Smart encoders & actuators

User's guide

AMM8A

- Multiturn modular encoder with optical scanning
- Compact and low-profile design for comfortable installation
- Resolution up to 21 x 12 bits (2,097,152 cpr x 4,096 rev.)
- SSI / BiSS C-mode interface with Sine/Cosine additional track
- For direct integration into robots, motors and OEM applications

Suitable for the following models:

- AMM8Axx/xxxxxBGx...
- AMM8Axx/xxxxxGGx...
- AMM8Axx/xxxxxSCx...

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Typographic and iconographic conventions

In this guide, to make it easier to understand and read the text the following typographic and iconographic conventions are used:

- parameters and objects both of Lika device and interface are coloured in **GREEN**;
- alarms are coloured in **RED**;
- states are coloured in **FUCSIA**.

When scrolling through the text some icons can be found on the side of the page: they are expressly designed to highlight the parts of the text which are of great interest and significance for the user. Sometimes they are used to warn against dangers or potential sources of danger arising from the use of the device. You are advised to follow strictly the instructions given in this guide in order to guarantee the safety of the user and ensure the performance of the device. In this guide the following symbols are used:

	This icon, followed by the word **WARNING**, is meant to highlight the parts of the text where information of great significance for the user can be found: user must pay the greatest attention to them! Instructions must be followed strictly in order to guarantee the safety of the user and a correct use of the device. Failure to heed a warning or comply with instructions could lead to personal injury and/or damage to the unit or other equipment.
	This icon, followed by the word **NOTE**, is meant to highlight the parts of the text where important notes needful for a correct and reliable use of the device can be found. User must pay attention to them! Failure to comply with instructions could cause the equipment to be set wrongly: hence a faulty and improper working of the device could be the consequence.
	This icon is meant to highlight the parts of the text where suggestions useful for making it easier to set the device and optimize performance and reliability can be found. Sometimes this symbol is followed by the word **EXAMPLE** when instructions for setting parameters are accompanied by examples to clarify the explanation.

Preliminary information

This guide is designed to provide the most complete and exhaustive information the operator needs to correctly and safely install and operate the **AMM8A absolute modular encoder with SSI and BiSS C-mode interface**.

This encoder is able to provide a total amount of position information up to 33 bits (21 x 11 bits = 2,097,152 cpr, 4,096 revolutions). Thus the overall length of the SSI data packet is up to 33 bits; while the overall length of the BiSS data packet is up to 41 bits (33 bit position information + 1 bit error nE + 1 bit warning nW + 6 bit CRC cyclic redundancy check). It further provides additional 1Vpp sine-cosine signals for speed feedback (1024 sinusoidal waves per mechanical revolution). For information on the encoder resolution please see the order code.

To achieve proper installation and correct operation of the encoder a software is expressly developed and released by Lika Electronic. It allows the operator to set up and calibrate the AMM8A modular encoder during installation. The program is supplied for free and can be installed in any PC fitted with a Windows operating system (Windows XP or later).
The name of the program executable file is:

- **IF90-SC_AMM8_BiSS**_vx.x.x.exe for **BiSS interface** encoders;
- **IF90-SC_AMM8_SSI**_vx.x.x.exe for **SSI interface** encoders.

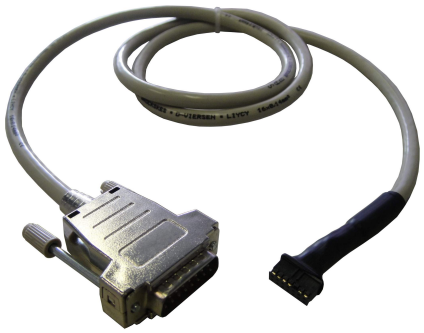
The connection between the encoder and the PC is established by using the kit (IF90-SC module + USB cable + AC-DC power supply, order code IF90-SC) expressly supplied by Lika Electronic. The EC-FCI-LK-TF12-0,5 and EXC-D15M-S71-A16-1,0-FCI-S71 cables must be ordered separately as well as the PF5013 mechanical spacer and the PF5015 positioning tool for mechanical installation.

To make it easier to read and understand the text, this guide can be divided into three main sections.
In the first section some general information concerning the safety, the mechanical installation and the electrical connection as well as tips for setting up and running properly and efficiently the unit are provided.
In the second section, entitled **Calibration and synchronization procedure**, specific information on properly calibrating the encoder during installation is given. In this section the software tool features are fully described.
In the third section, entitled **SSI interface**, both general and specific information is given on the SSI interface.
In the fourth section, entitled **BiSS C-mode interface**, both general and specific information is given on the BiSS C-mode interface. In this section the parameters implemented in the unit are fully described.

IF90-SC kit component parts

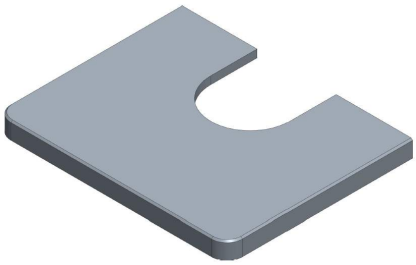
IF90-SC module
USB cable
AC-DC power supply

Further accessories **to be ordered separately**:

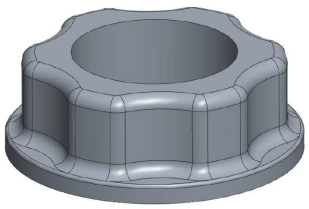


A) **EXC-D15M-S71-A16-1,0-FCI-S71 cable** for calibration and synchronization (see on page 31)
- 15-pin male D-Sub connector to the IF90-SC interface D-Sub connector
- 14-pin SQW-107-01-F-D-VS connector to the modular encoder unit

B) **EC-FCI-LK-TF12-0,5 connection cable** for operation (see on page 25)
- 0.5 m cordset with SQW-107-01-F-D-VS 14-pin connector



C) **PF5013 mechanical spacer** to properly place the disk on the flange, at the right distance, see on page 18



D) **PF5015 positioning tool** to press the code disk into place on the mechanical spacer, see on page 18

1 - Safety summary

1.1 Safety

- Always adhere to the professional safety and accident prevention regulations applicable to your country during device installation and operation;
- installation and maintenance operations have to be carried out by qualified personnel only, with power supply disconnected and stationary mechanical parts;
- device must be used only for the purpose appropriate to its design: use for purposes other than those for which it has been designed could result in serious personal and/or the environment damage;
- high current, voltage and moving mechanical parts can cause serious or fatal injury;
- warning! Do not use in explosive or flammable areas;
- failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment;
- Lika Electronic assumes no liability for the customer's failure to comply with these requirements.

1.2 Electrical safety

- Turn off power supply before connecting the device;
- connect according to explanation in the "5 - Electrical connections" section on page 24;
- if not used, connect Zero setting/Preset and Counting direction inputs to 0Vdc;
  - to set the zero/preset, connect Zero setting/Preset input to +Vdc for 100 µs at least, then disconnect +Vdc; normally voltage must be at 0Vdc; zero/preset must be set after Counting direction; we suggest setting the zero/preset when the encoder shaft is not running;
  - Counting direction: CW increasing count (viewed from flange side): connect to 0Vdc; CCW increasing count: connect to +Vdc;
- in compliance with the 2014/30/EU norm on electromagnetic compatibility, following precautions must be taken:

  - before handling and installing, discharge electrical charge from your body and tools which may come in touch with the device;
  - power supply must be stabilized without noise, install EMC filters on device power supply if needed;
  - always use shielded cables (twisted pair cables whenever possible);
  - avoid cables runs longer than necessary;
  - avoid running the signal cable near high voltage power cables;
  - mount the device as far as possible from any capacitive or inductive noise source, shield the device from noise source if needed;
  - to guarantee a correct working of the device, avoid using strong magnets on or near by the unit;
  - minimize noise by connecting the shield and/or the frame to ground. Make sure that ground is not affected by noise. The connection point to ground

can be situated both on the device side and on user's side. The best solution to minimize the interference must be carried out by the user.

1.3 Mechanical safety

- Install the device following strictly the information in the "4 - Mounting instructions" section on page 16;
- mechanical installation has to be carried out with stationary mechanical parts;
- do not disassemble the encoder;
- do not tool the encoder or its shaft;
- delicate electronic equipment: handle with care; do not subject the device and the shaft to knocks or shocks;
- respect the environmental characteristics declared by manufacturer; the encoder must be adequately protected under an appropriate enclosure for the specific application.

1.4 Specific handling and cleaning instructions and safety information against electrostatic discharges

Please be sure to strictly observe the following safety precautions and instructions before handling and installing the modular encoder.

- Open the box and handle the electronic components only within an EPA (Electrostatic Protective Area) and when you are properly grounded;
- before handling the modular encoder the operator must wear:
  - a wrist strap; it must be worn on the hand and connected to ground through a 1 megohm resistor;
  - an ESD smock made of dissipative material;
  - dissipative gloves; they are further used not to dirty the code disk while mounting;
- always handle the encoder by grasping the metal enclosure on the sides;
- the code disk must always be handled by grasping its collar;

- avoid flexing the disk, exposing it to direct sunlight, excessive heat and/or humidity;
- if dust or fingerprints get on to the disk, wipe with a soft dry cloth or camera lens tissue; wipe the disk using circular motions; more stubborn fingerprints or stains can be removed using a soft cloth lightly moistened with a few drops of alcohol; do not use gasoline, kerosene, benzene or other solvents, as they damage the disk.

2 - Identification

Device can be identified through the **order code** and the **serial number** printed on the label applied to its body. Information is listed in the delivery document too. Please always quote the order code and the serial number when reaching Lika Electronic. For any information on the technical characteristics of the product refer to the technical catalogue.

Warning: encoders having order code ending with "/Sxxx" may have mechanical and electrical characteristics different from standard and be supplied with additional documentation for special connections (Technical Info).

3 - Get started

For **installation and set up procedure**, follow the instructions in the "4.3 Mounting the encoder and executing the synchronization procedure" section on page 18. The complete procedure with calibration and synchronization processes is described on page 31.

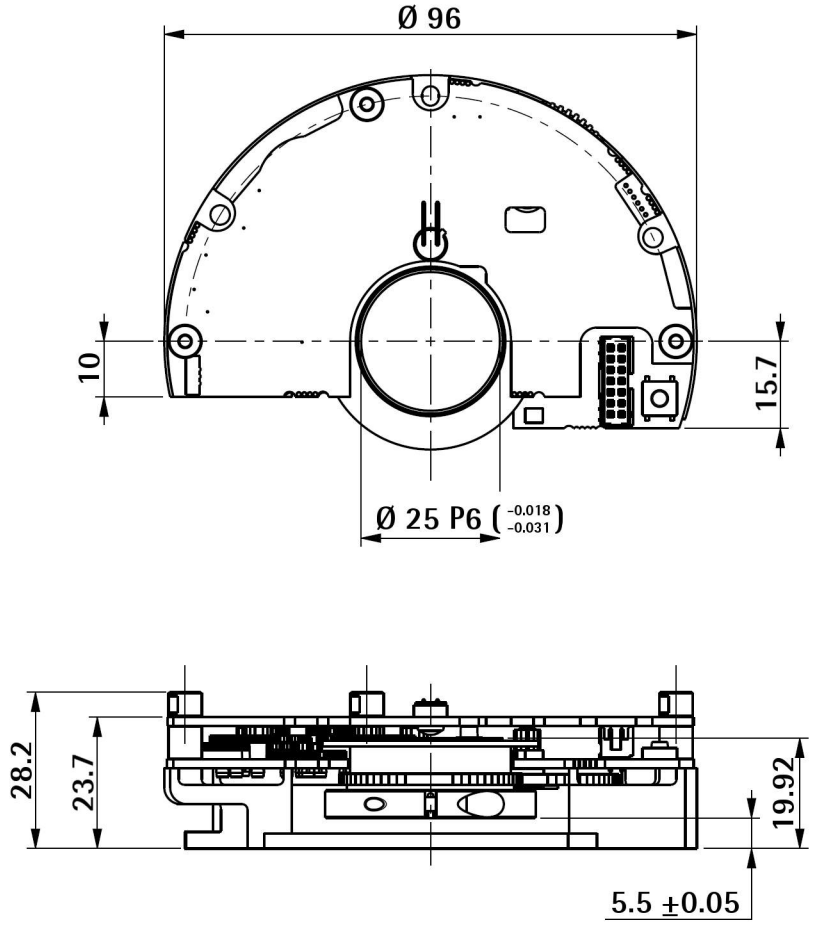
4 - Mounting instructions

WARNING
Installation must be carried out by qualified personnel only, with power supply disconnected and mechanical parts compulsorily in stop.

WARNING
Before handling and mounting the device please be sure to read carefully the handling instructions and safety information reported in the "1.4 Specific handling and cleaning instructions and safety information against electrostatic discharges" section on page 12.

4.1 AMM8A encumbrance sizes

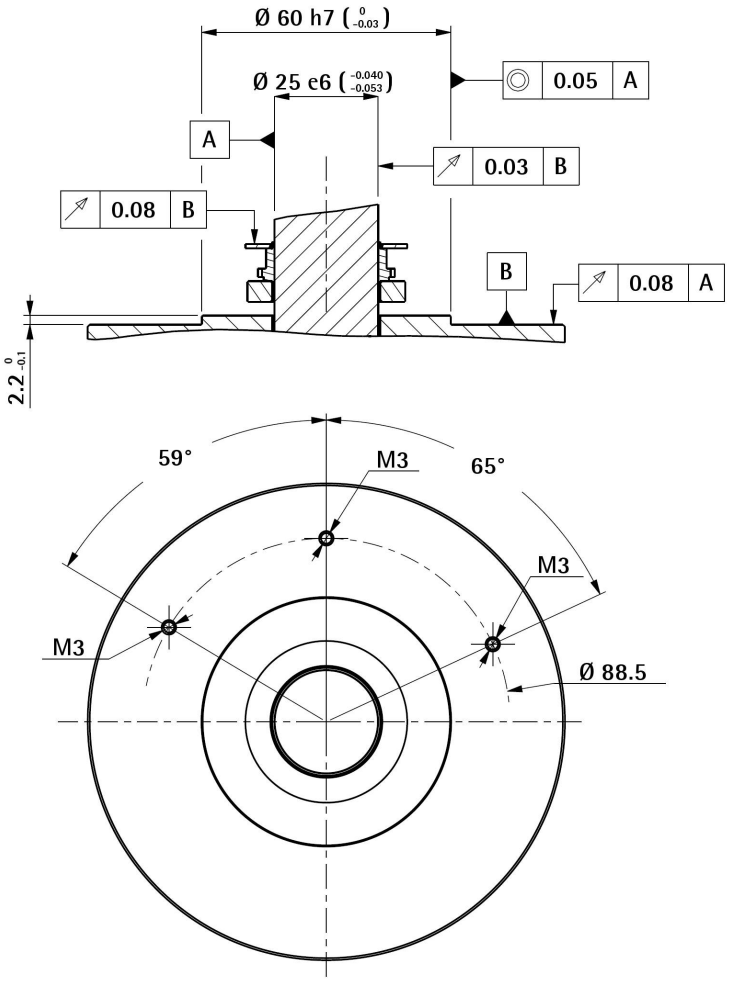
(values are expressed in mm)



4.2 Mechanical characteristics of the mounting support

This encoder module is specifically designed for installation in motors having the mechanical characteristics indicated in the following drawing.

(values are expressed in mm)



4.3 Mounting the encoder and executing the synchronization procedure

Refer also to the "3 - Get started" section on page 15.

