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Our Competence in the Business Segments

Factory automation

With its intelligent sensors, safety systems, and auto identification solutions, SICK offers comprehensive solutions for factory automation.

- Non-contact detecting, counting, classifying, and positioning of any type of object
- Accident protection and personal safety using sensors, as well as safety software and services

Logistics automation

Solutions from SICK automate material flows and optimize sorting and warehousing processes.

- Automated identification with bar code reading devices for the purpose of sorting and target control in industrial material flow
- Detecting volume, position, and contours of objects and surroundings with laser measurement systems

Process automation

Analyzers and process instrumentation from SICK provide the best possible acquisition of environmental and process data.

- Complete system solutions for gas analysis, dust measurement, flow rate measurement, water analysis, liquid analysis, and level measurement as well as other tasks

SICK
Sensor Intelligence.

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SICK

Encoders and Motor Feedback Systems

CATALOG

Encoders and Motor Feedback Systems

Incremental and Absolute Rotary Encoders
Non-Contact and Wire-Draw Linear Encoders
Linear and Incremental Motor Feedback Systems

SICK
Sensor Intelligence.

Contents

Introduction

Incremental Encoders

Absolute Encoders

Leadership

SICK is a technological and market leader in sensing technology. With our headquarters in southwest Germany and more than 5,000 employees in almost 50 subsidiaries, numerous representatives and holdings, we have a worldwide presence – and have had for many decades.

Innovation

SICK innovations have been continuously setting worldwide standards in sensor intelligence since 1946. Today, we are the technological market leader and continue to be the driver for breakthrough innovations in the industrial sensor market.

Independence

SICK is large enough to be independent – but still flexible enough to react quickly. As a result, we can concentrate on the development of the products the market needs.

SICK solutions strive to enhance your quality and productivity.

SICK develops products and solutions that generate sustainable benefits for customer applications by enhancing their productivity and quality. Our products and solutions deliver superior sensing performance, resulting in fewer errors in production processes. Additionally, our safety products help to avoid accidents and increase safety, while maintaining productivity.

SICK is focused on the right solution for you!

The combination of our broad product portfolio and knowledge of our customers' business and application needs results in best-fit solutions. Customers come to understand that SICK products and solutions bring lowest life cycle costs and ensure minimum down-time. Ultimately, we are focused on providing added value for our customers and guarantee a safe investment through a sustainable future and continuity in our product lines.

Openness

SICK embraces an open connectivity philosophy that enables our products and solutions to be integrated into all machinery, regardless of platform.

Factory automation

- Non-contact detecting, counting, classifying and positioning of any type of object
- Detection of shape, position and surface differences
- Accident protection and personal safety using sensors, safety software and services

Logistics automation

- Automated identification with barcode and RFID reading devices for sorting and target control in industrial material flow
- Detecting volume, position and contours of objects and surroundings with laser measurement systems

Rotary Encoders

Angle, position, revolutions: encoders are unbeatable, where accurate position determination is required.

- Incremental Encoders
- Absolute Encoders Singleturn and Multiturn

With customer-oriented products, SICK-STEGMANN has been an indispensable partner in industry for more than five decades. Complex, high-tech Encoders and Motor Feedback Systems meet customer requirements in the best ways possible.

Benefit from our extensive know-how in many different applications: for speed and position measurement in electric drive technoogy, with maximum precision.

Linear Encoders

High-resolution position measurement systems for linear applications. Non-contact length measurement systems for measured lengths up to 1,700 m (depending on the version) and Wire Draw Encoders for measured lengths up to 50 m supply position data reliably even under the harshest operating conditions.

- Wire Draw Encoders, Absolute/Incremental
- Non-Contact Linear Encoders

Motor Feedback Systems

Motor Feedback Systems with HIPERFACE® interface are used by renowned motor manufacturers throughout the world: in servo motors, for self- and force-ventilated drives, in hollow shaft and asynchronous motors.

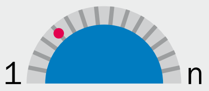
- Incremental Motor Feedback Systems
- Motor Feedback Systems with HIPERFACE® Singleturn/Multiturn
- Linear Motor Feedback Systems with HIPERFACE®

Incremental, Absolute, Linear…
Which encoder is right for your application?

Often the differences between two encoders seem to be small. This guide will help you find these differences quickly and easily, enabling you to choose the right encoder product family.

What is the difference between …?

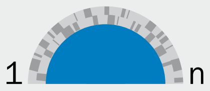
Incremental



- Counts pulses from 1 to n
- Reference run (zero pulse) necessary to obtain absolute position value
- The number of pulses defines the resolution

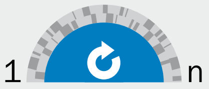
and

Absolute



- Measures the absolute position from 1 to n
- Every measuring step is defined by a unique (absolute) code pattern
- The number of steps defines the resolution

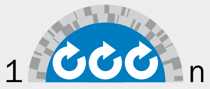
Absolute Singleturn



- Variant of an Absolute Encoder
- Measures the absolute position from 1 to n within one revolution

and

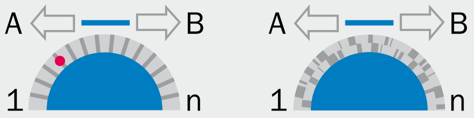
Absolute Multiturn



- Variant of an Absolute Encoder
- Measures the absolute position from 1 to n within one revolution
- In addition, measures the number of revolutions

And between …?

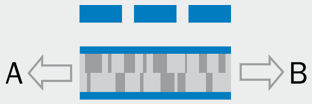
Wire Draw Encoders



- Measures lengths between A and B
- Consists of a Rotary Encoder and a wire draw mechanism
- The wire is mounted to the moving part
- The encoder is fixed

and

Linear Encoders



- Measures lengths between A and B
- Consists of read head and scale
- The read head is mounted to the moving part
- The scale is fixed

What should be measured?
Angle, speed, velocity or distance?

From speed monitoring to tracking products on a conveyor, SICK helps you select an encoder based on the parameters that need to be measured.

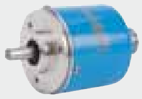
Angle, Speed or Velocity = Rotary Encoders

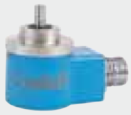
See Incremental Encoder Selection Guide on pages 15-18.
See Absolute Encoder Selection Guide on pages 129-131.

Incremental Encoders

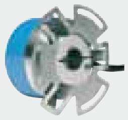
DFS60

DRS60/61


DRS25/26

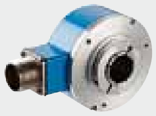

DRS20/21

DGS20/25


DGS21/22

DKS40

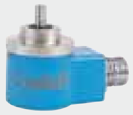
DKV60


DGS34/35

Absolute Singleturn Encoders

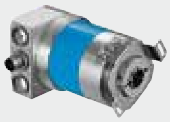
AFS60

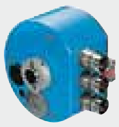
ARS60


ARS20/25

Absolute Multiturn Encoders

AFM60


ATM60


ATM90

SRM64/50 + fieldbus module

SKM36 + fieldbus module

Distance = Linear Encoders

See Linear Encoder Selection Guide on pages 228-229.

Incremental Wire Draw Encoders

PKS

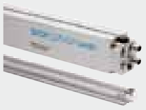
PRF

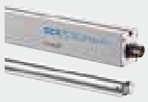
Absolute Wire Draw Encoders

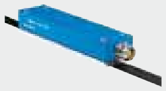
BKS/XKS

BTF

Linear Encoders with Scale


KH53


KH53 A


L230

Key to Technology Icons

Rotary Encoders

Incremental Encoders

Absolute Encoders Singleturn

Absolute Encoders Multiturn

Linear Encoders

Absolute Wire Draw Encoders

Incremental Wire Draw Encoders

Non-Contact Linear Encoders

Adapter

HIPERFACE® by SICK | STEGMANN

Interface Adapter Modules for the following interfaces

SSI SYNCHRON SERIELLES INTERFACE

PROFI® PROCESS FIELD BUS BUS

DeviceNet™

CANopen

Motor Feedback Systems

Incremental Motor Feedback Systems

Motor Feedback Systems with HIPERFACE® Singleturn/Multiturn

Linear Motor Feedback Systems with HIPERFACE®

Rotary Encoders

Rotary Encoders

Incremental Encoders

Product Datasheets

Heavy Duty Encoders

Industrial Duty Encoders

Light Duty Encoders

Special Purpose Encoders

Wheeled Encoders

Absolute Encoders

Product Datasheets

Incremental Encoders

Use an incremental encoder when retention of absolute position upon power loss is not required.

Basic Operation of Optical Rotary Incremental Encoders

Incremental encoders have five main components:

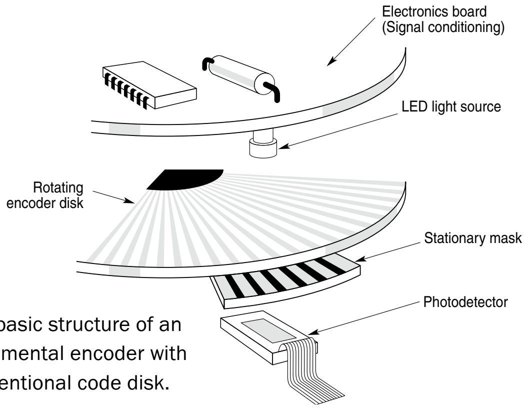
- LED light source
- Rotating code disk
- Stationary mask
- Photodetector(s)
- Amplifying/squaring electronics

As the code disk rotates in front of the stationary mask, it shutters light from the LED. The light that passes through the mask is received by the photodetector, which produces pulses in the form of a quasi-sine wave. The encoder electronics convert the sine wave into a square signal, ready for transmission to a counter. Application examples include velocity control and simple point-to-point applications.

Conventional Code Disks

Conventional incremental code disks contain a fixed number of equally spaced opaque lines that produce a corresponding number of pulses per revolution (PPR). Each line count requires a unique code disk. The position and spacing of the lines on the disk requires a high degree of precision. Physical limitations determine the maximum number of lines that can be created on a code disk of a given size.

However, using new technology, our new DFS family will allow up to 65,536 lines and certain versions of the encoder will allow the customer to program it and reprogram it to various line counts, as needed.



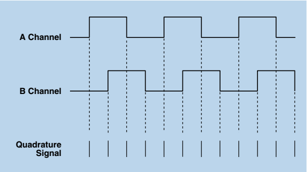
The basic structure of an incremental encoder with conventional code disk.

Tachometer Encoders

A single channel (e.g. A) incremental encoder, or tachometer, is used in systems that operate in only one direction and require simple velocity information. Velocity can be determined from the time interval between pulses, or by the number of pulses within a given time period.

Quadrature Encoders

Quadrature encoders have dual channels, A and B, which are electrically phased 90° apart. Thus, direction of rotation can be determined by monitoring the phase relationship between the two channels. In addition, with a dual-channel encoder, a four times multiplication of resolution can be achieved by externally counting the rising and falling edges of each channel (A and B). For example, an encoder that produces 2,500 pulses per revolution can generate 10,000 counts after quadrature.

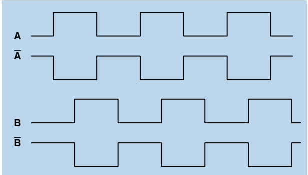


Differential Outputs

Correct position information can depend on eliminating false signals caused by external electrical noise. An encoder with complemented outputs, in combination with a control that uses differential operational-amplifiers, can minimize noise problems. When channel A goes high, its complement channel A goes low. Electrical noise will affect both channels in the same way, and can thus be ignored by the differential op-amps.

Marker Pulse

The zero, or marker pulse is a rectangular pulse that is transmitted once per revolution. It is used as a reference to a defined mechanical position, mainly during commissioning or start-up after power loss. With our CoreTech series, this can be set by a pushbutton or by applying a signal wire.

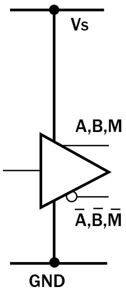


Bandwidth Considerations

Encoder resolution and shaft speed determine the frequency of the output signals. Careful consideration of the application requirements and the encoder capabilities is required.

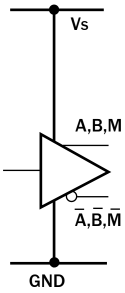
Electronic Interface Options

3487
LINE DRIVER
V_s=5V



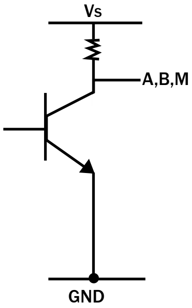
The 3487 RS422 driver has 5V supply and supplies a TTL output.

7272
LINE DRIVER
V_s=8-24V



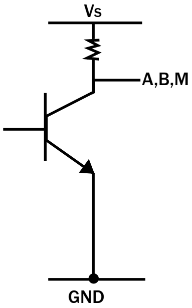
The 7272 line driver can sink or source 40 mA. It has both PNP and NPN transistors on the IC.

7406
OPEN COLLECTOR
V_s=8-24V



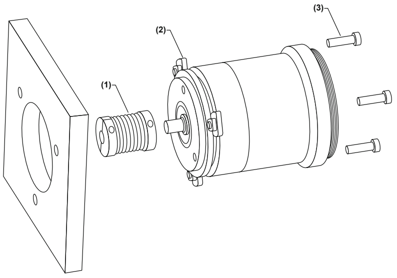
The 7406 line driver can sink 40 mA. It has an NPN transistor on board the IC.

7273
OPEN COLLECTOR
V_s=8-24V

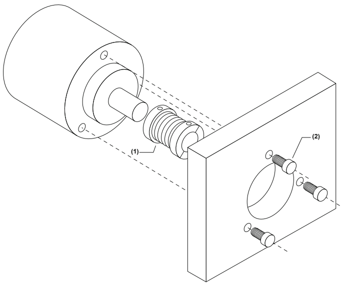


The 7273 is similar to the 7406 and can sink 40 mA of current.

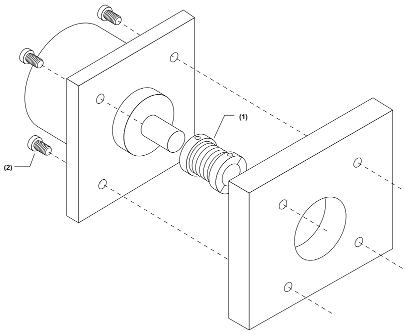
Mechanical Interface Options



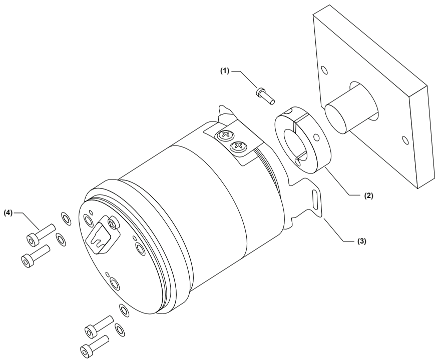
Mounting of encoders with servo mount



Mounting of encoders with face mount flange

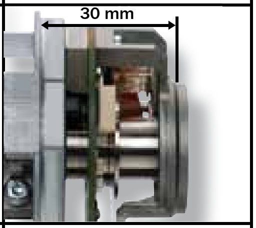
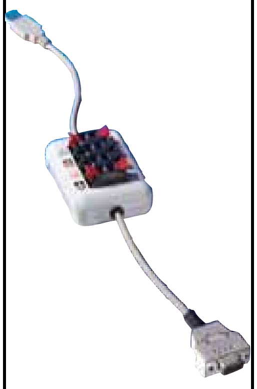


Mounting of encoders with square flange



Mounting of encoders with blind or through hollow shaft

Advantages of Using DFS Encoders Versus Conventional Encoders

	Conventional Encoders	The DFS Solution	
Limited Pulses Per Revolution	Many industrial applications require a higher line count than has been available with traditional incremental encoders. In the past, there were several ways to increase resolution: quadrature, interpolation, or using a larger encoder.	The DFS has a completely new ASIC design, which provides 1 to 65,536 pulses per revolution, and up to 262,144 counts after quadrature; significantly increasing resolution available in incremental encoders.	
Shock, Vibration & Temperature Limitations	The rotating discs used in encoders are typically glass or plastic. Glass discs can shatter when exposed to excessive vibration or shock. Plastic discs, while they won't shatter, cannot achieve the same level of accuracy as glass discs. Additionally, they are limited to a lower working temperature, rendering them unsuitable for the temperature tolerances often required in harsh environments.	The DFS encoder features a nickel code disc designed both for increased robustness and a higher temperature tolerance (-20... +100 °C).	
Bearing Lifetime and Run Out	The life of an encoder bearing can be shortened by several factors: high shaft loads, high speeds of rotation, and shaft misalignment. Once a bearing fails, the encoder needs to be replaced.	The loads on the bearings have been greatly reduced on the DFS due to the 30 mm distance between the bearings. This greater bearing distance also decreases vibration of the encoder, which helps extend the life of the bearings.	
Programmability	Typical encoders are shipped by the manufacturer with the customers' desired line count, pulse and electrical interface preset and unchangeable. This means that if customers need several encoders with various line counts and/or electrical interfaces, they will need to have several encoders for backup in inventory.	The programmable versions of the DFS allow the user to program the encoder to the line count desired and reprogram it, as needed. Additionally, zero set and electrical interface (to either TTL or HTL) can be programmed, which is very unique to DFS encoders. A simple programming tool connected to a PC with a USB cable is used for all programming functions.	
Axial and Radial Cable Outlets	Currently, when users require cable outlets for their encoders, they have the choice of a radial or axial outlet. It is possible they will need encoders with both in the same environment requiring additional inventory. Also, if the cable is somehow damaged, the encoder has to be returned to the manufacturer who will repair the encoder by replacing the cable.	The DFS encoders are available with a pluggable outlet that can be used in either a radial or axial direction which requires less installation depth. Since it is detachable, if the cable is damaged, no repair is necessary by the manufacturer. The customer can simply order a new cable and plug it into the encoder. Various cable lengths and connectors at the end of the cable are also available.	

RoHS
2002/95/EC

Other Features of the DFS

- RoHS compliant
- High frequency response
- IP 65 protection class
- Excellent concentricity
- High shaft loading
- High operating speed
- Programmable versions come with diagnostic function that reads shaft position

Incremental Encoders Selection Guide

DFS60 Incremental Encoders

The DFS60 line offers a complete range of high resolution, freely programmable incremental encoders that can be programmed to accommodate any value from 1 to 65,536 pulses per revolution (PPR). The DFS60 also offers output voltage and zero set position programming through the software interface. The DFS60 has an operating temperature range up to 100° C.

DFS60
Heavy Duty Incremental Encoders

Incremental Encoders

	DFS 60	DFS 60	DFS 60
	Blind Hollow Shaft	Through Hollow Shaft	Heavy Duty Solid Shaft
Resolution	1...65,536 ppr	1...65,536 ppr	1...65,536 ppr
Diameter Size	60 mm	60 mm	60 mm
Interface	TTL/RS 422, HTL	TTL/RS 422, HTL	TTL/RS 422, HTL
Supply Voltage	5 V or 10...32 V	5 V or 10...32 V	5 V or 10...32 V
Shaft Size/Bore	0.375 in, 0.5 in, or 10, 12, 14 and 15 mm	0.375 in, 0.5 in, or 10, 12, 14 and 15 mm	6 mm or 10 mm
Mounting	Integral flex mount	Integral flex mount	Servo mount or face mount
Protection Class	IP 65	IP 65	IP 65
Electrical Connections	M23 or M12 connectors; shielded cable	M23 or M12 connectors; shielded cable	M23 or M12 connectors; shielded cable
Optional Customer Programmability	Pulses per revolution, zero pulse set & electrical interface	Pulses per revolution, zero pluse set & electrical interface	Pulses per revolution, zero pulse set & electrical interface
RoHS Compliance	Yes	Yes	Yes

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Incremental Encoders Selection Guide

DRS Incremental Encoders

The DRS line of encoders combines user-defined resolutions and simple set up, enabling the user to create custom resolutions at the click of a mouse button. This encoder line contains CoreTech®, an unprecedented blend of custom-designed OPTO-ASIC technology and a modular mechanical concept. Customers can choose from a large variety of encoders with different mechanical interfaces, housing styles, resolutions and electronic features.

	Incremental Encoders Featuring CoreTech — Solid Shaft			Hub/Hollow Shaft
	DRS 20	**DRS 25**	**DRS 60/DRS 61**	**DRS 60/DRS 61 CoreTech®**
	DRS 21*	**DRS 26***	**DRS 61***	**DRS 61***
Resolution	1...8,192 ppr	1...8,192 ppr	1...8,192 ppr	1...8,192 ppr
Diameter Size	2.0 in	2.5 in	60 mm	60 mm
Interface	Differential line drivers	Differential line drivers	Differential line driver or push-pull	TTL/RS 422, HTL push-pull
Supply Voltage	5 V or 8...24 V	5 V or 8...24 V	5 V or 10...32 V	5 V or 10...32 V
Shaft Size/Bore	0.25 in, 0.375 in or 10 mm	0.25 in, 0.375 in or 10 mm	6 mm or 10 mm	15 mm hub shaft or 14 mm hollow shaft with collets for 6, 8, 10 or 12 mm and 0.25, 0.375 or 0.5 in
Mounting	Square flange or servo mount with face holes	Square flange or servo mount with face holes	Servo mount or face mount	Integral flex mount
Protection Class	IP 66	IP 66	IP 66	IP 66
Electrical Connections	6, 7 or 10-pin MS connector; shielded cable	6, 7 or 10-pin MS connector; shielded cable	MS23 12-pin connector; shielded cable	MS23 12-pin connector; shielded cable
Customer Programmability	N/A	N/A	Pulses per revolution and zero pulse (available only on the DRS 61)	Pulses per revolution and zero pulse (available only on the DRS 61)
RoHS Compliance	Yes	Yes	Yes	No

*Customer programmable versions

DGS Incremental Encoders

The DGS family of heavy duty incremental encoders are built using traditional code disk technology. They are built to last under tough environmental conditions.

	Incremental Encoders — Solid Shaft		Hub/Hollow Shaft	
	DGS 20	**DGS 25**	**DGS 21/DGS 22**	**DGS 35/DGS 34**
Resolution	1...3,000 ppr	1...5,000 ppr	1...2,500 ppr	120...16,384 ppr
Diameter Size	2.0 in	2.5 in	2.0 in	3.5 in
Interface	Differential line drivers or open collector	Differential line drivers or open collector	Differential line driver or open collector	Differential line driver or open collector
Supply Voltage	5 V or 8...24 V	5 V or 8...24 V	5 V or 8...24 V	5 V, 5...15 V or 8...24 V
Shaft Size/Bore	0.25 in, 0.375 in or 10 mm	0.25 in, 0.375 in or 10 mm	0.375 or 0.5 in	1 in or 30 mm with collets for 0.5, 0.625, 0.75 and 0.875 in
Mounting	Square flange or servo mount with face holes	Square flange or servo mount with face holes	Integral flex mount	Tether arm or anti-rotational pin
Protection Class	IP 66	IP 66	IP 50	IP 66
Electrical Connections	6, 7 or 10-pin MS connector; shielded cable	6, 7 or 10-pin MS connector; shielded cable	Shielded cable	10-pin MS connector; shielded cable
RoHS Compliance	Yes	Yes	Yes	Yes

Incremental Encoders Selection Guide

Light Duty Incremental Encoders

	Light Duty Encoders			
	DDS36X-B/S	**DDS50X-S**	**LD 20**	**DKS 40**
Resolution	100...3,600 ppr	100...2,500 ppr	10...2,500 ppr	1...1,024 ppr
Diameter Size	36 mm	50 mm, 2.0 in	2.0 in	40 mm
Interface	TTL/RS422, HTL push-pull or open collector NPN	TTL/RS422, HTL push-pull or open collector NPN	Differential line driver or open collector	TTL/RS 422, HTL push-pull or open collector
Supply Voltage	5 V or 7...24 V	5 V or 7...24 V	5 V or 8...24 V	5 V or 10...30 V
Shaft Size/Bore	8 mm hub shaft, 6 mm solid shaft	8 mm solid shaft	0.25 in	8 mm
Mounting	Integral flex mount for hub, face mount for shafted version	Face mount	Face mount	Face mount flange, servo flange
Protection Class	IP 65	IP 65	IP 50	IP 64
Electrical Connections	Shielded cable	Shielded cable	Shielded cable	Shielded cable
RoHS Compliance	No	No	Yes	No

Special Purpose Incremental Encoders

	Special Purpose Encoders		Wheeled Encoders		
	HD 32	**HD 52**	**DKV 60 Measuring Wheel**	**DGV 31 Measuring Wheel**	**DFV 60 Measuring Wheel**
Resolution	10...2,500 ppr	10...2,500 ppr	1...2,048 ppr	1...3,000 ppr	1...65,536 ppr•
Diameter Size	3.25 in cube	3.25 in x 3.25 in x 5.7 in long	60 mm	12 in wheel circumference	300 mm wheel circumference
Interface	Differential line driver or open collector	Differential line driver or open collector	TTL/RS 422, HTL push-pull	TTL/RS422, HTL push-pull or open collector	TTL/RS422, HTL push-pull
Supply Voltage	5 V or 8...24 V	5 V or 8...24 V	5 V or 10...30 V	5 V or 8...24 V	5...30 V
Shaft Size/Bore	0.375 in single or double ended	0.375 in or 0.625 in	N/A	N/A	N/A
Mounting	Foot mount or face mount	Face mount	Wheeled encoder	Wheeled encoder with spring mount	Wheeled encoder
Protection Class	IP 65	IP 66	IP 65	IP 60	IP 65
Electrical Connections	6 or 10-pin MS connector	7 or 14-pin MS connector	Shielded cable	3 or 6-pin MS connector M12 4 pin, shielded cable	M12 8 pin
RoHS Compliance	Yes	Yes	No	No	Yes

• Customer Programmable versions

DGS 20, DGS 25, DGS 21/22 and DGS 35/34: Incremental Encoders for rough environmental conditions

Number of lines
1 to 16,384
Incremental Encoder

Incremental encoders in the DGS series are in use world-wide under the toughest environmental conditions.
The rugged construction – up to IP 67 degree protection – and the individual adaptation of the design to the requirements of the user are the outstanding features of this series.
Resolutions up to 16,384 lines are available.

Select your individual encoder!
Possible product variations:
1/4” and 3/8” in solid shafts with square flange or servo mount, through or blind hollow shafts with connector or cable outlet, TTL or HTL interface.

Thanks to this wide variety of products, there are numerous possible uses, for example in:
- machine tools
- textile machines
- woodworking machines
- packaging machines

Number of lines 1 to 3,000

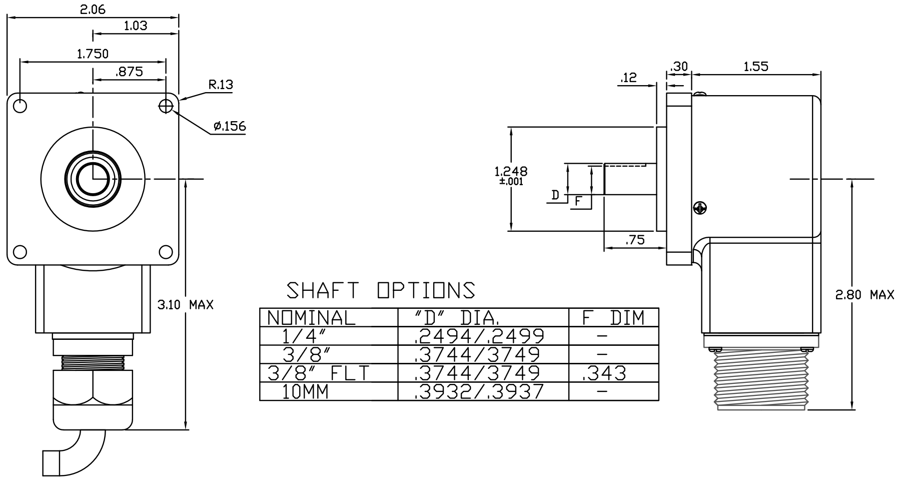
Incremental Encoder

- Square or servo flange
- Connector or cable outlet
- Protection class up to IP66
- Electrical interfaces, line drivers and open collectors

CE

Accessories – see pages 410-448

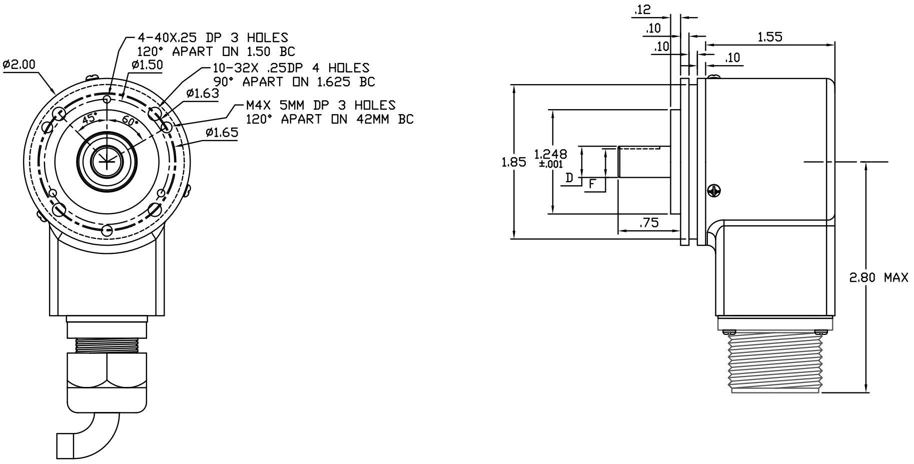
Dimensional drawing



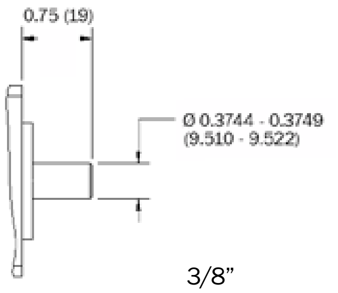
SHAFT OPTIONS

NOMINAL	"D" DIA.	F DIM
1/4"	.2494/.2499	–
3/8"	.3744/3749	–
3/8" FLT	.3744/3749	.343
10MM	.3932/.3937	–

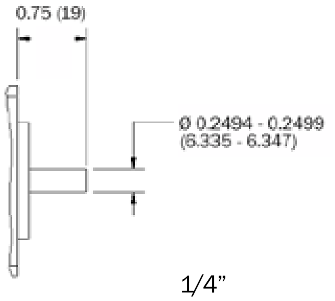
Dimensional drawing mounting options



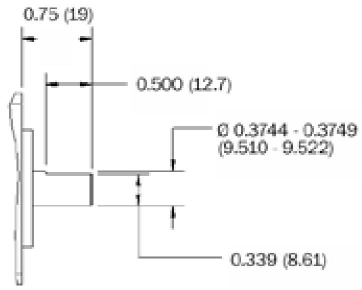
Dimensional drawing shaft options



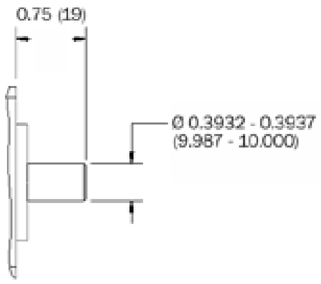
3/8”



1/4”



3/8” w/flat



10 mm

Technical Data	DGS 20
Solid Shaft	1/4”, 3/8”, 10mm
Number of lines (Z) per revolution	00001 to 03000, see order info
Electrical Interface	
+5V in/+5V differential line driver (3487)	
+8…24V in/open collector (7406)	
+8…24V in/8…24V differential line driver (7272)	
+8…24V in/+5V differential line driver (3487)	
Mass [1]	8 oz (0.23 kg)
Moment of inertia of the rotor	2.4 x 10^{-4} oz in sec^2 (16.9 gcm^2)
Measuring step	90°/number of lines
Reference signal	
Number	1
Position	gated 180° nominal
Error limits	45/Z °
Measuring step deviation	45/Z °
Max. output frequency	200 kHz
Max. operating speed [2]	
max shaft loading	3,000 rpm
reduced shaft loading	5,000 rpm
Max. angular acceleration	5-x-10^5 rad/s^2
Start up torque	
with shaft seal	5.0 oz-in (3.5 Ncm)
without shaft seal	1.5 oz-in (1.1 Ncm)
Permissible shaft loading	
radial (at end of shaft)	35 lb (155N)
axial	40 lb (178N)
Bearing lifetime	5.0-x-10^9 revolutions
Working temperature range	0° … + 70 °C
Storage temperature range	-20 … + 85 °C
Permissible relative humidity [3]	90 %
Resistance	
to shocks	50/11 g/ms
to vibration	5/2000 Hz at 20 g
Protection class	IP 66
Operating voltage range	4.75…5.25 V
	8.0…24.0 V
Operating current range at no load	120 mA

[1] For an encoder with connector outlet

[2] At speeds > 3000 rpm the shaft seal must be removed

[3] Condensation not permitted

Heavy Duty Incremental Encoder DGS 20

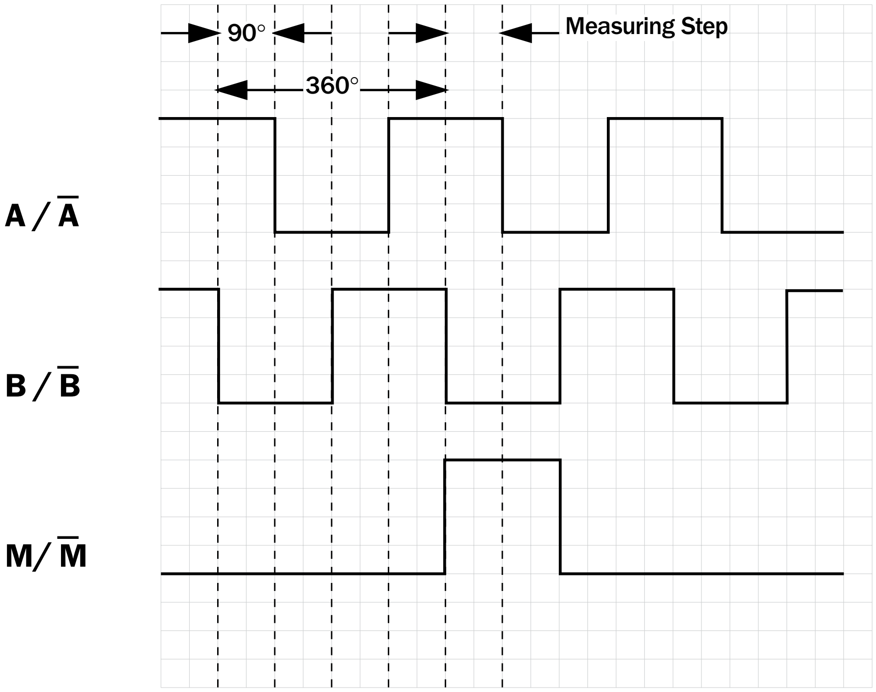
Number of lines
1 to 3,000
Incremental Encoder

- Square or servo flange
- Connector or cable outlet
- Protection class up to IP66
- Electrical interfaces, line drivers and open collectors

CE

Accessories – see pages 410-448

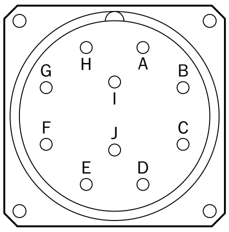
Incremental pulse diagram (clockwise rotation viewed from shaft end)



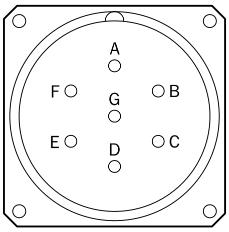
Electrical interfaces

Supply voltage	4.75…5.25V	8.0…24.0V	8.0…24.0V	8.0…24.0V
Interfaces/drivers	5V line driver	5V line driver	8/24V line driver	open collector

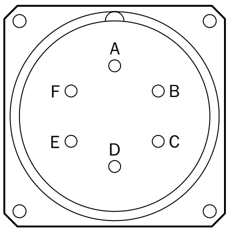
Connection type



10 Pin MS3102R



7 Pin MS3102R



6 Pin MS3102R

PIN and wire allocation

Function	6 pin	7 pin	10 pin1)	Cable1)
A	E	A	A	White
B	D	B	B	Pink
M	C	C	C	Lilac
A not	N/A	N/A	H	Brown
B not	N/A	N/A	I	Black
M not	N/A	N/A	J	Yellow
+Vs	B	D	D	Red
Common	A	F	F	Blue
Case Ground	N/A	G	G	N/A
Shield	N/A	N/A	N/A	Drain wire

1) Anot, Bnot, Mnot are not available with open collector outputs

Order information

Incremental Encoder DGS 20

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**0**	**–**								

Electrical interface	
5 V, 5 V, 3487	= 1
8…24 V, 5 V, 3487	= 3
8…24 V, 8…24 V, 7272	= 5
8…24 V open collector (7406/7273)	= 9

Mechanical interface	
Square Flange, 1/4” shaft	= E
Square Flange, 3/8” shaft	= F
Square Flange, 3/8” shaft with flat	= G
Square Flange, 10 mm shaft	= C
Servo Flange/Face Holes 1/4” shaft	= 5
Servo Flange/Face Holes 3/8” shaft	= 6
Servo Flange/Face Holes 3/8” shaft with flat	= 7
Servo Flange/Face Holes 10 mm shaft	= 8

Connection type	
Radial Cable 1.0 m	= 2
Radial Cable 1.5 m	= K
Radial Cable 3 m	= L
Radial Cable 5 m	= M
Radial Cable 10 m [1]	= N
Radial Connector MS 10-pin	= 4
Radial Connector MS 7-pin	= 5
Radial Connector MS 6-pin	= 6

1) n/a with open-collector

Number of lines
Always five characters in clear text. (see chart)

Number of lines (Z) per revolution							
00001	00060	00150	00300	00720	01200	01500	02400
00005	00064	00180	00360	00800	01250	01600	02500
00010	00080	00200	00400	00900	01260	01800	02540
00020	00100	00250	00500	01000	01280	02000	02750
00030	00120	00254	00512	01024	01472	02048	03000
00050	00128	00256	00600				

Order example: Incremental Encoder DGS 20

5V, 5V, (3487 line driver), 180° marker; square flange; 3/8” shaft; 10 pin, radial; number of steps: 2500

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**0**	**–**	**1**	**F**	**4**	**0**	**2**	**5**	**0**	**0**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**0**	**–**								

Number of lines
1 to 5000

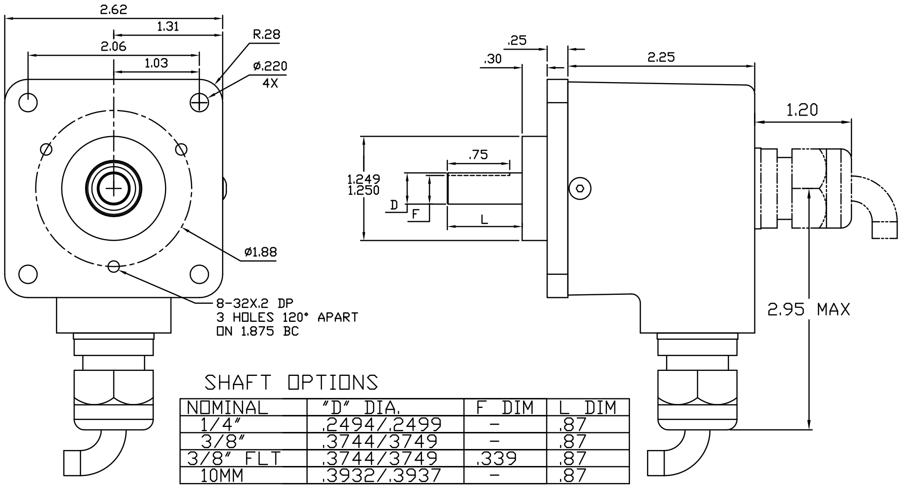
Incremental Encoder

- Square or servo flange
- Connector or cable outlet
- Protection class up to IP66
- Electrical interfaces, line drivers and open collectors

CE

Accessories – see pages 410-448

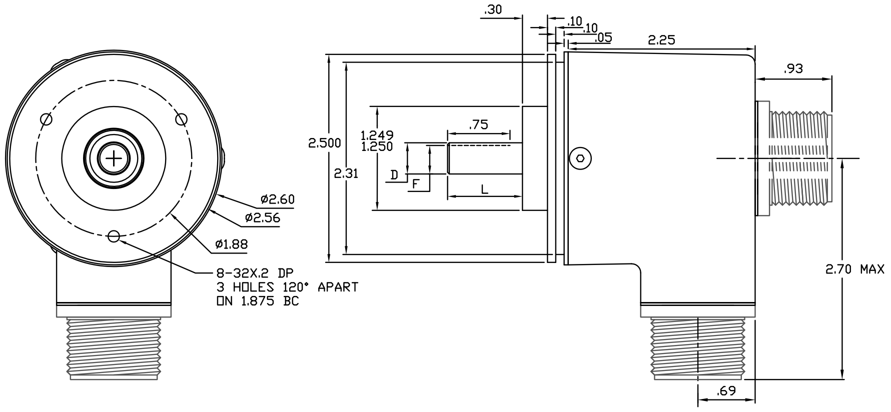
Dimensional drawing square flange mount



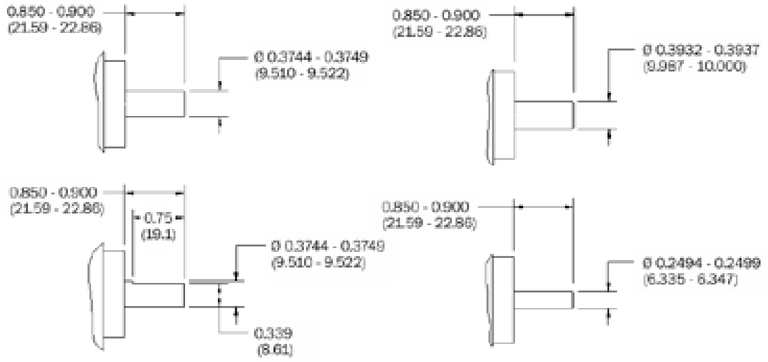
SHAFT OPTIONS

NOMINAL	"D" DIA.	F DIM	L DIM
1/4"	.2494/.2499	–	.87
3/8"	.3744/3749	–	.87
3/8" FLT	.3744/3749	.339	.87
10MM	.3932/.3937	–	.87

Dimensional drawing servo/flange face mount



Dimensional drawing shaft options



Technical Data	DGS 25	
Solid Shaft	1/4", 3/8", 10 mm	▨
Number of lines (Z) per revolution	00001 to 05000, see order info	▨
Electrical Interface		
+5V in/+5V differential line driver (3487)		▨
+8…24V in/open collector (7406)		▨
+8…24V in/8…24V differential line driver (7272)		▨
+8…24V in/+5V differential line driver (3487)		▨
Mass [1]	14 oz (0.40 kg)	▨
Moment of inertia of the rotor	2.4 x 10^{-4} oz in sec^2 (16.9 gcm^2)	
Measuring step	90°/number of lines	▨
Reference signal		
Number	1	▨
Position	gated 180° nominal	▨
Error limits	45/Z °	▨
Measuring step deviation	45/Z °	▨
Max. output frequency	200 kHz	▨
Max. operating speed [2]		
max shaft loading	3,000 rpm	▨
reduced shaft loading	5,000 rpm	▨
Max. angular acceleration	5-x-10^5 rad/s^2	▨
Start up torque		
with shaft seal	5 oz-in (3.5 Ncm)	▨
without shaft seal	1.5 oz-in (1.1 Ncm)	▨
Permissible shaft loading		
radial (at end of shaft)	35 lb (155N)	▨
axial	40 lb (178N)	▨
Bearing lifetime	5.0-x-10^9 revolutions	▨
Working temperature range	0° … + 70 °C	▨
Storage temperature range	-20 … + 85 °C	▨
Permissible relative humidity [3]	90 %	▨
Resistance		
to shocks	50/11 g/ms	▨
to vibration	5/2000 Hz at 20 g	▨
Protection class	IP 66	▨
Operating voltage range	4.75…5.25 V	▨
	8.0…24.0 V	▨
Operating current range at no load	120 mA	▨

[1] For an encoder with connector outlet

[2] At speeds > 3000 rpm the shaft seal must be removed

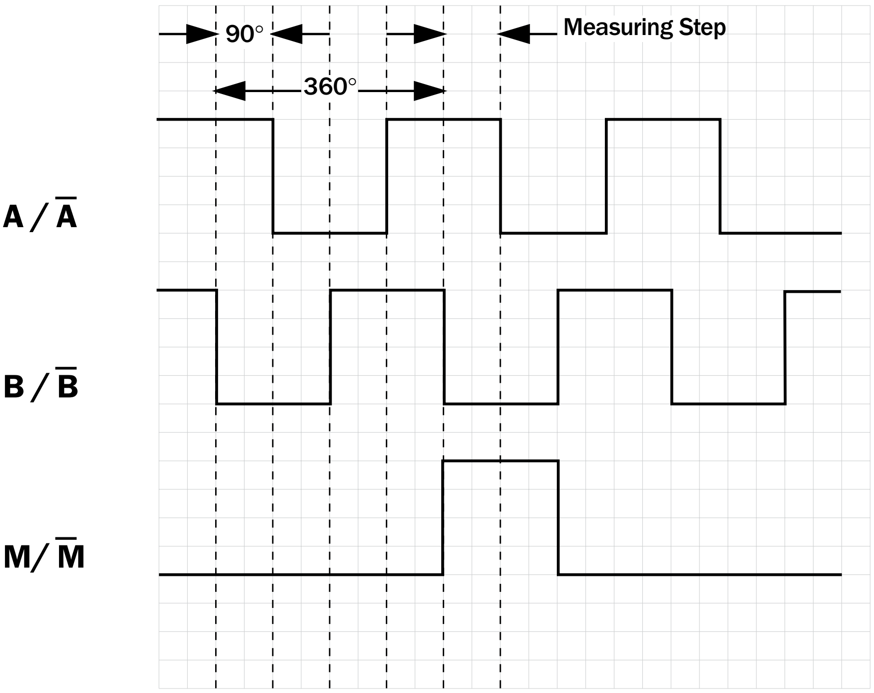
[3] Condensation not permitted

Number of lines
1 to 5000

Incremental Encoder

- Square or servo flange
- Connector or cable outlet
- Protection class up to IP66
- Electrical interfaces, line drivers and open collectors

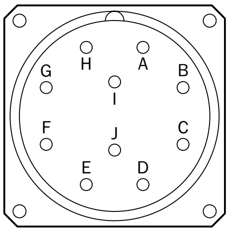
Incremental pulse diagram (clockwise rotation viewed from shaft end)



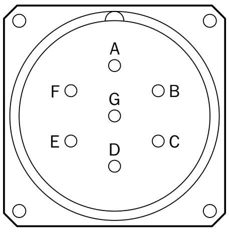
Electrical interfaces

Supply voltage	4.75…5.25V	8.0…24.0V	8.0…24.0V	8.0…24.0V
Interfaces/drivers	5V line driver	5V line driver	8/24V line driver	open collector

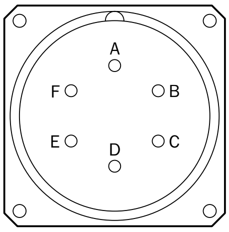
Connection type



10 Pin MS3102R



7 Pin MS3102R



6 Pin MS3102R

PIN and wire allocation

Function	6 pin	7 pin	10 pin[1]	Cable[1]
A	E	A	A	White
B	D	B	B	Pink
M	C	C	C	Lilac
A not	N/A	N/A	H	Brown
B not	N/A	N/A	I	Black
M not	N/A	N/A	J	Yellow
+Vs	B	D	D	Red
Common	A	F	F	Blue
Case Ground	N/A	G	G	N/A
Shield	N/A	N/A	N/A	Drain wire

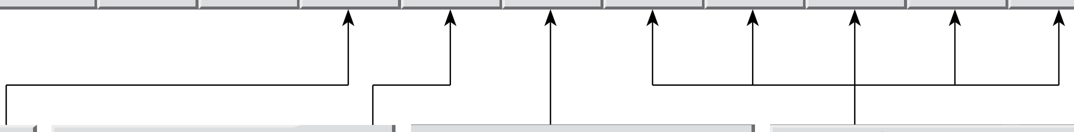
1) Anot, Bnot, Mnot are not available with open collector outputs

Accessories – see pages 410-448

Order information

Incremental Encoder DGS 25, heavy duty

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**5**	**–**								



Electrical interface	
5 V, 5 V, 3487	= 1
8…24 V, 5 V, 3487	= 3
8…24 V, 8…24 V, 7272	= 5
8…24 V open collector (7406/7273)	= 9

Mechanical interface	
Square Flange, 1/4” shaft	= E
Square Flange, 3/8” shaft	= F
Square Flange, 3/8” shaft with flat	= G
Square Flange, 10 mm shaft	= C
Servo Flange/Face Holes 1/4” shaft	= 5
Servo Flange/Face Holes 3/8” shaft	= 6
Servo Flange/Face Holes 3/8” shaft with flat	= 7
Servo Flange/Face Holes 10 mm shaft	= 8

Connection type	
Radial Cable 1.0 m	= 2
Radial Cable 1.5 m	= K
Radial Cable 3 m	= L
Radial Cable 5 m	= M
Radial Cable 10 m1)	= N
Axial Cable 1.0 m	= 3
Axial Cable 1.5 m	= R
Axial Cable 3.0 m	= S
Axial Cable 5.0 m	= T
Axial Cable 10 m1)	= U
Radial Connector MS 10-pin	= 4
Radial Connector MS 7-pin	= 5
Radial Connector MS 6-pin	= 6
Axial Connector MS 10-pin	= 7
Axial Connector MS 7-pin	= 8
Axial Connector MS 6-pin	= 9

1) n/a on open-collector outputs

Number of lines
Always five characters in clear text. (see chart)

Number of lines (Z) per revolution

00001	00064	00200	00400	00900	01280	02048	03600
00005	00080	00250	00500	01000	01472	02400	04000
00010	00100	00254	00512	01024	01500	02500	04096
00020	00120	00256	00600	01200	01600	02540	04500
00030	00128	00300	00720	01250	01800	02750	05000
00050	00150	00360	00800	01260	02000	03000	
00060	00180						

Order example: Incremental Encoder DGS 25

5 V, 5 V (3487 line driver) 180° marker; Square Flange; 3/8” shaft; 10-pin, radial; number of steps 2500

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**5**	**–**	**1**	**F**	**4**	**0**	**2**	**5**	**0**	**0**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**5**	**–**								

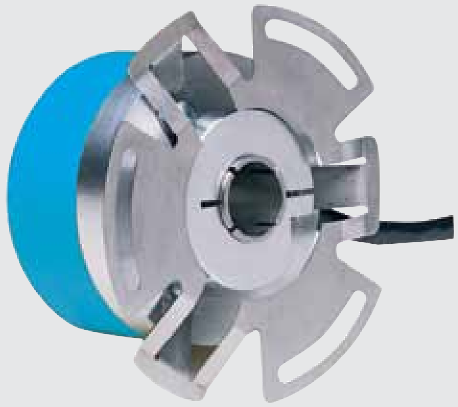
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**5**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**5**	**–**								

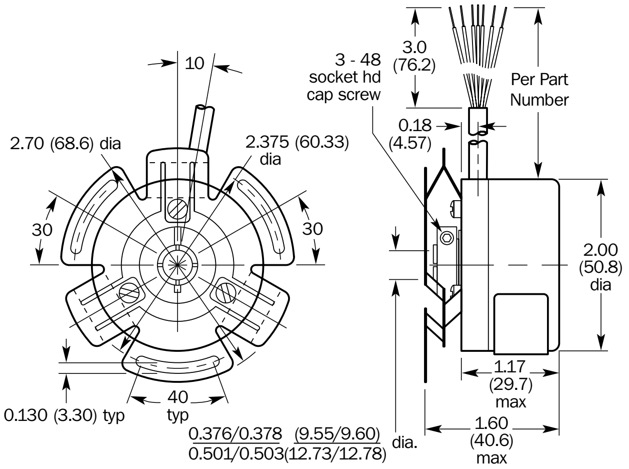
Number of lines
1 to 2,500

Incremental Encoder

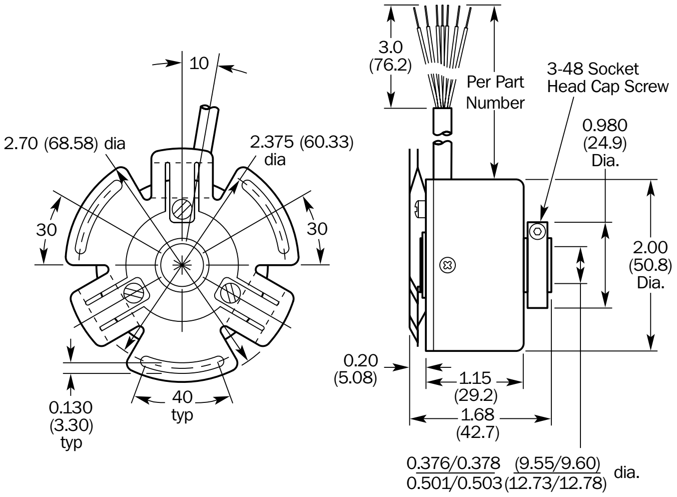
- Blind or through hollow shaft
- Cable outlet
- Protection class up to IP50
- Electrical interfaces, line drivers and open collectors



Dimensional drawing



DGS 22 Blind Hollow Shaft



DGS 21 Through Hollow Shaft

Accessories – see pages 410-448

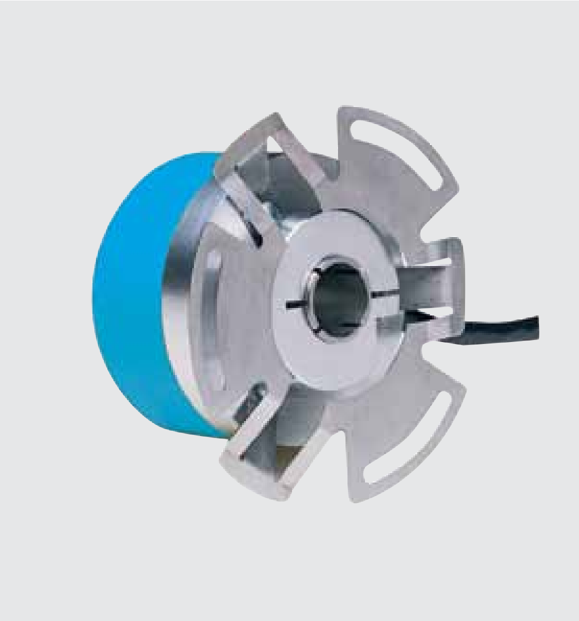
Technical Data	DGS 21/22
Hollow shaft	3/8”, 1/2”
Number of lines (Z) per revolution	00001 to 02500, see order info
Electrical Interface	
+5V in/+5V differential line driver (3487)	
+8…24V in/open collector (7406)	
+8…24V in/8…24V differential line driver (7272)	
+8…24V in/+5V differential line driver (3487)	
Mass	4 oz (0.12 kg)
Moment of inertia of the rotor	2.75 x 10^{-4} oz in sec^2 (19.4 gcm^2)
Measuring step	90°/number of lines
Reference signal	
Number	1
Position	non-gated 180° ±90° electrical
Error limits	45/Z °
Measuring step deviation	45/Z °
Max. output frequency	200 kHz
Max. operating speed	
max shaft loading	3,000 rpm
Max. angular acceleration	5-x-10^5 rad/s^2
Start up torque	1.0 oz-in (0.7 Ncm)
Permissible shaft movement	
radial	0.005 in (0.13 mm)
axial	0.030 in (0.76 mm)
Bearing lifetime	2.4-x-10^9 revolutions
Working temperature range	0° … +70 °C
Storage temperature range	-20 … +85 °C
Permissible relative humidity [1]	90 %
Resistance	
to shocks	20g/11ms
to vibration	5g/10…150Hz
Protection class	IP50
Operating voltage range	4.75…5.25 V
	8.0…24.0 V
Operating current range at no load	120 mA
Signal cable	
diameter	0.19 in (5 mm)
(power supply and drain wire are isolated from housing)	

[1] Condensation not permitted

Number of lines
1 to 2,500

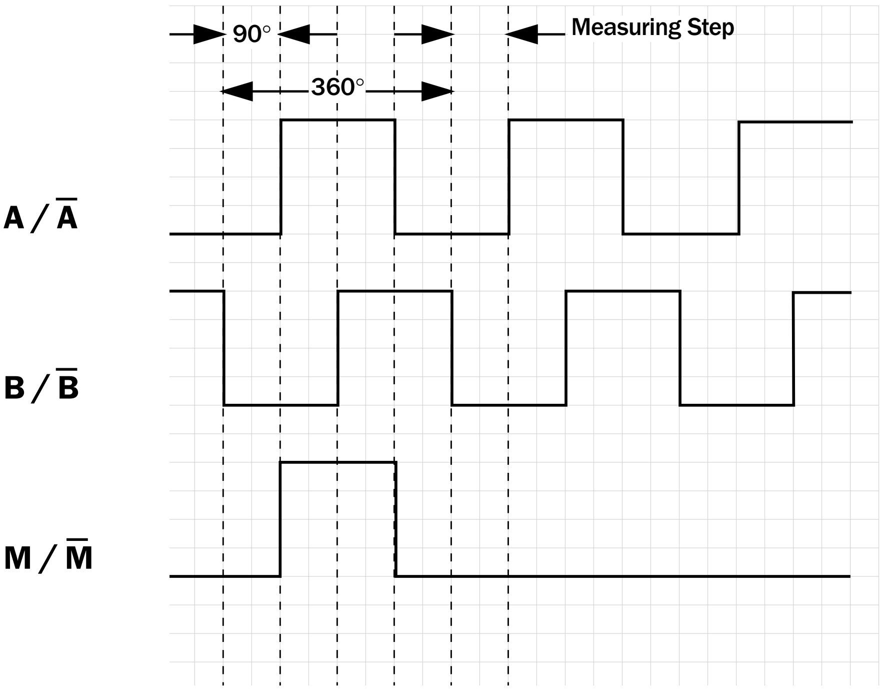
Incremental Encoder

- Blind or through hollow shaft
- Cable outlet
- Protection class up to IP50
- Electrical interfaces, line drivers and open collectors



CE

Incremental pulse diagram (clockwise rotation viewed from mounting end)



Electrical interfaces

Supply voltage	4.75…5.25V	8.0…24.0V	8.0…24.0V	8.0…24.0V
Interfaces/drivers	5V line driver	5V line driver	8/24V line driver	open collector

Wire allocation

Function	Cable Line Driver	Cable Open collector
+Vs	Red	Red
Common	Black	Black
A	White	White
B	Green	Green
M	White/Black	White/Black
A not	Blue	N/A
B not	Orange	N/A
M not	Red/Black	N/A
Shield	Drain Wire	Drain wire

Accessories – see pages 410-448

Order information

Incremental Encoder DGS 21, through hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**1**	**–**								

Electrical interface	
5 V, 5 V, 3487	= 1
8…24 V, 5 V, 3487	= 3
8…24 V, 8…24 V, 7272	= 5
8…24 V open collector (7406/7273)	= 9

Mechanical interface	
Stator Coupling with 3/8” shaft	= R
Stator Coupling with 1/2” shaft	= U

Connection type	
Radial Cable 1.0 m	= 2
Radial Cable 1.5 m	= K
Radial Cable 3 m	= L
Radial Cable 5 m	= M
Radial Cable 10 m [1]	= N

[1] n/a with open-collector

Number of lines
Always five characters in clear text. (see chart)

Order example: Incremental Encoder DGS 21 Through Hollow Shaft

5 V, 5 V (3487 line driver) 180° marker; stator coupling with 3/8” shaft; 1 meter cable, radial; number of steps: 2500

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**1**	**–**	**1**	**R**	**2**	**0**	**2**	**5**	**0**	**0**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**1**	**–**								

Incremental Encoder DGS 22, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**2**	**–**								

Electrical interface	
5 V, 5 V, 3487	= 1
8…24 V, 5 V, 3487	= 3
8…24 V, 8…24 V, 7272	= 5
8…24 V open collector (7406/7273)	= 9

Mechanical interface	
Stator Coupling with 3/8” shaft	= R
Stator Coupling with 1/2” shaft	= U

Connection type	
Radial Cable 1.0 m	= 2
Radial Cable 1.5 m	= K
Radial Cable 3 m	= L
Radial Cable 5 m	= M
Radial Cable 10 m [1]	= N

[1] n/a with open-collector

Number of lines
Always five characters in clear text. (see chart)

Order example: Incremental Encoder DGS 22 Blind Hollow Shaft

5 V, 5 V (3487 line driver) 180° marker; stator coupling with 3/8” shaft; 1 meter cable, radial; number of steps: 2500

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**2**	**–**	**1**	**R**	**2**	**0**	**2**	**5**	**0**	**0**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**2**	**2**	**–**								

Number of lines (Z) per revolution DGS 21/22

00001	00060	00150	00300	00720	01250	01800
00005	00064	00180	00360	00800	01260	02000
00010	00080	00200	00400	00900	01280	02048
00020	00100	00250	00500	01000	01472	02400
00030	00120	00254	00512	01024	01500	02500
00050	00128	00256	00600	01200	01600	01800

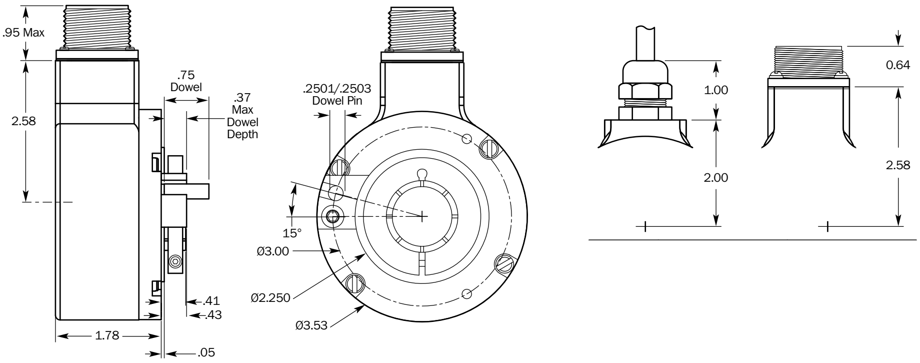
Number of lines
120 to 16,384

Incremental Encoder

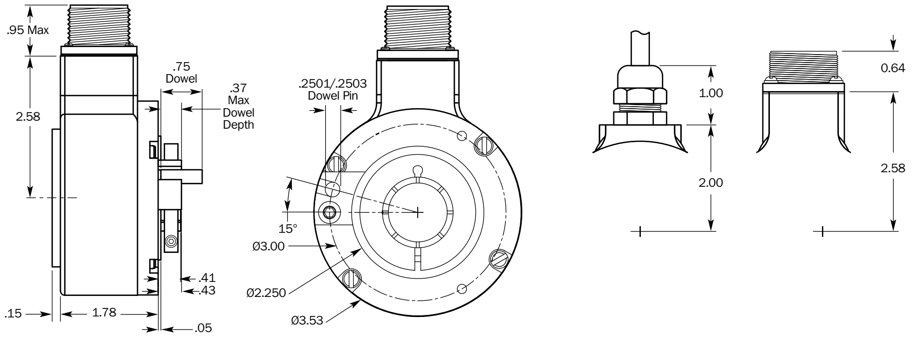
- Blind through hollow shaft
- Connector or cable outlet
- Protection class up to IP66
- Electrical interfaces, line drivers and open collectors

Accessories – see pages 410-448

Dimensional drawing blind shaft (anti-rotation pin shown)

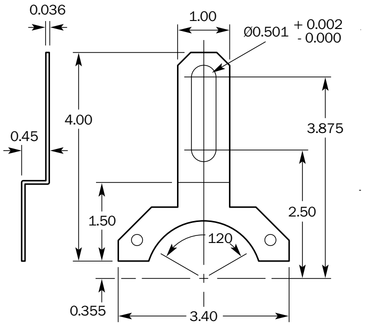


Dimensional drawing through shaft (anti-rotation pin shown)



Dimensional drawing tether option

T1
(Slotted hole for 3/8" bolt on 2.5 to 3.875
radius to fit AC motor fan cover)



Technical Data	DGS 35/34
Hollow Shaft	1”, 30 mm
Number of lines (Z) per revolution	00120 to 16384, see order info
Electrical Interface	
	+5V/5V line driver (3487)
	+8…24V/5V line driver (3487)
	+8…24V/+8…24V line driver (7272)
	+8…24V/5V open collector (7273)
	+5V…15V/+5V…15V line driver (4469)
Mass[1]	16 oz (1.1 kg)
Moment of inertia of the rotor	490 gcm^2
Measuring step	90°/number of lines
Error limits	45/Z °
Measuring step deviation	45/Z °
Max. output frequency	300 kHz (1-8192 PPR)
	600 kHz (x 2 multiplication) (above 8192 PPR)
Max. operating speed	3,000 rpm;
	higher rpms available, please consult factory
Max. angular acceleration	1-x-10^5 rad/s^2
Operating torque	9.91 oz-in (7.0 Ncm)
Start up torque	12.78 oz-in (9.0 Ncm)
Permissible shaft movement	
radial (static/dynamic)	0.020in (0.5mm)/0.004in (0.1mm)
axial (static/dynamic)	0.020in (0.5mm)/0.020in (0.5mm)
Bearing lifetime	4.5-x-10^9 revolutions
Working temperature range	-20 … + 70 °C
Storage temperature range	-30 … + 85 °C
Permissible relative humidity [3]	95 %
Resistance	
to shocks	50/11 g/ms
to vibration	5/2000 Hz at 20 g
Protection class	
Conn	IP 66
Cable	IP 66
Operating current range at no load	
24 V	100 mA
5 V	120 mA

[1] For an encoder with connector outlet

[2] At speeds > 3000 rpm the shaft seal must be removed

[3] Condensation not permitted

[4] with muting connector fitted

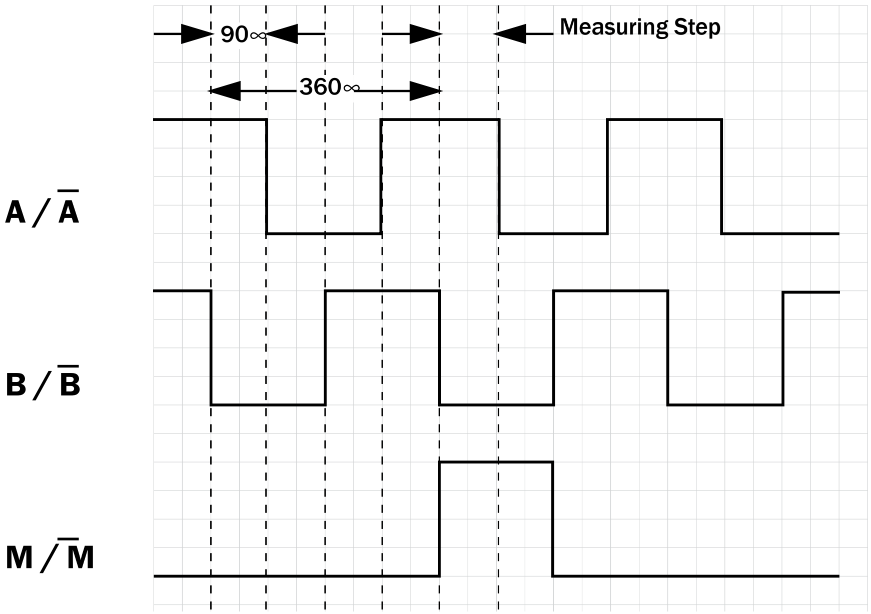
Industrial Hollow Shaft Incremental Encoder DGS 35/34

Number of lines
120 to 16,384

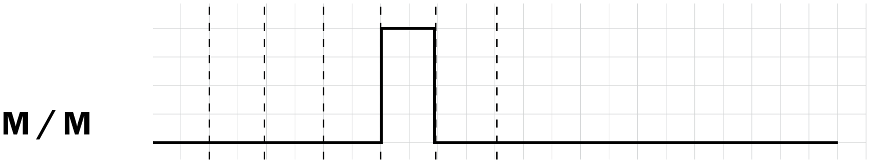
Incremental Encoder

- Blind through hollow shaft
- Connector or cable outlet
- Protection class up to IP66
- Electrical interfaces, line drivers and open collectors

Incremental pulse diagram (view from clamp end)

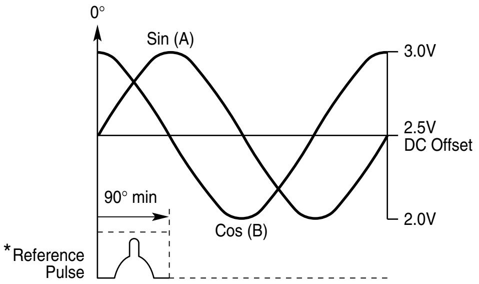


For resolutions less than 10,000 PPR



For resolutions greater than or equal to 10,000 PPR and push-pull driver option

Sine wave



*Waveforms shown are single-ended. Voltages are referenced from ground.

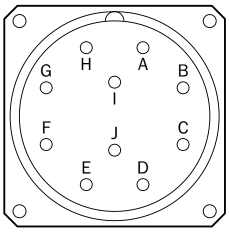
*The standard marker pulse is a basic analog signal. An optional square wave marker pulse is available upon request from the factory.

Electrical interfaces

Supply voltage	4.75…5.25V	8.0…24.0 V	8.0…24.0 V
Interfaces/drivers	Line drivers	Line drivers	Open collector

Accessories – see pages 410-448

Connection type



10 Pin MS3102R

PIN and wire allocation

Function	10 pin	Cable
A	A	White
B	B	Pink
M	C	Lilac
A not	H	Brown
B not	I	Black
M not	J	Yellow
+Vs	D	Red
Common	F	Blue
Case ground	G	N/A
Shield	N/A	N/A

Order information

Incremental Encoder DGS 35, Through Hollow Shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**3**	**5**	**–**								

Electrical interface

5 V, 5 V, 3487, marker 180 = 1
8-24V, 5V, 3487, marker 180 = 3
8-24V, 8/24V, 7272, marker 180 = 5
5-15V, 5-15V, 4469, marker 180 = 7
8-24 V, open collector (7273) marker 180 = 9
5 V, 5 V, 3487, marker 90* = Y
8-24V, 5V, 3487, marker 90* = 2
8-24V, 8/24V, 7272, marker 90* = 4
5-15V, 5-15V, 4469, marker 90* = 6
8-24 V, open collector (7273) marker 90* = 8
5 V SINE with amplification (1 V Peak to Peak)** = L

Notes:
* 10,000 and 16,384ppr only come with 90° marker
** Cannot use with 10,000 and 16,384 PPR

Mechanical interface

T1 Tether, 1in bore (see collets below, sold separately) = H
P block, 1in bores (see collets below, sold separately) = J
T1 Tether, 30mm bore = K
P block, 30mm bore = L

Connection type

Radial Cable 1.0 m = 2
Radial Cable 1.5 m = K
Radial Cable 3 m = L
Radial Cable 5 m = M
Radial Cable 10 m [1] = N
Radial Connector MS 10-pin = 4

[1] n/a on open collector outputs

Number of lines

Always five characters in clear text. (see chart)

Number of lines (Z) per revolution

00120	00600	02048	03600	05000	08192	10000*	16384*
00360	01024	02500	04096				

* Note: 10,000 and 16,384ppr only come with 90° marker

Order example: Incremental Encoder DGS 35

5 V, 5 V (3487 line driver) 180° marker; T1 tether with 1" bore shaft; 1 meter cable, radial; number of steps: 2500

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**3**	**5**	**–**	**1**	**H**	**2**	**0**	**2**	**5**	**0**	**0**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**3**	**5**	**–**								

Collets for DGS 35 encoder with Through Hollow Shaft

Type for 1" Bore	Part no.	Shaft Diameter
SPZ-1E2-DD35-AD	7 102 155	1/2"
SPZ-5E8-DD35-AD	7 102 156	5/8"
SPZ-3E4-DD35-AD	7 102 157	3/4"
SPZ-7E8-DD35-AD	7 102 158	7/8"

Type for 30 mm Bore	Part no.	Shaft Diameter
SPZ-024-MD35-AD	7 130 587	24 mm
SPZ-025-MD35-AD	7 130 588	25 mm

Type for 1" Bore	Part no.	Shaft Diameter
SPZ-010-DD35-AD	7 130 582	10 mm
SPZ-012-DD35-AD	7 130 583	12 mm
SPZ-014-DD35-AD	7 130 584	14 mm
SPZ-015-DD35-AD	7 127 328	15 mm
SPZ-018-DD35-AD	7 130 585	18 mm
SPZ-020-DD35-AD	7 130 529	20 mm
SPZ-022-DD35-AD	7 130 586	22 mm

Order information

Incremental Encoder DGS 34, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**3**	**4**	**–**								

Electrical interface

5 V, 5 V, 3487, marker 180 = 1
8-24V, 5V, 3487, marker 180 = 3
8-24V, 8/24V, 7272, marker 180 = 5
5-15V, 5-15V, 4469, marker 180 = 7
8-24 V, open collector (7406/7273) marker 180 = 9
5 V, 5 V, 3487, marker 90* = Y
8-24V, 5V, 3487, marker 90* = 2
8-24V, 8/24V, 7272, marker 90* = 4
5-15V, 5-15V, 4469, marker 90* = 6
8-24 V, open collector (7406/7273) marker 90* = 8
5 V SINE with amplification (1 V Peak to Peak)** = L

Mechanical interface

T1 Tether, 1in bore (see collets below, sold separately) = H
P block, 1in bores (see collets below, sold separately) = J
T1 Tether, 30 mm bore = K
P block, 30 mm bore = L

Connection type

Radial Cable 1.0 m = 2
Radial Cable 1.5 m = K
Radial Cable 3 m = L
Radial Cable 5 m = M
Radial Cable 10 m 1) = N
Radial Connector MS 10-pin = 4

1) n/a on open collector outputs

Number of lines

Always five characters in clear text. (see chart)

Notes:
* 10,000 and 16,384ppr only come with 90° marker
** Cannot use with 10,000 and 16,384 PPR

Number of lines (Z) per revolution

00120	00600	02048	03600	05000	08192	10000*	16384*
00360	01024	02500	04096				

* Note: 10,000 and 16,384ppr only come with 90° marker

Order example: Incremental Encoder DGS 34

5 V, 5 V (3487 line driver) 180° marker; T1 tether with 1" bore shaft; 1 meter cable, radial; number of steps: 2500

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**3**	**4**	**–**	**1**	**H**	**2**	**0**	**2**	**5**	**0**	**0**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**S**	**3**	**4**	**–**								

Collets for DGS 35 encoder with Through Hollow Shaft

Type for 1" Bore	Part no.	Shaft Diameter
SPZ-1E2-DD35-AD	7 102 155	1/2"
SPZ-5E8-DD35-AD	7 102 156	5/8"
SPZ-3E4-DD35-AD	7 102 157	3/4"
SPZ-7E8-DD35-AD	7 102 158	7/8"

Type for 30 mm Bore	Part no.	Shaft Diameter
SPZ-024-MD35-AD	7 130 587	24 mm
SPZ-025-MD35-AD	7 130 588	25 mm

Type for 1" Bore	Part no.	Shaft Diameter
SPZ-010-DD35-AD	7 130 582	10 mm
SPZ-012-DD35-AD	7 130 583	12 mm
SPZ-014-DD35-AD	7 130 584	14 mm
SPZ-015-DD35-AD	7 127 328	15 mm
SPZ-018-DD35-AD	7 130 585	18 mm
SPZ-020-DD35-AD	7 130 529	20 mm
SPZ-022-DD35-AD	7 130 586	22 mm

DRS21/26: Incremental encoders, number of lines and zero pulse width freely programmable

DRS20/25: Incremental encoders with Zero-Pulse-Teach

Number of lines
1 up to 8,192
Incremental Encoder

CoreTech technology permits tailor-made solutions for every application, due to its modular design. With DRS21/26 incremental encoders, the number of lines from 1 to 8,192 and the width of the zero pulse can be freely programmed by the customer. Therefore, they will be of particular interest to end users, distributors, consulting engineers and system integrators. DRS 20/25 incremental encoders are available with any desired number of lines between 1 and 8,192. Further highlights of this generation of encoders:

- Simple zero-pulse-teach remotely via a signal line
- Excellent price/performance ratio

- Long LED lifetime as a result of automatic light regulation
- Maximum reliability as a result of opto-ASICs with Chip-on-Board technology
- Square flange, servo and face mount options with 1/4”, 3/8” and 10 mm solid shafts.

