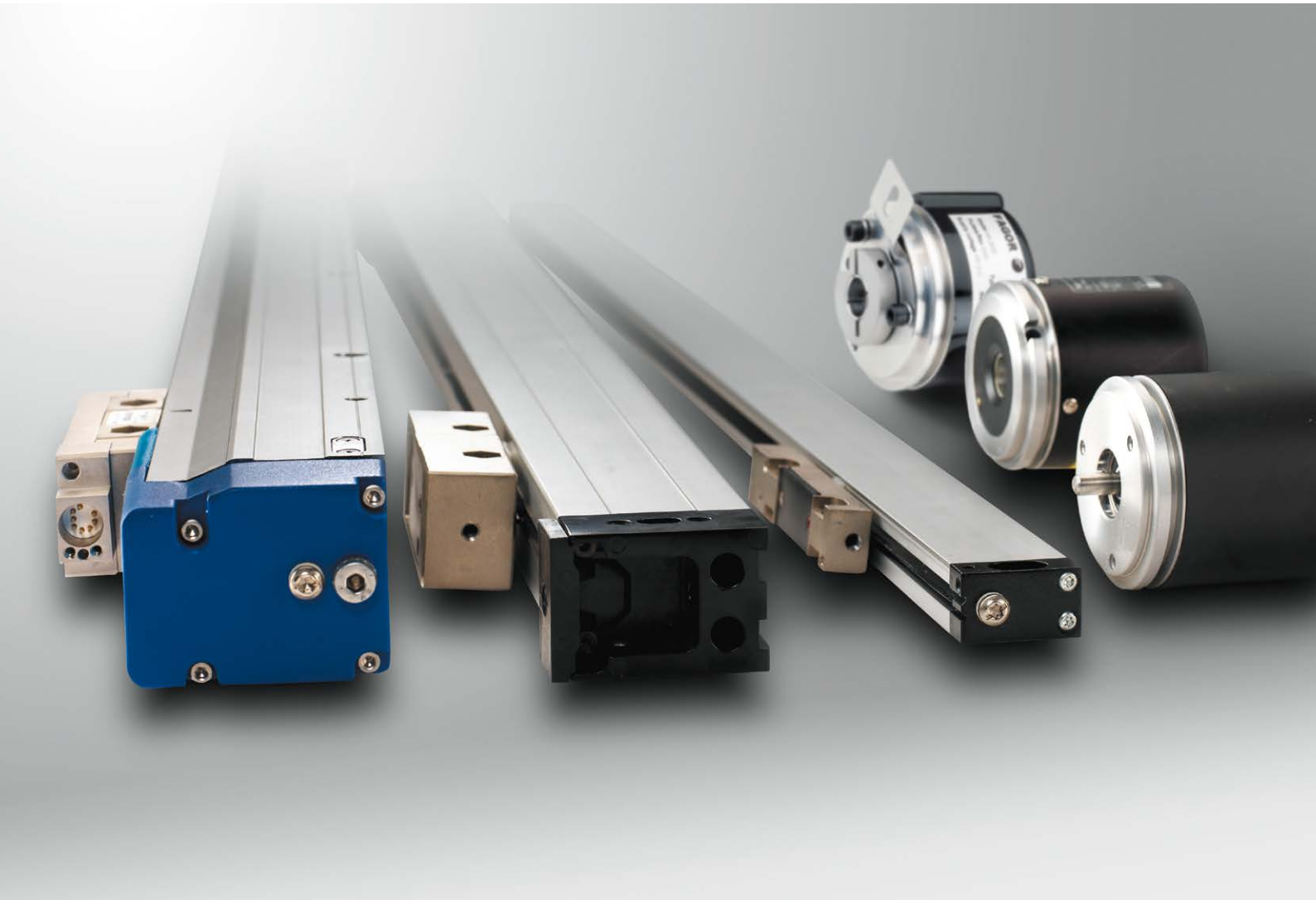
Encoders

LINEAR AND ANGULAR, STANDARD SERIES

FAGOR AUTOMATION

Open to your world



Technology

An encoder measures the actual machine position without the effect of any mechanical inaccuracies. Machine errors induced due to mechanical inaccuracies are eliminated as the encoder is attached to the machine guide ways and hence provides the actual machine position to the controller. Some of the potential sources of such errors in a machine tool such as lead screw pitch, certain amount of backlash and thermal behavior can be minimized using these encoders.

Measuring methods

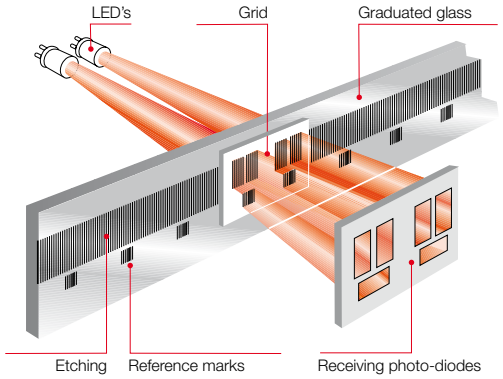
Fagor uses two measuring methods in their incremental encoders:

- **Graduated glass:** Linear encoders with a measuring length of up to 3040 mm use optical transmission. The light from the LED goes through an engraved glass and a reticule before reaching the receiving photo diodes. The period of the generated electrical signals is the same as the graduation pitch.
- **Graduated steel:** Linear encoders with a measuring length over 3040 mm use auto imaging principle which uses diffuse light reflected from the graduated steel tape. This optical reading system consists of a LED as a light source, a mesh that creates the image and a monolithic photo detector element in the image plane, which is specially designed and patented by Fagor.

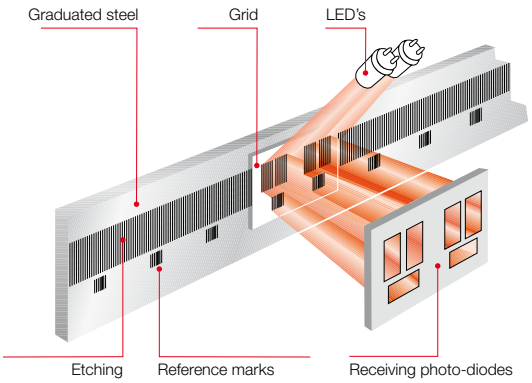
Types of incremental encoders

- **Linear encoder:** Suitable for applications on milling, turning, boring mills, grinding machines for feedrates of up to 120 m/min and vibration levels up to 10 g.
- **Rotary encoder:** Used as measurement device for rotary axis, angular speed and also for linear movements for mechanisms like lead screws etc. They are widely used in machine tools, wood working equipment, robots and material handlers etc.

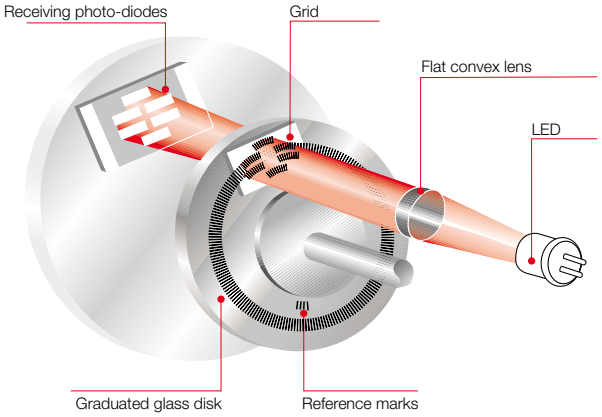
Graduated glass linear encoder

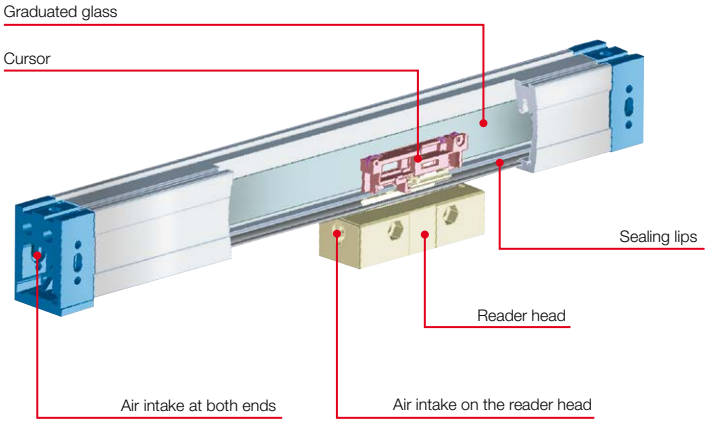


Graduated steel linear encoder



Graduated glass rotary encoder

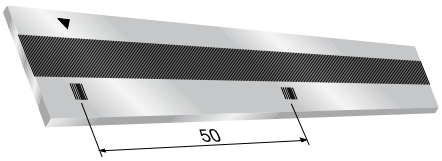




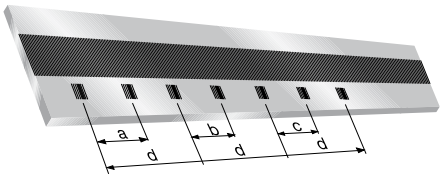
Enclosed design:

The graduated scale in a linear encoder is protected by the enclosed aluminum profile. The highly durable sealing lips protect the encoder from industrial contaminants and liquid splashes as the reader head moves along the profile. The reader head movement in complete synchronization captures and transmits the position and movement of the machine. The reader head moves along the graduated scale on linear bearings minimizing the friction. For enhanced protection against contamination both ends of the encoder and also the reader head can be connected to pressurized air.

