Series 3

LINEAR ENCODERS

FAGOR AUTOMATION

Open to your world

LINEAR
ENCODERS

OVER 45 YEARS OF CONTINUOUS EVOLUTION

Fagor Automation has been manufacturing high quality linear encoders using precision optical technology for more than 45 years.

Over the years Fagor has created, developed and patented systems, components and technologies that allow us to offer best quality and features over the complete range of product utilizing innovative production methods.

Hence making Fagor Automation the most efficient alternative in the world of feedback systems.

MODERN FACILITIES AND INNOVATIVE PROCESSES

In order to ensure quality and reliability in all its products Fagor Automation utilizes the most advanced technology and testing and manufacturing facilities. From centralized computer control temperature monitoring, cleanliness and relative humidity control, a must for the feedback system manufacturing process, to laboratories for climate, vibration and EMC testing to certify the designs.

WITH STATE-OF-THE-ART TECHNOLOGY

Fagor Automation's commitment to this technology and quality is evident by creation of **Aotek** in 2002, a dedicated research center providing various technological breakthroughs. This investment has resulted in large number of patents and customized solutions in electrical, optical and mechanical fields.

FAGOR TECHNOLOGY*

Steel-tape tensioner

3Statech Technology

FAGOR TECHNOLOGY*

Optical reading technology

(*) Over its history, Fagor Automation has developed its own technology, which has been registered in a large number of patents.

SUPERIOR TECHNOLOGY AND INNOVATIVE DESIGN

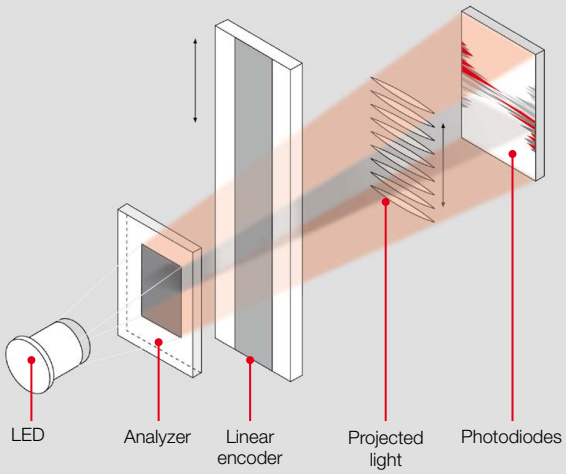
Fagor Automation develops with maximum professionalism the three cornerstones in encoder design: optical design, electronic design and mechanical design that result in a state-of-the-art product.

Optical design

In the vanguard of measurement technologies, Fagor Automation uses transmission and reflective optics in its range of encoders. With new scanning techniques, such as the new single-window scanning technology, more immune to contamination, which is critical for operations in extreme conditions, and contributes to attaining high quality signals that minimize interpolation errors, resulting in improved accuracy of the measurement system.

Electronic design

Fagor Automation uses latest generation integrated electronic components in their design. Owing to that, the optimization of the signals at high traversing speeds is achieved, with micrometric accuracy and nanometric resolution.



Mechanical design

Fagor Automation designs and manufactures the most innovative and reliable measuring systems using its advanced mechanical designs. These designs, together with the materials, provide the encoders with optimum robustness ensuring best performance in machine tool applications.

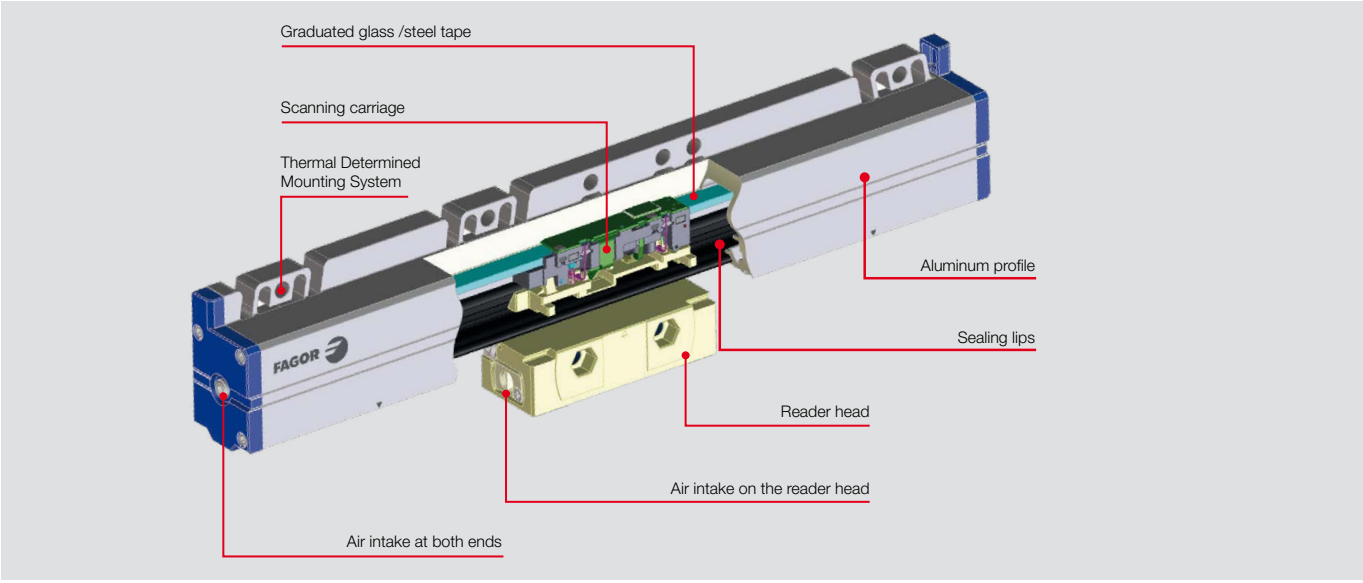
QUALITY

Accuracy certificate

Every single Fagor encoder is subjected to an extensive final accuracy check. This control is carried out on a computerized measuring bench equipped with a laser interferometer located inside a climate controlled chamber at 20 °C. The resulting final accuracy graph is supplied with every Fagor encoder.

The quality of the measurement is mainly determined by:

- Etching quality
- The quality of the scanning process
- The quality of the electronics that processes the signals



Thermal performance

When designing the encoders Fagor Automation has taken into account the effect of temperature change on their performance.

Most machine shops do not operate in temperature controlled environment hence affecting the accuracy of finished part. Using the Thermal Determined Mounting System which controls expansion/contraction, Fagor linear encoders can deliver consistent accuracy and repeatability.

For linear encoders more than three meters long, Fagor guarantees a thermal behavior identical to that of the machine surface it is mounted on thanks to the special mounting system at the end of the linear encoders.

The system is only available on
G3 and SV3 series linear encoders.

Enclosed design

The robust aluminum profile encasing the graduated glass provides the primary protection. The sealing lips provides protection against contaminants and liquids as the reader head travels along the profile. The reader head movement along the graduated glass provides a perfectly balanced system accurately capturing the machine movement. The reader heard travels on precision bearing with minimum contact with the profile hence minimizing the friction.

The optional air inlet at both ends of the encoder and at the reader head provides increased protection levels against contaminants and liquids.

Range

Analyze the application to make sure that the proper encoder will be selected for the machine.

To do this, bear in mind the following considerations:

Installation: Consider the physical length of the installation and the space available for it.
These aspects are crucial to determine the type of linear encoder to use (type of profile).

Accuracy: Each linear encoder comes with a graph showing its accuracy along its measuring length.

Signal: The signal selection considers the communication protocols compatible with the main CNC and drives manufacturers.

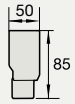
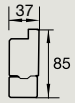
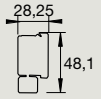
Resolution: The resolution of the control of machine-tools depends on the linear encoder.

Cable length: The length of the cable depends on the type of signal.

Compatibility: The signal must be compatible with the control system.

Speed: The speed requirements for the application must be analyzed before choosing the linear encoder.

Shock and Vibration: Fagor linear encoders withstand vibrations of up to 300 m/s² and shocks of up to 300 m/s².

Series	Section	Measuring lengths
L3B Wide		440 mm to 50 m
G3B Wide		140 mm to 3240 mm
S3B Reduced		70 mm to 1240 mm
SV3B Reduced		70 mm to 2040 mm

Technology

The absolute measurement system is a direct digital measure of machine position. It is fast, accurate and does not require homing of the machine. The position value is available from the moment the machine is turned on and may be requested by the connected device (CNC) at any time.

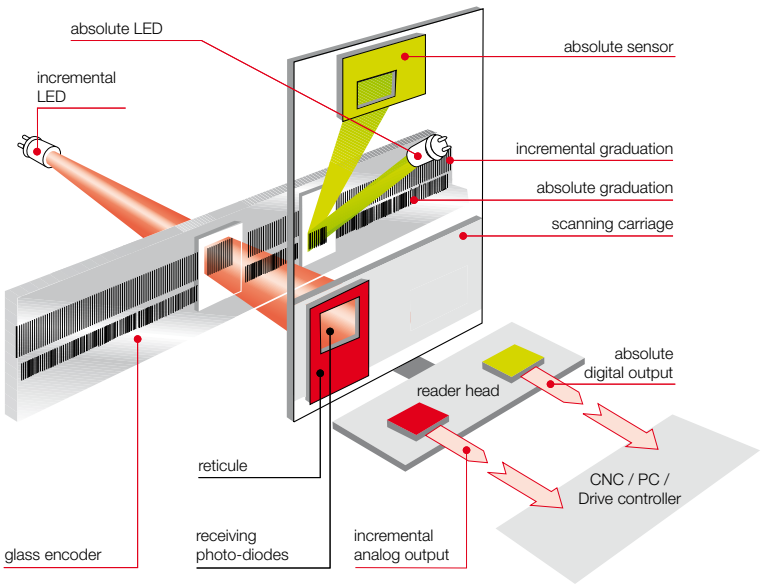
The absolute encoders provide direct measure of machine position without using any intermediate device. The positioning errors originating from machine mechanics are minimized as the encoder is directly mounted to the machine surface and the guide ways. The encoder sends the real machine movement data to the CNC and mechanical errors caused due to thermal behavior of the machine, pitch error compensation and backlash etc. are minimized.

