SICK | STEGMANN

LinCoder® L 230
Absolute, non-contact length measuring system

SSI SYNCHRONOUS SERIAL INTERFACE

HIPERFACE® by SICK | STEGMANN

Areas of use, features, dimensional drawings and positional tolerances

Features

- Non-contact length measuring system, wear-free
- Magnetic method of operation
- Scale provided by a magnetic tape
- Measurement lengths up to 40 m using a sensor part only 23 cm long
- All evaluation electronics contained within the sensor
- Absolute position determination, no reference run
- Position resolution 1 µm or 10 µm
- Reproducibility ±10 µm
- Configuration interface (RS 485)
- Electronically adjustable
- Length-independent position sensing time
- SSI and/or *HIPERFACE® interface

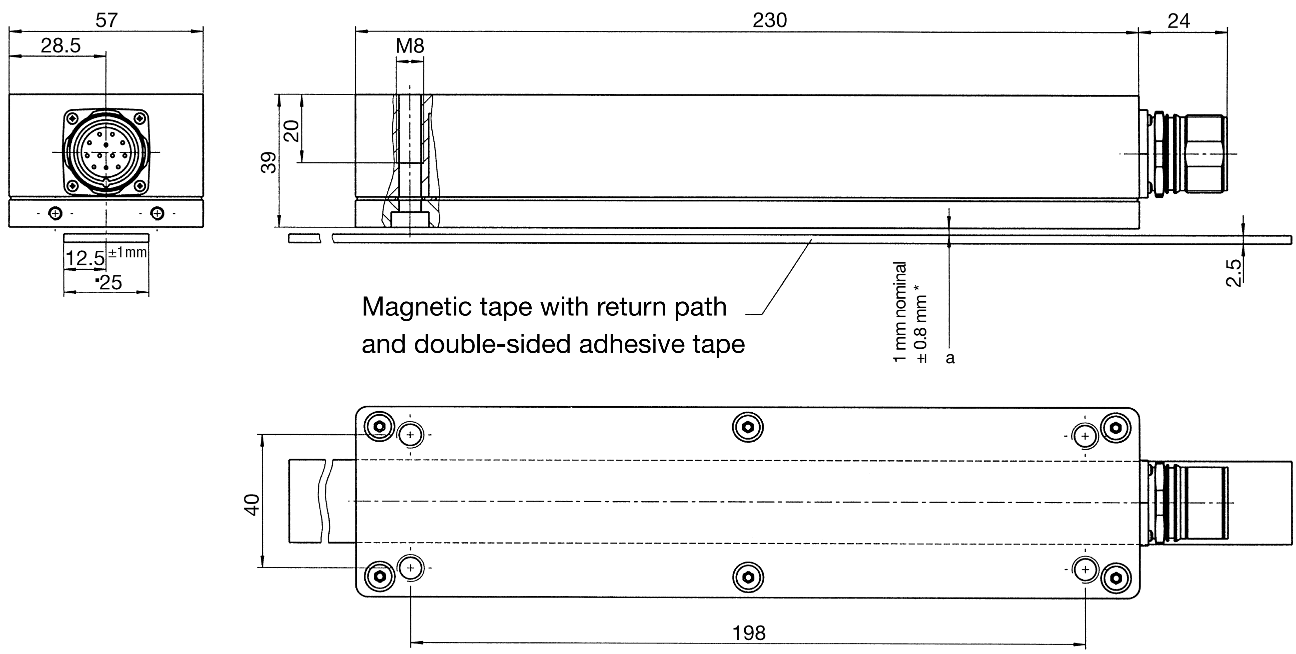
Areas of use

- in wood working and glass working
- on paper machines
- on in-feed axes
- on portal robots
- on linear motors
- on presses

and anywhere where high travel speed, small dimensions and simple mounting determine the requirements for a reliable measuring system.

