

User's guide

SFE

Programmable incremental draw-wire encoder



lika

Smart encoders & actuators

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The logo for Lika Electronic s.r.l. features the word "lika" in a bold, lowercase, sans-serif typeface. The letters are black and have a modern, clean appearance.

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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 are coloured in **GREEN**;
- alarms are coloured in **RED**;
- states are coloured in **FUCSIA**.

Some icons in the pages 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 **SFE programmable incremental draw-wire encoder**.

SFE cable-pulling encoder is aimed at speed and position measurements and controls in a variety of industrial applications through the movement of a **5,000 mm (196.85")** or **10,000 mm (393.7")** stainless steel wire. The typical back and forth travel of the moving equipment causes the wire to reel and unreel and thus the linear movement to be converted into a rotative motion detected by the encoder which is coupled to the drum.

SFE is distinguished by the integration of a programmable incremental encoder. Thus it allows to maximize customization and get a complete parametrization and the better configuration that perfectly suit specific needs in a good many applications and machines.

SFE draw-wire encoder is further available in pre-programmed version having the linear resolution as follows: 0.05 mm (SFE-xxxxx-x-4000-...); 0.1 mm (SFE-xxxxx-x-2000-...); 0.2 mm (SFE-xxxxx-x-1000-...).

The parametrization and set up of the programmable encoder integrated into the SFE draw-wire unit is achieved through a software expressly developed and released by Lika Electronic. The program is supplied for free and can be installed in any PC fitted with a Windows operating system (Windows XP or later). It allows the operator to set the working parameters of the device and monitor whether the device is running properly. The connection between the encoder and the PC is established by using the USB connection kit order code **KIT IP/IQ58** provided by Lika Electronic; M2 connection devices need the kit to be matched with **EC-IP/IQ-M23** order code cordset; M connection devices need the kit to be matched with **EC-IP/IQ-M12** order code cordset.

To make it easier to read and understand the text, this guide is divided into two 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 SFE cable-actuated encoder are provided.

In the second section, entitled **Programming Interface**, both general and specific information is given on the programming interface. In this section the software tool features and the parameters implemented in the unit are fully described.

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 s.r.l. 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 section "Electrical connection";
- the wires of unused output signals must be cut at different lengths and insulated singularly;
- in compliance with 2004/108/EC norm on electromagnetic compatibility, following precautions must be taken:
 - before handling and installing the equipment, 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 connector housing 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 section "Mechanical installation";
- mechanical installation has to be carried out with stationary mechanical parts;
- do not disassemble the unit;
- do not tool the unit 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 of the product;
- we suggest installing the unit providing protection means against waste, especially swarf as turnings, chips, or filings; should this not be possible, please make sure that adequate cleaning measures are in place in order to prevent the wire from jamming;
- to avoid failures, never exceed the maximum measuring length and prevent the wire from tangling up;
- never release the wire freely, always help the wire wind properly: risk of personal injury and/or equipment damage;
- always keep the wire aligned not to damage the equipment;
- the stroke per turn of the draw-wire unit is 200 mm (7.874").

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. It is provided with a further label (see the Figure below). Please note down the programmed values in this label and then stick the label to the enclosure for any future reference. Please always quote the order code, the serial number and the programmed values when reaching Lika Electronic. For any information on the technical characteristics of the product refer to the technical catalogue.

SFE series Encoder setting			
PPR:	_____	<input type="checkbox"/> CW	<input type="checkbox"/> CCW
Index:	<input type="checkbox"/> 90°	<input type="checkbox"/> 180°	www.lika.biz



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).

