Yanlanmc®
For smarter equip

通讯手册

绝对值编码器

通信接口 SSI

MANUAL
NME ENCODERS WITH SSI INTERFACE



- Absolute singleturn and multiturn on one PCB
- NME solution – no ball bearing, no tether, ultra compact: 20 mm and 36 mm diameter
- Digital serial interface: SSI
- Electrical resolution: Up to 19 bit singleturn, up to 24 bit multiturn, configurable by customer
- progressive TMR technology
- Operating temperature: -40 to +105 °C / -40 to 221 °F
- Very robust, insensitive to dust or humidity
- Easy installation, no manual alignment due to electronic calibration, relaxed mechanical tolerances
- In comparison to resolvers, full digital interface, no signal processing on motor controller required, no additional expensive voltage generator needed
- Additional functionality like electronic datasheet (EDS), up to 4 Kbyte OEM memory
- Integrated temperature sensor on board
- NME design includes shielding concept against external fields e.g. from magnetic brake

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Release Note

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Version Number: 1.1

Authors: KNE, DKI, JWE

Reviewer:

Valid for

NME Encoder Type	Firmware version
NME-S100B-XXXX-XXXX-JAQ	≥ 1.2.5
NME-S100B-XXXX-XXXX-BAQ	≥ 1.4.2

User Annotation

Pease note that no responsibility is assumed by YANLAN for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained people.

The original instructions consist of a user manual, a data sheet and an installation leaflet, which can be found on our website.

YANLAN welcomes all readers to send us feedback and comments about this document.

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General Advice



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.

Safety

- The encoder must be installed by qualified personnel only, exhibiting knowledge in electronics and mechanics.
- Consider all safety and accident regulations valid for your country.
- 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
-
-

Intended Use and other parts and also during the assembly process.

NME encoders are designed for integration into motors such as servo, stepper, or BLDC motors. Typical ap-plications are robotic systems, Cobots, AGVs, linear actuator, stepper and servo motors as well as mechan-ical engineering.

Maintenance/Service

The product is maintenance-free.

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1. Introduction

With a combination of accuracy, reliability, robustness and cost efficiency POSITAL's magnetic NME 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 NME encoders applicable in lots of environmental conditions. The NME 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 har-vesting system. The SSI interface enables a direct digital sensor data transmission.

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 NME encoders requires no clean room similar conditions and can be performed under normal factory conditions. The integrated electronic autocal-ibration 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 NME encoder's embedded soft-ware 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 SSI NME encoder is presented. The electrical connection and characteristics of the device are provided in chapter 2, a brief description of the SSI protocol is given in chapter 3. Chapter 4 gives a description of the serial communication protocol UBICOM, which can be used for configuration purposes aside from SSI. The integrated hardware and software features of the NME encoder are described in chapter 5.

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2. Electrical Data

2.1 Connector

Connector Type:

Ø 36mm

Ø

Ø

Ø

Ø : BM08B-GHS-TBT (JST)

Ø 20mm NME: BM08B-SRSS-TB (JST)

Pin No.	Symbol	Description
1 (blue)	GND	Ground reference voltage
2 (rose)	Preset	Preset trigger
3 (gray)	Config	Config via serial communication (UBICOM)
4 (green)	Data +	SSI Data +
5 (yellow)	Data -	SSI Data -
6 (white)	CLK -	SSI Clock -
7 (brown)	CLK +	SSI Clock +
8 (red)	VCC	Supply Voltage with respect to GND

Table 1: Main Connector Allocation.

2.2 Electrical Characteristics

Item No.	Parame-ter	Sym-bol	Ø	Typekey	Min.	Typ.	Max.	Unit	Remark
201	Supply Voltage	VCC	36mm	NME-S100B	4.75	5.0	15.0	V	@25 °C, DC, other voltages possible on request.
			20mm	NME-S100B	4.5	5.0	5.5		

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Item No.	Parame-ter	Sym-bol	Ø	Typekey	Min.	Typ.	Max.	Unit	Remark
202	Power Con-sumption	PC	36mm	NME-S100B		0.18	0.3	W	-
			20mm	NME-S100B		0.3			
203	Reverse Polarity Protec-tion		36mm	NME-S100B			-15.0	V	-
			20mm	NME-S100B			-		
204	Supply voltage rise time		36mm	NME-S100B	10			V/s	
							15	ms	Alternative, if min 10 V/s cannot be en-sured: ramp-up time from 0V to 5V
			20mm	NME-S100B			-		

Table 2: NME Encoder Electrical Characteristics.

2.3 Communication Parameters

The communication parameters are listed below and can also be found in the memory of the NME encoder.

