POSITAL

OPERATING INSTRUCTIONS – KIT ENCODERS WITH BISS C INTERFACE

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General safety information and general safety instructions

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Please Note!

Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by POSITAL for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained people.

- Switch off the supply voltage of all devices connected to the encoder before installation.
- Avoid an electrical supply voltage while connecting the encoder.
- Avoid exerting shocks on motor shaft and mounting flange to prevent the encoder from being mechanically damaged.
- Rotary machine shafts may catch hair and cloths and cause injury.
- Mount the encoder in an ESD-conform fashion, avoid high voltages, e.g. static electricity discharged from a human body.

- Consider the specifications of the encoder. The device must be operated in the specified range.
- Metal filings or metal dust must be kept away from kit encoder parts and also during the assembly process.

1. Product Overview

1.2. Product Description

With a combination of accuracy, reliability, robustness and cost efficiency POSITAL's magnetic kit encoders provide a unique variety of functionalities. An electrical resolution of up to 19 bit offers an accurate singleturn measurement. The multiturn range covers more than one million revolutions. A large temperature range between -40 °C and +105 °C makes the kit encoders applicable in lots of environmental conditions. The kit encoder components include an electronics package mounted on a compact PCB and a small permanent magnet, designed to be mounted on the end of a motor shaft. The electronics package includes a TMR sensor, a powerful 32 bit microprocessor and a rotation counter based on POSITAL's Wiegand energy harvesting system. The BiSS C interface enables a direct digital sensor data transmission and access to device and customer related register data, stored in the kit encoders internal memory.

The multiturn counting is realized by POSITAL's energy harvesting system, based on the Wiegand effect. At any revolution, a voltage pulse is generated, which triggers the increment of an internal multiturn counter. This Wiegand pulse counting requires no external energy source. Therefore, a backup battery or complex gear systems can be eliminated.

In contrast to optical encoders, the installation of POSITAL's magnetic kit encoders requires no clean room similar conditions and can be performed under normal factory conditions. The integrated electronic autocalibration function corrects position errors due to minor misalignments between motor shaft and electronics package and makes a manual alignment procedure obsolete. In addition, a software integrated Wiegand pulse test determines the performance of the multiturn counter system. The kit encoder's embedded software monitors the system and provides associated error codes, that are transmitted during normal sensor operation. Furthermore, status and error information can be read out from the memory register.

In this manual, an overview of our BiSS C kit encoder is presented. The electrical connection and characteristics of the device a brief description of the BiSS C protocol and an overview to the memory

allocation are presented in this document. Chapter 6 gives a description of the serial communication protocol UBICOM, which can be used for configuration purposes aside from BiSS C.

1.3. Intended Use

Kit encoders are designed for integration into motors such as servo, stepper, or BLDC motors. Typical applications are robotic systems, Cobots, AGVs, linear actuator, stepper and servo motors as well as mechanical engineering.

1.4. Key Product Specifications

Release Note

Version Date: 2024-02-15

Version Number: 1.0

Authors: DKI, KNE

Valid for

Kit Encoder Type	Firmware version
KTD-BC00B-XXXX-XXXX-JAQ	≥ 1.1.0

2. Installation

Check the Installation Instruction file.

3. Transporting, Handling and Storing the Product and/or the Components

Check the Installation Instruction file.

4. Original Equipment Manufacturer Settings

The BiSS C interface provides a communication connection between a master device, representing the motor control unit and its connected slave device, representing the kit encoder. The devices are connected in a point to point configuration, that only requires two unidirectional lines (clock and data) using differential signaling each. The slave device is synchronized by the clock signal (MA), generated by the master. Therefore, it receives the transferred clocks and passes on its generated signal to the slave output line (SLO), which is directly connected to the input line of the master. A detailed description of the protocol is presented by iC-Haus. For information about the BiSS interface, check this website.