NOTE

For your ease and convenience, before starting the installation, please make sure that the mounting kit and tools are ready to hand. Always refer to the mounting tolerances specified in the "4.1 AMM8A encumbrance sizes" section on page 16.

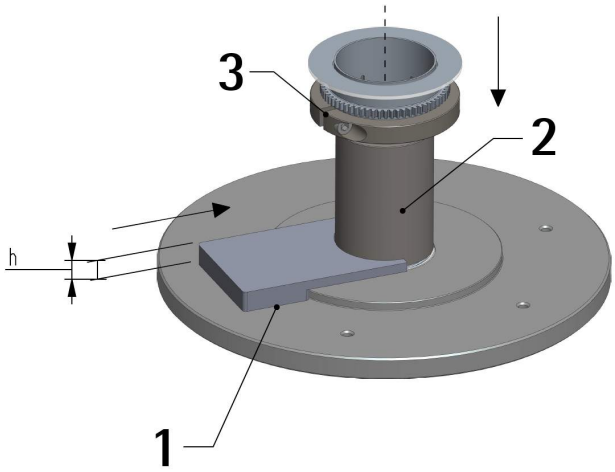
WARNING

- Before installation, carefully clean the code disk from dust or fingerprints, wipe it with a soft dry cloth or camera lens tissue; wipe the disk using circular motions; more stubborn fingerprints or stains can be removed using a soft cloth lightly moistened with a few drops of alcohol; do not use gasoline, kerosene, benzene or other solvents, as they damage the disk;
- the code disk must always be handled by grasping its collar;
- protect the disk from scratching;
- avoid flexing the disk;
- always handle the encoder unit by grasping the metal enclosure on the sides.

WARNING

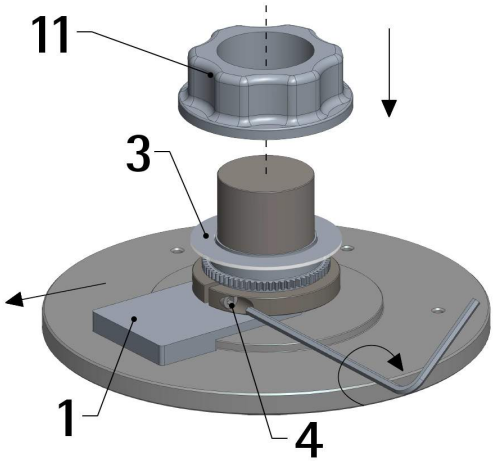
Never supply the encoder unit if it is not installed on the code disk and can read it; the error that is generated cannot be reset.

Step 1



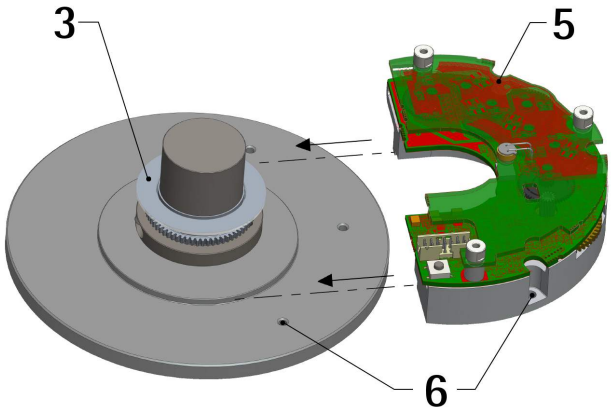
Place the **PF5013** spacing tool **1** against the shaft **2**. Insert the code disk **3** into the shaft **2** and lay it down on the spacing tool **1**; always handle the code disk **3** by grasping its collar.

Step 2



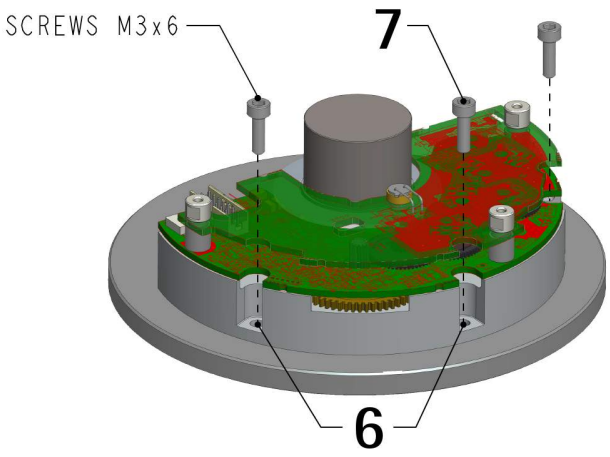
Use the **PF5015** positioning tool **11** to properly press the code disk **3** into place on the **PF5013** spacing tool **1**. Tighten the M2 x 12 DIN 912 screw **4** to firmly fasten the code disk **3**; make sure that the code disk **3** perfectly rests on the spacing tool **1** before fixing it; the max. tightening torque is **0.45 Nm**.

Step 3



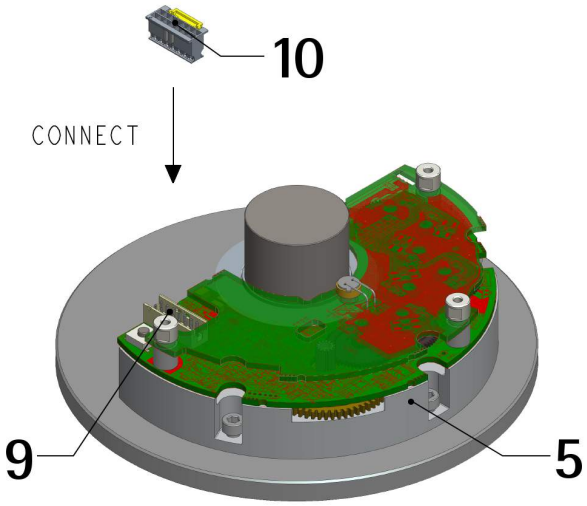
Slide the encoder unit **5** over the code disk **3** until the screw holes **6** match up; make sure that the metal enclosure of the encoder unit **5** does not hit or touch the code disk **3**; always handle the encoder unit **5** by holding the metal enclosure on the sides.

Step 4



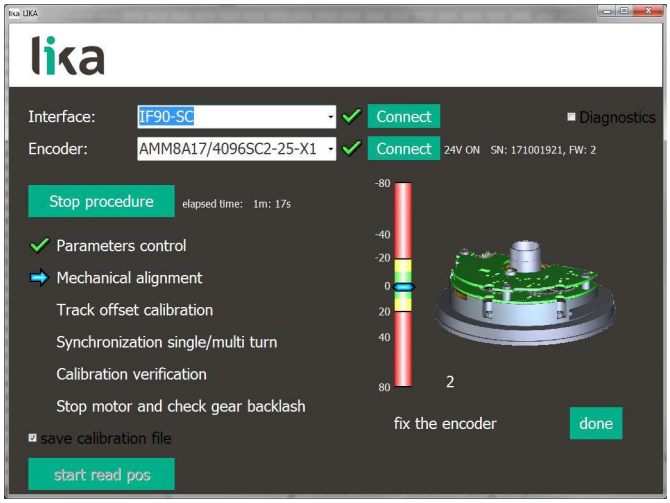
Insert the three M3 x 6 cylinder-head bolts **7** in the holes **6**, do not tighten them, just get a few turns to allow the position of the encoder unit **5** to be slightly adjusted. Please ensure that the encoder unit **5** does not move up and down.

Step 5



Connect the **EXC-D15M-S71-A16-1,0-FCI-S71** cable **10** to the 14-pin male connector **9** of the encoder unit **5** on one side, to the connector of the interface on the other side.

Step 6

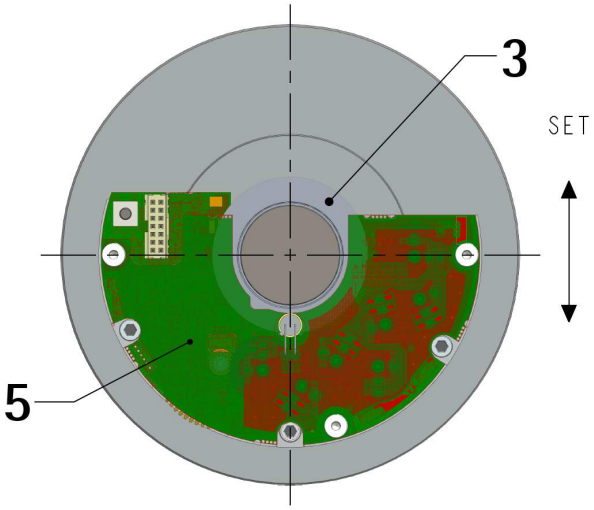


Now you need to align the encoder unit **5** over the code disk **3**. For complete information on the mechanical alignment, the calibration procedure and the synchronization operation using the **IF90-SC program**, please refer to the "6 - Calibration and synchronization procedure" section on page 31.

Before starting the calibration and synchronization procedure please make sure that:

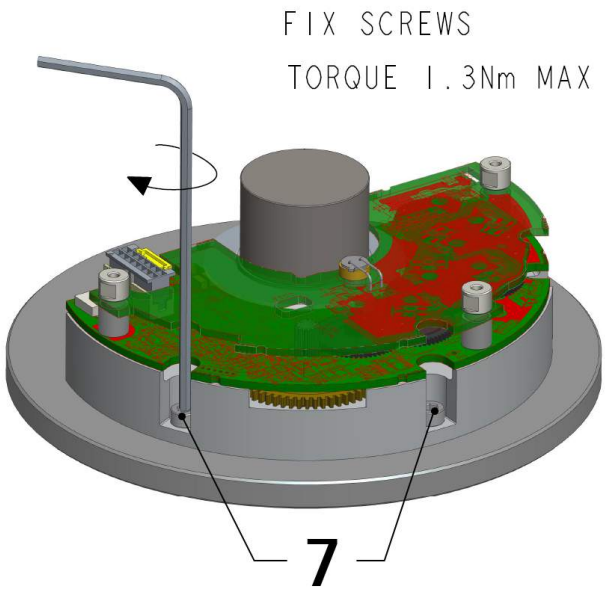
- the **EXC-D15M-S71-A16-1,0-FCI-S71** cable **10** is properly connected on both sides;
- the USB cable is properly connected to both the IF90-SC interface and the PC;
- the IF90-SC interface is powered;
- the motor is running at an ideal speed of 60 ±10 rpm.

Step 7



Adjust the position of the encoder unit **5** until it is well aligned over the code disk **3** and the **Fix the encoder** message appears on the calibration interface page (see the Figure in the previous **Step 6**).

Step 8



Tighten the three bolts **7** to firmly fix the encoder unit **5**, torque to **1.3 Nm** max. Hold the encoder unit **5** down and avoid any movements while tightening. Finally press the **DONE** button in the calibration and synchronization interface page.

Step 9

Finalize the calibration and synchronization procedure.

After installation, calibration and synchronization procedures are carried out, replace the **EXC-D15M-S71-A16-1,0-FCI-S71** calibration cable with the **EC-FCI-LK-TF12-0,5** connection cable.

5 - Electrical connections

WARNING
Power supply must be turned off before performing any electrical connection!
If wires of unused signals come in contact, irreparable damage may be caused to the device. Thus they must be cut at different lengths and insulated singularly.

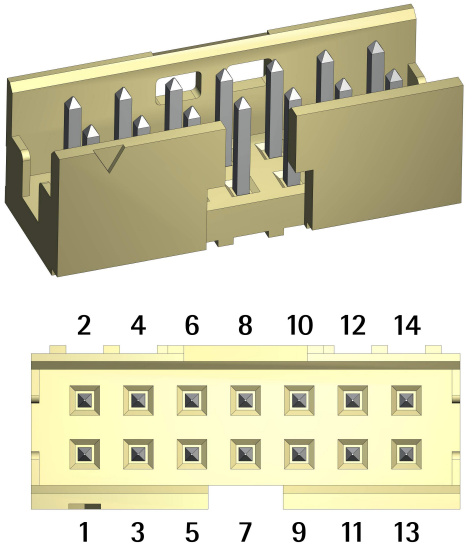
Function	14-pin male connector	TF12 cable
+Vdc [1]	1	Brown_Green
0Vdc	2	White_Green
Counting direction	3	Blue
Zero setting / Preset	4	White
CLOCK IN - / MA -	5	Yellow
CLOCK IN + / MA +	6	Violet
DATA OUT - / SLO -	7	Pink
DATA OUT + / SLO +	8	Grey
+5Vdc OUT (100 mA max.)	9	n.c.
Input 1 (reserved)	10	n.c.
B+ (SIN +)	11	Red
A- (COS -)	12	Brown
B- (SIN -)	13	Black
A+ (COS +)	14	Green

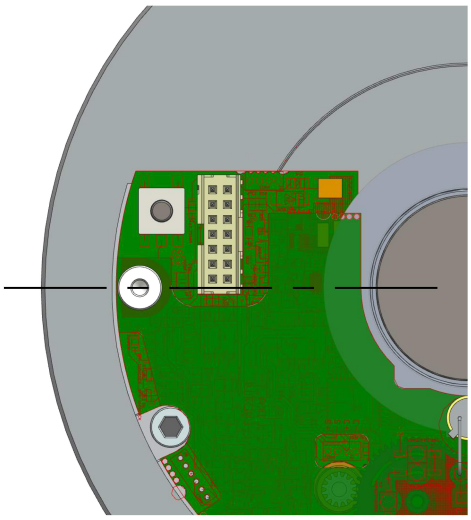
n.c. = not connected

1 See the order code for power supply voltage level
1 = +5Vdc ± 5%
2 = +8Vdc +32Vdc

EXAMPLE
AMM8Axx/xxxxx-SC**1**-... +Vdc = +5Vdc ± 5%
AMM8Axx/xxxxx-SC**2**-... +Vdc = +8Vdc +32Vdc

5.1 98414-G06-14LF 14-pin male connector





Mating connector: **SQW-107-01-F-D-VS**

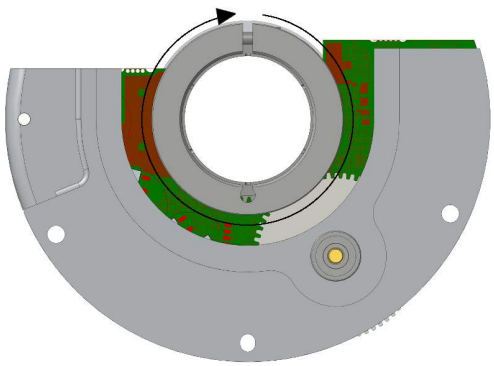
5.2 TF12 cable specifications

Model	: LIKA TF12 encoder cable
Cross section	: 6 x 2 twisted pairs (28 AWG)
Jacket	: special flame retardant PVC compound
Shield	: tinned copper braid, coverage > 80%
Outer diameter	: 5.4 mm ±0.1 mm (0.21" ±0.004")
Min. bending radius	: min. 54 mm (2.12")
Work temperature	: -15°C +80°C (+5°F +176°F)
Conductor resistance	: < 242.02 Ω/km

Used with EC-FCI-LK-TF12-0,5 cordset 0.5 m with 14-pin connector.

5.3 Counting direction input

The Counting direction input allows to set whether the position value output by the encoder increases when the encoder disk rotates clockwise (CW, see Figure on the right) or counter-clockwise (CCW). If the Counting direction input is connected to 0Vdc, the position value increases when the encoder disk rotates clockwise; on the contrary, if the Counting direction



input is connected to +Vdc, the position value increases when the encoder disk rotates counter-clockwise. CW and CCW rotations are viewed from flange side. If not used, connect the Counting direction input to 0Vdc (standard counting direction, see the Figure).