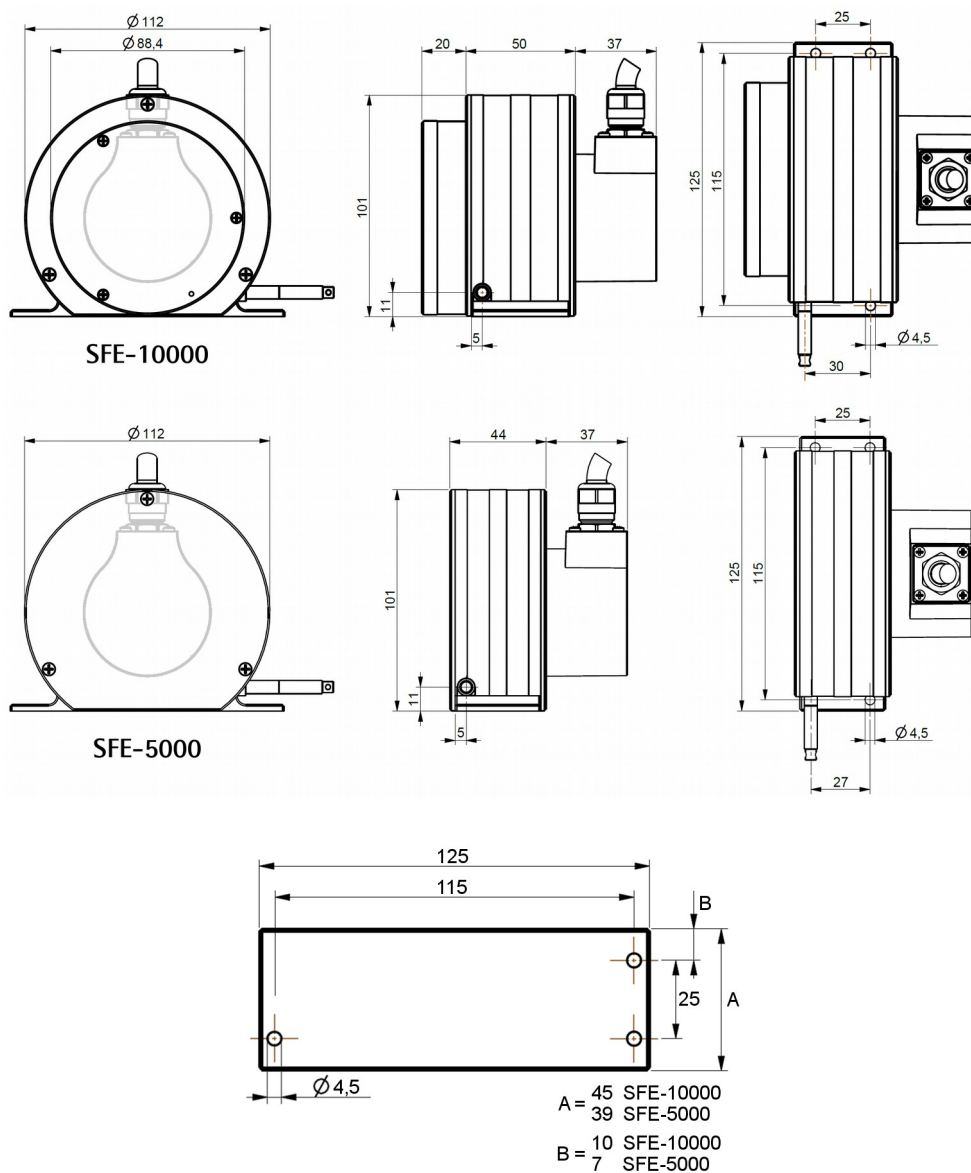
3 Mechanical installation



WARNING

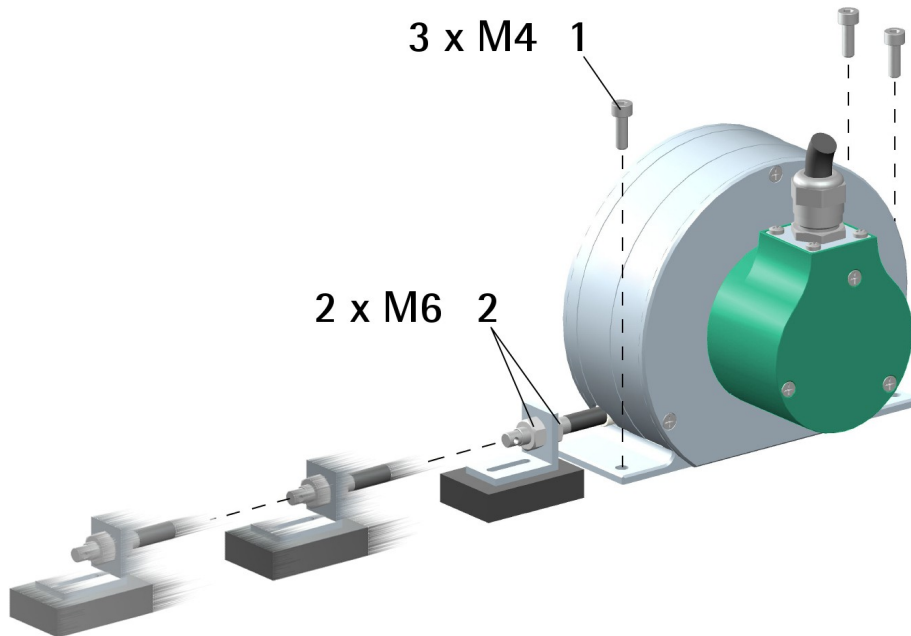
Installation has to be carried out by qualified personnel only, with power supply disconnected and mechanical parts compulsorily in stop.

3.1 Overall dimensions



Values are expressed in mm

3.2 Mounting instructions



- Fasten the draw-wire unit onto a fixed support using three M4 screws **1**;
- remove the transport safety wire that pins the end of the measuring wire;
- fix the end of the measuring wire to the moving unit using the provided M6 nuts **2**.

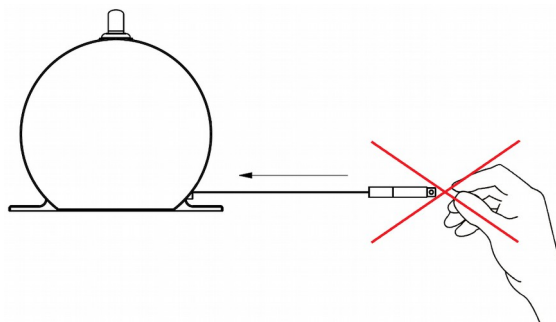


WARNING

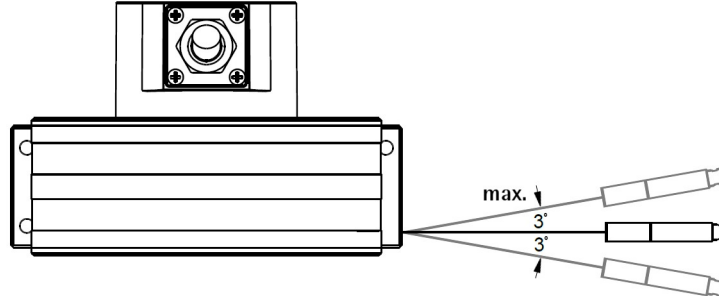
We suggest installing the unit providing protection means against waste, especially swarf as turnings, chips, or filings; should this not be possible, please make sure that adequate cleaning measures are in place in order to prevent the wire from jamming.

