SICK | STEGMANN

Motor Feedback system for servomotors SinCos® SCS-KIT 101 (HIPERFACE® compatible)

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List of contents

* For HIPERFACE® detailed information, see product information 910 990 103 445

Highlights

- **1024 sine/cosine periods per revolution**
- **Absolute position with a resolution of 32768 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)**
- **Only *one* mechanical interface for low-end and high-end applications**

1. HIPERFACE® High Performance Interface

The universal interface for electric drives

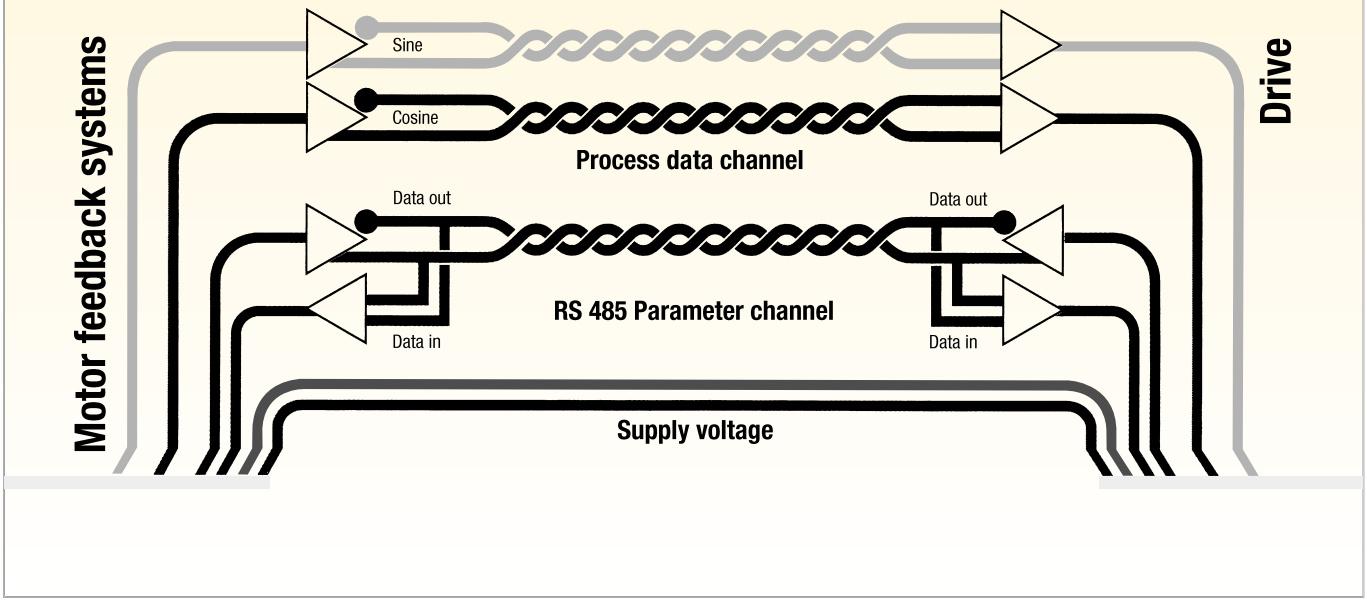
Depending on their design and application, electric drives need the following information from corresponding signal transmitters in the control loop:

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

All this information can be transferred via HIPERFACE®.

Technical innovation for 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 in compatible form in terms of their mechanical and electrical interface.
Electrical compatibilitiy is guaranteed in respect of all physical parameters 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 (automatic initialization).

2. System description

SinCos® - The new dimension in motor feedback systems

The design 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 install the device in the servomotor. This requires a wide temperature range and extremely high noise immunity.
- 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 up to 9000 revolutions/minute.
- It must be possible electronically assign an absolute positional value to any mechanical shaft position.
- It must be possible to electronically assign an absolute positional value to any mechanical shaft position.
- The interface to the controller should be such that, apart from the actual measured angle values, other information such as motor characteristics and logistic information can be read and stored.

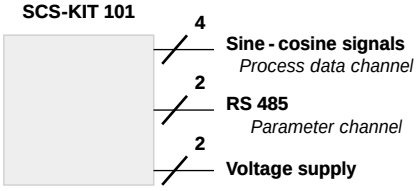
The novel features

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 incremental output signals.