Item No.	Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
301	Serial Communication Format	SSI					-
302	Output Driver	RS-422					-

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Item No.	Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
303	SSI	Multiturn (MT) Singleturn (ST)			24 bit 19 bit		16bit MT & 17 bit ST Default. MSB first, left aligned.
305	Clock Frequency	CF	0.3		10	MHz	See Figure 2/3
306	Interface Cycle Time	CT	50			µs	With a cycle time of 50 µs, a clock frequency >= 1MHz must be used.
307	SSI Timeout	Tout	1	3.75	40	µs	Configurable. Default 3.75µs.
308	Start Phase		8		73	bits	-

Table 3: Communication Parameters.

3. SSI Interface

The SSI interface provides a communication connection between a master device, representing the motor control unit and its connected slave device, representing the

encoder. The devices are c ly requires two unidirectional lines (clock and data) using s synchronized by the clock signal, generated by the mas and passes on its generated signal to the slave output l e of the master (see **Error! Reference source not foun**

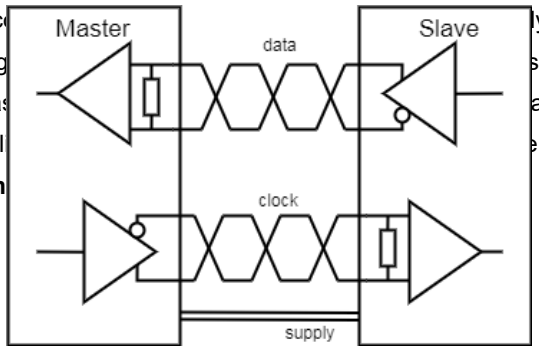


Figure 1: SSI Interface

3.1 Transmission Protocol

The communication between master and slave follows a defined pattern based on the SSI transmission frame (see Figure 2 / 3).

3.1.1 Start Phase

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The encoder needs a certain calculation time internally for a position request, which must not be underrun. Therefore, Pre-Bytes must be sent in the start phase before sending data. The number of Pre-Bytes in the start phase can be adjusted, for more info please see ‘5.9 SSI Interface: Parameter Change’.

3.1.2 Timeout

The timeout is the time required by the slave to realize that the transmission is complete. The transmission of data is controlled by the master and the transmission can be interrupted at any time just by stopping the clock sequence for a period longer than the timeout.

3.2 SSI Transmission Frame

The SSI transmission frame is started and ended by the master clock signal (MA). The first falling edge of the MA latches the NME encoder position. With the first rising edge, the slave sets the data line to “0”. The data line is “0” for the start phase. After the start phase the slave transmits the position data.

Type	Start Phase (default)	Position Value			
		MT	ST	D1	D2
NME-S1XXB-1618	8 bit	16 bit	18 bit		
NME-S1XXB-1617	8 bit	16 bit	17 bit	-	-
NME-S1XXB-0017	8 bit	-	17 bit	-	-
NME-S3XXB-1618	8 bit	16 bit	18 bit	1 bit	1 bit

3.2.1 NME-S1XXB-1617-XXXX-XXX

XXX The position data consists of:

- Multiturn value (MT) 16 bit
- Singleturn value (ST) 17 bit

The MSB is transmitted first.

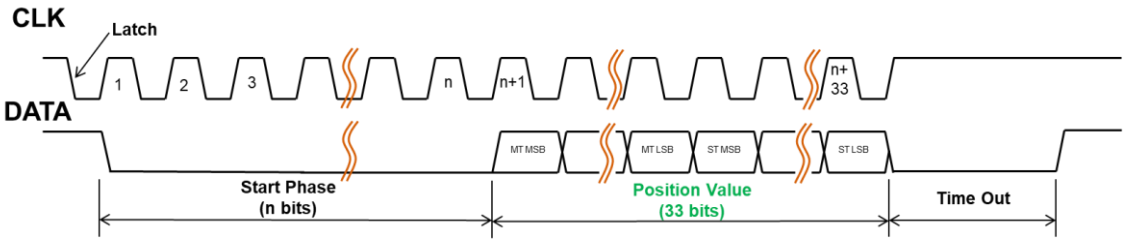


Figure 2: Protocol Structure S1XXB

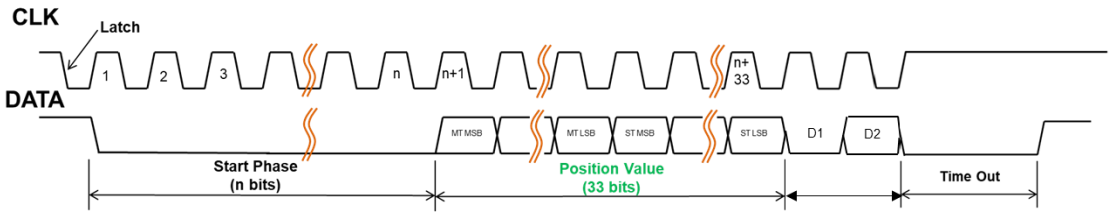
3.2.2 NME-S3XXB-1617-XXXX-XXX

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The position data consists of:

- Multiturn value (MT) 16 bit
- Singleturn value (ST) 17 bit
- D1: constant value “0” (1 bit)
- D2: Error Bit for indication of sensor internal status (1 bit)
  - Value “1”: no error
  - Value “0”: error

The MSB is transmitted first.