Whether with square flange or servo flange, with connector or cable outlet, TTL or HTL interface – DRS 20/25 encoders will meet virtually any application profile.

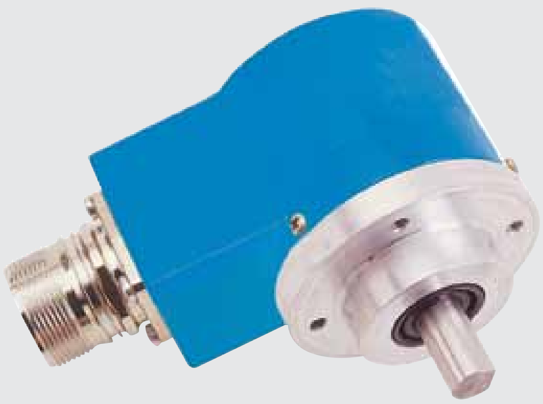
Thanks to this wide variety of products, there are numerous possible uses, for example in:

- machine tools
- textile machines
- woodworking machines
- packaging machines

Number of lines
1 up to 8,192

Incremental Encoder

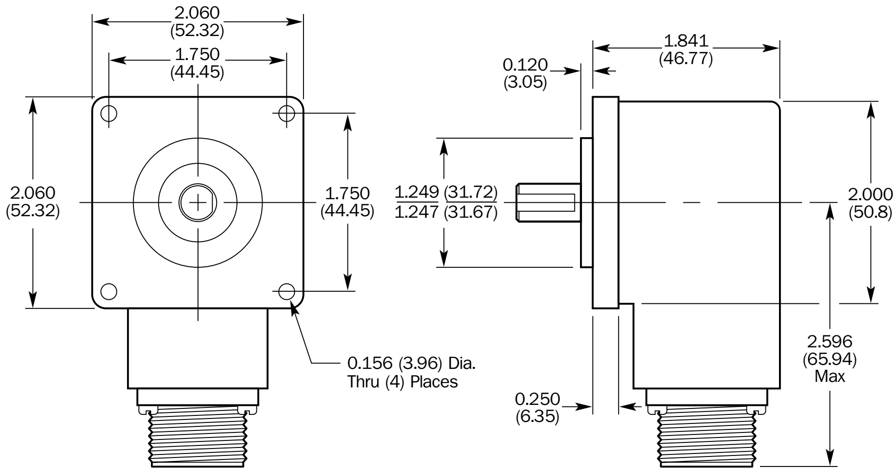
- Connector or cable outlet
- Protection class up to IP66
- Electrical Interfaces TTL and HTL Linedrivers
- Zero-Pulse-Teach remotely via signal line



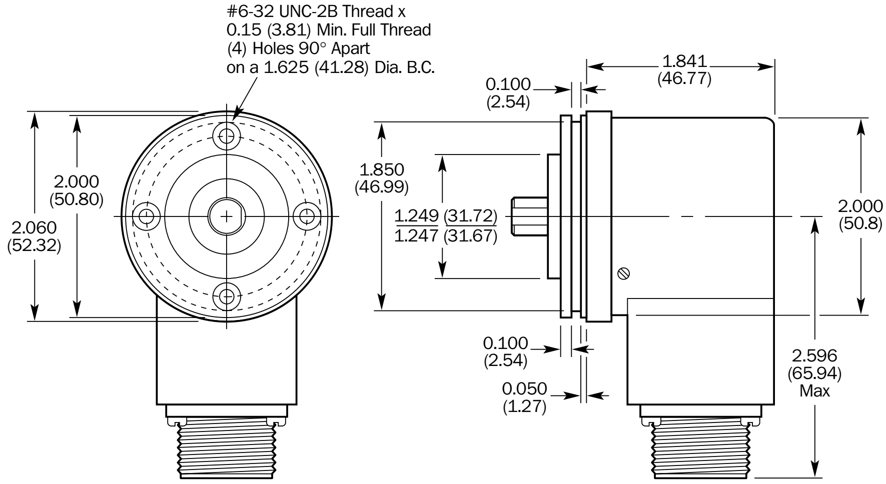
CE

Accessories – see pages 410-448

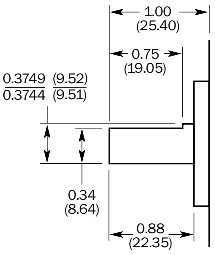
Dimensional Drawing Square Flange Mount



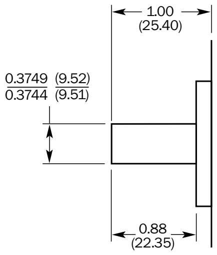
Dimensional Drawing Servo Flange Mount



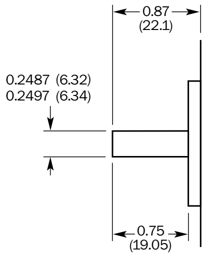
Dimensional Drawing Shaft Options – Square Flange Mount



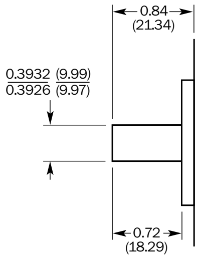
3/8" w/Flat



3/8"

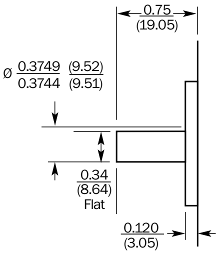


1/4"

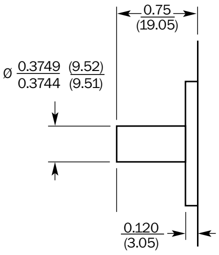


10 mm

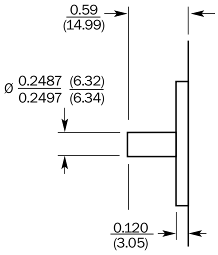
Dimensional Drawing Shaft Options – Servo Flange Mount



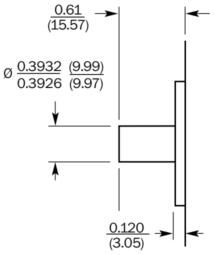
3/8" w/Flat



3/8"



1/4"



10 mm

Technical Data	DRS 20/21
Solid Shaft	1/4 in, 3/8 in, 10 mm
Number of lines per revolution	00001 up to 0**8192**, see order info
Electrical Interface	
+5 V in/+5V differential line driver (3487)	
+8…24V in /+5V differential line driver (3487)	
+8…24V in /+8…24V in differential line driver (7272)	
Mass 1)	Approx. 0.5 lb (0.22 kg)
Moment of inertia of the rotor	0.184 lb-in^2 (54 g-cm^2)
Measuring step	90°/number of lines
Reference signal	
Number	1
Position 2)	90° or 180°
Error limits	
binary number of lines	0.035°
non-binary number of lines	0.046°
Measuring step deviation	
binary number of lines	0.005°
non-binary number of lines	0.016°
Max. output frequency	
3487 line driver	820 kHz
7272 line driver	300 kHz
Max operating speed	
with shaft seal	6,000 rpm
without shaft seal	10,000 rpm
Max. angular acceleration	5-x-10^5 rad/s^2
Operating torque	0.2 lbf-in (2.6 Ncm)
Start up torque	0.3 lbf-in (3.4 Ncm)
Permissible shaft loading	
radial	4.5 lbf (20 N)
axial	2.25 lbf (20 N)
Bearing lifetime	3.6-x-10^9 revolutions
Working temperature range	-4 … 185 °F (-20…85°C)
Storage temperature range	-40 … 212 °F (-40…100°C)
Permissible relative humidity 3)	90 %
EMC 4)	
Resistance	
to shocks 5)	5 /11 g/ms
to vibration 6)	20/10 … 150 g/Hz
Protection class IEC 60529	
Connector outlet 7)	IP 65
Cable outlet	IP 66
Operating voltage range	see electrical interface
No-load operating current	
3487 line driver (+5 V)	typ. 120 mA
3487 line driver (+8…24 V)	typ. 150 mA
7272 line driver (+8…24 V)	typ. 120 mA
Operation of zero-set 8)	≥ 100 ms
Initialization time after power on	40 ms

1) Concerning encoder with connector

2) Electrical, logically linked to A and B

3) Condensation not permitted

4) To EN 50082-2 and EN 50081-2

5) To DIN IEC 68 2-27

6) To DIN IEC 68 2-6

7) With mating connector fitted

8) Only with shaft stationary

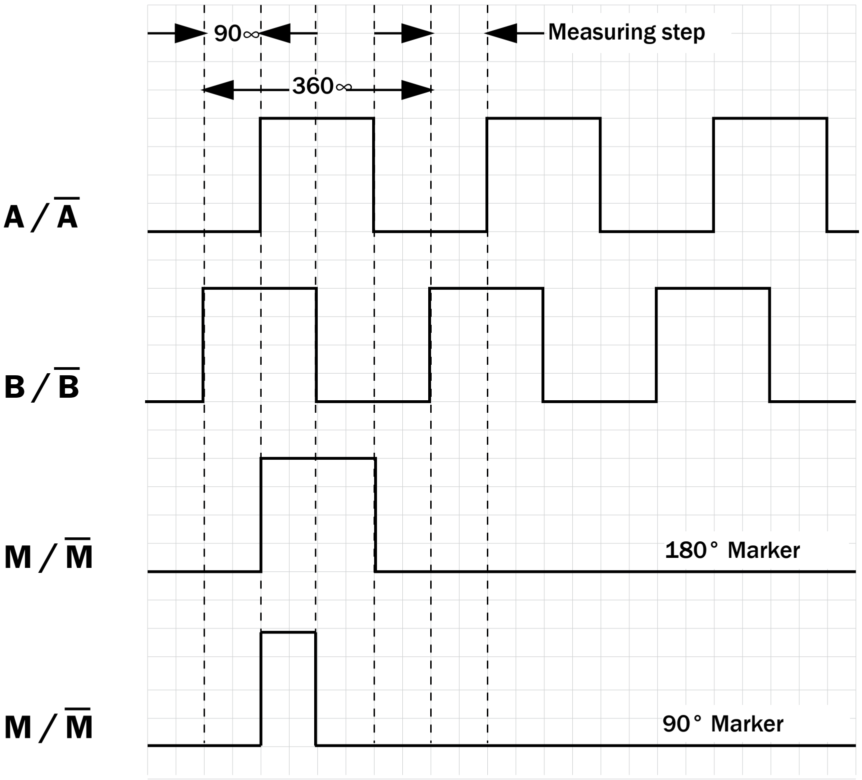
Number of lines
1 up to 8,192

Incremental Encoder

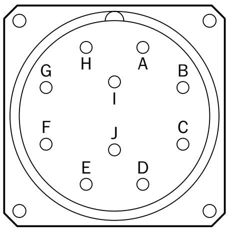
- Connector or cable outlet
- Protection class up to IP66
- Electrical Interfaces TTL and HTL Linedrivers
- Zero-Pulse-Teach remotely via signal line

Accessories – see pages 410-448

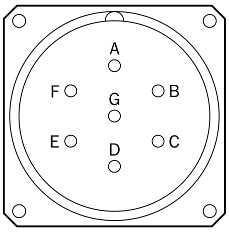
Incremental pulse diagram (for clockwise rotation facing shaft)



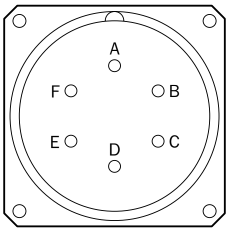
Connection type



10 Pin MS3102R



7 Pin MS3102R



6 Pin MS3102R

PIN and wire allocation

Signal	Cable	10 Pin	6 Pin	7 Pin
A	White	A	E	A
B	Pink	B	D	B
M	Lilac	C	C	C
A not	Brown	H	N/A	N/A
B Not	Black	I	N/A	N/A
M Not	Yellow	J	N/A	N/A
± Vs	Red	D	B	D
Common	Blue	F	A	F
Case Ground	Green	G	F	G
Set Zero*	Orange	E	N/A	E

*For setting marker (M) position - activated when connected to supply voltage for 100 ms

Order information

Incremental Encoder DRS 20

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	R	S	2	0	–								

Electrical Interface

5 V, 5 V, 3487, marker 90 = Y
5 V, 5 V, 3487, marker 180 = 1
8-24 V, 5 V, 3487, marker 90 = 2
8-24 V, 5 V, 3487, marker 180= 3
8-24 V, 8-24 V, 7272, marker 90= 4
8-24 V, 8-24 V, 7272, marker 180= 5

Mechanical Interface

Square Flange, 1/4” Shaft = E
Square Flange, 3/8” Shaft = F
Square Flange, 3/8” Shaft with Flat = G
Square Flange, 10mm Shaft = C
Servo Flange/Face Holes, 1/4” shaft = 5
Servo Flange/Face Holes, 3/8” shaft = 6
Servo Flange/Face Holes, 3/8” shaft w/ flat = 7
Servo Flange/Face Holes, 10 mm shaft = 8

Connection Type

Radial Cable 1.0 m = 2
Radial Cable 1.5 m = K
Radial Cable 3.0 m = L
Radial Cable 5.0 m = M
Radial Cable 10.0 m = N
Radial Connector (MS 10 pin) = 4
Radial Connector (MS 7 pin) = 5
Radial Connector (MS 6 pin) = 6

Resolution

Each number of lines from 00001 to 08192 possible. Always 5 characters in clear text

Order example Incremental Encoder DRS 20

5 V, 5 V (3487 line driver), 180° marker; Square Flange; 3/8” shaft; 10 pin, radial; number of steps 8192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 1
D	R	S	2	0	–	1	F	4	0	8	1	9	2

Incremental Encoder DRS 21

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	R	S	2	1	–				0	8	1	9	2

Electrical Interface

5 V, 5 V, 3487, marker 180 = 1
8-24 V, 5 V, 3487, marker 180= 3
8-24 V, 8-24 V, 7272, marker 180= 5

Mechanical Interface

Square Flange, 1/4” Shaft = E
Square Flange, 3/8” Shaft = F
Square Flange, 3/8” Shaft with Flat = G
Square Flange, 10mm Shaft = C
Servo Flange/Face Holes, 1/4” shaft = 5
Servo Flange/Face Holes, 3/8” shaft = 6
Servo Flange/Face Holes, 3/8” shaft w/ flat = 7
Servo Flange/Face Holes, 10 mm shaft = 8

Connection Type

Radial Cable 1.0 m = 2
Radial Cable 1.5 m = K
Radial Cable 3.0 m = L
Radial Cable 5.0 m = M
Radial Cable 10.0 m = N
Radial Connector (MS 10 pin) = 4
Radial Connector (MS 7 pin) = 5
Radial Connector (MS 6 pin) = 6

Resolution

Factory-programmed to 8,192

Order example Incremental Encoder DRS 21

5 V, 5 V (3487 line driver), 180° marker; Square Flange; 3/8” shaft; 10 pin, radial; number of steps 8192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	R	S	2	1	–	1	F	4	0	8	1	9	2

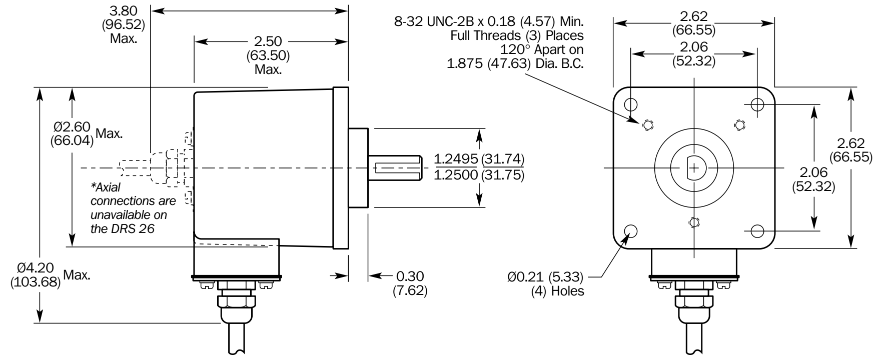
Number of lines
1 up to 8,192

Incremental Encoder

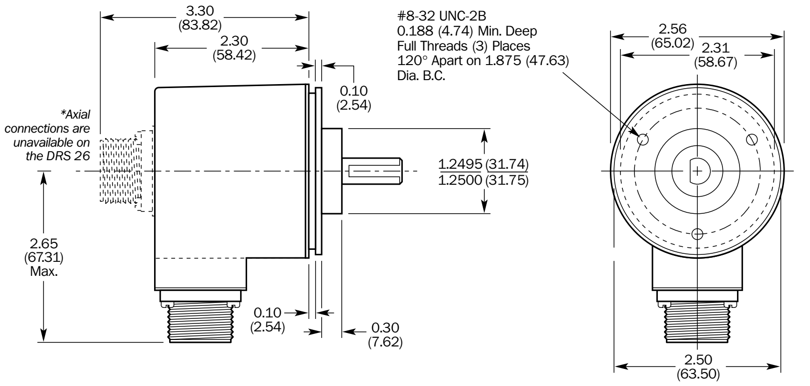
- Connector or cable outlet
- Protection class up to IP66
- Electrical Interfaces TTL and HTL Linedrivers
- Zero-Pulse-Teach remotely via signal line

Accessories – see pages 410-448

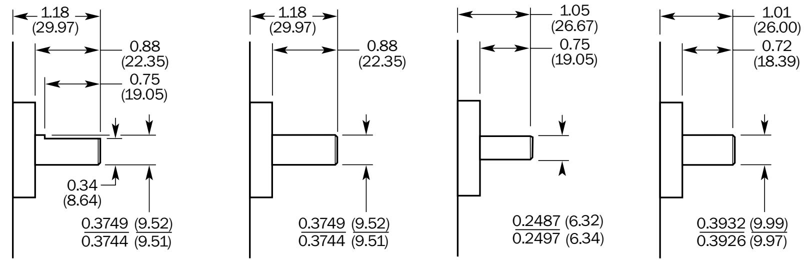
Dimensional Drawing Square Flange Mount



Dimensional Drawing Servo Flange Mount/Face Mount

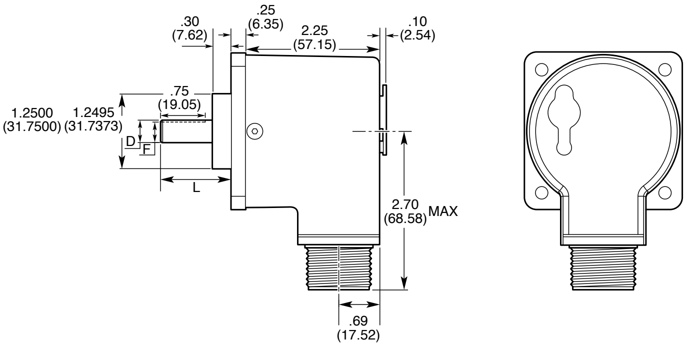


Dimensional Drawing Shaft Options



3/8 in w/ Flat   3/8 in   1/4 in   10 mm

DRS 26 Views



Technical Data	DRS 25/26
Solid Shaft	1/4 in, 3/8 in, 10 mm
Number of lines per revolution	00001 up to 0**8192**, see order info
Electrical Interface	
+5 V in/+5V differential line driver (3487)	
+8…24V in/+5V differential line driver (3487)	
+8…24V in /+8…24V in differential line driver (7272)	
+10…30V in, push-pull (no compliments)	
Mass 1)	Approx. 0.5 lb (0.22 kg)
Moment of inertia of the rotor	0.184 lb-in^2 (54 g-cm^2)
Measuring step	90°/number of lines
Reference signal	
Number	1
Position 2)	90° or 180°
Error limits	
binary number of lines	0.035°
non-binary number of lines	0.046°
Measuring step deviation	
binary number of lines	0.005°
non-binary number of lines	0.016°
Max. output frequency	
3487 line driver	820 kHz
7272 line driver	300 kHz
Max operating speed	
with shaft seal	6,000 rpm
without shaft seal	10,000 rpm
Max. angular acceleration	5-x-10^5 rad/s^2
Operating torque	0.2 lbf-in (2.6 Ncm)
Start up torque	0.3 lbf-in (3.4 Ncm)
Permissible shaft loading	
radial	4.5 lbf (20 N)
axial	2.25 lbf (20 N)
Bearing lifetime	3.6-x-10^9 revolutions
Working temperature range	-4 … 185 °F (-20…85°C)
Storage temperature range	-40 … 212 °F (-40…100°C)
Permissible relative humidity 3)	90 %
EMC 4)	
Resistance	
to shocks 5)	5 /11 g/ms
to vibration 6)	20/10 … 150 g/Hz
Protection class IEC 60529	
Connector outlet 7)	IP 65
Cable outlet	IP 66
Operating voltage range	see electrical interface
No-load operating current	
3487 line driver (+5 V)	typ. 120 mA
3487 line driver (+8…24 V)	typ. 150 mA
7272 line driver (+8…24 V)	typ. 120 mA
Push-pull	typ. 100 mA
Operation of zero-set 8)	≥ 100 ms
Initialization time after power on	40 ms

1) Concerning encoder with connector

2) Electrical, logically linked to A and B

3) Condensation not permitted

4) To EN 50082-2 and EN 50081-2

5) To DIN IEC 68 2-27

6) To DIN IEC 68 2-6

7) With mating connector fitted

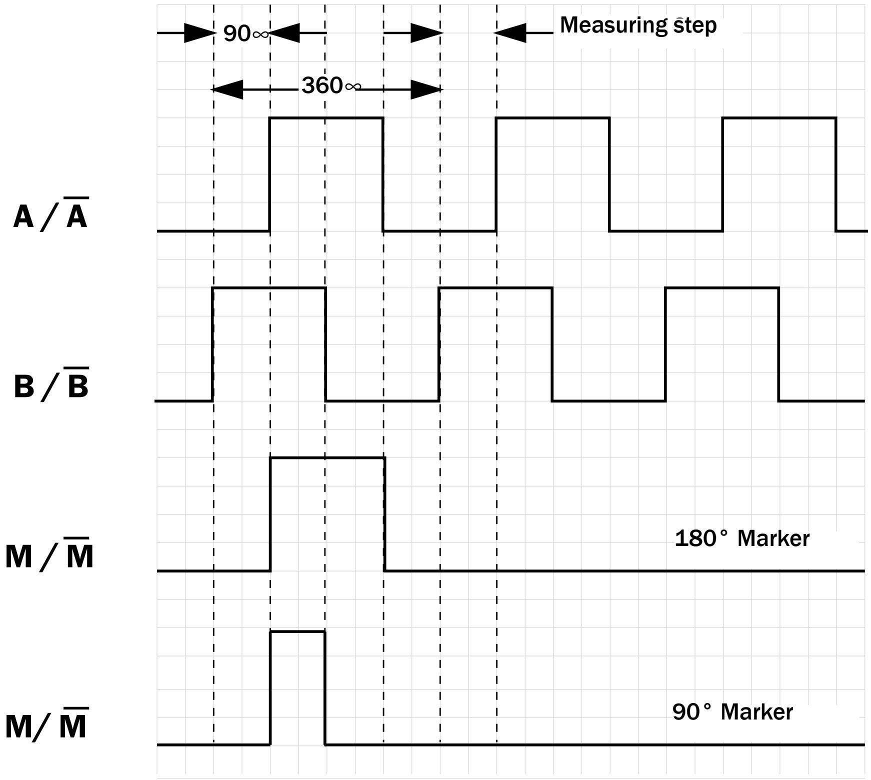
8) Only with shaft stationary

Number of lines
1 up to 8,192

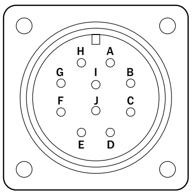
Incremental Encoder

- Connector or cable outlet
- Protection class up to IP66
- Electrical Interfaces TTL and HTL Linedrivers
- Zero-Pulse-Teach remotely via signal line

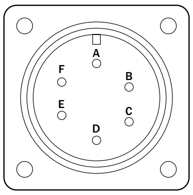
Incremental pulse diagram (for clockwise rotating facing shaft)



Connection type



10 Pin MS3102R



6 Pin MS3102R

PIN and wire allocation

Signal	**Cable**	**10 Pin**	**6 Pin**
A	White	A	E
B	Pink	B	D
M	Lilac	C	C
A not	Brown	H	N/A
B Not	Black	I	N/A
M Not	Yellow	J	N/A
± Vs	Red	D	B
Common	Blue	F	A
Case Ground	Green	G	F
Set Zero*	Orange	E	N/A

* For setting marker (M) position - activated when connected to supply voltage for 100 ms

Accessories – see pages 410-448

Order information

Incremental Encoder DRS 25

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	R	S	2	5	–								

Electrical Interface

5 V, 5 V, 3487, marker 90 = Y
5 V, 5 V, 3487, marker 180 = 1
8-24 V, 5 V, 3487, marker 90 = 2
8-24 V, 5 V, 3487, marker 180 = 3
8-24 V, 8-24 V, 7272, marker 90 = 4
8-24 V, 8-24 V, 7272, marker 180 = 5

Mechanical Interface

Square Flange, 1/4" Shaft = E
Square Flange, 3/8" Shaft = F
Square Flange, 3/8" Shaft with Flat = G
Square Flange, 10mm Shaft = C
Servo Flange/Face Holes, 1/4" shaft = 5
Servo Flange/Face Holes, 3/8" shaft = 6
Servo Flange/Face Holes, 3/8" shaft w/ flat = 7
Servo Flange/Face Holes, 10 mm shaft = 8

Connection type

Radial Cable 1.0 m = 2
Radial Cable 1.5 m = K
Radial Cable 3 m = L
Radial Cable 5 m = M
Radial Cable 10 m$^{1)}$ = N
Axial Cable 1.0 m = 3
Axial Cable 1.5 m = R
Axial Cable 3.0 m = S
Axial Cable 5.0 m = T
Axial Cable 10 m$^{1)}$ = U
Radial Connector MS 10-pin = 4
Radial Connector MS 6-pin = 6
Axial Connector MS 10-pin = 7
Axial Connector MS 6-pin = 9

Resolution

Each number of lines from 00001 to 08192 possible. Always 5 characters in clear text

Order example Incremental Encoder DRS 25

5 V, 5 V (3487 line driver), 180° marker;Square Flange; 3/8" Shaft;10-pin; number of steps 8192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	R	S	2	5	–	1	F	4	0	8	1	9	2

Incremental Encoder DRS 26

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	R	S	2	6	–				0	8	1	9	2

Electrical Interface

5 V, 5 V, 3487, marker 180 = 1
8-24 V, 5 V, 3487, marker 180 = 3
8-24 V, 8-24 V, 7272, marker 180 = 5

Mechanical Interface

Square Flange, 1/4" Shaft = E
Square Flange, 3/8" Shaft = F
Square Flange, 3/8" Shaft with Flat = G
Square Flange, 10mm Shaft = C
Servo Flange/Face Holes, 1/4" shaft = 5
Servo Flange/Face Holes, 3/8" shaft = 6
Servo Flange/Face Holes, 3/8" shaft w/ flat = 7
Servo Flange/Face Holes, 10 mm shaft = 8

Connection Type

Radial Cable 1.0 m = 2
Radial Cable 1.5 m = K
Radial Cable 3.0 m = L
Radial Cable 5.0 m = M
Radial Cable 10.0 m = N
Radial Connector (MS 10 pin) = 4
Radial Connector (MS 7 pin) = 5
Radial Connector (MS 6 pin) = 6

Resolution

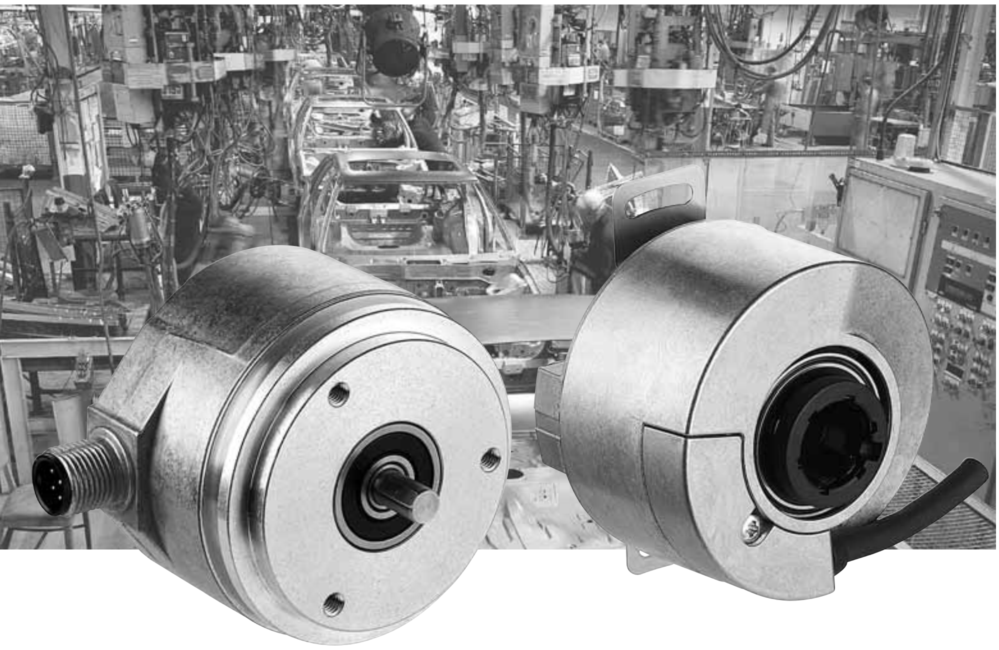
Factory-programmed to 8,192

Order example Incremental Encoder DRS 26

5 V, 5 V (3487 line driver), 180° marker;Square Flange; 3/8" Shaft;10-pin; number of steps 8192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	R	S	2	6	–	1	F	4	0	8	1	9	2

The high-resolution family: DFS60 Incremental Encoders



Number of lines
1 up to 65,536
Incremental Encoders

RoHS
2002/95/EC

The DFS60 is a high-resolution incremental hollow shaft Encoder in a 60 mm housing.

With a maximum of 65,536 lines, the DFS60 is unique in its class.

Excellent concentricity and exceptional robustness are achieved thanks to the large distance between the ball bearings which support the Encoder shaft. With electrical isolation between motor shaft and Encoder, the DFS60 version with through hollow shaft has a feature which substantially increases interference immunity and reliability. The DFS60 can therefore be used in harsh ambient conditions in any industrial application.

Product options:

- interfaces TTL/RS422, HTL/push-pull
- Face mount flange and Servo flange
- Blind hollow shaft and
- Through hollow shaft
- Cable outlet 1.5 m; 3 m and 5 m can be used radial or axial
- Connector outlet M12 or M23
- 1 to 65,536 lines, output level of the interfaces, zero pulse width programmable by customer
- Zero pulse Teach function

Due to the options available, applications are diverse, in areas such as:

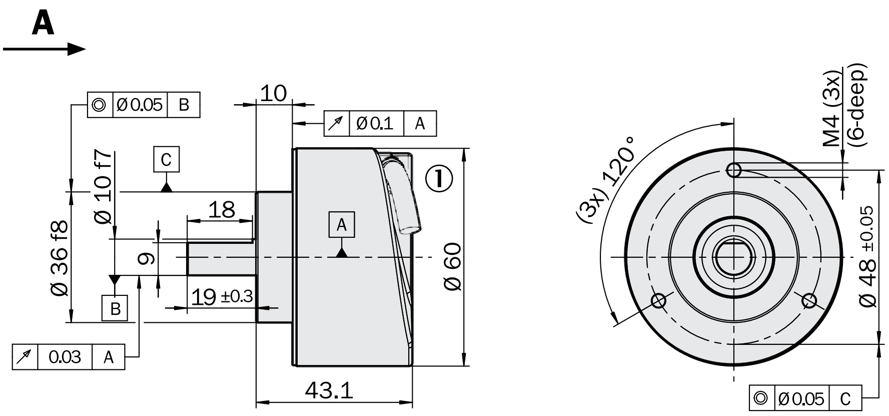
- printing machines
- textile machines
- woodworking machines
- packaging machines

Number of lines
1 up to 65,536

Incremental Encoders

- Connector or cable outlet
- Protection class IP 67
- Electrical interfaces
  TTL, HTL
- Number of lines, level of output signal and zero pulse width freely programmable

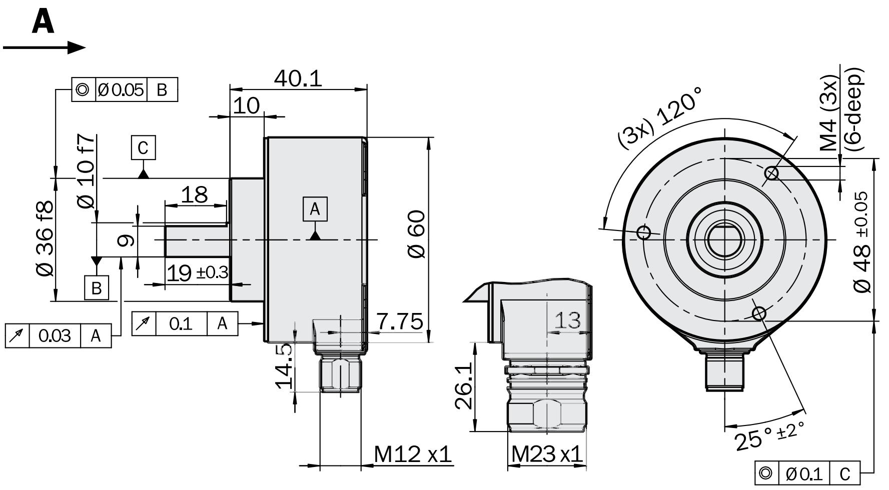
Dimensional drawing face mount flange, cable outlet



General tolerances according to DIN ISO 2768-mk

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Dimensional drawing face mount flange, connector outlet M12 and M23



General tolerances according to DIN ISO 2768-mk

RoHS
2002/95/EC

Accessories – see pages 410-448

Technical data to DIN 32878		DFS60 face mount flange			
Type			**E**	**B**	**A**
Shaft diameter		10 x 19 mm	▨	▨	▨
Electrical interface		4.5 ... 5.5 V, TTL/RS422	▨	▨	▨
		10 ... 32 V, TTL/RS422	▨	▨	▨
		10 ... 32 V, HTL/push-pull	▨	▨	▨
		4.5 ... 32 V, TTL/HTL programmable		▨	▨
Number of lines per revolution			100 ... 2048	1 ... 10000	1 ... 65536
Mass		0.3 kg	▨	▨	▨
Moment of inertia to the rotor		6.2 gcm^2	▨	▨	▨
Measuring step		90° electric/number of lines	▨	▨	▨
Reference signal	**Number**	1	▨	▨	▨
	Position	90° electr., gated with A and B	▨	▨	▨
Error limits			± 0.3°	± 0.05°	± 0.03°
Measuring step deviation		Number of lines 1 ... 99		± 0.08°	± 0.04°
		Number of lines 100 ... 10,000	± 0.2°	± 0.01°	± 0.008°
		Number of lines > 10,000			± 0.002°
Max. output frequency		TTL/RS422	300 kHz	600 kHz	820 kHz
		HTL/push-pull	300 kHz	600 kHz	820 kHz
		TTL/HTL programmable		600 kHz	820 kHz
Operating speed [1]			10,000 rpm	10,000 rpm	10,000 rpm
Angular acceleration		5 x 10^5 rad/s^2	▨	▨	▨
Max. Operating torque	**at 20 °C**	0.3 Ncm	▨	▨	▨
Starting torque	**at 20 °C**	0.5 Ncm	▨	▨	▨
Permissible shaft loading		radial	80 N	80 N	80 N
		axial	40 N	40 N	40 N
Bearing lifetime		3 x 10^9 revolutions	▨	▨	▨
Working temperature range			0 ... +70 °C	–20 ... +100 °C	–20 ... +100 °C
Storage temperature range (without package)			–40 ... +100 °C	–40 ... +100 °C	–40 ... +100 °C
Permissible relative humidity [2]		90 %	▨	▨	▨
EMC [3]			▨	▨	▨
Resistance		To shocks [4]	50 g/6 ms	70 g/6 ms	60 g/6 ms
		To vibration [5]	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529			▨	▨	▨
Shaft Side			IP 65	IP 65	IP 65
Housing side		Connector outlet [6]	IP 67	IP 67	IP 67
Housing side		Cable outlet	IP 67	IP 67	IP 67
Load current		4,5 ... 5,5 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, HTL/push pull	30 mA	30 mA	30 mA
		4,5 ... 32 V, TTL/HTL programmable		30 mA	30 mA
No load operating current		4,5 ... 5,5 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, HTL/push pull	40 mA	40 mA	40 mA
		4,5 ... 32 V, TTL/HTL programmable		60 mA	60 mA
Initialisation time after power		4,5 ... 5,5 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, HTL/push pull	40 ms	40 ms	40 ms
		4,5 ... 32 V, TTL/HTL programmable		max. 30 ms	max. 30 ms

[1] Self-warming 3.3k/1,000 min^{-1}
when applying, note working temperature range

[2] Condensation of the optical scanning not permitted

[3] To EN 61000-6-2 and EN 61000-6-4

[4] To EN 60068-2-27

[5] To EN 60068-2-6

[6] With mating connector fitted

Order information TTL and HTL interface

DFS60 Incremental Encoder, face mount flange

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**S**								

Type
E
B
A

Mechanical interface	
Solid shaft, 10 x 19 mm	= **4**

Electrical interface	
4.5 ... 5.5 V, TTL/RS422	= **A**
10 ... 32 V, TTL/RS422	= **C**
10 ... 32 V, HTL/push-pull	= **E**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Type E – Number of lines per revolution

00100	00314	00500	01000	02000
00200	00360	00512	01024	02048
00250		00720	01250	

Type B – Number of lines per revolution

00050	00300	00500	01000	02000	04000	07200
00100	00314	00512	01024	02048	04096	08192
00200	00360	00720	01250	02500	05000	10000
00250				03600		

Others on request

Type A – Number of lines per revolution

00100	00300	00500	01000	02000	04000	07200	16384
00200	00314	00512	01024	02048	04096	08192	32768
00250	00360	00720	01250	02500	05000	10000	65536
				03600			

Others on request

Order information DFS60 Incremental Encoder, type E, solid shaft 10 x 19 mm, Electrical interface 10 ... 32 V, HTL/push-pull, connector M12, 8-pin, radial, number of lines 1024

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**	**E**	**–**	**S**	**4**	**E**	**C**	**0**	**1**	**0**	**2**	**4**

Order information TTL or HTL programmable

DFS60 Incremental Encoder, face mount flange

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**S**								

Type
B
A

Mechanical interface	
Solid shaft, 10 x 19 mm	= **4**

Electrical interface	
4.5 ... 32 V, TTL/HTL programmable [1]	= **P**

[1] Preset level of output signal: TTL

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [2]	= **K**
Cable 8-core, universal 3 m [2]	= **L**
Cable 8-core, universal 5 m [2]	= **M**

[2] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

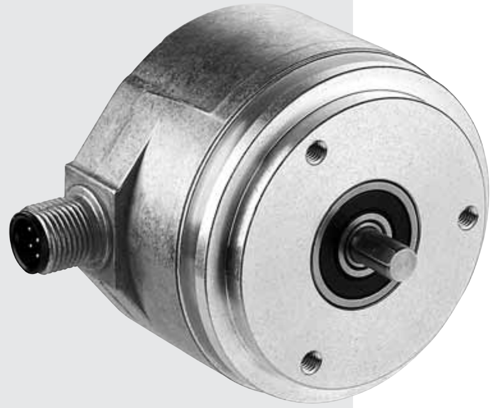
Order information	
DFS60 Incremental Encoder Type B	
Face mount flange	
Solid shaft 10 x 19 mm	
Type	**Part no.**
DFS60B-S4PA10000	1036720
DFS60B-S4PC10000	1036721
DFS60B-S4PK10000	1036722
DFS60B-S4PL10000	1036723
DFS60B-S4PM10000	1036724

Order information	
DFS60 Incremental Encoder Type A	
Face mount flange	
Solid shaft 10 x 19 mm	
Type	**Part no.**
DFS60A-S4PA65536	1036725
DFS60A-S4PC65536	1036726
DFS60A-S4PK65536	1036727
DFS60A-S4PL65536	1036728
DFS60A-S4PM65536	1036729

Number of lines
1 up to 65,536

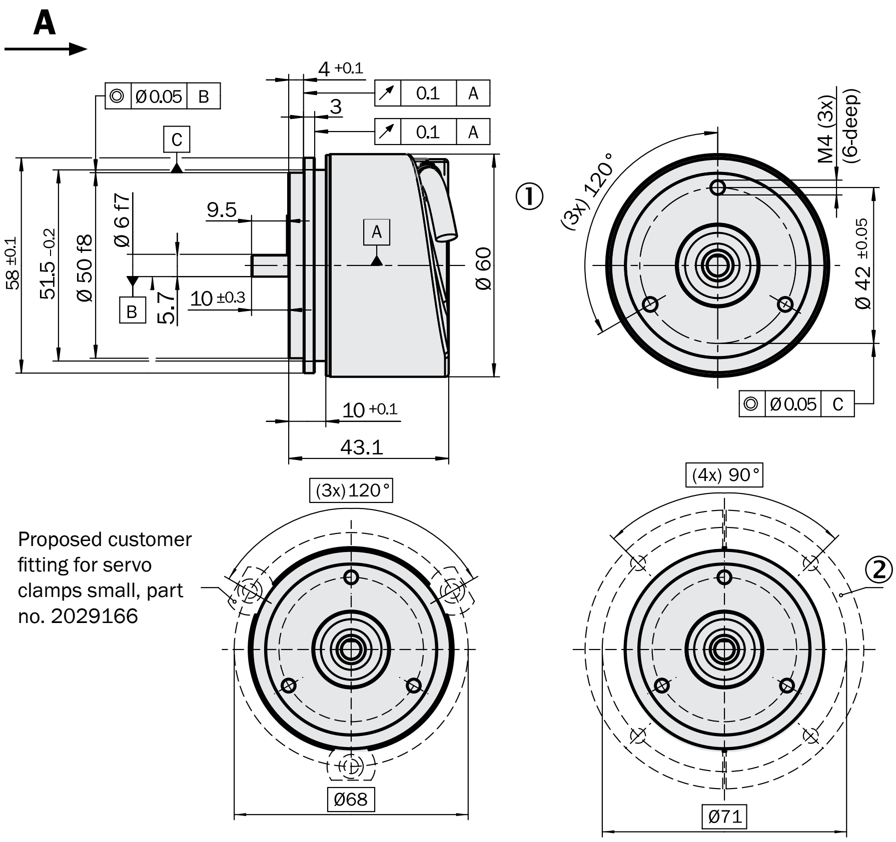
Incremental Encoders

- Connector or cable outlet
- Protection class IP 67
- Electrical interfaces
  TTL, HTL
- Number of lines, level of
  output signal and zero pulse
  width freely programmable



Accessories – see pages 410-448

Dimensional drawing servo flange, cable outlet

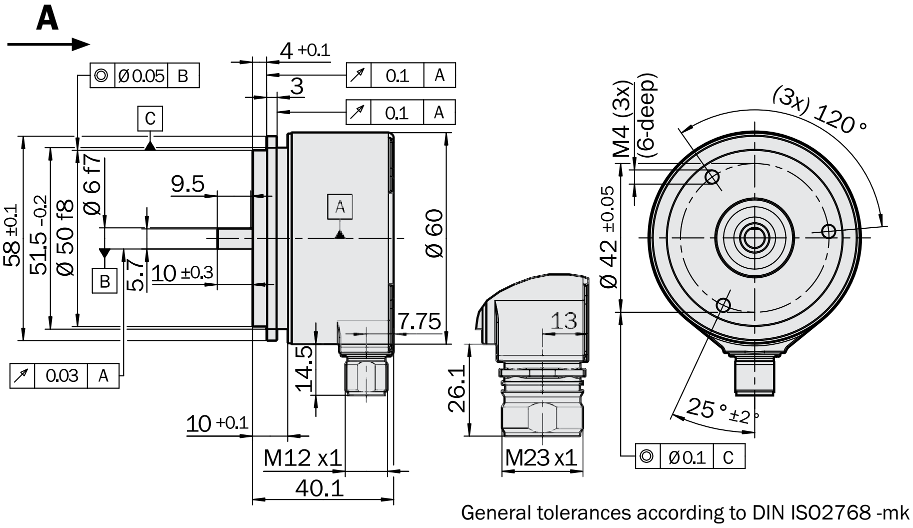


General tolerances according to DIN ISO2768 -mk

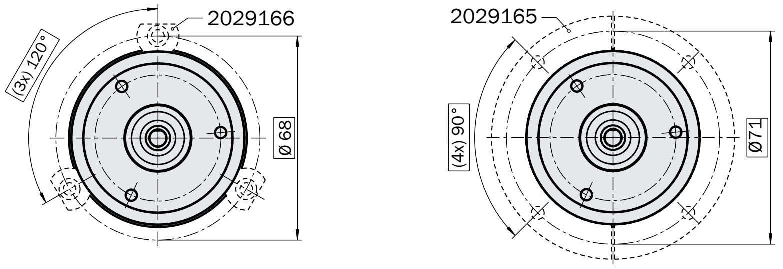
① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

② Proposed customer fitting for servo clamps half ring, part no. 2029165

Dimensional drawing servo flange, connector outlet M12 and M23



General tolerances according to DIN ISO2768 -mk



Proposed customer fitting for servo clamps small, part no. 2029166

Proposed customer fitting for servo clamps half ring, part no. 2029165

Technical data to DIN 32878		DFS60 servo flange			
Type			**E**	**B**	**A**
Shaft diameter		6 x 10 mm	▨	▨	▨
Electrical interface		4.5 ... 5.5 V, TTL/RS422	▨	▨	▨
		10 ... 32 V, TTL/RS422	▨	▨	▨
		10 ... 32 V, HTL/push-pull	▨	▨	▨
		4.5 ... 32 V, TTL/HTL programmable		▨	▨
Number of lines per revolution			100 ... 2048	1 ... 10000	1 ... 65536
Mass		0.3 kg	▨	▨	▨
Moment of inertia to the rotor		6.2 gcm^2	▨	▨	▨
Measuring step		90° electric/number of lines	▨	▨	▨
Reference signal	**Number**	1	▨	▨	▨
	Position	90° electr., gated with A and B	▨	▨	▨
Error limits			± 0.3°	± 0.05°	± 0.03°
Measuring step deviation		Number of lines 1 ... 99		± 0.08°	± 0.04°
		Number of lines 100 ... 10,000	± 0.2°	± 0.01°	± 0.008°
		Number of lines > 10,000			± 0.002°
Max. output frequency		TTL/RS422	300 kHz	600 kHz	820 kHz
		HTL/push-pull	300 kHz	600 kHz	820 kHz
		TTL/HTL programmable		600 kHz	820 kHz
Operating speed [1]			10,000 rpm	10,000 rpm	10,000 rpm
Angular acceleration		5×10^5 rad/s^2	▨	▨	▨
Max. Operating torque	**at 20 °C**	0.3 Ncm	▨	▨	▨
Starting torque	**at 20 °C**	0.5 Ncm	▨	▨	▨
Permissible shaft loading		radial	80 N	80 N	80 N
		axial	40 N	40 N	40 N
Bearing lifetime		3×10^9 revolutions	▨	▨	▨
Working temperature range			0 ... +70 °C	–20 ... +100 °C	–20 ... +100 °C
Storage temperature range (without package)			–40 ... +100 °C	–40 ... +100 °C	–40 ... +100 °C
Permissible relative humidity [2]		90 %	▨	▨	▨
EMC [3]			▨	▨	▨
Resistance		To shocks [4]	50 g/6 ms	70 g/6 ms	60 g/6 ms
		To vibration [5]	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class IEC 60529			▨	▨	▨
Shaft Side			IP 65	IP 65	IP 65
Housing side		Connector outlet [6]	IP 67	IP 67	IP 67
Housing side		Cable outlet	IP 67	IP 67	IP 67
Load current		4.5 ... 5.5 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, HTL/push-pull	30 mA	30 mA	30 mA
		4.5 ... 32 V, TTL/HTL programmable		30 mA	30 mA
No-load operating current		4.5 ... 5.5 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, HTL/push-pull	40 mA	40 mA	40 mA
		4.5... 32 V, TTL/HTL programmable		60 mA	60 mA
Initialisation time after power on		4.5 ... 5.5 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, HTL/Push pull	40 ms	40 ms	40 ms
		4.5 ... 32 V, TTL/HTL programmable		max. 30 ms	max. 30 ms

[1] Self-warming 3.3k/1,000 min^{-1}
when applying, note working temperature range

[2] Condensation of the optical scanning not permitted

[3] To EN 61000-6-2 and EN 61000-6-4

[4] To EN 60068-2-27

[5] To EN 60068-2-6

[6] With mating connector fitted

Order information TTL and HTL interface

DFS60 Incremental Encoder, servo flange

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**S**								

Type
E
B
A

Mechanical interface	
Solid shaft, 6 x 10 mm	= **1**

Electrical interface	
4.5 ... 5.5 V, TTL/RS422	= **A**
10 ... 32 V, TTL/RS422	= **C**
10 ... 32 V, HTL/push-pull	= **E**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Type E – Number of lines per revolution

00100	00314	00500	01000	02000
00200	00360	00512	01024	02048
00250		00720	01250	

Type B – Number of lines per revolution

00050	00300	00500	01000	02000	04000	07200
00100	00314	00512	01024	02048	04096	08192
00200	00360	00720	01250	02500	05000	10000
00250				03600		

Others on request

Type A – Number of lines per revolution

00100	00300	00500	01000	02000	04000	07200	16384
00200	00314	00512	01024	02048	04096	08192	32768
00250	00360	00720	01250	02500	05000	10000	65536
				03600			

Others on request

Order information: DFS60 Incremental Encoder, type E, solid shaft 6 x 10 mm, Electrical interface 10 ... 32 V, HTL/push-pull, connector M12, 8-pin, radial, number of lines 1024

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**	**E**	**–**	**S**	**1**	**E**	**C**	**0**	**1**	**0**	**2**	**4**

Order information TTL or HTL programmable

DFS60 Incremental Encoder, servo flange

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**S**								

Type
B
A

Mechanical interface	
Solid shaft, 6 x 10 mm	= **1**

Electrical interface	
4.5 ... 32 V, TTL/HTL programmable [1]	= **P**

[1] Preset level of output signal: TTL

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [2]	= **K**
Cable 8-core, universal 3 m [2]	= **L**
Cable 8-core, universal 5 m [2]	= **M**

[2] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

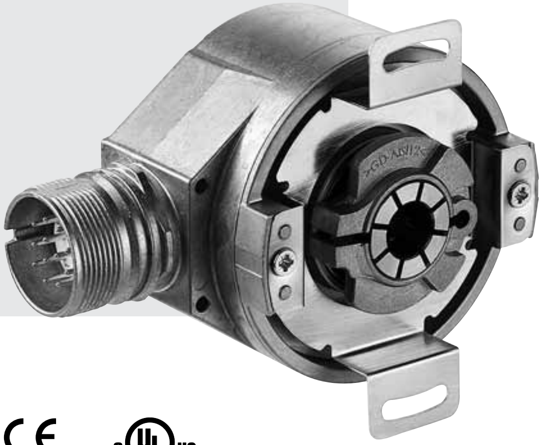
Order information	
DFS60 Incremental Encoder Type B	
Servo flange	
Solid shaft 6 x 10 mm	
Type	**Part no.**
DFS60B-S1PA10000	1036755
DFS60B-S1PC10000	1036756
DFS60B-S1PK10000	1036757
DFS60B-S1PL10000	1036758
DFS60B-S1PM10000	1036759

Order information	
DFS60 Incremental Encoder Type A	
Servo flange	
Solid shaft 6 x 10 mm	
Type	**Part no.**
DFS60A-S1PA65536	1036760
DFS60A-S1PC65536	1036761
DFS60A-S1PK65536	1036762
DFS60A-S1PL65536	1036763
DFS60A-S1PM65536	1036764

Number of lines
1 up to 65,536

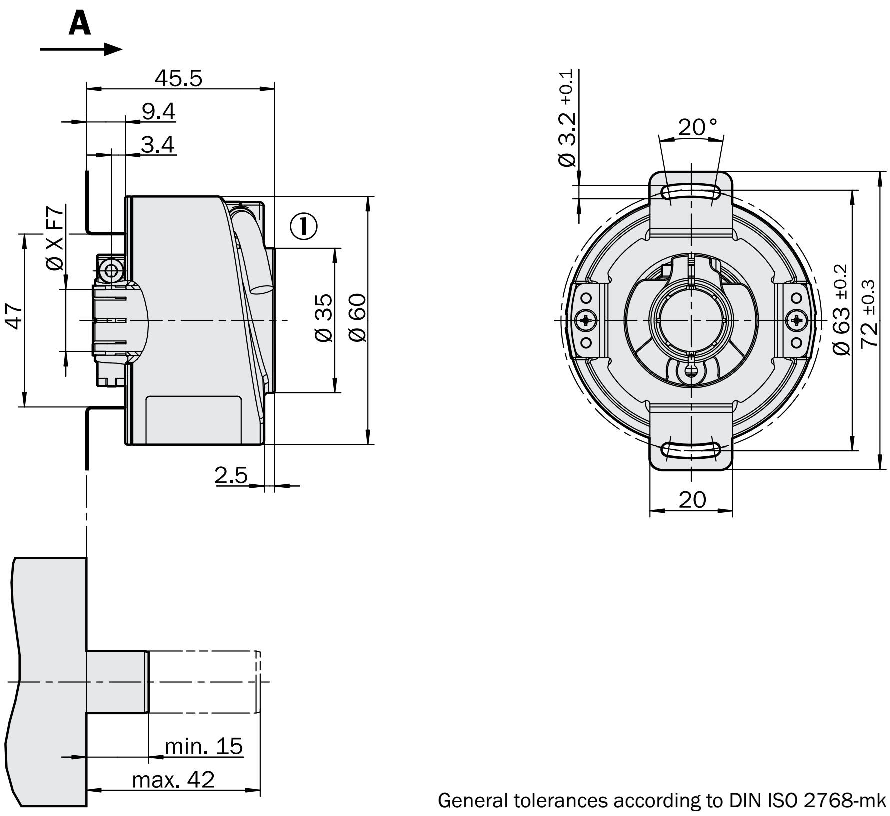
Incremental Encoders

- Connector or cable outlet
- Protection class IP 67
- Electrical interfaces
  TTL, HTL
- Number of lines, level of output signal and zero pulse width freely programmable



Accessories – see pages 410-448

Dimensional drawing blind hollow shaft, cable outlet

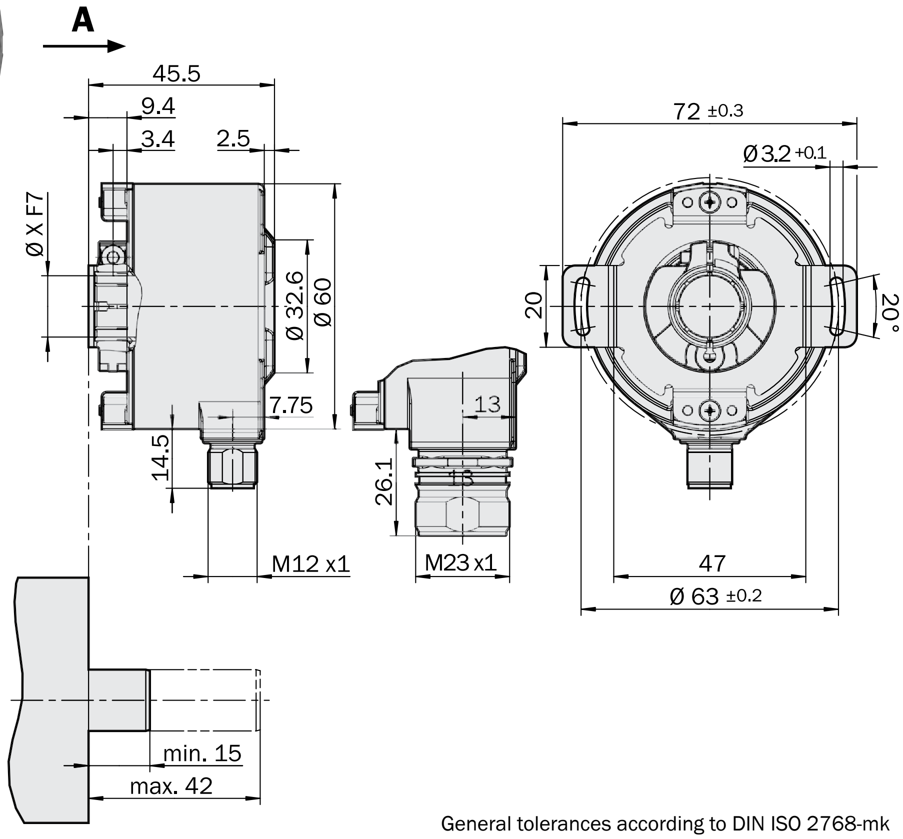


General tolerances according to DIN ISO 2768-mk

Customer-side

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Dimensional drawing blind hollow shaft, connector outlet M12 and M23



General tolerances according to DIN ISO 2768-mk

Customer-side

Technical data to DIN 32878		DFS60 blind hollow shaft			
Type			**E**	**B**	**A**
Shaft diameter		8, 10, 12, 14, 15 mm a. 3/8", 1/2", 5/8"			
Electrical interface		4.5 ... 5.5 V, TTL/RS422			
		10 ... 32 V, TTL/RS422			
		10 ... 32 V, HTL/push-pull			
		4.5 ... 32 V, TTL/HTL programmable			
Number of lines per revolution			100 ... 2048	1 ... 10000	1 ... 65536
Mass		0.2 kg			
Moment of inertia to the rotor		40 gcm^2			
Measuring step		90 ° electric/number of lines			
Reference signal	**Number**	1			
	Position	90° electr., gated with A and B			
Error limits			± 0.3°	± 0.05°	± 0.03°
Measuring step deviation		Number of lines 1 ... 99		± 0.08°	± 0.04°
		Number of lines 100 ... 10,000	± 0.2°	± 0.01°	± 0.008°
		Number of lines > 10,000			± 0.002°
Max. output frequency		TTL/RS422	300 kHz	600 kHz	820 kHz
		HTL/push-pull	300 kHz	600 kHz	820 kHz
		TTL/HTL programmable		600 kHz	820 kHz
Operating speed [1]			6,000 rpm	6,000 rpm	6,000 rpm
Angular acceleration		5 x 10^5 rad/s^2			
Max. Operating torque	**at 20 °C**	0.6 Ncm			
Starting torque	**at 20 °C**	0.8 Ncm			
Permissible movement of the drive element					
radial		Static/dynamic	± 0.3/± 0.1 mm	± 0.3/± 0.1 mm	± 0.3/± 0.05 mm
axial		Static/dynamic	± 0.5/± 0.2 mm	± 0.5/± 0.2 mm	± 0.5/± 0.01 mm
Bearing lifetime		3 x 10^9 revolutions			
Working temperature range			0 ... +70 °C	–20 ... +100 °C	–20 ... +100 °C
Storage temperature range (without package)			–40 ... +100 °C	–40 ... +100 °C	–40 ... +100 °C
Permissible relative humidity [2]		90 %			
EMC [3]					
Resistance		To shocks [4]	50 g/6 ms	70 g/6 ms	60 g/6 ms
		To vibration [5]	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529					
Shaft Side			IP 65	IP 65	IP 65
Housing side		Connector outlet [6]	IP 67	IP 67	IP 67
Housing side		Cable outlet	IP 67	IP 67	IP 67
Load current		4,5 ... 5,5 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, HTL/push pull	30 mA	30 mA	30 mA
		4,5 ... 32 V, TTL/HTL programmable		30 mA	30 mA
No load operating current		4,5 ... 5,5 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, HTL/push pull	40 mA	40 mA	40 mA
		4,5 ... 32 V, TTL/HTL programmable		60 mA	60 mA
Initialisation time after power on		4,5 ... 5,5 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, HTL/push pull	40 ms	40 ms	40 ms
		4,5 ... 32 V, TTL/HTL programmable		max. 30 ms	max. 30 ms

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[1] Self-warming 3.3k/1,000 min^{-1}
when applying, note working temperature range

[2] Condensation of the optical scanning not permitted

[3] To EN 61000-6-2 and EN 61000-6-4

[4] To EN 60068-2-27

[5] To EN 60068-2-6

[6] With mating connector fitted

Order information TTL and HTL interface

DFS60 Incremental Encoder, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**B**								

Type
E
B
A

Mechanical interface	
Blind hollow shaft 8 mm	= **B**
Blind hollow shaft 3/8"	= **C**
Blind hollow shaft 10 mm	= **D**
Blind hollow shaft 12 mm	= **E**
Blind hollow shaft 1/2"	= **F**
Blind hollow shaft 14 mm	= **G**
Blind hollow shaft 15 mm	= **H**
Blind hollow shaft 5/8"	= **J**

Electrical interface	
4.5 ... 5.5 V, TTL/RS422	= **A**
10 ... 32 V, TTL/RS422	= **C**
10 ... 32 V, HTL/push-pull	= **E**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Type E – Number of lines per revolution

00100	00314	00500	01000	02000
00200	00360	00512	01024	02048
00250		00720	01250	

Type B – Number of lines per revolution

00050	00300	00500	01000	02000	04000	07200
00100	00314	00512	01024	02048	04096	08192
00200	00360	00720	01250	02500	05000	10000
00250				03600		

Others on request

Type A – Number of lines per revolution

00100	00300	00500	01000	02000	04000	07200	16384
00200	00314	00512	01024	02048	04096	08192	32768
00250	00360	00720	01250	02500	05000	10000	65536
				03600			

Others on request

Order information: DFS60 Incremental Encoder, type E, blind hollow shaft, diameter 10 mm, Electrical interface 10 ... 32 V, HTL/push-pull, connector M12, 8-pin, radial, number of lines 1024

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**	**E**	**–**	**B**	**D**	**E**	**C**	**0**	**1**	**0**	**2**	**4**

Order information TTL or HTL programmable

DFS60 Incremental Encoder, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**B**								

Type
B
A

Mechanical interface	
Blind hollow shaft 8 mm	= **B**
Blind hollow shaft 3/8"	= **C**
Blind hollow shaft 10 mm	= **D**
Blind hollow shaft 12 mm	= **E**
Blind hollow shaft 1/2"	= **F**
Blind hollow shaft 14 mm	= **G**
Blind hollow shaft 15 mm	= **H**
Blind hollow shaft 5/8"	= **J**

Electrical interface	
4.5 ... 32 V, TTL/HTL programmable 1)	= **P**

1) Preset level of output signal: TTL

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m 2)	= **K**
Cable 8-core, universal 3 m 2)	= **L**
Cable 8-core, universal 5 m 2)	= **M**

2) The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Order information
DFS60 Incremental Encoder Type B
Blind hollow shaft
Connector M23

Type	Part no.
DFS60B-BBPA10000	1036765
DFS60B-BCPA10000	1036766
DFS60B-BDPA10000	1036767
DFS60B-BEPA10000	1036768
DFS60B-BFPA10000	1036769
DFS60B-BGPA10000	1036770
DFS60B-BHPA10000	1036771
DFS60B-BJPA10000	1036772

Order information
DFS60 Incremental Encoder Type B
Blind hollow shaft
Connector M12

Type	Part no.
DFS60B-BBPC10000	1036773
DFS60B-BCPC10000	1036774
DFS60B-BDPC10000	1036775
DFS60B-BEPC10000	1036776
DFS60B-BFPC10000	1036777
DFS60B-BGPC10000	1036778
DFS60B-BHPC10000	1036779
DFS60B-BJPC10000	1036780

Order information
DFS60 Incremental Encoder Type B
Blind hollow shaft
Cable 1,5 m

Type	Part no.
DFS60B-BBPK10000	1036781
DFS60B-BCPK10000	1036782
DFS60B-BDPK10000	1036783
DFS60B-BEPK10000	1036784
DFS60B-BFPK10000	1036785
DFS60B-BGPK10000	1036786
DFS60B-BHPK10000	1036787
DFS60B-BJPK10000	1036788

Order information
DFS60 Incremental Encoder Type B
Blind hollow shaft
Cable 3 m

Type	Part no.
DFS60B-BBPL10000	1036789
DFS60B-BCPL10000	1036790
DFS60B-BDPL10000	1036791
DFS60B-BEPL10000	1036792
DFS60B-BFPL10000	1036793
DFS60B-BGPL10000	1036794
DFS60B-BHPL10000	1036795
DFS60B-BJPL10000	1036796

Order information
DFS60 Incremental Encoder Type B
Blind hollow shaft
Cable 5 m

Type	Part no.
DFS60B-BBPM10000	1036797
DFS60B-BCPM10000	1036798
DFS60B-BDPM10000	1036799
DFS60B-BEPM10000	1036800
DFS60B-BFPM10000	1036801
DFS60B-BGPM10000	1036802
DFS60B-BHPM10000	1036803
DFS60B-BJPM10000	1036804

Order information
DFS60 Incremental Encoder Type A
Blind hollow shaft
Connector M23

Type	Part no.
DFS60A-BBPA65536	1036805
DFS60A-BCPA65536	1036806
DFS60A-BDPA65536	1036807
DFS60A-BEPA65536	1036808
DFS60A-BFPA65536	1036809
DFS60A-BGPA65536	1036810
DFS60A-BHPA65536	1036811
DFS60A-BJPA65536	1036812

Order information
DFS60 Incremental Encoder Type A
Blind hollow shaft
Connector M12

Type	Part no.
DFS60A-BBPC65536	1036813
DFS60A-BCPC65536	1036814
DFS60A-BDPC65536	1036815
DFS60A-BEPC65536	1036816
DFS60A-BFPC65536	1036817
DFS60A-BGPC65536	1036818
DFS60A-BHPC65536	1036819
DFS60A-BJPC65536	1036820

Order information
DFS60 Incremental Encoder Type A
Blind hollow shaft
Cable 1,5 m

Type	Part no.
DFS60A-BBPK65536	1036821
DFS60A-BCPK65536	1036822
DFS60A-BDPK65536	1036823
DFS60A-BEPK65536	1036824
DFS60A-BFPK65536	1036825
DFS60A-BGPK65536	1036826
DFS60A-BHPK65536	1036827
DFS60A-BJPK65536	1036828

Order information
DFS60 Incremental Encoder Type A
Blind hollow shaft
Cable 3 m

Type	Part no.
DFS60A-BBPL65536	1036829
DFS60A-BCPL65536	1036830
DFS60A-BDPL65536	1036831
DFS60A-BEPL65536	1036832
DFS60A-BFPL65536	1036833
DFS60A-BGPL65536	1036834
DFS60A-BHPL65536	1036835
DFS60A-BJPL65536	1036836

Order information
DFS60 Incremental Encoder Type A
Blind hollow shaft
Cable 5 m

Type	Part no.
DFS60A-BBPM65536	1036837
DFS60A-BCPM65536	1036838
DFS60A-BDPM65536	1036839
DFS60A-BEPM65536	1036840
DFS60A-BFPM65536	1036841
DFS60A-BGPM65536	1036842
DFS60A-BHPM65536	1036843
DFS60A-BJPM65536	1036844

Number of lines
1 up to 65,536

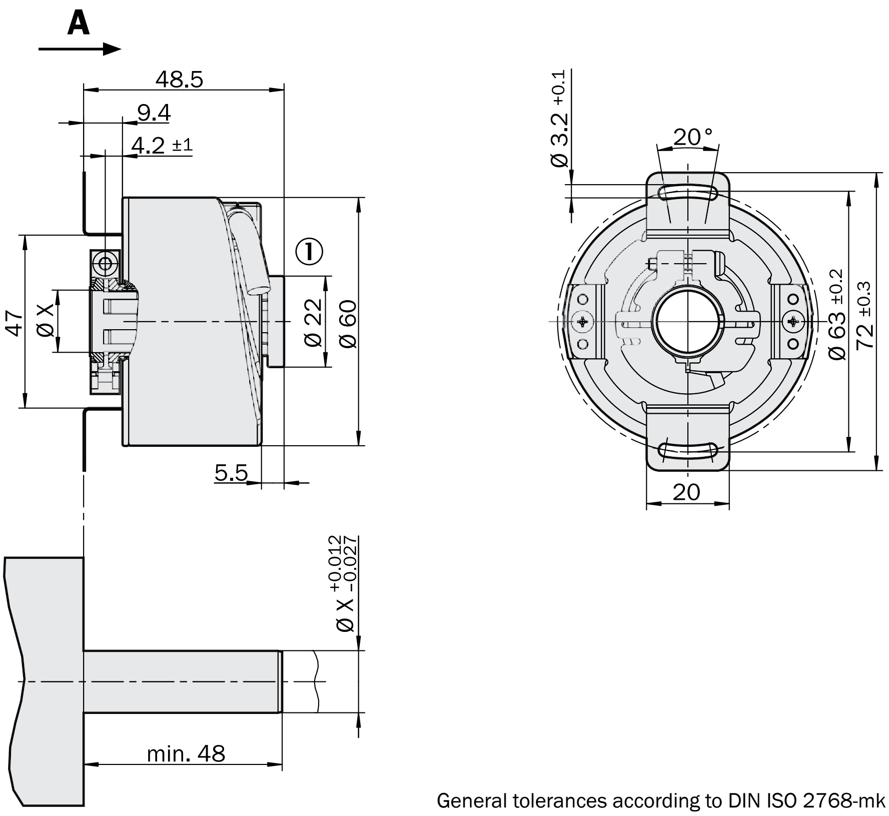
Incremental Encoders

- Connector or cable outlet
- Protection class IP 65
- Electrical interfaces
  TTL, HTL
- Number of lines, level of
  output signal and zero pulse
  width freely programmable

RoHS
2002/95/EC

Accessories – see pages 410-448

Dimensional drawing through hollow shaft plastic, cable outlet

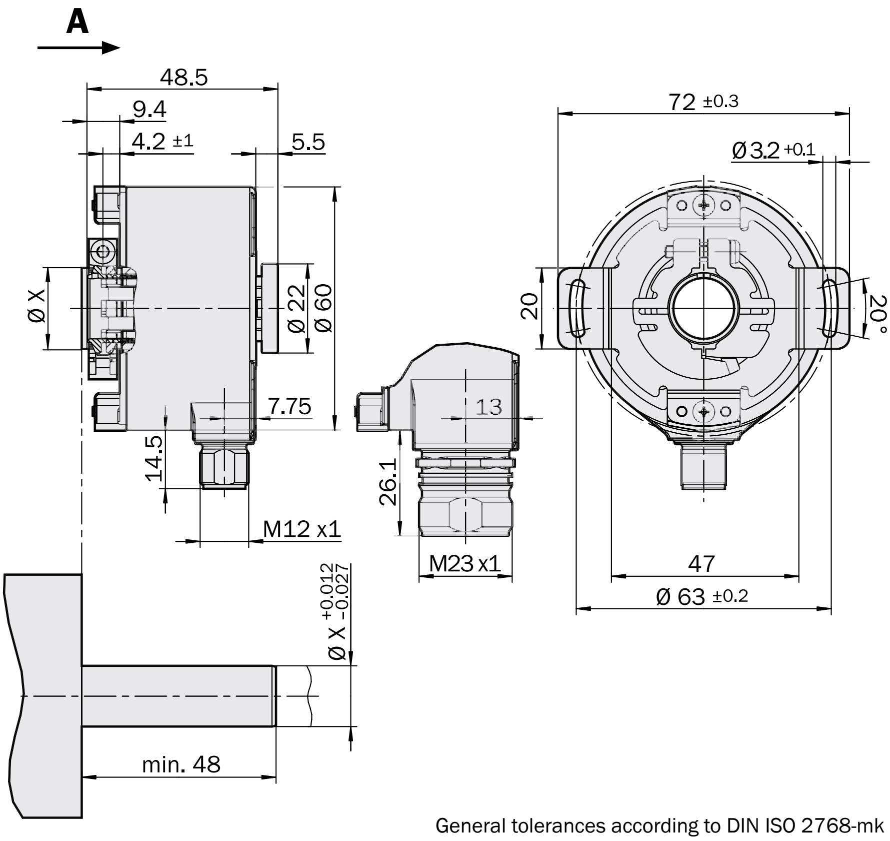


General tolerances according to DIN ISO 2768-mk

Customer-side

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Dimensional drawing through hollow shaft plastic, connector outlet M12 and M23



General tolerances according to DIN ISO 2768-mk

Customer-side

Technical data to DIN 32878		DFS60 through hollow shaft plastic			
Type			**E**	**B**	**A**
Shaft diameter		10, 12, 14, 15 mm a. 3/8", 1/2"			
Electrical interface		4.5 ... 5.5 V, TTL/RS422			
		10 ... 32 V, TTL/RS422			
		10 ... 32 V, HTL/push-pull			
		4.5 ... 32 V, TTL/HTL programmable			
Number of lines per revolution			100 ... 2048	1 ... 10000	1 ... 65536
Mass		0.2 kg			
Moment of inertia to the rotor		40 gcm^2			
Measuring step		90° electric/number of lines			
Reference signal	**Number**	1			
	Position	90° electr., gated with A and B			
Error limits			± 0.3°	± 0.05°	± 0.03°
Measuring step deviation		Number of lines 1 ... 99		± 0.08°	± 0.04°
		Number of lines 100 ... 10,000	± 0.2°	± 0.01°	± 0.008°
		Number of lines > 10,000			± 0.002°
Max. output frequency		TTL/RS422	300 kHz	600 kHz	820 kHz
		HTL/push-pull	300 kHz	600 kHz	820 kHz
		TTL/HTL programmable		600 kHz	820 kHz
Operating speed 1)			9,000 rpm	12,000 rpm	12,000 rpm
Angular acceleration		5 x 10^5 rad/s^2			
Max. Operating torque	**at 20 °C**	0.6 Ncm			
Starting torque	**at 20 °C**	0.8 Ncm			
Permissible movement of the drive element					
radial		Static/dynamic	± 0.3/± 0.1 mm	± 0.3/± 0.1 mm	± 0.3/± 0.05 mm
axial		Static/dynamic	± 0.5/± 0.2 mm	± 0.5/± 0.2 mm	± 0.5/± 0.01 mm
Bearing lifetime		3 x 10^9 revolutions			
Working temperature range			0 ... +70 °C	–20 ... +100 °C	–20 ... +100 °C
Storage temperature range (without package)			–40 ... +100 °C	–40 ... +100 °C	–40 ... +100 °C
Permissible relative humidity 2)		90 %			
EMC 3)					
Resistance		To shocks 4)	50 g/6 ms	70 g/6 ms	60 g/6 ms
		To vibration 5)	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529					
Shaft Side			IP 65	IP 65	IP 65
Housing side		Connector outlet 6)	IP 65	IP 65	IP 65
Housing side		Cable outlet	IP 65	IP 65	IP 65
Load current		4,5 ... 5,5 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, HTL/push pull	30 mA	30 mA	30 mA
		4,5 ... 32 V, TTL/HTL programmable		30 mA	30 mA
No load operating current		4,5 ... 5,5 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, HTL/push pull	40 mA	40 mA	40 mA
		4,5 ... 32 V, TTL/HTL programmable		60 mA	60 mA
Initialisation time after power on		4,5 ... 5,5 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, HTL/push pull	40 ms	40 ms	40 ms
		4,5 ... 32 V, TTL/HTL programmable		max. 30 ms	max. 30 ms