Linear encoder



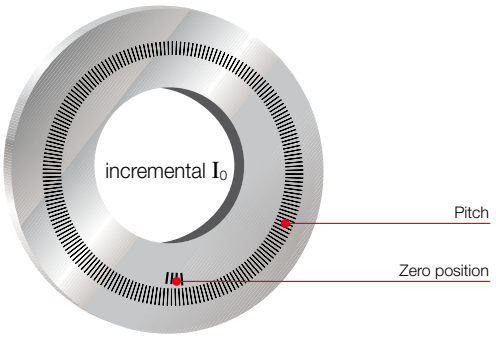
Incremental



Series	Distances			
	a	b	c	d
F	50.1	50.2	50.3	100
C, M	10.02	10.04	10.06	20

Distance-coded

Rotary encoder



Reference signals (I_0)

The reference signal is a specially etched mark along the graduated glass, which when scanned generates a pulse signal. They are used to set/recover the machine zero position and avoid possible errors after powering up the DRO or CNC system.

Fagor provides two different types of reference marks I_0:

- **Incremental:** The reference signal is synchronized with the feedback pulses to ensure perfect measuring repeatability.

  Linear: One every 50 mm of travel.
  Rotary: One signal per turn.

- **Distance-coded:** Each distance coded reference signal is separated from the next signal a different distance according to predefined mathematical function. The actual position value after power up is restored by moving through two consecutive reference signals. This is very useful for long travel axes as the movement needed to recover actual position is minimum.

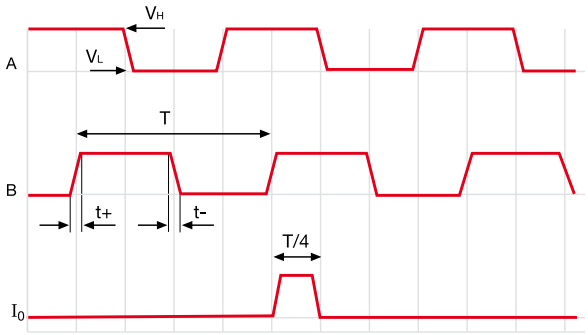
ELECTRICAL OUTPUT
SIGNALS

Differential TTL

These are complementary signals in compliance with the EIA standard RS-422. This characteristic together with a line termination of 120 Ω, twisted pair, and an overall shield provide greater immunity to electromagnetic noise caused by the surrounding environment.

Characteristics

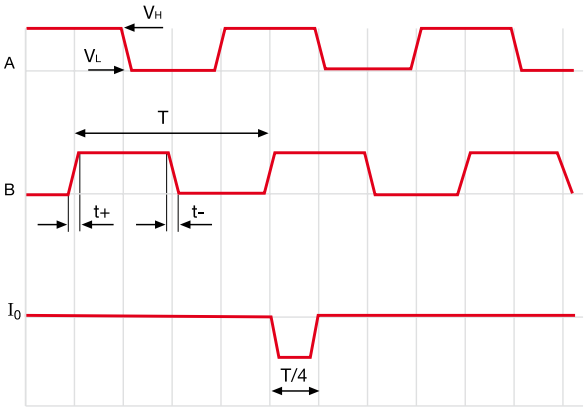
Signals	A, /A, B, /B, I_0, / I_0
Signal level	$V_H \geq 2.5V$ $I_H = 20$ mA $V_L \leq 0.5V$ $I_L = 20$ mA With 1 m cable
90º reference signal (I_0)	Synchronized with A and B
Switching time	t+/t-< 30ns With 1 m cable
T period	according to model
Max. cable length	50 meters
Load impedance	$Z_o = 120\ \Omega$ between differential



No differential TTL

Characteristics

Signals	A, B, /I_0
Signal level A, B, I_0	$V_H \geq 3.5$ V $I_H = 4$ mA $V_L \leq 0.4$ V $I_L = 4$ mA with 1 m cable
90º reference signal (I_0)	Synchronized with A and B
Switching time	t+/t-< 30ns with 1 m cable
T period	according to model
Max. cable length	20 meters



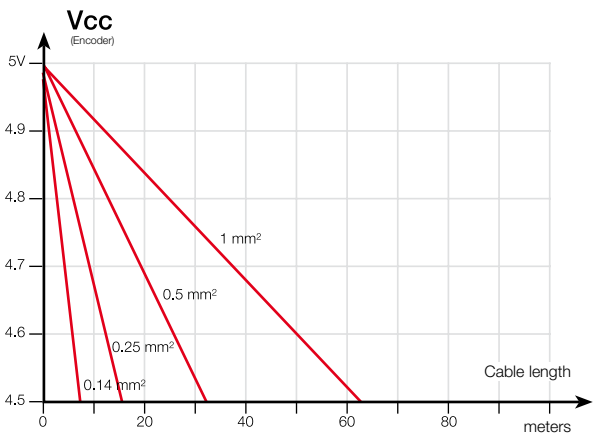
Voltage drop across cable

The voltage requirements for a TTL encoder are 5V ±5%. A simple formula described below, may be used to calculate the maximum cable length depending on the cross section diameter of the supply cable:

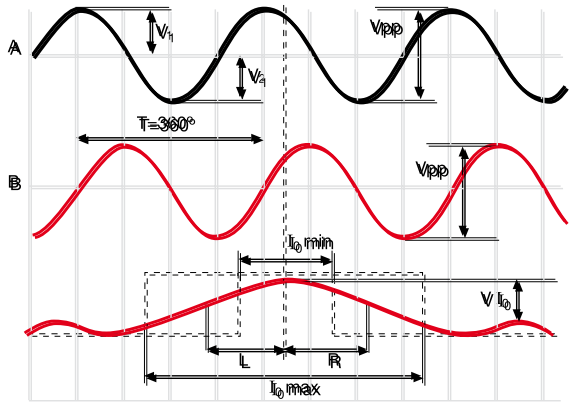
$L_{max} = (V_{CC}-4,5)^* 500 / (Z_{CABLE/Km}^* I_{MAX})$

Example

V_{cc} = 5V, IMAX	=	0.2 Amp (with 120 Ω load)	
Z (1 mm²)	=	16.6 Ω/Km	**(L_{max}= 75 m)**
Z (0.5 mm²)	=	32 Ω/Km	**(L_{max}= 39 m)**
Z (0.25 mm²)	=	66 Ω/Km	**(L_{max}= 19 m)**
Z (0.14 mm²)	=	132 Ω/Km	**(L_{max}= 9 m)**



Electrical output signals

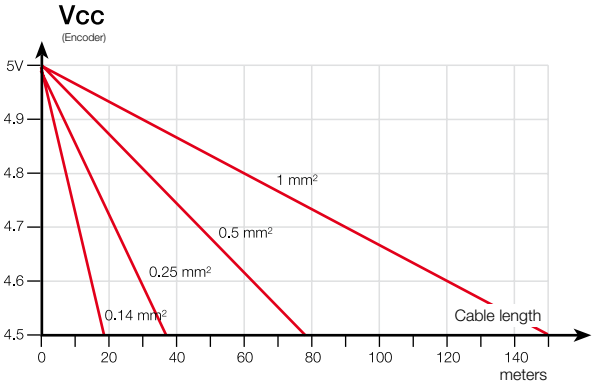


Differential 1 Vpp

They are complementary sinusoidal signals whose differential value is 1 Vpp centered on $V_{CC/2}$. This characteristic together with a line termination of 120 Ω, twisted pair, and an overall shield provide greater immunity against electromagnetic noise caused by their surrounding environment.

Characteristics

Signals	A, /A, B, /B, I_0, / I_0
V_{App}	1 V +20 %, -40 %
V_{Bpp}	1 V +20 %, -40 %
DC offset	2.5 V ± 0.5 V
Signal period	according to model
Max. cable length	150 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°
I_0 amplitude: V_{I0}	0.2 ÷ 0.8 V
I_0 width: L + R	I_0_min: 180° I_0_typ: 360° I_0_max: 540°
I_0 synchronism: L, R	180° ± 90°



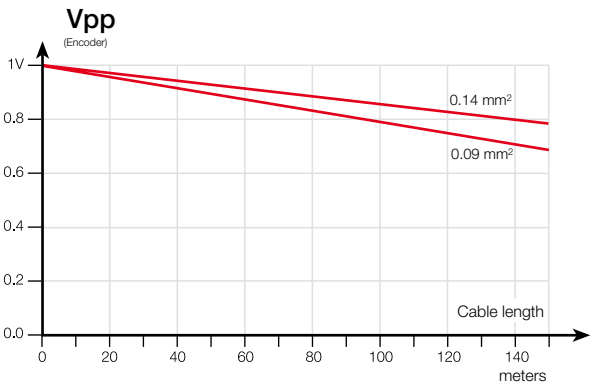
Voltage drop across cable

The voltage requirements for a 1 Vpp encoder are 5V ±10 %. A simple formula may be used to calculate the maximum cable length depending on the cross section diameter of the supply cables.

