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INCREMENTAL LINEAR ENCODERS

Sealed Versions





RSF Elektronik, Corporate Head Quarters Tarsdorf, Austria



RSF Elektronik, Manufacturing Subsidiary Chotěšov, Czech Republic

High-precision linear measuring systems and industrial electronics "Made in Austria" for cutting-edge positioning solutions

RSF Elektronik is one of the world's leading companies in the field of electronic linear measuring systems and it offers an extensive portfolio which includes almost all designs which are required by the market. The typical resolutions or measuring steps range from a few micrometres down to the nanometre range. Another core element of the product range are high-precision and resistant graduations which are manufactured in thin-layer technology on glass or other carrier substrates. RSF Elektronik also develops customized cable systems for the widest range of sectors and areas of application, and these are manufactured by the Chotěšov subsidiary. In order to safeguard the company's high quality standard, a comprehensive quality assurance and environmental management system – certified according to DIN EN ISO 9001 and DIN EN ISO 14001 – has been put in place. Thanks to the company's extensive distribution network, optimum customer service is guaranteed in practically all regions.

TABLE OF CONTENTS

	Design and Operation					
	Output Signals					
	Connecting Cables, Shielding					
	Switch Signal Output					
	Accuracy					
OVERVIEW	Selection Guide, Nomenclature	10–13				
LINEAR ENCODERS, MODELS	Technical Data	14–15				
	MSA 770, MSA 870					
	MSA 710, MSA 810					
	MSA 720, MSA 820					
	MSA 730, MSA 830					
	MSA 771, MSA 871					
	MSA 711, MSA 811					
	MSA 721, MSA 821					
	MSA 731, MSA 831					
	MSA 470, MSA 570					
	MSA 471, MSA 571	25				
	MSA 411, MSA 511					
	MSA 421, MSA 521					
	MSA 431, MSA 531					
ADDITIONAL SEALED	MSA 170 for tight Mounting Environment					
LINEAR ENCODERS, SPECIAL MODELS	MSA 373, MSA 374, MSA 375 with Selfguiding, for Presses					
	and Bending Machines					
ACCESSORIES	Male and female Connectors, Pin Assignments	32				
	Air Pressure Unit DA 400					
PRODUCT DIRECTORY	Exposed and Sealed Linear Encoders,					
	Rotary Encoders, Probes					
DISTRIBUTION CONTACTS	Addresses					

DESIGN AND OPERATION

The Linear Encoders from RSF are all-purpose. They are suited for manual applications; yet they are also particularly suitable for closed-loop drive systems.

Owing to their sealed design, the Linear Encoders of the **MSA 4**, **MSA 5**, **MSA 7** and **MSA 8** series are predestined for usage in **machine tools**. They are also very well suited for applications in **automation** and **production technology**, in which a protection for scale and reading head is required.

MSA 4, MSA 5, MSA 7 and MSA 8 represent a systematic advancement of tried-and-tested systems and feature improved construction details. During development, RSF paid particular attention to the optimization of system accuracy. We achieved this goal thanks to the perfect combination of several individual components. Beyond that, details that are stressed more intensively were built to be more robust so as to heighten long-term stability.

Measuring systems are made up of two components: **extrusion** and **reading head**. Preferably, the extrusion is to be mounted on the moveable part of the linear axis, and the reading head to the fixed part (cable duct) of the linear axis. The **extrusion** consists of a stable aluminum profile, fastening elements, a scale and sealing lips.

Drip caps at the profile and specially formed sealing lips prevent the intrusion of dust, filings and liquids into the extrusion. The fiber-reinforced **sealing lips** made of fluororubber (Viton®) are highly lubricant-resistant and coolant-resistant. High velocities are feasible due to the high degree of rigidity, coupled with the ideally formed blade area of the reading head. Optionally, a sealing air inlet for a greater demand for tighter sealing is on offer.

The **scale** is fastened by dint of a flexible adhesive film in the profile, which compensates for the differing linear expansion between the glass or glass ceramics and the aluminum. Thus a **reproducible thermal behavior** is ensured (symmetrical expansion or shortening of the scale to the profile in case of temperature changes). The scale can be fixed additionally in the profile in order to adjust the thermal zero point to each measuring requirement. Expansion differences between aluminum profile and machine slide are evened out by flexible fastening elements.

Depending on the model, the **reading head** is available with cable or device connector plug. The reading head houses the evaluation electronics. The **reading carriage** includes a reticle and the optoelectronics for signal generating. Reading head and reading carriage are coupled to each other.

