PRODUCT INFORMATION

TTK70/TTK50

MEASUREMENT OF POSITION AND SPEED WITH MAXIMUM PRECISION

SICK
Sensor Intelligence.

Linear motor feedback systems

MEASUREMENT OF POSITION AND SPEED WITH MAXIMUM PRECISION

Product description

Precision, speed and dynamics play a particularly important role in the measurement of linear movements. The compact linear measurement system TTK70 with HIPERFACE® or SSI interface fulfills all these properties. The magnetic principle of operation, the long measuring lengths, and the extremely high resolution open up all kinds of application possibilities for absolute position and speed recording. The non-contact measuring system consists of a compact read head and magnetic tape. The read head is responsible for recording position values. The magnetic tape is the measuring element and features a magnetic division into an incremental and an absolute track.

At a glance

- Non-contact absolute position and speed recording
- With HIPERFACE® or SSI interface
- Measurement lengths of up to 4 m
- For high traversing speeds of up to 10 m/s
- Reliable measurements, even in the event of contamination and condensation on the magnetic tape
- Small, compact read head
- Certified according to SIL2 and PL d (HIPERFACE® interface)

Your benefits

- Available with the HIPERFACE® and SSI interfaces
- Measurement lengths of up to 4 m
- Maintenance and wear-free thanks to non-contact measurement principle
- Compact design, low weight, and high traversing speed
- Immune to ambient conditions such as contamination and condensation
- No need for a reference run due to the absolute position recording
- Certification allows for easy integration into a safe drive system

Additional information

→ www.sick.com/TTK70

For more information, simply enter the link or scan the QR code and get direct access to technical data, CAD design models, operating instructions, software, application examples, and much more.

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Fields of application

- Linear motors
- Pick & Place applications

Detailed technical data

Features

Items supplied	Magnetic tape not included with delivery

Performance

Measuring step	0.244 µm For interpolation of the sine/cosine signals with, e. g., 12 bits
Measuring length	≤ 3,920 mm
Resolution	1 µm
Length of period	1 mm
Traversing speed	≤ 10 m/s, up to which the absolute position can be reliably produced 1.3 m/s
Repeatability	< 5 µm
System accuracy	± 10 µm (+20 °C)
Measured value backlash	< 10 µm

Interfaces

HIPERFACE®

Communication interface	HIPERFACE® [1]
Code type	Binary
Available memory area	1,792 Byte (E^2PROM 2048)

[1] SSIinterface described in publication 8013375.

Mechanical data

Dimensions	See dimensional drawing
Weight	
Read head	0.08 kg
Magnetic tape	0.18 kg/m
Magnetic strip length	See ordering information
Read head material	Zinc diecast
Material, magnetic tape	17410 Hard ferrite 9/28 P
Material mounting tape	Stainless steel

Electrical data

HIPERFACE®

Supply voltage	7 V DC ... 12 V DC
Recommended supply voltage	8 V DC
Operating current	≤ 65 mA (without load) [1]
Connection type	Male connector, M12, 8-pin Cable, 8-wire, 0.5 m

[1] 100 mA approx. during adjustment.

Ambient data

EMC	According to EN 61000-6-2 and EN 61000-6-3 [1]
Enclosure rating	IP67, with mating connector inserted (according to IEC 60529)
Operating temperature range	
Read head	–30 °C ... +80 °C
Magnetic tape	–20 °C ... +100 °C
Storage temperature range	
Read head	–40 °C ... +85 °C, without package
Magnetic tape	–30 °C ... +100 °C
Permissible relative humidity	100 %, condensation permitted
Resistance to shocks	30 g, 6 ms (EN 60068-2-27)
Resistance to vibration	20 g, 10 Hz ... 2,000 Hz (EN 60068-2-6)
Temperature coefficient magnetic tape	(11 ± 1) µm/K/m
Maximum permitted ambient field strength	< 3 kA/m ... 4 kA/m (3.8 mT ... 5 mT), to guarantee compliance with the quoted accuracy values [2]
Maximum permitted field strength	< 150 kA/m (< 190 mT), to ensure that the magnetic tape is not permanently damaged

[1] According to the listed standards, EMC is guaranteed if the motor feedback system is connected to the central grounding point of the motor controller via a cable shield and the encoder housing lays over a large area of the motor potential. If other shielding concepts are used, users must perform their own test.

[2] The maximum permitted external field influence is reached when the position value deviates from the original value (without external field influence) by more than 5 µm. This value is reached when, at the sensor location, a field strength of 3 kA/m to 4 kA/m (3.8 mT to 5 mT) occurs in addition to the field strength of the magnetic tape.

Safety-related parameters

Note	The following parameters are only valid for SIL2 certified versions
Safety integrity level	SIL2 (IEC 61508), SILCL2 (EN 62061) [1]
Category	3 (EN ISO 13849)
Maximum demand rate	Continuous (analog signals)
Performance level	PL d (EN ISO 13849)
PFH_D: Probability of dangerous failure per hour	2.02×10^{-8} [2]
T_M (mission time)	20 years (EN ISO 13849)
Safety-related accuracy	± 25 mm, = ± 1/4 pin length
Safety-related measuring step	0.25 mm

[1] For more detailed information on the exact configuration of your machine/unit, please consult your relevant SICK branch office.

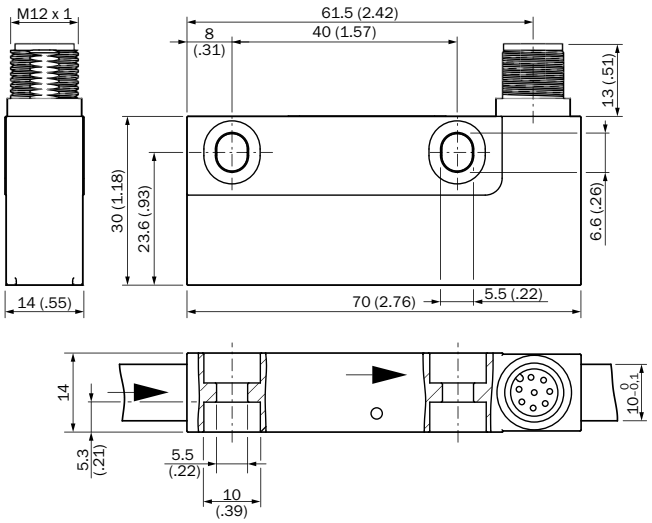
[2] The specified values apply to a diagnostic coverage rate of 90%, which must be achieved by the external drive system.