L_{max} = (V_{CC}-4,5)* 500 / ($Z_{CABLE/Km}$* I_{MAX})

Example

V_{cc}	=	5V, IMAX= 0.1 Amp	
Z (1 mm²)	=	16.6 Ω/Km	**(L_{max}= 150 m)**
Z (0.5 mm²)	=	32 Ω/Km	**(L_{max}= 78 m)**
Z (0.25 mm²)	=	66 Ω/Km	**(L_{max}= 37 m)**
Z (0.14 mm²)	=	132 Ω/ Km	**(L_{max}= 18 m)**



1 Vpp signal damping due to the cable section

Besides attenuation due to signal frequency, there is another signal attenuation caused by the section of the cable connected to the encoder.

F series

Especially designed for machines with longer travels and they are available up to 30 m in length.

In the incremental model the reference marks are 50 mm apart and distance coded model is also available. Both models come with a detachable cable connectors in the reader head. The steel tape graduation pitch is 100 µm. For measuring lengths over 4040 mm the encoder is supplied in multiple sections and is assembled together at the time of installation.

Measuring lengths in millimeters:

Measuring lengths from 3200 mm to 30 m in 200 mm increments. Contact Fagor Automation for custom length scales over 30 m.

General specification

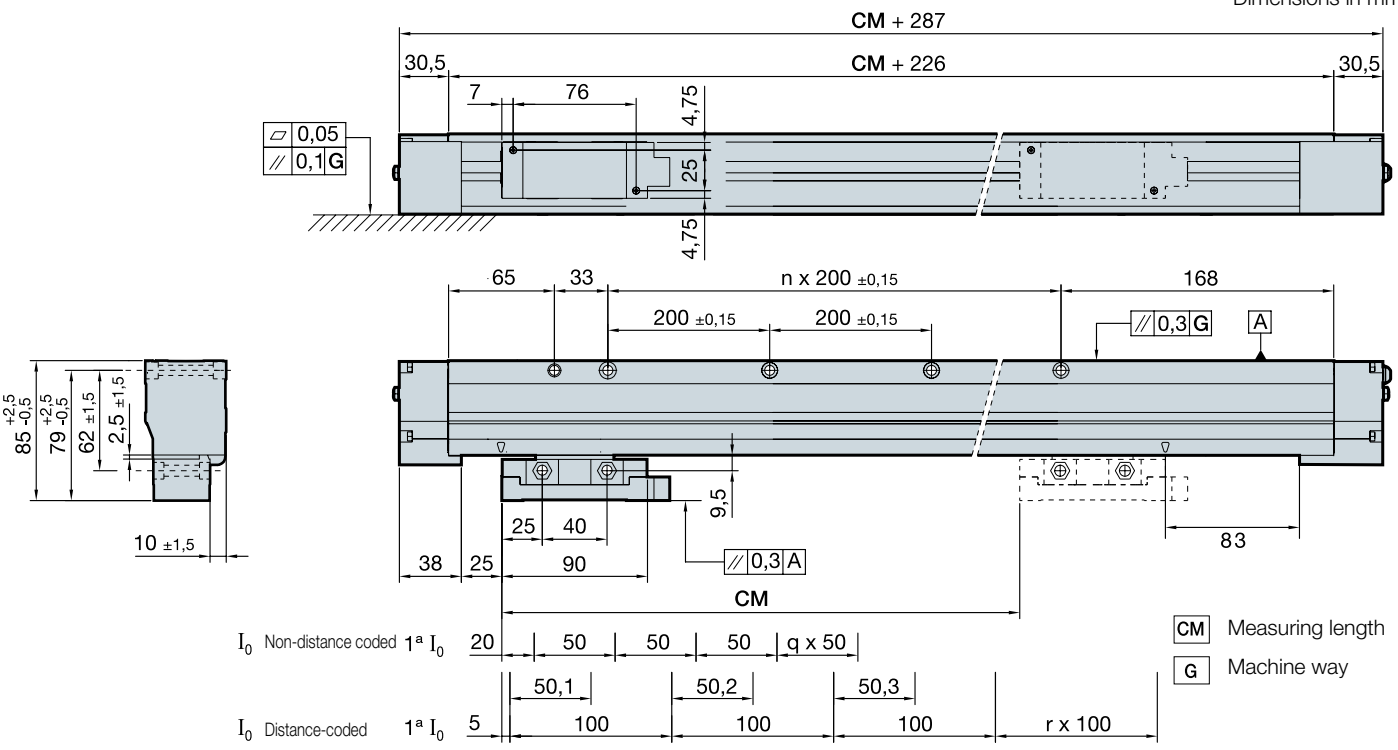
Measurement	By means of stainless steel linear encoder with 100 µm etching pitch
Steel tape accuracy	± 5 µm
Maximum speed	120 m/min.
Maximum vibration	10 g
Moving thrust	< 5 N
Operating temperature	0 °C...50 °C
Storage temperature	-20 °C...70 °C
Weight	1.50 kg + 4 kg/m
Relative humidity	20...80 %
Protection	IP 53 (standard) IP 64 (DIN 40050) using pressurized air in linear encoders at 0.8 ± 0.2 bar
Reader head	With detachable cable connector

Specific characteristics

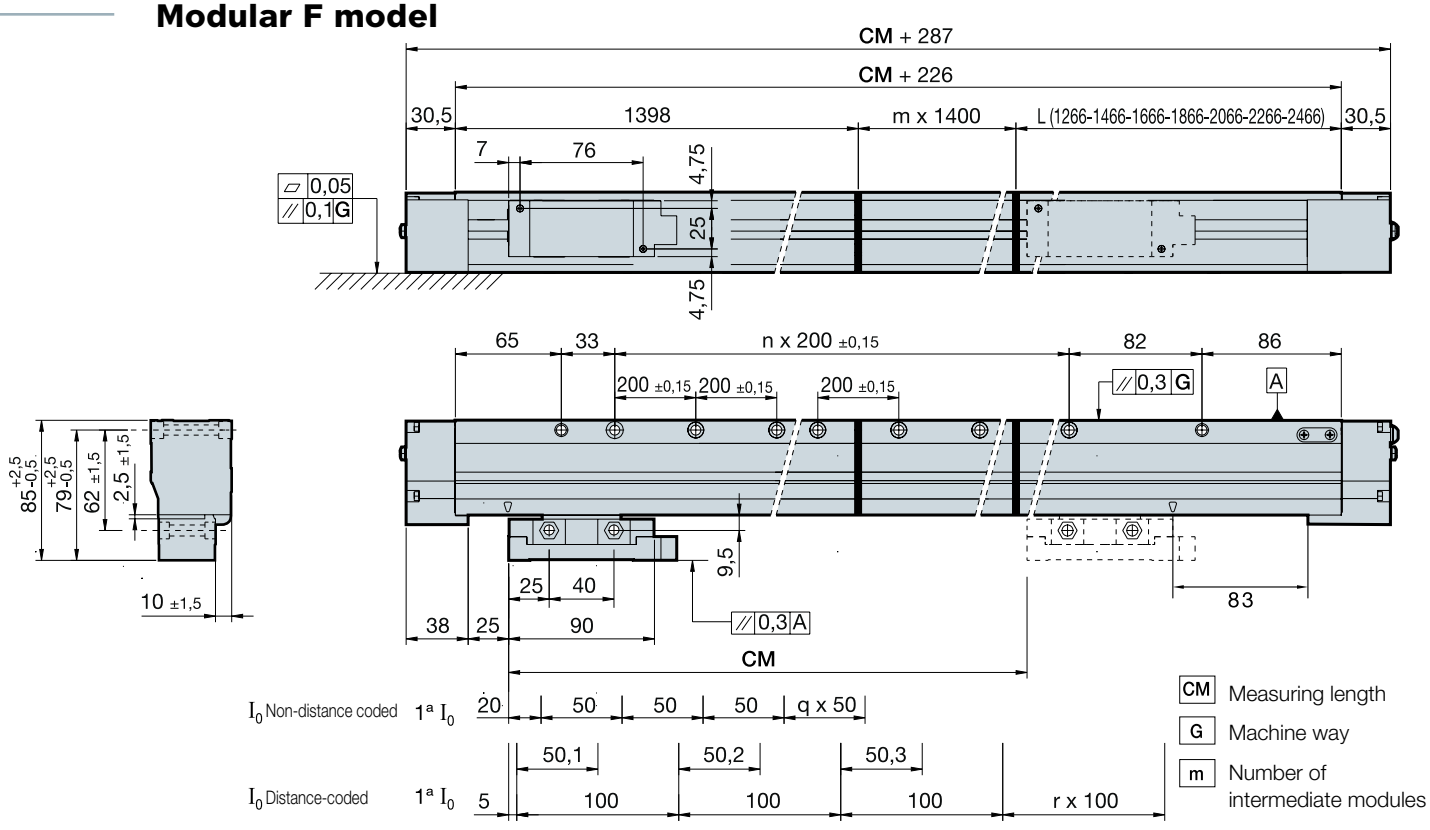
	FT FOT	FX FOX	FP FOP
Resolution	5 µm	1 µm	Up to 0.1 µm
Reference marks (I_0)	FT, FX, FP: every 50 mm FOT, FOX, FOP: Distance-coded I_0		
Output signals	⊓⊔ TTL	⊓⊔ TTL differential	∿ 1 Vpp
T period of output signals	20 µm	4 µm	100 µm
Limit frequency	100 kHz	500 kHz	20 kHz
Maximum cable length	20 m	50 m	150 m
Supply voltage	5 V ±5 % ,100 mA (without load)		5 V ±5 % ,100 mA (without load)

Dimensions in mm

Single F model



Modular F model



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

Order identification

Example for an incremental encoder: FX - 36

F		X	36
Type of profile: **F: for long distances**	***Type of reference mark*** I_0**:** • **Blank space: Incremental, one mark every 50 mm** • O: Distance-coded marks	***Type of signal:*** • T: 5 µm resolution TTL • **X: 1 µm resolution differential TTL** • P: 1 Vpp sinusoidal	***Ordering length code:*** In the example (36) = 3640 mm

C/C2 series

Designed for applications on standard machines with travels up to 3040 mm.