WARNING
In the BiSS C-mode interface the counting direction can be set also via software by setting the bit 6 **Counting direction** in the register 49 **Configuration**. The **Counting direction** parameter implies that the Counting direction input is set to 0Vdc (standard counting direction). Otherwise the resulting will be contrary to what is expected or intended.
When the counting direction is set to CW -**Counting direction** = 1 = CW-, if the Counting direction input has LOW logic level (0Vdc) the encoder will provide the increasing count (count up information) when the shaft is turning clockwise (and the decreasing count when the shaft is turning counter-clockwise); on the contrary, if the Counting direction input has HIGH logic level (+Vdc) the encoder will provide the increasing count when the shaft is turning counter-clockwise (and the decreasing count when the shaft is turning clockwise).
When the option CCW is set -**Counting direction** = 0 = CCW-, if the Counting direction input has LOW logic level (0Vdc) the encoder will provide the increasing count when the shaft is turning counter-clockwise (and the decreasing count when the shaft is turning clockwise); on the contrary, if the Counting direction input has HIGH logic level (+Vdc) the encoder will provide the increasing count when the shaft is turning clockwise (and the decreasing count when the shaft is turning counter-clockwise).

WARNING
After changing the counting direction you are required to set a new zero / Preset.

NOTE
The counting direction function affects the absolute position information, not the sine/cosine signal.

5.4 Zero setting / Preset input

The output position information at a point in the shaft rotation can be set either to 0 (SSI interface) or to a desired value called preset (BiSS C-mode interface; the preset value has to be set next to the **Preset** registers, see on page 60). The Zero setting/Preset input allows the operator to activate the zero setting/preset function by using an input signal sent by a PLC or other controller. To activate the zero setting/preset function, connect the Zero setting/Preset input to +Vdc for 100 µs at least, then disconnect +Vdc; normally voltage must be at 0Vdc. Zero setting/Preset must be set after Counting

direction. We suggest setting the zero setting/preset function when the encoder shaft is not running. If not used, connect the Zero setting/Preset input to 0Vdc.

WARNING
In the BiSS C-mode interface, the Zero setting/Preset input is active only when the **Enable preset** software function in the **Configuration** register is enabled (the bit 2 in the register 49 = 0, see on page 56); otherwise the hardware function is disabled.

NOTE
In the BiSS C-mode interface, the preset can be activated also by using the **Save and activate Preset** function of the **Command** register. For detailed information please refer to the **Command** register on page 55, the **Configuration** register on page 56 and the **Preset** registers on page 60.

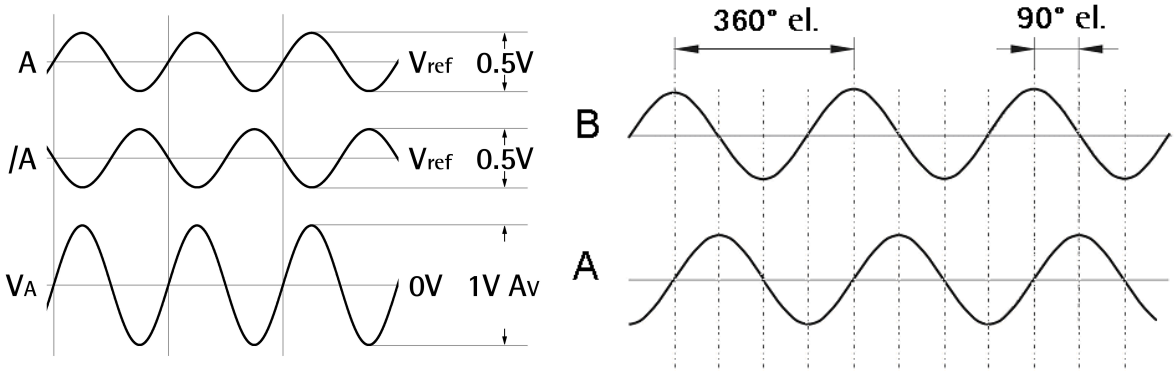
5.5 +5Vdc OUT

The encoder provides an auxiliary voltage output to separately supply the circuit or drive further electronics. It is over-current protected.
Output voltage: +5Vdc ±5%
Output current (max. load): max. 100 mA
It is not connected currently.

5.6 Input 1

This input is reserved for use by manufacturer.

5.7 Sine cosine signals



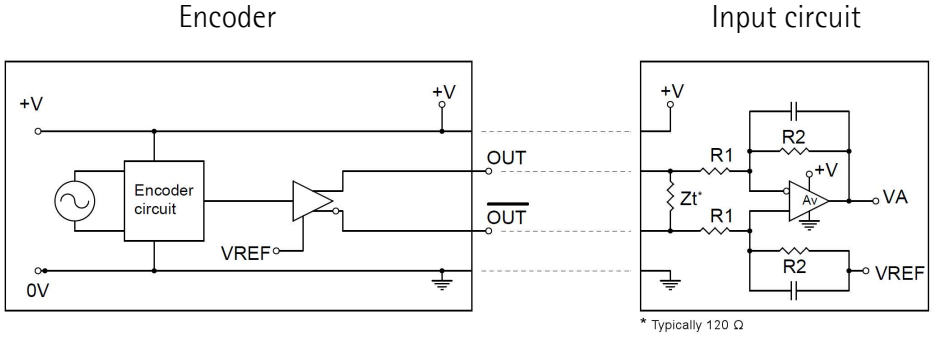
A (COSINE) and B (SINE) signals are to be intended with CW rotation as viewed from the flange side (see the Figure on page 25). They provide 1024 sinusoidal waves per each mechanical revolution with amplitude 1Vpp. 1Vpp output level

results from differential signals detection. The frequency of output signals is proportional to the rotational speed of the encoder (max. 80 kHz).

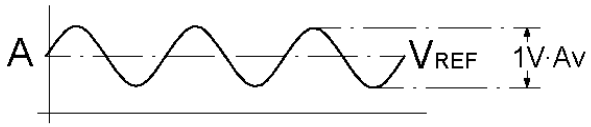
5.7.1 Output signals voltage level

The voltage level refers to the differential value between normal and inverted signal (differential).

Recommended input circuit

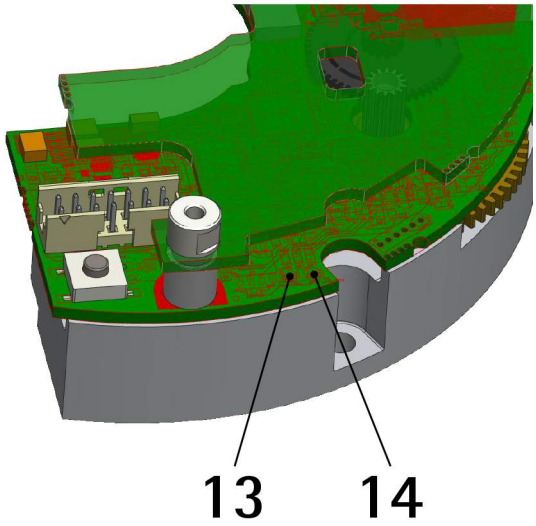


V_{REF} = 2.5V ± 0.5V V_A = 1Vpp * Av Av = R2/R1



5.8 LEDs

The encoder is equipped with two LEDs.
The **ERROR** LED **13** is used to signal an error condition during the encoder installation, see on page 29.
The **CALIBRATION** LED **14** is not used.
They are fully described hereafter.



5.8.1 ERROR LED

Depending on the encoder state, the **ERROR** LED **13** can be off or lit solidly or it can blink at any point while the disk is rotating.
The error condition is also signalled through the BiSS **Error** bit (page 51, active low) and the **Nonius error** bit (page 67, active high).

The ERROR LED is off

When the **ERROR** LED **13** is off, the encoder unit **5** and the code disk **3** are mounted properly and you can proceed with the synchronization procedure.

The ERROR LED is on solidly

If the **ERROR** LED **13** is on solidly and either the BiSS **Error** bit or the **Nonius error** bit or both are active (low and high respectively), the encoder unit **5** is not able to read the code disk **3** (maybe you turned on the power before mounting the encoder unit **5** on the disk?). The error cannot be reset. Please contact Lika Electronic After Sales Service.

The ERROR LED blinks at any point while the shaft is rotating

The **ERROR** LED **13** blinks at any point while the shaft is rotating and either the BiSS **Error** bit or the **Nonius error** bit or both are active (low and high respectively); the **ERROR** LED **13** blinks at the point where the encoder unit **5** is not able to read the code disk **3**:

- maybe the encoder unit **5** is not installed properly on the code disk **3**; loosen the fixing screws **7** and repeat the mechanical operations;
- or the code disk **3** is dirty: clean the disk.

If the **ERROR** LED **13** does not go off and the BiSS **Error** bit and the **Nonius error** bit do not go high and low respectively, execute the synchronization procedure (see the "4.3 Mounting the encoder and executing the synchronization procedure" section on page 18).

5.8.2 CALIBRATION LED

This LED is not used currently.

6 - Calibration and synchronization procedure

NOTE
Please refer to the "3 - Get started" section on page 15 before proceeding with this section.

6.1 Brief information on the software tool

To proper install the encoder and achieve its correct operation, a software is expressly developed and released by Lika Electronic. It allows the operator to set up and calibrate the AMM8A modular encoder during installation. The program is supplied for free and can be installed in any PC fitted with a Windows operating system (Windows XP or later). The connection between the encoder and the PC is established by using the devices of a kit (AC-DC power supply A + USB cable B + IF90-SC interface C, order code IF90-SC) expressly supplied by Lika Electronic. The EXC-D15M-S71-A16-1,0-FCI-S71 cable D must be ordered separately.

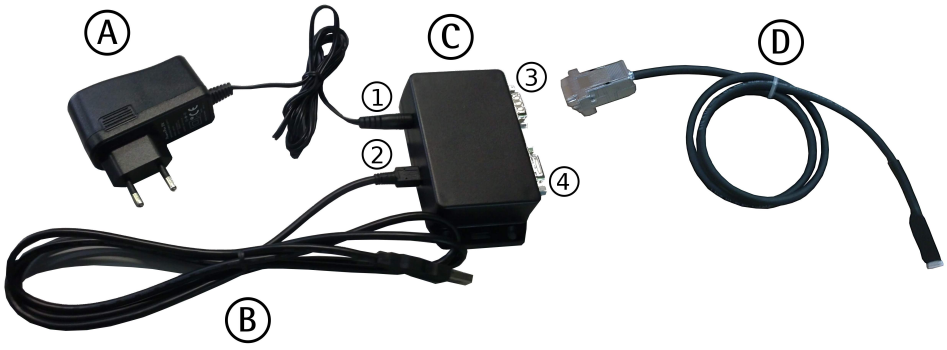
The name of the program executable file is:

- **IF90-SC_AMM8_BiSS**_vx.x.x.exe for **BiSS interface** encoders;
- **IF90-SC_AMM8_SSI**_vx.x.x.exe for **SSI interface** encoders.

Vx.x.x is the release version of the file. This is a portable application: it is designed to be installed simply by copying the executable file and the **File_data** folder to the desired location, thus no installation process is required. To launch it just double-click the file icon. To close the program press the **EXIT** button in the title bar.

WARNING
Use the release version of the IF90-SC program from v1.1 on.

6.2 IF90-SC interface



NOTE
Before starting the calibration and synchronization procedure, please make sure that the kit IF90-SC is ready to hand.
From the electrical point of view, the kit consists of the following devices:

A) AC-DC power supply, 24V
- Input Voltage AC min.: 100V
- Input Voltage AC max.: 240V
- Output Voltage nom.: 24V
- Output Connector: 2.5mm x 5.5mm female plug 

B) USB cable
- Standard-A USB plug to a PC Standard-A USB socket
- Mini-B USB plug to the IF90-SC interface USB socket 2

C) IF90-SC interface and power converter
- 1) Male power jack, 24V Input Voltage, for AC-DC power supply A
- 2) Mini-B USB socket for USB cable B
- 3) 9-pin female D-Sub connector – Not used, available for future use
- 4) 15-pin female D-Sub connector for EXC-D15M-S71-A16-1,0-FCI-S71 cable D

As previously stated, the EXC-D15M-S71-A16-1,0-FCI-S71 cable must be ordered separately.

D) EXC-D15M-S71-A16-1,0-FCI-S71 cable
- 15-pin male D-Sub connector to the IF90-SC interface D-Sub connector 4
- 14-pin SQW-107-01-F-D-VS connector to the modular encoder unit

Refer also to the "5 - Electrical connections" section on page 24.

WARNING
Please note that the IF90-SC interface further provides power conversion to power the encoder. When you choose the encoder model to connect to through the software tool (see on page 34) you automatically select also the voltage to be supplied to the encoder: if you select a wrong model and perhaps a wrong voltage, irreparable damage could be caused to the device.

6.3 Before launching the calibration and synchronization procedure

Before you start the calibration and synchronization procedure you must follow the steps below strictly:
- mount both the code disk and the encoder unit on the motor as explained in the "4.3 Mounting the encoder and executing the synchronization procedure" section on page 18;
- disconnect the EC-FCI-LK-TF12-0,5 cable from the 98414-G06-14LF 14-pin male connector of the modular encoder and connect the EXC-D15M-S71-A16-1,0-FCI-S71 cable D;

- connect the other end of the EXC-D15M-S71-A16-1,0-FCI-S71 cable D to the 15-pin D-Sub connector 4 of the IF90-SC interface C;
- connect the USB cable B to the Mini-B USB socket 2 of the IF90-SC interface C;
- connect the USB cable B to a Standard-A USB socket of your PC;
- connect the IF90-SC interface C to the power supply through the provided AC-DC power supply A;
- install the USB drivers as explained in the next "6.4 Installing the IF90-SC interface USB drivers" section on page 33;
- after drivers installation you can launch the executable file and open the encoder calibration interface; to know more refer to the "6.5 Encoder calibration and synchronization interface" section on page 34;
- start the motor running at an ideal speed of 60 ±10 rpm.

6.4 Installing the IF90-SC interface USB drivers

The first time you connect the IF90-SC interface to the PC through the supplied USB cable, you are requested to install the drivers of both the USB Serial Converter and the USB Serial Port of the interface.
Please follow the steps in the documents listed below to install the drivers. The drivers package and the relevant documents are found inside the USB_driver folder.
If you need to install the drivers under the **Microsoft Windows XP** operating system, please refer to the following document: Installation_Guide_for_WindowsXP.pdf.
If you need to install the drivers under the **Microsoft Windows Vista** operating system, please refer to the following document: Installation_Guide_for_VISTA.pdf.
If you need to install the drivers under the **Microsoft Windows 7** operating system, please refer to the following document: Installation_Guide_for_Windows7.pdf.
If you need to install the drivers under the **Microsoft Windows 8** operating system, please refer to the following document: Installation_Guide_for_Windows8.pdf.
If you need to install the drivers under the **Microsoft Windows 10** operating system, please refer to the following document: Installation_Guide_for_Windows10.pdf.

As a preliminary operation please follow the steps in the previous "6.3 Before launching the calibration and synchronization procedure" section on page 32.

A few seconds after connecting the USB cable to a USB socket of your PC, a message will appear in the notification area of the Windows taskbar and the USB Serial Converter drivers installation wizard will start. Then follow the instructions in the above mentioned pdf documents.

After installation you can launch the executable file and open the encoder calibration interface; to know more refer to the next section.

