LXM32M

ANA, DIG And RSR Encoder Modules

User Guide

Original instructions

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www.se.com

Legal Information

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Safety Information

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, 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.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result** in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Please Note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Qualification of Personnel

Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation are authorized to work on and with this product. These persons must have sufficient technical training, knowledge and experience and be able to foresee and detect potential hazards that may be caused by using the product, by modifying the settings and by the mechanical, electrical and electronic equipment of the entire system in which the product is used.

The qualified person must be able to detect possible hazards that may arise from parameterization, modifying parameter values and generally from mechanical, electrical, or electronic equipment.

The qualified person must be familiar with the standards, provisions, and regulations for the prevention of industrial accidents, which they must observe when designing and implementing the system.

Intended Use

The products described or affected by this document are, along with software, accessories and options, servo-drive systems for three-phase servo motors.

The products are intended for industrial use according to the instructions, directions, examples, and safety information contained in the present user guide and other supporting documentation.

The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data.

Prior to using the products, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety-related measures must be implemented.

Since the products are used as components in an overall machine or process, you must ensure the safety of persons by means of the design of this overall machine or process.

Operate the products only with the specified cables and accessories. Use only genuine accessories and spare parts.

Any use other than the use explicitly permitted as described herein is prohibited and may result in unanticipated hazards.

About the Book

Document Scope

The information provided in this user guide supplements the user guide of the servo drive LXM32M.

The functions described in this user guide are only intended for use with the associated product. You must read and understand the appropriate user guide of the drive.

Validity Note

This user guide applies to the encoder modules for the servo drive LXM32M, module identification ANA (VW3M3403), DIG (VW3M3402) and RSR (VW3M3401).

For product compliance and environmental information (RoHS, REACH, PEP, EOLI, etc.), go to www.se.com/ww/en/work/support/green-premium/.

The characteristics that are described in the present document, as well as those described in the documents included in the Related Documents section below, can be found online. To access the information online, go to the Schneider Electric home page www.se.com/ww/en/download/.

The characteristics that are described in the present document should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the document and online information, use the online information as your reference.

Related Documents

Title of documentation	Reference number
LXM32M - ANA, DIG and RSR Encoder Modules - User Guide (this user guide)	0198441113818 (eng) 0198441113819 (fre) 0198441113817 (ger)
Lexium 32M - Servo Drive - User Guide	0198441113767 (eng) 0198441113768 (fre) 0198441113766 (ger) 0198441113770 (spa) 0198441113769 (ita) 0198441113771 (chi)

Product Related Information

⚠WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1 (latest edition), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems” or their equivalent governing your particular location.

Terminology Derived from Standards

The technical terms, terminology, symbols and the corresponding descriptions in this manual, or that appear in or on the products themselves, are generally derived from the terms or definitions of international standards.

In the area of functional safety systems, drives and general automation, this may include, but is not limited to, terms such as *safety*, *safety function*, *safe state*, *fault*, *fault reset*, *malfunction*, *failure*, *error*, *error message*, *dangerous*, etc.

Among others, these standards include:

Standard	Description
IEC 61131-2:2007	Programmable controllers, part 2: Equipment requirements and tests.
ISO 13849-1:2015	Safety of machinery: Safety related parts of control systems. General principles for design.
EN 61496-1:2013	Safety of machinery: Electro-sensitive protective equipment. Part 1: General requirements and tests.
ISO 12100:2010	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN 60204-1:2006	Safety of machinery - Electrical equipment of machines - Part 1: General requirements
ISO 14119:2013	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
ISO 13850:2015	Safety of machinery - Emergency stop - Principles for design
IEC 62061:2015	Safety of machinery - Functional safety of safety-related electrical, electronic, and electronic programmable control systems
IEC 61508-1:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: General requirements.
IEC 61508-2:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Requirements for electrical/electronic/programmable electronic safety-related systems.
IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems: Software requirements.
IEC 61784-3:2016	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions.
2006/42/EC	Machinery Directive
2014/30/EU	Electromagnetic Compatibility Directive
2014/35/EU	Low Voltage Directive

In addition, terms used in the present document may tangentially be used as they are derived from other standards such as:

Standard	Description
IEC 60034 series	Rotating electrical machines
IEC 61800 series	Adjustable speed electrical power drive systems
IEC 61158 series	Digital data communications for measurement and control – Fieldbus for use in industrial control systems

Finally, the term *zone of operation* may be used in conjunction with the description of specific hazards, and is defined as it is for a *hazard zone* or *danger zone* in the *Machinery Directive* (*2006/42/EC*) and *ISO 12100:2010*.

NOTE: The aforementioned standards may or may not apply to the specific products cited in the present documentation. For more information concerning the individual standards applicable to the products described herein, see the characteristics tables for those product references.

Introduction

Overview of the Encoder Modules

Overview

The drive LXM32M features a slot (Slot 2) for encoder modules allowing for the connection of an additional encoder (machine encoder) or an encoder of a third-party motor (motor encoder).

This manual describes the 3 different encoder modules:

Description	Reference
Encoder module ANA (analog interface) with HD15 D-SUB connection (female)	VW3M3403
Encoder module DIG (digital interface) with HD15 D-SUB connection (female)	VW3M3402
Encoder module RSR (resolver interface) with DE9 D-SUB connection (female)	VW3M3401

The encoder modules can be used for two different purposes:

- Increased positioning accuracy due to direct measurement of the position with an additional encoder (machine encoder)
- Support of encoders of third-party motors (motor encoder)

Using an Additional Encoder (Machine Encoder)

An additional encoder (machine encoder) mounted to the machine can be operated together with a Schneider Electric motor.

Encoder module	Interface	Rotary	Linear
ANA (analog interface)	SinCos Hiperface(1) (without absolute position)	x	x
	SinCos 1Vpp (without Hall)	x	x
DIG (digital interface)	EnDat 2.2	x	x
	BiSS (variant B)	x	-
	ABI (Incremental)	x	x
	SSI	x	x(2)
(1) Is treated like SinCos 1Vpp. The serial communication of the SinCos Hiperface interface is not used for positioning. **(2)** Available with firmware version ≥V01.26 of the drive LXM32M.			

Using an Encoder of a Third-Party Motor (Motor Encoder)

Third-party motors can be operated in conjunction with an encoder module. Various interfaces are available for the encoders of such motors (motor encoders).

Encoder module	Interface	Rotary	Linear
ANA (analog interface)	SinCos Hiperface	x	-(1)
	SinCos 1Vpp (without Hall)	x	x
	SinCos 1Vpp (with Hall)	x	x
RSR	Resolver	x	-
(1) A linear encoder with a SinCos Hiperface interface can be used like a linear encoder with a SinCos 1Vpp (without Hall) interface.			

Only permanent magnet AC synchronous servo motors are supported.

NOTE: An encoder of a third-party motor (motor encoder) cannot be used in combination with the safety module eSM (VW3M3501).

Technical Data

Encoder Module ANA (Analog Interface)

D-Sub Connection

HD15 D-SUB female connector with UNC 4-40 thread.

Characteristic	Unit	Value
Tightening torque locking screw	N•m (lbf in)	0.4 (3.54)

The supply voltage can be adjusted to 5 Vdc or 12 Vdc to match the encoder. Depending on this setting, either pin *ENC+5V_OUT* or pin *ENC+12V_OUT* provides the supply voltage.

Both supply voltages are protected against reverse polarity and short-circuit protected.

Encoder Module Characteristics

The table presents the characteristics of the module:

Characteristic	Unit	Value
Supply voltage 5 Vdc	Vdc	5.1 (±5 %)
Supply voltage 12 Vdc	Vdc	11.5 (±5 %)
Maximum output current 5 Vdc	mA	200
Maximum output current 12 Vdc	mA	100
Triggering of short-circuit monitoring at 5 Vdc	mA	>300
Triggering of short-circuit monitoring at 12 Vdc	mA	>200
Maximum input frequency for sine cosine signals	kHz	100
Required temperature sensor Permissible temperature range Overtemperature	Ω	PTC <900 >2000
Maximum cable length	m (ft)	100 (328)

Encoder Module DIG (Digital Interface)

D-Sub Connection

HD15 D-SUB female connector with UNC 4-40 thread.

Characteristic	Unit	Value
Tightening torque	N•m (lbf in)	0.4 (3.54)

The supply voltage can be adjusted to 5 Vdc or 12 Vdc to match the encoder. Depending on this setting, either pin *ENC+5V_OUT* or pin *ENC+12V_OUT* provides the supply voltage.

Both supply voltages are protected against reverse polarity and short-circuit protected.

Encoder Module Characteristics

The table presents the characteristics of the module:

Characteristic	Unit	Value
Supply voltage 5 Vdc	Vdc	5.1 (±5 %)
Supply voltage 12 Vdc	Vdc	11.5 (±5 %)
Maximum output current at 5 Vdc	mA	200
Maximum output current at 12 Vdc	mA	100
Triggering of short-circuit monitoring at 5 Vdc	mA	>300
Triggering of short-circuit monitoring at 12 Vdc	mA	>200
Signal level for the signals *DATA_A+*, *DATA_A-*, *DATA_B+*, *DATA_B-*, *I+*, and *I-*	-	RS422
Frequency EnDat 2.2	kHz	2000
Frequency ABI	kHz EncInc/s	1000 $4 * 10^6$
Frequency SSI	kHz	200 or 1000 Adjustable via parameter

Maximum Cable Length

The maximum cable length depends on the interface and the frequency.

Interface	Frequency in kHz	Maximum cable length in m (ft)
EnDat 2.2	2000	100 (328)
BiSS	2000	100 (328)
ABI	1000	100 (328)
SSI	200	100 (328)
	1000	50 (164)

Encoder Module RSR (Resolver Interface)

D-Sub Connection

D9 D-SUB female connector with UNC 4-40 thread.

Characteristic	Unit	Value
Tightening torque	N•m (lbf in)	0.4 (3.54)

Encoder Module Characteristics

The table presents the characteristics of the module:

Characteristic	Unit	Value
Required temperature sensor: Permissible temperature range Overtemperature	Ω	PTC <900 >2000
Excitation frequency(1) (adjustable in increments of 250 Hz)	kHz	3 ... 12
Pairs of poles resolver(1)	-	1 ... 6
Maximum permissible speed of rotation	RPM	30000 / number of resolver pairs of poles
Transformation ratio(1)	-	0.3 0.5 0.8 1.0
Maximum cable length	m (ft)	100 (328)
(1) Adjustable via the commissioning software.		

