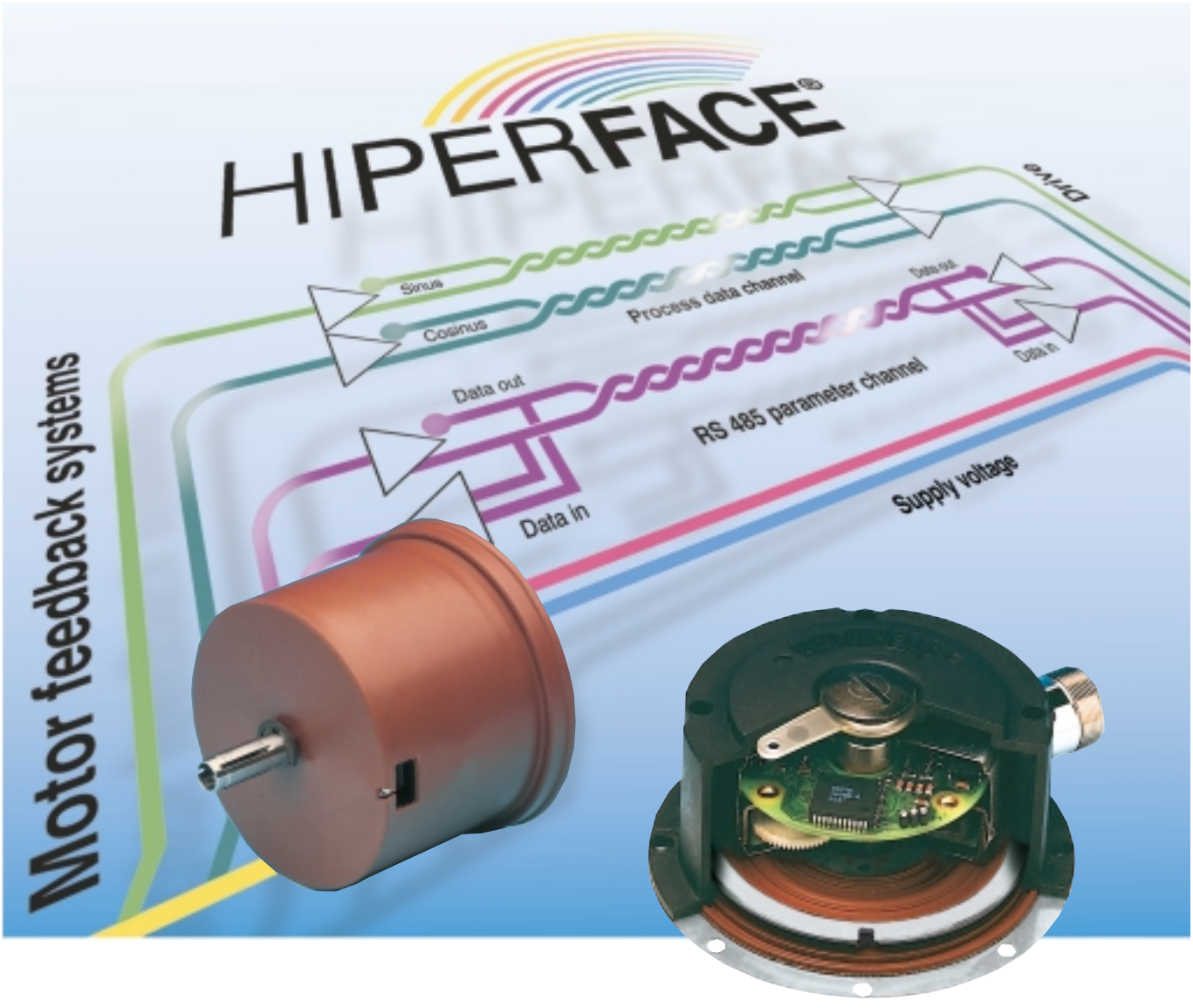
SICK | STEGMANN

Feedback systems for servomotors SinCos® SCS/SCM 60 and SCS/SCM 70 (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

*** For 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**
- **4096 revolutions measurable (only Multiturn SCM)**
- **Position value programming**
- **Encoder temperature interrogation**
- **Electronic type label**
- **128 byte of EEPROM freely programmable by the user (for example configuration/commissioning data)**
- **Individually configurable interface (baud rate and parity)**
- **Only *one* mechanical interface for low-end and high-end applications**

1. HIPERFACE® High Performance Interface

The universal interface for electric drives

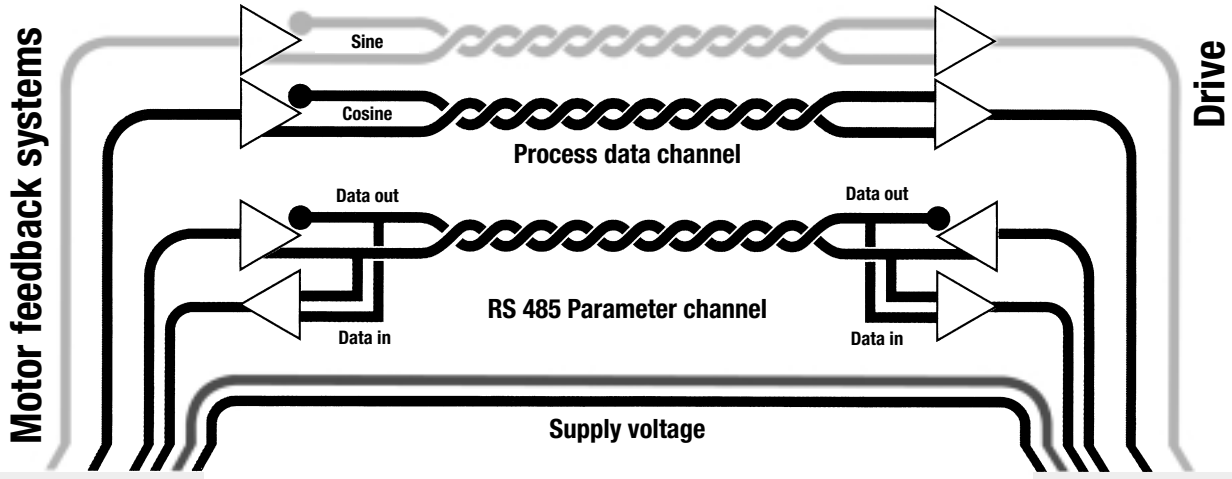
Depending on their design and application, electric drives need the following information from corresponding sensors in the control loop:

- ▷ 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.
The SinCoder® product line extends the range of motor feedback systems for standard and low-cost applications. SinCos® and SinCoder® can be supplied with compatible mechanical and electrical interfaces.
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 contoller is dispensed with (intrinsic initialisation).

