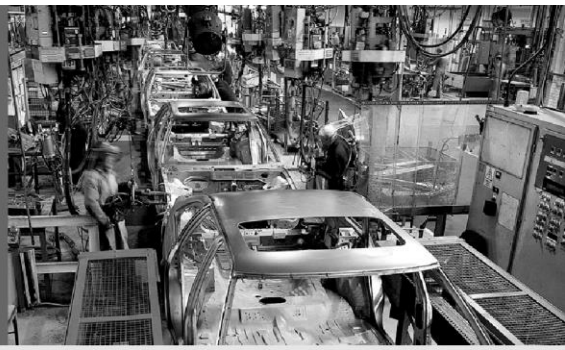
OPERATING INSTRUCTIONS



A3M60 Advanced

PROFIBUS Absolute Encoder

EN

SICK
Sensor Intelligence.

Contents

1 About this document

Please read this chapter carefully before working with this documentation and the A3M60 Advanced PROFIBUS Absolute Encoder.

1.1 Function of this document

These operating instructions are designed to inform *the technical personnel of the machine manufacturer* or *the machine operator* with regard to correct mounting, configuration, electrical installation, commissioning, operation and maintenance of the A3M60 Advanced PROFIBUS Absolute Encoder.

1.2 Target group

The operating instructions are addressed at the *designers*, *developers* and *operators* of systems in which one or more A3M60 Advanced PROFIBUS Absolute Encoders are to be integrated. They also address people who are in charge of commissioning or servicing and maintaining the A3M60 Advanced.

These instructions are written for trained personnel who are responsible for the installation, mounting and operation of the A3M60 Advanced in an industrial environment.

1.3 Information depth

These operating instructions contain information on the A3M60 Advanced PROFIBUS Absolute Encoder regarding the following subjects:

- electrical installation
- commissioning and configuration
- fault diagnosis and troubleshooting
- part numbers
- conformity and approval

The operating instructions do not contain any information on the mounting of the A3M60 Advanced. You will find this information in the mounting instructions included with the device.

Planning and using measurement systems such as the A3M60 Advanced also requires specific technical skills beyond the information in the operating instructions and mounting instructions. The information required to acquire these specific skills is not contained in this document.

When operating the A3M60 Advanced, the national, local and statutory rules and regulations must be observed.

Further information

PROFIBUS Nutzerorganisation e.V. (PNO), Haid-und-Neu-Str. 7, D‹76131 Karlsruhe
Web: http://www.profibus.com

Further literature and guidelines:

- PROFIBUS DP specification
- Guideline for PROFIBUS DP/FMS (V1.0), Order No. 2.112
- PROFIBUS RS485‹IS User and Installation Guideline (V1.1), Order No. 2.262
- Profile for PROFIBUS DP‹V0 Encoders (V1.1), Order No. 3.062
- M. Popp, PROFIBUS DP/DPV1, (Huethig, 2000), ISBN 3‹7785‹2781‹9
- The New Rapid Way to PROFIBUS DP (2002), Order No. 4.072
- PROFIBUS System Description (Vers. 10/2002), Order No. 4.002

1.4 Scope

These operating instructions are original operating instructions.

Note These operating instructions apply to the A3M60 Advanced PROFIBUS Absolute Encoders with the type identifier A3M60A‹xxx.

1.5 Abbreviations used

DP Decentralized Periphery

EEPROM Electrically Erasable Programmable Read-only Memory

FRAM Ferroelectric Random Access Memory

GC Global Control Frame

GSD Generic Station Description file = The characteristic communication features of a PROFIBUS device are described in the form of an electronic device data sheet.

IO Input and Output Data = input and output data

LSW Least Significant Word

MSW Most Significant Word

PAW Peripherie Ausgangswort = peripheral output word

PEW Peripherie Eingangswort = peripheral input word

1.6 Symbols used

Note Refer to notes for special features of the device.

□ Take action ... Instructions for taking action are highlighted by an arrow. Read carefully and follow the instructions for action.


WARNING

Warning!

A warning notice indicates an actual or potential risk or health hazard. They are designed to help you to prevent accidents.

Read carefully and follow the warning notices.

2 On safety

This chapter deals with your own safety and the safety of the equipment operators.

▶ Please read this chapter carefully before working with the A3M60 Advanced or the machine or system in which the A3M60 Advanced is used.

2.1 Authorized personnel

The A3M60 Advanced PROFIBUS Absolute Encoder must only be installed, commissioned and serviced by authorized personnel.

Note Repairs to the A3M60 Advanced are only allowed to be undertaken by trained and authorized service personnel from SICK AG.

The following qualifications are necessary for the various tasks:

Tab. 1: Authorized personnel

Activity	Qualification
Mounting	• Basic technical training • Knowledge of the current safety regulations in the workplace
Electrical installation and replacement	• Practical electrical training • Knowledge of current electrical safety regulations • Knowledge on the use and operation of devices in the related application (e.g. industrial robots, storage and conveyor technology)
Commissioning, operation and configuration	• Knowledge on the current safety regulations and the use and operation of devices in the related application • Knowledge of automation systems • Knowledge of decentralized peripheral systems on the PROFIBUS DP • Knowledge of the usage of automation software (e.g. SIMATIC Manager)

2.2 Correct use

The A3M60 Advanced PROFIBUS Absolute Encoder is a measuring device that is manufactured in accordance with recognized industrial regulations and that meets the quality requirements in accordance with ISO 9001.

An encoder is a device for mounting that cannot be used independent of its foreseen function. For this reason an encoder is not equipped with immediate safe devices.

Measures for the safety of personnel and systems must be provided by the constructor of the system as per statutory regulations.

The A3M60 Advanced is only allowed to be operated in a PROFIBUS DP network as per its purpose defined by its design. It is necessary to comply with the PROFIBUS DP specifications and guidelines for setting up a PROFIBUS DP network.

In case of any other usage as well as in case of modifications to the A3M60 Advanced, e.g. due to opening the housing during mounting and electrical installation, or to the SICK software, any claims against SICK AG under the warranty will be rendered void.

2.3 General safety notes and protective measures

WARNING

Please observe the following procedures in order to ensure the correct and safe use of the A3M60 Advanced.

The encoders are to be installed and maintained by trained and qualified personnel with knowledge of electronics, precision mechanics and control system programming. It is necessary to comply with the related standards covering the technical safety stipulations.

The safety regulations are to be met by all persons who are tasked with the installation, the operation or the maintenance of the device:

- The operating instructions must always be available and must always be followed.
- Unqualified personnel are not allowed to be present in the vicinity of the system during installation.
- The system is to be installed in accordance with the applicable safety stipulations and the mounting instructions.
- The work safety regulations published by the Berufsgenossenschaften (trade associations) and specialist associations in the related country are to be followed during installation.
- Failure to follow the applicable health and safety regulations may result in injury or damage to the system.
- The current sources and voltage sources in the encoders are designed in accordance with the applicable technical regulations.

2.4 Environmental protection

Please note the following information on disposal.

Tab. 2: Disposal of the assemblies

Assembly	Material	Disposal
Packaging	Cardboard	Waste paper
Shaft	Stainless steel	Scrap metal
Flange	Aluminium	Scrap metal
Electronic assemblies	Various	Hazardous waste

3 Product description

This chapter provides information on the special features and properties of the A3M60 Advanced PROFIBUS Absolute Encoder. It describes the construction and the operating principle of the device.

▶ Please read this chapter before mounting, installing and commissioning the device.

3.1 Special features

The A3M60 Advanced is a PROFIBUS Absolute Encoder in a 60 mm design. The highest reliability is achieved by means of electro-sensitive, magnetic scanning. The high resolution Hall sensor combines the robustness of a magnetic sensor with the high resolution that otherwise only optical sensors achieve.

Due to direct multiturn technology with a small number of moving parts, long and trouble-free operation is ensured.

The following properties characterize the A3M60 Advanced:

- output of the position value with a resolution of 31 bits
- total resolution (measuring range) maximum 2,147,483,648 steps
- resolution per revolution maximum 16,384 steps
- total resolution and resolution per turn can be scaled
- round axis functionality (endless shaft)
- PROFIBUS DP interface
  - cyclic data transmission as per DP‹V0
  - acyclic data transmission as per DP‹V1
  - The encoder supports the isochronous mode as per DP‹V2.
- The A3M60 Advanced supports the encoder profile V4.1 class 3 and 4.
- The A3M60 Advanced can be used as a replacement for the encoder type ATM60. The manufacturer-specific telegrams I0‹04 and I0‹08 for the A3M60 Advanced correspond to the process data telegrams for the ATM60.

3.2 Operating principle of the encoder

The sensor system in the A3M60 Advanced PROFIBUS Absolute Encoder is based on absolute acquisition of revolutions even when the supply voltage is switched off and without the use of an internal battery.

The A3M60 Advanced acquires the position of rotating axes and outputs the position in the form of a unique digital numeric value. The A3M60 Advanced can be used as a singleturn encoder or multiturn encoder.

Singleturn technology with Hall sensor

Singleturn encoders are used if absolute acquisition of the rotation of a shaft is required.

A high resolution Hall sensor supplies analog data to the microcontroller for the calculation of the absolute position within a revolution.

Multiturn technology with the aid of Wiegand wire technology

Multiturn encoders are used if more than one shaft revolution must be acquired absolutely.

- A magnet is mechanically attached to the encoder shaft.
- The rotating magnet generates a step change in the magnetic field in the Wiegand wire.
- This step change in the magnetic field generates a voltage pulse in the surrounding coil.
- The voltage pulse supplies a FRAM counter with energy.
- The turns are counted.

3.3 Integration in the PROFIBUS

The A3M60 Advanced is a PROFIBUS peripheral device and is integrated in the PROFIBUS as a slave.

The encoder is an input/output device. This means that the encoder uses data from the master on the bus (output data) and also produces data for the bus itself (input data).

The A3M60 Advanced complies with the requirements for the PROFIBUS ‹DP protocol DP‹V0 and V1 as per EN 50 170‹2 and the requirements for the encoder profile version 3.1 class 2 and as well as version 4.1 class 3 and class 4.

The A3M60 Advanced supports the clock synchronicity function (isochronous mode) as per DP‹V2.

3.3.1 RS‡485 interface

PROFIBUS DP and therefore also the A3M60 Advanced use RS‹485 for the transmission technology. The cabling is twisted pair. The transmission speed can be selected in the bus system in the range between 9.6 kbit/s and 12 Mbit/s, the A3M60 Advanced automatically adapts to the transmission speed of the bus system.