3.3 Register 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. To establish a register communication with the NME encoder (slave) is to build up serial communication via the config pin using the UBICOM protocol.

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4. 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.

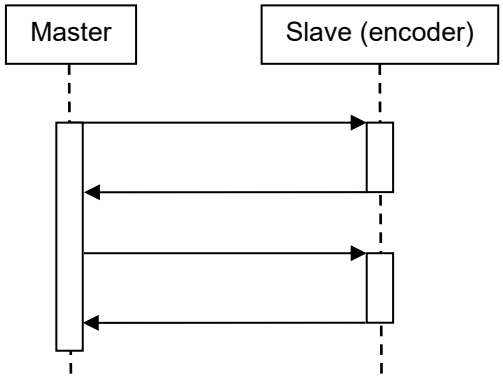


Figure 3: Transmission diagram.

4.1 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	Checksum
Sync	**Address**	**Command**	**Length of Payload**		
0x80	<node>	<cmd>	<len>	<data_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 bit. Example: NOT(0x80+0x01+0x01+0x02+0x00+0x00) = NOT(0x84) = 0x7B

Table 4: UBICOM definitions.

4.2 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.

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4.2.1 Read Register

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 5: Command read message (Master -> Slave)

The slave replies with the register value:

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

Table 6: Command read 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)

4.2.2 Write Register

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 7: 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 8: 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

4.2.3 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.

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

Table 9: Command get position (Master -> Slave)

The slave responds with the positon word. The payload always consists of 5 bytes, but the actual transmitted postion 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 10: Command get position response (Slave -> Master)

Example: NME-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 SSI interface should not be operated at the same time.

4.3 I/O Characteristics

Config Pin:

Item No.	Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
401	Output Low level	VOL	0		0.4	V DC	-
402	Output High Level	VOH	2.4		3.3	V DC	-
403	Input High Level	VIH	2.0		3.3	V DC	-
404	Input Low Level	VIL	0		0.8	V DC	-

+5 V DC level tolerant, do not exceed.

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5. Hardware and Software Features

5.1 Function Overview

The SSI NME 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 via the config pin using the UBICOM protocol. For the serial communication, hardware and software are available for direct use. For more details see chapter 7.

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

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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.

5.2 Temperature Readout

The NME 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:

$$T[°F] = 1.8 * T_{\mathrm{reg}} + 32$$

The specifications of the integrated temperature sensor can be found in Table 11. 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	0x26	T_{reg}	R	Read-out temperature register.

Parameter	Symbol	Remark			
Interface	TSI	UART, size: 8 bit			
Temperature Accuracy	TSA				
Temperature Range	TSR	-40		105	°C

Table 11: Temperature Sensor Properties.

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5.3 Wiegand Sensor Test

The

encoder uses a magnetic Wiegand counter to provide absolute multiturn values. The software-inte-grated Wiegand sensor test measures the Wiegand sensor properties, by analyzing Wiegand pulses for 515 motor shaft revolutions. The test must be carried out for both clockwise (CW) and counterclockwise (CCW) direction and is performed by the following sequence. Carry out the sequence for CW first and afterwards for CCW direction.

VIDEO INSTRUCTION

https://www.youtube.com/watch?v=RSaEPY-Q1a8

No.	Register Address	Value	OP	Remark
1	-	-	-	**Run the motor** at constant rotation speed in CW direction. A rotation speed of 500-2000 rpm is recommended.
2	0x2B	0x2A	W	**Enable device mode** configuration: Write password 0x2A to register.
3	0x2A	0x02	W	**Change device mode** to Wiegand sensor test mode.
4	0x46	0x01	W	**Start Wiegand sensor test**, **CW direction.** The duration of the test routine depends on the rotation speed of the motor. The test must run for at least 515 motor revolutions.
5	0x47		R	**Check the result of the test** by reading the Wiegand sensor test status register. If the pulse collection in CW direction is active, the register value is 0x01. If the pulse collection in CW direction is finished, the routine waits for the change of motor direction to CCW (value 0x03).
6	-	-	-	**Run the motor in CCW direction**.
7	0x46	0x02	W	**Start Wiegand sensor test**, **CCW direction.**
8	0x47		R	**Check the result of the test** by reading the Wiegand sensor test status register. If the pulse collection in CCW direction is active, the register value is 0x04. If the pulse collection in CCW direction is finished, the test is completed (value 0x06).
9	0x46	0x05	W	**Save the acquired result data** permanently. The saved data is not visible until an encoder reboot.
10	0x46	0x03	W	**Finish test.**
11	0x2A	0x00	W	**Change device mode** back to operation mode. **This step is obligatory after every attempted test**. After changing the device mode, the encoder will perform a restart. During