To avoid irreparable failures, never exceed the maximum measuring length and prevent the wire from tangling up.

Never release the wire freely, always help the wire wind properly: risk of personal injury and/or equipment damage.



Always keep the wire aligned not to damage the equipment (maximum deviation: 3°).



3.3 Useful information

If you want to know the maximum measuring length of the draw-wire encoder please refer to the order code. The resolution (i.e. the number of pulses per revolution, PPR) can be freely set through the programming interface to accommodate any value from 1 to 16,384 pulses; the default value is 16,384 PPR. Pre-programmed versions are further available (see the order code). The stroke per turn is always 200 mm (7.874"), the maximum number of turns is 25 for SFE-5000 and 50 for SFE-10000.



EXAMPLE

SFE-5000-H-PROG-4-RL1

Stroke per turn = 200 mm (7.874")

Resolution per turn = 16,384 PPR (default)

Linear resolution = 0.012 mm = 12 µm

Max. number of turns = 25

Max. measuring length = 5,000 mm (196.85")

Max. number of information = 409,600

3.4 Maintenance

The measuring system does not need any particular maintenance; anyway it has to be handled with the utmost care as any delicate electronic equipment. From time to time we recommend the following operations:

- the unit and the wire have to be cleaned regularly using a soft and clean cloth to remove dust, chips, moisture etc.; do not use oil to clean the wire.

4 Electrical connection



WARNING

Electrical connection has to be carried out by qualified personnel only, with power supply disconnected and mechanical parts compulsorily in stop.



WARNING

If wires of unused signals come in contact, irreparable damage could be caused to the device. Thus they must be cut at different lengths and insulated singularly.

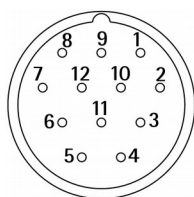
4.1 Cable and connectors connections + programming serial interface

Function	T12 cable	M23 12-pin	M12 12-pin
A	Violet	1	3
/A	Yellow	2	4
B	Grey	3	5
/B	Pink	4	6
0	Green	5	9
/0	Brown	6	10
+5Vdc +30Vdc	Brown/Green	7	2
0Vdc	White/Green	8	1
not connected	White	9	7
not connected	Blue	10	8
SDA	Red	11	11
not connected	Black	12	12
Shielding	Shield	Case	Case

4.2 T12 cable specifications

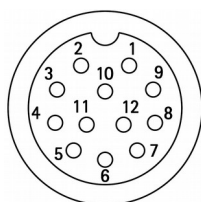
Model : LIKA T12 cable
 Cross section : $4 \times 0.25 \text{ mm}^2 + 4 \times 2 \times 0.14 \text{ mm}^2$ twisted pairs (24/26 AWG)
 Jacket : TPU, extra flexible
 Shield : tinned copper braid, coverage > 85%
 Outer diameter : $\varnothing 6.1 \text{ mm} \pm 0.1 \text{ mm}$ ($\varnothing 0.24" \pm 0.004"$)
 Min. bending radius : fix min. 25 mm (0.98") / dynamic min. 45 mm (1.77")
 Work temperature: fix $-50^\circ + 90^\circ\text{C}$ ($-58^\circ + 194^\circ\text{F}$) / dyn $-40^\circ + 90^\circ\text{C}$ ($-40^\circ + 194^\circ\text{F}$)
 Conductor resistance : $< 90 \Omega/\text{km}$ (0.25 mm^2) - $< 148 \Omega/\text{km}$ (0.14 mm^2)