The following cable lengths can be realized as a function of the transmission speed:

Tab. 3: Achievable cable lengths for the RS 485 interface

Baud rate [kBit/s]	**9.6**	**19.2**	**93.75**	**187.5**	**500**	**1500**	**12000**
Cable length [m]	1200	1200	1000	1000	400	200	100

Note Up to 32 stations (masters or slaves) can be connected together in a segment. With more than 32 stations, repeaters (line amplifiers) must be used to connect the individual bus segments.

3.3.2 GSD file

Common configuration tools (e.g. STEP7 for SIMATIC) require a GSD file to integrate the device into the network.

The GSD file STEG0C0A.gsd for the A3M60 Advanced is available at http://www.sick.com for download.

3.3.3 Isochronous mode

The isochronous mode permits fast and deterministic data exchange by means of clock synchronicity on the bus system. A cyclic, equidistant clock signal is transmitted by the master to all bus users. Master and slaves across the network can synchronize to this signal with an accuracy <1 µs.

As the bus cycle is constant to a large degree, the actual values are always measured at the same time, and also the timing of the activation of the speed setpoints is deterministic, as a result, fast position control loops can be implemented over the bus.

3.4 Communication telegrams for cyclic process data

The layout and content of the communication telegrams are dependent on the communication module selected. The modules IO‹04 and IO‹08 are manufacturer specific. The modules 81 and 83 correspond to the encoder profile V4.1.

3.4.1 Structure of telegrams IO›04 and IO›08 (vendor specific)

Structure of telegram IO›04

- output (PLC to slave): preset value
- input (Slave to PLC): position

Tab. 4: Output data in telegram IO 04

Data word	1	2
Value	Preset MSW[1)]	Preset LSW[2)]

Tab. 5: Input data in telegram IO 04

Data word	1	2
Value	Position MSW[1)]	Position LSW[2)]

Structure of telegram IO›08

- output (PLC to slave): preset value
- input (Slave to PLC): position, speed, time stamp

Tab. 6: Output data in telegram IO 08

Data word	1	2	3	4
Value	Preset MSW	Preset LSW	Not used	Not used

Tab. 7: Input data in telegram IO 08

Data word	1	2	3	4
Value	Position MSW	Position LSW	Speed	Time stamp

Position

The position is output in telegram IO‹04 or IO‹08 as an input to the PLC.

The position is stated in steps. The value is output in two data words (4 bytes). The value range is always between 00000000 ... 03FFFFFFh. The maximum value is defined using the configurable parameter **Total Measuring Range**.

WARNING

Evaluate bit 31 of the input data using your control system to detect serious errors!

If, in the case of serious error, it cannot be ensured the position output is correct, this situation is indicated by setting the most significant bit 31. The position value is therefore outside the valid range and can be identified as clearly erroneous (see section 5.4 “Error transmission via PROFIBUS” on page 35).

1) Most significant word.
2) Least significant word.

Preset

The preset value is applied in telegram I0‹04 or I0‹08 as an output from the PLC.

With the aid of a preset value the encoder can be set to any position within the measuring range. The value is transmitted in two data words (4 bytes) in the output data.

The preset value is activated by setting bit 31. The current position value is only set to the preset value if bit 31 was set to “0” in the previous cycle, i.e. a transition from “0” to “1” activates the preset function.

Example of setting the preset value

Tab. 8: Example of setting the preset value

Data word		**1**	**2**
Step 1			
Input	**Hex**	0000	00AA
	Bin	0000000000000000	0000000010101010
	Dec		170
Comment: The encoder outputs the current position (00AAh) as **input**.			
Output	**Hex**	0000	FFFF
	Bin	0000000000000000	1111111111111111
	Dec		65535
Comment: Bit 31 of the **output** is 0, the preset value (FFFFh) is not applied. The encoder therefore continues to output the measured position 00AAh in step 2 that follows.			
Step 2			
Input	**Hex**	0000	00AA
	Bin	0000000000000000	0000000010101010
	Dec		170
Output	**Hex**	8000	FFFF
	Bin	**1**000000000000000	1111111111111111
	Dec		2147549183 (= 2^{31}+65535)
Comment: Bit 31 of the **output** changes to 1, the preset (FFFFh) is applied and output in step 3 as **input**.			
Step 3			
Input	**Hex**	0000	**FFFF**
	Bin	0000000000000000	1111111111111111
	Dec		65535
Output	**Hex**	0000	FFFF
	Bin	0000000000000000	1111111111111111
	Dec		65535

WARNING

Immediately after triggering the preset function, check whether there is a hazard from the machine or system in which the encoder is integrated!

The preset function results in a change in the position value output by the encoder. This change could cause an unexpected movement that may result in a hazard for personnel or damage to the system or other items.

Note A preset can also be activated using a button (see Fig. 4 on page 29).

Speed and time stamp

The speed and time stamp are output in telegram I0‹08 as input to the PLC.

The speed is stated in revolutions per minute (rpm). The value is given in a data word (2 bytes) and has a sign, i.e. negative values for reducing position values (e.g. FF.FEh = –2).

The calculation is made using a moving average filter over 200 position values. The integration time is 1 s, the update interval is 5 ms.

The time stamp is incremented in steps of 1 s. The value is given in a data word (2 bytes). After each power-up the time stamp is reset to zero.

The type of speed output and the calculation of the speed can be configured (see section 3.6 on page 21 and section 4.4.4 on page 31).

3.4.2 Structure of telegrams 81 and 83 (as per encoder profile V4.1)

Structure of telegram 81

- output (PLC to slave)
- input (Slave to PLC): position 1 and position 2

Tab. 9: Output data in telegram 81

Data word	1	2
Value	STW2_ENC	G1_STW
Signal[3)]	80	9
Length	16 Bit	16 Bit
Meaning	Encoder control word	Sensor 1 control word

Tab. 10: Input data in telegram 81

Data word	1	2	3	4	5	6
Value	ZSW2_ENC	G1_ZSW	G1_XIST1 MSW	G1_XIST1 LSW	G1_XIST2 MSW	G1_XIST2 LSW
Length	16 Bit	16 Bit	32 Bit		32 Bit	
Signal[3)]	81	10	11		12	
Meaning	Encoder state word	Sensor 1 state word	Position 1		Position 2	

Structure of telegram 83

- output (PLC to slave)
- input (Slave to PLC): position 1 and position 2 as well as speed

Tab. 11: Output data in telegram 83

Data word	1	2
Value	STW2_ENC	G1_STW
Signal[3)]	80	9
Length	16 Bit	16 Bit
Meaning	Encoder control word	Sensor 1 control word

[3)] Signal numbers as per encoder profile V4.1.

Tab. 12: Input data in telegram 83

Data word	**1**	**2**	**3**	**4**
Value	ZSW2_ENC	G1_ZSW	G1_XIST1 MSW	G1_XIST1 LSW
Signal[3)]	81	10	11	
Length	16 Bit	16 Bit	32 Bit	
Meaning	Encoder state word	Sensor 1 state word	Position 1	
Data word	**5**	**6**	**7**	**8**
Value	G1_XIST2 MSW	G1_XIST2 LSW	NIST_B MSW	NIST_B LSW
Signal[3)]	12		8	
Length	32 Bit		32 Bit	
Meaning	Position 2		Speed	

3.4.3 Contents of the signals

Signal 80: Encoder control word 2 (STW2_ENC)

Tab. 13: Encoder control word 2 (STW2_ENC)

Bit	**Designation**	**Description**
15 ... 12	Master's Sign-of-Life (only relevant in the isochronous mode)	The master starts in the bits 15 ... 12 with a value between **1** and **15**. The value is increased by 1 per cycle. If an error occurs in the master, the value **0000** is output in the bits 15 ... 12.
10	Control by PLC	**0** No control by the PLC **1** Control by the PLC
7	Error feedback	Error-buffer handling not supported
11, 9 ... 0	Reserved	–

Signal 81: Encoder state word 2 (ZSW2_ENC)

Tab. 14: Encoder state word 2 (ZSW2_ENC)

Bit	**Designation**	**Description**
15 ... 12	Encoder's Sign-of-Life (only relevant in the isochronous mode)	After successful synchronization with the master, the encoder starts in the bits 15 ... 12 with a value between **1** and **15**. The value is increased by 1 per cycle. If an error occurs in the encoder, the value **0000** is output in the bits 15 ... 12.
11, 10	Reserved	–
9	Control requested	**0** No control by the PLC requested **1** Control by the PLC requested
8 ... 0	Reserved	–

Signal 9: Sensor control word 1 (G1_STW)

Tab. 15: Sensor control word 1 (G1_STW)

Bit	Designation	Description
15	Operation in case of encoder errors	**0** Encoder error message **not** acknowledged by PLC **1** Encoder error message acknowledged by the PLC
14	Activate park mode	**0** Normal operation **1** Activate park mode
13	Request for the absolute position value	**0** No request **1** Request by the master Results in the cyclic output of the position values in **G1_XIST2**.
12	Activate preset value	Defines that an acyclically transmitted preset value is used (see section 3.5 on page 17). **0** Preset value is not activated. **1** Preset value is activated.
11	Preset mode	Defines how an acyclically transmitted preset value is used. **0** Preset value is used as a new absolute value. **1** Preset value is added/subtracted to/from the previous value.
10 ... 0	Reserved	–

Signal 10: Sensor state word (G1_ZSW)

Tab. 16: Sensor state word (G1_ZSW)

Bit	Designation	Description
15	Encoder error	**0** No error **1** Error The error code is output in **G1_XIST2**.
14	Park mode activated	**0** Normal operation **1** Park mode activated Feedback based on G1_STW bit 14 • No output of position data **G1_XIST1** and **G1_XIST2** • The Slave's Sign-of-Life function remains active.
13	Transmission of absolute position value	**0** No transmission **1** Transmission by the master Position value is output in **G1_XIST2**.

Bit	Designation	Description
12	Status of the preset function	**0** No preset function **1** Preset function is run Feedback based on G1_STW bit 12 • New position value is output in **G1_XIST1** and **G1_XIST2**. • On conclusion of the preset function the bit is set to 0.
11	Return acknowledgement of encoder error	**0** No return acknowledgement of encoder error **1** Return acknowledgement of encoder error Reaction to bit 15 in the sensor control word 1 G1_STW acknowledged (see Tab. 15).
10	Reserved	–
9 ... 0	Reserved	–

Signal 11: Position values in the telegram part G1_XIST1

The current position value is transmitted in 32 bits **left-justified** in the two data words.

