SICK | STEGMANN

Motor Feedback Systems for Servomotors and Lift motors SinCos® SHS 170 (HIPERFACE® compatible)

AUDIN - 8, avenue de la malle - 51370 Saint Brice Courcelles
Tel : 03.26.04.20.21 - Fax : 03.26.04.28.20 - Web : http: www.audin.fr - Email : info@audin.fr

List of contents

* HIPERFACE® detailed information, see product information 910 980 103 445

Highlights

- **512 sine/cosine periods per revolution**
- **Absolute position with a resolution of 16384 steps per revolution**
- **Position value programming**
- **Encoder temperature interrogation**
- **Electronic type label**
- **128 bytes EEPROM freely programmable by the user (for example configuration/commissioning data)**
- **Individually configurable interface (baud rate and parity)**

1. HIPERFACE® High Performance Interface

The universal interface for electric drives

Depending on their design and application, electric drives need the following information from corresponding sensors in the control loop:

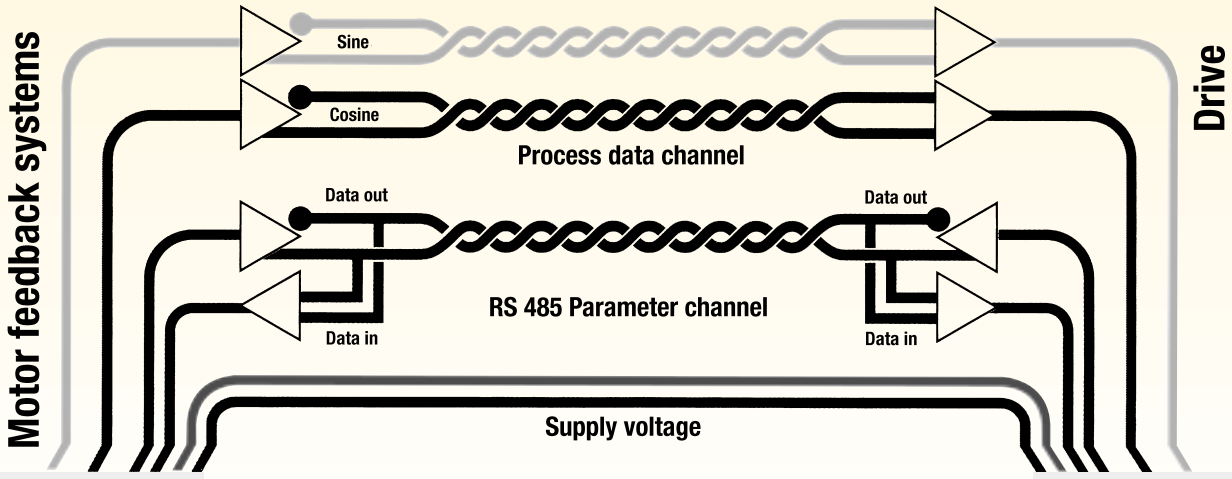
- ▷ Commutation information
- ▷ Rotational speed information
- ▷ Incremental position information
- ▷ Absolute position information over several revolutions

All this information can be transferred via HIPERFACE®.

Technical innovation to meet the highest requirements was brought into the marketplace by STEGMANN with their SinCos® product line.

Electrical compatibility in respect of all physical parameters is ensured by the introduction of HIPERFACE® as the mandatory interface.

- **Reliable data transmission**
- **High information content**
- **Electronic type label**
- **Only 8 lines**
- **Parameter channel with bus capability**
- **Real-time process data channel**



Benefit from the advantages of HIPERFACE®

- only ***one*** interface to the speed controller for all applications
- only ***one*** type of signal line between speed controller and signal transmitter
- manual parameter setting on the speed controller is dispensed with (selfinitialisation).

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2. System description

SinCos® - The new dimension in motor feedback systems

The development objectives

The objective of developing this product was to provide a cost-effective feedback system with a performance previously unattainable.

The feedback system must be suitable for use with servomotors of all kinds.