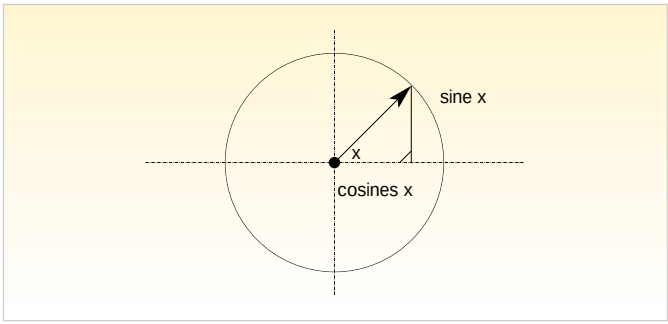
In order to attain a high resolution whilst ensuring suitability of the encoder to high speed applications, the incremental encoder signal is not transmitted as digital values, as is usual, but as an analogue sine/cosine voltage. With 1024 cycles per revolution, even at a speed of 6,000 rev/min the frequency produced is only 102.4 KHz, which can then be transmitted without difficulty, even over great distances.



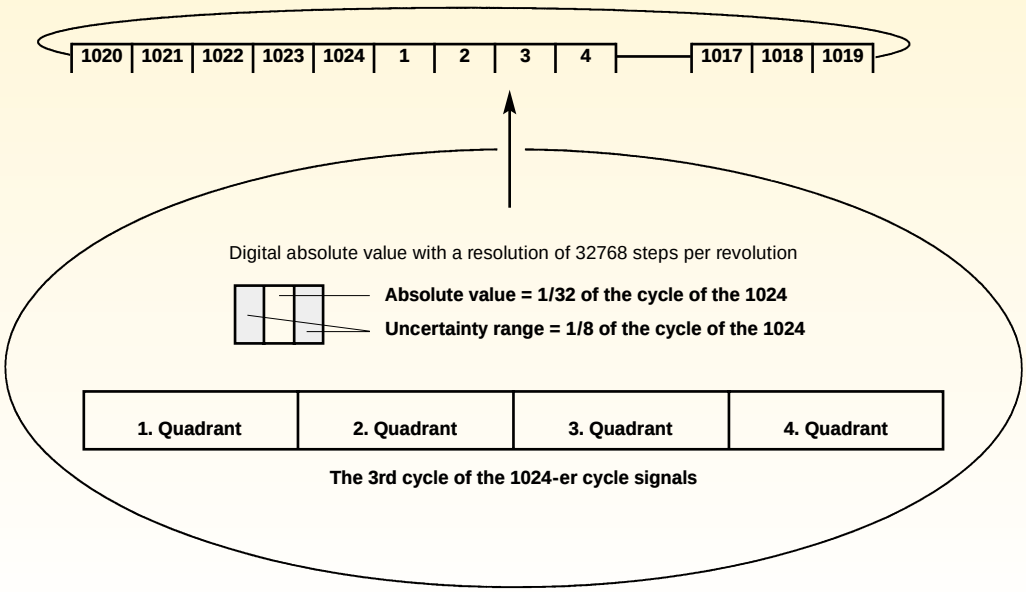
System description

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 1024 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 one cycle of the 1024 cycle is not performed by the SinCos® encoder but must be performed externally - in the motor drive or position control system.



The digital absolute-value information and its correlation with the respective cycle of 1024



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3. Technical data and characteristics to DIN 32 878