Installation

Installation of the Module

Mechanical Installation

If third-party motors are used, insufficient isolation may allow hazardous voltages to enter the PELV circuit.

⚠⚠DANGER

ELECTRIC SHOCK CAUSED BY INSUFFICIENT ISOLATION

- Verify protective separation between the temperature sensor and the motor phases.
- Verify that the signals at the encoder connection meet the PELV requirements.
- Verify protective separation between the brake voltage in the motor and the motor cable, and the motor phases.

Failure to follow these instructions will result in death or serious injury.

Electrostatic discharge (ESD) may permanently damage the module either immediately or over time.

NOTICE

EQUIPMENT DAMAGE DUE TO ESD

- Use suitable ESD measures (for example, ESD gloves) when handling the module.
- Do not touch internal components.

Failure to follow these instructions can result in equipment damage.

Install the module according to the instructions in the user guide of the drive.

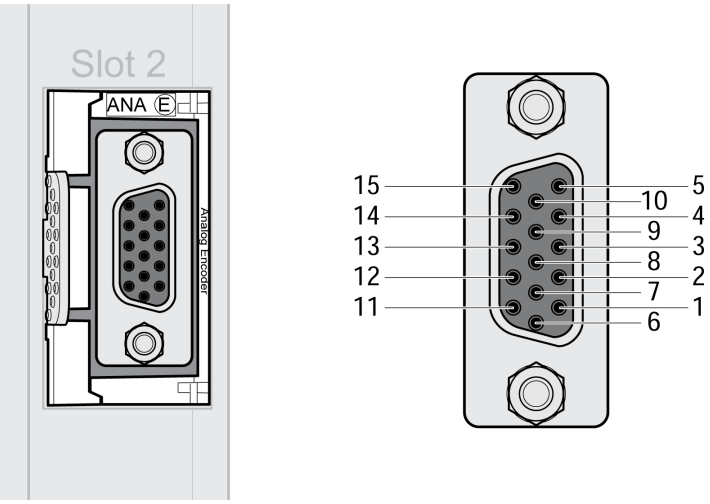
Cable Specification and Pin Assignment

Encoder Module ANA (Analog Interface)

Cable specification:

Characteristic	Value
Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Typical cable composition:	3 * 2 * 0.14 mm² + 2 * 0.34 mm² (3 * 2 * AWG 26 + 2 * AWG 22)
Maximum cable length:	100 m (328 ft)

Pin assignment:



Pin	Signal SinCos Hiperface	Signal SinCos 1Vpp (without Hall)	Signal SinCos 1Vpp (with Hall)	Wire pair	Meaning
1	*DATA+*	*INDEX+*	*INDEX+*	1	Data signal / index pulse
2	*DATA-*	*INDEX-*	*INDEX-*	1	Data signal / index pulse
3	-	-	*HALL_U*	-	Hall effect signal(1)
4	*SIN+*	*SIN+*	*SIN+*	2	Sine signal
5	*REFSIN*	*REFSIN*	*REFSIN*	2	Reference for sine signal
6	-	-	*HALL_V*	-	Hall effect signal(1)
7	*ENC+12V_OUT*	*ENC+12V_OUT*	*ENC+12V_OUT*	4a(2)	Encoder supply 12 Vdc and 100 mA
8	*ENC_0V / TEMP*	*ENC_0V / TEMP*	*ENC_0V / TEMP*	4	Reference potential for encoder supply and for Hall effect signals
9	*COS+*	*COS+*	*COS+*	3	Cosine signal
10	*REFCOS*	*REFCOS*	*REFCOS*	3	Reference for cosine signal
11	-	-	*HALL_W*	-	Hall effect signal(1)
12	*TEMP+*	*TEMP+*	*TEMP+*	-	Temperature sensor PTC(3)(4)
13	*TEMP-*	*TEMP-*	*TEMP-*	-	Temperature sensor PTC(3)
14	-	-	-	-	Reserved
15	-	*ENC+5V_OUT*	*ENC+5V_OUT*	4b(2)	Encoder supply 5 Vdc and 200 mA

Pin	Signal SinCos Hiperface	Signal SinCos 1Vpp (without Hall)	Signal SinCos 1Vpp (with Hall)	Wire pair	Meaning
-	*SHLD*	-	-	-	The shield is connected in the connector via the housing.

(1) The Hall effect signal inputs have an internal resistor with 1 kΩ pull-up to 5 Vdc.

(2) The supply voltage can be adjusted via parameter to 5 Vdc or 12 Vdc to match the encoder. Depending on this setting, either pin *ENC +5V_OUT* or pin *ENC+12V_OUT* provides the supply voltage.

(3) Temperature is only monitored if the encoder is used as a motor encoder.

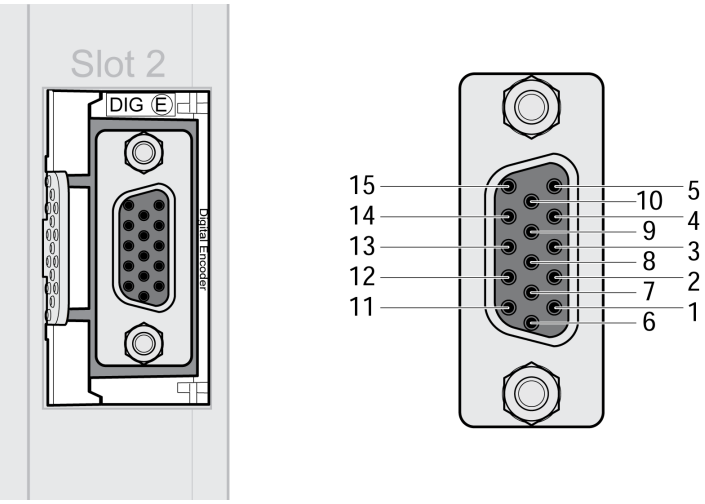
(4) If no temperature sensor is connected, pin 12 and pin 8 must be bridged. In this case, limit the motor temperature by means of other measures.

Encoder Module DIG (Digital Interface)

Cable specification:

Characteristic	Value
Shield:	Required, both ends grounded
Twisted Pair:	Required
PELV:	Required
Typical cable composition:	3 * 2 * 0.14 mm² + 2 * 0.34 mm² (3 * 2 * AWG 26 + 2 * AWG 22)
Maximum cable length:	The maximum cable length depends on the transmission rate and the protocol, see chapter Maximum Cable Length, page 13.

Pin assignment:



Pin	Signal	Wire pair	Meaning	EnDat 2.2 BiSS SSI	ABI
1	*DATA_A+*	1(1)	Data signal / channel A	Required	Required
2	*DATA_A-*	1(1)	Data signal / channel A (inverted)	Required	Required
3	-	-	Reserved	-	-
4	*/+*	3(1)	Index pulse	-	Optional
5	*/-*	3(1)	Index pulse	-	Optional
6	*CLK+*	4	Clock signal RS485	Required	-

Pin	Signal	Wire pair	Meaning	EnDat 2.2 BiSS SSI	ABI
7	*ENC+12V_OUT*	5a(2)	Encoder supply 12 Vdc and 100 mA	Optional	Optional
8	*ENC_0V*	5	Reference potential for encoder supply	Required	Required
9	-		Reserved	-	-
10	*DATA_B+*	2(1)	Channel B	-	Required
11	*DATA_B-*	2(1)	Channel B (inverted)	-	Required
12	-	-	Reserved	-	-
13	-	-	Reserved	-	-
14	*CLK-*	4	Clock signal RS485	Required	-
15	*ENC+5V_OUT*	5b(2)	Encoder supply 5 Vdc and 200 mA	Optional	Optional
-	*SHLD*	-	The shield is connected in the connector via the housing.	Required	Required

(1) RS422 signals.

(2) The supply voltage can be adjusted to 5 Vdc or 12 Vdc to match the encoder. Depending on this setting, either pin *ENC+5V_OUT* or pin *ENC+12V_OUT* provides the supply voltage.

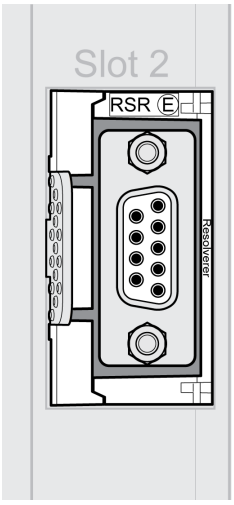
Encoder Module RSR (Resolver Interface)

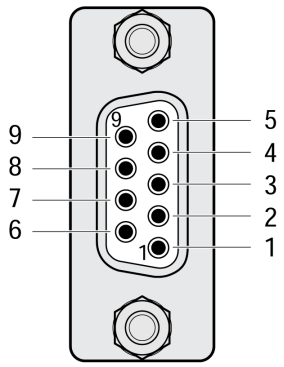
Cable specification:

Characteristic	Value
Shield:	Shielded cable with additionally shielded wire pairs, shield of the wire pairs to pin 1, outer shield grounded at both ends
Twisted Pair:	Required
PELV:	Required
Cable composition:	3 * 2 * 0.14 mm² + 2 * 1.0 mm² (3 * 2 * AWG 26 + 2 * AWG 18)
Maximum cable length:	100 m (328 ft)

NOTE: See the user guide for your drive for important information concerning equipotential grounding of equipment.

Pin assignment:





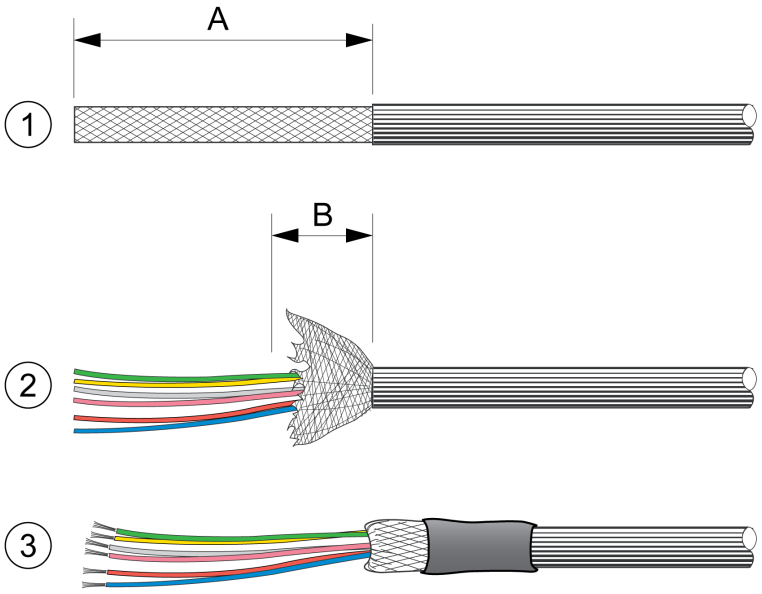
Pin	Signal	Color(1)	Typical connection designation	Meaning
1	*SHLD2*		-	Inner cable shields
2	*TEMP+*(2)		-	Temperature sensor PTC
3	*COS-*	Gray	S4	Cosine signal
4	*SIN+*	Yellow	S1	Sine signal
5	*REF+*	Red	R2	Reference signal
6	*TEMP-*(2)		-	Temperature sensor PTC
7	*COS+*	Pink	S2	Cosine signal
8	*SIN-*	Green	S3	Sine signal
9	*REF-*	Blue	R1	Reference signal
	SHLD		-	The shield is connected in the connector via the housing. The inner cable jackets must be isolated from the outer cable jacket.