- It must be possible to transmit the information required for speed control with high accuracy over a distance of 100 m using only a small number of cable cores even at speeds of up to 3600 revolutions/minute.

- It must be possible to carry out the fitting to the servomotor simply. Furthermore the encoder must remain serviceable and error-free with an axial expansion of the motor of up to 2 mm. Likewise, radial eccentricity of the motor shaft must not cause any angular error.

- It must be possible to electronically assign an absolute positional value to any mechanical shaft position.

- The interface to the motor controller is to be such that, in addition to the actual measured angle values, it must be possible to read and store other items of information, such as encoder temperature, motor characteristics and logistic information.

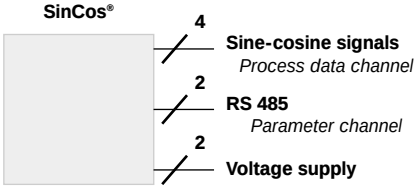
The novel features

Well known types of optical rotary encoders are so-called incremental encoders or absolute encoders. Because of their great complexity, absolute encoders are relatively expensive to produce using conventional methods.

This conventional method consists of reading binary information coded on a glass disc. Each binary position requires appropriate optical scanning. All these scanning operations must be synchronised with one another in such a way that there can be no read errors under all operating conditions. In addition, the electrical interface of such absolute encoders continuously transmits the complete absolute value.

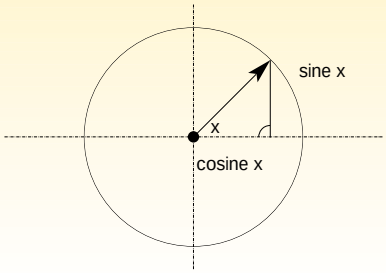
The SinCos® system can be considered as a mixture of an incremental encoder and an absolute encoder. In this case, the absolute value is initially formed only when the device is switched on, and is communicated via an RS 485 interface to an external counter, which then continues to count incrementally from this absolute value using the analogue sin/cosine interface.

In order to attain a high resolution whilst ensuring suitability of the encoder to high speed applications, the incremental encoder signal is not transmitted as digital values, as is usual, but as an analogue sine/cosine voltage. With 512 cycles per revolution, even at a speed of 3600 rev/min the frequency produced is only 31 KHz, which can then be transmitted without difficulty, even over great distances.

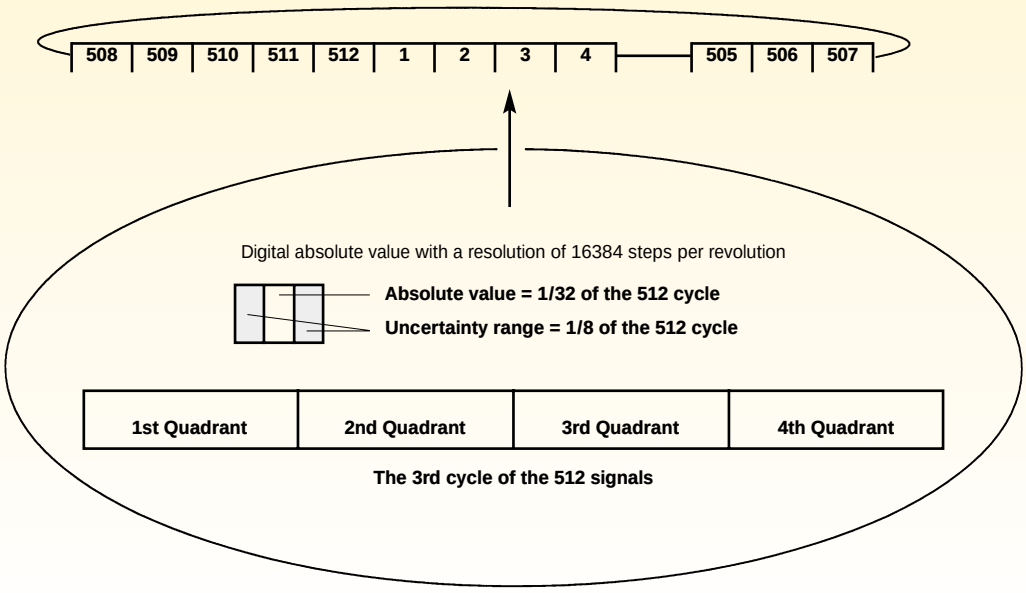


The advantage of using sinusoidal signals is that the transmission channel does not have to be designed for an extremely broad band, as is the case of digital signals, instead the bandwidth necessary is only determined by the speed.

