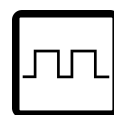


SFES1-01500 SFES1-02000



Miniature incremental draw-wire encoder

- Incremental draw-wire encoder with quadrature signal output
- Robust and compact design
- Resolution from 0.25 mm down to 0.05 mm
- Max. measuring length: 1500 mm or 2000 mm
- Universal output circuit HTL/TTL

Suitable for the following models:

- SFES1-01500-...
- SFES1-02000-...

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The logo for Lika Electronic s.r.l. consists of the word "lika" in a bold, lowercase, sans-serif font. The letter "i" has a dot above it. The logo is positioned in the bottom right corner of the page.

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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 **SFES1-01500 and SFES1-02000 incremental draw-wire encoders**.

SFES1-01500/SFES1-02000 cable-pulling encoder is aimed at speed and position measurements and controls in a variety of industrial applications through the movement of a **1,500 mm (59.055")** or **2,000 mm (78.74")** 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.

SFES1-01500/SFES1-02000 provides quadrature signals through the universal output circuit HTL/TTL (Push-Pull or Line Driver output signals).

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 SFES1-01500/SFES1-02000 cable-actuated encoder are provided.

In the second section, entitled **Output signals**, you can find detailed information on the quadrature output signals.

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 the power supply before connecting the device;
- connect according to the explanation in the "Electrical connection" section on page 13;
- the wires of unused output signals must be cut at different lengths and insulated singularly;
- in compliance with 2014/30/EU 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 the frame to ground. Make sure that ground is not affected by noise.



1.3 Mechanical safety

- Install the device following strictly the information in the "Mechanical installation" section on page 9;
- mechanical installation has to be carried out with stationary mechanical parts;
- do not disassemble the unit;
- do not tool the unit;
- delicate electronic equipment: handle with care; do not subject the device 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 100 mm (3.937").

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).

