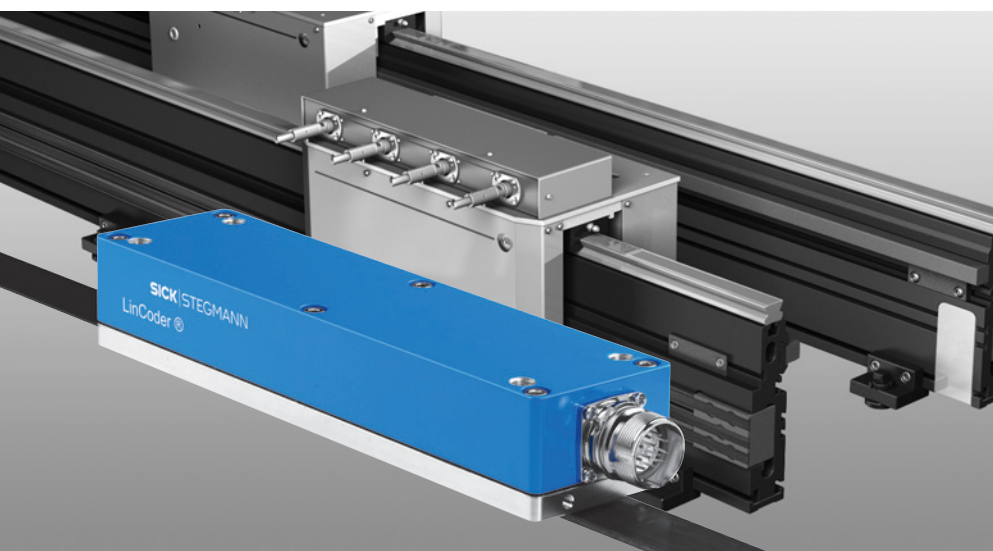


LinCoder® L230: Absolute, non-contact length measuring system



onto a ferromagnetic tape (steel tape) which, on the one hand, acts as a magnetic base and, on the other hand, as a form-stabilising assembly aid.

The magnetic tape can thus be bonded using adhesive directly to a ferromagnetic support, without any influence on the magnetisation.

A non-contact magnetic read head with integrated evaluation electronics and appropriate interface is guided over the measuring section, and its position is output up to 40 m.

Areas of use:

- in wood working and glass working
 - on paper machines
 - in-feed axes
 - portal robots
 - linear motors
 - presses
 - palletizers
- and anywhere where high travel speed, small dimensions and simple mounting determine the requirements for a reliable measuring system.

The LinCoder® measuring system comprises a magnetic tape and a read head. The magnetic tape constitutes the scale for a measuring section up to 40 metres long. The absolute information is magnetised onto the tape in a 12-bit sequential code. To achieve the highest possible resolution and accuracy, an additional incremental track has been magnetised onto the magnetic tape, i.e. the north and south poles always alternate. The manufacturer laminates the magnetic tape

	Resolution up to 1 µm
Linear Encoder	

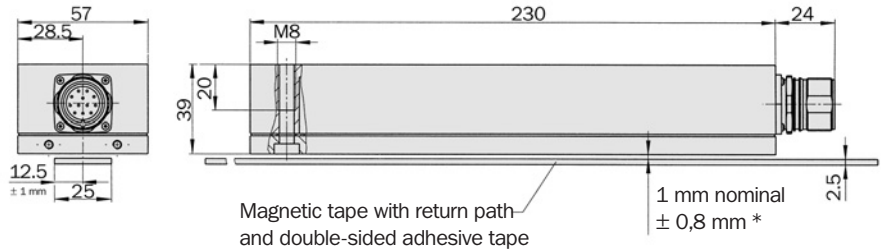


Resolution up to 1 μm

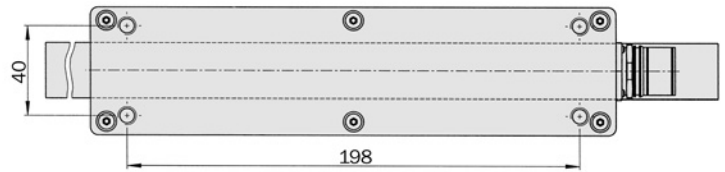
Linear Encoder

- Measurement lengths up to 40 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Different Interfaces
- Length-independent position sensing time
- Electronically adjustable
- Protection class up to IP 65