4.1. Pneumatic, Hydraulic, Electrical and Vacuum Settings

Due to the limited number of 7 bits for addressing, the accessible memory is partitioned into two 64 byte sections. The first section is defined from address 0x00 to 0x3F and is called bank section. The content of these registers depends on the selected bank. The active bank is selected by the bank selection register (address 0x40). The second section is fixed and always directly accessible from address 0x40 to 0x7F, called direct register.

The kit encoder has 68 banks which are used e.g. for encoder functions, to save electronic datasheets (EDS Encoder Data, EDS Motor Data) and OEM data. Bank 0x00 and 0x01 are used to execute special encoder functions such as the Wiegand sensor test. Bank 0x02 and 0x03 contain the electronic datasheets (EDS). Banks 0x04 to 0x43 are empty upon delivery and can be used to save data for your own needs e.g. motor related data. A detailed overview of the registers and the register entries is provided in the Appendix.

4.2. Parameters

4.2.1. Registers Communication

By using register communication, the slave registers can be accessed. This allows the execution of the sensor calibration, the Wiegand sensor test and the query of status and device information. Therefore, the slave registers are accessed with their corresponding addresses. There are two ways to establish a register communication with the kit encoder (slave). The first option is to build up serial communication via the config pin using the UBICOM protocol. For the definition and further details on the UBICOM protocol. The second option is to use a communication device supporting BiSS C (BiSS C master), such as a BiSS reader.

4.2.2. Registers Accessing

Registers can be addressed by using the BiSS register communication. The direct registers (second section) can be addressed directly. To access a specific bank register, write the bank number to the bank select. The following **example** demonstrates the reading of the “Minimum BiSS timeout”, located in register 0x05 in bank 0x02 (EDS Encoder Data):

1. Select bank 2:
   Write value 0x02 to the bank select register 0x40 (direct register).
2. Read register 0x05. The read value contains the “Minimum BiSS timeout”.

egister (address 0x40).

Register Address	Size	Bank 0x00…0x01	Bank 0x02…0x03	Bank 0x04…0x23	Bank 0x24…0x43
0x00 … 0x3F	64 byte	**Special Encoder Functions**	**EDS Encoder Data**	**EDS Motor Data**	**OEM Data**
0x40 … 0x7F	64 byte	**Direct Registers**			

Figure 1. Register Map

4.3. Hardware and Software Features

4.3.1. Function Overview

The BiSS C kit encoder provides a set of additional features aside the actual angle measurement:

- Temperature Readout
- Singleturn Calibration
- Wiegand Sensor Test
- OEM Data Storage
- Electronic Datasheet (EDS)
- Encoder Configuration

- Preset Function
- Diagnostics

The features can be run directly by BiSS C register communication or by use of serial communication via the config pin using the UBICOM protocol.

The activation of a feature requires the activation of the corresponding device mode, except for the temperature readout. The change of the device mode is password secured. To enable the device mode configuration, the password “0x2A” must be written to register 0x6B. Next, the desired register value is written to the device mode register 0x6A.

Command Register	Register Address (direct)
Password register (password: 0x2A)	0x6B
Device mode register	0x6A

The following device modes are available:

Device Mode Register	Register Value
Operation mode	0x00
Calibration mode	0x01
Wiegand Sensor Test mode	0x02
OEM/EDS Motor Data Write	0x04
Encoder Configuration mode	0x05
Preset mode	0x07

Note:

- All listed device features perform write cycles in the flash memory. Due to flash endurance, 1000 write cycles should not be exceeded.
- The device must be set back to operation mode, after carrying out a feature.

4.3.2. Temperature Readout

The BiSS C kit encoder has an internal temperature sensor to monitor the encoder temperature. The measured temperature value T_{reg} is stored in the direct register 0x66. The register value T_{reg} can be converted to °C with equation:

$$T[°C] = T_{reg} - 50$$

and to °F with equation:

$$T[°F] = 1.8 * T[°C] + 32$$

The specifications of the integrated temperature sensor can be found in Table 1. Temperature Sensor Properties. A change of the device mode is not necessary for this encoder feature.

