



NEW

Fagor absolute Linear Encoders

The best alternative

- Digital communication Interface
- Instant position control
on power up
- USB connection to a PC

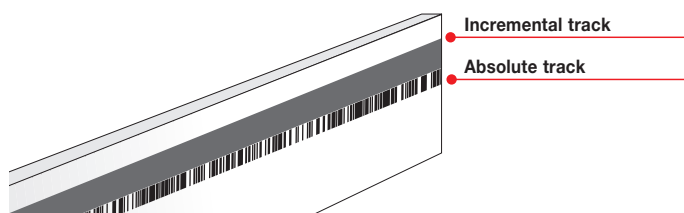
New FAGOR ABSOLUTE linear encoders

Digital measurement, accurate, fast and direct without having to home the machine

Fagor Automation presents the new absolute linear encoders that complete an already ample range of rotary and linear feedback systems.

Instant position control on machine power-up

In **absolute measurement**, the position value is available from the encoder the instant the unit is turned on and may be read at any time by the controller (CNC, PC, servo drive, DRO, etc.) to which it is connected.



The glass of the linear encoder has two different tracks: one is used to generate the incremental 1 Vpp signals (like on typical linear encoders), the other one is a binary code with a special sequence that avoids repetition all along the measuring length of the linear encoder.

The absolute position is calculated using the data of that code read by means of a high precision optical sensor.

DIGITAL COMMUNICATION

The encoder detects the work mode of the controller to which it is connected, recognizes the type of communication protocol of the controller and adapts to it automatically.

The types of Digital Communication offered by Fagor absolute linear encoders are:

Asynchronous Digital Communication (without clock)

Via a bidirectional data line RS-485.

Synchronous Digital Communication (with clock)

Via a bidirectional data line +clock: thus achieving higher communication speed between the controller and the encoder.

DIGITAL COMMUNICATION PROTOCOL

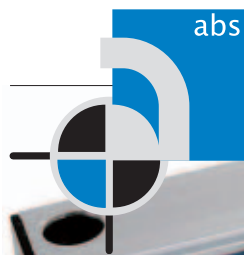
There are two types of protocols used by Fagor absolute linear encoders:

FeeDat (Feedback Data)

A bidirectional protocol offered by Fagor to controller manufacturers providing them with absolute coordinates and other features. This protocol is valid for both synchronous and asynchronous communication.

SSI (Serial Synchronous Interface)

Standard used for a simple encoder communication using two digital lines. This protocol is only good for synchronous communication.



Interfaces

The FeeDat (Feedback Data) is a bidirectional interface capable of offering absolute position values and working both in mixed and digital modes as required by the controller.

WORK MODES

FAGOR absolute encoders can work in two different modes:

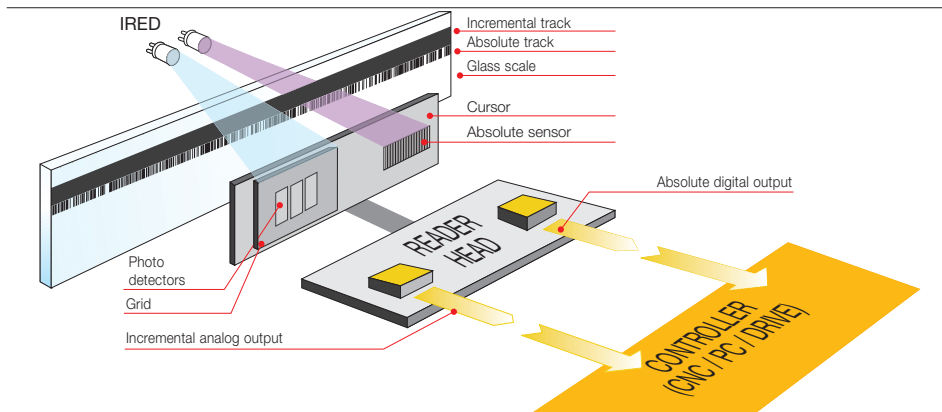
Mixed mode

The controller requests the absolute position on power up (or at any time) and then continues to count using the 1Vpp incremental signs.