Tab. 17: Example for position values in G1_XIST1 MSW

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Type	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Tab. 18: Example for position values in G1_XIST1 LSW

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Type	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0

Configuration of the resolution parameters has an effect on the position value. The shift factor in this case is **1**.

Note A preset value transmitted via acyclic process data only has an effect on G1_XIST1 if the parameter **Preset Control** is active (see 3.6.3 on page 22).

Signal 12: Position values in the telegram part G1_XIST2

The current position value is transmitted in 32 bits **right-justified** in the two data words.

Tab. 19: Example for position values in G1_XIST2 MSW

Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
Type	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Tab. 20: Example for position values in G1_XIST2 LSW

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Type	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Configuration of the resolution parameters and a preset value transmitted via acyclic process data has an effect on the position value.

Note If errors occur, an error code instead of the position value is output via G1_XIST2.

Signal 8: Speed value NIST_B

The current speed value is transmitted in 32 bits **right-justified**.

Note The value is output based on the units configured for the speed measurement (see section 3.6.12 on page 23).

3.5 Acyclic process data

The acyclic services are processed in parallel and in addition to the cyclic process data transmission. These services are normally not used continuously, but only as required.

The acyclic services essentially comprise the services “Read” and “Write” with which the master can obtain read or write access to data blocks in the PROFIBUS slave.

For communication via PROFIBUS, data set 47 (0x002F) is used to access parameters.

Basic telegram specification as per “Base Mode Parameter Access”:

The parameter channel defined in the PROFIdrive profile in accordance with the Base Mode Parameter Access protocol is accessed using data index 47.

Tab. 21: Basic telegram specification

DPV1 header	User data
Function, index, length etc.	Header + real data

Basic specification of the telegram part “User Data”:

The telegram part “User Data” is part of the Base Mode Parameter Access protocol.

If read access is necessary/required, only the telegram parts “Request Header” and “Address Header” need to be filled. For write access the telegram part “Data Value Block” must also be filled.

Tab. 22: Basic specification of the “User Data”

User data		
Request Header	**Address Header (1 ... N)**	**Data Value block (1 ... N)**
	Index/subindex	Data

The following sections list the parameters available for acyclic communication. A parameter is specified by the entry of its index and subindex.

3.5.1 PROFIdrive-specific parameters

Tab. 23: PROFIdrive-specific parameters

Index/ Subindex	Description	Access[4)]	Data type Data values
918	Node address	R	UINT‹16
922	Telegram	R	UINT‹16 81, 83
925	Sign-of-Life monitoring	R	UINT‹16 1
964	Device identification	R	Array [0..5] UINT‹16
.0	Vendor ID		01.01h 257
.1	Object type (vendor specific)		00.FFh
.2	Firmware version		xx.xx
.3	Firmware date (year)		yyyy
.4	Firmware date (day.month)		dd.mm
.5	Number of drive objects		Fixed to 00.01h
965	Encoder profile number	R	UINT‹16 3D.29h 61.41

[4)] R = Read (read access), W = Write (write access).

Index/ Subindex	Description	Access[4)]	Data type Data values
971	No function	W	UINT‹16
975	Encoder object identification	R	Array [0 ... 6] UINT‹16
.0	Vendor ID		01.01h 257
.1	Object type (vendor specific)		00.FFh
.2	Firmware version		xx.xx
.3	Firmware date (year)		yyyy
.4	Firmware date (day and month)		dd.mm
.5	PROFIdrive DO type classification 5 = Encoder		00.05h
.6	PROFIdrive DO subclassification 1 Bit‹15 = 1: Encoder Class 4 Bit‹14 = 1: Encoder Class 3		C0.00h **11**000000.0000000
979	Sensor format	R	Array [0 ... 5] UINT‹32
.0	Structure header		00.00.51.11h
.1	Sensor type Advanced		00.00.00.02h or 80.00.00.02h
.2	Sensor resolution (14 bits)		00.00.40.00h
.3	Shift factor in telegram part G1_XIST1 (left-justified)		00.00.00.01h
.4	Shift factor in telegram part G1_XIST2 (right-justified)		00.00.00.00h
.5	Number of revolutions (17 Bit)		00.02.00.00h

3.5.2 Vendor-specific parameters

Tab. 24: Vendor-specific parameters

Index/ Subindex	Description	Access	Data type Data values
1,000	Sensor status (bit oriented)	R	UINT‹16
1,001	Status flag 2 (bit oriented)	R	UINT‹16
1,002	Service log history information	R	Array [0..4] UINT‹32
.0	Power up counter		1 ... n
.1	Operating time in s, the time during which the encoder has moved with a minimum speed >6 RpM is output		0 ... n
.2	Maximum speed in RpM since the encoder has been in operation		1 ... 9,000
.3	Counter for forward rotation		1 ... n
.4	Counter for reverse rotation		1 ... n
1,007	Reserved for test application	R/W	Array [0..4] UINT‹32

Index/ Subindex	Description	Access	Data type Data values
1,008	Mode for the speed calculation	R/W	Array [0..3] UINT‹16
.0	Reserved		0
.1	In standard mode P1 = Refresh time x [ms]		1 ... 100 Default = 5
.2	In standard mode: Integration time x P1		1 ... 200 Default = 200
.3	In isochronous mode: Integration time x Q1 (Q1 is defined by bus cycle 1 ... 32 ms)		1 ... 200 Default = 10
1,009	Round axis functionality (endless shaft)	R	Array [0..10] UINT‹32
.0	Operating mode		**0** Off **1** On
.1	Input CNR‹N Nominator for the number of revolutions		1 ... 00.01.00.00h
.2	Input CNR‹D Divisor for the number of revolutions		1 ... 00.01.00.00h
.3	Input CMR Total resolution		1 ... 40.00.00.00h
.4	Range offset (saved in EEPROM)		1 ... 80.00.00.00h
.5	Internal PMR shift value		1 ... FF.FF.FF.FFh
.6	Output CNR‹N Nominator for the number of revolutions		See subindex .1
.7	Output CNR‹D Divisor for the number of revolutions		See subindex .2
.8	Output CMR Total resolution		See subindex .3
.9	CPR Steps per revolution, digits before the decimal separator		Ex.: at 1.555 = 1
.10	CPR Steps per revolution, digits after the decimal separator		Ex.: at 1.555 = 555

3.5.3 Encoder profile-specific parameters

Tab. 25: Encoder profile-specific parameters

Index/ Subindex	Description	Access[5]	Data type Data values
65,000	Preset value (is saved in EEPROM)	R/W	UINT‹32
65,001	Operating status	R	Array [0..11] UINT‹32
.0	Structure header		00.0B.01.01h 0B = 11 entries
.1	Operational status as per PRM telegram		Bit oriented, 00.00.AA.BBh
.2	Current errors		See section 5.4.4 on page 38
.3	Supported error messages		00.00.00.37h
.4	Current warnings		See section 5.4.4 on page 38
.5	Supported warnings		00.00.00.03h
.6	Version of the encoder profile		00.00.04.01h
.7	Operating time (value x 0.1 h)		1 ... 00.00.00.00h
.8	Offset value (saved in EEPROM)		1 ... 00.00.00.00h
.9	CPR (counts/pulse per revolution) Steps per revolution		1 ... 00.00.40.00h 1 ... 16,384
.10	CMR (total measuring range) Total resolution		1 ... 80.00.00.00h 1 ... 2,147,483,648
.11	Speed measuring unit		**0** steps/s **1** steps/100ms **2** steps/10ms **3** RpM **4** RpSec[6]

[5] R = Read (read access), W = Write (write access).
[6] Vendor specific.

3.6 Configurable functions

The A3M60 Advanced is configured using the configuration tool for a PLC (e.g. STEP7 for SIMATIC). The parameters for the different functions affect the operation of the encoder depending on the communication modules used.

Tab. 26: Configurable functions

Function	Modules IO§04 and IO§08	Modules 81 and 83
Class 2/4 functionality		
Code sequence		
G1_XIST1 Preset Control		
Scaling		
Alarm channel control		
Compatibility mode		
Simulate GC signal (manufacturer specific)		
Show fault code		
Steps per revolution		
Total resolution/measuring range		
Maximum tolerance failure (Master's Sign-of-Life)		
Speed measuring unit	Always rpm	
Number of samples for position determination		
Speed calculation on/off		
Round axis functionality		
Number of revolutions, nominator for the round axis functionality		
Number of revolutions, divisor for the round axis functionality		

3.6.1 Class 2/4 functionality

The **class 2/4 functionality** is the default factory setting. This parameter permits or prevents changes to the parameters **Code sequence**, **Scaling** and **Implementation of the preset**.

If the parameter is deactivated (disable), the settings for the following parameters are fixed:

- Code sequence = Clockwise
- Scaling = Off
- No preset via telegram or preset pushbutton possible.

3.6.2 Code sequence

The code sequence defines the direction of rotation, when looking at the end of the shaft, in which the position value increases.

- Clockwise = increasing position value on clockwise rotation of the shaft
- Counterclockwise = increasing position value on counter clockwise rotation of the shaft

3.6.3 G1_XIST1 Preset Control

The parameter defines whether the preset function affects the telegram part G1_XIST1 in the telegram for the modules 81 and 83. Otherwise the preset only acts on G1_XIST2.

Note The parameter can only be configured if the class 2/4 functionality is activated.

3.6.4 Scaling

Scaling makes it possible to scale the steps per revolution and the total resolution.

Note Only if the **Scaling** parameter is activated (enable), the values entered for the steps per revolution and total resolution are applied to the configuration. Otherwise the values will be ignored!

3.6.5 Alarm channel control

Note The parameter can only be deactivated (disable) if the parameter **Compatibility mode** is activated (enable).

- Alarm channel control active
  The diagnostic data is transmitted as per the encoder profile V4.1.
- Alarm channel control inactive
  Only the first 6 bytes of the diagnostic data is transferred.

3.6.6 Compatibility mode

Using the parameter the encoder can be configured such that it operates as per encoder profile **V3.1** and not as per V4.1. This parameter also affects the following functions:

- Alarm channel control
  The parameter can be configured inactive in the compatibility mode.
- Maximum tolerance failure (Master's Sign-of-Life)
  The parameter can be configured to 1 ... 15.
- In addition it is assumed that the bit **Control-by-PLC** in the telegram part STW2_ENC is permanently set to 1, as if the control system is constantly requesting control.