Attention: The sensor measures the encoder temperature and is not intended to substitute a motor temperature sensor!

No.	Register Address	Value	OP	Remark
1	0x66 (direct register)	Treg	R	Read-out temperature register.

Parameter	Symbol	Remark			
Interface	TSI	BiSS register entry, size: 8 bit			
Temperature Range	TSA	-40		150	°C

Table 1. Temperature Sensor Properties

4.3.3. Data Storage

The BiSS kit encoder offers the capability to access two different internal memory regions to store data: The EDS-Motor-Data and the Figure 2. Hardware Preset Diagram. The corresponding memory addresses are given in Table 2. Data Storage Overview. The accessibility of the specific memory depends on the access rights.

Memory	Start-Addr.	End-Addr.	Access	Remark
EDS Encoder Data	Bank 0x02	Bank 0x03	R	We support the BiSS Profile 3 as Standard Encoder Profile.
EDS-Motor-Data	Bank 0x04	Bank 0x23	R/W	2 Kbyte Motor Data: customer specific motor data
OEM-Data	Bank 0x24	Bank 0x43	R/W	2 Kbyte OEM Memory: open access for customer use

Table 2. Data Storage Overview

Writing the EDS-Motor-Data or OEM-Data is permitted by default. The written access is protected by a password. To write an EDS-Motor or OEM-Data register, carry out the following sequence:

No.	Register Address	Value	OP	Remark
1	0x6B (direct register)	0x2A	W	Unlock device mode configuration: Write password 0x2A to register.
2	0x6A (direct register)	0x04	W	Change the device mode to OEM / EDS Motor Data Write.
3	0x40 (direct register)	0x00	W	Select bank 0: Write value 0x00 to the bank selection register.
4	0x1B (bank 0)		R	Get write access: Read OEM / EDS-Motor Data Write status register until a value of 0x00 indicates permission to get write access to the EDS-Motor Data.
5	0x1A (bank 0)	0x01 or 0x02	W	Write the value to the OEM / EDS-Motor Data Write command register. 0x01: Access EDS-Motor Data 0x02: Access OEM-Data
6			W	Write data to the desired register, by using the BiSS register communication.
7	0x1B (bank 0)		R	Get save access: Read the OEM / EDS-Motor Data Write status register until a value of 0x01 indicates permission to get save access to the EDS-Motor Data.
8	0x1A (bank 0)	0x03	W	Write data to flash memory: Write the value 0x03 to the OEM / EDS-Motor Data Write command register. Encoder restarts (100ms).
9	0x1A (bank 0)	0x04	W	(Optional) Cancel write access: Write the value 0x04 to the OEM / EDS-Motor Data Write command register.

OEM / EDS-Motor Data Register	Register Address (bank 0)
Command register	0x1A
Status register	0x1B

OEM / EDS-Motor Data Command	Register Value
Get write access EDS-Motor Data	0x01
Get write access OEM-Data	0x02
Save data	0x03
Cancel write access	0x04

OEM / EDS-Motor Data Status Register	Register Value
Wait for write access	0x00
Wait for save command	0x01

Attention: Reading and writing data during motor operation is not allowed.

5. Operation

5.1. Encoder Configuration

The encoder can be adapted by the customer to better suit the individual application. Therefore, two parameters exist. The position filter selection and the BiSS Timeout time.

Register	Address	Value	Description
Filter Selection	0x6E (direct register)	0x02	Low Noise This filter provides position values with reduced dynamic performance, but decreased signal noise.
		0x03	Balanced (default) This filter provides a very well-balanced relation of signal noise and dynamic performance.
		0x04	Dynamic This filter provides position values with optimized dynamic performance, but increased signal noise.
BiSS Timeout	0x6D (direct register)	0x10… 0x0A	Set BiSS Timeout (unit = 250ns). Default value: 0x35 = 13,25µs.