The engraved graduation has two different etchings:

- **Incremental graduation:** Used to generate incremental signals that are counted inside the reader head.
  The incremental graduation also provides the 1 Vpp analog signals except in systems that only use digital signals.
- **Absolute graduation:** It is a unique code which is imprinted along the measuring length of encoder.
  The position in Fagor series 3 absolute encoders is calculated by employing their own patented technology **3STATECH**. The working principle is based upon the generation of a third state that can identify contamination in the measurement standard. Overall it means a technological evolution over other developments.

3Statech Technology

Graduated glass encoder (fig. 1)

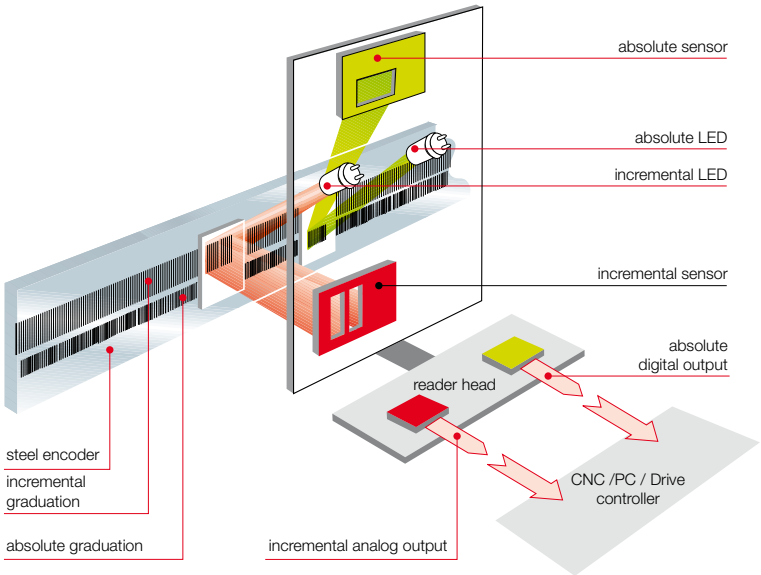


The specific characteristics of the engraved code, acquired in a high precisión optical sensor and the subsequent decoding in the electronic embedded software allows for the correct position calculation with less information.
The **3STATECH** technology provides enhanced resistance to contamination or stains which results in more robust performance of the encoders in hostile working environments.

Accuracy	Signals	Pitch Resolution up to	Model	Page
± 5 µm/m	SSI +1 Vpp FAGOR	0.1 µm	L3B	14
	SSI +1 Vpp SIEMENS®(*)	1 µm	L3BS	
	FANUC® / MITSUBISHI® / PANASONIC® / FAGOR / BiSS® C	0.01 µm (**)	L3BF / L3BM / L3BP / L3BD / L3BBC	
	SIEMENS®(*)		L3BD + EC-PA-DQ1-M	
± 5 µm/m and ± 3 µm/m	SSI +1 Vpp FAGOR / SIEMENS®(*)	0.1 µm	G3B / G3BS	16
	FANUC® / MITSUBISHI® / PANASONIC® / FAGOR / BiSS® C	0.001 µm (**)	G3BF / G3BM / G3BP / G3BD / G3BBC	
	SIEMENS®(*)		G3BD + EC-PA-DQ1-M	
		0.01 µm	G3BD-FS + EC-PA-DQS-M	
	YASKAWA®	0.009765625 µm	G3BK	
± 5 µm/m and ± 3 µm/m	SSI +1 Vpp FAGOR / SIEMENS®(*)	0.1 µm	S3B / S3BS	18
	FANUC® / MITSUBISHI® / PANASONIC® / FAGOR / BiSS® C	0.001 µm (**)	S3BF / S3BM / S3BP / S3BD / S3BBC	
	SIEMENS®(*)		S3BD + EC-PA-DQ1-M	
		0.01 µm	S3BD-FS + EC-PA-DQS-M	
± 5 µm/m and ± 3 µm/m	SSI +1 Vpp FAGOR / SIEMENS®(*)	0.1 µm	SV3B / SV3BS	20
	FANUC® / MITSUBISHI® / PANASONIC® / FAGOR / BiSS® C	0.001 µm (**)	SV3BF / SV3BM / SV3BP / SV3BD / SV3BBC	
	SIEMENS®(*)		SV3BD + EC-PA-DQ1-M	
		0.01 µm	SV3BD-FS + EC-PA-DQS-M	

(*) SIEMENS®: valid for family Solution Line and Sinumerik One.
(**) 0.00125 µm for FANUC®.

Graduated steel encoder (fig. 2)



Linear encoders

Fagor Automation uses the the following measuring methods in their absolute linear encoders:

- **Graduated glass (fig. 1):** Linear encoders with a measuring length of up to 3240 mm use optical transmission and reflection methods with a graduated glass:
  - The reflection method is used for the absolute graduation reading. The light beam emitted by an LED is reflected on a graduated glass, through a reticle and received on the sensor.
  - The transmission method is used for the incremental graduation reading. The light beam emitted by an LED goes through a graduated glass and a reticle to the single window receptor photodiode. The period of the generated electrical signals is the same as the graduation pitch.
- **Graduated steel (fig. 2):** Linear encoders with a measuring length over 3240 mm use optical reflection with a graduated steel tape:
  - The reflection method is used for the absolute graduation reading. The light beam emitted by an LED is reflected on a graduated steel tape, through a reticle and received on the sensor.
  - The incremental graduation reading is based on the autoimage principle by means of diffuse light reflected on the graduated steel tape. The reading system consists of one LED, as the lightsource of the linear encoder; a grating that makes the image and a monolithic photo detector element in the plane of the image specially designed and patented by Fagor Automation.

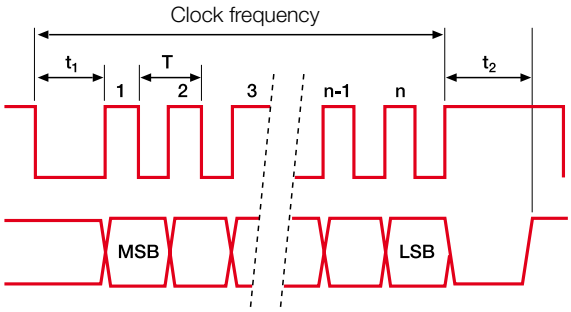
ELECTRICAL OUTPUT

SIGNALS

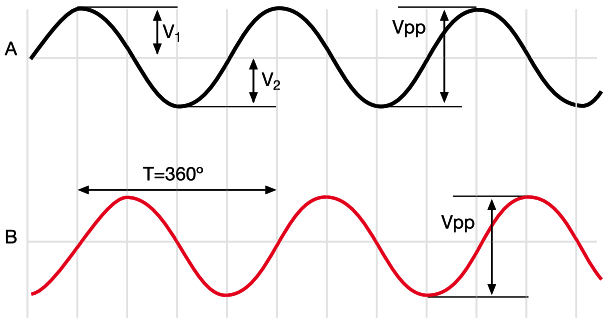
They are defined according to the communication protocol.
Protocols are specific communication languages used by linear encoders to communicate with the machine controller (CNC, drive, PLC, etc.).

There are different communication protocols depending on the CNC and drive manufacturer. Fagor Automation offers absolute encoders with different communication protocols compatible with the main CNC and drive manufacturers on the market such as FAGOR, FANUC®, SIEMENS®, MITSUBISHI®, PANASONIC® and others.

Absolute



1 Vpp differential



FAGOR systems

Fagor FeeDat® Serial Interface

These systems only use digital signals.
The absolute encoder is connected through QUERCUS drive system.

A high communication speed of 10 MHz provides a loop time of 10 microseconds. Communication also includes alarms, analog signal values and other encoder parameters.

Fagor FeeDat® is an open communication protocol that is also used to communicate with other CNC system manufacturers.

SIEMENS® systems

DRIVE-CLiQ® Interface

These systems only use digital signals.
The absolute encoder is connected through a cable having the electronics integrated into the connector and it is connected to the Solution Line and Sinumerik One families without the need for intermediate modules.

YASKAWA® Systems

Linear Encoder Serial Communication Interface

These systems only use digital signals.
The absolute encoder is connected through the Sigma series drive.

Sistemas FANUC®

Serial Interface for position feedback encoder

These systems only use digital signals. The absolute encoder is connected through the SDU (Separate Detector Unit) device and is valid for communication protocol versions FANUC® α and αi serial interface.

MITSUBISHI® systems

High Speed Serial Interface - HSSI

These systems only use digital signals. The absolute encoder is connected through the MDS Series drive and it is valid for MITSUBISHI® communication protocol versions Mit 03-2/4.

PANASONIC® systems

Serial Communication

These systems only use digital signals. The absolute encoder is connected through the MINAS series drive.

- The systems can be connected to linear motors, rotary motors and DD motors.
- Automatic drive/motor matching software available.
- Vibration, resonance suppression filters available with setting done automatically / manually.
- Drive range from 50 W to 15 kW at AC 100 V / 200 V / 400 V.
- Safety Torque Off feature available.

Systems with SSI or BiSS® C

The SSI or BiSS® C communication interfaces are widely implemented among manufacturers of drive and control systems (FAGOR, SIEMENS®, etc.). These systems and the absolute encoders with SSI or BiSS® C interfaces can be connected as long as they are compatible.

1. Systems with Serial Synchronous Interface - SSI

These systems synchronize the SSI interface with the sinusoidal 1 Vpp signals. Once the absolute position has been obtained through the SSI interface, the encoders keep operating with incremental 1 Vpp signals.