6.5 Encoder calibration and synchronization interface

To launch the program just double-click the IF90-SC_AMM8_xx_vx.x.x.exe executable file. The main page of the encoder calibration and synchronization interface will appear.
It consists of a single page where all features and diagnostic information are available.
Two main sections can be found in the page:

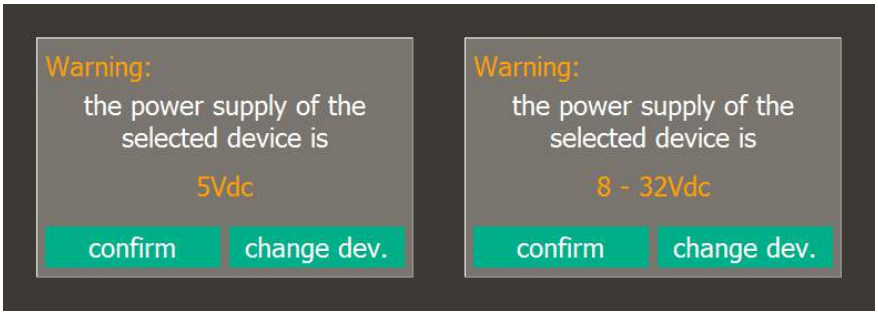
1. the section at the top of the page where the functions necessary for connection can be found;
2. the **Start procedure** section in the middle of the page where the functions necessary for the mechanical alignment, calibration and synchronization procedure can be found.

If you select the **Diagnostics** check box on the right side of the page, the window of the interface will enlarge: diagnostic information (data exchange) concerning the interface (not the encoder!) will be available in the column on the right. You can save the sequence of messages in the IF90_diagnostics.txt file (press the **SAVE FILE** button) or delete them (press the **CLEAR** button).

6.5.1 Establishing a connection to the IF90-SC interface

After opening the program, you must establish the connection between the IF90-SC interface and the encoder. You must select the interface unit model through the **Interface** drop-down menu first, then the encoder model through the **Encoder** drop-down menu, confirm the encoder choice and finally press the **CONNECT** buttons on the side of each item to establish the connection. Please note that you cannot try connecting to the encoder until the connection to the interface is missing, the relevant **CONNECT** button is disabled.

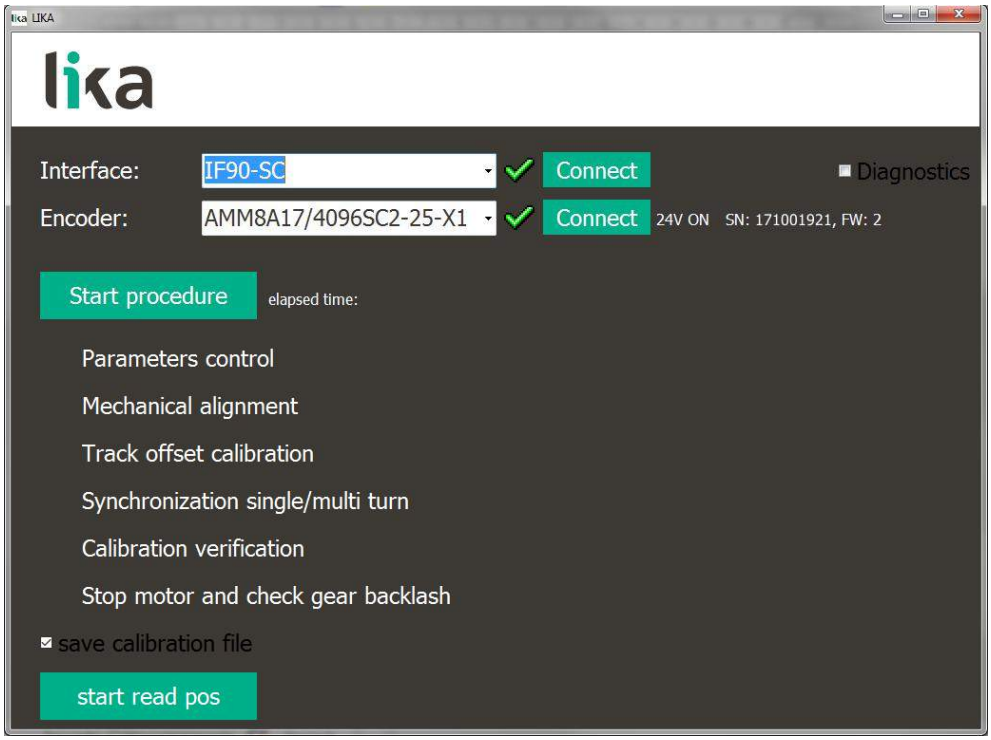
WARNING



Please note that, after choosing the encoder model, you will be required to confirm your choice by pressing the **CONFIRM** button in the pop-up window. The IF90-SC interface in fact also provides power conversion to power the encoder. When you choose the encoder model you automatically select also the voltage to be supplied to the encoder: if you select a wrong model and perhaps

a wrong voltage level, either the connection could not be established or irreparable damages could be caused to the device. If you select a wrong SSI output code (such as the Gray code -GG order code- instead of the Binary code -BG order code), an alarm message will be displayed during the **Calibration verification** phase (see on page 41).

If the connection is established properly, two green ticks (✔) appear next to both **Interface** and **Encoder** fields; additional information about the connected encoder also appears: the power supply voltage (24V ON in the Figure below), the serial number (SN: 171001921) and the version of the firmware (FW: 2). Furthermore the **START PROCEDURE** button becomes active.



If the program is not able to establish a connection to the IF90-SC interface, a red ✘ appears next to the **Interface** item and the **IF90 not connected** error message is invoked to appear (see on page 44). Press the **CONNECT** button to try establishing the connection again. If it is still not possible, please check that the IF90-SC interface is connected properly and the power is on. Make sure that the power supply voltage is correct. For any information please refer to the "6.3 Before launching the calibration and synchronization procedure" section on page 32.

6.5.2 Establishing a connection to the encoder

If the connection to the encoder is established properly, a green tick (✔) appears next to the **Encoder** field; also the **START PROCEDURE** button becomes active.

On the contrary, if the program is not able to establish a connection to the encoder, a red ✘ appears next to the **Encoder** item and the **Device not connected** error message is invoked to appear (see on page 44).
Should this happen, please check that the EXC-D15M-S71-A16-1,0-FCI-S71 cable is connected properly on both sides. Make sure that the IF90-SC interface is powered and the power supply voltage is correct. For any information please refer to the "6.3 Before launching the calibration and synchronization procedure" section on page 32.

6.5.3 Saving calibration data to a file

The system allows to save to a file the calibration data of each device which is being tested. To enable the data save select the **Save calibration file** check box at the bottom of the page.
At the end of the alignment, synchronisation and calibration procedure concerning each encoder which is being tested the **Save As** dialog box will appear on the screen: the operator will be requested to choose the directory where the file has to be saved and to either confirm or change the name of the file which is suggested as default: it consists of the device model and its own serial number (for instance: AMM8A_171001921.txt). The file is saved in a .txt format.

6.5.4 Checking the set parameters

NOTE
Please follow the encoder mounting instructions up to **Steps 5/6** before carrying on with the parameters control operation. Refer to the "4.3 Mounting the encoder and executing the synchronization procedure" section on page 18.

Press the **START PROCEDURE** button to start the check on the set parameters as well as the encoder's mechanical alignment, synchronisation and calibration operation. A blue arrow appears next to the **Parameters control** item. The button changes the text of the label into **STOP PROCEDURE**. The duration of the process, expressed in minutes and seconds, will be indicated on the right (**Elapsed time**).

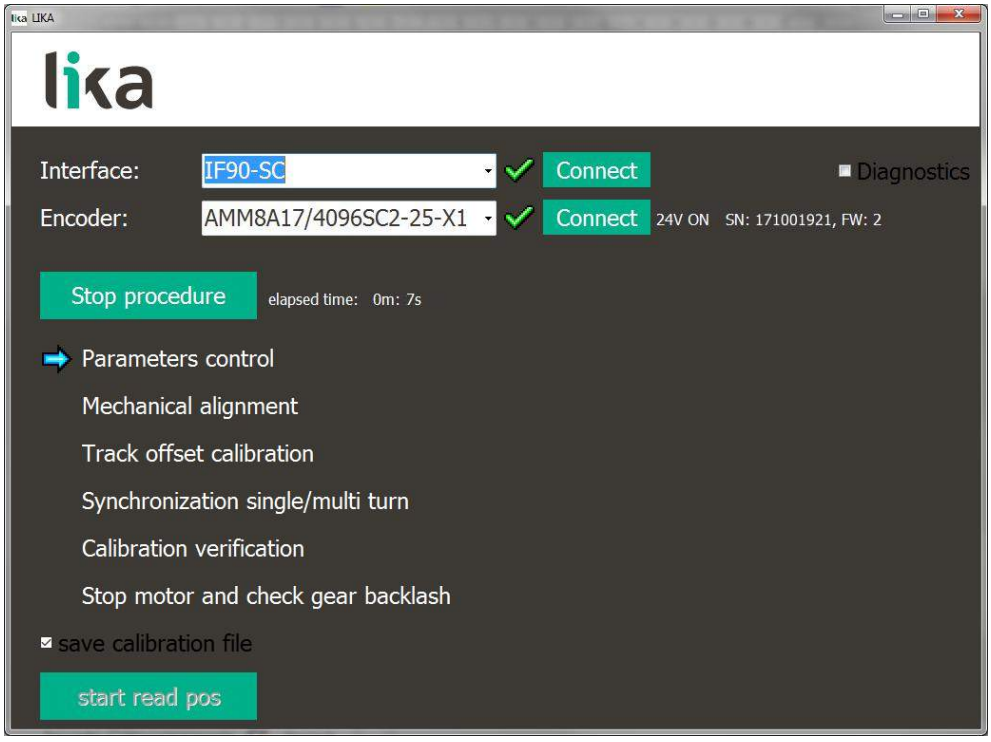
WARNING

If you press the **STOP PROCEDURE** button at whatever point in the phases described in this section, you will abort the whole calibration and synchronisation process of the device. When you press the **START PROCEDURE** button again, the process will begin from the first step, that is from the check on the set parameters of the encoder.

During this short first step the system checks the main parameters of the encoder; then, if the operation succeeds, it enters automatically the second step: the encoder mechanical alignment operation.

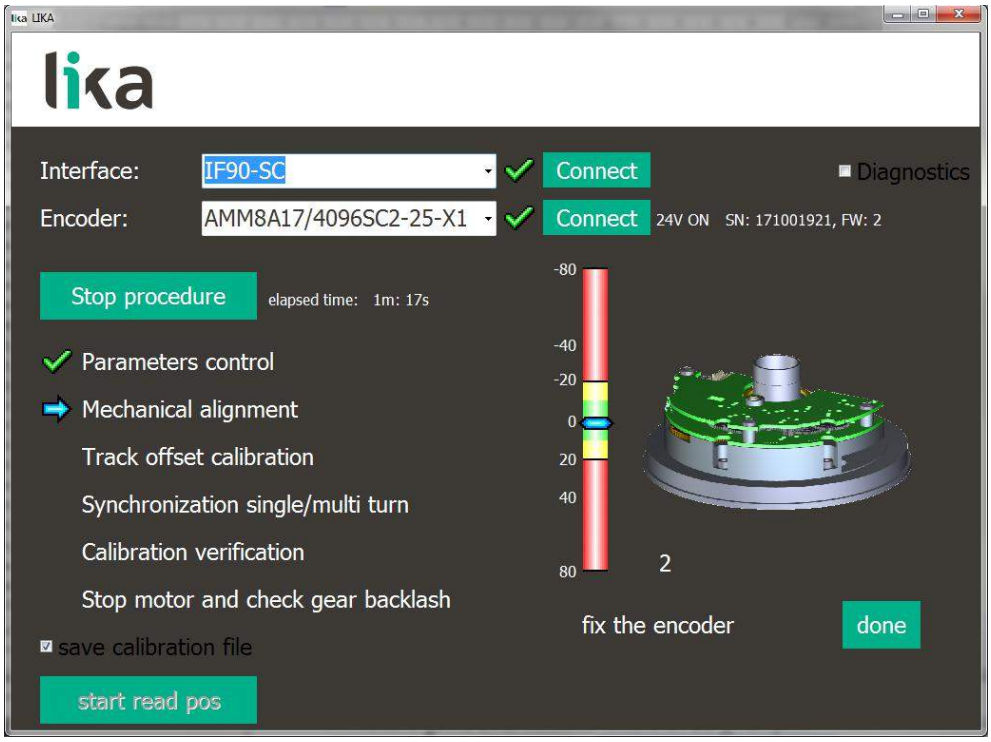
If everything is ok, a green tick (✔) will appear next to the **Parameters control** item and the program will start the next step automatically.

On the contrary, if an error occurs during the check operation, a red ✘ will appear next to the **Parameters control** item. The encoder must be sent back to Lika Electronic for some checks.



6.5.5 Aligning the encoder

As soon as the parameters control operation is carried out positively, the program enters automatically the encoder mechanical alignment operation. A blue arrow appears next to the **Mechanical alignment** item. A graphical picture of the encoder and all the tools useful to the operator for executing the mechanical alignment of the device will appear on the right of the page.



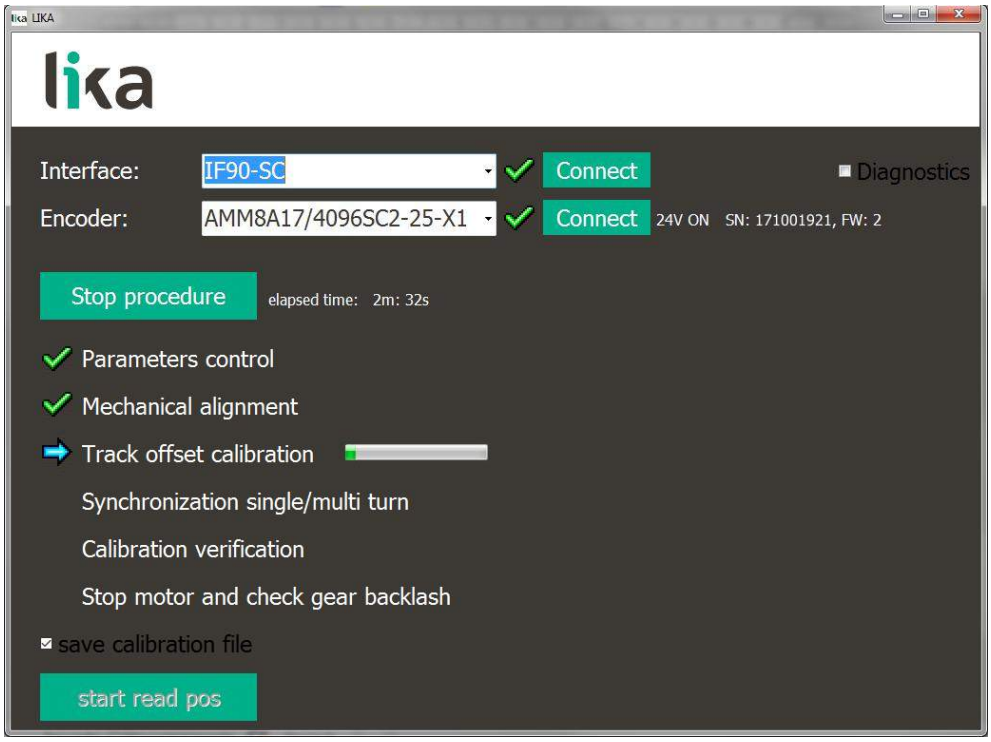
If the encoder is not aligned properly over the code disk, the position reference indicator in the vertical bar with numeric scale will be placed in the upper or lower red sections; furthermore a double headed yellow arrow will appear on the encoder picture. The deviation from the ideal position will be shown under the picture.
Mechanically adjust the position of the encoder unit until it is well aligned over the code disk (**Step 7** of the mounting instructions); the position reference indicator in the vertical bar must be well centred in the middle green section (0 position). The **Fix the encoder** message will appear under the encoder picture.
Tighten the three bolts down to firmly fix the encoder unit, torque to 1.3 Nm max. Hold the encoder unit down and avoid any movements while tightening. When the encoder unit is fixed press the **DONE** button to complete the mechanical alignment operation (**Step 8** of the mounting instructions).