Digital mode

There is also the possibility to work without the A and B signals of the encoder, by requesting the absolute position directly from the encoder, at any time, through the digital communication interface.

OPERATING DIAGRAM



TECHNICAL CHARACTERISTICS (GA/SA/SVA)

| | | |
|--|------------------------|--|
| Protocol | FeeDat (bidirectional) | Synchronous |
| | | Asynchronous |
| | SSI (unidirectional) | Synchronous |
| Distance-coded signals (absolute) | Data input | Differential line receiver complying with the "EIA RS-485" standard for the CLOCK and the DATA signals |
| | Data output | Differential line emitter complying with the "EIA RS-485" standard for DATA signals |
| | Signal level | Differential voltage outputs >1.7V with a load of 120 Ohm (EIA RS-485 standard) |
| | SSI Code | Binary code or gray code |
| Incremental signals | 1Vpp | |
| Cable | Cable length | Up to 150 m (495 ft) |
| | Digital signal delay | 6 ns/m |



SA/SVA Series

For lengths between 140 mm and 2040 mm and recommended resolutions of up to 0.1 μm (up to 0.000005 inch):

- Simple installation thanks to its support bar.
- Measuring of absolute position values and incremental signals via **FeeDat** and **SSI**.
- TDMS® (Thermally Determined Mounting System).



SPECIFICATIONS SA/SVA

| | |
|---|---|
| Method of measuring | Chromed glass scale with 20 μm (0.0008 inch) grating pitch |
| Thermal expansion coefficient | $\alpha_{\text{therm}} = 8 \text{ ppm/K}$ |
| Accuracy | $\pm 5 \text{ μm}$ ($\pm 0.0002''$) $\pm 3 \text{ μm}$ ($\pm 0.00012''$) |
| Maximum speed | 120 m/min. (396 ft / min.) |
| Maximum vibration | <10g without mounting support <20g with mounting support (add "V" to the model) |
| Moving force | <5N |
| Operating temperature | 0°...50°C |
| Storage temperature | -20°...70°C |
| Weight | 0.20 Kg + 0.50 Kg/m |
| Humidity | 20...80% |
| Protection | IP 53 (standard) IP 64 (DIN 40050) with pressurized air intake |
| Movement | On roller bearings |
| Power supply | 5V ± 5%, 100 mA |
| Reader head | With built-in connector |
| Absolute position measuring | "EIA RS-485" standard |
| Accuracy-feedrate ratio | The FAGOR absolute encoder always maintains its nominal accuracy regardless of the feedrate |
| Resolution of the absolute measurement | 0.1 μm |
| Incremental output signals | 1 Vpp |
| Period "T" of output signals | 20 μm |
| Limit frequency | > 130 kHz |
| Maximum cable length | 150 m (490 ft) |
| USB port connection | Through an RS-485-to-USB converter (optional) |

MEASURING LENGTH: S SERIES

| mm | inches | mm | inches | mm | inches |
|-----|--------|------|--------|------|--------|
| 70 | 2.7 | 520 | 20.5 | 1240 | 48 |
| 120 | 4.7 | 570 | 22.4 | 1340 | 52 |
| 170 | 6.7 | 620 | 24.4 | 1440 | 56 |
| 220 | 8.6 | 720 | 28 | 1540 | 60 |
| 270 | 10.6 | 770 | 30 | 1640 | 64 |
| 320 | 12.6 | 820 | 32 | 1740 | 68 |
| 370 | 14.5 | 920 | 36 | 1840 | 72 |
| 420 | 16.5 | 1020 | 40 | 2040 | 80 |
| 470 | 18.5 | 1140 | 44 | | |

- Recommended with mounting plate
- These measuring lengths require a mounting support plate.