Hall-sensors are integrated in the reading head, which generate switch signals for an additional position detection or enable a selection of reference marks. They are activated by magnets that can be optionally positioned in any way on the extrusion by the customer.

The **reading carriage** evens out alignment deviations between extrusion and machine guide. It rolls by dint of roller bearings on the scale and is pressed down by magnets that affect the ferromagnetic tapes on the extrusion (**magnet guide**). Hence there are no forces between reading head and extrusion that could stress guide parts of the linear axis. Moreover, the extrusion is not subjected to any bending strain.

In the measuring direction, reading carriage and reading head are connected by a wear-free and maintenance-free **magnetic coupling**. A ferromagnetic ball rolling freely between two magnetic plates makes for a connection that is very stiff in the measuring direction, yet flexible in all other degrees of freedom. Thus any deviation (within the tolerance) will be evened out by the ideal mounting of the measurement system.

The combination of magnetic guide and magnetic coupling allows for generous mounting tolerances without any negative influence on accuracy. Hence substantial benefits are achieved in comparison to traditional technologies.



A high accuracy grating is deployed as scale graduation. Depending on the model, glass ($\alpha \approx 8.5 \times 10^{-6}/K$) or glass ceramics ($\alpha \approx 0 \times 10^{-6}/K$) is employed as base.

The grating is the consistent series of lines and spaces of the same width. The width of one line and one space is called a grating pitch (T).

Parallel to the grating, there are one or more reference marks (RI) on a second track. Within the measuring length, any position is possible and additional reference marks can be chosen at will in a distance of 50 mm.

Linear Encoders with a suffix "K" in the model designation are equipped with distance-coded reference marks. After traveling a distance of 20 mm at maximum, the absolute tool position is available with these models. By dint of the optical scanning, a positionaccurate evaluation of the reference marks is ensured.



The incremental Linear Encoders work according to an imaging photoelectric measuring principle with a transmissive **singlefield scanning**.

The regulated light of an infrared LED is collimated by a condenser lens, passes through the grid of the reticle and the scale and generates a periodic intensity distribution on the structured sensor.

The sensor generates sinusoidal signals of the highest quality that prove to be widely insensitive to possible contaminations, which can never be entirely ruled out despite all technical precautions.

The regulation of the LED ensures a constant light output, guaranteeing stability in the case of temperature fluctuations as well as with long-run operation.



OUTPUT SIGNALS

RSF Elektronik

Sinusoidal voltage signals 1Vpp

(drawing shows "positive counting direction") Two sinusoidal voltage signals A1 and A2 and one reference mark signal (all with inverted signals).

Power supply: +5V±5%, max. 150 mA (unloaded) **Track signals** (differential voltage A1 to $\overline{A1}$ resp. A2 to $\overline{A2}$): Signal amplitude 0.6 Vpp to 1.2 Vpp; typ. 1 Vpp (with terminating impendance Zo = 120 Ω between A1 to $\overline{A1}$ resp. A2 to $\overline{A2}$)

Reference mark (differential voltage RI to $\overline{\text{RI}}$): Square-wave pulse with an amplitude of 0.8 to 1.2 V; typ. 1 V (with terminating impedance Zo = 120 Ω between RI to $\overline{\text{RI}}$)

Advantage:

High traversing speed with long cable lengths possible

Square-wave signals

(drawing shows "positive counting direction") With a Schmitt-Trigger (for times 1) or interpolation electronics (for times 2, -5, -10, -20, -25, -50 or -100) the photoelement output signals are converted into two square-wave signals that have a phase shift of 90°. Output signals either can be "single ended" or Line Driver "differential" (RS 422). The resolution equates to the distance between two edges of the square-wave signals.

The controls/DRO's must be able to detect each edge of the square-wave signals. The minimum edge separation a_{min} is listed in the technical data and refers to a measurement at the output of the interpolator (inside the scanning head). Propagation-time differences in the Line Driver, the cable and the Line Receiver reduce the edge separation.

Propagation-time differences:

Line Driver:max. 10 nsCable:0.2 ns per meterLine receiver:max. 10 ns refered to the recommended Line Receiver circuit

To prevent counting errors, the controls/DRO's must be able to process the resulting edge separation.

Example:

 $a_{min} = 125 \text{ ns}, 10 \text{ m cable}$ 125 ns - 10 ns - 10 x 0.2 ns - 10 ns = 103 ns

Power supply: +5 V ±5%, max. 180 mA (unloaded)

Advantage:

- Noise immune signals
- No further subdividing electronics necessary







CONNECTING CABLE, SHIELDING



According to the specific signal outputs of the Encoder, several connectors are possible. Standard cable length is 3 m. The PUR-cable jacket is a special thermoplastic, resistant to commercial coolants and lubricants.

