



Original operating instructions  
Encoder (SR) with CANopen interface

**GB**

**RM900S**  
**RM901S**  
**RM902S**  
**RM903S**



## Contents

1	Preliminary note . . . . .	3
1.1	Symbols used . . . . .	3
1.2	Warnings. . . . .	3
1.3	Items supplied. . . . .	3
1.4	Applicable documents . . . . .	4
1.5	Change history . . . . .	4
2	Safety instructions. . . . .	5
3	Safety-related requirements regarding the application . . . . .	6
3.1	Cyber security . . . . .	6
4	Intended use . . . . .	7
5	General function description . . . . .	8
5.1	Encoder (SR) safe state . . . . .	9
5.2	Mandatory safety check / measure . . . . .	10
6	Mounting . . . . .	11
6.1	Solid shaft . . . . .	11
6.1.1	Installation of the coupling . . . . .	11
6.1.2	Flange mounting . . . . .	12
6.1.3	Servo clamps . . . . .	13
6.2	Blind/hollow shaft . . . . .	14
6.2.1	Mounting the clamping ring . . . . .	14
6.3	Torque support – spring plate . . . . .	14
6.4	Lubricity . . . . .	15
6.5	Shaft torques. . . . .	16
6.6	Potential equalisation . . . . .	18
6.7	Replacing the encoder (SR) . . . . .	18
6.8	General notes on wiring . . . . .	19
6.9	Removing the connector with vibration protection . . . . .	19
6.10	Terminating resistor . . . . .	19
7	Electrical connection . . . . .	20
8	Technical data. . . . .	21
8.1	Functional safety. . . . .	23
8.2	Power supply . . . . .	23
8.3	Abbreviations and definitions . . . . .	24
9	Approvals . . . . .	25
9.1	UL / CSA approval . . . . .	25
10	Maintenance, repair and disposal . . . . .	26

# 1 Preliminary note

You will find instructions, technical data, approvals, accessories and further information using the QR code on the device / packaging or at [documentation.ifm.com](https://documentation.ifm.com).

## 1.1 Symbols used

- ✓ Requirement
- Instructions
- ▷ Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference
-  Important note  
Non-compliance may result in malfunction or interference.
-  Information  
Supplementary note

## 1.2 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:



### WARNING

Warning of serious personal injury

- ▷ If the warning is not observed, fatal and serious injuries are possible.



### CAUTION

Warning of minor to moderate personal injury

- ▷ If the warning is not observed, minor to moderate injuries are possible.

### ATTENTION

Warning of damage to property

- ▷ If the warning is not observed, damage to property is possible.

## 1.3 Items supplied

- 1 encoder (SR)
- 1 original operating instructions
- 2 protective dust caps



The protective dust caps supplied do not provide IP protection.

## 1.4 Applicable documents

Always use the latest documentation. Changes or additions to documentation can be found online at ifm.com.

Also observe the documentation of any additional devices used together with the safety module.

- Programming manual
- Technical data sheet
- Certificates
- Approvals
- EU Certificate of Conformity

## 1.5 Change history

Date	Version	Change
01/03/2024	00	First publication

## 2 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, programming, configuration, operation and maintenance of the product must be carried out by personnel qualified and authorised for the respective activity.
- Protect units and cables against damage.
- Replace damaged units, otherwise the technical data and safety will be impaired.
- Observe applicable documents.

### 3 Safety-related requirements regarding the application

- Ensure the power supply is switched off when wiring, opening and closing electrical connections.
- Ensure there is a ground reference point at all times. The system manufacturer must provide appropriate protection mechanisms for the external electronics.



#### WARNING

Failure of the safety function

- ▷ When used outside the defined environmental conditions, the safety-related function of the encoder (SR) cannot be guaranteed.
- ▶ Use only in accordance with the defined environmental conditions (→ Technical data).



- ▶ When storing and operating the encoder (SR), unused connectors must be fitted with either a mating connector or a protective cap.  
Select the IP class in accordance with the requirements.

#### 3.1 Cyber security

#### ATTENTION

Operating the machine in an unprotected network environment

- ▷ Unauthorised read or write access to data is possible.
- ▷ Unauthorised manipulation of the device function is possible.
- ▶ Check and restrict access options to the device.

## 4 Intended use

The encoder (SR) is designed to record angular movement and process the measurement data for a downstream evaluation system in plant equipment.

The encoder (SR) must be resistant to chemical substances with which it may come into contact and must be tested (in accordance with ISO 19014-3).

A material is considered to be resistant if the properties do not change sufficiently upon contact with a harmful substance to impair the material performance.

All materials in the encoder (SR) with potential media contact are listed in the technical data.

The encoder (SR) provides digital output signals based on the angular position of a moving part.

The measuring system is primarily used in plant equipment where reliable detection of the mechanical position or speed of a moving part is required.

In accordance with IEC 61800-5-3, safe absolute position (SAP) and safe speed (SSV) are available.

- Safe absolute position (SAP)  
This function provides reliable information on the mechanical position of the angular movement with specified tolerances via the CAN bus (→ Technical data).
- Safe speed value (SSV)  
This function provides reliable information on the speed of the angular movement with specified tolerances via the CAN bus (→ Technical data).

The entire processing chain of the higher-level and overall safety function must meet the requirements of the safety standard applied by the system integrator.

In safety applications, the encoder (SR) may only be used in conjunction with a controller that is certified in accordance with the applicable safety standard.

The encoder (SR) is not able to independently bring about a safe state in the safety function.

Hazardous situations must be detected and evaluated by a higher-level fail-safe processing unit.

The system manufacturer must check whether the properties of the encoder (SR) meet its application-specific safety requirements.

The responsibility for and decision regarding the use of the encoder (SR) lies with the system manufacturer.



In case of faults within the encoder (SR) which lead to switchover into a defined safe state, measures have to be taken which maintain the safe state when the complete control system continues to be operated.



### WARNING

Any improper use may lead to dangerous situations.