2. System description

SinCos® - The new dimension in motor feedback systems

The development aims

The objective of developing this product was to provide a cost-effective feedback system with a performance previously unattainable.
The feedback device must be suitable for use with servomotors of all kinds.

- It must be possible to install the device in the servomotor. This requires a high temperature range and a very high immunity to interference.
- It must be possible to transmit the information required for rotational speed control with high accuracy over a distance of 100 m using only a small number of cable cores even at speeds up to 12,000 revolutions/minute.
- It must be possible to install the encoder in the servomotor simply. Furthermore the encoder must remain serviceable and error-free with axial expansion of the motor shaft of up to 1.5 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 unit should be available in extremly compact form, both as a single-turn encoder or as a multiturn encoder with additional detection of 4096 revolutions, in the same mechanical dimensions.
- The electrical interface should be designed such that it is possible to read and store not only the actual angle measurements, but also other information such as encoder temperatures, motor characteristic data and logistic information.

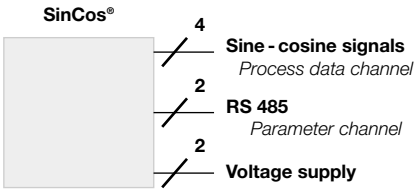
The novel features

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 sine/cosine interface.

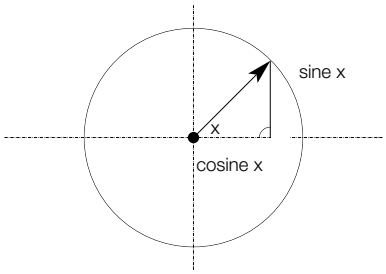
In order to attain a high resolution whilst ensuring suitability of the encoder to high speed applications, the incremental encoder signal is not transmitted as digital values, as is usual, but as an analogue sine/cosine voltage. With 512 cycles per revolution, even at a speed of 12,000 rev/min the frequency produced is only 102.4 KHz, which can then be transmitted without difficulty, even over long distances.



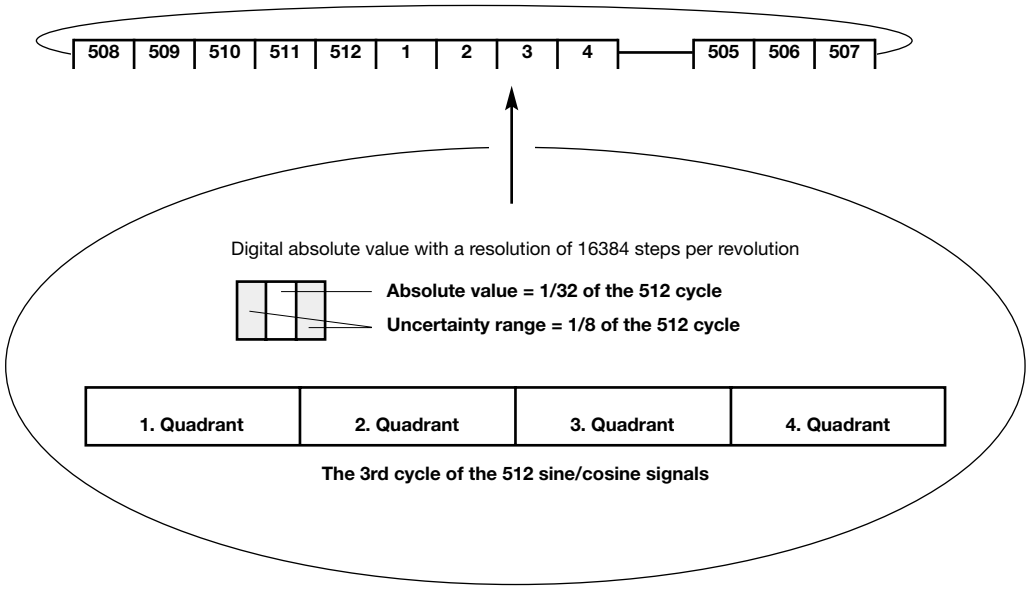
System description

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. The calculation of the absolute position within a 512 cycle is not performed by the SinCos® encoder but externally - in the motor drive or position controller.



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



3. Technical data and characteristics to DIN 32 878

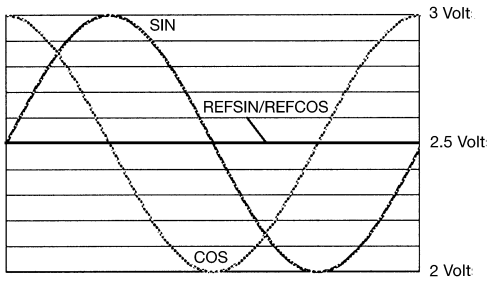
			SCS/SCM 60	SCS/SCM 70	Units
Number of sine/cosine cycles per revolution			512		
Dimensions			see dimensional drawing		mm
Mass	SCS/SCM 70 A	Surface-mounted unit		0.50	kg
	SCS/SCM 70 + SCS/SCM 60	Flush-mounted unit	0.25	0.25	kg
	SC 70	"stand alone"		1.00	kg
Moment of inertia of the rotor			20	30	gcm^2
Code type for the absolute value			binary		
Code direction with clockwise shaft rotation as viewed in direction "A" (see dimensional drawing)			increasing		
Measuring steps after forming the arctan with 12-bit resolution			0.6		Seconds of arc
Number of steps per revolution			16384		
Total number of steps		SCS 60 + SCS 70	16384 x 1		
		SCM 60 + SCM 70	67.108.864 = 16384 x 4096		
Error limits of the digital absolute value via RS 485			± 180		Seconds of arc
Error limits in evaluating the 512 cycle signals, integral non-linearity			± 40		Seconds of arc
Non-linearity within one sine/cosine cycle, differential non-linearity			± 18		Seconds of arc
Output frequency for sine/cosine signals			0...100		kHz
Working speed up to which the absolute position can be formed reliably			6000		min^{-1}
Operating speed			12000		min^{-1}
Max. angular acceleration			5×10^5		rad/s^2
Operating torque			0.1	0.2	Ncm
Starting torque			0.2	0.4	Ncm
Permissible shaft movement					
- Radial movement		static	± 0.5		mm
		dynamic	± 0.1		mm
- Axial movement		static	± 0.75		mm
		dynamic	± 0.25		mm
- Angular movement perpendicular to the axis of rotation		static	± 0.005		mm/mm
		dynamic	± 0.0025		mm/mm
Bearing service life			3.6×10^9		Revolutions
Working temperature range			-20 .... +115		°C
Operating temperature range			-20 .... +125		°C
Storage temperature range			-40 .... +125		°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	SCS/SCM 70 A		IP 66		
	SCS/SCM 60 + SCS/SCM 70 E		IP 40		
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			100 ... 130		mA
Available storage area in EEPROM			128		Bytes
Interface signals SIN, REFSIN, COS, REFCOS = *Process data channel* RS 485 = *Parameter channel*			analogue, differential digital		