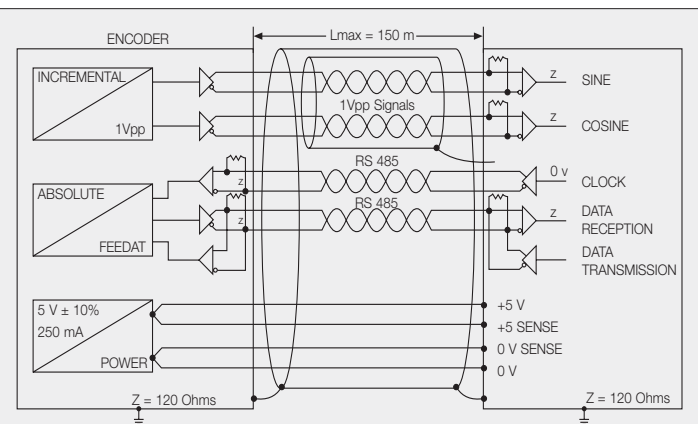
ORDER IDENTIFICATION

EXAMPLE: SVA - 420 - 3 - B

| | |
|------------|--|
| S | Type of profile: For limited space <ul style="list-style-type: none"> • S: Standard mounting for vibration up to 10 g • SV: Special mounting for vibration up to 20 g |
| A | Absolute encoder |
| 420 | Measuring length in mm In the example (420) = 420 mm (16.5 inches) |
| 3 | Accuracy <ul style="list-style-type: none"> • 5: ± 5 μm (± 0.0002 inch) • 3: ± 3 μm (± 0.00012 inch) |
| B | Linear encoder with or without mounting support <ul style="list-style-type: none"> • Blank space: Without support. Vibration up to 10 g • B: with support for vibration up to 20 g |
| A | <ul style="list-style-type: none"> • Blank space: Without air inlet on the reader head • A: With air inlet on the reader head |

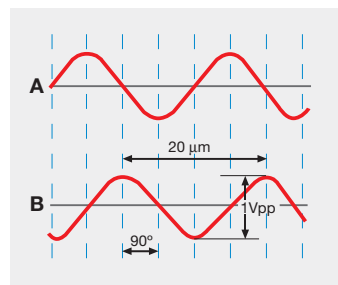
Signals

FeeDat AND SSI DATA INTERFACE



Encoder cable: (4 x 0.08 mm²) + 4 x 0.08 mm² + 4 x 0.14 mm²)
 Extension cable: (4 x 0.14 mm²) + 4 x 2 x 0.14 mm² + 4 x 0.14 mm²)

1 VPP SIGNALS CHARACTERISTICS



- $V_A = V_B = 0.6V_{pp} \div 1.2V_{pp}$
With 120Ω impedance
- Phase shift = $90^\circ \pm 10^\circ$
- Centering <6.5%
- Ratio $V_A/V_B = 0.8 \div 1.25$

GA Series

For lengths between 140 mm and 3040 mm and recommended resolutions of up to 0.1 μm (up to 0.000005 inch):

- TDMS® (Thermally Determined Mounting System).
- Measuring of absolute position values and incremental signals via **FeeDat** and **SSI**.
- High resistance to vibration.



SPECIFICATIONS GA

| | |
|---|---|
| Method of measuring | Chromed glass scale with 20 μm (0.0008 inch) grating pitch |
| Thermal expansion coefficient | $\alpha_{\text{therm}} = 8 \text{ ppm/K}$ |
| Accuracy | $\pm 5 \mu\text{m}$ ($\pm 0.0002''$) $\pm 3 \mu\text{m}$ ($\pm 0.00012''$) |
| Maximum speed | 120 m/min. (396 ft / min.) |
| Maximum vibration | <20g |
| Moving force | <5N |
| Operating temperature | 0°...50°C |
| Storage temperature | -20°...70°C |
| Weight | 0.25 Kg + 2.25 Kg/m |
| Humidity | 20...80% |
| Protection | IP 53 (standard) IP 64 (DIN 40050) with pressurized air intake |
| Movement | On roller bearings |
| Power supply | 5V $\pm 5\%$, 100 mA |
| Reader head | With built-in connector |
| Absolute position measuring | "EIA RS-485" standard |
| Accuracy-feedrate ratio | The FAGOR absolute encoder always maintains its nominal accuracy regardless of the feedrate |
| Resolution of the absolute measurement | 0.1 μm |
| Incremental output signals | 1 Vpp |
| Period "T" of output signals | 20 μm |
| Limit frequency | $\geq 130 \text{ kHz}$ |
| Maximum cable length | 150 m (490 ft) |
| USB port connection | Through an RS-485-to-USB converter (optional) |