A. FAGOR systems

ABSOLUTE signals

Transmission	SSI synchronous serial transfer via RS 485
Levels	EIA RS 485
Clock frequency	100 kHz - 500 kHz
Max. bit (n)	32
T	1 µs + 10 µs
t_1	> 1 µs
t_2	20 µs - 35 µs
SSI	Binary
Parity	No

1 Vpp DIFFERENTIAL signals

Signals	A, /A, B, /B
V_{App}	1 V +20 %, -40 %
V_{Bpp}	1 V +20 %, -40 %
DC offset	2.5 V ±0.5 V
Signal period	20, 40 µm
Supply V	5 V ±10 %
Max. cable length	75 meters
A, B centered: $\|V_1-V_2\| / 2\ V_{pp}$	< 0.065
A&B relationship V_{App} / V_{Bpp}	0.8÷1.25
A&B phase shift	90 °±10 °

B. SIEMENS® Systems

The connection of absolute encoders to SIEMENS® systems is made through the SME 25 or SMC 20 modules of the Solution Line and Sinumerik One family.

ABSOLUTE signals

Transmission	SSI synchronous serial transfer via RS 485
Levels	EIA RS 485
Clock frequency	100 kHz - 500 kHz
Max. bit (n)	28
T	1 µs + 10 µs
t_1	> 1 µs
t_2	20 µs - 35 µs
SSI	Gray
Parity	Yes

1 Vpp DIFFERENTIAL signals

Signals	A, /A, B, /B
V_{App}	1 V +20 %, -40 %
V_{Bpp}	1 V +20 %, -40 %
DC offset	2.5 V ±0.5 V
Signal period	20, 40 µm
Supply V	5 V ±10 %
Max. cable length	100 meters
A, B centered: $\|V_1-V_2\| / 2\ V_{pp}$	< 0.065
A&B relationship V_{App} / V_{Bpp}	0.8÷1.25
A&B phase shift	90 °±10 °

C. Other systems

Please contact FAGOR for information on compatibility of the encoders with other systems.

2. Systems with BiSS® C interface

These systems use digital + 1 Vpp sinusoidal signals or only digital signals.

The absolute encoder with BiSS® C BP3 protocol is compatible with BiSS® C Unidirectional.

The absolute encoder is connected to the drive or system with BiSS® C BP3 or BiSS® C unidirectional interface. Please contact FAGOR for information on compatibility of the encoders with these systems.

FUNCTIONAL SAFETY

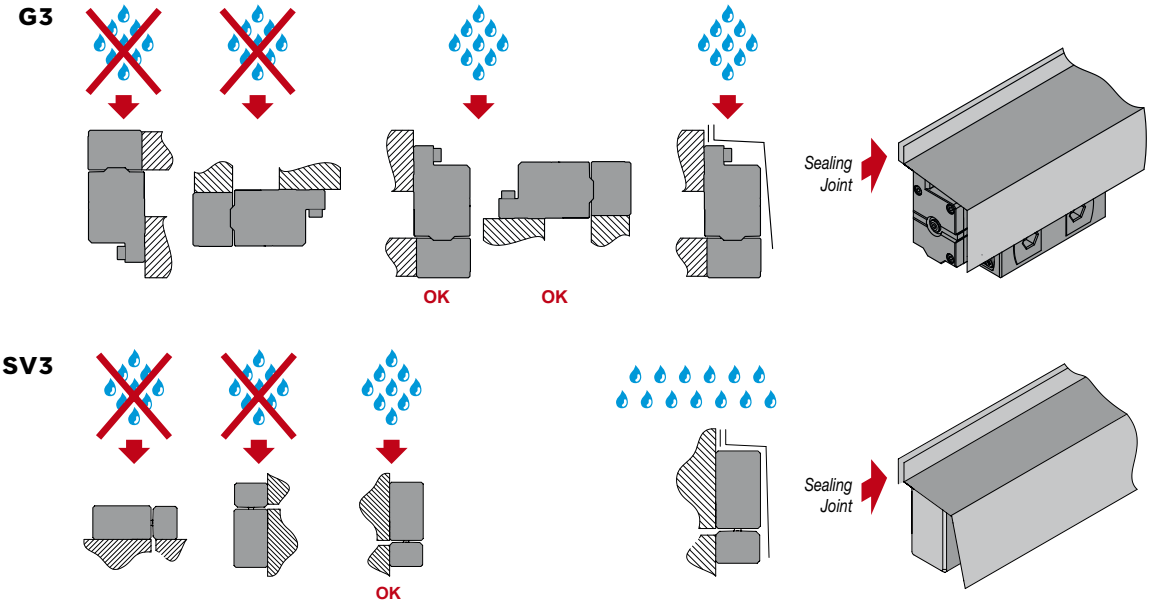
SYMBOLS THAT MAY APPEAR IN THIS CATALOG

WARNING or caution symbol.
It warns about a potentially dangerous situation. Ignoring this warning may cause serious injuries (even fatal) or damages to the unit.

MANDATORY symbol.
It warns about actions and operations that MUST BE carried out. THEY ARE NOT RECOMMENDATIONS. Ignoring this warning may mean non-compliance of some safety regulation.

Mounting

In the application, the encoder must be protected against solids and liquids ingress. Do not orient the sealing lips against pollution sources. See other protection considerations in the Protection section.



Mechanical fault exclusion for the fixation to the machine

In a safety application the fault of loosening or losing of attachment of the encoder readhead and the encoder profile to the machine must be eliminated because it cannot be guaranteed that these faults will be detected by the control. For this reason the mounting instructions in the mounting manual must be strictly followed and an adhesive screw lock (medium strength adhesive) must be used for the screws to fix the encoder readhead and the encoder profile to the machine. Also, the specified maximum acceleration and vibration must not be exceeded for the encoder readhead and for the encoder profile.

Thermal fixed point - Thermal expansion

The error in position due to thermal expansion is not included in the Safe Position Tolerance and must be taken into account for a safety related application. The graduated pattern substrate is made of glass with α_{therm}: 8 ppm/K aprox.

For the G3 and SV3 scale

The system for fixation of the scale profile to the machine is designed so that the thermal fix point used in the profile or spar determines which point of the graduated scale is fixed. At a temperature different from 20ºC the rest of the scale suffers line thermal expansion (or contraction) in the measurement lenght. The expansion or contraction is that of the glass scale inside the scale profile (and is not dependant on the expansion coefficient of the machine material). Thermal expansion or contraction of the graduated scale leads to an error in position.

For the S3 scale

The scale profile is fixed to the machine at both ends. At a temperature different from 20ºC the scale suffers line thermal expansion (or contraction) in the measurement length that leads to an error in position that depends on the construction of the machine.

For the readhead

Additional error due to thermal expansion of the part of the machine where the readhead of the encoder is fixed is dependant on the thermal expansion coefficient of the material of the machine and could lead to further position error.

The specific application must account for the corresponding position error related to thermal displacement of the readhead and whether it might lead to a dangerous error or not.

Replaceable parts

The encoders have a service life of 20 years. Maintenance is not required. However, several components may suffer from wear or degradation depending on the application.

In particular, due to the wide range of chemical compositions of lubricant and coolant fluids available, it cannot be ensured that the sealing lips will not lose performance. For this reason the sealing lips must be replaced when inspection shows wear or degradation.

The following components must be replaced when inspection shows wear or degradation:
- cables with frequent flexing
- sealing lips

Fault reaction time

The fault reaction time for the encoder system is the time elapsed from the occurrence of a fault in the encoder and the corresponding reaction takes place in the control Unit.
It can be calculated as:
- Time to communicate the fault to the Control Unit + Time needed for the Control Unit to react.
- Time to communicate the fault to the Control Unit ≤ 2 * The DRIVE-CLiQ® cycle time used to operate the encoder.
- Time needed for the Control Unit to react: This is competence of the builder of the Control Unit or the machine.

The overall fault reaction time for the encoder system may be suitable or not depending on the application or safety concept of the overall machine.

Installation manual

There is important information in the installation manual to ensure the correct installation of the encoder.
- Installation manual: LINEAR ENCODER MODEL G3BD-FS: 14460305
- Installation manual: LINEAR ENCODER MODEL S3BD-FS: 14460331
- Installation manual: LINEAR ENCODER MODEL SV3BD-FS: 14460332
- Installation manual: SPAR FOR LINEAR ENCODER SV3: B3 14460319

Startup time

The encoder is ready to answer to DRIVE-CLiQ® requests 2s after power supply of the encoder.

Electrical Safety

The power supply must be SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage).

System Test

The encoder is a component for integration in a larger system. The specifications in this catalog only apply to the specific encoder, not to the whole system. Installation or operation of the encoder outside of the specified conditions is at the user's own risk.
Comprehensive tests of the whole system must be carried out in order to ensure that the encoder works in the range of specified conditions. In particular, **vibration** conditions depend on the whole system, so the whole system must be tested to ensure operation within the limits specified for vibration.

Site Acceptance Test

The Site Acceptance Test is mandatory in order to guarantee the safety capability of the installed encoder system. The following points must be additionally checked in order to pass the Site Acceptance Test:
- The encoder serial number displayed in the Control Unit matches the serial number printed in the encoder label.
- The encoder resolution parameter shown in the Control Unit matches the values in the encoder label.

Functional Safety

Safety functions

The safety functions of the encoder are:

– **Safe Absolute Position:** The encoder always provides a safe absolute position value. This means that the encoder always provides an absolute value for the position that is correct within the safe position tolerance when the error bits are not set.

– **Safe Communication:** The encoder communicates two independently generated position values and error bits.

This allows a wide range of safety functions to be implemented in the control.

Functional Safety

Safety Capability

The encoder system with Functional Safety has the following characteristics related to the safety according to ISO13849-1:2015 and IEC61508:2010 norms.