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				a time period of 100 ms, the encoder interface will not be available for communication

The saved result data can be checked in the registers shown below, if step 9 has been carried out. The average pulse height of the analyzed pulses and its standard deviation is saved for CW and CCW direction. A Wiegand pulse height average minus 4x standard deviation greater than 5.3 V is recommended for operation.

Wiegand Sensor Test Status Register	**Register Value**
Test stopped	0x00
Pulse Collection active (CW)	0x01
Wait for change of motor rotation direction	0x03
Wrong motor rotation direction	0x30
Pulse Collection active (CCW)	0x04
Test complete	0x06
Test failed	0x07

Result Data (volatile, last test)	**Register Address**
Average Pulses (CW)	0x49
Average minus 4x Standard Deviation (CW)	0x4A
Average Pulses (CCW)	0x4B
Average minus 4x Standard Deviation (CCW)	0x4C

Result Data (saved)	**Register Address**
Average Pulses (CW)	0x49
Average minus 4x Standard Deviation (CW)	0x4A
Average Pulses (CCW)	0x4B
Average minus 4x Standard Deviation (CCW)	0x4C

Result Data (FRABA Production)	**Register Address**
Average Pulses (CW)	0x51
Average minus 4x Standard Deviation (CW)	0x52
Average Pulses (CCW)	0x53
Average minus 4x Standard Deviation (CCW)	0x54

Note

- Results may deviate at high temperatures.
- The result data values must be divided by 10 to get the value in volts.
- The Wiegand sensor test can be stopped at any time by writing value 0x03 to the pulse testing command register
- The measured pulses are not depended on rotation speed, but low rotation speeds can lead to long test times.

Attention

- It is mandatory to run the Wiegand sensor test once after installation is finished.
- The encoder cannot be used as a feedback system during the test.
- The encoder cannot detect the rotation direction of the motor during the test. Therefore, ensure that the rotation direction aligns with the test direction.
- Before starting another test, it is mandatory to finish the previous test and to set the device mode back to operation (encoder reboot). This also applies to unsuccessful / canceled tests.

5.4 Calibration

The electronic calibration of the NME encoder is required to improve the measurement accuracy after installa-tion. The NME encoder is shipped in a pre-calibrated state. In the pre-calibrated state, the accuracy of the NME encoder after installation is limited to an angle error below ± 0.3° typically. This is caused by mechanical tolerances during the mounting of the

encoder onto the motor shaft (static or build-up tolerances). By using the offered electronic calibration procedure, the impact of the static mounting tolerances on the NME encoder accuracy can be cancelled out and the system angle error will be improved towards the specified accuracy. Existing calibration is not lost when starting new calibration.

Please note the following:
1. The NME encoder must be installed in the final position before the calibration is started.
2. The operating temperature of the NME encoder must be in the range of 25 °C to 40 °C (77 °F to 104 °F).
3. For consistent and precise results, the calibration should be performed at 1000 rpm.

External Conditions for Calibration

To successfully calibrate the NME encoder, several conditions must be met. All external conditions should match the normal operation conditions as far as possible.

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Note

- The resulting angular accuracy is directly dependent on the rotational speed uniformity.

Calibration Procedure

- **VIDEO INSTRUCTION**
  https://www.youtube.com/watch?v=Lu7_dP3DrT0

The calibration procedure is performed by carrying out the following sequence of steps:

No.	Register Address	Value	OP	Remark
1	-	-	-	**Run the motor in CCW direction** at constant rotation speed
2	0x2B	0x2A	W	**Unlock device mode** configuration: Write password 0x2A to register.
3	0x2A	0x01	W	**Change the device mode** to calibration mode.
4	0x40	0x01	W	**Start the calibration routine, CCW direction:** Write value 0x01 to the calibration command register. The execution of the calibration routine takes about 5 seconds and stops automatically.
5	0x41		R	**Read the calibration** status until the register value is 0x02, then the calibration in CCW direction is finished. Note that while the encoder is performing the calibration, it may not respond.
6	-	-	-	**Run the motor in CW direction**.
7	0x40	0x02	W	**Start the calibration routine, CW direction:** Write value 0x02 to the calibration command register.
8	0x41		R	**Read the calibration status register** until the register value is 0x22, then the calibration in CW direction is finished. The calibration data is saved automatically.
9	0x2A	0x00	W	**Change device mode** back to operation mode.