1) Self-warming 3.3k/1,000 min^{-1}
when applying, note working temperature range

2) Condensation of the optical scanning not permitted

3) To EN 61000-6-2 and EN 61000-6-4

4) To EN 60068-2-27

5) To EN 60068-2-6

6) With mating connector fitted

Order information TTL and HTL interface

DFS60 Incremental Encoder, through hollow shaft plastic

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**T**								

Type
E
B
A

Mechanical interface	
Through hollow shaft	
Plastic 3/8"	= **3**
Plastic 10 mm	= **4**
Plastic 12 mm	= **5**
Plastic 1/2"	= **6**
Plastic 14 mm	= **7**
Plastic 15 mm	= **8**

Electrical interface	
4.5 ... 5.5 V, TTL/RS422	= **A**
10 ... 32 V, TTL/RS422	= **C**
10 ... 32 V, HTL/push-pull	= **E**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Type E – Number of lines per revolution

00100	00314	00500	01000	02000
00200	00360	00512	01024	02048
00250		00720	01250	

Type B – Number of lines per revolution

00050	00300	00500	01000	02000	04000	07200
00100	00314	00512	01024	02048	04096	08192
00200	00360	00720	01250	02500	05000	10000
00250				03600		

Others on request

Type A – Number of lines per revolution

00100	00300	00500	01000	02000	04000	07200	16384
00200	00314	00512	01024	02048	04096	08192	32768
00250	00360	00720	01250	02500	05000	10000	65536
				03600			

Others on request

Order information: DFS60 Incremental Encoder, type E, through hollow shaft plastic, diameter 10 mm, Electrical interface 10 ... 32 V, HTL/push-pull, connector M12, 8-pin, radial, number of lines 1024

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**	**E**	**–**	**T**	**4**	**E**	**C**	**0**	**1**	**0**	**2**	**4**

Order information TTL or HTL programmable

DFS60 Incremental Encoder, through hollow shaft plastic

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**T**								

Type
B
A

Mechanical interface	
Through hollow shaft	
Plastic 3/8"	= **3**
Plastic 10 mm	= **4**
Plastic 12 mm	= **5**
Plastic 1/2"	= **6**
Plastic 14 mm	= **7**
Plastic 15 mm	= **8**

Electrical interface	
4.5 ... 32 V, TTL/HTL programmable [1]	= **P**

[1] Preset level of output signal: TTL

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [2]	= **K**
Cable 8-core, universal 3 m [2]	= **L**
Cable 8-core, universal 5 m [2]	= **M**

[2] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Order information	
DFS60 Incremental Encoder Type B	
Through hollow shaft plastic	
Connector M23	
Type	**Part no.**
DFS60B-T3PA10000	1036845
DFS60B-T4PA10000	1036846
DFS60B-T5PA10000	1036847
DFS60B-T6PA10000	1036848
DFS60B-T7PA10000	1036849
DFS60B-T8PA10000	1036850

Order information	
DFS60 Incremental Encoder Type B	
Through hollow shaft plastic	
Connector M12	
Type	**Part no.**
DFS60B-T3PC10000	1036851
DFS60B-T4PC10000	1036852
DFS60B-T5PC10000	1036853
DFS60B-T6PC10000	1036854
DFS60B-T7PC10000	1036855
DFS60B-T8PC10000	1036856

Order information	
DFS60 Incremental Encoder Type B	
Through hollow shaft plastic	
Cable 1,5 m	
Type	**Part no.**
DFS60B-T3PK10000	1036857
DFS60B-T4PK10000	1036858
DFS60B-T5PK10000	1036859
DFS60B-T6PK10000	1036860
DFS60B-T7PK10000	1036861
DFS60B-T8PK10000	1036862

Order information	
DFS60 Incremental Encoder Type B	
Through hollow shaft plastic	
Cable 3 m	
Type	**Part no.**
DFS60B-T3PL10000	1036863
DFS60B-T4PL10000	1036864
DFS60B-T5PL10000	1036865
DFS60B-T6PL10000	1036866
DFS60B-T7PL10000	1036867
DFS60B-T8PL10000	1036868

Order information	
DFS60 Incremental Encoder Type B	
Through hollow shaft plastic	
Cable 5 m	
Type	**Part no.**
DFS60B-T3PM10000	1036869
DFS60B-T4PM10000	1036870
DFS60B-T5PM10000	1036871
DFS60B-T6PM10000	1036872
DFS60B-T7PM10000	1036873
DFS60B-T8PM10000	1036874

Order information	
DFS60 Incremental Encoder Type A	
Through hollow shaft plastic	
Connector M23	
Type	**Part no.**
DFS60A-T3PA65536	1036875
DFS60A-T4PA65536	1036876
DFS60A-T5PA65536	1036877
DFS60A-T6PA65536	1036878
DFS60A-T7PA65536	1036879
DFS60A-T8PA65536	1036880

Order information	
DFS60 Incremental Encoder Type A	
Through hollow shaft plastic	
Connector M12	
Type	**Part no.**
DFS60A-T3PC65536	1036881
DFS60A-T4PC65536	1036882
DFS60A-T5PC65536	1036883
DFS60A-T6PC65536	1036884
DFS60A-T7PC65536	1036885
DFS60A-T8PC65536	1036886

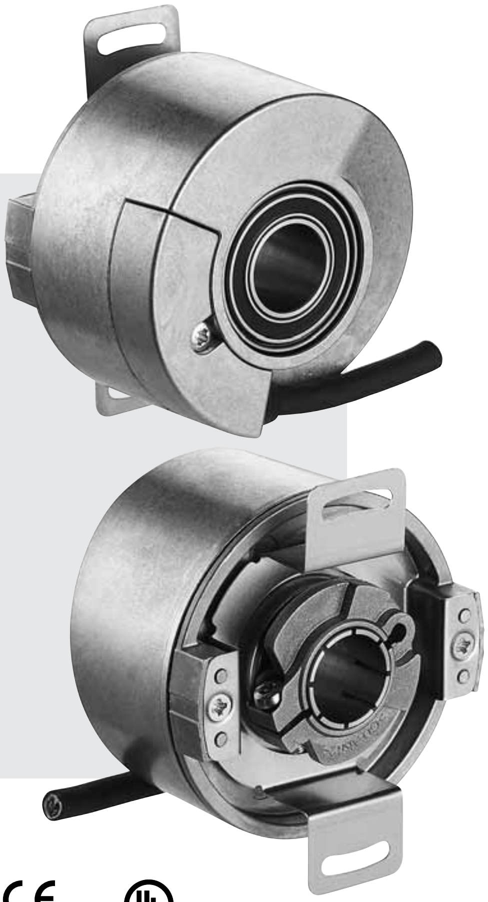
Order information	
DFS60 Incremental Encoder Type A	
Through hollow shaft plastic	
Cable 1,5 m	
Type	**Part no.**
DFS60A-T3PK65536	1036887
DFS60A-T4PK65536	1036888
DFS60A-T5PK65536	1036889
DFS60A-T6PK65536	1036890
DFS60A-T7PK65536	1036891
DFS60A-T8PK65536	1036892

Order information	
DFS60 Incremental Encoder Type A	
Through hollow shaft plastic	
Cable 3 m	
Type	**Part no.**
DFS60A-T3PL65536	1036893
DFS60A-T4PL65536	1036894
DFS60A-T5PL65536	1036895
DFS60A-T6PL65536	1036896
DFS60A-T7PL65536	1036897
DFS60A-T8PL65536	1036898

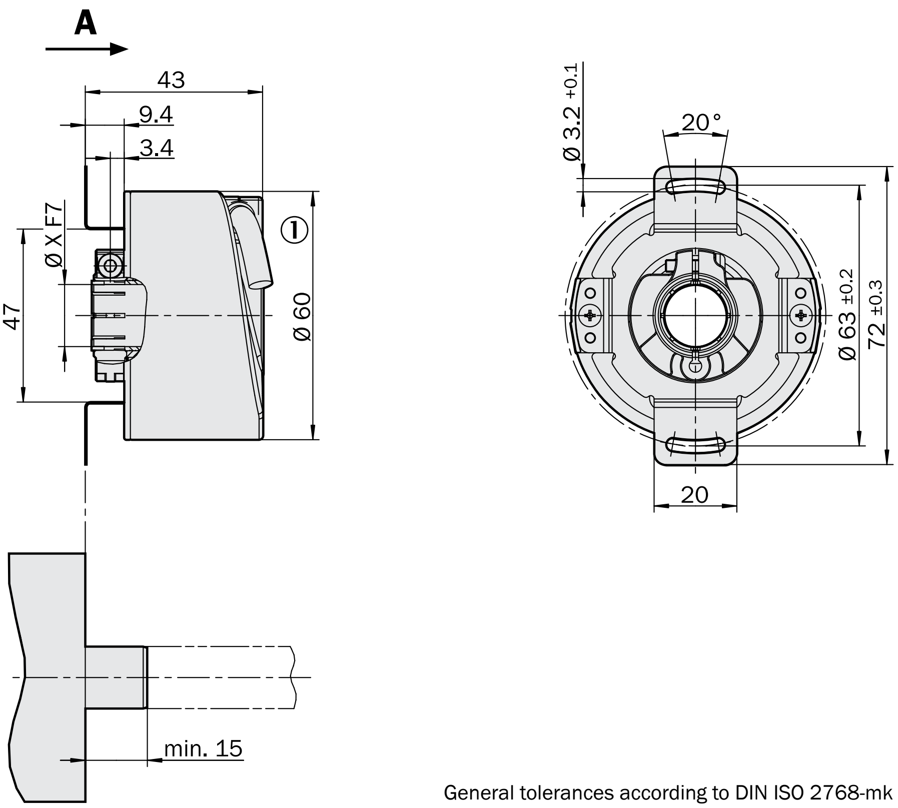
Order information	
DFS60 Incremental Encoder Type A	
Through hollow shaft plastic	
Cable 5 m	
Type	**Part no.**
DFS60A-T3PM65536	1036899
DFS60A-T4PM65536	1036900
DFS60A-T5PM65536	1036901
DFS60A-T6PM65536	1036902
DFS60A-T7PM65536	1036903
DFS60A-T8PM65536	1036904

Number of lines
1 up to 65,536
Incremental Encoders

- Connector or cable outlet
- Protection class IP 65
- Electrical interfaces TTL, HTL
- Number of lines, level of output signal and zero pulse width freely programmable



Dimensional drawing through hollow shaft metal, cable outlet

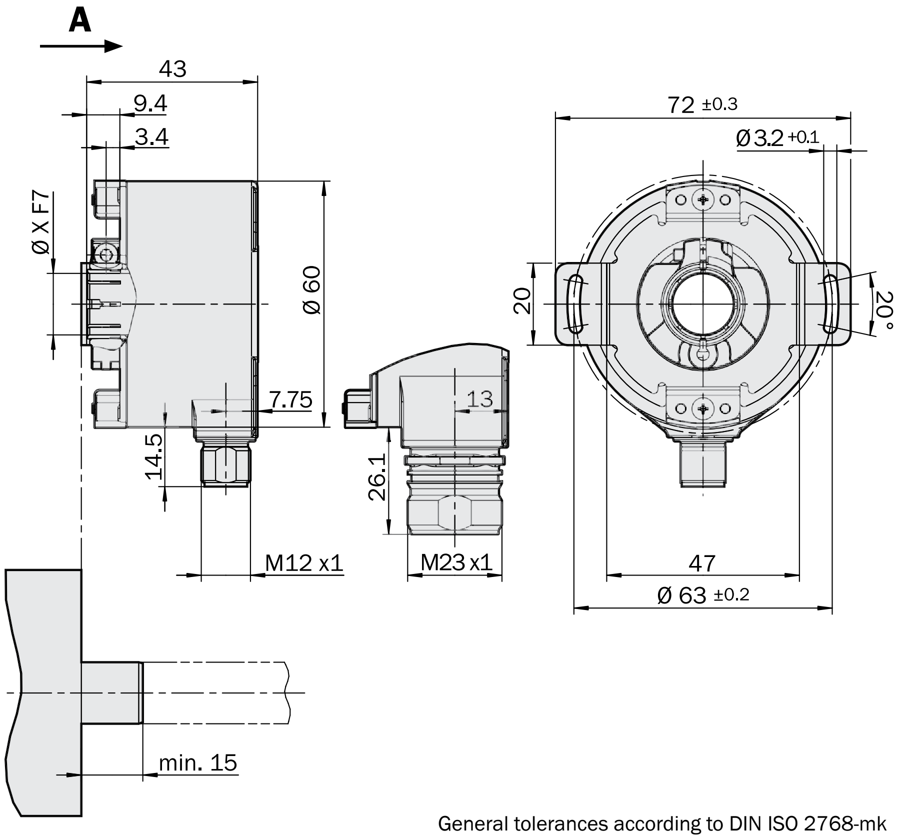


General tolerances according to DIN ISO 2768-mk

Customer-side

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Dimensional drawing through hollow shaft metal, connector outlet M12 and M23



General tolerances according to DIN ISO 2768-mk

Customer-side

Accessories – see pages 410-448

Technical data to DIN 32878		DFS60 through hollow shaft metal			
Type			**E**	**B**	**A**
Shaft diameter		8, 10, 12, 14, 15 mm a. 3/8", 1/2", 5/8"	■	■	■
Electrical interface		4.5 ... 5.5 V, TTL/RS422	■	■	■
		10 ... 32 V, TTL/RS422	■	■	■
		10 ... 32 V, HTL/push-pull	■	■	■
		4.5 ... 32 V, TTL/HTL programmable		■	■
Number of lines per revolution			100 ... 2048	1 ... 10000	1 ... 65536
Mass		0.2 kg	■	■	■
Moment of inertia to the rotor		40 gcm^2	■	■	■
Measuring step		90 ° electric/number of lines	■	■	■
Reference signal	**Number**	1	■	■	■
	Position	90° electr., gated with A and B	■	■	■
Error limits			± 0.3 °	± 0.05 °	± 0.03 °
Measuring step deviation		Number of lines 1 ... 99		± 0.08 °	± 0.04 °
		Number of lines 100 ... 10,000	± 0.2 °	± 0.01 °	± 0.008 °
		Number of lines > 10,000			± 0.002 °
Max. output frequency		TTL/RS422	300 kHz	600 kHz	820 kHz
		HTL/push-pull	300 kHz	600 kHz	820 kHz
		TTL/HTL programmable		600 kHz	820 kHz
Operating speed [1]			9,000 rpm	9,000 rpm	9,000 rpm
Angular acceleration		5 x 10^5 rad/s^2	■	■	■
Max. Operating torque	**at 20 °C**	0.6 Ncm	■	■	■
Starting torque	**at 20 °C**	0.8 Ncm	■	■	■
Permissible movement of the drive element					
radial		Static/dynamic	± 0.3/± 0.1 mm	± 0.3/± 0.1 mm	± 0.3/± 0.05 mm
axial		Static/dynamic	± 0.5/± 0.2 mm	± 0.5/± 0.2 mm	± 0.5/± 0.01 mm
Bearing lifetime		3 x 10^9 revolutions	■	■	■
Working temperature range			0 ... +70 °C	–20 ... +100 °C	–20 ... +100 °C
Storage temperature range (without package)			–40 ... +100 °C	–40 ... +100 °C	–40 ... +100 °C
Permissible relative humidity [2]		90 %	■	■	■
EMC [3]			■	■	■
Resistance		To shocks [4]	50 g/6 ms	70 g/6 ms	60 g/6 ms
		To vibration [5]	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529			■	■	■
Shaft Side			IP 65	IP 65	IP 65
Housing side		Connector outlet [6]	IP 65	IP 65	IP 65
Housing side		Cable outlet	IP 65	IP 65	IP 65
Load current		4,5 ... 5,5 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, TTL/RS422	30 mA	30 mA	30 mA
		10 ... 32 V, HTL/push pull	30 mA	30 mA	30 mA
		4,5 ... 32 V, TTL/HTL programmable		30 mA	30 mA
No load operating current		4,5 ... 5,5 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, HTL/push pull	40 mA	40 mA	40 mA
		4,5 ... 32 V, TTL/HTL programmable		60 mA	60 mA
Initialisation time after power on		4,5 ... 5,5 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, HTL/push pull	40 ms	40 ms	40 ms
		4,5 ... 32 V, TTL/HTL programmable		max. 30 ms	max. 30 ms

[1] Self-warming 3.3k/1,000 min^{-1}
when applying, note working temperature range

[2] Condensation of the optical scanning not permitted

[3] To EN 61000-6-2 and EN 61000-6-4

[4] To EN 60068-2-27

[5] To EN 60068-2-6

[6] With mating connector fitted

Order information TTL and HTL interface

DFS60 Incremental Encoder, through hollow shaft metal

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**T**								

Type

- E
- B
- A

Mechanical interface

Through hollow shaft

Metal 8 mm = **B**
Metal 3/8" = **C**
Metal 10 mm = **D**
Metal 12 mm = **E**
Metal 1/2" = **F**
Metal 14 mm = **G**
Metal 15 mm = **H**
Metal 5/8" = **J**

Electrical interface

4.5 ... 5.5 V, TTL/RS422 = **A**
10 ... 32 V, TTL/RS422 = **C**
10 ... 32 V, HTL/push-pull = **E**

Connection type

Connector M23, 12-pin, radial = **A**
Connector M12, 8-pin, radial = **C**
Cable 8-core, universal 1.5 m [1] = **K**
Cable 8-core, universal 3 m [1] = **L**
Cable 8-core, universal 5 m [1] = **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines

Always 5 characters in clear text

Selection depending on the type, see below.

Type E – Number of lines per revolution

00100	00314	00500	01000	02000
00200	00360	00512	01024	02048
00250		00720	01250	

Type B – Number of lines per revolution

00050	00300	00500	01000	02000	04000	07200
00100	00314	00512	01024	02048	04096	08192
00200	00360	00720	01250	02500	05000	10000
00250				03600		

Others on request

Type A – Number of lines per revolution

00100	00300	00500	01000	02000	04000	07200	16384
00200	00314	00512	01024	02048	04096	08192	32768
00250	00360	00720	01250	02500	05000	10000	65536
				03600			

Others on request

Order information: DFS60 Incremental Encoder, type E, through hollow shaft metal, diameter 10 mm, Electrical interface 10 ... 32 V, HTL/push-pull, connector M12, 8-pin, radial, number of lines 1024

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**	**E**	**–**	**T**	**D**	**E**	**C**	**0**	**1**	**0**	**2**	**4**

Order information TTL or HTL programmable

DFS60 Incremental Encoder, through hollow shaft metal

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**F**	**S**	**6**	**0**		**–**	**T**								

Type
B
A

Mechanical interface	
Through hollow shaft	
Metal 8 mm	= **B**
Metal 3/8"	= **C**
Metal 10 mm	= **D**
Metal 12 mm	= **E**
Metal 1/2"	= **F**
Metal 14 mm	= **G**
Metal 15 mm	= **H**
Metal 5/8"	= **J**

Electrical interface	
4.5 ... 32 V, TTL/HTL programmable [1]	= **P**

[1] Preset level of output signal: TTL

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [2]	= **K**
Cable 8-core, universal 3 m [2]	= **L**
Cable 8-core, universal 5 m [2]	= **M**

[2] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Order information
DFS60 Incremental Encoder Type B
Through hollow shaft metal
Connector M23

Type	Part no.
DFS60B-TBPA10000	1036905
DFS60B-TCPA10000	1036906
DFS60B-TDPA10000	1036907
DFS60B-TEPA10000	1036908
DFS60B-TFPA10000	1036909
DFS60B-TGPA10000	1036910
DFS60B-THPA10000	1036911
DFS60B-TJPA10000	1036912

Order information
DFS60 Incremental Encoder Type B
Through hollow shaft metal
Connector M12

Type	Part no.
DFS60B-TBPC10000	1036913
DFS60B-TCPC10000	1036914
DFS60B-TDPC10000	1036915
DFS60B-TEPC10000	1036916
DFS60B-TFPC10000	1036917
DFS60B-TGPC10000	1036918
DFS60B-THPC10000	1036919
DFS60B-TJPC10000	1036920

Order information
DFS60 Incremental Encoder Type B
Through hollow shaft metal
Cable 1,5 m

Type	Part no.
DFS60B-TBPK10000	1036921
DFS60B-TCPK10000	1036922
DFS60B-TDPK10000	1036923
DFS60B-TEPK10000	1036924
DFS60B-TFPK10000	1036925
DFS60B-TGPK10000	1036926
DFS60B-THPK10000	1036927
DFS60B-TJPK10000	1036928

Order information
DFS60 Incremental Encoder Type B
Through hollow shaft metal
Cable 3 m

Type	Part no.
DFS60B-TBPL10000	1036929
DFS60B-TCPL10000	1036930
DFS60B-TDPL10000	1036931
DFS60B-TEPL10000	1036932
DFS60B-TFPL10000	1036933
DFS60B-TGPL10000	1036934
DFS60B-THPL10000	1036935
DFS60B-TJPL10000	1036936

Order information
DFS60 Incremental Encoder Type B
Through hollow shaft metal
Cable 5 m

Type	Part no.
DFS60B-TBPM10000	1036937
DFS60B-TCPM10000	1036938
DFS60B-TDPM10000	1036939
DFS60B-TEPM10000	1036940
DFS60B-TFPM10000	1036941
DFS60B-TGPM10000	1036942
DFS60B-THPM10000	1036943
DFS60B-TJPM10000	1036944

Order information
DFS60 Incremental Encoder Type A
Through hollow shaft metal
Connector M23

Type	Part no.
DFS60A-TBPA65536	1036945
DFS60A-TCPA65536	1036946
DFS60A-TDPA65536	1036947
DFS60A-TEPA65536	1036948
DFS60A-TFPA65536	1036949
DFS60A-TGPA65536	1036950
DFS60A-THPA65536	1036951
DFS60A-TJPA65536	1036952

Order information
DFS60 Incremental Encoder Type A
Through hollow shaft metal
Connector M12

Type	Part no.
DFS60A-TBPC65536	1036953
DFS60A-TCPC65536	1036954
DFS60A-TDPC65536	1036955
DFS60A-TEPC65536	1036956
DFS60A-TFPC65536	1036957
DFS60A-TGPC65536	1036958
DFS60A-THPC65536	1036959
DFS60A-TJPC65536	1036960

Order information
DFS60 Incremental Encoder Type A
Through hollow shaft metal
Cable 1,5 m

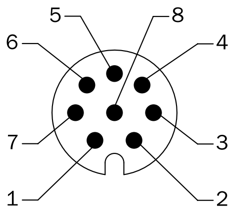
Type	Part no.
DFS60A-TBPK65536	1036961
DFS60A-TCPK65536	1036962
DFS60A-TDPK65536	1036963
DFS60A-TEPK65536	1036964
DFS60A-TFPK65536	1036965
DFS60A-TGPK65536	1036966
DFS60A-THPK65536	1036967
DFS60A-TJPK65536	1036968

Order information
DFS60 Incremental Encoder Type A
Through hollow shaft metal
Cable 3 m

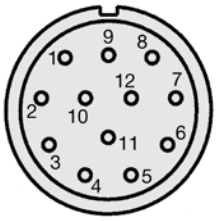
Type	Part no.
DFS60A-TBPL65536	1036969
DFS60A-TCPL65536	1036970
DFS60A-TDPL65536	1036971
DFS60A-TEPL65536	1036972
DFS60A-TFPL65536	1036973
DFS60A-TGPL65536	1036974
DFS60A-THPL65536	1036975
DFS60A-TJPL65536	1036976

Order information
DFS60 Incremental Encoder Type A
Through hollow shaft metal
Cable 5 m

Type	Part no.
DFS60A-TBPM65536	1036977
DFS60A-TCPM65536	1036978
DFS60A-TDPM65536	1036979
DFS60A-TEPM65536	1036980
DFS60A-TFPM65536	1036981
DFS60A-TGPM65536	1036982
DFS60A-THPM65536	1036983
DFS60A-TJPM65536	1036984



View to the connector M12 fitted to the encoder body

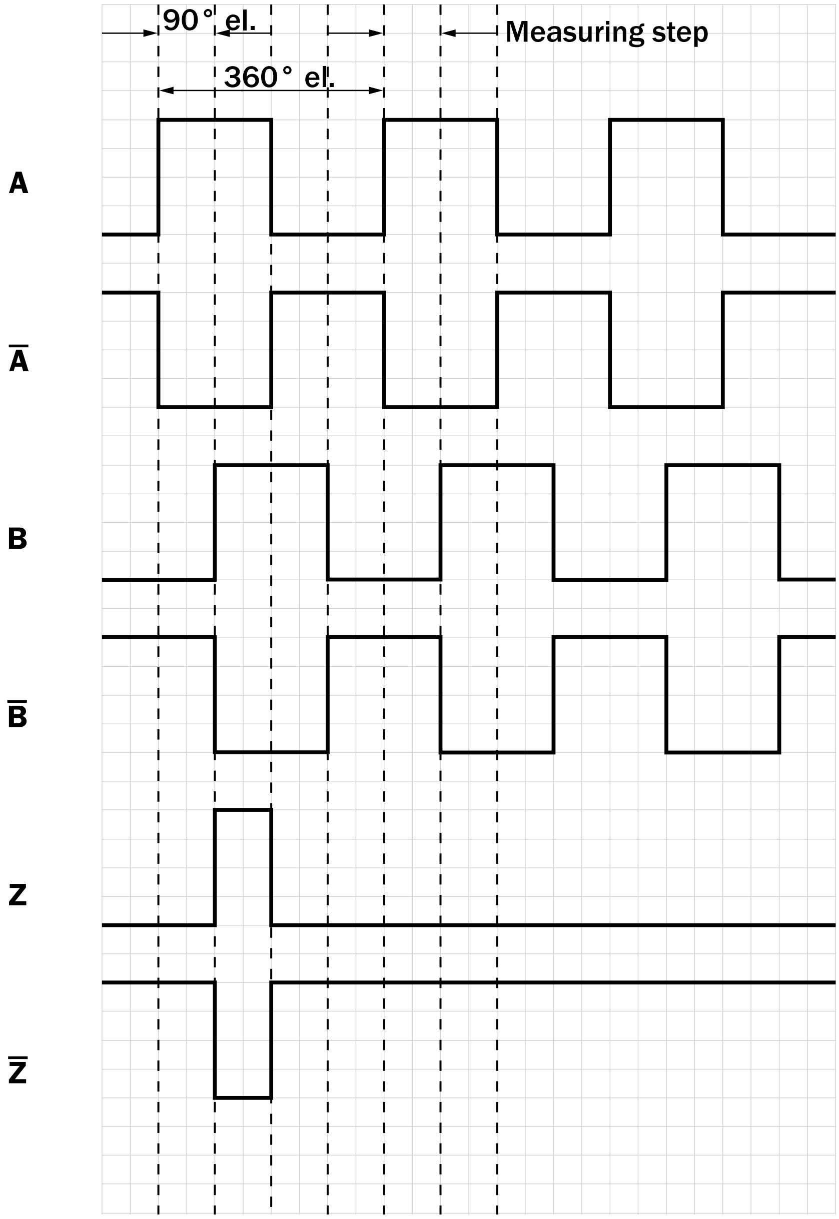


View to the connector M23 fitted to the encoder body

Pin and wire allocation, cable 8-core

PIN, 8-pin M12 Connector	PIN, 12-pin M23 Connector	Colour of wires	Signal TTL, HTL	Explanation
1	6	Brown	$\overline{A}$	Signal line
2	5	White	A	Signal line
3	1	Black	$\overline{B}$	Signal line
4	8	Pink	B	Signal line
5	4	Yellow	$\overline{Z}$	Signal line
6	3	Lilac	Z	Signal line
7	10	Blue	GND	Ground connection of the encoder
8	12	Rot	+Us	Supply voltage (Potential free to housing)
–	9	–	N. C.	Not connected
–	2	–	N. C.	Not connected
–	11	–	N. C.	Not connected
–	7	–	N. C.	Not connected
Screen	Screen	Screen	Screen	Screen on the encoder side connected to the housing. On the control side connected to earth.

Incremental pulse diagram



CW with view on the encoder shaft in direction "A", see dimensional drawing.

DRS61: Incremental encoders, number of lines and zero pulse width freely programmable DRS60: Incremental encoders with Zero-pulse teach

Number of lines 1 to 8,192

Incremental Encoder

CoreTech technology permits tailor-made solutions for every application, due to its modular design.

With DRS61 incremental encoders, the number of lines from 1 to 8,192 and the width of the zero pulse can be freely programmed **by the customer.** Therefore, they will be of particular interest to end users, distributors, consulting engineers and system integrators. DRS60 incremental encoders are available with any desired number of lines between 1 and 8,192.

Further highlights of this generation of encoders:

- Simple zero-pulse-teach by pressing a button located under a cap on the rear of the encoder
- Excellent price/performance ratio
- Long LED lifetime as a result of automatic light regulation
- Maximum reliability as a result of opto-ASICs with Chip-on-Board technology
- Interchangeable collets for hollow shaft diameters from 6 to 15 mm and 1/4, 3/8, 1/2 inch.

Whether with face mount flange, servo flange, blind or through hollow shaft with connector or cable outlet, TTL or HTL interface – DRS60/61 encoders will meet virtually any application profile.

Thanks to this wide variety of products, there are numerous possible uses, for example in:

- machine tools
- textile machines
- woodworking machines
- packaging machines

Number of lines
1 up to 8,192

Incremental Encoder

- Connector or cable outlet
- Protection class up to IP 66
- Electrical interfaces TTL and HTL
- Zero-Pulse Teach via pressing a button
- DRS61: number of lines and zero-pulse width can be freely programmed by the customer

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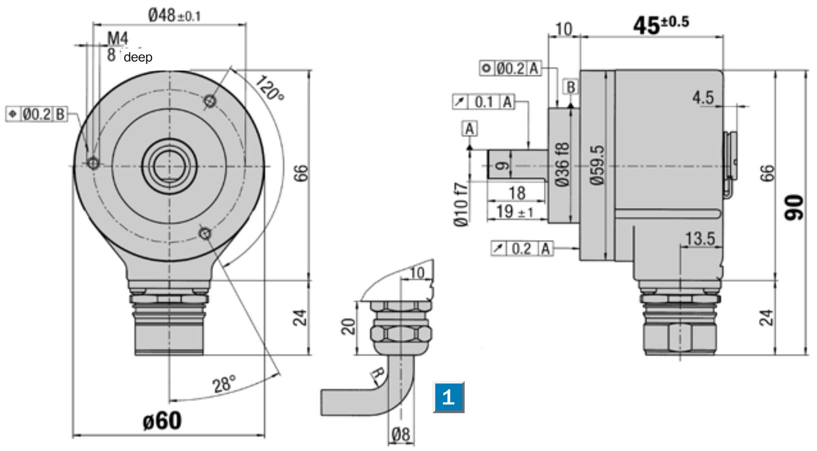
Accessories – see pages 410-448

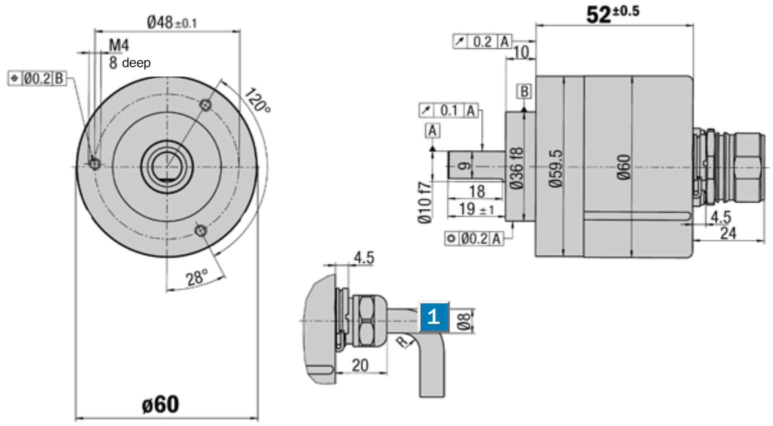
Dimensional drawing face flange mount radial



1 R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

Dimensional drawing face flange mount axial

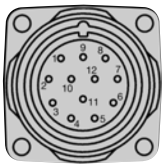


1 R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation/cable 11-core

PIN	Signal	Wire color (Cable outlet)	Explanation
1	B	black	Signal line
2	Sense	grey	Connected internally to U_S
3	Z	lilac	Signal line
4	Z	yellow	Signal line
5	A	white	Signal line
6	$\overline{A}$	brown	Signal line
7	N. C.	orange	Not connected
8	$\overline{B}$	pink	Signal line
9	Screen		Housing potential
10	GND	blue	Zero volt connected to the encoder
11	Sense –	green	Connected internally to GND
12	U_S	red	Supply voltage [1]

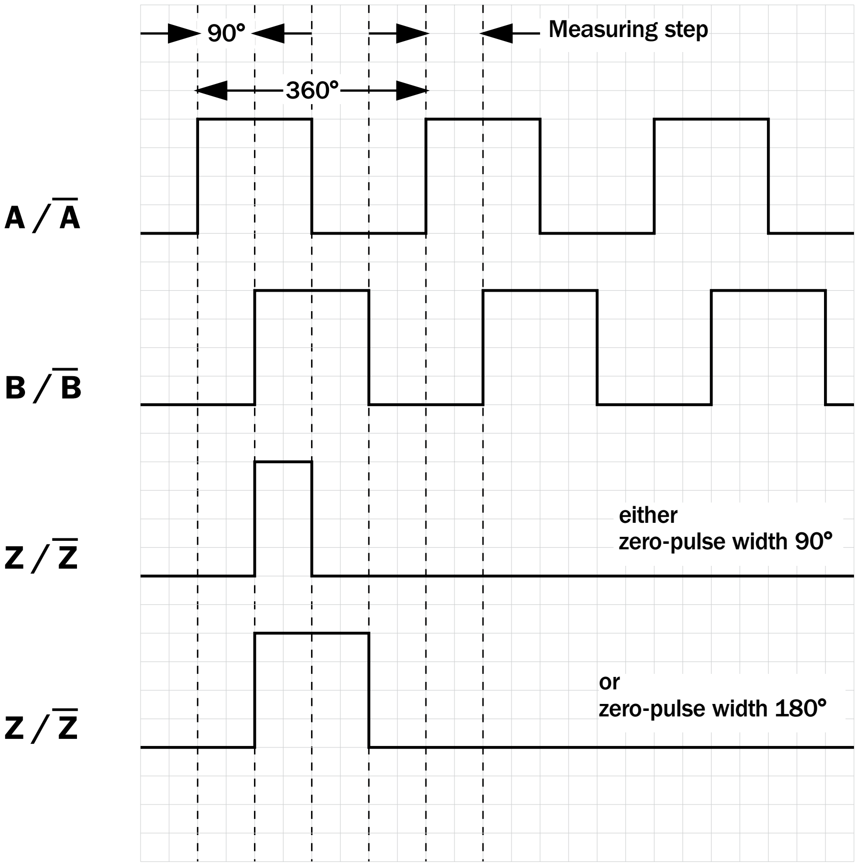


View of the connector M23 fitted to the encoder body

[1] Potential free to housing

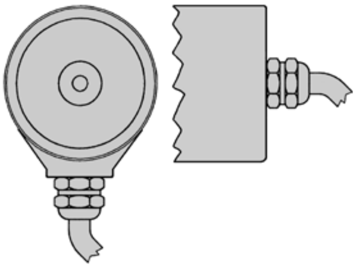
N. C. = Not connected

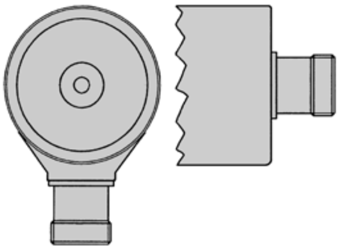
Incremental pulse diagram



Electrical interface			
Supply voltage	4.5 … 5.5 V	10 … 32 V	10 … 32 V
Interfaces/drivers	TTL (RS422)	TTL (RS422)	HTL (push-pull)

Connection type			
Cable radial	Cable axial	Connector radial	Connector axial





Order information

Incremental Encoder DRS60, face flange mount, solid shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**0**	**–**		**4**						

Electrical interface

4.5 … 5.5 V. TTL/RS422 Zero-pulse width 90°	= **A**
4.5 … 5.5 V. TTL/RS422 Zero-pulse width 180°	= **B**
10 … 32 V. TTL/RS422 Zero-pulse width 90°	= **C**
10 … 32 V. TTL/RS422 Zero-pulse width 180°	= **D**
10 … 32 V. HTL/push-pull Zero-pulse width 90°	= **E**
10 … 32 V. HTL/push-pull Zero-pulse width 180°	= **F**

Mechanical interface

Face flange mount, solid shaft 10 mm	= **4**

Connection type

Connector M23, 12-pin, radial	= **A**
Connector M23, 12-pin, axial	= **B**
Cable 11-core, radial 1.5 m	= **K**
Cable 11-core, radial 3 m	= **L**
Cable 11-core, radial 5 m	= **M**
Cable 11-core, radial 10 m	= **N**
Cable 11-core, axial 1.5 m	= **R**
Cable 11-core, axial 3 m	= **S**
Cable 11-core, axial 5 m	= **T**
Cable 11-core, axial 10 m	= **U**

Number of lines

Each number of lines from 00001 up to 08192 possible.
Always 5 characters in clear text.

Order example Incremental Encoder DRS60

4.5 … 5.5 V, TTL/RS422 zero-pulse width 90°; face flange mount; connector M23, 12-pin, radial; number of lines: 360

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**0**	**–**	**A**	**4**	**A**	**0**	**0**	**3**	**6**	**0**

NEW

Incremental Encoder DRS61 face flange mount, solid shaft (number of lines and zero-pulse width can be freely programmed by the customer) [1]

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**1**	**–**		**4**		**0**	**8**	**1**	**9**	**2**

Electrical interface

4.5 … 5.5 V, TTL/RS422	= **A**
10 … 32 V, TTL/RS422	= **C**
10 … 32 V, HTL/push-pull	= **E**

Mechanical interface

Face flange mount , solid shaft 10 mm	= **4**

Connection type

Connector M23, 12-pin, radial	= **A**
Connector M23, 12-pin, axial	= **B**
Cable 11-core, radial 1.5 m	= **K**
Cable 11-core, axial 1.5 m	= **R**

Number of lines

Factory-programmed to 8,192.

Order example Incremental Encoder DRS61

4.5 … 5.5 Volt, TTL/RS422; face flange mount; connector M23, 12-pin, radial; number of lines: 8,192 (factory-programmed)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**1**	**–**	**A**	**4**	**A**	**0**	**8**	**1**	**9**	**2**

[1] Please order programming tool separately (see accessories section at end of catalog)

Number of lines
1 up to 8,192

Incremental Encoder

- Connector or cable outlet
- Protection class up to IP 66
- Electrical interfaces TTL and HTL
- Zero-Pulse Teach via pressing a button
- DRS61: number of lines and zero-pulse width can be freely programmed by the customer

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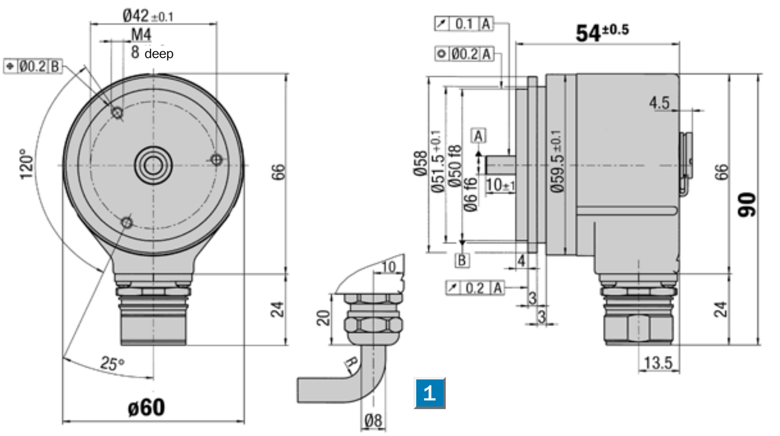
Accessories – see pages 410-448

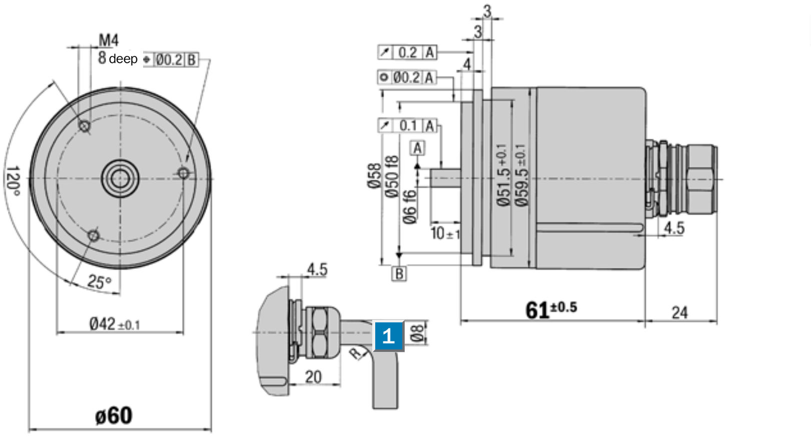
Dimensional drawing servo flange mount radial



1 R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

Dimensional drawing servo flange mount axial

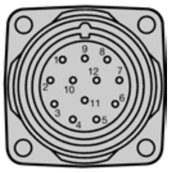


1 R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation/cable 11-core

PIN	Signal	Wire color (Cable outlet)	Explanation
1	B	black	Signal line
2	Sense	grey	Connected internally to U_S
3	Z	lilac	Signal line
4	$\bar{Z}$	yellow	Signal line
5	A	white	Signal line
6	$\bar{A}$	brown	Signal line
7	N. C.	orange	Not connected
8	B	pink	Signal line
9	Screen		Housing potential
10	GND	blue	Zero volt connected to the encoder
11	Sense –	green	Connected internally to GND
12	U_S	red	Supply voltage [1]

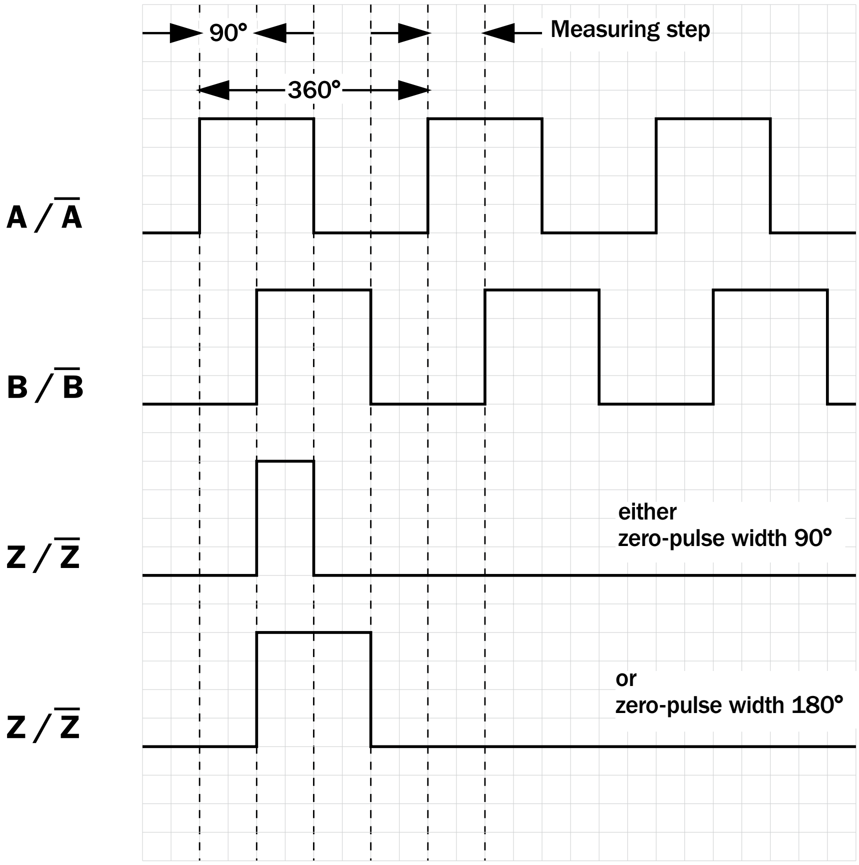


View of the connector M23 fitted to the encoder body

[1] Potential free to housing

N. C. = Not connected

Incremental pulse diagram

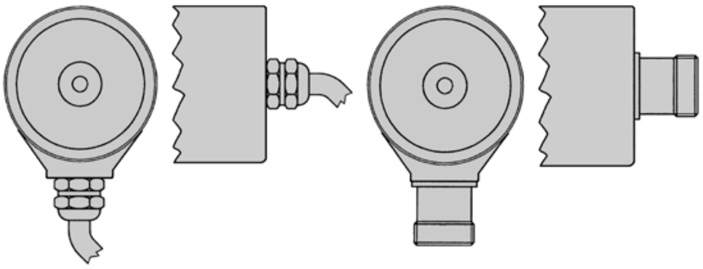


Electrical interface

Supply voltage	4.5 … 5.5 V	10 … 32 V	10 … 32 V
Interfaces/drivers	TTL (RS422)	TTL (RS422)	HTL (push-pull)

Connection type

Cable radial	Cable axial	Connector radial	Connector axial



Order information

Incremental Encoder DRS60, servo flange, solid shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**0**	**–**		**1**						

Electrical interface	
4.5 … 5.5 V, TTL/RS422 Zero-pulse width 90°	= **A**
4.5 … 5.5 V, TTL/RS422 Zero-pulse width 180°	= **B**
10 … 32 V, TTL/RS422 Zero-pulse width 90°	= **C**
10 … 32 V, TTL/RS422 Zero-pulse width 180°	= **D**
10 … 32 V, HTL/push-pull Zero-pulse width 90°	= **E**
10 … 32 V, HTL/push-pull Zero-pulse width 180°	= **F**

Mechanical interface	
Servo flange, solid shaft 6 mm	= **1**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M23, 12-pin, axial	= **B**
Cable 11-core, radial 1.5 m	= **K**
Cable 11-core, radial 3 m	= **L**
Cable 11-core, radial 5 m	= **M**
Cable 11-core, radial 10 m	= **N**
Cable 11-core, axial 1.5 m	= **R**
Cable 11-core, axial 3 m	= **S**
Cable 11-core, axial 5 m	= **T**
Cable 11-core, axial 10 m	= **U**

Number of lines

Each number of lines from 00001 up to 08192 possible.
Always 5 characters in clear text.

Order example Incremental Encoder DRS60

4.5 … 5.5 V, TTL/RS422 zero-pulse width 90°; servo flange; connector M23, 12-pin, radial; number of lines: 360

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**0**	**–**	**A**	**1**	**A**	**0**	**0**	**3**	**6**	**0**

NEW

Incremental-Encoder DRS61, servo flange, solid shaft (number of lines and zero-pulse width can be freely programmed by the customer) [1]

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**1**	**–**		**1**		**0**	**8**	**1**	**9**	**2**

Electrical interface	
4.5 … 5.5 V, TTL/RS422	= **A**
10 … 32 V, TTL/RS422	= **C**
10 … 32 V, HTL/push-pull	= **E**

Mechanical interface	
Servo flange, solid shaft 6 mm	= **1**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M23, 12-pin, axial	= **B**
Cable 11-core, radial 1.5 m	= **K**
Cable 11-core, axial 1.5 m	= **R**

Number of lines

Factory-programmed to 8,192.

Order example Incremental Encoder DRS61

4.5 … 5.5 Volt, TTL/RS422; servo flange; connector M23, 12-pin, radial; number of lines: 8,192 (factory-programmed)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**1**	**–**	**A**	**1**	**A**	**0**	**8**	**1**	**9**	**2**

[1] Please order programming tool separately (see accessories section at end of catalog)

Technical Data		**Flange type** face m.	servo
Solid shaft	10 mm	■	
	6 mm		■
Number of lines per revolution	00001 up to 08192, see order info	■	■
Electrical Interface	TTL/RS422, 6-channel	■	■
	HTL/push-pull, 6-channel	■	■
Mass [1]	Approx. 0.3 kg	■	■
Moment of inertia of the rotor	54 gcm^2	■	
	48 gcm^2		■
Measuring step	90°/number of lines	■	■
Reference signal			
Number	1	■	■
Position [2]	90° or 180°	■	■
Error limits			
binary number of lines	0.035°	■	■
non-binary number of lines	0.046°	■	■
Measuring step deviation			
binary number of lines	0.005°	■	■
non-binary number of lines	0.016°	■	■
Max. output frequency			
TTL	820 kHz	■	■
HTL	200 kHz	■	■
Operating torque max.			
with shaft seal	6,000 min^{-1}	■	■
without shaft seal [3]	10,000 min^{-1}	■	■
Max. angular acceleration	5 x 10^5 rad/s^2	■	■
Operating torque	Typ. 0.3 Ncm	■	
	Typ. 0.2 Ncm		■
Start up torque	Typ. 0.4 Ncm	■	
	Typ. 0.25 Ncm		■
Permissible shaft loading			
radial	20 N	■	■
axial	10 N	■	■
Bearing lifetime	3.6 x 10^9 revolutions	■	■
Working temperature range	-4 … 185° F (-20 … 85° C)	■	■
Storage temperature range	-40 … 212° F (-40 … 100° C)	■	■
Permissible relative humidity [4]	90%	■	■
EMC [5]		■	■
Resistance			
to shocks [6]	50/11 g/ms	■	■
to vibration [7] 20/10 … 2000 g/Hz		■	■
Protection class IEC 60529			
Connector outlet [8]	IP 65	■	■
Cable outlet	IP 66	■	■
Operating voltage range			
Load current TTL/RS422, 4.5 … 5.5 V	Max. 20 mA	■	■
TTL/RS422, 10 … 32 V	Max. 20 mA	■	■
HTL/push-pull, 10 … 32 V	Max. 60 mA	■	■
No-load operating current			
at 10 … 32 V	Typ. 100 mA	■	■
at 5 V	Typ. 120 mA	■	■
Operation of zero-set [9]	≥ 100 ms	■	■
Initialization time after power on	40 ms	■	■

[1] Concerning encoder with connector

[2] Electrical, logically linked to A and B

[3] In case, that shaft seal has been removed by customer

[4] Condensation of the optical scanning not permitted

[5] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[6] To DIN EN 60068-2-27

[7] To DIN EN 60068-2-6

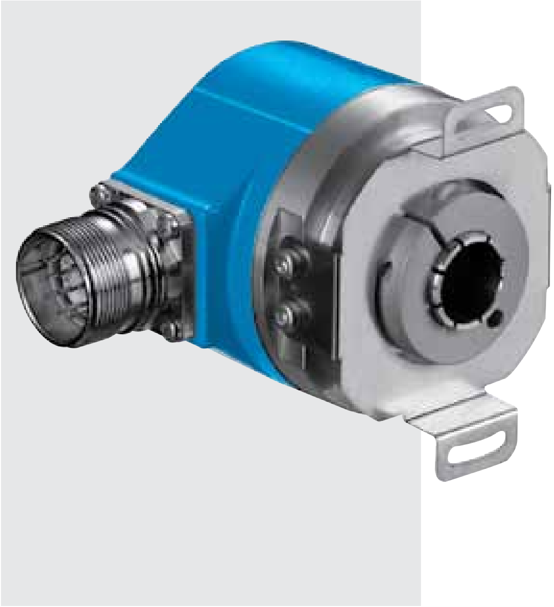
[8] With mating connector fitted

[9] Only with shaft stationary

Number of lines
1 up to 8,192

Incremental Encoder

- Connector or cable outlet
- Protection class up to IP 66
- Electrical interfaces TTL and HTL
- Zero-Pulse Teach via pressing a button
- DRS61: number of lines and zero-pulse width can be freely programmed by the customer



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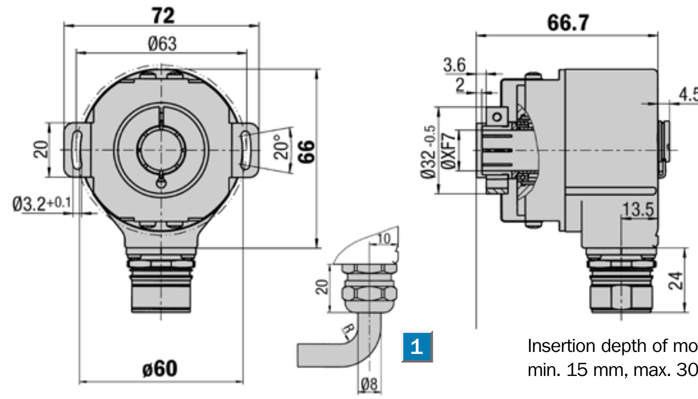
Accessories – see pages 410-448

Dimensional drawing blind and through hollow shaft radial

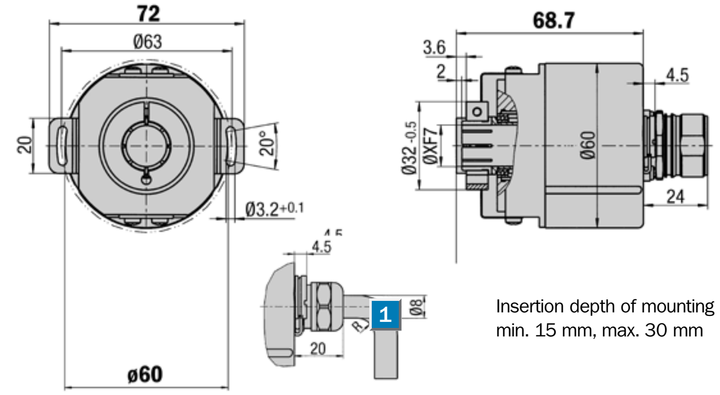


Insertion depth of mounting shaft
min. 15 mm, max. 30 mm

1 R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

Dimensional drawing blind and through hollow shaft axial



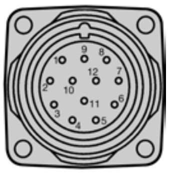
Insertion depth of mounting shaft
min. 15 mm, max. 30 mm

1 R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation/cable 11-core

PIN	Signal	Wire color (Cable outlet)	Explanation
1	B	black	Signal line
2	Sense	grey	Connected internally to U_S
3	$\overline{Z}$	lilac	Signal line
4	Z	yellow	Signal line
5	A	white	Signal line
6	$\overline{A}$	brown	Signal line
7	N. C.	orange	Not connected
8	$\overline{B}$	pink	Signal line
9	Screen		Housing potential
10	GND	blue	Zero volt connected to the encoder
11	Sense –	green	Connected internally to GND
12	U_S	red	Supply voltage [1]

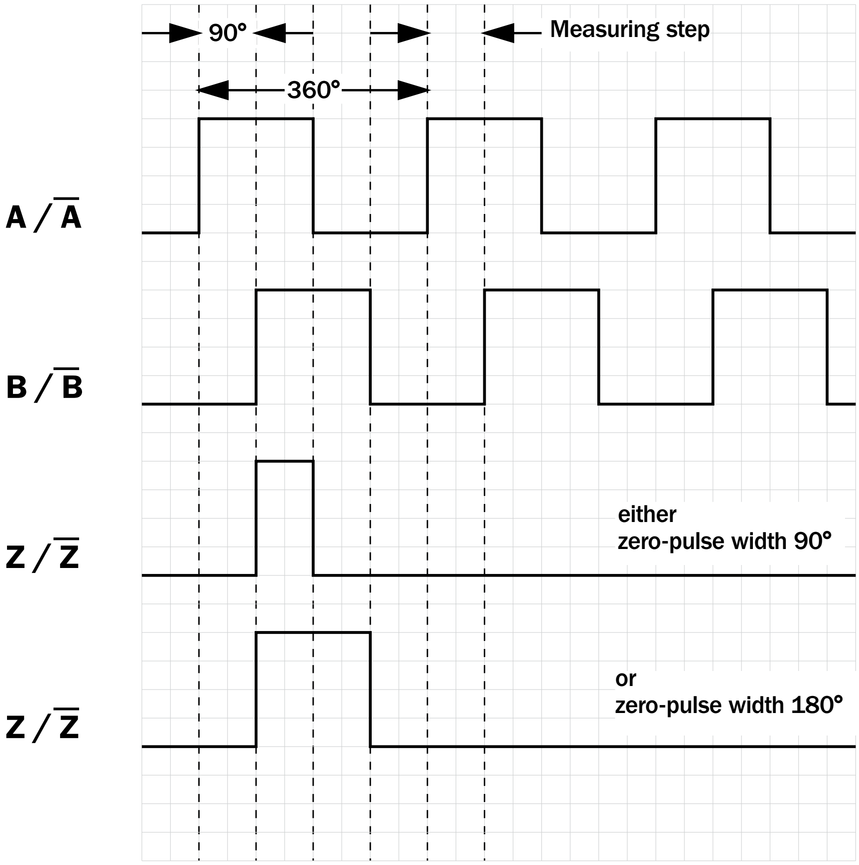


View of the connector M23 fitted to the encoder body

[1] Potential free to housing

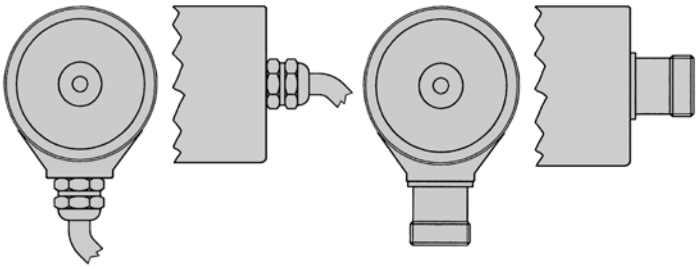
N. C. =
Not connected

Incremental pulse diagram



Electrical interface			
Supply voltage	4.5 … 5.5 V	10 … 32 V	10 … 32 V
Interfaces/drivers	TTL (RS422)	TTL (RS422)	HTL (push-pull)

Connection type			
Cable radial	Cable axial	Connector radial	Connector axial



Order information

Incremental Encoder DRS60, blind and through hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**0**	**–**		**A**						

Electrical interface

4.5 … 5.5 V, TTL/RS422
Zero-pulse width 90° = **A**

4.5 … 5.5 V, TTL/RS422
Zero-pulse width 180° = **B**

10 … 32 V, TTL/RS422
Zero-pulse width 90° = **C**

10 … 32 V, TTL/RS422
Zero-pulse width 180° = **D**

10 … 32 V, HTL/push-pull
Zero-pulse width 90° = **E**

10 … 32 V, HTL/push-pull
Zero-pulse width 180° = **F**

Mechanical interface

Blind hollow shaft[1] = **A**
Throug hollow shaft[1] = **D**

[1] Collets for 6, 8, 10, 12 mm and 1/4 in, 3/8 in and 1/2 in as accessories, separate order item (see accessories). For 15 mm shaft diameter, collet is not needed.

Connection type

*Connector M23, 12-pin, radial = **A**
Connector M23, 12-pin, axial = **B**
*Cable 11-core, radial 1.5 m = **K**
*Cable 11-core, radial 3 m = **L**
*Cable 11-core, radial 5 m = **M**
*Cable 11-core, radial 10 m = **N**
Cable 11-core, axial 1.5 m = **R**
Cable 11-core, axial 3 m = **S**
Cable 11-core, axial 5 m = **T**
Cable 11-core, axial 10 m = **U**

* For DRS60/DRS61 through hollow shaft only

Number of lines

Each number of lines from 00001 up to 08192 possible.
Always 5 characters in clear text.

Order example Incremental Encoder DRS60

4.5 … 5.5 V, TTL/RS422 zero-pulse width 90°; blind and through hollow shaft; connector M23, 12-pin, radial; number of lines: 360

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**0**	**–**	**A**	**A**	**A**	**0**	**0**	**3**	**6**	**0**

Incremental-Encoder DRS61 blind and through hollow shaft (number of lines and zero-pulse width can be freely programmed by the customer) 1

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**1**	**–**		**A**		**0**	**8**	**1**	**9**	**2**

Electrical interface

4.5 … 5.5 V, TTL/RS422 = **A**
10 … 32 V, TTL/RS422 = **C**
10 … 32 V, HTL/push-pull = **E**

Mechanical interface

Blind hollow shaft[1] = **A**
Through hollow shaft[1] = **D**

[1] Collets for 6, 8, 10, 12 mm and 1/4 in, 3/8 in and 1/2 in as accessories, separate order item (see accessories). For 15 mm shaft diameter, collet is not needed.

Connection type

Connector M23, 12-pin, radial = **A**
Connector M23, 12-pin, axial = **B**
Cable 11-core, radial 1.5 m = **K**
Cable 11-core, axial 1.5 m = **R**

Number of lines

Factory-programmed to 8,192.

Order example Incremental Encoder DRS61

4.5 … 5.5 Volt, TTL/RS422; blind hollow shaft; connector M23, 12-pin, radial; number of lines: 8,192 (factory-programmed)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**R**	**S**	**6**	**1**	**–**	**A**	**A**	**A**	**0**	**8**	**1**	**9**	**2**

1 Please order programming tool separately (see accessories section at end of catalog)

Technical Data		**Flange type** through	 blind
Hollow shaft diameter	6, 8, 10, 12 mm and 1/4 in, 3/8 in, 1/2 in	■	■
Number of lines per revolution	00001 up to 08192, see order info	■	■
Electrical Interface	TTL/RS422, 6-channel	■	■
	HTL/push-pull, 6-channel	■	■
Mass [1]	Approx. 0.3 kg	■	■
Moment of inertia of the rotor	See Fig. 1	■	■
Measuring step	90°/number of lines	■	■
Reference signal			
Number	1	■	■
Position [2]	90° or 180°	■	■
Error limits			
binary number of lines	0.035°	■	■
non-binary number of lines	0.046°	■	■
Measuring step deviation			
binary number of lines	0.005°	■	■
non-binary number of lines	0.016°	■	■
Max. output frequency			
TTL	820 kHz	■	■
HTL	200 kHz	■	■
Operating torque max.	3,000 min^{-1}	■	■
Max. angular acceleration	5 x 10^5 rad/s^2	■	■
Operating torque	Typ. 1.6 Ncm	■	
	Typ. 0.4 Ncm		■
Start up torque	Typ. 2.2 Ncm	■	
	Typ. 2.2 Ncm		■
Permissible movement of the drive element			
radial static/dynamic movement	± 0.3/± 0.1 mm	■	
axial static/dynamic movement	± 0.5/± 0.2 mm	■	
Bearing lifetime	3.6 x 10^9 revolutions	■	
Working temperature range	-4 … 185° F (– 20 … 85° C)	■	
Storage temperature range	-40 … 212° F (– 40 … 100° C)	■	
Permissible relative humidity [3]	90%	■	
EMC [4]		■	
Resistance			
to shocks [5]	50 /11 g/ms	■	■
to vibration [6]	20/10 … 2000 g/Hz	■	■
Protection class IEC 60529			
Connector outlet [7]	IP 64	■	■
Cable outlet	IP 64	■	■
Operating voltage range			
Load current TTL/RS422, 4.5 … 5.5 V	Max. 20 mA	■	■
TTL/RS422, 10 … 32 V	Max. 20 mA	■	■
HTL/push-pull, 10 … 32 V	Max. 60 mA	■	■
No-load operating current			
at 10 … 32 V	Typ. 100 mA	■	■
at 5 V	Typ. 120 mA	■	■
Operation of zero-set [8]	≥ 100 ms	■	■
Initialization time after power on	40 ms	■	■

[1] Concerning encoder with connector

[2] Electrical, logically linked to A and B

[3] Condensation of the optical scanning not permitted

[4] To DIN EN 61000-6-2 and DIN EN 61000-6-2

[5] To DIN EN 60068-2-27

[6] To DIN EN 60068-2-6

[7] With mating connector fitted

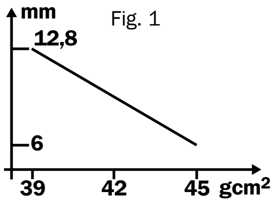
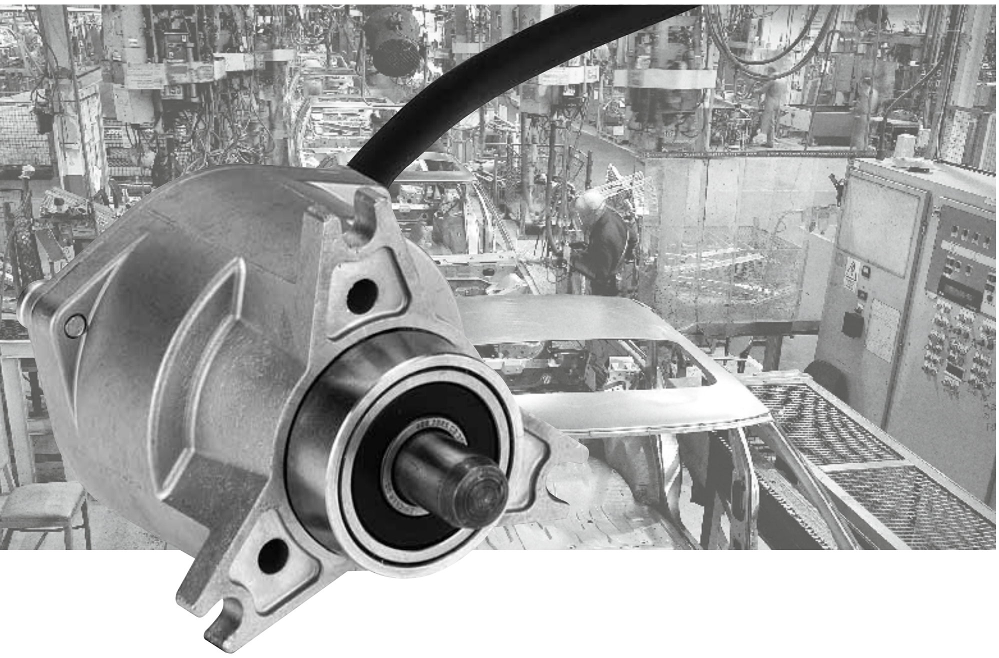


Fig. 1

DKS40:
Incremental Encoders



Number of lines
1 to 2,048
Incremental Encoders

The DKS40 Incremental Encoders offers exceptional quality for its price and its range of application. Its housing is a solid zinc die-casting and is extremely compact in its design, having an external diameter of only 50 mm. As a consequence, valuable space can be spared when installed.

By adopting highly successful Mini-Disc technology, the DKS40 is extremely robust and can resist high levels of shock and vibration. In addition the DKS40 has a very high protection class, IP 64.

Specify your individual 50 mm dia. Encoder.

Options available:
· Interfaces Open Collector
NPN,TTL/RS 422,
HTL/push-pull.
· Face mount flange with solid shaft
Ø 8 x 13 mm,
· Output cable up to 5 m
can be used radially or axially

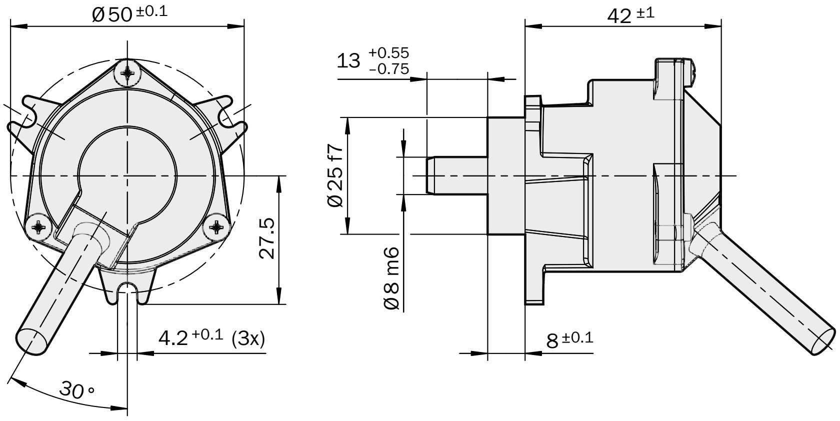
Thanks to product flexibility there are numerous applications, for example in:
· machine tools
· textile machines
· wood processing machines
· packaging machines

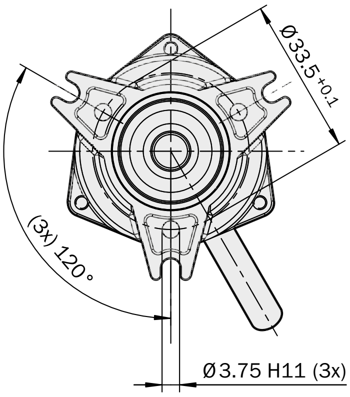
Number of lines
1 to 2,048

Incremental Encoders

- **Cable outlet**
- **Enclosure rating IP 64**
- **Electrical Interfaces**
  Open Collector NPN,
  TTL, HTL

Dimensional drawing face mount flange



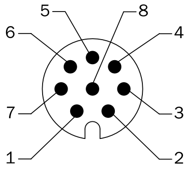


General tolerances according to DIN ISO 2768-mk

Accessories – see pages 410-448

Wire allocation/cable 8-core

8-Pin, M12 connector	Core colour	Signal OC	Signal TTL, HTL	Explanation
1	Brown	N. C. [3]	$\overline{A}$	Signal line
2	White	A	A	Signal line
3	Black	N. C. [3]	$\overline{B}$	Signal line
4	Pink	B	B	Signal line
5	Yellow	N. C. [3]	$\overline{Z}$	Signal line
6	Lilac	Z	Z	Signal line
7	Blue	GND	GND	Ground connection
8	Red	$+U_S$	$+U_S$	Power supply [1]
	Screen	Screen	Screen	Screen [2]



View of the connector fitted to the encoder body

[1] Potential free to housing

[2] Screen connected to Encoder housing. Connect screen on control side!