- ▷ Death, serious irreversible injuries and material damage are possible.
- ▶ Use the device only in accordance with the "Intended use".

## 5 General function description

### General function description

The encoder (SR) is a safe and absolute multi-turn position measuring system with a standardised, non-safety-related interface and a safety protocol.

The encoder (SR) consists of a redundant two-channel system in which two magnetic scanning units are arranged on a drive shaft (blind or solid shaft version).

The additional safe speed detection allows the following safety functions to be implemented at system level in accordance with IEC 61800-5-2 (→ Programming manual):

Sichere Bewegungsrichtung	Safe direction	(SDI)
Sicherer Stopp 1	Safe stop 1	(SS1)
Sicherer Stopp 2	Safe stop 2	(SS2)
Sicherer Betriebshalt	Safe operating stop	(SOS)
Sicher begrenzte Geschwindigkeit	Safely limited speed	(SLS)
Sicherer Geschwindigkeitsbereich	Safe speed range	(SSR)
Sichere Geschwindigkeitsüberwachung	Safe speed monitor	(SSM)
Sicher begrenzte Position	Safely-limited position	(SLP)
Sicherer Nocken	Safe cam	(SCA)

As a sensor, the encoder (SR) is always part of a safety chain.



#### WARNING

Failure of the safety sub-function

- ▷ Handheld radio equipment operated within a radius of <200 mm of the encoder (SR) can interfere with the safety sub-functions.
- ▶ Do not operate handheld radio equipment at a distance of <200 mm from the encoder (SR).

The safety sub-functions of the encoder (SR) are established by

- making each of the two scanning channels largely fail-safe through its own diagnostic measures.
- the encoder (SR) internally carrying out a two-channel comparison of the positions recorded by the two channels, also determining the speed on two channels and transferring the safe data to the controller in the CANopen safety protocol via a safety-related data object (SRDO) with corresponding safety mechanisms.
- the encoder (SR) switching the device to a safe state in the event of a failed channel comparison or other errors detected by internal diagnostic mechanisms.
- by securing the encoder (SR) initialisation and the execution of the preset adjustment function accordingly.
- the downstream safety-related evaluation unit (e.g. safe PLC) additionally checking whether the speed and position data received are within the position window expected by the controller. Unexpected position data include position jumps, tracking error deviations and incorrect direction of travel.
- the controller initiating appropriate safety measures (to be defined by the system manufacturer) when errors are detected.
- the system manufacturer carrying out a secured test during set-up and each time a parameter is changed.



The safety sub-functions are described in detail in the programming manual.



## 5.1 Encoder (SR) safe state

As a CANopen Safety participant, the encoder (SR) switches to the safe state if an error is detected.

This state is reported with a high-priority CAN telegram, the global fail-safe command (GFC) (further explanations → Chapter “Operation” in the programming manual).

A distinction is made between two safe states:

### “Passive safe state”

The passive safe state is always supported regardless of the operating mode set.

In the passive safe state, the encoder (SR) no longer participates in CANopen safety communication. The encoder (SR) stops the output of cyclical SRDO data so that the downstream CANopen safety master can detect an error after the safeguard cycle time (SCT) has elapsed.

This is the case, for example, if the communication link is disconnected due to a cable break.

### “Active safe state”

The active safe state is only supported in ifm mode.



#### WARNING

The safety function is displayed via the safe-state bit and must be evaluated.

- ▷ If the safe-state bit has been reset, the subsequent output data of the encoder (SR) is not safe in the sense of a safety standard.
- ▷ Further information on evaluation → Programming manual

In the active safe state, the encoder (SR) continues to maintain cyclical communication via SRDO.

The safe state is displayed in the user data of the SRDO via the ifm safety status / safe-state bit.

If additional user data is available for just one measuring channel (e.g. position or speed), this data will continue to be output.

This is the case, for example, if an internal fault is detected.

This allows the user to move the equipment (e.g. in manual mode) to a park position and bring it to a safe state.

Check through safety controller	Fault response
Cyclical consistency check of the current CANopen Safety SRDOs with the corresponding inverse SRDOs in accordance with EN 50325-5, chapter CANopen Safety / Cyclical data exchange specifications.	STOP
Monitoring of the safeguard cycle time (SCT) – Timing requirements for the CANopen Safety SRDOs in accordance with EN 50325-5, chapter CANopen Safety / Cyclic data exchange specifications.	STOP
Monitoring of the safety-related validation time (SRVT) – Timing requirements for the CANopen Safety SRDOs in accordance with EN 50325-5, chapter CANopen Safety / Cyclic data exchange specifications.	STOP
Only in ifm mode: Monitoring of the safe-state bit in object 0x2420 ifm safety status when using the “Status bit behaviour” function: Object 0x2410, Subindex 11 Safe-state bit 2 <sup>4</sup> = “0” Error behavior = “1”	STOP

## 5.2 Mandatory safety check / measure

Application-dependent parameterisation of the safety-related parameters:	
<b>ifm mode</b> 2410h: safety configuration parameter <b>CiA DS406 mode</b> 6100h: Safety position configuration parameters 6101h: Safety speed configuration parameters	-
When changing parameters, check whether the measure is carried out as required.	STOP

## 6 Mounting



### WARNING

Failure of the safety sub-function of the encoder (SR) caused by an unsafe shaft drive.

- ▶ The system manufacturer must take design measures to ensure that the encoder is driven by the shaft and that the encoder is secured at all times (fault exclusion). The specifications of IEC 61800-5-2:2017 “Adjustable speed electrical power drive systems – Safety requirements, Table D.8 - Motion and position feedback sensors” must be complied with.
- ▶ Suitable overdimensioning can also be used to justify fault exclusions for mechanical connection elements (see ISO 13849-1:2023, section 6.1.10.3 and ISO 13849-2:2012, Annex A).
- ▶ The system manufacturer must install the encoder (SR) correctly to ensure that it is always driven by the axis to be measured and is not overloaded.
- ▶ When attaching, observe the requirements and acceptance conditions of the overall system.
- ▶ Secure all fastening screws against unintentional loosening.