***HIPERFACE® Detailed information: see Product information 910 980 103 445**

Dimensions and positional tolerances



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

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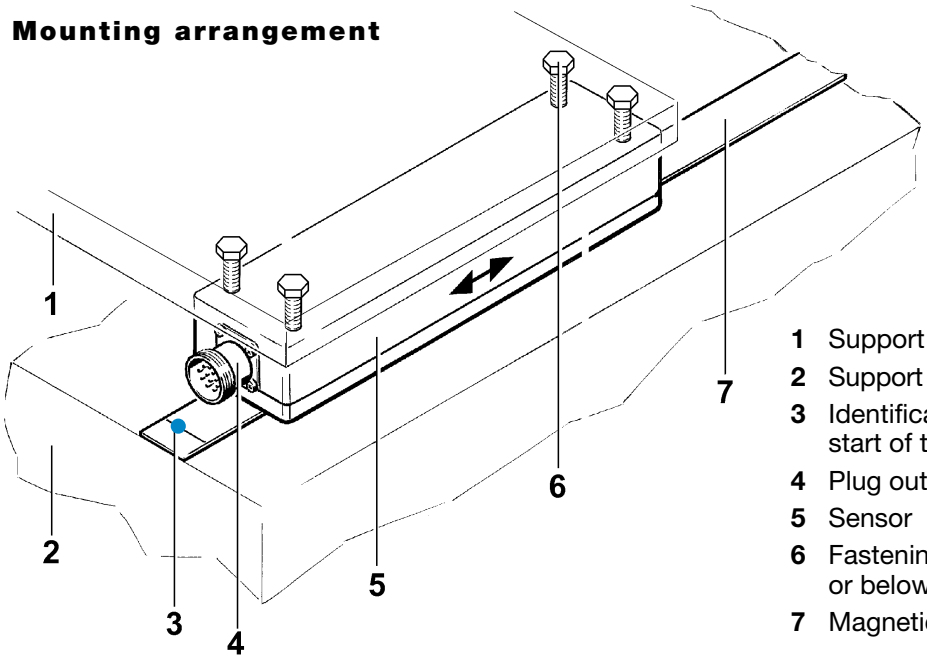
Functional principle and mounting arrangement

The LinCoder® measuring system comprises a magnetic tape and a sensor.
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. In order to achieve the highest possible resolution and accuracy, an incremental track is additionally magnetised onto the magnetic tape.
At the manufacturers, the magnetic tape is laminated onto a ferromagnetic tape (steel tape), which is used firstly as a magnetic return path and secondly as a dimensionally stabilising mounting aid.

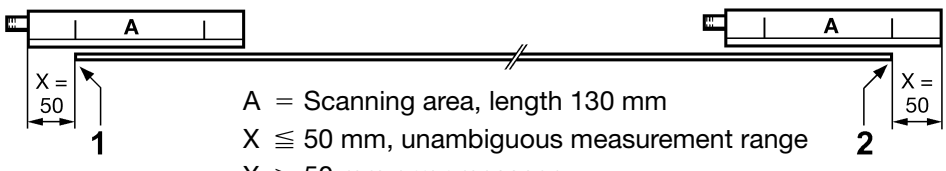
The magnetic tape can thus be bonded using adhesive directly to a ferromagnetic support, without any influence on the magnetisation. The magnetic tape can be supplied with or without an adhesive backing. If it is ordered with an adhesive backing, this is already bonded to the underside of the magnetic tape by the manufacturer.
A non-contact magnetic sensor with integrated evaluation electronics and appropriate interface is guided over the measuring section, and its position is output up to 40 m.

Mounting arrangement



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

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

Technical data and characteristics to DIN 32878

General Data

			Units
Measurement length		Max. 40	m
Magnetic strip length		Measurement length + 130 [1]	mm
Reproducibility		± 10	µm
Measurement accuracy		Typ. ± 0.3 mm/m at 20 °C	
Max. speed of travel		6	m/s
Temperature expansion coefficient	Tk Steel strip	16	µm/°C/m
Position and mounting tolerances		See page 2	
Dimansions		See dimensional drawing	
Mass	sensor part	0.685	kg
	magnetic strip	0.160	kg/m
Material	sensor part	AlMgSiPbF28	
	magnetic strip	Tromaflex 928	
	Edelstahlband	Nr. 1.4435	
Working temperature range		0 ... +70	°C
Operating temperature range		-20 ... +85	°C
Storage temperature range		-40 ... +100	°C
Protection class		IP 65	

[1] Technical necessary constant

SSI

			Units
Position resolution	0 to 8,35 m [2]	1 or 10	µm
	> 8.35 up to 40 m	10	µm
Position repetition time		750	µs
Initialisisation time		3500	ms
Supply voltage		10 … 32	V
Max. power consumption		4.8	W