With reference marks every 50 mm or distance-coded and detachable cable connector built into the reader head.

Measuring lengths in millimeters:

220 • 270 • 320 • 370 • 420 • 470 • 520 • 620 • 720 • 770 820 • 920 • 1020 • 1140 • 1240 • 1340 • 1440 • 1540 1640 • 1740 • 1840 • 1940 • 2040 • 2240 • 2440 • 2640 2840 • 3040

General specification

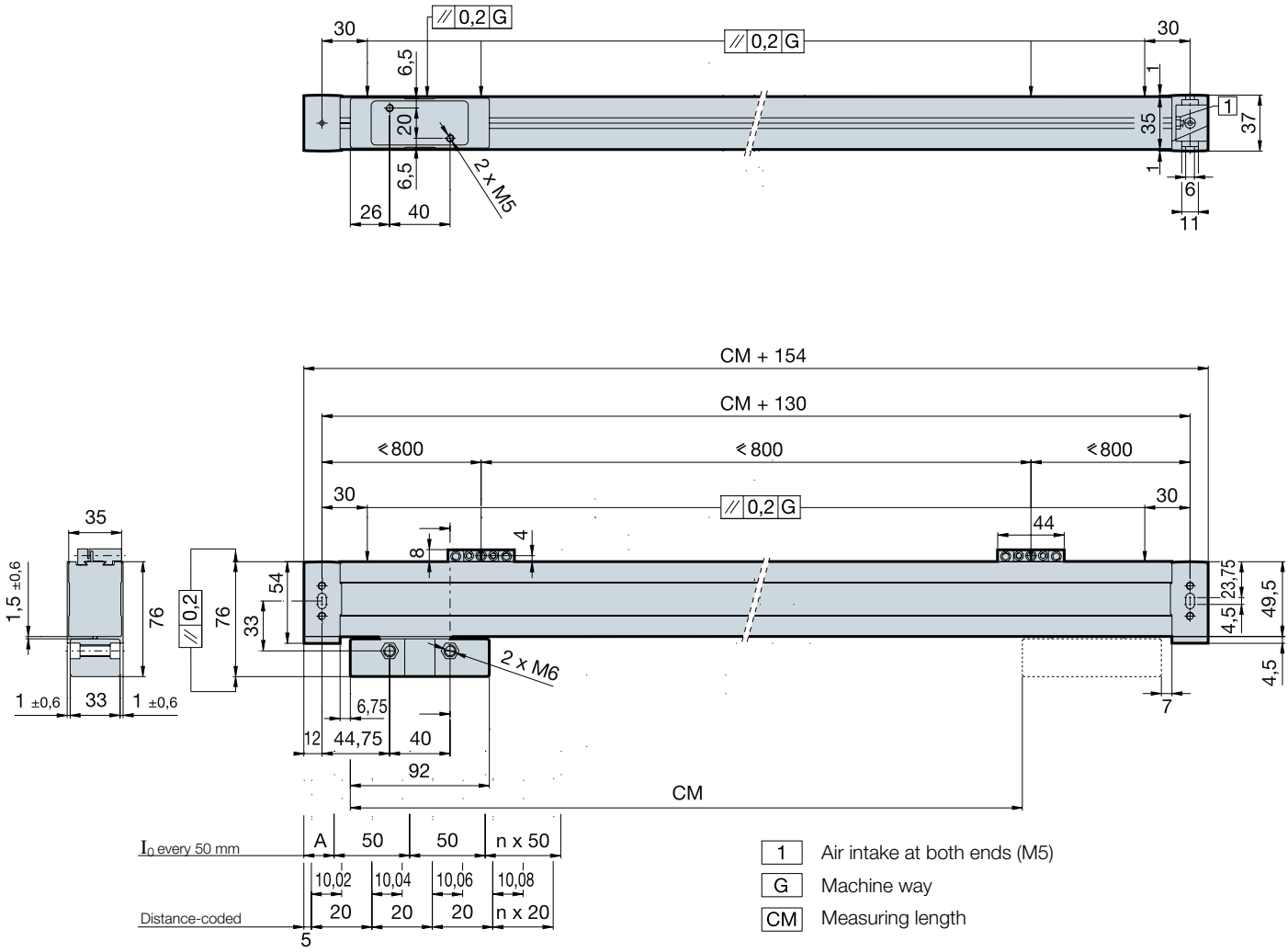
Measurement	By means of graduated glass scale, with 20 µm etching pitch
Maximum speed	60 m/min.
Maximum vibration	3 g
Moving thrust	< 5 N
Operating temperature	0 °C...50 °C
Storage temperature	-20 °C...70 °C
Weight	1.2 kg + 2.5 kg/m
Relative humidity	20...80 %
Protection	IP 53 (standard) IP 64 (DIN 40050) using pressurized air in linear encoders at 0.8 ± 0.2 bar
Reader head	With detachable cable connector

Specific characteristics

	CT COT	C2X C2OX	C2P C2OP
Accuracy	± 10 µm	± 5 µm	
Resolution	5 µm	1 µm	Up to 0.1 µm
Reference marks (I_0)	CT, C2X, C2P: every 50 mm COT, C2OX, C2OP: Distance-coded I_0		
Output signals	⊔⊓ TTL	⊔⊓ TTL differential	∿ 1 Vpp
T period of output signals	20 µm	4 µm	20 µm
Limit frequency	50 kHz	250 kHz	50 kHz
Maximum cable length	20 m	50 m	150 m
Supply voltage	5 V ± 5 %,100 mA (without load)		5 V ± 5 %,100 mA (without load)

Dimensions in mm

C/C2 model



Measuring lengths (CM)	
For CM ending in 20	A= 10
For CM ending in 40	A= 20
For CM ending in 70	A= 35

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

Order identification

Example for an incremental encoder: C2OP - 425

C2	O	P	42	5
Type of profile: **C/C2 for wide spaces**	***Type of reference mark*** I_0**:** • Blank space: Incremental, one mark every 50 mm • **O: Distance-coded marks**	***Type of signal:*** • T: 5 µm Resolution TTL • X: 1 µm Resolution differential TTL • **P: 1 Vpp sinusoidal**	***Measuring length in cm:*** In the example (42) = 42 cm = 420 mm	***Accuracy of the linear encoder:*** • **5: ± 5 µm** • Blank space: ± 10 µm

M/M2 series

Designed for applications on standard machines with travels up to 1540 mm.

With reference marks every 50 mm or distance-coded and detachable cable connector built into the reader head (except the MK series where the reader head comes standard with a 3-meter attached cable).

Measuring lengths in millimeters:

40 (*) • 70 • 120 • 140 • 170 • 220 • 270 • 320 • 370 420 • 470 • 520 • 620 • 720 • 770 • 820 • 920 • 1020 1140 • 1240 • 1340 • 1440 • 1540

(*) On MT and M2X models.

General specification

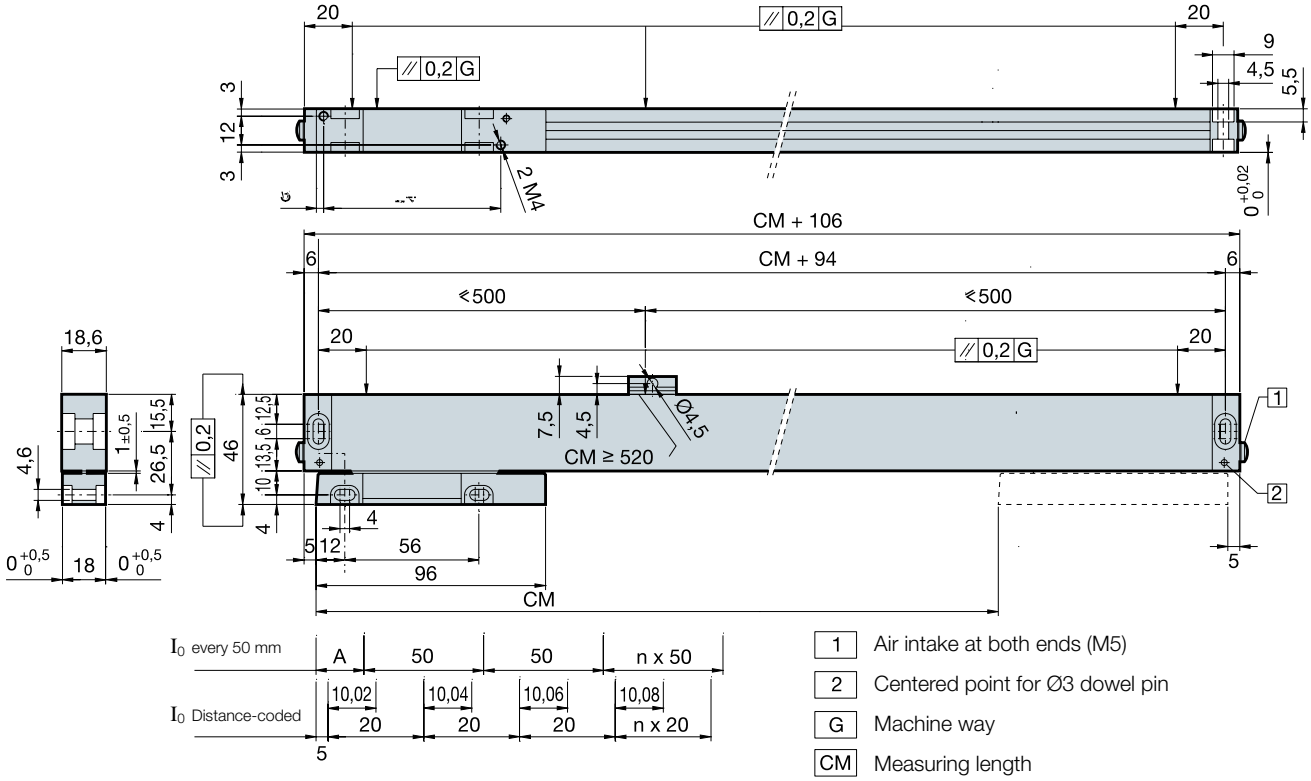
Measurement	By means of graduated glass scale, with 20 µm etching pitch
Maximum speed	60 m/min
Maximum vibration	3 g
Moving thrust	< 5 N
Operating temperature	0 °C...50 °C
Storage temperature	-20 °C...70 °C
Weight	0.58 kg + 0.6 kg/m
Relative humidity	20...80 %
Protection	IP 53 (standard) IP 64 (DIN 40050) using pressurized air in linear encoders at 0.8 ± 0.2 bar
Reader head	With detachable cable connector (except MKT and MKX)