4.3 M23 12-pin connector specifications



M23 12-pin connector
Male
Clockwise

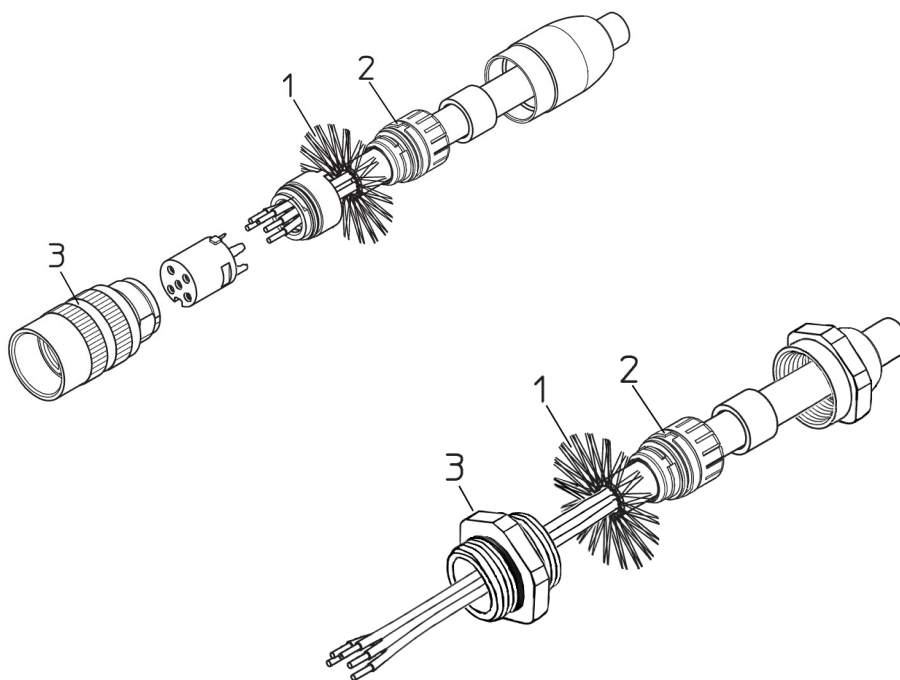
4.4 M12 12-pin connector specifications



Male
Frontal side
A coding

4.5 Connection of the shield

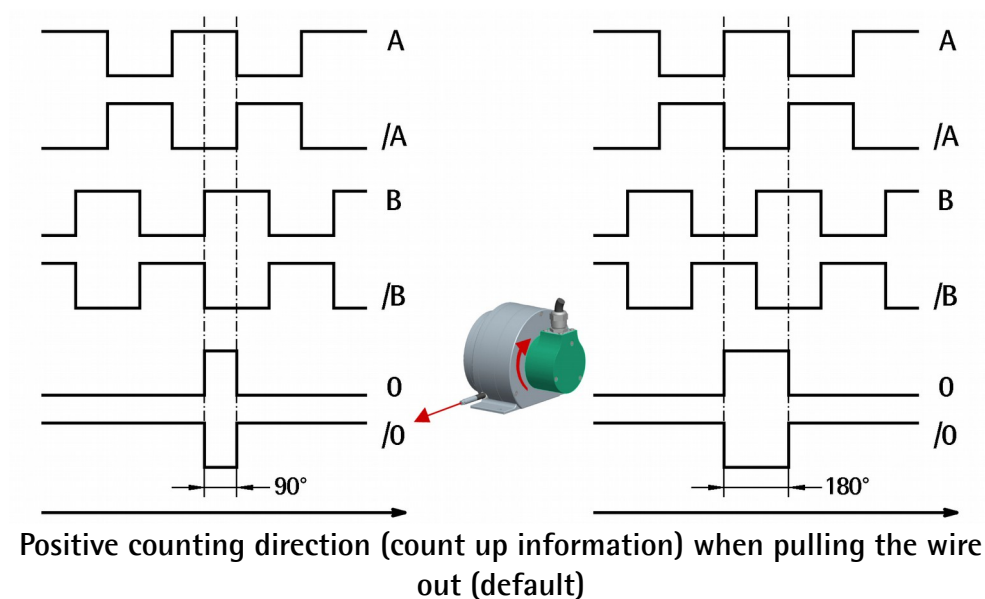
For signals transmission always use shielded cables. The cable shielding must be connected properly to the metal ring nut **3** of the connector in order to ensure a good earthing through the frame of the device. To do this disentangle and shorten the shielding **1** and then bend it over the part **2**; finally place the ring nut **3** of the connector. Be sure that the shielding **1** is in tight contact with the ring nut **3**.



4.6 Ground connection

Minimize noise by connecting the shield and/or the connector housing 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. You are advised to provide the ground connection as close as possible to the encoder.

4.7 ABO, /ABO output channels



4.8 Programming serial connection

The SFE programmable draw-wire encoder is equipped with a serial interface for the parametrization and set-up of the device. To communicate with the encoder, you must connect the device to the personal computer through a USB socket using the specific connection kit supplied by Lika Electronic upon request. The connection kit code is **KIT IP/IQ58**.

It is provided with a terminal for connecting the cable of the devices having Lx output connection code.

M2 connection devices need the kit to be matched with a cable - M23 12-pin female connector cordset, **EC-IP/IQ-M23** order code; M connection devices need the kit to be matched with a cable - M12 12-pin female connector cordset, **EC-IP/IQ-M12** order code.

To connect the encoder to the connection kit, please refer to the following table and the label applied to the connection kit terminal:

Function	Encoder/cordset cable	Terminal
+5Vdc power supply *	Brown/Green	PWR+
0Vdc	White/Green	PWR-
SDA Serial Data Line	Red	SDA



* WARNING

+5Vdc power supply from the USB connection. Do not connect any external power supply sources.



WARNING

Please make sure that only one encoder is connected to the KIT IP/IQ58 when you activate the USB connection !



NOTE

Before configuring the encoder by means of the programming interface, you must connect it to the personal computer through the KIT IP/IQ58 connection cable. You are required to install the drivers of the USB Serial Converter and the USB Serial Port first. The drivers are available for download from Lika web site www.lika.it.