(1) The colors relate to the cable “Helu Topgeber 510 77744”.

(2) If no temperature sensor is connected, pin 2 and pin 6 must be bridged. In this case, limit the motor temperature by means of other measures.

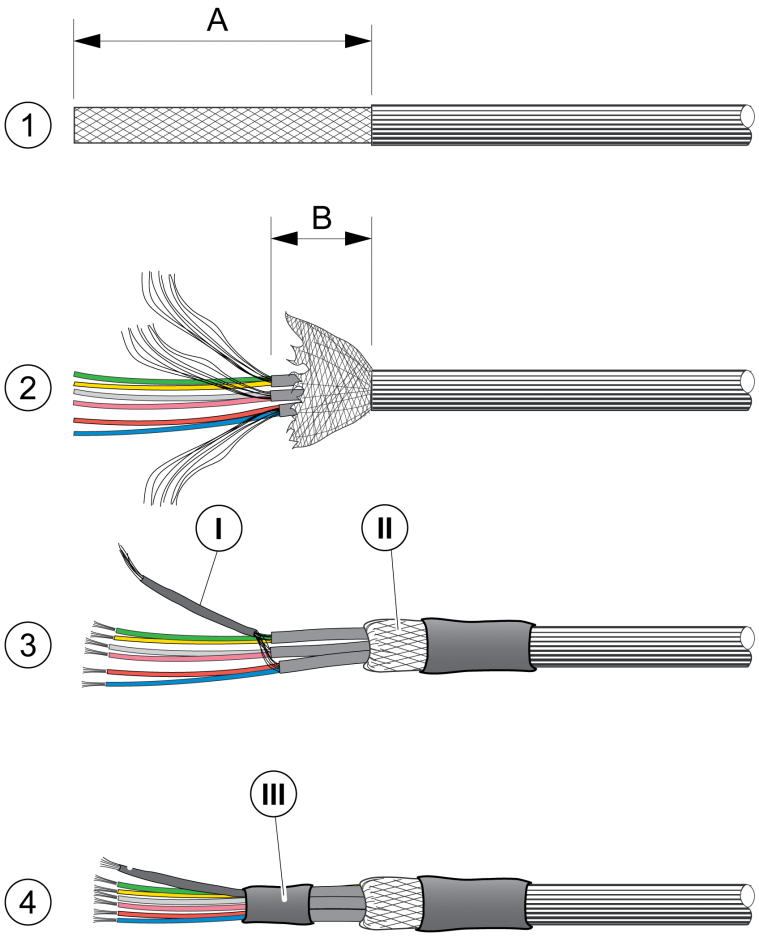
Cable Assembly

Cable Assembly for Encoder Modules ANA (Analog Interface) and DIG (Digital Interface)



Step	Action
1	Shorten the outer cable jacket of the cable. Length A depends on the connector used.
2	Shorten the outer shield (B) to a length of approximately 20 mm (0.79 in).
3	Slide the outer shield back over the outer cable jacket and fixate it with heat shrink tube in such a way that at least 10 mm (0.39 in) of the shield remains stripped. The stripped piece of shield will later be clamped into the metallic strain relief of the connector for a connection with the housing.

Cable Assembly for Encoder Module RSR (Resolver Interface)



Step	Action
1	Shorten the outer cable jacket of the cable. Length A depends on the connector used.
2	Shorten the outer shield (B) to a length of approximately 20 mm (0.79 in). Shorten the jackets of the inner shields. The inner jackets must be at least 10 mm (0.39 in) longer than the outer jacket.
3	Isolate the inner shields together with heat shrink tube (I). Slide the outer shield back over the outer cable jacket and fixate it with heat shrink tube in such a way that at least 10 mm (0.39 in) of the shield remains stripped. The stripped piece of shield (II) will later be clamped into the metallic strain relief of the connector for a connection with the housing.
4	Isolate the transition of the inner shields into the heat shrink tube with an additional piece of heat shrink tube (III).

Commissioning

General Settings

Preparation

General

This chapter describes how to commission the product.

⚠WARNING

UNINTENDED EQUIPMENT OPERATION

- Only start the system if there are no persons or obstructions in the zone of operation.
- Do not write values to reserved parameters.
- Do not write values to parameters unless you fully understand the function.
- Run initial tests without coupled loads.
- Verify correct word order for fieldbus communication.
- Do not establish a fieldbus connection unless you have fully understood the communication principles.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Required Components

The following is required for commissioning:

- Commissioning software “Lexium32 DTM Library”
  www.se.com/en/download/document/Lexium_DTM_Library/
- Fieldbus converter for the commissioning software for connection via the commissioning interface
- Lexium 32M Drive User Guide and this user guide, LXM32M ANA, DIG and RSR Encoder Modules User Guide

Setting the Type of Usage and the Type of Encoder

Setting the Type of Usage

The type of usage can be set via the parameter *ENC2_usage*.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENC2_usage	Type of usage of encoder 2 (module). **0 / None**: Undefined **1 / Motor**: Configured as motor encoder **2 / Machine**: Configured as machine encoder If the parameter is set to "Motor", encoder 1 has no functionality. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- 0 0 2	UINT16 R/W per. -	CANopen 3050:1$_h$ Modbus 20482 Profibus 20482 CIP 180.1.1 ModbusTCP 20482 EtherCAT 3050:1$_h$ PROFINET 20482

Setting the Type of Encoder

The type of encoder can be set via the parameter *ENC2_type*.

The setting defines the interface and the mechanic (rotary or linear).

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENC2_type	Type of encoder at encoder 2 (module). **0 / None**: Undefined **1 / SinCos Hiperface (rotary)**: SinCos Hiperface (rotary) **2 / SinCos 1Vpp (rotary)**: SinCos 1Vpp (rotary) **3 / Sincos 1Vpp Hall (rotary)**: SinCos 1Vpp Hall (rotary) **5 / EnDat 2.2 (rotary)**: EnDat 2.2 (rotary) **6 / Resolver**: Resolver **8 / BISS**: BISS **9 / A/B/I (rotary)**: A/B/I (rotary) **10 / SSI (rotary)**: SSI (rotary) **257 / SinCos Hiperface (linear)**: SinCos Hiperface (linear) **258 / SinCos 1Vpp (linear)**: SinCos 1Vpp (linear) **259 / SinCos 1Vpp Hall (linear)**: SinCos 1Vpp Hall (linear) **261 / EnDat 2.2 (linear)**: EnDat 2.2 (linear) **265 / A/B/I (linear)**: A/B/I (linear) **266 / SSI (linear)**: SSI (linear) Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on.	- 0 0 266	UINT16 R/W per. -	CANopen 3050:3$_h$ Modbus 20486 Profibus 20486 CIP 180.1.3 ModbusTCP 20486 EtherCAT 3050:3$_h$ PROFINET 20486

Setting the Absolute Position for Encoder 2

Setting the Absolute Position for Encoder 2

The absolute position of the encoder connected to the encoder module can be set via the parameter parameter *ENC2_adjustment*.

This setting is only relevant for analog encoders with the interface *SinCos Hiperface*, for digital encoders with the interface EnDat 2.2, BiSS or SSI, and for resolver encoders.

Setting the absolute position also shifts the position of the index pulse of the encoder and the index pulse of the encoder simulation.

The current absolute position can be read with the parameter *_p_act_ENC2*.

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
_p_act_ENC2	Actual position of encoder 2 (module).	usr_p - - -	INT32 R/- - -	CANopen 301E:1A$_h$ Modbus 7732 Profibus 7732 CIP 130.1.26 ModbusTCP 7732 EtherCAT 301E:1A$_h$ PROFINET 7732
ENC2_adjustment	Adjustment of absolute position of encoder 2. The value range depends on the encoder type at the physical port ENC2. This parameter can only be changed if the parameter *ENC_abs_source* is set to 'Encoder 2'. Singleturn encoder: 0 … x-1 Multiturn encoder: 0 … (y*x)-1 Singleturn encoder (shifted with parameter *ShiftEncWorkRang*): -(x/2) … (x/2)-1 Multiturn encoder (shifted with parameter *ShiftEncWorkRang*): -(y/2)*x … ((y/2)*x)-1 Definition of 'x': Maximum position for one encoder turn in user-defined units. This value is 16384 with the default scaling. Definition of 'y': Revolutions of the multiturn encoder. If processing is to be performed with inversion of the direction of movement, this must be set before the encoder position is adjusted. After the write access, the parameter values have to be saved to the nonvolatile memory and the drive has to be power cycled, before the change becomes active. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	usr_p - - -	INT32 R/W - -	CANopen 3005:24$_h$ Modbus 1352 Profibus 1352 CIP 105.1.36 ModbusTCP 1352 EtherCAT 3005:24$_h$ PROFINET 1352

After setting the absolute position and after restarting the drive, verify the absolute position via parameter *_p_act_ENC2*.

NOTE: If you have replaced the drive or replaced the encoder you must set and verify the absolute position again.

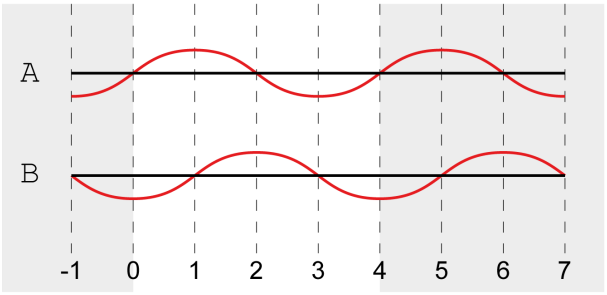
For more details on the parameters of the encoder (for example parameter *ShiftEncWorkRang*) see the user guide of the drive.