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

4. Signal specification

Signal specification of the process data channel

Signal variation with clockwise rotation of the shaft, as viewed in the direction "A"



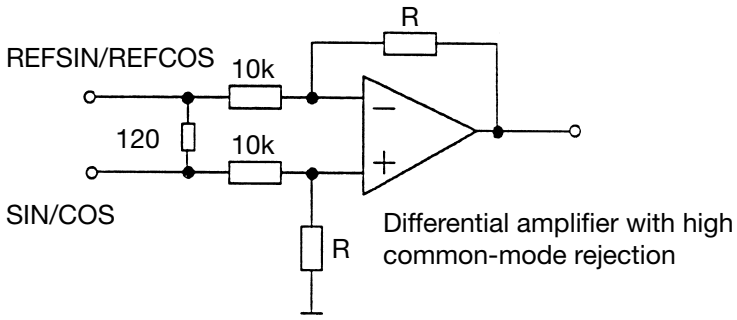
1 cycle = 360° : 512

Access to the process data 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.

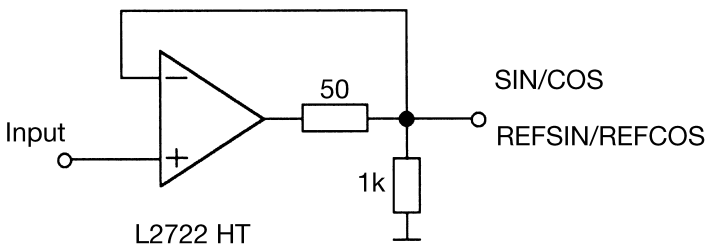
A sophisticated proven technique ensures that the amplitude of the analogue signals over the full range of specified environmental conditions varies by a maximum of only 20%.

Valid characteristics for all specified environmental conditions		**Units**
SIN, COS peak-peak signal Vp-t-p	0.9 ... 1.1	V
Signal offset REFSIN, REFCOS	2.2 ... 3.4	V

Recommended receiver circuit for the sine and cosine signals

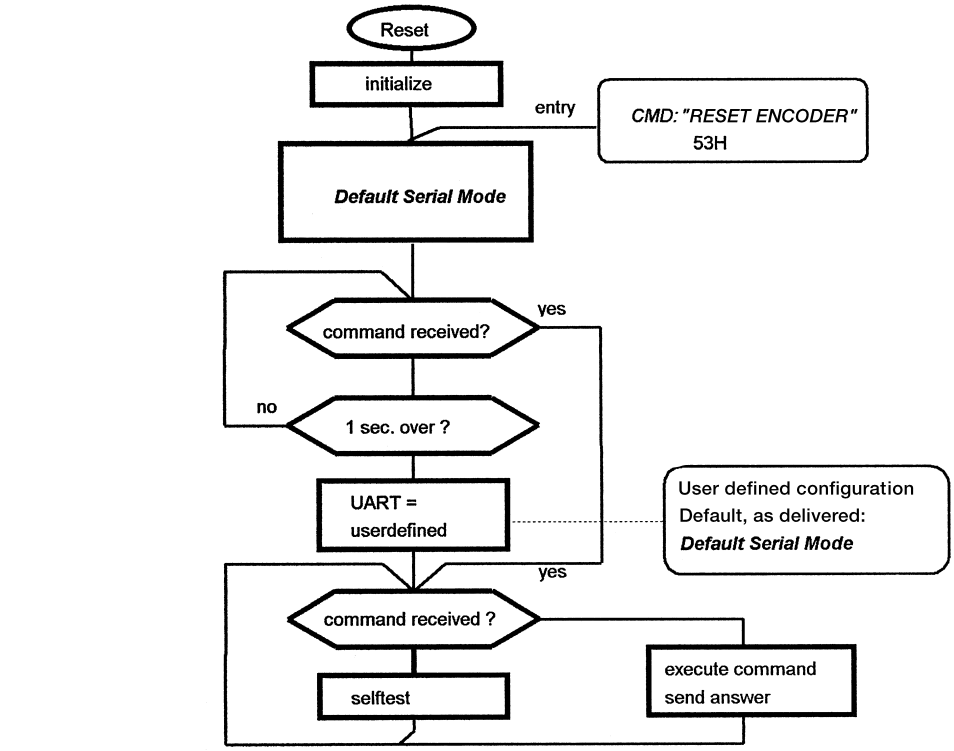


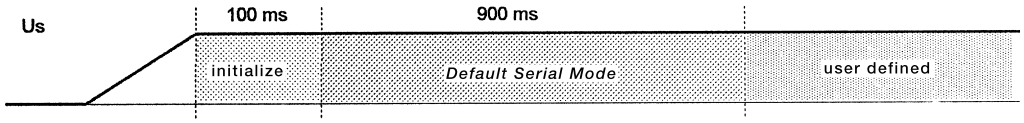
The output circuit of the process data channel in the SinCos® encoder