3.6.7 Simulate GC signal (manufacturer specific)

The parameter permits the simulation of the Global Control Frame signal[7)] (GC) in the isochronous mode (see section 3.3.3 on page 11).

The clock signal from the master is simulated by the simulation of the GC signal. As a rule this is only appropriate for debugging purposes.

Note **In operation the parameter must be configured as inactive (disabled).**

3.6.8 Show fault code

If the **Show Fault Code**[7)] parameter is active (enable), then a negative value is output in the telegrams I0‹04 and I0‹08 instead of a position value.

If the parameter is configured as inactive (disable), then **no** safe fault detection is provided. As default factory setting the indication is set to active in the parameters (enable).

7) Vendor-specific parameter.

3.6.9 Steps per revolution

The resolution is max. 16,384 steps per revolution. The resolution can be scaled from 1 ... 16,384 as an integer.

Note The parameter is not used if the round axis functionality (see 3.6.14 on page 24) is activated.

3.6.10 Total resolution/measuring range

The total resolution, that is the measuring range of the A3M60 Advanced, is max. 2,147,483,648 steps. The total resolution must be 2^n times the resolution per revolution.

Tab. 27: Examples for total resolution

Resolution per revolution	n	Total resolution
1,000	3	8,000
8,179	5	261,728
2,048	11	4,194,304

Note This restriction is not relevant if the round axis functionality (see 3.6.14 on page 24) is activated.

3.6.11 Maximum tolerance failure (Master's Sign-of-Life)

Note The parameter only has an effect if the parameter **Compatibility mode** is activated (enable) (see section 3.6.6 on page 22).

This parameter has an effect on the isochronous mode. If the compatibility mode is activated, you can configure the number of errors tolerated from 1 ... 15. If it is not activated, the number is set fixed to 1.

3.6.12 Speed measuring unit

Using this parameter you can define the units in which the speed information is transmitted.

Possible units are:

- steps/s
- steps/100ms
- steps/10ms
- RpM
- RpSec

The factory setting is **RpM**.

3.6.13 Number of samples for position determination

The parameter defines the number of sampled values used to determine the position value[8]. The factory setting for the A3M60 Advanced is configured such that an average value is calculated from eight position values.

Values of 1, 2, 4 or 8 can be configured. With higher sampling the position value is more accurate, with lower sampling the position value is determined more quickly. In the isochronous mode this value is automatically set internally to 1, independent of the configuration of the parameters.

[8] Vendor-specific parameter.

3.6.14 Round axis functionality

The round axis functionality removes the restriction that the total steps must be 2^n times the resolution per revolution. The shaft is considered as an **endless shaft**.

The steps per revolution are not configured directly, instead the nominator and divisor for the number of revolutions are defined.

The total measuring range can be scaled from 1 ... 1,073,741,824 as an integer.

3.6.15 Number of revolutions, nominator for the round axis functionality

The nominator can be scaled from 1 ... 65,536 as an integer. The default factory setting for the nominator is 4096.

3.6.16 Number of revolutions, divisor for the round axis functionality

The divisor can be scaled from 1 ... 65,536 as an integer. The default factory setting for the divisor is 1.

3.7 Controls and status indicators

The A3M60 Advanced PROFIBUS Absolute Encoder has two LEDs that indicate the operational status.

Fig. 1: Position of the LEDs

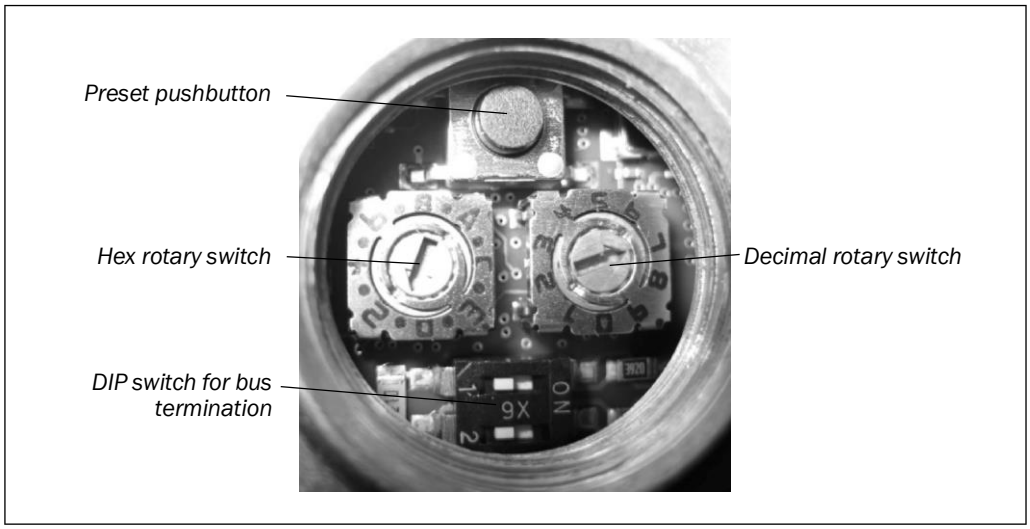
Tab. 28: Meaning of the LEDs

LED 1 PROFIBUS communication			**LED 2 Encoder diagnostics**	
Display		**Description**	**Display**	**Description**
●	Green	No error	● Green	No error
●	Red/green	Erroneous initialization or undervoltage	● Red/green	Erroneous initialization or undervoltage
●	Orange	Erroneous parameter, no data exchange	● Orange	Internal sensor error
●	Red	Connection error, no data exchange		

There are the following controls under the screw cover:

- rotary switch for addressing (address 1–125)
- preset pushbutton
- DIP switch for bus termination (termination)

Fig. 2: Position of the controls



4 Commissioning

This chapter provides information on the electrical installation, configuration and commissioning of the A3M60 Advanced PROFIBUS Absolute Encoder.

▶ Please read this chapter before mounting, installing and commissioning the device.

4.1 Mounting

See the mounting instructions included with the A3M60 Advanced.

4.2 Electrical installation

Switch the power supply off!

WARNING

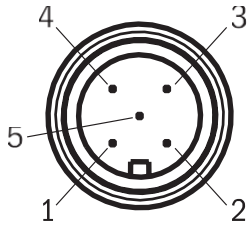
The machine/system could unintentionally start up while you are connecting the devices.

▶ Ensure that the entire machine/system is disconnected during the electrical installation.

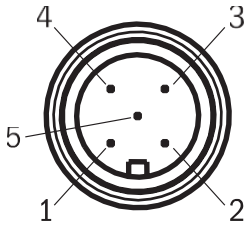
For the electrical installation you will need connection plugs and sockets (see section 7.2 “Accessories” on page 43).

4.2.1 Connections of the A3M60 Advanced

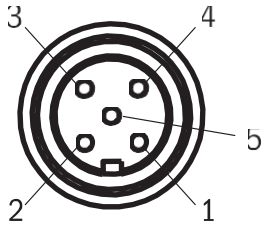
Fig. 3: Connections of the A3M60 Advanced



Voltage supply plug



PROFIBUS IN M12 × 5, plug



PROFIBUS OUT M12 × 5, socket

Tab. 29: Pin assignment for the connection of the voltage supply

Pin	Signal	Core color[9)]	Function
1	V_S	Brown	Supply voltage 10 V ... 32 V DC
2	–	White	Do not use
3	GND	Blue	0 V DC (ground)
4	–	Black	Do not use
5	–	Grey	Not assigned

Tab. 30: Pin assignment for the connection PROFIBUS IN

Pin	Signal	Core color[9)]	Function
1	–	–	Not assigned
2	A	Green	A‹wire PROFIBUS DP
3	–	–	Not assigned
4	B	Red	B‹wire PROFIBUS DP
5	Screen	–	Housing

Tab. 31: Pin assignment for the connection PROFIBUS OUT

Pin	Signal	Core color[9)]	Function
1	–	–	Not assigned
2	A	Green	A‹wire PROFIBUS DP
3	0 V DC	–	Ground
4	B	Red	B‹wire PROFIBUS DP
5	Screen	–	Housing

Notes

▶ **Connect the screen to the encoder’s housing!**

▶ Observe the maximum cable lengths (see Tab. 3 on page 10).

9) On the usage of pre-wired cables.

4.3 Hardware settings

There are the following controls for making settings under the screw cover:

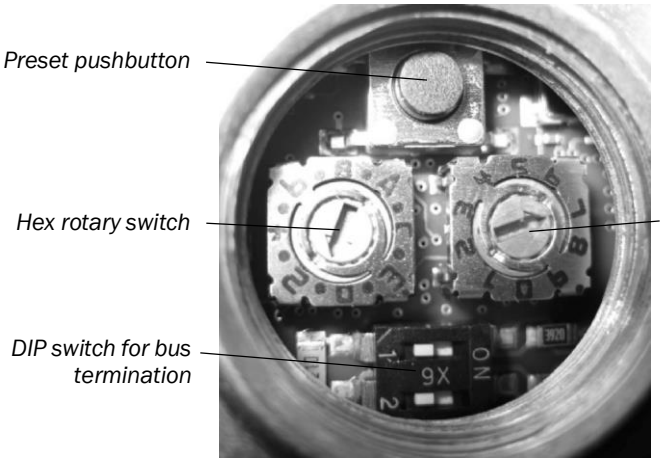
- DIP switch for bus termination (termination)
- rotary switch for addressing (address 1–125)
- preset pushbutton

▶ Open the screw cover using a screwdriver for slot-head screws with a blade width of min. 15.0 mm.

The A3M60 Advanced is supplied with the following default settings:

- Termination = OFF
- Address on the PROFIBUS = 2

Fig. 4: Possible hardware settings



4.3.1 Bus termination

At the start and end of each segment, the bus must be terminated using a terminator. The A3M60 Advanced PROFIBUS Absolute Encoder contains bus termination that can be enabled.

The bus can be terminated using the DIP switches.

▶ To terminate the bus, set both DIP switches to ON.

▶ Alternatively you can use an external terminator (see section 7.2 “Accessories” on page 43).

4.3.2 Addressing

Each device in the bus segment must have a unique address. Each address is only allowed to occur once in the bus segment. The A3M60 Advanced PROFIBUS Absolute Encoder is factory set to address 2. The highest address that is allowed to be set is 125.

To set the address use the hex rotary switch and the decimal rotary switch.

▶ Set the decades for the address using the hex rotary switch.

▶ Set the units for the address using the decimal rotary switch.