- ▶ Avoid shocks (e.g. hammer blows) to the shaft during installation.
- ▶ Avoid permanent water deposits on the shaft. Do not mount the shaft vertically upwards.



### WARNING

Ingress of solids, fluids, gases or chemical substances.

- ▷ The shaft is not protected against the ingress of solids, fluids, gases or chemical substances.
- ▶ Measures must be taken to ensure that none of these media are in the area of the shaft.

Use at low ambient temperatures results in increased values for the starting torque. This has to be taken into account during installation/shaft drive (→ Chapter Shaft torques).

### 6.1 Solid shaft

#### 6.1.1 Installation of the coupling

- ▶ Use a coupling suitable for the application with a positive connection (→ Accessories → [www.ifm.com](http://www.ifm.com)).

Pay attention to the following notes and installation instructions of the coupling manufacturer

- The coupling must be suitable for the specified speed and possible axial displacement
- Installation on a grease-free shaft
- Do not load the coupling and the encoder axially.
- Tighten the clamp screws to the torque defined by the coupling manufacturer.
- Secure the screws of the coupling against unintentional loosening.



- Observe the safety designs from the IEC 61800-5-3 standard.
- ▷ (→ Table G.1 - Encoder (SR) – Mechanical fault list and fault exclusions).

**WARNING**

Failure of the safety sub-function due to axial shifting of the encoder (SR) on the drive shaft.

- ▶ Fix the coupling.
- ▷ Axial shifting is prevented.

**WARNING**

Failure of the safety sub-function due to radial shifting (slippage) of the encoder (SR) on the drive shaft.

- ▶ Use a coupling with a keyway to achieve a positive fit by using a parallel key/keyway combination.
- ▷ Radial shifting (slippage) is prevented.

**WARNING**

Failure of the safety sub-function due to mechanical damage (breakage of the coupling).

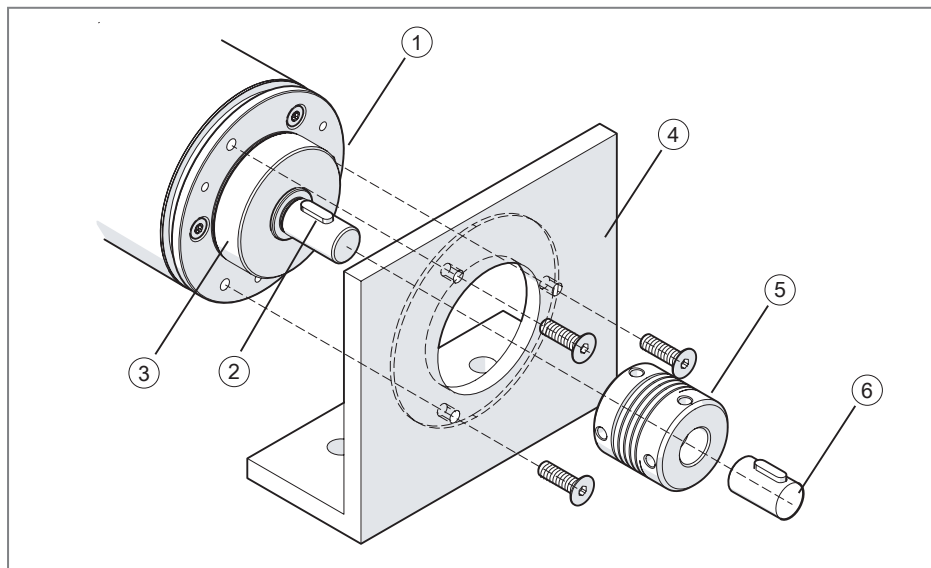
- ▶ Breakage of the coupling is not detected by the encoder (SR).
- ▷ Possible breakage of the coupling must be taken into account in the equipment's safety concept by the system manufacturer.

### 6.1.2 Flange mounting

The encoder (SR) is mounted on the machine side with three screws on the flange (centring collar).

- ▶ Use a flange plate for mounting on the machine with a suitable centring collar.
- ▶ Tighten the screws to a tightening torque of 2.2 Nm and secure with medium-strength screw retaining compound to prevent unintentional loosening.
- ▶ Use screws with sufficient thread length.
- ▶ Screw in the screws completely.

Observe the assembly instructions for mounting the coupling → Chapter "Mounting the coupling".



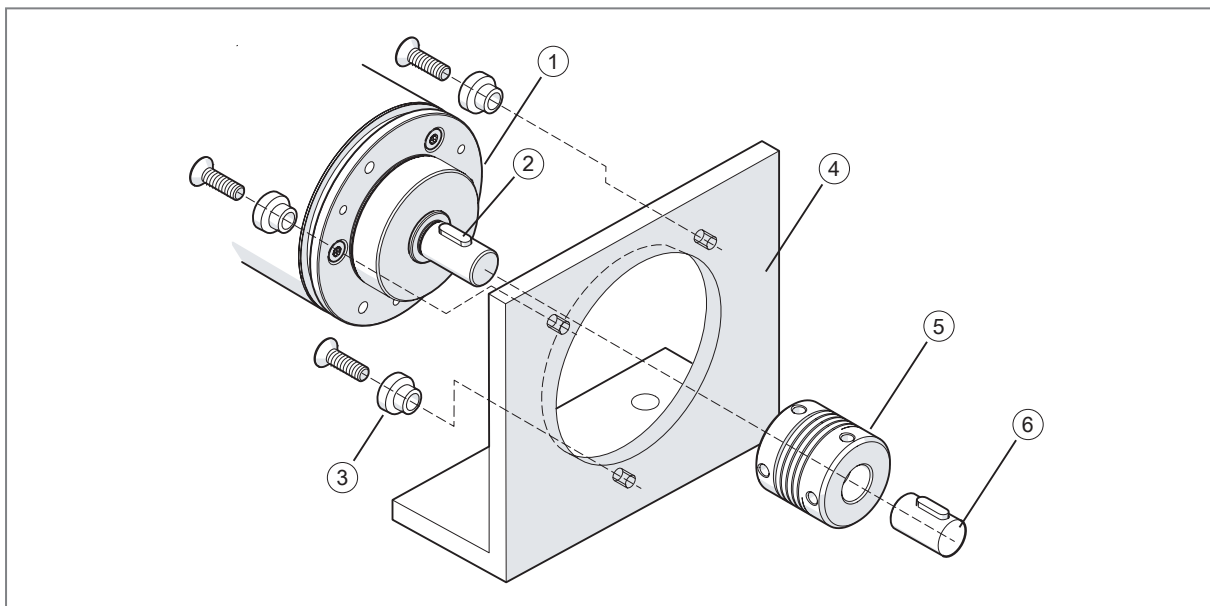
- 1: Encoder (SR)  
 3: Centering collar  
 5: Coupling with keyway

