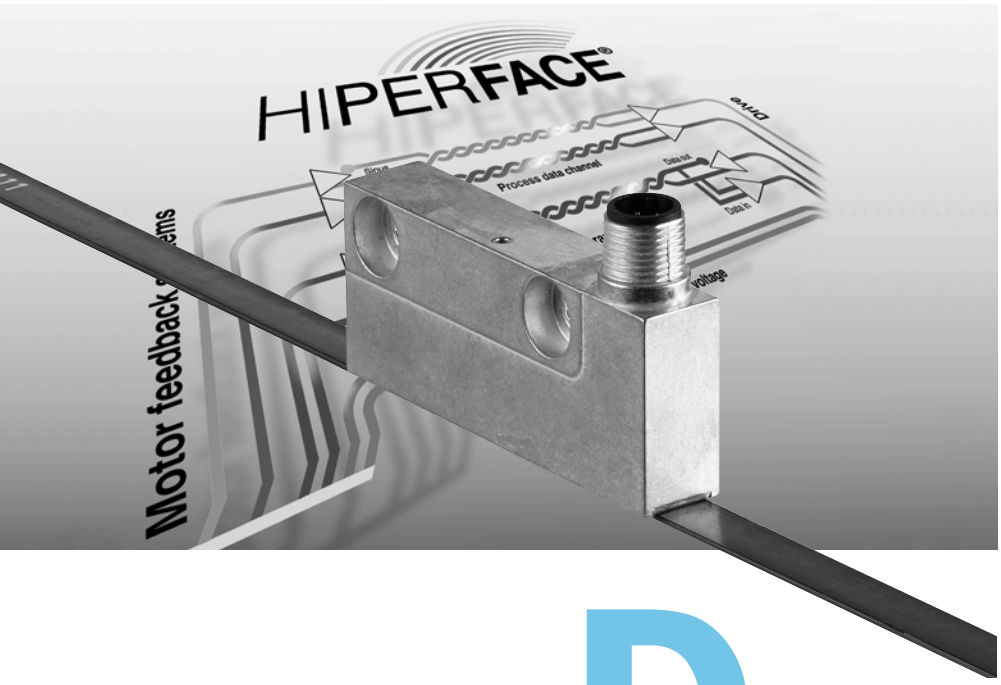
TTK70:
Absolute, non-contact linear measuring system for linear motors

DATA SHEET



In order to calculate the absolute position value, the reading head detects both the absolute and the incremental component without making contact.

The absolute position value thus created can be transmitted to a controller via the HIPERFACE® interface. In parallel, the incremental component is made available for evaluation as a sine/cosine signal with 1 Vp-t-p.

Period length 1 mm

Linear Encoders

HIPERFACE® by SICK|STEGMANN

RoHS 2002/95/EC

CE

The linear measuring system TTK70 consists of a reading head and magnetic tape. The magnetic tape has a magnetic code which forms the measuring scale.

The code consists of an incremental and an absolute track (twin-track tape).

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HVS
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Contact :
hvssystem@hvssystem.com