Specific characteristics

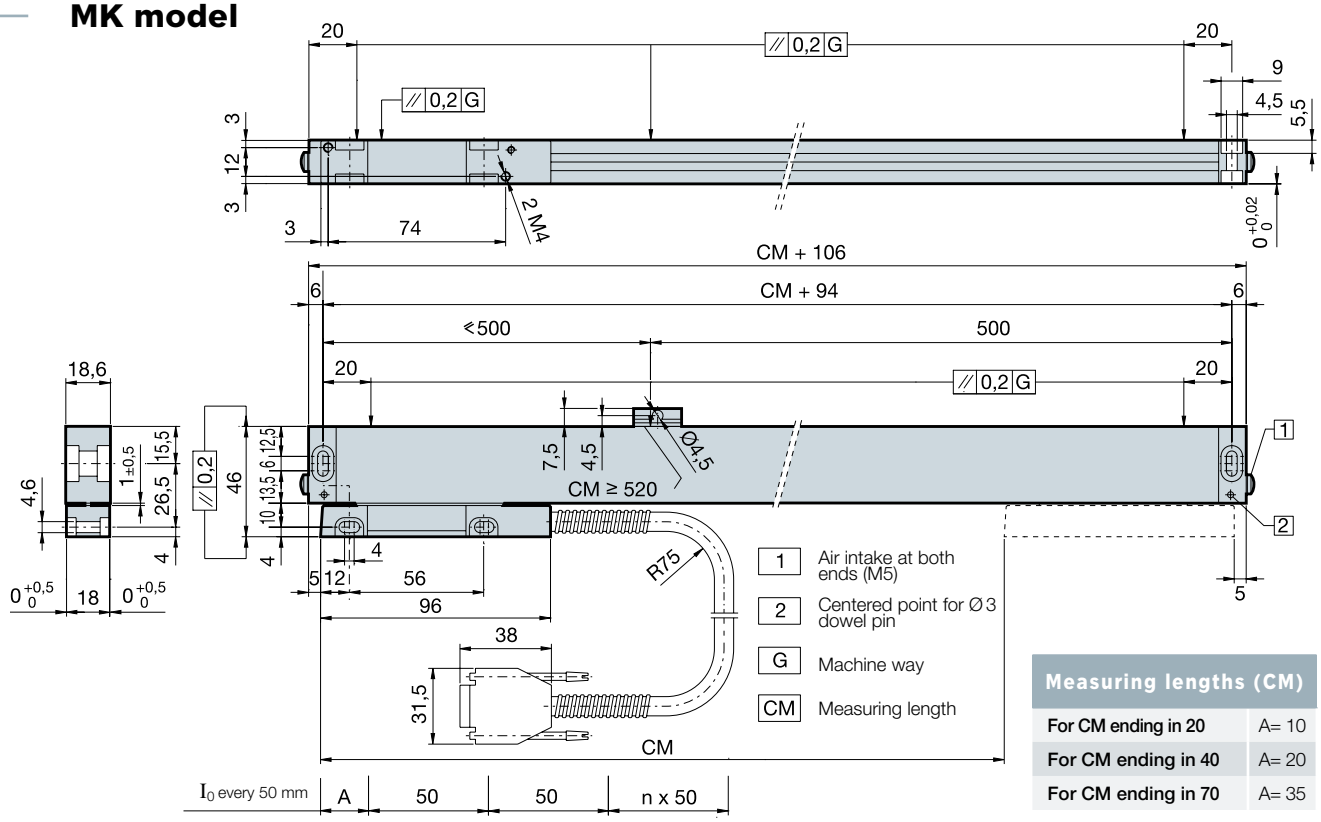
	MT MOT	MTD	MKT	M2X M2OX	MKX	M2P M2OP
Accuracy	± 10 µm			± 5 µm	± 10 µm	± 5 µm
Resolution	5 µm			1 µm		Up to 0.1 µm
Reference marks (I_0)	MKT, MKX: I_0 every 50 mm MT, MTD, M2X, M2P: I_0 every 50 mm MOT, M2OX, M2OP: Distance-coded I_0					
Output signals	⊔⊓ TTL	⊔⊓ TTL differential	⊔⊓ TTL	⊔⊓ TTL differential		⁓ 1 Vpp
T period of output signals	20 µm			4 µm		20 µm
Limit frequency	50 kHz			250 kHz		50 kHz
Maximum cable length	20 m	50 m	20 m	50 m		150 m
Supply voltage	5V ±5 % ,100 mA (without load)					5V ±5 % ,100 mA (without load)

Dimensions in mm

M/M2 model



MK model



Measuring lengths (CM)	
For CM ending in 20	A= 10
For CM ending in 40	A= 20
For CM ending in 70	A= 35

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

Identificación para pedidos

Example for an incremental encoder: M2OP - 425

M2	O	P	42	5
Type of profile: **M/M2: for limited spaces MK: for limited spaces, with cable included**	***Type of reference mark*** I_0**:** • Blank space: Incremental, one mark every 50 mm • **O: Absolute distance-coded marks** (*)	***Type of signal:*** • T: 5 µm resolution TTL • TD: 5 µm resolution differential TTL (*) • X: 1 µm resolution differential TTL • **P: 1 Vpp sinusoidal** (*)	***Measuring lengths in cm:*** In the example (42) = 42 cm = 420 mm	***Accuracy of the linear encoder:*** • **5: ± 5 µm** (*) • Blank space: ± 10 µm

(*): not available for MK.

MM/MM2 series

Designed for applications on standard machines with travels up to 520 mm.

With reference marks every 50 mm and detachable cable connector built into the reader head (except the MMK series where the reader head comes standard with a 3-meter attached cable). With very small profile, 5 mm less than the M series they are ideal for tight spaces.

Measuring lengths in millimeters:

40 (*) • 70 (*) • 120 • 140 • 170 • 220 • 270 • 320 • 370 420 • 470 • 520

(*) On MMT and MM2X models.