Dimensions and positional tolerances; Absolute length measuring system L230 SSI



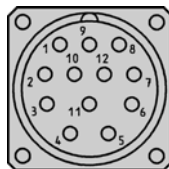
* Between ± 1.8 and ± 3.5 mm, position errors are undefined, at > 3.5 mm an error message is produced



General tolerances according to DIN ISO 2768-mk

PIN and wire allocation SSI Interface

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Signal line
3	Clock +	yellow	Signal line
4	RS 485 +	grey	Must not be connected by customer
5	RS 485 -	green	Must not be connected by customer
6	N. C.	-	Not connected
7	N. C.	-	Not connected
8	+ U_s	red	Supply voltage
9	SET ¹⁾	orange	Electronical adjustment
10	Data -	brown	Signal line
11	Clock -	lilac	Signal line
12	cw/ccw ²⁾	orange/black ³⁾	Counting sequence (increasing/decreasing)



View of the connector M23 fitted to the encoder body SSI

Caution! PINs labelled "N. C." must not be connected.

Screening via plug housing

- ¹⁾ This input is used for electronic adjustment. By means of a high signal (U_s) > 20 ms on this connection, the LinCoder position is set to 0.
- ²⁾ This output programs the counting direction of the LinCoder. If not connected, this input is »high«. If the LinCoder is moved from the start to the end of the magnetic tape, then it counts in a rising sequence. If the LinCoder is to count in a rising sequence from the end to the start of the magnetic tape, then this terminal must be connected continuously to »low« GND.
- ³⁾ If there is no orange/black core, then black (if orange/black does exist, black must not be used instead!)

Accessories

Connection systems



Technical data according to DIN 32878		L230	SSI							
Measurement length		Max. 40 m								
Magnetic strip length		Measurement length + 130 ¹⁾ mm								
Position resolution	0 ... 8.35 m ²⁾	1 or 10 µm								
	> 8.35 ... 40 m	10 µm								
Reproducibility		± 10 µm								
Measurement accuracy		Typ. ± 0.3 mm/m at 20 °C								
Temperature expansion coefficient Tk		16 µm/°C/m								
Mass	read head	0.685 kg								
	magnetic tape	0.160 Kg/m								
Material	read head	AlMgSiPbF28								
	magnetic tape	Tromaflex 928								
	stainless steel tape	no. 1.4435								
Resistance to shocks ³⁾										
read head		30/10 g/ms								
Resistance to vibration ⁴⁾										
read head		10/20 ... 250 g/Hz								
Working temperature range		0 ... + 70 °C								
Storage temperature range		- 40 ... + 100 °C								
Protection class ⁵⁾		IP 65								
Max. speed of travel ⁶⁾		6 m/s								
Initialisation time		3500 ms								
Position repetition time		750 µs								
Supply voltage		10 ... 32 V								
Max. power consumption		4.8 W								

¹⁾ Technical necessary constant

²⁾ Longer measurement lengths on request

³⁾ To DIN EN 61000-2-27

⁴⁾ To DIN EN 61000-2-6

⁵⁾ With mating connector inserted

⁶⁾ When exceeding the maximum travel speed limit or when leaving the surface of the measuring element the corresponding error message is produced: 7F FF FF hex

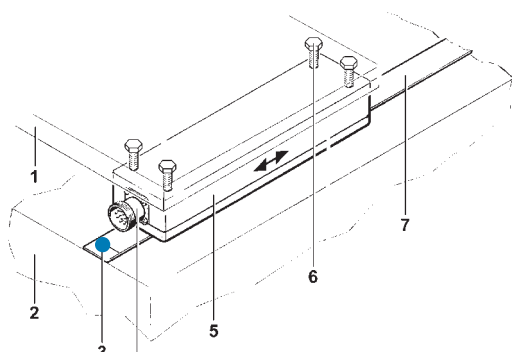
Caution:

External magnetic fields should not exceed 64 mT (640 Oe; 52kA/m) on the surface of the gauge, since this can damage the coding on the gauge. Magnetic fields > 1 mT at the measuring system affect the measurement accuracy.

Initial commissioning

The measurement path can start at any position between 0 m and 40 m. Therefore it will be helpful, prior to initial commissioning, to align the electrical zero point to your intended mechanical position. When operating with the SSI interface, this can be performed via the SET input, for HIPERFACE® variants, this can be programmed via software.