Tél : 0326824929
Fax : 0326851908

Siège social :
2 rue René Laennec
51500 Taissy
France

www.hvssystem.com

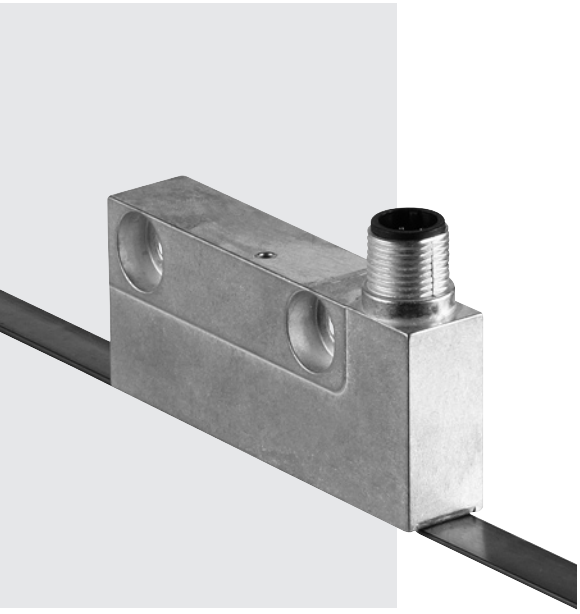
SICK|STEGMANN

11-2008

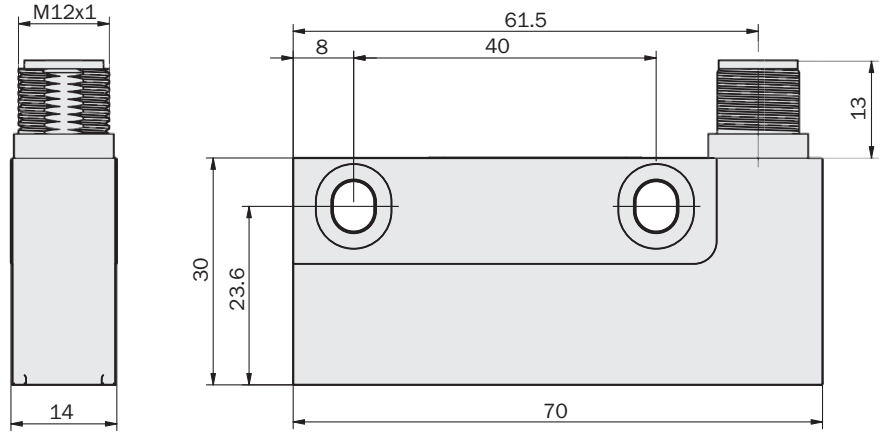
Period length 1 mm

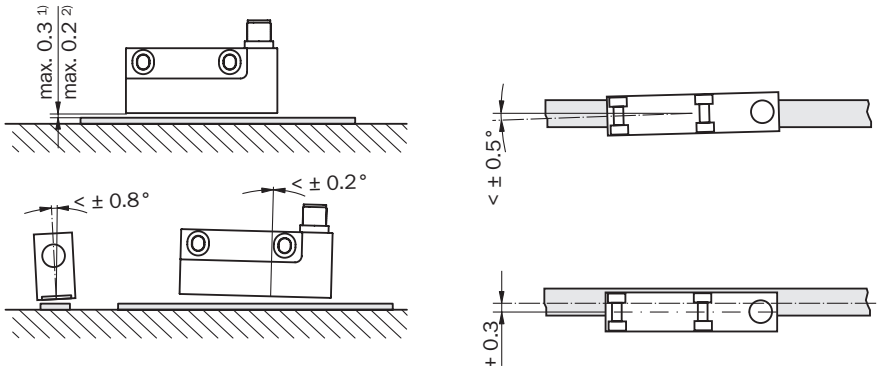
Linear Encoders

- Measurement length up to 4 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Length-independent position sensing time
- Electronically adjustable Protection class up to IP 65



Dimensions and positional tolerances



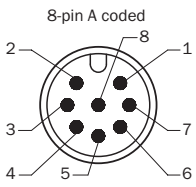


1) Without cover band

2) With cover band

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation



View of the plug-in face

PIN	Colour of wires	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	grey or yellow	Data +	RS-485 Parameter channel
6	green or purple	Data –	RS-485 Parameter channel
7	blue	GND	Ground connection
8	red	+ U_s	Encoder Supply voltage
	Screen		Housing potential