Cables should be protected with a metallic armour if exposed to a harsh environment like "hot metal chips".

The cables can be used in the following temperature ranges:

fixed cable mounting: -20 °C to +70 °C continuous flexing: -5 °C to +70 °C

Shielded PUR-cable, Ø: 4.3 mm Bending radius fixed mounting: > 10 mm, continuous flexing: > 50 mm Torsion: > 300.000 cycles Drag chain: > 5.000.000 cycles reading head shield on housing of the reading head connector pin reading head shield on housing of the reading head connector

Cable length is graduated up to 9 m (other lengths on request)

Max. permissible cable length according to power supply MSA 4, MSA 5, MSA 7 and MSA 8



SWITCH SIGNAL OUTPUT



ACCURACY

The accuracy of the Linear Encoders is classified with a "± tolerance" in $\mu m/m$ (e.g. ±5 $\mu m/m).$

The accuracy refers to any meter within the measuring length. For measuring lengths less than 1000 mm, the accuracy specification applies to the whole measuring length.

For best system accuracy, the encoder should be mounted near the machining level and as parallel as possible to the motion direction.

Example of a typical calibration chart for a MSA 810 scale:

lektronische Längenmes ligitale Positionsanzeigen dustrie-Elektronik, Präzi	sgeräte n sionsteilungen										
ESSPROTOKOUL .C		APT . F		GE		DEE Elektr	anik Gos m h H				
jerätetyp /pe	MSA	810.0		AGE .		NOF Eleku	Taradad				
erien-Nr.		02	1								
eria-INO. erie-No.		02					MSA 810.	03-1	Ser.Nr.: 0	22505100	
hangeindex dice de changement				Pos.	Error	-15	-10	-5	0	5	10
uftrag cknowledgement				(mm)	(µm)	1.1.1.1.	1.1.1.1.1.	1.1.1.	1.1.1.1.1.1.1		
ommande osition-Nr.				+0,0	+1,63	1	:	:	: ,	:	:
osition-No. osition-No.				+10.0 +20,0	+1,49			1	1		
				+30,0	+1,48			1	11		
				+60,0	+1,20			1	11		
				+80,0	+1,23	1		1	11		
				100,0	+1,16				1		
				120,0	+0,98				1		
DIN EN ISO Certificati	9001 on			140,0	+0,91			-	11		
F Linear Encoders	are	Dies		160,0	+0,79			1	11		
nufactured and ins	pected under	wurd		180,0	+0,71 +0,68	1		1	11		
ingent quality control	ol guidelines.	mod		200,0	+0,64			1	1		
		nerg		220,0	+0,53				1		
Linear Encoders a	re tested and	Unte		240,0	+0,40				1		
asured per the folic ditions/equipment:	wing	Länc	0:	260,0	+0,42			1	1		
renteries equipriterit.		Gena		280,0	+0,18			1	1	1	
		proto		300,0	+0,09	1		-	1		
Reference Temperat	ure 20°C	• Be		330.0	-0,09		1	1	4		
Humidity 50%		• Lu		350,0	-0,36				1		
Air Bearing guided Measuring Machine		Me		370,0	-0,88				1	1	
Heidenhain Laserint	erferometer	• He		390,0	-1.05						
Type: ILM 1131		Ty		410.0	-1,14						
				430,0	-1,02 -1,00			1			
				450,0	-1,10 -1,30			1			
				470,0	-1,30						
stem Data:	720 mm	Syste		500,0	-1,08					1	
asuring Length: ting Pitch:	20 µm	Maßs		520,0	-0,93				1		
put Signal:	1Vss	Ausga	0	540,0	-0.93			1	}!	1	1
oply Voltage:	ve	Verso Kahal		560,0	-1.27			1	11	1	
erence Index (RI) Positio	in: 10,0mm	Refer		580,0	-1,22	1		1	1	1	
Code:	04 ±5um/m	Refer		600,0	-1,12			1	1		
cification:	Tobulou	Dater		620,0	-1,00	1			1		
				640,0	-1,18 -1,19						
				660,0	-1,36				1		
				690.0	-1,46				1		
				710,0	-1,63				1		
					-1,03						
										-1.0.0.00000000000000000000000000000000	
			M	ax. Abwe	ichung	±1,63µm	max. tota	error ±	:1,63µm	Defaut maxi	±1,63µm
			5 5	ystemgen	auigkeit	±1,63µm/1000mm	system acc	uracy ±	: 1,63µm/1000mm	Precision du systeme	±1,63µm/1000mm

SCALE OVERVIEW

SELECTION GUIDE

The Linear Encoders of the **MSA 4** and **MSA 7** series are equipped with a fixed connecting cable. Alternatively RSF offers the **MSA 5** and **MSA 8** series with a detachable connecting cable.