- 2: Parallel key  
 4: Flange plate (machine)  
 6: Actuator shaft

### 6.1.3 Servo clamps

- ▶ Refer to the customer-specific drawing for dimensions and individual mounting options.
- ▶ Use three servo clamps for mounting. Distribute these around the encoder offset by 120° and fasten each to the flange plate with an M4 screw.
- ▶ Use a flange plate for mounting on the machine with a suitable centring collar.
- ▶ Use M4 steel screws (recommended: coated steel screws, e.g. galvanised) with a strength class of at least 6.8 (recommended: 8.8) to fasten the servo clamps to the flange plate.
- ▶ Depending on the environmental conditions, use stainless steel screws with a strength class of at least 70.
- ▶ Tighten the M4 screws to a tightening torque of 2.2 Nm and secure with medium-strength screw retaining compound to prevent unintentional loosening.
- ▶ Use screws with sufficient thread length.
- ▶ Screw in the screws completely.
- ▶ The screw-in depth in the flange plate must be at least 4 mm in steel and at least 6 mm in aluminium.
- ▶ Keep the surfaces to be clamped free of lubricants or other soiling.
- ▶ The type of servo clamps must match the outer diameter of the flange ring and be mounted in accordance with the “top” orientation.

When the spring engages in the flange groove, correctly orientated servo clamps should lie flat on the flange plate.



- |    |                      |    |                        |
|----|----------------------|----|------------------------|
| 1: | Encoder              | 2: | Parallel key           |
| 3: | E60041 clamp         | 4: | Flange plate (machine) |
| 5: | Coupling with keyway | 6: | Actuator shaft         |



#### WARNING

Failure of the safety sub-function due to mechanical damage (breakage of the torque support).

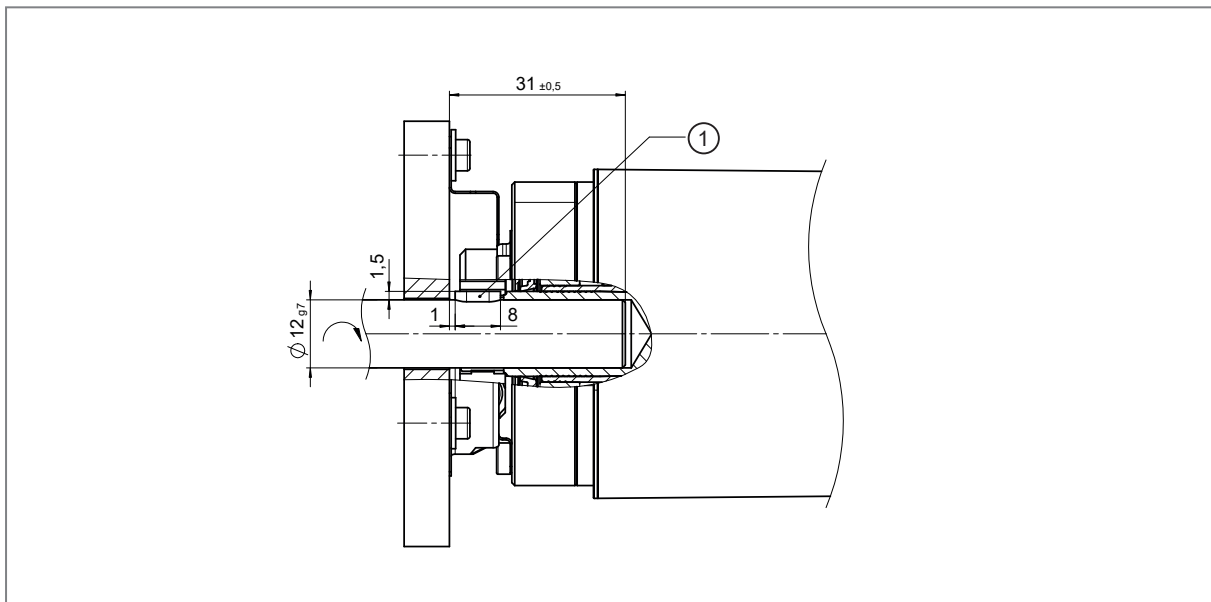
- ▷ Breakage of the torque support is not detected by the encoder (SR).
- ▶ Possible breakage of the torque support must be taken into account in the equipment's safety concept by the system manufacturer.

## 6.2 Blind/hollow shaft

### 6.2.1 Mounting the clamping ring

- ▶ Refer to the customer-specific drawing for dimensions and individual mounting options.
- ▶ Mount the encoder (SR) on a grease-free shaft.
- ▶ Prevent axial shifting of the encoder (SR) on the drive shaft by securing the clamping ring.
- ▶ Further measures may be necessary to prevent the encoder (SR) from shifting axially.
- ▶ Prevent radial shifting (slippage) of the encoder (SR) on the drive shaft by means of positive fit using a parallel key/keyway combination.
- ▶ Use a coupling with a keyway for this purpose.
- ▶ Do not subject the encoder (SR) clamp to axial load.
- ▶ Tighten the clamping ring screw with a torque spanner (2 Nm) and secure with medium-strength crew retaining compound to prevent unintentional loosening.