Examples

Tab. 32: Examples for setting the PROFIBUS address

Address	Hex rotary switch	Decimal rotary switch
17	1	7
123	C (corresponds to decimal 12)	3

4.3.3 Preset

The encoder is set to a pre-defined value by pressing the pushbutton. The value pre-defined in the factory setting is zero (0).

The function is used for electronic adjustment during commissioning to allocate a specific position value to a mechanical position of the encoder shaft (see also Tab. 8 on page 12).

WARNING

After triggering the preset function, check whether there is a hazard from the machine or system in which the encoder is integrated!

The preset function results in a change in the position value output by the encoder. This change could cause an unexpected movement that may result in a hazard for persons or damage to the system or other items.

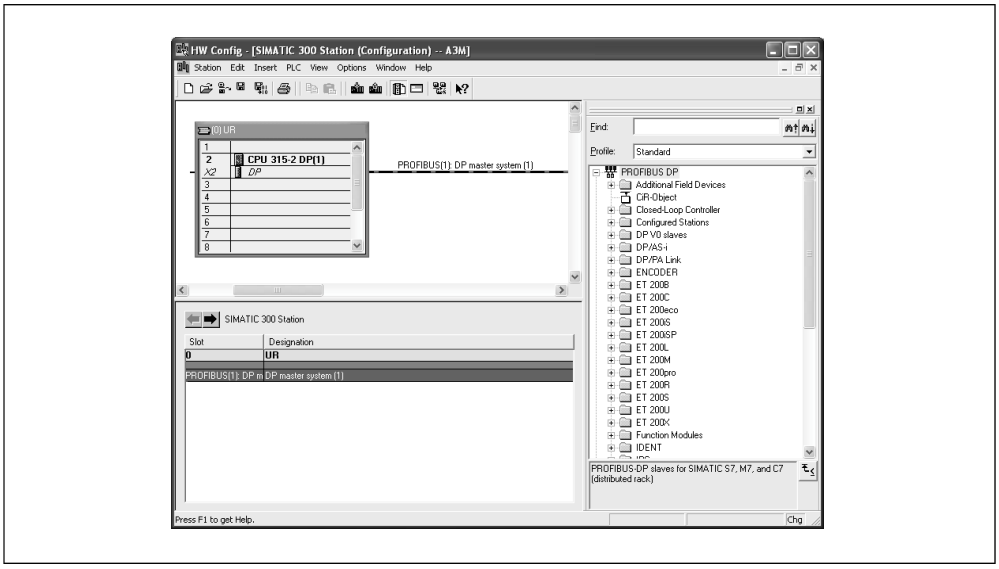
4.4 Configuration

Note All software instructions refer to the STEP7 configuration tool for the SIMATIC.

4.4.1 Loading the GSD file (once only)

▶ Open the hardware manager for your PLC.

Fig. 5: Hardware manager in the SIMATIC



▶ Install the GSD file STEG0C0A.gsd for the A3M60 Advanced using the **Options** menu, **Install GSD file... command**

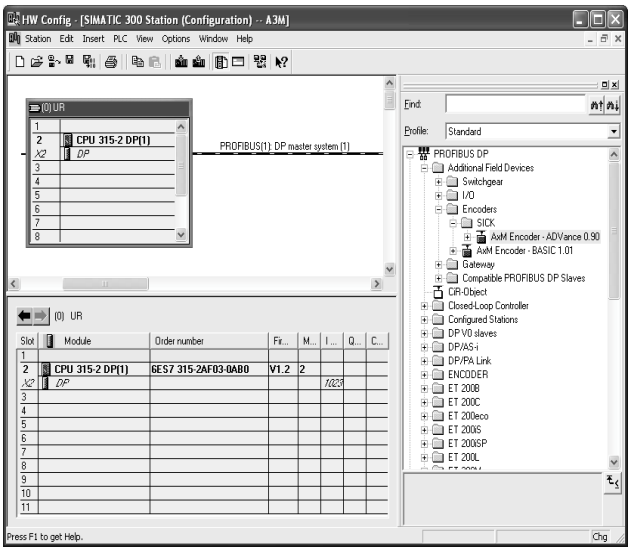
You will find the GSD file on the Internet at http://www.sick.com.

The A3M60 Advanced appears in **Additional Field Devices**.

4.4.2 Loading encoders into the hardware configuration window

▶ In **Additional Field Devices** open the folder **Encoders**.

*Fig. 6: A3M60 Advanced in **Additional Field Devices***



▶ Drag the icon for the AxM Encoder X.XX to the PROFIBUS DP master system using drag and drop.

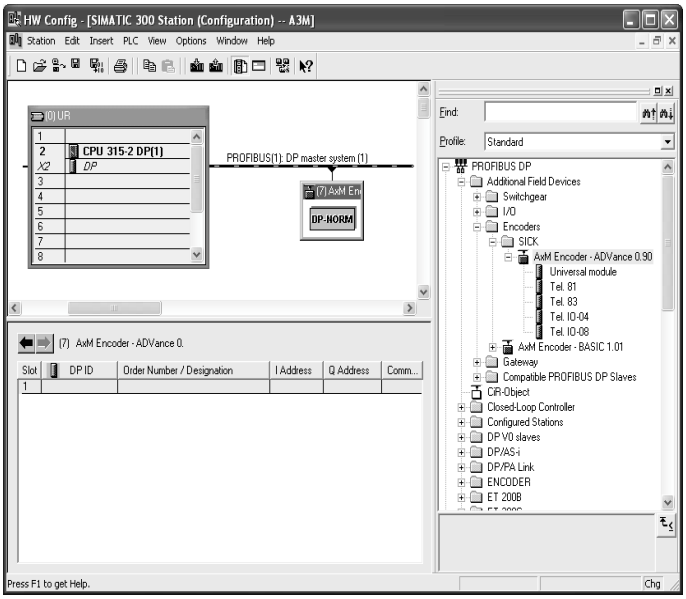
A window opens where you can enter the address of the A3M60 Advanced on the PROFIBUS.

4.4.3 Loading communication module into the slot

Four communication modules are allocated to the AxM Encoder Advanced X.XX (see section 3.4 on page 11).

▶ Drag the communication module Tel.IO‹04 or Tel.IO‹08 or Tel.81 or Tel.83 to the slot for the encoder.

Fig. 7: Communication module in the slot for the encoder



4.4.4 Configuration of the modules IO‧04 and IO‧08

▶ Double-click the encoder icon.

The **Properties** window is opened.

▶ Select the **Parameter Assignment** tab.

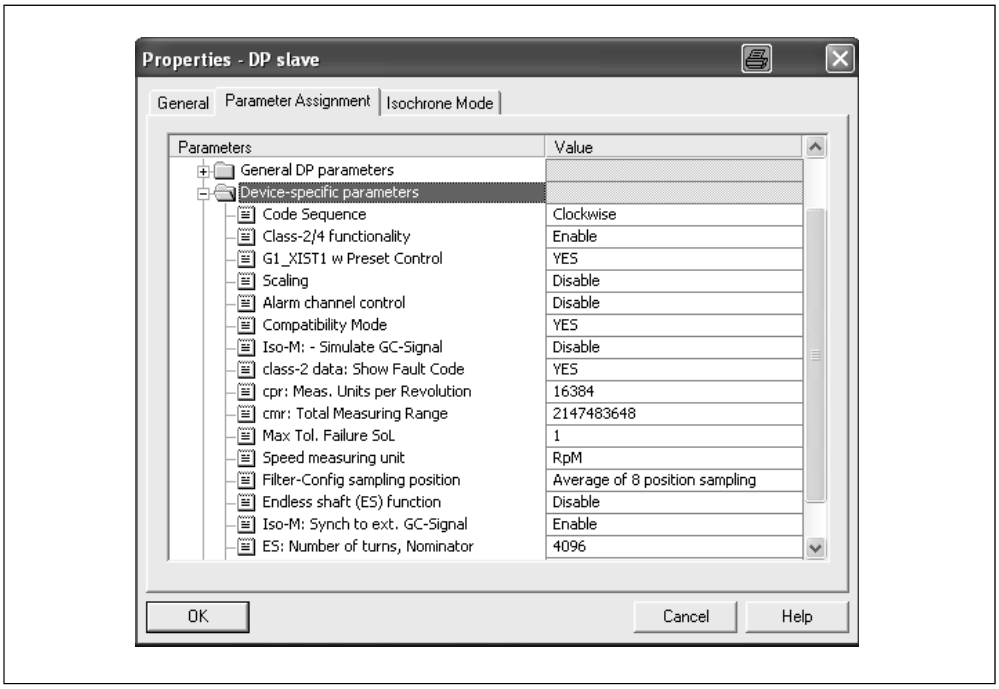


*Fig. 8: **Parameter Assignment** tab of the IO 04 and IO 08 modules*

Note For the possible parameter settings, see section 3.6 on page 21.

The A3M60 Advanced is supplied with the following parameters:

- Code sequence = Clockwise
- Class 2 functionality = Activated
- No scaling
- Steps per revolution = 16,384
- Total resolution = 2,147,483,648

Checking preset value

If you transmit a preset value to the A3M60 Advanced, then in the **Monitor/Modify Variables** dialog box for the STEP7 you can see the PEW (peripheral input word) and PAW (peripheral output word).

Fig. 9: Preset step 1

	Address	Symbol	Displ	Status value	Modify value
1	PEW 256		HEX	W#16#0000	
2	PEW 258		HEX	W#16#0024	
3	PAW 256		HEX		W#16#0000
4	PAW 258		HEX		W#16#0010

00000024h is transmitted from the encoder to the PLC as the position.

00000010h is transmitted from the PLC to the encoder as the preset.

Bit 31 is set to 0, as a result the preset value is not applied.

Fig. 10: Preset step 2

	Address	Symbol	Displ	Status value	Modify value
1	PEW 256		HEX	W#16#0000	
2	PEW 258		HEX	W#16#0010	
3	PAW 256		HEX		W#16#8000
4	PAW 258		HEX		W#16#0010

80000010h is transmitted from the PLC to the encoder as the preset.

Bit 31 is set to 1, i.e. a transition from 0 to 1 occurs, the preset value 10h is applied.

Fig. 11: Preset step 3

	Address	Symbol	Displ	Status value	Modify value
1	PEW 256		HEX	W#16#0000	
2	PEW 258		HEX	W#16#0010	
3	PAW 256		HEX		W#16#0000
4	PAW 258		HEX		W#16#0010

00000010h is transmitted from the encoder to the PLC as the position.