Safety Capability according ISO 13849-1: 2015 and IEC61508: 2010

	EC-PA-DQS + G3BD-FS **EC-PA-DQS + S(V)3BD-FS**
MTTFd (years) (2000 m above sea level)	66.75 years
DC (%)	99
Category	3
Performance level, PL	d
PFH (2000 m above sea level)	$19.48 \cdot 10^{-9}$
Safe Position Tolerance	+1738 µm, -210 µm (safety-related measuring step 200 µm)
For applications up to	SIL 2

The encoder system also complies with IEC61800-5-2:2017

Protection

Enclosed **linear encoders** meet the protection requirements IP 53 of the **IEC 60529** standard when mounted so water splashes don't hit the sealing lips directly. For further protection, a separate protection guard must be mounted.

If the encoder is exposed to liquids and vapor, compressed air has to be used to achieve a protection degree of IP 64 and prevent any contamination from getting inside. For these cases, Fagor Automation recommends their Air Filter unit AI-1000.

The **quality of air** supplied to the encoder must be 1/4/1 according to **ISO 8573-1**:2010. To achieve this air class, the air supplied to the AI-1000 unit must fulfil class 5/6/4 according to ISO 8573-1:2010.

For more information see the AI-1000 catalog and manual.

Safety switch

In order to guarantee the air flux it is necessary to install a **safety switch** capable of activating an alarm when the pressure gets below 60 % of the nominal pressure.

L3B series

Linear encoder with small reader head, air purge and connector at both ends, with threaded head for different mounting options without the need for nuts.

Its special mechanical extrusion design, protective lips and securing points on the linear encoder, the high quality optical components and powerful FPGA-based electronics using advanced embedded algorithms allow for the reduction of errors to ensure the accuracy and repeatability of linear encoders. From 4 meters onwards the module ends machining design together with an outstanding rubber seal allow for an easy installation and ensure the protection against liquids in the joints.

This results in linear encoders especially suited for hostile work environments in settings requiring high speed and vibration standards.

Measuring lengths in millimeters

Available in measuring lengths from 440 mm to 50 m in 200 mm increments. Contact Fagor Automation for custom solutions if your application requires longer lengths.

Model description:

L3B: Absolute linear encoders with SSI protocol for FAGOR and others.

L3BS: Absolute linear encoders with SSI protocol for SIEMENS® (Solution Line).

L3BF: Absolute linear encoders with FANUC® (α and αi) protocol.

L3BM: Absolute linear encoders with MITSUBISHI® CNC protocol.

L3BP: Absolute linear encoders with PANASONIC® (Matsushita) protocol.

L3BD: Absolute linear encoders with FeeDat® protocol for FAGOR and others.

L3BD + EC-PA-DQ1-M: Absolute linear encoders with DRIVE-CLiQ® protocol, for SIEMENS® (Solution Line and Sinumerik One).

L3BBC: Absolute linear encoders with BiSS® C protocol.

Characteristics

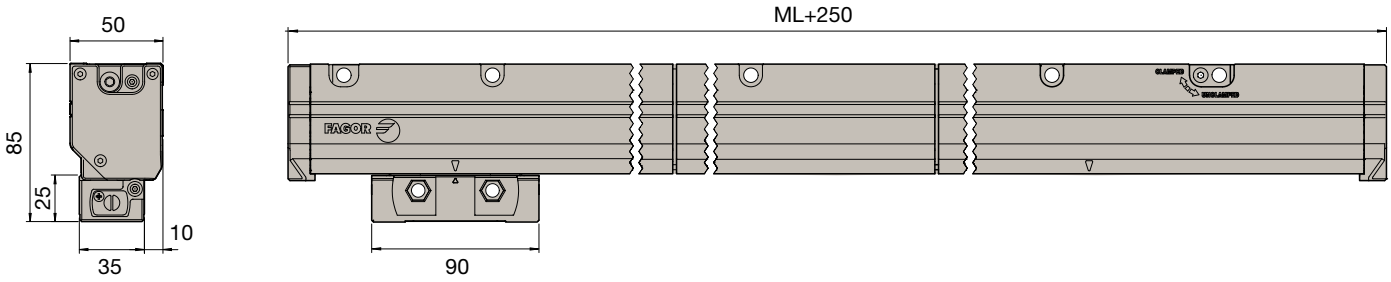
	L3B/L3BS	L3BF	L3BM L3BP	L3BD	L3BD + EC-PA-DQ1-M	L3BBC
Measurement	**Incremental:** By means of a 40 µm-pitch graduated stainless steel tape **Absolute:** Optical reading of sequential binary code					
Steel tape thermal expansion coefficient	α_{therm}: 11 ppm/K aprox.					
Measuring resolution	0.1 µm / 1 µm	Interface α: 0.05 µm / 0.01 µm Interface αi: 0.0125 µm / 0.00125 µm	0.01 µm / 0.05 µm	0.01 µm / 0.05 µm	0.01 µm / 0.05 µm	0.01 µm / 0.05 µm
Output signals	~ 1 Vpp	–	–	–	–	(**)
Incremental signal period	40 µm	–	–	–	–	–
Limit frequency	< 75 kHz for 1 Vpp	–	–	–	–	–
Maximum cable length	75 m (*) 100 m	50 m	30 m	100 m	30 m	50 m
Supply voltage	5V ± 10 %, < 250 mA (without load)					
Accuracy	± 5 µm/m					
Maximum speed	210 m/min					
Maximum vibration	Profile: 200 m/s² (55 ... 2000 Hz) IEC 60068-2-6 Reader head: 300 m/s² (55 ... 2000 Hz) IEC 60068-2-6					
Maximum shock	300 m/s² (11 ms) IEC 60068-2-27					
Maximum acceleration	100 m/s² in the measuring direction					
Required moving force	< 5 N					
Operating temperature	0 °C ... 50 °C					
Storage temperature	-20 °C ... 70 °C					
Weight	1.5 kg + 5 kg/m					
Relative humidity	20 ... 80 %					
Protection	IP 53 (standard) IP 64 (DIN 40050) using pressurized air at 0.8 ± 0.2 bar in linear encoders					
Reader head	With built-in connector Connection at both ends of the reader head					

(*) Contact Fagor Automation for other lengths.

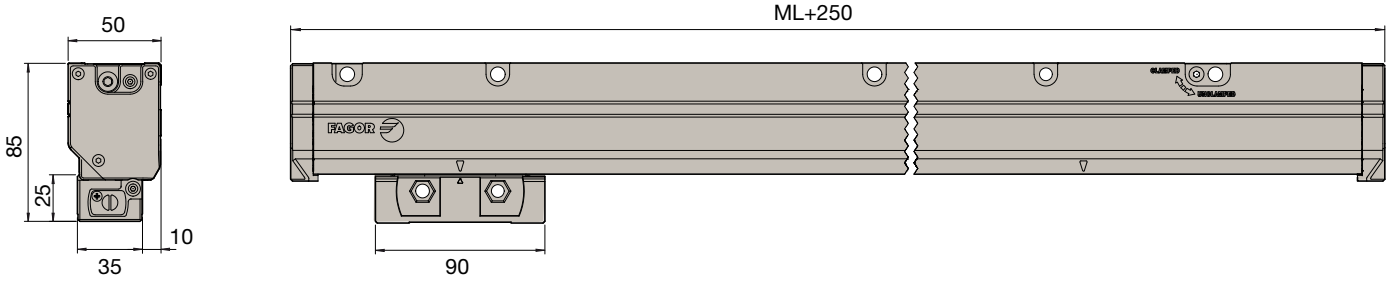
(**) Consult Fagor Automation for analog output signals.

Modular L3B model

Dimensions in mm



Single L3B model



Additional information can be found in the technical documentation and installation manual available on the website ***www.fagorautomation.com***

Order identification

Example of Linear Encoder: L3BF10-4640

L3	B	F	10	4640			
Type of profile for long space	***Letter identifying the absolute encoder***	***Type of communications protocol (1):*** • Blank space: SSI protocol (FAGOR) • D: FeeDat® protocol (FAGOR) (*) • S: SSI SIEMENS® (SL) protocol • **F: FANUC® (α and αi) protocol** • M: MITSUBISHI® CNC protocol • P: PANASONIC® (Matsushita) protocol • BC: BiSS® C protocol	***Resolution (2):*** • Blank space: (**) • 50: 0.05 µm • **10: 0.01 µm**	***Measuring lengths in millimeters:*** In the example (4640) = 4 640 mm	***Accuracy of the linear encoder:*** • **Blank space: ± 10 µm/m** • 5: ± 5 µm/m (***)	***Version:*** • **Blank space: standard** • M: mirror	***Threaded head:*** • **Blank space: M8** • T: M6

(1): contact Fagor Automation for availability.

(2): not all combinations of protocol and resolution are possible.
The characteristics table indicates the resolutions available for each protocol.

(*) plus EC-PA-DQ1-M with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One).

(**) only for SSI models SSI: Up to 0.1 µm FAGOR;
Up to 1 µm SIEMENS® (Solution Line and Sinumerik One).

(***) only for single module models.

G3B series

Linear encoder with small reader head, air purge and connector at both ends, with threaded head for different mounting options without the need for nuts.

Its special mechanical extrusion design, protective lips and securing points on the linear encoder, the high quality optical components and powerful FPGA-based electronics using advanced embedded algorithms allow for the reduction of errors to ensure the accuracy and repeatability of linear encoders.

This results in linear encoders especially suited for hostile work environments in settings requiring high speed and vibration standards.

Measuring lengths in millimeters

140 • 240 • 340 • 440 • 540 • 640 • 740 • 840 • 940 • 1 040 • 1 140 • 1 240 • 1 340 • 1 440 • 1 540 • 1 640 • 1 740 • 1 840 • 2 040 • 2 240 • 2 440 • 2 640 • 2 840 • 3 040 • 3 240

Model description:

G3B: Absolute linear encoders with SSI protocol for FAGOR and others.
G3BS: Absolute linear encoders with SSI protocol for SIEMENS® (Solution Line).
G3BF: Absolute linear encoders with FANUC® (α and αi) protocol.
G3BM: Absolute linear encoders with MITSUBISHI® CNC protocol.
G3BP: Absolute linear encoders with PANASONIC® (Matsushita) protocol.
G3BD + EC-PA-DQ1-M: Absolute linear encoders with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One).
G3BD-FS + EC-PA-DQS-M: Absolute linear encoders with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One) with Functional Safety.
G3BD: Absolute linear encoders with FeeDat® protocol for FAGOR and others.
G3BBC: Absolute linear encoders with BiSS® C protocol.
G3BK: Absolute linear encoders with YASKAWA® protocol.