[3] N. C. = not connected

Technical data according to 32878		DKS40	DKS
Number of lines (Z) per revolution		1 to 2,048	■
Electrical Interfacees		4.5 ... 5.5 V, Open Coll. NPN, 3-channel	■
		10 ... 30 V, Open Coll. NPN, 3-channel	■
		4.5 ... 5.5 V, TTL/RS422, 6-channel	■
		10 ... 30 V, HTL, 6-channel	■
Mass		0.18 Kg	■
Moment of inertia of the rotor		6 gcm^2	■
Measuring step		90°/number of lines	■
Reference signal	Number	1	■
	Position	90° electr., logic. interlocked with A+B	■
Error limits			
”binary” number of lines 1)		± 0.09 degree	■
”non-binary” number of lines 2)		± 0.13 degree	■
Measuring step deviation			
binary number of lines		± 0.035 degree	■
non-binary number of lines		± 0.07 degree	■
Max. output frequency	Open Collector	50 KHz	■
	TTL/RS422	200 KHz	■
	HTL/push-pull	200 KHz	■
Operating speed		6,000 min^{-1}	■
Angular acceleration		3.6 x 10^9 rad/s^2	■
Operating torque		0.4 Ncm	■
Start up torque		0.6 Ncm	■
Permissible shaft loading			
radial		40 N	■
axial		20 N	■
Bearing lifetime		2 x 10^9 revolutions	■
Working temperature range		0 ... + 60 °C	■
Storage temperature range		– 40 ... + 70 °C	■
Permissible relative humidity 3)		90 %	■
EMC 4)			■
Resistance			
to shocks 5)		50/7 g/ms	■
to vibration 6)		20/10 ... 2000 g/Hz	■
Protection class acc. IEC 60529		IP 64	■
Load current		30 mA	■
Operating current range at no load		40 mA	■
Initialisisation time after power on		40 ms	■

1) „Binary“ number of lines 2^n, n is a whole number

2) „Non binary“ number of lines 2^n, n is not a whole number

3) Condensation of optical scanning system not permitted

4) To DIN EN 61000-6-2 and DIN EN 61000-6-3

5) To DIN EN 60068-2-27

6) To DIN EN 60068-2-6

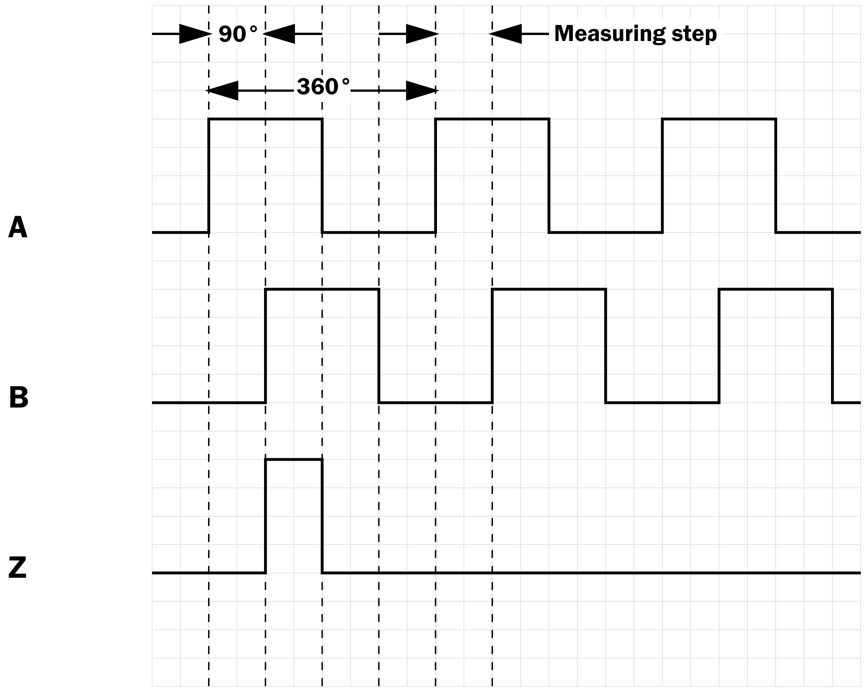
Number of lines 1 to 2,048

Incremental Encoders

- Cable outlet
- Enclosure rating IP 64
- Electrical Interfaces Open Collector NPN, TTL, HTL

Accessories – see pages 410-448

Incremental pulse diagram



CW rotation when looking at the encoder shaft

$\overline{A}$, $\overline{B}$, $\overline{Z}$ inverted signals to A, B, Z

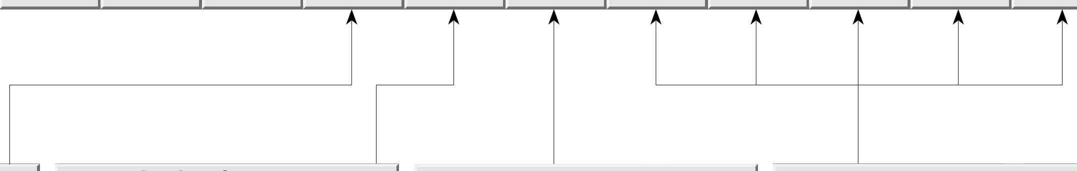
Electrical interfaces

Supply voltage	4.5 ... 5.5 V	10 ... 30 V	4.5 ... 5.5 V	10 ... 30 V
Interfaces/drivers	Open Coll. NPN	Open Coll. NPN	TTL/RS422	HTL/push-pull

Order information

Incremental Encoders DKS40, solid shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**K**	**S**	**4**	**0**	**–**		**5**						



Electrical interface	
4.5 ... 5.5 V, Open Collector NPN, 3-channel	= **P**
10 ... 30 V, Open Collector NPN, 3-channel	= **R**
4.5 ... 5.5 V, TTL/RS422, 6-channel	= **A**
10 ... 30 V, HTL/push-pull, 6-channel	= **E**

Mechanical interface	
Face mount flange, Solid shaft Ø 8 x 13 mm	= **5**

Connection type	
Cable 8-core, universal 0.5 m [1]	= **J**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**
Cable, universal 1.5 m [1] with connector M12, 8-pin	= **P**

Number of lines
Always 5 characters in clear text ① with leading zeros

[1] **The universal cable output is positioned so that a kink-free cable run is possible in radial or axial direction.**

① Number of lines (Z) per revolution

00010	00050	00200	00256	00500	00720	01024	02048
00020	00100	00250	00360	00512	01000	02000	**others on request**

Order example: Incremental Encoders DKS40

4.5 ... 5.5 Volt, TTL; face mount flange, cable 8-core, universal 0.5 m, number of lines: 360

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**K**	**S**	**4**	**0**	**–**	**A**	**5**	**J**	**0**	**0**	**3**	**6**	**0**

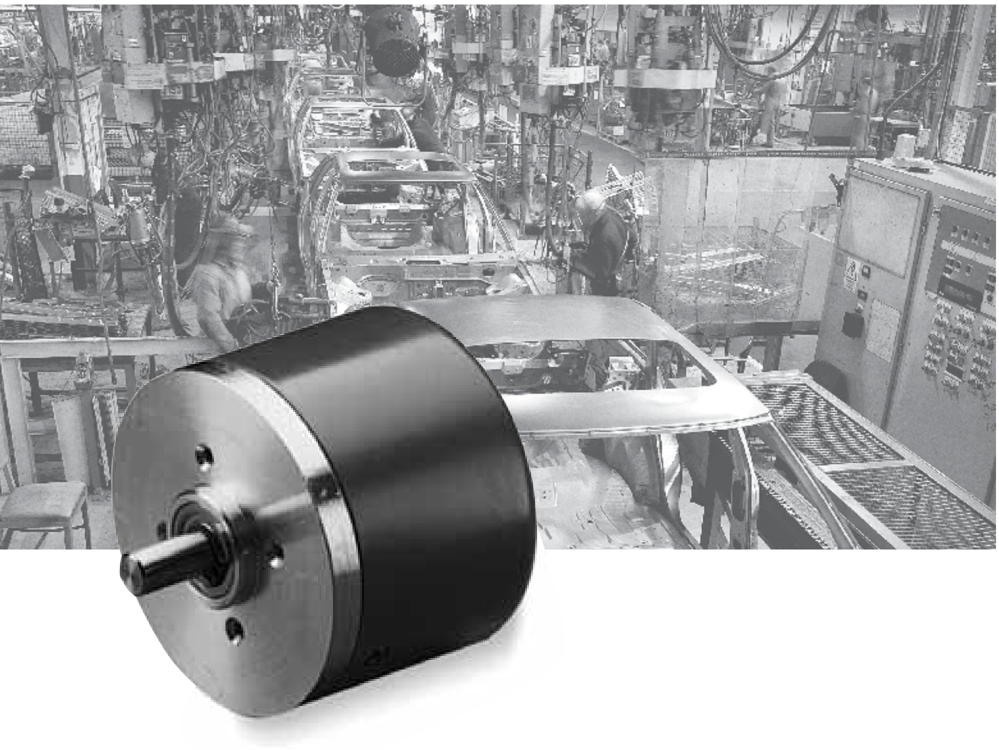
Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**K**	**S**	**4**	**0**	**–**		**5**						

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**K**	**S**	**4**	**0**	**–**		**5**						

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**K**	**S**	**4**	**0**	**–**		**5**						

LD20:
Light Duty Shaft Incremental Encoders



The LD20 incremental encoder, made with a light duty shaft, has an IP50 protection rating. It features a two inch outer diameter, sealed bearings and a quadrature output with a reference marker. Resolutions up to 3,000 are available with options of line driver or open collector output.

Applications could include:
- Machine tools
- Textile machines
- Woodworking machines
- Packaging machines

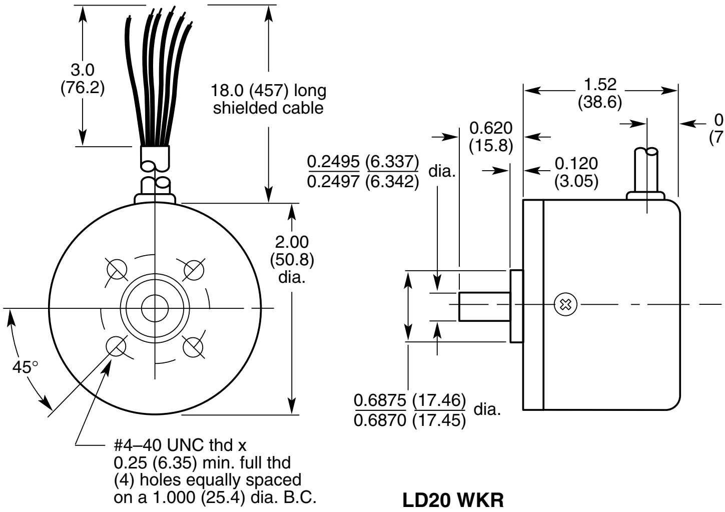
Number of lines
1 to 3,000
Incremental Encoder

Number of lines
1 to 3,000

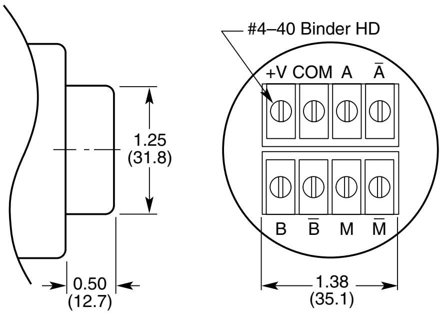
Incremental Encoder

- Terminal block or cable outlet
- Protection class up to IP50
- Electrical interfaces, line drivers and open collectors

Dimensional drawing



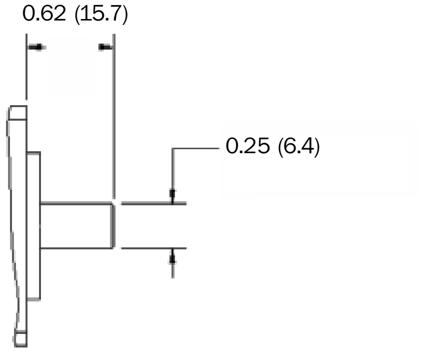
LD20 WKR



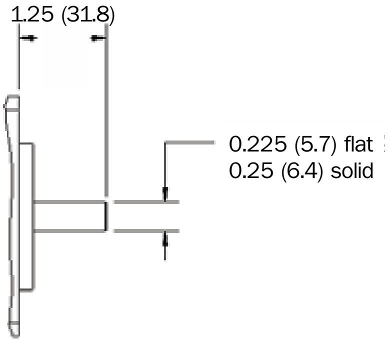
LD20 WTB

Dimensional drawing shaft options

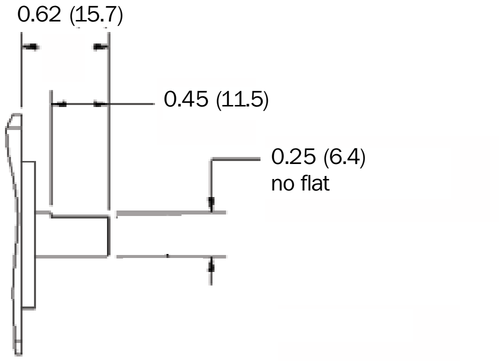
1/4"



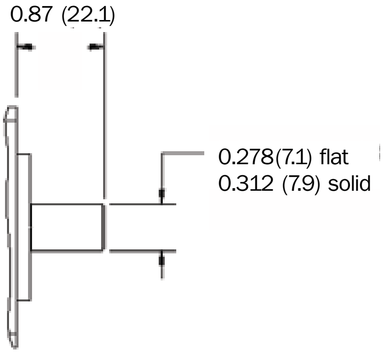
1/4" extended



1/4" flat



5/16"



Accessories – see pages 410-448

Technical Data	LD20
Solid Shaft	1/4”
Number of lines (Z) per revolution	00001 to 03000, see order info
Electrical Interface	
+5V in/+5V differential line driver (3487)	
5 V, 5 V open collector (7406)	
+8…24V in/open collector (7406)	
+8…24V in/8…24V differential line driver (7272)	
+8…24V in/+5V differential line driver (3487)	
Mass	4 oz (0.12 kg)
Moment of inertia of the rotor	2 x 10^{-4} oz in sec^2 (14.1 gcm^2)
Measuring step	90°/number of lines
Reference signal	
Number	1
Position	Non-gated 180° ± 90° electrical
	Gated 180° nominal (gated w/count channel A)
Error limits	45/Z °
Measuring step deviation	45/Z °
Max. output frequency	200 kHz
Max. operating speed	3,000 rpm max shaft loading
Max. angular acceleration	50,000 rad/s^2
Start up torque	0.2 oz-in (1.4 Ncm)
Permissible shaft loading	
radial (max at end of shaft)	5 lb (22 N)
axial	5 lb (22 N)
Bearing lifetime [1]	2.2 x 10^9 revolutions
Working temperature range	0° … + 70 °C
Storage temperature range	-20 … + 85 °C
Permissible relative humidity	95% (condensation not permitted)
Working voltage range	4.75…5.25 V
	8.0…24.0 V
Working current range at no load	120 mA
Signal cable	
power supply and drain wire are isolated from housing	
diameter	0.19 in (5 mm)

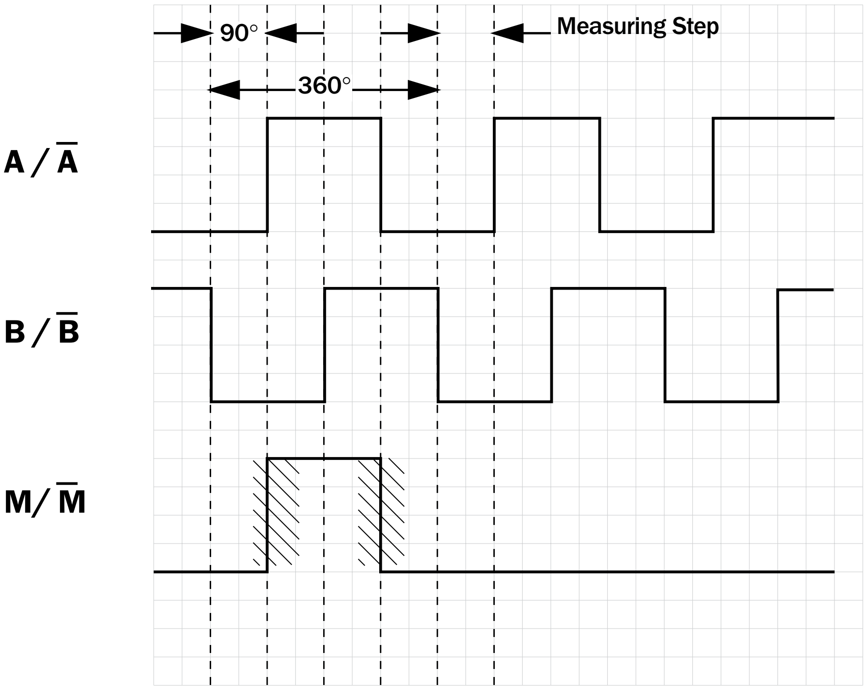
[1] B10 life with shaft loading of 1 lb (0.45Kg) axial and 2 lb (0.91 kg) radial (end of shaft)

Number of lines
1 to 3,000

Incremental Encoder

- Servo flange
- Cable outlet
- Protection class up to IP50
- Electrical interfaces, line drivers and open collectors

Incremental pulse diagram (clockwise rotation viewed from shaft end)



Shaded areas represent the locus of leading and trailing edges of marker pulse.

Electrical interfaces

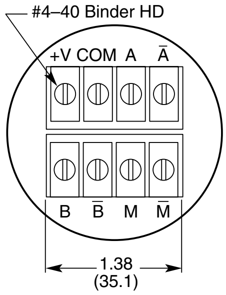
Supply voltage	4.75…5.25V	8.0…24.0V	8.0…24.0V	8.0…24.0V	5V
Interfaces/drivers	5V line driver	5V line driver	8/24V line driver	open collector	5V open collector

PIN and wire allocation

Function	**Cable1)**
A	White
B	Green
M	White/Black
A not	Blue
B not	Orange
M not	Red/Black
+Vs	Red
Common	Black
Case Ground	N/A
Shield	Drain wire

1) Anot, Bnot, Mnot are not available with open collector outputs

Connection type



Accessories – see pages 410-448

Order information

Incremental Encoder LD20

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
L	**D**	**2**	**0**	**–**								

Electrical interface	
5 V, 5 V, 3487	= 1
8…24 V, 5 V, 3487	= 3
8…24 V, 8…24 V, 7272	= 5
5 V, 5 V open collector (7406) OC	= 7
8…24 V open collector (7406/7273)	= 9

Mechanical interface	
Face Mount, 1/4" shaft	= 1
Face Mount, 1/4" shaft with flat	= 7
Face Mount, 1/4" shaft extended	= 4
Face Mount, 5/16" shaft	= 8

Connection type	
Radial Cable 0.5 m	= 1
Radial Cable 1.0 m	= 2
Radial Cable 1.5 m	= K
Radial Cable 3 m	= L
Radial Cable 5 m	= M
Radial Cable 10 m [1]	= N
Terminal Block	= 6

[1] n/a with open-collector

Number of lines
Always five characters in clear text. (see chart)

Number of lines (Z) per revolution

00001	00060	00150	00300	00720	01200	01500	02400
00005	00064	00180	00360	00800	01250	01600	02500
00010	00080	00200	00400	00900	01260	01800	02540
00020	00100	00250	00500	01000	01280	02000	02750
00030	00120	00254	00512	01024	01472	02048	03000
00050	00128	00256	00600				

Order example: Incremental Encoder LD20

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
L	**D**	**2**	**0**	**–**	**5**	**1**	**K**	**0**	**1**	**0**	**2**	**4**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
L	**D**	**2**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
L	**D**	**2**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
L	**D**	**2**	**0**	**–**								

DDS36/DDS50:
Incremental Encoders

Number of lines
100 up to 2,500
Incremental Encoders

The DDS36 and DDS50 SICK's low cost, light duty optical Incremental Encoders offer exceptional quality for their price level and application. Available in two housing styles, the DDS36 with a 36 mm housing diameter and the DDS50 with a 50 mm housing diameter. Their small size and low profile enables use in applications where space is limited. IP 65 sealing, almost unique in this class of encoder, is achieved by using a PG gland on the cable outlet and an additional seal on the shaft of the DDS36/DDS50. Therefore giving you the confidence to fit and forget, even in the presence of dust and water. The most popular resolution options will be held on stock to ensure you receive a fast delivery. The DDS family is also available with a wide variety of mounting brackets and flexible couplings aiding quick and low cost fitting to your machine.

Product options:
- Electrical interface
  TTL/RS422,
  HTL/push pull,
  Open Collector NPN
- Face mount flange for DDS36 and DDS50
- Blind hollow shaft 8 mm for the DDS36
- Axial cable outlet 1.5 m, 3 m and 5 m
- Number of lines 100 up to 2,500

The extensive variety of options result in a diverse range of applications in areas such as:
- Textile machines
- Packaging machines
- Woodworking machines
- Printing machines

Number of lines
100 up to 2,500

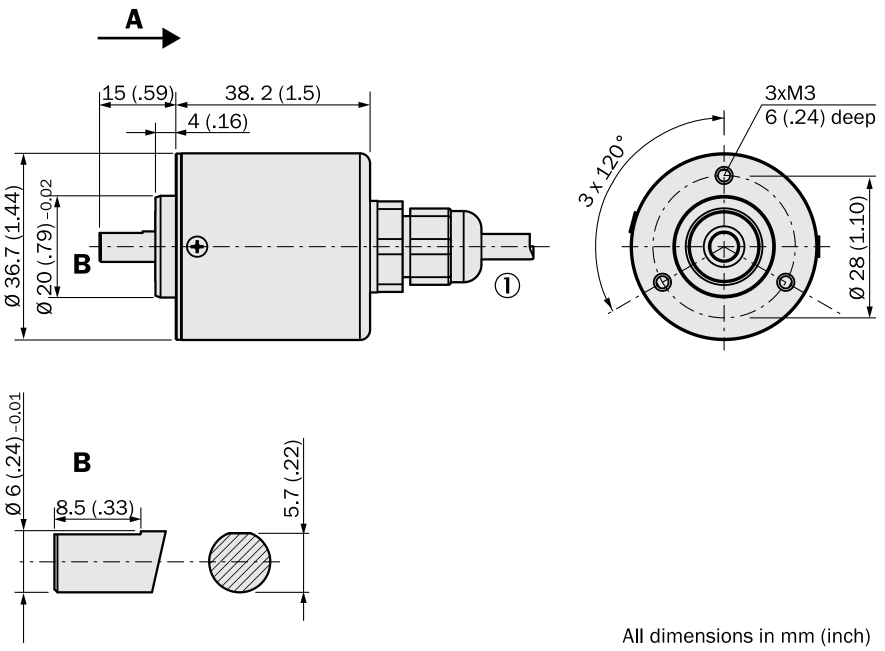
Incremental Encoders

- Cable outlet
- Enclosure rating IP 65
- Electrical Interfaces
  Open Collector NPN,
  TTL, HTL

CE

Accessories – see pages 410-448

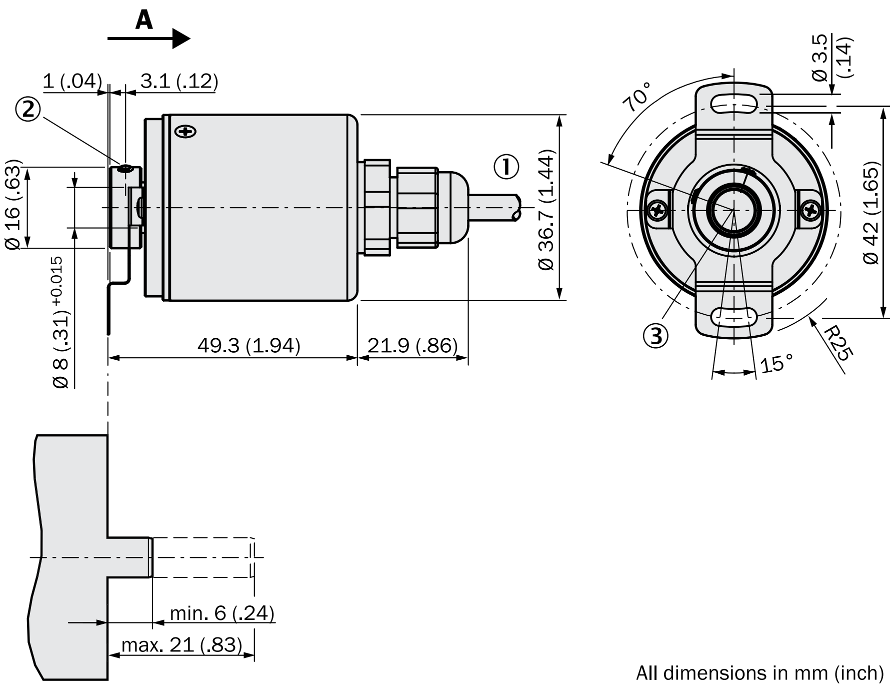
Dimensional drawing DDS36 solid shaft



All dimensions in mm (inch)

① Cable diameter 5.1 (.20) ± 0.2 mm, bending radius R = 66 (2.60)

Dimensional drawing DDS36 blind hollow shaft



All dimensions in mm (inch)

① Cable diameter 5.1 (.20) ± 0.2 mm, bending radius R = 66 (2.60)
② Hexagon socket screw M3
③ Index pulse output ± 10°

Technical data		DDS36E-	**S** Solid shaft	**B** Hollow shaft
Electrical interface		4.5 to 5.5 V, TTL/RS422, 6 channels	■	■
		7 to 24 V, TTL/RS422, 6 channels	■	■
		7 to 24 V, HTL/push pull, 3 channels	■	■
		4.5 to 5.5 V, Open Collector, 3 channels, NPN	■	■
Mechanical interface		Face mount flange, solid shaft Ø 6 x 11 mm	■	
		Blind hollow shaft, Ø 8 mm		■
Number of lines (Z)		100 to 2,500	■	■
Mass		120 g	■	
		130 g		■
Moment of inertia of the rotor		0.3 kg/mm^2	■	
		1.5 kg/mm^2		■
Measuring step (M)		360°/(Z x 4)	■	■
Reference signal	Number	1	■	■
	Position	90° electr., gated with A and B	■	■
Measuring step deviation (MA)		M x 0.1	■	■
Error limits		MA x 3	■	■
Output frequency		300 kHz	■	■
Operating speed[1]		6,000 rpm	■	■
Angular acceleration		5 x 10^5 rad/s^2	■	■
Operating torque at +20 °C		4 Nmm	■	■
Start up torque at +20 °C		6 Nmm	■	■
Permissible shaft loading	Radial	30 N	■	
	Axial	15 N	■	
Permissible movement of the drive element				
	Radial static/dynamic	± 0.3/± 0.1 mm		■
	Axial static/dynamic	± 0.5/± 0.2 mm		■
Bearing lifetime		2 x 10^9 revolutions	■	■
Working temperature range		–10 to +70 °C	■	■
Storage temperature range (without package)		–25 to +85 °C	■	■
Permissible relative humidity[2]		90 %	■	■
EMC according to EN 61000-6-2 and EN 61000-6-4			■	■
Resistance				
to shocks (according to EN 60068-2-27)		100 g/6 ms	■	■
to vibration (according to EN 60068-2-6)		5 g/10 to 200 Hz	■	■
Enclosure rating		IP 65	■	■
Load current		20 mA	■	■
Operating current at no load		100 mA	■	■

[1] Self-warming 3.3 k/1,000 min^{-1}, when applying, note working temperature range.

[2] Condensation of the optical scanning not permitted.

Ordering Information DDS36, Solid Shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**D**	**S**	**3**	**6**	**E**	**–**	**S**	**4**							

Mechanical interface
Solid shaft = **S**

Shaft diameter
Face mount flange, solid shaft 6 x 11 mm = **4**

Electrical interface
4.5 to 5.5 V, TTL/RS422, 6 channels = **A**
7 to 24 V, TTL/RS422, 6 channels = **C**
7 to 24 V, HTL/push pull, 3 channels = **G**
4.5 to 5.5 V, Open Collector, 3 channels, NPN = **P**

Connection type
Cable 8-core, axial, 1.5 m = **R**
Cable 8-core, axial, 3 m = **S***)
Cable 8-core, axial, 5 m = **T***)

*) Available January 2010

Number of lines ①
Always 5 characters in clear text**)

**) Available number of lines see below

Available number of lines ①						
00100	00300	00400	00500	00600	01000	02000
00200	00360				01024	02048
00256					01200	02500

Ordering example: Incremental Encoder DDS36E; solid shaft 6 x 11 mm; face mount flange; electrical interface 7 to 24 V, HTL/push pull, 3 channels; cable 8-core, axial, 1.5 m; number of lines 2500

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**D**	**S**	**3**	**6**	**E**	**–**	**S**	**4**	**G**	**R**	**0**	**2**	**5**	**0**	**0**

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**D**	**S**	**3**	**6**	**E**	**–**	**B**	**B**							

Mechanical interface
Blind hollow shaft = **B**

Shaft diameter
Metal Ø 8 mm = **B**

Electrical interface
4.5 to 5.5 V, TTL/RS422, 6 channels = **A**
7 to 24 V, TTL/RS422, 6 channels = **C**
7 to 24 V, HTL/push pull, 3 channels = **G**
4.5 to 5.5 V, Open Collector, 3 channels, NPN = **P**

Connection type
Cable 8-core, axial, 1.5 m = **R**
Cable 8-core, axial, 3 m = **S**[*)]
Cable 8-core, axial, 5 m = **T**[*)]

[*)] Available January 2010

Number of lines ①
Always 5 characters in clear text[**)]

[**)] Available number of lines see below

Available number of lines ①

00100	00300	00400	00500	00600	01000	02000
00200	00360				01024	02048
00256					01200	02500

Ordering example: Incremental Encoder DDS36E; blind hollow shaft; metal Ø 8 mm; electrical interface 4.5 to 5.5 V, TTL/RS422, 6 channels; cable 8-core, axial, 1.5 m; number of lines 2500

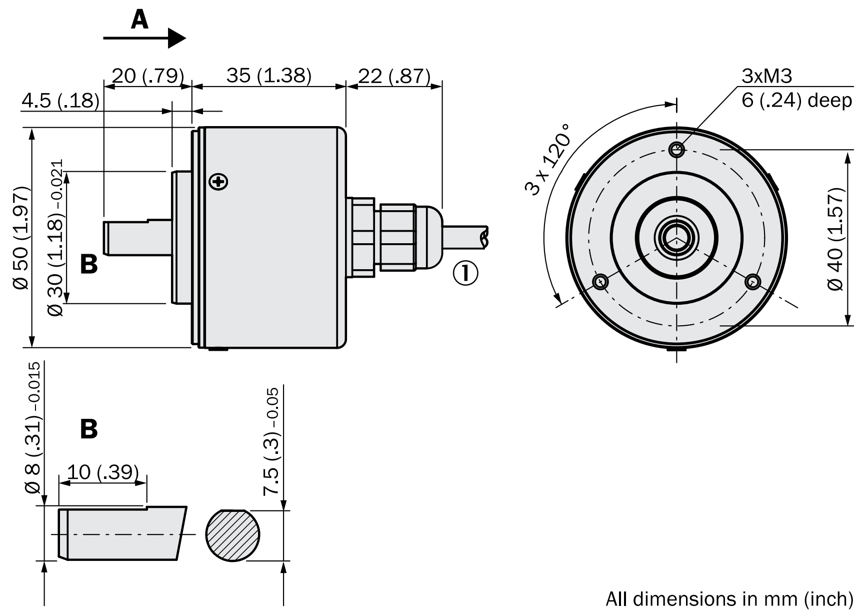
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**D**	**S**	**3**	**6**	**E**	**–**	**B**	**B**	**A**	**R**	**0**	**2**	**5**	**0**	**0**

Number of lines
100 up to 2,500

Incremental Encoders

- Cable outlet
- Enclosure rating IP 65
- Electrical Interfaces
  Open Collector NPN,
  TTL, HTL

Dimensional drawing DDS50 solid shaft



All dimensions in mm (inch)

① Cable diameter 5.1 (.20) ± 0.2 mm, bending radius R = 66 (2.60)

Accessories – see pages 410-448

Technical data		DDS50E-	**S** Solid shaft
Electrical interface		4.5 to 5.5 V, TTL/RS422, 6 channels	■
		7 to 24 V, TTL/RS422, 6 channels	■
		7 to 24 V, HTL/push pull, 3 channels	■
		4.5 to 5.5 V, Open Collector, 3 channels, NPN	■
Mechanical interface		Face mount flange, solid shaft Ø 8 x 15.5 mm	■
Number of lines (Z)		100 to 2,500	■
Mass		145 g	■
Moment of inertia of the rotor		0.8 kg/mm²	■
Measuring step (M)		360°/(Z x 4)	■
Reference signal	Number	1	■
	Position	90° electr., gated with A and B	■
Measuring step deviation (MA)		M x 0.1	■
Error limits		MA x 3	■
Output frequency		300 kHz	■
Operating speed[1]		6,000 rpm	■
Angular acceleration		5 x 10^5 rad/s^2	■
Operating torque at +20 °C		4 Nmm	■
Start up torque at +20 °C		6 Nmm	■
Permissible shaft loading	Radial	50 N	■
	Axial	30 N	■
Bearing lifetime		2 x 10^9 revolutions	■
Working temperature range		–10 to +70 °C	■
Storage temperature range (without package)		–25 to +85 °C	■
Permissible relative humidity[2]		90 %	■
EMC according to EN 61000-6-2 and EN 61000-6-4			■
Resistance			
to shocks (according to EN 60068-2-27)		100 g/6 ms	■
to vibration (according to EN 60068-2-6)		5 g/10 to 200 Hz	■
Enclosure rating		IP 65	■
Load current		20 mA	■
Operating current at no load		100 mA	■

[1] Self-warming 3.3 k/1,000 min^{-1}, when applying, note working temperature range.

[2] Condensation of the optical scanning not permitted.

Ordering Information DDS50, Solid Shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**D**	**S**	**5**	**0**	**E**	**–**	**S**	**4**							

Mechanical interface
Solid shaft = **S**

Shaft diameter
Face mount flange, solid shaft 8 x 15.5 mm = **4**

Electrical interface
4.5 to 5.5 V, TTL/RS422, 6 channels = **A**
7 to 24 V, TTL/ 422, 6 channels = **C**
7 to 24 V, HTL/push pull, 3 channels = **G**
4.5 to 5.5 V, Open Collector, 3 channels, NPN = **P**

Connection type
Cable 8-core, axial, 1.5 m = **R**
Cable 8-core, axial, 3 m = **S** *)
Cable 8-core, axial, 5 m = **T** *)

*) Available January 2010

Number of lines ①
Always 5 characters in clear text**)

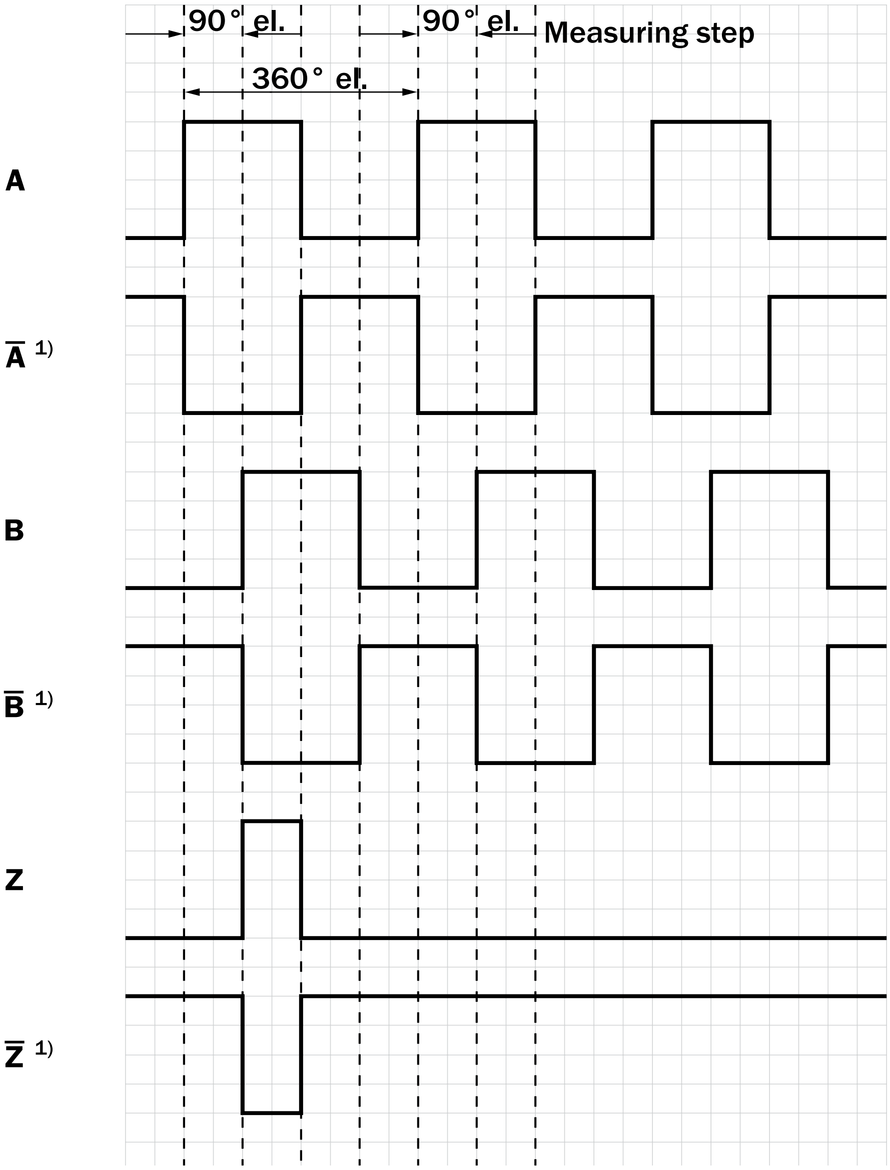
**) Available number of lines see below

Available number of lines ①						
00100	00300	00400	00500	00600	01000	02000
00200	00360				01024	02048
00256					01200	02500

Ordering example: Incremental Encoder DDS50E; solid shaft 8 x 15.5 mm; face mount flange; electrical interface 7 to 24 V, HTL/push pull, 3 channels; cable 8-core, axial, 1.5 m; number of lines 2500

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
D	**D**	**S**	**5**	**0**	**E**	**–**	**S**	**4**	**G**	**R**	**0**	**2**	**5**	**0**	**0**

Incremental pulse diagram



CW with view on the Encoder shaft in direction “A”, see dimensional drawing.

[1] Only for interfaces 4.5 to 5.5 V, TTL/RS422 and 7 to 24 V ,TTL/RS422

Allocation

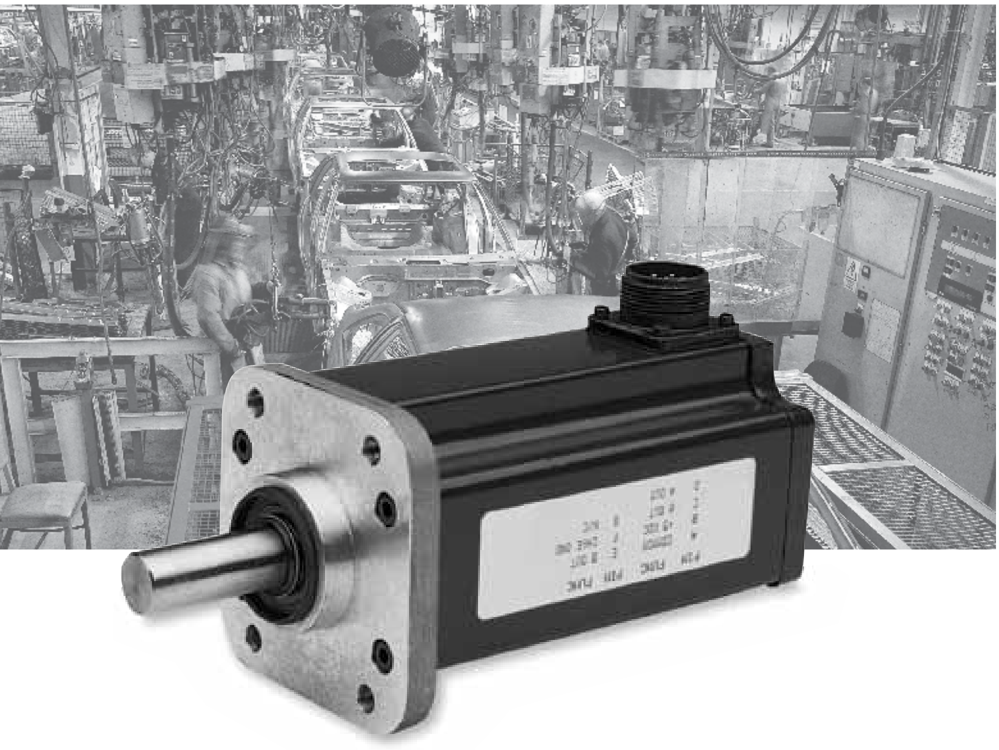
Colour of wires	Signal OC, HTL	Signal TTL	Explanation
Brown	Not connected	$\overline{A}$	Signal line
White	A	A	Signal line
Black	Not connected	$\overline{B}$	Signal line
Pink	B	B	Signal line
Yellow	Not connected	$\overline{Z}$	Signal line
Lilac	Z	Z	Signal line
Blue	GND	GND	Ground connection of the Encoder
Red	$+U_S$	$+U_S$	Supply voltage (potential free to housing)
Screen	Screen	Screen	Screen (screen connected to Encoder housing. Connect screen on control side!)

HD52: Special Purpose Incremental Encoders

The HD32 is a heavy duty incremental encoder with 100 lb. radial shaft rating. It has a rugged die-cast aluminum housing with IP66 protection. Its quadrature output with reference marker makes it an excellent choice for special purpose applications.

Applications could include:

- Machine tools
- Textile machines
- Woodworking machines
- Packaging machines



Number of lines
1 to 3,000

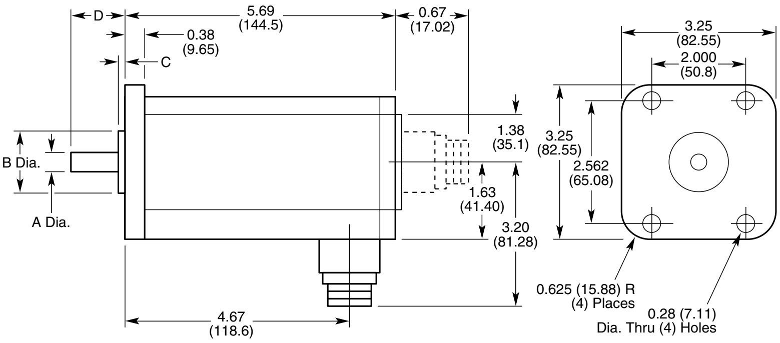
Incremental Encoder

Number of lines
1 to 3,000

Incremental Encoder

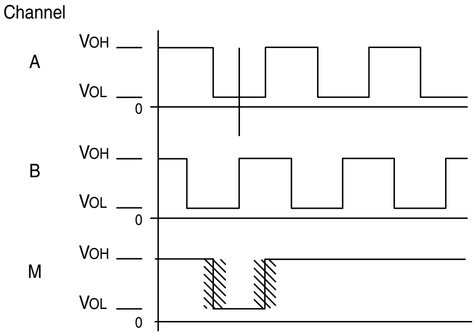
- IP66 protection class
- Electrical interfaces, line drivers and open collectors

Dimensional drawing – inches (mm)



	"A" Dia.	"B" Dia.	"C"	"D"
3/8" (0.9525) shaft	0.3748 /0.3746 (0.9520)/(0.9515)	1.250/1.249 (3.175)/(3.173)	0.125 (0.318)	1.125 (2.858)
5/8" (1.588) shaft	0.6248/0.6246 (1.587)/(1.586)	1.625/1.624 (4.128)/(4.125)	0.375 (0.953)	2 (5.08)

Incremental pulse diagram (clockwise rotation viewed from shaft end)



Shaded areas represent the locus of leading and trailing edges of marker pulse.

Notes

1. Channel B leads Channel A for clockwise rotation as when viewed from shaft end.
2. Marker pulse, when ordered, is approximately centered on positive-going edge of Channel B and is 180° ±90° electrical edge.
3. Complementary signals ($\bar{A}$, $\bar{B}$, and $\bar{M}$) are standard on units with line drivers.

Electrical interfaces

Supply voltage	4.75...5.25V	8.0...24.0V	5V
Interfaces/drivers	5V line driver	8/24V line driver	5V open collector

Pin and wire allocation

MS 7-Pin Connector

Pin	Function	Cable
A	Common	Blue
B	+Vs	Red
C	M Output	Lilac
D	A Output	White
E	B Output	Pink
F	Case Ground	Black
G	N/C	–

MS 14-Pin Connector

Pin	Function	Cable
A*	Common	Blue
B*	+Vs	Red
C	M Output	Violet
D	A Output	Black
E	B Output	Brown
F	N/C	–
G	A Output	Pink
H	B Output	White
I	M Output	Yellow
J	N/C	–
K*		Orange
L*		Gray
M	N/C	–
N	Case Ground	Green

*A jumped to K, and B jumped to L, to permit parallel power leads and reduce line drop.

Accessories – see pages 410-448

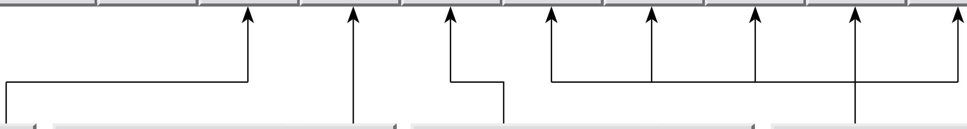
Technical Data	HD52
Solid Shaft	3/8", 5/8"
Number of lines (Z) per revolution	00010-02500, see order info
Electrical Interface	
+5 V in/+5 V differential line driver (3487)	
5 V in/5 V open collector (7406)	
12 V in/12 V open collector	
+8…24 V in/8…24 V differential line driver (7272)	
Mass	3 lb (1.36 kg)
Moment of inertia of the rotor	3.1 x 10^{-4} oz-in-sec^2 (21.9 gcm^2)
Measuring step	90°/number of lines
Reference signal	
Number	1
Position	Non-gated 180° ±90° electrical
Error limits	45/Z °
Measuring step deviation	45/Z °
Max. output frequency	100 kHz
Max. operating speed	3,000 rpm max shaft loading
Max. angular acceleration	50,000 rad/s^2
Max. starting torque	
3/8" dia. shaft	6.0 oz-in (42 Ncm)
5/8" dia. shaft	12.0 oz-in (84 Ncm)
Permissible shaft loading	
radial (at end of shaft)	100 lb (445 N)
axial	45 lb max (200 N)
Bearing lifetime [1]	
3/8" shaft	1.7 x 10^9 revolutions
5/8" shaft	6.0 x 10^9 revolutions
Working temperature range	0° … + 70 °C
Storage temperature range	-20 … + 85 °C
Permissible relative humidity	95% (condensation not permitted)
Protection class	IP66
Working voltage range	4.75…5.25 V
	8.0…24.0 V
Working current range at no load	120 mA

[1] B10 life with shaft loading of:
3/8" 15 lb (6.8 kg) axial and 25 lb (11.4 kg) radial (end of shaft)
5/8" 30 lb (13.6 kg) axial and 60 lb (27.2 kg) radial (end of shaft)

Order information

Incremental Encoder HD52

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
H	**D**	**5**	**2**	**–**								



Connection Type	
7 Pin Radial Connector	= 7S
7 Pin Axial Connector	= 7B
14 Pin Radial Connector	= 9S
14 Pin Axial Connector	= 9B

Shaft Designation	
3/8" Shaft	= 1
3/8" Shaft with two flats	= 7
5/8" Shaft	= 4
5/8" Shaft with keyway	= 8

Electrical Interface	
5 V, 5 V (3487)	= 5
5 V Open Collector	= C
12 V Open Collector	=12C
8-24 V, 8/24 V (7272)	= 4

Number of Lines
Always five characters in clear text. (see chart)

Number of lines (Z) per revolution							
00010	00128	00256	00512	01000	01230	01500	02048
00020	00150	00300	00600	01024	01250	01512	02400
00030	00180	00336	00720	01140	01260	01800	02500
00050	00200	00360	00800	01152	01270	01888	
00060	00240	00400	00900	01200	01386	02000	
00100	00250	00500	00960				

Order example: Incremental Encoder HD52

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
H	**D**	**5**	**2**	**–**	**7S**	**1**	**5**	**0**	**1**	**0**	**2**	**4**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
H	**D**	**5**	**2**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
H	**D**	**5**	**2**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13
H	**D**	**5**	**2**	**–**								

HD32:
Special Purpose Incremental Encoders

The HD32 is a heavy duty incremental encoder with 100 lb. radial shaft rating. It has a rugged die-cast aluminum housing with IP65 protection. Its double-ended shaft option and quadrature output with reference marker make it an excellent choice for special purpose applications.

Applications could include:
- Machine tools
- Textile machines
- Woodworking machines
- Packaging machines

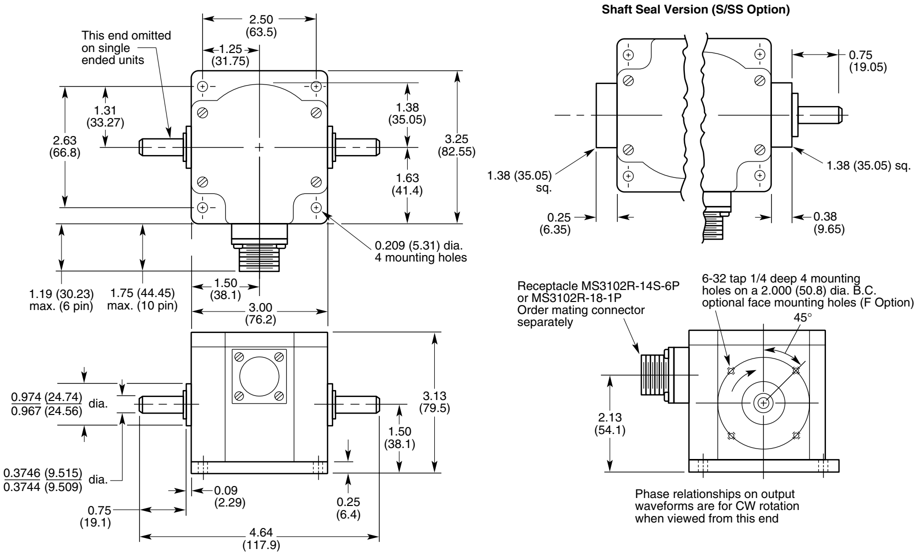
Number of lines
1 to 3,000
Incremental Encoder

Number of lines
1 to 3,000

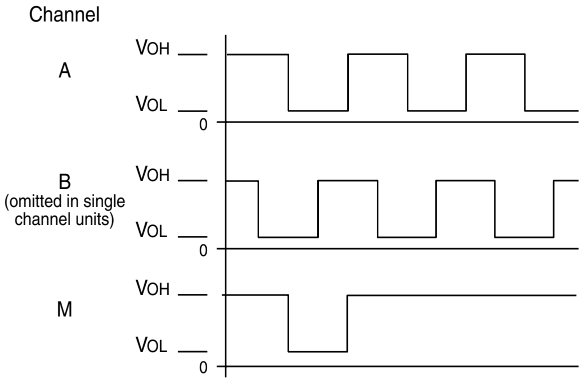
Incremental Encoder

- 3.25" cube housing style
- IP65 protection class
- Electrical interfaces and line drivers and open collectors
- Double/single ended shaft

Dimensional drawing


Shaft Seal Version (S/SS Option)
This end omitted on single ended units
2.50 (63.5)
1.25 (31.75)
1.31 (33.27)
2.63 (66.8)
1.38 (35.05)
3.25 (82.55)
1.63 (41.4)
0.209 (5.31) dia. 4 mounting holes
1.19 (30.23) max. (6 pin)
1.75 (44.45) max. (10 pin)
1.50 (38.1)
3.00 (76.2)
0.974 (24.74)
0.967 (24.56) dia.
0.3746 (9.515)
0.3744 (9.509) dia.
3.13 (79.5)
1.50 (38.1)
0.09 (2.29)
0.25 (6.4)
0.75 (19.1)
4.64 (117.9)
0.75 (19.05)
1.38 (35.05) sq.
1.38 (35.05) sq.
0.25 (6.35)
0.38 (9.65)
Receptacle MS3102R-14S-6P or MS3102R-18-1P Order mating connector separately
6-32 tap 1/4 deep 4 mounting holes on a 2.000 (50.8) dia. B.C. optional face mounting holes (F Option)
45°
2.13 (54.1)
Phase relationships on output waveforms are for CW rotation when viewed from this end

Incremental pulse diagram (clockwise rotation viewed from shaft end)



Notes

1. Channel B leads Channel A for clockwise rotation as defined on dimension drawing.
2. Marker pulse, when ordered, is gated with negative going Channel A and is negative going.
3. Complementary signals ($\overline{A}$, $\overline{B}$, and $\overline{M}$) are standard on units with line drivers.

Pin and wire allocation

Function	Standard 6-Pin Receptacle	10-Pin Receptacle (Supplied on Line Driver Units)	Cable
Common	A	A	Black
+Vs	B	B	Red
M Output	C	C	Blue
B Output	D	D	Green
A Output	E	E	White
Case Ground	F	F	Gray
$\overline{A}$ Output	N/A	G	Pink
$\overline{B}$ Output	N/A	H	White
$\overline{M}$ Output	N/A	I	Yellow

Accessories – see pages 410-448

Technical Data	HD32
Solid Shaft	3/8”
Number of lines (Z) per revolution	00010 to 02500, see order info
Electrical Interface	
+5 V in/+5 V differential line driver (3487)	
+8…24 V in/8…24 V differential line driver (7272)	
Mass	24 oz (0.68 kg)
Moment of inertia of the rotor	3.1 x 10^{-4} oz-in-sec^2 (21.9 gcm^2)
Measuring step	90°/number of lines
Reference signal	
Number	1
Position	Gated 180° nominal (gated with count channel A)
Error limits	45/Z °
Measuring step deviation	45/Z °
Max. output frequency	100 kHz
Max. operating speed	3,000 rpm max shaft loading
	5,000 rpm reduced shaft loading
Max. angular acceleration	50,000 rad/s^2
Max. starting torque	
without shaft seal	2.0 oz-in (14 Ncm)
with (1) shaft seal	6.0 oz-in (42 Ncm)
with (2) shaft seal	10.0 oz-in (70 Ncm)
Permissible shaft loading	
radial (at end of shaft)	100 lb (445 N)
axial	40 lb (178 N)
Bearing lifetime 1)	2.0 x 10^9 revolutions
Working temperature range	0° … + 70 °C
Storage temperature range	-20 … + 85 °C
Permissible relative humidity	95% (condensation not permitted)
Protection class	IP65
Working voltage range	4.75…5.25 V
	8.0…24.0 V
Working current range at no load	120 mA

1) B10 life with shaft loading of 15 lb (6.8 kg) axial and 40 lb (18.2 kg) radial (end of shaft)

Order information

Incremental Encoder HD32

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
H	**D**	**3**	**2**	**–**							

Shaft Designation

Double ended = 1

Single ended = 2

Double ended with face mount holes = 1F

Single ended with face mount holes = 2F

Double ended with shaft seal = SS

Single ended with shaft seal = S

Electrical Interface

5 V, 5 V (3487) 6 channel = 5

5 V, 5 V (3487) 3 channel = 5E

8-24 V, 8/24 V (7272) 6 channel = 24

8-24 V, 8/24 V (7272) 3 channel = 24E

Number of Lines

Always five characters in clear text. (see chart)

Number of lines (Z) per revolution

00010	00128	00256	00512	01000	01230	01500	02048
00020	00150	00300	00600	01024	01250	01512	02400
00030	00180	00336	00720	01140	01260	01800	02500
00050	00200	00360	00800	01152	01270	01888	
00060	00240	00400	00900	01200	01386	02000	
00100	00250	00500	00960				

Order example: Incremental Encoder HD32

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
H	**D**	**3**	**2**	**–**	**1**	**5E**	**0**	**1**	**0**	**2**	**4**

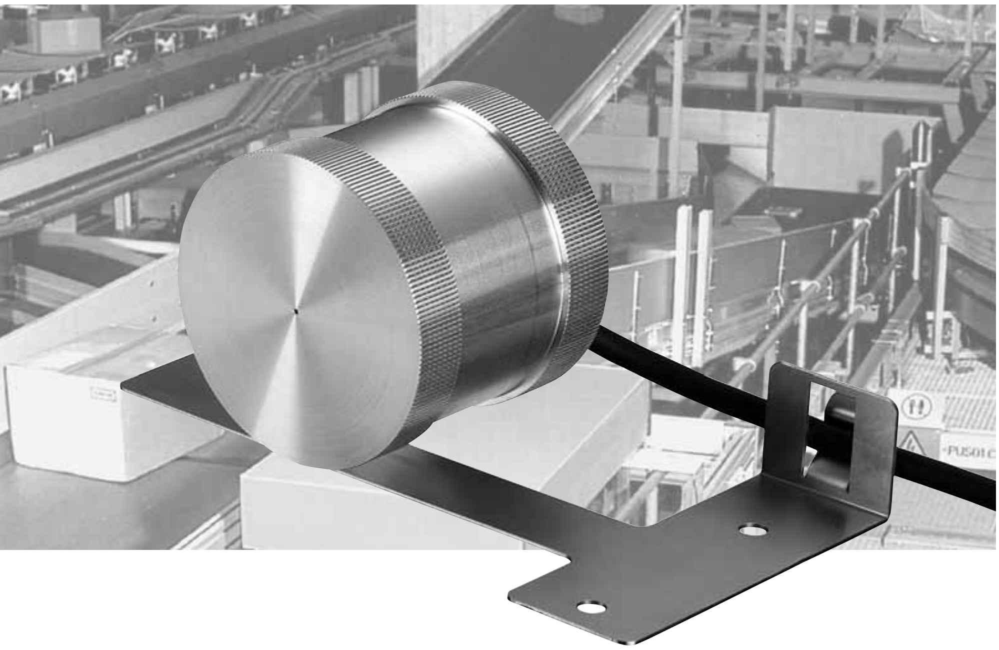
Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
H	**D**	**3**	**2**	**–**							

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
H	**D**	**3**	**2**	**–**							

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12
H	**D**	**3**	**2**	**–**							

DKV60:
Incremental Measuring Wheel Encoders



Number of lines
1 up to 2,000
Incremental Encoders

The DKV60 Incremental Measuring Wheel Encoder is a cost-effective and extremely compact solution for the direct determination of position and speed of a conveyor belt.

The DKV60 Incremental Measuring Wheel Encoder can be fitted directly to the conveyor belt, without the need of any mechanical accessories.

The basis of the product is the DKS40 Incremental Encoder. The DKS40 and therefore the DKV60 utilise Mini-Disc technology, making the DKV60, extremely robust and resistant to shock and vibration. The DKV60 also features a high protection rating (IP 65).

Specify your own individual Measuring Wheel Encoder!

Possible product variations:

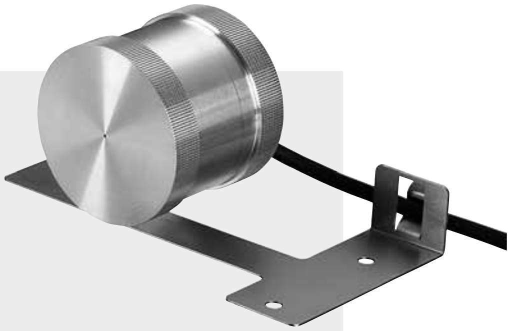
- Interface
  TTL/RS422, HTL/push-pull
- Measuring drum
  Knurled surface,
  ‘O’ ring surface
- Cable outlet 1.5 m

The product versatility enables many uses, e. g. in:
- Woodworking machinery
- Steel and sheet processing machinery
- Storage and conveying technology
- Sorting systems
- Conveyor belts
- Textile machinery
- Printing and paper

Number of lines
1 up to 2,000

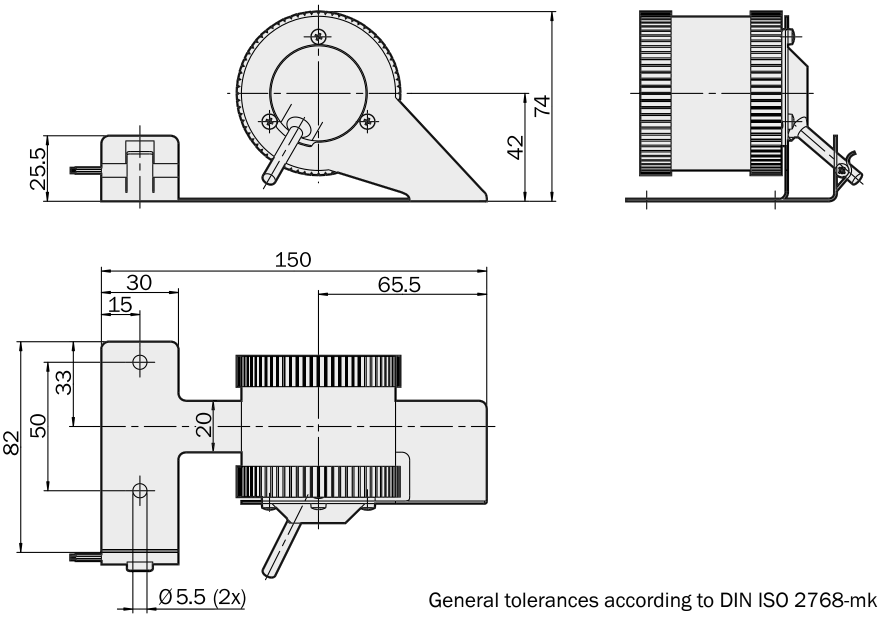
Incremental Encoders

- Cable outlet
- Protection rating up to IP 65
- Electrical interfaces
  TTL and HTL



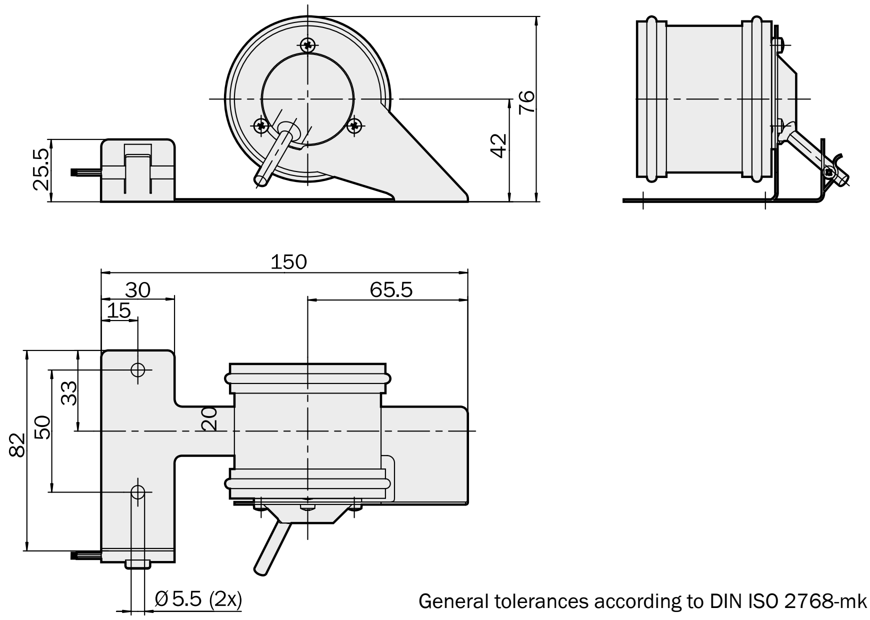
Accessories – see pages 410-448

Dimensional drawing DKV60 knurled surface



General tolerances according to DIN ISO 2768-mk

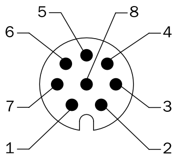
Dimensional drawing DKV60 'O' ring surface



General tolerances according to DIN ISO 2768-mk

Wire allocation/cable 8-core

8-Pin, M12 connector	Core colour	Signal TTL, HTL	Explanation
1	Brown	$\overline{A}$	Signal line
2	White	A	Signal line
3	Black	$\overline{B}$	Signal line
4	Pink	B	Signal line
5	Yellow	$\overline{Z}$	Signal line
6	Lilac	Z	Signal line
7	Blue	GND	Ground connection
8	Red	$+U_S$	Power supply [1]
	Screen	Screen	Screen [2]



View of the connector fitted to the encoder body

[1] Potential free to housing

[2] Screen connected to Encoder housing. Connect screen on control side!

Technical Data to DIN 32878	DKV60	DKV									
Pulses per 200 mm	1 to 2,000	■									
Electrical interface	4.5 ... 5.5 V, TTL/RS 422, 6-channel	■									
	10 ... 30 V, HTL, 6-channel	■									
Mass	0.42 kg	■									
Reference signal											
Number	1	■									
Position	90° electr., logically linked with A and B	■									
Error limits											
Knurled surface	± 0.5 mm/m	■									
'O' ring surface	± 4 mm/m	■									
Max. operating speed	1,500 min^{-1}	■									
Bearing lifetime	2 x 10^9 revolutions	■									
Working temperature range	– 10 ... + 60 °C	■									
Storage temperature range	– 40 ... + 70 °C	■									
Permissible relative humidity [1]	90 %	■									
EMC [2]		■									
Resistance											
to shocks [3]	50/7 g/ms	■									
to vibration [4]	20/10 ... 2000 g/Hz	■									
Protection class IEC 60529	IP 65	■									
Load current											
4.5 ... 5.5 V, TTL/RS 422	Max. 30 mA	■									
10 ... 30 V, HTL/push-pull	Max. 30 mA	■									
No-load operating current											
4.5 ... 5.5 V, TTL/RS 422	40 mA	■									
10 ... 30 V, HTL/push-pull	40 mA	■									
Initialization time after power on	40 ms	■									

[1] Condensation of the optical scanning is not permitted

[2] To DIN EN 61000-6-2 and DIN EN 61000-6-3

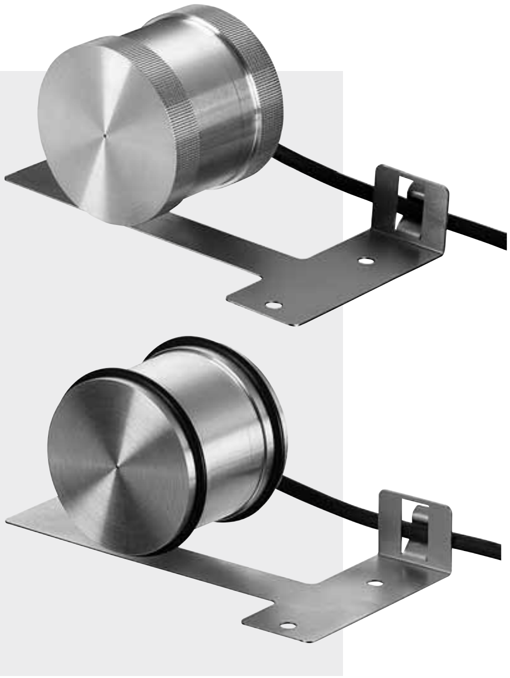
[3] To DIN EN 60068-2-27

[4] To DIN EN 60068-2-6

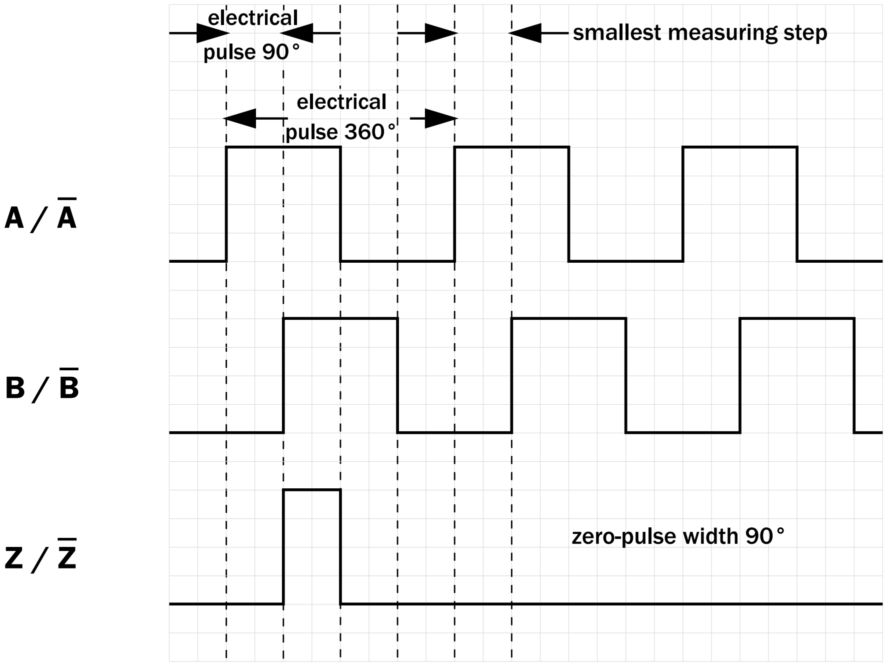
Number of lines
1 up to 2,000

Incremental Encoders

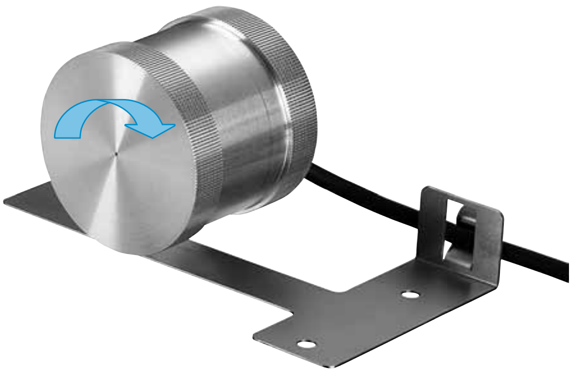
- Cable outlet
- Protection rating up to IP 65
- Electrical interfaces TTL and HTL



Signal outputs



Cw looking at the measuring drum



Accessories – see pages 410-448

Order information

Incremental Encoder DKV60

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**K**	**V**	**6**	**0**	**–**			**K**					

Electrical interface

4.5 ... 5.5 V, TTL/RS 422 6-channel	= **A**
10 ... 30 V, HTL/push-pull 6-channel	= **E**

Mechanical version

Measuring drum, knurled surface DIN82-RAA 1	= **1**
Measuring drum, 'O' ring surface EPDM, Highly abrasion-resistant	= **2**

Connection type

Cable 8-core, 1.5 m	= **K**
Cable, universal 1.5 m [1)] with connector M12, 8-pin	= **P**

Pulses per 200 mm

Always 5 characters in clear text.