The absolute information within one 512 cycle
As the figure below shows, the angle x can be determined absolutely by means of the two analogue voltages sine x and cosine x. This calculation of the absolute position within a 512 cycle is not performed by the SinCos® encoder but is carried out externally – in the controller or the position control system.



The digital absolute information and the assignment to the respective 512 cycle



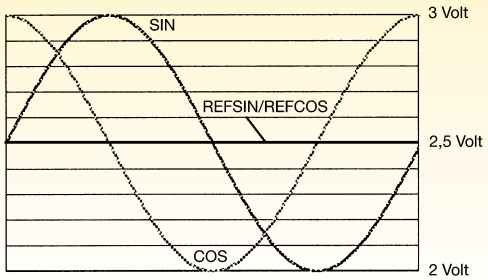
3. Technical data and characteristics to DIN 32 878

		SHS 170	Units
Number of sine/cosine cycles per revolution		512	
Dimensions		see drawing	mm
Mass		0.66	kg
Moment of inertia of the rotor		3890	gcm^2
Code type for the absolute value		binary	
Code direction with clockwise shaft rotation as viewed in direction "A" (see dimensional drawing)		rising	
Measuring step after forming the arctan with 12-bit resolution		0.6	Seconds of arc
Number of steps per revolution		16384	
Total number of steps		16384 x 1	
Error limits of the digital absolute value via RS 485		± 80	Seconds of arc
Error limits in evaluating the 512 signals, integral non-linearity		± 80	Seconds of arc
Non-linearity within one sine/cosine cycle, differential non-linearity		± 30	Seconds of arc
Output frequency for sine/cosine signals		0 ... 31	kHz
Working speed up to which the absolute position can be formed reliably		3600	min^{-1}
Operating speed		3600	min^{-1}
Max. angular acceleration		5×10^5	rad/s^2
Operating torque		70	Ncm
Starting torque		12	Ncm
Permissible shaft movement			
- Radial movement	static	± 0.5	mm
	dynamic	± 0.1	mm
- Axial movement	static	± 2	mm
	dynamic	± 0.25	mm
- Angular movement perpendicular to the axis of rotation	static	± 0.00015	mm/mm
	dynamic	± 0.000075	mm/mm
Bearing service life		3.6×10^9	Revolutions
Working temperature range		0 ... +85	°C
Operating temperature range		-20 ... +110	°C
Storage temperature range		-20 ... +110	°C
Permissible relative air humidity (no condensation allowed)		90	%
Resistance to shocks when assembled, to DIN IEC 68 Part 2-27		85/6	g/ms
Resistance to vibration when assembled, to DIN IEC 68 Part 2-6		20/10 ... 2000	g/Hz
Degree of protection to DIN VDE 0470 Part 1 when assembled		IP 52	
EMV to EN 50082-2 and EN 50081-2			
Operating voltage range		7 ... 12	V
Recommended supply voltage		8	V
Max. no-load operating current		250 ... 270	mA
Available storage area in EEPROM		128	bytes
Interface signals			
SIN, REFSIN, COS, REFCOS	= *Process data channel*	analogue	
RS 485	= *Parameter channel*	digital	

4. Signal specification

Signal specification of the process data channel

Signal form with clockwise rotation of the shaft, as viewed in the direction »A«
(see drawings on page 10)



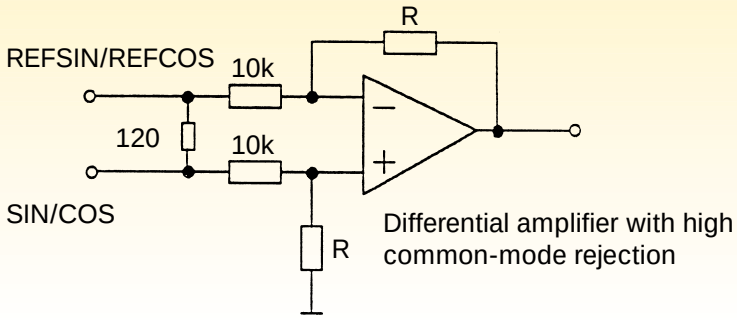
360° : 512

Access to the process data which are used for the actual speed control, that is the sine and cosine signals, is virtually always ”on line”.