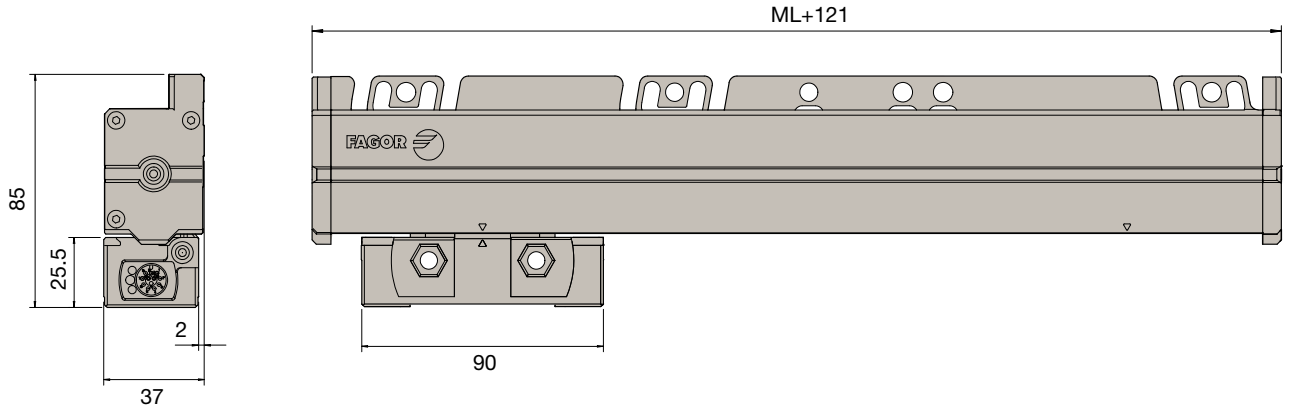
Characteristics

	G3B / G3BS	G3BF	G3BM / G3BP / G3BD+ EC-PA-DQ1-M	G3BD-FS+ EC-PA-DQS-M	G3BD	G3BBC	G3BK
Measurement	**Incremental:** By means of a 20 µm-pitch graduated glass **Absolute:** Optical reading of sequential binary code						
Glass thermal expansion coefficient	α_{therm}: 8 ppm/K aprox.						
Measuring resolution	0.1 µm	Interface α: 0,05 µm / 0.01 µm Interface αi: 0.0125 µm / 0.00125 µm	0.001 µm / 0.01 µm	0.01 µm / 0.05 µm	0.001 µm / 0.01 µm	0.001 µm / 0.01 µm	0.009765625 µm / 0.078125 µm
Output signals	~ 1 Vpp	–	–	–	–	(**)	–
Incremental signal period	20 µm	–	–	–	–	–	–
Limit frequency	< 150 kHz for 1 Vpp	–	–	–	–	–	–
Maximum cable length	75 m (*) / 100 m	50 m	30 m	30 m	100 m	50 m	30 m
Supply voltage	5V ± 10 %, < 250 mA (without load)						
Accuracy	± 5 µm/m ± 3 µm/m						
Maximum speed	210 m/min			180 m/min	210 m/min		
Maximum vibration	300 m/s² (55 ... 2000 Hz) IEC 60068-2-6 / 200 m/s² [for **G3BD-FS** model]						
Maximum shock	300 m/s² (11 ms) IEC 60068-2-27						
Maximum acceleration	100 m/s² in the measuring direction						
Required moving force	< 5 N						
Operating temperature	0 °C ... 50 °C						
Storage temperature	-20 °C ... 70 °C						
Weight	0.25 kg + 2.25 kg/m						
Relative humidity	20 ... 80 %						
Protection	IP 53 (standard) IP 64 (DIN 40050) using pressurized air at 0.8 ± 0.2 bar in linear encoders						
Reader head	With built-in connector Connection at both ends of the reader head						

(*) Contact Fagor Automation for other lengths.
(**) Consult Fagor Automation for analog output signals.

G3B model

Dimensions in mm



Additional information can be found in the technical documentation and installation manual available on the website ***www.fagorautomation.com***

Order identification

Example of Linear Encoder: G3BD10-1640-5-T-FS

G3	B	D	10	1640	5	T	FS
Type of profile for ample space, small head	***Letter identifying the absolute encoder***	***Type of communications protocol (1):*** • Blank space: SSI protocol (FAGOR) • **D: FeeDat® protocol (FAGOR) (*)** • S: SSI SIEMENS® (SL) protocol • F: FANUC® (α and αi) protocol • M: MITSUBISHI® CNC protocol • P: PANASONIC® (Matsushita) protocol • BC: BiSS® C protocol • K: YASKAWA® protocol	***Resolution (2):*** • Blank space: up to 0.1 µm (**) • 01: 0.001 µm • 50: 0.05 µm • **10: 0.01 µm** • 211: 0.009765625 µm (***) • 208: 0.078125 µm (***)	***Measuring lengths in millimeters:*** In the example (1640) = 1 640 mm	***Accuracy of the linear encoder:*** • **5: ± 5 µm** • 3: ± 3 µm	***Threaded head:*** • Blank space: M8 • **T: M6**	***Safety:*** • Blank space: No • **FS: Functional Safety** (****)

(1): contact Fagor Automation for availability.

(2): not all combinations of protocol and resolution are possible.
The characteristics table indicates the resolutions available for each protocol.

(*) plus EC-PA-DQ1-M with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One).

(**) only for SSI models.

(***) only for YASKAWA® models.

(****) only for G3BD + EC-PA-DQS-M with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One) with Functional Safety.

S3B series

Linear encoder with small reader head, with threaded head for different mounting options without the need for nuts.

The linear encoder special mechanical extrusion design, protective lips and end caps, its high quality optical components and powerful FPGA-based electronics using advanced embedded algorithms allow for the reduction of errors to ensure accuracy and repeatability for the linear encoders.

This results in linear encoders especially suited for hostile work environments in settings requiring high speed and vibration standards.

Measuring lengths in millimeters

70 • 120 • 170 • 220 • 270 • 320 • 370 • 420 • 470 • 520 • 570 • 620 • 670 • 720 • 770 • 820 • 870 • 920 • 1 020 • 1 140 • 1 240

Model description:

S3B: Absolute linear encoders with SSI protocol for FAGOR and others.
S3BS: Absolute linear encoders with SSI protocol for SIEMENS® (Solution Line).
S3BF: Absolute linear encoders with FANUC® (α and αi) protocol.
S3BM: Absolute linear encoders with MITSUBISHI® CNC protocol.
S3BP: Absolute linear encoders with PANASONIC® (Matsushita) protocol.
S3BD + EC-PA-DQ1-M: Absolute linear encoders with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One).
S3BD-FS + EC-PA-DQS-M: Absolute linear encoders with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One) with Functional Safety.
S3BD: Absolute linear encoders with FeeDat® protocol for FAGOR and others.
S3BBC: Absolute linear encoders with BiSS® C protocol.

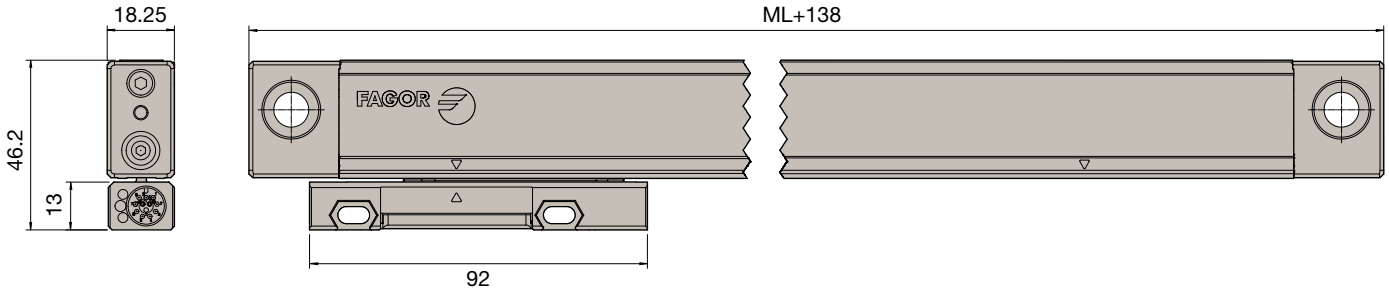
Characteristics

	S3B / S3BS	S3BF	S3BM / S3BP / S3BD+ EC-PA-DQ1	S3BD-FS+ EC-PA-DQS-M	S3BD	S3BBC
Measurement	**Incremental:** By means of a 20 µm-pitch graduated glass **Absolute:** Optical reading of sequential binary code					
Glass thermal expansion coefficient	α_{therm}: 8 ppm/K aprox.					
Measuring resolution	0.1 µm	Interface α: 0.05 µm / 0.01 µm Interface αi: 0.0125 µm / 0.00125 µm	0.001 µm / 0.01 µm	0.01 µm / 0.05 µm	0.001 µm / 0.01 µm	0.001 µm / 0.01 µm
Output signals	~ 1 Vpp	–	–	–	–	(**)
Incremental signal period	20 µm	–	–	–	–	–
Limit frequency	< 150 kHz for 1 Vpp	–	–	–	–	–
Maximum cable length	75 m (*) / 100 m	50 m	30 m	30 m	100 m	50 m
Supply voltage	5V ± 10 %, < 250 mA (without load)					
Accuracy	± 5 µm/m ± 3 µm/m					
Maximum speed	210 m/min			180 m/min	210 m/min	
Maximum vibration	Profile: 100 m/s² (55 ... 2000 Hz) IEC 60068-2-6 Reader head: 200 m/s² (55 ... 2000 Hz) IEC 60068-2-6					
Maximum shock	300 m/s² (11 ms) IEC 60068-2-27					
Maximum acceleration	100 m/s² in the measuring direction					
Required moving force	< 4 N					
Operating temperature	0 °C ... 50 °C					
Storage temperature	-20 °C ... 70 °C					
Weight	0.2 kg + 0.50 kg/m					
Relative humidity	20 ... 80 %					
Protection	IP 53 (standard) IP 64 (DIN 40050) using pressurized air at 0.8 ± 0.2 bar in linear encoders					
Reader head	With built-in connector					

(*) Contact Fagor Automation for other lengths.
(**) Consult Fagor Automation for analog output signals.