Ordering information

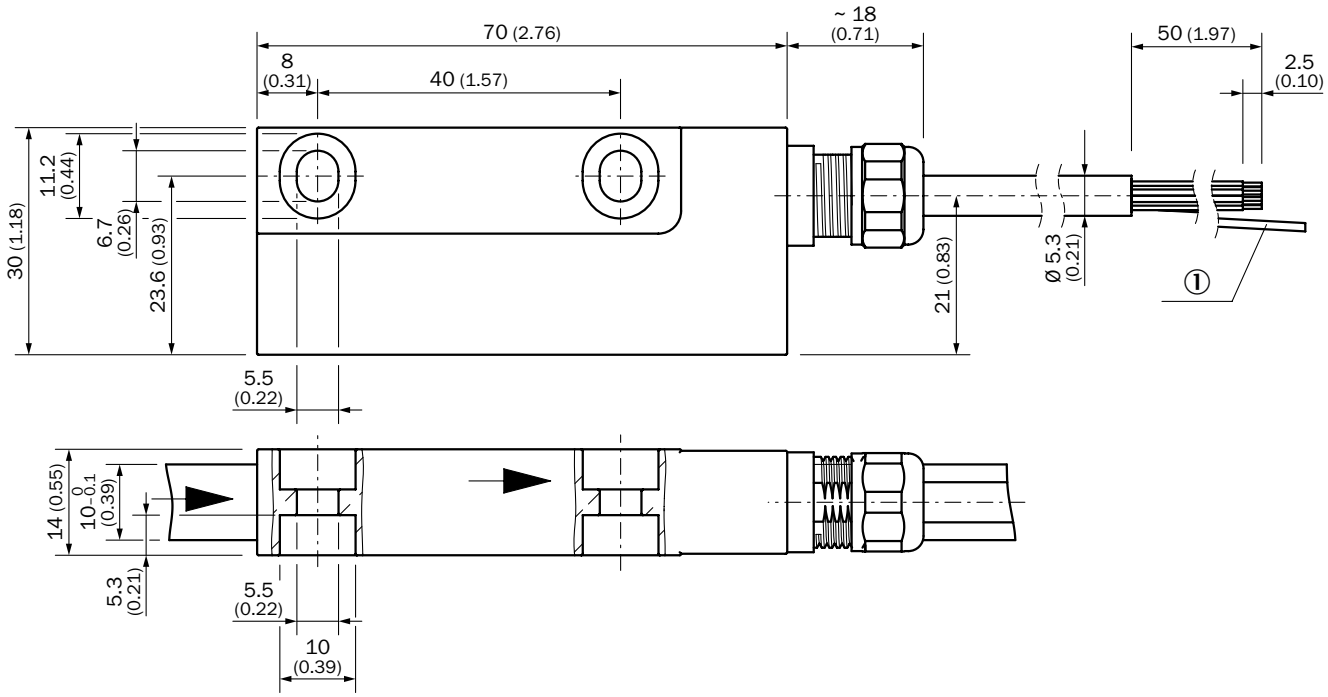
System part	Magnetic strip length	Connection type	Safety system	Type	Part no.
Magnetic tape	0.5 m	–	–	MVM-0M5-2MC-MKLB	6037415
	1 m	–	–	MVM-01M-2MC-MKLB	6037417
	1.5 m	–	–	MVM-1M5-2MC-MKLB	6037418
	2 m	–	–	MVM-02M-2MC-MKLB	6037419
	2.5 m	–	–	MVM-2M5-2MC-MKLB	6037420
	3 m	–	–	MVM-03M-2MC-MKLB	6037421
	3.5 m	–	–	MVM-3M5-2MC-MKLB	6037422
	4 m	–	–	MVM-04M-2MC-MKLB	6037423
Read head	–	Cable, 8-wire, 0.5 m	✔	TTK70S-HXJ0-K02	1099701
			–	TTK70-HXJ0-K02	1063567
		Male connector, M12, 8-pin	✔	TTK70S-HXA0-K02	1099700
			–	TTK70-HXA0-K02	1037434

Dimensional drawings (Dimensions in mm (inch))

Read head, male connector



Read head, cable



① Screen

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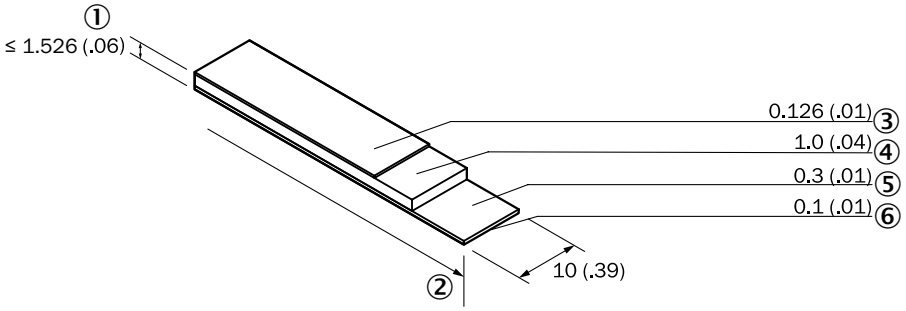
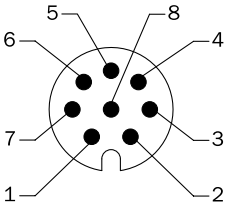
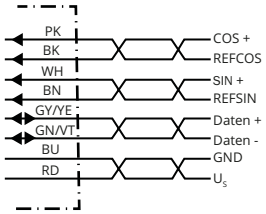
Magnetic tape



① Thickness
② Length
③ Conveying tape
④ Magnetic tape
⑤ Substrate tape
⑥ Adhesive tape