Working with Encoder Increments

Definition of Encoder Increments for Analog Encoders

For analog encoders, 1 period (line) corresponds to 4 encoder increments.

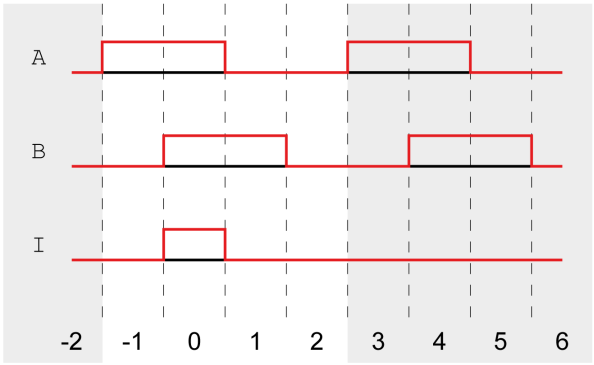
One period for analog encoders:



Definition of Encoder Increments for Digital Encoders With the Interface ABI

For digital encoders with the interface ABI, 1 period (line) corresponds to 4 encoder increments.

One period for digital encoders with the interface ABI:



Definition of Encoder Increments for Digital Encoders With the Interface EnDat 2.2, BiSS or SSI

For digital encoders with the interface EnDat 2.2, BiSS or SSI, bit 0 (LSB) corresponds to 1 encoder increment.

Setting the Maximum Distance for Search for Index Pulse

Description

The maximum distance for the search for the index pulse can be set via the parameter *ENCSinCosMaxIx*.

This setting is only relevant for analog encoders with the interface SinCos 1Vpp (without Hall) or SinCos 1Vpp (with Hall).

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
ENCSinCosMaxIx	Maximum distance for search for index pulse for SinCos encoder. The parameter specifies the maximum number of periods during which the index pulse must be found (search range). A tolerance of 10 % is added to this value. If no index pulse is found within this range (including the 10% tolerance), an error message is generated. Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.01.	- 1 1024 2147483647	INT32 R/W per. -	CANopen 3051:4$_h$ Modbus 20744 Profibus 20744 CIP 181.1.4 ModbusTCP 20744 EtherCAT 3051:4$_h$ PROFINET 20744

Settings for Machine Encoders

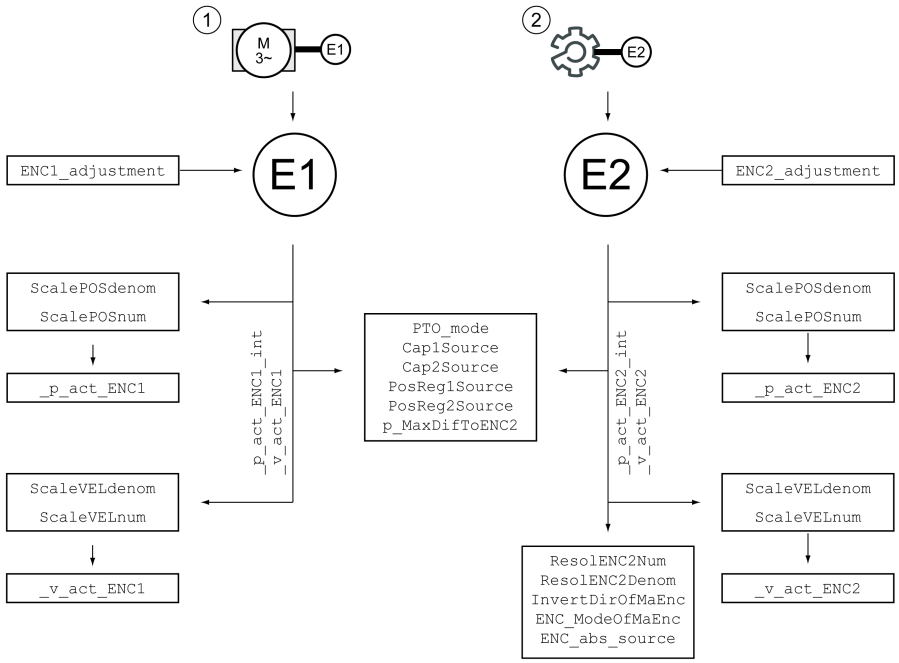
Usage as a Machine Encoder

Overview

If the encoder module is used to connect a machine encoder, you must first set the interface parameters to enable communication between the encoder and the encoder module.

Once you have set the parameters for the supply voltage and the interface, the machine encoder must be adapted to the mechanical situation.

The illustration below shows an overview of the affected parameters:



1 Motor encoder

2 Machine encoder

Setting the Supply Voltage

Supply Voltage for Analog Encoders

The supply voltage can be adjusted to 5 Vdc or 12 Vdc via the parameter *ENCAnaPowSupply* to match the encoder. Depending on this setting, either pin *ENC+5V_OUT* or pin *ENC+12V_OUT* provides the supply voltage.

This setting is only relevant for encoders with the interface SinCos 1Vpp (without Hall).

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCAnaPowSupply	Power supply encoder module ANA (analog interface). **5 / 5V**: 5 V supply voltage **12 / 12V**: 12 V supply voltage Power supply of the analog encoder only if the encoder is used as a machine encoder supplying 1Vpp encoder signals. This parameter is not used for Hiperface encoders. Hiperface encoders are supplied with 12 V. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	- 5 5 12	UINT16 R/W per. -	CANopen 3051:2$_h$ Modbus 20740 Profibus 20740 CIP 181.1.2 ModbusTCP 20740 EtherCAT 3051:2$_h$ PROFINET 20740

Supply Voltage for Digital Encoders

The supply voltage can be adjusted to 5 Vdc or 12 Vdc via the parameter *ENCDigPowSupply* to match the encoder. Depending on this setting, either pin *ENC+5V_OUT* or pin *ENC+12V_OUT* provides the supply voltage.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCDigPowSupply	Power supply encoder module DIG (digital interface). **5 / 5V**: 5 V supply voltage **12 / 12V**: 12 V supply voltage Power supply of the digital encoder. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	- 5 5 12	UINT16 R/W per. -	CANopen 3052:4$_h$ Modbus 21000 Profibus 21000 CIP 182.1.4 ModbusTCP 21000 EtherCAT 3052:4$_h$ PROFINET 21000

Settings for the Interface EnDat 2.2

Setting the Evaluation of Bits of EnDat 2.2 Encoders With More Than 32 Bits Related to the Position

The drive can evaluate position values with 32 bits. However, the drive supports EnDat 2.2 encoders with position values with more than 32 bits.

If an encoder with position values with more than 32 bits is used, the 32 most significant bits (MSB) are evaluated. The entire working range of the encoder is available, but the resolution is reduced.

With firmware version ≥V01.32 of the drive, you can set via the parameter *ENCDigEnDatBits* whether the 32 most significant bits (MSB) or the 32 least significant bits (LSB) are evaluated.

- If the 32 most significant bits are evaluated, the entire working range of the encoder is available. The resolution is reduced.
- If the 32 least significant bits are evaluated, the entire resolution of the encoder is available. The working range is reduced.

Example for an EnDat 2.2 encoder with 36 bits:

Value 0 (32 most significant bits): Bits 4 to 35 of the position value of the encoder are evaluated.

Value 1 (32 least significant bits): Bits 0 to 31 of the position value of the encoder are evaluated.

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
ENCDigEnDatBits	Evaluation of bits of EnDat 2.2 encoders with more than 32 bits. **0 / Evaluate32MostSignificantBits**: Evaluate the 32 most significant bits (MSB) **1 / Evaluate32LeastSignificantBits**: Evaluate the 32 least significant bits (LSB) This parameter specifies the way the bits provided by EnDat 2.2 encoders with more than 32 bits are evaluated. The parameter specifies whether the 32 most significant bits (MSB) or the 32 least significant bits (LSB) are evaluated. If the 32 most significant bits are evaluated, the entire working range of the encoder is available. The resolution is reduced. If the 32 least significant bits are evaluated, the entire resolution of the encoder is available. The working range is reduced. Example for an EnDat 2.2 encoder with 36 bits: Value 0: Bits 4 to 35 are evaluated. Value 1: Bits 0 to 31 are evaluated. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.32.	- 0 0 1	UINT16 R/W per. -	CANopen 3052:F_h Modbus 21022 Profibus 21022 CIP 182.1.15 ModbusTCP 21022 EtherCAT 3052:F_h PROFINET 21022

Settings for the Interface BiSS

Setting the Position Coding

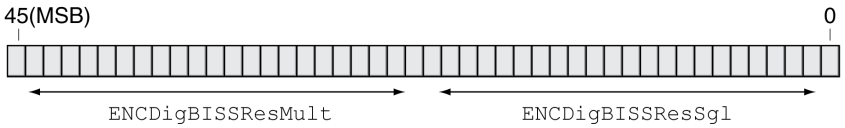
Transmission via the BiSS protocol requires the data to be available as pure position data. The data can be transmitted in Binary or Gray format.

The position coding can be set via the parameter *ENCDigBISSCoding*.

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
ENCDigBISSCoding	Position coding of BISS encoder. **0 / binary**: Binary coding **1 / gray**: Gray coding This parameter defines the type of position coding of the BISS encoder. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	- 0 0 1	UINT16 R/W per. -	CANopen 3052:A_h Modbus 21012 Profibus 21012 CIP 182.1.10 ModbusTCP 21012 EtherCAT 3052:A_h PROFINET 21012

Setting the Resolution

The resolution can be set via the parameters *ENCDigBISSResSgl* and *ENCDigBISSResMult*. Together, the values of these parameters must not exceed 46 bits.