[1)] **The universal cable output is positioned so that a kink-free cable run is possible in radial or axial direction.**

Order example

DKV60; 4.5 ... 5.5 V, TTL/RS 422; 6-channel; Measuring drum knurled surface

Type	Part no.	Pulses/200 mm	Resolution	Smallest measuring step
DKV60-A1K00020	1035039	20	1 pulse = 10 mm	2.5 mm
DKV60-A1K00200	1035040	200	1 pulse = 1 mm	0.25 mm
DKV60-A1K01000	1035041	1000	1 pulse = 0.2 mm	0.05 mm
DKV60-A1K02000	1035042	2000	1 pulse = 0.1 mm	0.025 mm

DKV60; 4.5 ... 5.5 V, TTL/RS 422; 6-channel; Measuring drum 'O' ring surface; EPDM, Highly abrasion-resistant

Type	Part no.	Pulses/200 mm	Resolution	Smallest measuring step
DKV60-A2K00020	1035043	20	1 pulse = 10 mm	2.5 mm
DKV60-A2K00200	1035044	200	1 pulse = 1 mm	0.25 mm
DKV60-A2K01000	1035045	1000	1 pulse = 0.2 mm	0.05 mm
DKV60-A2K02000	1035046	2000	1 pulse = 0.1 mm	0.025 mm

DKV60; 10 ... 30 V, HTL/push-pull; 6-channel; Measuring drum knurled surface

Type	Part no.	Pulses/200 mm	Resolution	Smallest measuring step
DKV60-E1K00020	1035047	20	1 pulse = 10 mm	2.5 mm
DKV60-E1K00200	1035048	200	1 pulse = 1 mm	0.25 mm
DKV60-E1K01000	1035049	1000	1 pulse = 0.2 mm	0.05 mm
DKV60-E1K02000	1035050	2000	1 pulse = 0.1 mm	0.025 mm

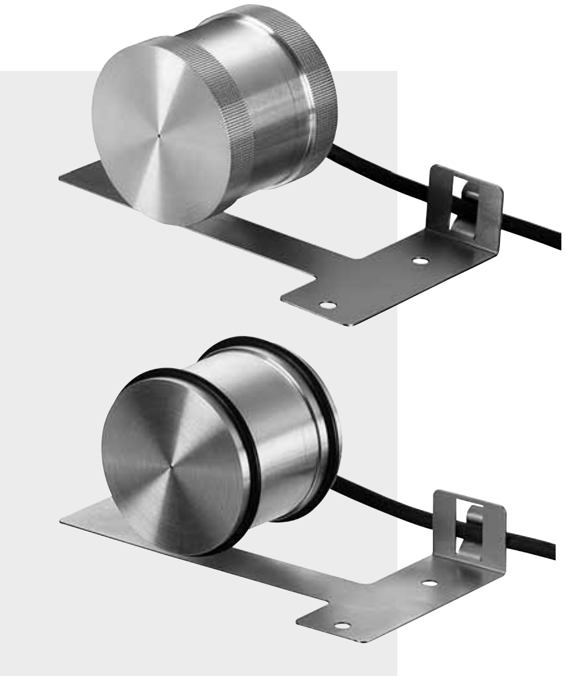
DKV60; 10 ... 30 V, HTL/push-pull; 6-channel; Measuring drum 'O' ring surface; EPDM, Highly abrasion-resistant

Type	Part no.	Pulses/200 mm	Resolution	Smallest measuring step
DKV60-E2K00020	1035051	20	1 pulse = 10 mm	2.5 mm
DKV60-E2K00200	1035052	200	1 pulse = 1 mm	0.25 mm
DKV60-E2K01000	1035053	1000	1 pulse = 0.2 mm	0.05 mm
DKV60-E2K02000	1035054	2000	1 pulse = 0.1 mm	0.025 mm

Number of lines
1 up to 2,000

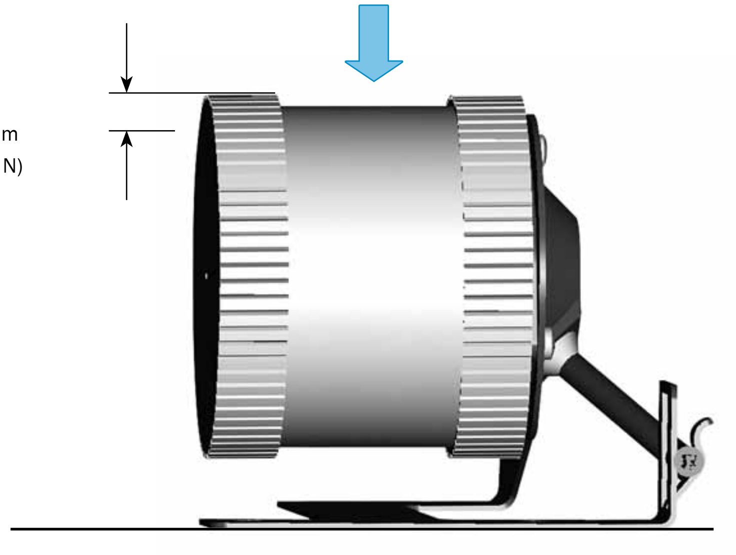
Incremental Encoders

- Cable outlet
- Protection rating up to IP 65
- Electrical interfaces
  TTL and HTL



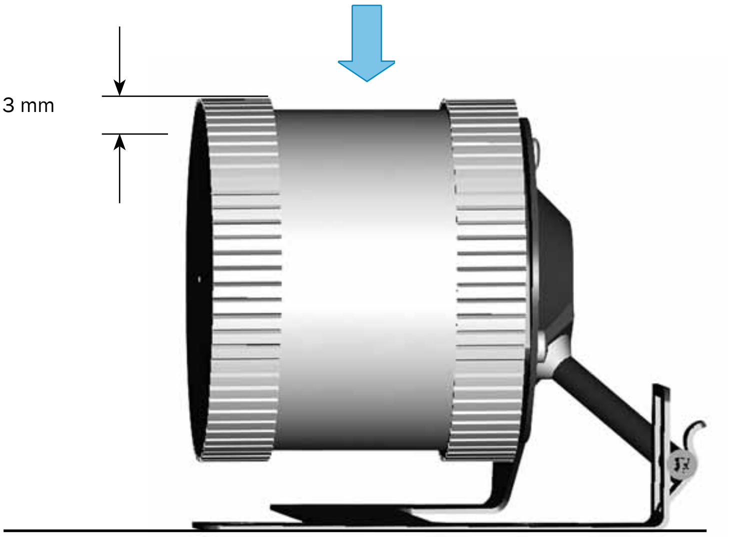
Accessories – see pages 410-448

Working position/force

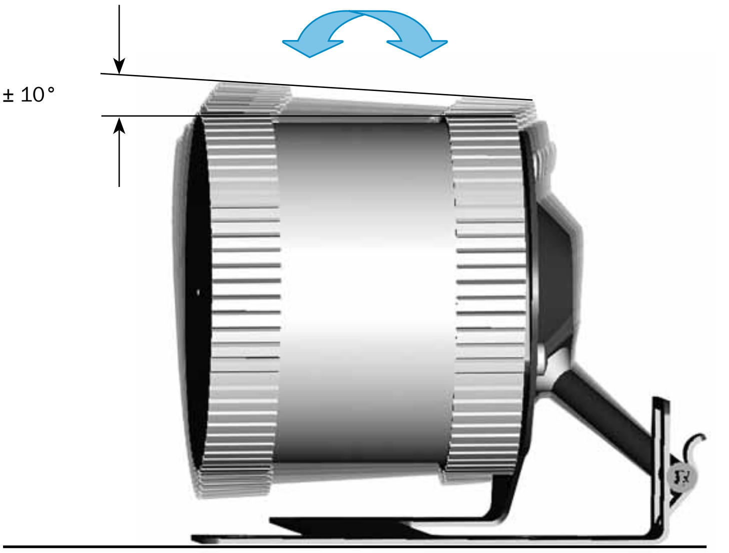


Working position/
force = 2 ... 5 mm
(5 ... 10 N)

Max. deflection



Max. deflection Y = 3 mm



Max. deflection X = ± 10°

DFV60:
Incremental Measuring Wheel Encoders

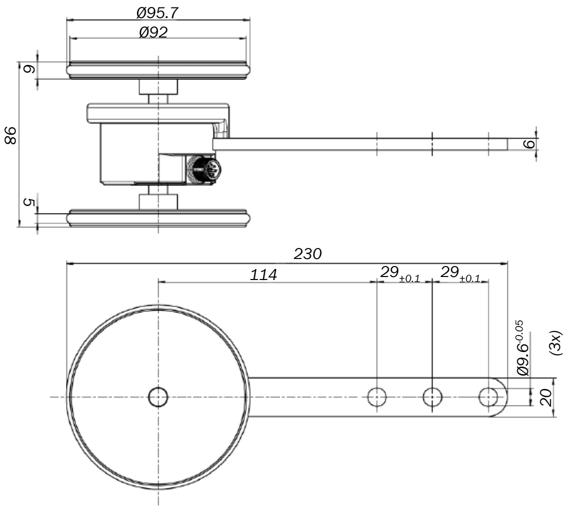
Number of lines
1 up to 2,000
Incremental Encoders

Number of lines 65536

Incremental Encoder

- Electrical Interface 5 ... 32 V, TTL/HTL programmable
- Measuring drum, Circumference C = 300 mm, O-ring surface
- Connector M12, 8-pin
- Number of lines 65536

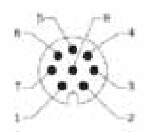
Dimensional drawing measuring drum, O-ring surface



CE

Pin allocation connector M12, 8-pin

PIN	Signal	Explanation
1	A_	Signal line
2	A	Signal line
3	B_	Signal line
4	B	Signal line
5	Z_	Signal line
6	Z	Signal line
7	GND	Ground connection of the Encoder
8	Us	Supply voltage, potential free to the housing



View of the connector fitted to the encoder body

Order information

Type	Part no.
DFV60A-W2PC65536	1037952

Accessories – see pages 410-448

Technical Data acc. to DIN 32878	DFV60A-W2PC65536
Number of lines	65536
Electrical interface	5 ... 32 V, TTL/HTL, programmable
Mass	0.5 kg
Reference signal	
Number	1
Position	90° electr,. logically gated with A and B
Error limits	
O-ring surface	± 4 mm/m
Max. operating speed-1	1.500 min -1
Bearing lifetime	2 x 109 revolutions
Working temperature range	- 10 ... + 85 °C
Storage temperature range	- 40 ... + 70 °C
Permissible relative humidity 1)	90 %
EMC2)	
Resistance to shocks 3)	50/7 g/ms
Resistance to vibration 4)	20/10 ... 2.000 g/Hz
Protection class IEC 60529	IP 65
Load current	
10 ... 30 V TTL/HTL programmable	max. 30 mA
No-load operating current	
10 ... 30 V TTL/HTL programmable	60 mA
Initialization time after power on	1000 ms

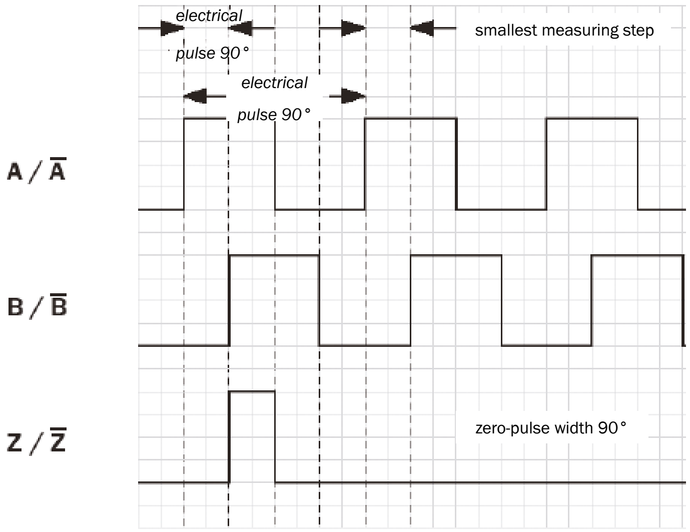
1) Condensation of the optical scanning is not permitted

2) To DIN EN 61000-6-2 and DIN EN 61000-6-3

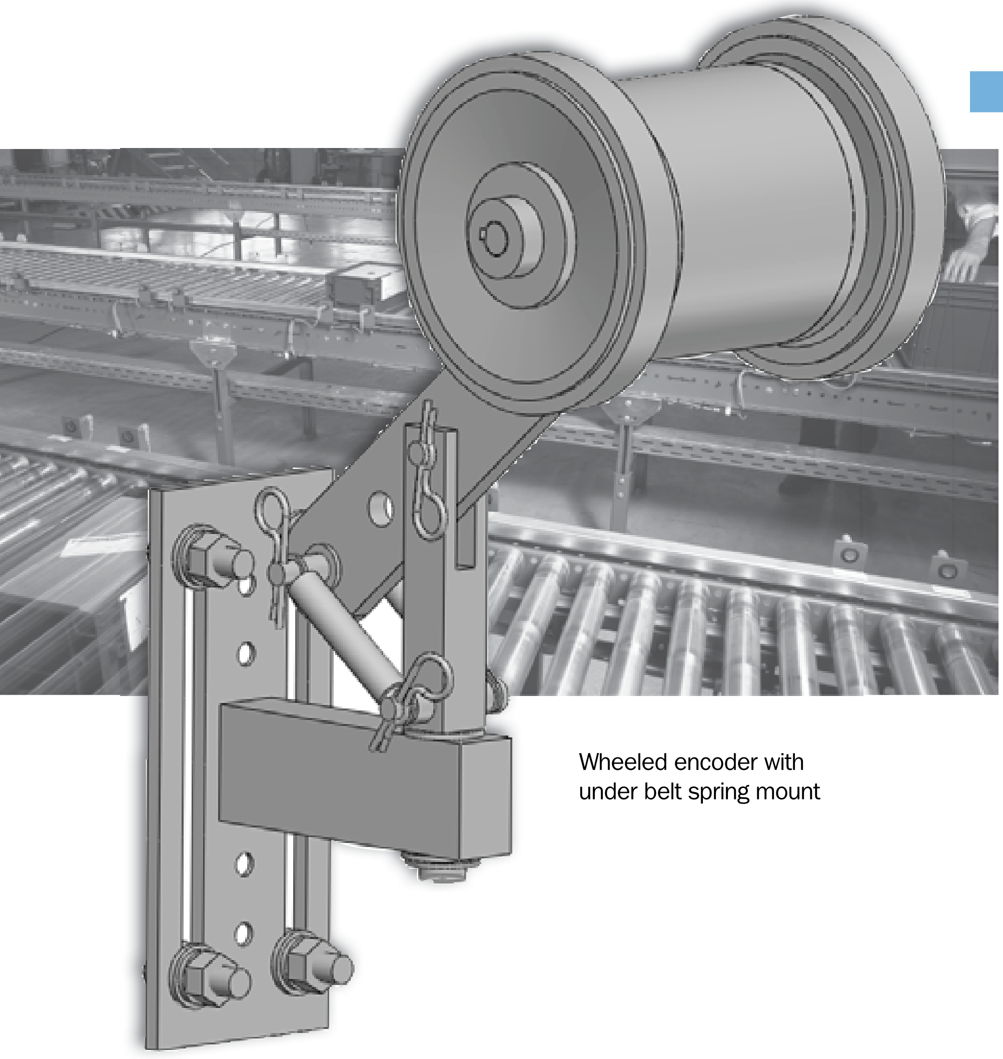
3) To DIN EN 60068-2-27

4) To DIN EN 60068-2-6

Signal outputs



DGV31 Incremental Measuring Wheel Encoder



Wheeled encoder with
under belt spring mount

The DGV31 is an incremental measuring wheel encoder used mostly in conveyor applications. With the use of a spring mounting system, the encoder can be easily mounted underneath a conveyor belt and different parameters such as direction of conveyor movement, and speed of the conveyor can be determined. The DGV31 has three options for electrical outputs: TTL, HTL and open collector. The industries that commonly use this style of encoder are:

- Steel & sheet processing
- Storing & conveying
- Textile
- Printing & paper

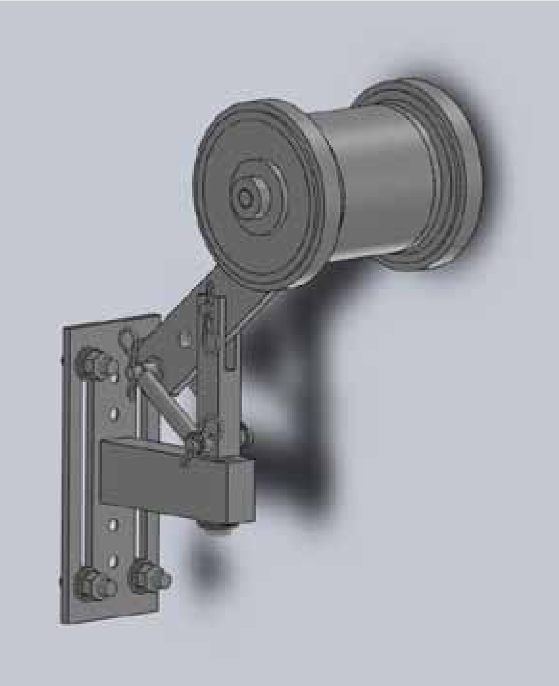
Number of lines
1 to 3,000 ppr
Measuring Wheel Encoder

- **Electrical interface**
  8-24 V Line Driver
  5 V Line Driver
  8-24 V Open Collector
- **Mechanical interface**
  3/8" shaft with 12" circumference measuring wheels
- **Mounting Options**
  Under belt spring mount
  Under belt counter weight
  Yoke assembly
  No mounting
- **Connection Type**
  3 or 6-pin connector

Number of lines
1 to 3,000 ppr

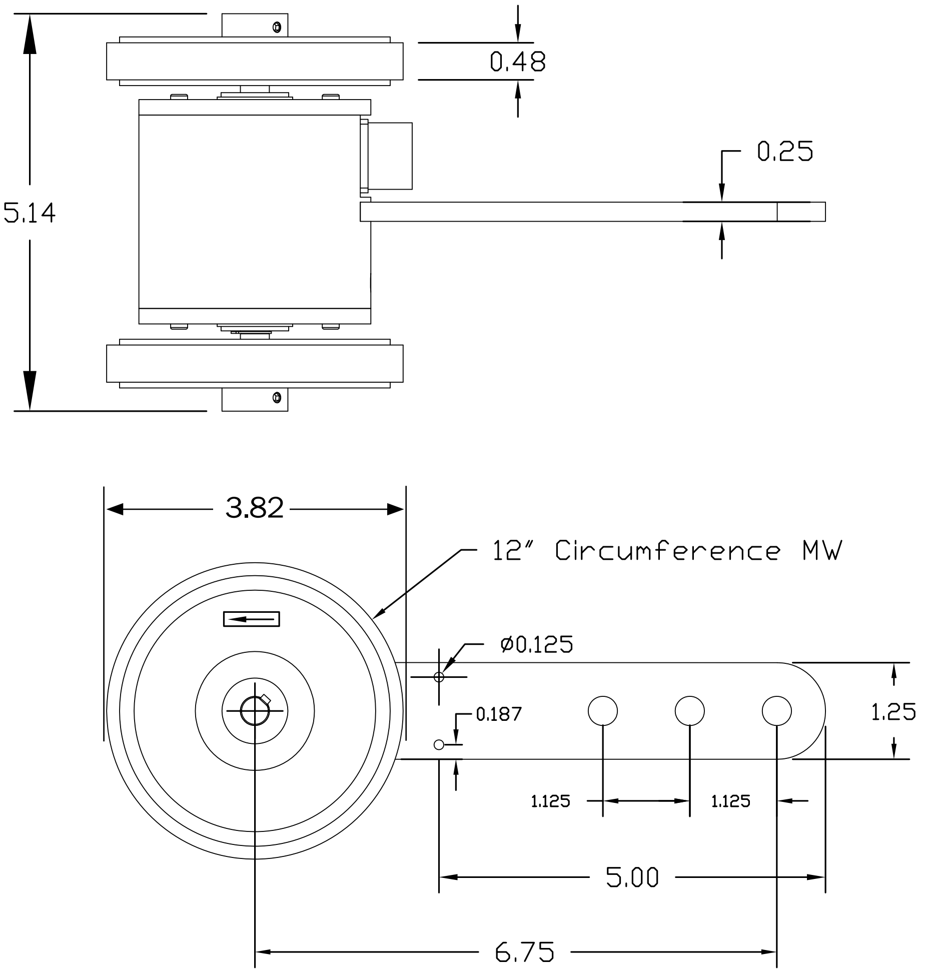
Measuring Wheel Encoder

- Line drivers or open collector
- Protection class IP60
- With or without mounting
- 3/8" shaft or 12" circumference



CE

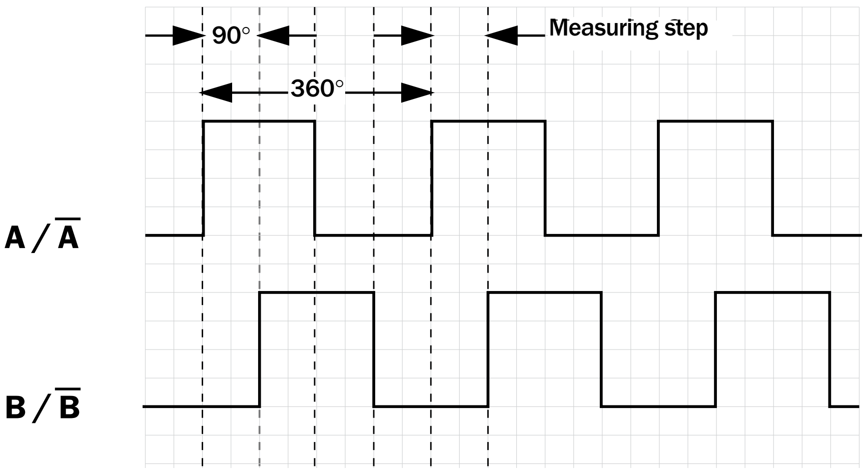
Dimensional drawing



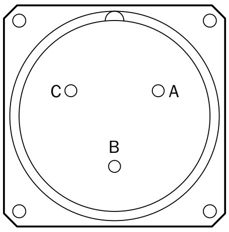
Accessories – see pages 410-448

Technical Data/Features	DGV31
Number of pulses per revolution (Z)	00001, 00005, 00010, 00020, 00030, 00050, 00060, 00064, 00080, 00100, 00120, 00128, 00150, 00180, 00200, 00250, 00254, 00256, 00300, 00360, 00400, 00500, 00512, 00600, 00720, 00800, 00900, 01000, 01024, 01200, 01260, 01280, 01472, 01500, 01600, 01800, 02000, 02048, 02400, 02500, 02540, 02750, 03000
Interfaces	RS-422 (3487 line driver) Open collector (7406) 8-24 V line driver (7272)
Dimensions	See drawing
Mass	2.25 lb. (1 kg) with measuring wheels
Permissible shaft loading	Radial (at end of shaft) 75 lb. (333 N) Axial 40 lb. (178 N)
Service life of bearings	2.0 x 10^9 revolutions
Working temperature range	0° … + 70 °C
Storage temperature range	-20 … + 85 °C
Permissible relative humidity	95 % (condensation not permitted)
Protection class	IP 60
Working voltage range	4.75 to 5.25 V 8.0 to 24.0 V
Working current at no load	120 mA
Error limits	45/Z°
Measurement step deviation	45/Z°
Max output frequency	100 kHz
Max operating speed	3000 rpm at max shaft loading 5000 rpm at reduced shaft loading

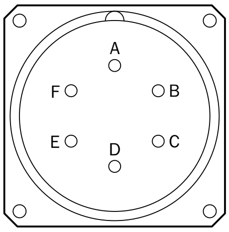
Incremental Pulse Diagram



Connection type



3-Pin MS3102A



6-Pin MS3102R

Pin and wire allocation

Function	3-Pin	6-Pin	Wire Color
COM	C	A	Black
+Vs	A	B	Red
N/C	–	C	N/C
A	B	D	White
B	–	E	Green
N/C	–	F	N/C

Order information

Incremental Encoder DGV31

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**V**	**3**	**1**	**–**								

Electrical interface

5 V, 5 V, 3487 = 1
8…24 V, 5 V, 3487 = 3
8…24 V, 8…24 V, 7272 = 5
8…24 V open collector (7406/7273) = 9

Mounting Type

Under Belt Spring Mounting Assembly = S
Under Belt Counter Weight Mounting Assembly = C
Yoke 1 Mounting Assembly = Y
Yoke 2a Mounting Assembly = W
No Mounting = N

Connection type

3-pin 20 ft. cable = C
6-pin 20 ft. cable = D
6-pin 30 ft. cable & M12 4-pin = E
3-pin no cable = F
6-pin no cable = G

Number of lines

Always five characters in clear text (see chart)

Number of lines per revolution

00001	00064	00180	00360	00720	01200	01500	02400
00005	00080	00200	00400	00800	01250	01600	02500
00010	00100	00250	00500	00900	01260	01800	02540
00020	00120	00254	00512	01000	01280	02000	02750
00030	00128	00256	00600	01024	01472	02048	03000
00050	00150	00300					
00060							

Common Resolutions and Pulses per mm

30 pulses = 1 pulse per 10 mm
300 pulses = 1 pulse per 1 mm
600 pulses = 1 pulse per 0.5 mm
1500 pulses = 1 pulse per 0.2 mm
3000 pulses = 1 pulse per 0.1 mm

Order example: Incremental Encoder DGV31

8-24 V (7272 line driver), Under Belt Sprint Mounting Assembly, 3-pin, 30 ppr (1 pulse = 10 mm)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
D	**G**	**V**	**3**	**1**	**–**	**5**	**S**	**C**	**0**	**0**	**0**	**3**	**0**

Absolute Encoders

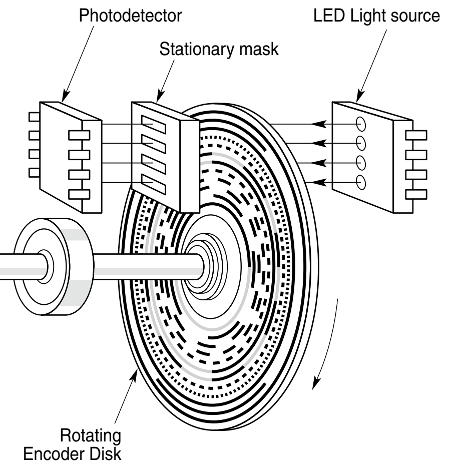
Use absolute encoders when position data must be retained after loss of power.

Basic Operation of Optical Rotary Absolute Encoders
As with incremental encoders, absolute optical rotary encoders use a rotating disk to interrupt the light path to a photodetector, which produces an output signal. However, absolute encoders read uniquely coded tracks to generate position information. No two adjacent positions are alike. Therefore, absolute encoders do not lose position data when power is lost. True position is available as soon as power is restored. Application examples include robotics, lead/ball screws, overhead cranes, and rack and pinion applications.

Conventional Optical Absolute Encoder Disks
A conventional absolute encoder disk features a series of concentric tracks, each consisting of a pattern of transparent and opaque segments. These independent tracks provide a unique combination of absolute values for each resolvable position. One track is needed for each "bit" of position information that is output as either a serial or parallel data "word."

The preferred code format is Gray Code, in which only one bit of information changes between adjacent positions on the disk. This limits the position error from the track sensors to plus or minus one count. Other available codes, such as Natural Binary or Binary Coded Decimal (BCD), may have several bits change between adjacent positions.

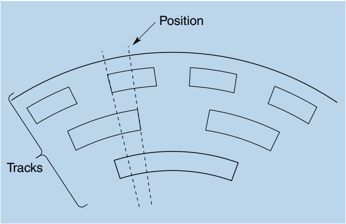
Absolute rotary encoder with conventional code disk.



Magnetic Absolute Encoders
Many applications require resistance to extremely high shock and vibration, wide temperature variations, or high humidity with condensation. Our magnetic absolute encoders meet these unique challenges.

Magnetic field strength of a proprietary 32-pole magnetic ring is measured using two strategically spaced magneto-resistors that pick up variation of the magnetic field intensity along the circumference of the ring. The resulting 32 sine/cosine signals per turn (5-bit) are then enhanced by 8-bit interpolation. A single north-south pole magnet, read by a Hall effect sensor, is used to assign absolute values to individual sine/cosine cycles. Thus, the 32-pole magnetic ring is calibrated for a 13-bit singleturn absolute position feedback. Additional software is used to compensate for temperature variation and resulting differential thermal expansion to insure data integrity.

Electronic Zero Position Teach
With all our absolute encoders, the zero position is electronically assigned by the user to the current mechanical position by activation of a pushbutton or set line. No mechanical detachment or rotation of the encoder is necessary.



Typical disk pattern showing radial scanning method used to read position

Serial Transmission
We developed SSI (Synchronous Serial Interface) to offer a cost-effective solution for long cable runs. The encoder produces serial data which is transmitted using only six wires, regardless of encoder resolution. This is ideal for transmission at high speed over long distances — up to 3,000 feet. Superior noise immunity is achieved using differential clock and data signals.

Singleturn and Multiturn Absolute Encoders
Use singleturn encoders when the full range of motion in the application occurs within one full revolution (360°) of the encoder shaft. Multiturn encoders are recommended for applications involving multiple revolutions of the encoder shaft.

In our multiturn encoders, a high precision, miniaturized gear train, with a magnet on each gear stage, is used to mechanically store position information over as many as 8,192 turns. The position of each gear stage is determined with a pair of Hall sensors. This eliminates the need for costly and often unreliable counters and battery back up systems. Also, position changes that occur while the power is off are automatically tracked.

Serial to Parallel Conversion Module
The AD-SSI-PA converter module can be used with our SSI absolute encoders to convert the transmitted data from serial to parallel format. These devices can be used if the control does not directly accept the SSI format.

Fieldbus Systems
Our absolute encoders can also be supplied with popular fieldbus interfaces including DeviceNet, Profibus, and CANopen.

Advantages of Absolute Encoders

NON-VOLATILE MEMORY

Absolute encoders are non-volatile position verification devices. True position is not lost if the power fails. Continuous reading of position is not required.

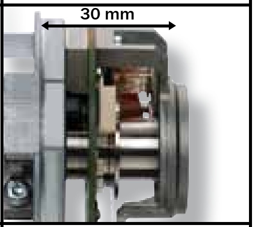
PROTECTION

In some applications, a loss of position could result in damage to the machinery or injury to the operator. An absolute encoder provides position verification the moment power is applied without requiring movement to a reference position.

NOISE IMMUNITY

Absolute encoders determine position by continually reading a coded signal. Stray pulses will not accumulate and accurate position is available again on the next reading.

Advantages of Using AFS and AFM Encoders Versus Conventional Encoders

	Conventional Encoders	The AFS/AFM Solution	
Limited Pulses Per Revolution	Many industrial applications require a higher line count than has been available with traditional absolute encoders. In the past, there were several ways to increase resolution: interpolation or using a larger encoder.	The AFS and AFM encoders have a completely new ASIC design, which provides 1 to 262,144 counts per revolution, 4096 revolutions; significantly increasing resolution available in absolute encoders.	
Shock, Vibration & Temperature Limitations	The rotating discs used in encoders are typically glass or plastic. Glass discs can shatter when exposed to excessive vibration or shock. Plastic discs, while they won't shatter, cannot achieve the same level of accuracy as glass discs. Additionally, they are limited to a lower working temperature, rendering them unsuitable for the temperature tolerances often required in harsh environments.	The AFS and AFM encoders feature a nickel code disc designed both for increased robustness and a higher temperature tolerance (-20… +100 °C).	
Bearing Lifetime and Run Out	The life of an encoder bearing can be shortened by several factors: high shaft loads, high speeds of rotation, and shaft misalignment. Once a bearing fails, the encoder needs to be replaced.	The loads on the bearings have been greatly reduced on the AFS and AFM due to the 30 mm distance between the bearings. This greater bearing distance also decreases vibration of the encoder, which helps extend the life of the bearings.	
Programmability	Typical encoders are shipped by the manufacturer with the customers' desired line count, pulse and electrical interface preset and unchangeable. This means that if customers need several encoders with various line counts and/or electrical interfaces, they will need to have several encoders for backup in inventory.	The programmable versions of the AFS and AFM allow the user to program the encoder to the line count desired and reprogram it, as needed. Additionally, zero set can be programmed through the s/w interface, which is very unique to our encoders. A simple programming tool connected to a PC with a USB cable is used for all programming functions.	
Axial and Radial Cable Outlets	Currently, when users require cable outlets for their encoders, they have the choice of a radial or axial outlet. It is possible they will need encoders with both in the same environment requiring additional inventory. Also, if the cable is somehow damaged, the encoder has to be returned to the manufacturer who will repair the encoder by replacing the cable.	The AFS and AFM encoders are available with a pluggable outlet that can be used in either a radial or axial direction which requires less installation depth. Since it is detachable, if the cable is damaged, no repair is necessary by the manufacturer. The customer can simply order a new cable and plug it into the encoder. Various cable lengths and connectors at the end of the cable are also available.	

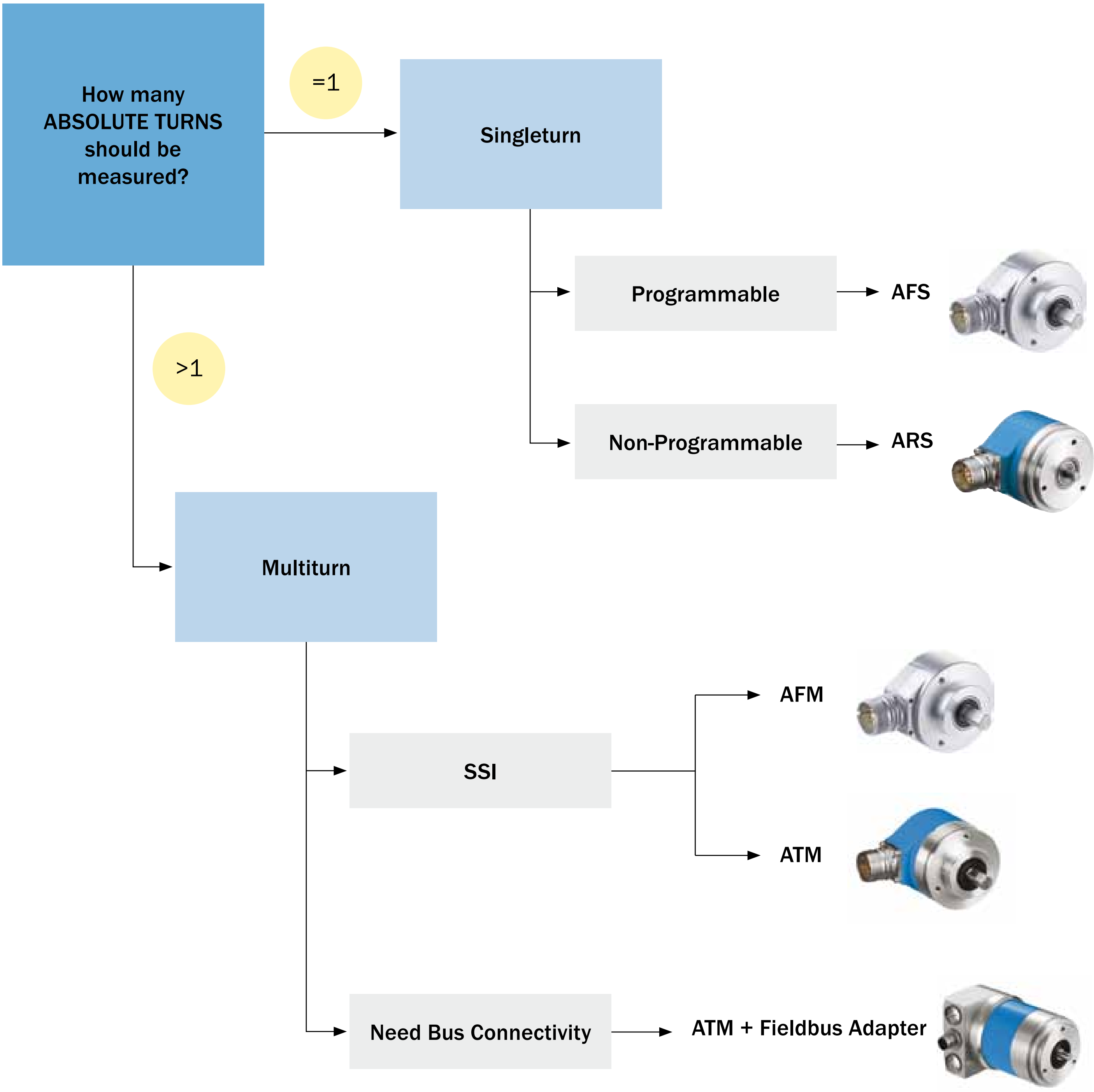
Other Features of the AFS/AFM

- RoHS compliant
- High frequency response
- IP 65 protection class
- Excellent concentricity
- High shaft loading
- High operating speed
- Programmable versions come with diagnostic function that reads shaft position

Absolute Encoders Selection Tool

Which Absolute Encoder to Choose?

This selection tool will help you choose the encoder that best fits your application. From easy-to-use programming options to customization at the click of a button, SICK encoders provide precise measurements for a wide range of applications in robotic, mobile vehicle, packaging and general manufacturing environments.



Absolute Encoders Selection Guide

Absolute Singleturn Encoders

	CoreTech Singleturn Encoders			
	AFS 60•	**ARS 20**	**ARS 25**	**ARS 60**
		(CoreTech)	**(CoreTech)**	**(CoreTech)**
Resolution	2...262,144 cpr	2...32,768 cpr	2...32,768 cpr	2...32,768 cpr
Diameter Size	60 mm	2.0 in	2.5 in	60 mm
Interface	SSI	SSI, Push-pull, Open collector, TTL	SSI, Push-pull, Open collector, TTL	SSI or parallel
Supply Voltage	5...32 V	10...30 V, 8...24 V, 5 V	10...30 V, 8...24 V, 5 V	10...32 V
Output Code Formats	Gray	Gray, Gray Excess, Natural Binary, Binary Coded Decimal	Gray, Gray Excess, Natural Binary, Binary Coded Decimal	Gray, Gray Excess, Natural Binary, Binary Coded Decimal
Bore/Shaft Size and Mounting	6 mm with servo mount or 10 mm with face mount; 8, 10, 12, 14, 15 mm and 3/8, 1/2 and 5/8 in hub and through hollow	0.25 in, 0.375 in, 10 mm; Square flange, servo mount with face holes	0.25 in, 0.375 in, 10 mm; Square flange, servo mount with face holes	6 mm with servo mount or 10 mm with face mount; 15 mm hub shaft or 14 mm hollow shaft with integral flex mount and collets for 6, 8, 10 or 12 mm and 0.25, 0.375 or 0.5 in
Protection Class	IP 67/65	IP 66	IP 66	IP 66
Electrical Connections	MS23 12-pin connector; shielded cable; M12 8-pin	17, 19 or 23-pin MS connector; MS23 12-pin connector; shielded cable	17, 19 or 23-pin MS connector; MS23 12-pin connector; shielded cable	MS23 12-pin connector; shielded cable
RoHS Compliance	Yes	Yes	Yes	No

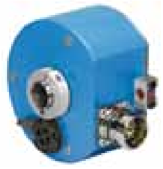
• Customer Programmable versions

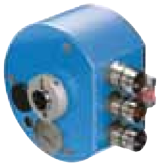
Absolute Encoders Selection Guide

Absolute Multiturn Encoders

Absolute Multiturn Encoders — ATM 60 and AFM 60

	AFM 60	ATM 60-A	ATM 60-D	ATM 60-C	ATM 60-P
	(SSI)	(SSI)	(DeviceNet)	(CANopen)	(Profibus)
Resolution	18 bits per turn x 4,096 turns programmable	13 bits per turn x 8,192 turns (26 bit max), programmable	13 bits per turn x 8,192 turns (26 bit max), programmable	13 bits per turn x 8,192 turns (26 bit max), programmable	13 bits per turn x 8,192 turns (26 bit max), programmable
Diameter Size	60 mm	60 mm	60 mm	60 mm	60 mm
Interface	SSI	SSI	DeviceNet specification release 2.0	Communication Profile DS 301 V4.0; Device Profile DSP 406 V2.0	RS 485 bus coupling to Profibus DP specifications
Supply Voltage	5...32 V	10...32 V	10...32 V	10...32 V	10...32 V
Output Code Formats	Gray	Gray			
Bore/Shaft Size and Mounting	6 mm with servo mount or 10 mm with face mount; 8, 10, 12, 14, 15 mm and 3/8, 1/2 and 5/8 in hub and through hollow	6 mm with servo mount or 10 mm with face mount; 15 mm hub shaft with integral flex mount and collets for 6, 8, 10 or 12 mm and 0.25, 0.375 or 0.5 in	6 mm with servo mount or 10 mm with face mount; 15 mm hub shaft with integral flex mount and collets for 6, 8, 10 or 12 mm and 0.25, 0.375 or 0.5 in	6 mm with servo mount or 10 mm with face mount; 15 mm hub shaft with integral flex mount and collets for 6, 8, 10 or 12 mm and 0.25, 0.375 or 0.5 in	6 mm with servo mount or 10 mm with face mount; 15 mm hub shaft with integral flex mount and collets for 6, 8, 10 or 12 mm and 0.25, 0.375 or 0.5 in
Protection Class	IP 67/65	IP 67	IP 67	IP 67	IP 67
Electrical Connections	M12 8-pin, M12 12-pin connector, shielded cable	MS23 12-pin connector; shielded cable	Separate bus connector with single or dual 5-pin micro connectors, or single or dual PG gland	Separate bus connector with one, two or three PG cable glands	Separate bus connector





Absolute Multiturn Encoders — ATM 90

	ATM 90-A **(SSI)**	**ATM 90-P** **(Profibus)**
Resolution	13 bits per turn x 8,192 turns (26 bit max), programmable	13 bits per turn x 8,192 turns (26 bit max), programmable
Diameter Size	93 mm	93 mm
Interface	SSI, RS 422	RS 485 bus coupling to Profibus DP specifications
Supply Voltage	10...32 V	10...32 V
Output Code Formats	Gray	
Bore/Shaft Size and Mounting	12 mm, 16 mm or 0.5 in hollow shaft with anti-rotational pin mount	12 mm, 16 mm or 0.5 in hollow shaft with anti-rotational pin mount
Protection Class	IP 65	IP 65
Electrical Connections	MS23 12-pin connector	Three M14 7-pin connectors or three PG cable glands

ARS20/ARS25: Singleturn Absolute Encoders. Modular Design for tailor-made solutions.

Number of steps
2 to 32,768
Absolute Encoder Singleturn

CoreTech®
by SICK|STEGMANN

CoreTech technology permits tailor-made solutions for every application, due to its modular design. ARS20/25 singleturn absolute encoders are available with any desired number of steps between 2 and 32,768. Further highlights of this generation of encoders:

- Simple zero adjustment remotely via a signal line.
- Excellent price/performance ratio
- Long LED lifetime as a result of automatic light regulation
- Maximum reliability as a result of opto-ASICSs with Chip-on-Board technology
- Square flange, servo and face mount options with 1/4”, 3/8” and 10 mm solid shafts.

Whether with square flange, servo flange with connector or cable outlet, SSI or Parallel interface – ARS20/25 singleturn absolute encoders will meet virtually any application profile.

Thanks to this wide variety of products, there are numerous possible uses, for example in:

- machine tools
- textile machines
- woodworking machines
- packaging machines

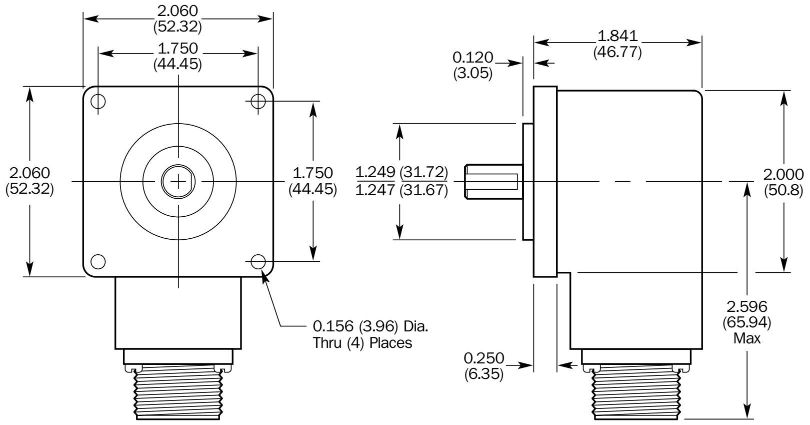
Number of steps
2 to 32,768

Absolute Encoder Singleturn

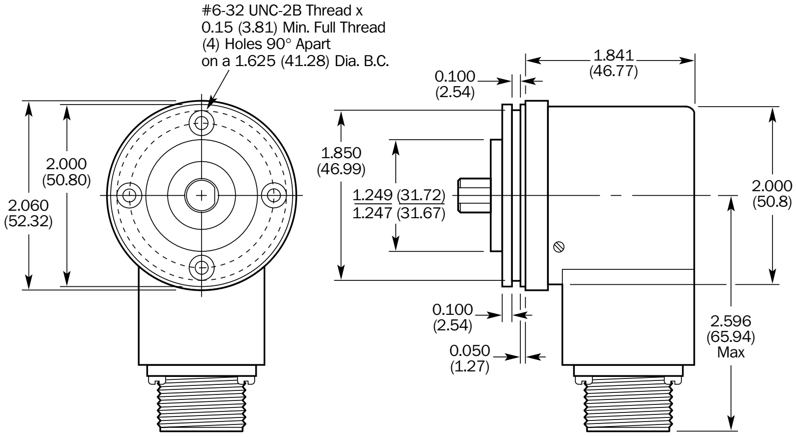
- Connector or cable outlet
- Protection class up to IP 66
- Electrical Interfaces
  SSI or Parallel
- Zero adjustment via a remote line

Accessories – see pages 410-448

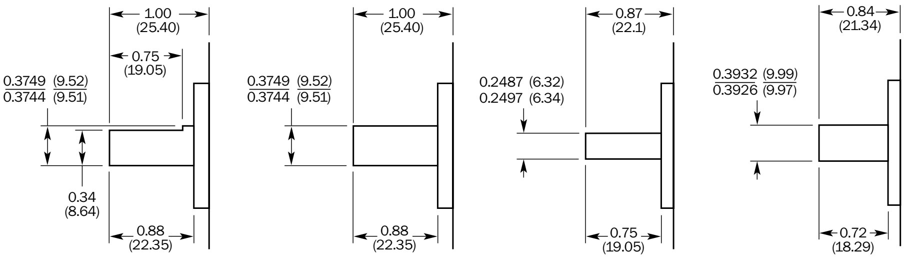
Dimensional Drawing Square Flange Mount



Dimensional Drawing Servo Flange Mount



Dimensional Drawing Shaft Options



3/8" w/Flat 3/8" 1/4" 10mm

Technical data	ARS20
Solid shaft diameter	1/4", 3/8", 10 mm
Number of steps per revolution	00002 … 32,768
Electrical interfaces	SSI
	+5-26 V Open Collector
	+5 V TTL
	+10-30 V Push-Pull
Mass 1)	Approx. 0.5 lb (0.22 kg)
Moment of inertia of the rotor	0.184 lb-in^2 (54 g-cm^2)
Code direction 2)	CW
Measurement range	1 revolution
Measuring step	360°/number of steps
Repeatability	0.005°
Error limits	
binary number of steps	0.035°
non-binary number of steps	0.046°
Measuring step deviation	
binary number of steps	0.005°
non-binary number of steps	0.016°
Measured value backlash	0.005°
Response threshold	0.003°
Max. angular acceleration	5-x-10^5 rad/s^2
Max. operating speed	
with shaft seal	6,000 rpm
without shaft seal	10,000 rpm
Operating torque	0.2 lbf-in^2 (2.6 Ncm)
Start up torque	0.3 lbf-in^2 (3.4 Ncm)
Permissible shaft loading	
radial	4.5 lbf (20 N)
axial	2.25 lbf (10 N)
Bearing lifetime	3.6-x-10^9 revolutions
Working temperature range	-4…185° F (-20 … 85 °C)
Storage temperature range	-40…212° F (-40 … 100 °C)
Permissible relative humidity 3)	90 %
EMC 4)	
Resistance	
to shocks 5)	50/11 g/ms
to vibration 6)	20/10 … 150 g/Hz
Protection class acc. IEC 60529	
connector outlet 7)	IP 65
cable outlet	IP 66
Operating voltage range (+Vs)	
SSI	10…30 V
Open Collector	8…24 V
TTL	4.75…5.25 V
Push-Pull	10…30 V
Operating current	
SSI/Parallel	Typ. 60/90 mA
Switching level of the control inputs	
	Logic H = 0.7 x Vs
	Logic L = 0 V … 0.3 x Vs
Operation of zero-set 8)	≥ 100 ms
Initialization time after power on	40 ms

1) For an encoder with connector outlet

2) Increasing when viewing the clockwise rotating shaft

3) Condensation not permitted

4) To DIN EN 61000-6-2 and DIN EN 61000-6-3

5) To DIN EN 60068-2-27

6) To DIN EN 60068-2-6

7) With mating connector fitted

8) Only with shaft stationary (note initialization time)

Order information SSI Interface

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**								

Electrical Interface

10…30 V SSI Gray = **A**

10…30 V SSI Gray Capped = **B**

Mechanical Interface

Square Flange, 1/4” Shaft = **E**

Square Flange, 3/8” Shaft = **F**

Square Flange, , 3/8” Shaft with Flat = **G**

Square Flange, 10 mm Shaft = **C**

Servo Flange/Face Holes, 1/4” shaft = **5**

Servo Flange/Face Holes, 3/8” shaft = **6**

Servo Flange/Face Holes, 3/8” shaft w/ flat = **7**

Servo Flange/Face Holes, 10 mm shaft = **8**

Connection Type

Radial Connector (M23, 12 pin) = **A**

Radial Cable 1.0 m = **2**

Radial Cable 1.5 m = **K**

Radial Cable 3.0 m = **L**

Radial Cable 5.0 m = **M**

Radial Cable 10.0 m = **N**

Resolution

Any number of steps from 00002 up to 32,768 possible.

Always 5 characters in clear text.

Order example: Singleturn Absolute Encoder ARS20 SSI

10…30 V, SSI, Gray; Square Flange; 3/8” shaft; 12-pin, radial, number of steps: 8192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**	**A**	**F**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**								

Order information Parallel Interface

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**								

Electrical Interface	
10…30 V Par Gray	= **F**
10…30 V Par Gray Capped	= **G**
10…30 V Par Binary	= **H**
10…30 V Par BCD	= **J**
8…24 V, Open Collector[1], Gray	= **2**
8…24 V, Open Collector[1], Gray Capped	= **3**
8…24 V, Open Collector[1], Binary	= **4**
8…24 V, Open Collector[1], BCD	= **5**
5 V, TTL (7407) Gray	= **6**
5 V, TTL (7407) Gray Capped	= **7**
5 V, TTL (7407) Binary	= **8**
5 V, TTL (7407) BCD	= **9**

1) Open Collector (7407)

Mechanical Interface	
Square Flange, 1/4" Shaft	= **E**
Square Flange, 3/8" Shaft	= **F**
Square Flange, 3/8" Shaft with Flat	= **G**
Square Flange, 10mm Shaft	= **C**
Servo Flange/Face Holes, 1/4" shaft	= **5**
Servo Flange/Face Holes, 3/8" shaft	= **6**
Servo Flange/Face Holes, 3/8" shaft w/ flat	= **7**
Servo Flange/Face Holes, 10 mm shaft	= **8**

Connection Type	
Radial Cable 1.0 m	= **2**
Radial Cable 1.5 m	= **K**
Radial Cable 3.0 m	= **L**
Radial Cable 5.0 m	= **M**
Radial Cable 10.0 m	= **N**
Radial Connector (MS 23 pin)	= **4**
Radial Connector (MS 19 pin)	= **5**

Resolution
Any number of steps from 00002 up to 32,768 possible, with the following electrical interfaces: 10 … 32 V, parallel, Gray 10 … 32 V, parallel, Gray Excess 10 … 32 V, parallel, BIN
Number of steps from 00002 up to 08000 possible, with the electrical interface: 10 … 32 V, parallel, BCD Always 5 characters in clear text.

Order example: Singleturn Absolute Encoder ARS20 Parallel

10…30 V, Push-Pull, Gray; Square Flange; 3/8" shaft; 23-pin, radial, number of steps: 8192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**	**F**	**F**	**4**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**								

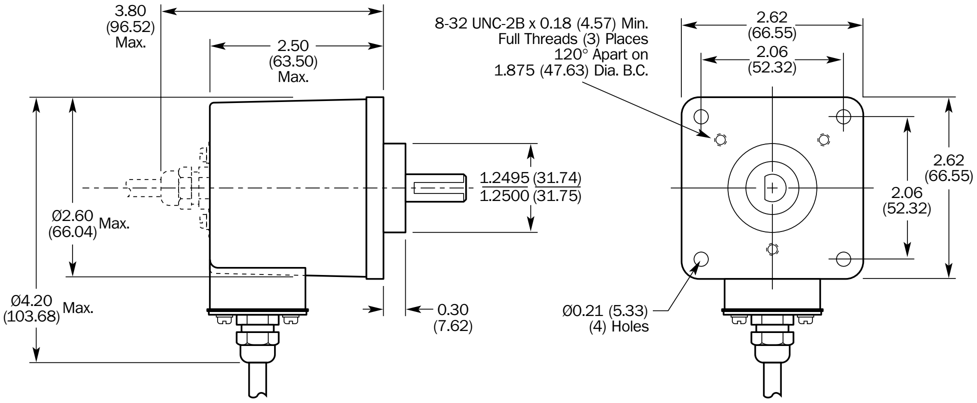
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**0**	**–**								

Number of steps
2 to 32,768

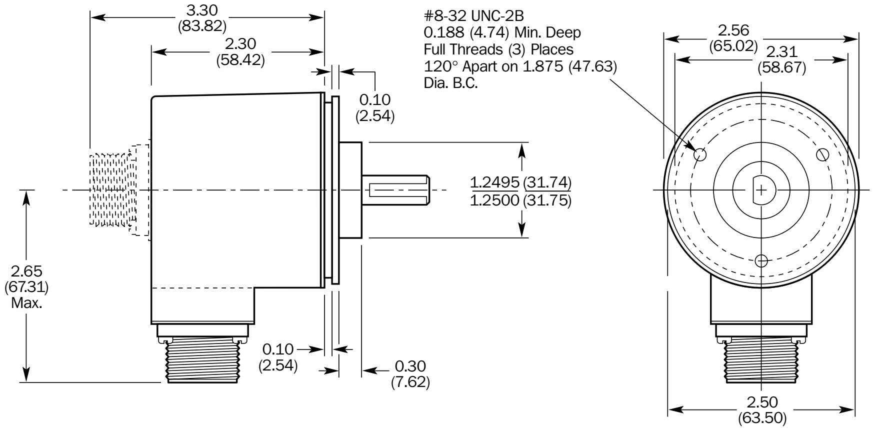
Absolute Encoder Singleturn

- Connector or cable outlet
- Protection class up to IP 66
- Electrical Interfaces
  SSI or Parallel
- Zero adjustment via a remote line

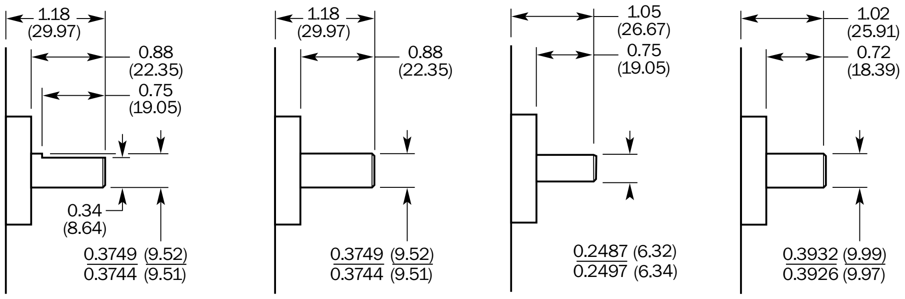
Dimensional Drawing Square Flange Mount



Dimensional Drawing Servo Flange Mount/Face Mount



Dimensional Drawing Shaft Options



3/8" w/Flat 3/8" 1/4" 10 mm

Accessories – see pages 410-448

Technical data	ARS25
Solid shaft diameter	1/4", 3/8", 10mm
Number of steps per revolution	00002 … 32,768
Electrical interfaces	SSI
	+5-26 V Open Collector
	+5 V TTL
	+10-30 V Push-Pull
Mass 1)	Approx. 0.75 lb (0.35 kg)
Moment of inertia of the rotor	0.184 lb-in^2 (54 g-cm^2)
Code direction 2)	CW
Measurement range	1 revolution
Measuring step	360°/number of steps
Repeatability	0.005°
Error limits	
binary number of steps	0.035°
non-binary number of steps	0.046°
Measuring step deviation	
binary number of steps	0.005°
non-binary number of steps	0.016°
Measured value backlash	0.005°
Response threshold	0.003°
Max. angular acceleration	5-x-10^5 rad/s^2
Max. operating speed	
with shaft seal	6,000 rpm
without shaft seal	10,000 rpm
Operating torque	0.2 lbf-in^2 (2.6 Ncm)
Start up torque	0.3 lbf-in^2 (3.4 Ncm)
Permissible shaft loading	
radial	4.5 lbf (20 N)
axial	2.25 lbf (10 N)
Bearing lifetime	3.6-x-10^9 revolutions
Working temperature range	-4…185° F (-20 … 85 °C)
Storage temperature range	-40…212° F (-40 … 100 °C)
Permissible relative humidity 3)	90 %
EMC 4)	
Resistance	
to shocks 5)	50/11 g/ms
to vibration 6)	20/10 … 150 g/Hz
Protection class acc. IEC 60529	
connector outlet 7)	IP 65
cable outlet	IP 66
Operating voltage range (+Vs)	
SSI	10…30 V
Open Collector	8…24 V
TTL	4.75…5.25 V
Push-Pull	10…30 V
Operating current	
SSI/Parallel	Typ. 60/90 mA
Switching level of the control inputs	
	Logic H = 0.7 x Vs
	Logic L = 0 V … 0.3 x Vs
Operation of zero-set 8)	≥ 100 ms
Initialization time after power on	40 ms

1) For an encoder with connector outlet

2) Increasing when viewing the clockwise rotating shaft

3) Condensation not permitted

4) To DIN EN 61000-6-2 and DIN EN 61000-6-3

5) To DIN EN 60068-2-27

6) To DIN EN 60068-2-6

7) With mating connector fitted

Order information SSI Interface

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**								

Electrical Interface

10…30 V SSI Gray = **A**
10…30 V SSI Gray Capped = **B**

Mechanical Interface

Square Flange, 1/4” Shaft = **E**
Square Flange, 3/8” Shaft = **F**
Square Flange, 3/8” Shaft with Flat = **G**
Square Flange, 10 mm Shaft = **C**
Servo Flange/Face Holes, 1/4” shaft = **5**
Servo Flange/Face Holes, 3/8” shaft = **6**
Servo Flange/Face Holes, 3/8” shaft w/ flat = **7**
Servo Flange/Face Holes, 10 mm shaft = **8**

Connection Type

Radial Connector (M23, 12 pin) = **A**
Axial Connector (M23, 12 Pin) = **B**
Radial Cable 1.0 m = **2**
Radial Cable 1.5 m = **K**
Radial Cable 3.0 m = **L**
Radial Cable 5.0 m = **M**
Radial Cable 10.0 = **N**
Axial Cable 1.0 m = **3**
Axial Cable 1.5 m = **R**
Axial Cable 3.0 m = **S**
Axial Cable 5.0 m = **T**
Axial Cable 1.0 m = **U**

Resolution

Any number of steps from 00002 up to 32,768 possible

Always 5 characters in clear text.

Order example: Singleturn Absolute Encoder ARS25 SSI

10…30 V, SSI, Gray; Square Flange; 3/8” shaft; 12-pin, radial, number of steps: 8192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**	**A**	**F**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**								

Order information Parallel Interface

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**								

Electrical Interface

10…30 V Par Gray = **F**
10…30 V Par Gray Capped = **G**
10…30 V Par Binary = **H**
10…30 V Par BCD = **J**
8…24 V, Open Collector[1], Gray = **2**
8…24 V, Open Collector[1], Gray Capped = **3**
8…24 V, Open Collector[1], Binary = **4**
8…24 V, Open Collector[1], BCD = **5**
5 V, TTL (7407) Gray = **6**
5 V, TTL (7407) Gray Capped = **7**
5 V, TTL (7407) Binary = **8**
5 V, TTL (7407) BCD = **9**

1) Open Collector (7407)

Mechanical Interface

Square Flange, 1/4" Shaft = **E**
Square Flange, 3/8" Shaft = **F**
Square Flange, 3/8" Shaft with Flat = **G**
Square Flange, 10 mm Solid Shaft = **C**
Servo Flange/Face Holes, 1/4" shaft = **5**
Servo Flange/Face Holes, 3/8" shaft = **6**
Servo Flange/Face Holes, 3/8" shaft w/ flat = **7**
Servo Flange/Face Holes, 10 mm shaft = **8**

Connection Type

Radial Cable 1.0 m = **2**
Radial Cable 1.5 m = **K**
Radial Cable 3.0 m = **L**
Radial Cable 5.0 m = **M**
Radial Cable 10.0 m = **N**
Axial Cable 1.0 m = **3**
Axial Cable 1.5 m = **R**
Axial Cable 3.0 m = **S**
Axial Cable 5.0 m = **T**
Axial Cable 10 m = **U**
Radial Connector (MS 23 pin) = **4**
Radial Connector (MS 19 pin) = **5**
Axial Connector (MS 23 pin) = **7**
Axial Connector (MS 19 pin) = **8**
Axial Connector (MS 17 pin) = **9**

Resolution

Any number of steps from 00002 up to 32,768 possible, with the following electrical interfaces:
10 … 32 V, parallel, Gray
10 … 32 V, parallel, Gray Excess
10 … 32 V, parallel, BIN

Number of steps from 00002 up to 08000 possible, with the electrical interface:
10 … 32 V, parallel, BCD
Always 5 characters in clear text.

Order example: Singleturn Absolute Encoder ARS25 Parallel

10…30 V, Push-Pull, Gray; Square Flange; 3/8" shaft; 23-pin, radial, number of steps: 8192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**	**F**	**F**	**4**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

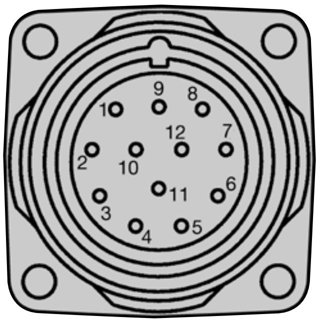
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**2**	**5**	**–**								

PIN and wire allocation

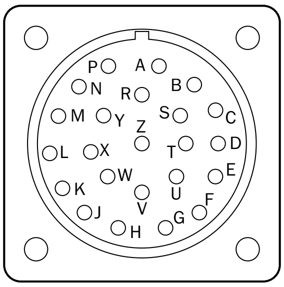
Allocation for encoder with 12 pin connector; SSI Interface



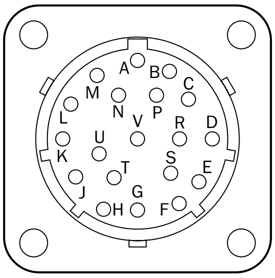
View of the connector M23 fitted to the encoder body SSI

Signal	Cable	12 Pin
GND	Blue	1
Data (+)	White	2
Clock (+)	Yellow	3
N/C		4
cw/ccw	Pink	5
N/C		6
N/C		7
+Vs	Red	8
Set Zero	Orange	9
Data (–)	Brown	10
Clock (–)	Violet	11
N/C		12
Case	Shield	

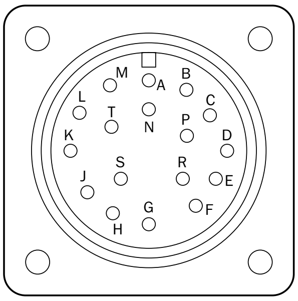
Allocation for encoder with 23, 19, or 17 pin connector Parallel Interface



23 Pin KPT02E20-23P



19 Pin KPT02E14-19P



17 Pin MS3102R

Function	Cable	17 pin	19 pin	23 pin
Bit 0	Lilac	A	A	A
Bit 1	white/brown	B	B	B
Bit 2	white/green	C	C	C
Bit 3	white/yellow	D	D	D
Bit 4	white/grey	E	E	E
Bit 5	white/pink	F	F	F
Bit 6	white/blue	G	G	G
Bit 7	white/red	H	H	H
Bit 8	white/black	J	J	J
Bit 9	brown/green	K	K	K
Bit 10	brown/yellow	L	L	L
Bit 11	brown/grey	M	M	M
Bit 12	brown/pink	N	N	N
Bit 13	brown/blue	--	P	P
Bit 14	brown/red	--	**R	R
cw/ccw	brown	T	S	S
GND	blue	R	T	T
Store	pink	--	**R	U
+Vs	red	S	V	V
Set Zero	grey	P	U	W
Enable	yellow*	--	--	X*
Parity	green	--	--	Y
Case	shield	--	--	Z

* Available only with 10…30 V Push-Pull (7272) on ARS25.
** For 15 bit encoders, bit 14 is pin R.
For 14 bit and lower, Store is on pin R.

V_s	Supply voltage to the encoder (before commissioning, note must be taken of the type label of the encoder).
GND	Zero volt connection to the encoder: electrically isolated from the housing. The voltage referred to GND is +V_s.
CW/CCW_	Forward/reverse: this input programs the counting direction of the encoder. If not connected, this input is »HIGH«. If the encoder shaft, as viewed on the drive shaft, rotates in the clockwise direction, it counts in an increasing sequence. If it should count upwards when the shaft rotates in the anti-clockwise direction, this connection must be connected permanently to »LOW« level (zero volts).
Enable_	This input activates the data output driver when a »LOW« level is applied. If not connected, this input is »LOW«. In the case of a »HIGH« level, the outputs are in the tristate mode.
Store_	This input stores the encoder data in Gray code when a »LOW« level is applied. This avoids a read error if the out-put data ist requested in binary code. If this input is »LOW«, the data at the encoder output is stable, irrespective of whether the input shaft rotates. If not switched, this input is »HIGH«.
Parity	This output supplies a »HIGH« level when the binary check sum of the data bits is even.
SET	This input serves to set the zero electronically. If the SET line is connected to +V_s for more than 100 ms, the mechanical position corresponds to the value 0.

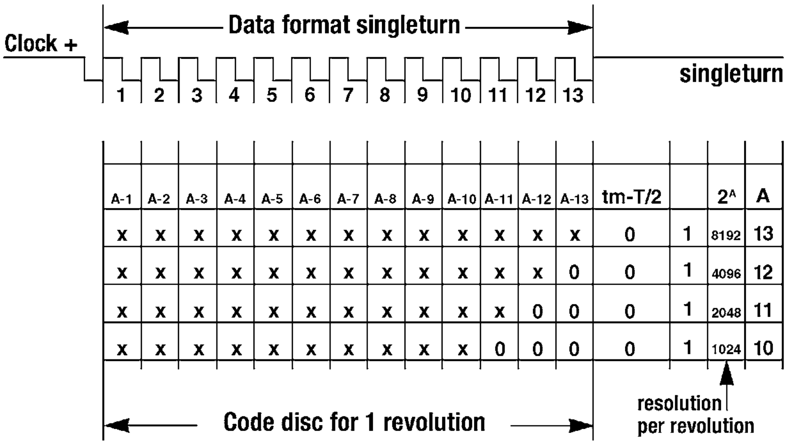
Signal outputs

Data format for resolutions ≤ 8,192 (1-13 bits)

In order to be compatible with the data formats on the market, a distinction is made in the ARS 60 between two data formats.

The first data format applies to the encoder designs with-resolutions up to 13 bits.

This is the standard data format for the singleturn absolute encoder.



A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	A-12	A-13	tm-T/2		2^A	A
x	x	x	x	x	x	x	x	x	x	x	x	x	0	1	8192	13
x	x	x	x	x	x	x	x	x	x	x	x	0	0	1	4096	12
x	x	x	x	x	x	x	x	x	x	x	0	0	0	1	2048	11
x	x	x	x	x	x	x	x	x	x	0	0	0	0	1	1024	10

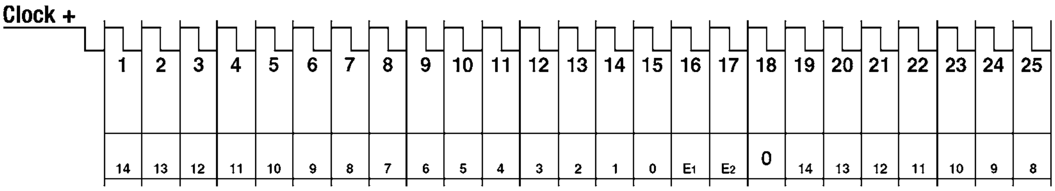
Data format for resolutions > 8,192 (14 and 15 bits)

The data transmitted is left-justified. The 15 data bits are followed by two error bits.

Error 1 (E_1) = Position error

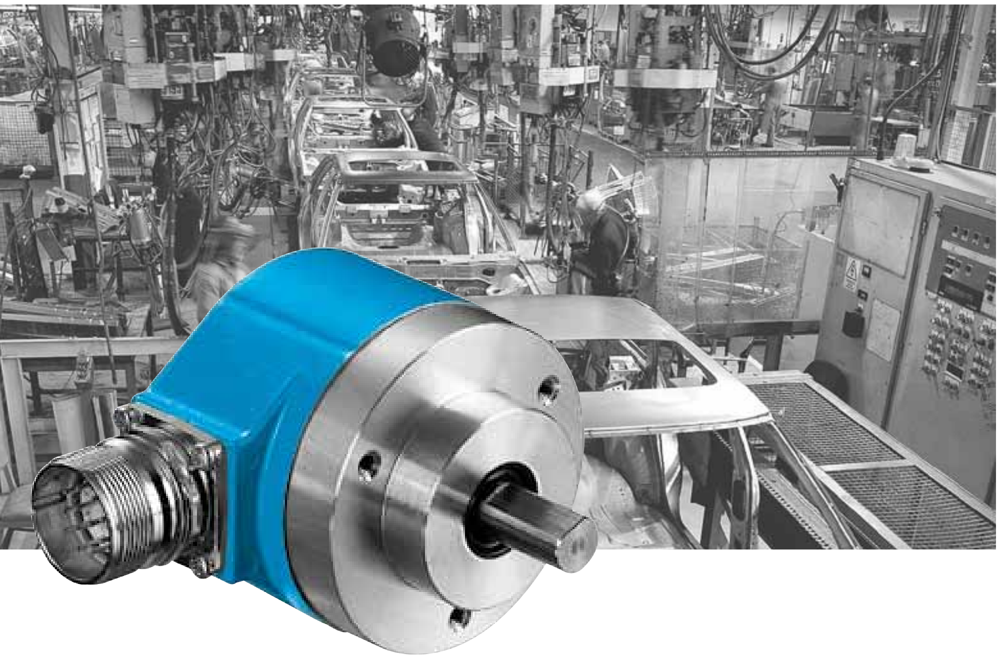
During the determination of the position, an error has occurred since the last SSI transmission. This error bit will be deleted during the next SSI transmission.

Error 2 (E_2) = light source monitoring



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	E_1	E_2	0	14	13	12	11	10	9	8

ARS60: Absolute Encoders Singleturn. Modular Design for tailor-made solutions.



Number of steps
2 to 32,768
Absolute Encoders Singleturn

CoreTech®
by SICK | STEGMANN

CoreTech technology permits tailor-made solutions for every application, due to its modular design. ARS60 absolute encoders singleturn are available with any desired number of steps between 2 und 32,768. Further highlights of this generation of encoders:

- Simple zero adjustment by pressing a button located under a cap on the rear of the encoder or remotely via a signal line.
- Excellent price/performance ratio
- Long LED lifetime as a result of automatic light regulation
- Maximum reliability as a result of opto-ASICSs with Chip-on-Board technology
- Interchangeable collets for hollow shaft diameters from 6 to 15 mm and 1/4, 3/8, 1/2 inch.

Whether with face mount flange, servo flange, blind or through hollow shaft with connector or cable outlet, SSI or Parallel interface – ARS60 absolute singleturn encoders will meet virtually any application profile.

Thanks to this wide variety of products, there are numerous possible uses, for example in:

- machine tools
- textile machines
- woodworking machines
- packaging machines

Number of steps
2 to 32,768

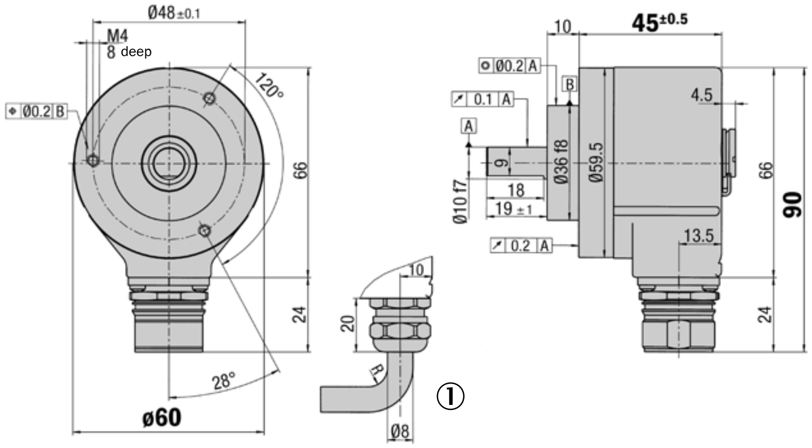
Absolute Encoders Singleturn

- Connector or cable outlet
- Protection class up to IP 66
- Electrical Interfaces
  SSI or Parallel
- Zero adjustment directly on
  the encoder or via a remote line

CE cULus

Accessories – see pages 410-448

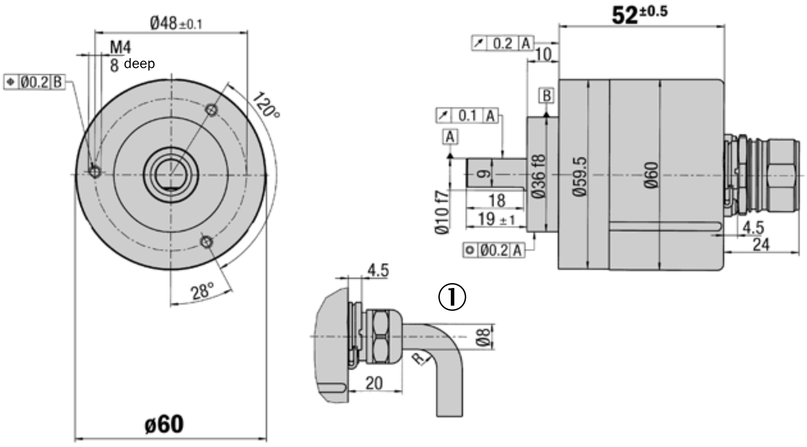
Dimensional drawing face mount flange radial exit



① R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

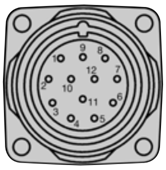
Dimensional drawing face mount flange axial exit



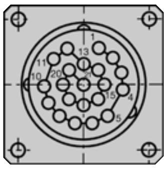
① R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation



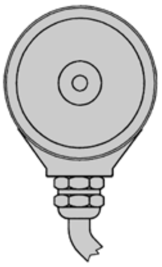
View of the connector M23 fitted to the encoder body SSI



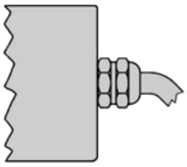
View of the connector M23 fitted to the encoder body Single, Parallel

Connection type

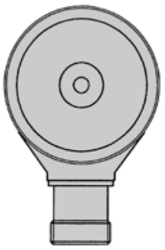
Radial cable



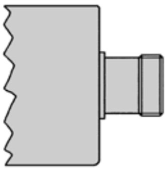
Axial cable



Radial connector



Axial connector



Technical data acc. to DIN 32878	ARS60 face mount flange	**Flange type**									
		face m.									
Solid shaft	10 mm	■									
Number of steps per revolution	00002 ... 32,768, see ordering information	■									
Electrical interfaces	SSI or Parallel	■									
Mass 1)	Approx. 0.3 kg	■									
Moment of inertia of the rotor	54 gcm^2	■									
Code direction 2)	CW	■									
Measurement range	1 revolution	■									
Measuring step	360°/number of steps	■									
Repeatability	0.005°	■									
Error limits											
binary number of steps	0.035°	■									
non-binary number of steps	0.046°	■									
Measuring step deviation											
binary number of steps	0.005°	■									
non-binary number of steps	0.016°	■									
Measured value backlash	0.005°	■									
Response threshold	0.003°	■									
Max. angular acceleration	5 x 10^5 rad/s^2	■									
Max. operating speed											
with shaft seal	6,000 min^{-1}	■									
without shaft seal 3)	10,000 min^{-1}	■									
Operating torque	Typ. 0.3 Ncm	■									
Start up torque	Typ. 0.4 Ncm	■									
Permissible shaft loading											
radial	20 N	■									
axial	10 N	■									
Bearing lifetime	3.6 x 10^9 revolutions	■									
Working temperature range	–20 ... +85 °C	■									
Storage temperature range	–40 ... +100 °C	■									
Permissible relative humidity 4)	90 %	■									
EMC 5)		■									
Resistance											
to shocks 6)	50/11 g/ms	■									
to vibration 7)	20/10 ... 2000 g/Hz	■									
Protection class acc. IEC 60529											
connector outlet 8)	IP 65	■									
cable outlet	IP 66	■									
Operating voltage range (U_s)	10 ... 32 V	■									
Operating current											
SSI	Typ. 60 mA	■									
Parallel	Typ. 90 mA	■									
Switching level of the control inputs											
	Logic H = 0.7 x U_s	■									
	Logic L = 0 V ... 0.3 x U_s	■									
Operation of zero-set 9)	≥ 100 ms	■									
Initialisation time after power on	40 ms	■									

1) For an encoder with connector outlet

2) Increasing when viewing the clockwise rotating shaft

3) If the shaft seal has been removed by the customer

4) Condensation not permitted

5) To DIN EN 61000-6-2 and DIN EN 61000-6-3

6) To DIN EN 60068-2-27

7) To DIN EN 60068-2-6

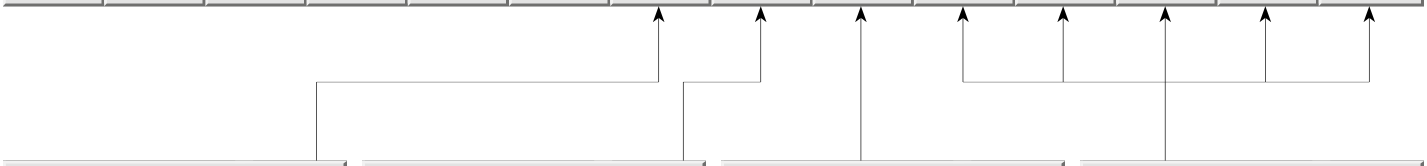
8) With mating connector fitted

9) Only with shaft stationary (note initialisation time)

Order information SSI interface

Absolute Encoder Singleturn ARS60 SSI, face mount flange, solid shaft 10 mm

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								



Electrical interface	
10 ... 32 V, SSI, Gray	= **A**
10 ... 32 V, SSI, Gray Excess	= **B**

Mechanical interface	
Face mount flange, solid shaft 10 mm	= **4**

Connection type	
Connector M23, 12 pin, radial	= **A**
Connector M23, 12 pin, axial	= **B**
Cable 11 core, radial 1.5 m	= **K**
Cable 11 core, radial 3 m	= **L**
Cable 11 core, radial 5 m	= **M**
Cable 11 core, axial 1.5 m	= **R**
Cable 11 core, axial 3 m	= **S**
Cable 11 core, axial 5 m	= **T**

Resolution

Any number of steps from 00002 up to 32,768 possible. Always 5 characters in clear text.

Order example: Absolute Encoder Singleturn ARS60 SSI

10 ... 32 V, SSI, Gray; face mount flange; connector M23, 12 pin, radial; number of steps: 8,192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**	**A**	**4**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

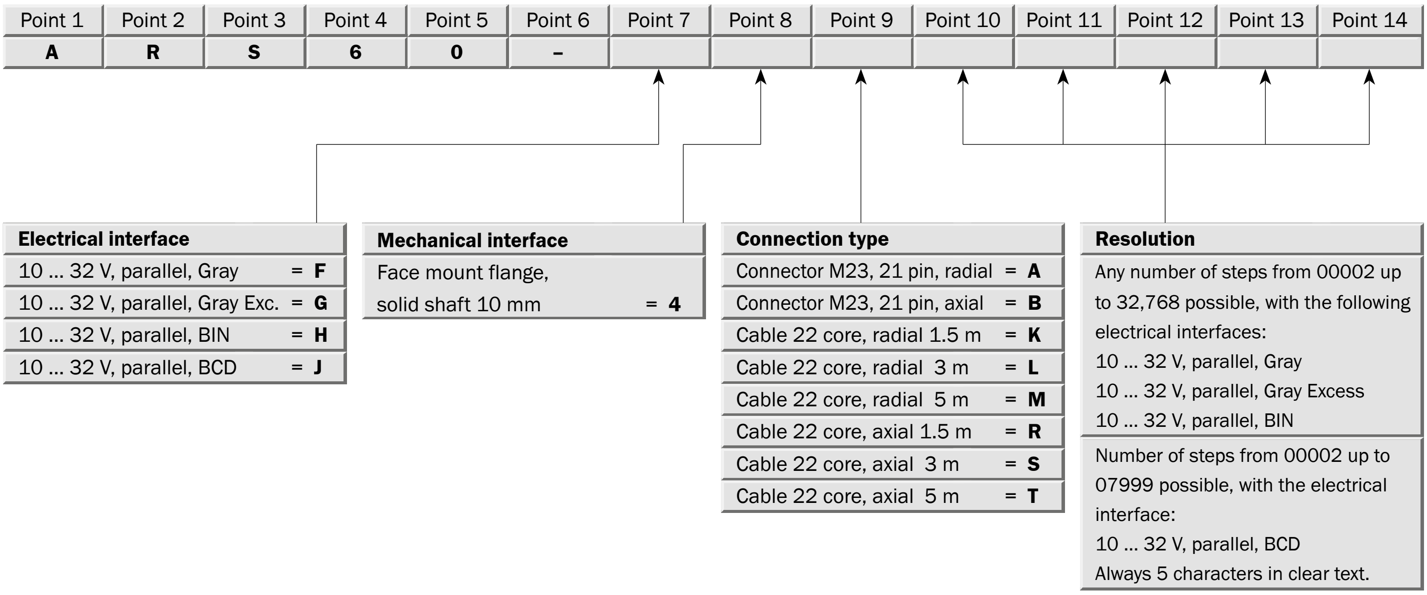
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Order information Parallel interface

Absolute Encoder Singleturn ARS60 Parallel, face mount flange, solid shaft 10 mm



Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Electrical interface	
10 ... 32 V, parallel, Gray	= **F**
10 ... 32 V, parallel, Gray Exc.	= **G**
10 ... 32 V, parallel, BIN	= **H**
10 ... 32 V, parallel, BCD	= **J**

Mechanical interface	
Face mount flange, solid shaft 10 mm	= **4**

Connection type	
Connector M23, 21 pin, radial	= **A**
Connector M23, 21 pin, axial	= **B**
Cable 22 core, radial 1.5 m	= **K**
Cable 22 core, radial 3 m	= **L**
Cable 22 core, radial 5 m	= **M**
Cable 22 core, axial 1.5 m	= **R**
Cable 22 core, axial 3 m	= **S**
Cable 22 core, axial 5 m	= **T**

Resolution

Any number of steps from 00002 up to 32,768 possible, with the following electrical interfaces:
10 ... 32 V, parallel, Gray
10 ... 32 V, parallel, Gray Excess
10 ... 32 V, parallel, BIN

Number of steps from 00002 up to 07999 possible, with the electrical interface:
10 ... 32 V, parallel, BCD
Always 5 characters in clear text.