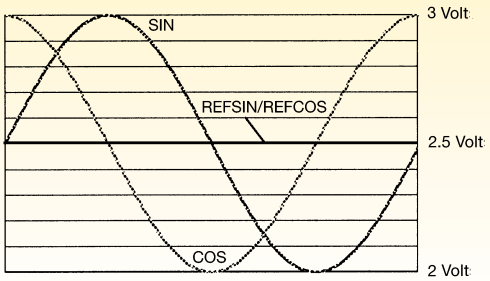
			Units
Number of sine/cosine cycles per revolution		1024	
Dimensions		see drawing	mm
Mass of the sensor block		0.2	kg
Mass of the code disc			
CS 25 SC		29	g
CS 35 SC		32	g
CS 45 SC		40	g
CS 53 SC		46	g
Moment of inertia of the code disc			
CS 25 SC		160	g/cm^2
CS 35 SC		197	g/cm^2
CS 45 SC		297	g/cm^2
CS 53 SC		390	g/cm^2
Tightening torque for the code disc set screws		20 ... 50	Ncm
Code type for the absolute value		binary	
Code direction with clockwise shaft rotation as viewed in direction »A« (see dimensional drawing)		increasing	
Measuring step after forming the arctan with 12 bit resolution		0.3	Seconds of arc
Number of steps per revolution (digital absolute value via RS 485)		32768	
Limits of error of the digital absolute value via RS 485 *		± 320	Seconds of arc
Error limits in the evaluation of the 1034-cycle signals, integral non-linearity *		± 180	Seconds of arc
Non-linearity within one sine/cosine period, differential non-linearity		± 12	Seconds of arc
Output frequency for sine/cosine signals		0 ... 200	kHz
Working speed up to which the absolute position can be formed reliably		6000	min^{-1}
Operating speed		9000	min^{-1}
Max. angular acceleration		0.2×10^6	rad/s^2
Permissible shaft movement			
- Radial movement	dynamic	± 0.01	mm
- Axial movement	dynamic	± 0.05	mm
Working temperature range		-10 ... +100	°C
Operating temperature range		-20 ... +110	°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		70/10	g/ms
Resistance to vibration when assembled, to DIN IEC 68 Part 2-6		10/10 ... 2000	g/Hz
Degree of protection to DIN VDE 0470 Part 1 when assembled		IP 00	
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		< 110	mA
Available storage area in EEPROM		128	Byte
Interface signals			
SIN, REFSIN, COS, REFCOS = *Process data channel*		analogue, differential	
RS 485 = *Parameter channel*		digital	

* with a maximum runout of the code tracks of 0.06 mm (see drawing on page 11)

4. Signal specification

Signal specification of the process data channel

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



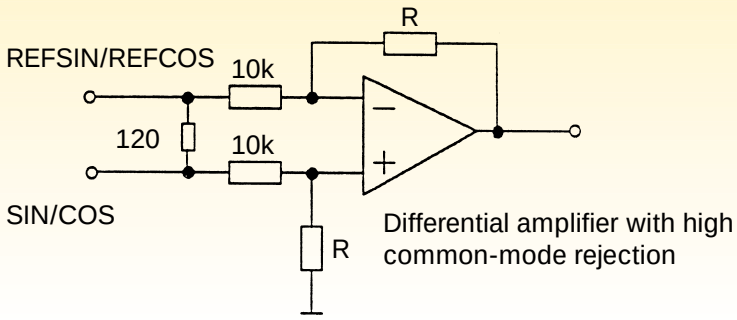
1 cycle = 360° : 1024

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.

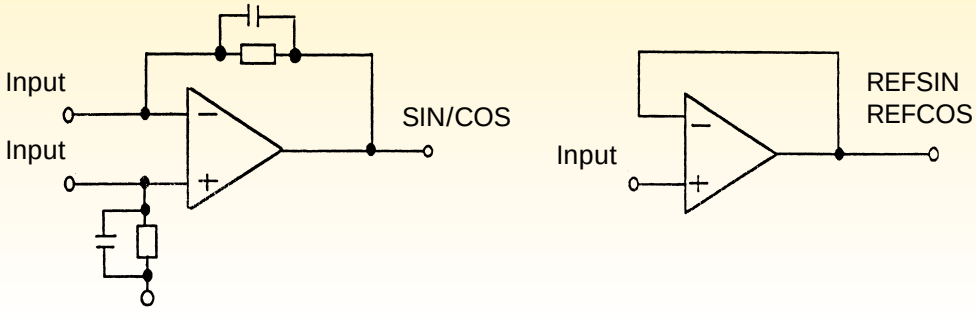
A sophisticated proven technique ensures that the amplitude of the analogue signals over the full range of specified environmental conditions varies by a maximum of only 20%.

Valid characteristic values for all specified environmental conditions		Units
SIN, COS peak - peak signal Vp-t-p	0.8 ... 1.1	V
Signal offset REFSIN, REFCOS	2.2 ... 2.8	V