Requirements for the customer shaft



1: DIN 6885-A parallel key (4x4x8 mm)

- ▶ Secure the encoder (SR) as shown in the diagram on the drive side.
- ▶ Observe the mounting instructions for mounting the clamping ring → Chapter “Mounting the clamping ring”.

## 6.3 Torque support – spring plate



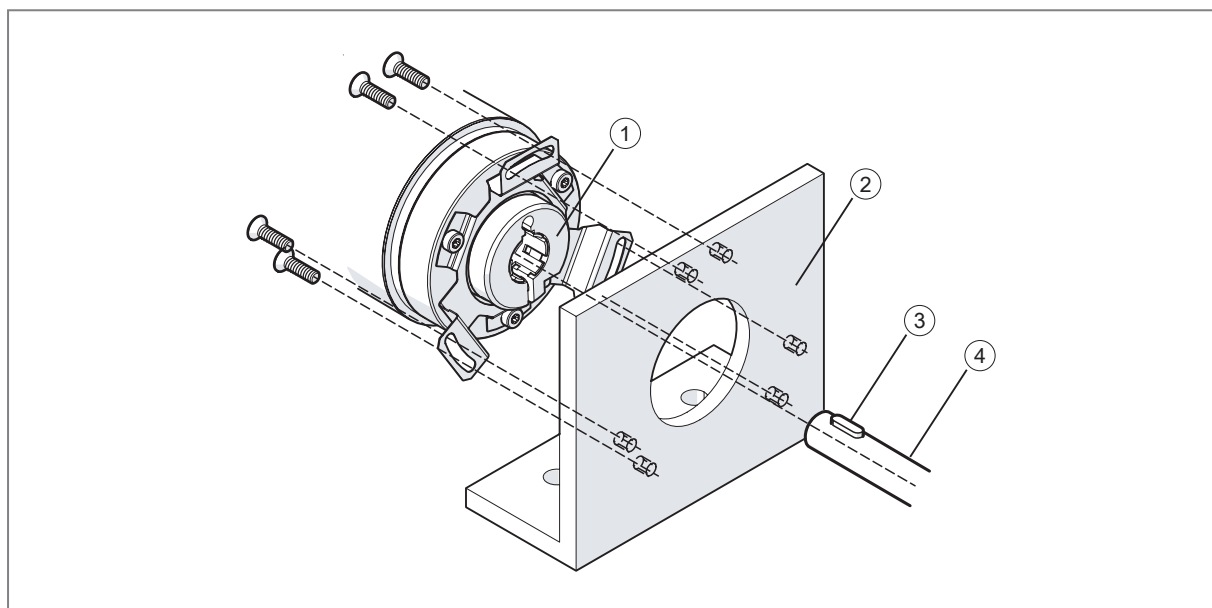
### WARNING

Failure of the safety sub-function due to mechanical damage (breakage of the torque support).

- ▷ Breakage of the torque support is not detected by the encoder (SR).
- ▶ Possible breakage of the torque support must be taken into account in the equipment's safety concept by the system manufacturer.

- ▶ Observe the environmental conditions, the shaft load and the permissible axial and radial shaft movement tolerances specified in the part number-specific data sheet.
- ▶ Installation in idle state without mains connection
- ▶ Slide the encoder (SR) onto the drive shaft.
- ▶ Fasten all three wings of the torque support to the machine using two M3 cylinder head screws, each in combination with suitable washers.
- Do not warp or prestress the plates.
- The screw connections must be secured with medium-strength screw retaining compound to prevent unintentional loosening.
- The nominal tightening torque for M3 standard threads applies depending on the strength class of the screw, with a minimum tightening torque of 0.5 Nm.
- ▶ Fasten the clamping ring to the drive shaft with the clamping ring screw (tightening torque 2 Nm).
- ▶ Do not warp or prestress the torque support.
- ▶ Do not reuse improperly fitted or damaged torque supports.
- ▶ Observe the mounting instructions for mounting the clamping ring → Chapter “Mounting the clamping ring”.

The torque support is corrosion-resistant in an industrial atmosphere. Clarify special environmental conditions / media with ifm electronic.



- 1: Clamping ring
- 2: Flange plate (machine)
- 3: Parallel key
- 4: Actuator shaft

## 6.4 Lubricity



Regular movement of the shaft preserves lubricity during service life.

- ▷ Long-term storage reduces lubricity.

## 6.5 Shaft torques



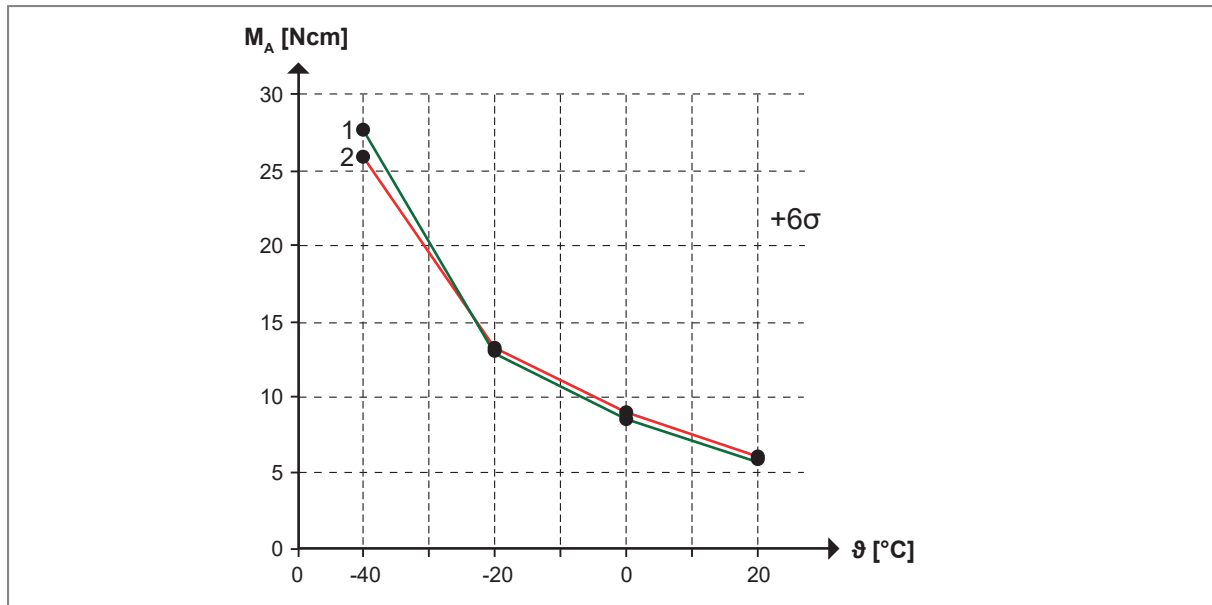
The break-away torque is the maximum torque that is required, depending on the temperature, in order to set the shaft in motion.