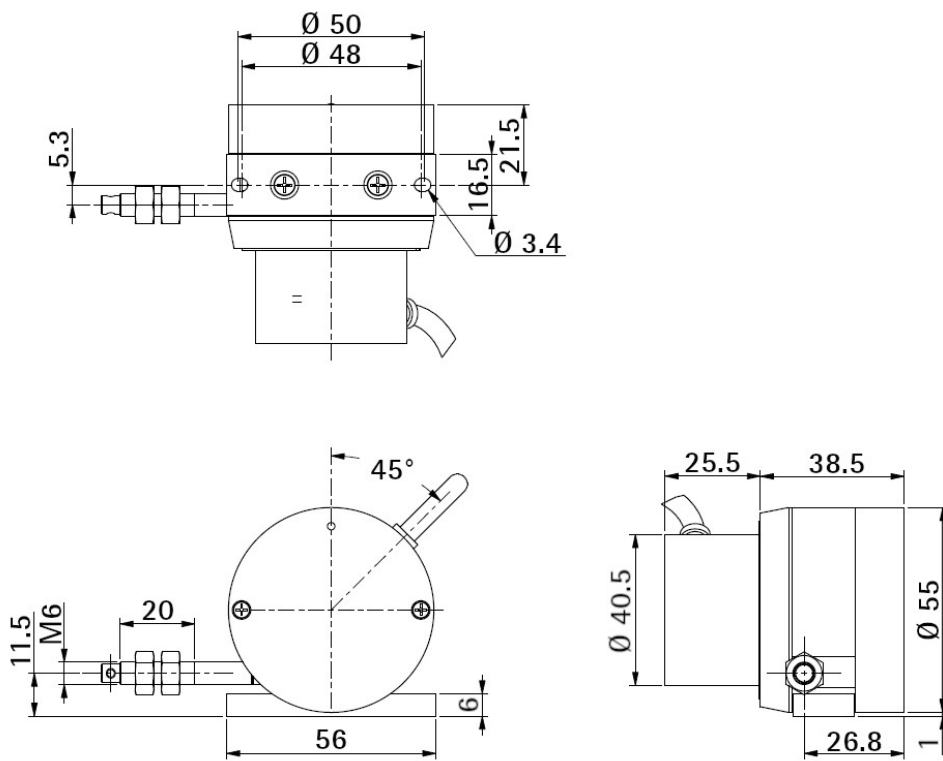
3 Mechanical installation



WARNING

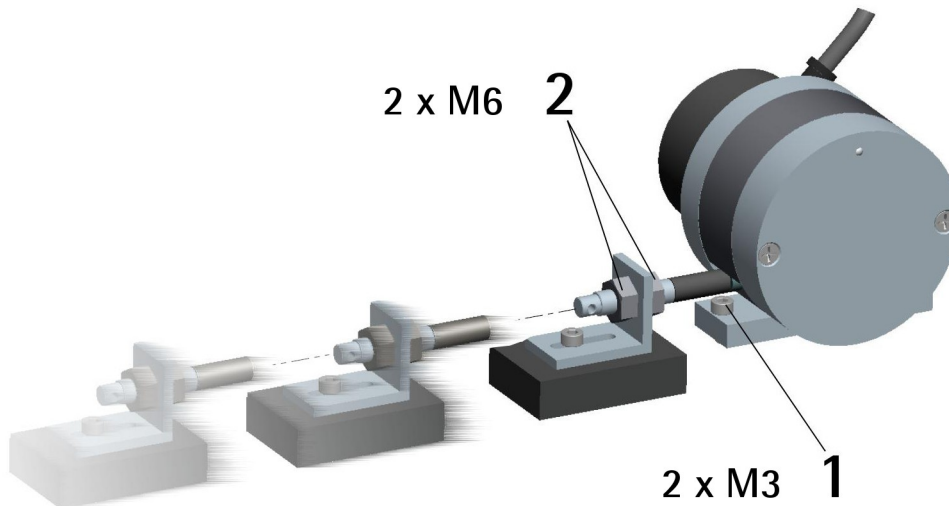
Installation has to be carried out by qualified personnel only, with power supply disconnected and mechanical parts compulsorily in stop.

3.1 Overall dimensions



Values are expressed in mm

3.2 Mounting instructions



- Fasten the draw-wire unit onto a fixed support using two M3 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 element using the provided M6 nuts **2**.

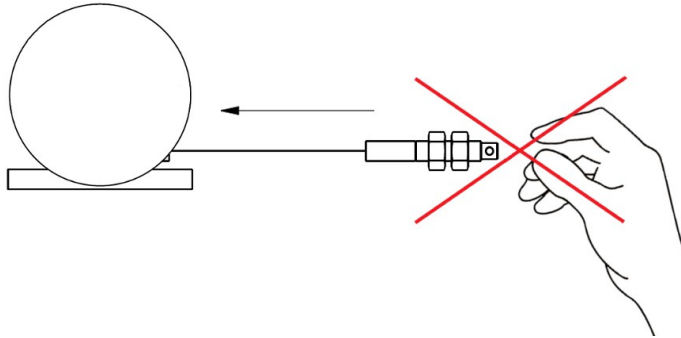


WARNING

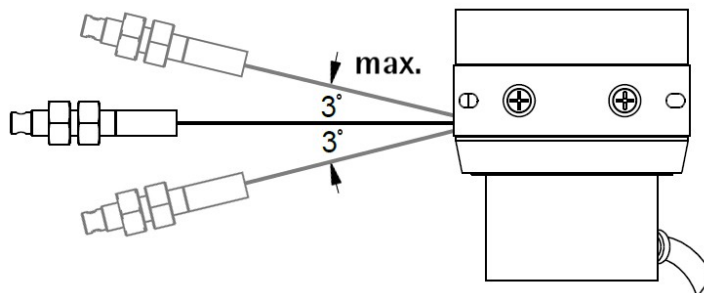
We suggest installing the unit providing protection means against waste, especially swarf as turnings, chips, or filings; should this not be possible, please make sure that adequate cleaning measures are in place in order to prevent the wire from jamming.

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** and the **resolution** of the draw-wire encoder please refer to the order code. The stroke per turn is always 100 mm (3.937"), the maximum number of turns is 15 for SFES1-01500 and 20 for SFES1-02000.



EXAMPLE 1

SFES1-01500-H4-00500-RL010

Stroke per turn = 100 mm (3.937")

Resolution per turn = 500 PPR

Linear resolution = 0.2 mm = 200 μm

Max. number of turns = 15

Max. measuring length = 1,500 mm (59")

Number of information = 7,500 pulses

**EXAMPLE 2**

SFES1-**02000**-H4-**00250**-RL020

Stroke per turn = 100 mm (3.937")

Resolution per turn = 250 PPR

Linear resolution = 0.4 mm = 400 µm

Max. number of turns = 20

Max. measuring length = 2,000 mm (78.74")

Number of information = 5,000 pulses

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 must 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 I8 cable connection

Function	I8 cable
A	Yellow
/A	Blue
B	Green
/B	Orange
0	White
/0	Grey
+5Vdc +30Vdc	Red
0Vdc	Black
Shielding	Shield