Depending on the electrical version the detachable connecting cable is available in graduated lengths up to 9 m (other lengths on request).

The Linear Encoders **MSA 7**xx and **MSA 8**xx series are characterized by a considerably improved thermal behavior.

Flexible fastening elements at the scale unit compensate repeatably the lengthextension resp. -contraction, which appears due to temperature variations at the machine.

With a fixed fastening element (left side, middle or right side) a datum-point *(thermal fixed-point)* is defined.

Additionally it is also possible to fix the scale inside of the extrusion.

MSA 7XX.XX-X XX

- Small cross section
- Max. measuring length: up to 3040 mm
- (only at 20 µm grating pitch)
- Connecting cable

Small cross section

up to 3040 mm

Max. measuring length:

(only at 20 µm grating pitch)

Detachable connecting cable

System height: 49 resp. 57 mm

System height: 46 resp. 54 mm











connecting cable

MSA 8x1

MSA 8x0

81 57

MSA 4XX.XX-X XX

MSA 5XX.XX-X XX

Large cross section

up to 3040 mm

Max. measuring length:

(only at 20 µm grating pitch) Detachable connecting cable

System height 77 resp. 75 mm

MSA 8XX.XX-X XX

- Large cross section
- Max. measuring length: up to 3040 mm
- (only at 20 µm grating pitch)
- Detachable connecting cable
- System height: 77 resp. 75 mm









MSA 4x1

0

MSA 570

0

0____0______



0

connecting cable -

connecting cable -

	48,5
<u>35</u>	+

MSA 5x1

0







- Fixed mounting-point centered
- Flexible fastening element
- left and right
- Max. measuring length: 1240 mm

Available versions:

MSA 720, MSA 820

Page 18

MSA X30.XX-X XX

- Fixed mounting-point right
- Flexible fastening element left
- Max. measuring length: 1240 mm



Available versions: MSA 730, MSA 830

Page 19

OVERVIEW, SELECTION GUIDE



MSA X21.XX-X XX

- Fixed mounting-point centered
- All other fastening elements flexible
- Max. measuring length: 3040 mm (only at 20 µm grating pitch)



MSA 421, MSA 521 Page 27



MSA 721, MSA 821 Page 22

MSA X31.XX-X XX

- Fixed mounting-point right
- All other fastening elements flexible
- Max. measuring length: 3040 mm (only at 20 µm grating pitch)



Page 28

MSA 431, MSA 531



NOMENCLATURE



TECHNICAL DATA MSA 4, MSA 5, MSA 7, MSA 8 SERIES

Scale model electronic version	Output signals	System resolution [µm]	Accuracy grades [µm/m]	Grating pitch [µm]	Integrated interpolation	Max. velocity [m/s]	Max. output frequency [kHz]
MSA xxx.03	~ 1 Vpp	dep. on external interpolation	±3, ±5	20		2.0	100
MSA xxx.01	~ 1 Vpp	dep. on external interpolation	±3, ±5	10		2.0	200
MSA xxx.00	∼ 1 Vp	dep. on external interpolation	±2, ±3, ±5	8		2.0	250
							Edge separation a _{min}
MSA xxx.23	л	5.0	±3, ±5	20	times 1	2.00	1.25 µs
MSA xxx.33	л	2.5	±3, ±5	20	times 2	2.00	625 ns
MSA xxx.63	л	1.0	±3, ±5	20	times 5	2.00	250 ns
MSA xxx.73	л	0.5	±3, ±5	20	times 10	1.92	250 ns
MSA xxx.61	л	0.5	±3, ±5	10	times 5	1.92	250 ns
MSA xxx.71	л	0.25	±3, ±5	10	times 10	0.96	250 ns
MSA xxx.51	л	0.1	±3, ±5	10	times 25	0.77	125 ns
MSA xxx.81	л	0.05	±3, ±5	10	times 50	0.38	125 ns
MSA xxx.30	л	1.0	±2, ±3, ±5	8	times 2	2.00	250 ns
MSA xxx.70	л	0.2	±2, ±3, ±5	8	times 10	0.77	250 ns
MSA xxx.80	л	0.04	±2, ±3, ±5	8	times 50	0.30	125 ns
MSA xxx.90	л	0.02	±2, ±3, ±5	8	times 100	0.15	125 ns