Screening via plug housing

Electronically adjustable via Programming Tool

Accessories

Connection systems

Programming Tool

Technical Data to DIN 32878		TTK70 HIPERFACE®
Period length		1 mm
Max. Measurement length		4,000 mm
Magnetic tape length		Measurement length + 80 mm (min. 200 mm)
Dimensions		mm (see dimensional drawing)
Max. distance ot the sensor to the magnetic tape		
without cover band		0.3 mm
with cover band		0.2 mm
Mass	read head	0.08 kg
	magnetic tape	0.18 kg/m
Material	read head	zinc diecasting
	magnetic tape	17410 Hard ferrite 9/28 P
Code type for the absolut value		Binary
Measurement step at interpolation of the sine/cosine signals		
with e. g. 12 bits		0.244 µm
System accuracy		< ± 10 µm
Repeatability		
unidirectional		< 5 µm
bidirectional		< 15 µm
Operating speed up to which the absolute position		
can be reliably produced		1.5 m/s
Max. Operating speed		10 m/s
Permitted mounting tolerance		See dimensional drawing page 2
Working temperature range		– 30 ... + 85 °C
Storage temperature range [1]		– 40 ... + 100 °C
Permissible relative humidity		100 % (condesation permitted)
Temperature coefficient magnetic tape		(11 ± 1) x 10^{-6}/K
Maximum permitted ambient field strength to guarantee compliance		
with the quoted accuracy values [2]		< 3 .. 4 kA/m (3.8 .. 5 mT)
Maximum permitted field strength to ensure that the magnetic tape		
is not permanently damaged		< 150 kA/m (< 190 mT)
Resistance (read head)		
to shocks [3]		30 g/6 ms
to vibration [4]		20 g/10 ... 2,000 Hz
Protection class to IEC 60529 [5]		IP 65
EMC [6]		
Operating voltage range		7 ... 12 V
Recommended supply voltage		8 V
Max. operating current, no load		< 55 mA [7]
Available memory area		
within EEPROM 2048 [8]		1,792 bytes
Interface signals		
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential
Parameter channel = RS 485		Digital

[1] Without packaging

[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 ... 4 kA/m (3.8 .. 5 mT) occurs in addition to the field strength of the magnetic tape.

[3] To EN 60068-2-27

[4] To EN 60068-2-6

[5] With mating plug mounted

[6] To EN 61000-6-2 and EN 61000-6-3
The EMC according to the standards quoted is achieved when the motor feedback system is mounted in an electrically conductive housing, which is connected to the central earthing point of the motor controller via a cable screen.
Users must perform their own tests when other screen designs are used.

[7] 100 mA approx. during adjustment

[8] If applying the electronic type label, in connection with numeric controllers, attention should be paid to Patent EP 425 912 B 2; Application of the electronic type label in connection with speed regulation is exempt.

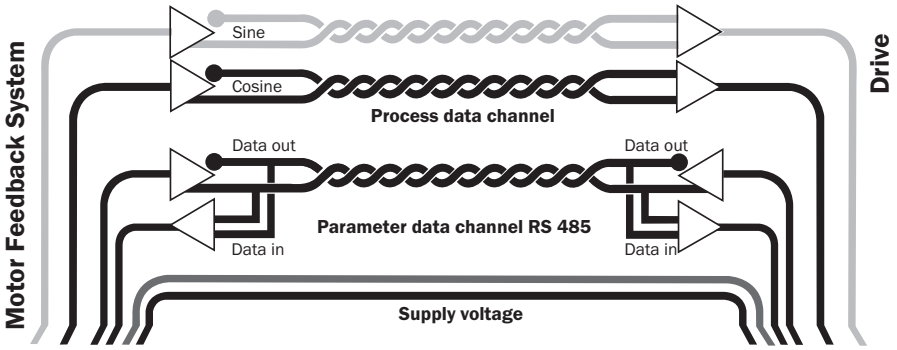
Ordering information		
Length measuring system TTK70		
Type	**Part no.**	**Description**
TTK70-HXA0-K02	1037434	Read head

Ordering information		
Magnetic tape with adhesive tape and cover band incl.		
Type	**Part no.**	**Description**
MVM-0M5-2MC-MKLB	6037415	Magnetic tape 0.5 m
MVM-01M-2MC-MKLB	6037417	Magnetic tape 1.0 m
MVM-1M5-2MC-MKLB	6037418	Magnetic tape 1.5 m
MVM-02M-2MC-MKLB	6037419	Magnetic tape 2.0 m
MVM-2M5-2MC-MKLB	6037420	Magnetic tape 2.5 m
MVM-03M-2MC-MKLB	6037421	Magnetic tape 3.0 m
MVM-3M5-2MC-MKLB	6037422	Magnetic tape 3.5 m
MVM-04M-2MC-MKLB	6037423	Magnetic tape 4.0 m