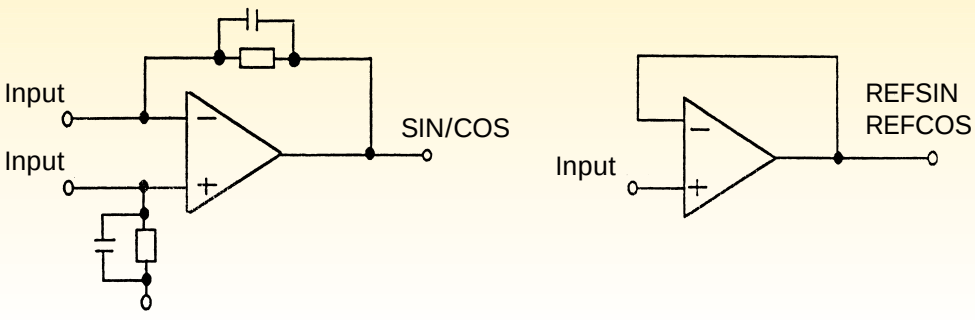
When the supply voltage is switched on, the speed controller can access this information at any time.

Valid characteristics for all specified environmental conditions		Units
SIN, COS peak-peak signal Vp-t-p	0.75 ... 1.25	V
Signal offset REFSIN, REFCOS	2.2 ... 2.8	V

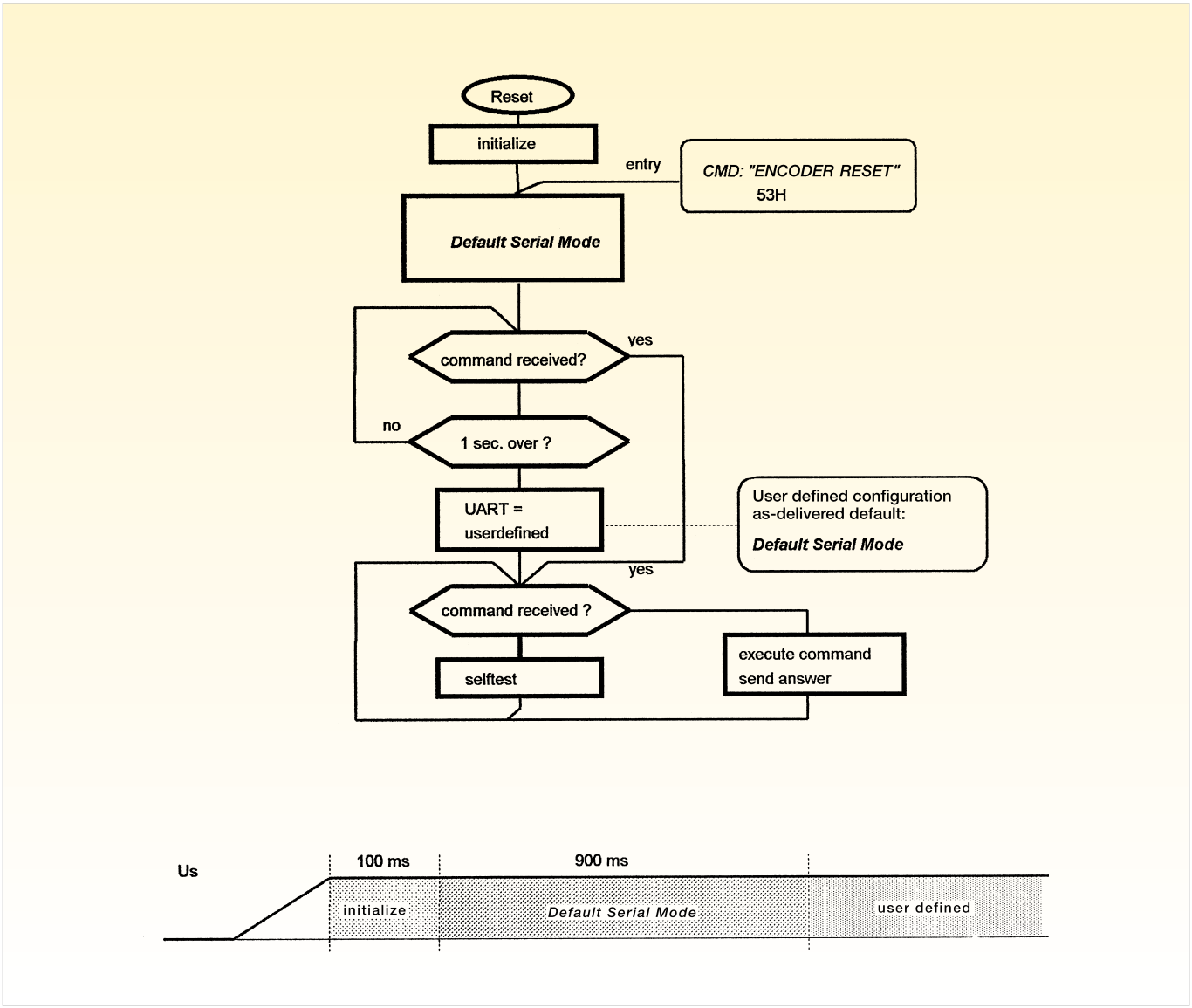
Recommended receiver circuit for the sine and cosine signals