4.8.1 Installing the KIT IP/IQ58 USB drivers

Please follow the steps in the documents listed below to install the drivers of both the USB Serial Converter and the USB Serial Port of the KIT IP/IQ58. The drivers package and the relevant documents are found inside the DRIVER USB folder. As stated, the drivers are available for download from Lika web site www.lika.it.

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 or 8 operating system, please refer to the following document: [Installation_Guide_for_Windows7.pdf](#).

As a preliminary operation please:

1. connect the encoder to the KIT IP/IQ58 terminal through the encoder cable or using either the M23 12-pin connector cordset or the M12 12-pin connector cordset (for the cable connection scheme please refer to the table in the previous page); you do not need to power the encoder by means of an external power pack as the device gets the power from USB;
2. connect the cable fitted with the USB connector to a USB socket of your PC; after a few seconds 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 programming interface; to know more refer to the "Programming interface" section on page 17.

5 Programming interface

5.1 Configuring the encoder using the software tool

SFE programmable incremental draw-wire encoder is provided with a software expressly developed and released by Lika Electronic in order to easily programme and configure the device. It allows the operator to set the working parameters of the device and monitor whether the device is running properly. 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 **KIT_IP_IQ58_vx.x.exe** where vx.x is the release version of the file. The program is available for download from Lika web site www.lika.it.

The program is designed to be installed simply by copying the executable file (*.exe file) to the desired location and there is **no installation** process. To launch the program just double-click the file icon. To close the program press the **EXIT** button in the title bar.



WARNING

Please be aware that the following compatibilities between the hardware-software version of the device and the software version of the executable file have to be respected compulsorily.

Compatibility	HW-SW	Connection kit	EXE FILE
	1-1.0	KIT IP/IQ58	From v2.4 up to ...



NOTE

Before starting the program and establishing a communication with the device, it is necessary to connect it to the personal computer through the programming serial interface. To communicate with the encoder, you must connect the device to the personal computer through a USB port using the specific connection kit order code **KIT IP/IQ58** supplied by Lika Electronic.

For any further information please refer to the "4.8 Programming serial connection" section on page 14.



WARNING

Please make sure that only one encoder is connected to the KIT IP/IQ58 when you activate the USB connection !





WARNING

Please always close the programming interface before disconnecting the encoder !

5.2 Starting the program

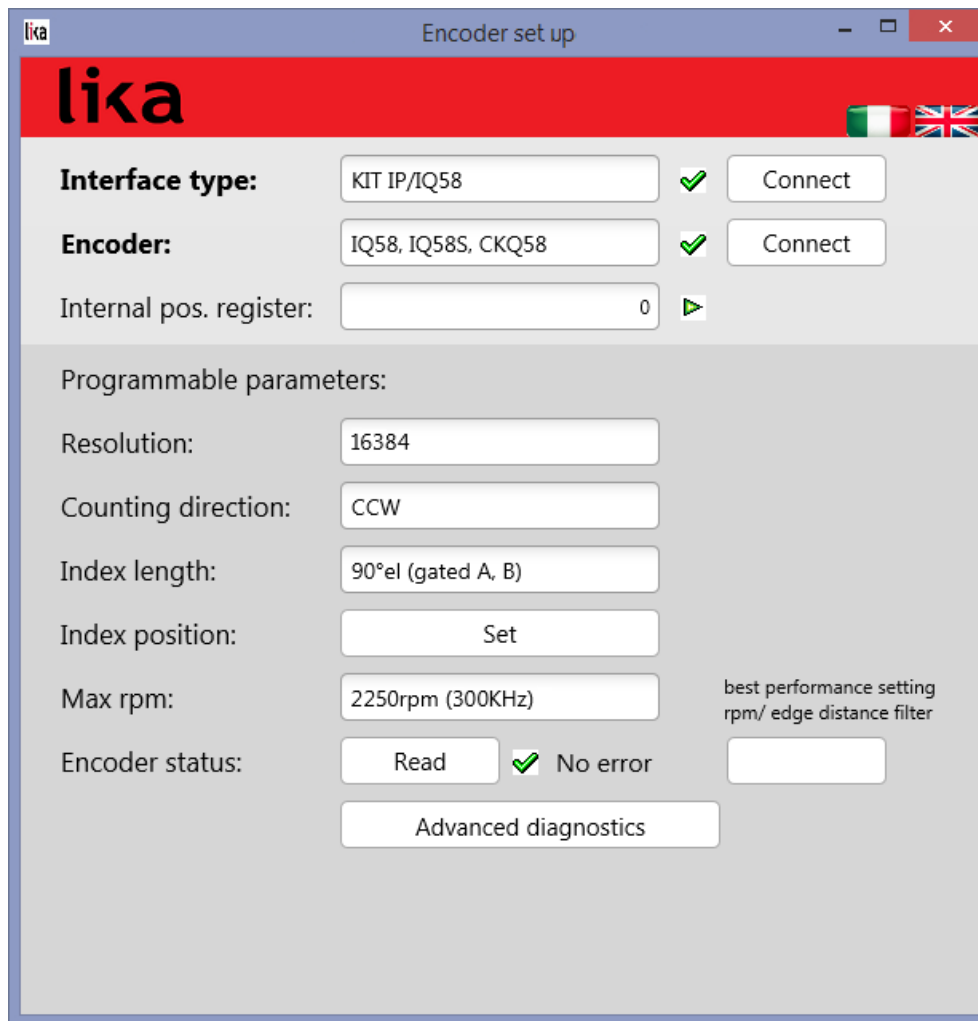
To launch the program just double-click the **KIT IP_IQ58_vx.x.EXE** executable file.