Recommended receiver circuit for the sine and cosine signals

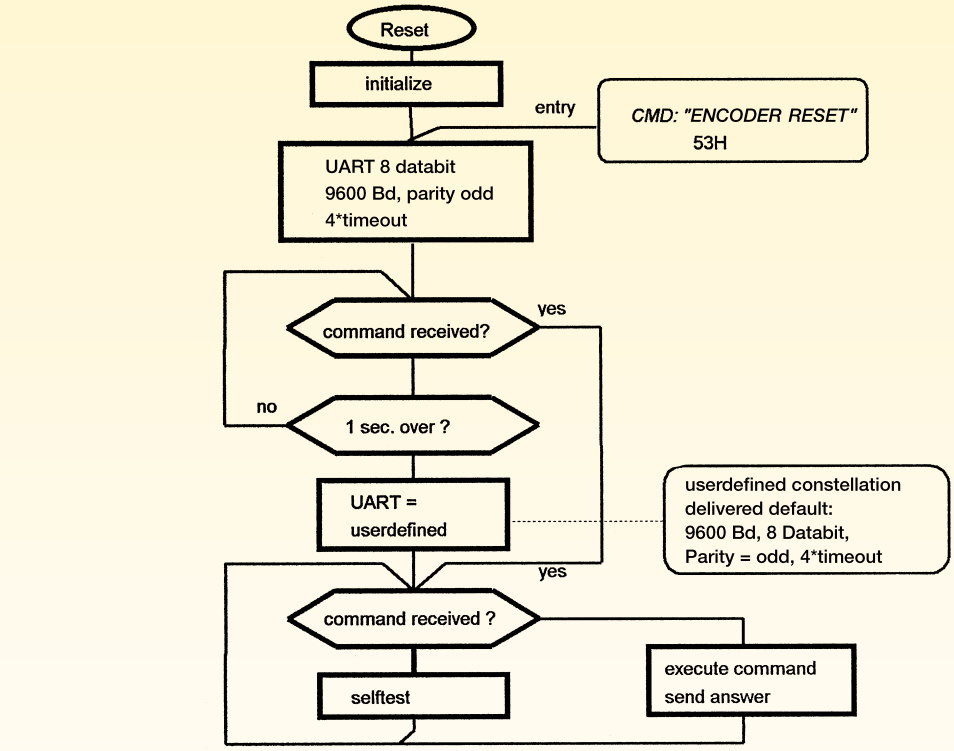


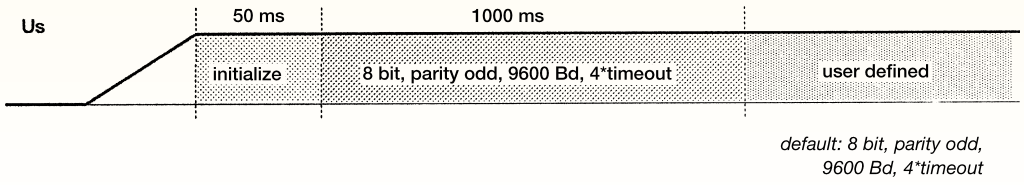
The output circuit of the process data channel in the SinCos® SCS-KIT



5. Restart

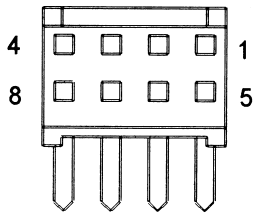
The default baud rate and definition of the parity are restored by performing an *ENCODER RESET (53H)* or by switching the encoder off and on again.





default: 8 bit, parity odd,
*9600 Bd, 4*timeout*

6. Pin allocation



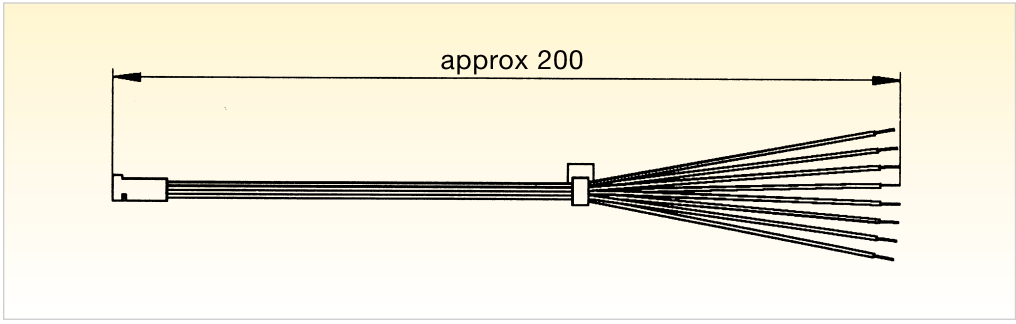
Viewed from
wireing side

PIN	Colour of the stran-ded cable	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	

Stranded cable

Article number
046 029 000 320

The stranded cable with Berg-Dubox-connection 2 x 4 is not included in the scope of delivery. Please order separately.