Mounting arrangement

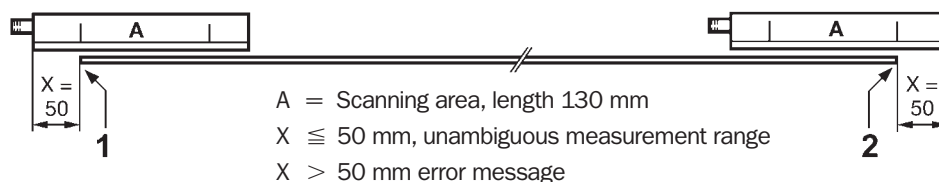


- 1 Support for the read head (customer)
- 2 Support for the magnetic tape (customer)
- 3 Identification – zero point of the start of the magnetic tape
- 4 Plug outlet from the read head
- 5 Read head
- 6 Fastening of the read head from above or below
- 7 Magnetic tape

Caution:

The mounting arrangement must ensure that the sensor can overtravel the start and finish of the magnetic tape by at least 50 mm; this enables the complete measurement length of the tape to be registered. The start of the tape is marked by a coloured dot (●).

Due to the way the system operates, the magnetic tape is always 130 mm longer than the measurement length required.

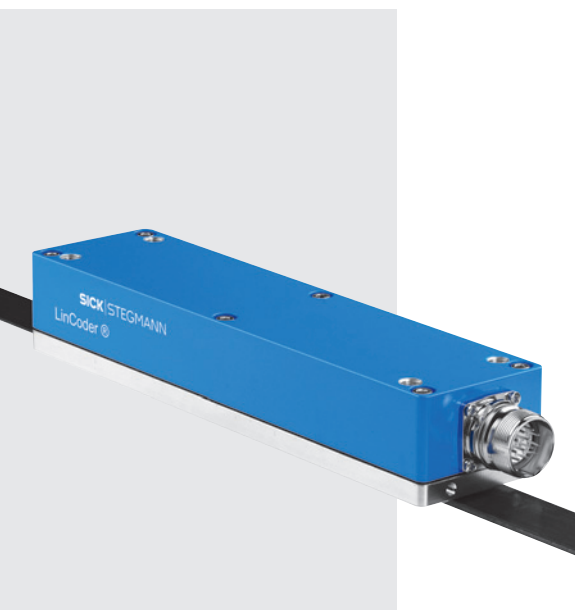


- 1 Start of tape
- 2 End of tape

**Resolution
up to 1 μm**

Linear Encoder

- Measurement lengths up to 40 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Different Interfaces
- Length-independent position sensing time
- Electronically adjustable
- Protection class up to IP 65



Accessories

Connection systems

SSI interface description

The LinCorder® with SSI interface outputs the serial data in Gray code with a word length of 24 bits and a clock frequency of 100 kHz to 1 MHz. In the length measurement device, the clock signal is galvanically separated from the encoder supply voltage, by an optocoupler. When using this interface in the LinCorder®, some specific features need to be noted:

Supplement to SSI standard operation

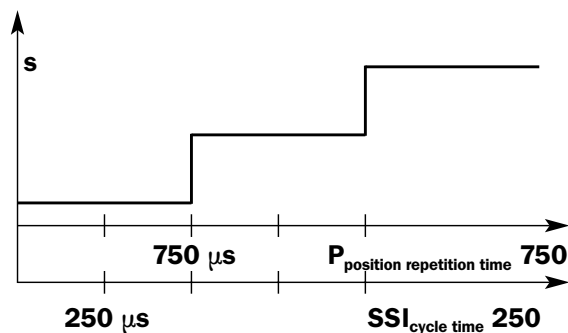
The diagram alongside shows a calculated position waveform under continuous acceleration. It can clearly be seen that, during one SSI cycle (SSIcycle = control cycle for reading and processing the current value once) of 250 μs , the identical travel information from the measurement system is read at least once, max. 4 times, before a new position is available. The position repetition time of 750 μs of the LinCorder® and the rapid read-out and processing of the control system produce an oscillatory behaviour of the system connected downstream, as a result of the asynchronous response of the two systems (controller and measuring system).

If the sensor travels more than 50 mm beyond the start of the tape or the end of the tape (see page 3 below), the error message 7F FF FF hex is output.

In standard operation, the LinCorder® forms a position value every 0.75 milliseconds, cyclically and independently of the SSI read cycle, and places this value in the output register provided for this, to be retrieved by the interface. Since the SSI read cycle and the position formation cycle can never be identical, there will be a continuous displacement of the time/position relationship. In other words:

In this mode of operation, the time/position value relationship fluctuates from 2 to 750 μs .