MEASURING LENGTH: G SERIES

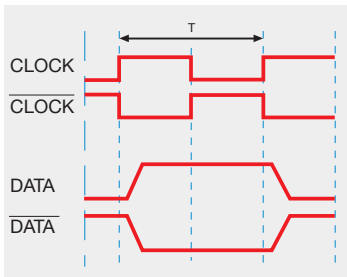
| mm | inches | mm | inches | mm | inches |
|-----|--------|------|--------|------|--------|
| 140 | 5.5 | 940 | 37 | 1740 | 68 |
| 240 | 9.5 | 1040 | 41 | 1840 | 72 |
| 340 | 13.4 | 1140 | 44 | 2040 | 80 |
| 440 | 17.3 | 1240 | 48 | 2240 | 88 |
| 540 | 21.3 | 1340 | 52 | 2440 | 96 |
| 640 | 25 | 1440 | 56 | 2640 | 104 |
| 740 | 29 | 1540 | 60 | 2840 | 112 |
| 840 | 33 | 1640 | 64 | 3040 | 120 |

ORDER IDENTIFICATION

EXAMPLE: GA - 1460 - 5

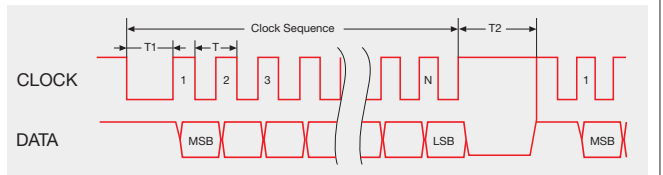
| | |
|-------------|---|
| G | Type of profile: For average space |
| A | Absolut encoder |
| 1640 | Measuring length in mm In the example (1640) = 1640 mm (64.57 inches) |
| 5 | Accuracy • 5: $\pm 5 \mu\text{m}$ ($\pm 0.0002 \text{ inch}$) • 3: $\pm 3 \mu\text{m}$ ($\pm 0.00012 \text{ inch}$) |

DIGITAL SIGNALS CHARACTERISTICS



- Logic levels, according to the EIA 485 standard
- CLOCK frequency: 100Khz ÷ 500Khz

TIME DIAGRAM OF SSI SIGNALS



- N= 32 Bits
- T= 1 μs ÷10 μs
- T1> 1 μs
- T2=20÷35 μs
- Logic levels, according to the EIA 485 standard

Cables and Connections



MAY BE CONNECTED TO A PC VIA THE USB PORT

USB adapter

Using an adapter, the absolute encoders may be connected to a PC through the USB port.

This allows various tasks to be performed such as modifying parameters set-up, run diagnosis or reading the axis position in real time on a PC monitor.

Together with the adapter, Fagor Automation supplies libraries to use the encoder with the PC and sample programs.

ABSOLUTE LINEAR FEEDBACK CONNECTION ELEMENTS

Fagor Automation offers cables beyond the sample shown here. Contact us for other possibilities. All models may be supplied with or without armour. If armour is not required add an "N" to the cable name (eg. EC-...-PA-DA-N).