Standard measuring lengths (ML): [mm]	70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 570, 620, 670, 720, 770, 820, 870, 920, 970, 1040, 1140, 1240, 1340, 1440, 1540, 1640, 1740, 1840, 1940, 2040, 2240, 2440, 2640, 2840, 3040 (only possible with 20 μm grating pitch), (8 or 10 μm grating pitch only possible up to measuring length 1140 mm) (other measuring lengths on request)				
Scale unit:	■ Glass scale (α≈8.5x10 ⁻⁶ /K)				
	 Glass ceramic scale (α≈0x10⁻⁶/K) up to ML 1440 mm (longer measuring lengths on request) 				
Location of reference mark (RI):	 Distance-coded reference mark (K) after travelling max. 20 mm the absolute position is available 				
	Optional: one reference mark at any location additional reference marks can be selected by distances of n x 50 mm				
Required moving force:	With standard sealing lips: < 2.0 N				
	With low drag respectively without any sealing lips: < 0.1 N				
Environmental sealing acc.	With standard sealing lips: IP 53				
EN 60529:	With DA 400: IP 64 (see Page 33)				
Permissible vibration:	100 m/s² (40 up to 2000 Hz)				
Permissible shock:	200 m/s² (8 ms)				
Permissible temperature:	 -20 °C up to +70 °C (storage) 0 °C up to +50 °C (operation) 				
Weight of Linear Encoder (approx.):	 MSA 470, MSA 570: 460 g+2.5 g/mm (ML) MSA 4x1, MSA 5x1: 295 g+2.5 g/mm (ML) 				
	+ 175 g (reading head without cable)				
	MSA 7xx , MSA 8xx: 75 g+0,57 g/mm (ML) + 50 g (reading head MSA 7xx without cable)				
	+ 65 g (reading head MSA 8 xx without cable)				
Weight of cable (approx.):	30 g/m				
Power supply:	Sinusoidal voltage signals 1 Vpp +5 V ±5%, max. 150 mA (unloaded)				
	Square-wave signals via Line Driver +5 V ±5%, max. 180 mA (unloaded)				
RoHS-conformity:	The Linear Encoders of the MSA 4, MSA 5, MSA 7 and MSA 8 series comply with the guideline of the RoHS-directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment				

MSA 770, MSA 870

MSA 770





Dimensions, mounting tolerances MSA 870:



ŝ

4

12 ML

<u>К // 0.2 м</u>

56

4

La

M ML G ⊲—⊳ A	= = =	machine guideway measuring length gauging points 0 ML cable
_HI12	=	male connector
K	=	required mating dimensions
optional: S1, S2 RI		M5 air inlet switch signals selectable reference mark actuator magnet sensor position

8.8

4

<u>0 ±2</u> (K)

MSA 710, MSA 810





Dimensions, mounting tolerances MSA 810:



12

ML

56

M	=	machine guideway
ML	=	measuring length
G	=	gauging points
$\triangleleft \!\!\!\! \rightarrow \!$	=	0 ML
A	=	cable
LHI12	=	male connector
~		
(K)	=	required mating dimensions
optional:		
Р	=	M5 air inlet
S1, S2	=	switch signals
RI	=	selectable reference mark
*	=	actuator magnet
**	=	sensor position

MSA 720, MSA 820



MSA 730, MSA 830



Dimensions, mounting tolerances MSA 730:



MSA 771, MSA 871





Dimensions, mounting tolerances MSA 871:



M ML ∢—⊳ A		machine guideway measuring length 0 ML cable
LHI12	=	male connector
K	=	required mating dimensions
optional: P S1, S2 RI *	= = = =	M5 air inlet switch signals selectable reference mark actuator magnet sensor position



MSA 721, MSA 821



22



MSA 470, MSA 570



Dimensions, mounting tolerances MSA 470:



124

24

MSA 471, MSA 571



Dimensions, mounting tolerances MSA 571:



option P: air inlet scale left or right side mountable



accessory: air inlet reading head (ID 1079056-01)



Dimensions MSA 571:



connecting cable detachable (accessory)

ര

MSA 411, MSA 511



Dimensions, mounting tolerances MSA 411:







= required mating dimensions

= fixed-point

optional: P

FΧ

RI

*

**

= air inlet M5 S1, S2

- switch signals =
- = selectable reference mark

= actuator magnet = sensor position

option P: air inlet scale left or right side mountable





5 6 \odot ⊕ ۱P

Dimensions MSA 511:



connecting cable detachable (accessory)