Table 3. Encoder Configuration Registers

To change the encoder configuration, carry out the following sequence:

No.	Register Address	Value	OP	Remark
1	0x6B (direct register)	0x2A	W	Enable device mode configuration: Write password 0x2A to register.
2	0x6A (direct register)	0x05	W	Change device mode to encoder configuration mode.
3	0x40 (direct register)	0x00	W	Select bank 0: Write value 0x00 to the bank selection register.
4	0x25 (bank 0)		R	Get write access: Read filter status register. A value of 0x00 indicates permission to get write access.
5	0x24 (bank 0)	0x01	W	Write value 0x01 to the command register.
6	0x25 (bank 0)		R	Read status register. A value of 0x02 indicates granted access.
7	0x24 (bank 0)		W	Set values according to Table 3. Encoder Configuration Registers
8	0x24 (bank 0)	0x02	W	Save configuration: Write value to command register. Encoder restarts with new filter setting (100ms).

Encoder Configuration Register	Register Address (bank 0)
Command register	0x24
Status register	0x25

Commands	**Register Value**
Get write access	0x01
Save filter selection	0x02
Cancel access	0x05
Status	**Register Value**
No access	0x00
Access granted,	0x02
Error, use cancel command to retry	0x04

Attention: The encoder cannot be used as a feedback system during the filter change!

Note, that the former Filter Selection function (KCD) is still operational.

5.2. Preset Functions

The preset function can be used to adapt the encoder position to the mechanical alignment of the system. By performing a preset, the actual position value of the encoder is set to the desired preset value. The preset value is specified in registers 0x02 to 0x07 (bank 1). In registers 0x02 to 0x04 (bank 1) the singleturn preset value is saved in little endian format. In registers 0x05 to 0x07 (bank 1) the multiturn preset value is saved in little endian format. The preset can be triggered by hardware pin or software command.

The encoder must be powered on while performing the preset.

Preset Value	**Singleturn preset value**			**Multiturn preset value**		
Register Address (bank 1)	0x02	0x03	0x04	0x05	0x06	0x07
Endianness	LSB		MSB	LSB		MSB

Table 4. Preset Value Register

5.2.1. Hardware Preset

To perform a preset, the voltage level at the preset pin must be pulled to V_{preset} and held for at least t_{min} = 100 ms (see Table 5. Preset Parameter Table, see Figure 2. Hardware Preset Diagram). After $t_{min,}$ the current position value is read-in regardless of a prolonged high level on the input channel. The preset is completed t_{min} after the falling edge. By default, the hardware preset performs a 'ST + MT' preset with preset value set to '0'.