ENCDigBISSResMult + ENCDigBISSResSgl = ≤46 Bit

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCDigBISSResSgl	BISS singleturn resolution. This parameter is only relevant for BISS encoders (singleturn and multiturn). Example: If ENCDigBISSResSgl is set to 13, an BISS encoder with a singleturn resolution of 2^13 = 8192 increments must be used. If a multiturn encoder is used, the sum of ENCDigBISSResMult + ENCDigBISSResSgl must be less than or equal to 46 bits. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	bit 8 13 25	UINT16 R/W per. -	CANopen 3052:8h Modbus 21008 Profibus 21008 CIP 182.1.8 ModbusTCP 21008 EtherCAT 3052:8h PROFINET 21008
ENCDigBISSResMul	BISS multiturn resolution. This parameter is only relevant for BISS encoders (singleturn and multiturn). If a singleturn BISS encoder is used, ENCDigBISSResMult must be set to 0. Example: If ENCDigBISSResMult is set to 12, the number of turns of the encoder used must be 2^12 = 4096. The sum of ENCDigBISSResMult + ENCDigBISSResSgl must be less than or equal to 46 bits. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	bit 0 0 24	UINT16 R/W per. -	CANopen 3052:9h Modbus 21010 Profibus 21010 CIP 182.1.9 ModbusTCP 21010 EtherCAT 3052:9h PROFINET 21010

Settings for the Interface ABI (Incremental)

Setting the Maximum Frequency of the ABI Signals

The maximum frequency of the ABI signals can be set with the parameter *ENCDigABIMaxFreq*.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCDigABIMaxFreq	ABI maximum frequency. The maximum possible ABI frequency is encoder-specific (specified by the encoder manufacturer). The encoder module DIG supports a maximum ABI frequency of 1 MHz (this is the default and maximum value of ENCDigABIMaxFreq). An ABI frequency of 1 MHz means that there are 4000000 encoder increments in 1 second. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	kHz 1 1000 1000	UINT16 R/W per. -	CANopen 3052:6$_h$ Modbus 21004 Profibus 21004 CIP 182.1.6 ModbusTCP 21004 EtherCAT 3052:6$_h$ PROFINET 21004

Setting the Maximum Distance to the Index Pulse

The maximum distance to the index pulse can be set with the parameter *ENCDigABImaxIx*.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCDigABImaxIx	ABI maximum distance for index pulse search. In the case of a reference movement to the index pulse, ENCDigABImaxIx contains the maximum distance within which the index pulse must be found. If no physical index pulse is found over this range, an error message is generated. Example: A rotary ABI encoder with one index pulse per revolution is connected. The resolution of the encoder is 8000 encoder increments per revolution (this value can be determined using parameter _Inc_Enc2Raw. _Inc_Enc2Raw and ENCDigABImaxIx have the same scaling). The maximum distance necessary for a reference movement to the index pulse is one revolution. This means that ENCDigABImaxIx should be set to 8000. Internally, a tolerance of 10% is added. This means that during a reference movement to the index pulse, an index pulse must be found within 8800 encoder increments. Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.01.	EncInc 1 10000 2147483647	INT32 R/W per. -	CANopen 3052:7$_h$ Modbus 21006 Profibus 21006 CIP 182.1.7 ModbusTCP 21006 EtherCAT 3052:7$_h$ PROFINET 21006

Settings for the Interface SSI

Setting the Position Coding

Transmission via the SSI protocol requires the data to be available as pure position data. The data can be transmitted in Binary or Gray format.

The position coding can be set via the parameter *ENCDigSSICoding*.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCDigSSICoding	Position coding of SSI encoder. **0 / binary**: Binary coding **1 / gray**: Gray coding This parameter defines the type of position coding of the SSI encoder. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	- 0 0 1	UINT16 R/W per. -	CANopen 3052:3$_h$ Modbus 20998 Profibus 20998 CIP 182.1.3 ModbusTCP 20998 EtherCAT 3052:3$_h$ PROFINET 20998

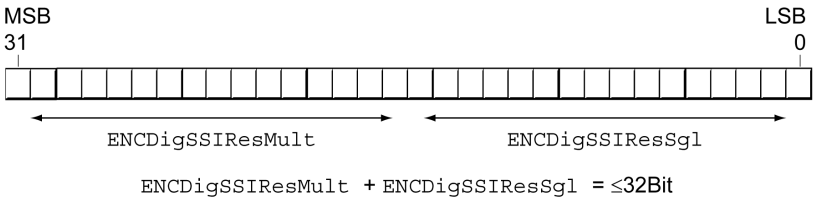
Setting the Maximum Transfer Frequency

The maximum transfer frequency of the SSI interface can be set via the parameter *ENCDigSSIMaxFreq*.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCDigSSIMaxFreq	SSI maximum transfer frequency. This parameter is used to set the SSI transfer frequency for SSI encoders (singleturn and multiturn). The SSI transfer frequency depends on the encoder (maximum frequency specified by the encoder manufacturer) and on the length of the encoder cable. The encoder module supports SSI transfer frequencies of 200 kHz and 1000 kHz. If your SSI encoder supports a maximum frequency of 1000 kHz, set the value of this parameter to 1000. If the length of the encoder cable in your system exceeds 50 m, set the value of this parameter to 200, regardless of the maximum possible frequency specified by the encoder manufacturer. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	kHz 200 200 1000	UINT16 R/W per. -	CANopen 3052:5$_h$ Modbus 21002 Profibus 21002 CIP 182.1.5 ModbusTCP 21002 EtherCAT 3052:5$_h$ PROFINET 21002

Setting the Resolution for Rotary Encoders

The resolution for rotary encoders can be set via the parameters *ENCDigSSIResSgl* and *ENCDigSSIResMult*. Together, the values of these parameters must not exceed 32 bits.



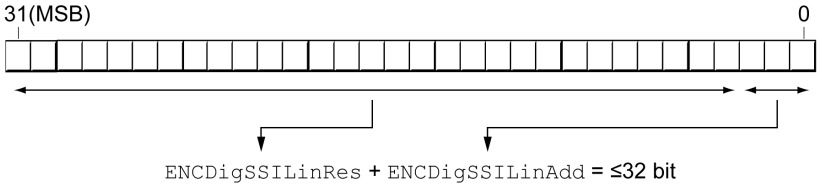
Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
ENCDigSSIResSgl	SSI singleturn resolution (rotary). This parameter is only relevant for SSI encoders (singleturn and multiturn). Example: If ENCDigSSIResSgl is set to 13, an SSI encoder with a singleturn resolution of 2^13 = 8192 increments must be used. If a multiturn encoder is used, the sum of ENCDigSSIResMult + ENCDigSSIResSgl must be less than or equal to 32 bits. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	bit 8 13 25	UINT16 R/W per. -	CANopen 3052:1$_h$ Modbus 20994 Profibus 20994 CIP 182.1.1 ModbusTCP 20994 EtherCAT 3052:1$_h$ PROFINET 20994
ENCDigSSIResMult	SSI multiturn resolution (rotary). This parameter is only relevant for SSI encoders (singleturn and multiturn). If a singleturn SSI encoder is used, ENCDigSSIResMult must be set to 0. Example: If ENCDigSSIResMult is set to 12, the number of turns of the encoder used must be 2^12 = 4096. The sum of ENCDigSSIResMult + ENCDigSSIResSgl must be less than or equal to 32 bits. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.01.	bit 0 0 24	UINT16 R/W per. -	CANopen 3052:2$_h$ Modbus 20996 Profibus 20996 CIP 182.1.2 ModbusTCP 20996 EtherCAT 3052:2$_h$ PROFINET 20996

Setting the Resolution for Linear Encoders

The resolution for linear encoders can be set via the parameter *ENCDigSSILinRes*.

Additional bits (if available) can be set via the parameter *ENCDigSSILinAdd*.

Together, the values of these parameters must not exceed 32 bits.



Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCDigSSILinRes	SSI encoder resolution bits (linear). This parameter is used to set the number of resolution bits of a linear SSI encoder. The total number of resolution bits (*ENCDigSSILinRes*) and additional bits (*ENCDigSSILinAdd*) is limited to 32. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.26.	bit 8 24 32	UINT16 R/W per. -	CANopen 3052:C_h Modbus 21016 Profibus 21016 CIP 182.1.12 ModbusTCP 21016 EtherCAT 3052:C_h PROFINET 21016
ENCDigSSILinAdd	SSI encoder additional bits (linear). This parameter is used to set the number of resolution bits of a linear SSI encoder. The total number of resolution bits (*ENCDigSSILinRes*) and additional bits (*ENCDigSSILinAdd*) is limited to 32. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.26.	bit 0 0 3	UINT16 R/W per. -	CANopen 3052:D_h Modbus 21018 Profibus 21018 CIP 182.1.13 ModbusTCP 21018 EtherCAT 3052:D_h PROFINET 21018

Setting the Ratio Between Machine Encoder and Motor Encoder

Overview

The ratio between the machine encoder and the motor encoder adjusts the machine encoder to the internal units of the drive.

Definition: A specific number of Encoder increments *ResolENC2Num* correspond to a specific number of motor revolutions *ResolENC2Denom*.

This can be determined either by calculation or by measuring.

Calculating the Ratio for Rotary Encoders

Formula for calculation of the ratio:

$$\frac{\texttt{ResolENC2Num}}{\texttt{ResolENC2Denom}} = \frac{\text{EncIncOneRev}}{1} \times \frac{\text{MechGearDenom}}{\text{MechGearNum}} \times \frac{1}{\text{AnaDig}}$$

Item	Meaning
EncIncOneRev	Number of encoder increments of one revolution of the machine encoder. For the definition of encoder increments, see Definition of Encoder Increments, page 25.
MechGearDenom(1)	Denominator of the mechanical gear. Example: Value 2, if a mechanical gear with a ratio of 5:**2** is used.
MechGearNum(1)	Numerator of the mechanical gear. Example: Value 5, if a mechanical gear with a ratio of **5**:2 is used.
AnaDig	For analog encoders: Value 4 For digital encoders: Value 1
(1) If a mechanical gear is used.	

