Measuring Systems

Precision in Measuring

Linear encoders

Rotary measuring encoders

Angle encoders

Digital position readouts

MEYLE®

Measuring Systems

Summary

Precision measurements, graduations

Precision grating of chrome coated glass is a highly technological process for linear and rotary encoders.

Chrome coated glass precision graduations are composed of an extremely thin layer of chrome on glass.

A small output signals 20µm or 40µm periode ensures high repeatability and accuracy for all kind of applications:
- Optics
- High precision measurements
- Semiconductor technology
- Inspection Devices

MEYLE

Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.: +49 5481-9385-0 Internet: www.meyle.de
49525 Lengerich/Germany Fax: +49 5481-9385-12 E-Mail: sales@meyle.de

Linear Encoders for length measurements:

Linear encoders measure the position of linear axis and are suitable for positioning accuracy on machines. The scales are protected against chip, dust and cooling water and are designed for use on various machine tools and installations such as:

- Lathes,
- Milling machines,
- Drilling and boring machines,
- machining centres,
- grinding machines, EDM machines,
- Bending presses,
- welding machines,
- other positioning devices etc.

We offer a wide range of linear encoders requiring different types of feedback signals for manufacturer's and end-user's of machine tools.

- Incremental glass linear encoders
- NC Incremental glass linear encoders
- Long lengths linear metal tape encoder
- Absolute Linear encoders

Linear encoders are used primarily on conventional metal working machine tools (lathes, milling machine tools, drilling and boring machines, grinding machine tools, machining centres, EDM, press brakes, etc).
Both the scale and reading head are protected against the influence of industrial environment
Available resolutions from 10 to 0,5 microns, output signals 11uA, 5V TTL RS422A, 12V square wave, +/-12V sinusoidal etc, Reference marks: one, two, upon request or distance coded reference marks.

With incremental linear scales current position is determined by starting at reference position and counting measuring steps.

The Linear Encoders family consists of optoelectronic incremental linear encoders types: 111, 113, 115, 130, 131, 170.

111

113

130

170

Model Name	111	113/115	130/131	170
Output signals	SO=Sine voltage DI=square wave differential DO=square wave	SO=Sine voltage, DS=square wave differential RS422A DO=square wave	SI = 11µApp, SV = 1Vpp DS=square wave differential RS422A DO=square wave	SI = 11µApp, SV = 1Vpp DS=square wave differential RS422A DO=square wave
Engraving pitch	20um or 40um	20um or 40um	20um or 40um	20um or 40um
Resolution	Available: 1um, 2um, 5um, 10um	Available: 0.5um, 1um, 2um, 5um, 10µm	Available: 0.5um, 1um, 2um, 5um, 10µm	Available: 0.5um, 1um, 2um, 5um, 10µm
Accuracy (at 20µC/68µF)	±3 um (Lm<520mm), ±5 um, ±10 µm	±3 um (Lm<520mm), ±5 um, ±10 µm	±3 um, ±5 um, ±10 um	±3 um, ±5 um, ±10 um
Light source	IR LED	IR LED	IR LED	IR LED
Photo detector	Photo transistor	Solar Cell		
Cross section	20x32mm (47,6mm)	16,3x29mm (45mm)	18x32mm (46mm)	37x51,5mm (77,5mm)
Measuring length [mm] Type 111: up to 2020mm Type 113: up to 1120mm Type 115: up to 1720mm Type 130: up to 1240mm Type 131: up to 2040mm Type 170: up to 3040mm	70.120.170.220.270.320. 370. 420. 470. 520. 570. 620. 670. 720. 770. 820, 920, 1020, 1120 (max for Type 113). 1220. 1320. 1420. 1520. 1620. 1720 (max for Type 115). 1820, 2020 (max for Type 111)		70.120.170.220.270.320. 370. 420. 470. 520. 570. 620. 670. 720. 770. 820. 920, 1020, 1140, 1240 (max for Type 130 and Type 131 without mounting bar). 1340, 1440. 1540. 1640. 1740. 1840. 2040 (max for Type 131 with mounting bar). 2240, 2440, 2640, 2840, 3040 (max for Type 170)	
Reference Mark	Reference Marks: 111: optionally each 100 mm 113/115: optionally each 50 mm		Reference Marks: 130: : optionally each 50 mm 131/170: optionally each 50 mm or Distance coded: Passing two adiacent reference marks that are max. 20 mm apart from each other reproduces absolute position.	
Operating temperature	0°C to +50°C. (32uF to 122uF)		0°C to +50°C. (32uF to 122uF)	
Storage temperature	-30°C to +70°C. (-22uF to 158uF)		-30°C to +70°C. (-22uF to 158uF)	
Humidity range	30% to 90% (no condensation)		30% to 90% (no condensation)	
Protective design grade (class)	Normal: IP53: with Air Purge: IP64		Normal: IP53: with Air Purge: IP64	
Atmosphere	Corrosive gas should not be contained in the atmosphere		Corrosive gas should not be contained in the atmosphere	
Vibration resistance (max vibration)	30 m/s²		30 m/s²	
Shock resistance (max shock)	100m/s²		100 m/s²	
Max. Response speed	45 m/min		60 m/min	
Power supply Power consumption	+5 V ± 5% 130 mA max.		+5V±5% 130 mA max.	
Cable length:	3m standard, available up to 50m		3m standard, SI: up to 20m DS: DO: up to 50m SV: up to 150m	

Linear Encoder for press brakes

Model Name	179
Output signals	SI = 11µApp, SV = 1Vpp DS=square wave differential RS422A
Engraving pitch	20mm or 40mm
Resolution	Available: 0.5um, 1um, 2um, 5um, 10um
Accuracy (at 20°C/68°F)	±3 µm, ±5 µm, ±10 µm
Light source	IR LED
Photo detector	Solar Cell
Cross section	55.2 x 51.5 mm (182 mm)
Measuring length [mm]	70.120.170.220.270.320. 370. 420. 470. 520, 570, 620, 670, 720, 770, 820, 920,
Reference Mark	Reference Marks: Optionally each 50 mm or Distance coded: Passing two adiacent reference marks that are max. 20 mm apart from each other reproduces absolute position.
Operating temperature	0°C to +50°C, (32°F to 122°F)
Storage temperature	-30°C to +70°C, (-22°F to 158°F)
Humidity range	30% to 90% (no condensation)
Protective design grade (class)	Normal: IP53: with Air Purge: IP64
Atmosphere	Corrosive gas should not be contained in the atmosphere
Vibration resistance (max. vibration)	30 m/s²
Shock resistance (max shock)	100 m/s²
Max. Response speed	60 m/min
Power supply	+5 V ± 5%
Power consumption	130 mA max.
Cable length:	3m standard, SI: up to 20m DS: DO: up to 50m SV: up to 150m

MEYLE
Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.:+49 5481-9385-0 Internetwwwmeyle.de
49525 Lengerich/German Fax:+49 5481-9385-12 E-Mailsales@meyle.de

Long length metal tape Linear Encoder: 190

The linear encoders type are designed for measuring ranges from 3m to 30m with recommended resolutions from 10ym to1 microns.

Available output signals 11uA, 1Vpp, 5V TTL RS422A.

Reference marks: selectable via magnet selector or distance coded.

Model Name	**Special long lengths linear encoder 190**
Output signals	SI = 11uApp, SV = 1Vpp DS=square wave differential RS422A
Engraving pitch	40mm
Resolution	Available: 1um, 2um, 5um, 10um
Accuracy (at 20°C/68°F)	±10 µm
Light source	IR LED
Photo detector	Solar Cell
Cross section	50x58.5 mm (85 mm)
Measuring length [mm]	Single Section Housing: 440, 640, 840, 1040, 1240, 1440, 1640, 1840, 2040, 2240, 2440, 2640, 2840, 3040, 3240, 3440 Multi Section Housing: 3640, 3840 ... 29840, 30040
Reference Mark	Optionally each 100 mm selectable by magnet selector or Distance coded: Passing two adjacent reference marks that are max. 80 mm apart from each other reproduces absolute position.
Operating temperature	0°C to +50°C, (32°F to 122°F)
Storage temperature	-30°C to +70°C, (-22°F to 158°F)
Humidity range	30% to 90% (no condensation)
Protective design grade (class)	Normal: IP53; with Air Purge: IP64
Atmosphere	Corrosive gas should not be contained in the atmosphere
Vibration resistance (max vibration)	100 m/s²
Shock resistance (max shock)	100 m/s²
Max. Response speed	120 m/min
Power supply	+5 V ± 5%
Power consumption	130 mA max
Cable length:	3m standard. SI: up to 20m DS: DO: up to 50m SV: up to 150m

190

NC Incremental Glass Linear Encoders: 133, 173

The NC linear encoders types 133, 173 are primarily used for NC machine tools applications (CNC lathes, Machining centres, CNC EDM, etc). They may also be used for measuring and positioning in the semiconductor industry. Recommended resolutions from 1ym to 0.1 microns. Available output signals 11uA, 1Vpp, 5V TTL RS422A. The scales are with defined thermal behaviour. Reference marks: one, two, upon request or distance coded. The NC Linear Encoders family consists of optoelectronic incremental linear encoders types: 133 (slim size), 173 (medium size).

Model Name	133 (Slim size)	173 (Medium size)
Output signals	SI=11uApp, SV=1Vpp, DS=square wave differential RS422A	SI=11uApp, SV=1Vpp, DS=square wave differential RS422A
Engraving pitch	20µm	20µm
Resolution	for SI and SV output signals: Recommended: 0.1µm, 0.5µm, 1µm For DS output signals: Available: 0.1µm, 0.5µm, 1µm	for SI and SV output signals: Recommended: 0.1µm, 0.5µm, 1µm For DS output signals: Available: 0.1µm, 0.5µm, 1µm
Accuracy (at 20°C/68°F)	±3 µm, ±5 µm, ±10 µm	±3 µm, ±5 µm, ±10 µm
Light source	IR LED	IR LED
Photo detector	Solar Cell	Solar Cell
Cross section	18 x 32 mm (46 mm)	37 x 58.5 mm (85 mm)
Measuring length [mm] TGM133: max length up to 2040mm TGM173: max length up to 3040mm	70,140,170,240,270,340, 370, 440, 470, 540, 570, 640, 670, 740, 770, 840, 940, 1040, 1140 (max for 133 without mounting bar), 1240, 1340, 1440, 1540, 1640, 1740, 1840, 2040 (max for 133 with mounting bar), 2240, 2440, 2640, 2840, 3040 (max for 173)	
Measuring length [inch]	5.5, 7.5, 9.4, 13.4, 17.3, 21.3, 25.2, 29.1, 33.1, 37.0, 40.9, 44.9, 48.8, 52.8, 56.7, 60.6, 64.6, 68.5, 72.4, 80.3, 88.2, 96.1, 103.9, 111.8, 119.7	
Reference Mark	Distance coded: Passing two adjacent reference marks that are max. 20 mm apart from each other reproduces absolute position.	
Operating temperature	0°C to +50°C, (32°F to 122°F)	
Storage temperature	-30°C to +70°C, (-22°F to 158°F)	
Humidity range	30% to 90% (no condensation)	
Protective design grade (class)	Normal: IP53; with Air Purge: IP64	
Atmosphere	Corrosive gas should not be contained in the atmosphere	
Vibration resistance (max vibration)	100 m/s²	
Shock resistance (max shock)	100 m/s²	
Max. Response speed	120 m/min	
Power supply	+5V±5%	
Power consumption	130 mA max.	
Cable length:	3m standard. SI: up to 20m DS: up to 50m SV: up to 150m	

133

173

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Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.: +49 5481-9385-0 Internet: www.meyle.de
49525 Lengerich/Germany Fax: +49 5481-9385-12 E-Mail: sales@meyle.de

ABSOLUTE Linear Encoders:
A133. A173

The ABSOLUTE linear encoders types A133. A173 are primarily used for CNC machine tools. positioning systems. robotics. production lines. semiconductor equipment etc.

The absolute position value is accertained By evaluating a pseudo-random code. Next to this code is an incremental track with grating periode of 32µm. Available resolutions from 1µm to 0.1 microns. Available output signals 1Vpp. 5V TTL RS422A. Type of absolute code interface: SSI or BiSS. The scales are with defined thermal behaviour.

The ABSOLUTE Linear Encoders family consists of linear encoders types: **A133 (slim size). A173 (medium size).**

Model Name	A133 (Slim size)	A173 (Medium size)
Incremental output signals	SV=1Vpp. DS=square wave differential RS422A	SV=1Vpp. DS=square wave differential RS422A
Engraving pitch	32µm	32µm
Resolution	for SV (1Vpp) output signals: Recommended: 0.1µm. 0.2µm. 0.5µm. 1µm. 2µm For DS (5V TTL RS422A) output signals: Available: 0.1µm. 0.2µm. 0.5µm. 1µm. 2µm	for SV (1Vpp) output signals: Recommended: 0.1µm. 0.2µm. 0.5µm. 1µm. 2µm For DS (5V TTL RS422A) output signals: Available: 0.1µm. 0.2µm. 0.5µm. 1µm. 2µm
Absolute code Interface	SSI or BISS	SSI or BISS
Accuracy (at 20°C/68°F)	±3 µm. ±5 µm	±3 µm. ±5 µm
Light source	IR LED	IR LED
Photo detector	Integrated light to voltage converter	Integrated light to voltage converter
Cross section	18 x 32 mm (62 mm)	37 x 58.5 mm (85 mm)
Measuring length [mm]	70.140.170.240.270.340. 370. 440. 470. 540. 570. 640. 670. 740. 770. 840. 940. 1040. 1140. 1240 (for 133 mounting bar recommended). 1240. 1340. 1440. 1540. 1640. 1740. 1840. 2040 (max for 133. mounting bar required). 2240. 2440. 2640. 2840. 3040 (max for 173)	
Operating temperature	0°C to +50°C, (32°F to 122°F)	
Storage temperature	-30°C to +70°C. (-22°F to 158°F)	
Humidity range	30% to 90% (no condensation)	
Protective design grade (class)	Normal: IP53: with Air Purge: IP64	
Atmosphere	Corrosive gas should not be contained in the atmosphere	
Vibration resistance (max vibration)	100 m/s²	
Shock resistance (max shock)	100 m/s²	
Max. Response speed	120 m/min	
Power supply	+5V±5%	
Power consumption	150 mA max.	
Cable length:	3m standard: max for DS: up to 50m: max for SV: up to 150m	

A1712

A133

Rotary Encoders for angle and position measurements

Rotary Encoders

Rotary encoders transform mechanical rotation into a series of electrical pulses. The operating principle is based on an optoelectronic technique. They are used in various industrial fields for accurate angle. positionand rotation speed measurements. Rotary encoders can be divided into two groups

Used for rotary motion applications. angular velocity. and linear position measurements when used in conjunction: with mechanical measuring standards like lead screw's.