After break-away, the starting torque must be applied to set the shaft in motion. The difference between break-away torque and starting torque may be due to ice formation at low temperatures, for example.

Temperature [°C]	Break-away torques / starting torques [Ncm] at +6 σ	
	Solid shaft	Blind/hollow shaft
20	+5.7 / 4.6	+5.7 / 4.6
0	8.1 / 5.1	8.1 / 5.1
-20	13.3 / 5.8	13.0 / 7.4
-40	25.8 / 9.3	28.3 / 12.4

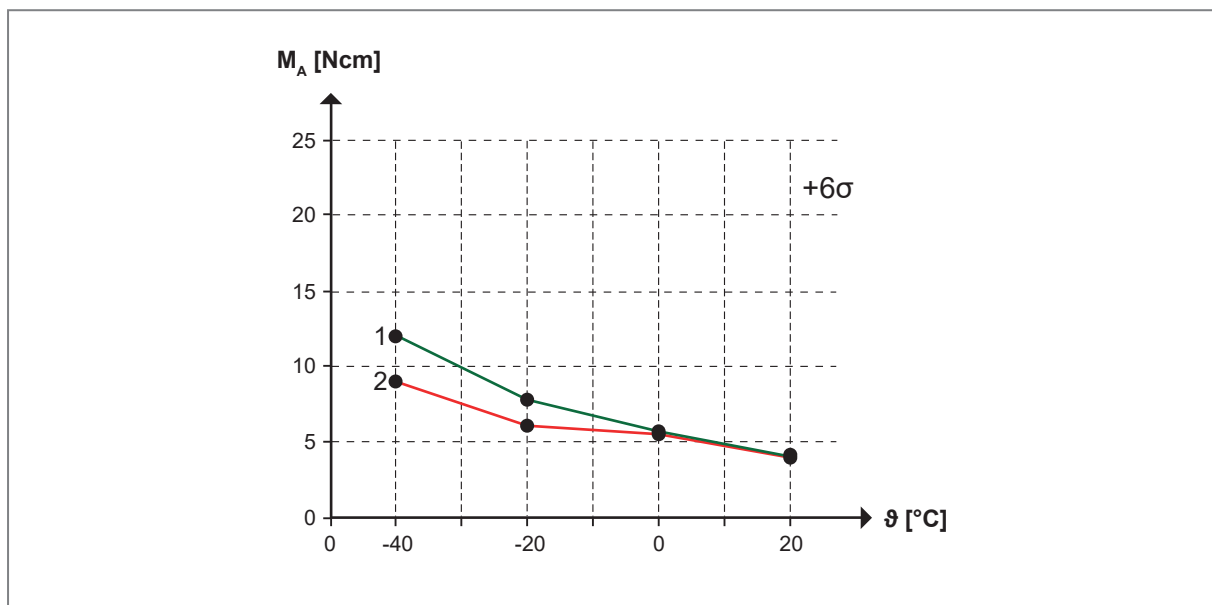


## Break-away torques



- 1: Hollow shaft  
2: Solid shaft

## Starting torques



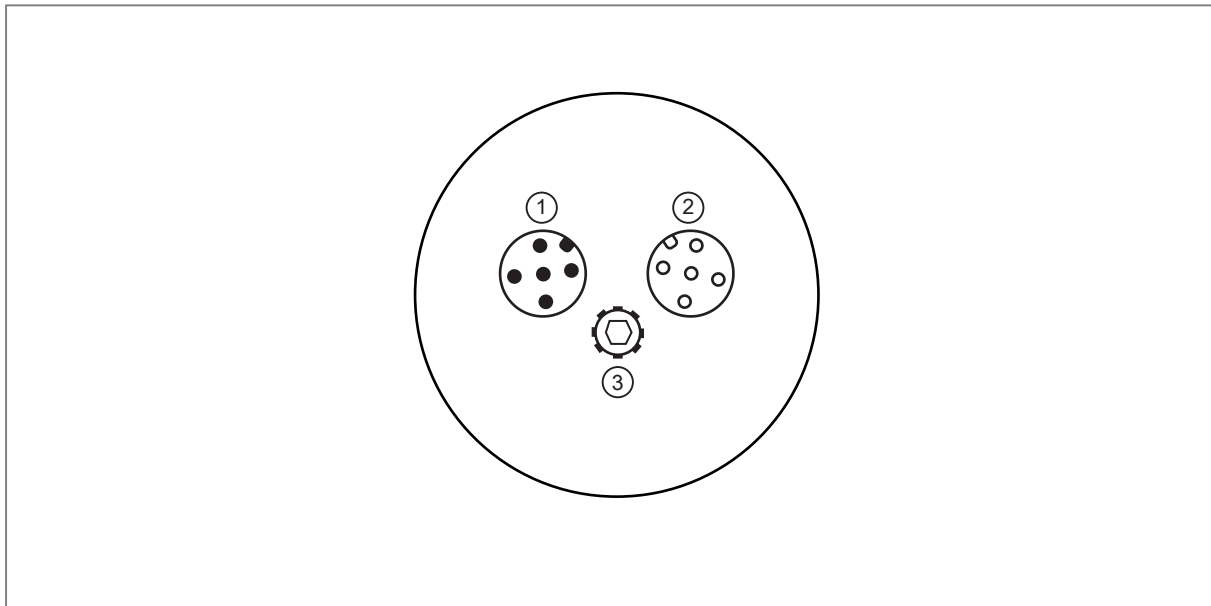
- 1: Hollow shaft  
2: Solid shaft



Safety couplings are dependent on the respective application.