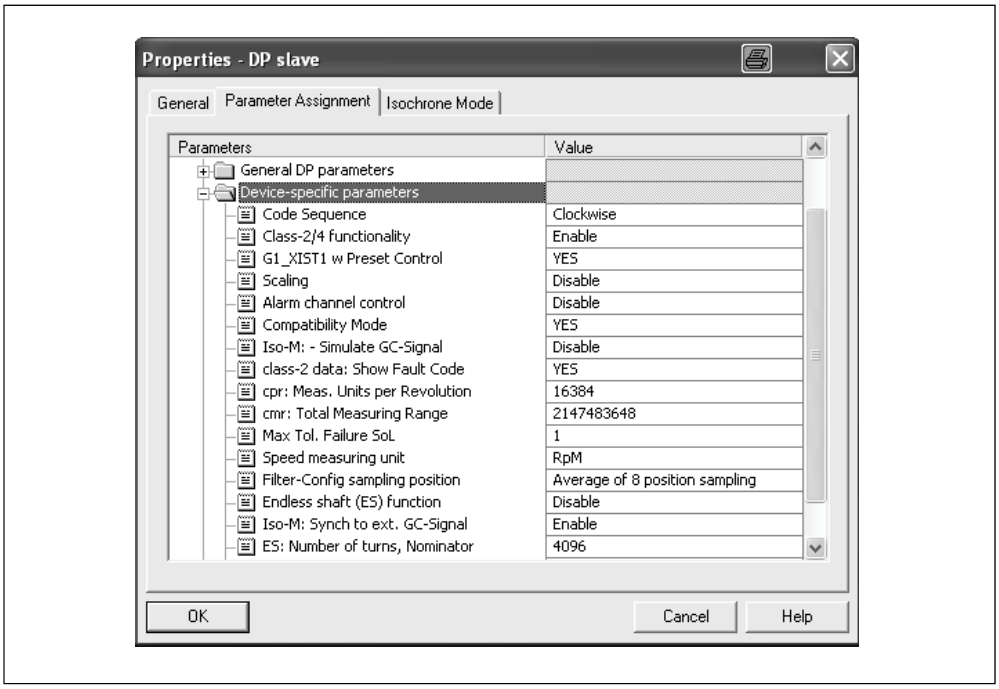
4.4.5 Configuration of the modules 81 and 83

▶ Double-click the encoder icon.

The **Properties** window is opened

▶ Select the **Parameter Assignment** tab.

*Fig. 12: **Parameter Assignment** tab*



For the possible parameter settings, see section 3.6 on page 21.

The A3M60 Advanced is supplied with the following parameters:

- Code sequence = Clockwise
- Class 2/4 functionality = Activated
- G1_XIST1 Preset Control = Yes
- Scaling = None
- Alarm channel control = Not activated
- Compatibility mode = Yes
- Simulate GC signal[10)] = Not activated
- Class 2 data[10)] = Error code is transmitted
- Steps per revolution = 16,384
- Total resolution/measuring range = 2,147,483,648
- Maximum tolerance failure = 1
- Speed measuring unit = RpM
- Number of samples for position determination[10)] = Average of 8 positions
- Speed calculation[10)] = Activated
- Round axis functionality[10)] = Not activated
- Isochronous mode = Activated
- Nominator for round axis functionality[10)] = 4,096
- Divisor for round axis functionality[10)] = 1

[10)] Vendor-specific parameter.

4.5 Test notes


WARNING

Commissioning requires a thorough check by authorized personnel!

Before you operate a system equipped with the A3M60 Advanced for the first time, make sure that the system is first checked and released by authorized personnel. Please read the notes in chapter 2 “On safety” on page 7.

5 Fault diagnosis

This chapter describes how to identify and remedy errors and malfunctions during the operation of the A3M60 Advanced PROFIBUS Absolute Encoder.

5.1 In the event of faults or errors

Cease operation if the cause of the malfunction has not been clearly identified!

WARNING

Stop the machine if you cannot clearly identify or allocate the error and if you cannot safely rectify the malfunction.

5.2 Support

If you cannot remedy an error with the help of the information provided in this chapter, please contact your local SICK representative.

5.3 Error and status indications on the LEDs

See section 3.7 “Controls and status indicators” on page 24.

5.4 Error transmission via PROFIBUS

PROFIBUS provides diagnostics features that help you to locate a problem if the cause of the error is unclear or if there are availability problems. The following diagnostic features are available:

- diagnostics telegram
- error codes in the IO telegram of the modules IO‹04 and IO‹08
- error codes in the telegram part G1_XIST2 of the modules 81 and 83
- error messages via acyclic services

5.4.1 Diagnostics telegram (channel-related-diagnosis-model)

Note The telegram is used for the modules IO‹04 and IO‹08 as well as for the modules 81 and 83.

The diagnostics telegram on the A3M60 Advanced is based on the **channel-related diagnosis model**. The diagnostics comprise three bytes per error that occurs. If, for example, a second error occurs at the same time, the entire three bytes are transmitted again for this second error, i.e. the total length is then six bytes.

Tab. 33: Structure of the diagnostics telegram

Byte 1	Byte 2	Byte 3
Header	Channel specification	Error code
81h (fix)	40h (fix)	See Tab. 34 on page 36

Tab. 34: Contents of byte 3 of the diagnostics telegram

Byte 3	Name	F/W[11)]	See also Tab. 37 page 38
30h	Max. speed exceeded	W	S_STAT‹A, Bit 5
36h	Position error	F	S_STAT‹A, Bit 6
38h	Memory error	F	S_STAT‹A, Bit 15, 7
3Bh	Isochronous mode Error in the Master's Sign-of-Life function	F	S_STAT‹B, Bit 4
3Ch	Synchronization error in the isochronous mode due to lack of GC signals	F	S_STAT‹B, Bit 5
3Dh	Synchronization error in the isochronous mode due to deviating GC signals	F	S_STAT‹B, Bit 6

5.4.2 Error codes in the IO telegram of the modules IO‡04 and IO‡08

If, in case of a serious error, a correct position calculation cannot be ensured, the output of the position within the process data is blocked and instead an error code output. These manufacturer-specific error codes are outside the valid value range and permit a detailed error analysis.

Tab. 35: Error codes in the IO telegram

Error code		Diagnostics messages in byte 3	Description
Dec	Hex		
–12	FF.FF.FF.F4	Memory error 38h	Invalid parameters in the µC‹Flash
–11	FF.FF.FF.F5	Position error 36h	Erroneous communication with FRAM (Wiegand IC)
–10	FF.FF.FF.F6	Position error 36h	Synchronization error on shut down
–8	FF.FF.FF.F8	Position error 36h	Synchronization error on switch on
–5	FF.FF.FF.FB	Position error 36h	Analog signals out of tolerance (vector length)
–4	FF.FF.FF.FC	Position error 36h Memory error 38h	Erroneous communication with EEPROM
–3	FF.FF.FF.FD	Position error 36h	Analog signals out of tolerance (amplitude)
–16	FF.FF.FF.F0	Position and/or memory error	Occurrence of several errors simultaneously

WARNING

Evaluate bit 31 of the input data using your control system to detect serious errors!

If, in the case of serious error, it cannot be ensured the position output is correct, this situation is indicated by setting the most significant bit 31. The position value is then outside the valid range and can be identified as clearly erroneous (see section 5.4 on page 35).

11) F = Error; W = Warning.

5.4.3 Error codes in the telegram part G1_XIST2 of the modules 81 and 83

In the case of an error, an error code is output in the cyclic process data in the telegram part G1_XIST2 (see Tab. 10 on page 13 and Tab. 12 on page 14). These manufacturer-specific error codes permit detailed error analysis.

Tab. 36: Error codes in telegram part G1_XIST2

Error code in G1_XIST2	Description	See also Tab. 37 page 38
00.01h	Error in the encoder signal	S_STAT‹A, Bit 8, 6
00.02h	Inconsistent value in the telegram G1_XIST1 or ‹2 or in the reference signal	S_STAT‹A, Bit 13
00.04h	Search for a reference value cancelled	S_STAT‹A, Bit 10, 11
00.08h	Transmission of the absolute value cancelled	S_STAT‹A, Bit 14, 12
0F.02h	Isochronous mode, error in the Master's Sign-of-Life function The number of errors that can be tolerated has been exceeded (see section 3.6.11 on page 23).	S_STAT‹B, Bit 4
0F.03h	Isochronous mode, synchronization error due to deviating GC signal	S_STAT‹B, Bit 6
0F.04h	Isochronous mode, synchronization error due to lack of GC signal	S_STAT‹B, Bit 5
Vendor-specific error codes		
10.01h	Memory error caused by an invalid checksum in the data saved (in the µC‹Flash or external EEPROM)	S_STAT‹A, Bit 15
10.02h	Memory error (I^2C) caused by invalid I^2C communication (read, write) with the external EEPROM	S_STAT‹A, Bit 7

5.4.4 Error messages via acyclic services

Access via acyclic services via parameter 1000 (S_Stat‹A). This parameter is vendor specific.

Tab. 37: Error messages via parameter 1000

S_Stat‹A›Bit	Description
15	Invalid parameters in the µC‹Flash or EEPROM
14	Communication error with I²C device with FRAM (Wiegand IC)
13	The synchronization of Wiegand and quadrature counters results in a large deviation.
12	Reserved
11	Synchronization error from Wiegand and quadrature counters
10	Error due to incorrect linearization
9	Position error Analog signals out of tolerance (vector length, sine or cosine)
8	Position error Analog signals out of tolerance (vector length, sine or cosine)
7	Communication error with I²C device (EEPROM)
6	Amplitude error in the sine or cosine
5	Maximum rotational speed of 9,000 rpm exceeded

Access via acyclic services via parameter 1001 (S_Stat‹B). This parameter is vendor specific.

Tab. 38: Error messages via parameter 1001

S_Stat‹B›Bit	Description
6	Isochronous mode, synchronization error due to deviating GC signal
5	Isochronous mode, synchronization error due to lack of GC signal
4	Isochronous mode, error in the Master's Sign-of-Life function. The number errors that can be tolerated has been exceeded (see section 3.6.11 on page 23).

The attributes "Enc‹Profile Faults" and "Enc‹Profile Warnings"

Access via acyclic services via parameter 65001, subindex .2 and .4 (operating status). The attributes listed are only supported by the encoder profile V4.1 with class 3 or class 4 functionality.