If everything is ok, a green tick (✔) will appear next to the **Mechanical alignment** item and the program will start the next step automatically.

On the contrary, if an error occurs during the mechanical alignment operation, a red ✘ will appear next to the **Mechanical alignment** item. You will need to repeat the operation and check, for instance, if the disk is dirty.

6.5.6 Calibrating the track offset

As soon as the encoder mechanical alignment operation is carried out positively, the program starts the track offset calibration procedure automatically. A blue arrow appears next to the **Track offset calibration** item while a green progress bar visualizes the progression of the calibration operation.

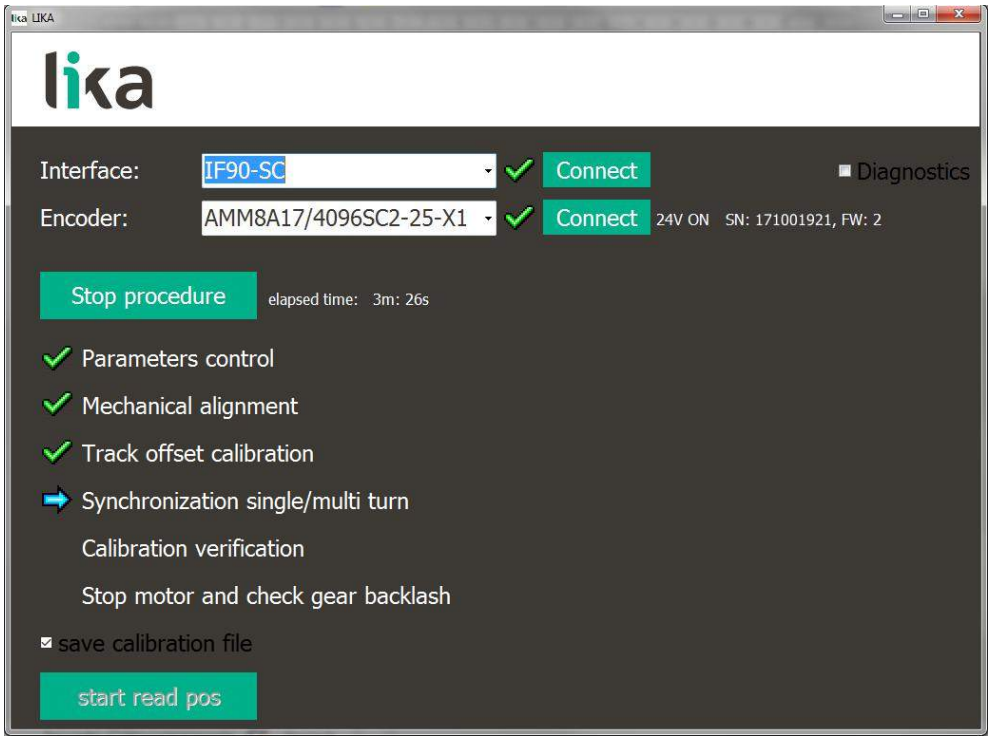


As soon as the calibration procedure is carried out positively, a green tick (✔) will appear next to the **Track offset calibration** item and the program will start the next step automatically.

On the contrary, if an error occurs during the calibration procedure, after about ten attempts, a red ✘ will appear next to the **Track offset calibration** item. It may be necessary to clean the disk and perform a new mechanical alignment operation.

6.5.7 Synchronizing singleturn and multiturn positions

As soon as the track offset calibration procedure is carried out positively, the synchronization between the singleturn and the multiturn positions is required. This operation starts automatically on positive completion of the track offset calibration procedure. A blue arrow appears next to the **Synchronization single/multi turn** item.

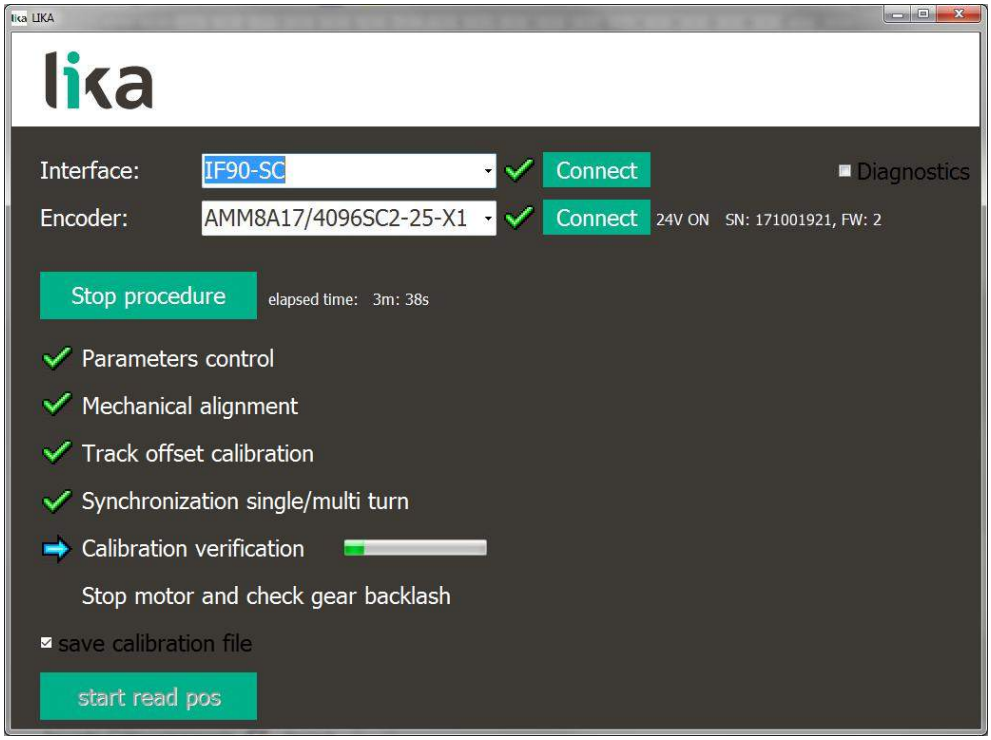


As soon as the singleturn/multiturn synchronization procedure is carried out positively, a green tick (✔) will appear next to the **Synchronization single/multi turn** item and the program will start the next step automatically.

On the contrary, if an error occurs during the synchronization procedure, a red ✘ will appear next to the **Synchronization single/multi turn** item. It may be necessary to clean the disk and perform a new calibration procedure.

6.5.8 Verification of calibration

As soon as the singleturn / multiturn synchronisation procedure is carried out positively, the verification of the calibration is required. This operation starts automatically on positive completion of the singleturn / multiturn synchronisation procedure. A blue arrow appears next to the **Calibration verification** item while a green progress bar visualizes the progression of the check operation.



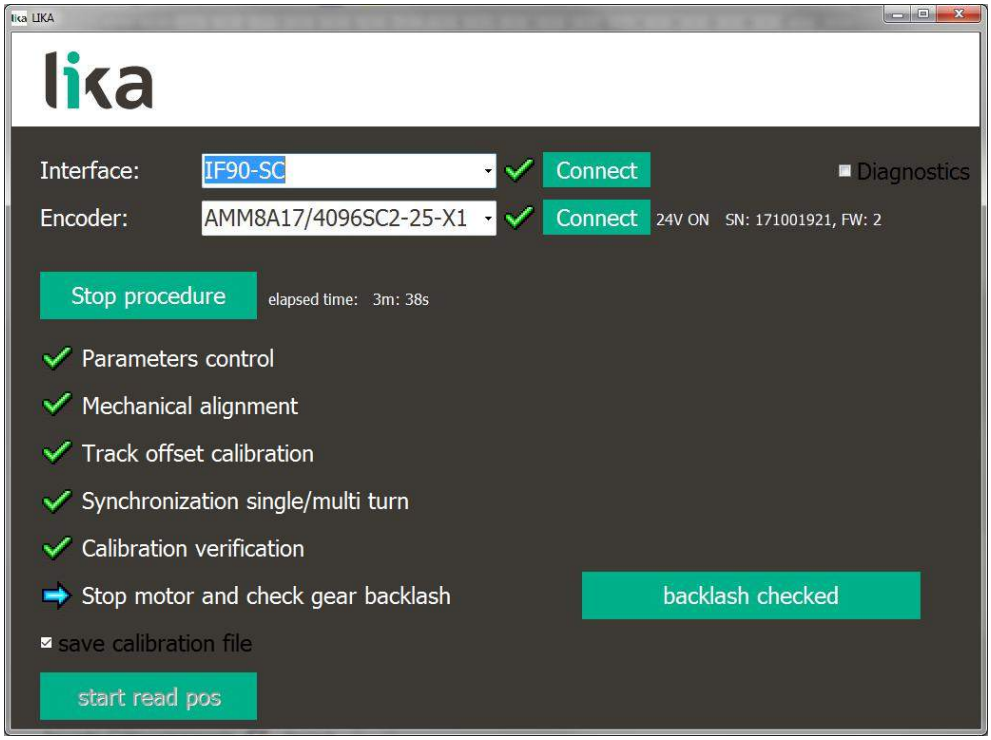
As soon as the procedure meant to check the calibration operation is carried out positively, a green tick (✔) will appear next to the **Calibration verification** item; this is the last step in the software control of the correct installation and calibration of the AMM8A encoder. Now the operator must stop the motor.

On the contrary, if an error occurs during the verification of calibration procedure, a red ✘ will appear next to the **Calibration verification** item. It may be necessary to clean the disk and perform a new calibration procedure.

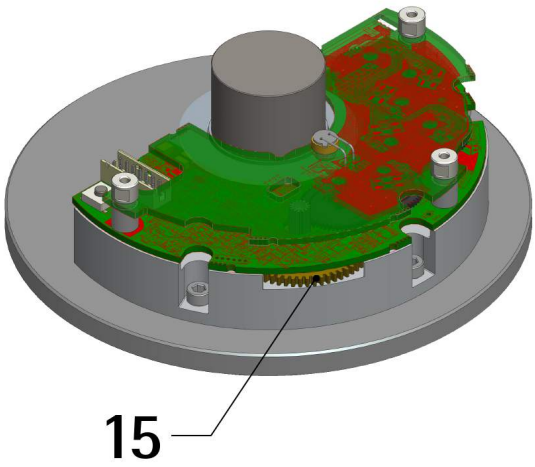
6.5.9 Checking the gear backlash

WARNING
Stop the motor before executing this operation.

As soon as the verification of the calibration procedure is carried out positively, the software control of the correct installation and calibration of the AMM8A encoder is completed. The operator is now required to execute a final manual check: he must verify that there is an optimum play in the movement of the gears.



To check that the gears turn correctly and there is a proper play in their movement, the operator must stop the motor and turn the gear **15** manually. He must rely on his own sensitivity and experience: the movement must be steady and smooth, without any irregularities and jams.



If the verification is positive, press the **BACKLASH CHECKED** button and a green tick (✔) will appear next to the **Stop motor and check gear backlash** item. The **STOP PROCEDURE** button will change the text of its label into **START PROCEDURE** while the **START READ POS** button will become active.
Furthermore, if the operator requested to save calibration data to a file by selecting the **SAVE CALIBRATION FILE** check box (see the "6.5.3 Saving calibration data to a file" section on page 36), the **Save As** dialog box will appear on the screen and the operator will have to confirm the operation.

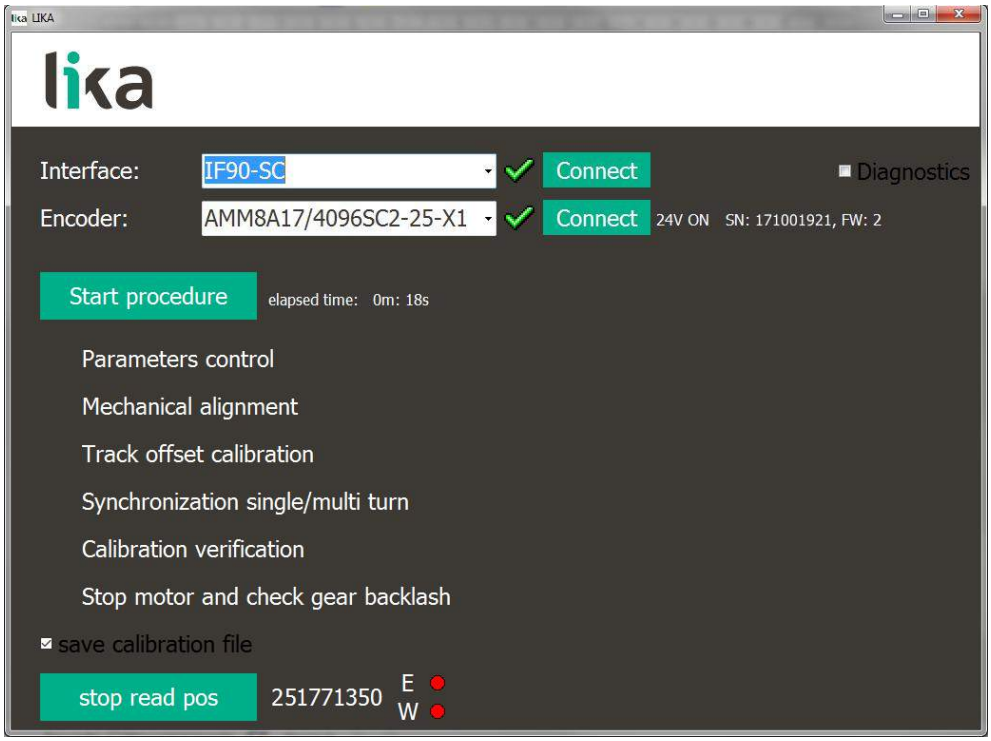
This is the last operation that is necessary for the mechanical alignment, calibration and synchronisation of the encoder, the procedure is carried out now and the encoder is ready for operation.

On the contrary, if the movement of the gears is not steady and smooth and you detect irregularities and jams, the procedure cannot be finished positively. You must abort the process and press the **STOP PROCEDURE** button. By pressing the **STOP PROCEDURE** button you stop the whole calibration and synchronisation operation and abort the process. It will be necessary to restart it from the first step, that is from the mechanical alignment of the encoder.

WARNING
If the movement of the gears is not steady and smooth and you detect irregularities and jams, do not press the **BACKLASH CHECKED** button, but execute again the whole operation for the mechanical alignment, calibration and synchronisation of the encoder. Mechanical troubles cause the gears to wear out rapidly and to produce dusty waste which dirts the disk; in other words they fatally compromise the proper operation of the encoder.

6.5.10 Reading the position of the encoder

As soon as you press the **START READ POS** button, the current position of the encoder will be displayed in the field on the right. Also the state of the two bits Error (see **E** label, refer to the **Error** bit on page 51) and Warning (see the **W** label, refer to the **Warning** bit on page 52) of the BiSS data protocol SCD (Single Cycle Data).
When the logic state of the bits is low (="0"), an error or a warning is active in the system and the relevant field is coloured red.
On the contrary, when the logic state of the bits is high (="1"), no error or warning is active in the system and the relevant field is coloured white.



6.6 Information, warning and error messages

(in alphabetical order)

Amplitude signals error. Run a new calibration?