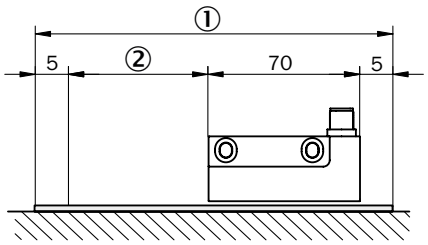
PIN and wire assignment





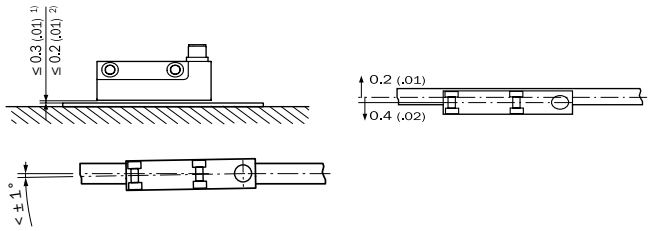
PIN	Wire colors (cable connection)	Signal	Explanation
1	Brown	REFSIN	Process data channel
2	White	+ SIN	Process data channel
3	Black	REFCOS	Process data channel
4	Pink	+ COS	Process data channel
5	Gray or yellow	Data +	Parameter channel RS 485
6	Green or purple	Data -	Parameter channel RS 485
7	Blue	GND	Ground connection
8	Red	U_S	Supply voltage
	Screen		Housing

Order note for magnetic tape length



① Required band length = measurement path + 80 mm
② Measurement path

Position tolerance



General tolerances according to DIN ISO 2768-mk
① Without cover strip
② With cover strip

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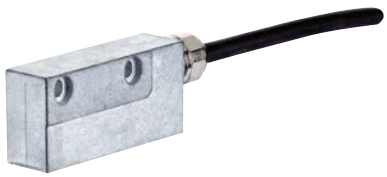
TOP-SPEED MEASUREMENT FOR LINEAR MOTORS



Additional information

Product description

Precision, speed, dynamics, stiffness and high control accuracy - it is exactly these properties which play an important role in high-end applications in drive technology. The TTK50 linear measurement system has all these properties and is a very compact motor feedback system with HIPERFACE® interface. The magnetic principle of operation, the long measuring length, and the extremely high resolution open up all kinds of application possibilities for absolute position detection with linear motors. The TTK50 contains the newest sensor and evaluation technology. The sensor board aligned to the measuring plane is equipped with Hall sensors in two parallel tracks. Their arrangement corresponds with the division of the magnetic tape into an incremental and an absolute component. To calculate the absolute position values during operation, the read head initially detects the absolute starting position when the linear motor starts. All other actual positions of the drive are then determined via the incremental position on the magnetic track or the sine/cosine signals.

At a glance

- Absolute, non-contact, wear-free length measurement system for linear motors
- Measured lengths of up to 1 m
- Suitable for high traverse speeds of up to 10 m/s
- Reliable location positioning even in the event of condensation and contamination of the magnetic tape
- Electronic type label and programming of the position value
- Absolute location positioning, no reference run
- HIPERFACE® interface
- Certified according to SIL2 and PL d

Your benefits

- Reference traverse no longer necessary due to absolute measuring system
- Maintenance-free thanks to non-contact measuring principle
- Simple integration of the system due to the HIPERFACE® interface
- Developed specifically for use in linear direct drives
- Also for use in rough ambient conditions
- Certification allows for easy integration into a safe drive system

➜ **www.sick.com/TTK50**

For more information, simply enter the link or scan the QR code and get direct access to technical data, CAD design models, operating instructions, software, application examples, and much more.

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Detailed technical data

Features

Items supplied	Magnetic tape not included with delivery

Performance

Measuring step	0.244 µm For interpolation of the sine/cosine signals with, e. g., 12 bits
Measuring length	≤ 940 mm
Resolution	1 µm
Length of period	1 mm
Traversing speed	≤ 10 m/s, up to which the absolute position can be reliably produced 1.3 m/s
Repeatability	< 5 µm
System accuracy	± 10 µm (+20 °C)
Measured value backlash	< 10 µm

Interfaces

Code type	Binary
Available memory area	1,972 Byte (E^2PROM 2048)

Mechanical data

Dimensions	See dimensional drawing
Weight	
Read head	0.06 kg, without cable
Magnetic tape	0.18 kg/m
Magnetic strip length	See ordering information
Read head material	Zinc diecast
Material, magnetic tape	17410 Hard ferrite 9/28 P
Material mounting tape	Stainless steel

Electrical data

Supply voltage	7 V DC ... 12 V DC
Recommended supply voltage	8 V DC
Operating current	≤ 55 mA (without load) [1]
Connection type	Cable, 8-wire, 0.5 m Cable, 8-wire, 2 m

[1] 100 mA approx. during adjustment.

Ambient data

EMC	According to EN 61000-6-2 and EN 61000-6-3 [1]
Enclosure rating	IP67, with mating connector inserted (according to IEC 60529)
Operating temperature range	
Read head	–30 °C ... +80 °C
Magnetic tape	–20 °C ... +100 °C
Storage temperature range	

[1] According to the listed standards, EMC is guaranteed if the motor feedback system is connected to the central grounding point of the motor controller via a cable shield and the encoder housing lays over a large area of the motor potential. If other shielding concepts are used, users must perform their own test.

[2] The maximum permitted external field influence is reached when the position value deviates from the original value (without external field influence) by more than 5 µm. This value is reached when, at the sensor location, a field strength of 3 kA/m to 4 kA/m (3.8 mT to 5 mT) occurs in addition to the field strength of the magnetic tape.

