1) 0	R_ST(0) 0

Table 12: Register layout

BiSS EDS BP1

Adr.	Symbol	Description	Group	Format	Unit	Values
0x00	BP_VER	Version	Orga	U8	-	1
0x01	BP_LEN	Length of this profile	Orga	U8	Banks	1
0x02 0x03	BP_ID	Profile ID BP1 (same content in adresses 0x42 and 0x43)	Orga	U8 U8	- -	0x2C 0x0C
0x04	FB1	Feedback bit 1 = error nE = 1	Orga	U8	Table B	1
0x05	FB2	Feedback bit 2 = warning nW = 2	Orga	U8	Table B	2
0x06	PON_PDL	Maximum power on delay until process data available	Timing	U8	ms	5
0x07		Reserved	Prot	U8	-	0
0x08	EN_TYP	Encoder type = rotary = 0	Orga	U8	Table T	0
0x09	POS_NUM	Position value = position value 1 = 0	Safety	U8	Table N	0
0x0A	MT_LEN	Data length MULTITURN = 0 bit	Orga	U8	bit	0
0x0B	MT_FMT	Data format MULTITURN = right aligned = 0	Meas	U8	Table F	0
0x0C	CO_LEN	Data length COARSE = 0 bit	Orga	U8	bit	0
0x0D	CO_FMT	Data format COARSE = left aligned = 1	Meas	U8	Table F	1
0x0E	FI_LEN	Data length FINE = 6 bit	Orga	U8	bit	12
0x0F	FI_FMT	Data format FINE = left aligned = 1	Meas	U8	Table F	1
0x10 0x11 0x12 0x13	MT_CNT	Number of distinguishable revolutions = 0	Meas	U32[1]	-	0x00 0x00 0x00 0x00
0x14 0x15 0x16 0x17	SIP_CNT	1 signal periods per revolution	Meas	U32[1]	PPR (rotary) nm (linear)	0x00 0x00 0x00 0x01
0x18 0x19 0x1A 0x1B	SIP_RES	12 bit resolution per signal period (LSB of interpolation)	Meas	U32[1]	bit	0x00 0x00 0x10 0x00
0x1C 0x1D 0x1E 0x1F	CPOLY	CRC polynome = $X^6 + X^1 + X^0$ = 0x43 (32:1) = 0x21	Orga	U32[1]	-	0x00 0x00 0x00 0x21
0x20 0x21 0x22 0x23	CSTART	CRC start value = 0	Orga	U32[1]	-	0x00 0x00 0x00 0x00
0x24 0x25	ABS_ACU	Absolute accuracy	Meas	U16[1]	LSB/2	0x00 0x06

0x26 0x27	REL_ACU	Relative accuracy	Meas	U16[1]	LSB/2	0x00 0x05
0x28 0x29	SPD_ACU	Accuracy depending on rotational speed	Meas	U16[1]	LSB/2	0x00 0x06
0x2A 0x2B	HYST	Hysteresis	Meas	U16[1]	LSB/2	0x00 0x02
0x2C 0x2D	SPD_MAX	Maximum rotational speed 60000 RPM	Mech	U16[1]	1/min m/min	0xEA 0x60
0x2E 0x2F	ACC_MAX	Maximum angular acceleration 40000 RPM^2	Mech	U16[1]	1/min^2 m/min^2	0x9C 0x40
0x30 0x31	TMP_MIN	Minimum operating temperature -40 °C = 233 °K	Mech	U16[1]	K	0x00 0xE9
0x32 0x33	TMP_MAX	Maximum operating temperature +115 °C = 388 °K	Mech	U16[1]	K	0x01 0x84
0x34 0x35	VLT_MIN	Minimum supply voltage 4.5 V	Elec	U16[1]	mV	0x11 0x94
0x36 0x37	VLT_MAX	Maximum supply voltage 5.5 V	Elec	U16[1]	mV	0x15 0x7C
0x38 0x39	CUR_MAX	Maximum supply current 50 mA	Elec	U16[1]	mA	0x00 0x32
0x3A		Reserved	Prot	U8	-	0
0x3B		Reserved	Prot	U8	-	0
0x3C		Reserved	Prot	U8	-	0
0x3D		Reserved	Prot	U8	-	0
0x3E		Reserved	Prot	U8	-	0
0x3F	CHKSUM	Check sum (additon of all bytes in this bank)	Orga	U8	-	0x

Table 14: EDS for BP1 0-12

[1)] The U16 and U32 values are saved as a Big Endian, i.e. with the highest-value byte at the lowest-value address.

EXAMPLE III: 24-24++

Multiturn Encoder with extended singleturn
For this encoder with 24 bit multiturn and 26 bit singleturn the Variant 24-24++ is applied.

	Adr. 0x42								Adr. 0x43							
Electrical Identifier	0	0	1	0	0	0	1	1	0	0	0	1	1	0	1	0

Data Format					
MT(23:0)	ST(25:0)	nE	nW	CRC(5:0)

The total data length is 52 bit.

Data format: POS(50) + nE(1) + nW(1) + CRC(6)

DL_MT = 24 Bit
R_MT = 24 Bit = 0b11000.

DL_ST = 26 Bit
R_ST = 26 Bit.