S3B model

Dimensions in mm



Additional information can be found in the technical documentation and installation manual available on the website ***www.fagorautomation.com***

Order identification

Example of Linear Encoder: S3BD10-1140-5-T-FS

S3	B	D	10	1140	5	T	FS
Type of profile for reduced space: • **S3: Standard mounting for vibrations of up to 100 m/s²**	***Letter identifying the absolute encoder***	***Type of communications protocol (1):*** • Blank space: SSI protocol (FAGOR) • **D: FeeDat® protocol (FAGOR) (*)** • S: SSI SIEMENS® (SL) protocol • F: FANUC® (α and αi) protocol • M: MITSUBISHI® CNC protocol • P: PANASONIC® (Matsushita) protocol • BC: BiSS® C protocol	***Resolution (2):*** • Blank space: up to 0.1 µm (**) • 01: 0.001 µm • 50: 0.05 µm • **10: 0.01 µm**	***Measuring lengths in millimeters:*** In the example (1140) = 1 140 mm	***Accuracy of the linear encoder:*** • **5: ± 5 µm** • 3: ± 3 µm	***Threaded head:*** • Blank space: No • **T: M4**	***Safety:*** • Blank space: No • **FS: Functional Safety** (***)

(1): contact Fagor Automation for availability.

(2): not all combinations of protocol and resolution are possible.
The characteristics table indicates the resolutions available for each protocol.

(*) plus EC-PA-DQ1-M with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One).

(**) only for SSI models.

(***) only for S3BD + EC-PA-DQS-M with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One) with Functional Safety.

SV3B series

Linear encoder with small reader head, with threaded head for different mounting options without the need for nuts.

The linear encoder special mechanical extrusion design, protective lips and end caps, its high quality optical components and powerful FPGA-based electronics using advanced embedded algorithms allow for the reduction of errors to ensure accuracy and repeatability for the linear encoders.

The mounting spar has small dimensions and also a particular design of the fixing points. To ease the installation top or bottom alternatives are provided to secure the encoder.

This results in linear encoders especially suited for hostile work environments in settings requiring high speed and vibration standards.

Measuring lengths in millimeters

70 • 120 • 170 • 220 • 270 • 320 • 370 • 420 • 470 • 520 • 570 • 620 • 670 • 720 • 770 • 820 • 870 • 920 • 970 • 1.020 • 1.070 • 1 140 • 1 240 • 1 340 • 1 440 • 1 540 • 1 640 • 1 740 • 1 840 • 2 040

Model description:

SV3B: Absolute linear encoders with SSI protocol for FAGOR and others.

SV3BS: Absolute linear encoders with SSI protocol for SIEMENS® (Solution Line).

SV3BF: Absolute linear encoders with FANUC® (α and αi) protocol.

SV3BM: Absolute linear encoders with MITSUBISHI® CNC protocol.

SV3BP: Absolute linear encoders with PANASONIC® (Matsushita) protocol.

SV3BD + EC-PA-DQ1-M: Absolute linear encoders with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One).

SV3BD-FS + EC-PA-DQS-M: Absolute linear encoders with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One) with Functional Safety.

SV3BD: Absolute linear encoders with FeeDat® protocol for FAGOR and others.

SV3BBC: Absolute linear encoders with BiSS® C protocol.

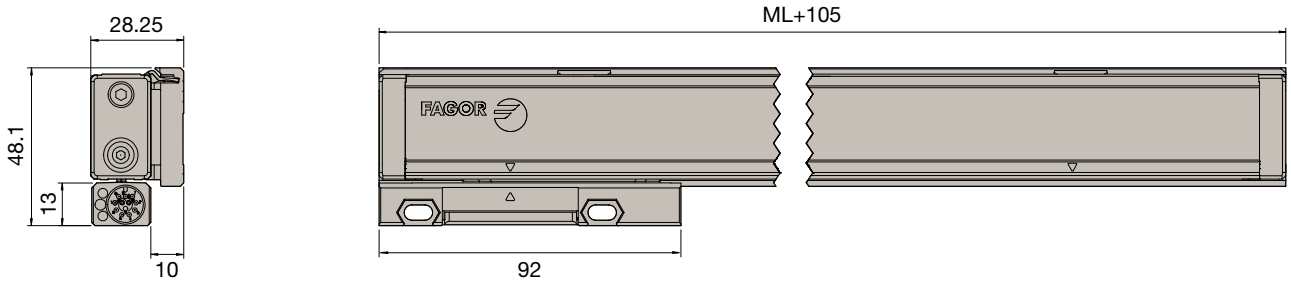
Characteristics

	SV3B / SV3BS	SV3BF	SV3BM / SV3BP / SV3BD+ EC-PA-DQ1	SV3BD-FS+ EC-PA-DQS-M	SV3BD	SV3BBC
Measurement	**Incremental:** By means of a 20 µm-pitch graduated glass **Absolute:** Optical reading of sequential binary code					
Glass thermal expansion coefficient	α_{therm}: 8 ppm/K aprox.					
Measuring resolution	0.1 µm	Interface α: 0.05 µm / 0.01 µm Interface αi: 0.0125 µm / 0.00125 µm	0.001 µm / 0.01 µm	0.01 µm / 0.05 µm	0.001 µm / 0.01 µm	0.001 µm / 0.01 µm
Output signals	~ 1 Vpp	–	–	–	–	(**)
Incremental signal period	20 µm	–	–	–	–	–
Limit frequency	< 150 kHz for 1 Vpp	–	–	–	–	–
Maximum cable length	75 m (*) / 100 m	50 m	30 m	30 m	100 m	50 m
Supply voltage	5V ± 10 %, < 250 mA (without load)					
Accuracy	± 5 µm/m ± 3 µm/m					
Maximum speed	210 m/min			180 m/min	210 m/min	
Maximum vibration	Reader head: 200 m/s² (55 ... 2000 Hz) IEC 60068-2-6 Housing with mounting support and cable outlet right 150 m/s²; or left 100 m/s² (55 ... 2000 Hz) IEC 60068-2-6					
Maximum shock	300 m/s² (11 ms) IEC 60068-2-27					
Maximum acceleration	100 m/s² in the measuring direction / 60 m/s² [for **SV3BD-FS** model]					
Required moving force	< 4 N					
Operating temperature	0 °C ... 50 °C					
Storage temperature	-20 °C ... 70 °C					
Weight	0.25 kg + 1.55 kg/m					
Relative humidity	20 ... 80 %					
Protection	IP 53 (standard) IP 64 (DIN 40050) using pressurized air at 0.8 ± 0.2 bar in linear encoders					
Reader head	With built-in connector					

(*) Contact Fagor Automation for other lengths.
(**) Consult Fagor Automation for analog output signals.

SV3B model

Dimensions in mm



Additional information can be found in the technical documentation and installation manual available on the website ***www.fagorautomation.com***

Order identification

Example of Linear Encoder: SV3BF10-320-3-T + B3-320

SV3	B	F	10	320	3	T	FS
Type of profile for reduced space and securing to the mounting spar	***Letter identifying the absolute encoder***	***Type of communications protocol (1):*** • Blank space: SSI protocol (FAGOR) • D: FeeDat® protocol (FAGOR) (*) • S: SSI SIEMENS® (SL) protocol • **F: FANUC® (α and αi) protocol** • M: MITSUBISHI® CNC protocol • P: PANASONIC® (Matsushita) protocol • BC: BiSS® C protocol	***Resolution (2):*** • Blank space: up to 0.1 µm (**) • 01: 0.001 µm • 50: 0.05 µm • **10: 0.01 µm**	***Measuring lengths in millimeters:*** In the example (320) = 320 mm	***Accuracy of the linear encoder:*** • 5: ± 5 µm • **3: ± 3 µm**	***Threaded head:*** • Blank space: No • **T: M4**	***Safety:*** • **Blank space: No** • FS: Functional Safety (***)

(1): contact Fagor Automation for availability.

(2): not all combinations of protocol and resolution are possible. The characteristics table indicates the resolutions available for each protocol.

(*) plus EC-PA-DQ1-M with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One).

(**) only for SSI models.

(***) only SV3BD + EC-PA-DQS-M with DRIVE-CLiQ® protocol for SIEMENS® (Solution Line and Sinumerik One) with Functional Safety.