Read head	–40 °C ... +85 °C, without package
Magnetic tape	–30 °C ... +100 °C
Permissible relative humidity	100 %, condensation permitted
Resistance to shocks	30 g, 6 ms (EN 60068-2-27)
Resistance to vibration	20 g, 10 Hz ... 2,000 Hz (EN 60068-2-6)
Temperature coefficient magnetic tape	(11 ± 1) µm/K/m
Maximum permitted ambient field strength	< 3 kA/m ... 4 kA/m (3.8 mT ... 5 mT), to guarantee compliance with the quoted accuracy values [2]
Maximum permitted field strength	< 150 kA/m (< 190 mT), to ensure that the magnetic tape is not permanently damaged

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Note	The following parameters are only valid for SIL2 certified versions
Safety integrity level	SIL2 (IEC 61508), SILCL2 (EN 62061) [1]
Category	3 (EN ISO 13849)
Maximum demand rate	Continuous (analog signals)
Performance level	PL d (EN ISO 13849)
PFH_D: Probability of dangerous failure per hour	2.02×10^{-8} [2]
T_M (mission time)	20 years (EN ISO 13849)
Safety-related accuracy	± 25 mm, = ± 1/4 pin length
Safety-related measuring step	0.25 mm

[1] For more detailed information on the exact configuration of your machine/unit, please consult your relevant SICK branch office.

[2] The values displayed apply to a diagnostic degree of coverage of 90%, which must be achieved by the external drive system.

Ordering information

System part	Magnetic strip length	Connection type	Safety system	Type	Part no.
Magnetic tape	1 m	–	–	MVM-1M0-2MC-MKLB	6049001
Read head	–	Cable, 8-wire, 0.5 m	✔	TTK50S-HXJ0-K02	1099696
			–	TTK50-HXJ0-K02	1057791
		Cable, 8-wire, 2 m	✔	TTK50S-HXQ0-K02	1099698
			–	TTK50-HXQ0-K02	1057793

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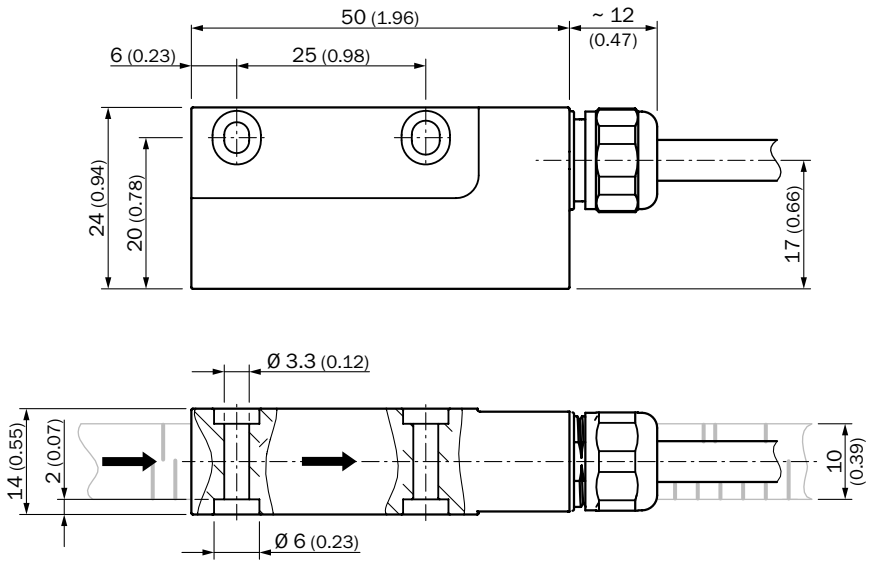
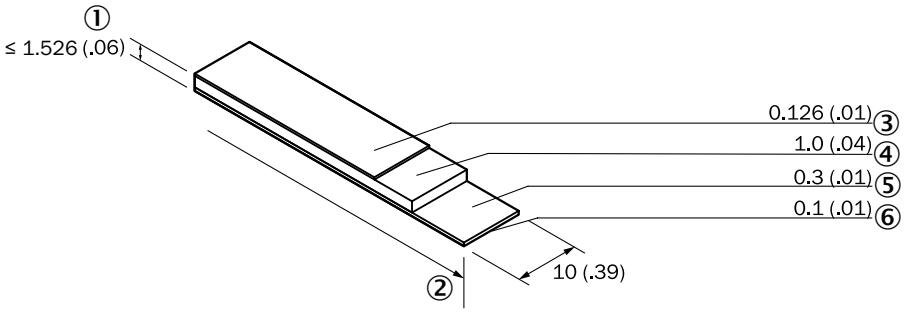
Dimensional drawings (Dimensions in mm (inch))

Read head

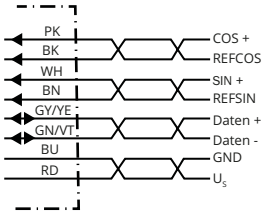


Magnetic tape



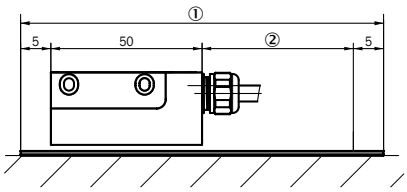
① Thickness
② Length
③ Conveying tape
④ Magnetic tape
⑤ Substrate tape
⑥ Adhesive tape

PIN and wire assignment



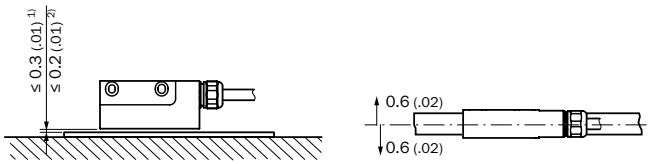
Wire colors (cable connection)	Signal	Explanation
Brown	REFSIN	Process data channel
White	+ SIN	Process data channel
Black	REFCOS	Process data channel
Pink	+ COS	Process data channel
Gray or yellow	Data +	Parameter channel RS 485
Green or purple	Data -	Parameter channel RS 485
Blue	GND	Ground connection
Red	U_S	Supply voltage
Screen		Housing

Order note for magnetic tape length



① Required band length = measurement path + 60 mm
② Measurement path

Position tolerance



General tolerances according to DIN ISO 2768-mk
① Without cover strip
② With cover strip