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

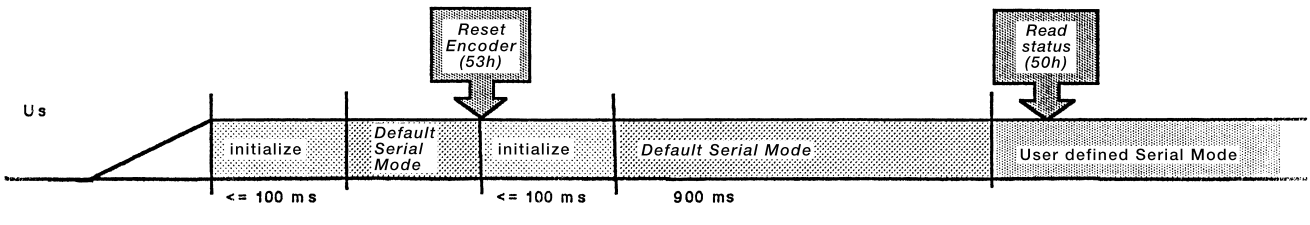
5. Restart



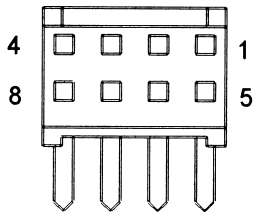


Default Serial Mode = E4h
see Command 57h

In special cases, unfavourable operating voltage at start-up may impair the power-up sequence of the encoder. In this instance, we recommend that after the encoder supply voltage has been switched on (t > 100 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).



6. Connection details SCS/SCM 60



Viewing direction »B«

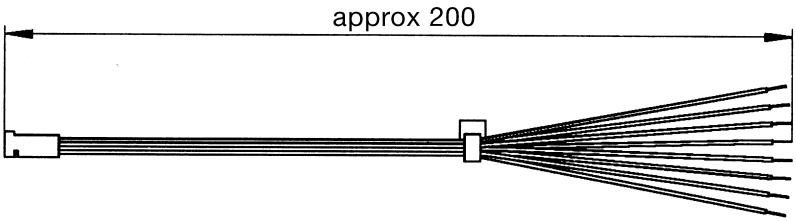
PIN	Colour	Signal	
1	red	Us	7 - 12 V
2	blue	GND	
3	brown	REFSIN	
4	black	REFCOS	
5	grey	Data+	RS 485
6	green	Data-	RS 485
7	white	SIN	
8	pink	COS	

Please note! For satisfactory operation, it is imperative that the stranded screen wire (200 mm) is connected.

Stranded cable

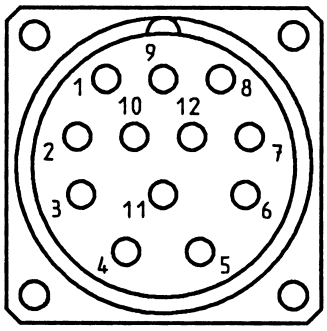
Article number
046 029 000 320

The stranded cable with Berg-Dubox 2 x 4 female strip connector is not included in the scope of supply. Please order separately.



7. Connection details SCS/SCM 70

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./Screen	
10	blue	GND	
11	–	N.C.	
12	red	Us	7 - 12 V



View on plug side

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

* Screen connection for flush-mounted version, PIN 9 to encoder housing.
Screen connection for surface-mounted version via connector housing to the internal housing.

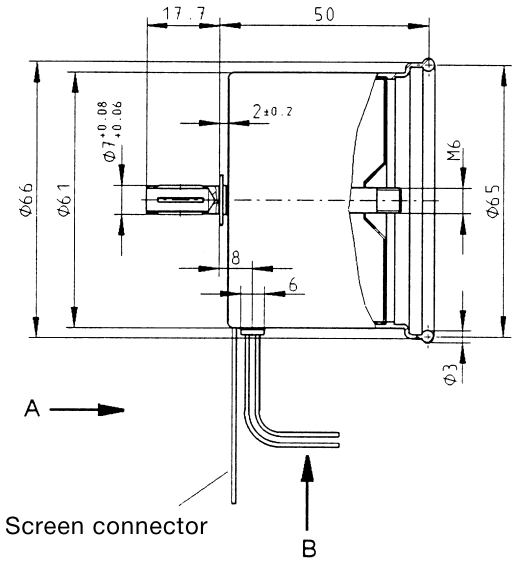
N.C. = not connected

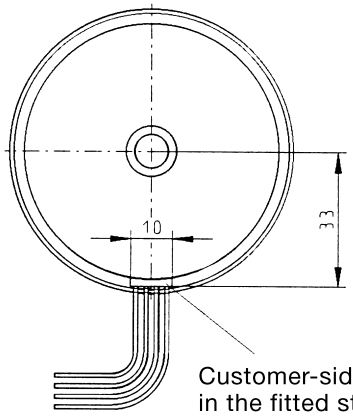
8. Ordering information

When ordering, please use the following
ordering details.

Mode of operation	**S**ingle turn encoder	**M**ultiturn encoder
Standard (single-ended)	SC**S** 60	SC**M** 60
	SC**S** 70	SC**M** 70
BUS	SCS 60 **BUS**	SCM 60 **BUS**
	SCS 70 **BUS**	SCM 70 **BUS**