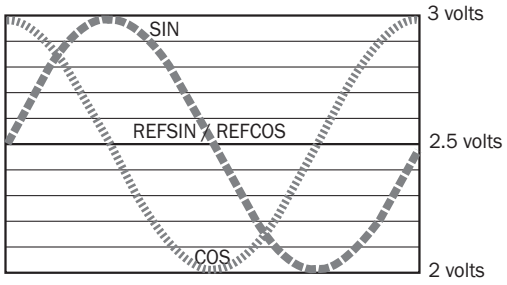
HIPERFACE® by SICK|STEGMANN

Electrical interface

- Safe data transmission
- High information content
- Electronic type label
- Only 8 leads
- Bus-enabled parameter channel
- Process data channel in real time



Signal specification of the process data channel

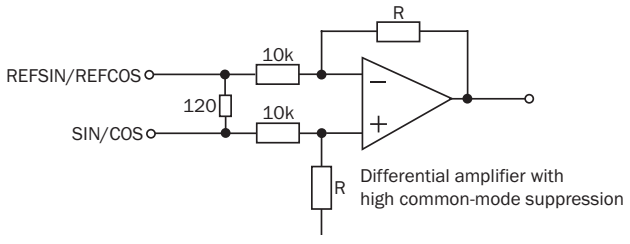


Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always "online". When the supply voltage is applied, the speed controller has access to this information at any time.

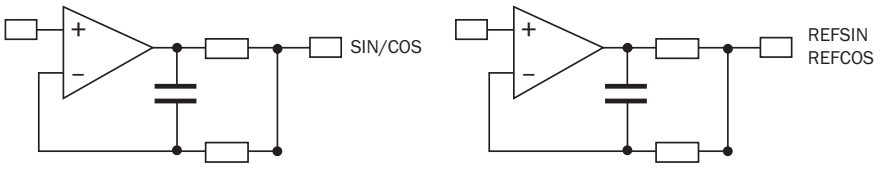
Sophisticated technology guarantees stable amplitudes of the analogue signals across all specified environmental conditions, with a maximum variation of only 20 %.

Characteristics applicable to all permissible environmental conditions	
Signal	**Value/Units**
Signal peak, peak V_{ss} of SIN, COS	0.9 ... 1.1 V
Signal offset REFSIN, REFCOS	2.2 ... 2.8 V

Recommended receiver circuit for sine and cosine signals



The output circuit of the process data channel within the SinCos encoder



Further informations to the interface
see HIPERFACE®-description
part no. 8010701

HIPERFACE® by SICK|STEGMANN

Type-specific settings	TTK70
Type ID (command 52h)	FFh
Free EEPROM [bytes]	1,792
Address	40h
Mode_485	E4h
Codes 0 ... 3	55h
Counter	0

Overview of commands supported			TTK70
Command byte	Function	Code 0 [1]	Comments
42h	Read position (5 bits per sine/cosine period)		31.25 µm
43h	Set position	•	
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 area		
4Fh	Change access code		
50h	Read encoder status		
52h	Read out name plate		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 internal synchronization	•	
6Bh	Sensor adjustment (during commissioning) *	•	

[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.

* See pages 6 and 7

Overview of status messages			
Error type	Status code	Description	TTK70
	00h	The encoder has recognised no error	•
Initialisation	02h	Faulty internal angular offset	•
	03h	Data field partitioning table damaged	•
	04h	Analogue limit values not available	•
	05h	Internal I^2C bus not operational	•
	06h	Internal checksum error	•
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	•
	24h	Command is not allowed in the actual state	•
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	•
Position	20h	Sensor is not adjusted or is in adjustment mode.	•
	21h	Distance magnetic tape/sensor too high	•
	23h	Positional error	•
	25h	Faulty adjustment data for position value determination	•
Other	1Ch	Monitoring the value of the analogue signals (process data)	•
	1Eh	Encoder temperature critical	•
	08h	Counter overflow	•