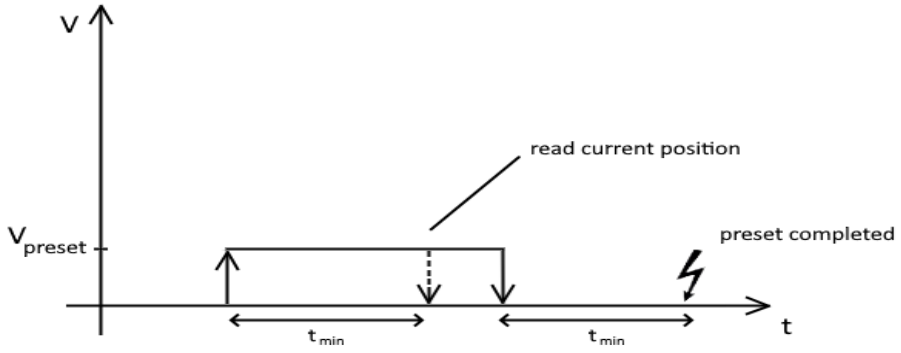

Figure 2. Hardware Preset Diagram

5.2.2. Software Preset

No.	Register Address	Value	OP	Remark
1	0x6B (direct register)	0x2A	W	Enable device mode configuration: Write password 0x2A to register.
2	0x6A (direct register)	0x07	W	Change device mode to preset mode.
3	0x40 (direct register)	0x01	W	Select bank 1: Write value 0x01 to the bank selection register.
4	0x00 (bank 1)	0x01 0x04 0x05	W	Perform preset: 0x01: ST + MT 0x04: ST 0x05: MT
5	0x6A (direct register)	0x00	W	Change the device mode back to operation mode.

5.2.3. Preset Configuration

No.	Register Address	Value	OP	Remark
1	0x6B (direct register)	0x2A	W	Enable device mode configuration: Write password 0x2A to register.
2	0x6A (direct register)	0x07	W	Change device mode to preset mode.
3	0x40 (direct register)	0x01	W	Select bank 1: Write value 0x01 to the bank selection register.
4	0x00 (bank 1)	0x02	W	Enable preset configuration edit.
5	0x01 (bank 1)		R	Read status register, a value of 0x01 indicates waiting for value to enter.
6	0x02 – 0x04 (bank 1)		W	Enter singleturn preset value.
7	0x05 – 0x07 (bank 1)		W	Enter multiturn preset value.
8	0x08 (bank 1)	0x01 0x02 0x03	W	Enter hardware preset configuration. 0x01: ST + MT 0x02: ST 0x03: MT
9	0x00 (bank 1)	0x03	W	Save preset configuration. Encoder restarts (100ms).

Example

Encoder singleturn resolution:	**17 bit**
Desired singleturn position:	**270°**
Corresponding decimal value in digits:	**98304**
Expressed as a hex value:	**0x18000**

For this configuration, the register entries must be set as follows:

Register Address (bank 1)	0x02	0x03	0x04
Register Value	0x00	0x80	0x01

Preset Registers	**Register Address (bank 1)**
Command register	0x00
Status register	0x01
Singleturn preset value register	0x02 – 0x04
Multiturn preset value register	0x05 – 0x07
Hardware preset configuration register	0x08

Commands	**Register Value**
Perform preset (ST + MT)	0x01
Perform preset (ST)	0x04

Perform preset (MT)	0x05
Enable preset value edit	0x02
Save preset value	0x03
Hardware Preset Configuration	**Register Value**
ST + MT (Default)	0x01
ST	0x02
MT	0x03
Hardware Preset Disabled	0x00

Item No.	Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
401	Preset voltage, high level	V_{preset}	3.3		VCC	V	-
402	Preset voltage, low level				1.0	V	-
403	Preset hold time	t_{min}	100			ms	-
404	Preset value			0			-

Table 5. Preset Parameter Table

6. Other Operating Instructions

6.1. Configuration Interface (UBICOM)

The UBICOM protocol defines a straightforward communication protocol over the UART Interface. The Interface operates in half-duplex master-slave mode, where the slave (encoder) responds only to requests. The hardware connection with the encoder is established through the config pin.

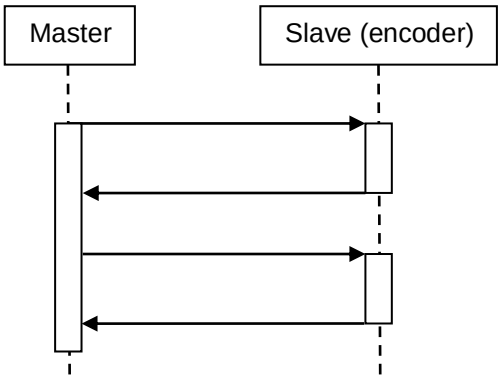

Figure 2. Transmission Diagram

6.1.2. Message Format

The data is sent with 115200 Baud in 8N1 over the UART port (RS232 TTL level).
The data is transmitted with the LSB first.