The main page of the configuration interface will appear on the screen. A further page is dedicated to the diagnostic information; it can be accessed by pressing the **ADVANCED DIAGNOSTICS** button below in the page (see on page 25).

First of all the main page allows the operator to choose the language used to display texts and items in the user interface. Click the **Italian flag**  icon to choose the Italian language; click the **UK flag**  icon to choose the English language.

Two sections can be found in the main page of the configuration interface:

1. a top section groups the items needful to establish the connection between the encoder and the interface, the connection buttons as well as the drop-down boxes designed to select the interface type and the series of the encoder to connect;
2. the section where the parameters to program the encoder can be found; also the buttons to check the work status of the encoder and enter the diagnostic information page can be found below in this section.



lika Encoder set up

Interface type: KIT IP/IQ58 ✓ Connect

Encoder: IQ58, IQ58S, CKQ58 ✓ Connect

Internal pos. register: 0 ▶

Programmable parameters:

Resolution: 16384

Counting direction: CCW

Index length: 90°el (gated A, B)

Index position: Set

Max rpm: 2250rpm (300KHz) best performance setting rpm/ edge distance filter

Encoder status: Read ✓ No error

Advanced diagnostics

5.3 Connection with the encoder

When you start the program, the system automatically detects the type of interface you plugged into (**INTERFACE TYPE**: "KIT IP/IQ58").

You are required to select the series of the programmable incremental encoder integrated into the SFE draw-wire measuring system. To do this open the **ENCODER** drop-down box and select the "IQ58, IQ58S, CKQ58" option in the list.

If the connection is established properly, a green tick ✓ appears next to both buttons; on the contrary, if the program is not able to establish a connection to the encoder, a red X ✗ appears next to either button. After positive connection the fields in the page are filled with information acquired from

the connected device. Furthermore the buttons and the commands become active.

5.4 Setting the parameters



WARNING

To save the data on the EEPROM permanently, after having entered the new value you must press the ENTER button in the keyboard. The parameter is saved instantly.

Internal pos. register

It is used to show the value in the internal position register, that is: the current position of the encoder. When you start the program, 0 appears next to this item. Press the **START** button to start the routine which allows to continuously read and display the current position: the encoder current position appears on the field. Press the **PAUSE** button to stop the routine; the last position value is kept "frozen" in the display field. After having set a new resolution value, a zero setting operation is carried out by the system. If the routine is running, the 0 value is shown in the internal position register; otherwise the last "frozen" position is shown.



NOTE

Please consider that the value displayed in this item is expressed in pulses. Thus you have then to convert the number of pulses displayed here into a linear measuring unit. For any information please refer to the note in the next parameter.

Resolution

This parameter allows the operator to set a custom number of pulses the encoder will output per each revolution (PPR). Please enter the desired value and then press the **ENTER** button to confirm. If you set a value that is out of range (lower or greater than allowed), the system automatically sets either the minimum or the maximum value in the range.

After having set the resolution, set also the encoder maximum rotational speed, see the parameter **Max rpm**. Please always consider the pulse multiplication factor (x1, x2 or x4) of your subsequent electronics before entering a new resolution value.

Default = 16384 (min. value = 1; max. value = 16384)



NOTE

Please consider that the value entered next to this item is expressed in pulses. Thus you have then to convert the number of pulses set here into a linear measuring unit.

To convert the position value into millimetres (mm) or micrometres (µm) you have to multiply the number of information by the linear resolution of the encoder expressed in millimetres or micrometres.

To know the linear resolution of the encoder please consider that **the stroke per turn is 200 mm.**

The linear resolution results from the following calculation:

$$\text{Linear resolution} = \frac{\text{Stroke per turn}}{\text{Resolution}}$$

If you want then to know the linear position value you will need to multiply the position value displayed next to the **Internal pos. register** item by the linear resolution.

Linear position value = transmitted position * linear resolution



EXAMPLE

The default resolution of the measuring device is 16384 PPR (**Resolution** = 16384).

As stated, the linear resolution results from the following calculation:

$$\text{Linear resolution} = \frac{\text{Stroke per turn}}{\text{Resolution}}$$

$$\text{Linear resolution} = \frac{200}{16384} = 0.012 \text{ mm} = 12 \text{ µm}$$

Let's say that the transmitted position value is: 123 (**Internal pos. register** = 123).