[2] Longer measurement lengths on request

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			Units
Periodic length		5 ± 3%	mm
Position resolution	(Periodic length/32 = 5 mm/32)	156.25	µm
Initialisisation time		2500	ms
Supply voltage		7 … 12	V
Max. operating current, no load		650	mA
Interface signals:			
Process data channel	SIN, COS	0.9 … 1.1	Vpp
	REFSIN, REFCOS	2.2 … 2.8	V
	Non-linearity within one sine/ cosine cycle, differential non-linearity	± 50	µm
Parameter channel		to EIA 485	

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.

Order information

Type	Part no.	Explanation
L230-P580A7K15300	1 033 569	Linear Encoder; sensor SSI; resolution 1 µm; 5.0 m cable
L230-P580A7S00000	1 033 534	Linear Encoder; sensor SSI; resolution 1 µm;
		connector M23, 12-pin
L230-P580B7S00000	1 033 533	Linear Encoder; sensor SSI; resolution 10 µm;
		connector M23, 12-pin
L230-P580C2S00000	1 033 532	Linear Encoder; sensor HIPERFACE; resolution 156,25 µm;
		connector M23, 12 pin
Magnetic tape	2 030 642	with adhesive backing (supplied by the metre)*)
Magnetic tape	5 313 643	without adhesive backing (supplied by the metre)*)
Magnetic tape	2 030 646	with adhesive backing, length 10.0 m
Magnetic tape	2 031 275	with adhesive backing, length 12.0 m
Magnetic tape	2 031 288	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 sensors with a resolution of 10 µm and 156.25 µm. For sensors with a resolution of 1 µm, this MUST be specified when ordering the magnetic tape.

Accessories

Screw-in system M23

Connector M23 female, 12 pin for Sensors with SSI-Interface and HIPERFACE interface

Type	Part no.	Contacts
DOS-2312-G	6 027 538	12

Connector M23 female, 12 pin, straight, pre-wired with cable 12 core, screened, flexible for sensors with SSI interface

Type	Part no.	Contacts	Cable length
DOL-2312-G1M5MA1	2 029 200	12	1.5 m
DOL-2312-G03MMA1	2 029 201	12	3.0 m
DOL-2312-G05MMA1	2 029 202	12	5.0 m
DOL-2312-G10MMA1	2 029 203	12	10.0 m
DOL-2312-G20MMA1	2 029 204	12	20.0 m
DOL-2312-G30MMA1	2 029 205	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, flexible, cable diameter 7.8 mm for sensors with SSI interface

Type	Part no.	Cores	Explanation
LTG-2512-MW	6 027 531	12	
LTG-2612-MW	6 028 516	12	UV and salt water resistant

Connector M23 female, 12 pin, straight, pre-wired with cable 8 cores, screened, flexible for sensors with HIPERFACE interface

Type	Part no.	Contacts	Cable length
DOL-2308-G1M5JB2	2 031 069	12	1.5 m
DOL-2308-G03MJB2	2 031 070	12	3.0 m
DOL-2308-G05MJB2	2 031 071	12	5.0 m
DOL-2308-G10MJB2	2 031 072	12	10.0 m
DOL-2308-G15MJB2	2 031 073	12	15.0 m

Cable, 8 cores, supplied by the meter 4 x 2 x 0.15 mm² for sensors with HIPERFACE interface

Type	Part no.	Cores
LTG-2708-MW	6 028 361	8

Programming Tool for LinCoder with HIPERFACE interface

Type	Part no.
PGT-03-S	1 034 252

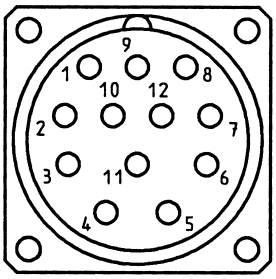
Connection details for SSI interface and HIPERFACE®

12-pin round connector	Cable	
PIN	Colour	Signal
1	blue	GND
2	white	data (+)
3	yellow	clock (+)
4	grey	RS 485 (+)
5	green	RS 485 (-)
6	-	N. C.
7	-	N. C.
8	red	U_S (+)
9	orange	Set [1]
10	brown	data (-)
11	lilac	clock (-)
12	black	cw/$\overline{ccw}$ [2]

12-pin round connector	Cable	
PIN	Colour	Signal
1	black	REFCOS
2	grey	RS 485 (+)
3	-	N. C.
4	-	N. C.
5	white	SIN
6	brown	REFSIN
7	green	RS 485 (-)
8	pink	COS
9	-	N. C.
10	blue	GND
11	-	N. C.
12	red	U_S

* This input is used for electronic adjustment. By means of a high signal (Us) > 20 ms on this connection, the LinCoder position is set to 0.