Order example: Absolute Encoder Singleturn ARS60 Parallel

10 ... 32 V, Parallel, Gray; face mount flange; connector M23, 21 pin, radial; number of steps: 8,192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**	**F**	**4**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Absolute Encoders Singleturn ARS60 SSI and Parallel, Servo Flange

Number of steps
2 to 32,768

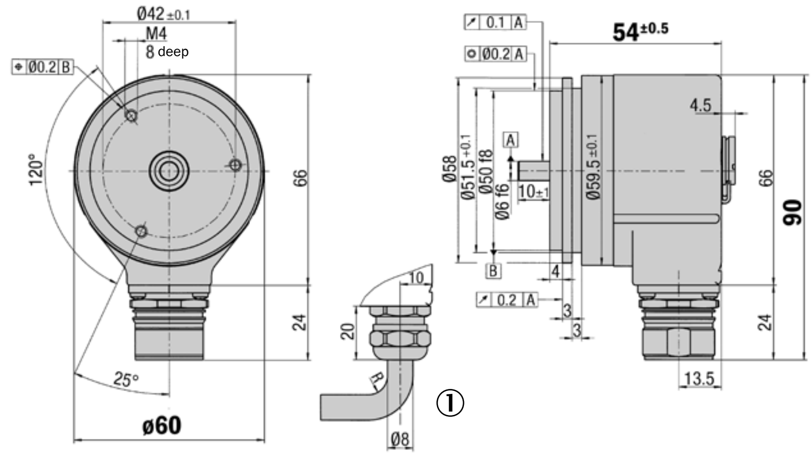
Absolute Encoders Singleturn

- Connector or cable outlet
- Protection class up to IP 66
- Electrical Interfaces
  SSI or Parallel
- Zero adjustment directly on
  the encoder or via a remote line

CE c UL us

Accessories – see pages 410-448

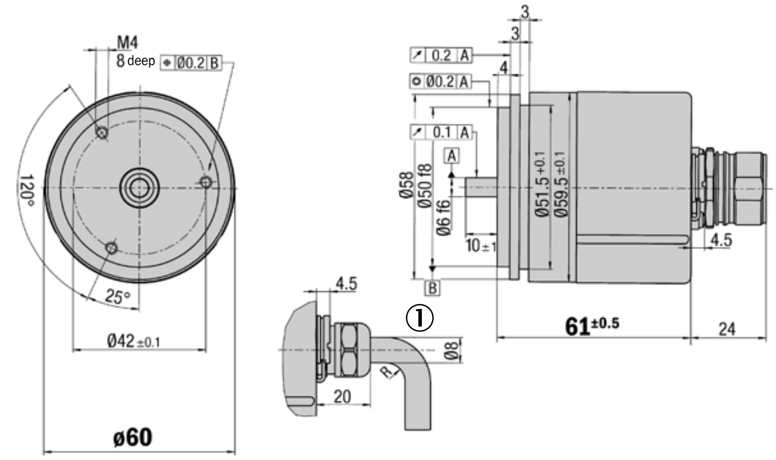
Dimensional drawing servo flange radial exit



① R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

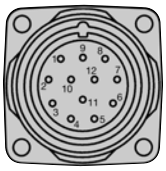
Dimensional drawing servo flange axial exit



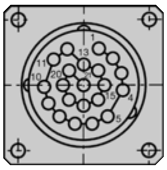
① R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation

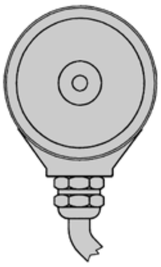
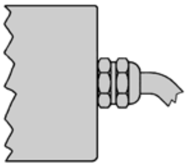
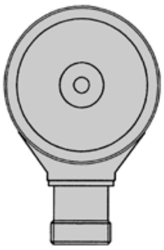
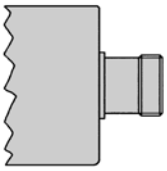


View of the connector M23 fitted to the encoder body SSI



View of the connector M23 fitted to the encoder body Single, Parallel

Connection type

Radial cable	Axial cable	Radial connector	Axial connector
			

Technical data acc. to DIN 32878	ARS60 servo flange	Flange type
		servo
Solid shaft	6 mm	▨
Number of steps per revolution	00002 ... 32,768, see ordering information	▨
Electrical interfaces	SSI or Parallel	▨
Mass 1)	Approx. 0.3 kg	▨
Moment of inertia of the rotor	48 gcm^2	▨
Code direction 2)	CW	▨
Measurement range	1 revolution	▨
Measuring step	360°/number of steps	▨
Repeatability	0.005°	▨
Error limits		
binary number of steps	0.035°	▨
non-binary number of steps	0.046°	▨
Measuring step deviation		
binary number of steps	0.005°	▨
non-binary number of steps	0.016°	▨
Measured value backlash	0.005°	▨
Response threshold	0.003°	▨
Max. angular acceleration	5×10^5 rad/s^2	▨
Max. operating speed		
with shaft seal	6,000 min^{-1}	▨
without shaft seal 3)	10,000 min^{-1}	▨
Operating torque	Typ. 0.2 Ncm	▨
Start up torque	Typ. 0.25 Ncm	▨
Permissible shaft loading		
radial	20 N	▨
axial	10 N	▨
Bearing lifetime	3.6×10^9 revolutions	▨
Working temperature range	–20 ... +85 °C	▨
Storage temperature range	–40 ... +100 °C	▨
Permissible relative humidity 4)	90 %	▨
EMC 5)		▨
Resistance		
to shocks 6)	50/11 g/ms	▨
to vibration 7)	20/10 ... 2000 g/Hz	▨
Protection class acc. IEC 60529		
connector outlet 8)	IP 65	▨
cable outlet	IP 66	▨
Operating voltage range (U_s)	10 ... 32 V	▨
Operating current		
SSI	Typ. 60 mA	▨
Parallel	Typ. 90 mA	▨
Switching level of the control inputs		
	Logic H = $0.7 \times U_s$	▨
	Logic L = 0 V ... $0.3 \times U_s$	▨
Operation of zero-set 9)	≥ 100 ms	▨
Initialisation time after power on	40 ms	▨

1) For an encoder with connector outlet

2) Increasing when viewing the clockwise rotating shaft

3) If the shaft seal has been removed by the customer

4) Condensation not permitted

5) To DIN EN 61000-6-2 and DIN EN 61000-6-3

6) To DIN EN 60068-2-27

7) To DIN EN 60068-2-6

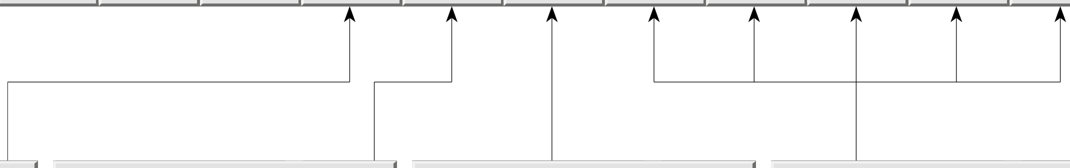
8) With mating connector fitted

9) Only with shaft stationary (note initialisation time)

Order information SSI interface

Absolute Encoder Singleturn ARS60 SSI, servo flange, solid shaft 6 mm

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								



Electrical interface	
10 ... 32 V, SSI, Gray	= **A**
10 ... 32 V, SSI, Gray Excess	= **B**

Mechanical interface	
Servo flange, solid shaft 6 mm	= **1**

Connection type	
Connector M23, 12 pin, radial	= **A**
Connector M23, 12 pin, axial	= **B**
Cable 11 core, radial 1.5 m	= **K**
Cable 11 core, radial 3 m	= **L**
Cable 11 core, radial 5 m	= **M**
Cable 11 core, axial 1.5 m	= **R**
Cable 11 core, axial 3 m	= **S**
Cable 11 core, axial 5 m	= **T**

Resolution

Any number of steps from 00002 up to 32,768 possible. Always 5 characters in clear text.

Order example: Absolute Encoder Singleturn ARS60 SSI

10 ... 32 V, SSI, Gray; servo flange; connector M23, 12 pin, radial; number of steps: 8,192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**	**A**	**1**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

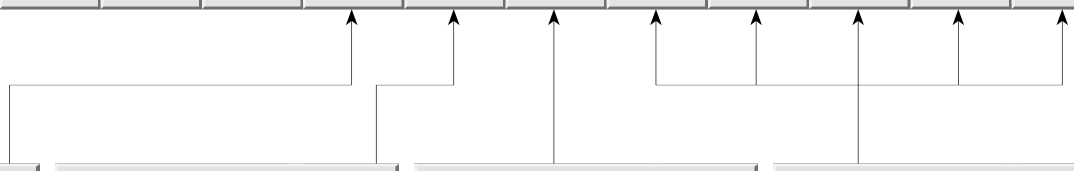
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Order information Parallel Interface

Absolute Encoder Singleturn ARS60 Parallel, servo flange, solid shaft 6 mm

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								



Electrical interface

10 ... 32 V, parallel, Gray = **F**

10 ... 32 V, parallel, Gray Exc. = **G**

10 ... 32 V, parallel, BIN = **H**

10 ... 32 V, parallel, BCD = **J**

Mechanical interface

Servo flange, solid shaft 6 mm = **1**

Connection type

Connector M23, 21 pin, radial = **A**

Connector M23, 21 pin, axial = **B**

Cable 22 core, radial 1.5 m = **K**

Cable 22 core, radial 3 m = **L**

Cable 22 core, radial 5 m = **M**

Cable 22 core, axial 1.5 m = **R**

Cable 22 core, axial 3 m = **S**

Cable 22 core, axial 5 m = **T**

Resolution

Any number of steps from 00002 up to 32,768 possible, with the following electrical interfaces:
10 ... 32 V, parallel, Gray
10 ... 32 V, parallel, Gray Excess
10 ... 32 V, parallel, BIN

Number of steps from 00002 up to 07999 possible, with the electrical interface:
10 ... 32 V, parallel, BCD
Always 5 characters, in clear text.

Order example: Absolute Encoder Singleturn ARS60 Parallel

10 ... 32 V, Parallel, Gray; servo flange; connector M23, 21 pin, radial; number of steps: 8,192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**	**F**	**1**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

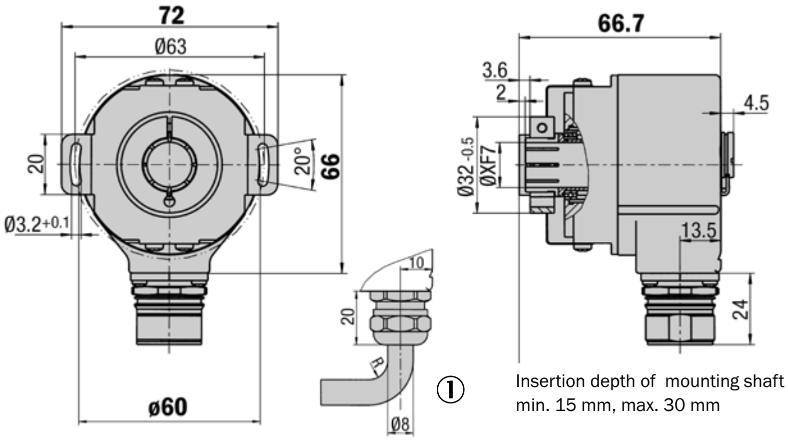
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Number of steps
2 to 32,768

Absolute Encoders Singleturn

- Connector or cable outlet
- Protection class up to IP 66
- Electrical Interfaces
  SSI or Parallel
- Zero adjustment directly on
  the encoder or via a remote line

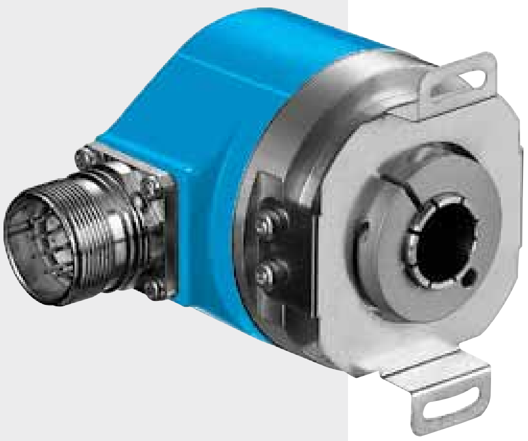
Dimensional drawing blind hollow shaft radial exit



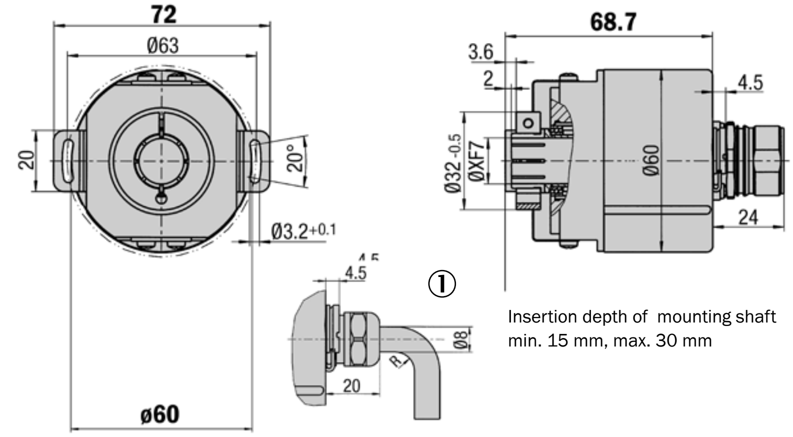
Insertion depth of mounting shaft
min. 15 mm, max. 30 mm

① R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk



Dimensional drawing blind hollow shaft axial exit

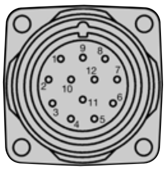


Insertion depth of mounting shaft
min. 15 mm, max. 30 mm

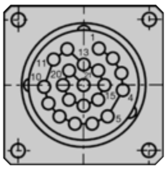
① R = bending radius min. 40 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation



View of the connector M23 fitted to the encoder body SSI

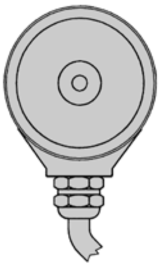


View of the connector M23 fitted to the encoder body Single, Parallel

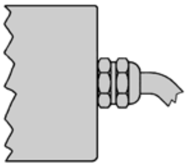
Accessories – see pages 410-448

Connection type

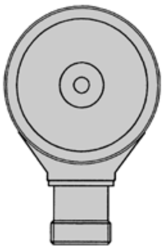
Radial cable



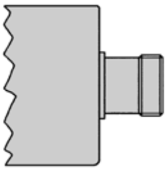
Axial cable



Radial connector



Axial connector



Technical data acc. to DIN 32878	ARS60 blind hollow shaft	**Flange type**									
		blind									
Hollow shaft diameter	6, 8, 10, 12, 14, 15 mm, 1/4", 3/8", 1/2"	▨									
Number of steps per revolution	00002 ... 32,768, see ordering information	▨									
Electrical interfaces	SSI or Parallel	▨									
Mass [1]	Approx. 0.3 kg	▨									
Moment of inertia of the rotor	See Fig. 1	▨									
Code direction [2]	CW	▨									
Measurement range	1 revolution	▨									
Measuring step	360°/number of steps	▨									
Repeatability	0.005°	▨									
Error limits		▨									
binary number of steps	0.035°	▨									
non-binary number of steps	0.046°	▨									
Measuring step deviation											
binary number of steps	0.005°	▨									
non-binary number of steps	0.016°	▨									
Measured value backlash	0.005°	▨									
Response threshold	0.003°	▨									
Max. angular acceleration	5 x 10^5 rad/s^2	▨									
Max. operating speed	3,000 min^{-1}	▨									
Operating torque	Typ. 0.4 Ncm	▨									
Start up torque	Typ. 0.6 Ncm	▨									
Permissible movement											
of the drive element											
radial movement static/dynamic	± 0.3/± 0.1 mm	▨									
axial movement static/dynamic	± 0.5/± 0.2 mm	▨									
Bearing lifetime	3.6 x 10^9 revolutions	▨									
Working temperature range	–20 ... +85 °C	▨									
Storage temperature range	–40 ... +100 °C	▨									
Permissible relative humidity [3]	90 %	▨									
EMC [4]		▨									
Resistance											
to shocks [5]	50/11 g/ms	▨									
to vibration [6]	20/10 ... 2000 g/Hz	▨									
Protection class acc. IEC 60529											
connector outlet [7]	IP 65	▨									
cable outlet	IP 66	▨									
Operating voltage range (Us)	10 ... 32 V	▨									
Operating current											
SSI	Typ. 60 mA	▨									
Parallel	Typ. 90 mA	▨									
Switching level of the control inputs											
	Logic H = 0.7 x U_S	▨									
	Logic L = 0 V ... 0.3 x U_S	▨									
Operation of zero-set [8]	≥ 100 ms	▨									
Initialisation time after power on	40 ms	▨									

[1] For an encoder with connector outlet

[2] Increasing when viewing the clockwise rotating shaft

[3] Condensation not permitted

[4] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[5] To DIN EN 60068-2-27

[6] To DIN EN 60068-2-6

[7] With mating connector fitted

[8] Only with shaft stationary (note initialisation time)

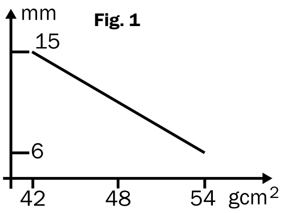


Fig. 1

Order information SSI Interface

Absolute Encoder Singleturn ARS60 SSI, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Electrical interface	
10 ... 32 V, SSI, Gray	= **A**
10 ... 32 V, SSI, Gray Excess	= **B**

Mechanical interface	
Blind hollow shaft [1]	= **A**

[1] **Collets for 6, 8, 10, 12, 14 mm and 1/4", 3/8" and 1/2" as accessories, separate order item (see accessories section). For 15 mm shaft diameter collet is not needed.**

Connection type	
Connector M23, 12 pin, radial	= **A**
Connector M23, 12 pin, axial	= **B**
Cable 11 core, radial 1.5 m	= **K**
Cable 11 core, radial 3 m	= **L**
Cable 11 core, radial 5 m	= **M**
Cable 11 core, axial 1.5 m	= **R**
Cable 11 core, axial 3 m	= **S**
Cable 11 core, axial 5 m	= **T**

Resolution

Any number of steps from 00002 up to 32,768 possible. Always 5 characters in clear text.

Order example: Absolute Encoder Singleturn ARS60 SSI

10 ... 32 V, SSI, Gray; blind hollow shaft; connector M23, 12 pin, radial; number of steps 8,192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**	**A**	**A**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Order information Parallel Interface

Absolute Encoder Singleturn ARS60 Parallel, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Electrical interface

10 ... 32 V, parallel, Gray = **F**
10 ... 32 V, parallel, Gray Exc. = **G**
10 ... 32 V, parallel, BIN = **H**
10 ... 32 V, parallel, BCD = **J**

Mechanical interface

Blind hollow shaft [1] = **A**

Connection type

Connector M23, 21 pin, radial = **A**
Connector M23, 21 pin, axial = **B**
Cable 22 core, radial 1.5 m = **K**
Cable 22 core, radial 3 m = **L**
Cable 22 core, radial 5 m = **M**
Cable 22 core, axial 1.5 m = **R**
Cable 22 core, axial 3 m = **S**
Cable 22 core, axial 5 m = **T**

Resolution

Any number of steps from 00002 up to 32,768 possible, with the following electrical interfaces:
10 ... 32 V, parallel, Gray
10 ... 32 V, parallel, Gray Excess
10 ... 32 V, parallel, BIN

Number of steps from 00002 up to 07999 possible, with the electrical interface:
10 ... 32 V, parallel, BCD
Always 5 characters, in clear text.

[1] **Collets for 6, 8, 10, 12 and 14 mm and 1/4", 3/8" and 1/2" as accessories, separate order item (see accessories section). For 15 mm shaft diameter collet is not needed.**

Order example: Absolute Encoder Singleturn ARS60 Parallel
10 ... 32 V, Parallel, Gray; blind hollow shaft; connector M23, 21 pin, radial; number of steps 8,192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**	**F**	**A**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

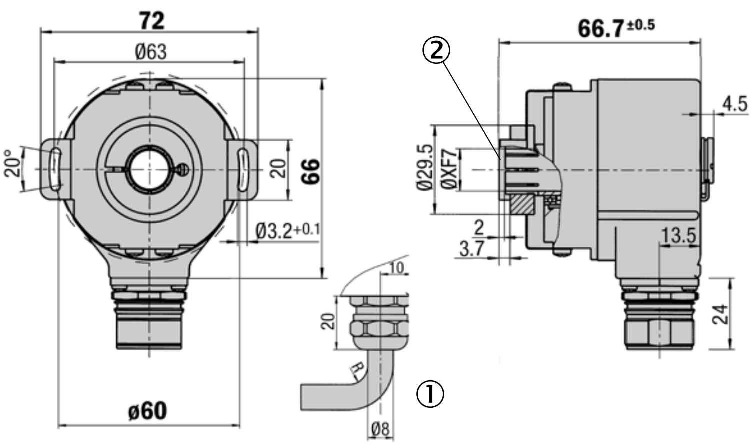
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Number of steps
2 to 32,768

Absolute Encoders Singleturn

- Connector or cable outlet
- Protection class up to IP 64
- Electrical Interfaces
  SSI or Parallel
- Zero adjustment directly on
  the encoder or via a remote line

Dimensional drawing through hollow shaft, radial exit

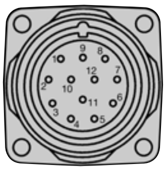


① R = bending radius min. 40 mm

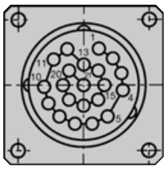
② Insertion depth of mounting shaft min. 15 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation



View of the connector M23 fitted to the encoder body SSI

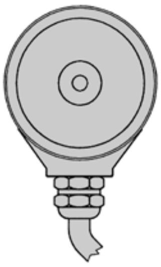


View of the connector M23 fitted to the encoder body Single, Parallel

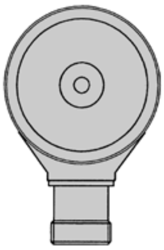
Accessories – see pages 410-448

Connection type

Radial cable



Radial connector



Technical data acc. to DIN 32878	ARS60 through hollow shaft	**Flange type**
		through
Hollow shaft diameter	6, 8, 10, 12 mm, 1/4", 3/8", 1/2"	■
Number of steps per revolution	00002 ... 32,768, see ordering information	■
Electrical interfaces	SSI or Parallel	■
Mass 1)	Approx. 0.3 kg	■
Moment of inertia of the rotor	See Fig. 1	■
Code direction 2)	CW	■
Measurement range	1 revolution	■
Measuring step	360°/number of steps	■
Repeatability	0.005°	■
Error limits		■
binary number of steps	0.035°	
non-binary number of steps	0.046°	■
Measuring step deviation		■
binary number of steps	0.005°	
non-binary number of steps	0.016°	■
Measured value backlash	0.005°	■
Response threshold	0.003°	■
Max. angular acceleration	5×10^5 rad/s^2	■
Max. operating speed	3,000 min^{-1}	■
Operating torque	Typ. 1.6 Ncm	■
Start up torque	Typ. 2.2 Ncm	■
Permissible movement		■
of the drive element		
radial movement static/dynamic	± 0.3/± 0.1 mm	■
axial movement static/dynamic	± 0.5/± 0.2 mm	■
Bearing lifetime	3.6×10^9 revolutions	■
Working temperature range	–20 ... +85 °C	■
Storage temperature range	–40 ... +100 °C	■
Permissible relative humidity 3)	90 %	■
EMC 4)		■
Resistance		
to shocks 5)	50/11 g/ms	■
to vibration 6)	20/10 ... 2000 g/Hz	■
Protection class acc. IEC 60529		
connector outlet 7)	IP 64	■
cable outlet	IP 64	■
Operating voltage range (U_S)	10 ... 32 V	■
Operating current		
SSI	Typ. 60 mA	■
Parallel	Typ. 90 mA	■
Switching level of the control inputs		
	Logic H = 0.7 x U_S	■
	Logic L = 0 V ... 0.3 x U_S	■
Operation of zero-set 8)	≥ 100 ms	■
Initialisation time after power on	40 ms	■

1) For an encoder with connector outlet

2) Increasing when viewing the clockwise rotating shaft

3) Condensation not permitted

4) To DIN EN 61000-6-2 and DIN EN 61000-6-3

5) To DIN EN 60068-2-27

6) To DIN EN 60068-2-6

7) With mating connector fitted

8) Only with shaft stationary (note initialisation time)

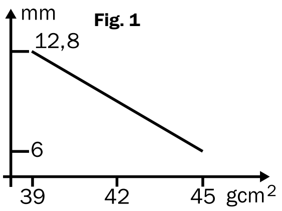
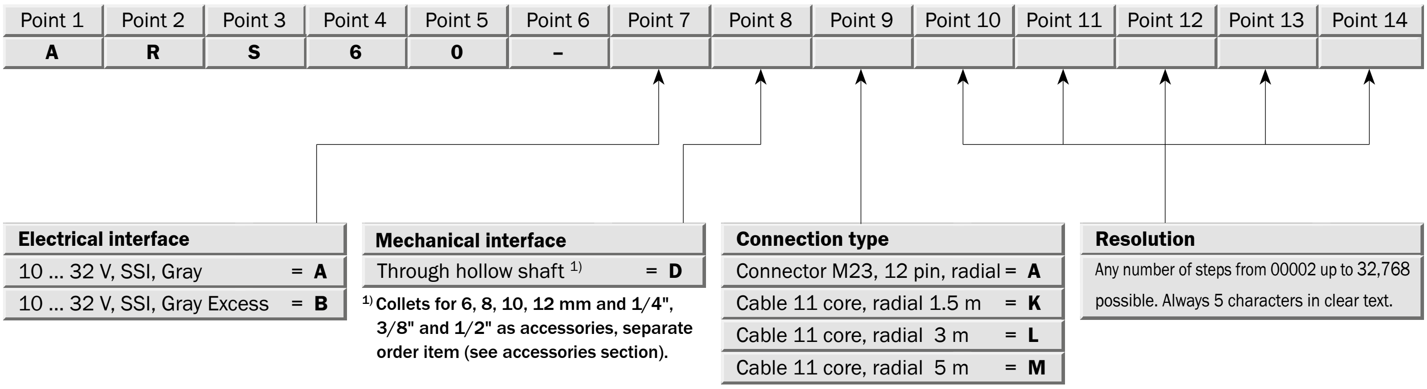


Fig. 1

Order information SSI Interface

Absolute Encoder Singleturn ARS60 SSI, through hollow shaft



Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Electrical interface	
10 ... 32 V, SSI, Gray	= **A**
10 ... 32 V, SSI, Gray Excess	= **B**

Mechanical interface	
Through hollow shaft [1]	= **D**

[1] Collets for 6, 8, 10, 12 mm and 1/4", 3/8" and 1/2" as accessories, separate order item (see accessories section).

Connection type	
Connector M23, 12 pin, radial	= **A**
Cable 11 core, radial 1.5 m	= **K**
Cable 11 core, radial 3 m	= **L**
Cable 11 core, radial 5 m	= **M**

Resolution

Any number of steps from 00002 up to 32,768 possible. Always 5 characters in clear text.

Order example: Absolute Encoder Singleturn ARS60 SSI

10 ... 32 V, SSI, Gray; through hollow shaft; connector M23, 12 pin, radial; number of steps 8,192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**	**A**	**D**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Order information Parallel Interface

Absolute Encoder Singleturn ARS60 Parallel, through hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Electrical interface	
10 ... 32 V, parallel, Gray	= **F**
10 ... 32 V, parallel, Gray Exc.	= **G**
10 ... 32 V, parallel, BIN	= **H**
10 ... 32 V, parallel, BCD	= **J**

Mechanical interface	
Through hollow shaft [1]	= **D**

[1] Collets for 6, 8, 10, 12 mm and 1/4", 3/8" and 1/2" as accessories, separate order item (see accessories section).

Connection type	
Connector M23, 21 pin, radial	= **A**
Cable 22 core, radial 1.5 m	= **K**
Cable 22 core, radial 3 m	= **L**
Cable 22 core, radial 5 m	= **M**

Resolution

Any number of steps from 00002 up to 32,768 possible, with the following electrical interfaces:
10 ... 32 V, parallel, Gray
10 ... 32 V, parallel, Gray Excess
10 ... 32 V, parallel, BIN

Number of steps from 00002 up to 07999 possible, with the electrical interface:
10 ... 32 V, parallel, BCD
Always 5 characters, in clear text.

Order example: Absolute Encoder Singleturn ARS60 Parallel
10 ... 32 V, Parallel, Gray; through hollow shaft; connector M23, 21 pin, radial; number of steps 8,192

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**	**F**	**D**	**A**	**0**	**8**	**1**	**9**	**2**

Please enter your individual encoder here

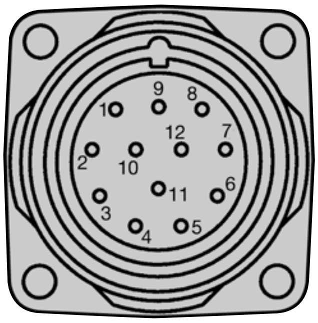
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14
A	**R**	**S**	**6**	**0**	**–**								

PIN and wire allocation

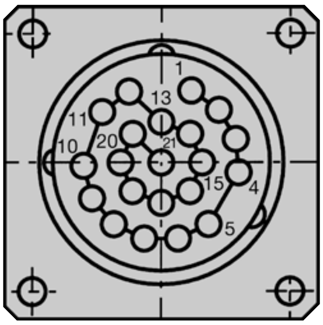
Allocation for encoder with 12 pin connector; SSI Interface



View of the connector M23 fitted to the encoder body SSI

Signal	12-pin connector	11-core cable outlet
GND	1	blue
Data (+)	2	white
Clock (+)	3	yellow
N. C.	4	–
CW/$\overline{\text{CCW}}$	5	pink
N. C.	6	–
N. C.	7	–
U_s	8	red
SET	9	orange
Data (–)	10	brown
Clock (–)	11	violet
N. C.	12	–

Allocation for encoder with 21 pin connector Single; Parallel Interface



View of the connector M23 fitted to the encoder body Single, Parallel

PIN	Wire colour by cable outlet	Binary	Gray	BCD	Explanation
1	violet	2^0	G_0	2^0 v.10^0	Data lines, outputs
2	white/brown	2^1	G_1	2^1 v.10^0	
3	white/green	2^2	G_2	2^2 v.10^0	
4	white/yellow	2^3	G_3	2^3 v.10^0	
5	white/grey	2^4	G_4	2^0 v.10^1	
6	white/pink	2^5	G_5	2^1 v.10^1	
7	white/blue	2^6	G_6	2^2 v.10^1	
8	white/red	2^7	G_7	2^3 v.10^1	
9	white/black	2^8	G_8	2^0 v.10^2	
10	brown/green	2^9	G_9	2^1 v.10^2	
11	brown/yellow	2^{10}	G_{10}	2^2 v.10^2	
12	brown/grey	2^{11}	G_{11}	2^3 v.10^2	
13	brown/pink	2^{12}	G_{12}	2^0 v.10^3	
14	brown/blue	2^{13}	G_{13}	2^1 v.10^3	
15	brown/red	2^{14}	G_{14}	2^2 v.10^3	
16	green	Parity	Parity	Parity	
17	pink	Store_	Store_	Store_	
18	yellow	Enable_	Enable_	Enable_	
19	brown	CW/CCW_	CW/CCW_	CW/CCW_	
*)	grey	SET	SET	SET	
20	blue	GND	GND	GND	
21	red	U_s	U_s	U_s	
Housing		Screen	Screen	Screen	

* Set line only possible with a cable outlet

U_s	Supply voltage to the encoder (before commissioning, note must be taken of the type label of the encoder).
GND	Zero volt connection to the encoder: electrically isolated from the housing. The voltage referred to GND is U_s.
CW/CCW_	Foreward/reverse: this input programs the counting direction of the encoder. If not connected, this input is »HIGH«. If the encoder shaft, as viewed on the drive shaft, rotates in the clockwise direction, it counts in an increasing sequence. If it should count upwards when the shaft rotates in the anti-clockwise direction, this connection must be connected permanently to »LOW« level (zero volts).
Enable_	This input activates the data output driver when a »LOW« level is applied. If not connected, this input is »LOW«. In the case of a »HIGH« level, the outputs are in the tristate mode.
Store_	This input stores the encoder data in Gray code when a »LOW« level is applied. This avoids a read error if the output data is requested in binary code. If this input is »LOW«, the data at the encoder output is stable, irrespective of whether the input shaft rotates. If not switched, this input is »HIGH«.
Parity	This output supplies a »HIGH« level when the binary checksum of the data bits is even.
SET	This input serves to set the zero electronically. If the SET line is connected to U_s for more than 100 ms, the mechanical position corresponds to the value 0.

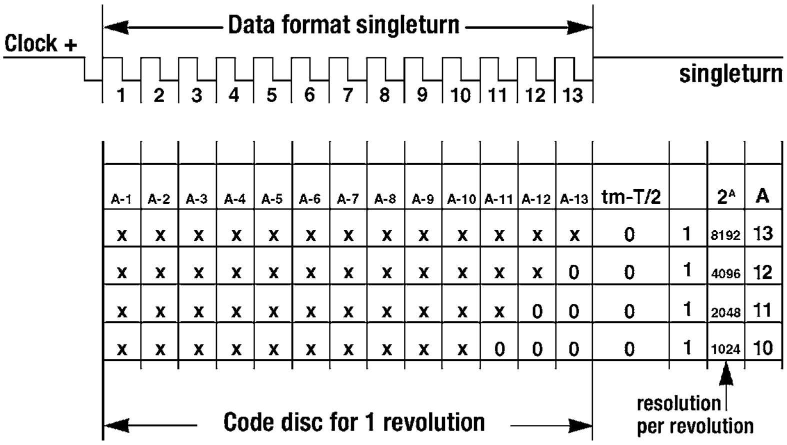
Signal outputs

Data format for resolutions ≤ 8,192 (1-13 bits)

In order to be compatible with the data formats on the market, a distinction is made in the ARS60 between two data formats.

The first data format applies to the encoder designs with-resolutions up to 13 bits.

This is the standard data format for the singleturn absolute encoder.



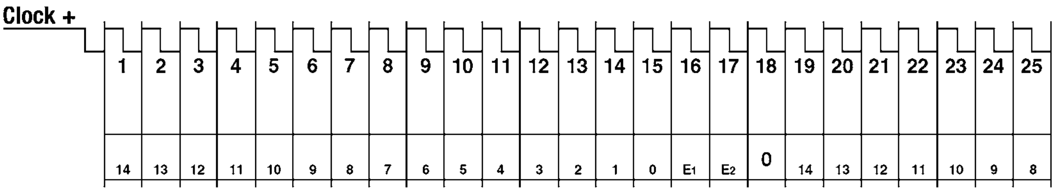
A-1	A-2	A-3	A-4	A-5	A-6	A-7	A-8	A-9	A-10	A-11	A-12	A-13	tm-T/2		2^A	A
x	x	x	x	x	x	x	x	x	x	x	x	x	0	1	8192	13
x	x	x	x	x	x	x	x	x	x	x	x	0	0	1	4096	12
x	x	x	x	x	x	x	x	x	x	x	0	0	0	1	2048	11
x	x	x	x	x	x	x	x	x	x	0	0	0	0	1	1024	10

Data format for resolutions > 8,192 (14 and 15 bits)

The data transmitted is left-justified. The 15 data bits are followed by two error bits.

Error 1 (E_1) = Position error
During the determination of the position, an error has occurred since the last SSI transmission. This error bit will be deleted during the next SSI transmission.

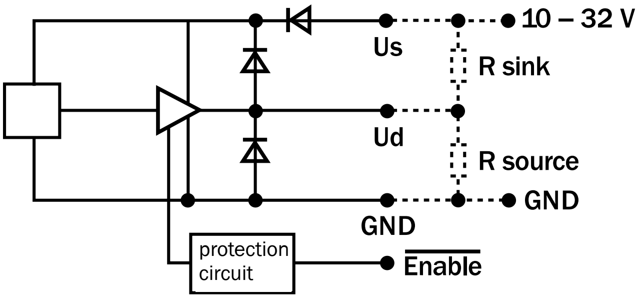
Error 2 (E_2) = light source monitoring



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	E1	E2	0	14	13	12	11	10	9	8

Parallel Interface (Output driver 7272 push-pull)

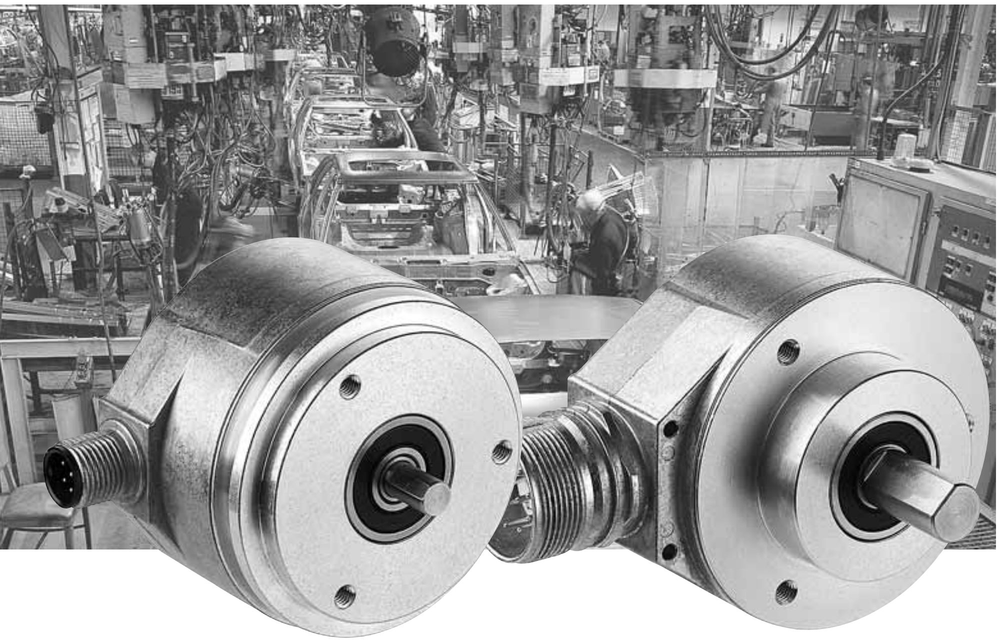
Tristate capability
Short-circuit protected
Protected against reverse polarity
Integrated transient protection diodes



Technical data: Parallel interface

Id_H max. at +85° C 8 nF 6000 min^{-1}			30 mA
Id_L max. at +85° C 8 nF 6000 min^{-1}			30 mA
Output saturation voltage (H-level)	to Id_H	10 mA	2.8 V
U_S-Ud_H		30 mA	3.0 V
Output saturation voltage (L-level)	to Id_L	10 mA	0.4 V
Ud_L		30 mA	2.0 V
Position refresh time (dependent upon the encoder resolution and output code)	Parallel Gray-Code		60 µs
	Parallel BIN-Code		60 µs
	Parallel BCD-Code		200 µs

AFS60: Absolute Encoders Singleturn, SSI
AFM60: Absolute Encoders Multiturn, SSI



Resolution up to 18 bits
Absolute Encoders Singleturn

Resolution up to 30 bits
Absolute Encoders Multiturn

With a 30-bit resolution and an extremely robust construction, the new AFM60 Absolute Encoders Multiturn sets a new benchmark. Even its small brother, the AFS60 Absolute Encoders Singleturn, is impressive, with its high resolution of 18 bits. Consequently, both new product ranges are particularly suitable for harsh operating conditions in all industrial applications where high levels of accuracy and reliability are paramount.

With a maximum singleturn resolution of 18 bits, the AFM60 is among the highest performing encoders in its market segment. With the addition of a 12-bit multiturn resolution, the encoder reaches a class leading resolution totalling 30 bits.

Thanks to the 30 mm separation of the shaft bearings, the AFM/AFS60 product range offers users a substantially more robust solution than encoders with more conventional bearing arrangements. Even at maximum operating speeds, the increased bearing separation leads to exceptionally smooth operation as well as optimum runout. Despite the large bearing separation, the AFS/AFM60 product ranges have an extremely compact construction enabling use in applications with very limited space.

Both the AFM60 and the AFS60 can be programmed using the same programming tool as used with the DFS60 series of incremental encoders. For the very first time, incremental, singleturn Absolute and multiturn Absolute Encoders can be parametrised using just one universal programming tool.

Product options:
Face mount flange and servo flange, blind hollow shaft and throug hollow shaft
M12 or M23 Connector outlet
1.5 m, 3 m or 5 m cable outlet, radial or axial Resolution: Singleturn 18 bits max. Multiturn 12 bits

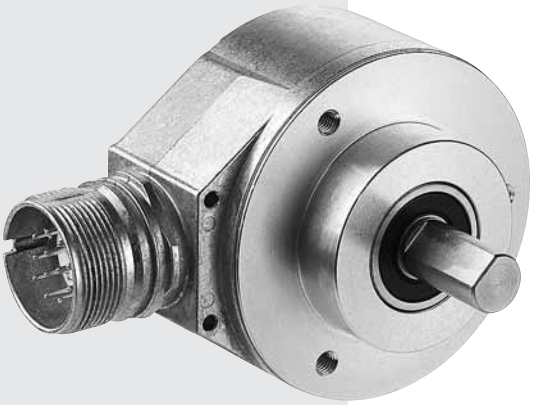
Resolution up to 18 bits

Absolute Encoders Singleturn

Resolution up 30 bits

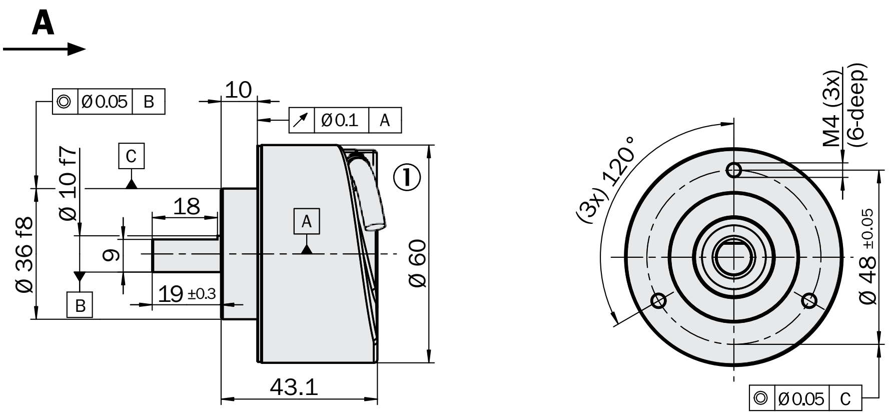
Absolute Encoders Multiturn

- Connector or cable outlet
- Protection class IP 67
- Electrical interface SSI
- Direction of rotation, zero point, offset and resolution freely programmable



Accessories – see pages 410-448

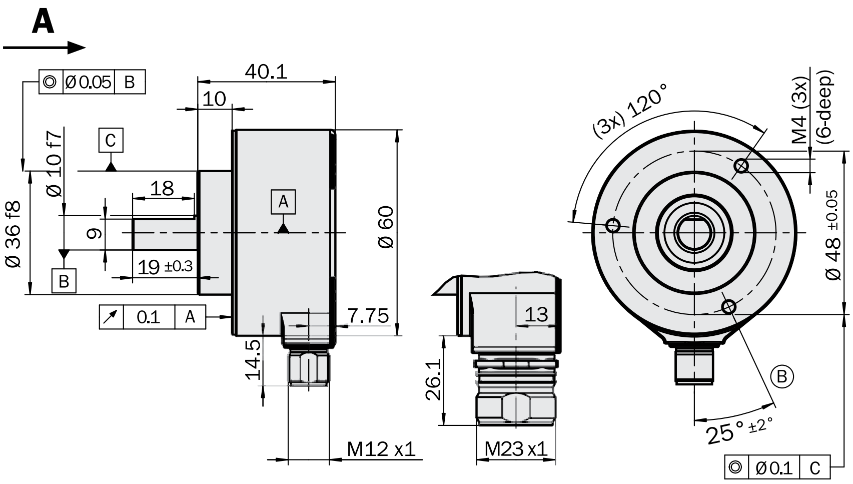
Dimensional drawing face mount flange, cable outlet



General tolerances according to DIN ISO 2768-mk

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Dimensional drawing face mount flange, connector outlet M12 and M23



General tolerances according to DIN ISO 2768-mk

Technical data to DIN 32878	AFS60/AFM60 face mount flange			
Type		**E**	**B**	**A**
Shaft diameter	10 x 19 mm			
Mass 1)	0.26 kg			
Moment of inertia to the rotor	6.2 gcm^2			
Code type	Gray			
Code sequence adjustable	CW/$\overline{\text{CCW}}$			
Measuring step	360° number of lines	0.09°	0.01°	0.0014°
Number of steps per revolution max.	Singleturn and Multiturn	4096	32768 ①	262144 ①
Number of lines	4,096 Multiturn (AFM60)			
Error limits		± 0.2°	± 0.05°	± 0.03°
Measuring step deviation	Number of lines per revol. 1 ... 399	± 0.2°	± 0.08°	± 0.04°
	Number of lines per revol. 400 ... 40000	± 0.2°	± 0.01°	± 0.008°
	Number of lines per revol. > 40000			± 0.002°
Repeatability	0.002°			
Operating speed 2)	9,000 min^{-1}			
Position sample time	< 1 µs			
Angular acceleration max.	5 x 10^5 rad/s^2			
Operating torque at 20 °C	0.3 Ncm			
Starting torque at 20 °C	0.5 Ncm			
Permissible shaft movement	radial	80 N	80 N	80 N
	axial	40 N	40 N	40 N
Bearing lifetime	3 x 10^9 revolutions			
Working temperature range		0 ... +70 °C	–20 ... +85 °C	–20 ... +100 °C
Storage temperature range (without package)		–40 ... +100 °C	–40 ... +100 °C	–40 ... +100 °C
Permissible relative humidity 3)	90 %			
EMC 4)				
Resistance	To shocks 5)	50 g/6 ms	70 g/6 ms	60 g/6 ms
	To vibration 6)	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529				
Shaft side		IP 65	IP 65	IP 65
Housing side	Connector outlet 7)	IP 67	IP 67	IP 67
Housing side	Cable outlet	IP 67	IP 67	IP 67
Operating voltage	4.5 ... 32 V			
Power consumption, no load	0.5 W			
Initialisation time 8)	50 ms			
Signal line 9)				
Clock +, Clock –, Data +, Data –	SSI max. clock frequency 2 MHz	1 MHz	2 MHz	2 MHz
	or min. LOW level (Clock +): 500 ns			
SET (electronic adjustment)	H-activ (L = 0 - 3 V; H = 4 - U$_s$ V)			
CW/$\overline{\text{CCW}}$ (Counting sequence when turning)	L-activ (L = 0 - 1,5 V; H = 2,0 - U$_s$ V)			

1) Based on encoders with a connector outlet

2) Self-warming 3.3k/1,000 min^{-1} when applying, note working temperature range

3) Condensation of the optical scanning not permitted

4) To EN 61000-6-2 and EN 61000-6-3

5) To EN 60068-2-27

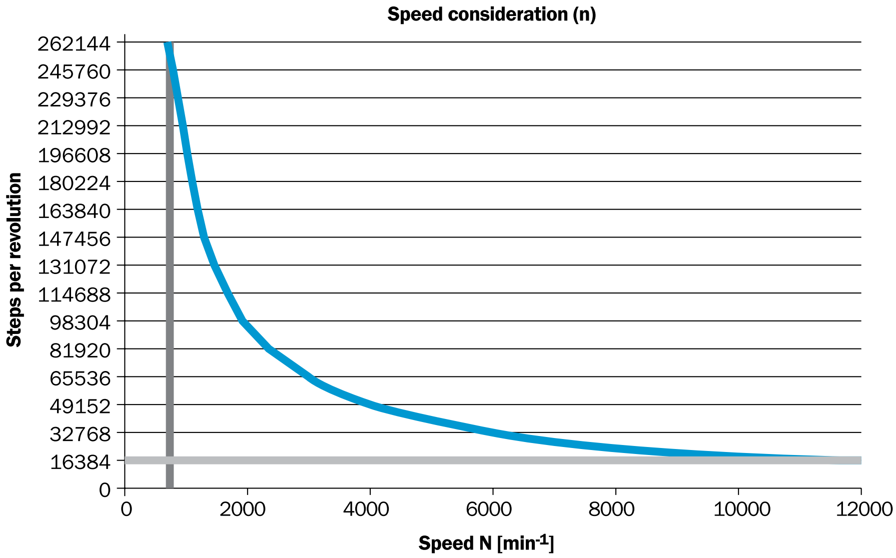
6) To EN 60068-2-6

7) With mating connector fitted

8) Valid positional data can be read once this time has elapsed

9) Signal lines via 12-pin encoder connector, electrically isolated from the housing, ie. 12-core cable

① Maximum speed consideration AFS60/AFM60



Order information

AFS60 Absolute Encoders Singleturn, face mount flange

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**		**–**	**S**									

Type
E
B
A

Mechanical interface	
Solid shaft, 10 x 19 mm	= **4**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **A**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution
Steps per rev.

Selection depending on the type, see below.

Type E – Number of lines per revolution

000256 = 8 bits	001024 = 10 bits	004096 = 12 bits
000512 = 9 bits	002048 = 11 bits	

Type B – Number of lines per revolution

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits
001024 = 10 bits	008192 = 13 bits	

Type A – Number of lines per revolution

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits	131072 = 17 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits	262144 = 18 bits
001024 = 10 bits	008192 = 13 bits	065536 = 16 bits	

Order example: AFS60 Absolute Encoders Singleturn, type E, solid shaft 10 x 19 mm, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**	**E**	**–**	**S**	**4**	**A**	**C**	**0**	**0**	**1**	**0**	**2**	**4**

Order information

AFS60 Absolute Encoders Singleturn, face mount flange, programmable version

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**		**–**	**S**									

Type
B
A

Mechanical interface	
Solid shaft, 10 x 19 mm	= **4**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **P**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution *
Steps per rev.

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

Order information programmable version
AFS60 Absolute Encoders Singleturn
Type B, face mount flange, solid shaft 10 x 19 mm

Type	Part no.
AFS60B-S4PA032768	1037483
AFS60B-S4PC032768	1037484
AFS60B-S4PK032768	1037485
AFS60B-S4PL032768	1037486
AFS60B-S4PM032768	1037487

Order information programmable version
AFS60 Absolute Encoders Singleturn
Type A, face mount flange, solid shaft 10 x 19 mm

Type	Part no.
AFS60A-S4PA262144	1037488
AFS60A-S4PC262144	1037489
AFS60A-S4PK262144	1037490
AFS60A-S4PL262144	1037491
AFS60A-S4PM262144	1037492

Order information

AFM60 Absolute Encoders Multiturn, 4096 revolutions, face mount flange

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**		**–**	**S**									

Type
E
B
A

Mechanical interface	
Solid shaft, 10 x 19 mm	= **4**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **A**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution
Steps per rev.

Selection depending on the type, see below.

Type E – Number of lines per revolution x 4096 (12 bits)

000256 = 8 bits	001024 = 10 bits	004096 = 12 bits
000512 = 9 bits	002048 = 11 bits	

Type B – Number of lines per revolution x 4096 (12 bits)

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits
001024 = 10 bits	008192 = 13 bits	

Type A – Number of lines per revolution x 4096 (12 bits)

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits	131072 = 17 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits	262144 = 18 bits
001024 = 10 bits	008192 = 13 bits	065536 = 16 bits	

Order example: AFM60 Absolute Encoders Multiturn, type E, solid shaft 10 x 19 mm, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits) x number of revolutions (12 bits)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**	**E**	**–**	**S**	**4**	**A**	**C**	**0**	**0**	**1**	**0**	**2**	**4**

Order information

AFM60 Absolute Encoders Multiturn, 4096 revolutions, face mount flange, programmable version

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**		**–**	**S**									

Type
B
A

Mechanical interface	
Solid shaft, 10 x 19 mm	= **4**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **P**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution *
Steps per rev.

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

Order information programmable version
AFM60 Absolute Encoders Multiturn, 4096 revolutions, Type B, face mount flange, solid shaft 10 x 19 mm

Type	Part no.
AFM60B-S4PA032768	1037503
AFM60B-S4PC032768	1037504
AFM60B-S4PK032768	1037505
AFM60B-S4PL032768	1037506
AFM60B-S4PM032768	1037507

Order information programmable version
AFM60 Absolute Encoders Multiturn, 4096 revolutions, Type A, face mount flange, solid shaft 10 x 19 mm

Type	Part no.
AFM60A-S4PA262144	1037508
AFM60A-S4PC262144	1037509
AFM60A-S4PK262144	1037510
AFM60A-S4PL262144	1037511
AFM60A-S4PM262144	1037512

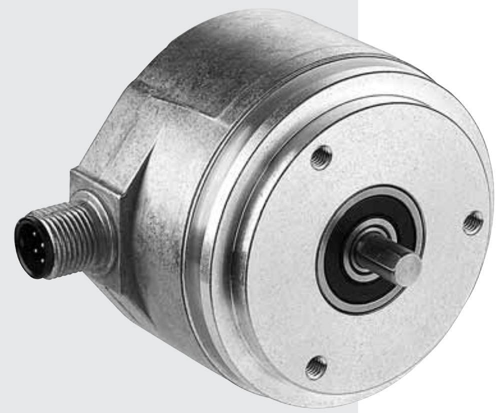
Resolution up to 18 bits

Absolute Encoders Singleturn

Resolution up 30 bits

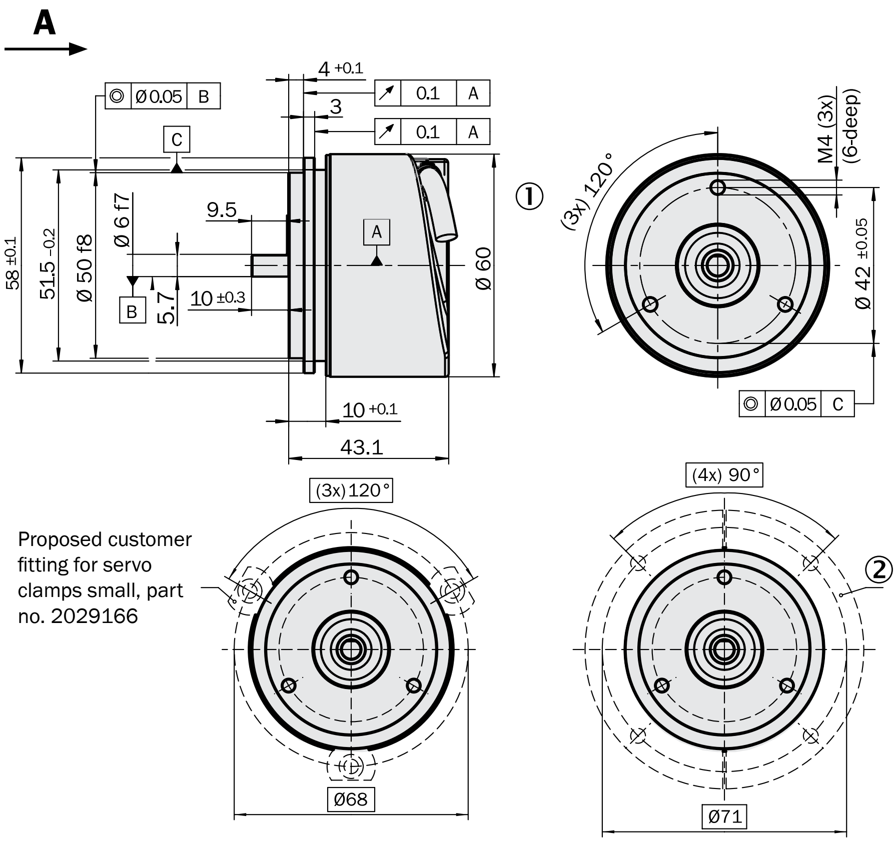
Absolute Encoders Multiturn

- Connector or cable outlet
- Protection class IP 67
- Electrical interface SSI
- Direction of rotation, zero point, offset and resolution freely programmable



Accessories – see pages 410-448

Dimensional drawing servo flange, cable outlet



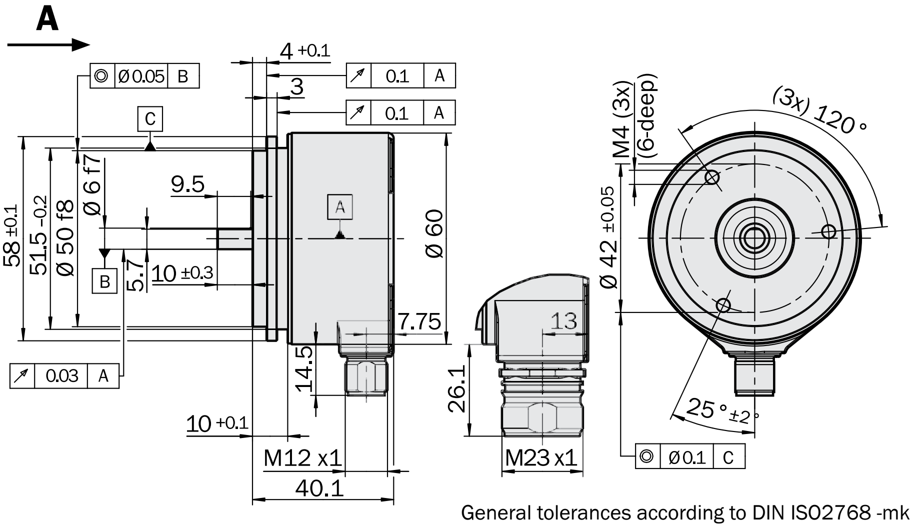
Proposed customer fitting for servo clamps small, part no. 2029166

General tolerances according to DIN ISO2768 -mk

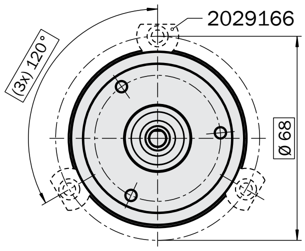
① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

② Proposed customer fitting for servo clamps half ring, part no. 2029165

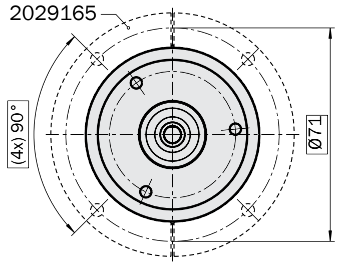
Dimensional drawing servo flange, connector outlet M12 and M23



General tolerances according to DIN ISO2768 -mk



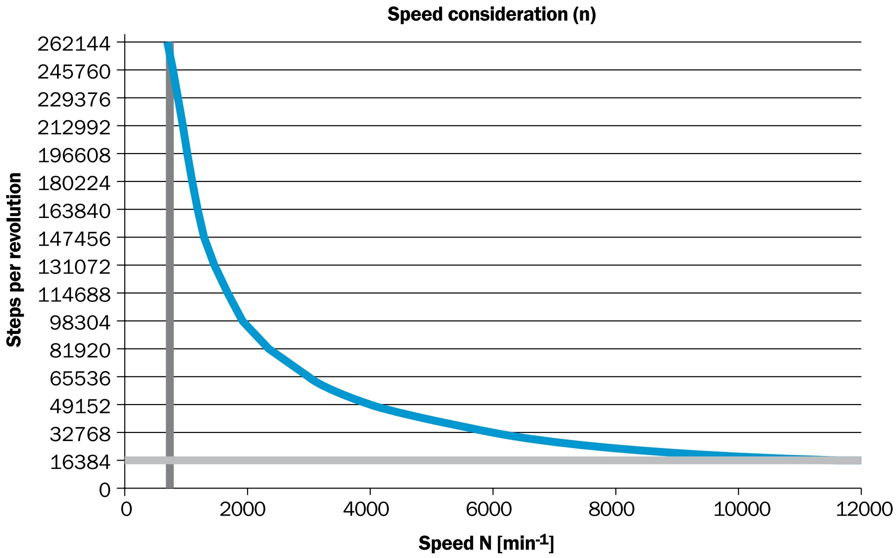
Proposed customer fitting for servo clamps small, part no. 2029166



Proposed customer fitting for servo clamps half ring, part no. 2029165

Technical data to DIN 32878	AFS60/AFM60 servo flange			
Type		E	B	A
Shaft diameter	6 x 10 mm			
Mass [1]	0.26 kg			
Moment of inertia to the rotor	6.2 gcm^2			
Code type	Gray			
Code sequence adjustable	CW/$\overline{\text{CCW}}$			
Measuring step	360° number of lines	0.09°	0.01°	0.0014°
Number of steps per revolution max.	Singleturn and Multiturn	4096	32768 ①	262144 ①
Number of lines	4,096 Multiturn (AFM60)			
Error limits		± 0.2°	± 0.05°	± 0.03°
Measuring step deviation	Number of lines per revol. 1 ... 399	± 0.2°	± 0.08°	± 0.04°
	Number of lines per revol. 400 ... 40000	± 0.2°	± 0.01°	± 0.008°
	Number of lines per revol. > 40000			± 0.002°
Repeatability	0.002°			
Operating speed [2]	9,000 min^{-1}			
Position sample time	< 1 µs			
Angular acceleration max.	5 x 10^5 rad/s^2			
Operating torque at 20 °C	0.3 Ncm			
Starting torque at 20 °C	0.5 Ncm			
Permissible shaft movement	radial	80 N	80 N	80 N
	axial	40 N	40 N	40 N
Bearing lifetime	3 x 10^9 revolutions			
Working temperature range		0 ... +70 °C	–20 ... +85 °C	–20 ... +100 °C
Storage temperature range (without package)		–40 ... +100 °C	–40 ... +100 °C	–40 ... +100 °C
Permissible relative humidity [3]	90 %			
EMC [4]				
Resistance	To shocks [5]	50 g/6 ms	70 g/6 ms	60 g/6 ms
	To vibration [6]	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529				
Shaft side		IP 65	IP 65	IP 65
Housing side	Connector outlet [7]	IP 67	IP 67	IP 67
Housing side	Cable outlet	IP 67	IP 67	IP 67
Operating voltage	4.5 ... 32 V			
Power consumption, no load	0.5 W			
Initialisation time [8]	50 ms			
Signal line [9]				
Clock +, Clock –, Data +, Data –	SSI max. clock frequency 2 MHz	1 MHz	2 MHz	2 MHz
	or min. LOW level (Clock +): 500 ns			
SET (electronic adjustment)	H-activ (L = 0 - 3 V; H = 4 - U_s V)			
CW/$\overline{\text{CCW}}$ (Counting sequence when turning)	L-activ (L = 0 - 1,5 V; H = 2,0 - U_s V)			

① Maximum speed consideration AFS60/AFM60



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[1] Based on encoders with a connector outlet

[2] Self-warming 3.3k/1,000 min^{-1} when applying, note working temperature range

[3] Condensation of the optical scanning not permitted

[4] To EN 61000-6-2 and EN 61000-6-3

[5] To EN 60068-2-27

[6] To EN 60068-2-6

[7] With mating connector fitted

[8] Valid positional data can be read once this time has elapsed

[9] Signal lines via 12-pin encoder connector, electrically isolated from the housing, ie. 12-core cable

Order information

AFS60 Absolute Encoders Singleturn, servo flange

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**		**–**	**S**									

Type
E
B
A

Mechanical interface	
Solid shaft, 6 x 10 mm	= **1**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **A**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m 1)	= **K**
Cable 8-core, universal 3 m 1)	= **L**
Cable 8-core, universal 5 m 1)	= **M**

1) The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution
Steps per rev.

Selection depending on the type, see below.

Type E – Number of lines per revolution

000256 = 8 bits	001024 = 10 bits	004096 = 12 bits
000512 = 9 bits	002048 = 11 bits	

Type B – Number of lines per revolution

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits
001024 = 10 bits	008192 = 13 bits	

Type A – Number of lines per revolution

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits	131072 = 17 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits	262144 = 18 bits
001024 = 10 bits	008192 = 13 bits	065536 = 16 bits	

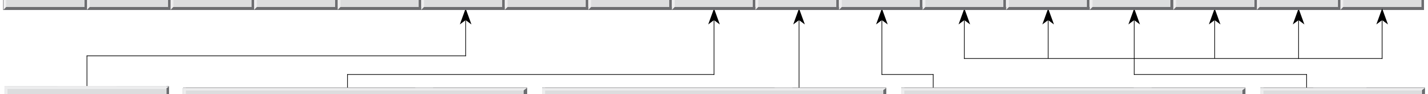
Order example: AFS60 Absolute Encoders Singleturn, type E, solid shaft 6 x 10 mm, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**	**E**	**–**	**S**	**1**	**A**	**C**	**0**	**0**	**1**	**0**	**2**	**4**

Order information

AFS60 Absolute Encoders Singleturn, servo flange, programmable version

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**		**–**	**S**									



Type
B
A

Mechanical interface	
Solid shaft, 6 x 10 mm	= **1**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **P**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution *
Steps per rev.

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

Order information programmable version
AFS60 Absolute Encoders Singleturn
Type B, servo flange, solid shaft 6 x 10 mm

Type	Part no.
AFS60B-S1PA032768	1037493
AFS60B-S1PC032768	1037494
AFS60B-S1PK032768	1037495
AFS60B-S1PL032768	1037496
AFS60B-S1PM032768	1037497

Order information programmable version
AFS60 Absolute Encoders Singleturn
Type A, servo flange, solid shaft 6 x 10 mm

Type	Part no.
AFS60A-S1PA262144	1037498
AFS60A-S1PC262144	1037499
AFS60A-S1PK262144	1037500
AFS60A-S1PL262144	1037501
AFS60A-S1PM262144	1037502

Order information

AFM60 Absolute Encoders Multiturn, 4096 revolutions, servo flange

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**		**–**	**S**									

Type
E
B
A

Mechanical interface	
Solid shaft, 6 x 10 mm	= **1**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **A**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution
Steps per rev.

Selection depending on the type, see below.

Type E –Number of lines per revolution x 4096 (12 bits)

000256 = 8 bits	001024 = 10 bits	004096 = 12 bits
000512 = 9 bits	002048 = 11 bits	

Type B – Number of lines per revolution x 4096 (12 bits)

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits
001024 = 10 bits	008192 = 13 bits	

Type A – Number of lines per revolution x 4096 (12 bits)

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits	131072 = 17 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits	262144 = 18 bits
001024 = 10 bits	008192 = 13 bits	065536 = 16 bits	

Order example: AFM60 Absolute Encoders Multiturn, type E, solid shaft 6 x 10 mm, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pol., radial, number of lines 1024 (10 Bit) x number of revolutions (12 bits)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**	**E**	**–**	**S**	**1**	**A**	**C**	**0**	**0**	**1**	**0**	**2**	**4**

Order information

AFM60 Absolute Encoders Multiturn, 4096 revolutions, servo flange, programmable version

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**		**–**	**S**									

Type
B
A

Mechanical interface	
Solid shaft, 6 x 10 mm	= **1**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **P**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution *
Steps per rev.

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

Order information programmable version
AFM60 Absolute Encoders Multiturn, 4096 revolutions, Type B, servo flange, solid shaft 6 x 10 mm

Type	Part no.
AFM60B-S1PA032768	1037513
AFM60B-S1PC032768	1037514
AFM60B-S1PK032768	1037515
AFM60B-S1PL032768	1037516
AFM60B-S1PM032768	1037517

Order information programmable version
AFM60 Absolute Encoders Multiturn, 4096 revolutions, Type A, servo flange, solid shaft 6 x 10 mm

Type	Part no.
AFM60A-S1PA262144	1037518
AFM60A-S1PC262144	1037519
AFM60A-S1PK262144	1037520
AFM60A-S1PL262144	1037521
AFM60A-S1PM262144	1037522

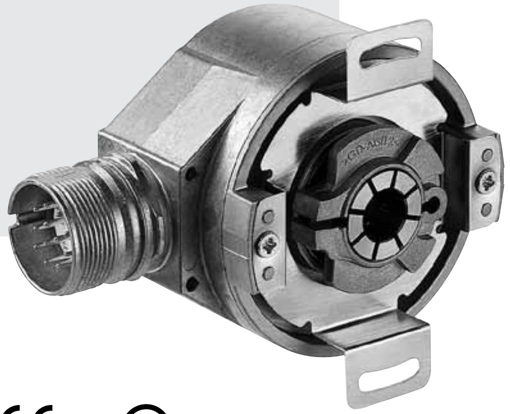
Resolution up to 18 bits

Absolute Encoders Singleturn

Resolution up 30 bits

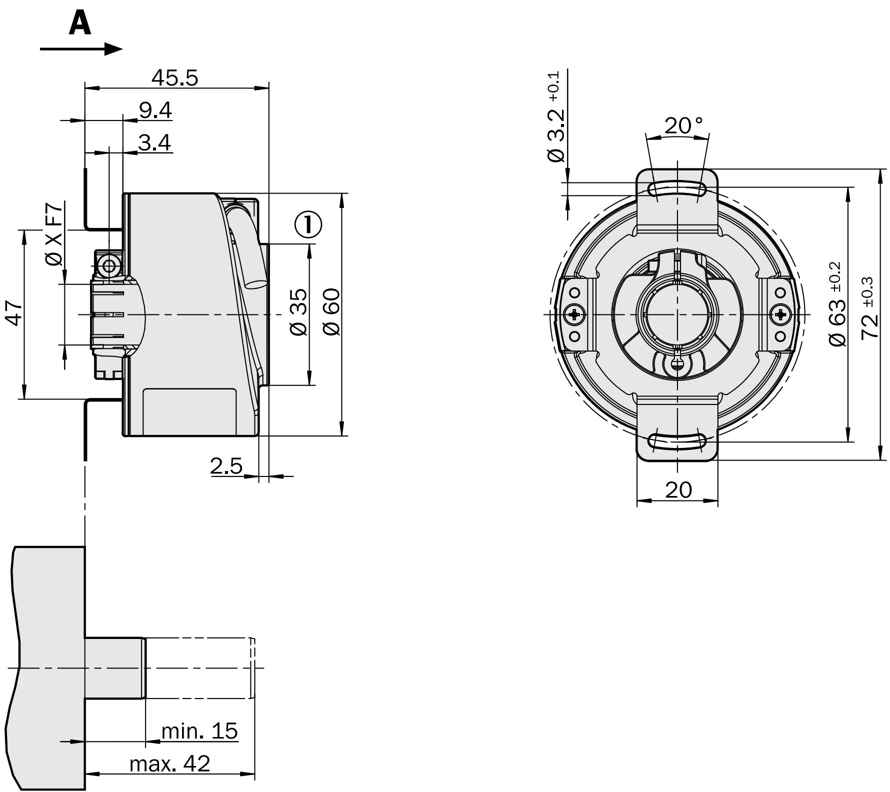
Absolute Encoders Multiturn

- Connector or cable outlet
- Protection class IP 67
- Electrical interface SSI
- Direction of rotation, zero point, offset and resolution freely programmable



Accessories – see pages 410-448

Dimensional drawing blind hollow shaft, cable outlet

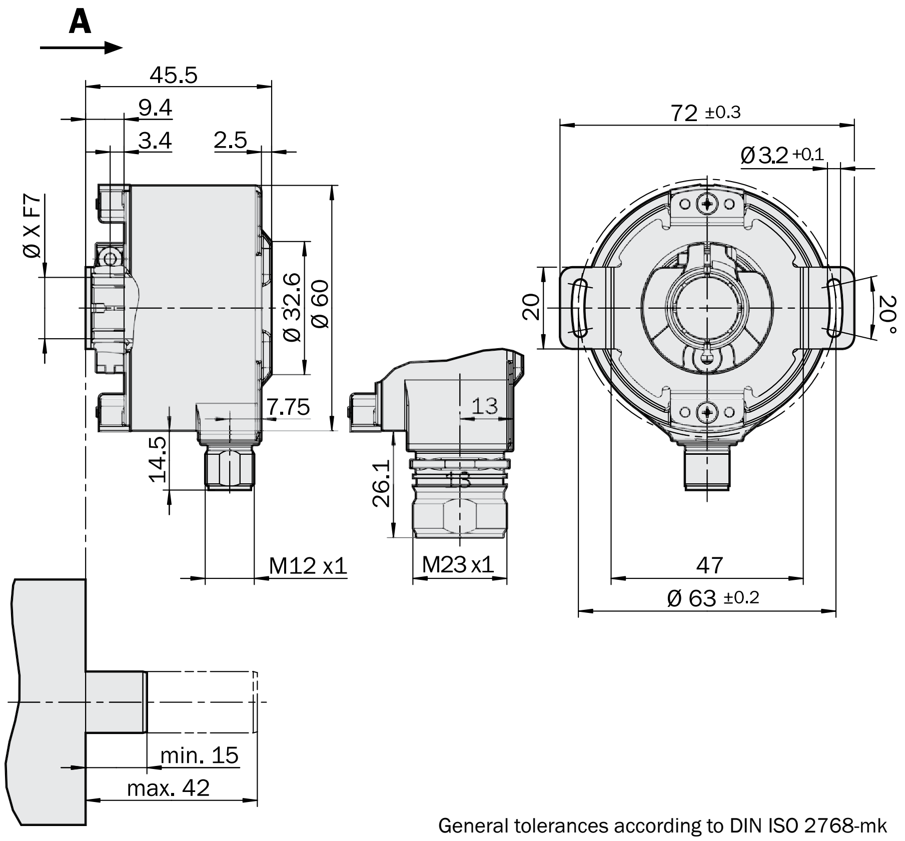


General tolerances according to DIN ISO 2768-mk

Customer-side

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Dimensional drawing blind hollow shaft, connector outlet M12 and M23

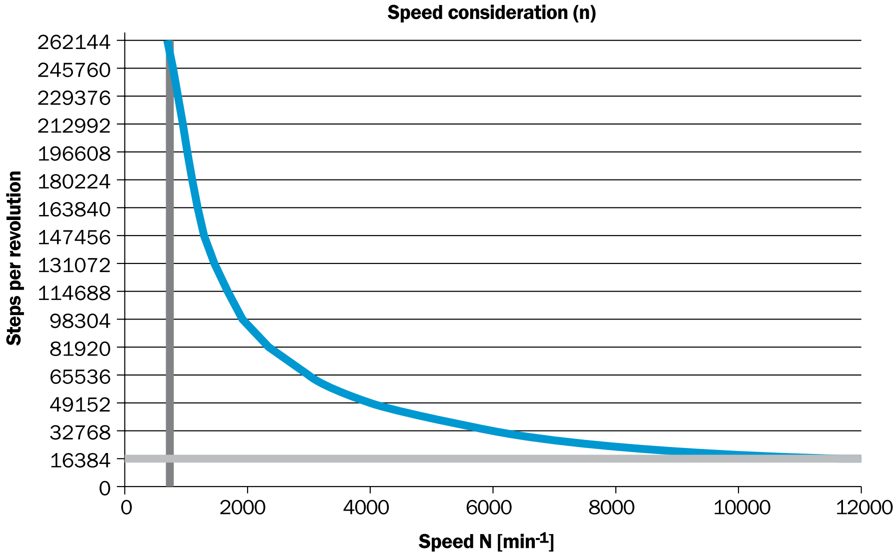


General tolerances according to DIN ISO 2768-mk

Customer-side

Technical data acc. to DIN 32878	AFS60/AFM60 blind hollow shaft			
Type		**E**	**B**	**A**
Shaft diameter	8,10,12,14,15 mm and 3/8",$^{1}/_{2}$", 5/8"			
Mass 1)	0.2 kg			
Moment of inertia of the rotor	40 gcm^2			
Code type	Gray			
Code sequence adjustable	CW/$\overline{\text{CCW}}$			
Measuring step	360 ° number of lines	0.09 °	0.01 °	0.0014 °
Number of steps per revolution max.	Singleturn and Multiturn	4096	32768 ①	262144 ①
Number of lines	4,096 Multiturn (AFM60)			
Error limits		± 0.3 °	± 0.05 °	± 0.03 °
Measuring step deviation	Number of lines per revol. 1 ... 399	± 0.2 °	± 0.08 °	± 0.04 °
	Number of lines per revol. 400 ... 40.000	± 0.2 °	± 0.01 °	± 0.008 °
	Number of lines per revol. > 40.000			± 0.002 °
Repeatability	0.002 °			
Operating speed 2)	6.000 min^{-1}			
Position sample time	< 1 µs			
Angular acceleration max.	5 x 10^5 rad/s^2			
Operating torque at 20 °C	0.6 Ncm			
Starting torque at 20 °C	0.8 Ncm			
Permissible movement of the drive element				
radial	static / dynamic	± 0.3 / ± 0.1 mm	± 0.3 / ± 0.1 mm	± 0.3 / ± 0.05 mm
axial	static / dynamic	± 0.5 / ± 0.2 mm	± 0.5 / ± 0.2 mm	± 0.5 / ± 0.01 mm
Bearing lifetime	3 x 10^9 revolutions			
Working temperature range		0 ... +70 °C	–20 ... +100 °C	–20 ... +100 °C
Storage temperature range (without package)		–40 ... +100 °C	–40 ... +100 °C	–40 ... +100 °C
Permissible relative humidity 3)	90 %			
EMC 4)				
Resistance	To shocks 5)	50 g/6 ms	70 g/6 ms	60 g/6 ms
	To vibration 6)	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529				
Shaft side		IP 65	IP 65	IP 65
Housing side	Connector outlet 7)	IP 67	IP 67	IP 67
Housing side	Cable outlet	IP 67	IP 67	IP 67
Operating voltage	4.5 ... 32 V			
Power consumption, no load	0.5 W			
Initialisation time 8)	50 ms			
Signal line 9)				
Clock +, Clock –, Data +, Data –	SSI max. clock frequency 2 MHz	1 MHz	2 MHz	2 MHz
	or min. LOW level (Clock +): 500 ns			
SET (electronic adjustment)	H-activ (L = 0 - 3 V; H = 4 - U_s V)			
CW/$\overline{\text{CCW}}$ (Counting sequence when turning)	L-activ (L = 0 - 1,5 V; H = 2,0 - U_s V)			

① Maximum speed consideration AFS60/AFM60



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1) Based on encoders with a connector outlet

2) Self-warming 3.3k/1,000 min^{-1} when applying, note working temperature range

3) Condensation of the optical scanning not permitted

4) To EN 61000-6-2 and EN 61000-6-3

5) To EN 60068-2-27

6) To EN 60068-2-6

7) With mating connector fitted

8) Valid positional data can be read once this time has elapsed

9) Signal lines via 12-pin encoder connector, electrically isolated from the housing, ie. 12-core cable

Order information

AFS60 Absolute Encoders Singleturn, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**		**–**	**B**									

Type
E
B
A

Mechanical interface	
Blind hollow shaft 8 mm	= **B**
Blind hollow shaft 3/8"	= **C**
Blind hollow shaft 10 mm	= **D**
Blind hollow shaft 12 mm	= **E**
Blind hollow shaft 1/2"	= **F**
Blind hollow shaft 14 mm	= **G**
Blind hollow shaft 15 mm	= **H**
Blind hollow shaft 5/8"	= **J**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **A**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution
Steps per rev.