Green: **G** / Yellow: **Y** / Blue: **B** / Red: **R** / Brown: **Br** / Grey: **Gr** / White: **W** / Pink: **P** / Violet: **VI** / Black: **BI**

EC-...PA-DA Cable Applications: Fagor digital readout models NVA

| Signal | DATA | /DATA | CLOCK | /CLOCK | +5V | +5V_Sensor | OV | OV_Sensor | External Shield |
|--------|----------|----------|----------|----------|----------|------------|----------|-----------|-----------------|
| Pin | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Housing |
| Color | G | Y | B | R | B | Gr | W | P | Shield |

EC-B-D Cable Applications: FAGOR CNC and FAGOR DRIVE

| Signal | A | /A | B | /B | DATA | /DATA | CLOCK | /CLOCK | +5V | +5V_Sensor | OV | OV_Sensor | Internal Shield | External Shield |
|--------|----------|----------|----------|----------|-----------|----------|-----------|-----------|-----------|------------|----------|-------------|-----------------|-----------------|
| Pin | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 15 | Housing |
| Color | G | Y | B | R | Gr | P | BI | VI | Br | R-B | W | Gr-P | Internal Shield | Shield |

EC-B-C9 Cable Applications: To be connected to extension cables or to non-FAGOR Controllers

| Signal | A | /A | B | /B | DATA | /DATA | CLOCK | /CLOCK | +5V | +5V_Sensor | OV | OV_Sensor | Internal Shield | External Shield |
|--------|----------|----------|----------|----------|-----------|----------|-----------|-----------|-----------|------------|----------|-------------|-----------------|-----------------|
| Pin | 15 | 16 | 12 | 13 | 14 | 17 | 8 | 9 | 7 | 1 | 10 | 4 | 11 | Housing |
| Color | G | Y | B | R | Gr | P | BI | VI | Br | R-B | W | Gr-P | Internal Shield | Shield |

EC-B-O Cable Applications: To be connected to non-FAGOR CNC's

| Signal | A | /A | B | /B | DATA | /DATA | CLOCK | /CLOCK | +5V | +5V_Sensor | OV | OV_Sensor | Internal Shield | External Shield |
|--------|----------|----------|----------|----------|-----------|----------|-----------|-----------|-----------|------------|----------|-------------|-----------------|-----------------|
| Color | G | Y | B | R | Gr | P | BI | VI | Br | R-B | W | Gr-P | | |

Extension cables XC-C8-...F-C9 Applications: For connecting more extension cables

| Signal | A | /A | B | /B | DATA | /DATA | CLOCK | /CLOCK | +5V | +5V_Sensor | OV | OV_Sensor | Internal Shield | External Shield |
|--------|-------------|-------------|-------------|-------------|-----------|----------|-----------|----------|-------------|------------|------------|-----------|-----------------|-----------------|
| Pin | 15 | 16 | 12 | 13 | 14 | 17 | 8 | 9 | 7 | 1 | 10 | 4 | 11 | Housing |
| Color | G-BI | Y-Bk | B-BI | R-BI | Gr | P | VI | Y | Br-G | B | W-G | W | Internal Shield | Shield |

Extension cables XC-C8-...F-D Applications: To be connected to FAGOR systems that use extension cables

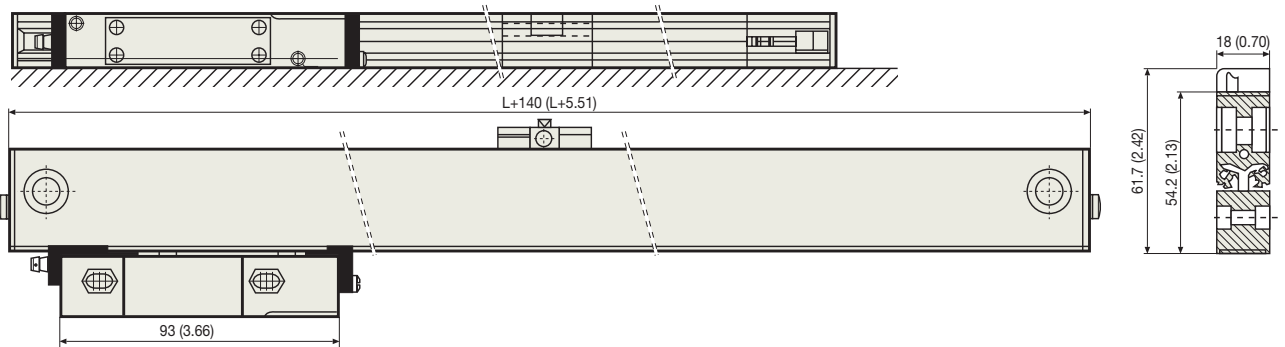
Note: the connection of this connector is the same as that of the XC-C8-...F-C9 extension cable.