General specification

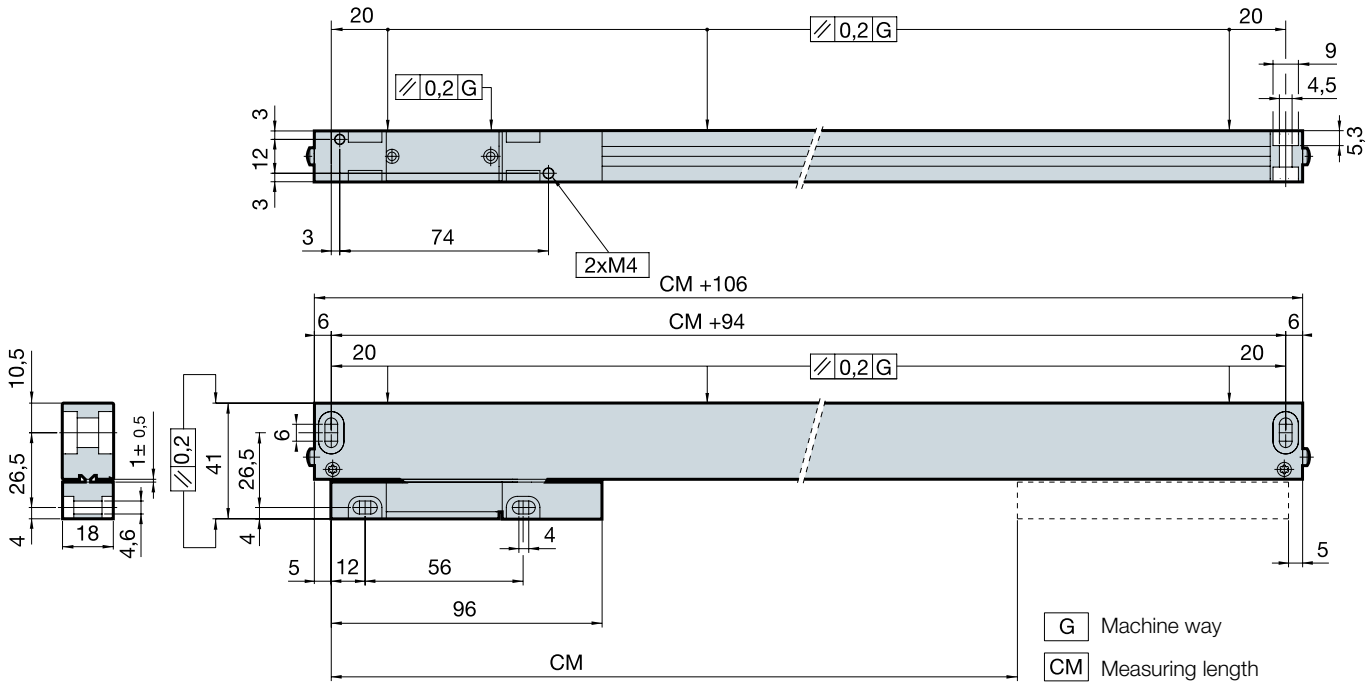
Measurement	By means of graduated glass scale, with 20 µm etching pitch
Maximum speed	60 m/min.
Maximum vibration	3 g
Moving thrust	< 5 N
Operating temperature	0 °C...50 °C
Storage temperature	-20 °C...70 °C
Weight	0.58 kg + 0.5 kg/m
Relative humidity	20...80 %
Protection	IP 53 (standard) IP64 (DIN 40050) using pressurized air in linear encoders at 0.8 ± 0.2 bar
Reader head	With detachable cable connector (except MMKT and MMKX)

Specific characteristics

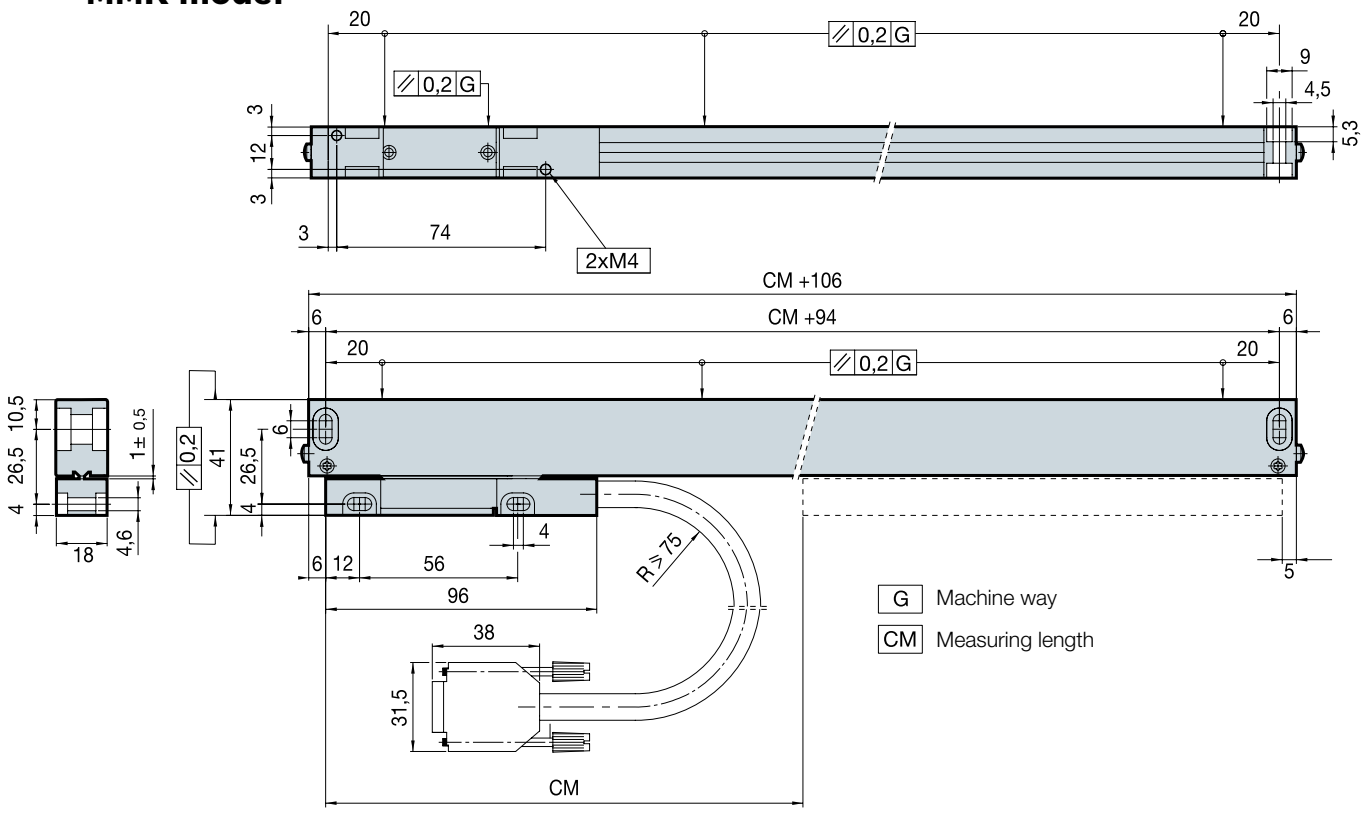
	MMT	MMKT	MM2X	MMKX	MM2P
Accuracy	± 10 µm		± 5 µm	± 10 µm	± 5 µm
Resolution	5 µm		1 µm		Up to 0.1 µm
Reference marks I_0	I_0 every 50 mm				
Output signals	⊔⊓ TTL		⊔⊓ TTL differential		∿ 1 Vpp
T period of output signals	20 µm		4 µm		20 µm
Limit frequency	50 kHz		250 kHz		50 kHz
Maximum cable length	20 m		50 m		150 m
Supply voltage	5 V ± 5 %, 100 mA (without load)				5V ±10%, <100 mA (without load)

MM/MM2 model

Dimensions in mm



MMK model



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

Order identification

Example for an incremental encoder: MMT-27

MM	T	27
Type of profile:	***Type of signal:***	***Measuring lengths in cm:***
MM/MM2: for very limited space **MMK: for limited spaces, with cable included**	• **T: 5 µm resolution TTL** • X: 1 µm resolution differential TTL • P: 1 Vpp sinusoidal (*)	In the example (27) = 27 cm = 270 mm

(*): not available for MMK.

H, S series

General specification

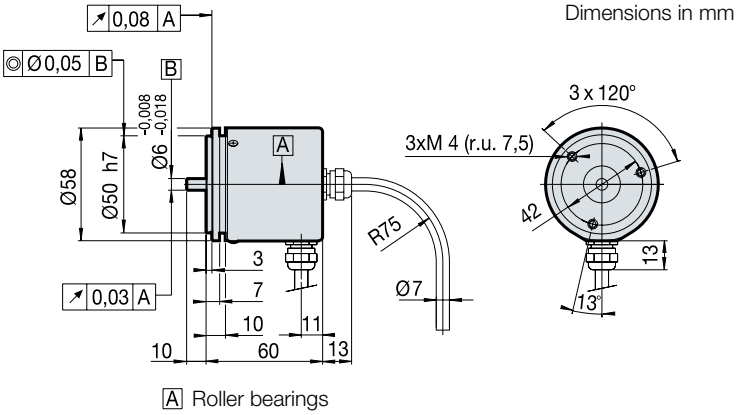
	S	SP	H	HP	HA
Measurement	**Up to 625 pulses/turn:** By means of perforated metallic disk **From 625 pulses/turn on:** By means of graduated glass disk				
Accuracy	± 1/10 of the pitch				
Maximum speed	12000 rpm				6000 rpm
Vibration	100 m/seg^2 (10 ÷ 2000 Hz)				
Shock	300 m/seg^2 (11 m/seg)				
Inertia	$1.6 \cdot 10^{-6}$ kgm^2				$3 \cdot 10^{-6}$ kgm^2
Starting torque	0.003 Nm (30 gr/cm) max. at 20 °C				0.02 Nm (200 gr/cm)
Type of shaft	Solid shaft		Hollow shaft		Hollow shaft
Maximum load on the shaft	Axial: 10 N Radial: 20 N		–		–
Weight	0.3 kg				0.5 kg
Ambient characteristics:					
Running temperature	0 °C…+70 °C				
Storage temperature	-30 °C…+80 °C				
Relative humidity	98 % non-condensing				
Protection	IP 64 (DIN 40050). On S and SP models: Optional IP 66				IP 65
Light source	IRED (InfraRed Emitting Diode)				
Maximum frequency	200 kHz				300 kHz
Reference signal I_0	One reference signal per encoder turn				
Supply voltage	5 V ± 5 % (TTL)	5 V ± 10 % (1 Vpp)	5 V ± 5 % (TTL)	5 V ± 10 % (1 Vpp)	5 V ± 5 % (TTL)
Consumption	70 mA typical, 100 mA max. (without load)				
Output signals	⊓⊓ TTL differential	~ 1 Vpp	⊓⊓ TTL differential	~ 1 Vpp	⊓⊓ TTL differential
Maximum cable length	50 m	150 m	50 m	150 m	50 m