Miniature 22. 23. 24 (diameter 22mm) and standard 10. 11 12. (diameter 58mm) rotary encoders types: up to 5000 lin/rev. while 30 is a handwheel for manual positioning. Line numbers: 50-5.000 lin/rev. Output signals: square waves or sinusoidal. Sinusoidal signals can be interpolated by 5. 10. 25 and 50.

Model Name	Miniature versions. Diameter 22mm			Standard versions. Diameter 58mm			Hand wheel
	22	23	24	10	11	12	30
Cable axial version	22.5	23.5	24.5	10.5	11.5	12.5	3000
Cable radial version	22.4	23.4	24.4	10.6	11.6	12.6	3001
Connector axial version				10.3	11.3	12.3	3002
Connector axial version				10.4	11.4	12.4	
Flange diameter	22	30	24	58	58	58	58
Shaft diameter	F6f7	F5f7	F4f7	F10f8	F6f8	F8h7	-
Mechanical protection	IP50	IP64. IP65	IP64. IP65	IP64. IP65	IP50		
Output signals: DO(square waves). DS (square waves differential with line driver). SI(11uA sine). SV(1Vpp sine)	DO. DS			DO. DS SI (11uA sine). SV (1Vpp sine)	DO. DS SI (11uA sine). SV (1Vpp sine)	DO. DS SI (11uA sine). SV (1Vpp sine)	DO. DS SI (11uA sine). SV (1Vpp sine)
Output levels: C (OC). T: 5V TTL. S: sine current. L: C-MOS. P: Push-Pull	C. T. P			C. T. L. S. P	C. T. L. S. P	C. T. L. S. P	C. T. L. S. P
Supply voltage	5V. 12V. 15-30V			5V. 12V. 15-30V	5V. 12V. 15-30V	5V. 12V. 15-30V	5V. 12V. 15-30V
Max frequency	50kHz			T.L: 300kHz. C: 150kHz. S: 85kHz	T.L: 300kHz. 150kHz. S: 85kHz	T.L: 300kHz. 150kHz. S: 85kHz	T.L: 300kHz. 150kHz. S: 85kHz
No. lines/rev.	standard: 100. 250. 360. 1024 other on special request			standard: 50. 60. 100. 125. 127. 150. 180. 200. 250. 360. 500. 600. 900. 1000. 1024. 1250. 1500. 1800. 2000. 2500. 3600. 5000 also available with integrated interpolation electronic x10			100
Accessories	Couplings K. M. H: Fastening plates			Couplings K. M. H: fastening plates. connectors. mounting flanges			no

11

12

62

72

72

Angular Encoders

Are used in various applications like NC rotary tables, high precision angle measuring tables, machining heads, telescopes, etc.

61, 62 (diameter 90 mm) 71, 72 (diameter 170 mm) are primarily used for high - precision angle measurement for rotary tables: 6000, 9000, 18.000 and 36.000 lines/rev..

Output signals: square waves or sinusoidal. Sinusoidal signals can be interpolated by 5, 10, 25 and 50.

Model name	61	62
Cable axial version	61.5	-
Cable radial version	61.6	62.6
Flange dimension [mm]	90	90
Shaft diameter [mm]	F10H6	Hole F20H6
Mechanical protection	IP64	IP64
Output signals: DS: RS422A SI: (11mA sine), SV(1Vpp sine)	DS (square waves differential with line driver), SV, SI	DS (square waves differential with line driver), SV, SI
Supply voltage	5V±5%	5V±5%
No. lines/rev.	5000, 6000, 9000, 18000	5000, 6000, 9000, 18000
Reference marks	1 or DCR (Distance coded) only for 18000 lines	1 or DCR (Distance coded) only for 18000 lines
Accuracy	±2.5'', ±7.5''	±5'', ±7.5''
Accessories	Couplings	Couplings

Model name	71	72
Cable axial version	-	-
Cable radial version	71.6	72.6
Diameter [mm]	F170	F170
Shaft diameter [mm]	F14H6	Hole F50H7
Mechanical protection	IP64	IP64
Output signals: DS: RS422A SI: (11mA sine), SV(1Vpp sine)	DS (square waves differential with line driver), SV, SI	DS (square waves differential with line driver), SV, SI
Supply voltage	5V±5%	5V±5%
No. lines/rev.	16384, 18000, 36000	16384, 18000, 36000
Reference marks	1 or DCR (Distance coded) only for 18000 and 36000 lines	1 or DCR (Distance coded) only for 18000 and 36000 lines
Accuracy	±1.5'', ±2.5''	±2.5'', ±5''
Accessories	Couplings	Couplings

A110

A120

Accessories

Interpolation Electronics

Digitizing and interpolation single - axis units. They convert the sine wave current (11uA) or voltage signals (1Vpp) from the measuring transducers (linear encoders or rotary encoders) into TTL compatible square wave signals for digital up-down counter (e.g. digital position readouts, numerical CNC controllers etc.).

Model nam	A110	A 125 / 150
Interpolations factor	5, 10	25, 50
Input signals	Sine current 11uA or 1Vpp	Sine current 11uA or 1Vpp
Output signals	Square waves with line driver (A, Ainv, B, Binv, Rl, Riinv, ERRinv)	Square waves with line driver (A, Ainv, B, Binv, Rl, Riinv, ERRinv)
Power supply	5V	5V
Input frequency	50kHz	50kHz
Dimensions	100x65x35mm	100x65x35mm

Magnet Field Sensor

The magnet field sensor is designed for measuring gear wheel speeds and for measuring the relative angle of gear wheel rotation. Its output signals are square wave A and B. Phase shift between signals depends on the gear wheel module. There are 4 nominal modules: 0.5, 1, 1.5 and 2).

MEYLE

Meyer Industrie-Electronic GmbH MEYLE
Carl-Bosch-Stra e 8 Tel.:+49 5481-9385-0 Internetwwwmeyle.de
49525 Lengerich/German Fax:+49 5481-9385-12 E-Mailsales@meyle.de

Digital Position Readouts for conventional manually - operated machine tools

A family of RO (RO 10. 20. 20Z. 21. 22. 30. 31) and ROE (ROE 20. 30) based on sophisticated technology (microprocessor structure) with wide selection of standard and special functions.

Family of one. two. three or four - axis digital position readouts for applications on different kinds of machine tools (lathes. lathes with analogue main spindle drive. milling machine tools. drilling and boring machines. grinding machine tools. machining centres. EDM. tool presetters. etc)

A digital position readout system consists of one. two. three or four linear encoders or rotary encoders for position measuring and of digital position readout unit for showing position values.

The RO system offers a great advantage over conventional measuring systems and provide's considerable improvement to new and used machine tools. substantially increasing productivity as well as profitability. They save a time. increase the dimensional accuracy of machine parts and enable operating easy.

Type	RO10	RO20	RO20Z	RO21	RO22	RO30	RO31	ROE20	ROE30
Housing versions availible	Box Console 'V' Panel mounting (special request)	Box Console 'V' Panel mounting (special request)	Box Console 'V' Panel mounting (special request)	Box Console 'V' Panel mounting (special request)	Box Console 'V' Panel mounting (special request)	Box Console 'V' Panel mounting (special request)	Box Console 'V' Panel mounting (special request)	Console 'V' Panel mounting (special request)	Console 'V' Panel mounting (special request)
Input signals versions	RS 422 (DS) 11uA (SI)	RS 422 (DS) 11uA (SI)	RS 422 (DS) 11uA (SI)	RS 422 (DS) 11uA (SI)	RS 422 (DS) 11uA (SI)	RS 422 (DS) 11uA (SI)	RS 422 (DS) 11uA (SI)	RS 422 (DS) 11uA (SI)	RS 422 (DS) 11uA (SI)
Axis number	1 1+1 (option)	2 2+1 (option)	3	2 2+1 (option)	2 2+1 (option)	3 3+1 (option)	3	3 3+1 (option)	3 3+1 (option)
Axis designation	X X. X' Application	X. Z X. Z. Z' Lathes	X. Zo. Z Lathes	X. Y X.Y + X' or Y' Two coordinate machine tools	X. Z X. Z. Z' Tool Preseters	X. Y. Z X. Y. Z.+X' or Y' or Z' Milling machines. Horizontal milling machines with parallel 4th axis	X. Y. Z EDM	X. Y. Z X. Y. Z. + X' or Y' or Z' Lathes	X. Y. Z X. Y. Z. + X' or Y' o rZ' Milling machines. Horizontal milling machines with parallel 4th axis
Reset	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Preset	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Reference Point Standard and DCRM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ABS/REL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Inch/mm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R/D	No	Yes	Yes	No	Yes	No	No	Yes	Yes
Datum Points	9	9	99	9	99	9	9	99	99
Conicity calculation	No	Yes	Yes	No	No	No	No	Yes	No
Bolt holes	No	No	No	No	No	Yes	Yes	No	Yes
Linear packet of holes	No	No	No	No	No	No	No	No	Yes
Rectangular packet of holes	No	No	No	No	No	No	No	No	Yes
Angle measuring	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Linear error compensation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Halving of the positioning values	Yes	Yes In Z axes	Yes In Z axes	Yes	Yes In Z axes	Yes	Yes	Yes In Z axes	Yes
Tool dimension compensation	No	Yes - 9	Yes - 99	No	Yes - 99	No	No	Yes - 99	Yes 1
Feedrate display	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Scalling factor	No	No	No	No	No	No	No	Yes	Yes
Electronic rotation - SKEW	No	No	No	No	No	No	No	No	Yes
RPM calculator	No	No	No	No	No	No	No	Yes	Yes
EDM machining mode	No	No	No	No	No	No	Yes	No	No
Analog output for main spindle drive	No	Option	Option	No	No	No	No	Option	Option
Constant surface speed	No	Option	Option	No	No	No	No	Option	Option
RS232C	Option	Option	Option	Option	Yes	Option	Option	Option	Option
Built in interpolator	Option	Option	Option	Option	Option	Option	Option	Option	Option
Touch sensor	Option	Option	Option	Option	Option	Option	Option	Option	Option
Battery back up	Option	Option	Option	Option	Option	Option	Option	Option	Option

RO 10

RO20

RO21

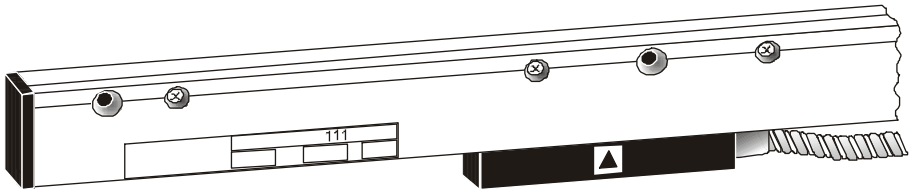
RO31

RO20

MEYLE
Meyer Industrie-Electronic GmbH MEYLE
Carl-Bosch-Stra e 8 Tel.: +49 5481-9385-0 Internetwww.meyle.de
49525 Lengerich/German Fax:+49 5481-9385-12 E-Mailsales@meyle.de

INCREMENTAL LINEAR SCALES 111

Optoelectronic

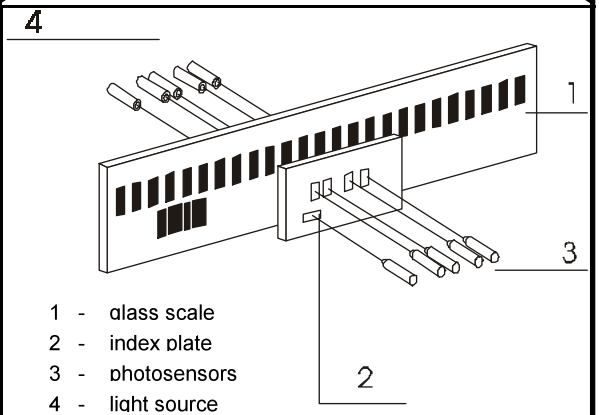


GENERAL DESCRIPTION:

The 111 is an optoelectronic incremental sealed linear scale: applied in numerous industrial areas for high-precision position measuring(machine tool industry, positioning systems, robotics, etc.).