Subindex .2 indicates the current errors:

Tab. 39: Attribute "Enc Profile Faults"

Bit	Description	See also Tab. 37 page 38
5	Memory error	S_STAT‹A, Bit 15, 7
4 ... 1	Not supported	
0	Position error	S_STAT‹A, Bit 14 ... 6

Subindex .4 indicates the current warnings:

Tab. 40: Attribute "Enc Profile Warnings"

Bit	Description	See also Tab. 37 page 38
6 ... 1	Not supported	
0	Maximum frequency exceeded	S_STAT‹A, Bit 5

6 Technical specifications

6.1 Data sheet

Tab. 41: Data sheet A3M60 Advanced

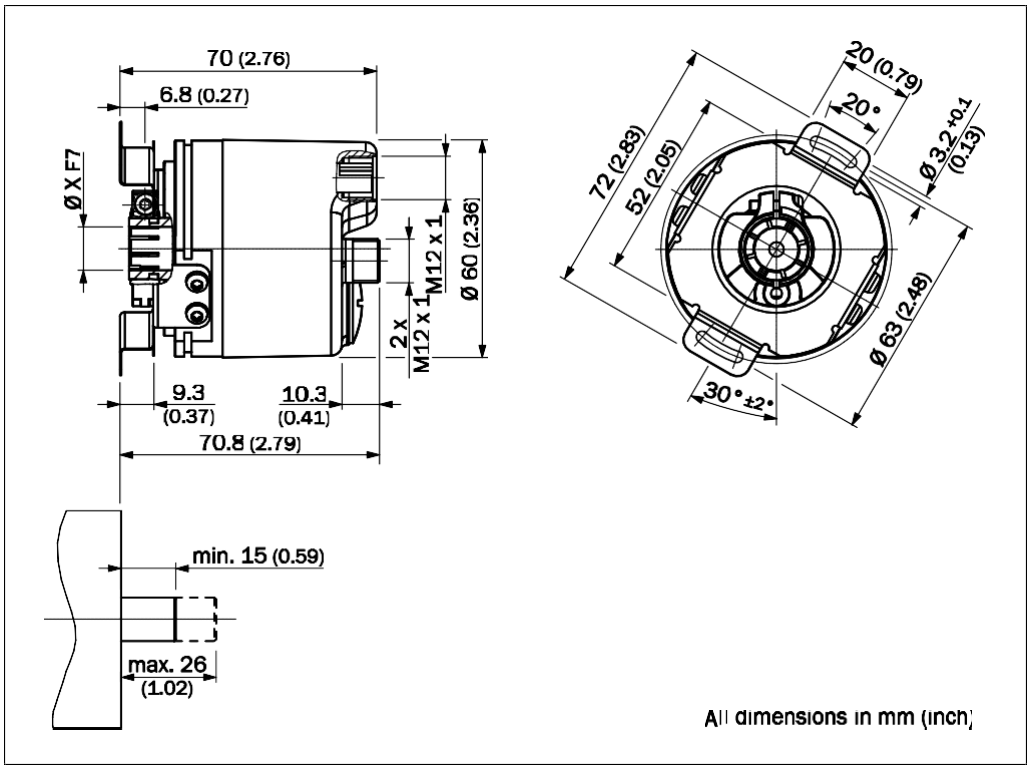
	Minimum	Typical	Maximum
Mechanical data			
Shaft designs			
Face mount flange	10 × 19 mm		
Servo flange	6 × 10 mm		
Blind hollow shaft	8, 10, 12, 14, 15 mm and 3/8", 1/2", 5/8"		
Weight		0.280 kg	
Material			
Shaft	Stainless steel		
Flange	Aluminium		
Housing	Aluminium		
Operating speed			9,000 rpm
Shock resistance	80 g/6 ms (EN 60 028‹2‹27)		
Sinusoidal vibration	30 g, 10 ... 2000 Hz (EN 60 068‹2‹6)		
Permissible shaft load			
Radial			80 N
Axial			40 N
Permissible shaft movement of the drive element			
Radial (static/dynamic)			±0.3 mm/ ±0.1 mm
Axial (static/dynamic)			±0.5 mm/ ±0.2 mm
Bearing service life [rotations]	3×10^9		
Angular acceleration			5×10^5 rad/s^2

	Minimum	Typical	Maximum
Electrical data			
Operating voltage	10 V		30 V
Power consumption			1.5 W
Steps Per revolution Revolutions, total			 16,384 131,072
Repeat accuracy at room temperature		±0.15°	
Error limit at room temperature		±0.35°	
PROFIBUS			
Protocol	DP‹V0, ‹V1, -V2 (EN 50 170‹2)		
Interface	RS‹485		
Transmission speed			12 MBaud
Programmable parameters	See section 3.6 on page 21		
General data			
Enclosure rating Housing Shaft	 IP 67 (IEC 60529) IP 67 (IEC 60529)		
Operating temperature range	–30 °C		+80 °C
Storage temperature range	–40 °C		+100 °C max. 24 h
Permissible relative humidity			95 %

6.2 Dimensional drawings

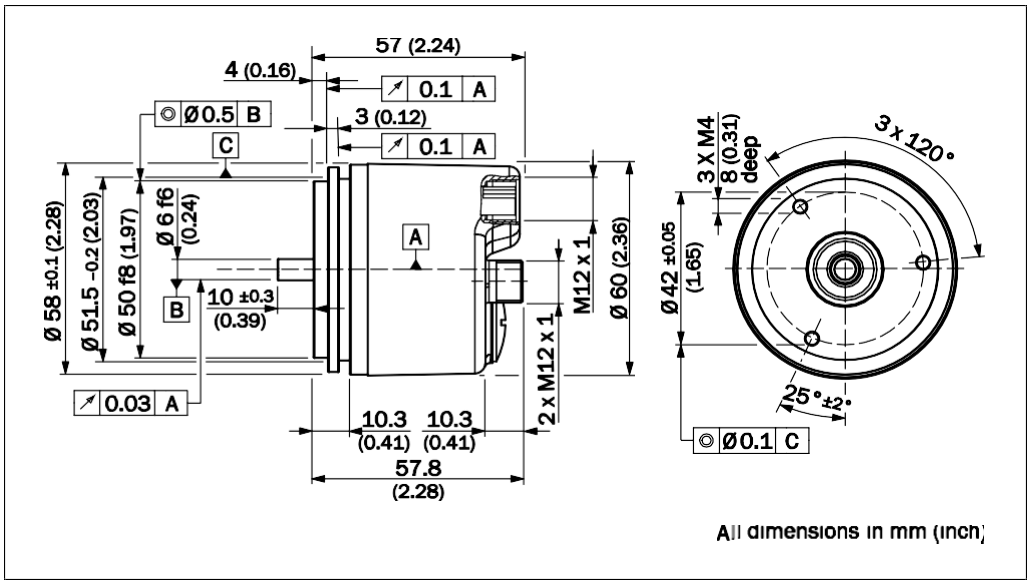
6.2.1 A3M60 Advanced with blind hollow shaft

Fig. 13: A3M60 Advanced with blind hollow shaft



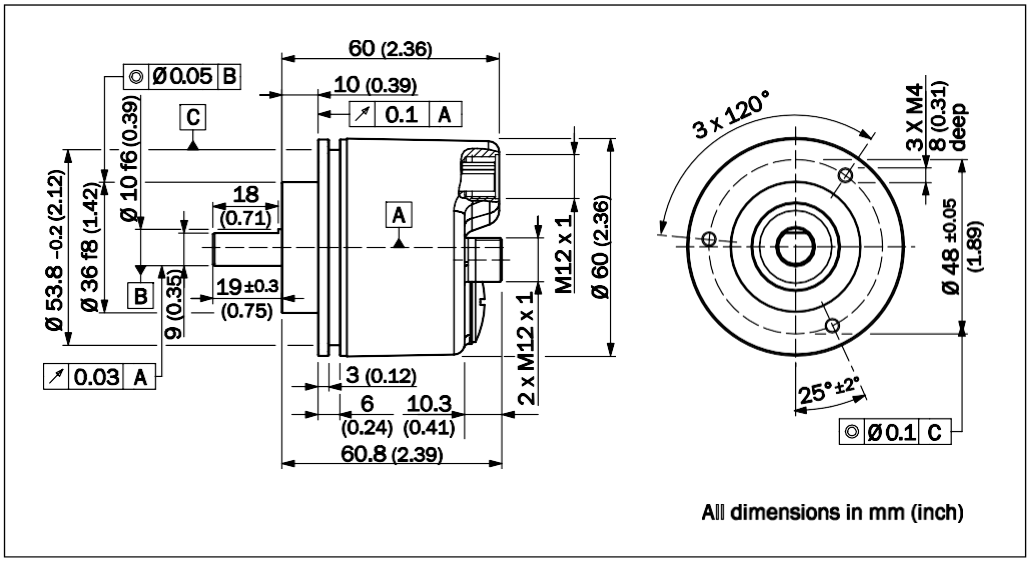
6.2.2 A3M60 Advanced with servo flange

Fig. 14: A3M60 Advanced with servo flange



6.2.3 A3M60 Advanced with face mount flange

Fig. 15: A3M60 Advanced with face mount flange



7 Ordering information

7.1 Types available

Tab. 42: Types available

Type	Description	Part number
A3M60A-BBPB014X17	Blind hollow shaft, ∅ 8 mm	1053330
A3M60A-BCPB014X17	Blind hollow shaft, ∅ 3/8"	1053334
A3M60A-BDPB014X17	Blind hollow shaft, ∅ 10 mm	1053331
A3M60A-BEPB014X17	Blind hollow shaft, ∅ 12 mm	1053332
A3M60A-BFPB014X17	Blind hollow shaft, ∅ 1/2"	1053335
A3M60A-BGPB014X17	Blind hollow shaft, ∅ 14 mm	1053336
A3M60A-BHPB014X17	Blind hollow shaft, ∅ 15 mm	1053333
A3M60A-BJPB014X17	Blind hollow shaft, ∅ 5/8"	1053337
A3M60A-S1PB014X17	Servo flange, 6 × 10 mm	1053342
A3M60A-S4PB014X17	Face mount flange, 10 × 19 mm	1053341