Number of pulses/turn

S	SP	H	HP	HA
100	–	100	–	–
200	–	200	–	–
250	–	250	–	–
400	–	400	–	–
500	–	500	–	–
600	–	600	–	–
635	–	635	–	–
1000	1000	1000	1000	–
1024	1024	1024	1024	1024
1250	1250	1250	1250	1800
1270	1270	1270	1270	2000
1500	1500	1500	1500	2048
2000	2000	2000	2000	2500
2500	2500	2500	2500	3000
3000	3000	3000	3000	3600
–	3600	–	–	4000
–	4320	–	–	4096
5000	5000	5000	5000	5000
–	–	–	–	10000

S, SP models

Dimensions in mm

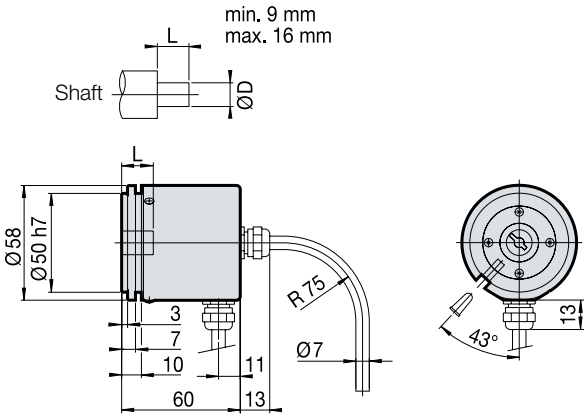


A Roller bearings

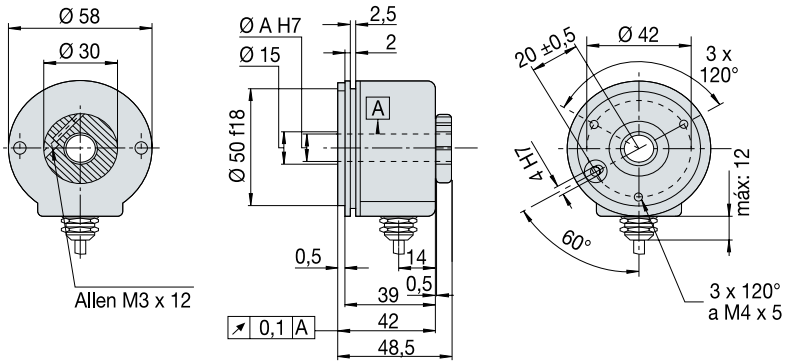
H, HP models

L: Min. 9 mm, max. 16 mm

ØD g7 mm
3
4
6
6.35
7
8
9.53
10



HA models



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

Order identification - models H, HP, S and SP

Example for a Rotary Encoder: SP-1024-R-C5-IP 66

S	P	1024	R	C5	IP 66
Model: • **S: Solid shaft** • H: Hollow shaft	***Type of signal:*** • Blank space: square signal (TTL or HTL) • **P: 1 Vpp sinusoidal signal**	***Number of pulses/turn*** (See table page 14)	***Cable exit*** *(not needed for C type of connector, it can be only radial):* • **R: Radial** • Blank space: Axial	***Type of connector:*** • Blank space:1 m cable without connector • C: Flange socket CONNEI 12 • **C5: 1 m cable with CONNEI 12 connector**	***Protection:*** • Blank space: Standard protection (IP 64) • **Protection IP 66 (only S model)**

Identificación para pedidos - modelo HA

Example for a Rotary Encoder: HA - 22132 - 2500

HA	2	2	1	3	2	2500
Model: • **H: Hollow shaft**	***Type of clamp:*** • 1: Rear clamp • **2: Front clamp**	***Size of the hollow shaft (ØA):*** • **2: 12 mm**	***Output signals:*** • **1: A, B, I_0 plus their inverted**	***Type of connection:*** • **3: Radial cable (1 m) with CONNEI 12 connector**	***Supply voltage:*** • **2: RS-422 (5 V)**	***Number of pulses/turn*** (See table page 14)

CONNECTION TO FAGOR

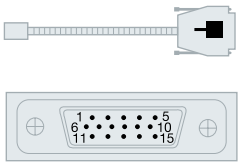
UP TO 12 METERS

EC-...T-D

Lengths: 1, 3, 6, 9 and 12 meters

SUB D 15 HD connector (male Pin ■)

Pin	Signal	Color
1	A	Green
3	B	Brown
5	I_0	Grey
9	+5 V	Yellow
11	0 V	White
15	Ground	Shield
Housing	Ground	Shield

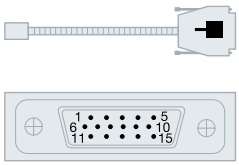


EC-...P-D

Lengths: 1, 3, 6, 9 and 12 meters

SUB D 15 HD connector (male Pin ■)

Pin	Signal	Color
1	A	Green
2	/A	Yellow
3	B	Blue
4	/B	Red
5	I_0	Grey
6	I_0	Pink
9	+5 V	Brown
11	0 V	White
15	Ground	Shield
Housing	Ground	Shield



FROM 12 METERS ON

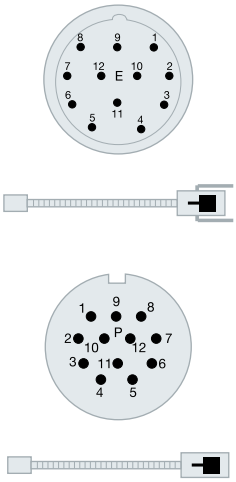
EC-...A-C1 cable + XC-C2-...-D extension cable

EC-...A-C1/ EC-...A-C5

Lengths: 1 and 3 meters

M23 12 connector (male Pin ■)

Pin	Signal	Color
5	A	Green
6	/A	Yellow
8	B	Blue
1	/B	Red
3	I_0	Grey
4	/I_0	Pink
7	/Alarm	Purple
12	+5 V	Brown
2	+5 V sensor	
10	0 V	White
11	0 V sensor	
Housing	Ground	Shield

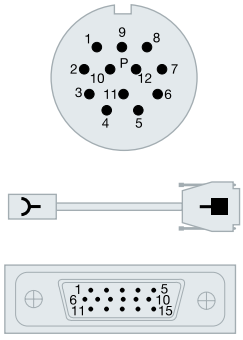


XC-C2-...-D extension cable

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

M23 12 connector (female Pin ⊃)
SUB D 15 HD connector (male Pin ■)

Pin	Pin	Signal	Color
5	1	A	Brown
6	2	/A	Green
8	3	B	Grey
1	4	/B	Pink
3	5	I_0	Red
4	6	/I_0	Black
7	8	/Alarm	Purple
12	9	5 V	Brown/ Green
2	9	+5 V sensor	Blue
10	11	0 V	White/ Green
11	11	0 V sensor	White
Housing	Housing	Ground	Shield



CONNECTION TO OTHER CNC'S

UP TO 12 METERS

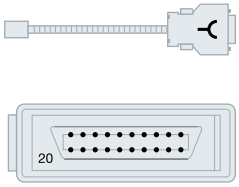
For direct connection to FANUC® (second feedback)

EC-...C-FN1

Lengths: 1, 3, 6, 9 and 12 meters

HONDA / HIROSE connector (female Pin)

Pin	Signal	Color
1	A	Green
2	/A	Yellow
3	B	Blue
4	/B	Red
5	I_0	Grey
6	$/I_0$	Pink
9	+5 V	Brown
18-20	+5 V sensor	
12	0 V	White
14	0 V sensor	
16	Ground	Internal shield
Housing	Ground	External shield



For direct connection to SIEMENS® (Solution Line and Sinumerik One).

SME20 (1 Vpp only)

EC-...A-C5

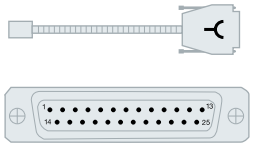
SMC20 (1 Vpp only)

EC-...P-S3

Lengths: 1, 3, 6, 9 and 12 meters

SUB D25 connector (female Pin)

Pin	Signal	Color
3	A	Green
4	/A	Yellow
6	B	Blue
7	/B	Red
17	I_0	Grey
18	$/I_0$	Pink
1	+5 V	Brown
14	+5 V sensor	
2	0 V	White
16	0 V sensor	
Housing	Ground	Shield



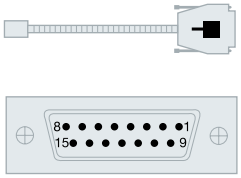
SMC30 (differential TTL only)

EC-...P-S2

Lengths: 1, 3, 6, 9 and 12 meters

SUB D 15 connector (male Pin)

Pin	Signal	Color
15	A	Green
14	/A	Yellow
13	B	Blue
12	/B	Red
10	I_0	Grey
11	$/I_0$	Pink
4	+5 V	Brown
5	+5 V	
7	0 V	White
Housing	Ground	Shield



Without a connector at one end; for other applications.