4.2 I8 cable specifications

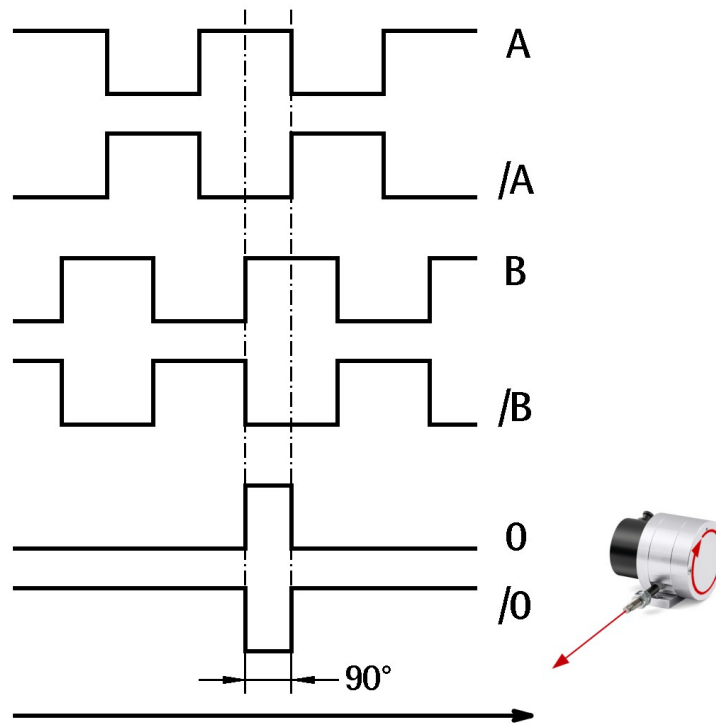
Model:	LIKA encoder cable type I8
Cross section:	8 x 0.22 mm ² (24 AWG)
Jacket:	PVC, oil and flame retardant
Shield:	Tape aluminium/PET, coverage 100%
Outer diameter:	5.1 mm ±0.2 mm / 0.2" ±0.0079"
Min. bend radius:	Outer diameter x 10, static application Outer diameter x 15, dynamic application
Work temperature:	-20°C +80°C / -4°F +176°F, static application -5°C +70°C / +23°F +158°F, dynamic application, not for continuous use
Conductor resistance:	≤ 92.5 Ω/km

4.3 Ground connection

Minimize noise by connecting the shield and 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.

5 Output signals

5.1 Quadrature signals



Positive counting direction (count up information) when pulling the wire out



NOTE

We advise the complementary signals to be always connected if the subsequent electronic equipment is capable of accepting them. Otherwise each output must be insulated singularly.



WARNING

Connecting /A, /B, or /0 signal wires to each other or to +Vdc or to 0Vdc may cause permanent damage to the unit.

The number of output pulses is proportional to the displacement of the moving unit (axis) the wire is fastened to.

The resolution can be read in the order code:

Order code	Resolution x1	Resolution x4
SFES1-...-00500...	0.2 mm / 200 µm	0.050 mm / 50 µm
SFES1-...-00250...	0.4 mm / 400 µm	0.100 mm / 100 µm
SFES1-...-00200...	0.5 mm / 500 µm	0.125 mm / 125 µm
SFES1-...-00100...	1.0 mm / 1000 µm	0.250 mm / 250 µm

Resolution x1: reading 1 edge at every period.

Resolution x4: reading 4 edges at every period.

The 0 and /0 signals are generated every 100 mm (i.e. once per revolution).



NOTE

Please consider that the output position value is expressed in pulses. Thus you have then to convert the number of pulses 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.

The linear resolution of the encoder can be easily read in the order code.

Anyway it can be got from the following calculation; please consider that **the stroke per turn is 100 mm / 3.937"**.

The linear resolution results from the following calculation:

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

Then if you want to know the linear position value you will need to multiply the position value by the linear resolution.

Linear position value = transmitted position * linear resolution



EXAMPLE

Let's say we are connected to the SFES1-01500-H4-00500 type encoder. The resolution of the measuring device is 500 PPR.

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

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

$$\text{Linear resolution} = \frac{100 \text{ mm}}{500 \text{ PPR}} = 0.2 \text{ mm} = 200 \mu\text{m}$$

Let's say that the transmitted position value is: 123.

Thus the linear position value will be as follows:

Linear position value = transmitted position * linear resolution

Linear position value = 123 * 0.2 = 24.6 mm = 24,600 μm

6 Maintenance

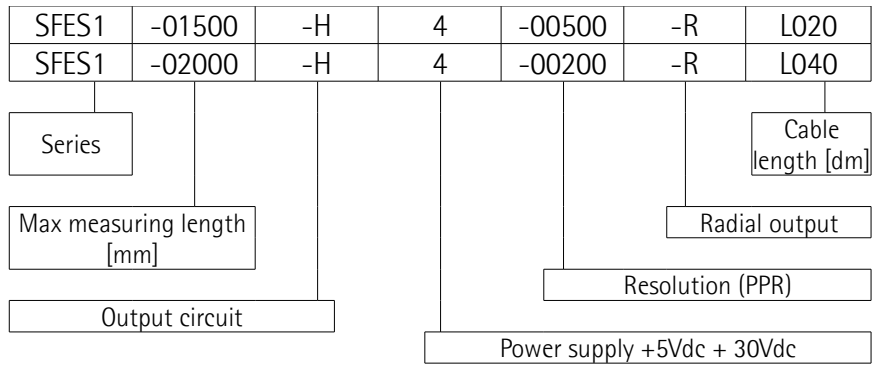
The measuring system does not need any particular maintenance; anyway it has to be handled with the utmost care as any delicate electronic equipment. From time to time we recommend the following operations:

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

7 Order code



EXAMPLES



Document release	Release date	Description	HW	SW	Installation file version
1.0	22.02.2012	First issue	-	-	-
1.1	13.04.2015	General revision	-	-	-
1.2	02.02.2023	New product name, new order code, Italian and English versions separated	-	-	-



Dispose separately

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