Selection depending on the type, see below.

Type E – Number of lines per revolution

000256 = 8 bits	001024 = 10 bits	004096 = 12 bits
000512 = 9 bits	002048 = 11 bits	

Type B – Number of lines per revolution

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits
001024 = 10 bits	008192 = 13 bits	

Type A – Number of lines per revolution

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits	131072 = 17 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits	262144 = 18 bits
001024 = 10 bits	008192 = 13 bits	065536 = 16 bits	

Order example: AFS60 Absolute Encoders Singleturn, type E, blind hollow shaft, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)

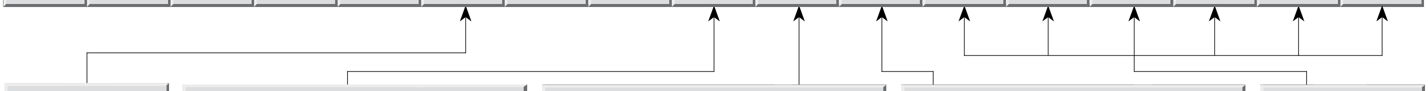
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**	**E**	**–**	**B**	**x**	**A**	**C**	**0**	**0**	**1**	**0**	**2**	**4**

x stands for hollow shaft diameter B to J, put in the corresponding letter at point 9.

Order information

AFS60 Absolute Encoders Singleturn, blind hollow shaft, programmable version

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**		**–**	**B**									



Type
B
A

Mechanical interface	
Blind hollow shaft 8 mm	= **B**
Blind hollow shaft 3/8"	= **C**
Blind hollow shaft 10 mm	= **D**
Blind hollow shaft 12 mm	= **E**
Blind hollow shaft 1/2"	= **F**
Blind hollow shaft 14 mm	= **G**
Blind hollow shaft 15 mm	= **H**
Blind hollow shaft 5/8"	= **J**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **P**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution *
Steps per rev.

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

Order information programmable version
AFS60 Absolute Encoders Singleturn
Type B, blind hollow shaft

Type
AFS60B-BxPA032768
AFS60B-BxPC032768
AFS60B-BxPK032768
AFS60B-BxPL032768
AFS60B-BxPM032768

Order information programmable version
AFS60 Absolute Encoders Singleturn
Type A, blind hollow shaft

Type
AFS60A-BxPA262144
AFS60A-BxPC262144
AFS60A-BxPK262144
AFS60A-BxPL262144
AFS60A-BxPM262144

x stands for hollow shaft diameter B to J, put in the corresponding letter at point 9.

Order information

AFM60 Absolute Encoders Multiturn, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**		**–**	**B**									

Type
E
B
A

Mechanical interface	
Blind hollow shaft 8 mm	= **B**
Blind hollow shaft 3/8"	= **C**
Blind hollow shaft 10 mm	= **D**
Blind hollow shaft 12 mm	= **E**
Blind hollow shaft 1/2"	= **F**
Blind hollow shaft 14 mm	= **G**
Blind hollow shaft 15 mm	= **H**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **A**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution
Steps per rev.

Selection depending on the type, see below.

Type E – Number of lines per revolution x 4096 (12 Bit)

000256 = 8 bits	001024 = 10 bits	004096 = 12 bits
000512 = 9 bits	002048 = 11 bits	

Type B – Number of lines per revolution x 4096 (12 Bit)

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits
001024 = 10 bits	008192 = 13 bits	

Type A – Number of lines per revolution x 4096 (12 Bit)

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits	131072 = 17 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits	262144 = 18 bits
001024 = 10 bits	008192 = 13 bits	065536 = 16 bits	

Order example: AFM60 Absolute Encoders Multiturn, type E, blind hollow shaft, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**	**E**	**–**	**B**	**x**	**A**	**C**	**0**	**0**	**1**	**0**	**2**	**4**

x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.

Order information

AFM60 Absolute Encoders Multiturn, blind hollow shaft, programmable version

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**		**–**	**B**									

Type
B
A

Mechanical interface	
Blind hollow shaft 8 mm	= **B**
Blind hollow shaft 3/8"	= **C**
Blind hollow shaft 10 mm	= **D**
Blind hollow shaft 12 mm	= **E**
Blind hollow shaft 1/2"	= **F**
Blind hollow shaft 14 mm	= **G**
Blind hollow shaft 15 mm	= **H**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **P**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution *
Steps per rev.

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

Order information programmable version
AFM60 Absolute Encoders Multiturn
Type B, blind hollow shaft

Type
AFM60B-BxPA032768
AFM60B-BxPC032768
AFM60B-BxPK032768
AFM60B-BxPL032768
AFM60B-BxPM032768

Order information programmable version
AFM60 Absolute Encoders Multiturn
Type A, blind hollow shaft

Type
AFM60A-BxPA262144
AFM60A-BxPC262144
AFM60A-BxPK262144
AFM60A-BxPL262144
AFM60A-BxPM262144

x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.

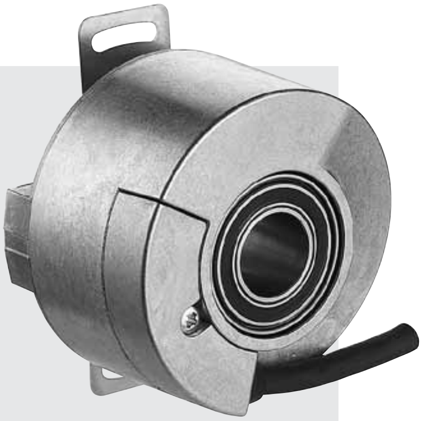
Resolution up to 18 bits

Absolute Encoders Singleturn

Resolution up 30 bits

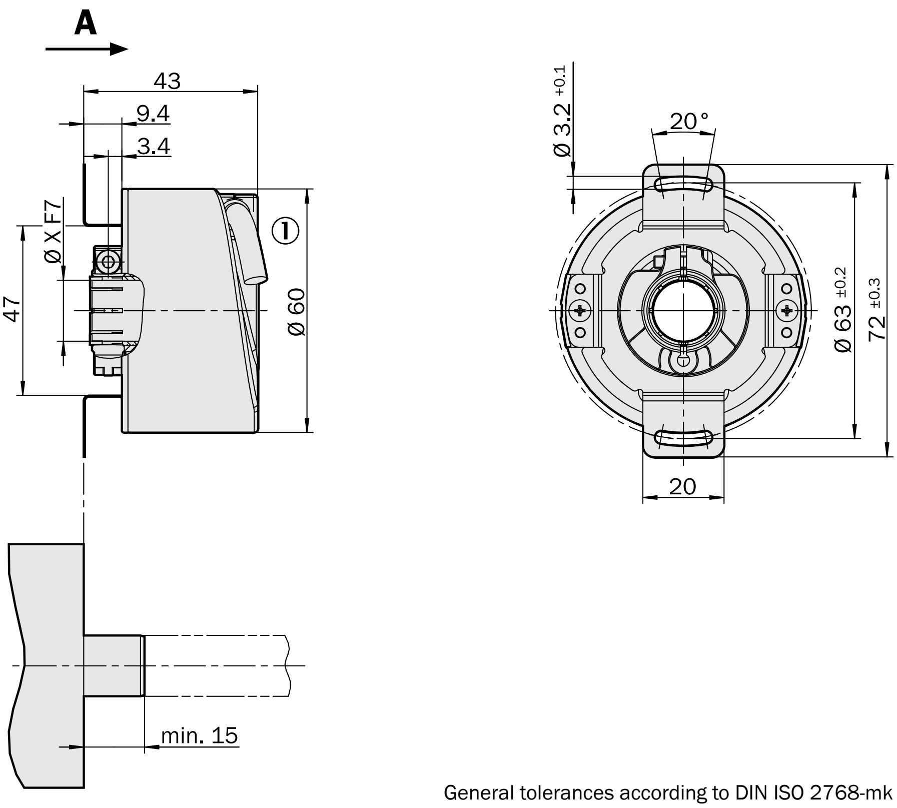
Absolute Encoders Multiturn

- Connector or cable outlet
- Protection class IP 65
- Electrical interface SSI
- Number of lines, level of output signal and zero pulse width freely programmable



Accessories – see pages 410-448

Dimensional drawing through hollow shaft metal, cable outlet

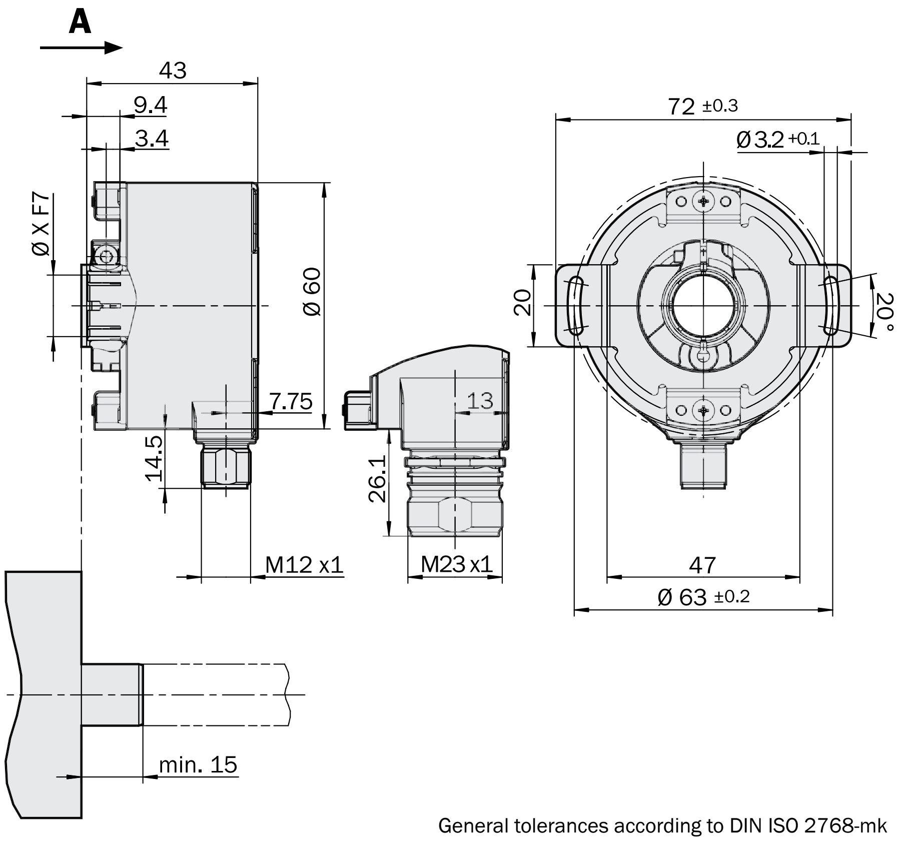


General tolerances according to DIN ISO 2768-mk

Customer-side

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Dimensional drawing through hollow shaft, connector outlet M12 and M23

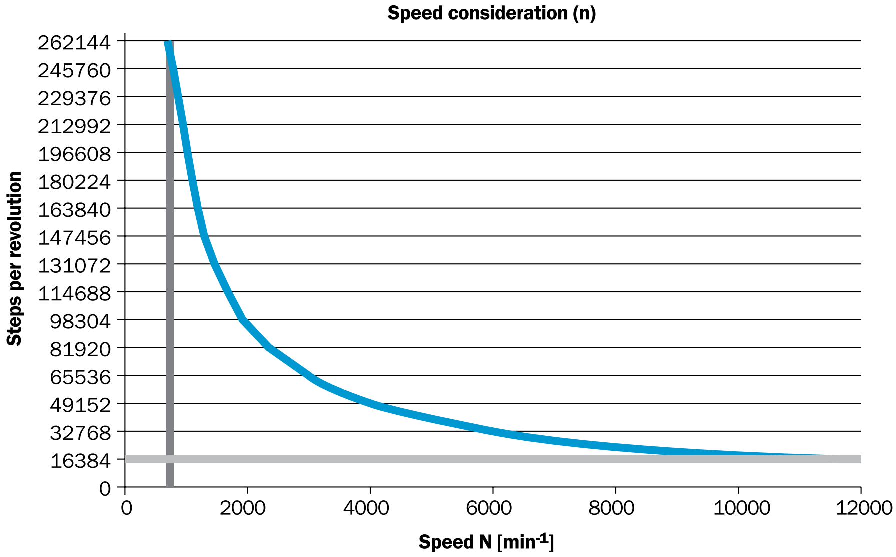


General tolerances according to DIN ISO 2768-mk

Customer-side

Technical data acc. to DIN 32878	AFS60/AFM60 through hollow shaft			
Type		**E**	**B**	**A**
Shaft diameter	8,10,12,14,15 mm and 3/8",1/2", 5/8"			
Mass 1)	0.2 kg			
Moment of inertia of the rotor	40 gcm^2			
Code type	Gray			
Code sequence adjustable	CW/$\overline{\text{CCW}}$			
Measuring step	360° number of lines	0.09°	0.01°	0.0014°
Number of steps per revolution max.	Singleturn and Multiturn	4096	32768 ①	262144 ①
Number of lines	4,096 Multiturn (AFM60)			
Error limits		± 0.3°	± 0.05°	± 0.03°
Measuring step deviation	Number of lines per revol. 1 ... 399	± 0.2°	± 0.08°	± 0.04°
	Number of lines per revol. 400 ... 40.000	± 0.2°	± 0.01°	± 0.008°
	Number of lines per revol. > 40.000			± 0.002°
Repeatability	0.002°			
Operating speed 2)	9.000 min^{-1}			
Position sample time	< 1 µs			
Angular acceleration max.	5 x 10^5 rad/s^2			
Operating torque at 20 °C	0.6 Ncm			
Starting torque at 20 °C	0.8 Ncm			
Permissible movement of the drive element				
radial	static / dynamic	± 0.3 / ± 0.1 mm	± 0.3 / ± 0.1 mm	± 0.3 / ± 0.05 mm
axial	static / dynamic	± 0.5 / ± 0.2 mm	± 0.5 / ± 0.2 mm	± 0.5 / ± 0.01 mm
Bearing lifetime	3 x 10^9 revolutions			
Working temperature range		0 ... +70 °C	−20 ... +100 °C	−20 ... +100 °C
Storage temperature range (without package)		−40 ... +100 °C	−40 ... +100 °C	−40 ... +100 °C
Permissible relative humidity 3)	90 %			
EMC 4)				
Resistance	To shocks 5)	50 g/6 ms	70 g/6 ms	60 g/6 ms
	To vibration 6)	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529				
Shaft side		IP 65	IP 65	IP 65
Housing side	Connector outlet 7)	IP 65	IP 65	IP 65
Housing side	Cable outlet	IP 65	IP 65	IP 65
Operating voltage	4.5 ... 32 V			
Power consumption, no load	0.5 W			
Initialisation time 8)	50 ms			
Signal line 9)				
Clock +, Clock –, Data +, Data –	SSI max. clock frequency 2 MHz	1 MHz	2 MHz	2 MHz
	or min. LOW level (Clock +): 500 ns			
SET (electronic adjustment)	H-activ (L = 0 - 3 V; H = 4 - U_S V)			
CW/$\overline{\text{CCW}}$ (Counting sequence when turning)	L-activ (L = 0 - 1,5 V; H = 2,0 - U_S V)			

① Maximum speed consideration AFS60/AFM60



1) Based on encoders with a connector outlet

2) Self-warming 3.3k/1,000 min^{-1} when applying, note working temperature range

3) Condensation of the optical scanning not permitted

4) To EN 61000-6-2 and EN 61000-6-3

5) To EN 60068-2-27

6) To EN 60068-2-6

7) With mating connector fitted

8) Valid positional data can be read once this time has elapsed

9) Signal lines via 12-pin encoder connector, electrically isolated from the housing, ie. 12-core cable

Order information

AFS60 Absolute Encoders Singleturn, through hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**		**–**	**T**									

Type
E
B
A

Mechanical interface	
Through hollow shaft 8 mm	= **B**
Through hollow shaft 3/8"	= **C**
Through hollow shaft 10 mm	= **D**
Through hollow shaft 12 mm	= **E**
Through hollow shaft 1/2"	= **F**
Through hollow shaft 14 mm	= **G**
Through hollow shaft 15 mm	= **H**
Through hollow shaft 5/8"	= **J**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **A**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution
Steps per rev.

Selection depending on the type, see below.

Type E – Number of lines per revolution

000256 = 8 bits	001024 = 10 bits	004096 = 12 bits
000512 = 9 bits	002048 = 11 bits	

Type B – Number of lines per revolution

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits
001024 = 10 bits	008192 = 13 bits	

Type A – Number of lines per revolution

000256 = 8 bits	002048 = 11 bits	016384 = 14 bits	131072 = 17 bits
000512 = 9 bits	004096 = 12 bits	032768 = 15 bits	262144 = 18 bits
001024 = 10 bits	008192 = 13 bits	065536 = 16 bits	

Order example: AFS60 Absolute Encoders Singleturn, type E, through hollow shaft, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**	**E**	**–**	**T**	**x**	**A**	**C**	**0**	**0**	**1**	**0**	**2**	**4**

x stands for hollow shaft diameter B to J, put in the corresponding letter at point 9.

Order information

AFS60 Absolute Encoders Singleturn, through hollow shaft, programmable version

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**S**	**6**	**0**		**–**	**T**									

Type
B
A

Mechanical interface	
Through hollow shaft 8 mm	= **B**
Through hollow shaft 3/8"	= **C**
Through hollow shaft 10 mm	= **D**
Through hollow shaft 12 mm	= **E**
Through hollow shaft 1/2"	= **F**
Through hollow shaft 14 mm	= **G**
Through hollow shaft 15 mm	= **H**
Through hollow shaft 5/8"	= **J**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **P**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m 1)	= **K**
Cable 8-core, universal 3 m 1)	= **L**
Cable 8-core, universal 5 m 1)	= **M**

1) The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution *
Steps per rev.

* Number of steps of 2 to 262144 freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

Order information programmable version
AFS60 Absolute Encoders Singleturn
Type B, through hollow shaft

Type
AFS60B-TxPA032768
AFS60B-TxPC032768
AFS60B-TxPK032768
AFS60B-TxPL032768
AFS60B-TxPM032768

Order information programmable version
AFS60 Absolute Encoders Singleturn
Type A,through hollow shaft

Type
AFS60A-TxPA262144
AFS60A-TxPC262144
AFS60A-TxPK262144
AFS60A-TxPL262144
AFS60A-TxPM262144

x stands for hollow shaft diameter B to J, put in the corresponding letter at point 9.

Order information

AFM60 Absolute Encoders Multiturn, through hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**		**–**	**T**									

Type
E
B
A

Mechanical interface	
Through hollow shaft 8 mm	= **B**
Through hollow shaft 3/8"	= **C**
Through hollow shaft 10 mm	= **D**
Through hollow shaft 12 mm	= **E**
Through hollow shaft 1/2"	= **F**
Through hollow shaft 14 mm	= **G**
Through hollow shaft 15 mm	= **H**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **A**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution
Steps per rev.

Selection depending on the type, see below.

Type E – Number of lines per revolution x 4096 (12 Bit)

000256 = 8 bits
000512 = 9 bits
001024 = 10 bits
002048 = 11 bits
004096 = 12 bits

Type B – Number of lines per revolution x 4096 (12 Bit)

000256 = 8 bits
000512 = 9 bits
001024 = 10 bits
002048 = 11 bits
004096 = 12 bits
008192 = 13 bits
016384 = 14 bits
032768 = 15 bits

Type A – Number of lines per revolution x 4096 (12 Bit)

000256 = 8 bits
000512 = 9 bits
001024 = 10 bits
002048 = 11 bits
004096 = 12 bits
008192 = 13 bits
016384 = 14 bits
032768 = 15 bits
065536 = 16 bits
131072 = 17 bits
262144 = 18 bits

Order example: AFM60 Absolute Encoders Multiturn, type E, through hollow shaft, Electrical interface 4.5 ... 32 V, SSI/Gray, connector M12, 8-pin., radial, number of lines 1024 (10 bits)

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**	**E**	**–**	**T**	**x**	**A**	**C**	**0**	**0**	**1**	**0**	**2**	**4**

x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.

Order information

AFM60 Absolute Encoders Multiturn, through hollow shaft, programmable version

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16	Point 17
A	**F**	**M**	**6**	**0**		**–**	**T**									

Type
B
A

Mechanical interface	
Through hollow shaft 8 mm	= **B**
Through hollow shaft 3/8"	= **C**
Through hollow shaft 10 mm	= **D**
Through hollow shaft 12 mm	= **E**
Through hollow shaft 1/2"	= **F**
Through hollow shaft 14 mm	= **G**
Through hollow shaft 15 mm	= **H**

Electrical interface	
4.5 ... 32 V, SSI/Gray	= **P**

Connection type	
Connector M23, 12-pin, radial	= **A**
Connector M12, 8-pin, radial	= **C**
Cable 8-core, universal 1.5 m [1]	= **K**
Cable 8-core, universal 3 m [1]	= **L**
Cable 8-core, universal 5 m [1]	= **M**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Resolution *
Steps per rev.

* Number of steps of 256 (8 bits) to 262144 (18 bits) freely programmable by customer. Factory-programmed to
Type B: 032768
Type A: 262144

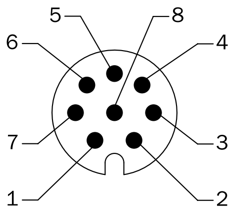
Order information programmable version
AFM60 Absolute Encoders Multiturn
Type B, through hollow shaft

Type
AFM60B-TxPA032768
AFM60B-TxPC032768
AFM60B-TxPK032768
AFM60B-TxPL032768
AFM60B-TxPM032768

Order information programmable version
AFM60 Absolute Encoders Multiturn
Type A,through hollow shaft

Type
AFM60A-TxPA262144
AFM60A-TxPC262144
AFM60A-TxPK262144
AFM60A-TxPL262144
AFM60A-TxPM262144

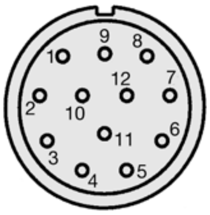
x stands for hollow shaft diameter B to H, put in the corresponding letter at point 9.



View to the connector M12 fitted to the encoder body

Pin and wire allocation, connector M12, 8-pin

PIN, 8-pin M12 connector	Signal SSI	Explanation
1	Data –	Interface signals
2	Data +	Interface signals
3	cw/$\overline{\text{ccw}}$	Counting sequence when turning
4	SET	Electronic adjustment
5	Clock +	Interface signals
6	Clock –	Interface signals
7	GND	Ground connection
8	+U_S	Supply voltage



View to the connector M23 fitted to the encoder body

Pin and wire allocation, connector M23, 12-pin

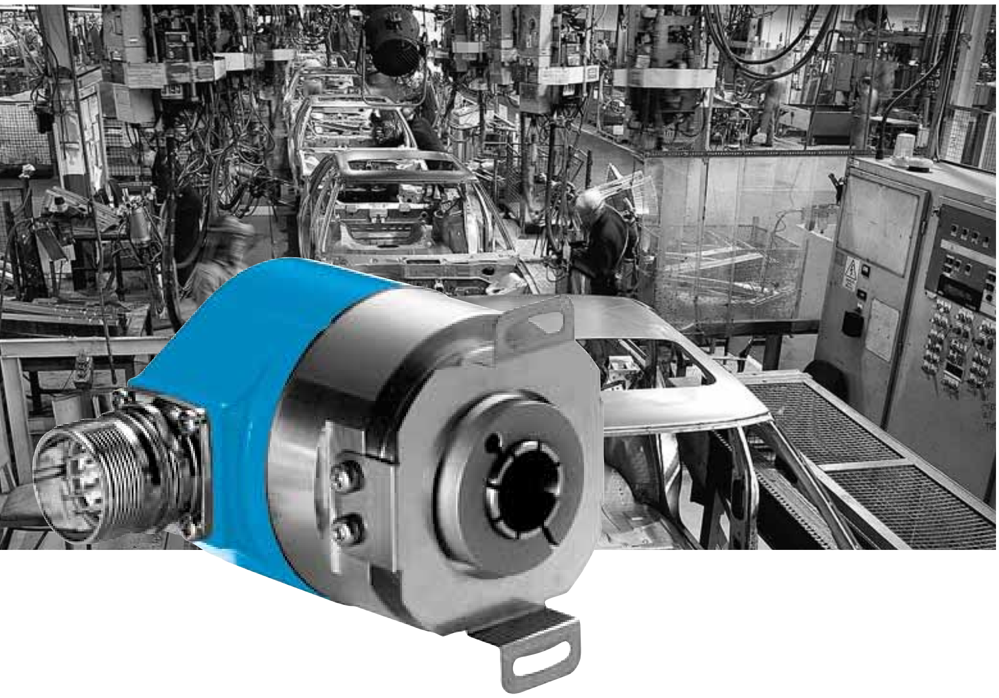
PIN	Signal	Explanation
1	GND	Earth connection
2	Data +	Interface signals
3	Clock +	Interface signals
4	N. C.	Not connected
5	N. C.	Not connected
6	N. C.	Not connected
7	N. C.	Not connected
8	U_S	Supply voltage
9	SET	Electronic adjustment
10	Data –	Interface signals
11	Clock –	Interface signals
12	cw/$\overline{\text{ccw}}$	Counting sequence when turning
	Screen	Housing potential

Allocation cable outlet, cable 8-core

Colour of wires	Signal	Explanation
Brown	Data –	Interface signals
White	Data +	Interface signals
Black	cw/$\overline{\text{ccw}}$	Counting sequence when turning
Pink	SET	Electronic adjustment
Yellow	Clock +	Interface signals
Lilac	Clock –	Interface signals
Blue	GND	Earth connection
Red	+ U_S	Supply voltage

CW/$\overline{\text{CCW}}$	Foreward/reverse: This input programs the counting direction ot the encoder. If not connected, this input is "HIGH". If the encoder shaft, as viewed on the drive shaft, rotates in the clockwise direction, it counts in an increasing sequence. If it should count upwards when the shaft rotates in the anti-clockwise direction, this connection must be connected permanently to "LOW" level (zero volts).
SET	This input activates the electronic zero set. When the SET line is connected to Us for more than 100 ms, the current mechanical position is assigned the value 0 or the pre-programmed SET-value.

ATM60/ATM90: Absolute Encoders Multiturn extremely robust and exceptionally reliable.



Resolution up to 26 bits

Absolute Encoders Multiturn

All multiturn designs are implemented using mechanical gearboxes. These supply the revolution information very reliably and free from interference.

Whether with face mount flange, servo flange, blind or through hollow shaft with connector or cable outlet, the Absolute Encoders Multiturn will meet virtually any application profile.

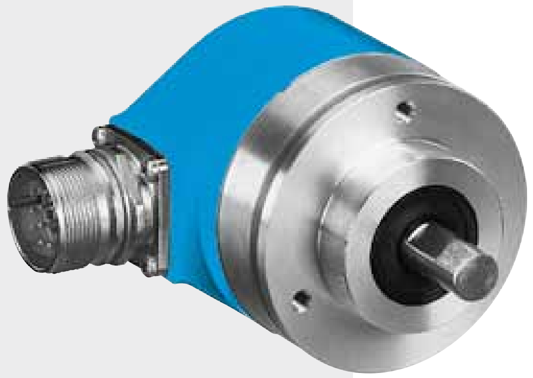
With SSI or RS 422 configuration interface, Profibus, CANopen or DeviceNet field bus technology, all current interfaces suitable for the high requirements in automation technology are also available.

Thanks to this wide variety of products, there are numerous possible uses, for example in:
- machine tools
- textile machines
- woodworking machines
- packaging machines
- wind turbines

Resolution up to 26 bits

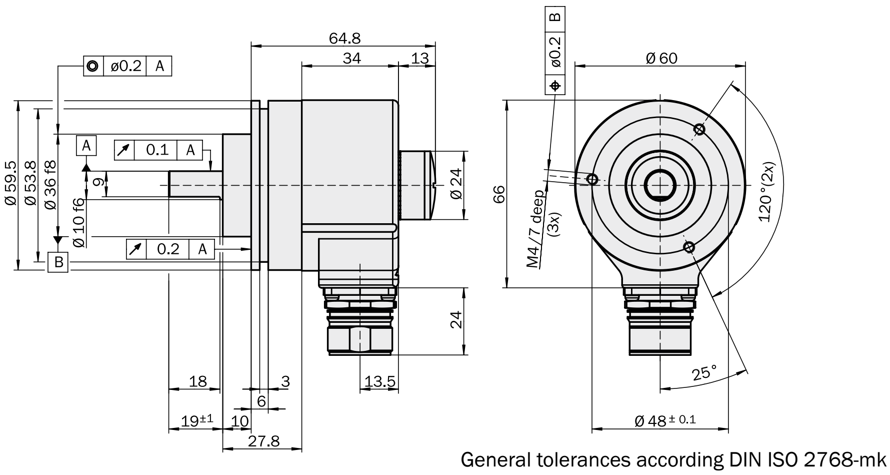
Absolute Encoders Multiturn

- Extremely robust
- SSI and RS 422 configuration interface
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67



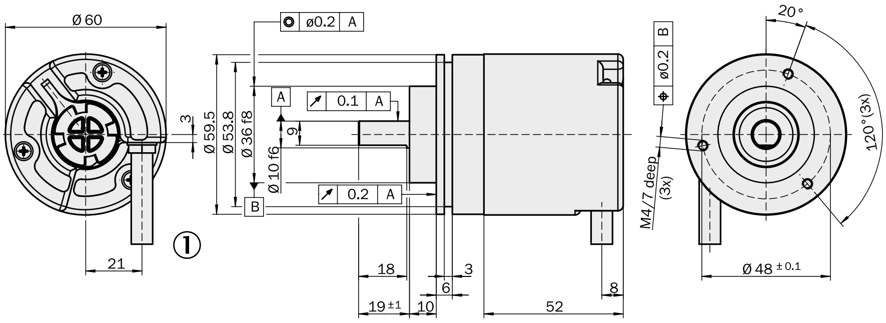
Accessories – see pages 410-448

Dimensional drawing face mount flange, connector radial



General tolerances according DIN ISO 2768-mk

Dimensional drawing face mount flange, cable radial

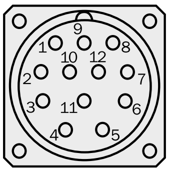


① = bending radius min. 40 mm

General tolerances according DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Signal line
3	Clock +	yellow	Signal line
4	R x D +	grey	RS 422 programming line
5	R x D –	green	RS 422 programming line
6	T x D +	pink	RS 422 programming line
7	T x D –	black	RS 422 programming line
8	U_S	red	Supply voltage
9	SET	orange	Electronical adjustment
10	Data –	brown	Signal line
11	Clock –	lilac	Signal line
12	CW/$\overline{\text{CCW}}$	orange/black	Counting sequence when turning
	Screen		Housing potential



View of the connector M23 fitted to the encoder body

CW/$\overline{\text{CCW}}$	Foreward/reverse: This input programs the counting direction ot the encoder. If not connected, this input is "HIGH". If the encoder shaft, as viewed on the drive shaft, rotates in the clockwise direction, it counts in an increasing sequence. If it should count upwards when the shaft rotates in the anti-clockwise direction, this connection must be connected permanently to "LOW" level (zero volts).
SET	This input activates the electronic zero set. When the SET line is connected to U_S for more than 100 ms, the current mechanical position is assigned the value 0 or the pre-programmed SET-value.

Technical data according to DIN 32878	ATM60 SSI	Flange type face m.
Solid shaft	10 mm	▨
Mass [1]	Approx. 0.5 kg	▨
Moment of inertia of the rotor	35 gcm^2	▨
Programmable code type	Gray/binary	▨
Programmable code direction	CW/CCW	▨
Measuring step	0.043°	▨
Max. number of steps per revolution	8,192	▨
Max. number of revolutions	8,192	▨
Error limits	± 0.25°	▨
Repeatability	0.1°	▨
Operating speed	6,000 min^{-1}	▨
Position forming time	0.15 ms	▨
Max. angular acceleration	5×10^5 rad/s^2	▨
Operating torque		
with shaft seal	1.8 Ncm	▨
without shaft seal [2]	0.3 Ncm	▨
Start up torque		
with shaft seal	2.5 Ncm	▨
without shaft seal [2]	0,5 Ncm	▨
Max. shaft loading		
radial	300 N	▨
axial	50 N	▨
Bearing lifetime	3.6×10^9 revolutions	▨
Working temperature range	– 20 ... + 85 °C	▨
Storage temperature range	– 40 ... + 100 °C	▨
Permissible relative humidity	98 %	▨
EMC [3]		▨
Resistance		▨
to shocks [4]	100/6 g/ms	▨
to vibration [5]	20/10 ... 2000 g/Hz	▨
Protection class acc. IEC 60529		
with shaft seal	IP 67	▨
without shaft seal [6]	IP 43	▨
without shaft seal [7]	IP 65	▨
Operating voltage range (Us)	10 ... 32 V	▨
Power consumption	0.8 W	▨
Initialisation time [8]	1050 ms	▨
Signals [9]		▨
Interface signals		
Clock +, Clock –, Data +, Data – [10]	SSI max. clock frequency 1 MHz i.e. min.	▨
	duration of low level (clock +): 500 ns	▨
T x D +, T x D –, R x D +, R x D –	RS 422	▨
SET (electronic adjustment)	H-active (L ≙ 0 - 4.7 V; H ≙ 10 - U_S V)	▨
CW/$\overline{\text{CCW}}$ (steps sequence in	L-active (L ≙ 0 - 1.5 V; H ≙ 2.0 - U_S V)	▨
direction of rotation)		

[1] For an encoder with connector outlet

[2] If the shaft seal has been removed by the customer

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] On encoder flange not sealed

[7] On encoder flange sealed

[8] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

[9] Carried by 12 way connector, potential-free with respect to housing, or 12 core cable

[10] For higher clock frequencies, choose synchronous SSI

Order information

ATM60 face mount flange solid shaft; U_S 10 ... 32 V; SSI

① Configuration ex-works: 4,096 steps x 4,096 revolutions, Gray-Code, Set = 0

Type	Part no.	Explanation
ATM60-A4A12X12	1030001	Connector M23, 12 pin
ATM60-A4K12X12	1030002	Cable 1.5 m
ATM60-A4L12X12	1030003	Cable 3 m
ATM60-A4M12X12	1030004	Cable 5 m
ATM60-A4N12X12	1032915	Cable 10 m

① Other configurations on request

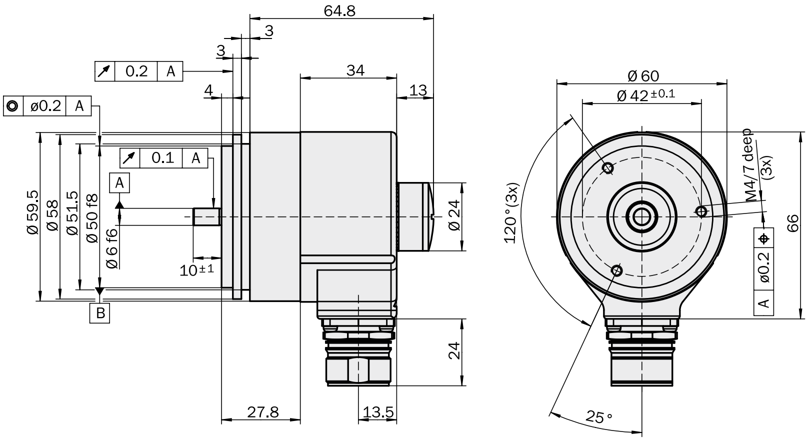
Resolution up to 26 bits

Absolute Encoders Multiturn

- Extremely robust
- SSI and RS 422 configuration interface
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67

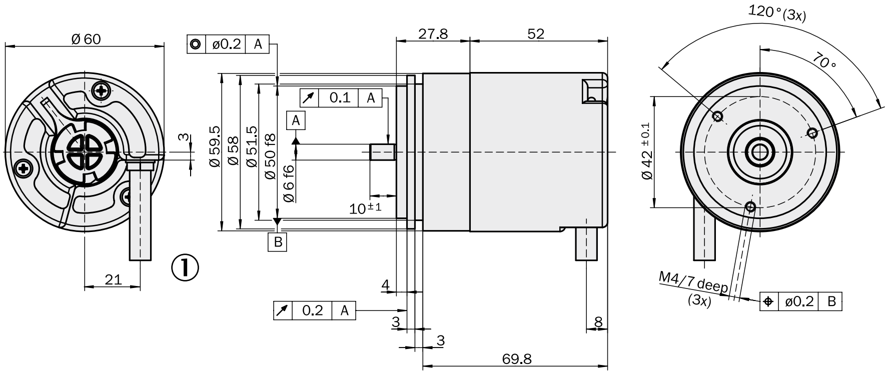
Accessories – see pages 410-448

Dimensional drawing servo flange, connector radial



General tolerances according DIN ISO 2768-mk

Dimensional drawing servo flange, cable radial

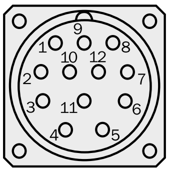


① = bending radius min. 40 mm

General tolerances according DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Signal line
3	Clock +	yellow	Signal line
4	R x D +	grey	RS 422 programming line
5	R x D –	green	RS 422 programming line
6	T x D +	pink	RS 422 programming line
7	T x D –	black	RS 422 programming line
8	U_s	red	Supply voltage
9	SET	orange	Electronical adjustable
10	Data –	brown	Signal line
11	Clock –	lilac	Signal line
12	CW/$\overline{\text{CCW}}$	orange/black	Counting sequence when turning
	Screen		Housing potential



View of the connector M23 fitted to the encoder body

CW/$\overline{\text{CCW}}$	Foreward/reverse: This input programs the counting direction ot the encoder. If not connected, this input is "HIGH". If the encoder shaft, as viewed on the drive shaft, rotates in the clockwise direction, it counts in an increasing sequence. If it should count upwards when the shaft rotates in the anti-clockwise direction, this connection must be connected permanently to "LOW" level (zero volts).
SET	This input activates the electronic zero set. When the SET line is connected to U_s for more than 100 ms, the current mechanical position is assigned the value 0 or the pre-programmed SET-value.

7028241 / 2010-02-01
Subject to change without notice

Technical data according to DIN 32878	ATM60 SSI	**Flange type**
		servo
Solid shaft	6 mm	■
Mass 1)	Approx. 0.5 kg	■
Moment of inertia of the rotor	35 gcm^2	■
Programmable code type	Gray/binary	■
Programmable code direction	CW/CCW	■
Measuring step	0.043 °	■
Max. number of steps per revolution	8,192	■
Max. number of revolutions	8,192	■
Error limits	± 0.25 °	■
Repeatability	0.1 °	■
Operating speed	6,000 min^{-1}	■
Position forming time	0.15 ms	■
Max. angular acceleration	5 x 10^5 rad/s^2	■
Operating torque		
with shaft seal	1.8 Ncm	■
without shaft seal 2)	0.3 Ncm	■
Start up torque		
with shaft seal	2.5 Ncm	■
without shaft seal 2)	0.5 Ncm	■
Max. shaft loading		
radial	300 N	■
axial	50 N	■
Bearing lifetime	3.6 x 10^9 revolutions	■
Working temperature range	– 20 ... + 85 °C	■
Storage temperature range	– 40 ... + 100 °C	■
Permissible relative humidity	98 %	■
EMC 3)		■
Resistance		■
to shocks 4)	100/6 g/ms	■
to vibration 5)	20/10 ... 2000 g/Hz	■
Protection class acc. IEC 60529		
with shaft seal	IP 67	■
without shaft seal 6)	IP 43	■
without shaft seal 7)	IP 65	■
Operating voltage range (Us)	10 ... 32 V	■
Power consumption	0.8 W	■
Initialisation time 8)	1050 ms	■
Signals 9)		■
Interface signals		
Clock +, Clock –, Data +, Data – 10)	SSI max. clock frequency 1 MHz i.e. min.	■
	duration of low level (clock +): 500 ns	■
T x D +, T x D –, R x D +, R x D –	RS 422	■
SET (electronic adjustment)	H-active (L ≙ 0 - 4.7 V; H ≙ 10 - U_S V)	■
CW/$\overline{\text{CCW}}$ (steps sequence in	L-active (L ≙ 0 - 1.5 V; H ≙ 2.0 - U_S V)	■
direction of rotation)		

---

1) For an encoder with connector outlet

2) If the shaft seal has been removed by the customer

3) To DIN EN 61000-6-2 and DIN EN 61000-6-3

4) To DIN EN 60068-2-27

5) To DIN EN 60068-2-6

6) On encoder flange not sealed

7) On encoder flange sealed

8) From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

9) Carried by 12 way connector, potential-free with respect to housing, or 12 core cable

10) For higher clock frequencies, choose synchronous SSI

Order information

ATM60 servo flange solid shaft; U_S 10 ... 32 V; SSI

① Configuration ex-works: 4,096 steps x 4,096 revolutions, Gray-Code, Set = 0

Type	**Part no.**	**Explanation**
ATM60-A1A12X12	1030005	Connector M23, 12 pin
ATM60-A1K12X12	1030006	Cable 1.5 m
ATM60-A1L12X12	1030007	Cable 3 m
ATM60-A1M12X12	1030008	Cable 5 m
ATM60-A1N12X12	1032925	Cable 10 m

① Other configurations on request

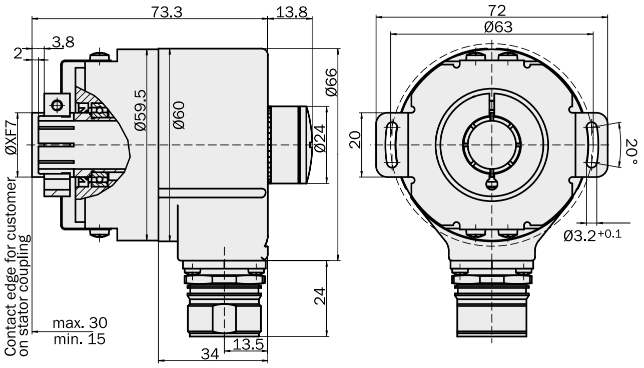
Absolute Encoders Multiturn ATM60 SSI, Blind Hollow Shaft

Resolution up to 26 bits

Absolute Encoders Multiturn

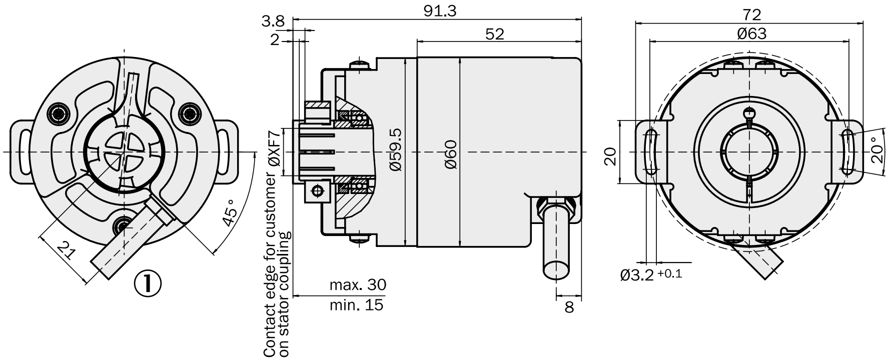
- Extremely robust
- SSI and RS 422 configuration interface
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67

Dimensional drawing blind hollow shaft, connector radial



General tolerances according DIN ISO 2768-mk

Dimensional drawing blind hollow shaft, cable radial

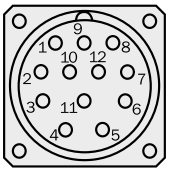


① = bending radius min. 40 mm

General tolerances according DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Signal line
3	Clock +	yellow	Signal line
4	R x D +	grey	RS 422 programming line
5	R x D –	green	RS 422 programming line
6	T x D +	pink	RS 422 programming line
7	T x D –	black	RS 422 programming line
8	U_S	red	Supply voltage
9	SET	orange	Electronical adjustment
10	Data –	brown	Signal line
11	Clock –	lilac	Signal line
12	$CW/\overline{CCW}$	orange/black	Counting sequence when turning
	Screen		Housing potential



View of the connector M23 fitted to the encoder body

$CW/\overline{CCW}$	Foreward/reverse: This input programs the counting direction ot the encoder. If not connected, this input is "HIGH". If the encoder shaft, as viewed on the drive shaft, rotates in the clockwise direction, it counts in an increasing sequence. If it should count upwards when the shaft rotates in the anti-clockwise direction, this connection must be connected permanently to "LOW" level (zero volts).
SET	This input activates the electronic zero set. When the SET line is connected to U_s for more than 100 ms, the current mechanical position is assigned the value 0 or the pre-programmed SET-value.

Accessories – see pages 410-448

Technical data according to DIN 32878	ATM60 SSI	Flange type									
		blind									
① **Hollow shaft diameter**	6, 8, 10, 12, 15 mm, 1/4", 3/8", 1/2"	▨									
Mass 1)	Approx. 0.4 kg	▨									
Moment of inertia of the rotor	55 gcm^2	▨									
Programmable code type	Gray/binary	▨									
Programmable code direction	CW/CCW	▨									
Measuring step	0.043°	▨									
Max. number of steps per revolution	8,192	▨									
Max. number of revolutions	8,192	▨									
Error limits	± 0.25°	▨									
Repeatability	0.1°	▨									
Operating speed	3,000 min^{-1}	▨									
Position forming time	0.15 ms	▨									
Max. angular acceleration	5 x 10^5 rad/s^2	▨									
Operating torque	0.8 Ncm 2)	▨									
Start up torque	1.2 Ncm 2)	▨									
Permissible shaft movement											
of the drive element											
radial static/dynamic	± 0.3/± 0.1 mm	▨									
axial static/dynamic	± 0.5/± 0.2 mm	▨									
Bearing lifetime	3.6 x 10^9 revolutions	▨									
Working temperature range	– 20 ... + 85 °C	▨									
Storage temperature range	– 40 ... + 100 °C	▨									
Permissible relative humidity	98 %	▨									
EMC 3)		▨									
Resistance											
to shocks 4)	100/6 g/ms	▨									
to vibration 5)	20/10 ... 2000 g/Hz	▨									
Protection class acc. IEC 60529 2)	IP 67	▨									
without shaft seal 6)	IP 43	▨									
Operating voltage range (Us)	10 ... 32 V	▨									
Power consumption	0.8 W	▨									
Initialisation time 7)	1050 ms	▨									
Signals 8)		▨									
Interface signals											
Clock +, Clock –, Data +, Data – 9)	SSI max. clock frequency 1 MHz i.e. min.	▨									
	duration of low level (clock +): 500 ns	▨									
T x D +, T x D –, R x D +, R x D –	RS 422	▨									
SET (electronic adjustment)	H-active (L ≙ 0 - 4.7 V; H ≙ 10 - U$_S$ V)	▨									
CW/$\overline{\text{CCW}}$ 10)	L-active (L ≙ 0 - 1.5 V; H ≙ 2.0 - U$_S$ V)	▨									

1) For an encoder with connector outlet

2) With shaft seal

3) To DIN EN 61000-6-2 and DIN EN 61000-6-3

4) To DIN EN 60068-2-27

5) To DIN EN 60068-2-6

6) On encoder flange not sealed

7) From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

8) Carried by 12 way connector, potential-free with respect to housing, or 12 core cable

9) For higher clock frequencies, choose synchronous SSI

10) Step sequence in direction of rotation

② **Other configurations on request**

Order information

ATM60 blind hollow shaft; U$_S$ 10 ... 32 V; SSI

② **Configuration ex-works: 4,096 steps x 4,096 revolutions, Gray-Code, Set = 0**

Type	Part no.	Explanation
ATM60-AAA12X12	1030009	Connector M23, 12 pin
ATM60-AAK12X12	1030010	Cable 1.5 m
ATM60-AAL12X12	1030011	Cable 3 m
ATM60-AAM12X12	1030012	Cable 5 m
ATM60-AAN12X12	1033169	Cable 10 m

① **Attention: Please order the collet with required diameter separately**

Type	Part no.	Shaft diameter
SPZ-006-AD-A	2029174	6 mm
SPZ-1E4-AD-A	2029175	1/4"
SPZ-008-AD-A	2029176	8 mm
SPZ-3E8-AD-A	2029177	3/8"
SPZ-010-AD-A	2029178	10 mm
SPZ-012-AD-A	2029179	12 mm
SPZ-1E2-AD-A	2029180	1/2"
SPZ-014-AD-A	2048863	14 mm

For 15 mm shaft diameter, collet is not needed

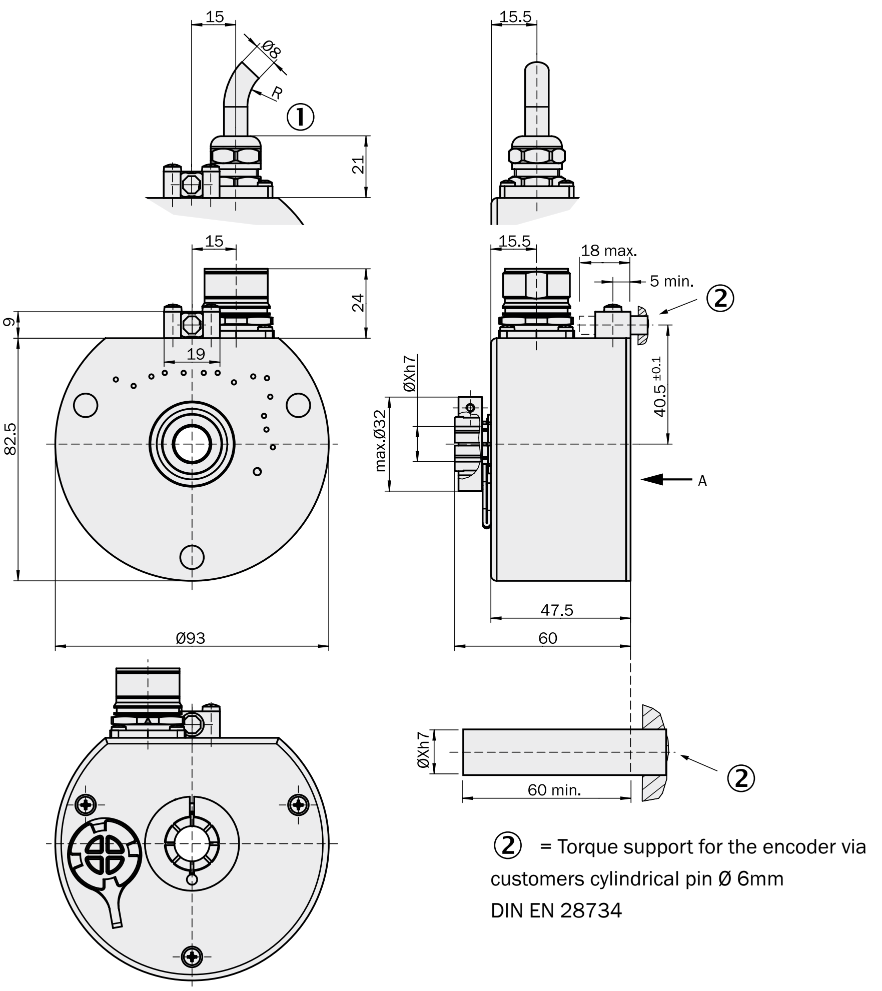
Resolution up to 26 bits

Absolute Encoders Multiturn

- Extremely robust
- SSI and RS 422 configuration interface
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 65

Accessories – see pages 410-448

Dimensional drawing through hollow shaft; connector radial, cable radial



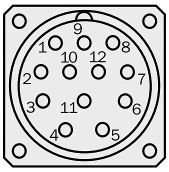
② = Torque support for the encoder via customers cylindrical pin Ø 6mm DIN EN 28734

① = bending radius min. 40 mm

General tolerances according DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Signal line
3	Clock +	yellow	Signal line
4	R x D +	grey	RS 422 programming line
5	R x D –	green	RS 422 programming line
6	T x D +	pink	RS 422 programming line
7	T x D –	black	RS 422 programming line
8	U_S	red	Supply voltage
9	SET	orange	Electronical adjustment
10	Data –	brown	Signal line
11	Clock –	lilac	Signal line
12	CW/$\overline{CCW}$	orange/black	Counting sequence when turning
	Screen		Housing potential



View of the connector M23 fitted to the encoder body

CW/$\overline{CCW}$	Foreward/reverse: This input programs the counting direction ot the encoder. If not connected, this input is "HIGH". If the encoder shaft, as viewed on the drive shaft, rotates in the clockwise direction, it counts in an increasing sequence. If it should count upwards when the shaft rotates in the anti-clockwise direction, this connection must be connected permanently to "LOW" level (zero volts).
SET	This input activates the electronic zero set. When the SET line is connected to U_S for more than 100 ms, the current mechanical position is assigned the value 0 or the pre-programmed SET-value.

Technical data according to DIN 32878	ATM90 SSI	Flange type									
		through									
Hollow shaft diameter	12, 16 mm, 1/2“	■									
Mass [1]	Approx. 0.8 kg	■									
Moment of inertia of the rotor	152.77 gcm^2	■									
Programmable code type	Gray/binary	■									
Programmable code direction	CW/CCW	■									
Measuring step	0.043°	■									
Max. number of steps per revolution	8,192	■									
Max. number of revolutions	8,192	■									
Error limits	± 0.25°	■									
Repeatability	0.1°	■									
Operating speed	2,000 min^{-1}	■									
Position forming time	0.15 ms	■									
Max. angular acceleration	5×10^5 $\mathrm{rad/s}^2$	■									
Operating torque	0.4 Ncm	■									
Start up torque	0.5 Ncm	■									
Bearing lifetime	3.6×10^9 revolutions	■									
Working temperature range	– 20 ... + 70 °C	■									
Storage temperature range	– 40 ... + 100 °C	■									
Permissible relative humidity	98 %	■									
EMC [2]		■									
Resistance		■									
to shocks [3]	100/6 g/ms	■									
to vibration [4]	20/10 ... 2000 g/Hz	■									
Protection class acc. IEC 60529											
with shaft seal	IP 65	■									
Operating voltage range (Us)	10 ... 32 V	■									
Power consumption	0.8 W	■									
Initialisation time [5]	1050 ms	■									
Signals [6]		■									
Interface signals											
Clock +, Clock –, Data +, Data – [7]	SSI max. clock frequency 1 MHz i.e. min.	■									
	duration of low level (clock +): 500 ns	■									
T x D +, T x D –, R x D +, R x D –	RS 422	■									
SET (electronic adjustment)	H-active (L ≙ 0 - 4.7 V; H ≙ 10 - U_s V)	■									
CW/$\overline{\text{CCW}}$ [8]	L-active (L ≙ 0 - 0.9 V; H ≙ 1.9 - U_s V)	■									

---

[1] For an encoder with connector outlet

[2] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[3] To DIN EN 60068-2-27

[4] To DIN EN 60068-2-6

[5] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

[6] Carried by 12 way connector, potential-free with respect to housing, or 12 core cable

[7] For higher clock frequencies, choose synchronous SSI

[8] Step sequence in direction of rotation

Order information

ATM90 through hollow shaft; U_s 10 ... 32 V; SSI

① Configuration ex-works: 4,096 steps x 4,096 revolutions, Gray-Code, Set = 0

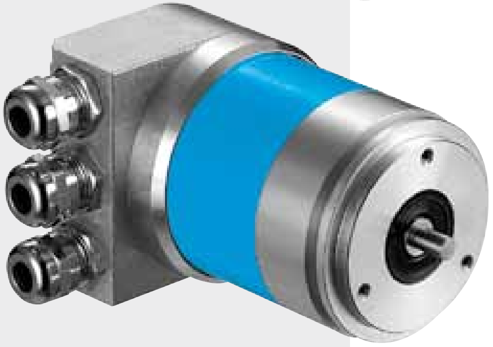
Type	Part no.	Explanation
ATM90-ATA12X12	1030030	Ø12 mm, connector M23, 12 pin
ATM90-ATK12X12	1030031	Ø12 mm, cable 1.5 m
ATM90-ATL12X12	1030032	Ø12 mm, cable 3 m
ATM90-ATM12X12	1030033	Ø12 mm, cable 5 m
ATM90-AUA12X12	1030034	Ø1/2“ , connector M23, 12 pin
ATM90-AUK12X12	1030035	Ø1/2“ , cable 1.5 m
ATM90-AUL12X12	1030036	Ø1/2“ , cable 3 m
ATM90-AUM12X12	1030037	Ø1/2“ , cable 5 m
ATM90-AXA12X12	1030038	Ø16 mm, connector M23, 12 pin
ATM90-AXK12X12	1030039	Ø16 mm, cable 1.5 m
ATM90-AXL12X12	1030040	Ø16 mm, cable 3 m
ATM90-AXM12X12	1030041	Ø16 mm, cable 5 m

① Other configurations on request

Resolution up to 26 bits

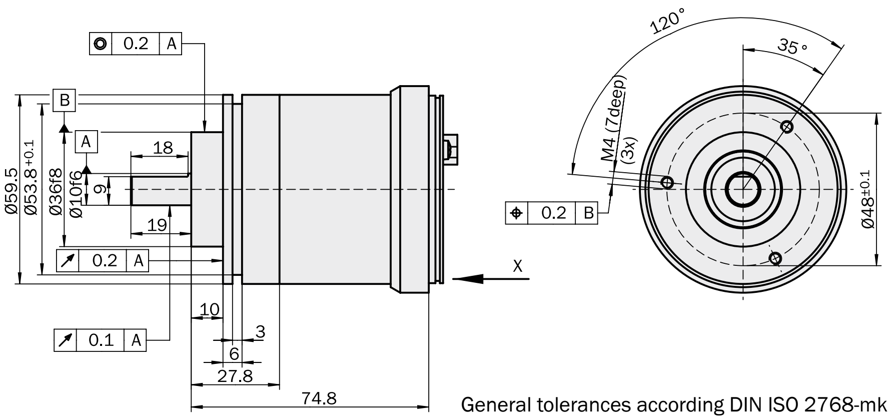
Absolute Encoders Multiturn

- Extremely robust
- RS 485 bus coupling to Profibus DP Specification
- Electronically adjustable, configuration adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67



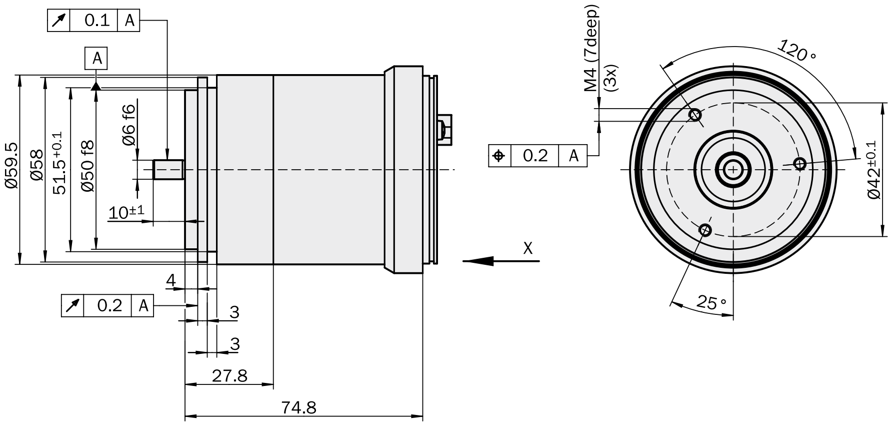
Accessories – see pages 410-448

Dimensional drawing face mount flange



General tolerances according DIN ISO 2768-mk

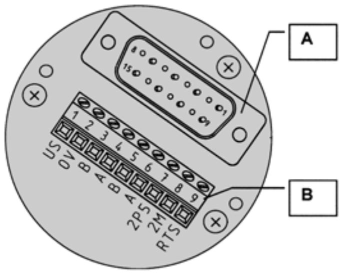
Dimensional drawing servo flange



General tolerances according DIN ISO 2768-mk

① PIN and wire allocation for Profibus adapter

Terminal strip	Connector 4 pin	Connector 5 pin	Conn. female 5 pin	Signal	Explanation
1	1	–	–	U_S (24 V)	Supply voltage 10 ... 32 V
2	3	–	–	0 V (GND)	Ground (0 V)
3	–	–	4	B	Profibus DP B line (out)
4	–	–	2	A	Profibus DP A line (out)
5	–	4	–	B	Profibus DP B line (in)
6	–	2	–	A	Profibus DP A line (in)
7	–	–	1	2P5 [1]	+ 5 V (DC isolated)
8	–	–	3	2M [1]	0 V (DC isolated)
9	–	–	–	RTS [2]	Request To Send
–	2	1	–	N. C.	–
–	4	3	–	N. C.	–
–	–	5	5	Screen	Housing potential



A Internal plug connection to the encoder
B External connection to the bus

[1] Use for external bus termination or to supply the transmitter/receiver of an optical transmission link.

[2] Signal is optional, used to detect the direction of an optical connection.

① Encoders with a Profibus adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the Profibus adapter is unscrewed from the complete device. The figure shows the pin allocation within the bus connection.

Technical data according to DIN 32878	ATM60 Profibus	**Flange type**	
		face m.	servo
Solid shaft	10 mm	■	
	6 mm		■
Mass	Approx. 0.59 kg	■	■
Moment of inertia of the rotor	35 gcm^2	■	■
Measuring step	0.043°	■	■
Max. number of steps per revolution	8,192	■	■
Max. number of revolutions	8,192	■	■
Error limits	± 0.25°	■	■
Repeatability	0.1°	■	■
Operating speed	6,000 min^{-1}	■	■
Position forming time	0.15 ms	■	■
Max. angular acceleration	5×10^5 rad/s^2	■	■
Operating torque			
with shaft seal	1.8 Ncm	■	■
without shaft seal 1)	0.3 Ncm	■	■
Start up torque			
with shaft seal	2.5 Ncm	■	■
without shaft seal 2)	0.5 Ncm	■	■
Max. shaft loading			
radial	300 N	■	■
axial	50 N	■	■
Bearing lifetime	3.6×10^9 revolutions	■	■
Working temperature range	– 20 ... + 80 °C	■	■
Storage temperature range	– 40 ... + 125 °C	■	■
Permissible relative humidity	98 %	■	■
EMC 2)		■	■
Resistance			
to shocks 3)	100/6 g/ms	■	■
to vibration 4)	20/10 ... 2000 g/Hz	■	■
Protection class acc. IEC 60529			
with shaft seal	IP 67	■	■
without shaft seal 5)	IP 43	■	■
without shaft seal 6)	IP 66	■	■
Operating voltage range (Us)	10 ... 32 V	■	■
Power consumption	2.0 W	■	■
Initialisation time 7)	1250 ms	■	■
Bus Interface Profibus DP			
Electrical interface 8)	RS 485	■	■
Protocol	Profile for Encoders (07_{hex}) – Class 2	■	■
Address setting (node number)	0 ... 127 (DIP switches or protocol)	■	■
Data transmission rate (Baudrate)	9.6 kBaud – 12 MBaud 9)	■	■
Electronic adjustment (Number SET)	Via PRESET push button or protocol	■	■
Status information	Operation (LED green),	■	■
	bus aktivity (LED red)	■	■
Bus termination	Via DIP switches 10)	■	■
Electrical connection	Bus adapter with srew fixing (x3)	■	■

1) If the shaft seal has been removed by the customer

2) To DIN EN 61000-6-2
and DIN EN 61000-6-3

3) To DIN EN 60068-2-27

4) To DIN EN 60068-2-6

5) On encoder flange not sealed

6) On encoder flange sealed

7) From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

8) To EN 50 170-2 (DIN 19245 part 1-3)
DC isolated via opto-couplers

9) Automatic detection

10) Should only be connected in the final device

Order information

ATM60 Profibus face mount flange and servo flange solid shaft; U$_s$ 10 ... 32 V

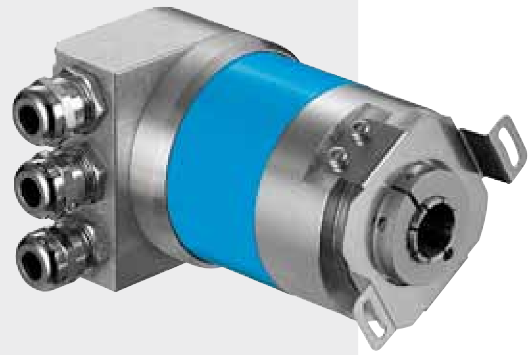
Type	**Part no.**	**Explanation**
ATM60-P4H13X13	1030013	Face mount fl., solid shaft Ø 10 mm
ATM60-P1H13X13	1030014	Servo flange, solid shaft Ø 6 mm

Attention: Please order the Profibus adapter separately (see accessories section)

Resolution up to 26 bits

Absolute Encoders Multiturn

- Extremely robust
- RS 485 bus coupling to Profibus DP Specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67



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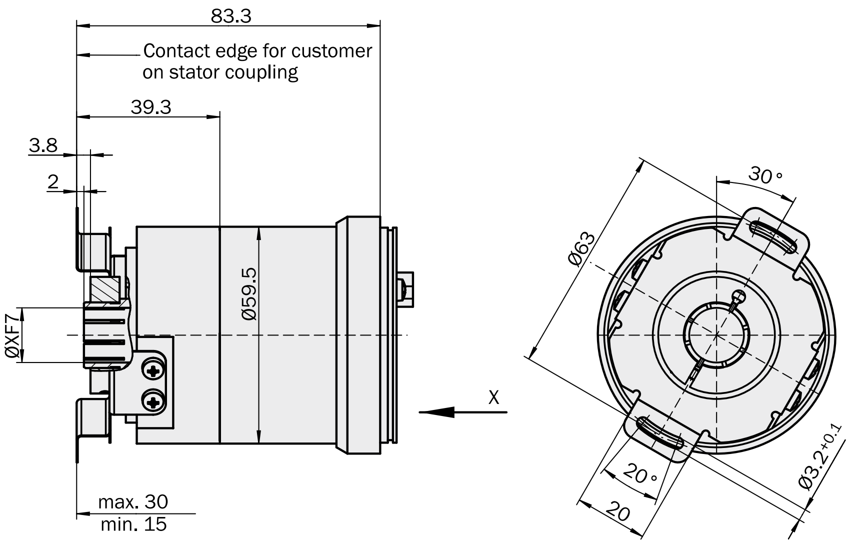
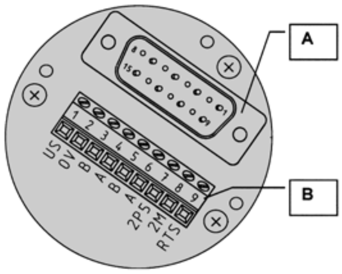
Dimensional drawing blind hollow shaft



General tolerances according DIN ISO 2768-mk

① PIN and wire allocation for Profibus adapter

Terminal strip	Connector 4 pin	Connector 5 pin	Conn. female 5 pin	Signal	Explanation
1	1	–	–	U_S (24 V)	Supply voltage 10 ... 32 V
2	3	–	–	0 V (GND)	Ground (0 V)
3	–	–	4	B	Profibus DP B line (out)
4	–	–	2	A	Profibus DP A line (out)
5	–	4	–	B	Profibus DP B line (in)
6	–	2	–	A	Profibus DP A line (in)
7	–	–	1	2P5 [1]	+ 5 V (DC isolated)
8	–	–	3	2M [1]	0 V (DC isolated)
9	–	–	–	RTS [2]	Request To Send
–	2	1	–	N. C.	–
–	4	3	–	N. C.	–
–	–	5	5	Screen	Housing potential



A Internal plug connection to the encoder
B External connection to the bus

[1] Use for external bus termination or to supply the transmitter/receiver of an optical transmission link.

[2] Signal is optional, used to detect the direction of an optical connection.

① Encoders with a Profibus adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the Profibus adapter is unscrewed from the complete device. The figure shows the pin allocation within the bus connection.

Accessories – see pages 410-448

Technical data according to DIN 32878	ATM60 Profibus	**Flange type** blind
① **Hollow shaft diameter**	6, 8, 10, 12, 15 mm, 1/4”, 3/8”, 1/2”	■
Mass	Approx. 0.59 kg	■
Moment of inertia of the rotor	55 gcm^2	■
Measuring step	0.043°	■
Max. number of steps per revolution	8,192	■
Max. number of revolutions	8,192	■
Error limits	± 0,25°	■
Repeatability	0.1°	■
Operating speed	3,000 min^{-1}	■
Position forming time	0.25 ms	■
Max. angular acceleration	5 x 10^5 rad/s^2	■
Operating torque	0.8 Ncm 1)	■
Start up torque	1.2 Ncm 1)	■
Permissible shaft movement		
of the drive element		
radial static/dynamic	± 0.3/± 0.1 mm	■
axial static/dynamic	± 0.5/± 0.2 mm	■
Bearing lifetime	3.6 x 10^9 revolutions	■
Working temperature range	– 20 ... + 80 °C	■
Storage temperature range	– 40 ... + 125 °C	■
Permissible relative humidity	98 %	■
EMC 2)		■
Resistance		
to shocks 3)	100/6 g/ms	■
to vibration 4)	20/10 ... 2000 g/Hz	■
Protection class acc. IEC 60529 1)	IP 67	■
without shaft seal 5)	IP 43	■
Operating voltage range (Us)	10 ... 32 V	■
Power consumption	2.0 W	■
Initialisation time 6)	1250 ms	■
Bus Interface Profibus DP		
Electrical Interface 7)	RS 485	■
Protocol	Profile for Encoders (07_{hex}) – Class 2	■
Address setting (node number)	0 ... 127 (DIP switches or protocol)	■
Data transmission rate (baud rate)	9.6 kBaud – 12 MBaud 8)	■
Electronic adjustment (number SET)	Via PRESET push button or protocol	■
Status information	Operation (green LED), bus activity (red LED)	■
Bus termination	Via DIP switches 9)	■
Electrical connection	Bus connector with srew fixing (x 3)	■

Order information

ATM60 Profibus blind hollow shaft; U$_s$ 10 ... 32 V

Type	Part no.	Explanation
ATM60-PAH13X13	1030015	Blind hollow shaft

Attention: Please order the Profibus adapter separately (see accessories section)

① Attention: Please order the collet with required diameter separately

Type	Part no.	Shaft diameter
SPZ-006-AD-A	2029174	6 mm
SPZ-1E4-AD-A	2029175	$^{1}/_{4}$“
SPZ-008-AD-A	2029176	8 mm
SPZ-3E8-AD-A	2029177	$^{3}/_{8}$“
SPZ-010-AD-A	2029178	10 mm
SPZ-012-AD-A	2029179	12 mm
SPZ-1E2-AD-A	2029180	$^{1}/_{2}$“
SPZ-014-AD-A	2048863	14 mm

For 15 mm shaft diameter, collet is not needed

---

1) With shaft seal

2) To DIN EN 61000-6-2
and DIN EN 61000-6-3

3) To DIN EN 60068-2-27

4) To DIN EN 60068-2-6

5) On encoder flange not sealed

6) From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

7) To EN 50 170-2 (DIN 19245 part 1-3)
DC isolated via opto-couplers

8) Automatic detection

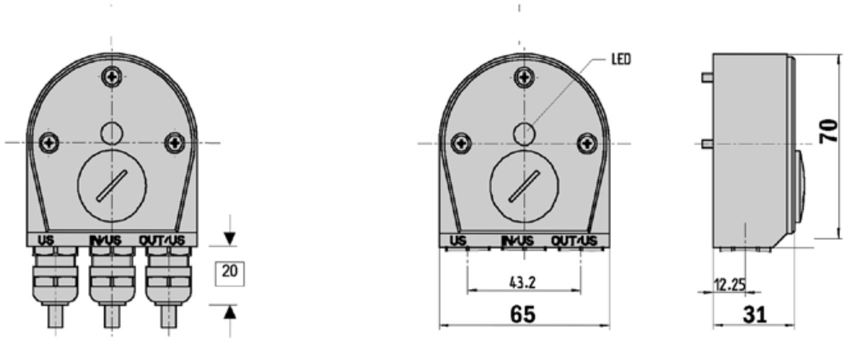
9) Should only be connected in the final device

Resolution up to 26 bits

Absolute Encoders Multiturn

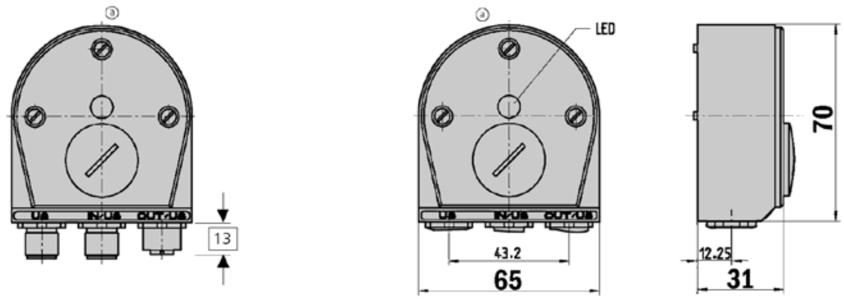
- Extremely robust
- RS 485 bus coupling to Profibus DP Specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67

Dimensional drawing Profibus adapter KA3



General tolerances according DIN ISO 2768-mk

Dimensional drawing Profibus adapter SR3



General tolerances according DIN ISO 2768-mk

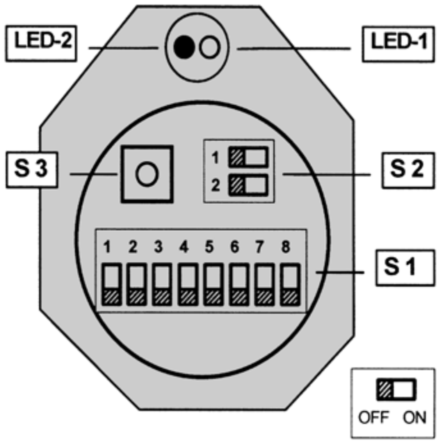
Order information

ATM60 Profibus adapter

Type	Part no.	Explanation
AD-ATM60-KA3PR	2029225	Profibus adapter KA3, 3 x PG
AD-ATM60-SR3PR	2031985	Profibus adapter SR3, 1 x M12, 4 pin., 2 x M12, 5 pin.