Examples:

Type of encoder	Mechanical gear	Result
Analog encoder Resolution: 20000 encoder increments (5000 periods/lines) per revolution of the machine encoder	None	*ResolENC2Num*: 20000 x 1 x 1 = 20000 *ResolENC2Denom*: 1 x 1 x 4 = 4
	Ratio 5:2	*ResolENC2Num*: 20000 x 2 x 1 = 40000 *ResolENC2Denom*: 1 x 5 x 4 = 20
Digital encoder ABI Resolution: 20000 encoder increments (5000 periods/lines) per revolution of the machine encoder	None	*ResolENC2Num*: 20000 x 1 x 1 = 20000 *ResolENC2Denom*: 1 x 1 x 1 = 1
	Ratio 5:2	*ResolENC2Num*: 20000 x 2 x 1 = 40000 *ResolENC2Denom*: 1 x 5 x 1 = 5
Digital encoder EnDat 2.2, BiSS or SSI Resolution: 8192 encoder increments (13 bits) per revolution of the machine encoder	None	*ResolENC2Num*: 8192 x 1 x 1 = 8192 *ResolENC2Denom*: 1 x 1 x 1 = 1
	Ratio 5:2	*ResolENC2Num*: 8192 x 2 x 1 = 16384 *ResolENC2Denom*: 1 x 5 x 1 = 5

Calculating the Ratio for Linear Encoders

Formula for calculation of the ratio:

$$\frac{\texttt{ResolENC2Num}}{\texttt{ResolENC2Denom}} = \frac{\left(\frac{\text{Feed}}{\text{Resol}}\right)}{1} \times \frac{\text{MechGearDenom}}{\text{MechGearNum}} \times \frac{1}{\text{AnaDig}}$$

Item	Meaning
Feed	The feed of the linear axis with one revolution of the input shaft. Use the same unit as for “Resol”.
Resol	The resolution of the machine encoder corresponding to 1 encoder increment. Use the same unit as for “Feed”. For the definition of encoder increments see chapter Definition of Encoder Increments, page 25.
MechGearDenom(1)	Denominator of the mechanical gear. Example: Value 3, if a mechanical gear with a ratio of 7:**3** is used.
MechGearNum(1)	Numerator of the mechanical gear. Example: Value 7, if a mechanical gear with a ratio of **7**:3 is used.
AnaDig	For analog encoders: Value 4 For digital encoders: Value 1
(1) If a mechanical gear is used.	

Examples:

Type of encoder	Feed of the linear axis	Mechanical gear	Result
Analog encoder Resolution: 1 periods/lines correspond to 0.02 mm, therefore 1 encoder increment correspond to 0.005 mm	One revolution of the input shaft correspond to 155 mm	None	*ResolENC2Num*: (155/0.005) x 1 x 1 = 31000 *ResolENC2Denom*: 1 x 1 x 4 = 4
		Ratio 7:3	*ResolENC2Num*: (155/0.005) x 3 x 1 = 93000 *ResolENC2Denom*: 1 x 7 x 4 = 28
Digital encoder ABI Resolution: 1 periods/lines correspond to 0.02 mm, therefore 1 encoder	One revolution of the input shaft correspond to 155 mm	None	*ResolENC2Num*: (155/0.005) x 1 x 1 = 31000 *ResolENC2Denom*: 1 x 1 x 1 = 1
		Ratio 7:3	*ResolENC2Num*: (155/0.005) x 3 x 1 = 93000

Type of encoder	Feed of the linear axis	Mechanical gear	Result
increment correspond to 0.005 mm			*ResolENC2Denom*: 1 x 7 x 1 = 7
Digital encoder EnDat 2.2 or SSI Resolution: 1 encoder increment (1 bit) correspond to 0.005 mm	One revolution of the input shaft correspond to 155 mm	None	*ResolENC2Num*: (155/0.005) x 1 x 1 = 31000 *ResolENC2Denom*: 1 x 1 x 1 = 1
		Ratio 7:3	*ResolENC2Num*: (155/0.005) x 3 x 1 = 93000 *ResolENC2Denom*: 1 x 7 x 1 = 7

Measuring the Ratio (Alternative)

Procedure:

Step	Action
1	Set the parameter *ENC_ModeOfMaEnc* to the value 0 to keep the motor from being controlled during the procedure.
2	Read the value of the parameter *_Inc_ENC2Raw* using the commissioning software.
3	Move the motor shaft by exactly one revolution in positive direction using the commissioning software.
4	Calculate the difference between *_Inc_ENC2Raw* before and after the revolution of the motor.
5	Set the value of the parameter *ResolENC2Num* to the difference calculated.
6	Set the parameter *ResolENC2Denom* to: • For analog encoders: Value 4 • For digital encoders: Value 1
7	Reset the parameter *ENC_ModeOfMaEnc* to the original value.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_Inc_ENC2Raw	Raw increment value of encoder 2. This parameter is only needed for commissioning of encoder 2 in case of an indeterminable machine encoder resolution. Available with firmware version ≥V01.01.	EncInc - - -	INT32 R/- - -	CANopen 301E:25$_h$ Modbus 7754 Profibus 7754 CIP 130.1.37 ModbusTCP 7754 EtherCAT 301E:25$_h$ PROFINET 7754

Parameters for the Ratio

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
ResolENC2Num	Resolution of encoder 2, numerator. Digital encoders: Specification of the encoder increments the external encoder returns for one or several revolutions of the motor shaft. The value is indicated with a numerator and a denominator so that it is possible, for example, to take into account the gear ratio of a mechanical gearing. The value must not be set to 0. The resolution factor is not applied until this numerator value is specified. Example: One motor revolution causes 1/3 encoder revolution at an encoder resolution of 16384 EncInc/revolution. ResolENC2Num = 16384 EncInc ResolENC2Denom = 3 revolutions Analog encoders: Num/Denom must be set equivalent to the number of analog periods per 1 motor revolution. Example: One motor revolution causes 1/3 encoder revolution at an encoder resolution of 16 analog periods per revolution. ResolENC2Num = 16 periods ResolENC2Denom = 3 revolutions Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	EncInc 1 10000 2147483647	INT32 R/W per. -	CANopen 3050:6$_h$ Modbus 20492 Profibus 20492 CIP 180.1.6 ModbusTCP 20492 EtherCAT 3050:6$_h$ PROFINET 20492
ResolENC2Denom	Resolution of encoder 2, denominator. See numerator (*ResolEnc2Num*) for a description. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	revolution 1 1 16383	INT32 R/W per. -	CANopen 3050:5$_h$ Modbus 20490 Profibus 20490 CIP 180.1.5 ModbusTCP 20490 EtherCAT 3050:5$_h$ PROFINET 20490

Setting the Maximum Deviation Between Motor Encoder and Machine Encoder

The maximum deviation between motor encoder and machine encoder can be set via the parameter *p_MaxDifToENC2*.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
p_MaxDifToENC2	Maximum permissible deviation of encoder positions. The maximum permissible position deviation between the encoder positions is cyclically monitored. If the limit is exceeded, an error is detected. The position deviation is available via the parameter '_p_DifEnc1ToEnc2'. The default value corresponds to 1/2 motor revolution. The maximum value corresponds to 100 motor revolutions. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	Inc 1 65536 13107200	INT32 R/W per. -	CANopen 3050:7$_h$ Modbus 20494 Profibus 20494 CIP 180.1.7 ModbusTCP 20494 EtherCAT 3050:7$_h$ PROFINET 20494

Settings for Positioning

Setting the Counting Direction of the Machine Encoder

Depending on the mechanical components, a movement can imply different directions for the motor encoder and the machine encoder. The counting direction for both encoders must be identical even if the directions of movement are different.

Procedure for verifying the counting direction:

Step	Action
1	Set the parameter *ENC_ModeOfMaEnc* to the value 0 to keep the motor from being controlled during the procedure.
2	Read the values of the parameters *_p_act_ENC1* and *_p_act_ENC2* using the commissioning software.
3	Move the motor by means of the commissioning software.
4	Compare the change in values of the two parameters *_p_act_ENC1* and *_p_act_ENC2*. If both parameter values have increased or decreased, the counting direction is correct.
5	If the parameters count in different directions, set the parameter *InvertDirOfMaEnc* to 1 to adjust the counting direction.
6	Reset the parameter *ENC_ModeOfMaEnc* to the original value.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
_p_act_ENC1	Actual position of encoder 1. Available with firmware version ≥V01.01.	usr_p - - -	INT32 R/- - -	CANopen 301E:27$_h$ Modbus 7758 Profibus 7758 CIP 130.1.39 ModbusTCP 7758 EtherCAT 301E:27$_h$ PROFINET 7758
_p_act_ENC2	Actual position of encoder 2 (module).	usr_p - - -	INT32 R/- - -	CANopen 301E:1A$_h$ Modbus 7732 Profibus 7732 CIP 130.1.26 ModbusTCP 7732 EtherCAT 301E:1A$_h$ PROFINET 7732
InvertDirOfMaEnc	Inversion of direction of machine encoder. **0 / Inversion Off**: Inversion of direction is off **1 / Inversion On**: Inversion of direction is on Setting can only be modified if power stage is disabled. Modified settings become active immediately.	- 0 0 1	UINT16 R/W per. -	CANopen 3050:8$_h$ Modbus 20496 Profibus 20496 CIP 180.1.8 ModbusTCP 20496 EtherCAT 3050:8$_h$ PROFINET 20496

Setting the Mode of the Machine Encoder

The mode of the machine encoder can be set via the parameter *ENC_ ModeOfMaEnc*.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENC_ModeOfMaEnc	Selection of mode of machine encoder. **0 / None**: Machine encoder is not used for motor control **1 / Position Control**: Machine encoder is used for position control **2 / Velocity And Position Control**: Machine encoder is used for velocity and position control It is not possible to use the machine encoder for velocity control and the motor encoder for position control. Setting can only be modified if power stage is disabled. Modified settings become active the next time the power stage is enabled.	- 0 1 2	UINT16 R/W per. -	CANopen 3050:2$_h$ Modbus 20484 Profibus 20484 CIP 180.1.2 ModbusTCP 20484 EtherCAT 3050:2$_h$ PROFINET 20484

Setting the Source for Reading the Absolute Position Value

The source for reading the absolute position value can be set via the parameter *ENC_abs_source*.

Set this parameter to the value **Encoder 2 (module)** to increase the position accuracy.

This setting is only relevant for encoders with the interface EnDat 2.2, BiSS or SSI.

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
ENC_abs_source	Source for setting absolute encoder position. **0 / Encoder 1**: Absolute position determined from encoder 1 **1 / Encoder 2 (module)**: Absolute position determined from encoder 2 (module) This parameter defines the encoder source which is used to determine the base absolute position after power cycling. If this is set to Encoder 1, the absolute position from encoder 1 is read and copied to the system values of encoder 2. Modified settings become active the next time the product is powered on.	- 0 0 1	UINT16 R/W per. -	CANopen 3005:25$_h$ Modbus 1354 Profibus 1354 CIP 105.1.37 ModbusTCP 1354 EtherCAT 3005:25$_h$ PROFINET 1354

Verifying the Maximum Position Value of the Machine Encoder

Description

Each machine encoder with the interface EnDat 2.2, BiSS, or SSI has to be verified whether the maximum position value of the machine encoder exceeds the maximum positioning value of the drive.

The maximum position value of the machine encoder depends on two factors:

- The resolution of the machine encoder
- The ratio between the motor encoder and machine encoder, page 35

A formula can be used to calculate the maximum position value of the machine encoder.