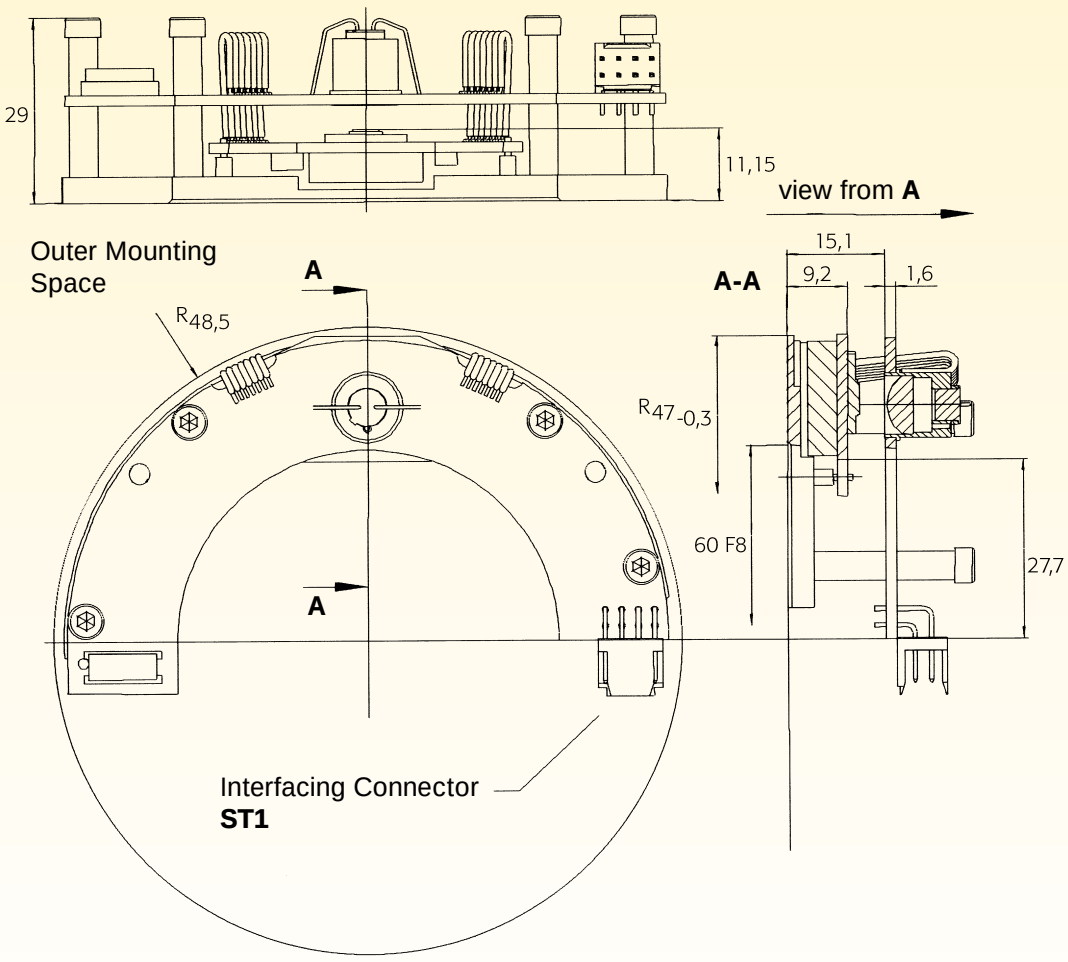
7. Ordering information, scope of delivery

Shaft diameter	KIT	Code disk	Sensor block
25	SCS-KIT 101-25	CS 25 SC	SB 101 SCS
35	SCS-KIT 101-35	CS 35 SC	
45	SCS-KIT 101-45	CS 45 SC	
53	SCS-KIT 101-53	CS 53 SC	

Scope of delivery:
Sensor block, code disk, mounting screws, test report, pin allocation
2 Distance blocks Art.-No. 022 500 004 330 (not included in the scope of supply)
are required for concentric mounting the sensor block.