** 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.



View on plug side at the LinCoder®

The mating connector is not included in the scope of supply.
Please order separately.

N. C. = no connection

Screening via plug housing

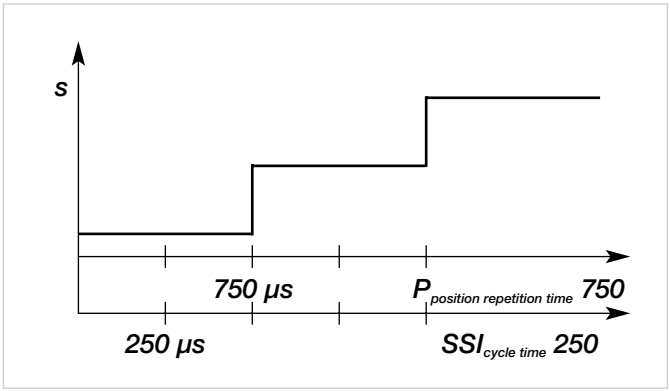
Please observe the connection details of the measuring system unconditionally.

One of the interfaces for absolute measuring systems which is very well-known in industrial control engineering is the SSI interface (synchronous serial interface) introduced by STEGMANN in 1985. The LinCoder® with this interface outputs the serial information in the Gray code with a word length of 24 bits and a clock frequency of 100 kHz to 1 MHz. In the length measuring device, the clock signal is electrically isolated from the supply voltage of the encoder by an optocoupler. More detailed information about this interface can be obtained in the Technical Information sheet 910 950 101 965 from STEGMANN.

If the sensor travels more than 50 mm beyond the start of the tape or the end of the tape (see Fig.3), the error message 7F FF FF hex is output.
In standard operation, the LinCoder® 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.

Supplement to SSI standard operation

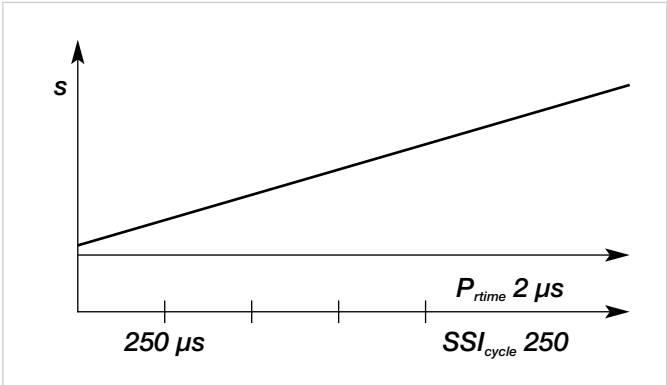
The diagram alongside shows a calculated position waveform under continuous acceleration. It can clearly be seen that, during one SSI cycle (SSI_{cycle} = control cycle for reading and processing the current value once) of 250 µs, the identical travel information from the measurement system is read at least once, max. 4 times, before a new position is available. The position repetition time of 750 µs of the LinCoder® 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).