Note: the connection of this connector is the same as that of the EC-B-D cable.

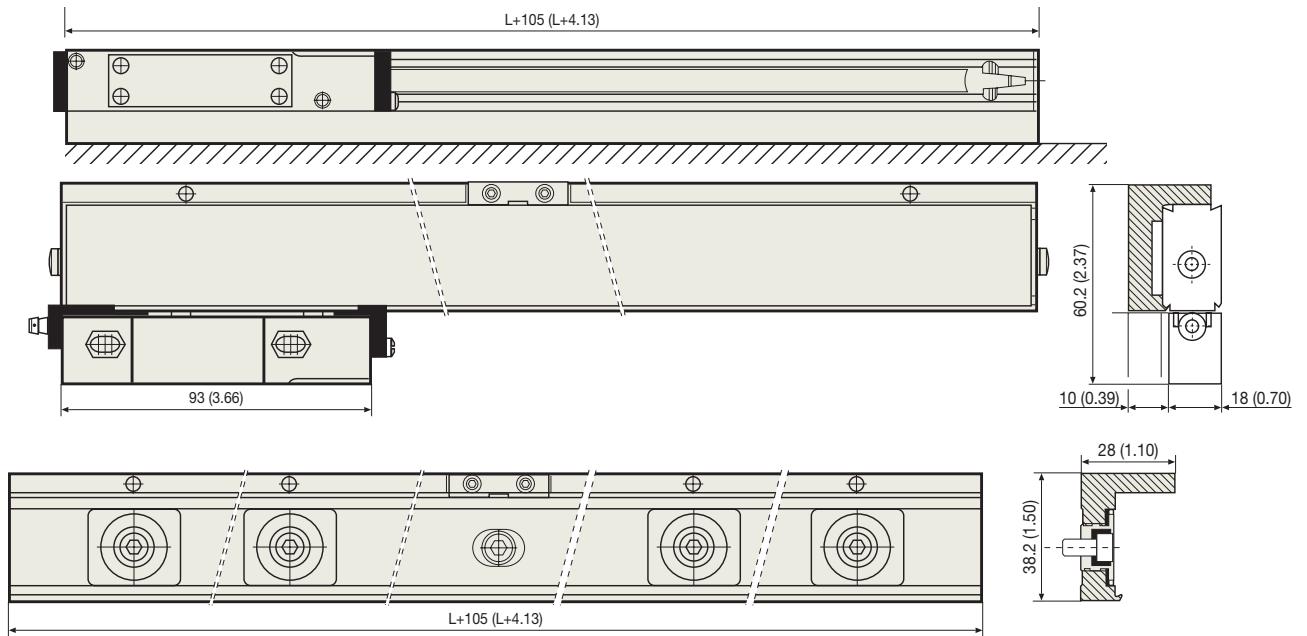
Dimensions



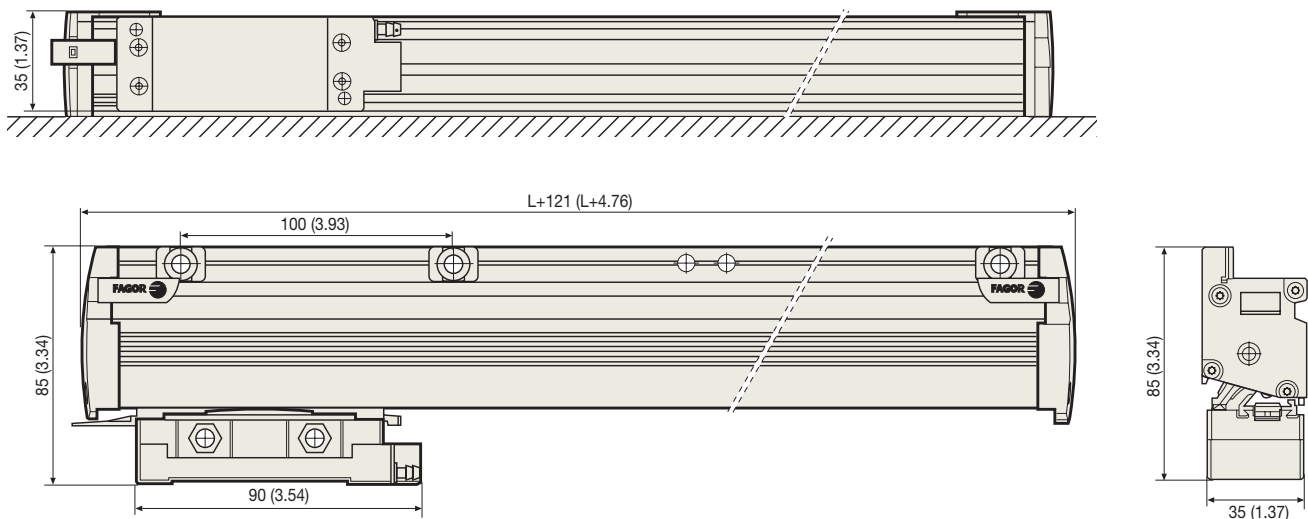
SA SERIES



SVA SERIES



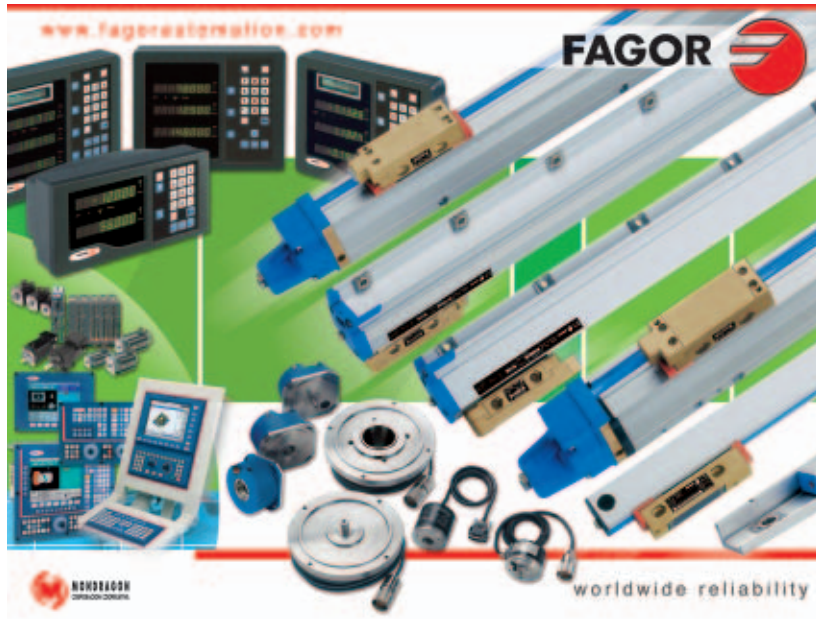
GA SERIES





THE BEST ALTERNATIVE

A real and close alternative for its worldwide sales and service network.



The absolute linear encoders presented in this catalog complete the wide range of linear and rotary feedback systems that make Fagor Automation the best alternative for feedback product users in the market and consequently an excellent reference for automation projects in this field.

The Best alternative is a statement that is backed up by the design and characteristics of our feedback products, which include:

- **The mechanical design of linear encoders:**
 - Mechanical compatibility with market standards.
- **The electrical design of linear encoders:**
 - Electrical compatibility (signals) with market standards.
 - SMD technology.
- **Wide range of angular encoders:**
 - Standard series for applications requiring from 50 to 10000 pulses/turn.
 - High resolution series for applications requiring from 18000 to 180000 pulses/turn and diameters of 90, 170 and 200 mm.

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Fagor Automation holds the ISO 9001 Quality System Certificate and the CE Certificate for all its products