Header				Payload	Check-sum
Sync	Address	Command	Length of Payload		
0x80	<node>	<cmd>	<len>	<da-ta_0>…<data_n>	<chk>

Sync	**0x80, start of frame**
Address	0x01
Command	See description below
Length of Payload	Length of payload in bytes
Payload	Depends on command. See description
Checksum	8 bit checksum. The checksum is calculated over the sum of all bytes, inverted and masked with 8 bits. Example: NOT(0x80+0x01+0x01+0x02+0x00+0x00) = NOT(0x84) = 0x7B

Table 6. UBICOM definitions

6.1.3. Commands

When transmitting consecutive commands, wait for the encoder to respond with a message before sending the next command. This process may take up to 50 ms.

6.1.4. Read Registers

For reading an encoder register, use command 0x01. The length of the payload is 0x02 and the payload consists of a 16 bit address, with the most significant byte is transmitted first.

Name	**Command**	**LEN**	**Payload**
Read Register	0x01	0x02	<Address (16 bit)>

Table 7. Command real message (Master - > Slave)

Name	Command	LEN	Payload
Read Register	0x01	0x01	<Value (8 bit)>

Table 8. Commans and response (Slave -> Master)

Example: Read current filter setting (register 0x2E)

Master sends 0x80+0x01+0x01+0x02+0x00+0x2E+0x4D

Slave replies 0x80+0x01+0x01+0x01+0x03+0x79 (balanced filter is active = 0x03)

6.1.5. Write Registers

For writing an encoder register, use command 0x02. The length of the payload is 0x03. The payload consists of the target address (16 bit) and value (8 bit). The most significant byte of the address is transmitted first.

Name	Command	LEN	Payload
Write Register	0x02	0x03	<Address (16 bit)><Value (8 bit)>

Table 9. Command write message (Master -> Slave)

The Slave replies with a status message:

Name	Command	LEN	Payload
Write Register	0x02	0x01	<Status (8 bit)> 0x90: DATA_ACK 0xA0: DATA_NAK

Table 10. Command write response (Slave -> Master)

Example: Set device mode to filter selection (write value 0x05 to register 0x2A).

Master sends 0x80+0x01+0x02+0x03+0x00+0x2A+0x05+0x4A

Slave replies 0x80+0x01+0x02+0x01+0x90+0xEB

6.1.6. Get Position Word

For reading out the encoder position word, use command 0x03. The length of the payload is 0x01 and the payload is 0x01.

Name	Command	LEN	Payload
Get Position Word	0x03	0x01	0x01

Table 11. Command Get Possition (Master -> Slave)

The slave responds with the position word. The payload always consists of 5 bytes, but the actual transmitted position is determined by the encoder resolution. As a result, some of the upper bits may remain unused.

Name	Command	LEN	Payload
Get Position Word	0x03	0x05	<Position word (40 bit)>

Table 12. Command Get Possition Response (Slave - > Master)

Example: KCD-S1XXB-1617 (ST: 98304, MT: 8)

Master sends 0x80+0x01+0x03+0x01+0x01+0x79

Slave responds 0x80+0x01+0x03+0x05+0x00+0x80+0x11+0x00+0x00+0xE5

Note: The UBICOM and BiSS C interface should not be operated at the same time

7. Troubleshooting and Repair Information

7.1. Diagnostics

The BiSS C kit encoder monitors internal system components and failures and transmits status information in the form of error and warning bits. The two status bits are transmitted active-low, as an error or warning is indicated by a ‘0’. Beyond that, there are two registers that provide information on the cause of the error or warning.