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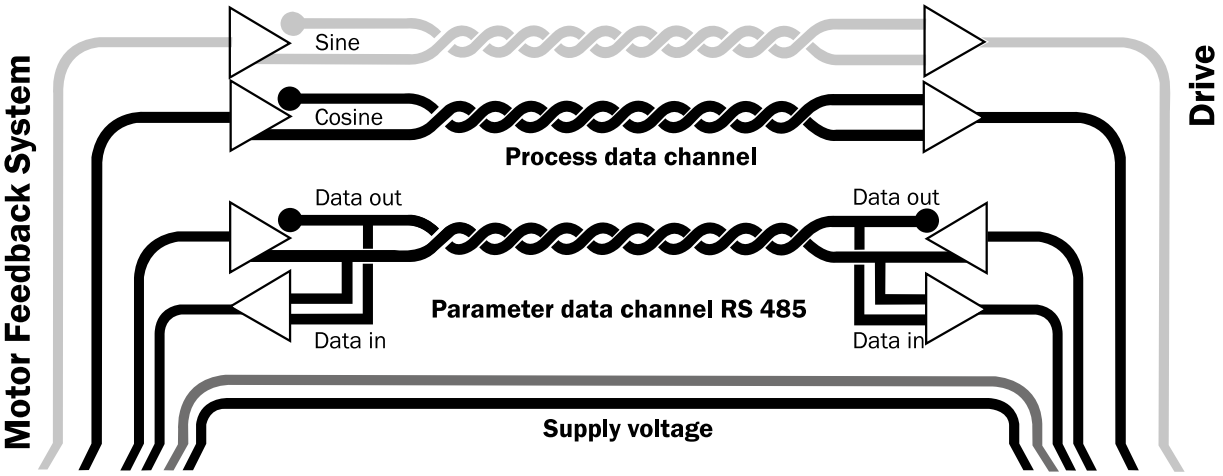
Communication interface



① Secure data transmission
② High information content
③ Electronic type label
④ Only 8 cables
⑤ Bus-compatible parameter channel
⑥ Process channel in real time

Technical Description

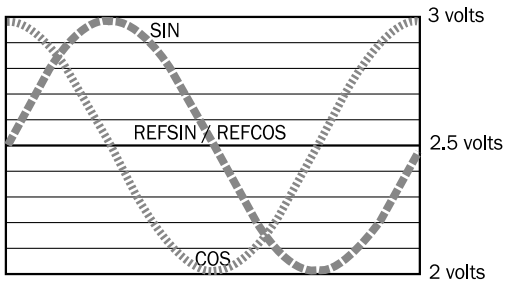
Notes on the diagrams

Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always “online”. When the supply voltage is applied, the speed controller has access to this information at any time.

Sophisticated technology guarantees stable amplitudes of the analog signals across all specific environmental conditions, with a maximum variation of only 20 %.

Diagrams

Signal diagram for clockwise shaft rotation, looking in direction “A” (see dimensional drawing) 1 period = 360° : 64/128/256



Charactersitics applicable to all permissible environmental conditions

Signal	Values/unit
Signal peak, peak V_{ss} of SIN, COS	0.9 V ... 1.1 V
Signal offset REFSIN, REFCOS	2.2 V ... 2.8 V

Model-specific settings

	TTK70	TTK50
Model ID (command 52h)	FFh	FFh
Free E^2PROM [bytes]	1,792	1,792
Address	40h	40h

	TTK70	TTK50
Mode_485 [1]	E4h	E4h
Codes 0 to 3	55h	55h
Counter	0	0
[1] The linear length measuring system supports the following baud rates: 9600, 19200 and 38400.		

Overview of supported commands for HIPERFACE®

			TTK70	TTK50
Command byte	**Function**	**Code 0 [1]**	**Comment**	**Comment**
42h	Read position (5 bits per sine/cosine period)		31,25 µm	31,25 µm
43h	Set position	■		
44h	Read analog value		Channel number 48h	Channel number 48h
			Temperature [°C] [2]	Temperature [°C] [2]
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 area			
4Fh	Change access code			
50h	Read encoder status			
52h	Read out name plate		Encoder type = FFh	Encoder type = FFh
53h	Encoder reset			
55h	Allocate encoder address	■		
56h	Read serial number and program version			
57h	Configure serial interface	■		
67h	Change serial interface temporary			
6Ah	Set position with interanal synchronization	■	See page 17	See page 17
6Bh	Sensor adjustment (during commissioning)	■		
[1] The commands thus marked include the parameter ‘Code 0’. Code 0 is a byte inserted into the protocol to provide additional protection of vital system parameters against accidental overwriting. When the device is supplied, ‘Code 0’ = 55h.				
[2] The temperature value will be reliably formed approx. 2 s after power on/ reset.				

Overview of status messages for HIPERFACE®

Error type	Status code	Description	TTK70	TTK50
	00h	The encoder has recognized no error	■	■

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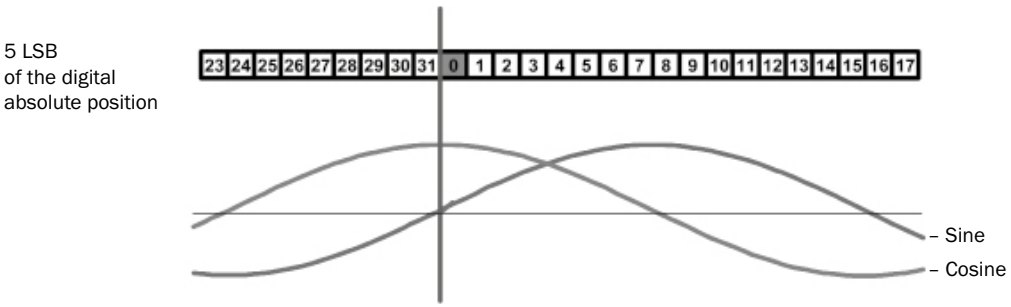
Error type	Status code	Description	TTK70	TTK50
Initialization	01h	Adjustment data faulty	■	■
	02h	Faulty internal angular offset	■	■
	03h	Data field partitioning table destroyed	■	■
	04h	Analog limit values not available	■	■
	05h	Internal I²C bus not operational	■	■
	06h	Internal checksum error	■	■
Protocols	09h	Parity error	■	■
	0Ah	Checksum of the data transmitted data 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 may not be written to	■	■
	0Fh	Incorrect access code	■	■
	10h	Size of data field stated cannot be changed	■	■
	11h	Word address states, is outside data field	■	■
	12h	Access to non-existent data field	■	■
Position	20h	Sensor is not adjusted or is in adjustment mode	■	■
	21h	Distance magnetic tape/sensor too high	■	■
	23h	Positional error	■	■
Other	1Ch	Monitoring the value of analog signals (process data)	■	■
	1Eh	Encoder temperature critical	■	■
	08h	Counter overflow	■	■
For more information on the interface see HIPERFACE® - description, part no. 8010701				