- Align the torques of the encoder shaft with those of the coupling.  
To do this, take the starting torques, break-away torques and accelerations into account.

## 6.6 Potential equalisation



- 1: M12 A-coded connector
- 2: M12 A-coded socket
- 3: M4 screw for potential equalisation

If the encoder (SR) is installed on machine parts with different potentials, compensation currents can occur via the shaft.

Recommendation: Establish potential equalisation to avoid these compensation currents.

- Optionally establish the potential equalisation at the M4 screw with a cable lug.

## 6.7 Replacing the encoder (SR)

Observe the following points when replacing the encoder (SR):

- The replacement encoder (SR) must have the same article number as the encoder (SR) to be replaced. Any deviations must be expressly clarified with ifm.
- The replacement encoder (SR) must be installed in accordance with the specifications and requirements in the "Installation" chapter.
- The replacement encoder (SR) must be connected in accordance with the specifications in the interface-specific user manual.
- As the parameters of the encoder (SR) are generally stored in the controller, the replacement encoder (SR) is configured with the projected settings during the start-up phase. If this mechanism is not available, it must be ensured that the replacement encoder (SR) is given the same setting values.
- Depending on the application, the output position value may need to be adjusted to the machine reference position. The position value must be adjusted in accordance with the programming manual.
- When restarting the replacement encoder (SR), first ensure that it functions correctly by carrying out a test run in real conditions.
- Organisational measures must be taken to ensure replacement of the encoder (SR) before the bearing service life / operational life is reached. The service life may differ from the operational life depending on the stress (→ see technical data).

## 6.8 General notes on wiring

The threaded connections in the device correspond to the M12 standard. To ensure compliance with the specified protection rating, only cables that comply with this standard may be used. In the case of self-assembled cables, the system manufacturer is responsible for the protection rating.

- ▶ Use connectors with gold-plated contacts.
- ▶ During installation, place the connectors vertically so that the coupling nut will not damage the thread.
- ▶ Observe the coding of the connectors during installation.

If connector in device:

- ▶ Tighten the cable socket according to the torque specifications indicated by the cable manufacturer. At least 1.2 Nm, maximum permissible torque: 1.5 Nm

If socket in device:

- ▶ Tighten the cable plugs according to the torque specifications indicated by the cable manufacturer. At least 1.2 Nm, maximum permissible torque: 1.5 Nm
- ▶ Cover unused connections with protective caps.



Secure the cable entries of the mating connectors by cable strain relief to prevent them from being pulled out.

The IP rating of the overall system depends on the protection ratings of the individual devices, the applied connection elements and the corresponding protective caps.

### ATTENTION

No protection rating / no protection of the contacts without mounted connectors / protective caps.

- ▷ Inadmissible soiling / moisture possible.
- ▷ Separation of circuits / safety might be impaired.
- ▶ Before installation / when replacing the device, observe pollution degree 2.
- ▶ Ensure separation / safety.

## 6.9 Removing the connector with vibration protection

- ▶ Press the connector against the unit and simultaneously loosen the coupling nut.

## 6.10 Terminating resistor

If the encoder (SR) is used at the end of the CAN bus topology, a terminating resistor is required.

## 7 Electrical connection



The unit must be connected by a qualified electrician.

- ▶ Observe the national and international regulations for the installation of electrical equipment.
- ▶ Disconnect power.
- ▶ Connect the unit as follows:

M12 A-coded connector (CAN-In)	
	1: CAN shield 2: VBB 3: GND 4: CAN_H 5: CAN_L PE via housing screw
M12 A-coded socket (CAN-out)	
	1: CAN shield 2: VBB 3: GND 4: CAN_H 5: CAN_L PE via housing screw

## 8 Technical data

Application area		
Operating principle		Absolute
Rotation type		Multi-turn
Detection system		Magnetic
Operating temperature (active)	[°C]	-40...85

Electrical data		
Operating voltage	[V]	8...36 DC
Current consumption	[mA]	< 60; (24 V DC)
Power consumption	[W]	1.5
Protection class		III
Reverse polarity protection		Yes
Overvoltage protection		yes; (< 60 V DC)
Power-on delay time	[s]	< 2

Outputs		
Contact rating		max. 1.5 A (24 V DC)
Type of code		Binary

Measuring / setting range		
Resolution per revolution		8192 steps (13 bit)
Number of revolutions		65536 (16 bits)
Total resolution		536870912 steps (29 bit)

Accuracy / deviations			
Accuracy	[°]	non-safety	0.2
		safety	0.5
Repeatability		± 0,1 °; (magnetic)	
Contouring error	[rpm]	< 250	
Speed tolerance	[rpm]	± 3.6	

Response times		
Response time on safety request	[ms]	7

Software / programming,		
Parameter setting options		Scaling; Preset; Baud rate; Node ID; Limit switch; Gear function; Monitoring window; Counting direction; Speed parameters; Integration time; ifm mode

Interfaces		
Number of CAN interfaces		2
Transmission rate		20 kBits/s... 1 Mbit/s
Terminating resistor		yes; (external M12)