Thus the linear position value will be as follows:

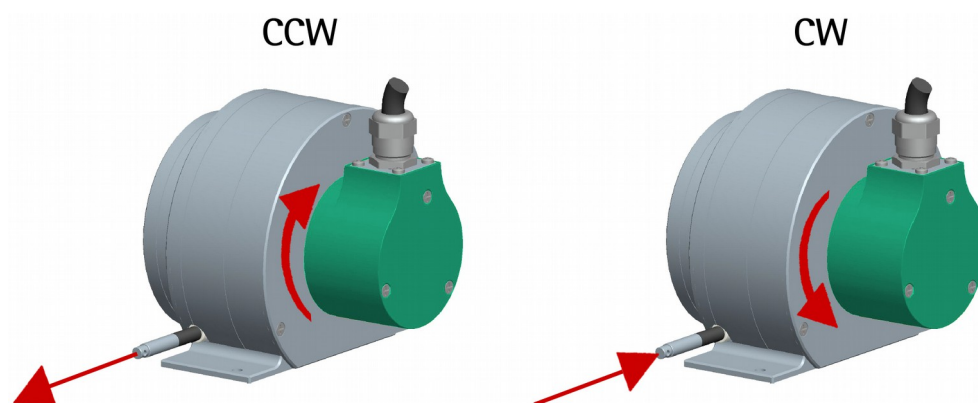
Linear position value = transmitted position * linear resolution

Linear position value = 123 * 0.012 = 1.476 mm = 1,476 µm

Counting direction

By default the counting direction is positive when pulling the wire out (the A channel leads the B channel, see the Figure on page 23). This parameter allows to reverse the counting direction, i.e to have a count up when the wire rewinds around the drum. Set **Counting direction** = **CCW** to have the increasing count when you pull the wire out; set **Counting direction** = **CW** to have the increasing count when the wire rewinds around the drum.

Default = CCW (min. value = CCW; max. value = CW)



WARNING

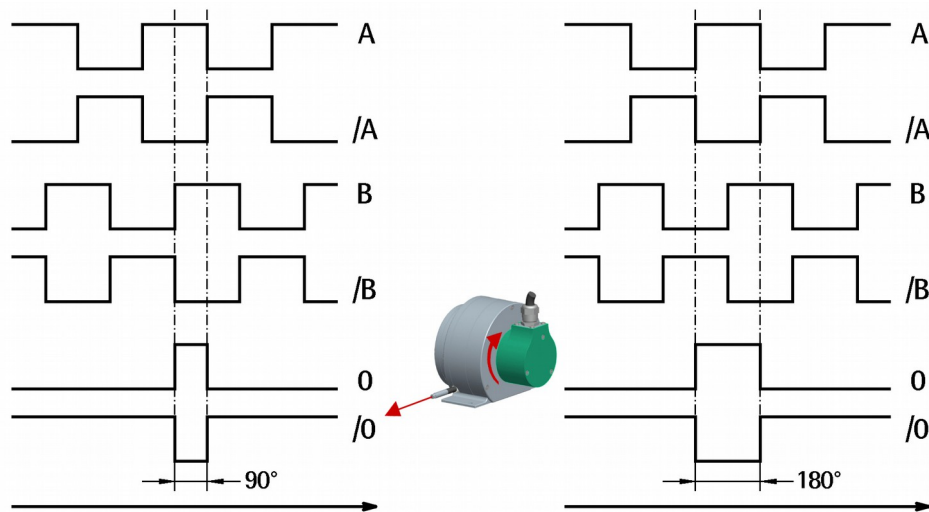
After having set the new counting direction it is necessary to set also the Index pulse (**Index position** parameter).

Index length

This parameter allows to set the width of the Index pulse (0 pulse) expressed in electrical degrees. Two options are available and selectable in the drop-down box: **90° el (gated A, B)** and **180° el (gated A)**. Please note that the 0 pulse having a width of 90 electrical degrees is synchronised with A and B pulses, while the 0 pulse having a width of 180 electrical degrees is synchronised with A pulse. See the Figure below.

Default = 90° el (gated A, B)

Min. value = 90° el (gated A, B); max. value = 180° el (gated A)



Index position

The encoder provides the zero signal (Index pulse) once every 200 mm / 7.874" of linear displacement (that is once per revolution of the encoder shaft) as relative positioning reference (home position, see the Figure above). This function allows to set the point at which the 0 pulse will be output. When you want to set the position of the 0 signal you must move the axis to the desired position, then press the **SET** button next to this **Index position** item while the encoder and the mechanical assembly are in stop.



WARNING

Please check that the position of the 0 pulse and set it if necessary whenever you set a new resolution next to the **Resolution** parameter or reverse the counting direction next to the **Counting direction** item.



NOTE

The width of the 0 pulse can be set next to the **Index length** parameter. Two options are available: 90° and 180°. Please note that the 0 pulse having a width of 90 electrical degrees is synchronised with A and B pulses, while the 0 pulse having a width of 180 electrical degrees is synchronised with A pulse. For further information please refer to page 22.

Max rpm

It allows to optimize the encoder performance (by keeping the most efficient ratio between the encoder rotational speed and the signal edge distance), depending on the maximum speed the application is able to reach. Select the speed value option that is immediately higher than the maximum speed of the application. Please consider the max. mechanical speed: 2 m/s, i.e. 600 rpm. If you do not know the maximum speed the application is able to reach, please enter the maximum rotational speed option available.

Encoder status

It displays the work state of the encoder.