The operator has pressed the **START PROCEDURE** button in order to perform the encoder calibration procedure. A fault has occurred while completing the encoder mechanical alignment operation. This message is intended to ask the operator to confirm a new calibration procedure to start. If he presses the **YES** button a new calibration procedure will start again: the operator may be required to accomplish the encoder mechanical alignment operation once again. This further calibration procedure lasts about 5 minutes. On the contrary, if he presses the **NO** button the new calibration procedure is aborted and the encoder is not ready for operation.

Calibration mode is not active

The operator has pressed the **CONNECT** button in order to establish the connection to the encoder but a fault has occurred: the encoder is connected yet incorrectly. Please check that the EXC-D15M-S71-A16-1,0-FCI-S71 cable is connected properly on both sides. Make sure that the IF90-SC interface is powered and the power supply voltage is correct. For any information please refer to the "6.3 Before launching the calibration and synchronization procedure" section on page 32.

Calibration OK

As soon as the calibration procedure is carried out positively, a green tick (✔) appears next to the **Check calibration** item and the **Calibration OK** message is displayed. At the end of the positive procedure, the encoder is ready for the synchronization operation. For further information refer to the "6.5.6 Calibrating the track offset" section on page 39.

Current calibration is not adequate (code ...). Run a new calibration?

The operator has pressed the **START PROCEDURE** button in order to perform the encoder calibration procedure. A fault has occurred while completing the calibration procedure. This message is intended to ask the operator to confirm a new calibration procedure to start. If he presses the **YES** button a new calibration procedure will start again: the operator may be required to accomplish the encoder mechanical alignment operation once again. This further calibration procedure lasts about 5 minutes. On the contrary, if he presses the **NO** button the new calibration procedure is aborted and the encoder is not ready for operation.

Device connected

The operator has pressed the **CONNECT** button in order to establish the connection to the encoder, the operation has been carried out properly.

Device not connected

The operator has pressed the **CONNECT** button in order to establish the connection to the encoder but a fault has occurred: the program is not able to establish a connection to the encoder. Please check that the EXC-D15M-S71-A16-1,0-FCI-S71 cable is connected properly on both sides. Make sure that the IF90-SC interface is powered and the power supply voltage is correct. For any information please refer to the "6.3 Before launching the calibration and synchronization procedure" section on page 32.

Fix the encoder

During the encoder mechanical alignment operation, the operator must adjust the position of the encoder unit over the code disk. As soon as the encoder unit is well aligned over the code disk and the reference in the vertical bar of the **Check encoder** section is well centred in the middle green section, this **Fix the encoder** message appears under the encoder picture. Now the operator is required to tighten the three bolts down to firmly fix the encoder unit. He must always hold the encoder unit down and avoid any movements while tightening. Finally he must press the **DONE** button to complete the mechanical alignment operation. For any information please refer to the "6.5.5 Aligning the encoder" section on page 38.

IF90 not connected

The operator has pressed the **CONNECT** button in order to establish the connection to the encoder but a fault has occurred: the program is not able to establish a connection to the IF90-SC interface. Please check that the EXC-D15M-S71-A16-1,0-FCI-S71 cable is connected properly on both sides. Make sure that the IF90-SC interface is powered and the power supply voltage is correct. For any information please refer to the "6.3 Before launching the calibration and synchronization procedure" section on page 32.

Synchronization OK

As soon as the synchronization procedure is carried out positively, a green tick (✔) appears next to the **Synchronization single/multi turn** item and the **Synchronization OK** message is displayed. At the end of the positive procedure, the encoder is ready for operation. For further information refer to the "6.5.7 Synchronizing singleturn and multiturn positions" section on page 40.

Zero setting OK

As soon as the zero setting operation is carried out positively, a green tick (✔) appears next to the **MAKE ZERO SETTING** item and the **Zero setting OK** message is displayed.

7 - SSI interface

Order codes: **AMM8Axx/xxxxxBGx-...**
AMM8Axx/xxxxxGGx-...

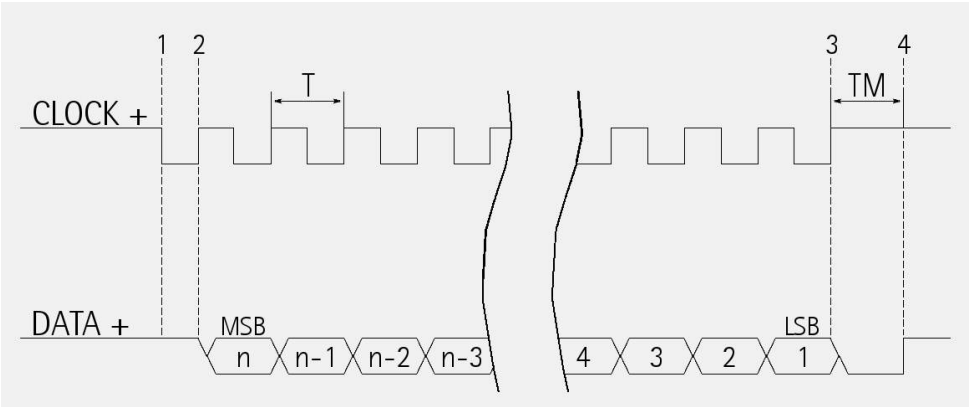
7.1 SSI (Synchronous Serial Interface)

SSI (the acronym for **Synchronous Serial Interface**) is a synchronous point-to-point serial interface engineered for unidirectional data transmission between one Master and one Slave. Developed in the first eighties, it is based on the RS-422 serial standard. Its most peculiar feature is that data transmission is achieved by synchronizing both the Master and the Slave devices to a common clock signal generated by the controller; in this way the output information is clocked out at each controller's request. Furthermore only two pairs of twisted wires are used for data and clock signals, thus a six-wire cable is required.
The main advantages in comparison with parallel or asynchronous data transmissions are:

- less conductors are required for transmission;
- less electronic components;
- possibility of insulting the circuits galvanically by means of optocouplers;
- high data transmission frequency;
- hardware interface independent from the resolution of the absolute encoder.

Furthermore the differential transmission increases the noise immunity and decreases the noise emissions. It allows multiplexing from several encoders, thus process controls are more reliable with simplified line design and easier data management.

Data transmission is carried out as follows.
At the first falling edge of the clock signal (**1**, the logic level changes from high to low) the absolute position value is stored while at the following rising edge (**2**) the transmission of data information begins starting from the MSB.



At each change of the clock signal and at each subsequent rising edge (**2**) one bit is clocked out at a time, up to LSB, so completing the data word transmission. The cycle ends at the last rising edge of the clock signal (**3**). This means that up to n + 1 rising edges of the clock signals are required for each data word transmission (where n is the bit resolution); for instance, a 13-bit encoder needs 14 clock edges. If the number of clocks is greater than the number of bits of the data word, then the system will send a zero (low logic level signal) at each additional clock, zeros will either lead (LSB ALIGNED protocol) or follow (MSB ALIGNED protocol) or lead and/or follow (TREE FORMAT protocol) the data word. After the period Tm monoflop time, having a typical duration of 12 µsec, calculated from the end of the clock signal transmission, the encoder is then ready for the next transmission and therefore the data signal is switched high.
The clock signal has a typical logic level of 5V, the same as the output signal which has customarily a logic level of 5V in compliance with RS-422 standard.
The output code can be either Binary or Gray (see the order code).

7.2 "MSB left aligned" protocol

"MSB left aligned" protocol allows to left align the bits, beginning from MSB (most significant bit) to LSB (least significant bit); MSB is then sent at the first clock cycle. If the number of clock signals is higher than the data bits, then unused bits are forced to logic level low (0) and follow the data word. This protocol can be used in encoders having any resolution.
The number of clocks to be sent to the encoder must equal the number of data bits at least, anyway it can be higher, as stated previously. The great advantage of this protocol over the TREE format or the LSB RIGHT ALIGNED format is that data can be transmitted with a minimum time loss and Tm monoflop time can immediately follow the data bits without any additional clock signal.
The length of the word is variable according to the resolution, as shown in the following table.

Model	Length of the word	Max. number of information
AMM8A17/4096...	29 bits	536,870,912
AMM8A21/4096...	33 bits	8,589,934,592

The output code can be GRAY or BINARY (see the order code).

Structure of the position information

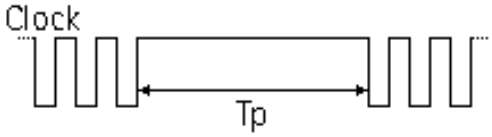
AMM8A17/4096...	**bit**	**28**	**...**	**0**
AMM8A21/4096...	**bit**	**32**	**...**	**0**
	value	MSB	...	LSB

7.3 Recommended transmission rates

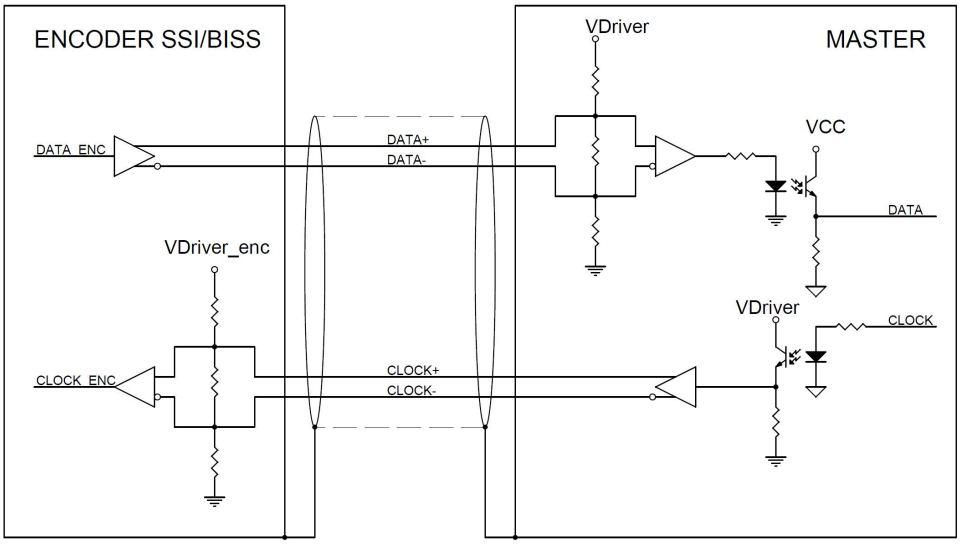
The SSI interface has a frequency of data transmission ranging between 100 kHz and 2 MHz.
The CLOCK signal and the DATA signal comply with the "EIA standard RS-422".
The SSI clock frequency (baud rate) depends on the length of the cable and must comply with the technical information reported in the following table:

Cable length	Baud rate
< 50 m	< 400 kHz
< 100 m	< 300 kHz
< 200 m	< 200 kHz
< 400 m	< 100 kHz

The time interval between two Clock sequence transmissions must be at least 12 µs (Tp > 12 µs).



7.4 Recommended SSI input circuit



8 - BiSS C-mode interface

Order code: AMM8Axx/xxxxxSC1-...
AMM8Axx/xxxxxSC2-...

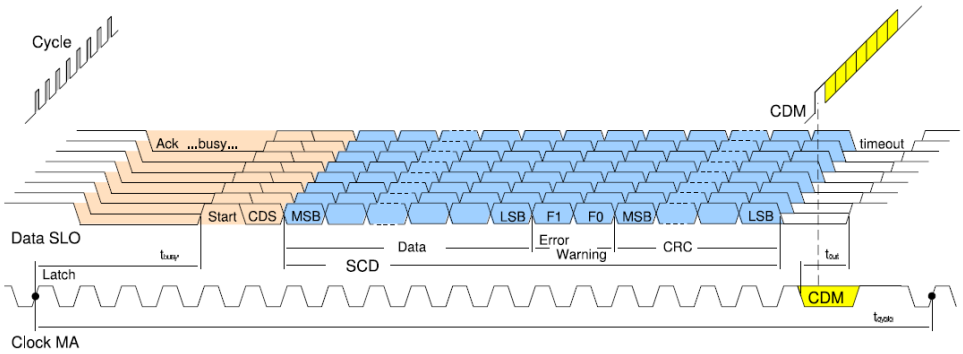
Lika encoders are always Slave devices and comply with the "BiSS C-mode interface" and the "Standard encoder profile".
Refer to the official BiSS website for all information not listed in this manual (www.biss-interface.com).
The device is designed to work in a point-to-point configuration and must be installed in a "single Master, single Slave" network.
The clock MA and Data SLO signal levels are according to the "EIA standard RS-422".

WARNING
Never install the encoder in a "single Master, multi Slave" network.

8.1 Communication

The BiSS C-mode protocol uses two types of data transmission protocols:

- **Single Cycle Data (SCD):** it is the main data transmission protocol. It is used to send process data from the Slave to the Master. For any information refer to the "8.2 Single Cycle Data SCD" section on page 51.
- **Control Data (CD):** transmission of a single bit following the SCD data. It is used to read or write data into the registers of the Slave. For any information refer to the "8.3 Control Data CD" section on page 52.



8.2 Single Cycle Data SCD

8.2.1 SCD structure

SCD data has a variable length according to the resolution of the encoder. It is nbitres+7 long where "nbitres" is the resolution of the encoder expressed in bits. It consists of the following elements: position or speed or acceleration value (**Position / Speed / Acceleration**) according to the **Data type** setting in the **Configuration** register, 1 error bit nE (**Error**), 1 warning bit nW (**Warning**) and a 6-bit CRC Cyclic Redundancy Check (**CRC**).

bit	nbitres+7 ... 8	7	6	5 ... 0
function	Position Speed Acceleration	Error	Warning	CRC

Position
Speed
Acceleration
It is the process data transmitted from the Slave to the Master. It has a variable length, it is as long as the resolution of the encoder expressed in bits.
It provides information about either the current position or the current speed or the current acceleration of the encoder according to the **Data type** setting (bits 0 and 1) in the **Configuration** register: 00 = position information (default value); 10 = speed information; 01 = acceleration information.
The transmission starts with msb (most significant bit) and ends with lsb (least significant bit). "Nbitres" is the resolution of the encoder expressed in bits.

bit	nbitres+7	...	...	8
value	msb	...	...	lsb

The bits that are not used (in case of speed and acceleration values) head the process data and are set to 0.

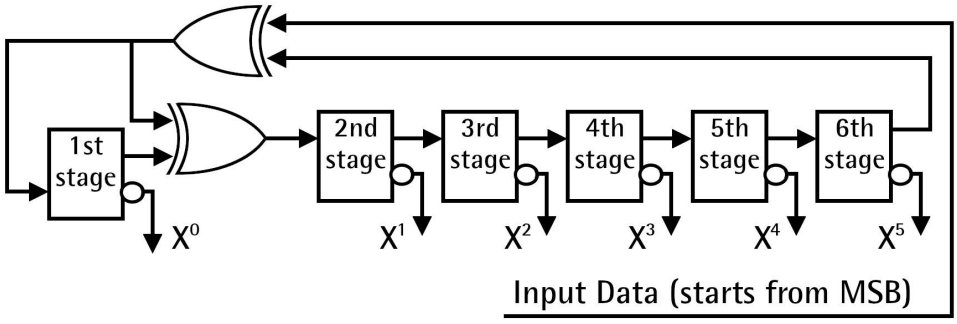
For complete information refer to page 57.

Error
(1 bit)
It is intended to communicate the normal or fault status of the Slave.
When nE = "0", an error is active in the system. For a comprehensive list of the available error messages and their meaning please refer to the registers 74 **Encoder warnings and errors** and 76-77 **Sensor errors** on page 65 ff.
nE = "1": no active error
= "0": error status: an error is active in the system.