Measuring lengths: 170 to 2220 mm
Cross section: 20 x 32 mm (47.6 mm)
Accuracy: ± 10. ± 5. ± 3 um(for $L_m \leq 520$ mm)
Resolution: 1. 2. 5. 10 um
Output signals: DO (square wave)
SO (sine-wave voltage)
DI (square wave inverted signals)

OPERATING PRINCIPLE:



1 - glass scale
2 - index plate
3 - photosensors
4 - light source

MECHANICAL DATA:

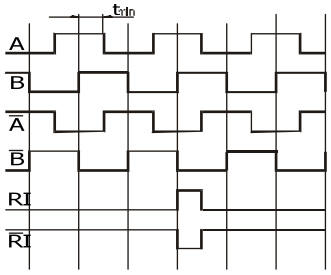
Standard measuring length "Lm" (mm)	170/220/250/270/320/370/420/470/520/620/720/820/920/ 1020/1120/1220/1320/1420/1520/1620/1720/1820/2020/2220
Reference mark	Standard position in centre. Other positions optional at spacing of 100 mm along the measuring length.
Accuracy class	±10 um. ± 5 um. (± 3 um only for Lm ≤ 520 mm)
Interval	20 um or 40 um
Resolution	1 um. 2 um. 5 um. 10 um (for DO and DI output signal version)
Maximal speed	45 m/min
Permissible acceleration	30 m/s^2
Moving force for scanning unit	≤ 4N
Degree of mechanical protection	IP 53 (in compliance with mounting instructions)
Vibrations (50...2000 Hz)	30 m/s^2
Shocks (11ms)	100 m/s^2
Temperature	operating: 0sC to 50sC storage: -30sC to + 70sC
Permissible relative humidity	20% - 70%
Cable length	standard 3 m. extension on order to 50 m
Mass	0.4 kg + 1 kg/m measuring length

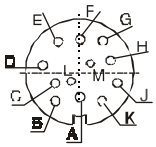
ELECTRICAL DATA:

Output signals	Voltage U_n	Current I_n
DI - square-wave inverted signals	5 V ± 5%	≤ 100 mA
DO - square-wave signals	12V ± 5%	≤ 120 mA
SO - sine-wave voltage signals	+/-12V ± 5%	≤ 70 mA (+12V) ≤ 20 mA (-12V)

ELECTRICAL DATA:

Square-wave output signals with inverted values -

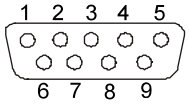




12 pole connector (Amphenol)
square-wave inverted output signals (DI)

contact	A	B	C	D	E	G	H	K	L
signal	shield	0 V	A	$\overline{A}$	B	RI	$\overline{RI}$	+ V	$\overline{B}$

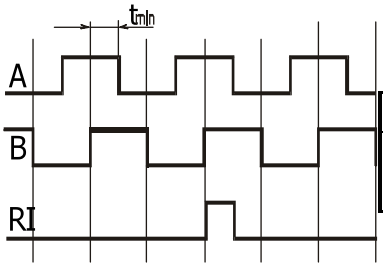
Signal level ...	TTL
I_{sink} = 15 mA	$U_{OL} \leq 0.5$ V
I_{source} = 15 mA	$U_{OH} \geq 4.0$ V
Transition time:	
$t_{tLH} = t_{tHL} \leq 60$ ns:	without load
t_{min}= f(v)	



9 pole connector (D-Sub)
square-wave output signals (DI)

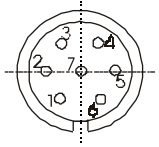
contact	1	2	3	4	5	6	7	8	9
signal	shield	$\overline{RI}$	$\overline{B}$	$\overline{A}$	+5V	RI	B	A	0V

Square-wave output signals - DO:



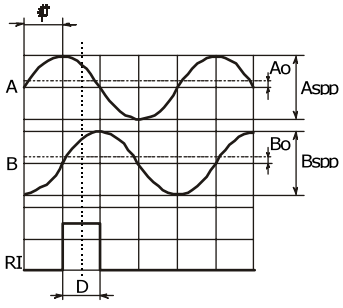
Signal level ...	HTL	Transition time:
I_{sink} = 1 mA	$U_{OL} \leq 0.5$ V	$t_{tHL} \leq$ 2 µs
I_{source} = 4 mA	$U_{OH} \geq 11$ V	$t_{tHL} \leq$ 250 ns; without load

7 pole connector (Amphenol)
square-wave output signals (DO)



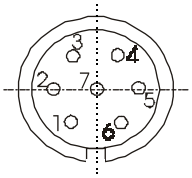
contact	1	2	3	4	5	6	7
signal	0 V		A	B	+ V	RI	shield

Sine wave voltage output signals - SO:



Amplitude characteristics
$I A_0 I - I B_0 I \leq 0.25$ V
$I A_{spp} - B_{spp} I \leq 0.5$ V
$A_{spp} = B_{spp}$ = 15 - 16 V at f ≤ 15 kHz
7 - 8 V at f = 50 kHz
Phase shift of signals A_s and B_s
i = 90s ± 15s f < 15 kHz
i = 90s ± 30s f = 50 kHz

7 pole connector (Amphenol)
sine-wave voltage output signals (SO)

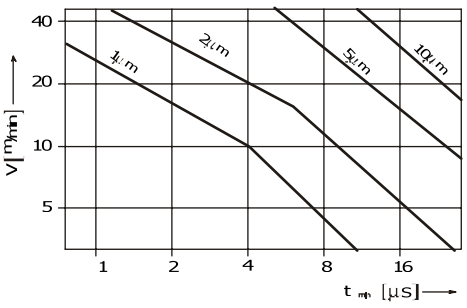


contact	1	2	3	4	5	6	7
signal	0 V	- V	A_s	B_s	+ V	RI	shield

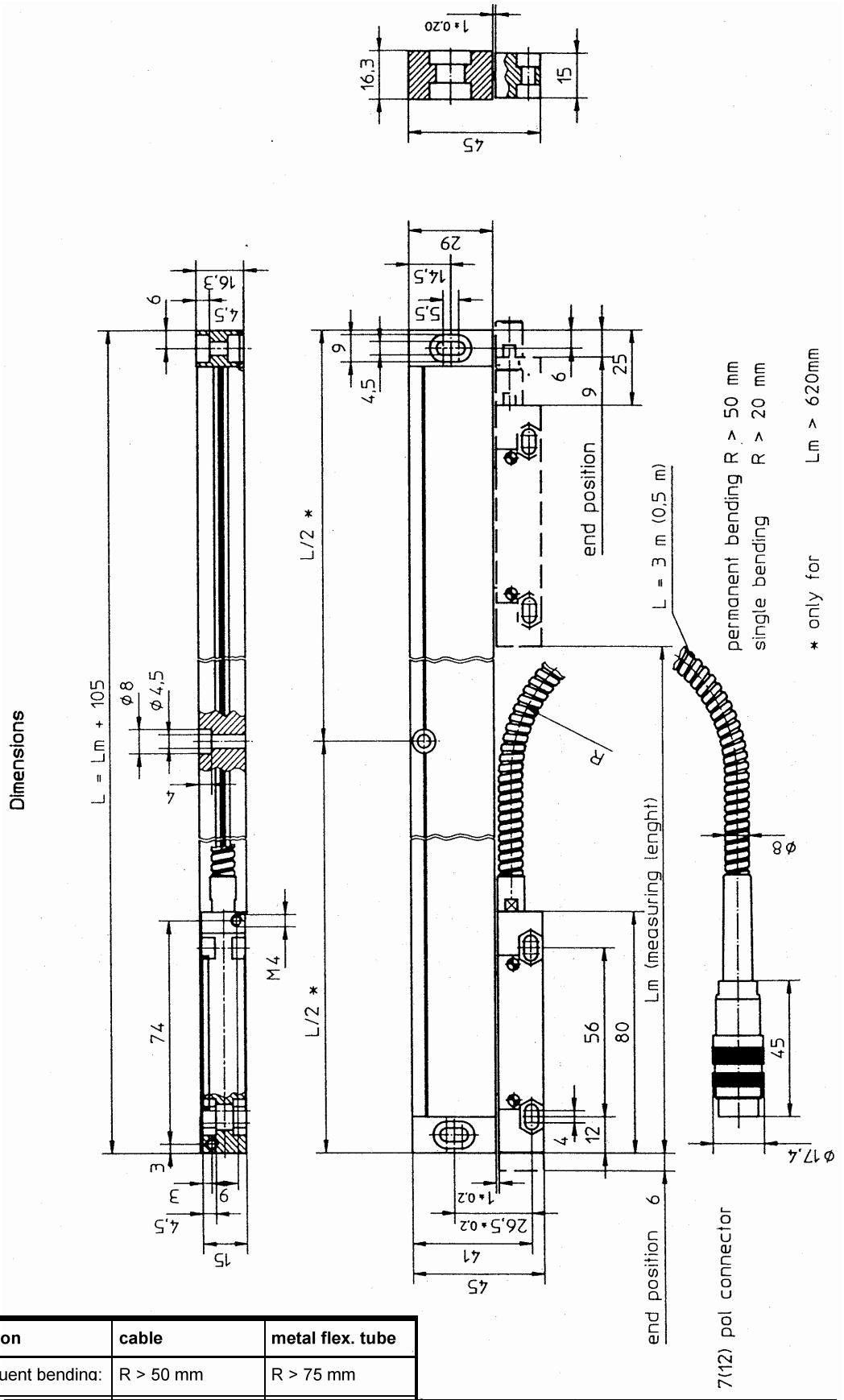
SPEED AND SCANNING UNIT

The maximum measuring speed allowed by the mechanical construction is given in the mechanical data table.

The dependence of minimum time interval between two neighbouring fronts of square-wave output signals is given at right.



DIMENSIONS:



option	cable	metal flex. tube
frequent bending:	R > 50 mm	R > 75 mm
rigid bending:	R > 20 mm	R > 20 mm

ORDERING DATA:

Standard requirements							Special requirements			
113	- XX -	X -	XX -	X -	X -	XXXX-	XX-	X-	X-	X-

Air inlet connection
[special requirement]:
0 ... without
1 ... with

Metal flexible tube:
0 ... without
1 ... with

Connector is defined with electrical versions DO. DS. DI or SO:
1 ... Amphenol 12 pole
2 ... Amphenol 7 pole
4 ... Contact 12 pole (female screw)
7 ... D-Sub 9 pole
9 ... other (specify)
0 without connector

Cable length in [m]:
Standard 3 m : 03
Example: 1.5 m : 1.5
25 m : 25

Measuring length:
see Mechanical Data

Accuracy:
3 ... ±3 µm
5 ... ±5 µm
0 ... ±10 µm

Reference mark:
0 ... without
1 ... in the middle
2 ... on agreement

Output signals:
DI. DS. SO. DO

Resolution (DI. DO. DS):
0.5 ... 0.5 µm
1 ... 1 µm 5 ... 5 µm
2 ... 2 µm 0 ... 10 µm

Periode (SO):
20 ... 20 µm
40 ... 40 µm

Voltage supply:
05 ... 5 V
12 ... 12 V

Remark
Standard delivery includes:
3 m
cable length with metal flexible tube
12 pole
Amphenol connector (for DI. DS)
7 pole
Amphenol connector (for DO. SO)

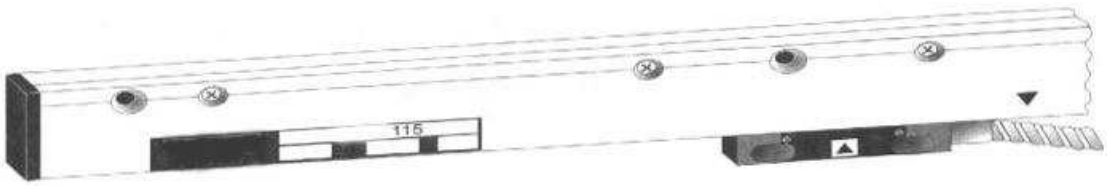
MEYLE

Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.: +49 5481-9385-0 Internet: www.meyle.de
49525 Lengerich/Germany Fax: +49 5481-9385-12 E-Mail: sales@meyle.de

INCREMENTAL LINEAR SCALES

Optoelectronic

115



GENERAL DESCRIPTION:

The 115 is an optoelectronic incremental sealed linear scale, applied in numerous industrial areas for high-precision measuring of positions (machine tool industry, positioning systems, robotics, etc.).

Measuring lengths: 170 to 1740 mm

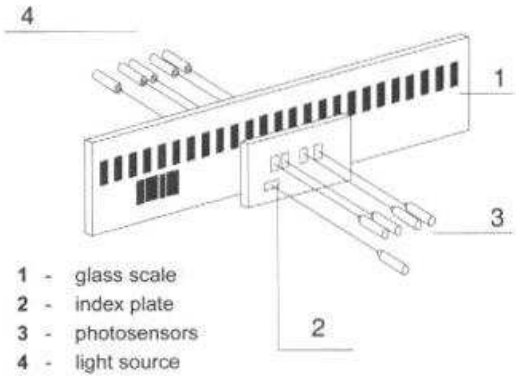
Cross section: 16 x 29 mm (45 mm)

Accuracy: ± 10, ± 5 um,± 3 um,

Resolution: 0.5, 1, 2, 5, 10 µm

Output signals:
- DO (square wave)
- SO (sine-wave voltage)
- DI (square wave inverted signals)
- DS (square wave with line driver RS422 standard)

OPERATING PRINCIPLE:



1 - glass scale
2 - index plate
3 - photosensors
4 - light source

MECHANICAL DATA:

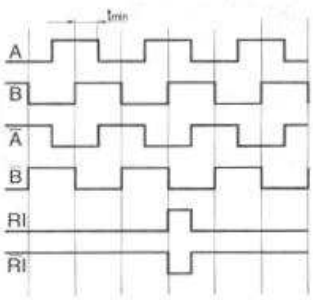
Standard measuring length "Lm" (mm)	170/220/250/270/320/370/420/470/520/620/720/820/920/ 1020/1140/1240/1340/1440/1540/1640/1740
Reference mark	Standard position in centre. Other positions optional at spacing of 50 mm along the measuring length.
Accuracy class	±10 µm, ± 5 µm, ± 3 µm
Interval	20 µm or 40 µm
Resolution	0.5µm, 1 µm, 2 µm, 5 µm, 10 µm (for DI,DS); 5um, 10um only for DO
Maximal speed	45 m/min
Permissible acceleration	30 m/s^2
Moving force for scanning unit	≤ 4N
Degree of mechanical protection	IP 53 (in compliance with mounting instructions), IP 64 with compressed air
Vibrations (50...2000 Hz)	30 m/s^2
Shocks (11ms)	100 m/s^2
Temperature	operating: 0°C to 50°C storage: -30°C to 70°C
Permissible relative humidity	20% - 70%
Cable length	standard 3 m, exstension on order to 50 m
Mass	0,4 kg + 0.7 kg/m measuring length