Register	**Address (BiSS C)**	**Address (UBICOM)**	**Access**
Error Register	0x68 (direct bank)	0x28	R
Warning Register	0x69 (direct bank)	0x29	R

7.1.1. Error Registers

Error Bit	Error	Description
0	FRAM Error	Indicates a problem with the MT counter memory status. Detected during encoder startup.
2	Singleturn Error	Indicates that the singleturn position was at least temporarily unreliable.
3	Temperature Sensor Error	The temperature sensor readings provide results that are inconsistent or unphysical.
4-7	Not used	

7.1.2. Warning Registers

Warning Bit	Warning	Description
0	Temperature Warning	Set at T >= 125°C. Clear warning at T < 123°C.
1-7	Not used	

8. Appendix

8.1. Version History

Version	Date	Changes
1.0	2024-02-00	Initial Release

8.2. List of Tables

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8.3. Registers Overview

8.3.1. Direct Registers

Address Register	Address Global	Description / Symbol	Access
0x40	0x00	BANK Select	R/W
0x41	0x01	EDS Start Bank	R
0x42	0x02	Profile ID	R
0x43	0x03		R
0x44	0x04	Serial Number (U32, Little-Endian)	R
0x45	0x05		R
0x46	0x06		R
0x47	0x07		R
0x66	0x26	Temperature Intern	R
0x68	0x28	Error Register	R
0x69	0x29	Warning Register	R
0x6A	0x2A	Device Mode	R/W
0x6B	0x2B	Protection	R/W
0x6E	0x2E	Selected Filter	R

Address Register	**Address Global**	**Description / Symbol**	**Access**
0x74	0x34	Major Firmware Release	R
0x75	0x35	Minor Firmware Release	R
0x76	0x36	Firmware Patch Level	R
0x78	0x38	Device ID	R
0x79	0x39		R
0x7A	0x3A		R
0x7B	0x3B		R
0x7C	0x3C		R
0x7D	0x3D		R
0x7E	0x3E	Manufacturer Coder	R
0x7F	0x3F		R

8.3.2. Banck 0/ Special Encoder Functions

Address **Bank Register**	**Address** **Global**	**Description / Symbol**	**Access**
0x00	0x40	Calibration Command	R/W
0x01	0x41	Calibration Status	R
0x06	0x46	Wiegand Sensor Test, Command Register	R/W
0x07	0x47	Wiegand Sensor Test, Status Register	R
0x08	0x48	Wiegand Sensor Test, Error Code	R
0x09	0x49	Wiegand Sensor Test, Average Pulses CW (last test result)	R
0x0A	0x4A	Wiegand Sensor Test, Average minus 4x Standard Deviation CW (last test result)	R
0x0B	0x4B	Wiegand Sensor Test, Average Pulses CCW (last test result)	R
0x0C	0x4C	Wiegand Sensor Test, Average minus 4x Standard Deviation CCW (last test result)	R
0x0D	0x4D	Wiegand Sensor Test, Average Pulses CW (FRABA Production)	R
0x0E	0x4E	Wiegand Sensor Test, Average minus 4x Standard Deviation CW (FRABA Production)	R

Address **Bank Register**	**Address** **Global**	**Description / Symbol**	**Access**
0x0F	0x4F	Wiegand Sensor Test, Average Pulses CCW (FRABA Production)	R
0x10	0x50	Wiegand Sensor Test, Average minus 4x Standard Deviation CCW (FRABA Production)	R
0x11	0x51	Wiegand Sensor Test, Average Pulses CW (saved test result)	R
0x12	0x52	Wiegand Sensor Test, Average minus 4x Standard Deviation CW (saved test result)	R
0x13	0x53	Wiegand Sensor Test, Average Pulses CCW (saved test result)	R
0x14	0x54	Wiegand Sensor Test, Average minus 4x Standard Deviation CCW (saved test result)	R
0x1A	0x5A	OEM / EDS-Motor Data Write, Command Register	R/W
0x1B	0x5B	OEM / EDS-Motor Data Write, Status Register	R
0x24	0x64	Filter Selection, Command Register	R/W
0x25	0x65	Filter Selection, Status Register	R