Warning
(1 bit)
It is intended to communicate the normal or fault status of the Slave.
When nW = "0", a warning is active in the system. For a comprehensive list of the available warning messages and their meaning please refer to the registers 74 **Encoder warnings and errors** and 75 **Sensor warnings** on page 65 ff.
nW = "1": no active warning
= "0": warning status: a warning is active in the system.

CRC
Correct transmission control (inverted output). Cyclic Redundancy Check is an error checking which is the result of a "Redundancy Check" calculation performed on the message contents. This is intended to check whether transmission has been performed properly. It is 6-bit long.
Polynomial: X^6+X^1+1 (binary: 1000011)

Logic circuit



8.3 Control Data CD

Main control data is described in this section. Please refer to the official BiSS documents for complete CD structure: "BiSS C Protocol Description" in the BiSS homepage.

Register address
It sets the number of the register you need either to read or to write. It is 7-bit long.

RW
RW = "01": when you need to write in the register.
RW = "10": when you need to read in the register.
It is 2-bit long.

DATA

When you need to write in a register (**RW** = "01"), it allows to enter the value to be written in the register (transmitted from the Master to the Slave).
When you need to read in a register (**RW** = "10"), it shows the value read in the register (transmitted from the Slave to the Master).
It is 8-bit long.

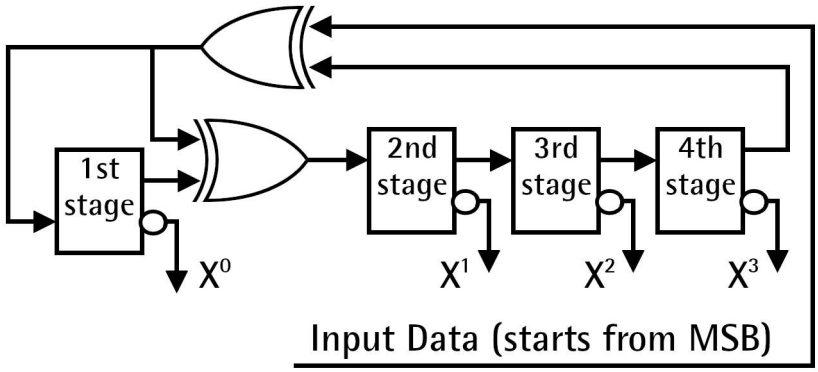
Data bit structure:

bit	7	...	...	0
	msb	...	...	lsb

CRC

Correct transmission control (inverted output). Cyclic Redundancy Check is an error checking which is the result of a "Redundancy Check" calculation performed on the message contents. This is intended to check whether transmission has been performed properly. It is 4-bit long.
Polynomial: X^4+X^1+1 (binary: 10011)

Logic circuit:



8.4 Implemented registers

Register (hex)	Function	Access type
42 - 43	Profile ID	ro
44 ... 47	Serial number	ro
48	Command	wo
49	Configuration	rw
4A	reserved	-
4B ... 4D	Information per revolution	ro
4E - 4F	Number of revolutions	ro
50 ... 54	Preset	rw
55	Device type	ro

56	N° of bits used for singleturn resolution	ro
57	N° of bits used for multiturn resolution	ro
58	Resolution of sine-cosine signals	ro
59 ... 5C	Work cycles counter	ro
5D ... 5F	Work cycles warning limit	rw
60 ... 62	Acceleration	ro
63 ... 65	Acceleration peak warning limit	rw
66-67	Speed	ro
68-69	Speed peak warning limit	rw
6A ... 72	not used	-
73	reserved	-
74	Encoder warnings and errors	ro
75	Sensor warnings	ro
76-77	Sensor errors	ro
78 ... 7D	Device ID	ro
7E - 7F	Manufacturer ID	ro

All registers described in this section are listed as follows:

Function name
[Address, Attribute]
Description of the function and specification of the default value.

- Address: the register address is expressed in hexadecimal notation.
- Attribute: ro = read only
  rw = read and write
  wo = write only
- Default parameter value is written in **bold**.

Profile ID

[42 - 43, ro]
These registers contain the identification code of the used profile.

Register	42	43
AMM8A	00	00

See "Standard encoder profile", "data format", "Variant 0-24".

Serial number

[44 ... 47, ro]

These registers contain the serial number of the device expressed in hexadecimal notation.
Register 44: year of production.
Register 45: week of production.
Registers 46 and 47: serial number in ascending order.

Serial number registers structure:

Register	44	45	46	47
	YoP	WoP	Serial number	
	MSB	...	...	LSB
	2^{31} ... 2^{24}	2^{23} ... 2^{16}	2^{15} ... 2^{8}	2^{7} ... 2^{0}

Command

[48, wo]

Value	Function
00	**Normal operational state**
01	**Save parameters on EEPROM**
02	**Save and activate Preset**
04	**Load and save default parameters**
08	**Reset all warnings / errors**

Normal operational state

It indicates the normal operational state. After sending any command, the register is set back to "00" (**Normal operational state**) automatically.

Save parameters on EEPROM

After having set a new value in the registers, use the **Save parameters on EEPROM** function in this register to store it. Set "01" in the **Command** register.
Wait min. 30 ms (EEPROM writing time) before using a new function.

Save and activate Preset

After having set a new Preset value, use the **Save and activate Preset** function in this register to both store the value and activate the preset at the same time. Set "02" in the **Command** register.
Wait min. 30 ms (EEPROM writing time) before using a new function.

Load and save default parameters

Default parameters are set at the factory by Lika Electronic engineers to allow the operator to run the device for standard operation in a safe mode. As soon as the command is sent, the default parameters are uploaded and activated. All parameters which have been set previously are overwritten, thus previously set values are lost. The complete list of machine data and the relevant default parameters preset by Lika Electronic engineers are available on page 70. Set "04" in the **Command** register.

WARNING

As soon as the **Load and save default parameters** command is sent, all parameters which have been set previously are overwritten, thus previously set values are lost!

Reset all warnings / errors

It resets the specified counters and all the active warning and error messages. Set "08" in the **Command** register.

Please note that, after resetting the warning or error message, if the problem that caused the message to be triggered has not been solved, the warning or error message will be invoked to appear again.

For the complete list of the available encoder error and warning messages, please refer to the **Encoder warnings and errors** register on page 65.

For the complete list of the available sensor warning messages, please refer to the **Sensor warnings** register on page 67.

For the complete list of the available sensor error messages, please refer to the **Sensor errors** registers on page 68.

Default = 00

Configuration

[49, rw]

Any new setting in the **Configuration** register will be active immediately after transmission. Use the **Save parameters on EEPROM** function to store the new value permanently (set "01" in the register 48 **Command**).

Default = 60h = 0110 0000_2

Bit	Function	bit = 0	bit = 1
0 lsb 1	**Data type**	**00 = Position information** 10 = Speed information 01 = Acceleration information	
2	**Enable preset**	**Enable**	Disable
3	Not used	-	
4	Not used	-	
5	**Output code**	Gray	**Binary**
6	**Counting direction**	CCW rotation	**CW rotation**
7 msb	Not used	-	

Data type

It sets the type of data that is provided to output through SCD data frame (see on page 51). It can be either the encoder current position information (00) or the current speed information (10) or the current acceleration information (01).

Bit 0	Bit 1	
0	**0**	**= encoder current position information (default value)**
1	0	= current speed information
0	1	= current acceleration information

Position information

If **Data type** is set to ="00" the encoder current position information will be provided to output through SCD.

Speed information

If **Data type** is set to ="10" the current speed information will be provided to output through SCD. The speed value is expressed in RPM.
For complete information on the speed value please refer to the **Speed** registers on page 64.

Acceleration information

If **Data type** is set to ="01" the current acceleration / deceleration information will be provided to output through SCD. The acceleration / deceleration value is expressed in RPM per second.
For complete information on the acceleration / deceleration value please refer to the **Acceleration** registers on page 63.

Default = 00 (encoder current position information)

Enable preset

It enables / disables the preset function. When you need to enter a new preset value, you have to enable the preset function first. To do this set the bit 2 **Enable preset** in this register to ="0", then enter the wished preset value next to the **Preset** registers and finally send the **Save and activate Preset** command (set "02" in the register 48 **Command**) to confirm the changes and activate the preset.
For detailed information refer to the **Preset** registers on page 60.
Default = 0 (Enable)

NOTE
You can activate the preset also by means of a signal from a PLC or a controller through the Zero setting / Preset input, see the "5.4 Zero setting / Preset input" section on page 26.

Output code

The encoder provides the absolute position or speed or acceleration information in the set code format: GRAY code (bit 5 = "0") or BINARY code (bit 5 = "1").
Default = 1 (Binary)

Counting direction

It allows to set whether the position information output by the encoder increases when the shaft rotates clockwise or counter-clockwise. Clockwise and counter-clockwise rotations are viewed from the flange (see on page 25). It is possible to choose the following options: bit 6 = "0" = CCW and bit 6 = "1" = CW. When the counting direction is set to CW (**Counting direction** = 1 = CW), the encoder will provide the increasing count when it turns clockwise (provided that the counting direction input is connected as explained); on the contrary when the counting direction is set to CCW (**Counting direction** = 0 = CCW), the encoder will provide the increasing count when it turns counter-clockwise.
Default = 1 (CW)

WARNING
The counting direction can be set also via hardware (see the Counting direction input, "5.3 Counting direction input" section on page 25). If not used, the Counting direction input must be connected to 0Vdc. The **Counting direction** parameter implies that the Counting direction input is set to 0Vdc. Otherwise the resulting will be contrary to what is expected or intended. Thus when the counting direction is set to CW -**Counting direction** = 1 = CW-, if the Counting direction input has LOW logic level (0Vdc) the encoder will provide the increasing count when the shaft is turning clockwise (and the decreasing count when the shaft is turning counter-clockwise); on the contrary if the Counting direction input has HIGH logic level (+Vdc) the encoder will provide the increasing count when the shaft is turning counter-clockwise (and the decreasing count when the shaft is turning clockwise). When the option CCW is set -**Counting direction** = 0 = CCW-, if the Counting direction input has LOW logic level (0Vdc) the encoder will provide the increasing count when the shaft is turning counter-clockwise (and the decreasing count when the shaft is turning clockwise); on the contrary if the Counting direction input has HIGH logic level (+Vdc) the encoder will provide the increasing count when the shaft is turning clockwise (and the decreasing count when the shaft is turning counter-clockwise).
For any information on the electrical connection of the Counting direction input refer to the "5.3 Counting direction input" section on page 25.

WARNING
After having set the new counting direction it is necessary to set also a new preset.

NOTE
The counting direction function affects the absolute position information, not the sine/cosine signals.

CONFIGURATION SETTING EXAMPLE

You need to set the following parameters next to the **Configuration** register:
Data type = 00 = current encoder position information
Enable preset = 0 = enable
Output code = 1 = Binary
Counting direction = 1 = CW

Thus you will have as follows:

Bit 0 Bit 1 **Data type**	= POSITION INFORMATION	= 0 = 0
Bit 2 **Enable preset**	= ENABLE	= 0
Bit 3	= not used	= 0
Bit 4	= not used	= 0
Bit 5 **Output code**	= BINARY	= 1
Bit 6 **Counting direction**	= CW	= 1
Bit 7	= not used	= 0

Therefore you must set 60h = 0110 0000_2

1. Enter the value 60h = 0110 0000_2 next to this **Configuration** register.
2. Save the value by using the **Save parameters on EEPROM** function in the **Command** register (set "01" in the **Command** register).

Function	ADDR	DATA Tx
Writing in the Configuration register	49	60
Save parameters on EEPROM function in the **Command** register	48	1

Information per revolution

[4B ... 4D, ro]

These registers are meant to show the number of physical information per revolution (singleturn resolution). For information see the order code, the singleturn resolution can be up to 20 bits, i.e. 1,048,576 cpr (AMM8A**xx**/xxxxx...). You can read the number of bits used for the singleturn resolution also at the register 56 **N° of bits used for singleturn resolution**.

Information per revolution registers structure:

Register	4B	4C	4D
	MSB	...	LSB
	2^{23} ... 2^{16}	2^{15} ... 2^{8}	2^{7} ... 2^{0}

Default = see the order code (AMM8A**xx**/xxxxx...)
For example: 02 00 00h (=131,072 cpr, 17 bits)

Number of revolutions

[4E - 4F, ro]

These registers are meant to show the number of physical revolutions. For information see the order code, the number of revolution can be up to 4,096 (AMM8Axx/**xxxxx**...).

You can read the number of bits used for the number of revolutions also at the register 57 **N° of bits used for multiturn resolution**.

Number of revolutions registers structure:

Register	4E	4F
	MSB	LSB
	2^{15} ... 2^{8}	2^{7} ... 2^{0}

Default: see the order code (AMM8Axx/**xxxxx**...)
For example: 10 00h (=4,096 revolutions)

Preset

[50 ... 54, rw]

WARNING

You are allowed to enter a value next to the **Preset** registers only if the **Enable preset** bit in the **Configuration** register is set to "1".

These registers allow the operator to set the Preset value. The Preset function is meant to assign a desired value to a physical position of the encoder. The chosen physical position (i.e. the transmitted position value) will get the value set next to these registers and all the previous and following positions will get a value according to it. For instance, this can be useful for getting the zero point of the encoder and the zero point of the application to match. The preset value will be set for the position of the encoder in the moment when the command is sent through the **Save and activate Preset** function of the **Command** register (or through the Zero setting / Preset input signal, see the "5.4 Zero setting / Preset input" section on page 26).

After having entered a value next to the **Preset** registers you can either save it without activating the preset function or both save and activate it at the same time.
Use the **Save parameters on EEPROM** function (set "01" in the **Command** register) to save the new Preset value without activating it.
Use the **Save and activate Preset** function (set "02" in the **Command** register) to both save and activate the new Preset value.

The Preset value you are allowed to enter must be less than or equal to (**Information per revolution** * **Number of revolutions**) - 1.
Default = 00 00 00 00 00h
Min. value: 00 00 00 00 00h
Max. value: 03 FF FF FF FFh

NOTE
We suggest setting the preset when the encoder shaft is in stop.

Preset registers structure:

Register	50	51	52	53	54
	MSB	...	...	...	LSB
	2^{39} ... 2^{32}	2^{31} ... 2^{24}	2^{23} ... 2^{16}	2^{15} ... 2^{8}	2^{7} ... 2^{0}

PRESET SETTING EXAMPLE
You want to set the following Preset value = 01 86 A0h = $100{,}000_{10}$

1. First of all you must enable the setting of the Preset registers by entering the value "0" next to the **Enable preset** bit of the Configuration register.
2. Enter the desired preset value (01 86 A0 h = $100{,}000_{10}$) next to this Preset parameter.
3. To save the new Preset value without activating it, you must use the **Save parameters on EEPROM** function in the Command register (set "01" in the Command register).
4. Otherwise, to both save and activate the new Preset value at the same time, you must use the **Save and activate Preset** function in the Command register (set "02" in the Command register).

Function	ADDR	DATA Tx
Setting the Enable preset bit of the Configuration register	49, bit 2	0
Writing in the Preset register	50	00
	51	00
	52	01
	53	86
	54	A0
Save parameters on EEPROM function in the Command register	48	01
or		
Save and activate Preset function in the Command register	48	02

WARNING
After having set the new counting direction it is necessary to set also a new preset.

Device type

[55, ro]
This register describes the type of device.
Default = 04h: multiturn rotary encoder with BiSS C-mode interface + sine-cosine additional signals (AMM8Axx/xxxxxSCx-...)