SSI standard operation



NOTE: The SSI cycle (cyclic access to the LinCorder® by controller/regulator) of 250 μs is assumed here.

Real-time compensated SSI operation

In order to avoid any fluctuation in the time/position relationship, which may lead to very unconventional behaviour in the control loop, the real-time compensated SSI mode of operation has been developed by SICK-STEGMANN (installed as standard). In the case of length measuring systems controlled by microcontrollers, the so-called dead time of a measuring system is greater than in a pure "hardware"-based measuring systems as a result of the time which is needed by the microcontroller in order to calculate the position.

In order to implement the formation of a position which is as real-time compatible as possible, even with a length measuring system controlled by a microcontroller, a hardware logic unit is connected downstream of the microcontroller and takes over this sequence. As distinct from the SSI standard operation, the circuit is loaded with the difference from

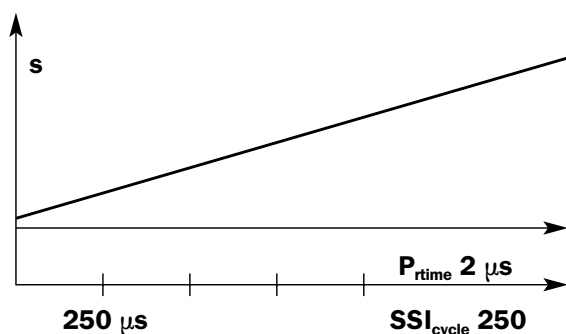
the last position rather than with the calculated position. The logic circuit then adds this position difference to the last position value. In order that this position calculation cycle of the microcontroller is compensated for, the logic circuit then permanently adds the last-loaded difference to the position value, in a cycle of about $2 \mu\text{s}$, until after about $750 \mu\text{s}$ a newly calculated difference is available from the microcontroller and is accepted by the logic unit.

The synchronisation of the position output to the controller takes place with the first falling flank of the SSI clock signal which causes the output register to be loaded. In parallel with the loading of the output register, the addition of the difference to the position value is passed on by the circuit. The dead time for forming the position in the LinCoder® is thus restricted to a maximum of $2 \mu\text{s}$ (gate propagation time of the logic circuit).

With a real-time compensated position repetition time (P_{rtime}), the position waveform of the LinCoder® runs linearly up to the $2 \mu\text{s}$ position repetition time (dead time), given uniform acceleration.

If the current value from the LinCoder® is then read by a regulator or controller at a uniform cycle time of $250 \mu\text{s}$, the position has been updated more than 100 times by the logic circuit. There is thus a synchronous relationship between the length measuring system and the downstream control system.

Real-time compensated SSI operation



Order information

Absolute length measuring system L230 SSI

Type	Part no.	Explanation
L230-P580A7K15300	1033569	Read head SSI; resolution $1 \mu\text{m}$; 5.0 m cable (Magnetic tape max. 8.35 m)
L230-P580A7S00000	1033534	Read head SSI; resolution $1 \mu\text{m}$; connector M23, 12-pin (Magnetic tape max. 8.35 m)
L230-P580B7S00000	1033533	Read head SSI; resolution $10 \mu\text{m}$; connector M23, 12-pin (Magnetic tape max. 40 m)

Magnetic tapes

Type	Part no.	Explanation
Magnetic tape	2030642	With adhesive backing (supplied by the metre) *)
Magnetic tape	5313643	Without adhesive backing (supplied by the metre) *)
Magnetic tape	2030646	With adhesive backing, length 10.0 m
Magnetic tape	2031275	With adhesive backing, length 12.0 m
Magnetic tape	2031288	With adhesive backing, length 16.0 m

*) The magnetic tape must be ordered by the metre (material representation), at least 0.5 m ... 40 m.

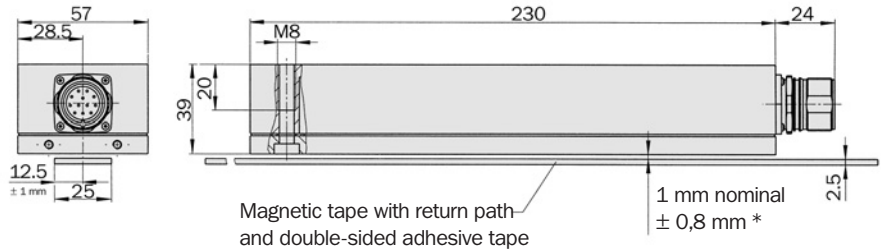
Where not otherwise specified, the magnetic tape is supplied to match read heads with a resolution of $10 \mu\text{m}$. For read heads with a resolution of $1 \mu\text{m}$, this MUST be specified when ordering the magnetic tape.