The output circuit of the process data channel in the SinCos® transmitter

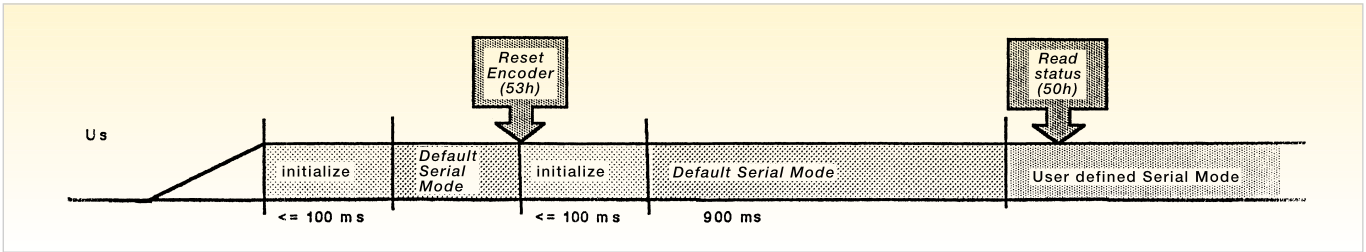


5. Restart



Default Serial Mode = E4h
see Command 57h

In special cases, unfavourable operating voltage at start-up may impair the power-up sequence of the encoder. Here, we recommend that after the encoder supply voltage has been switched on (t > 100 ms), a software reset (53H) should be initiated. This causes the power-up sequence to be implemented again. The encoder status can then be checked after one second (Command 50H).



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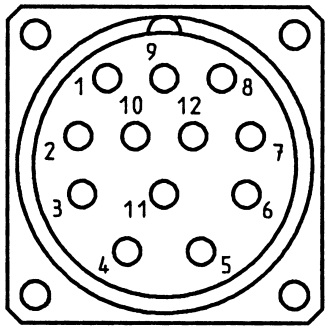
6. Connection details SHS 170

PIN	Colour	Signal	
1	black	REFCOS	
2	grey	Data +	RS 485
3	–	n.c.	
4	–	n.c.	
5	white	SIN	
6	brown	REFSIN	
7	green	Data -	RS 485
8	pink	COS	
9	–	n.c.	
10	blue	earth	
11	–	n.c.	
12	red	Us	7 - 12 V

Screen connetion via plug housing
n.c. = no connection



View on plug side

The C12 FUR mating connector
is not included in the scope of supply.
Please order separately.