MSA 421, MSA 521



Dimensions, mounting tolerances MSA 421:





		0
		Î
measuring length	n	
ML > 56 - 600 ML > 600 - 1200 ML > 1200 - 1800 ML > 1800 - 2400 ML > 2400 - 3000 ML > 3000 - 3040	2 4 6 8 10 12	

(K) // 0.1 / 25 A

6.5

35

K<u>0 ±0.5</u>

(75)

48.5 40.5 (K) <u>1.5 ±0.5</u>

Μ	=	machine guideway
ML	=	measuring length
$\triangleleft \!\!\!\! \rightarrow \!$	=	0 ML
A	=	cable
K	=	required mating dimension
FX	=	fixed-point
optional:		
Р	=	air inlet M5
S1, S2	=	switch signals
RI	=	selectable reference mark
*	=	actuator magnet

= sensor position

**

option P: air inlet scale left or right side mountable





accessory: air inlet reading head (ID 1079056-01)



Dimensions MSA 521:



connecting cable detachable (accessory)

MSA 431, MSA 531



Dimensions, mounting tolerances MSA 431:







option P: air inlet scale left or right side mountable







Dimensions MSA 531:



- 28

MSA 170



Scale model electronic version	Output signals	System resolution [µm/m]	Accuracy grades [µm/m]	Grating pitch [µm]	Integrated interpolation	Max. velocity [m/s]	Max. output frequency [kHz]
MSA 170.03	∼ 1 Vpp	dep. on external interpolation	±3, ±5	20		1.0	50
							Edge separation amin
MSA 170.23	л	5.0	±3, ±5	20	times 1	1.0	3.3 µs
MSA 170.63	л	1.0	±3, ±5	20	times 5	1.0	500 ns
MSA 170.73	л	0.5	±3, ±5	20	times 10	1.0	300 ns
MSA 170.53	л	0.2	±3, ±5	20	times 25	0.64	300 ns
MSA 170.83	л	0.1	±3, ±5	20	times 50	0.32	300 ns

Standard measuring lengths (ML): [mm] 50, 70, 120, 170, 220, 270, 320, 370, 420, 470, 520

Scale unit: Glass scale ($\alpha \approx 8.5 \times 10^{-6}/K$)

Location of reference mark (RI):

- Distance-coded reference mark (K) after travelling max. 20 mm the absolute position is available

- One reference mark in the middle of measuring length, or 10 mm from either end of measuring length (excluding ML 50 mm)
- Optional: one reference mark at any location, additional reference marks can be selected by distances of n x 25 mm

Required moving force: <1 N

Environmental sealing acc. EN 60529: IP 53 - With DA 400: IP 64 (see page 33) Permissible vibration: 100 m/s² (40 to 2000 Hz)

Permissible shock: 150 m/s² (8 ms)

Permissible temperature:

-20 °C to +70 °C (storage), 0 °C to +50 °C (operation)

Weight (approx.): 20 g+0.17 g/mm (ML)+35 g (reading head without cable)

Power supply: +5 V ±5% max. 75 mA (unloaded) ~ 1 Vpp, max. 120 mA (unloaded) -

RoHS-conformity:

The Linear Encoders of the MSA 170 series comply with the guideline of the RoHS- directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment



MSA 373, MSA 374, MSA 375



Scale model electronic version	Output signals	System resolution [µm/m]	Accuracy grades [µm/m]	Grating pitch [µm]	Integrated interpolation	Max. velocity [m/s]	Max. output frequency [kHz]
MSA 37x.65	л	5 µm	±10	100	times 5	1,0	1.6 µs
MSA 37x.55	л	1 µm	±10	100	times 25	1,0	800 ns

Standard measuring lengths (ML): [mm]

70, 120, 170, 220, 270, 320, 370, 420, 470, 520, 620, 720, 770, 820, 920, 1040, 1140, 1240 (other ML on request)

Scale unit: Glass scale ($\alpha \approx 8.5 \times 10^{-6}/K$)

Free positionable actuator magnets for special functions: The position of the two switch-points (S1 und S2) can be

selected by the customer within measuring length.