 **Resolution up to 1 µm**

Linear Encoder

- Measurement lengths up to 40 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Different Interfaces
- Length-independent position sensing time
- Electronically adjustable
- Protection class up to IP 65

Dimensions and positional tolerances; Absolute length measuring system L230 SSI



* Between ± 1.8 and ± 3.5 mm, position errors are undefined, at > 3.5 mm an error message is produced

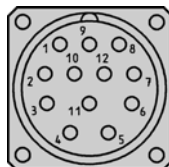


General tolerances according to DIN ISO 2768-mk



PIN and wire allocation HIPERFACE® interface

PIN	Signal	Wire colours	Explanation
(cable outlet)			
1	REFCOS	black	Processs data channel
2	Data +	grey or yellow	RS485 parameter channel
3	N. C.	–	Not connected
4	N. C.	–	Not connected
5	SIN	white	Processs data channel
6	REFSIN	brown	Processs data channel
7	Data –	green or purple	RS485 parameter channel
8	COS	pink	Processs data channel
9	N. C.	–	Not connected
10	GND	blue	Earth connection
11	N. C.	–	Not connected
12	+ U _s	red	Supply voltage



View of the connector M23 fitted to the encoder body HIPERFACE®

Caution! PINs labelled "N. C." must not be connected.

Screening via plug housing

Electronically adjustable via Programming Tool

Accessories

Connection systems
Programming tool

Technical data according to DIN 32878		L230 HIPERFACE®								
Measurement length		Max. 40 m								
Magnetic strip length		Measurement length + 130 ¹⁾ mm								
Position resolution ²⁾		156.25 µm								
Reproducibility		± 10 µm								
Measurement accuracy		Typ. ± 0.3 mm/m at 20 °C								
Temperature expansion coefficient Tk		16 µm/°C/m								
Mass	read head	0.685 kg								
	magnetic tape	0.160 Kg/m								
Material	read head	AlMgSiPbF28								
	magnetic tape	Tromaflex 928								
	stainless steel tape	no. 1.4435								
Resistance to shocks ³⁾										
read head		30/10 g/ms								
Resistance to vibration ⁴⁾										
read head		10/20 ... 250 g/Hz								
Working temperature range		0 ... + 60 °C								
Storage temperature range		- 40 ... + 100 °C								
Protection class ⁵⁾		IP 65								
Max. speed of travel ⁶⁾		6 m/s								
Positionswiederholzeit		750 µs								
Initialisation time		2500 ms								
Supply voltage		7 ... 12 V								
Operating current consumption (without load)		4.5 W								
Interface signals										
Process data channel										
	SIN, COS	0.9 ... 1.1 Vpp								
	REFSIN, REFCOS	2.2 ... 2.8 V								
	Non-linearity within one sine/co-sine cycle, differential non-linearity	± 50 µm								
Parameter channel										
		To EIA 485								

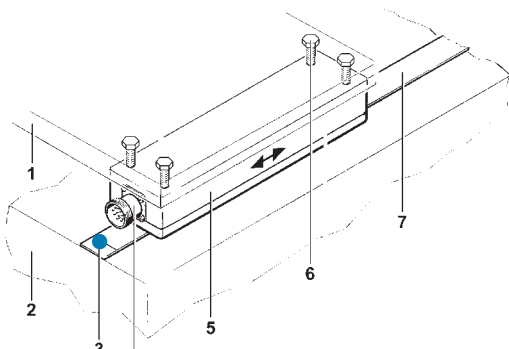
¹⁾ Technical necessary constant
²⁾ Period length/32 = 5 mm/32
³⁾ To DIN EN 61000-2-27
⁴⁾ To DIN EN 61000-2-6

⁵⁾ With mating connector inserted
⁶⁾ When exceeding the maximum travel speed limit or when leaving the surface of the measuring element the corresponding error message is produced: 7F FF FF hex

Caution:
 External magnetic fields should not exceed 64 mT (640 Oe; 52kA/m) on the surface of the gauge, since this can damage the coding on the gauge. Magnetic fields > 1 mT at the measuring system affect the measurement accuracy.