7.2 Accessories

7.2.1 Voltage supply

Tab. 43: Accessories voltage supply

Type	Description	Part number
DOS-1204-G	M12 cable socket, 4‹pin, straight, screened	6007302
DOL-1205-G05MAC	M12 cable socket, 5‹pin, straight, pre-wired 5 × 0.34 mm^2, screened, 5 m long	6036384
DOL-1205-G10MAC	M12 cable socket, 5‹pin, straight, pre-wired 5 × 0.34 mm^2, screened, 10 m long	6036385
DOL-1205-G20MAC	M12 cable socket, 5‹pin, straight, pre-wired 5 × 0.34 mm^2, screened, 20 m long	6036386
DOS-1204-W	M12 cable socket, 4‹pin, angled, A‹coded	6007303
DOL-1202-W05MC	M12 cable socket, 5‹pin, angled, A‹coded, assembled 5 m	6042067
DOL-1202-W10MC	Supply voltage, M12 cable socket, 5‹pin, angled, A‹coded, assembled 10 m	6042068

7.2.2 PROFIBUS IN

Tab. 44: Accessories PROFIBUS IN

Type	Description	Part number
DOS-1205-GQ	PROFIBUS IN M12 cable socket, 5‹pin, straight, screened, B‹coded	6021353
DOL-1205-G05MQ	PROFIBUS IN M12 cable socket, 5‹pin, straight, pre-wired with 2‹core bus cable, 2 × 0.22 mm^2, screened, B‹coded, 5 m long	6026006
DOL-1205-G10MQ	PROFIBUS IN M12 cable socket, 5‹pin, straight, pre-wired with 2‹core bus cable, 2 × 0.22 mm^2, screened, B‹coded, 10 m long	6026008
DOS-1205-WQ	PROFIBUS IN M12 cable socket, 5‹pin, angled, B‹coded	6041429
DOL-1205-W05MQ	PROFIBUS IN M12 cable socket, 5‹pin, angled, B‹coded, assembled 5 m	6041423
DOL-1205-W10MQ	PROFIBUS IN M12 cable socket, 5‹pin, angled, B‹coded, assembled 10 m	6041425

7.2.3 PROFIBUS OUT

Tab. 45: Accessories PROFIBUS OUT

Type	Description	Part number
STE-1205-GQ	PROFIBUS OUT M12 cable plug, 5‹pin, angled, B‹coded	6021354
STL-1205-G05MQ	PROFIBUS OUT M12 cable plug, 5‹pin, straight, pre-wired with 2‹core cable, 2 × 0.22 mm^2, screened, B‹coded, 5 m long	6026005
STL-1205-G10MQ	PROFIBUS OUT M12 cable plug, 5‹pin, straight, pre-wired with 2‹core cable, 2 × 0.22 mm^2, screened, B‹coded, 10 m long	6026007
STE-1205-WQ	PROFIBUS OUT M12 cable plug, 5‹pin, angled, B‹coded	6041428
STL-1205-W05MQ	PROFIBUS OUT M12 cable plug, 5‹pin, angled, B‹coded, assembled 5 m	6041426
STL-1205-W10MQ	PROFIBUS OUT M12 cable plug, 5‹pin, angled, B‹coded, assembled 10 m	6041427

7.2.4 PROFIBUS accessories

Tab. 46: Accessories PROFIBUS

Type	Description	Part number
LTG-2102-MW	Bus cable, 2‹core, by the meter, 2 × 0.22 mm², screened	6021355
PRE-STE-END	PROFIBUS terminator	6021156

7.2.5 Shaft couplings

Tab. 47: Shaft couplings

Type	Shaft diameter	Part number
Shaft coupling bellows, max. radial shaft offset ±0.3 mm, axial shaft offset 0.4 mm, angle ±4°, torsional stiffness 120 Nm/rad, bellows made of stainless steel, hub made of aluminum		
KUP-0606-B	6 mm to 6 mm	5312981
KUP-0610-B	6 mm to 10 mm	5312982
KUP-1010-B	10 mm to 10 mm	5312983
KUP-1012-B	10 mm to 12 mm	5312984
Shaft coupling spring disk, max. radial shaft offset ±0.3 mm, axial shaft offset 0.4 mm, angle ±2.5°, torsional stiffness 50 Nm/rad, flange made of aluminum, spring disk made of plastic, glass-fiber reinforced		
KUP-0610-F	6 mm to 10 mm	5312985
KUP-1010-F	10 mm to 10 mm	5312986

7.2.6 Mechanical adapters

Tab. 48: Mechanical adapters

Type	Description	Part number
BEF-FA-036-050	Flange adapter made of aluminum for face mount flange with 36 mm centering collar, to produce encoder with 50 mm servo flange	2029160
BEF-FA-036-060REC	Flange adapter made of aluminum for face mount flange with 36 mm centering collar, to produce encoder with a square 60 mm mounting plate	2029162
BEF-FA-036-060RSA	Flange adapter made of aluminum for face mount flange with 36 mm centering collar, to produce encoder with a square 60 mm mounting plate with shock absorber	2029163
BEF-FA-036-063REC	Flange adapter made of aluminum for face mount flange with 36 mm centering collar, to produce encoder with a square 63 mm mounting plate	2034225
BEF-MG-50	Mounting cover incl. mounting kit for encoders with servo flange with 50 mm centering collar	5312987
BEF-WF-36	Mounting angle incl. mounting kit for encoder with face mount flange with 36 mm centering collar	2029164
BEF-WG-SF050	Servo clamp half shell, set (contents 2 pieces) for servo flanges with 50 mm centering collar	2029165
BEF-WK-SF	Servo clamp short, set (contains 3 pieces) for servo flanges	2029166
BEF-FA-B12-010	Bearing block for absorbing larger radial and axial shaft loads	2042728
Measuring wheels for encoder shafts with diameter 10 mm, plastic coating (Hytrel), wheel body plastic with aluminum hub		
BEF-MR-010020	Circumference 0.2 m, surface finish smooth	5312988
BEF-MR-010020G	Circumference 0.2 m, surface finish grooved	5318678
BEF-MR-010050	Circumference 0.5 m, surface finish smooth	5312989
BEF-MR-010030	Circumference 0.3 m, surface finish O‹ring	2049278

8 Annex

8.1 Conformities and certificates

You can obtain declarations of conformity, certificates, and the current operating instructions for the product at www.sick.com. To do so, enter the product part number in the search field (part number: see the entry in the “P/N” or “Ident. no.” field on the type label).

8.1.1 Compliance with EU directives

EU declaration of conformity (extract)

The undersigned, representing the manufacturer, herewith declares that the product is in conformity with the provisions of the following EU directive(s) (including all applicable amendments), and that the standards and/or technical specifications stated in the EU declaration of conformity have been used as a basis for this.Konformität mit UK statutory instruments

8.1.2 Compliance with UK statutory instruments

UK declaration of conformity (extract)

The undersigned, representing the following manufacturer herewith declares that this declaration of conformity is issued under the sole responsibility of the manufacturer. The product of this declaration is in conformity with the provisions of the following relevant UK Statutory Instruments (including all applicable amendments), and the respective standards and/or technical specifications have been used as a basis.

8.2 List of tables

8.3 List of illustrations

8014117/1EF3/2021-12-08 · LF_07 · A4 4c int49

Australia
Phone +61 (3) 9457 0600
1800 33 48 02 – tollfree
E-Mail sales@sick.com.au

Austria
Phone +43 (0) 2236 62288-0
E-Mail office@sick.at

Belgium/Luxembourg
Phone +32 (0) 2 466 55 66
E-Mail info@sick.be

Brazil
Phone +55 11 3215-4900
E-Mail comercial@sick.com.br

Canada
Phone +1 905.771.1444
E-Mail cs.canada@sick.com

Czech Republic
Phone +420 234 719 500
E-Mail sick@sick.cz

Chile
Phone +56 (2) 2274 7430
E-Mail chile@sick.com

China
Phone +86 20 2882 3600
E-Mail info.china@sick.net.cn

Denmark
Phone +45 45 82 64 00
E-Mail sick@sick.dk

Finland
Phone +358-9-25 15 800
E-Mail sick@sick.fi

France
Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Germany
Phone +49 (0) 2 11 53 010
E-Mail info@sick.de

Greece
Phone +30 210 6825100
E-Mail office@sick.com.gr

Hong Kong
Phone +852 2153 6300
E-Mail ghk@sick.com.hk

Hungary
Phone +36 1 371 2680
E-Mail ertekesites@sick.hu

India
Phone +91-22-6119 8900
E-Mail info@sick-india.com

Israel
Phone +972 97110 11
E-Mail info@sick-sensors.com

Italy
Phone +39 02 27 43 41
E-Mail info@sick.it

Japan
Phone +81 3 5309 2112
E-Mail support@sick.jp

Malaysia
Phone +603-8080 7425
E-Mail enquiry.my@sick.com

Mexico
Phone +52 (472) 748 9451
E-Mail mexico@sick.com

Netherlands
Phone +31 (0) 30 229 25 44
E-Mail info@sick.nl

New Zealand
Phone +64 9 415 0459
0800 222 278 – tollfree
E-Mail sales@sick.co.nz

Norway
Phone +47 67 81 50 00
E-Mail sick@sick.no

Poland
Phone +48 22 539 41 00
E-Mail info@sick.pl

Romania
Phone +40 356-17 11 20
E-Mail office@sick.ro

Russia
Phone +7 495 283 09 90
E-Mail info@sick.ru

Singapore
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Slovakia
Phone +421 482 901 201
E-Mail mail@sick-sk.sk

Slovenia
Phone +386 591 78849
E-Mail office@sick.si

South Africa
Phone +27 10 060 0550
E-Mail info@sickautomation.co.za

South Korea
Phone +82 2 786 6321/4
E-Mail infokorea@sick.com

Spain
Phone +34 93 480 31 00
E-Mail info@sick.es

Sweden
Phone +46 10 110 10 00
E-Mail info@sick.se

Switzerland
Phone +41 41 619 29 39
E-Mail contact@sick.ch

Taiwan
Phone +886-2-2375-6288
E-Mail sales@sick.com.tw

Thailand
Phone +66 2 645 0009
E-Mail marcom.th@sick.com

Turkey
Phone +90 (216) 528 50 00
E-Mail info@sick.com.tr

United Arab Emirates
Phone +971 (0) 4 88 65 878
E-Mail contact@sick.ae

United Kingdom
Phone +44 (0)17278 31121
E-Mail info@sick.co.uk

USA
Phone +1 800.325.7425
E-Mail info@sick.com

Vietnam
Phone +65 6744 3732
E-Mail sales.gsg@sick.com

Detailed addresses and further locations at **www.sick.com**

SICK
Sensor Intelligence.