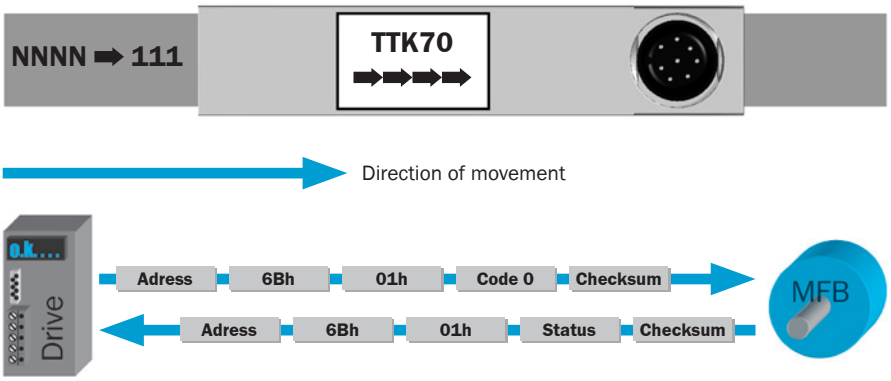
Further informations to the interface see HIPERFACE®-description part no. 8010701

Sensor adjustment 6Bh

For the linear sensor TTK70 it is mandatory, prior to initial commissioning, to perform an adjustment run (calibration) in order to calibrate the sensor to the magnetic tape.

The sensor adjustment is integrated into the HIPERFACE® Programming Tool (part no. 1034252) from software version 3.2 onwards. The three necessary steps are described on the two following pages.

An important requirement for correct adjustment is that the sensor is correctly positioned over the magnetic tape. This is illustrated below:



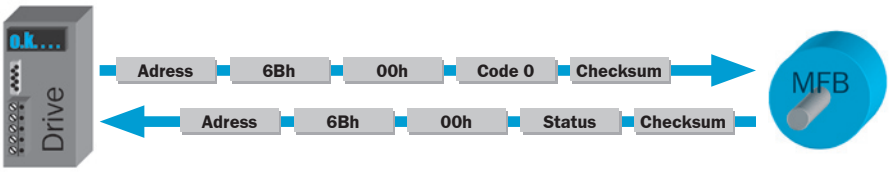
The adjustment is **not** started when the following error conditions exist:

- ▶ Number of transmitted command bytes incorrect (WRONG_COMMAND_LENGTH, 0Ch),
- ▶ incorrect access code entered (ERR_ACCESS_CODE, 0Fh),
- ▶ incorrect command arguments entered (WRONG_ARGUMENT, 0Dh)

Starting the sensor adjustment

If the adjustment starts correctly, this is displayed in the status byte by the value 01h. This value identifies the starting value of a counter which runs from 01h to 0Fh and displays the different states of the adjustment procedure. In addition, in the upper 4 bits of the status byte, another counter also runs and counts the number of 1 mm period cycles. This counter is reset depending on the state of the adjustment procedure. **Having entered the above command sequence, the sensor must be moved smoothly in the plug connector/cable outlet direction at a speed of < 3 mm/s.**

Checking the adjustment procedure



During the movement of the sensor, for state control, the state of adjustment can be controlled with the above command sequence. Two counters, in which the current state is mapped, run in the status byte. The following states are allocated to the counter values in the lower 4 bits of the status byte:

01h .. 03h: incremental adjustment; determination of the signal amplitudes and the offset values of the analogue signals (SIN, COS). The counter in the upper half byte runs from of 1 .. 8.

04h .. 08h: determination of the offset value between analogue value and incremental counter. The counter value in the upper half byte is now irrelevant.

09h .. 0Fh: determination of the offset value between absolute track and incremental track. The counter value in the upper half byte is irrelevant.

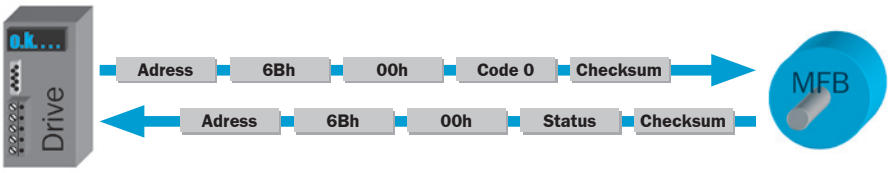
If faulty analogue values are detected during the incremental adjustment, the adjustment is aborted with an error message (ANALOG_RANGE_CHECK, 1Ch). In this situation, the sensor no longer operates correctly, and a position value cannot be calculated!

During adjustment, commands relating to the position value (R_Pos, 42h; W_Pos, 43h; _Pos-Aligned, 6Ah) are answered with an error message (ERR_NOT_CALIBRATED, 20h).