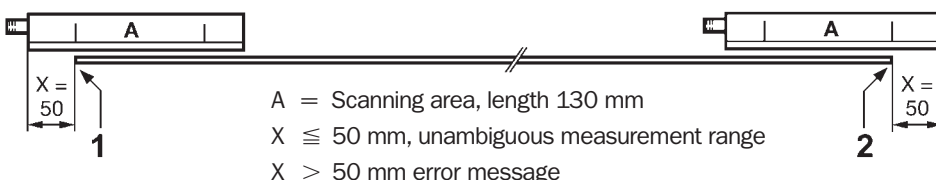
Initial commissioning
 The measurement path can start at any position between 0 m and 40 m. Therefore it will be helpful, prior to initial commissioning, to align the electrical zero point to your intended mechanical position. When operating with the SSI interface, this can be performed via the SET input, for HIPERFACE® variants, this can be programmed via software.

Mounting arrangement



- 1 Support for the read head (customer)
- 2 Support for the magnetic tape (customer)
- 3 Identification – zero point of the start of the magnetic tape
- 4 Plug outlet from the read head
- 5 Read head
- 6 Fastening of the read head from above or below
- 7 Magnetic tape

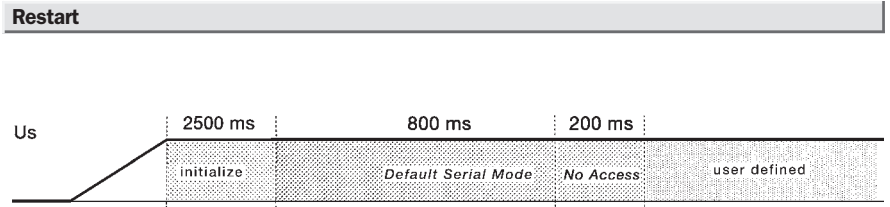
Caution:
 The mounting arrangement must ensure that the sensor can overtravel the start and finish of the magnetic tape by at least 50 mm; this enables the complete measurement length of the tape to be registered. The start of the tape is marked by a coloured dot (●).
 Due to the way the system operates, the magnetic tape is always 130 mm longer than the measurement length required.



- 1 Start of tape
- 2 End of tape

Resolution up to 1 µm
Linear Encoder

- Measurement lengths up to 40 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Different Interfaces
- Length-independent position sensing time
- Electronically adjustable
- Protection class up to IP 65

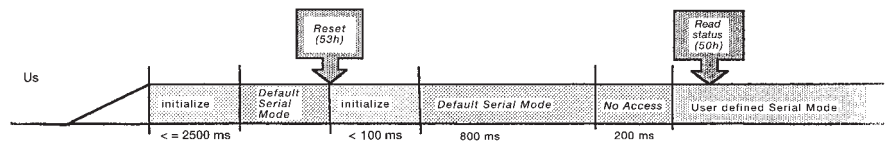


Default Serial Mode = E4h

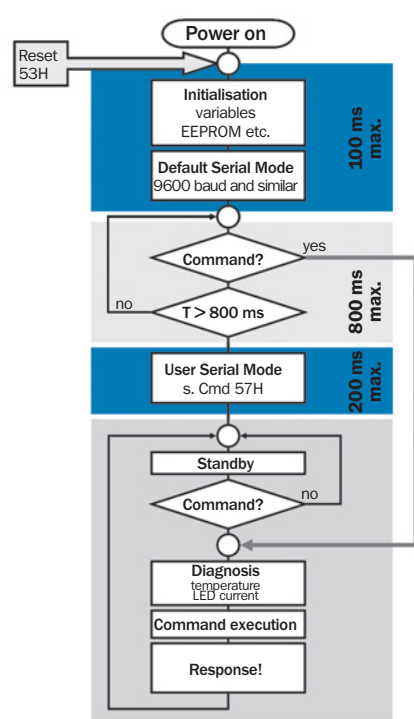
see Command 57h

In special cases, an unfavourable operating voltage start-up may impair the power-up sequence of the encoder. In this instance we recom-

mend that, after the encoder supply voltage has been switched on ($t > 2500$ ms), a software reset (53H) be initiated. This causes the power-up sequence to be implemented again. The encoder status can then be checked after one second (command 50H).



- Accessories**
- Connection systems
 - Programming tool



CAUTION:
During the phases highlighted in blue, **no RS485** communication is possible!