Calibration Register	Register Address
Command register	0x40
Status register	0x41

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Calibration Status Register	Register Value
Calibration running	0x01
Calibration finished (CCW)	0x02
Calibration finished (CW)	0x22
Wrong rotation direction	0x30
Temperature out of range	0x31
Motor speed out of range	0x32
Calibration failure	0x33

Attention: The encoder cannot be used as a feedback system during calibration!

Note, that If calibration fails in CW direction the calibration table is lost, which leads to an increase of the angle error.

5.5 Data Storage

The

encoder offers the capability to access two different internal memory regions to store data: The EDS-Motor-Data and the OEM-Data. The corresponding memory addresses are given in Table 12. The accessi-bility of the specific memory depends on the access rights.

Memory	Start-Addr.	End-Addr.	Access	Remark
EDS En-coder Data	0xC0	0x13F	R	The BiSS Profile 3 is used as Standard Encoder Profile.
EDS-Motor-Data	0x140	0x93F	R/W	2 Kbyte Motor Data: customer specific motor data
OEM-Data	0x940	0x113F	R/W	2 Kbyte OEM Memory: open access for customer use

Table 12: Data Storage Overview.

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

No.	Register Address	Value	OP	Remark
1	0x2B	0x2A	W	**Unlock device mode** configuration: Write password 0x2A to register.
2	0x2A	0x04	W	**Change the device mode** to OEM / EDS Motor Data Write.
3	0x5B		R	**Get write access:** Read OEM / EDS-Motor Data Write sta-tus register until a value of 0x00 indicates permission to get write access to the EDS-Motor Data.

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4	0x5A	0x01 0x02	W	Write the value to the OEM / EDS-Motor Data Write command register. ▪ 0x01: access EDS-Motor Data ▪ 0x02: access OEM-Data
5			W	Write data to the desired registers. Note: no limit to the number of write operations in this step.
6	0x5B		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.
7	0x5A	0x03	W	**Write data to flash memory:** Write the value 0x03 to the OEM / EDS-Motor Data Write command register.
8	0x5A	0x04	W	**(Optional) Cancel write access:** Write the value 0x04 to the OEM / EDS-Motor Data Write command register.
9	0x2A	0x00	W	**Change the device mode** back to operation mode.

OEM / EDS-Motor Data Register	**Register Address**
Command register	0x5A
Status register	0x5B

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.

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5.6 Encoder Configuration

The encoder can be adapted by the customer to better suit the individual application. Therefore, seven parameters exist. The position filter selection, the four SSI interface config parameters and the position value resolution for Multiturn and Singleturn.

Register	Address	Value	Description
Filter Selection	0x2E	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.
SSI Timeout	0x2D	0x01… 0x0A	Set SSI Timeout. Unit = 250ns. Default value: 0x0F = 3,75µs.
SSI Pre-bytes	0x31	0x01… 0x08	Set SSI Pre-bytes count. Unit = Pre-byte count = 8 bits before payload data starts. Default value: 0x02 = 2 Pre-bytes = 16 Pre-bits.
SSI Offset-bits	0x2F	0x00… 0x07	Set SSI Offset-bit count to add an additional bitwise offset to the configured Pre-bytes e.g. for specific alignment. Unit = Offset-bit count before payload data starts Default value: 0x01 = 1 Offset-bit
SSI Frame config	0x30	0x00	No graycode, no diagnostic bit, no parity / CRC **Former S1 version**
		0x02	No graycode, Error + always-one bit, no parity / CRC **Former S3 version**
		0x0C	No graycode, Error / Warning BiSS-C style, 6-bit CRC **Like BiSS-C**
Multiturn Resolution	0x16	0x00… 0x24	Set Multiturn Resolution in BCD coded bit count (24bit = 0x24). Not possible on Singleturn-only encoders.
Singleturn Resolution	0x17	0x00… 0x19	Set Singleturn Resolution in BCD coded bit count (19bit = 0x19).

Table 13: Encoder Configuration Registers.

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

No.	Register Address	Value	OP	Remark
1	0x2B	0x2A	W	**Enable device mode** configuration: Write password 0x2A to register.
2	0x2A	0x05	W	**Change device mode** to encoder configuration mode.
3	0x65		R	**Get write access:** Read filter status register. A value of 0x00 indicates permission to get write access.
4	0x64	0x01	W	Write value 0x01 to the command register.
5	0x65		R	Read status register. A value of 0x02 indicates granted access.
6	0x2D…0x31, 0x16, 0x17		W	**Set SSI config**, **set Filter Selection** or **set Resolution**
7	0x64	0x02	W	**Save configuration**: Write value to command register. After this command, the encoder will perform a restart. During a time period of 100 ms, the encoder interface will not be available for communication.