7. Ordering information

When ordering, please use the
following ordering description.

Mode of operation	**S**ingle turn encoder
Standard (single-ended)	SH**S** 170
BUS	SHS 170 **BUS**

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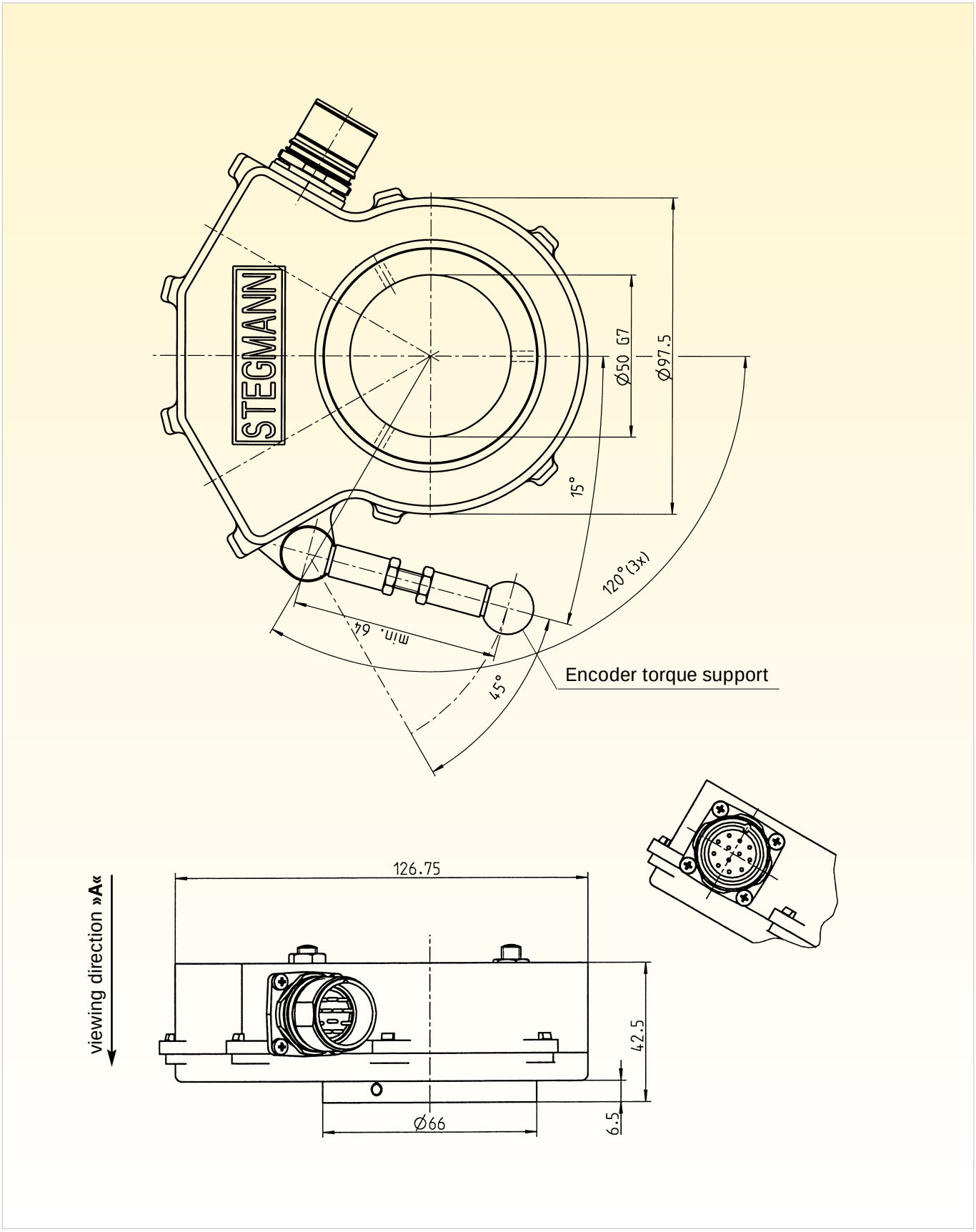
8. Dimensional drawings and suggested installation, SHS 170