Additional information

Set position with internal synchronization 6 Ah

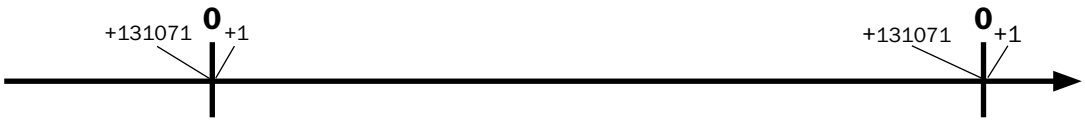
With this command, the encoder position is set such that the required position value points to the beginning of a period of the SIN signal. This is achieved by not changing, in contrast to the
command “Set position” (43h), the lower 5 bits of the position value, as these are responsible for the interpolation within a period.
The position value given in the command is transmitted in the “unsigned long” format with the LSB right-aligned and saved to non-volatile memory. The value range is between 0 .. 127999 and must be interpreted as a multiple of 1/32mm.
The following events trigger an error message:

- Number of transmitted command bytes wrong (WRONG_ COMMAND_LENGTH, 0Ch)
- Wrong access code entered (ERR_ACCESS_CODE, 0Fh),
- Internal error occurred, which would lead to an invalid position value (ERR_INT_ANGLE_OFFSET, 02h),
- Encoder is not adjusted (ERR_NOT_CALIBRATED, 20h),
- Transmitted command argument is invalid (WRONG_ARGUMENT, 0Dh),
- Internal checksum error (ERR_CHKSUM, 06h)



Codification magnetic tape TTK70

The absolute coding of the magnetic tape allows a maximum measuring range of 4095.999 mm. As the resolution of the position data is 1/32 mm, the resulting numeric value for the maximum measuring range is 131072.

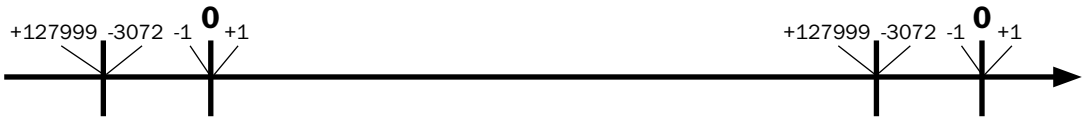


Internal position calculation TTK70

Position value (-3072 .. 00 .. +127999):

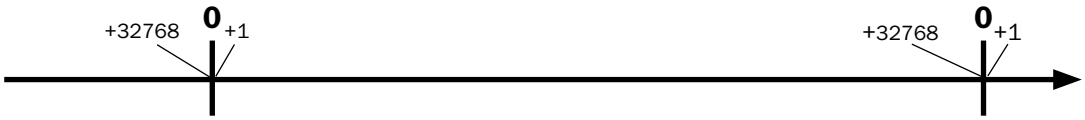
To avoid rapid jumps to the maximum value, around the 0 position, the max. measuring range is limited to 4000mm (= 128000 * 1/32mm). Therefore, in the negative direction of travel, a range of –96mm (= –3072 * 1/32mm) can be detected.

Due to the positional calculations performed inside the TTK70, during commissioning it is necessary to send the command “6Ah” (Position set with internal synchronisation) at the start of the magnetic tape.



Codification magnetic tape TTK50

The absolute coding of the magnetic tape allows a max. measuring range of 1023.999 mm. As the resolution of the position data is 1/32 mm, the resulting numeric value for the maximum measuring range is 32768.

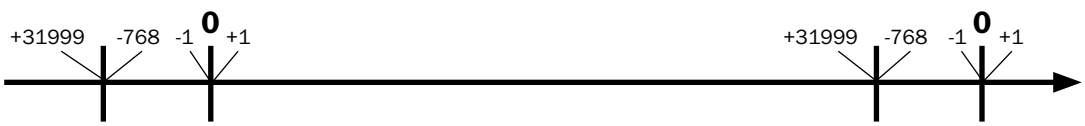


Internal position calculation TTK50

Position value (-768 .. 00 .. +31999):

To avoid rapid jumps to the maximum value, around the 0 position, the max. measuring range is limited to 1000 mm (= 32000 * 1/32 mm). Therefore, in the negative direction of travel, a range of –24 mm (= –768 * 1/32 mm) can be detected.

It is necessary to send the command “6Ah” (Position set with internal synchronisation) at the start of the magnetic tape due to the positional calculations performed inside the TTK50, during commissioning. To avoid that, the sensor produces a negative value, which the connected controller might not be able to interpret correctly, the tape is limited to a length of 1000 mm. The magnetization of the magnetic tape is such that the sensor only sends positive values. Due to this the maximum measuring range is restricted 940 mm.