EC-...AS-O

Lengths: 1, 3, 6, 9 and 12 meters

Signal	Color
A	Green
/A	Yellow
B	Blue
/B	Red
I_0	Grey
$/I_0$	Pink
+5 V	Brown
+5 V sensor	Purple
0 V	White
0 V sensor	Black
Ground	Shield

CONEXIÓN A OTROS CNC'S

FROM 12 METERS ON

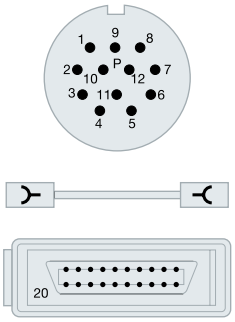
EC-...A-C1 cable + XC-C2-...-FN1 extension cable
EC-...A-C5 cable + XC-C4-...-C5 extension cable (1 Vpp only)
EC-...A-C5 cable + XC-C4-...-S3 extension cable (1 Vpp only)
EC-...A-C5 cable + XC-C4-...-S2 extension cable (differential TTL only)

XC-C2-...-FN1 extension cable

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

M23 12 connector (female Pin)
HONDA / HIROSE connector (female Pin)

Pin	Pin	Signal	Color
5	1	A	Brown
6	2	/A	Green
8	3	B	Grey
1	4	/B	Pink
3	5	I_0	Red
4	6	$/I_0$	Black
12	9	+5 V	Brown/ Green
2	18-20	+5 V sensor	Blue
10	12	GND	White/ Green
11	14	GND sensor	White
Housing	16	Ground	Shield

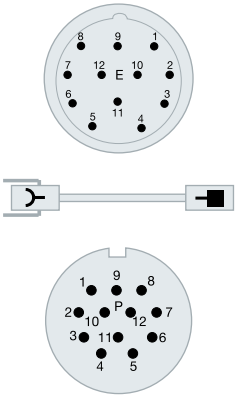


XC-C4-...-C5 extension cable

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

M23 12 connector (female Pina)
M23 12 connector (male Pin)

Pin	Pin	Signal	Color
5	5	A	Brown
6	6	/A	Green
8	8	B	Grey
1	1	/B	Pink
3	3	I_0	Red
4	4	$/I_0$	Black
12	12	+5 V	Brown/ Green
2	2	+5 V sensor	Blue
10	10	0 V	White/ Green
11	11	0 V sensor	White
7	7	/Alarm	Purple
Housing	Housing	Ground	Shield

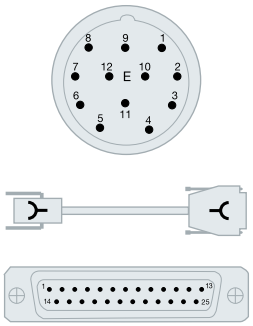


XC-C4-...-S3 extension cable

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

M23 12 connector (female Pin)
SUB D25 connector (female Pin)

Pin	Pin	Signal	Color
5	3	A	Brown
6	4	/A	Green
8	6	B	Grey
1	7	/B	Pink
3	17	I_0	Red
4	18	$/I_0$	Black
12	1	+5 V	Brown/ Green
2	14	+5 V sensor	Blue
10	2	0 V	White/ Green
11	16	0 V sensor	White
Housing	Housing	Ground	Shield

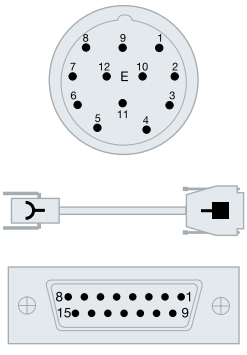


XC-C4-...-S2 extension cable

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

M23 12 connector (female Pin)
SUB D15 connector (male Pin)

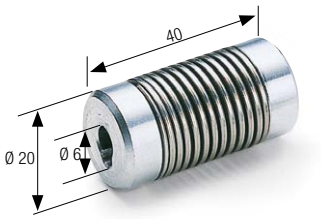
Pin	Pin	Signal	Color
5	15	A	Brown
6	14	/A	Green
8	13	B	Grey
1	12	/B	Pink
3	10	I_0	Red
4	11	$/I_0$	Black
12	4	+5 V	Brown/ Green
	5	+5 V	
2	6	+5 V sensor	Blue
10	7	0 V	White/ Green
11	9	0 V sensor	White
Housing	Housing	Ground	Shield



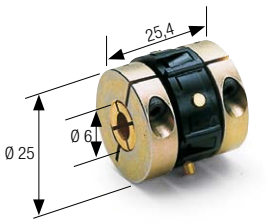
ACCESSORIES

Coupling for rotary encoders

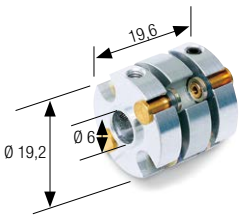
For solid shaft encoders



AF model



AC model



AL model

Specific characteristics

	AF	AC	AL
Maximum radial misalignment permitted λ	2 mm	1 mm	0.2 mm
Maximum angular misalignment permitted α	8°	5°	4°
Maximum axial misalignment permitted δ	± 1.5 mm	—	± 0.2 mm
Maximum torque that may be transmitted	2 Nm	1.7 Nm	0.9 Nm
Torsion rigidity	1.7 Nm/rad.	50 Nm/rad.	150 Nm/rad.
Maximum rotating speed	12 000 rpm		

AH couplings

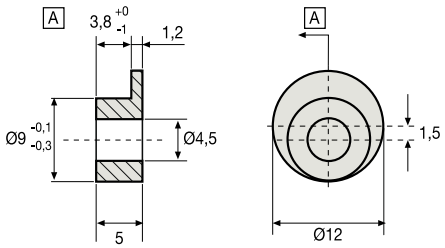
Couplings for hollow shaft encoders

The hollow shaft encoders are accompanied by a standard 6 mm cap diameter (Ø 6).

Can also be supplied in the following diameters:
Ø 3, Ø 4, Ø 6, Ø 7, Ø 8 and Ø 10 mm, 1/4" and 3/8".

AD-M washer

Washer for mounting rotary encoder models H, HP, S, SP.



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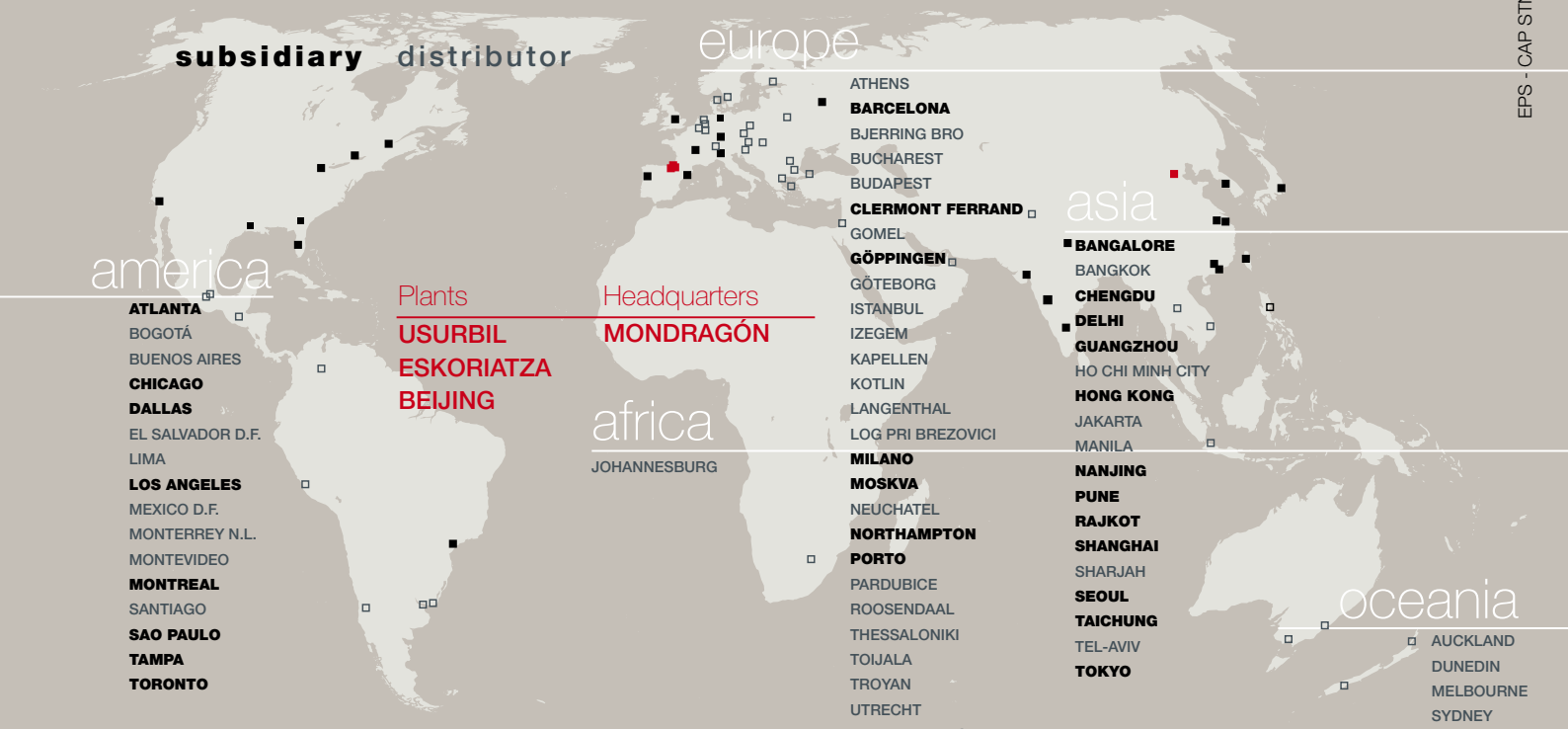

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