Notes

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Tel : 03.26.04.20.21 - Fax : 03.26.04.28.20 - Web : http: www.audin.fr - Email : info@audin.fr

Max Stegmann GmbH
Motion control technology
Electronics

Postbox 15 60
D - 78 156 Donaueschingen
Dürrheimer Straße 36
D - 78 166 Donaueschingen
Telephone (07 71) 8 07 - 0
Telefax (07 71) 80 71 00
Internet:
www. stegmann.de
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Fax (0 45 21) 7 42 79
Internet: www.wolf.here.de
e-mail: wolf-ind@t-online.de

P. c. 32, 33, 40 - 42, 44 - 59
STEGMANN
Vertriebs GmbH West
Reichspräsidentenstraße 21-25
D - 45 470 Mülheim/Ruhr
Tel. (02 08) 3 08 96 - 0
Fax (02 08) 3 08 96 - 66
e-mail: stegmann-west@t-online.de

P. c. 35, 36, 55, 60, 61, 63 - 69
747 - 749, 767, 768, 97
TBO – Techn. Büro
Oberkötter GmbH
Neue Straße 23
D - 63636 Brachttal
Tel. (0 60 53) 60 06 - 42 / 43
Fax (0 60 53) 60 06 44
e-mail: tbogmbh@t-online.de

P. c. 70 - 79, 88, 89 except
747 - 749, 767, 768, 893, 894
ifb-Ingenieurbüro
Hans-Dieter Razum
P. O. Box 19 39
D - 72 709 Reutlingen
Tel. (0 71 21) 23 99 03
Fax (0 71 21) 24 07 64

P. c. 01 - 04, 07 - 09, 26 - 31, 34, 37, 38, 80 - 87, 893, 894, 90 - 96, 98
Max STEGMANN GmbH
Antriebstechnik_Elektronik
Postfach 1560
D - 78156 Donaueschingen
Tel. (07 71) 8 07 - 0
Fax (07 71) 8 07 - 1 00
Internet: www.stegmann.de
e-mail: info@stegmann.de

Distributors

A Austria
Ing. Franz Schmachtl KG
P. O. Box 3 62
Pummererstraße 36
A - 4021 Linz
Tel. 07 32 - 76 46 - 0
Fax 07 32 - 78 50 36
Internet: www.schmachtl.at
e-mail: office.linz@schmachtl.at

AUS Australia
Erwin Sick
Optic Electronic Pty. Ltd.
899 Heidelberg Road
Ivanhoe, Victoria 3079
Tel. 03 9497 4100
Fax 03 9497 1187
Internet: www.sickoptic.com.au
e-mail: sales@sickoptic.com.au

B / LUX
STEGMANN B. V.
Hengelder 16
NL - 6902 PA Zevenaar
Tel. 00 31 . 316 . 24 99 60
Fax 00 31 . 316 . 24 98 10
Internet: www.stegmann.nl
e-mail: sales@stegmann.nl

Brasilia
Sick Indústria e Comércio Ltda.
Rua Conde de Porto Alegre, 1633
Campo Belo - CEP 04 608 - 003
São Paulo - SP
Tel. + 55 11 5561 2683
Fax + 55 11 535 - 4153

CH Switzerland
SMT Keller AG
P. O. Box 2 22
Landstraße 35
CH - 8450 Andelfingen
Tel. 0 52 - 317 33 60
Fax 0 52 - 317 35 51
e-mail: smtkeller@bluewin.ch

CZ Czech Republic
Schmachtl CS
Videnskà 185
CZ - 25242 Vestec-Praha
Tel. 02 - 44 00 15 00
Fax 02 - 44 91 07 00
Internet: www.schmachtl.cz
e-mail: office@schmachtl.cz