Encoder Configuration Register	Register Address
Command register	0x64
Status register	0x65

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.

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5.6.1 Prebyte Parameter

The encoder needs a certain calculation time internally for a position request (comparable to the min. busytime in BiSS-C), which must not be underrun. Therefore, Pre-Bytes must be sent before sending data (see Figure 4).

If the clock frequency is increased, the time available for calculations decreases. Therefore, the number of sent Pre-Bytes must be adjusted. Table 14 shows the step sizes provided for this purpose.

Parameter: Pre-Byte	Pre-Clocks	Min. Clock Frequency	Max. Clock Frequency
1	8		1.67 MHz
2	16		3.33 MHz
3	24		5.00 MHz
4	32		6.67 MHz
5	40	0.6 MHz	8.33 MHz
6	48	4.5 MHz	10.00 MHz
7	56	7.0 MHz	10.00 MHz

Table 14: Pre-Byte Parameter.

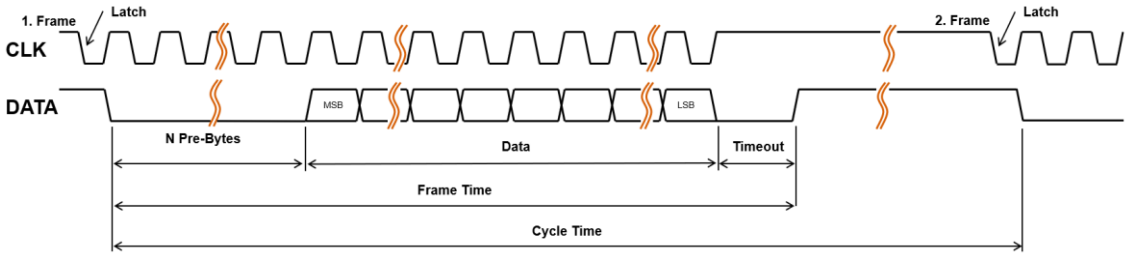


Figure 4: SSI Frame.

5.7 Preset Function

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 0x82 to 0x87 . In registers 0x82 to 0x84 the singleturn preset value is saved in little endian format. In registers 0x85 to 0x87 the multiturn preset value is saved in little endian format. The preset can be triggered by hardware pin or software command.

Preset Value	Singleturn preset value			Multiturn preset value		
Register Address	0x82	0x83	0x84	0x85	0x86	0x87
Endianness	LSB		MSB	LSB		MSB

Table 15: Preset value register.

5.7.1 Hardware Preset

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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 16, see Figure 5). 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'.

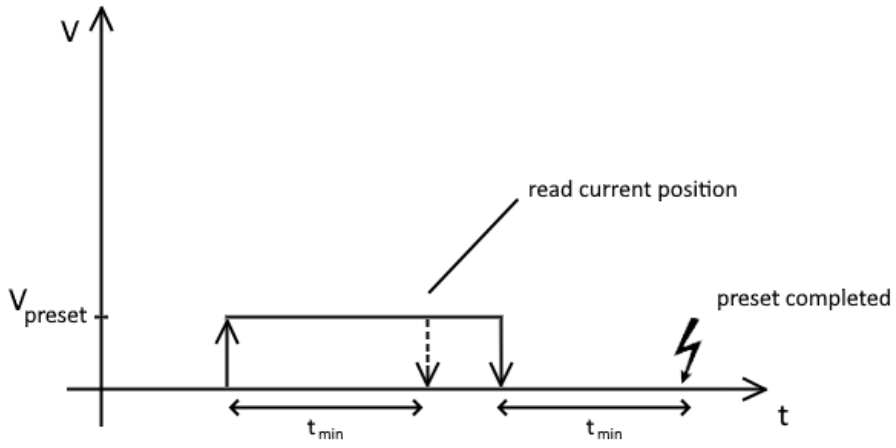


Figure 5: Hardware Preset Diagram.

5.7.2 Software Preset

No.	Register Address	Value	OP	Remark
1	0x2B	0x2A	W	**Enable device mode** configuration: Write password 0x2A to register.
2	0x2A	0x07	W	**Change device mode** to preset mode.
3	0x80	0x02	W	Enable **preset configuration** edit.
4	0x81		R	Read status register, a value of 0x01 indicates waiting for value to enter.
5	0x82 – 0x84		W	Enter singleturn preset value.
6	0x85 – 0x87		W	Enter multiturn preset value.
7	0x88	0x01 0x02 0x03	W	Enter hardware preset configuration. ▪ 0x01: ST + MT (Default) ▪ 0x02: ST ▪ 0x03: MT
8	0x80	0x03	W	**Save preset configuration.** After this command, the encoder will perform a restart. During a time period of 100 ms, the encoder interface will not be available for communication.