The adjustment is ended after 20-25 mm approx. and/or when the counter has the value 15 (xFh) in the lower 4 bits.

Ending/stopping the adjustment

The adjustment must be explicitly stopped by the command sequence below.



For a successfully executed adjustment, the status byte returns a value which specifies the number of adjustments performed so far. By saving the determined values in the EEPROM, the command execution time is approximately 12 ms. Immediately afterwards, the absolute position can be accessed.

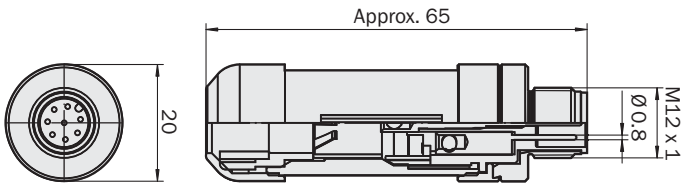
If the adjustment is aborted prior to ending the same, by the stop command, the original adjustment values are re-accepted, and the error message **ERR_NOT_CALIBRATED (20h)** is output.

If “Stop Calibration” (adr,6Bh,00h,55h,cs) is performed during “normal” operation of the commands, the value **08h (NOT_ALLOWED)** is output as an error message.

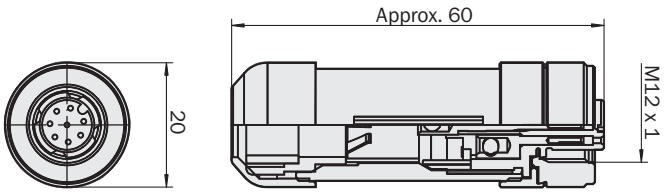
Dimensional drawings and ordering information

Round screw system M12

Cable connector M12 male, 8-pin, straight, screened, for field assembly (adapter side)		
Type	**Part no.**	**Contacts/cable diameter**
STE-1208-GA	6028370	8 / 4 ... 8 mm

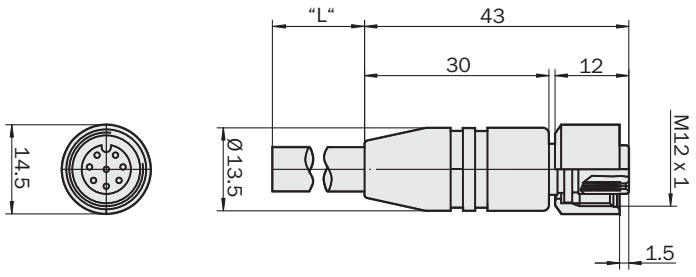


Cable connector M12 female, 8-pin, straight, screened, for field assembly (adapter side)		
Type	**Part no.**	**Contacts/cable diameter**
DOS-1208-GA	6028369	8 / 4 ... 8 mm



Cable HIPERFACE®, 8 wires, per metre 4 x 2 x 0,15 mm²		
Type	**Part no.**	**Wires**
LTG-2708-MW	6028361	8

Female connector M12, 8-pin, straight, pre-wired with cable 8-wire, 4 x 2 x 0.25 mm2, screened, flexible (adapter side)			
Type	**Part no.**	**Contacts**	**Cable length „L“**
DOS-1208-G02MAC1	6032866	8	2.0 m
DOS-1208-G05MAC1	6032867	8	5.0 m
DOS-1208-G10MAC1	6032868	8	10.0 m
DOS-1208-G20MAC1	6032869	8	20.0 m



Dimensional drawings and ordering information

Programming Tool

Programming Tool for TTK70 with HIPERFACE® interface	
Type	**Part no.**
PGT-03-S	1034252

Contact:

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

Belgique/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 vzdinfo@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

Italia
Phone +39 011 797965
E-Mail stegmann@stegmann.it

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

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

Nederland
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

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

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

More representatives and agencies
in all major industrial nations at
www.sick.com

SICK | STEGMANN

SICK
6900 West 110th Street
Minneapolis, MN 55438
Ph: 800.325.SICK (7425) • Fax: 952.941.9287
www.sickusa.com

SICK STEGMANN, INC.
7496 Webster Street
Dayton, OH 45414
Ph: 800.811.9110 • Fax: 937.454.1955
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