Location of reference mark (RI):

- One reference mark in the middle of measuring length, or 35 mm from either end of measruring length
- Optional: one reference mark at any location, additional reference marks can be selected by distances of n x 50 mm

Required moving force: <1 N

Environmental sealing acc. EN 60529: IP 53 - With DA 400: IP 64 (see page 33) Permissible vibration: 150 m/s 2 (40 to 2000 Hz) Permissible shock: 300 m/s 2 (8 ms)

Permissible temperature:

-20 °C to +70 °C (storage), 0 °C to +50 °C (operation)

Weight (approx.): 250 g+1.34 g/mm (ML)+210 g (reading head without cable)

Power supply: +5 V ±5%, max. 120 mA (unloaded)

RoHS-conformity:

The Linear Encoders of the MSA 373, 374, 375 series comply with the guideline of the RoHS- directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

ACCESSORY: CB8-150 COUPLING BAR (ONLY FOR MSA 373 AND MSA 375)

Axis distance: 150 mm (other axis distances on request) Included in delivery: 2 hexagone socket screws M8 x 20 ISO 4762 for mounting





MSA 373



spring rod clamping left side possible (allen wrench 3 mm)

* clamping length spring rod

** fastening screw thread for coupling bar

- OT = overtravel
- (K) = required mating dimensions

MSA 374











MSA 375

MALE AND FEMALE CONNECTORS, PIN ASSIGNMENTS

SUB MIN-D

Connector LD15 15-pin (weight: 25 g)



Pin assignment (view on pins)



LD15

Pin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sinusoidal voltage signals 1 Vpp	nc	0 V sensor	nc	RI	A2	A1	+5 V sensor	+5 V	0 V	S1*	S2*	RI	A2	A1	shield
Square-wave signals via Line Driver	nc	0 V sensor	US	RI	T2	T1	+5 V sensor	+5 V	0 V	S1*	S2*	RI	T2	T1	shield

Sensor: The sensor-Pins are bridged in the chassis with the particular power supply

*Version without switch signals (version 0) = nc

Shield is additionally connected with the chassis



Connector L121 12-pin (weight: 75 g)

Pin assignment male connector (view on pins) Female connector K121 12-pin

Female connector KM121 12-pin











L121, K121, KM121

Pin	1	2	3	4	5	6	7	8	9	10	11	12
Sinusoidal voltage signals 1 Vpp	A2	+5 V sensor	RI	RI	A1	A1	nc	A2	nc	0 V	0 V sensor	+5 V
Square-wave signals via Line Driver	T2	+5 V sensor	RI	RI	T1	T1	US	T2	nc	0 V	0 V sensor	+5 V

Sensor: The sensor-pins are bridged in the chassis with the particular power supply Shield is additionally connected with the chassis





Pin assignment

Female connector K120



L120, K120

Pin	А	В	С	D	E	F	G	н	J	К	L	М
Sinusoidal voltage signals 1 Vpp	nc	0 V	A1	A1	A2	S1*	RI	RI	S2*	+5 V	A2	nc
Square-wave signals via Line Driver	nc	0 V	T1	T1	T2	S1*	RI	RI	S2*	+5 V	T2	US

Shield is additionally connected with the chassis

*Version without switch signals (version 0) = nc

AIR PRESSURE UNIT DA 400

For applications where the Linear Encoders are used in harsh environments (e.g. oil and coolants), RSF offers a method of extra protection beyond the enclosed unit's standard set of sealing lips.

An air inlet can be provided for filtered air to be input into the scale spar. A limiting flow restrictor helps set the optimum overpressure airflow inside the scale spar to further prevent oil and coolants from entering the seal. To ensure fail-safe operation of the Linear Encoder, only "clean" and pretreated air should be put into the scale housing.

The scale cavity should have a flow rate of about 7 to 10 l/min (per Linear Encoder). The setted overpressure (adjustable from 0.5 to 3×10^5 Pa) depends on the number of the connected Linear Encoders (max. 10 Linear Encoders) and the design of the compressed-air supply. DA 400 consists of three filter stages (prefilter, fine filter and activated carbon filter) and a pressure regulator with pressure gauge.

To reach the promised accuracy of the measuring system, the air temperature has to be +20 $^{\circ}$ C.



PRODUCT DIRECTORY



MS 2x Series

Reflective scanning Linear Encoder with integrated mounting control (only MS 25, MS 26)

- Easy mounting; no test box or oscilloscope needed
- Quality of the scanning signals is directly visible at the reading head via a 3-coloured LED
- Two independent switch signals for individual special functions Position of reference mark
- selectable
- High insensitivity against contamination
- High traversing speed
- Integrated subdividing: up to times 100 interpolation
- Max. measuring length Glass scale: 3140 mm Steel tape scale: 20 000 mm