ELECTRICAL DATA:

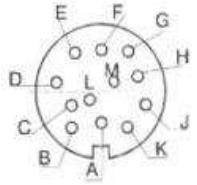
Output signals	Voltage U_n	Current I_n
DI - square-wave inverted signals	5 V ± 5%	≤ 100 mA
DO - square-wave signals	12V ± 5%	≤ 120 mA
DS - square-wave inverted signals with RS422	5 V ± 5%	≤ 130 mA
SO - sine-wave voltage signals	+/- 12V ± 5%	≤ 70 mA (+12V) ≤ 20 mA (-12V)

ELECTRICAL DATA:

Square-wave signals with inverted signals and RS 422A - DI, DS:

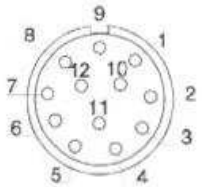


DS (RS-422 A)		
I_{sink}	= 20 mA	$U_{OL} \leq 0{,}5$ V
I_{source}	= -20mA	$U_{OH} \geq 2{,}5$ V
$t_{tLH} = t_{tHL} \leq 30$ ns;		without load
DI		
I_{sink}	= 15 mA	$U_{OL} \leq 0{,}5$ V
I_{source}	= -15 mA	$U_{OH} \geq 4{,}0$ V
$t_{tLH} = t_{tHL} \leq 60$ ns;		without load



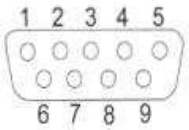
12 pole connector (Amphenol) square-wave output signals (DI, DS)

contact	A	B	C	D	E	G	H	K	L
signal	shield	0 V	A	$\overline{A}$	B	RI	$\overline{RI}$	+ V	$\overline{B}$



12 pole connector (Contact) square-wave output signals (DI, DS)

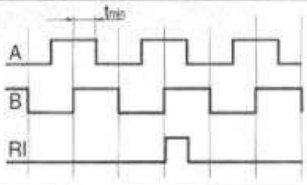
contact	1	2	3	4	5	6	7	8	9	10	11	12
signal	$\overline{B}$	+5V	RI	$\overline{RI}$	A	$\overline{A}$		B	shield	0V	0V	+5V



9 pole connector (D-Sub) square-wave output signals (DI, DS)

contact	1	2	3	4	5	6	7	8	9
signal	shield	$\overline{RI}$	$\overline{B}$	$\overline{A}$	+5V	RI	B	A	0V

Square-wave output signals - DO:

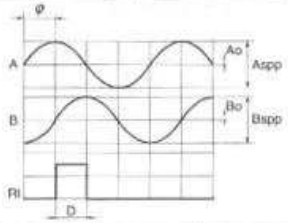


Signal level ...	HTL	Transition time:
I_{sink} = 1 mA	$U_{OL} \leq 0{,}5$ V	$t_{tHL} \leq 2$ µs
I_{source} = 4 mA	$U_{OH} \geq 11$ V	$t_{tHL} \leq 250$ ns; without load

7 pole connector (Amphenol) square-wave output signals (DO)

contact	1	2	3	4	5	6	7
signal	0 V		A	B	+ V	RI	shield

Sinusoidal output signals - SO:



Amplitude characteristics	Phase shift of signals A_s and B_s
$\lvert A_o \rvert - \lvert B_o \rvert \leq 0{,}25$ V	
$\lvert A_{spp} - B_{spp} \rvert \leq 0{,}5$ V	$\varphi = 90° \pm 15°$ f < 15 kHz
$A_{spp} = B_{spp}$ = 15 - 16 V at f ≤ 15 kHz	$\varphi = 90° \pm 30°$ f = 50 kHz
7 - 8 V at f = 50 kHz	

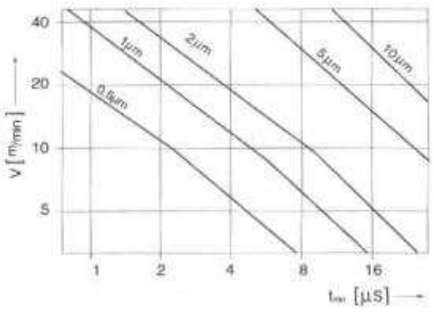
7 pole connector (Amphenol) sinee-wave voltage output signals (SO)

contact	1	2	3	4	5	6	7
signal	0 V	- V	A_s	B_s	+ V	RI	shield

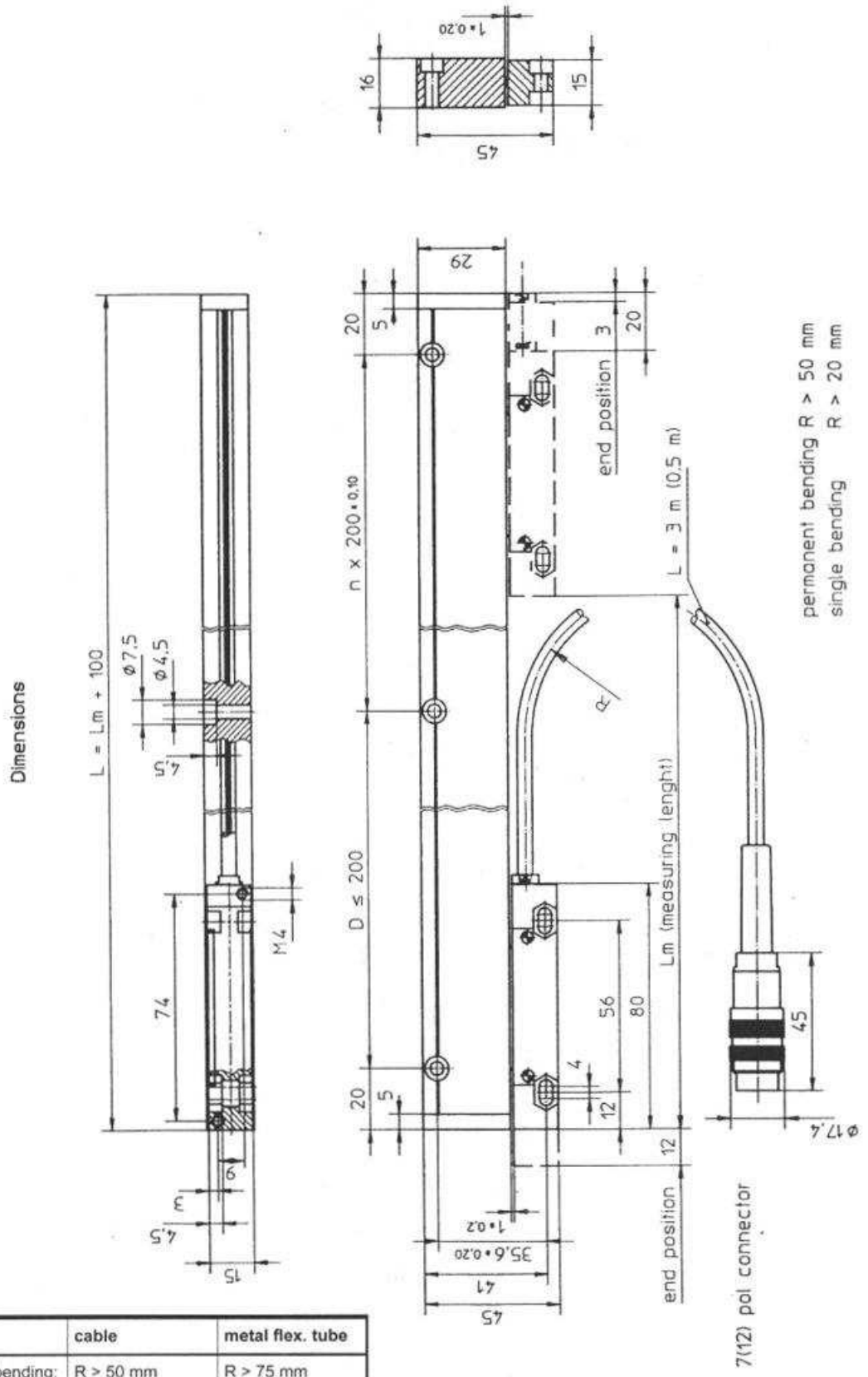
SPEED AND SCANNING UNIT

The maximum measuring speed allowed by the mechanical construction is given in the mechanical data table.

The dependence of minimum time interval between two neighbouring fronts of square-wave output signals is given at right.



DIMENSIONS:



option	cable	metal flex. tube
frequent bending:	R > 50 mm	R > 75 mm
rigid bending:	R > 20 mm	R > 20 mm

ORDERING DATA:

Standard requirements							Special requirements			
115	- XX -	X -	XX -	X -	X -	XXXX-	XX-	X-	X-	X-

Air inlet connection
[special requirement]:
0 ... without
1 ... with

Metal flexible tube:
0 ... without
1 ... with

Connector is defined with electrical versions DO, DI, DS or SO:
1 ... Amphenol 12 pole
2 ... Amphenol 7 pole
4 ... Contact 12 pole (female screw)
7 ... D-Sub 9 pole
9 ... other (specify)
0 without connector

Cable length in [m]:
Standard 3 m : 03
Example: 1.5 m : 1.5
25 m : 25

Measuring length:
Standard length

Accuracy:
3 ... ±3 µm
5 ... ±5 µm
0 ... ±10 µm

Reference mark:
0 ... without
1 ... in the middle
2 ... on agreement

Output signals:
DI, DS, SO, DO

Resolution (DI, DO, DS):
0.5 ... 0.5 µm
1 ... 1 µm
2 ... 2 µm
5 ... 5 µm
0 ... 10 µm

Periode (SO):
20 ... 20 µm
40 ... 40 µm

Voltage supply:
05 ... 5 V
12 ... 12 V

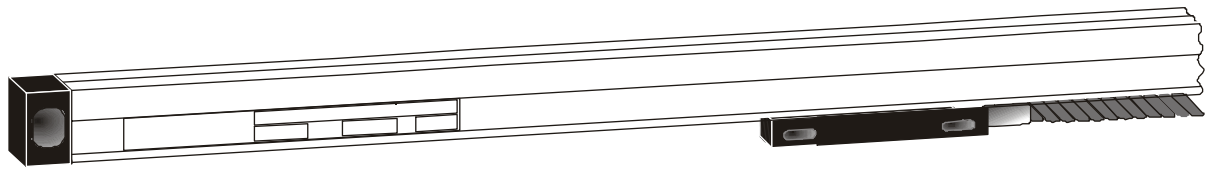
Remark
Standard delivery includes:
3 m
cable with metal flaxible tube
12 pole
Amphenol connector (for DI, DS)
7 pole
Amphenol connector (for DO, SO)

MEYLE®

Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.: +49 5481-9385-0 Internet: www.meyle.de
49525 Lengerich/Germany Fax: +49 5481-9385-12 E-Mail: sales@meyle.de

INCREMENTAL LINEAR SCALES 130

Optoelectronic

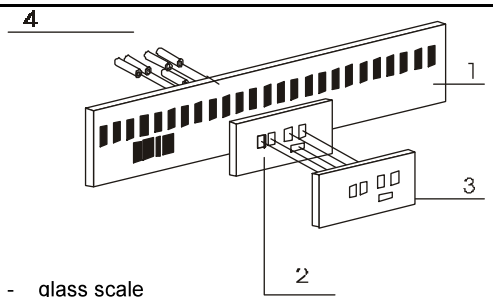


GENERAL DESCRIPTION:

The 130 is an optoelectronic incremental sealed linear scale, applied in numerous industrial areas for high-precision measuring of positions (machine tool industry, positioning systems, robotics, etc.).

Measuring lengths: 70 to 1240 mm
Cross section: 18 x 32 mm (46 mm)
Accuracy: ± 10, ± 5, ± 3 µm
Resolution: 0.5, 1, 2, 5, 10 µm
Output signals: DO (square wave)
DI (square wave inverted signals)
DS (square inverted signals RS422A)
SI (sine-wave current signals)
SV (sine- wave voltage signals 1Vpp)

OPERATING PRINCIPLE:



1 - glass scale
2 - index plate
3 - photosensors
4 - light source

MECHANICAL DATA:

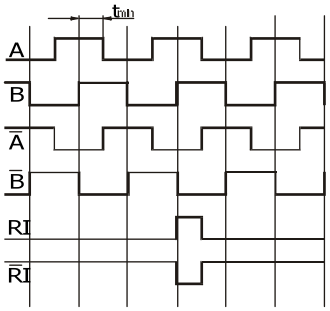
Standard measuring length "Lm" (mm)	70/120/170/220/270/320/370/420/470/520/570/620/670/720/770/820/920/1020/1140/1240
Reference mark	Standard position: for Lm <= 1020 mm: 35 mm from the beginning to the end of measuring length for Lm >= 1140 mm: 45 mm from the beginning to the end of measuring length Other position optional at spacing of 50 mm along the measuring length.
Accuracy class	±10 µm, ± 5 µm, ± 3 µm
Interval	20 µm or 40 µm
Resolution	0.5,1, 2, 5, 10 µm for DI or DS output signals: 5 or 10 µm square wave output signals DO (12 V)
Maximal speed	45 m/min continously, 60m/min temporarily
Permissible acceleration	30 m/s^2
Moving force for scanning unit	$\leq$ 5N
Degree of mechanical protection	IP 53 (in compliance with mounting instructions); IP 64 with compressed air purge
Vibrations (50...2000 Hz)	30 m/s^2, option 300 m/s^2
Shocks (11ms)	100 m/s^2
Temperature	operating: 0°C to 50°C storage: -20°C to 70°C
Permissible relative humidity	20% - 70%
Cable length	standard 3m, extension on order to 20m (SI signals), extension on order to 50m (DI and DS signals), extension on order to 150m (SV signals)
Mass	0.45 kg + 0.65 kg/m

ELECTRICAL DATA:

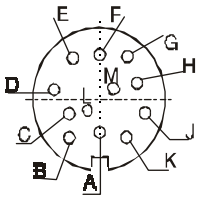
Output signals	**Voltage U_n**	**Current I_n**
DS - square-wave inverted RS422A	5 V ± 5%	$\leq$ 130 mA
DI - square-wave inverted	5 V ± 5%	$\leq$ 120 mA
SI - sine-wave current	5 V ± 5%	$\leq$ 70 mA
DO - square-wave	12 V ± 5%	$\leq$ 120 mA
SV - sine wave voltage	5 V ± 5%	$\leq$ 150 mA

ELECTRICAL DATA:

Square-wave signals with inverted signals and RS 422A - DI. DS:

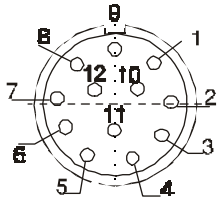


DS (RS- 422 A)		
I_{sink}	= 20 mA	$U_{OL} \leq 0.5$ V
I_{source}	= -20mA	$U_{OH} \geq 2.5$ V
$t_{tLH} = t_{tHL} \leq 30$ ns:		without load
DI		
I_{sink}	= 15 mA	$U_{OL} \leq 0.5$ V
I_{source}	= -15 mA	$U_{OH} \geq 4.0$ V
$t_{tLH} = t_{tHL} \leq 60$ ns:		without load



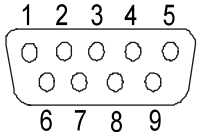
12 pole connector (Amphenol) square-wave output signals (DI. DS)

contact	A	B	C	D	E	G	H	K	L
signal	shield	0 V	A	$\overline{A}$	B	RI	$\overline{RI}$	+ V	$\overline{B}$



12 pole connector (Contact) square-wave output signals (DI. DS)

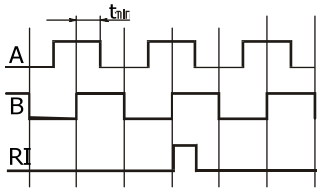
contact	1	2	3	4	5	6	7	8	9	10	11	12
signal	$\overline{B}$	+5V	RI	$\overline{RI}$	A	$\overline{A}$		B	shield	0V	0V	+5V



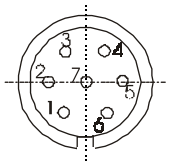
9 pole connector (D-Sub) square-wave output signals (DI.DS)

contact	1	2	3	4	5	6	7	8	9
signal	shield	$\overline{RI}$	$\overline{B}$	$\overline{A}$	+5V	RI	B	A	0V

Square-wave output signals - DO:



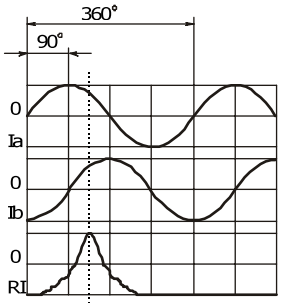
Signal level ...	HTL	Transition time:
I_{sink} = 1 mA	$U_{OL} \leq 0.5$ V	$t_{tLH} = t_{tHL} \leq 60$ ns. without load
I_{source} = 4 mA	$U_{OH} \geq 11$ V	t_{min}= f(v)



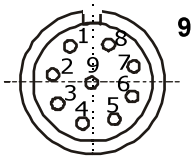
7 pole connector (Amphenol) square-wave output signals (DO)

contact	1	2	3	4	5	6	7
signal	0 V		A	B	+ V	RI	shield

Sinusoidal output signals - SI:



Amplitude of signals
I_b = I_a = 7 - 16 μA_{pp} at load 1 kW
I_{ri} = 2 - 8 μA_{pp} used component



9 pole connector (Contact) sine -wave output signals (SI)

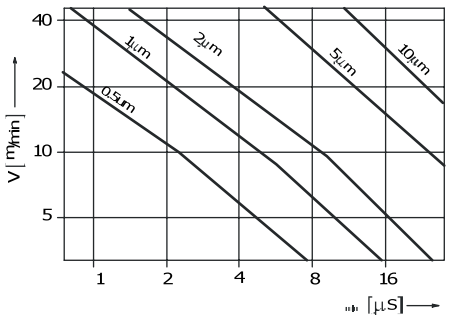
contact	1	2	3	4	5	6	7	8	9
signal	I_a+	I_a-	+5 V	0 V	I_b+	I_b-	I_{ri}+	I_{ri}-	shield

Sine wave voltage signals 1 V pp 5V

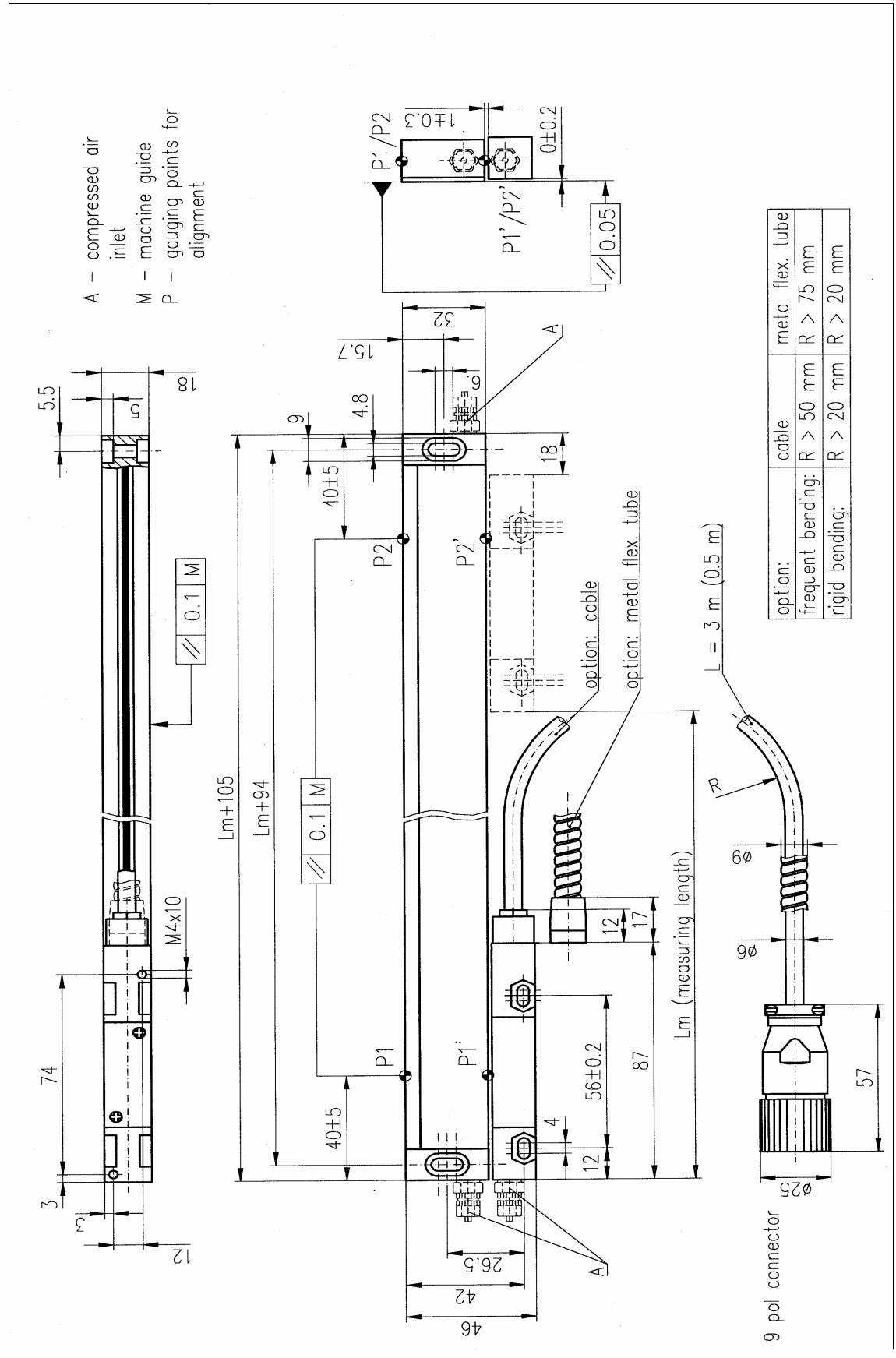
SPEED AND SCANNING UNIT

The maximum measuring speed allowed by the mechanical construction is given in the mechanical data table.

The dependence of minimum time interval between two neighbouring fronts of square-wave output signals is given at right.



DIMENSIONS:


A – compressed air inlet
M – machine guide
P – gauging points for alignment
P1/P2
P1'/P2'
0±0.2
0.05
32
15.7
A
5.5
8
5
9
4.8
18
40±5
P2
P2'
0.1 M
option: cable
option: metal flex. tube
L = 3 m (0.5 m)
option: | cable | metal flex. tube
frequent bending: | R > 50 mm | R > 75 mm
rigid bending: | R > 20 mm | R > 20 mm
Lm+105
Lm+94
P1
P1'
40±5
56±0.2
87
Lm (measuring length)
12
17
4
12
R
6ø
9ø
ø25
57
74
3
M4x10
12
26.5
42
46
9 pol connector

ORDERING DATA:

Standard requirements							Special requirements			
130	- XX -	X -	XX -	X -	X -	XXXX-	XX-	X-	X-	X-

Air inlet connection [special requirement]:
0 ... without
1 ... with

Metal flexible tube:
0 ... without
1 ... with

Connector is defined with electrical versions DO. DI. DS or SI:
1 ... Amphenol 12 pole
2 ... Amphenol 7 pole
3 ... Contact 9 pole (male screw)
4 ... Contact 12 pole (female screw)
5 ... Contact 9 pole (female screw)
6 ... Contact 12 pole (male screw)
7 ... D-Sub 9 pole
9 ... other (specify)
0 without connector

Cable length in [m]:
Standard 3 m : 03
Example: 1.5 m : 1.5
25 m : 25

Measuring length:
Standard length

Accuracy:
3 ... ±3µm
5 ... ±5µm
0 ... ±10µm

Reference mark:
0 ... without
1 ... in the middle
2 ... on agreement
3 ...2x35mm (see mechanical data)
2x45mm (see mechanical data)

Output signals:
DI. DS. SI. DO. SV

Resolution (DI. DO. DS):
0.5 ... 0.5 µm
1 ... 1 µm
2 ... 2 µm
5 ... 5 µm
0 ... 10 µm

Periode (SI):
20 ... 20 µm
40 ... 40 µm

Voltage supply:
05 ... 5 V
12 ... 12 V

Remark
Standard delivery includes:
3 m
cable with metal flexible tube
12 pole
Amphenol connector (for DI. DS)
9 pole
Contact connector (for SI) or
7 pole
Amphenol connector (for DO)

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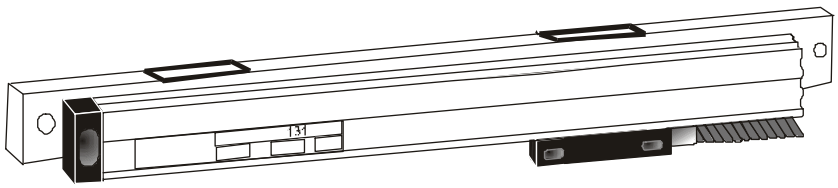
Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.: +49 5481-9385-0 Internet: www.meyle.de
49525 Lengerich/Germany Fax: +49 5481-9385-12 E-Mail: sales@meyle.de

INCREMENTAL LINEAR SCALES 131

with mounting bar

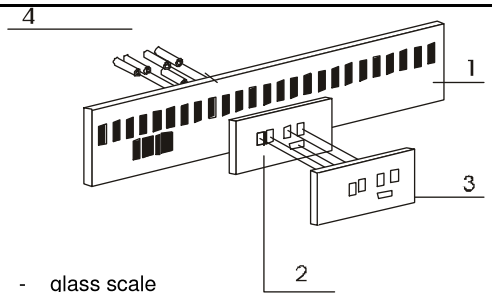


GENERAL DESCRIPTION:

The 131 is an optoelectronic incremental sealed linear scale with mounting bar, applied in numerous industrial areas for high-precision measuring of positions (machine tool industry, positioning systems, robotics, etc.).