8. Dimensions – Sensor block

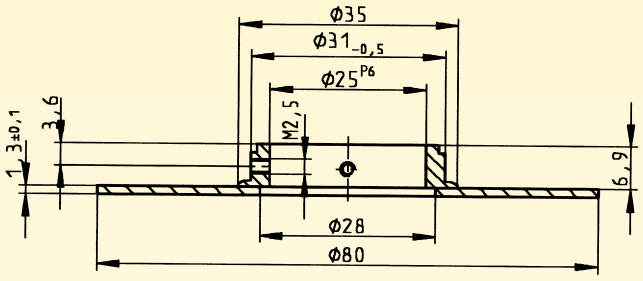
Sensor block SB-101-SCS



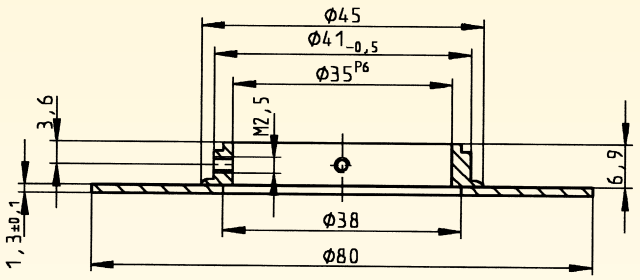
general tolerances according DIN ISO 2768-mK

9. Dimensions – Code disc with hub

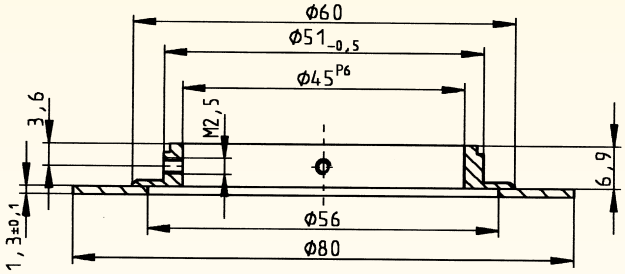
CS 25 SC



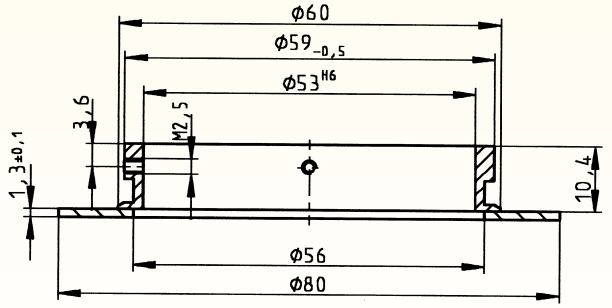
CS 35 SC



CS 45 SC



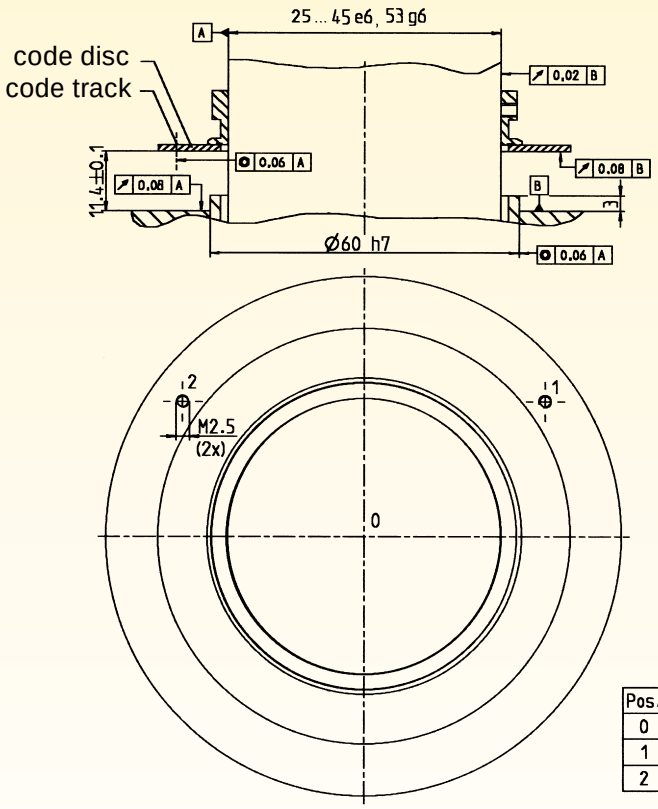
CS 53 SC



Material of the hub X12CrMoS17 No. 1.4104 general tolerances according DIN ISO 2768-mK

10. Recommended mounting arrangement

Mounting requirements



Pos.	X±0,05	Y±0,05
0	0.000	0.000
1	35.218	25.957
2	-35.218	25.957

general tolerances according DIN ISO 2768-mK

Notes

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