5.7.3 Preset Configuration

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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	0x82	0x83	0x84
Register Value	0x00	0x80	0x01

Preset Registers	**Register Address**
Command register	0x80
Status register	0x81
Singleturn preset value register	0x82 – 0x84
Multiturn preset value register	0x85 – 0x87
Hardware preset configuration register	0x88

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

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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 16: Preset parameter table.

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5.8 Diagnostics

The encoder has various errors and warning states, which can be read via registers. If no diagnostic bit is configured to be transmitted within the SSI frame (cmp. 5.6), in case of any error, the SSI interface will turn off, the data signal is logical “1” and communication will only be possible via UBICOM. If a diagnostic bit is configured to be transmitted within the SSI frame, the SSI interface will remain operational, and the error state is indicated by the error bit in the interface. frame. The error and warning state is cleared by a power cycle.

Register	Address (UBICOM)	Access
Error Register	0x28	R
Warning Register	0x29	R

5.8.1 Error Register

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	

5.8.2 Warning Register

Warning Bit	Warning	Description
0	Temperature Warning	Encoder temperature too high
1	Wiegand Sensor Test Position Warning	Will be set during the Wiegand Sensor Test to indicate that the position values are not trustworthy. Will be deleted after leaving the testing device mode.
1-7	Not used	

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6. Plug & Play via USB

For easy commissioning, it is possible to connect the encoder to a PC and access, configure or calibrate the encoder. We do recommend two ready-to-use solutions.

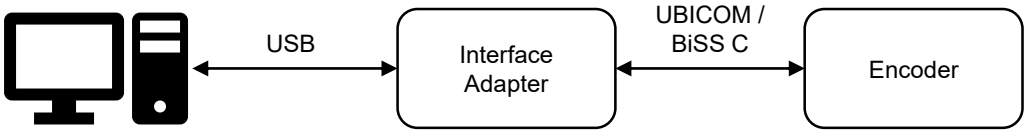


Figure 6: Connection of interface adapter.

6.1 NME Configuration Tool

Using UBICOM for communication

- Access position and register data
- Software GUI to run the main NME encoder functions
- Easy way to perform calibration, preset, Wiegand sensor test and configure filter settings
- Update firmware
- Readout encoder temperature and firmware version
- Alternatively program your own encoder related requests based on the UBICOM protocol

- **VIDEO INSTRUCTION**
  https://www.youtube.com/watch?v=kKhWuKGElzA

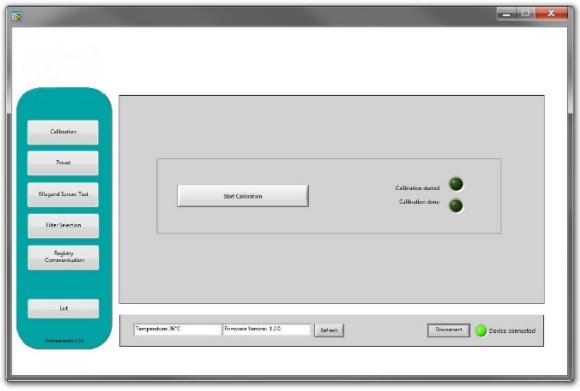




Figure 7: NME Configuration Tool and software GUI by YANLAN.

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7. References

8. Appendix

8.1 Register Overview

8.1.1 Direct Registers

Address Global	Description / Symbol	Access
0x04	Serial Number (U32, Little-Endian)	R
0x05		R
0x06		R
0x07		R
0x16	Multiturn Resolution BCD coded	R/W
0x17	Singleturn Resolution BCD coded	R/W
0x26	Temperature Intern	R
0x28	Error Register	R
0x29	Warning Register	R
0x2A	Device Mode	R/W
0x2B	Protection	R/W
0x2D	SSI Timeout	R/W
0x2E	Selected Filter	R/W
0x2F	SSI Offset-bits	R/W
0x30	SSI Framce-config	R/W
0x31	SSI Pre-bytes	R/W
0x34	Major Firmware Release	R
0x35	Minor Firmware Release	R
0x36	Firmware Patch Level	R
0x38	Device ID	R
0x39		R
0x3A		R

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Address Global	Description / Symbol	Access
0x3B		R
0x3C		R
0x3D		R
0x3E	Manufacturer Coder	R
0x3F		R

Table 17: Direct Registers.