Partitioned into 13 bit COARSE at one 8192 signal periods and 13 bit FINE at 8192 interpolation steps each signal periode.

The master does verify the CRC and transfers only the received data without CRC.

BiSS Profile Idenitifier

***BiSS* PROFILE IDENTIFIER**								
Addr	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x42	0	0	1	0	0	0	R_MT(4) 1	R_MT(3) 1
0x43	R_MT(2) 0	R_MT(1) 0	R_MT(0) 0	R_ST(4) 1	R_ST(3) 1	R_ST(2) 0	R_ST(1) 1	R_ST(0) 0

Table 15: Register layout

BiSS EDS BP1

Adr.	Symbol	Description	Group	Format	Unit	Values
0x00	BP_VER	Version	Orga	U8	-	1
0x01	BP_LEN	Length of this profile	Orga	U8	Banks	1
0x02 0x03	BP_ID	Profile ID BP1 (same content in adresses 0x42 and 0x43)	Orga	U8 U8	- -	0x23 0x1A
0x04	FB1	Feedback bit 1 = error nE = 1	Orga	U8	Table B	1
0x05	FB2	Feedback bit 2 = warning nW = 2	Orga	U8	Table B	2
0x06	PON_PDL	Maximum power on delay until process data available	Timing	U8	ms	10
0x07		Reserved	Prot	U8	-	0
0x08	EN_TYP	Encoder type = rotary = 0	Orga	U8	Table T	0
0x09	POS_NUM	Position value = position value 1 = 0	Safety	U8	Table N	0
0x0A	MT_LEN	Data length MULTITURN = 24 bit	Orga	U8	bit	24
0x0B	MT_FMT	Data format MULTITURN = right aligned = 0	Meas	U8	Table F	0
0x0C	CO_LEN	Data length COARSE = 13 bit	Orga	U8	bit	13
0x0D	CO_FMT	Data format COARSE = left aligned = 1	Meas	U8	Table F	1
0x0E	FI_LEN	Data length FINE = 13 bit	Orga	U8	bit	13
0x0F	FI_FMT	Data format FINE = left aligned = 1	Meas	U8	Table F	1
0x10 0x11 0x12 0x13	MT_CNT	16777216 distinguishable revolutions	Meas	U32[1]	-	0x01 0x00 0x00 0x00
0x14 0x15 0x16 0x17	SIP_CNT	8192 signal periods per revolution	Meas	U32[1]	PPR (rotary)	0x00 0x00 0x02 0x00
0x18 0x19 0x1A 0x1B	SIP_RES	13 bit resolution per signal period (LSB of interpolation)	Meas	U32[1]	bit	0x00 0x00 0x02 0x00
0x1C 0x1D 0x1E 0x1F	CPOLY	CRC polynome = $X^6 + X^1 + X^0$ = 0x43(32:1) = 0x21	Orga	U32[1]	-	0x00 0x00 0x00 0x21
0x20 0x21 0x22 0x23	CSTART	CRC start value = 0	Orga	U32[1]	-	0x00 0x00 0x00 0x00
0x24 0x25	ABS_ACU	Absolute accuracy	Meas	U16[1]	LSB/2	0x00 0x08

0x26 0x27	REL_ACU	Relative accuracy	Meas	U16[1]	LSB/2	0x00 0x06
0x28 0x29	SPD_ACU	Accuracy depending on rotational speed	Meas	U16[1]	LSB/2	0x00 0x0C
0x2A 0x2B	HYST	Hysteresis	Meas	U16[1]	LSB/2	0x00 0x04
0x2C 0x2D	SPD_MAX	Maximum rotational speed / maximum speed	Mech	U16[1]	1/min m/min	0x17 0x70
0x2E 0x2F	ACC_MAX	Maximum angular acceleration / maximum acceleration	Mech	U16[1]	1/min^2 m/min^2	0x09 0xC4
0x30 0x31	TMP_MIN	Minimum operating temperature -10 °C = 263 °K	Mech	U16[1]	K	0x01 0x66
0x32 0x33	TMP_MAX	Maximum operating temperature +85 °C = 358 °K	Mech	U16[1]	K	0x01 0x66
0x34 0x35	VLT_MIN	Minimum supply voltage 9 V	Elec	U16[1]	mV	0x23 0x28
0x36 0x37	VLT_MAX	Maximum supply voltage 30 V	Elec	U16[1]	mV	0x75 0x30
0x38 0x39	CUR_MAX	Maximum supply current 250 mA	Elec	U16[1]	mA	0x00 0xFA
0x3A		Reserved	Prot	U8	-	0
0x3B		Reserved	Prot	U8	-	0
0x3C		Reserved	Prot	U8	-	0
0x3D		Reserved	Prot	U8	-	0
0x3E		Reserved	Prot	U8	-	0
0x3F	CHKSUM	Check sum (additon of all bytes in this bank)	Orga	U8	-	0x

Table 17: EDS adress mapping for BP1 24-24++

[1)] The U16 and U32 values are saved as a Big Endian, i.e. with the highest-value byte at the lowest-value address.

REVISION HISTORY

Rev	Memo	Seite	Details
A3			First release version
A4		7 7 9	CPOLY = 0x21 FBx: error(nE) = 1; warning(nW) = 2 Examples incl. EDS added

Table 19: Revision History