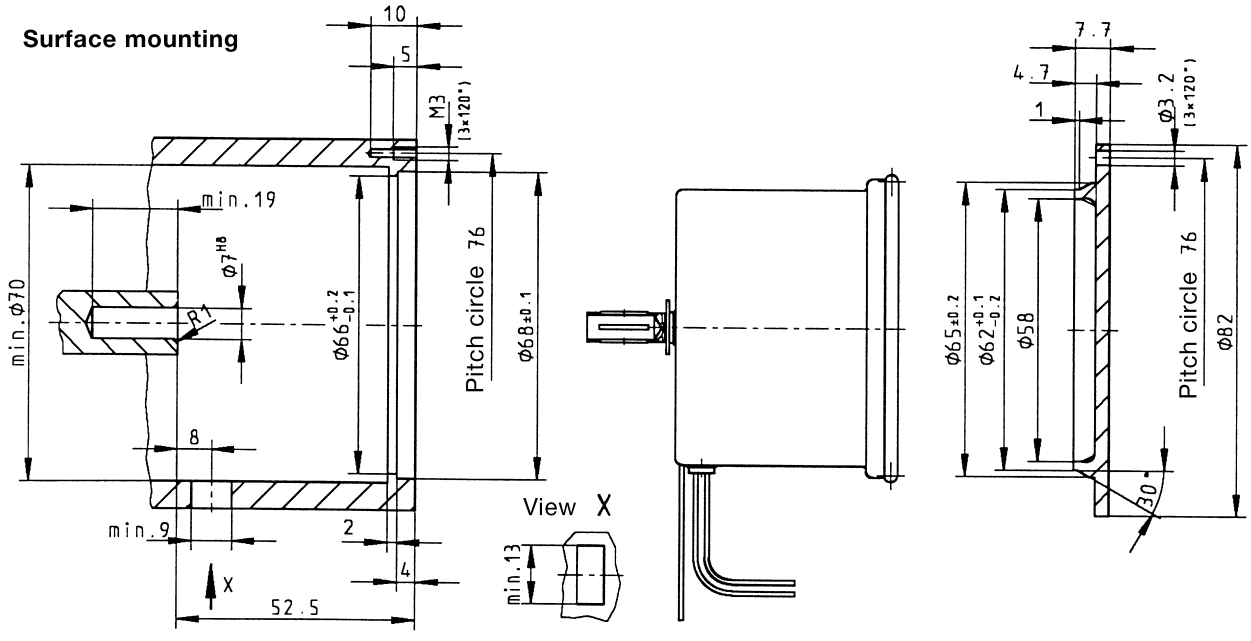
9. Dimensional drawings and suggested installation, SCS/SCM 60





The encoder may be pressed in or removed only by using the rear end of the shaft.
Under no circumstances should you press on the housing!
Follow the mounting instructions!

Surface mounting



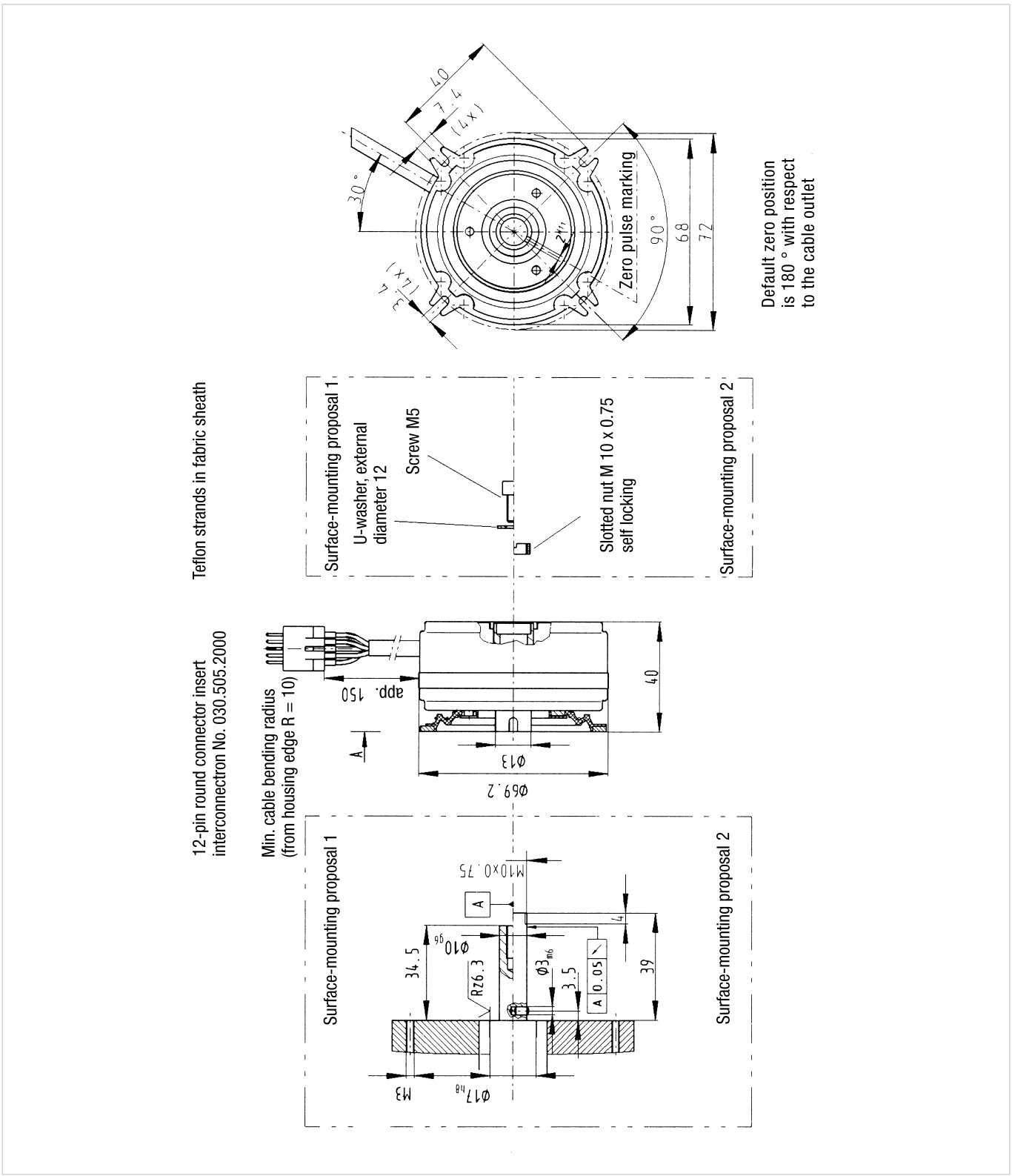
STEGMANN
AUDIN - 8, avenue de la malle - 51370 Saint Brice Courcelles
Tel : 03.26.04.20.21 - Fax : 03.26.04.28.20 - Web : http: www.audin.fr - Email : info@audin.fr