8.3.3. Bank 1 / Special Encoder Functions

Address Bank Register	Address Global	Description / Symbol	Access
0x00	0x80	Preset Command	R/W
0x01	0x81	Preset Status	R
0x02	0x82	Preset singleturn value, byte 0	R/W
0x03	0x83	Preset singleturn value, byte 1	R/W
0x04	0x84	Preset singleturn value, byte 2	R/W
0x05	0x85	Preset multiturn value, byte 0	R/W
0x06	0x86	Preset multiturn value, byte 1	R/W
0x07	0x87	Preset multiturn value, byte 2	R/W
0x08	0x88	Preset hardware preset configuration	R/W

8.3.4. Bank 2 / EDS Encoder Data

We support the BiSS Profile 3 as Standard Encoder Profile.

Address Bank Register	Address Global	Description / Symbol	Access
0x00	0xC0	EDS Version (continuous number)	R

Address Bank Register	Address Global	Description / Symbol	Access
0x01	0xC1	EDS Length (bank count completely)	R
0x02	0xC2	Bank Address USER Start (bank selection in address 64, 255 = not available)	R
0x03	0xC3	Bank Address USER End (bank selection address 64)	R
0x05	0xC5	Minimum BiSS Timeout (0 = adaptive)	R
0x06	0xC6	Maximum BiSS Timeout (0 = adaptive)	R
0x0B	0xCB	Minimum Cycle Time (0 = no limitation)	R
0x0C	0xCC	Maximum Processing Time SCD	R
0x0E	0xCE	Maximum "power on delay" until control communication is available	R
0x0F	0xCF		R
0x10	0xD0	Number of data channel in this device (number of words)	R
0x11	0xD1	Area of validity for this EDS (number of slave addresses)	R
0x14	0xD4	Bank Address for content description data channel 1 (profile EDS)	R
0x15	0xD5	Data Length, Data Channel 1	R
0x16	0xD6	Data Format, Data Channel 1	R
0x17	0xD7	CRC Polynomial (8:1) for Data Channel 1	R

Address Bank Register	Address Global	Description / Symbol	Access
0x3F	0xFF	Checksum (addition of all bytes in this bank)	R

8.3.5. Bank 3 / EDS Encoder Data

We support the BiSS Profile 3 as Standard Encoder Profile.

Address Bank Register	Address Global	Description / Symbol	Access
0x00	0x100	BiSS Profile 3 Version	R
0x01	0x101	Length of this profile	R
0x02	0x102	Profile Identification BP3 (content also	R
0x03	0x103	available in addresses 0x42 and 0x43)	R
0x04	0x104	Feedback bit 1	R
0x05	0x105	Feedback bit 2	R
0x06	0x106	Maximum "power on delay" until position data is available	R
0x08	0x108	Encoder Type	R
0x0A	0x10A	Data Length MULTITURN	R
0x0C	0x10C	Data Length COARSE	R
0x1C	0x11C	CRC Polynomial (32:1)	R

Address Bank Register	Address Global	Description / Symbol	Access
0x1D	0x11D		R
0x1E	0x11E		R
0x1F	0x11F		R
0x20	0x120	CRC Start Value	R
0x21	0x121		R
0x22	0x122		R
0x23	0x123		R
0x2C	0x12C	Maximum revolution speed/maximum speed [1/min]	R
0x2D	0x12D		R
0x30	0x130	Minimum operating temperature [K]	R
0x31	0x131		R
0x32	0x132	Maximum operating temperature [K]	R
0x33	0x133		R
0x34	0x134	Minimum operating voltage [mV]	R
0x35	0x135		R
0x36	0x136	Maximum operating voltage [mV]	R
0x37	0x137		R

Address Bank Register	Address Global	Description / Symbol	Access
0x38	0x138	Maximum current consumption [mA]	R
0x39	0x139		R
0x3F	0x13F	Checksum (addition of all bytes in this bank)	R