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

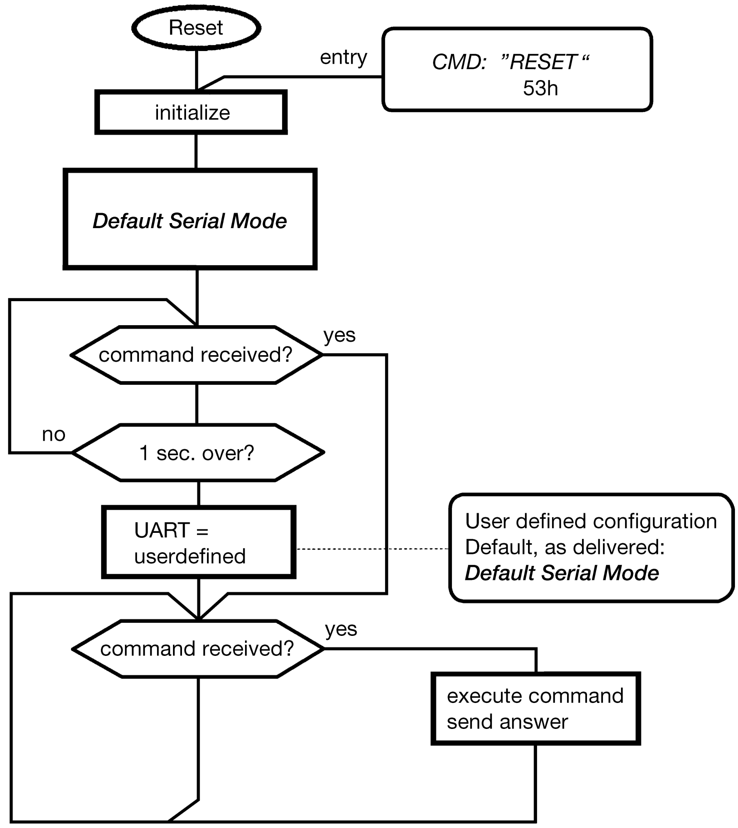
Real-time compensated SSI operation

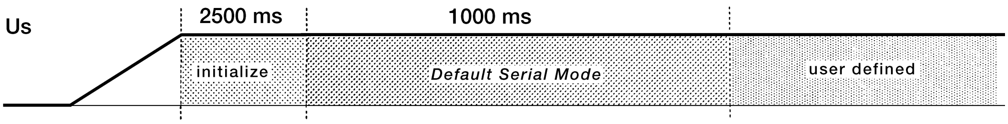
In order to avoid any fluctuation in the time/position relationship, which may lead to very unconventional behaviour in the control loop, the real-time compensated SSI mode of operation has been developed by STEGMANN (installed as standard). In the case of length measuring systems controlled by microcontrollers, the so-called dead time of a measuring system is greater than in a pure „hardware“-based measuring systems (e.g. AG 615), 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 µs, until after about 750 µs 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 µs (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 µs 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 µs, 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.



HIPERFACE® – Type specific

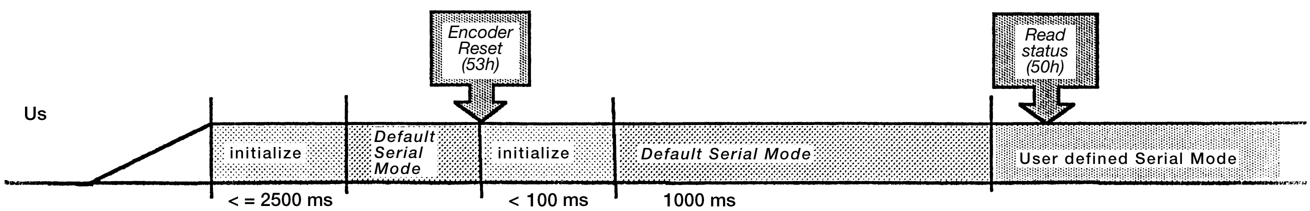
Restart





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 recommend 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).



HIPERFACE® – Type specific

Type-specific settings

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

Command byte	Function	*Code 0* [1]	Comments
42h	Read Position [2]		
43h	Set Position [2]	●	
44h	Read analogue value		Channel number 48h, 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 rating 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] Encoder temperature = $\frac{\text{Digital value} + 40}{2.048}$

Overview of the status messages

Error type	Status code	Description
	00h	The encoder has recognised no error
Initialisation	05h	Internal I²C-bus not operational
	09h	Parity error
	0Ah	Checksum of the data transmitted is incorrect
Protocol	0Bh	Unknown command code
	0Ch	Number of data transmitted is incorrect
	0Dh	Command argument transmitted is not allowed
	0Eh	The selected data field must not be written to
	0Fh	Incorrect access code
	10h	Size of data field stated cannot be changed
Data	11h	Word address stated, is outside data field
	12h	Access to non-existent data field
	1Ch	Monitoring the value of the analogue signals (process data)
	1Eh	Encoder temperature critical
	08h	Counter overflow

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