10. Dimensional drawings and suggested installation, SCS/SCM 70

Flush-mounted encoder with hollow shaft

SCS 70 DVE (Single turn)

SCM 70 DVE (Multiturn)



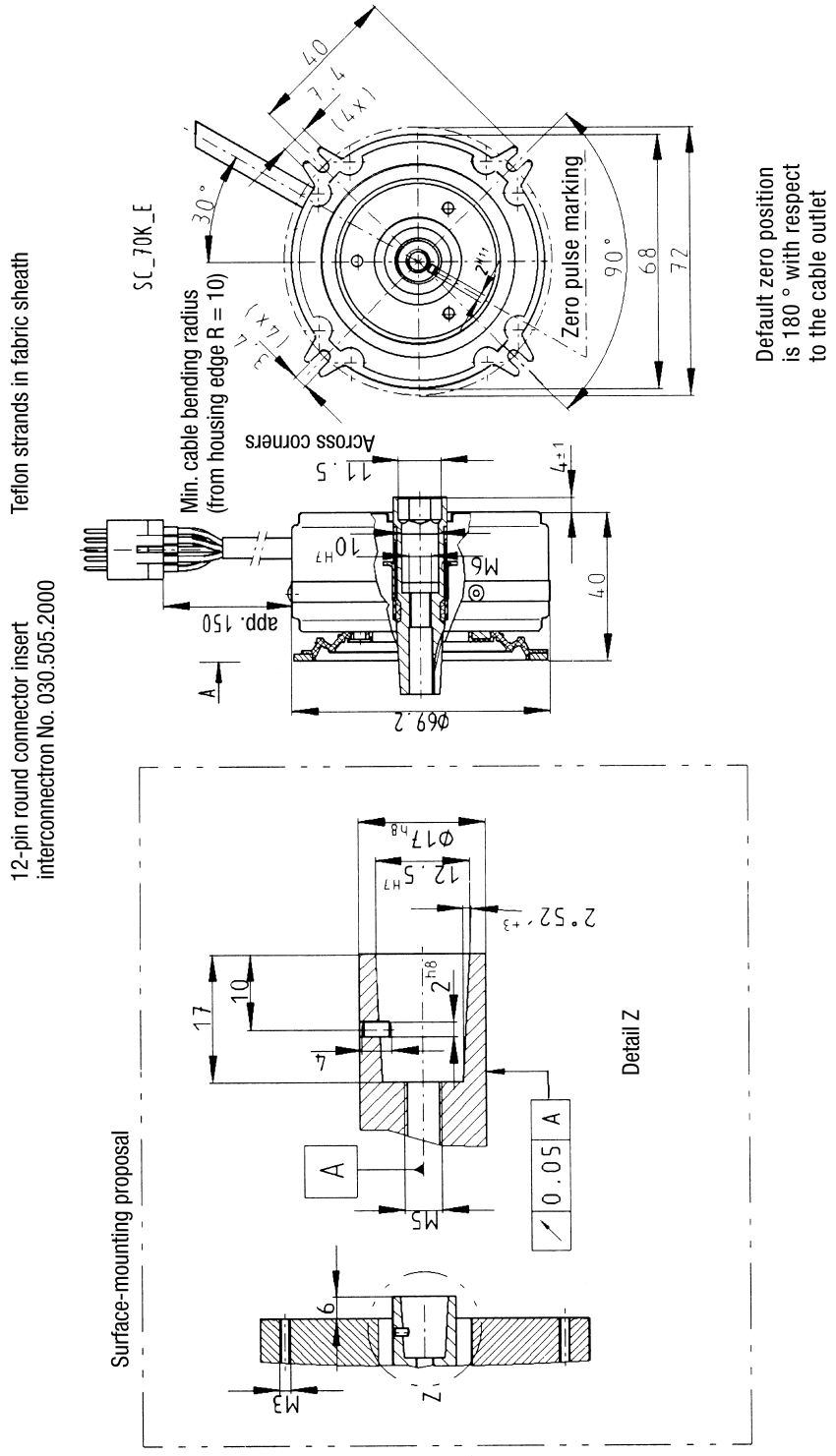
AUDIN - 8, avenue de la malle - 51370 Saint Brice Courcelles
Tel : 03.26.04.20.21 - Fax : 03.26.04.28.20 - Web : http: www.audin.fr - Email : info@audin.fr

Dimensional drawings and order details

Flush-mounted encoder with conical shaft

SCS 70 KVE (Single turn)

SCM 70 KVE (Multiturn)