MS 30, MS 31 Series Reflective scanning

Linear Encoder

- Two independent switch signals for individual special functions
- Position of reference mark
- selectable Small dimensions
- Easy mounting as a result of large mounting tolerances
- High traversing speed
- High insensitivity against
- contamination Integrated subdividing:
- up to times 100 interpolation Max. measuring length
- Glass scale: 3140 mm Steel tape scale: 11940 mm

MS 45 Series

Reflective scanning Linear Encoder with integrated mounting <u>control</u>

- Easy mounting; no test box or oscilloscope needed
- Quality of the scanning signals is directly visible at the reading head via a 3-coloured LED
- Small dimensions
- Easy mounting as a result of large mounting tolerances
- High insensitivity against contamination
- High traversing speed
- Integrated subdividing: up to times 100 interpolation
- Max. measuring length Steel tape scale: 30 000 mm



MS 82 Series

- Interferential Linear Encoder Two switch tracks
- for individual special functions
- Non-contact reflective scanning
- High traversing speed Small dimensions
- Scale unit: glass scale or ROBAX® glass cramic scale with phasse grating
- Max. measuring length Glass scale: 3140 mm Glass ceramic: 1840 mm



MS 14 Series

Reflective scanning Linear Encoder with integrated mounting

- Easy mounting; no test box or oscilloscope needed
- Quality of the scanning signals is directly visible at the reading head via a 3-coloured LED
- Extremely small dimensions Easy mounting as a result of
- large mounting tolerances High insensitivity against contamination
- High traversing speed
- Integrated subdividing:
- up to times 100 interpolation Max. measuring length
- Steel tape scale: 20000 mm

MSR 40

Modular Rotary Encoder with steel tape scale

- Different versions
- Full-circle or segment version
- Grating pitch: 200 μm Accuracy of the grating (stretched): ±30 µm/m
- High rotational speed resp. circumferential speed
- Integrated subdividing: up to times 100 interpolation

MSR 20

- Segment version
- Grating pitch: 40 μm
- Accuracy of the grating (stretched): ±15 µm/m
- High circumferential speed
- Integrated subdividing:
- up to times 100 interpolation



DG 118, DG 120

- - graduated from 100 to 5400



DIT 10, DIT 30, DIT 48

Precision Measuring Probes

- For universal applications
- Stroke length: 10, 30, 48 mm Mounting on shaft sleeve
- Mounting with two tapped
- holes on body (DIT 30, DIT 48) With cable lifter
- Integrated pneumatic lifter
- optional Sealing bellows optional
- (DIT 30, DIT 48)

34 -

Rotary Encoder





MSA 65x, MSA 35x

- Sealed Linear Encoders
- For retrofit of machine toolsLarge mounting tolerances
- Guided by ball bearings
- Outled by ball bean
 Distance-coded reference marks
- Two sets of sealing lips for additional contamination protection (only MSA 352)
- Mounting holes on the extrusion ends (MSA 650, MSA 35x)
- Mounting holes on top of the extrusion - improves vibration rating (MSA 651)
- Mounting supports (MSA 35x)Max. measuring lengths:
- MSA 650: 1740 mm MSA 651: 2240 mm MSA 35x: 3040 mm



Z 300

Digital Readouts

- for universal application Number of alphanumeric axis:
- 2 or 3 Monochrome flat screen
- Clearly readable display
- Robust cast aluminum housing
- Splash-proof fulltravel keypad
- Practice-oriented functions
- Standard version for turning, drilling or milling machine



UFC 430

USB-Interface-Module

- USB-interface acc. to spec. 2.0
- Available inputs: 1 Vpp max. 200 kHz or TTL (RS 422) max. 500 kHz
- Interpolation: up to times 400 for measuring systems with output 1 Vpp and up to times 4 for measuring systems with square-wave Line Driver signals
- Three 15-pin Sub-D female connectors for 3 encoder inputs
- 32 Bit counter with preset and latch register

IFC 430R

- Encoder-interface-card
- PC interface board for quadrature encoder signal evaluation: times 1, -2 or -4
- Latch logic for measured values
- Three counter channels à 32 bit, one load and two latch registers for each channel
- PC busSignal edge separation:
- up to 100 ns
 Demo program with examples
 - and driver software



Precision Graduations

 Length graduations on glass, chromium coated

- Length graduations on steel tape, gold coated or polished surface
- Circular graduations on glass, chromium coated
- Graticules
- Antireflex coatings
- Coatings



Cable Systems

- Individual cable design
- Hybrid cable
- Trailing cable
- System solutions
- Function control

DISTRIBUTION CONTACTS

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Linear Encoders Digital Readouts Precision Graduations Cable Systems

Certified acc. to DIN EN ISO 9001 DIN EN ISO 14001

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