Type-specific settings	L230
Type ID (command 52h)	82h
Free EEPROM [bytes]	128
Address	40h
Mode_485	E4h
Codes 0 ... 3	55h
Counter	0

Overview of the commands supported			L230
Command byte	Function	Code 0 ¹⁾	Comments
42h	Read position ²⁾		
43h	Set position ²⁾	•	
44h	Read analogue value		Channel number 48 h Temperature [°C]
46h	Read Counter		
47h	Increase Counter		
49h	Reset Counter	•	
4Ah	Read data		
4Bh	Save data		
4Ch	Determine status of a data field		
4Dh	Create data field		
4Eh	Determine available memory data		
4Fh	Change access code		
50h	Read encoder status		
52h	Read out name plate		Encoder type = 82h
53h	Encoder reset		
55h	Allocate encoder address	•	
56h	Read serial number and program version		
57h	Configure serial interface	•	

¹⁾ The commands thus labelled include the parameter "Code 0". Code 0 is a byte inserted into the protocol, for additional safeguarding of vital system parameters against accidental overwriting. When shipped, "Code 0" = 55h.

²⁾ The position is defined as a signed long integer value.

Overview of the status messages			L230
Error type	Status code	Description	
	00h	The encoder has recognised no error	•
Initialisation	05h	Internal I ² C-bus not operational	•
Protocol	09h	Parity error	
	0Ah	Checksum of the data transmitted is incorrect	•
	0Bh	Unknown command code	
	0Ch	Number of data transmitted is incorrect	•
	0Dh	Command argument transmitted is not allowed	•
Data	0Eh	The selected data field must not be written to	•
	0Fh	Incorrect access code	•
	10h	Size of data field stated cannot be changed	•
	11h	Word address stated, is outside data field	•
	12h	Access to non-existent data field	•
Others	1Ch	Monitoring the value of the analogue signals (process data)	•
	1Eh	Encoder temperature critical	
	08h	Counter overflow	•

Order information

Absolute length measuring system L230 HIPERFACE

Type	Part no.	Explanation
L230-P580C2S00000	1033532	Read head HIPERFACE®; resolution 156.25 µm; connector M23, 12-pin

Magnetic tapes

Type	Part no.	Explanation
Magnetic tape	2030642	With adhesive backing (supplied by the metre) ^{*)}
Magnetic tape	5313643	Without adhesive backing (supplied by the metre) ^{*)}
Magnetic tape	2030646	With adhesive backing, length 10.0 m
Magnetic tape	2031275	With adhesive backing, length 12.0 m
Magnetic tape	2031288	With adhesive backing, length 16.0 m

^{*)} The magnetic tape must be ordered by the metre (material representation), at least 0.5 m ... 40 m.

Dimensional drawings and order information

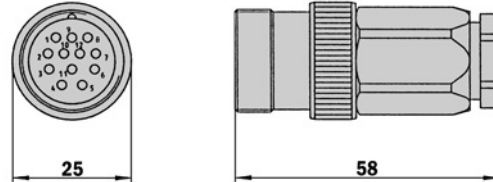
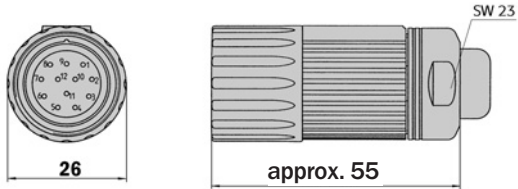
Screw-in system M23, 12-pin for LinCoder L230 with SSI interface

Connector M23 female, 12-pin, straight, screened

Type	Part no.	Contacts
DOS-2312-G	6027538	12

Connector M23 male, 12-pin, straight, screened

Type	Part no.	Contacts
STE-2312-G	6027537	12



General tolerances according to DIN ISO 2768-mk

General tolerances according to DIN ISO 2768-mk

Connector M23 female, 12-pin, straight, cable 12-cores, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm² screened, capable of being dragged, cable diameter 7.8 mm for LinCoder L230 with SSI interface

Type	Part no.	Contacts	Cable length
DOL-2312-G1M5MA1	2029200	12	1.5 m
DOL-2312-G03MMA1	2029201	12	3.0 m
DOL-2312-G05MMA1	2029202	12	5.0 m
DOL-2312-G10MMA1	2029203	12	10.0 m
DOL-2312-G20MMA1	2029204	12	20.0 m
DOL-2312-G30MMA1	2029205	12	30.0 m

Cable 12-core, per meter, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm² screened, capable of being dragged, cable diameter 7.8 mm for LinCoder L230 with SSI interface