STEGMANN

AUDIN - 8, avenue de la malle - 51370 Saint Brice Courcelles

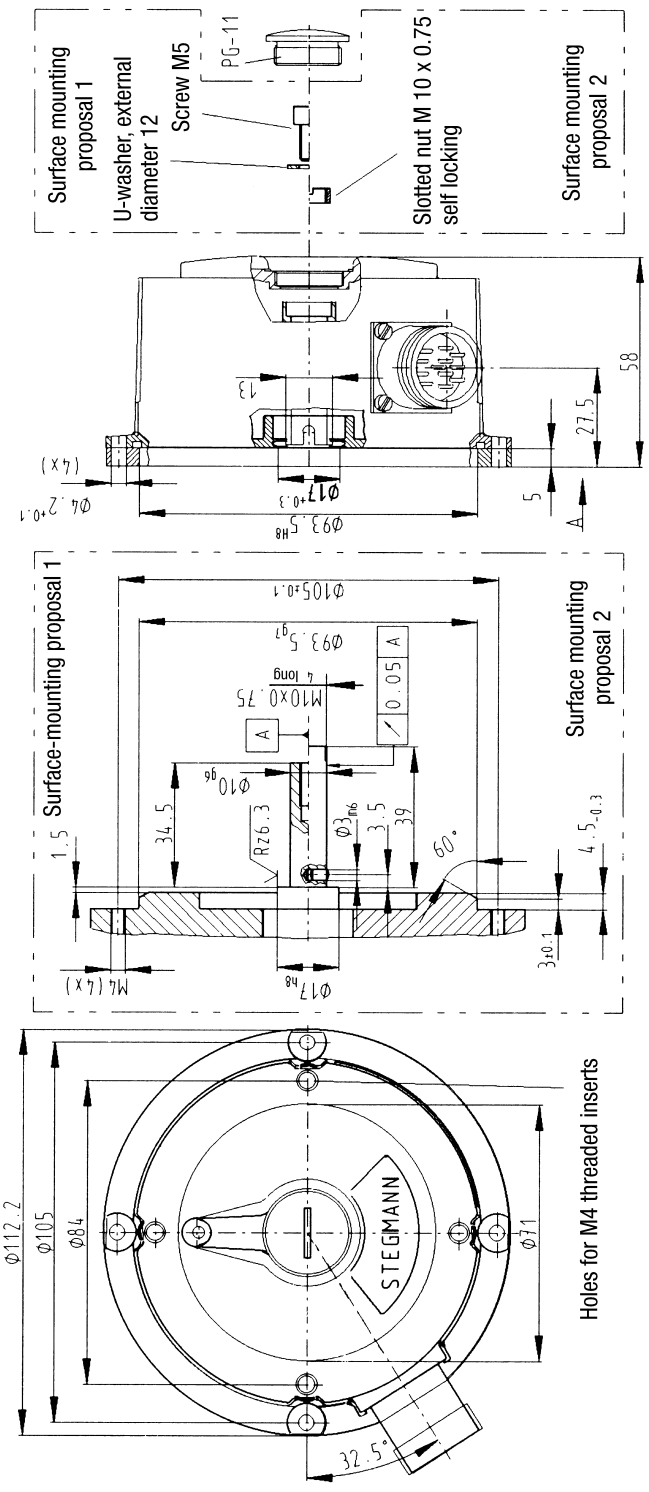
Tel : 03.26.04.20.21 - Fax : 03.26.04.28.20 - Web : http: www.audin.fr - Email : info@audin.fr

Dimensional drawings and order details

Surface-mounted encoder with hollow shaft

SCS 70 DVA (Single turn)

SCM 70 DVA (Multiturn)

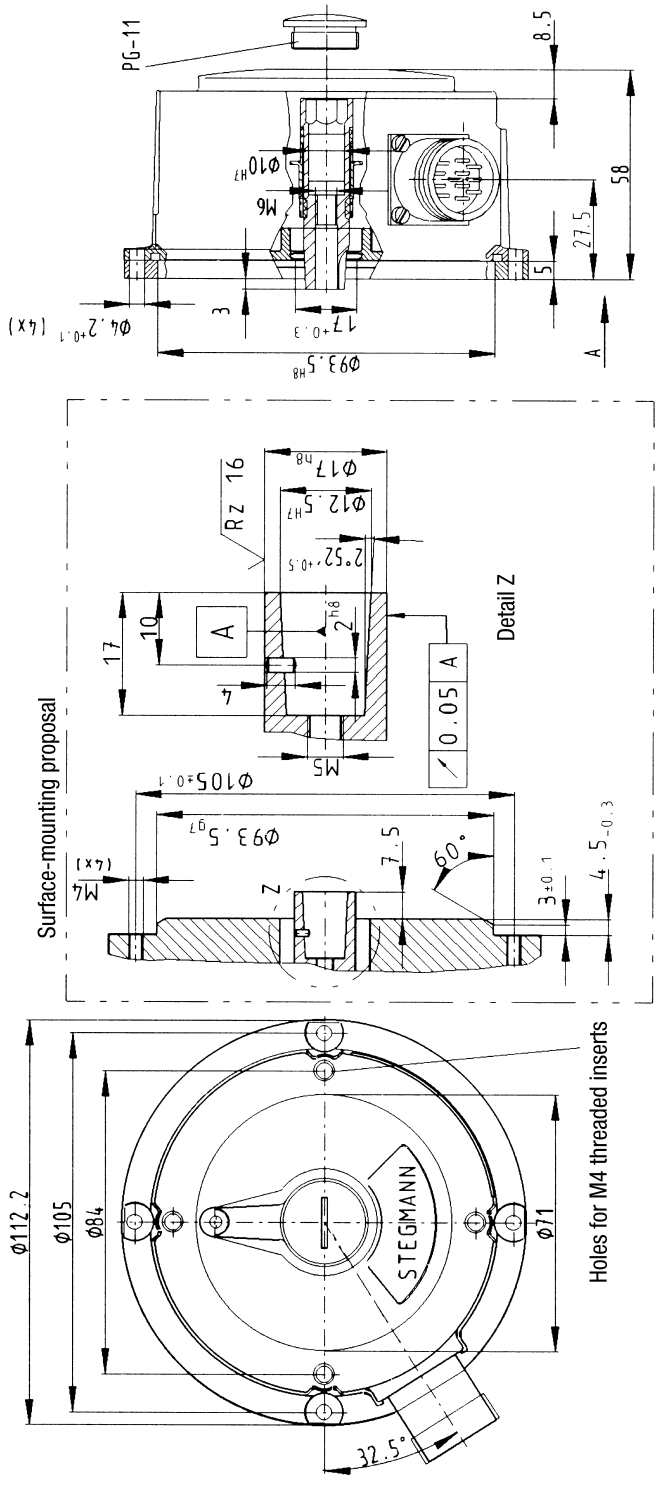


Dimensional drawings and order details

Surface-mounted encoder with conical shaft

SCS 70 KVA (Single turn)

SCM 70 KVA (Multiturn)



STEGMANN

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

13. The SinCos® encoder »stand alone« unit

The SinCos® encoder cannot always be fitted to a motor. In some cases, *angle measurement* has to be carried out *via a toothed belt or pinion*. Equally, it may be mechanically preferable to use a shaft coupling. To offer a solution to these applications with the SinCos® encoder, a flange attachment has been designed, which is available either as a ready to fit kit (FV 112), or as a complete unit (SC_70K_AF).
As the flange attachment has its own robust mounting, the shaft load may be very high. SinCos® encoders in the SC_70K_A range can be fitted to this kit.