Measuring lengths:	70 to 1240 mm, 1340-2040mm with mounting bar
Cross section:	18 x 32 mm (46 mm), 28x40 (51) with m.bar
Accuracy:	± 10, ± 5, ± 3 um
Resolution:	0.5, 1, 5, um
Output signals:	DO (square wave)
	DS (square inverted signals with RS422A)
	SI (sine-wave current signals)
	SV (sine wave 1 Vpp)

OPERATING PRINCIPLE:



1 - glass scale
2 - index plate
3 - photosensors
4 - light source

MECHANICAL DATA:

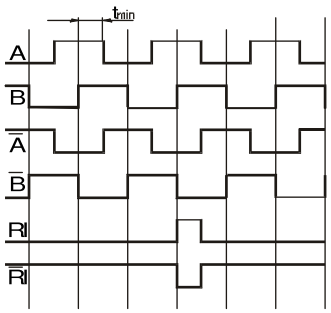
Standard measuring length "Lm" (mm)	70/120/170/220/270/320/370/420/470/520/570 Mounting bar recommended: 620/670/720/770/820/920/1020/1140/1240 Mounting bar required: 1340/1440/1540/1640/1740/1840/1940/2040
Reference mark	Optional at spacing of 10 mm along the measuring length. Absolute Reference Impulse (ARI)
Accuracy class	±10 µm, ± 5 µm, ± 3 µm
Interval	20 µm
Resolution	0.5 µm, 1 µm, 5µm for DS output signals: 5µm for DO 12 V versions
Maximal speed	45 m/min continously, 60 m/min temporarily
Permissible acceleration	30 m/s^2
Moving force for scanning unit	$\leq$ 5N
Degree of mechanical protection	IP 53 (in compliance with mounting instructions); IP 64 with compressed air purge
Vibrations (50...2000 Hz)	30 m/s^2 .100 m/s^2 (option)
Shocks (11ms)	100 m/s^2
Temperature	operating: 0sC to 50sC storage: -20sC to 70sC
Permissible relative humidity	20% - 70%
Cable length	standard 3m, extension on order to 20m (SI signals), extension on order to 50 m (DO, DS signals), extension on order to 150 m (SV signals)
Mass	0.45 kg + 0.65 kg/m .....without mounting bar 0.45 kg + 1.45 kg/m .....with mounting bar

ELECTRICAL DATA:

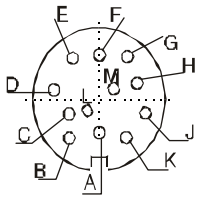
	Voltage U_n	Current I_n
DS - square-wave inverted with RS422A	5 V ± 5%	$\leq$ 130 mA
SI - sine-wave current	5 V ± 5%	$\leq$ 70 mA
DO - square-wave	12 V ± 5%	$\leq$ 120 mA
SV - sine wave voltage 1Vpp	5 V ± 5%	$\leq$ 150 mA

ELECTRICAL DATA:

Square-wave signals with inverted signals and RS 422A - DS:

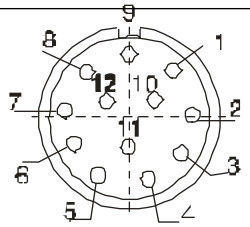


	DS (RS-	422 A)
I_{sink}	= 20 mA	$U_{OL} \leq 0.5$ V
I_{source}	= -20mA	$U_{OH} \geq 2.5$ V
$t_{tLH} = t_{tHL} \leq 30$ ns:		without load



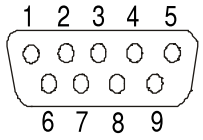
12 pole connector (Amphenol) square-wave output signals (DS)

contact	A	B	C	D	E	G	H	K	L
signal	shield	0 V	A	$\overline{A}$	B	RI	$\overline{RI}$	+ V	$\overline{B}$



12 pole connector (Contact) square-wave output signals (DS)

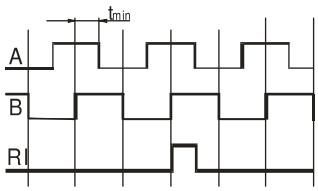
contact	1	2	3	4	5	6	7	8	9	10	11	12
signal	$\overline{B}$	+5V	RI	$\overline{RI}$	A	$\overline{A}$		B	shield	0V	0V	+5V



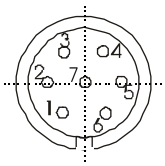
9 pole connector (D-Sub) square-wave output signals (DS)

contact	1	2	3	4	5	6	7	8	9
signal	shield	$\overline{RI}$	$\overline{B}$	$\overline{A}$	+5V	RI	B	A	0V

Square-wave output signals - DO:



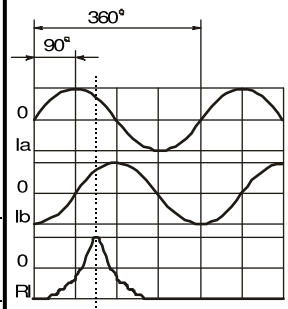
Signal level ...	HTL	Transition time:
I_{sink} = 1 mA	$U_{OL} \leq 0.5$ V	$t_{tLH} = t_{tHL} \leq 60$ ns, without load
I_{source} = 4 mA	$U_{OH} \geq 11$ V	t_{min}= f(v)



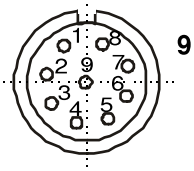
7 pole connector (Amphenol) square-wave output signals (DO)

contact	1	2	3	4	5	6	7
signal	0 V		A	B	+ V	RI	shield

Sinusoidal output signals - SI:



Amplitude of signals
$I_b = I_a = 7 - 16\ \mu A_{pp}$ at load 1 kW
$I_{ri} = 2 - 8\ \mu A_{pp}$ used component



9 pole connector (Contact) sine-wave output signals (SI)

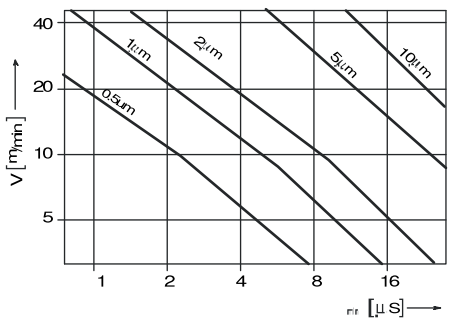
contact	1	2	3	4	5	6	7	8	9
signal	I_a+	I_a-	+5 V	0 V	I_b+	I_b+	I_{ri}+	I_{ri}-	shield

Sine wave voltage signals 1 V pp SV (remark: for details see Electrical DATA on page 28

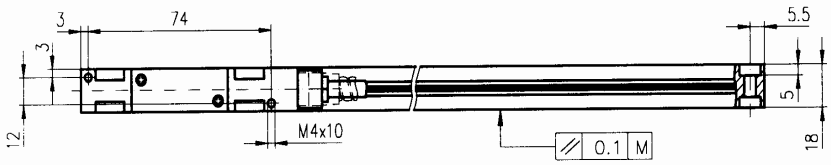
SPEED AND SCANNING UNIT

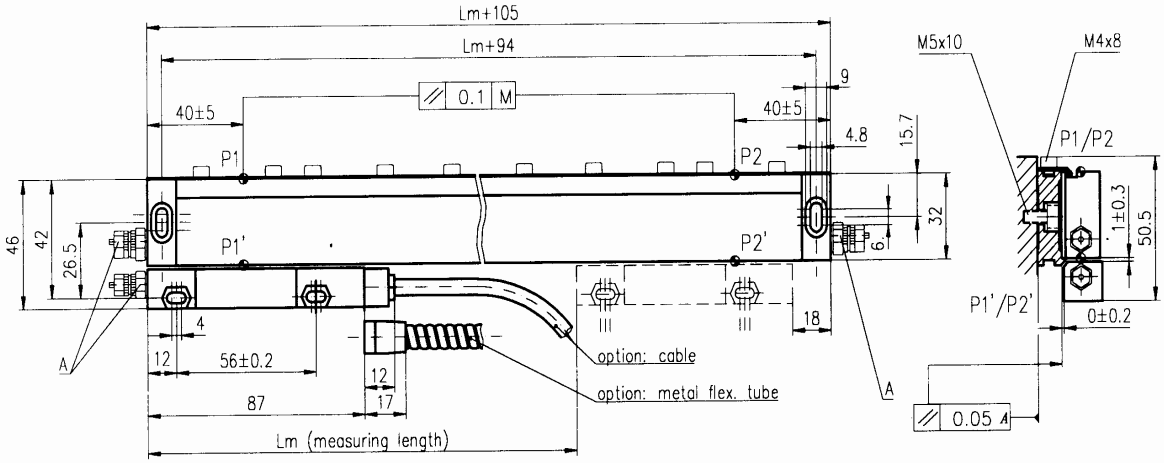
The maximum measuring speed allowed by the mechanical construction is given in the mechanical data table.

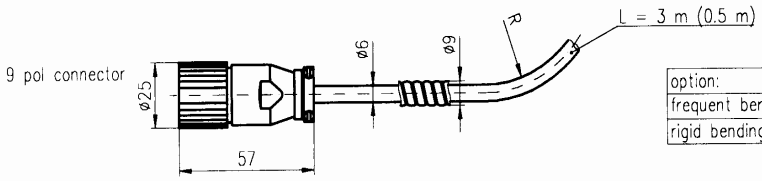
The dependence of minimum time interval between two neighboring fronts of square-wave output signals is given at right.



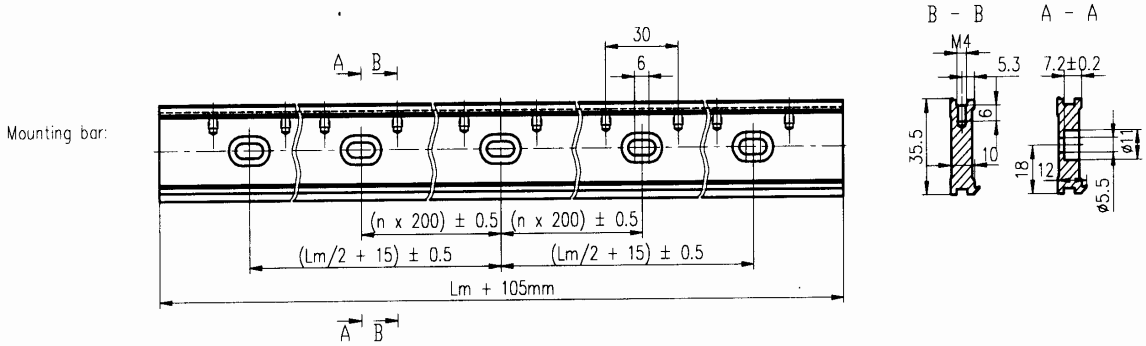
DIMENSIONS:







option:	cable	metal flex. tube
frequent bending:	R > 50 mm	R > 75 mm
rigid bending:	R > 20 mm	R > 20 mm



A – compressed air inlet
M – machine guide
P – gauging points for alignment

Lm	< 520	570–920	1020–1340	1440–1740	1840–2040
n	0	1	2	3	4

INCREMENTAL LINEAR SCALES 131
with mounting bar

ORDERING DATA:

Standard requirements							Special requirements				
131	- XX -	X -	XX -	X -	X -	XXXX-	XX-	X-	X-	X-	-X

Voltage supply:
05 ... 5 V
12 ... 12 V

Resolution (DO. DS):
0.5 ... 0.5 um
1 ... 1 um
5 ... 5 um

Periode (SI. SV):
20 ... 20 um

Output signals:
DS. SI. DO: SV

Reference mark:
0 ... without
1 ... in the middle
2 ... on agreement
4 ... Absolute RI

Accuracy:
3 ... ±3µm
5 ... ±5µm
0 ... ±10µm

Measuring length:
Standard length

Cable length in [m]:
Standard 3 m : 03
Example: 1.5 m : 1.5
25 m : 25

Connector is defined with electrical versions DO. DI. DS or SI:
1 ... Amphenol 12 pole
2 ... Amphenol 7 pole
3 ... Contact 9 pole (male screw)
4 ... Contact 12 pole (female screw)
5 ... Contact 9 pole (female screw)
6 ... Contact 12 pole (male screw)
7 ... D-Sub 9 pole
9 ... other (specify)
0 without connector

Air inlet connection [special requirement]:
0 ... without
1 ... with

Metal flexible tube:
0 ... without
1 ... with

Mounting bar:
0 ... without

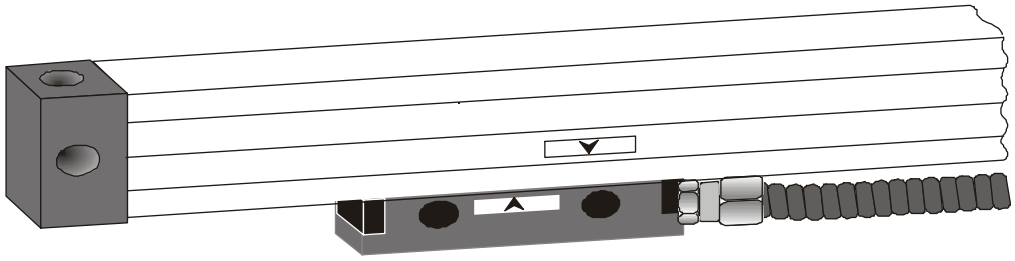
Remark

Standard delivery includes:
3 m
cable with metal flexible tube
12 pole
Amphenol connector (for DS)
Contact connector (for SV)
9 pole
Contact connector (for SI) or
7 pole
Amphenol connector (for DO)

MEYLE®
Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.: +49 5481-9385-0 Internet: www.meyle.de
49525 Lengerich/Germany Fax: +49 5481-9385-12 E-Mail: sales@meyle.de

INCREMENTAL LINEAR SCALES 170

Optoelectronic

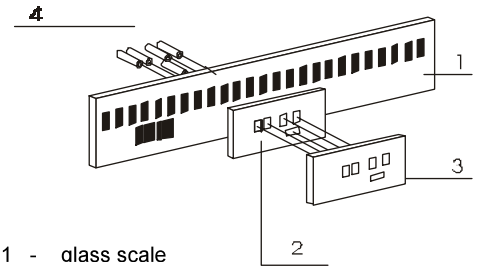


GENERAL DESCRIPTION:

The 170 is an optoelectronic incremental sealed linear scale: applied in numerous industrial areas for high-precision measuring of positions (machine tool industry, positioning systems, robotics, etc.)