CAN		
Protocol		CANopen; CANopen safety; CAN specification 2.0 A
Factory settings		Baud rate: 250 kBits/s
		Node ID: 32
Version		CiA 406 V4.1.0; CiA 301 V4.2.0; CiA DSP-305 V3.0.0 LSS; EN 50325-4; EN 50325-5; EN 11898

Environmental conditions		
Ambient temperature	[°C]	-40...85
Derating operating temperature		The permissible operating temperature is reduced by the specified factor depending on the speed n: $T_A = -0.004 \cdot n + 85^\circ \text{C}$ (IP67) The operating temperature must be taken into account to allow for internal heat generation when the shaft is rotating.
Storage temperature	[°C]	-40...90
Note on storage temperature		dry
Max. permissible relative humidity	[%]	98
Max. height above sea level	[m]	5000
Protection rating		IP67, IP 69K; (with ifm socket duly screwed on)

Approvals / tests			
EMC		IEC 61000-4-2 ESD 6	6 kV CD / 15 kV AD
		IEC 61000-4-3 HF radiated:	20 V/m (27...1000 MHz) 10 V/m (1000...2000 MHz) 3 V/m (2000...6000MHz)
		IEC 61000/4/4 Burst	4 kV
		IEC 61000-4-5 Surge	2 kV (screen)
		IEC 61000-4-6 HF	20 V
		IEC 55011	Class B
		IEC 61000-4-8 magnetic fields	30 A/m (50 Hz) / 1000 A/m (0 Hz) Criterion A from any direction
Vibration resistance		IEC 60068-2-64	15 g; Sinus; (50...2000 Hz)
		ISO 19014-3	5.7 g; RMS
Shock resistance		IEC 60068-2-27	100 g 6 ms half-sine; 100 shocks each in every direction of the 3 coordinate axes
Standard		compliant with ECE R 10 Rev.6	
Salt spray test		IEC 60068-2-52	Severity level 5
Comment		Can be used in applications up to <ul style="list-style-type: none"> <li>SIL 2 in accordance with IEC 62061</li> <li>Ag PL d in accordance with ISO 25119</li> <li>MPL d in accordance with ISO 19014-3</li> </ul>	

Safety classification		
Meets the requirements of		IEC 61508 SIL 2
		IEC 61800-5-2
		IEC 61800-5-3
		EN ISO 13849-1 PL d Cat.3
Mission Time (TM)	[h]	175800
Mission time TM (additional indication)		(20 years)
PFH	[1/h]	2,00E <sup>-8</sup>

Mechanical data		
Dimensions	[g]	Ø 58 / L = 98.8
Materials		Flange: aluminium; Housing: Aluminium; Seals: NBR / HNBR; Display: polycarbonate; Connections (axial): Diecast zinc, nickel-plated; Connections (radial): nickel-plated brass
Max. revolution mechanical	[rpm]	6000
Max. starting torque	[Nm]	5
Tightening torque reference temperature	[°C]	20
Max. axial shaft load (10 mm from flange)	[N]	80 @ 3000 min <sup>-1</sup> 40 @ 6000 min <sup>-1</sup>
Max. radial shaft load (10 mm from flange)	[N]	100 @ 3000 min <sup>-1</sup> 50 @ 6000 min <sup>-1</sup>
Shaft material		1.4305 (stainless steel / 303)
Angular acceleration	[rad/s <sup>2</sup> ]	≤ 1*10 <sup>4</sup>
Bearing service life		Ln <sub>mr</sub> 3.6*10 <sup>10</sup> U (6000 min <sup>-1</sup> ; 60 °C; 40 N axial / 50 N radial)
		Ln <sub>mr</sub> 3.9*10 <sup>9</sup> U (6000 min <sup>-1</sup> ; 60 °C; 80 N axial / 100 N radial)

## 8.1 Functional safety

The attainable Safety Integrity Level or Performance Level depends on the device and is noted on the type label.

EN ISO 13849-1: 2023, performance level	PLd / Cat. 3
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## 8.2 Power supply

- Only operate the encoder on power supply units in accordance with the requirements of SELV/ PELV (IEC 60364-4-41:2005).
- In UL applications, only operate the encoder on NEC Class 2 power supply units.

Nominal voltage	24 V DC
Power consumption	≤ 6 watts

### 8.3 Abbreviations and definitions

EMC	Electromagnetic compatibility
ESD	Electrostatic discharge
Fault exclusion	Compromise between the technical safety requirements and the theoretical possibility of a fault occurring.
Functional safety	Part of overall plant safety that depends on the correct functioning of safety-related systems for risk reduction. Functional safety is ensured if each safety function is executed as specified.
IEC	International Electrotechnical Commission
ISO	International Standard Organisation
PL	Performance level: Discrete level that specifies the capability of safety-related parts of a controller to perform a safety function under predictable conditions.
SIL	Safety integrity level Four discrete levels (SIL1 to SIL4). The higher the SIL of a safety-related system, the lower the probability that the system will not be able to carry out the required safety functions.
SR	Safety Related
Ag PL d	The standard defines the Agricultural Performance Levels (AgPL) QM, a–e. AgPL a to e correspond to the Performance Levels (PL) a to e as defined in ISO 13849.
MPL d	This part of ISO 19014 specifies general principles for the development and assessment of the attained machine performance level (MPL a–e) of safety control systems (SCS).



## 9 Approvals

### 9.1 UL / CSA approval

Encoders with this approval are labelled with the UL symbol on the type label.



- ▶ In UL applications, only operate the encoder on NEC Class 2 power supply units.

## 10 Maintenance, repair and disposal

The operation of the unit is maintenance-free.

Only the manufacturer is allowed to repair the unit.

- After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.

However, if the bearing service life according to the product data sheet is exceeded within the operational life of 20 years, the encoder (SR) must be taken out of service.

Further information on this can be found in the standards

- IEC 62061 and
- IEC 61508

with the title “Safety of machinery – Functional safety of safety-related electrical/electronic/programmable electronic systems”.