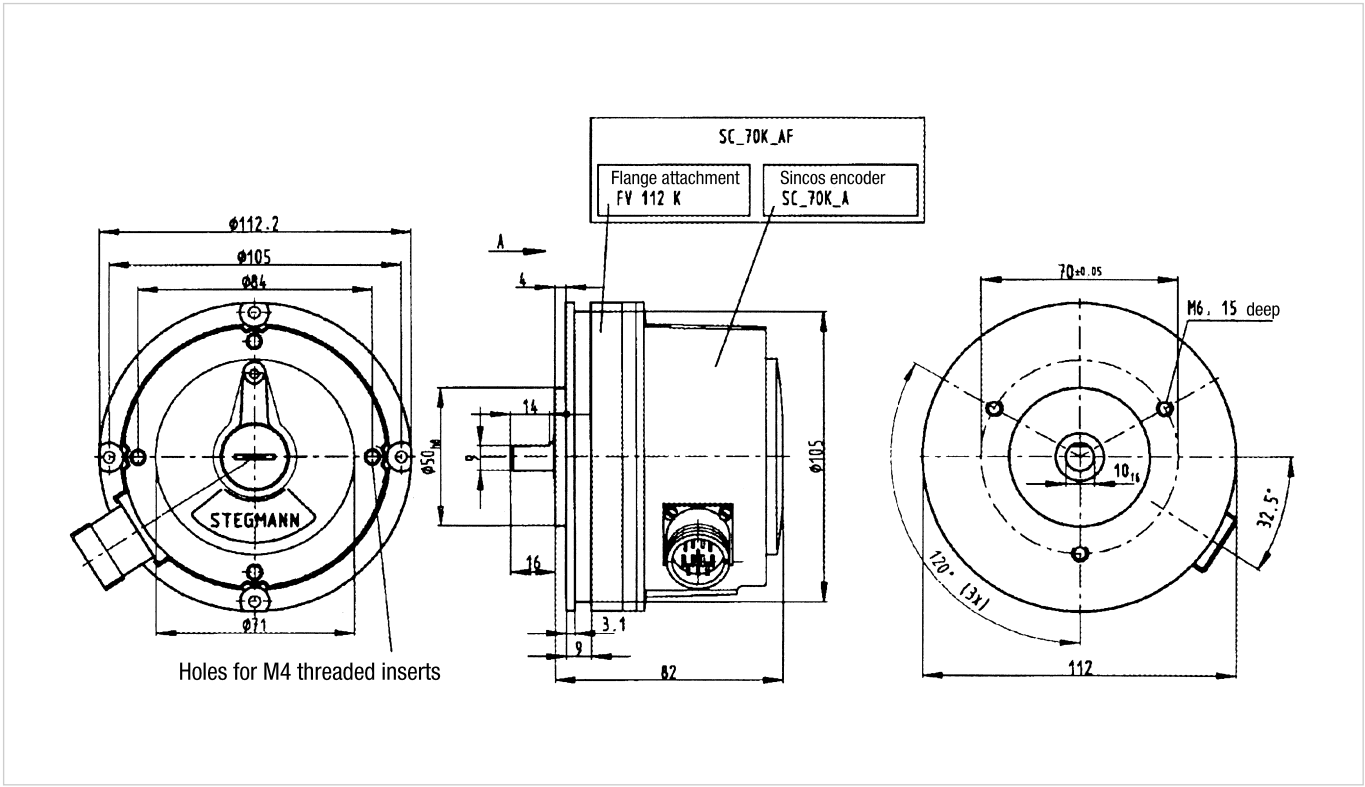
Characteristics			
Shaft load	- axial	200	N
	- radial	400	N
Operating torque		1	Ncm
Starting torque		2	Ncm
Degree of protection		IP 65	

Dimensions

SCS 70 KVAF
(Single turn, flange)

SCM 70 KVAF
(Multiturn, flange)

or falnge attachment FV 112 K



Notes

Max Stegmann GmbH
Motion control technology
Electronics

Postbox 15 60
D - 78156 Donaueschingen
Dürrheimer Straße 36
D - 78166 Donaueschingen
Telephone (07 71) 8 07 - 0
Telefax (07 71) 80 71 00
Internet:
www. stegmann.de
e-mail: info@ stegmann.de

Precision in motion

Incremental and
absolute measuring systems.
Feedback systems
for servomotors.

Synchronous motors
Stepping motors
Control units for motors
Gears · Actuating drives
Positioning drives

Agents

Post codes 17 - 25
Heinrich Wolf
Industrieautomation
Röntgenstraße 1
D - 23701 Eutin
Tel. (0 45 21) 7 39 52
Fax (0 45 21) 7 42 79
Internet: www.wolf.here.de
e-mail: wolf-ind@t-online.de

P. c. 29 - 31, 34, 37, 38
Stefan Büttner
Hermann-Löns-Straße 20
D - 37627 Stadtoldendorf
Tel. (05532) 99 48 05
Fax (05532) 99 48 06
e-mail: Stefan.Buettner
@t-online.de

P. c. 32, 33, 40 - 42, 44 - 54, 56 - 59
STEGMANN
Vertriebs GmbH West
Talstraße 95
D - 45475 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, 06 - 09, 26 - 28, 39,
80 - 87, 893, 894, 90 - 96, 98, 99
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
Pummererstraße 36
A - 4020 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 / New Zealand
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 - 08206 Sabadell
Tel. 93 - 7 27 00 74
Fax 93 - 7 25 35 76
Internet: www.sasistel.com

FIN Finland
SENSONOR OY
Kartanontie 20
SF - 00330 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 - 67205 Oberhausbergen
Tel. 0825 849 749
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 - 10093 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. z o. o.
ul. Braci Mieroszewskich 124
41 - 219 Sosnowiec
Tel. +48 (32) 29 04 950
Fax +48 (32) 29 04 951
Internet: www.stegmann.pl
e-mail: info@stegmann.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 / Canada
STEGMANN INC.
7496 Webster Street
Dayton, Ohio 45414
P. O. Box 13596
Dayton, OH 45 413 - 13596
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 40393
Cleveland 2022
Rep. of S. Africa
Tel. (011) 615 - 75 56/7/8
Fax (011) 615 - 75 13

Product Information 910 990 103 471, Issue 09/00
0299/2/3/0900/1000

© Max Stegmann GmbH 2001. All rights reserved.
The products are as specified in the data sheet. This product information contains no assurance of properties for use.
We reserve the right to alter delivery options and technical details.

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