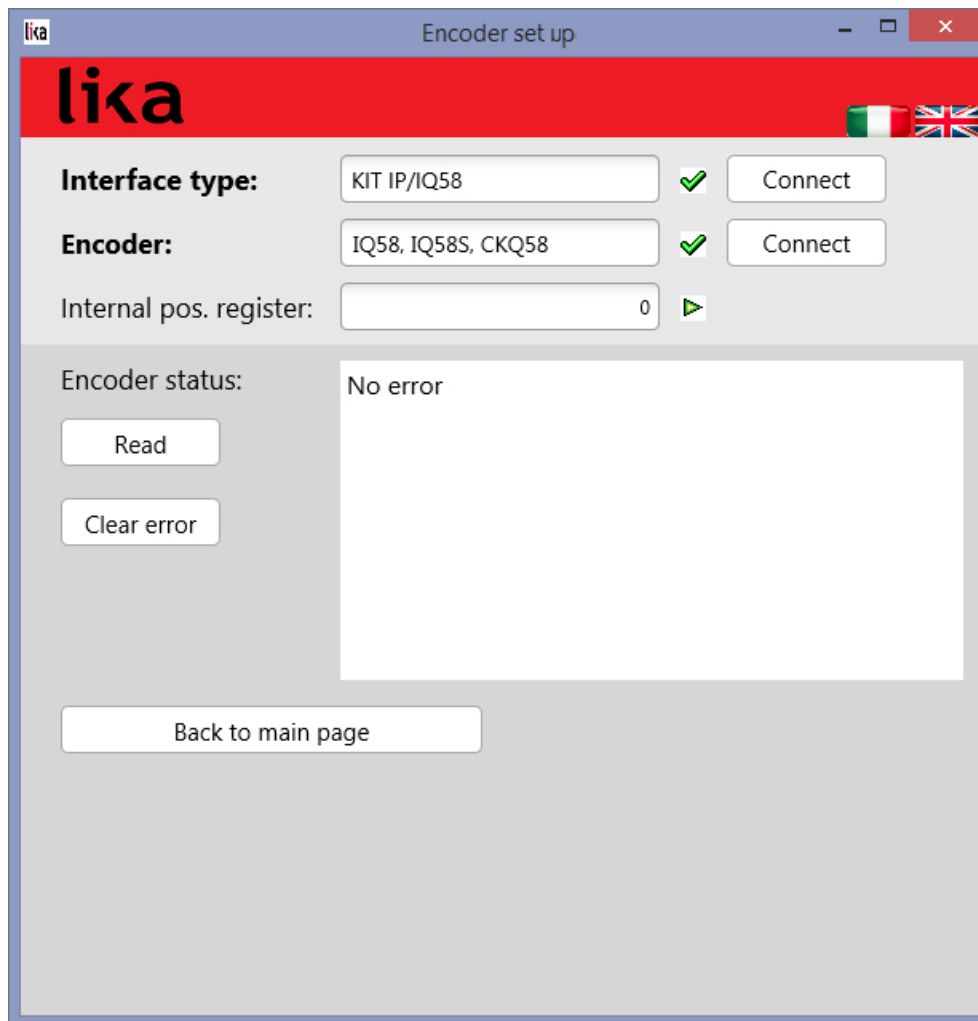
Press the **READ** button to update the state visualization.

If the encoder is working properly, the **NO ERROR** message appears on the right of the **READ** button. If a fault condition arises, the **WARNING** message is invoked to appear. By pressing the **CLEAR ERROR** button the system tries to solve the problem. If this is not possible, please press the **ADVANCED DIAGNOSTICS** button to learn more about the occurred fault.

5.5 Diagnostics page

When you press the **ADVANCED DIAGNOSTICS** button in the main page, you enter the Diagnostics page.

In this page you can find detailed information on the work status of the encoder. The current status is described in the window in the bottom right.



The screenshot shows a web-based interface titled "Encoder set up". At the top, there is a red header with the "lika" logo and flags for Italy and the United Kingdom. Below the header, the interface is divided into several sections:

- Interface type:** A dropdown menu showing "KIT IP/IQ58" with a green checkmark and a "Connect" button.
- Encoder:** A dropdown menu showing "IQ58, IQ58S, CKQ58" with a green checkmark and a "Connect" button.
- Internal pos. register:** A text input field showing "0" with a green play button icon.
- Encoder status:** A section with a "Read" button and a "Clear error" button. To the right of these buttons is a large white box displaying "No error".
- Back to main page:** A button at the bottom of the interface.

If an error occurs and the system is not able to solve it after pressing the **CLEAR ERROR** button, please take note of the error code that appears in the window and reach Lika Electronic's After Sales and Technical Service.

Press the **BACK TO MAIN PAGE** button to display back the main page.

6 Default parameters list

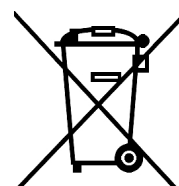
Parameters list	Default value		
Resolution	16384 *		
Counting direction	CCW		
Index length	90° el (gated A, B)		
Index position	-		
Max rpm	2250rpm (300 kHz)		

* 16384 PPR is the default resolution of the PROG order code version only, for instance: SFE-5000-H-**PROG**-4RL2. Versions with factory preset resolution may provide different PPR information, see your specific order code in the label applied to the encoder enclosure, for instance: SFE-5000-H-**1000**-4RL2 (in this case: preset resolution = 1000 PPR).

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HW-SW version	Interface release	Document release	Description
1-1.0	from 2.4 to ...	1.0	1 st issue
1-1.0	from 2.4 to ...	1.1	Default values, general revision



Dispose separately



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