N° of bits used for singleturn resolution

[56, ro]
This register shows the number of bits used for the singleturn resolution (the number of physical information -cpr- is available next to the **Information per revolution** parameter, registers 4B ... 4D).
Default = see the order code (AMM8A**xx**/xxxxx...)
For example: 11h (= 17 bits, AMM8A**17**/xxxxx...)

N° of bits used for multiturn resolution

[57, ro]
This register shows the number of bits used for the number of physical revolutions (the number of physical revolutions is available next to the **Number of revolutions** parameter, registers 4E-4F).
Default = see the order code (AMM8Axx/**xxxxx**...)
For example: 0Ch (= 12 bits, AMM8Axx/**4096**...)

Resolution of sine-cosine signals

[58, ro]
This register shows the resolution of the sine cosine additional signals.
00h = no sine cosine signals
11h = 1024 sinusoidal waves per mechanical revolution, see on page 27
Default = 11h

Work cycles counter

[59 ... 5C, ro]
The work cycles counter allows to record the total number of work cycles accomplished by the encoder. A work cycle corresponds to 2 encoder revolutions. The counter value is always incremental both if the encoder rotates clockwise and if the encoder rotates counter-clockwise. A hysteresis of ±1

revolution occurs nearby the point where the counter changes its value. After increasing the counter value, if you move backward less than 1 revolution and then you move forward less than 2 revolutions, the counter does not increase its value; the same if you then move backward and forward less than 2 revolutions. On the contrary, if, after increasing the counter value, you move backward more than 1 revolution and then move forward more than 1 revolution, the counter increases its value.
As soon as the power is turned on, the system loads from EEPROM the count previously saved and starts increasing it. When the power is turned off, the system immediately saves on EEPROM the current count. If an error occurs during save, the system recovers the last saved count and sets to high (="1") the error bit 4 **Work cycles save error** in the **Encoder warnings and errors** register.
It is possible to set a work cycles limit next to the **Work cycles warning limit** registers. As soon as the counter reaches the set limit, the warning bit 0 **Work cycles limit reached** in the **Encoder warnings and errors** register is set to high (="1").

Work cycles counter registers structure:

Register	59	5A	5B	5C
	MSB	...	...	LSB
	2^{31} ... 2^{24}	2^{23} ... 2^{16}	2^{15} ... 2^{8}	2^{7} ... 2^{0}

Work cycles warning limit

[5D ... 5F, rw]

These registers allow to set a work cycles warning limit. As soon as the **Work cycles counter** (registers 59 ... 5C) reaches the limit set in this item, the warning bit 0 **Work cycles limit reached** in the **Encoder warnings and errors** register is set to high (="1").
If these registers are set to ="00 00 00h", then the work cycles warning limit function is disabled. Any value greater than 0 will set the number of cycles after which the warning message will be invoked to appear.
See also **Work cycles counter**.
Default = 00 00 00h

Acceleration

[60 ... 62, ro]

These registers display either the current acceleration / deceleration value or the acceleration / deceleration peak reached by the encoder; and the kind of movement (acceleration phase or deceleration phase).
18 bits (2^{0} ... 2^{17}) are meant to show either the current acceleration / deceleration value or the acceleration / deceleration peak reached by the encoder. If the **Acceleration peak warning limit** registers are set to "00 00 00h", the **Acceleration** registers show the current acceleration / deceleration

value; if the **Acceleration peak warning limit** registers are set to any value greater than "00 00 00h", the **Acceleration** registers show the acceleration / deceleration peak reached by the encoder. The acceleration / deceleration peak can be reset by setting "08" in the **Command** register.
Bits 2-6 of register 60 (2^{18} ... 2^{22}) are not used (they are set to "0").
Bit 7 of register 60 is meant to show whether the encoder is accelerating (bit 7 = "1") or decelerating (bit 7 = "0").
The acceleration / deceleration value is expressed in RPM/sec.
It is sampled every 7.8125 msec.; the system detects acceleration / deceleration values greater than 500,000 RPM/sec. and records them with increments of 30 RPM/sec.
It is possible to set an acceleration peak warning limit next to the **Acceleration peak warning limit** registers. As soon as the acceleration value reaches the set peak limit, the warning bit 1 **Acceleration peak limit reached** in the **Encoder warnings and errors** register is set to high (="1").

Acceleration registers structure:

Register	60			61	62
	Acc. / Dec.	Not used	Acceleration / Deceleration value/peak		
	MSB	...	...	...	LSB
	2^{23}	2^{22} ... 2^{18}	2^{17} - 2^{16}	2^{15} ... 2^{8}	2^{7} ... 2^{0}

Acceleration peak warning limit

[63 ... 65, rw]

These registers allow to set an acceleration / deceleration peak warning limit. As soon as the registers 60 ... 62 **Acceleration** reach the limit set in this item, the warning bit 1 **Acceleration peak limit reached** in the **Encoder warnings and errors** register is set to high (="1").
If the registers are set to ="00 00 00h", then the acceleration / deceleration peak warning limit function is disabled and the registers 60 ... 62 **Acceleration** show the current acceleration / deceleration value. Any value greater than 0 will set the acceleration / deceleration peak limit at which the warning message will be invoked to appear; moreover the **Acceleration** registers will show the acceleration / deceleration peak reached by the encoder instead.
See also **Acceleration**.
Default = 00 00 00h

Speed

[66–67, ro]

These registers display either the current speed value or the speed peak reached by the encoder. The value is 16 bit long (2^{0} ... 2^{15}).
If the **Speed peak warning limit** registers are set to "00 00 00h", the **Speed** registers show the current speed value; if the **Speed peak warning limit** registers are set to any value greater than "00 00 00h", the **Speed** registers

show the speed peak reached by the encoder. The speed peak can be reset by setting "08" in the **Command** register.
The speed value is expressed in RPM.
The speed is sampled every 7.8125 msec.; the system detects speed values up to 7,324 RPM and records them with increments of 1 RPM.
It is possible to set a speed peak warning limit next to the **Speed peak warning limit** registers. As soon as the speed value reaches the set peak limit, the warning bit 2 **Speed peak limit reached** in the **Encoder warnings and errors** register is set to high (="1").

Speed registers structure:

Register	66	67
	MSB	LSB
	2^{15} ... 2^{8}	2^{7} ... 2^{0}

Speed peak warning limit

[68–69, rw]

These registers allow to set a speed peak warning limit. As soon as the registers 66-67 **Speed** reach the limit set in this item, the warning bit 2 **Speed peak limit reached** in the **Encoder warnings and errors** register is set to high (="1").
If the registers are set to ="00 00 00h", then the speed peak warning limit function is disabled and the registers 66-67 **Speed** show the current speed value. Any value greater than 0 will set the speed peak limit at which the warning message will be invoked to appear; moreover the **Speed** registers will show the speed peak reached by the encoder instead.
See also **Speed**.
Default = 00 00 00h

Encoder warnings and errors

[74, ro]

This register is meant to show the warning and error messages that are currently active (the relevant bit = "1") in the encoder. To clear the warning and error messages, set "08" in the **Command** register. Please note that, after resetting the message, if the problem that caused the message to be triggered has not been solved, the warning or error message will be invoked to appear again.

Bit 0

Work cycles limit reached

The work cycles warning limit set next to the **Work cycles warning limit** registers has been reached. To clear the warning message, set "08" in the **Command** register. Please note that, after resetting the message, if the work

hours warning limit is not extended, the warning message will be invoked to appear again.

Bit 1

Acceleration peak limit reached

The acceleration peak warning limit set next to the **Acceleration peak warning limit** registers has been reached. To clear the warning message, set "08" in the **Command** register. Please note that, after resetting the message, if the acceleration peak warning limit is not extended or the acceleration is not decreased, the warning message will be invoked to appear again.

Bit 2

Speed peak limit reached

The speed peak warning limit set next to the **Speed peak warning limit** registers has been reached. To clear the warning message, set "08" in the **Command** register. Please note that, after resetting the message, if the speed peak warning limit is not extended or the speed is not decreased, the warning message will be invoked to appear again.

Bit 3

Multiturn gear error

The correct count of the encoder revolutions is checked dynamically during operation. If a counting error occurs, this bit is set to high (="1"). To clear the error message, set "08" in the **Command** register. Maybe there is a breakdown in the photoelements or in the mechanical gears. The system cannot operate properly. If the problem lingers, please contact Lika Electronic After Sales Service.

Bit 4

Work cycles save error

As soon as the power is turned off, the system immediately saves on EEPROM the current count of the work cycles (see the **Work cycles counter** registers). If an error occurs during save, the system recovers the last saved count and sets to high (="1") this error bit 4. To clear the error message, set "08" in the **Command** register.

Bit 5

Gears offset error

The count of the encoder revolutions is achieved by using a synchronization algorithm; after an automatic self-synchronization phase, the algorithm calculates some offsets in order to compensate for the phase shift between the gears. This error is activated at power-on when the offset values are not uploaded correctly. The system cannot operate properly, this error message cannot be reset. Please contact Lika Electronic After Sales Service.

Bit 6

Synchronization error

After mechanical installation, it is necessary to carry out the procedure meant to synchronize the gears and the single-multi turn information code. The proper synchronization is achieved by uploading at power-on the offset value calculated during the synchronization procedure. If an error occurs while performing the synchronization procedure or when uploading the calculated offset at power-on, this bit is set to high (="1"). The system cannot operate properly, this error message cannot be reset. Please contact Lika Electronic After Sales Service.
For complete information on the synchronization procedure please refer to the "4.3 Mounting the encoder and executing the synchronization procedure" section on page 18.

Bit 7

EEPROM error

Error while reading the EEPROM, an error occurred while uploading the configuration parameters at power-on. The system cannot operate properly, this error message cannot be reset. Please contact Lika Electronic After Sales Service.

Sensor warnings

[75, ro]

Bits 0 ... 2
Not used.

Bit 3

Nonius error

The BiSS **Error** bit (page 51) and the **Nonius error** bit (page 67) are low and high respectively when the encoder requires a fast synchronization of singleturn and multiturn position first and eventually the complete calibration and synchronization procedure. For complete information refer to the "4.3 Mounting the encoder and executing the synchronization procedure" section on page 18; and to the "6 - Calibration and synchronization procedure" section on page 31.

Bits 4 and 5
Reserved for calibration mode.

Bit 6

Encoder Sensor EEPROM error

An EEPROM access failure occurred while performing the singleturn-multiturn synchronization procedure.

Bit 7

Excessive temperature warning

This warning bit is set to high (="1") when the sensor temperature exceeds 90°-95°C (194°-203°F). To clear the error, the sensor temperature must drop below 85°C (185°F).

Sensor errors

[76-77, ro]

Register 76

Bit 0

Excessive temperature error

This error bit is set to high (="1") when the sensor temperature exceeds 100°-105°C (212°-221°F). To clear the error, the sensor temperature must drop below 85°C (185°F).

Bits 1 ... 7
Reserved for calibration mode.

Register 77

Bits 0 ... 7
Reserved for calibration mode.

Device ID

[78 ... 7D, ro]
These registers contain the Device ID (78 ... 7C) and the version of the installed software (7D). Refer also to the order code. Identification name and software version are expressed in hexadecimal ASCII code.

Register	78	79	7A	7B	7C	7D
Hex	41	4D	4D	38	41	xx
ASCII	A	M	M	8	A	x

Registers 78-7C = encoder model (AMM8A model)
Register 7D = software version, see the example

EXAMPLE
If the value in the register 7D is "32" hex, then the software version is "2".

Manufacturer ID

[7E-7F, ro]

These registers contain the Manufacturer ID. Identification name is expressed in hexadecimal ASCII code.

Register	7E	7F
Hex	4C	69
ASCII	L	i

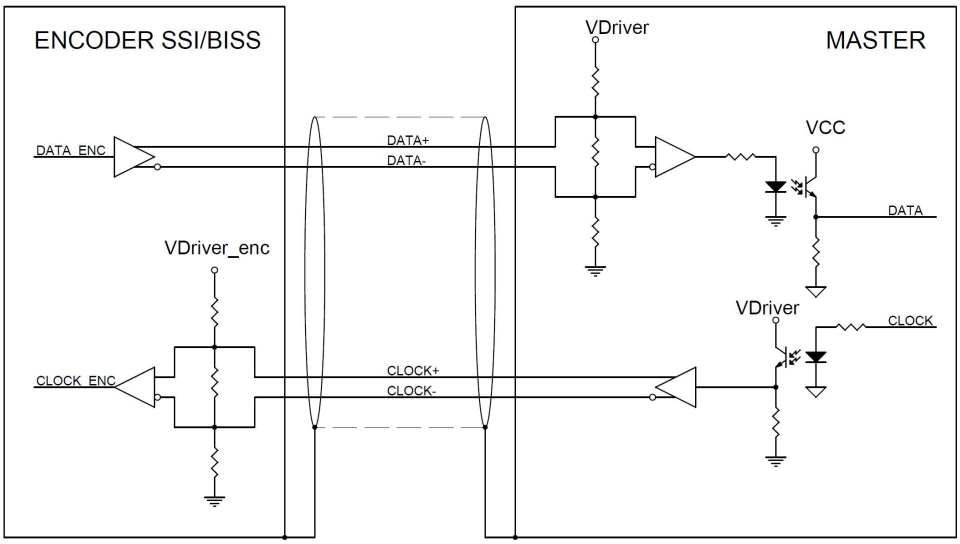
Li = Lika Electronic

8.5 Application notes

Data transmission:

Parameter	Value
Clock Frequency	Min. 70 KHz, max. 10 MHz
BiSS time-out	Self-adaptable to the clock, 700 ns min., 8 µs max.

8.6 Recommended BiSS input circuit



9 - Default parameters list

BiSS C-mode interface

Parameters list	Default value *		
Command	00 = Normal operational state		
Configuration	60		
Bit 0 Bit 1 Data type	00 = position information		
Bit 2 Enable preset	0 = Enable		
Bit 3 not used	0		
Bit 4 not used	0		
Bit 5 Output code	1 = Binary		
Bit 6 Counting direction	1 = CW		
Bit 7 not used	0		
Information per revolution	see the order code		
Number of revolutions	see the order code		
Preset	00 00 00 00 00		
Device type	04		
N° of bits used for singleturn resolution	see the order code		
N° of bits used for multiturn resolution	see the order code		
Resolution of sine-cosine signals	11		
Work cycles warning limit	00 00 00		
Acceleration peak warning limit	00 00 00		
Speed peak warning limit	00 00		
Device ID	41 4D 4D 38 41 xx		
Manufacturer ID	4C 69		

* All values are expressed in hexadecimal notation.

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Document release	Release date	Description	HW	SW	Interface
1.0	01.06.2016	First issue		1	SW IF90-SC_v1.0
...	...	...		...	...
1.8	27.04.2018	New software release for SSI interface devices		3	IF90-SC_AMM8_BiSS_v2.4.0 IF90-SC_AMM8_SSI_v2.4.0
1.9	20.05.2019	Encumbrance size drawings updated (tolerances)		3	IF90-SC_AMM8_BiSS_v2.4.0 IF90-SC_AMM8_SSI_v2.4.1
1.10	14.12.2020	Information about singleturn resolution (21 bits max.) and the number of revolutions (12 bits max.) updated		3	IF90-SC_AMM8_BiSS_v2.4.4 IF90-SC_AMM8_SSI_v2.4.3
1.11	28.10.2021	New clamping ring, "4.4 Mounting the encoder and executing the fast synchronization procedure" section removed		3	IF90-SC_AMM8_BiSS_v2.4.5 IF90-SC_AMM8_SSI_v2.4.4

Dispose separately

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