8.1.2 Special Encoder Functions

Address Global	Description / Symbol	Access
0x40	Calibration Command	R/W
0x41	Calibration Status	R
0x46	Wiegand Sensor Test, Command Register	R/W
0x47	Wiegand Sensor Test, Status Register	R
0x48	Wiegand Sensor Test, Error Code	R
0x49	Wiegand Sensor Test, Average Pulses CW (last test result)	R
0x4A	Wiegand Sensor Test, Average minus 4x Standard Deviation CW (last test result)	R
0x4B	Wiegand Sensor Test, Average Pulses CCW (last test result)	R
0x4C	Wiegand Sensor Test, Average minus 4x Standard Deviation CCW (last test result)	R
0x4D	Wiegand Sensor Test, Average Pulses CW (FRABA Production)	R
0x4E	Wiegand Sensor Test, Average minus 4x Standard Deviation CW (FRABA Production)	R
0x4F	Wiegand Sensor Test, Average Pulses CCW (FRABA Production)	R
0x50	Wiegand Sensor Test, Average minus 4x Standard Deviation CCW (FRABA Production)	R
0x51	Wiegand Sensor Test, Average Pulses CW (saved test result)	R

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Address Global	Description / Symbol	Access
0x52	Wiegand Sensor Test, Average minus 4x Standard Deviation CW (saved test result)	R
0x53	Wiegand Sensor Test, Average Pulses CCW (saved test result)	R
0x54	Wiegand Sensor Test, Average minus 4x Standard Deviation CCW (saved test result)	R
0x5A	OEM / EDS-Motor Data Write, Command Register	R/W
0x5B	OEM / EDS-Motor Data Write, Status Register	R
0x64	Filter Selection, Command Register	R/W
0x65	Filter Selection, Status Register	R

Table 18: Special Encoder Functions.

8.1.3 Special Encoder Functions 2

Address Global	Description / Symbol	Access
0x80	Preset Command	R/W
0x81	Preset Status	R
0x82	Preset singleturn value, byte 0	R/W
0x83	Preset singleturn value, byte 1	R/W
0x84	Preset singleturn value, byte 2	R/W
0x85	Preset multiturn value, byte 0	R/W
0x86	Preset multiturn value, byte 1	R/W
0x87	Preset multiturn value, byte 2	R/W
0x88	Preset hardware preset configuration	R/W

Table 19: Special Encoder Functions.

8.1.4 EDS Encoder Data

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Address Global	Description / Symbol	Access
0xC2	Bank Address USER Start (bank selection in address 64, 255 = not available)	R
0xC3	Bank Address USER End (bank selection address 64)	R
0xC5	Minimum Timeout (0 = adaptive)	R
0xC6	Maximum Timeout (0 = adaptive)	R
0xCB	Minimum Cycle Time (0 = no limitation)	R
0xCE	Maximum "power on delay" until control communication is available	R
0xCF		R
0xD5	Data Length, Data Channel 1	R
0xD6	Data Format, Data Channel 1	R

Table 20: Electronic Data Sheet, Encoder Data.

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9. Version History

Version	Date	Changes
1.0	2024-05-00	Initial Release
1.1	2026-03-01	Added 20mm KTD

Table 21: Document Version History

注意事项Special Attention

- 编码器属于精密仪器，请轻拿轻放、小心使用，尤其对编码器外壳请勿敲 、撞击及硬拽等。
- 通电之前请**检查正负接线，避免接错或者短路，**否则可能会 造成电路永久性损坏!
- 产品的预测平均失效时间(MTBF)被认为足够长，但可预测的失效率不是零。因此，建议用户当产品可能出现故障时，用户应承担这些产品造成的所 有问题，并应将多种安全手段纳入您的产品、系统或设备中，以防止导致严重的系统故障。

服务/维护/保修 Service/ maintenance/ warranty

Service服务

Shanghai Yanlan Automation Technology Co., Ltd
509-510, No.1 Dongchen South Road, Pujiang Town, Shanghai
www.yanlanmc.cn www.yanlanmc.com Email:info@yanlanmc.cn

Warranty维护

The warranty expires at the end of the legal warranty-period or alternatively if the housing is opened. Dunkermotoren can allow no warranty for module da mage that is caused by wrong wiring.
保修期在法定保修期结束时到期，或者如果外壳被打开，保修期也会到期。Yanlanmc 对因接线错误或者不正当使用造成的模块损坏不提供免费保修。

Storage存 储

Please store the module protected from dust, contamination and humidity. Please look for the storage conditions. Please make sure that the storage conditi ons do not exceed the allowed storage temperature and humidity (see technical data).
请将模块存放在防尘、防污染和防潮的地方。请查看储存条件。请确保储存条件不超过允许的储存温度和湿度（见技术数据）。

Transport/ transmission运 输 / 传 输

Please transport the modules under storage conditions and additionally shock-protected. 请在储存条件下运输模块，并额外提供防震保护。

Disposal报 废 处 理

The module is with its highly integrated circuit board electrical special waste and has to be disposed accordingly. 处置该模块具有高度集成的电路板电气特殊废物，必须相应处置。

印记 Imprint

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