Example Spar: B3-320

B3	320
Mounting spar	***Measuring length of the linear encoder in milimeters:*** In the example (320) = 320 mm

SSI CONNECTION

UP TO 9 METERS

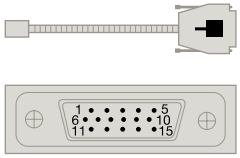
Connector for direct connection to FAGOR

EC-...B-D

Lengths: 1, 3, 6 and 9 meters

SUB D 15 HD connector (male Pin)

Pin	Signal	Color
1	A	Green
2	/A	Yellow
3	B	Blue
4	/B	Red
5	Data	Grey
6	/Data	Pink
7	Clock	Black
8	/Clock	Purple
9	+5 V	Brown
10	+5 V sensor	Light green
11	0 V	White
12	0 V sensor	Orange
15	Ground	Internal shield
Housing	Ground	External shield



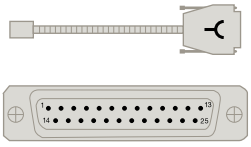
Connector for direct connection to SIEMENS® SMC20

EC-...B-S1

Lengths: 1, 3, 6 and 9 meters

SUB D 25 connector (female Pin)

Pin	Signal	Color
3	A	Green
4	/A	Yellow
6	B	Blue
7	/B	Red
15	Data	Grey
23	/Data	Pink
10	Clock	Black
12	/Clock	Purple
1	+5 V	Brown
14	+5 V sensor	Light green
2	0 V	White
16	0 V sensor	Orange
5	Ground	Internal shield
Housing	Ground	External shield



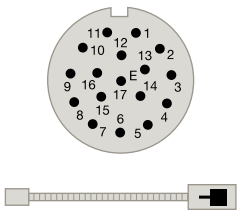
Connector for direct connection to SIEMENS® SME25

EC-...B-C9

Lengths: 1, 3, 6 and 9 meters

M23 17 connector (male Pin)

Pin	Signal	Color
15	A	Green
16	/A	Yellow
12	B	Blue
13	/B	Red
14	Data	Grey
17	/Data	Pink
8	Clock	Black
9	/Clock	Purple
7	+5 V	Brown
1	+5 V sensor	Light green
10	0 V	White
4	0 V sensor	Orange
11	Ground	Internal shield
Housing	Ground	External shield



FROM 9 METERS ON

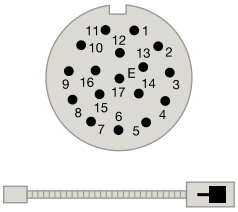
For connection to FAGOR: **EC-...B-C9 Cable + XC-C8-...F-D extension cable**
For connection to SIEMENS® SMC20: **EC-...B-C9 Cable + XC-C8-...F-S1 extension cable**
For connection to SIEMENS® SME25: **EC-...B-C9 Cable + XC-C8-...F-C9 extension cable**

EC-...B-C9

Lengths: 1 and 3 meters
(consult Fagor Automation for others)

M23 17 connector (male Pin ■)

Pin	Signal	Color
15	A	Green
16	/A	Yellow
12	B	Blue
13	/B	Red
14	Data	Grey
17	/Data	Pink
8	Clock	Black
9	/Clock	Purple
7	+5 V	Brown
1	+5 V sensor	Light green
10	0 V	White
4	0 V sensor	Orange
11	Ground	Internal shield
Housing	Ground	External shield

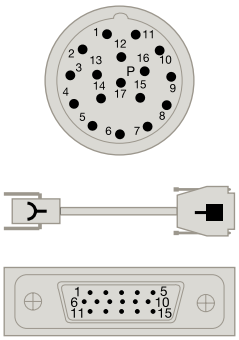


XC-C8-...F-D extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M23 17 connector (female Pin ⊁)
SUB D 15 HD connector (male Pin ■)

Pin	Pin	Signal	Color
15	1	A	Green/Black
16	2	/A	Yellow/Black
12	3	B	Blue/Black
13	4	/B	Red/Black
14	5	Data	Grey
17	6	/Data	Pink
8	7	Clock	Purple
9	8	/Clock	Yellow
7	9	+5 V	Brown/Green
1	10	+5 V sensor	Blue
10	11	0 V	White/Green
4	12	0 V sensor	White
11	15	Ground	Internal shield
Housing	Housing	Ground	External shield

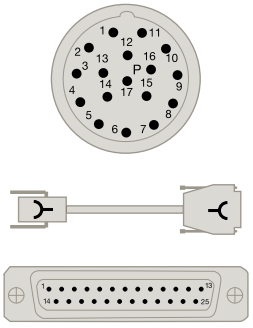


XC-C8-...F-S1 extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M23 17 connector (female Pin ⊁)
SUB D25 connector (female Pin ⊀)

Pin	Pin	Signal	Color
15	3	A	Green/Black
16	4	/A	Yellow/Black
12	6	B	Blue/Black
13	7	/B	Red/Black
14	15	Data	Grey
17	23	/Data	Pink
8	10	Clock	Purple
9	12	/Clock	Yellow
7	1	+5 V	Brown/Green
1	14	+5 V sensor	Blue
10	2	0 V	White/Green
4	16	0 V sensor	White
11	5	Ground	Internal shield
Housing	Housing	Ground	External shield

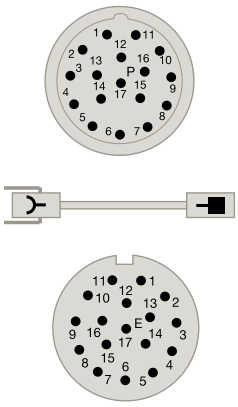


XC-C8-...F-C9 extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M23 17 connector (female Pin ⊁)
M23 17 connector (male Pin ■)

Pin	Pin	Signal	Color
15	15	A	Green/Black
16	16	/A	Yellow/Black
12	12	B	Blue/Black
13	13	/B	Red/Black
14	14	Data	Grey
17	17	/Data	Pink
8	8	Clock	Purple
9	9	/Clock	Yellow
7	7	+5 V	Brown/Green
1	1	+5 V sensor	Blue
10	10	0 V	White/Green
4	4	0 V sensor	White
11	11	Ground	Internal shield
Housing	Housing	Ground	External shield



CONNECTION TO OTHER CNC'S

UP TO 9 METERS

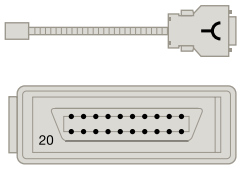
Connector for direct connection to FANUC®

EC-...PA-FN

Lengths: 1, 3, 6 and 9 meters

HONDA / HIROSE connector (female Pin)

Pin	Signal	Color
1	Data	Green
2	/Data	Yellow
5	Request	Blue
6	/Request	Red
9	+5 V	Brown
18-20	+5 V sensor	Grey
12	0 V	White
14	0 V sensor	Pink
16	Ground	Shield



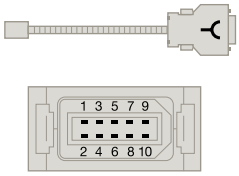
Connector for direct connection to MITSUBISHI®

EC-...AM-MB

Lengths: 1, 3, 6 and 9 meters

10-pin MOLEX/3M RECTANGULAR connector (female Pin)

Pin	Signal	Color
7	SD (MD)	Green
8	/SD (MD)	Yellow
3	RQ (MR)	Grey
4	/RQ (MR)	Pink
1	+5 V	Brown + purple
2	0 V	White + black + blue
Housing	Ground	Shield



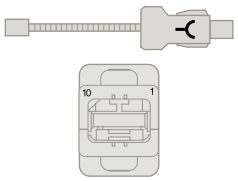
Connector for direct connection to PANASONIC® MINAS A5

EC-...PA-PN5

Lengths: 1, 3, 6 and 9 meters

PANASONIC 10 pin connector (female Pin)

Pin	Signal	Color
3	Data	Green
4	/Data	Yellow
1	+5 V	Brown + grey
2	0 V	White + pink
Housing	Ground	Shield



Connector for connection with extension cable (M12 H-RJ45) to SIEMENS® Sinamics/Sinumerik®

EC-...PA-DQ1-M
EC-...PA-DQS-M

Lengths: 1, 3, 6 and 9 meters

Pin	Signal
3	RXP
4	RXN
6	TXN
7	TXP
1	Vcc (24 V)
5	0 V

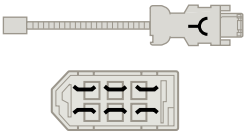
Connector for direct connection to YASKAWA®

EC-...PA-PN

Lengths: 1, 3, 6 and 9 meters

6-pin MOLEX connector (female Pin)

Pin	Signal	Color
5	Data	Green
6	/Data	Yellow
1	+5 V	Brown + grey
2	0 V	White + pink
Housing	Ground	Shield



FROM 9 METERS ON

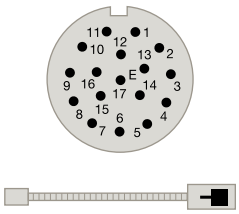
For connection to FANUC®:
EC-... B-C9 Cable + XC-C8-... -FN extension cable
EC-... PA-M1-N Cable + XC-M2-...D- FN extension cable
For connection to MITSUBISHI®: EC-... B-C9-F Cable + XC-C8-... -MB extension cable
For connection to PANASONIC® MINAS: EC-...B-C9 Cable + XC-C8-...A-PN5 extension cable
For connection to YASKAWA® SIGMA: EC-...B-C9 Cable + XC-C8-...A-PN extension cable
For connection to SIEMENS®:
RJ 45 connector with IP 20: EC-...PA-DQ1-M Cable / EC-...PA-DQS-M + XC- M2-...S-RJ2 extension cable
RJ 45 connector with IP 67: EC-...PA-DQ1-M Cable / EC-...PA-DQS-M + XC- M2-...S-RJ6 extension cable

EC-...B-C9

Lengths: 1 and 3 meters
(consult Fagor Automation for others)

M23 17 connector (male Pin ■)

Pin	Signal	Color
14	Data	Grey
17	/Data	Pink
8	Request	Black
9	/Request	Purple
7	+5 V	Brown
1	+5 V sensor	Light green
10	0 V	White
4	0 V sensor	Orange
Housing	Ground	Shield

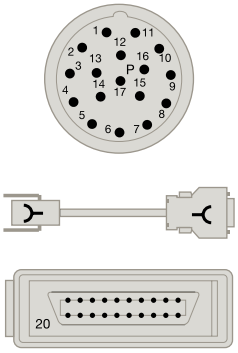


XC-C8...-FN extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M23 17 connector (female Pin ⊁)
HONDA / HIROSE connector (female Pin ⊀)

Pin	Pin	Signal	Color
14	1	Data	Grey
17	2	/Data	Pink
8	5	Request	Purple
9	6	/Request	Yellow
7	9	+5 V	Brown/Green
1	18-20	+5 V sensor	Blue
10	12	0 V	White/Green
4	14	0 V sensor	White
Housing	16	Ground	Shield