Recommended accessories

Mounting systems

Nuts and screws

Screws

Figure	Brief description	Type	Part no.
	Mounting kit for SIL2 applications for safe and easy mounting of the TTK70S; 2x titan cylinder screws, 2x galvanized steel lock washers, 2x washers, 2x female connectors	BEF-MK-S12	2105618
	Mounting kit for SIL2 applications for safe and easy mounting of the TTK50S; 2x countersunk head screws, 1x mounting plate	BEF-MK-S13	2109583

Plug connectors and cables

Plug connectors and cables

Cables (ready to assemble)

Brief description	Type	Part no.
Head A: cable Head B: Flying leads Cable: HIPERFACE®, HIPERFACE®, PUR, halogen-free, shielded, 4 x 2 x 0.15 mm², 5.3 mm Signalart: HIPERFACE®, HIPERFACE®	LTG-2708-MW	6028361

Connection cables

Figure	Brief description	Length of cable	Type	Part no.
	Head A: female connector, M23, 12-pin, straight Head B: male connector, M23, 17-pin, straight Cable: HIPERFACE®, unshielded, 5.6 mm Signalart: HIPERFACE®	1 m	DSL-2317-G01MJB2	2071328
	Head A: female connector, JST, 8-pin, straight Head B: male connector, M23, 17-pin, straight Cable: HIPERFACE®, unshielded, 5.6 mm Signalart: HIPERFACE®	1 m	DSL-2317-G01MJB6	2071327
	Head A: female connector, M12, 8-pin, straight Head B: male connector, M23, 17-pin, straight Cable: HIPERFACE®, unshielded, 5.6 mm Signalart: HIPERFACE®	1 m	DSL-2317-G01MJC1	2071329
	Head A: female connector, terminal box, 8-pin, straight Head B: male connector, M23, 17-pin, straight Cable: HIPERFACE®, unshielded, 5.6 mm Signalart: HIPERFACE®	1 m	DSL-2317-G01MJC6	2071330

Dimensional drawings ➜ page 20

Field-attachable connectors

Figure	Brief description	Type	Part no.
	Head A: female connector, M12, 8-pin, straight Head B: - Cable: shielded	DOS-1208-GA	6028369

Figure	Brief description	Type	Part no.
	Head A: female connector, M12, 8-pin, straight, A-coded Head B: - Cable: Incremental, SSI, shielded, CAT5, CAT5e Signalart: Incremental, SSI	DOS-1208-GA01	6045001
	Head A: female connector, M12, 8-pin, angled, A-coded Head B: - Cable: Ethernet, shielded, CAT5, CAT5e Signalart: Ethernet	DOS-1208-WA	6043358
	Head A: male connector, M12, 8-pin, straight Head B: - Cable: shielded	STE-1208-GA	6028370
	Head A: male connector, M12, 8-pin, straight, A-coded Head B: - Cable: Incremental, shielded, CAT5, CAT5e Signalart: Incremental	STE-1208-GA01	6044892

Dimensional drawings ➜ page 20

Further accessories

Programming and configuration tools

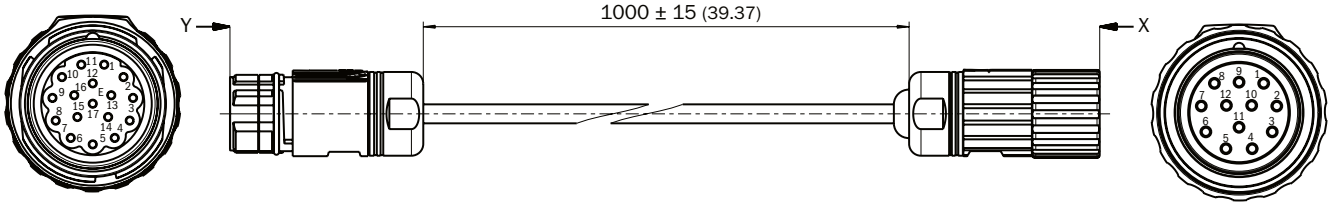
Figure	Brief description	Type	Part no.
	SVip® LAN programming tool for all motor feedback systems	PGT-11-S LAN	1057324

Dimensional drawings ➜ page 22

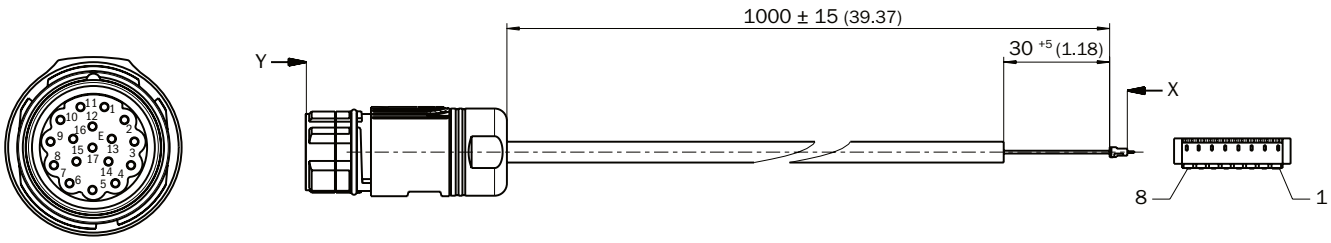
Dimensional drawings for accessories (Dimensions in mm (inch))