Measuring lengths:	170 to 3040 mm
Cross section:	37 x 51.5 mm (77.5 mm)
Accuracy:	± 10, ± 5, ± 3um
Resolution:	0.5, 1, 2, 5, 10 um (for DI: DS)
Output signals:	DI (square wave inverted signals) DS (square inverted signals RS 422 standard) SI (sine-wave current signals) SV (sine - wave voltage 1V pp signals)

OPERATING PRINCIPLE:



1 - glass scale
2 - index plate
3 - photosensors
4 - light source

MECHANICAL DATA:

Standard measuring length "Lm" (mm)	170/220/270/320/370/420/470/520/620/720/770/820/920/1020/1140/1240/1340/1440/1540/1640/1740/1840/2040/2240/2440/2640/2840/3040
Reference mark	Standard position in center. Other positions optional at spacing of 50 mm along the measuring length.
Accuracy class	±10 um, ± 5 um, ± 3 um
Interval	20 um, 40 um
Resolution	0.5, 1, 2, 5, 10 um (for DI and DS signals)
Maximal speed	45 m/min continously, 60 m/min temporarily
Permissible acceleration	30 m/s^2
Moving force for scanning unit	$\leq$ 6N
Degree of mechanical protection	IP 53, IP 64 (in compliance with mounting instructions)
Vibrations (50...2000 Hz)	30 m/s^2
Shocks (11ms)	100 m/s^2
Temperature	operating: 0°C to 50°C storage: -20°C to 70°C
Permissible relative humidity	20% - 70%
Cable length	standard 3 m, extension on order to 20 m (SI output signals), extension on order to 50 m (DI, DS output signals), 150 m SV
Mass	0.4 kg + 2.2 kg/m measuring length

ELECTRICAL DATA:

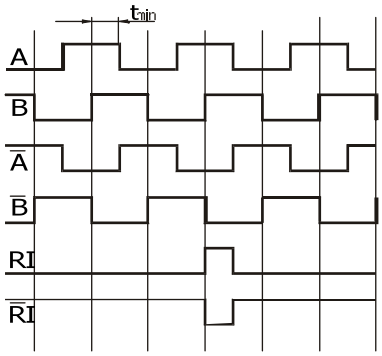
Output signals	Voltage U_n	Current I_n
DS - square wave inverted RS422A standard	5 V ± 5%	$\leq$
DI - square - wave inverted	5 V ± 5%	$\leq$ 130 mA
SI - sine - wave current	5 V ± 5%	$\leq$ 70 mA
SV - sine wave voltage 1Vpp	5 V ± 5%	$\leq$ 150 mA

INCREMENTAL LINEAR SCALES 170

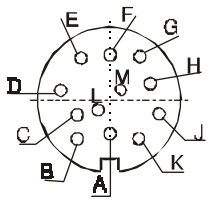
Optoelectronic

ELECTRICAL DATA:

Square-wave signals with inverted signals and RS 422A - DI, DS:

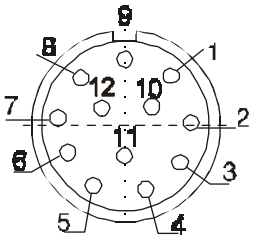


DS (RS- 422 A)		
I_{sink}	= 20 mA	$U_{OL} \leq 0.5$ V
I_{source}	= -20mA	$U_{OH} \geq 2.5$ V
$t_{tLH} = t_{tHL} \leq 30$ ns:		without load
DI		
I_{sink}	= 15 mA	$U_{OL} \leq 0.5$ V
I_{source}	= -15 mA	$U_{OH} \geq 4.0$ V
$t_{tLH} = t_{tHL} \leq 60$ ns:		without load



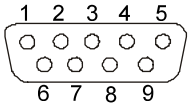
12 pole connector (Amphenol) square-wave output signals (DI, DS)

contact	A	B	C	D	E	G	H	K	L
signal	shield	0 V	A	$\overline{A}$	B	RI	$\overline{RI}$	+ V	$\overline{B}$



12 pole connector (Contact) square-wave output signals (DI, DS)

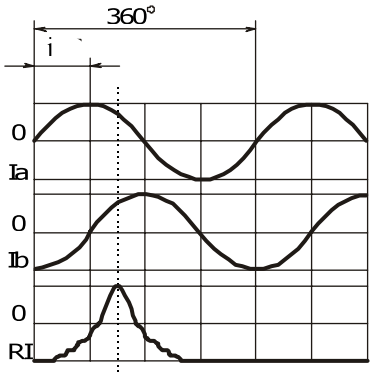
contact	1	2	3	4	5	6	7	8	9	10	11	12
signal	$\overline{B}$	+5V	RI	$\overline{RI}$	A	$\overline{A}$		B	shield	0V	0V	+5V



9 pole connector (D-Sub) square-wave output signals (DI)

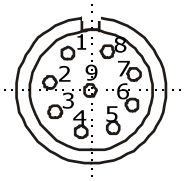
contact	1	2	3	4	5	6	7	8	9
signal	shield	$\overline{RI}$	$\overline{B}$	$\overline{A}$	+5V	RI	B	A	0V

Sinusoidal output signals (SI):



Amplitude of signals
I_b = I_a = 7 - 16 μA_{pp} at load 1 kW
I_{ri} = 2 - 8 μA_{pp} used component
Phase - shift of signals I_a and I_b:
i = 90s ± 15s f < 15 kHz
i = 90s ± 30s f = 60 kHz

9 pole connector (Contact) sine-wave output signals (SI)



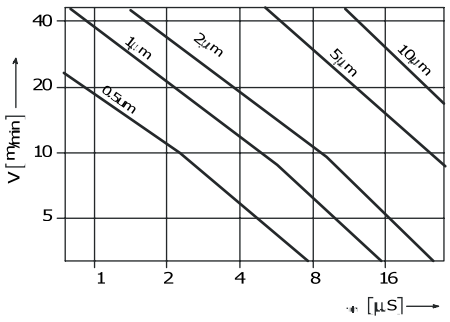
contact	1	2	3	4	5	6	7	8	9
signal	I_a+	I_a-	+5 V	0 V	I_b+	I_b-	I_{ri}+	I_{ri}-	shield

Sine wave voltage signals 1 V pp SV

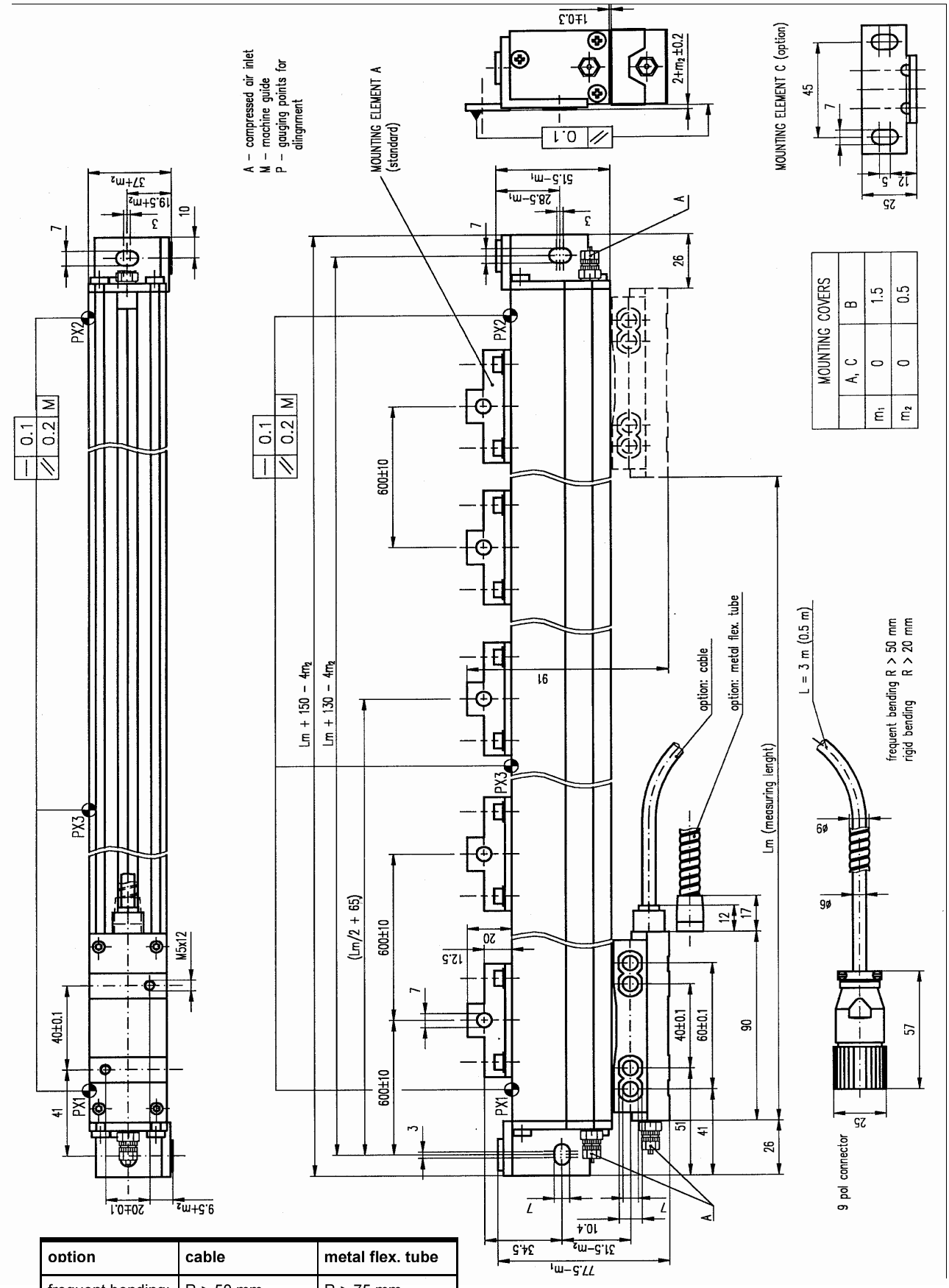
SPEED AND SCANNING UNIT

The maximum measuring speed allowed by the mechanical construction is given in the mechanical data table.

The dependence of minimum time interval between two neighboring fronts of square-wave output signals is given at right.



DIMENSIONS:



option	cable	metal flex. tube
frequent bending:	R > 50 mm	R > 75 mm
rigid bending:	R > 20 mm	R > 20 mm

ORDERING DATA:

Standard requirements							Special requirements				
170	- XX -	X -	XX -	X -	X -	XXXX-	XX-	X-	X-	X-	X

mounting elements

Air inlet connection [special requirement]:
0 ... without
1 ... with

Metal flexible tube:
0 ... without
1 ... with

Connector is defined with electrical versions DS. DI or SI:
1 ... Amphenol 12 pole
3 ... Contact 9 pole (male screw)
4 ... Contact 12 pole (female screw)
5 ... Contact 9 pole (female screw)
6 ... Contact 12 pole (male screw)
7 ... D-Sub 9 pole
8 ... Hirose
9 ... other (specify)
0 without connector

Cable length in [m]:
Standard 3 m : 03
Example: 1.5 m : 1.5
25 m : 25

Measuring length:
Standard length

Accuracy:
3 ... ±3 µm
5 ... ±5 µm
0 ... ±10 µm

Reference mark:
0 ... without
1 ... in the middle
2 ... on agreement

Output signals:
DI. DS. SI. SV

Resolution (DI. DS):
0.5 ... 0.5 µm
1 ... 1 µm
2 ... 2 µm
5 ... 5 µm
0 ... 10 µm

Periode (SI):
20 ... 20 µm
40 ... 40 µm

Voltage supply:
05 ... 5V

Remark

Standard delivery includes: scale cover with m1 and m2 =0 (see drawing: dimensions)

3 m
cable length
12 pole
Amphenol connector
(for DI. DS)
Contact connector (for SV)
or
9 pole
Contact connector
female screw
(for SI)

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Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.: +49 5481-93 85-0 Internet: www.meyle.de
49525 Lengerich/Germany Fax: +49 5481-93 85-12 E-Mail: sales@meyle.de

INCREMENTAL LINEAR SCALES 179

Self-aligned, for press brakes and similar machines

GENERAL DESCRIPTION:

The 179 is an optoelectronic incremental, sealed, self-aligned linear scale; applied in numerous industrial areas for high-precision measuring of positions. Due to integrated guiderail is specialy suitable for press brakes and similar machine tools. Flexible coupled mounting block allows wide range of mounting tolerances.

Measuring lengths: 170 to 920 mm

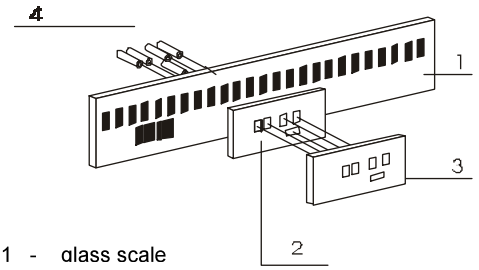
Cross section: 55.2 x 102 mm

Accuracy: ± 10, ± 5, ± 3um

Resolution: 0.5, 1, 2, 5, 10 um (for DS)

Output signals: DS (square inverted signals RS 422 standard)
SI (sine-wave current signals)
SV (sine - wave voltage 1V pp signals)

OPERATING PRINCIPLE:



1 - glass scale
2 - index plate
3 - photosensors
4 - light source

MECHANICAL DATA:

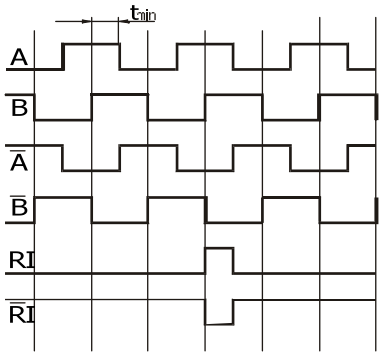
Standard measuring length "Lm" (mm)	170/220/270/320/370/420/470/520/620/720/770/820/920
Reference mark	Standard position in center. DCR. Other positions optional at spacing of 20 mm along the measuring length.
Accuracy class	±10 µm, ± 5 µm, ± 3 µm
Interval	20 µm, 40 µm
Resolution	0.5, 1, 2, 5, 10 µm (for DS signals)
Maximal speed	60 m/min
Permissible acceleration	30 m/s^2
Moving force for scanning unit	$\leq$ 6N
Degree of mechanical protection	IP 53 (in compliance with mounting instructions) IP 64 (with compressed air)
Vibrations (50...2000 Hz)	30 m/s^2
Shocks (11ms)	100 m/s^2
Temperature	operating: 0°C to 50°C storage: -20°C to 70°C
Permissible relative humidity	20% - 70%
Cable length	standard 3 m, extension on order to 20 m (SI output signals), extension on order to 50 m (DS output signals), 150 m SV
Mass	0.8 kg + 2.5 kg/m measuring length

ELECTRICAL DATA:

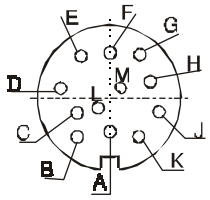
Output signals	Voltage U_n	Current I_n
DS - square wave inverted RS422A standard	5 V ± 5%	< 150 mA (without load)
SI - sine - wave current	5 V ± 5%	$\leq$ 70 mA
SV - sine wave voltage 1Vpp	5 V ± 5%	$\leq$ 130 mA (with 120 Ω terminating resistor)

ELECTRICAL DATA:

Square-wave signals with inverted signals and RS 422A - DS:

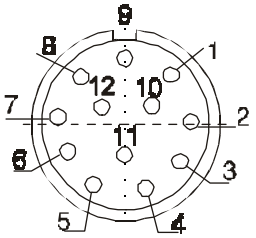


DS (RS- 422 A)		
I_{sink}	= 20 mA	$U_{OL} \leq 0.5$ V
I_{source}	= -20mA	$U_{OH} \geq 2.5$ V
$t_{tLH} = t_{tHL} \leq 30$ ns:		without load



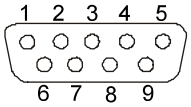
12 pole connector (Amphenol) square-wave output signals (DS)

contact	A	B	C	D	E	G	H	K	L
signal	shield	0 V	A	$\overline{A}$	B	RI	$\overline{RI}$	+ V	$\overline{B}$



12 pole connector (Contact) square-wave output signals (DS)

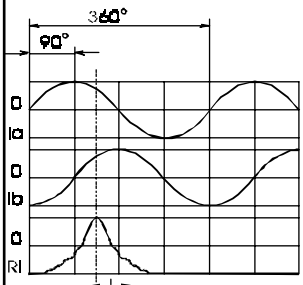
contact	1	2	3	4	5	6	7	8	9	10	11	12
signal	$\overline{B}$	+5V	RI	$\overline{RI}$	A	$\overline{A}$		B	shield	0V	0V	+5V



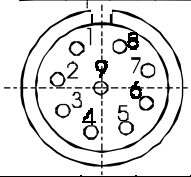
9 pole connector (D-Sub) square-wave output signals (DS)

contact	1	2	3	4	5	6	7	8	9
signal	shield	$\overline{RI}$	$\overline{B}$	$\overline{A}$	+5V	RI	B	A	0V

Sinusoidal output signals (SI):



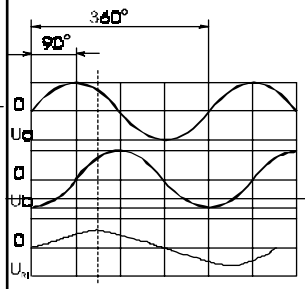
Amplitude of signals
I_b = I_a = 7 - 16 μA_{pp} at load 1 kOhm
I_{ri} = 2 - 8 μA_{pp} used component
Phase - shift of signals I_a and I_b:
i = 90° ± 15° f < 15 kHz
i = 90° ± 30° f = 60 kHz



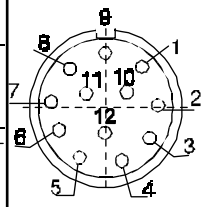
9 pole connector (Contact) square-wave output signals

contact	1	2	3	4	5	6	7	8	9
signal	I_a+	I_a-	+5V	0V	I_b+	I_b-	I_{ri}+	I_{ri}-	shield

Sine-wave voltage signals, 1Vpp (SV):



Amplitude of signals
U_b = U_a = 0.6- 1.2 V_{pp}
U_{ri} = 0.5 V_{pp} on termination imp. 120Ohm



12 pole connector (Contact) sine-wave voltage 1Vpp signals

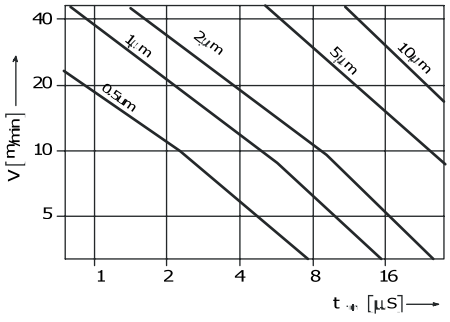
contact	1	2	3	4	5	6	7	8	9	10	11	12
signal	U_{b-}	sense +5V	U_{RI+}	U_{RI-}	U_{A+}	U_{A-}		U_{B+}		0V	sense +5V	+5V

Sine wave voltage signals 1 V pp SV (remark: for details see Electrical DATA on page 28

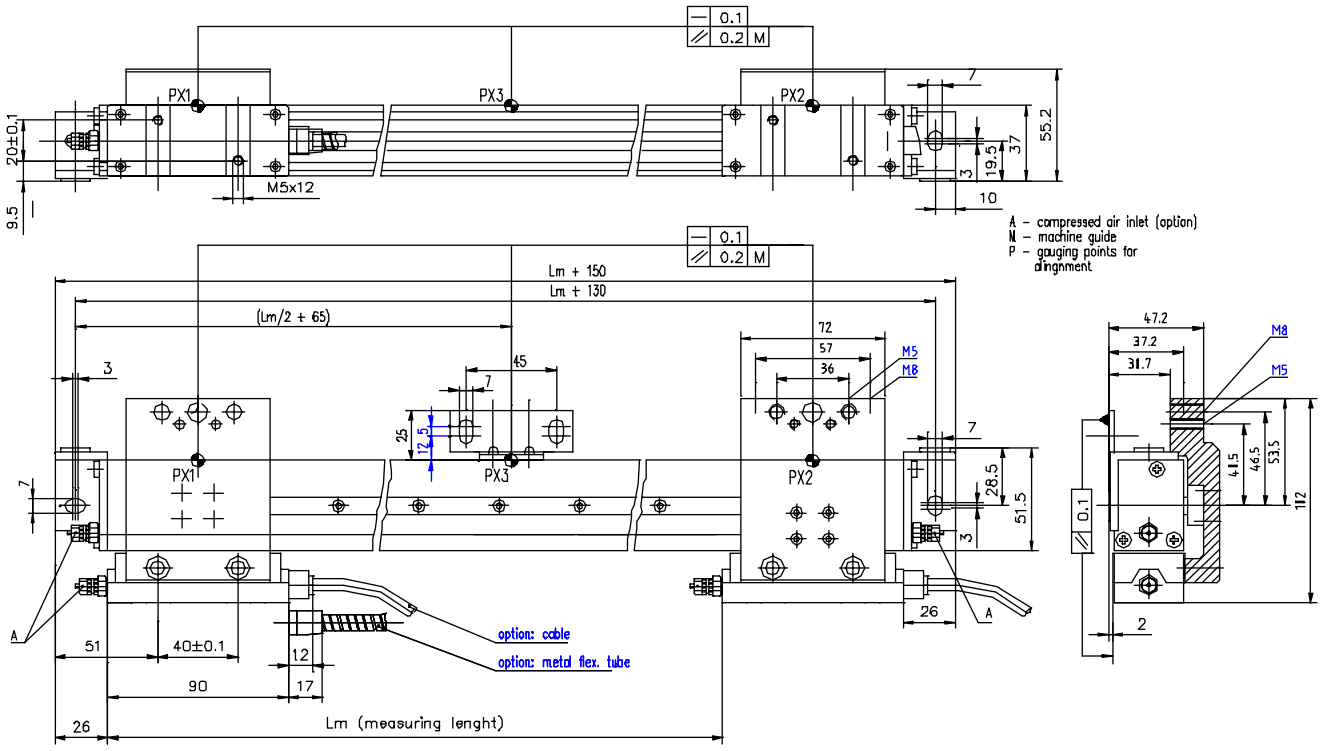
SPEED AND SCANNING UNIT

The maximum measuring speed allowed by the mechanical construction is given in the mechanical data table.

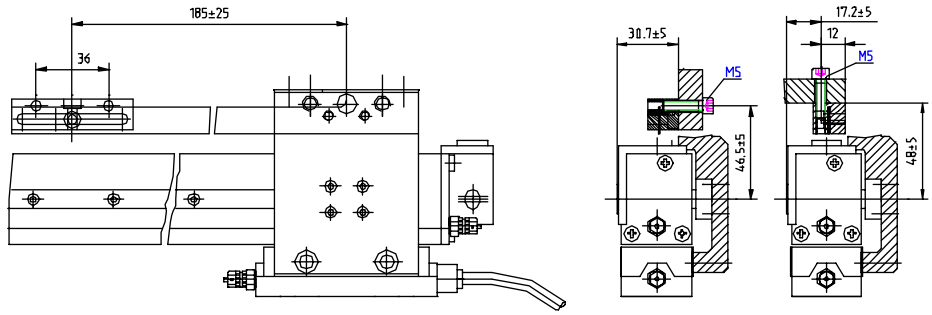
The dependence of minimum time interval between two neighboring fronts of square-wave output signals is given at right.



DIMENSIONS:



Installation with flexible coupled mounting block



INCREMENTAL LINEAR SCALES 179

Self-aligned, for press brakes and similar machines

ORDERING DATA:

Standard requirements							Special requirements				
179	- XX -	X -	XX -	X -	X -	XXXX-	XX-	X-	X-	X-	X

Voltage supply:
05 ... 5V

Resolution (DI, DS):
0.5 ... 0.5 µm
1 ... 1 µm
2 ... 2 µm
5 ... 5 µm
0 ... 10 µm

Periode (SI):
20 ... 20 µm
40 ... 40 µm

Output signals:
DS, SI, SV

Reference mark:
0 ... without
1 ... in the middle
2 ... on agreement
4 ... DCR

Accuracy:
3 ... ±3 µm
5 ... ±5 µm
0 ... ±10 µm

Measuring length:
Standard length

Cable length in [m]:
Standard 3 m : 03
Example: 1.5 m : 1.5
25 m : 25

Connector is defined with electrical versions DS, DI or SI:
1 ... Amphenol 12 pole
3 ... Contact 9 pole (male screw)
4 ... Contact 12 pole (female screw)
5 ... Contact 9 pole (female screw)
6 ... Contact 12 pole (male screw)
7 ... D-Sub 9 pole
8 ... Hirose
9 ... other (specify)
0 without connector

Metal flexible tube:
0 ... without
1 ... with

Air inlet connection
[special requirement]:
0 ... without
1 ... with

Flexible coupled mounting block

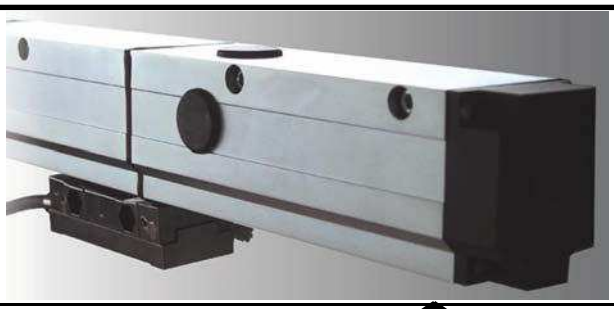
Remark

Standard delivery includes:

- **3 m** cable length
- **12 pole** Amphenol connector (for DS) (code 1)
- **12 pole** Contact connector (for SV) (code 4) or
- **9 pole** Contact connector female screw (for SI)(code 5)
- **Flexible mounting block included**

MEYLE®
Meyer Industrie-Electronic GmbH – MEYLE
Carl-Bosch-Straße 8 Tel.: +49 5481-9385-0 Internet: www.meyle.de
49525 Lengerich/Germany Fax: +49 5481-9385-12 E-Mail: sales@meyle.de

Long length linear scale 190

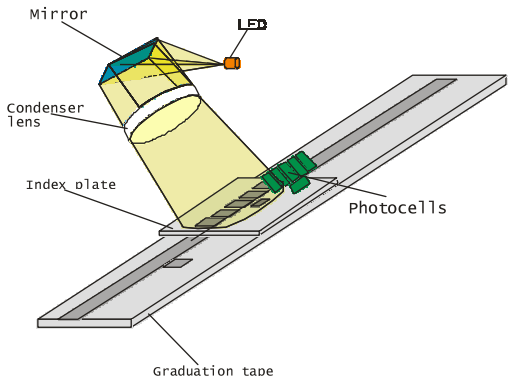


GENERAL DESCRIPTION:

The 190 is an optoelectronic incremental long length linear scale: applied in numerous industrial areas for high-precision measuring of positions (machine tool industry, positioning systems, robotics, etc.)

Measuring lengths: 3640 mm ÷ 30040 mm
Cross section: 50 x 58.5 mm
Accuracy: ± 10 µm/m
Resolution: 1. 2. 5. 10 µm
Output signals: DS (square inverted signals RS 422 standard)
SI (sine-wave current signals)
SV (sine - wave voltage 1V pp signals

OPERATING PRINCIPLE:



MECHANICAL DATA:

Standard measuring length "Lm"	3640 mm ÷ 30040 mm in 200 mm steps segment lengths: 1000. 1200. 1400. 1600. 1800. 2000 mm
Reference mark	Standard: Every 100 mm selectable by magnet selector Option: Distance Coded Reference Mark – 80 mm pitch
Accuracy class	± 10 µm/m
Interval	40 µm
Resolution	1. 2. 5. 10 µm
Maximal speed	120 m/min
Permissible acceleration	30 m/s^2
Moving force for scanning unit	≤ 6N
Degree of mechanical protection	IP 53. IP 64 (in compliance with mounting instructions)
Vibrations (50...2000 Hz)	≤ 300 m/s^2
Shocks (11ms)	≤ 300 m/s^2
Temperature	operating: 0°C to 50°C storage: -20°C to 70°C
Permissible relative humidity	20% - 70%
Cable length	standard 3 m. extension on order to 20 m (SI output signals). extension on order to 50 m (DI. DS output signals). 150 m SV
Mass	1.8 kg + 3.3 kg/m measuring length

Output signals	Voltage U_n	Current I_n
DS - square wave inverted RS422A standard	5 V ± 5%	≤ 150 mA
SV - sine-wave voltage 1Vpp	5 V ± 5%	≤ 100 mA
SI - sine-current wave	5 V ± 5%	≤ 100 mA