DK Denmark
Compower A/S
Smedeholm 13 B
DK - 2730 Herlev
Tel. 44 92 66 20
Fax 44 92 66 02
Internet: www.compower.dk
e-mail: info@compower.dk

E Spain
S. A. Sistel
Santanac, 25
E - 08 206 Sabadell
Tel. 93 - 7 27 00 74
Fax 93 - 7 25 35 76
Internet: www.sasistel.es

FIN Finland
SENSONOR OY
Kartanontie 20
SF - 00 330 Helsinki
Tel. 358 - 9 - 4777 200
Fax 358 - 9 - 4777 2020
Internet: www.sensonor.fi

F France
STEGMANN S. à. r. l.
15, rue du Parc
F - 67 205 Oberhausbergen
Tel. 03 88 56.92.00
Fax 03 88 56.92.05
Internet: www.stegmann.fr
e-mail: stob@stegmann.fr

GB United Kingdom & Eire
STEGMANN UK Ltd.
5 The Courtyard
Reddicap Trading Estate
GB - Sutton Coldfield. B 75 7 BU
Tel. 0121 - 311 30 00
Fax 0121 - 311 01 91
Internet: www.stegmann.co.uk
e-mail: mail@stegmann.co.uk

I Italy
STEGMANN s. r. l.
Via R. Luxemburg 12/14
I - 10 093 Collegno
Tel. 011 - 79 79 65
Fax 011 - 7 79 07 42
Internet: www.stegmann.it
e-mail: stegmann@stegmann.it

IND India
PG ELECTRONICS
217 Ashirwad Industrial Estate
Bldg. No. 3, Ram Mandir Road
Goregoan (West),
Bombay - 400 104
Tel. 0 22 - 8 73 61 57
Fax 0 22 - 8 72 49 21

JAPAN
MORITANI & Co. Ltd.
1-4-22 Yaesu, Chuo Ku
Tokyo 103-8680
Tel. 81 - (0)3 - 32 78 - 60 63
Fax. 81 - (0)3 - 32 78 - 61 95
e-mail: sakanashi@moritani.co.jp

KOREA
STEGMANN-KWANGWOO Co. Ltd.
196 Anyang-7 Dong
Manan-Ku, Anyang-City, Kyounki-Do
Tel. 031 467 - 29 00
Fax 031 467 - 29 04

NL Netherlands
STEGMANN B. V.
Hengelder 16
NL - 6902 PA Zevenaar
Tel. 00 31 . 316 . 24 99 60
Fax 00 31 . 316 . 24 98 10
Internet: www.stegmann.nl
e-mail: sales@stegmann.nl

N Norway
Stork A/S
Brynsveien 100
N - 1352 Kolsås
Tel. 47 67 17 64 00
Fax 47 67 17 64 01
e-mail: stork@stork.no

PL Poland
STEGMANN Sp. zo. o.
ul. Braci Mieroszewskich 124
41 - 219 Sosnowiec
Tel. 48 32 29 04 950
Fax 48 32 29 04 951
e-mail: stegmann@silesia.top.pl

SK Slowakei
Schmachtl SK s. r. o.
Bardosova 2/A
SK 83309 Bratislava
Tel. 7 / 54 777 484
Fax 7 / 54 777 491
e-mail: office@schmachtl.sk

S Sweden
SENSONOR AB
Segersbyvägen 7
S-14563 Norsborg
Tel. 08 531 70 800
Fax 08 531 71 400
Internet: www.sensonor.fi
e-mail: sensonor@swipnet.se

USA United States
STEGMANN INC.
7496 Webster Street
Dayton, Ohio 45 414
P. O. Box 13 596
Dayton, OH 45 413 - 13 596
Tel. 1 937 454 1956
Fax 1 937 454 1955
Internet: www.stegmann.com
e-mail: sales@stegmann.com

ZA South Africa
Countapulse
Controls (Pty.) Ltd.
P. O. Box 40 393
Cleveland 2022
Rep. of S. Africa
Tel. (011) 615 - 75 56/7/8
Fax (011) 615 - 75 13

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