If the maximum position value of the machine encoder exceeds the maximum positioning value of the drive you can ether change mechanical components (for example, use of a machine encoder with a lower resolution or use of a mechanical gear box with a lower ratio) or you can limit the resolution of the machine encoder via a parameter.

Calculating the Maximum Position Value

The maximum position value of the machine encoder can be calculated using the following formula. The result must be lower or equal to 2147483647.

$$2^{RESOBITS} \times \left(\frac{\texttt{ResolENC2Denom}}{\texttt{ResolENC2Num}}\right) \times 131072 \leq 2147483647$$

Definition of RESOBITS (resolution bits):

Interface	Value for RESOBITS
Rotary EnDat 2.2	Number of the bits of the singleturn resolution plus number of the bits of the multiturn resolution (see the technical data of the encoder for the values)(1)
Linear EnDat 2.2	Number of the bits of the position resolution (see the technical data of the encoder for the values)
Rotary BiSS	Number of the bits of the singleturn resolution (same as parameter *ENCDigBISSResSgl*) plus number of the bits of the multiturn resolution (same as parameter *ENCDigBISSResMul*)(1)
Rotary SSI	Number of the bits of the singleturn resolution (same as parameter *ENCDigSSIResSgl*) plus number of the bits of the multiturn resolution (same as parameter *ENCDigSSIResMult*)(1)
Linear SSI	Number of the bits of the position resolution (same as parameter *ENCDigSSILinRes*)
(1) In case of singleturn encoder, the value for the bits of the multiturn resolution is 0.	

If the maximum position value of the machine encoder exceeds the maximum positioning value of the drive and if the mechanical components cannot be modified, then you can limit the resolution of the machine encoder via a parameter.

NOTE: Limiting the resolution of the machine encoder considerably reduces the mechanical movement range.

Limiting the Resolution of the Machine Encoder

For rotary encoders, the resolution of the machine encoder can be limited by specifying the number of bits used for the multiturn resolution via parameter *ENCDigResMulUsed*.

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
ENCDigResMulUsed	Number of bits of the multiturn resolution used from the encoder. Specifies the number of bits of the multiturn resolution used for position evaluation. If ENCDigResMulUsed = 0, all bits of the multiturn resolution of the encoder are used. Example: If ENCDigResMulUsed = 11, only 11 bits of the multiturn resolution of the encoder are used. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.03.	bit 0 0 24	UINT16 R/W per. -	CANopen 3052:B_h Modbus 21014 Profibus 21014 CIP 182.1.11 ModbusTCP 21014 EtherCAT 3052:B_h PROFINET 21014

For linear encoders, the resolution of the machine encoder can be limited by specifying the number of bits used for the position resolution via parameter *ENCDigLinBitsUsed*.

Parameter name HMI menu HMI name	Description	Unit Minimum value Factory setting Maximum value	Data type R/W Persistent Expert	Parameter address via fieldbus
ENCDigLinBitsUsed	Linear encoder: Number of bits of the position resolution used. Specifies the number of bits of the position resolution used for position evaluation. If ENCDigLinBitsUsed = 0, all position bits of the position resolution of the encoder are used. Example: If ENCDigLinBitsUsed = 22, only 22 bits of the position resolution of the encoder are used. Setting can only be modified if power stage is disabled. Modified settings become active the next time the product is powered on. Available with firmware version ≥V01.26.	bit 0 0 31	UINT16 R/W per. -	CANopen 3052:E_h Modbus 21020 Profibus 21020 CIP 182.1.14 ModbusTCP 21020 EtherCAT 3052:E_h PROFINET 21020

Examples for Rotary Encoders

Example 1:

- Resolution singleturn bits: 17 bits
- Resolution multiturn bits: 12 bits
- Mechanical gear box: None
- Parameter *ResolENC2Num*: 131072
- Parameter *ResolENC2Denom*: 1

$2^{(17+12)}$ x (1/131072) x 131072 = 536870912

536870912 is less than 2147483647. No limitation of the resolution necessary.

Example 2:

- Resolution singleturn bits: 17 bits
- Resolution multiturn bits: 12 bits
- Mechanical gear box: 3:1
- Parameter *ResolENC2Num*: 131072
- Parameter *ResolENC2Denom*: 3

$2^{(17+12)}$ x (3/131072) x 131072 = 1610612736

1610612736 is less than 2147483647. No limitation of the resolution necessary.

Example 3:

- Resolution singleturn bits: 17 bits
- Resolution multiturn bits: 12 bits
- Mechanical gear box: 5:1
- Parameter *ResolENC2Num*: 131072
- Parameter *ResolENC2Denom*: 5

$2^{(17+12)}$ x (5/131072) x 131072 = 2684354560

2684354560 is greater than 2147483647. Change mechanical components (for example a machine encoder with a lower resolution or use of a mechanical gear box with a lower ratio) or limit the resolution of the machine encoder via the parameter *ENCDigResMulUsed*.

Limitation of the resolution of the machine encoder:

- Parameter *ENCDigResMulUsed*: 11

$2^{(17+11)}$ x (5/131072) x 131072 = 1342177280

1342177280 is less than 2147483647.

Examples for Linear Encoders

Example 1:

- Resolution bits: 20 bits
- 10 motor revolutions correspond to 3000 encoder increments
- Parameter *ResolENC2Num*: 3000
- Parameter *ResolENC2Denom*: 10

2^{20} x (10/3000) x 131072 = 458129845

458129845 is less than 2147483647. No limitation of the resolution necessary.

Example 2:

- Resolution bits: 24 bits
- 10 motor revolutions correspond to 6702 encoder increments
- Parameter *ResolENC2Num*: 6702
- Parameter *ResolENC2Denom*: 10

2^{24} x (10/6702) x 131072 = 3281144816

3281144816 is greater than 2147483647. Change mechanical components (for example a machine encoder with a lower resolution or use of a mechanical gear box with a lower ratio) or limit the resolution of the machine encoder via the parameter *ENCDigLinBitsUsed*.

Limitation of the resolution of the machine encoder:

- Parameter *ENCDigLinBitsUsed*: 23

2^{23} x (10/6702) x 131072 = 1640572408

1640572408 is less than 2147483647.

Settings for Encoders of Third-Party Motors

Usage as a Motor Encoder

General

If third-party motors are used, incorrect parameterization or wiring may cause unintended movements or destruction.

⚠WARNING

UNINTENDED MOVEMENT

- Verify that the motor encoder is compatible for the encoder module.
- Verify correct connection of the motor.
- Set the correct values for the appropriate parameters.
- Ensure that the third party motor parameters are also configured correctly as the type plate cannot be read from the encoder.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

If the interface SinCos 1Vpp (without Hall) is used, a static load on the motor (for example, vertical axis) causes an incorrect point of reference for commutation. Incorrect commutation can trigger unintended movements.

⚠WARNING

UNINTENDED MOVEMENT

Verify that no static load (for example, a load hanging on a vertical axis) greater than 10% of the nominal value (torque or force specified for the motor) can act on the motor when the power stage is enabled.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The motor needs to be able to move freely while you set the commutation. If the motor cannot move freely, it results in an incorrect point of reference for commutation. Incorrect commutation can cause unintended movements and leads to reduced efficiency.

⚠WARNING

UNINTENDED OPERATION

- Perform the test movement without coupled loads.
- Install linear motors in a horizontal position.
- Verify that the holding brake is released before performing the test movement.
- Take into account that the limit switch signals are not evaluated during the test movement.
- Verify that a functioning button for emergency stop is within reach.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Third-party Motors / Encoders

The commissioning software, page 22 allows you to parameterize, store and manage various motor types. For this, use the tab **[3rd party motor]**.

- Enter the motor data in the appropriate fields. The values can be found on the nameplate or in the data sheet of your motor. See also Notes on the Motor Data, page 46.
- Verify the values entered before saving them. The motor may move even if the values are incorrect, i.e., the fact that the motor moves is not an indication that the values are correct.
- Go through the 5 steps of the wizard (bottom of the screen).
- Save the motor data.

Notes on the Motor Data

The table below explains a variety of values:

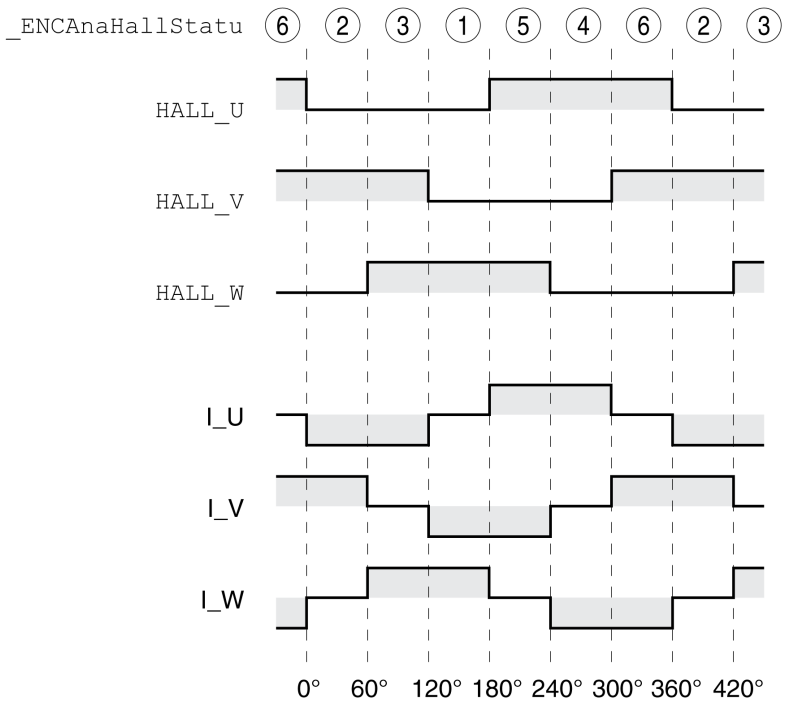
Designation	Unit	Meaning and notes
M_n_nom	Rotary: RPM Linear: mm/s	Rotary: Nominal speed of rotation. Linear: Nominal velocity.
M_I_max	Arms	Maximum current.
M_I_nom	Arms	Nominal current.
M_I_0	Arms	Continuous stall current.
M_U_max	V	Maximum permissible winding voltage.
M_Polepair	-	Number of pole pairs.
M_M_0	Rotary: Ncm Linear: N	Rotary: Continuous stall torque. Linear: Continuous stall force.
M_R_UV	Ω	Winding resistance.
M_L_q	mH	Winding inductance of the stator, measured vertically with reference to the direction of the magnetic field of the rotor between 2 connections.
M_L_d	mH	Winding inductance of the stator, measured in the direction of the magnetic field of the rotor between 2 connections.
M_Fieldrotation	-	This value is used to adjust the direction of movement. If the test movement yields an incorrect counting direction despite correct wiring, this value must be changed from 1 to 0 or from 0 to 1 in order to correct the counting direction.
M_kE	Rotary: Vrms/1000 RPM Linear: Vrms/(m/s)	The voltage constant kE is the voltage induced between 2 connections (line to line) at 1000 RPM. To convert Vs to Vrms/1000 RPM, multiply Vs by 1000 x 2 π/60 s. (Example: 0.28648 Vs x 104.7198/s = ~30 V).
M_I2T	ms	Maximum permissible time for maximum current.
M_n_max	Rotary: RPM Linear: mm/s	Rotary: Maximum permissible speed of rotation. Linear: Maximum permissible velocity.
M_Jrot	Rotary: Ncm Linear: N	Moment of inertia.