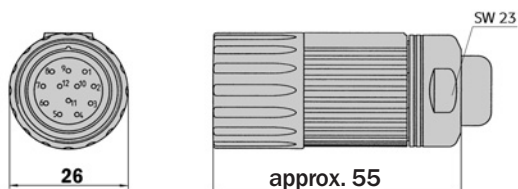
Type	Part no.	Wires	Explanation
LTG-2512-MW	6027531	12	
LTG-2612-MW	6028516	12	UV- and salt water resistant

Dimensional drawings and order information

Screw-in system M23, 12-pin for LinCorder L230 with HIPERFACE® interface

Connector M23 female, 12-pin, straight, screened

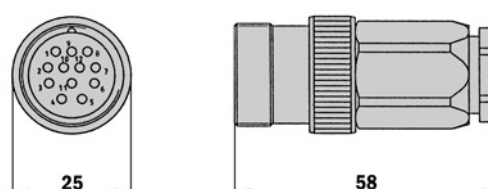
Type	Part no.	Contacts
DOS-2312-G	6027538	12



General tolerances according to DIN ISO 2768-mk

Connector M23 male, 12-pin, straight, screened

Type	Part no.	Contacts
STE-2312-G	6027537	12



General tolerances according to DIN ISO 2768-mk

Cable connector M23 female, 12-pin, straight cable 12-core, screened, capable of being dragged, for read heads with HIPERFACE® interface

Type	Part no.	Contacts	Cable length
DOL-2308-G1M5JB2	2031069	12	1.5 m
DOL-2308-G03MJB2	2031070	12	3.0 m
DOL-2308-G05MJB2	2031071	12	5.0 m
DOL-2308-G10MJB2	2031072	12	10.0 m
DOL-2308-G15MJB2	2031073	12	25.0 m

HIPERFACE® cable 8 wires, supplied by the metre, 4 x 2 x 0.15 mm² screened, flexible for read heads with HIPERFACE® interface

Type	Part no.	Cores
LTG-2708-MW	6028361	8

Programming tool

Programming tool for L230 with HIPERFACE® interface

Type	Part no.
PGT-03-S	1034252

Australia

Phone +61 3 9497 4100
1800 33 48 02 – tollfree
E-Mail sales@sick.com.au

Belgium/Luxembourg

Phone +32 (0)2 466 55 66
E-Mail info@sick.be

Brasil

Phone +55 11 5091-4900
E-Mail sac@sick.com.br

Ceská Republika

Phone +420 2 57 91 18 50
E-Mail sick@sick.cz

China

Phone +852-2763 6966
E-Mail ghk@sick.com.hk

Danmark

Phone +45 45 82 64 00
E-Mail sick@sick.dk

Deutschland

Phone +49 (0)2 11 53 01-250
E-Mail info@sick.de

España

Phone +34 93 480 31 00
E-Mail info@sick.es

France

Phone +33 1 64 62 35 00
E-Mail info@sick.fr

Great Britain

Phone +44 (0)1727 831121
E-Mail info@sick.co.uk

India

Phone +91-22-2822 7084
E-Mail info@sick-india.com

Italia

Phone +39 011 79 79 65
E-Mail info@sick.it

Japan

Phone +81 (0)3 3358 1341
E-Mail support@sick.jp

Nederlands

Phone +31 (0)30 229 25 44
E-Mail info@sick.nl

Norge

Phone +47 67 81 50 00
E-Mail austefjord@sick.no

Österreich

Phone +43 (0)22 36 62 28 8-0
E-Mail office@sick.at

Polska

Phone +48 22 837 40 50
E-Mail info@sick.pl

Republic of Korea

Phone +82-2 786 6321/4
E-Mail kang@sickkorea.net

Republika Slovenija

Phone +386 (0)1-47 69 990
E-Mail office@sick.si

Russia

Phone +7 495 775 05 34
E-Mail denis.kesaev@
sickautomation.ru

Schweiz

Phone +41 41 619 29 39
E-Mail contact@sick.ch

Singapore

Phone +65 6744 3732
E-Mail admin@sicksgp.com.sg

Suomi

Phone +358-9-25 15 800
E-Mail sick@sick.fi

Sverige

Phone +46 8 680 64 50
E-Mail info@sick.se

Taiwan

Phone +886 2 2365-6292
E-Mail sickgrc@ms6.hinet.net

Türkiye

Phone +90 216 587 74 00
E-Mail info@sick.com.tr

USA

Phone +1 937-454-1956
E-Mail sales@stegmann.com

More representatives and agencies
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