Plug connectors and cables

DSL-2317-G01MJB2



DSL-2317-G01MJB6



② blu
③ red
⑦ blk
⑪ pnk
⑫ vi
⑭ yel
⑮ brn
⑯ wht

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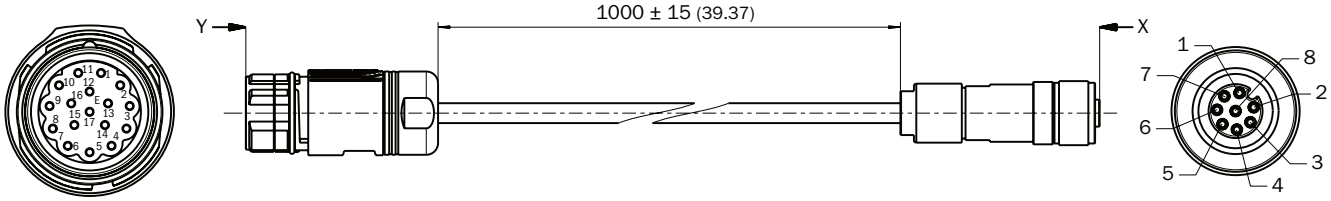
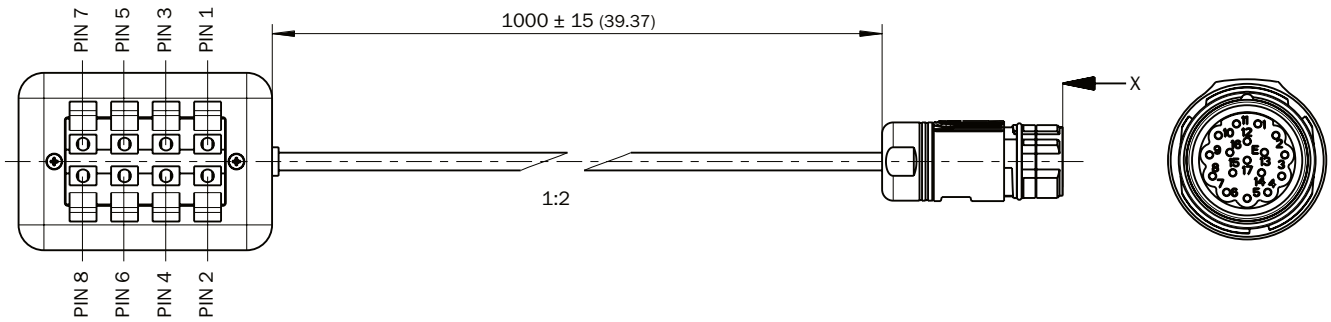
Subject to change without notice

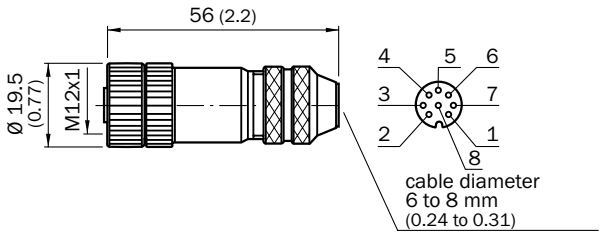
DSL-2317-G01MJC1



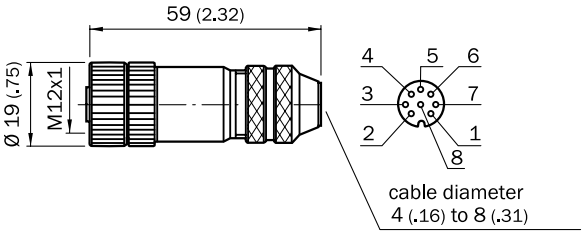
DSL-2317-G01MJC6



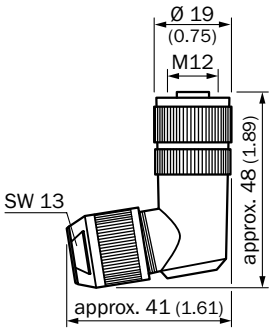
DOS-1208-GA



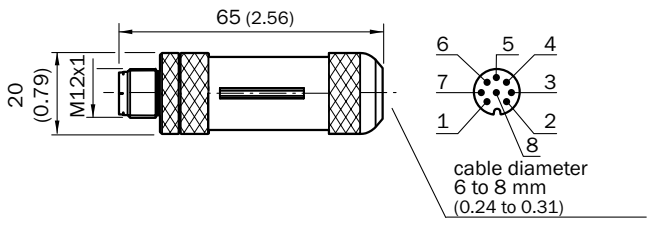
DOS-1208-GA01



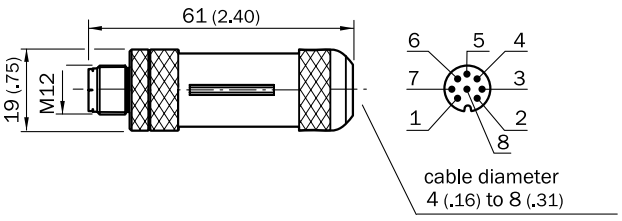
DOS-1208-WA



STE-1208-GA

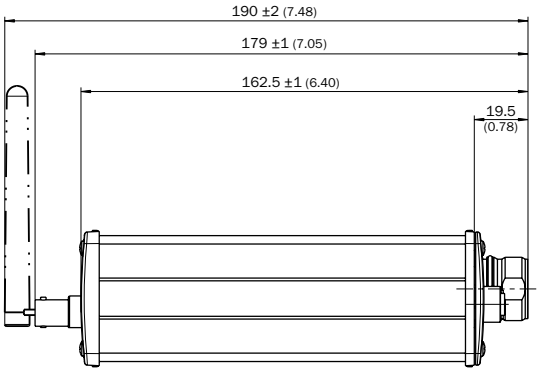


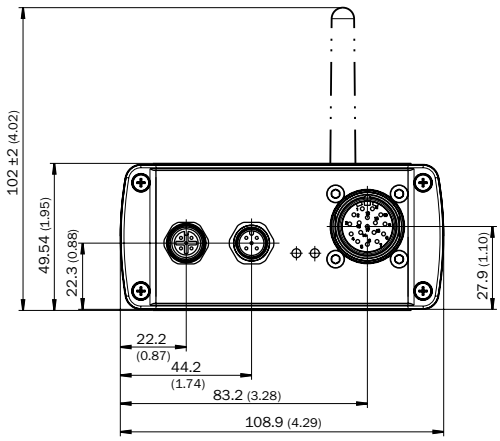
STE-1208-GA01

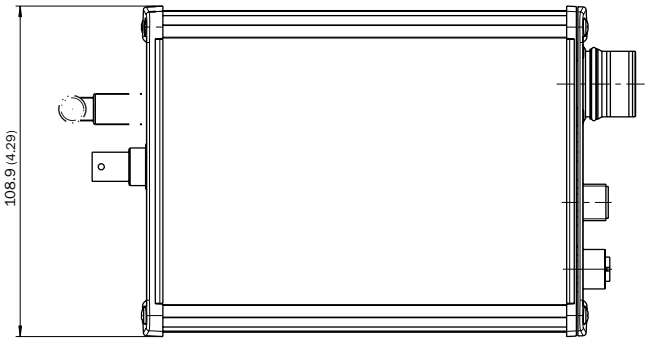


Programming and configuration tools

PGT-11-S LAN







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