NOTE: The information differs from vendor to vendor and the values may have to be converted.

Interface for Hall Effect Sensors

Overview

The sequence of the Hall effect sensor signals must correspond to the pattern 2 - 3 - 1 - 5 - 4 - 6 as indicated in the following illustration.



The encoders of third-party motors may deliver a different pattern even though the designations *HALL_U*, *HALL_V* and *HALL_W* are used. In such a case, the encoder pins *HALL_U*, *HALL_V* and *HALL_W* must be wired differently.

Verification of the Sequence

Observe and note the values of the parameter *_ENCAnaHallStatu* in the commissioning software for one rotation of the motor shaft in positive direction of movement. Positive direction of rotation is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.

The noted sequence must correspond to the pattern 2 - 3 - 1 - 5 - 4 - 6.

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
_ENCAnaHallStatu	Sequence of Hall effect sensor signals of analog encoder. This parameter can be used to read the sequence of the Hall effect sensor signals of an analog encoder with the interface "SinCos 1Vpp (with Hall)". Available with firmware version ≥V01.01.	- 0 - 7	UINT16 R/- - -	CANopen 3051:3$_h$ Modbus 20742 Profibus 20742 CIP 181.1.3 ModbusTCP 20742 EtherCAT 3051:3$_h$ PROFINET 20742

If the sequence noted is different, adapt the wiring of the Hall effect sensor:

- For sequence 4 - 5 - 1 - 3 - 2 - 6: interchange the Hall effect signals *HALL_U* with *HALL_V*.
- For sequence 1 - 3 - 2 - 6 - 4 - 5: interchange the Hall effect signals *HALL_V* with *HALL_W*.
- For sequence 4 - 6 - 2 - 3 - 1 - 5: interchange the Hall effect signals *HALL_U* with *HALL_W*, *HALL_V* with *HALL_U* and *HALL_W* with *HALL_V*.

  NOTE: If the sequence noted is not listed above, your Hall effect sensor is not supported.

Settings for Wake & Shake

General

The motor needs to be able to move freely while you set the commutation. If the motor cannot move freely, it results in an incorrect point of reference for commutation. Incorrect commutation can cause unintended movements and leads to reduced efficiency.

⚠WARNING

UNINTENDED OPERATION

- Perform the test movement without coupled loads.
- Install linear motors in a horizontal position.
- Verify that the holding brake is released before performing the test movement.
- Take into account that the limit switch signals are not evaluated during the test movement.
- Verify that a functioning button for emergency stop is within reach.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The function Wake & Shake corresponds to a test movement to automatically determine the commutation angle.

Wake & Shake is used if the commutation angle cannot be determined by means of other mechanisms, for example, via the SinCos Hiperface interface, Hall effect signals or the resolver.

Wake & Shake is only available for motor encoders.

Wake & Shake movement is started in the following cases:

- With analog encoders with the interface SinCos 1Vpp (without Hall):

  After enabling the power stage for the first time (after starting the drive).
- With analog encoders with the interface SinCos Hiperface and encoders with the interface Resolver:

  During the commissioning via the wizard of the commissioning software.

Gain for Wake & Shake

Use the parameter *WakesAndShakeGain* to adapt Wake & Shake to your mechanical system.

Parameter name **HMI menu** **HMI name**	**Description**	**Unit** **Minimum value** **Factory setting** **Maximum value**	**Data type** **R/W** **Persistent** **Expert**	**Parameter address via fieldbus**
WakesAndShake-Gain	Gain for wake and shake. If wake and shake does not work properly, this parameter can be used to adapt the dynamics of the wake and shake procedure. Value >100 %: Increases dynamics which leads to less motor movement. Value <100 %: Reduces dynamics which leads to more motor movement. In increments of 0.1 %. Setting can only be modified if power stage is disabled. Modified settings become active immediately. Available with firmware version ≥V01.10.	% 1.0 100.0 400.0	UINT16 R/W per. -	CANopen 3050:E_h Modbus 20508 Profibus 20508 CIP 180.1.14 ModbusTCP 20508 EtherCAT 3050:E_h PROFINET 20508

Diagnostics and Troubleshooting

Mechanical and Electrical Issues

Refer also to the user guide of the drive for information on diagnostics and troubleshooting. This section describes errors and troubleshooting related to encoder 2.

Issue	Cause	Corrective
Motor does not rotate.	Motor blocked by holding brake.	Release holding brake. Verify, and correct if necessary, the brake wiring.
	Motor phases interrupted.	Verify, and correct or replace if necessary, the motor cable and the connection. One or more motor phases are not connected.
	No torque.	Set the parameters for maximum current, maximum speed of rotation to values greater than zero.
	Incorrect operating mode selected.	Set the input signal and parameters for the desired operating mode.
	Drive system switched off.	Switch on the drive system. Enable the power stage.
	Analog reference value is missing.	Verify, and correct if necessary, the controller program and the wiring.
	Motor phases reversed.	Correct the order of the motor phases.
	Motor mechanically blocked.	Verify, and correct if necessary, the coupled components.
	Current limitation active (analog input or parameter).	Verify, and correct if necessary, the current limitation.
	Incorrect adjustment of commutation offset angle.	Validate the adjustment and re-commission the commutation offset angle.
Motor jerks briefly.	Motor phases reversed.	Verify, and correct or replace if necessary, the motor cable and connection. Connect motor phases U, V and W in the same way at the motor and device ends.
	Incorrect setting of parameter *M_Fieldrotation*.	Verify, and correct if necessary, the setting of the parameter *M_Fieldrotation*.
	Resolver signals reversed.	Interchange *SIN+* and *SIN-*.
	Incorrect adjustment of commutation offset angle.	Validate the adjustment and re-commission the commutation offset angle.
	Incorrect motor data, for example number of pole pairs or inductance values.	Verify, and correct if necessary, the motor data.
Motor oscillates.	Velocity controller P gain too high.	Reduce P gain (velocity controller).
	Error in motor encoder system.	Verify, and correct or replace if necessary, the motor encoder cable.
	Reference potential of analog signal missing.	Connect reference potential of analog signal to the reference value source.
	Incorrect motor data, for example number of pole pairs or inductance values.	Verify, and correct if necessary, the motor data.
Motor movement too soft.	Integral term TNn too high.	Reduce TNn (velocity controller).
	Velocity controller P gain too low.	Increase P gain (velocity controller).
	Incorrect motor data, for example number of pole pairs or inductance values.	Verify, and correct if necessary, the motor data.
Motor movement too rough.	Integral term TNn too small.	Increase TNn (velocity controller).
	Velocity controller P gain too high.	Reduce P gain (velocity controller).
	Incorrect motor data, for example number of pole pairs or inductance values.	Verify, and correct if necessary, the motor data.

Issue	Cause	Corrective
Commissioning software cannot connect to the drive.	Drive system switched off.	Switch on the drive system.
	Wiring error.	Verify proper wiring.
	Incorrect PC interface selected.	Select correct interface.
Motor does not generate sufficient torque.	Incorrect adjustment of commutation offset angle.	Validate the adjustment and re-commission the commutation offset angle
Motor temperature too high (I^2t limitation triggered).	Incorrect adjustment of commutation offset angle.	Validate the adjustment and re-commission the commutation offset angle
Motor does not reach maximum speed of rotation.	Incorrect motor data, for example number of pole pairs or inductance values.	Verify, and correct if necessary, the motor data.
Motor positions inaccurately and does not run smoothly.	Incorrect resolver reference point.	Contact your local Schneider Electric service representative / replace motor.
	Incorrect excitation frequency.	Contact vendor for correct excitation frequency and correct.
	Cable shield not properly connected.	Verify, and correct or replace if necessary, the cable.
Error message LOS (loss of signal), amplitude of sine or cosine too small.	Resolver transformation ratio not properly parameterized.	Verify, and correct if necessary, the resolver data.

Glossary

D

Direction of rotation :

Rotation of the motor shaft in a positive or negative direction of rotation. Positive direction of rotation is when the motor shaft rotates clockwise as you look at the end of the protruding motor shaft.

DOM:

Date **o**f **m**anufacturing: The nameplate of the product shows the date of manufacture in the format DD.MM.YY or in the format DD.MM.YYYY. Example:

31.12.09 corresponds to December 31, 2009

31.12.2009 corresponds to December 31, 2009

E

EMC:

Electromagnetic compatibility

Error class:

Classification of errors into groups. The different error classes allow for specific responses to errors, for example by severity.

Error:

Discrepancy between a computed, observed or measured value or condition and the specified or theoretically correct value or condition.

F

Factory setting:

Factory settings when the product is shipped

Fault reset:

A function used to restore the drive to an operational state after a detected error is cleared by removing the cause of the error so that the error is no longer active.

Fault:

Fault is a state that can be caused by an error. Further information can be found in the pertinent standards such as IEC 61800-7, ODVA Common Industrial Protocol (CIP).

G

GSD file:

A file provided by the vendor; contains specific information on a Profibus device and is required for commissioning the device

I

I/O:

Inputs/outputs

Inc:

Increments

Incremental signals:

Steps of an encoder as rectangular pulse sequences. The pulses indicate changes in positions.

L

Limit switch:

Switches that signal overtravel of the permissible range of travel.

P

Parameter :

Device data and values that can be read and set (to a certain extent) by the user.

PTC:

Resistor with positive temperature coefficient. Resistance value increases as the temperature rises.

Q

Quick Stop:

Function which can be used for fast deceleration of the motor via a command or in the event of an error.

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As standards, specifications, and design change from time to time, please ask for confirmation of the information given in this publication.

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