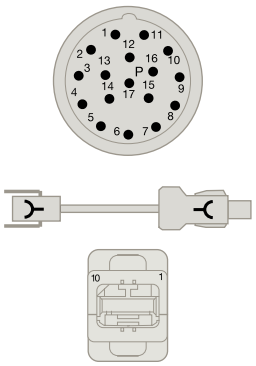


XC-C8-...A-PN5 extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M23 17 connector (female Pin ⊁)
PANASONIC 10 pin connector (female Pin ⊀)

Pin	Pin	Signal	Color
14	3	Data	Grey
17	4	/Data	Pink
7	1	+5 V	Brown+Black
1	1	+5 V sensor	Green +Yellow
10	2	GND	White+ Purple
4	2	GND sensor	Blue+Red
Housing	Housing	Ground	Shield

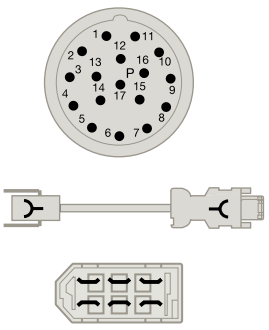


XC-C8-...A-PN extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M23 17 connector (female Pin ⊁)
6-pin MOLEX connector (female Pin ⊀)

Pin	Pin	Signal	Color
14	5	Data	Grey
17	6	/Data	Pink
7		+5 V	Brown+ Black
10	2	GND	White+ Purple
Housing	Housing	Ground	Shield



CONNECTION TO OTHER CNC'S

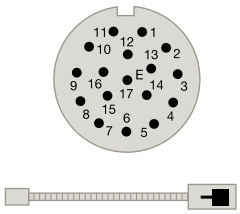
FROM 9 METERS ON

EC-...B-C9-F

Lengths: 1 and 3 m with Ferrite
(consult Fagor Automation for others)

M23 17 connector (male Pin ■)

Pin	Signal	Color
14	Data	Grey
17	/Data	Pink
8	Request	Black
9	/Request	Purple
7	+5 V	Brown
1	+5 V sensor	Light green
10	0 V	White
4	0 V sensor	Orange
Housing	Ground	Shield

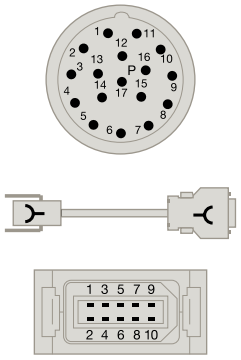


XC-C8...-MB extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M23 17 connector (female Pin ⊁)
10-pin MOLEX/3M RECTANGULAR connector (female Pin ⊀)

Pin	Pin	Signal	Color
8	7	SD (MD)	Purple
9	8	/SD (MD)	Yellow
14	3	RQ (MR)	Grey
17	4	/RQ (MR)	Pink
7	1	+5 V	Brown/Green
1	1	+5 V sensor	Blue
10	2	GND	Red
4	2	0 V sensor	White
12	2	SEL	Black
Housing	Housing	Ground	Shield

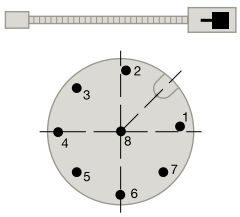


EC-...PA-M1-N

Lengths: 1 and 3 meters
(consult Fagor Automation for others)

M12 8 pin connector (male Pin ■)

Pin	Signal	Color
8 & 2	+5V	Brown + Grey
5 & 1	0 V	White + Pink
3	Data	Green
4	/Data	Yellow
7	Clock (REQ)	Blue
6	/Clock (/REQ)	Red
Housing	Ground	Shield



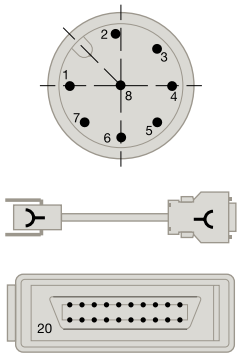
XC-M2-...D-FN extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M12 8 pin connector (female Pin ⊁)
HONDA / HIROSE connector (female Pin ⊀)

Pin	Pin	Signal	Color
2	18, 20	+5V sensor	White
1	14	0 V sensor	Blue
8	9	+5V	White-Green
7	5	REQ	Purple
6	6	/REQ	Pink
5	12	0 V	Brown-Green
3	1	Data	Yellow
4	2	/Data	Grey
Housing	16	Ground	Shield

Maximum length of EC-PA-M1 cable plus XC-M2-D-FN extension cable: 30 meters

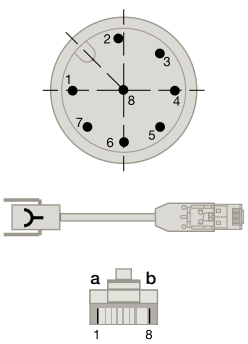


XC-M2-...S-RJ2 extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M12 8 pin connector (female Pin ⊁)
RJ45 (IP 20) connector

RJ45 IP 20 Pin	Pin	Signal	Color
3	1	RXP	Pink
4	2	RXN	Blue
7	3	TXP	Green
6	6	TXN	Yellow
1	a	Vcc (24V)	Red
5	b	0 V	Black
Housing	Housing	Ground	Shield

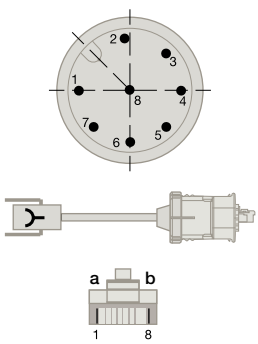


XC-M2-...S-RJ6 extension cable

Lengths: 5, 10, 15, 20 and 25 meters

M12 8 pin connector (female Pin ⊁)
RJ45 (IP 67) connector

RJ45 IP 67 Pin	Pin	Signal	Color
3	1	RXP	Pink
4	2	RXN	Blue
7	3	TXP	Green
6	6	TXN	Yellow
1	a	Vcc (24V)	Red
5	b	0 V	Black
Housing	Housing	Ground	Shield



Other languages are available in the Downloads section from Fagor Automation's website.

FAGOR AUTOMATION

Open to your world

Fagor Automation, S. Coop.
Bº San Andrés, 19
E-20500 Arrasate - Mondragón
SPAIN
Tel.: +34 943 039 800
Fax: +34 943 791 712
E-mail: contact@fagorautomation.es

www.fagorautomation.com

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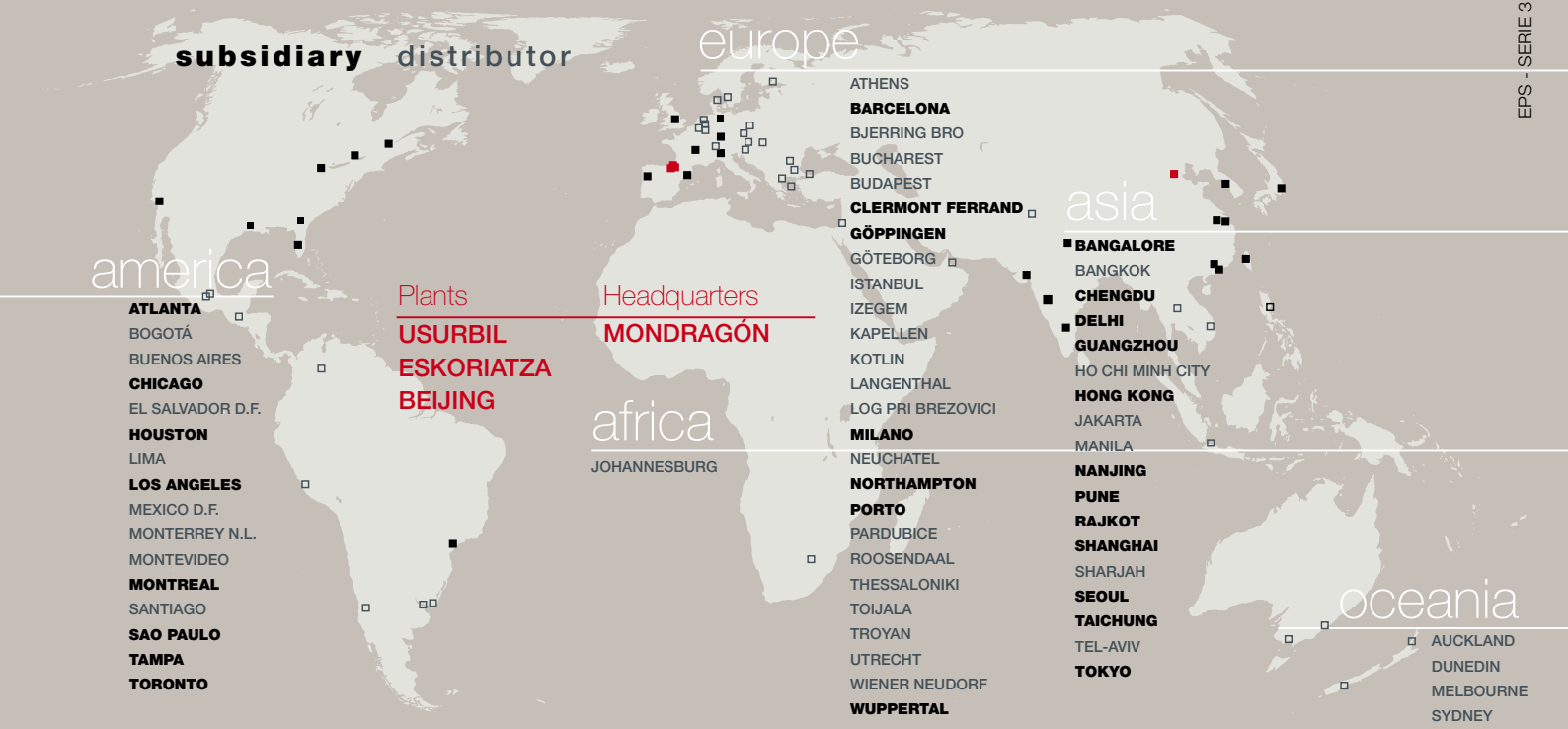
EPS - SERIE 3 EN 0225



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