Accessories – see pages 410-448

Switch settings



Switch settings

Access to the switches is gained by opening the removable screw cap (PG) on the rear of the bus adapter. Use of the following elements.

S 1 (1-7)	Address setting (0 ... 127)
S 1 (8-8)	Counting direction (CW/CCW)
S 2	Bus termination
S 3	Preset push button (Number SET)

Status information via LEDs

LED-1	Operating voltage (green)
LED-2	Bus activity (red)

Implementation

DP Functionalities
in accordance with the Profibus DP basic functions.

DP services
- Data interchange (Write_Read_Data)
- Address allocation (Set_Slave_Address)
- Control commands (Global_Control)
- Read the inputs (Read_Inputs)
- Read the outputs (Read_Outputs)
- Read diagnostic data (Slave_Diagnosis)
- Send configuration data (Set_Param)
- Check configuration data (Chk_Config)

Communication
- Cyclic master – slave data traffic

Protective mechanisms
- Data transfer with HD = 4
- Time monitoring of the data traffic

Configuration
Settings in accordance with Encoder Profile
- Counting direction (CW, CCW)
- Class-2 functionality (ON, OFF)
- Scaling function (ON, OFF)
- Steps per turn (1 ... 8192)
- Total resolution (GA) -- 1 ... 67,108,864 steps, with GA = 2^n x SpU. -- (n=0 ... 13)
- "Activation of SSA-service" [2]
- Selection of the station address [2]

Configuration
Setting the formats (IN/OUT)
for the cyclic data interchange via
configuration byte (K-1)

2 words IN/OUT data (I-1/O-1) [1]
4 words IN/OUT data (I-1, I-2, I-3/O-1) [2]

Data interchange: - Input Data (IN)

I-1	Position value [1]	4 bytes
I-2	Speed (rev/min) [2]	2 bytes
I-3	Time stamp [2]	2 bytes

Data interchange: - Output data (OUT)

O-1	PRESET Value [1]	4 bytes

Diagnostic information
- Station-related diagnosis (63 bytes in acc. with Encoder Profile Class 2)

Setting: - PRESET value
The PRESET function is used for set into operation and to allocate a specific position value to the current physical angular position.
The following settings are possible:
- by hardware (PRESET push button: S3)
- by software: -- (see Output data)

Setting: - Counting direction
- by hardware via DIP switch S1-(8)
- by software via Telegram

Counting direction increasing:
Rotation of the shaft in the clockwise direction (CW) as viewed on the shaft

Setting: - Station address
- by hardware via DIP switch S1
- by software via Telegram

The setting by software is carried out only if the “SSA-service” has been previously activated.

Setting: - Bus termination
The 2-way DIP switch (S2) permits an internal bus termination to be switched in and out (ON/OFF).
If the bus is terminated externally, switch S2 must be in the OFF position.

Device-specific file (GS.)
For the purpose of automatic set into operation of the encoder, use is made of the GS file.
All the characteristic features of the device are defined in it.

STEG 00FE.GSD	German
STEG 00FE.GSE	English
STEG 00FE.GSF	French

[1] As per Encoder Profile
[2] Manufacturer specific function

Absolute Encoders Multiturn ATM90 Profibus, Through Hollow Shaft

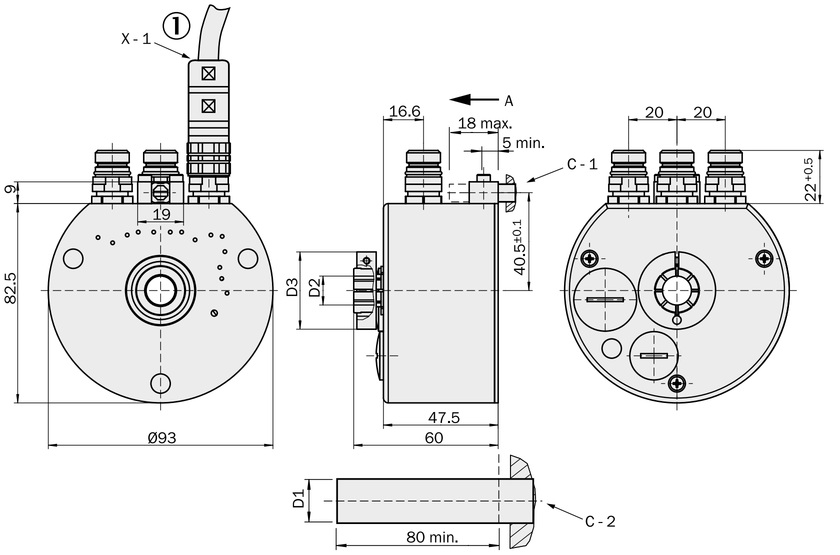
Resolution up to 26 bits

Absolute Encoders Multiturn

- Extremely robust
- RS 485 bus coupling to Profibus DP Specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 65

Accessories – see pages 410-448

Dimensional drawing through hollow shaft, connector radial



① = bending radius min. 40 mm

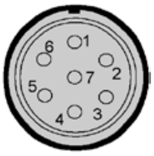
General tolerances according DIN ISO 2768-mk

Through hollow shaft	D1	D2	D3
12 mm	12.0_{h7}	12.0^{F7}	29.5
$^{1}/_{2}$“	12.7_{h7}	12.7^{F7}	29.5
16 mm	16.0_{h7}	16.0^{F7}	32.0

C - 1	Torque support via cylindrical pin (customer) Ø 6_{m6} to DIN EN ISO 8734
C - 2	Drive shaft (customer)
X - 1	7 pin plug connector MINITEC, (3x), M14
A	Direction of view on encoder (used to define the direction of rotation)

PIN and wire allocation Profibus DP (In/Out)

PIN	Signal	Explanation
1	RTS	Request To Send [2]
2	A	Profibus DP A line
3	N. C.	Not connected
4	B	Profibus DP B line
5	2M	0 V (potential free) [1]
6	2P5	+ 5 V (potential free) [1]
7	N. C.	Not connected

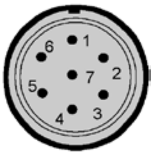


[1] Use for external bus termination or to supply the transmitter/receiver of an optical fibre transmission link.

[2] Signal is optional, is used to detect the direction of an optical fibre connection.

PIN and wire allocation U_S

PIN	Signal	Explanation
1	U_S (24 V)	Supply voltage
2	N. C.	Not connected
3	GND (0 V)	0 V (Gnd)
4	N. C.	Not connected
5	RTS	Request To Send [2]
6	N. C.	Not connected
7	N. C.	Not connected



[2] Signal is optional, is used to detect the direction of an optical fibre connection.

N. C. = Not connected

Technical data according to DIN 32878	ATM90 Profibus connector radial	**Flange type** through
Hollow shaft diameter	12, 16 mm, 1/2"	▨
Mass	Approx. 0.6 kg	▨
Moment of inertia of the rotor	153 gcm^2	▨
Measuring step	0.043 °	▨
Max. number of steps per revolution	8,192	▨
Max. number of revolutions	8,192	▨
Error limits	± 0.25 °	▨
Repeatability	0.1 °	▨
Operating speed	3,000 min^{-1}	▨
Position forming time	0.25 ms	▨
Max. angular acceleration	0.6 x 10^5 rad/s^2	▨
Operating torque	0.4 Ncm	▨
Start up torque	0.5 Ncm	▨
Bearing lifetime	3.6 x 10^9 revolutions	▨
Working temperature range	– 20 ... + 80 °C	▨
Storage temperature range	– 40 ... + 125 °C	▨
Permissible relative humidity	98 %	▨
EMC [1]		▨
Resistance		
to shocks [2]	100/6 g/ms	▨
to vibration [3]	20/10 ... 2000 g/Hz	▨
Protection class acc. IEC 60529		
with shaft seal	IP 65	▨
Operating voltage range (Us)	10 ... 32 V	▨
Power consumption	2.0 W	▨
Initialisation time [4]	1250 ms	▨
Bus Interface Profibus DP		
Electrical Interface [5]	RS 485	▨
Protocol	Profile for Encoders (07$_{hex}$) – Class 2	▨
Address setting (node number)	0 ... 127 (DIP switches or protocol)	▨
Data transmission rate (baud rate)	9.6 kBaud - 12 MBaud	▨
	automatic detection	▨
Electronic adjustment (number SET)	Via PRESET push button or protocol	▨
Status information	Operation (green LED), bus activity (red LED)	▨
Bus termination [6]	Via DIP switches	▨
Electrical connection	M14 plug connector (7 pin)	▨

[1] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[2] To DIN EN 60068-2-27

[3] To DIN EN 60068-2-6

[4] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

[5] To EN 50 170-2 (DIN 19245 part 1-3) DC isolated via opto-couplers

[6] Should only be connected in the final device

Order information

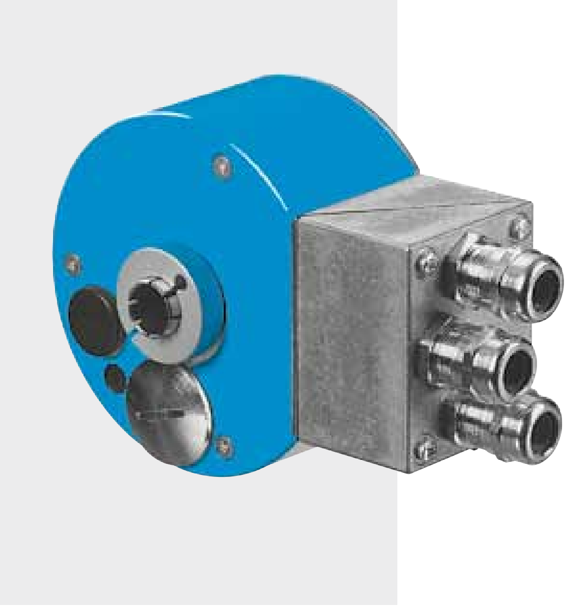
ATM90 Profibus through hollow shaft; connector radial; U_s 10 ... 32 V

Type	Part no.	Explanation
ATM90-PTF13X13	1030042	Through hollow Ø 12 mm, 3 x M14, 8.192 x 8.192
ATM90-PUF13X13	1030043	Through hollow Ø 1/2", 3 x M14, 8.192 x 8.192
ATM90-PXF13X13	1030044	Through hollow Ø 16 mm, 3 x M14, 8.192 x 8.192
ATM90-PTF13X11	1032654	Through hollow Ø 12 mm, 3 x M14, 8.192 x 2.048
ATM90-PUF13X11	1032655	Through hollow Ø 1/2", 3 x M14, 8.192 x 2.048
ATM90-PXF13X11	1032656	Through hollow Ø 16 mm, 3 x M14, 8.192 x 2.048
ATM90-PTF12X12	1032660	Through hollow Ø 12 mm, 3 x M14, 4.096 x 4.096
ATM90-PUF12X12	1032661	Through hollow Ø 1/2", 3 x M14, 4.096 x 4.096
ATM90-PXF12X12	1032662	Through hollow Ø 16 mm, 3 x M14, 4.096 x 4.096
ATM90-PTF11X13	1032896	Through hollow Ø 12 mm, 3 x M14, 2.048 x 8.192
ATM90-PUF11X13	1032897	Through hollow Ø 1/2", 3 x M14, 2.048 x 8.192
ATM90-PXF11X13	1032898	Through hollow Ø 16 mm, 3 x M14, 2.048 x 8.192

Resolution up to 26 bits

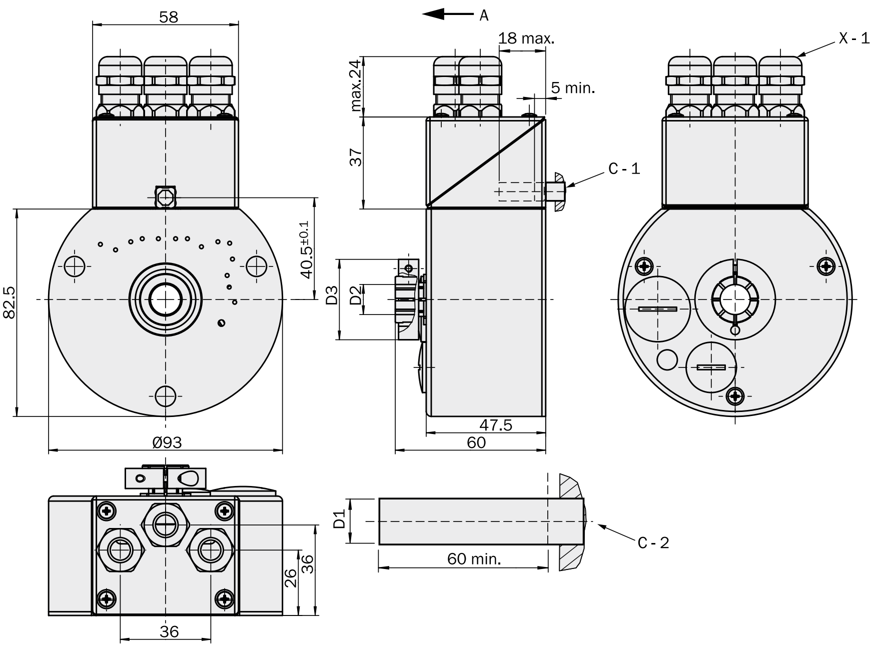
Absolute Encoders Multiturn

- Extremely robust
- RS 485 bus coupling to Profibus DP Specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 65



Accessories – see pages 410-448

Dimensional drawing through hollow shaft cable radial



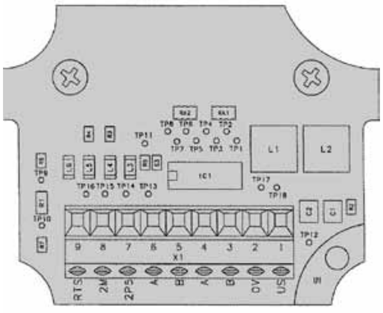
General tolerances according DIN ISO 2768-mk

Through hollow shaft	D1	D2	D3
12 mm	12.0_{h7}	12.0^{F7}	29.5
$^1/_2$“	12.7_{h7}	12.7^{F7}	29.5
16 mm	16.0_{h7}	16.0^{F7}	32.0

C - 1	Torque support via cylindrical pin (customer) Ø 6_{m6} to DIN EN ISO 8734
C - 2	Drive shaft (customer)
X - 1	3x screw fixings for cable connection, metric M16 x 1.5, 17
A	Direction of view on encoder (used to define the direction of rotation)

PIN and wire allocation for Profibus adapter

PIN	Signal	Explanation
1	U_S (24 V)	Supply voltage
2	GND (0 V)	0 V (Gnd)
3	B	Profibus DP B line (out)
4	A	Profibus DP A line (out)
5	B	Profibus DP B line (in)
6	A	Profibus DP A line (in)
7	2P5	+ 5 V (potential free) [1]
8	2M	0 V (potential free) [1]
9	RTS	Request To Send [2]



[1] Use for external bus termination or to supply the transmitter/receiver of an optical transmission link.

[2] Signal is optional, used to detect the direction of an optical connection.

Technical data according to DIN 32878	ATM90 Profibus with bus adapter	**Flange type** through
Hollow shaft diameter	12, 16 mm, 1/2”	▨
Mass	Approx. 0.8 kg	▨
Moment of inertia of the rotor	153 gcm^2	▨
Measuring step	0.043°	▨
Max. number of steps per revolution	8,192	▨
Max. number of revolutions	8,192	▨
Error limits	± 0.25°	▨
Repeatability	0.1°	▨
Operating speed	3,000 min^{-1}	▨
Position forming time	0.25 ms	▨
Max. angular acceleration	0.6 x 10^5 rad/s^2	▨
Operating torque	0.4 Ncm	▨
Start up torque	0.5 Ncm	▨
Bearing lifetime	3.6 x 10^9 revolutions	▨
Working temperature range	– 20 ... + 80 °C	▨
Storage temperature range	– 40 ... + 125 °C	▨
Permissible relative humidity	98 %	▨
EMC [1]		▨
Resistance		
to shocks [2]	100/6 g/ms	▨
to vibration [3]	20/10 ... 2000 g/Hz	▨
Protection class acc. IEC 60529		
with shaft seal	IP 65	▨
Operating voltage range (Us)	10 ... 32 V	▨
Power consumption	2.0 W	▨
Initialisation time [4]	1250 ms	▨
Bus Interface Profibus DP		
Electrical Interface [5]	RS 485	▨
Protocol	Profile for Encoders (07$_{hex}$) – Class 2	▨
Address setting (node number)	DIP switches or protocol	▨
Data transmission rate (baud rate)	9.6 kBaud - 12 MBaud	▨
	Automatic detection	▨
Electronic adjustment (number SET)	Via PRESET push button or protocol	▨
Status information	Operation (green LED), bus activity (red LED)	▨
Bus termination [6]	Via DIP switches	▨
Electrical connection	Screw fixing for cable (3x)	▨

Order information

ATM90 Profibus through hollow shaft; cable radial; U$_S$ 10 ... 32 V

Type	**Part no.**	**Explanation**
ATM90-PTG13X13	1030045	Through hollow Ø 12 mm, 3 x PG, 8.192 x 8.192
ATM90-PUG13X13	1030046	Through hollow Ø 1/2“, 3 x PG, 8.192 x 8.192
ATM90-PXG13X13	1030047	Through hollow Ø 16 mm, 3 x PG, 8.192 x 8.192
ATM90-PTG13X11	1032657	Through hollow Ø 12 mm, 3 x PG, 8.192 x 2.048
ATM90-PUG13X11	1032658	Through hollow Ø 1/2“, 3 x PG, 8.192 x 2.048
ATM90-PXG13X11	1032659	Through hollow Ø 16 mm, 3 x PG, 8.192 x 2.048
ATM90-PTG12X12	1032663	Through hollow Ø 12 mm, 3 x PG, 4.096 x 4.096
ATM90-PUG12X12	1032664	Through hollow Ø 1/2“, 3 x PG, 4.096 x 4.096
ATM90-PXG12x12	1032665	Through hollow Ø 16 mm, 3 x PG, 4.096 x 4.096
ATM90-PTG11x13	1032899	Through hollow Ø 12 mm, 3 x PG, 2.048 x 8.192
ATM90-PUG11x13	1032900	Through hollow Ø 1/2“, 3 x PG, 2.048 x 8.192
ATM90-PXG11x13	1032901	Through hollow Ø 16 mm, 3 x PG, 2.048 x 8.192

Attention: Bus adapter included

[1] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[2] To DIN EN 60068-2-27

[3] To DIN EN 60068-2-6

[4] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

[5] To EN 50 170-2 (DIN 19245 part 1-3) DC isolated via opto-couplers

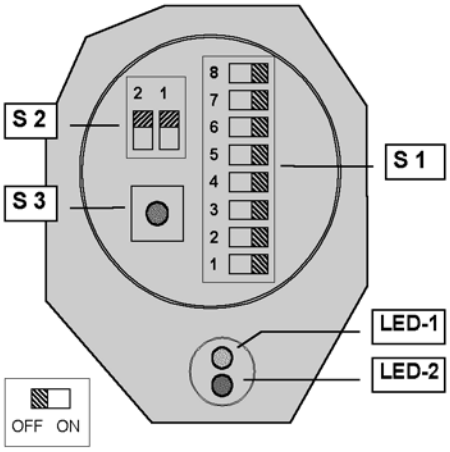
[6] Should only be connected in the final device

Resolution up to 26 bits

Absolute Encoders Multiturn

- Extremely robust
- RS 485 bus coupling to Profibus DP Specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 65

Switch settings



Switch settings

Access to the DIP switches used for configuring the encoder can be gained by removing the screw on the back of the encoder.

S 1 (1-7)	Address setting (0 ... 127)
S 1 (8-8)	Counting direction (CW/CCW)
S 2	Bus termination
S 3	Preset push button (Number SET)

In the version with a cable connection, the switches S1 and S2 are located inside the bus adapter.

Status information via LEDs

LED-1	Operating voltage (green)
LED-2	Bus activity (red)

Accessories – see pages 410-448

Implementation

DP Functionalities

in accordance with the Profibus DP basic functions.

DP services
- Data interchange (Write_Read_Data)
- Address allocation (Set_Slave_Address)
- Control commands (Global_Control)
- Read the inputs (Read_Inputs)
- Read the outputs (Read_Outputs)
- Read diagnostic data (Slave_Diagnosis)
- Send configuration data (Set_Param)
- Check configuration data (Chk_Config)

Communication
- Cyclic master – slave data traffic

Protective mechanisms
- Data transfer with HD = 4
- Time monitoring of the data traffic

Configuration

Settings in accordance with Encoder Profile
- Counting direction (CW, CCW)
- Class 2 functionality (ON, OFF)
- Scaling function (ON, OFF)
- Steps per turn (1 ... 8,192)
- Total resolution (TR) -- 1...6,108,864 steps, with TR = 2^n x CPR -- (n = 0 ... 13)
- “Activation of SSA-service” 2)
- Selection of the station address 2)

Configuration

Setting the data format (Cx) for the cyclic data interchange (In/Out) via configuration byte (K-1).

C1 1) 2 Word (IO) (I-1/O-1)
C2 2) 4 Word (IO) (I-1, I-2, I-3/O-1)

Data interchange: - Input Data (IN)

I-1	Position value 1)	4 bytes
I-2	Speed (rev/min) 2)	2 bytes
I-3	Time stamp 2)	2 bytes

Data interchange: - Output data (OUT)

O-1	PRESET Value 1)	4 bytes

Diagnostic information

- Station-related diagnosis (63 bytes in acc. with Encoder Profile Class 2)

Setting: - PRESET value

The PRESET function is used for set into operation and to allocate a specific position value to the current physical angular position.
The following settings are possible:
- by hardware (PRESET push button: S3)
- by software: -- (see Output data)

Setting: - Counting direction

- by hardware via DIP switch S1-(8)
- by software via Telegram

Counting direction increasing:
Rotation of the shaft in the clockwise direction (CW) as viewed on the shaft.

Setting: - Station address

- by hardware via DIP switch S1
- by software via Telegram

The setting by software is carried out only if the “SSA-service” has been previously activated.

Setting: - Bus termination

The 2-way DIP switch (S2) permits an internal bus termination to be switched in and out (ON/OFF).
If the bus is terminated externally, switch S2 must be in the OFF position.

Device-specific file (GS.)

For the purpose of automatic set into operation of the encoder, use is made of the GS file.
All the characteristic features of the device are defined in it.

STEG 00FE.GSD	German
STEG 00FE.GSE	English
STEG 00FE.GSF	French

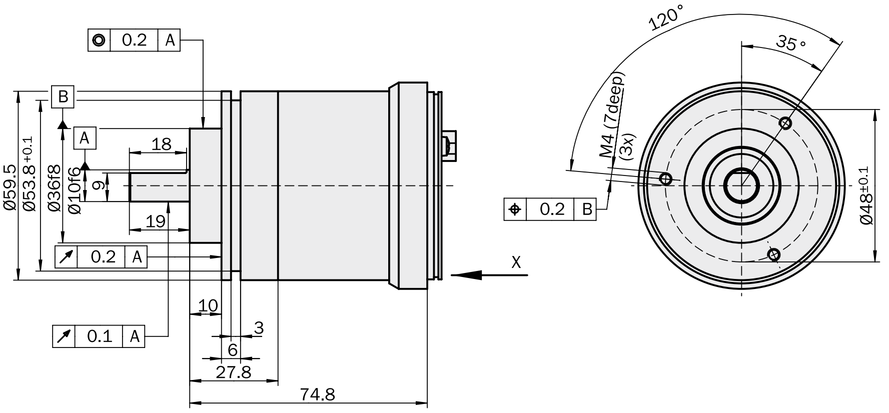
1) As per Encoder Profile
2) Manufacturer specific function

Resolution up to 26 bits

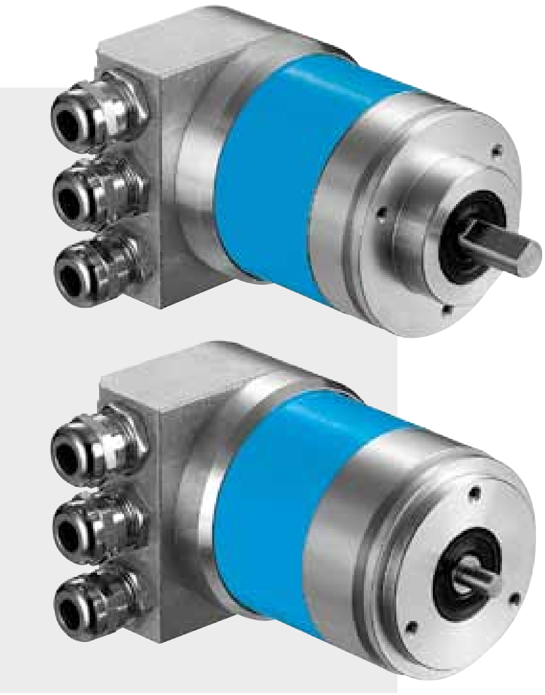
Absolute Encoders Multiturn

- Extremely robust
- Bus coupling to CAN-High speed specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67

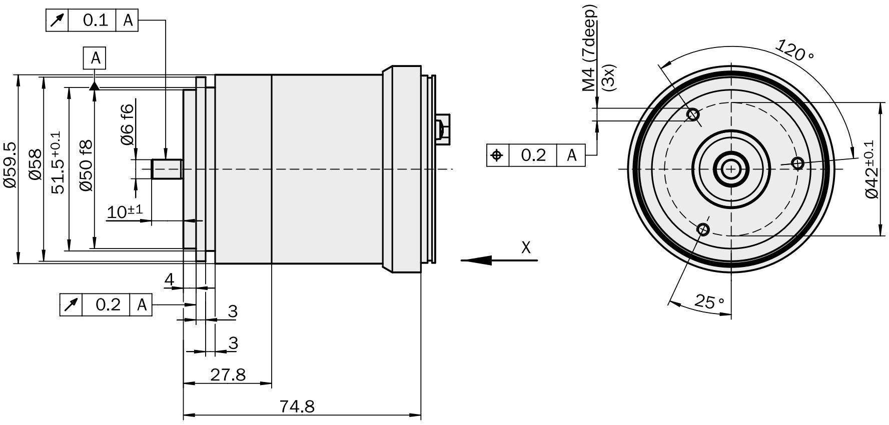
Dimensional drawing face mount flange



General tolerances according DIN ISO 2768-mk



Dimensional drawing servo flange



General tolerances according DIN ISO 2768-mk

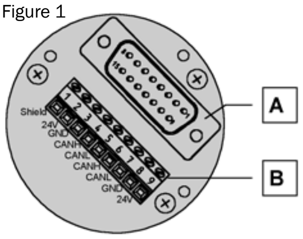
① PIN and wire allocation for bus adapter

Terminal strip	② Connector	Signal	Explanation
1	1	Shield	Screen
2	2	U_S (24 V)	Supply voltage 10 ... 32 V
3	3	GND (COM)	0V (Gnd)
4	4	CAN$_H$	CAN Bus Signal HIGH
5	5	CAN$_L$	CAN Bus Signal LOW
6		CAN$_H$	CAN Bus Signal HIGH
7		CAN$_L$	CAN Bus Signal LOW
8		GND (COM)	0V (Gnd)
9		U_S (24 V)	Supply voltage 10 ... 32 V

① Encoders with a CANbus adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the Profibus adapter is unscrewed from the complete device. The figure 1 shows the pin allocation within the bus connection.

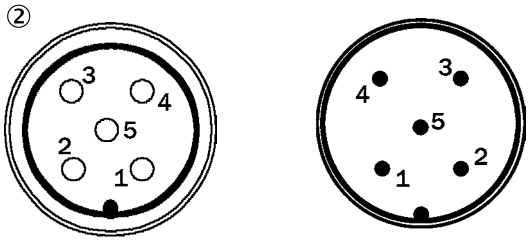
Accessories – see pages 410-448

Figure 1



A Internal plug connection to the encoder
B External connection to the bus

②



OUT/U_S (female) IN/U_S (male)
Connector M12 (Bus adapter)

Technical data according to DIN 32878	ATM60 CANopen	**Flange type**	
		face m.	servo
Solid shaft	10 mm	■	
	6 mm		■
Mass	Approx. 0.59 kg	■	■
Moment of inertia of the rotor	35 gcm^2	■	■
Measuring step	0.043°	■	■
Max. number of steps per revolution	8,192	■	■
Max. number of revolutions	8,192	■	■
Error limits	± 0.25°	■	■
Repeatability	0.1°	■	■
Operating speed	6,000 min^{-1}	■	■
Position forming time	0.25 ms	■	■
Max. angular acceleration	5 x 10^5 rad/s^2	■	■
Operating torque			
with shaft seal	1.8 Ncm	■	■
without shaft seal 1)	0.3 Ncm	■	■
Start up torque			
with shaft seal	2.5 Ncm	■	■
without shaft seal 2)	0.5 Ncm	■	■
Max. shaft loading			
radial	300 N	■	■
axial	50 N	■	■
Bearing lifetime	3.6 x 10^9 revolutions	■	■
Working temperature range	– 20 ... + 80 °C	■	■
Storage temperature range	– 40 ... + 125 °C	■	■
Permissible relative humidity	98 %	■	■
EMC 2)		■	■
Resistance			
to shocks 3)	100/6 g/ms	■	■
to vibration 4)	20/10 ... 2000 g/Hz	■	■
Protection class acc. IEC 60529			
with shaft seal	IP 67	■	■
without shaft seal 5)	IP 43	■	■
without shaft seal 6)	IP 66	■	■
Operating voltage range (Us)	10 ... 32 V	■	■
Power consumption	2.0 W	■	■
Initialisation time 7)	1250 ms	■	■
Bus Interface CANopen			
Electrical interface 8)	ISO-DIS 11898	■	■
Protocol	Communication Profile DS 301 V4.0	■	■
	Device Profile DSP 406 V2.0	■	■
Address setting (NODE ID)	0 ... 63 (DIP switches or protocol)	■	■
Data transmission rate (Baudrate)	{10, 20, 50, 125, 250, 500} kB, 1MB	■	■
	(DIP switches or protocol)	■	■
Electronic adjustment (number SET)	Via PRESET push button or protocol	■	■
Status Information	2-colour LED for CAN Controller status	■	■
Bus termination 9)	Via DIP switches	■	■
Electrical connection	Screw fixing with PG-9 for cable	■	■

1) In case that shaft seal has been removed by customer

2) To DIN EN 61000-6-2 and DIN EN 61000-6-3

3) To DIN EN 60068-2-27

4) To DIN EN 60068-2-6

5) Not sealed at encoder flange

6) Sealed at encoder flange

7) From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

8) (CAN High Speed) and CAN Specification 2.0 B, DC isolated

9) Should only be connected in the final device

Order information

ATM60 CANopen face mount and servo flange; solid shaft; U$_s$ 10 ... 32 V

Type	**Part no.**	**Explanation**
ATM60-C4H13X13	1030024	Face mount solid shaft Ø 10 mm
ATM60-C1H13X13	1030025	Servo flange solid shaft Ø 6 mm

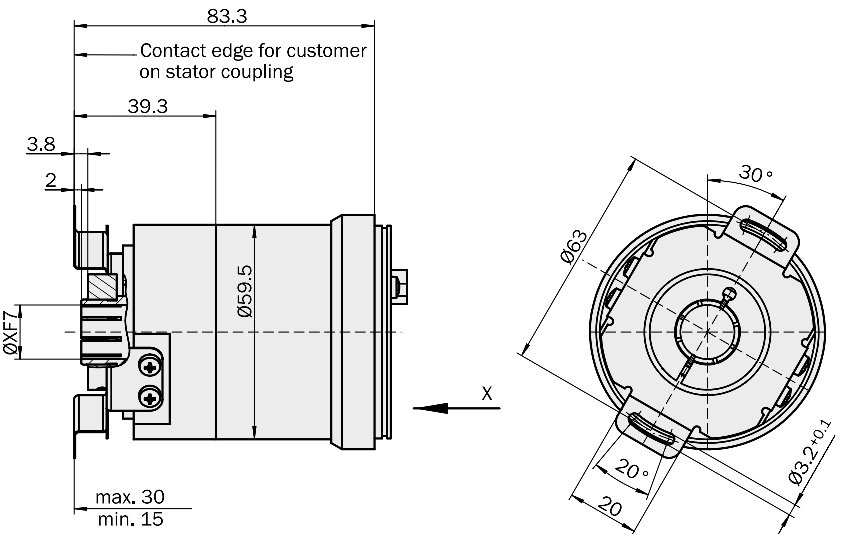
Attention: Please order the CANbus adapter separately (see accessories section)

Resolution up to 26 bits

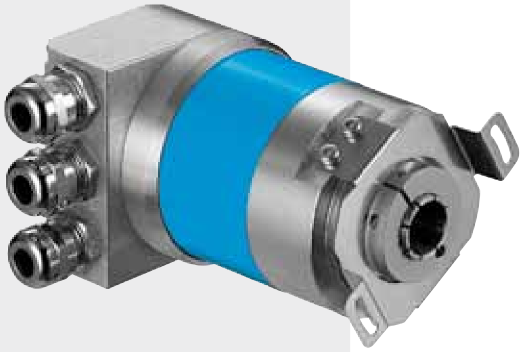
Absolute Encoders Multiturn

- Extremely robust
- Bus coupling to CAN-High speed specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67

Dimensional drawing blind hollow shaft



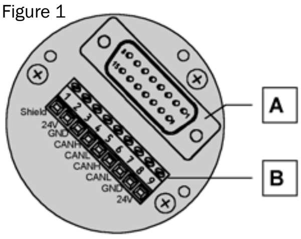
General tolerances according DIN ISO 2768-mk



① **PIN and wire allocation for bus adapter**

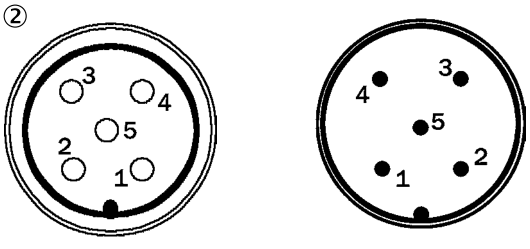
Terminal strip	② Connector	Signal	Explanation
1	1	Shield	Screen
2	2	U_S (24 V)	Supply voltage 10 ... 32 V
3	3	GND (COM)	0V (Gnd)
4	4	CAN$_H$	CAN Bus Signal HIGH
5	5	CAN$_L$	CAN Bus Signal LOW
6		CAN$_H$	CAN Bus Signal HIGH
7		CAN$_L$	CAN Bus Signal LOW
8		GND (COM)	0V (Gnd)
9		U_S (24 V)	Supply voltage 10 ... 32 V

Figure 1



A Internal plug connection to the encoder
B External connection to the bus

②



OUT/U_S (female) IN/U_S (male)

Connector M12 (Bus adapter)

① Encoders with a CANbus adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the Profibus adapter is unscrewed from the complete device. The figure 1 shows the pin allocation within the bus connection.

Accessories – see pages 410-448

Technical data according to DIN 32878	ATM60 CANopen	Flange type blind
① **Hollow shaft diameter**	6, 8, 10, 12, 15 mm, 1/4”, 3/8”, 1/2”	▨
Mass	Approx. 0.59 kg	▨
Moment of inertia of the rotor	55 gcm^2	▨
Measuring step	0.043°	▨
Max. number of steps per revolution	8,192	▨
Max. number of revolutions	8,192	▨
Error limits	± 0.25°	▨
Repeatability	0.1°	▨
Operating speed	3,000 min^{-1}	▨
Position forming time	0.25 ms	▨
Max. angular acceleration	5 x 10^5 rad/s^2	▨
Operating torque	0.8 Ncm 1)	▨
Start up torque	1.2 Ncm 1)	▨
Permissible shaft movement		
of the drive element		
radial static/dynamic	± 0.3/± 0.1 mm	▨
axial static/dynamic	± 0.5/± 0.2 mm	▨
Bearing lifetime	3.6 x 10^9 revolutions	▨
Working temperature range	– 20 … + 80 °C	▨
Storage temperature range	– 40 … + 125 °C	▨
Permissible relative humidity	98 %	▨
EMC 2)		▨
Resistance		
to shocks 3)	100/6 g/ms	▨
to vibration 4)	20/10 … 2000 g/Hz	▨
Protection class acc. IEC 60529 1)	IP 67	▨
without shaft seal 5)	IP 43	▨
Operating voltage range (Us)	10 … 32 V	▨
Power consumption	2.0 W	▨
Initialisation time 6)	1250 ms	▨
Bus Interface CANopen		
Electrical interface 7)	ISO-DIS 11898	▨
Protocol	Communication Profile DS 301 V4.0	▨
	Device Profile DSP 406 V2.0	▨
Address setting (NODE ID)	0 … 63 (DIP switches or protocol)	▨
Data transmission rate (Baudrate)	{10, 20, 50, 125, 250, 500} kB, 1MB	▨
	(DIP switches or protocol)	▨
Electronic adjustment (number SET)	Via PRESET push button or protocol	▨
Status Information	2-colour LED for CAN Controller status	▨
Bus termination 8)	Via DIP switches	▨
Electrical connection	Screw fixing with PG-9 for cable	▨

1) With shaft seal

2) To DIN EN 61000-6-2 and DIN EN 61000-6-3

3) To DIN EN 60068-2-27

4) To DIN EN 60068-2-6

5) Not sealed at encoder flange

6) From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

7) (CAN High Speed) and CAN Specification 2.0 B, DC isolated

8) Should only be connected in the final device

Order information

ATM60 CANopen blind hollow shaft; U$_s$ 10 … 32 V

Type	Part no.	Explanation
ATM60-CAH13X13	1030026	Blind hollow shaft

Attention: Please order the CANbus adapter separately (see accessories section)

① Attention: Please order the collet with required diameter separately

Type	Part no.	Shaft diameter
SPZ-006-AD-A	2029174	6 mm
SPZ-1E4-AD-A	2029175	$^{1}/_{4}$“
SPZ-008-AD-A	2029176	8 mm
SPZ-3E8-AD-A	2029177	$^{3}/_{8}$“
SPZ-010-AD-A	2029178	10 mm
SPZ-012-AD-A	2029179	12 mm
SPZ-1E2-AD-A	2029180	$^{1}/_{2}$“
SPZ-014-AD-A	2048863	14 mm

For 15 mm shaft diameter, collet is not needed

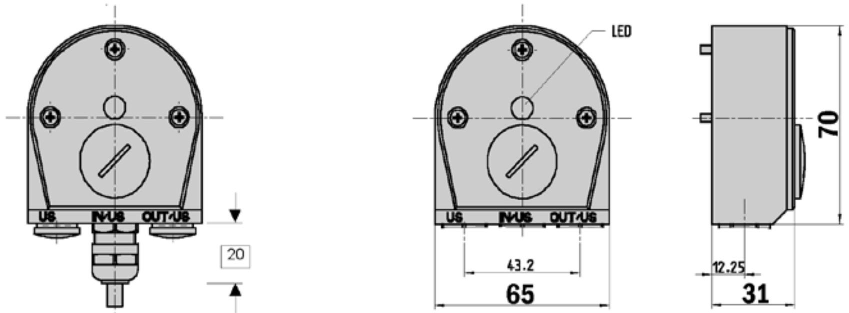
Resolution up to 26 bits

Absolute Encoders Multiturn

- Extremely robust
- Bus coupling to CAN-High speed specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67

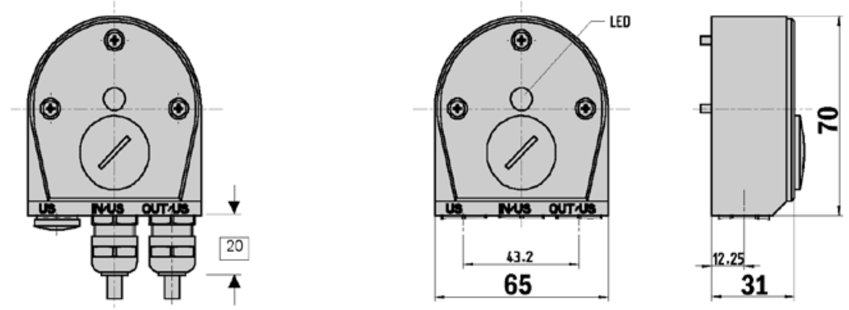
Accessories – see pages 410-448

Dimensional drawing CANopen adapter KR1



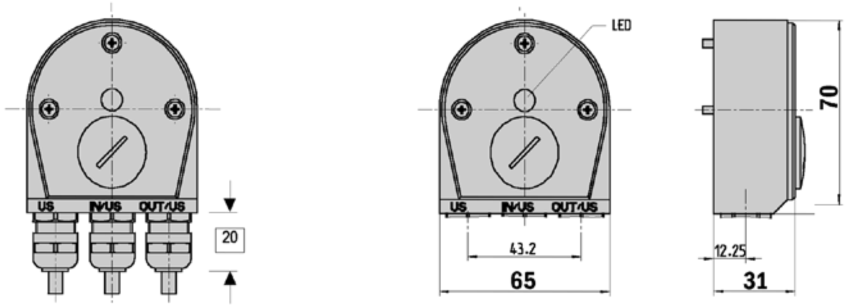
General tolerances according DIN ISO 2768-mk

Dimensional drawing CANopen adapter KR2



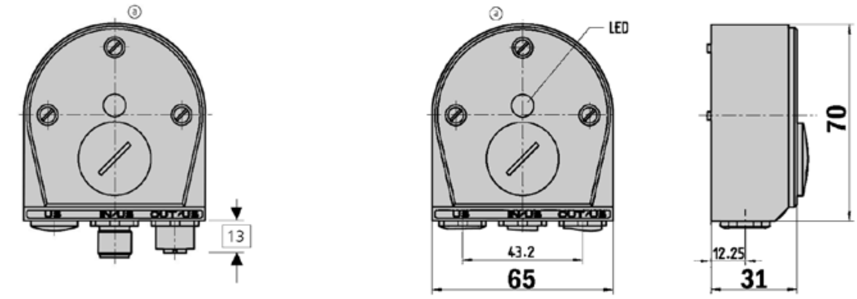
General tolerances according DIN ISO 2768-mk

Dimensional drawing CANopen adapter KR3



General tolerances according DIN ISO 2768-mk

Dimensional drawing CANopen adapter SR2



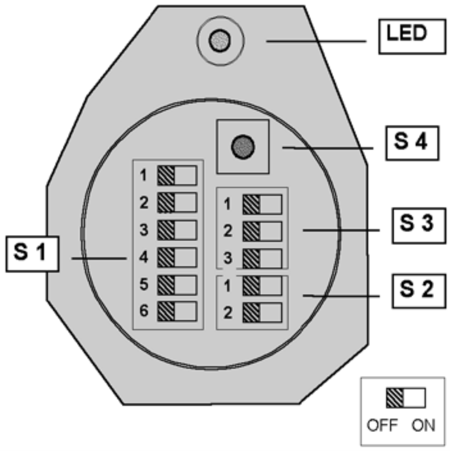
General tolerances according DIN ISO 2768-mk

Order information

ATM60 CANopen adapter

Type	Part no.	Explanation
AD-ATM60-KR1CO	2029230	Bus adapter KR1, 1 x PG
AD-ATM60-KR2CO	2029231	Bus adapter KR2, 2 x PG
AD-ATM60-KR3CO	2029232	Bus adapter KR3, 3 x PG
AD-ATM60-SR2CO	2020935	Bus adapter SR2, 2 x M12, 5 pin.
AD-ATM60-SR1CO	2031686	Bus adapter SR1, 1 x M12, 5 pin.

Switch settings



Switch settings

Access to the switches is gained by opening the removable screw cap (PG) on the rear of the bus adapter. Use of the following elements.

S 1	Address setting (Node ID)
S 2	Bus termination
S 3	Baud rate setting (Data Rate)
S 4	Preset push button (Number zero SET)

Status information via LED

LED	2-colour red/green
	CAN Controller status

Implementation

CANopen Functionality

Predefined Connection Set

- Sync Object
- Emergency Object
- NMT Network Object (Error Control services, Boot-Up service)
- One Service Data Object (SDO)
- Two Process Data Object (PDO)

I/O-Operating Modes

- Synchronic: -- Depends on Sync Object
- Asynchronous. -- No reference to Sync Object. Triggered by “Timer” (Cyclic) or by event (COS)
- Remote Transmission (RTR)

Encoder Parameters

according the Device Profile for Encoders:

- Code direction (CW, CCW)
- Scaling function (ON, OFF)
- PRESET value
- Steps per revolution (CPR) - 1 ... 8,192
- Total resolution (TR) -- 1 ... 67,108,864 steps, with TR = 2^n x CPR -- (n = 0 ... 13)
- Limits for the working range
- Cycle Timer for asynchronous PDOs
- 8 programmable cams with HIGH/LOW limits and hysteresis
- General Diagnostic parameters (Offset Value, Alarms, Warnings, version of profile and software)

Manufacturer specific Profile:

- Node commissioning. -- Location and values for Node-ID and Baud rate
- Hysteresis to position change required for Async PDOs with COS mode
- Limits and display format for the speed and acceleration values

PDO Data Mapping

Mapping of up to four data objects to each of the two Transmit PDOs. The resulting data length within one PDO is limited to 8 Byte.

(1)	Object 1/Pos Val1)	I-1
(n)	Object 2 ... Object 4	I-1 to I-7

Input Data Objects

I-1	Position value [Pos Val]	4 Byte
I-2	Status of cam	1 Byte
I-3	Status of working range	1 Byte
I-4	Alarms	1 Byte
I-5	Warnings	1 Byte
I-6	Speed value	4 Byte
I-7	Acceleration value	4 Byte

Setting: - Address (Node ID)

0 to 63 by Hardware (DIP Switch) or EEPROM

Setting: - Baud rate

10kb, 20kb, 50kb, 125kb, 250kb, 500kb, 1 MB by Hardware (DIP Switch) or EEPROM

Setting: - Bus Termination

The DIP-Switch (S2) is used to switch on/off an internal bus termination (ON/OFF). Not used (OFF) in case of using an external termination of the network

Setting: - PRESET Value

The Preset function supports adaptation of the encoder zero point to the mechanical zero point of the encoder system. The factory PRESET value is zero [0]

The adjustment is carried out in 2 ways:

- by Hardware (PRESET push button)
- by Software (CANopen Protocol)

Equipment Configuration

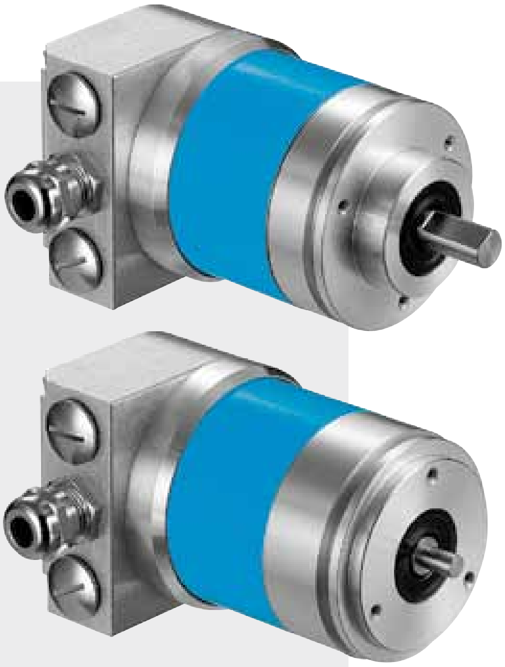
Configuring parameters of the encoder can be achieved by a configuration tool in conjunction with an EDS file (Electronic Data Sheet). It contains all the characteristics of the encoder.

1) Default Setting

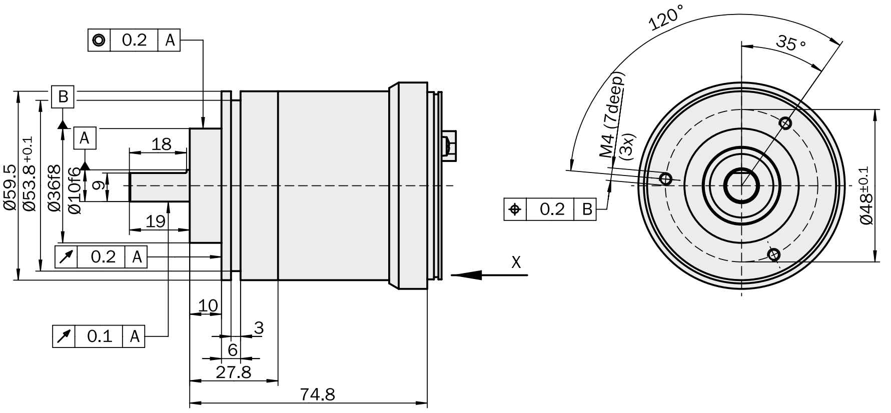
Resolution up to 26 bits

Absolute Encoders Multiturn

- Extremely robust
- Bus coupling to CAN-High speed specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67

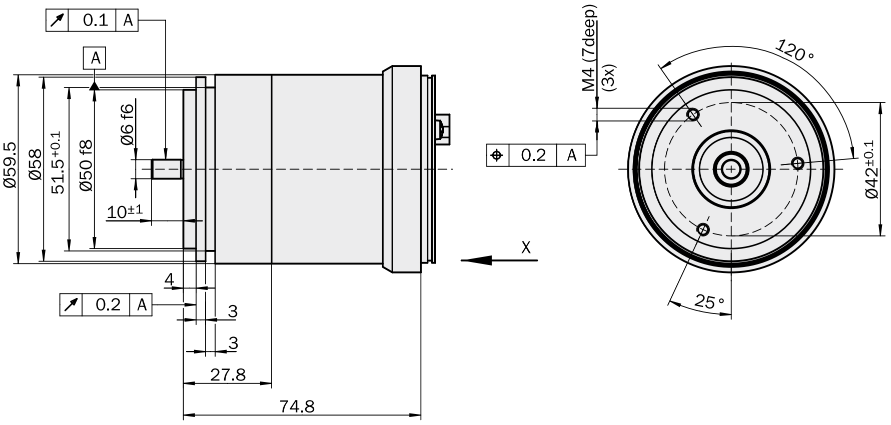


Dimensional drawing face mount flange



General tolerances according DIN ISO 2768-mk

Dimensional drawing servo flange



General tolerances according DIN ISO 2768-mk

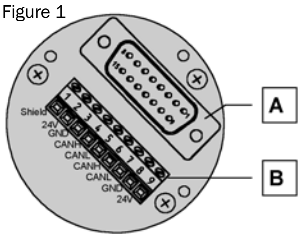
① PIN and wire allocation for bus adapter

Terminal strip	② Connector	Signal	Explanation
1	1	Shield	Screen
2	2	U_S (24 V)	Supply voltage 10 ... 32 V
3	3	GND (COM)	0V (Gnd)
4	4	CAN$_H$	CAN Bus Signal HIGH
5	5	CAN$_L$	CAN Bus Signal LOW
6		CAN$_H$	CAN Bus Signal HIGH
7		CAN$_L$	CAN Bus Signal LOW
8		GND (COM)	0V (Gnd)
9		U_S (24 V)	Supply voltage 10 ... 32 V

① Encoders with a DeviceNet adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the DeviceNet adapter is unscrewed from the complete device. The figure 1 shows the pin allocation within the bus connection.

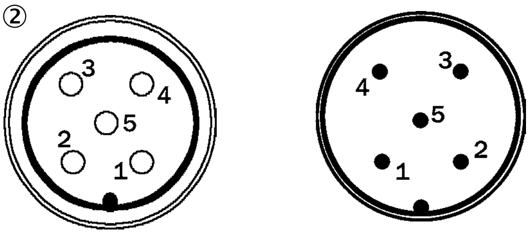
Accessories – see pages 410-448

Figure 1



A Internal plug connection to the encoder
B External connection to the bus

②



OUT/U_S (female) IN/U_S (male)

Connector M12 (Bus adapter)

Technical data according to DIN 32878	ATM60 DeviceNet	**Flange type**	
		face m.	servo
Solid shaft	10 mm	■	
	6 mm		■
Mass	Approx. 0.59 kg	■	■
Moment of inertia of the rotor	35 gcm^2	■	■
Measuring step	0.043°	■	■
Max. number of steps per revolution	8,192	■	■
Max. number of revolutions	8,192	■	■
Error limits	± 0.25°	■	■
Repeatability	0.1°	■	■
Operating speed	6,000 min^{-1}	■	■
Position forming time	0.25 ms	■	■
Max. angular acceleration	5 x 10^5 rad/s^2	■	■
Operating torque	1.8 Ncm [1]	■	■
without shaft seal [1]	0.3 Ncm	■	■
Start up torque	2.5 Ncm [1]	■	■
without shaft seal [2]	0.5 Ncm	■	■
Max. shaft loading			
radial	300 N	■	■
axial	50 N	■	■
Bearing lifetime	3.6 x 10^9 revolutions	■	■
Working temperature range	– 20 ... + 80 °C	■	■
Storage temperature range	– 40 ... + 125 °C	■	■
Permissible relative humidity	98 %	■	■
EMC [3]		■	■
Resistance			
to shocks [4]	100/6 g/ms	■	■
to vibration [5]	20/10 ... 2000 g/Hz	■	■
Protection class acc. IEC 60529		■	■
with shaft seal	IP 67	■	■
without shaft seal [6]	IP 43	■	■
without shaft seal [7]	IP 66	■	■
Operating voltage range (Us)	10 ... 32 V	■	■
Power consumption	2.0 W	■	■
Initialisation time [8]	1250 ms	■	■
Bus Interface DeviceNet			
Electrical interface [9]	ISO-DIS 11898	■	■
Protocol	DeviceNet Specification, Release 2.0	■	■
Address setting (NODE ID)	0 ... 63 (DIP switches or protocol)	■	■
Data transmission rate (Data Rate)	{125, 250, 500} kB	■	■
	(DIP switches or protocol)	■	■
Electronic adjustment (Number SET)	Via PRESET push button or protocol	■	■
Status Information	Network Status LED (NS), 2-colours	■	■
Bus Termination [10]	Via DIP switches	■	■
Electrical Connection	Bus adapter [11]	■	■

[1] With shaft seal

[2] In case that shaft seal has been removed by customer

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN IEN 60068-2-6

[6] Not sealed at encoder flange

[7] Sealed at encoder flange

[8] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

[9] (CAN High Speed) and CAN Specification 2.0 B, DC isolated

[10] Should only be connected in the final device

[11] For cable with PG 9 or connector (see bus adapter)

Order information

ATM60 DeviceNet face mount and servo flange solid shaft; U_s 10 ... 32 V

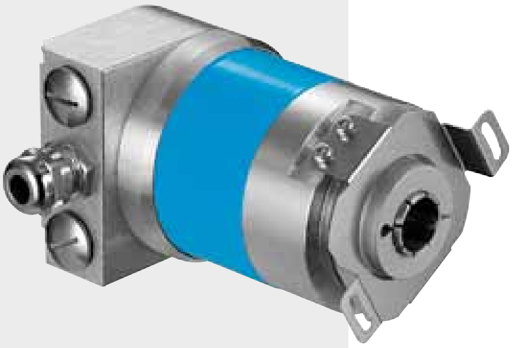
Type	**Part no.**	**Explanation**
ATM60-D4H13X13	1030017	Face mount solid shaft Ø 10 mm
ATM60-D1H13X13	1030018	Servo flange solid shaft Ø 6 mm

Attention: Please order the DeviceNet adapter separately (see accessories section)

Resolution up to 26 bits

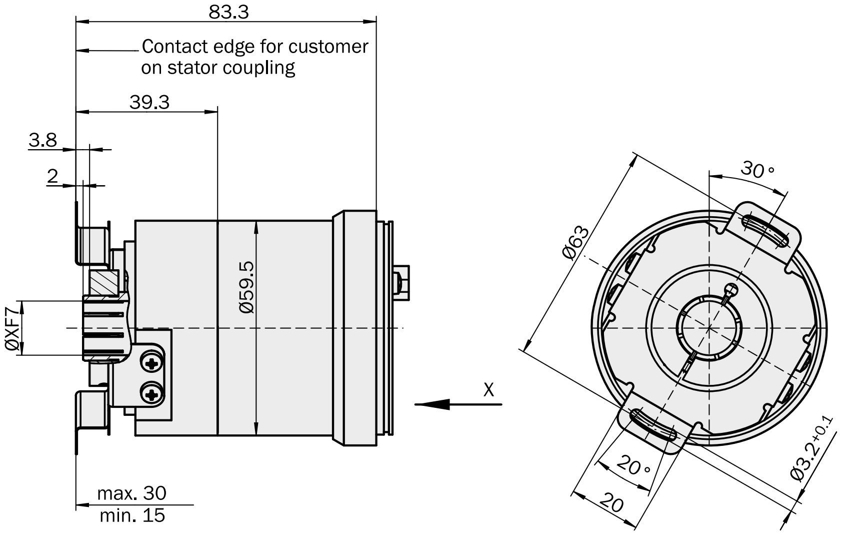
Absolute Encoders Multiturn

- Extremely robust
- Bus coupling to CAN-High speed specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67



Accessories – see pages 410-448

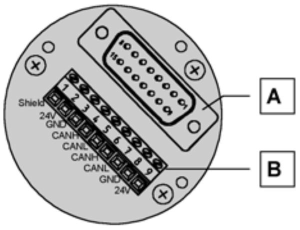
Dimensional drawing blind hollow shaft



General tolerances according DIN ISO 2768-mk

① PIN and wire allocation for bus adapter

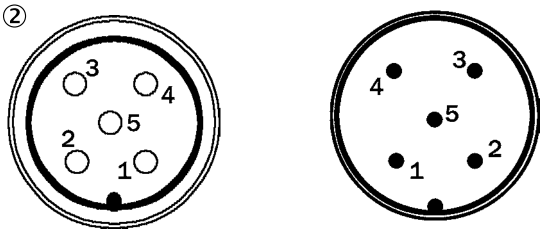
Terminal strip	② Connector	Signal	Explanation
1	1	Shield	Screen
2	2	U$_S$ (24 V)	Supply voltage 10 ... 32 V
3	3	GND (COM)	0V (Gnd)
4	4	CAN$_H$	CAN Bus Signal HIGH
5	5	CAN$_L$	CAN Bus Signal LOW
6		CAN$_H$	CAN Bus Signal HIGH
7		CAN$_L$	CAN Bus Signal LOW
8		GND (COM)	0V (Gnd)
9		U$_S$ (24 V)	Supply voltage 10 ... 32 V



① Encoders with a DeviceNet adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the DeviceNet adapter is unscrewed from the complete device. The figure shows the pin allocation within the bus connection.

A Internal plug connection to the encoder
B External connection to the bus

②



OUT/U$_S$ (female)   IN/U$_S$ (male)

Connector M12 (Bus adapter)

Technical data according to DIN 32878	ATM60 DeviceNet	**Flange type** blind
① **Hollow shaft diameter**	6, 8, 10, 12, 15 mm, 1/4", 3/8", 1/2"	▨
Mass	Approx. 0.59 kg	▨
Moment of inertia of the rotor	55 gcm^2	▨
Measuring step	0.043 °	▨
Max. number of steps per revolution	8,192	▨
Max. number of revolutions	8,192	▨
Error limits	± 0,25 °	▨
Repeatability	0.1 °	▨
Operating speed	3,000 min^{-1}	▨
Position forming time	0.25 ms	▨
Max. angular acceleration	5 x 10^5 rad/s^2	▨
Operating torque	0.8 Ncm 1)	▨
Start up torque	1.2 Ncm 1)	▨
Permissible shaft movement		
of the drive element		
radial static/dynamic	± 0.3/± 0.1 mm	▨
axial static/dynamic	± 0.5/± 0.2 mm	▨
Bearing lifetime	3.6 x 10^9 revolutions	▨
Working temperature range	– 20 ... + 80 °C	▨
Storage temperature range	– 40 ... + 125 °C	▨
Permissible relative humidity	98 %	▨
EMC 2)		▨
Resistance		
to shocks 3)	100/6 g/ms	▨
to vibration 4)	20 /10 ... 2000 g/Hz	▨
Protection class acc. IEC 60529 1)	IP 67	▨
without shaft seal 5)	IP 43	▨
Operating voltage range (Us)	10 ... 32 V	▨
Power consumption	2.0 W	▨
Initialisation time 6)	1250 ms	▨
Bus Interface DeviceNet		
Electrical interface 7)	ISO-DIS 11898	▨
Protocol	DeviceNet Specification, Release 2.0	▨
Address setting (NODE ID)	0 ... 63 (DIP switches or protocol)	▨
Data transmission rate (Data Rate)	{125, 250, 500} kB	▨
	(DIP switches or protocol)	▨
Electronic adjustment (Number SET)	Via PRESET push button or protocol	▨
Status Information	Network Status LED (NS), 2-colours	▨
Bus Termination 8)	Via DIP switches	▨
Electrical Connection	Bus adapter 9)	▨

---

1) With shaft seal

2) To DIN EN 61000-6-2 and DIN EN 61000-6-3

3) To DIN EN 60068-2-27

4) To DIN EN 60068-2-6

5) Not sealed at encoder flange

6) From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in

7) (CAN High Speed) and CAN Specification 2.0 B, DC isolated

8) Should only be connected in the final device

9) For cable with PG 9 or connector (see bus adapter)

Order information

ATM60 DeviceNet blind hollow shaft; U_s 10 ... 32 V

Type	**Part no.**	**Explanation**
ATM60-DAH13X13	1030019	Blind hollow shaft

Attention: Please order the DeviceNet adapter separately (see accessories section)

① **Attention: Please order the collet with required diameter separately**

Type	**Part no.**	**Shaft diameter**
SPZ-006-AD-A	2029174	6 mm
SPZ-1E4-AD-A	2029175	$^1/_4$“
SPZ-008-AD-A	2029176	8 mm
SPZ-3E8-AD-A	2029177	$^3/_8$“
SPZ-010-AD-A	2029178	10 mm
SPZ-012-AD-A	2029179	12 mm
SPZ-1E2-AD-A	2029180	$^1/_2$“
SPZ-014-AD-A	2048863	14 mm

For 15 mm shaft diameter, collet is not needed

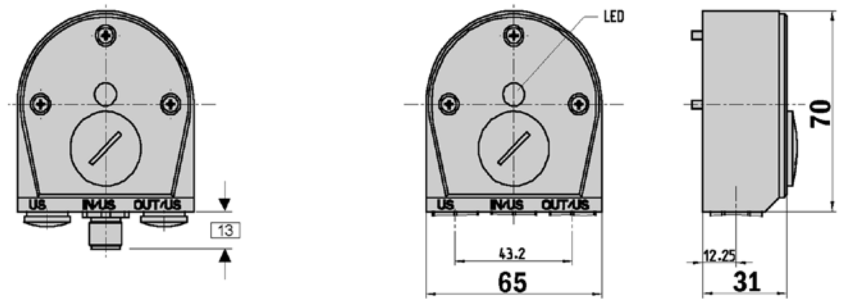
Resolution up to 26 bits

Absolute Encoders Multiturn

- Extremely robust
- Bus coupling to CAN-High speed specification
- Electronically adjustable, resolution adjustable
- Highly shock- and vibration-proof
- High degree of protection IP 67

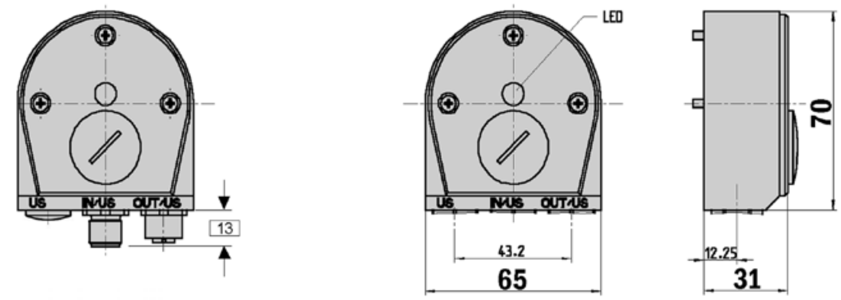
Accessories – see pages 410-448

Dimensional drawing DeviceNet adapter SR1



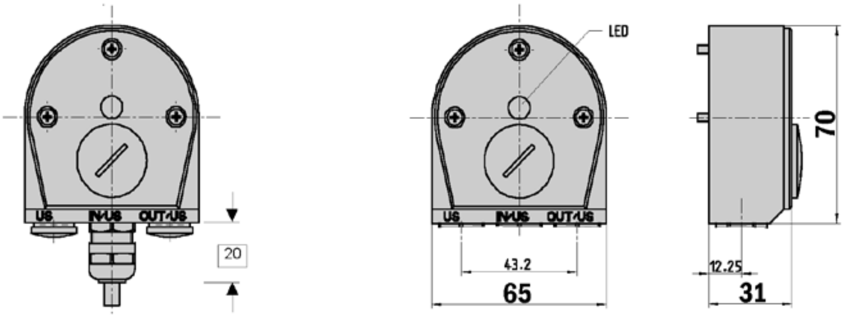
General tolerances according DIN ISO 2768-mk

Dimensional drawing DeviceNet adapter SR2



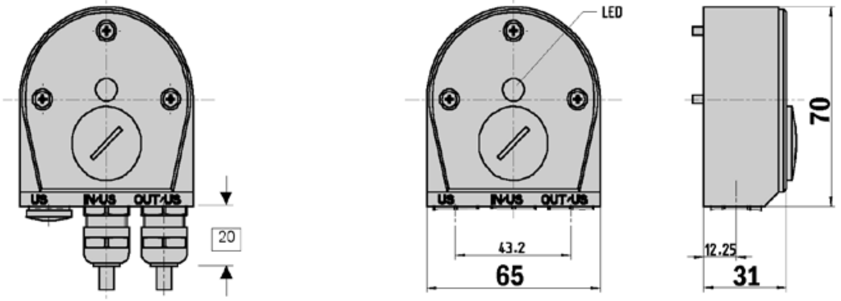
General tolerances according DIN ISO 2768-mk

Dimensional drawing DeviceNet adapter KR1



General tolerances according DIN ISO 2768-mk

Dimensional drawing DeviceNet adapter KR2



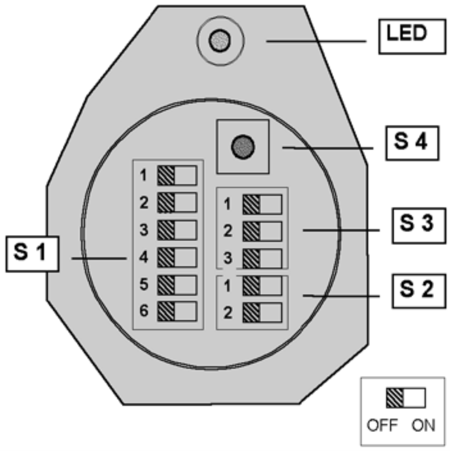
General tolerances according DIN ISO 2768-mk

Order information

ATM60 DeviceNet adapter

Type	Part no.	Explanation
AD-ATM60-SR1DN	2029226	Bus adapter SR1, 1 x M12, 5 pin
AD-ATM60-SR2DN	2029227	Bus adapter SR2, 2 x M12, 5 pin
AD-ATM60-KR1DN	2029228	Bus adapter KR1, 1 x PG
AD-ATM60-KR2DN	2029229	Bus adapter KR2, 2 x PG

Switch settings



Switch settings

Access to the switches is gained by opening the removable screw cap (PG) on the rear of the bus adapter. Use of the following elements.

S 1	Address setting (Node ID)
S 2	Bus termination
S 3	Baud rate setting (Data Rate)
S 4	Preset push button (Number zero SET)

Status information (NS) via LED

LED	2-colour red/green
	Network communication status

Implementation

DN Functionality

Object model
- Identity Object
- Message Router Object
- DeviceNet Object
- Assembly Object
- Connection Object
- Acknowledge Handler Object
- Encoder Object

I/O-Operating Modes
- Polling
- Change of State/Cyclic
- Bits Strobe

Encoder Parameters

according the Device Profile for Encoders:
- Code direction (CW, CCW)
- Scaling function (ON, OFF)
- PRESET value
- Hysteresis to position change of required for COS communication
- Steps per revolution (CPR) - 1 ... 8,192
- Total resolution (TR) -- 1 ... 67,108,864 steps, with TR = 2^n x CPR -- (n=0 ... 13)
- Limits for the working range (software limit switches)
- Limits and display format for the speed and acceleration values
- 8 programmable cams with HIGH/LOW limits and hysteresis
- General Diagnostic parameters (Offset Value, Alarms, Warnings, version of profile and software)

Manufacturer specific parameters:
- Assignment of the I/O Data Assembly to the different I/O operating modes
- Diagnostic data indicating the current maximum results of the encoder
- Device-specific data

I/O Data Assembly

1)	Pos Val (Position Value) 1)	I-1
2)	Pos Val + Flag	I-1, I-2
3)	Pos Val + Speed	I-1, I-3
4)	Pos Val + Status of Cam	I-1, I-4

Input Data Objects

I-1	Position value [Pos Val]	4 Byte
I-2	Flag (Alarm, Warning)	1 Byte
I-3	Speed	4 Byte
I-4	Status of cam	1 Byte

Setting: - Address (Node ID)

0 to 63 by Hardware (DIP Switch)

Setting: - Baud rate

125kb, 250kb, 500kb by Hardware (DIP Switch)

Setting: - Bus Termination

The DIP Switch (S2) is used to switch on/ off an internal bus termination (ON/OFF).
Not used (OFF) in case of using an external termination of the network

Setting: - PRESET Value

The Preset function supports adaptation of the encoder zero point to the mechanical zero point of the encoder system. The factory PRESET value is zero [0]

The adjustment is carried out in 2 ways:
- by Hardware (PRESET push button)
- by Software (DeviceNet Protocol)

Equipment Configuration

Configuring parameters of the encoder can be achieved by a configuration tool in conjunction with an EDS file (Electronic Data Sheet). It contains all the characteristics of the encoder.

1) Default Setting

Linear Encoders

Linear Encoders

Use linear encoders to measure incremental or absolute position along any axis. Linear encoders can be used in applications up to 1.7 kilometers long.

Non-Contact Linear Encoders

TTK70
The TTK70 consists of a coded magnetic tape and a small sensor head. The TTK70 has a compact head for measuring lengths up to 4 meters. The package has an integrated SSI interface with SinCos output. Using a separate bus adapter, different fieldbus interfaces like DeviceNet, Profibus and CanOpen are available. There are two versions of the TTK available – the sensor head with an SSI output or with a HIPERFACE output. This system has a very high accuracy of ±10 µm with revolutions of 1 µm with SSI and 3.906 µm for fieldbus interfaces.

L 230 Magnetic (Lincoder®)
The L 230 is similar to the TTK70. The magnetic tape provides the scale for measuring systems up to 40 meters long. The absolute information is magnetized onto the tape in a 12-bit sequential code. This position information is enhanced by interpolation of sine/cosine signals provided by an additional incremental track that is magnetized on the tape.

As the read head moves over the measuring tape, its position is output with a resolution as low as 1 µm over a 16 meter range, or 10 µm over a 40 meter range. Position data is output via real-time compensated SSI (Synchronous Serial Interface), HIPERFACE, or RS 485. The Lincoder is also programmable via RS 485, and a number of parameters such as offset, resolution and start points can be configured by the user.

**KH 53 (Pomux®) and Advanced KH 53
Long Distance Linear Encoders**
This style of encoder is unique to SICK and allows absolute measurement of up to 1.7 kilometers! The KH 53 consists of two basic components: Omega Profile sections and the sensor head. Each Omega Profile section contains a number of powerful permanent magnets. The separation between each magnet is unique and never repeated. These unique separations build up a code over the complete measurement path. In a working system, several Omega Profile sections are placed end to end along the complete measurement path. The total length of the system determines the number of profiles required. Each profile section is labeled with an identification number indicating the order in which the sections should be mounted.

The sensor head moves over the Omega Profile sections without contact, and produces absolute positional data. The KH 53 allows a generous vertical tolerance of ±10 mm around a 25 mm nominal value, and a horizontal tolerance of ±10 mm around the centerline. The output is available in SSI, and Profibus. Other networks can be realized using commercially available I/O modules.

In addition, this modular system offers several benefits to the user. If the measurement length of the system needs to increase in the future, the user simply needs to mount the extra profiles required. If the Omega Profile becomes damaged, only the damaged sections need to be replaced.

The Advanced KH 53 has 54 m or 548 m measuring lengths, a positional/mounting tolerance to ±20 mm, and an operating temperature of -30 to 70 °C. The Advanced KH 53 has the added advantage of requiring less installation time than the standard KH 53.

Wire-Draw Encoders

BCG Wire-Draw Encoders
SICK's new EcoLine of wire-draw encoders is a cost-effective solution for precise length/distance measurement applications. It is easy to set up and install and offers several advanced features that save time and reduce costs. The analog output is scalable and features and easy-to-use pushbutton that allows the user to configure the unit for different lengths.

This series also offers two versions of standalone wire-draw mechanisms that, when combined with SICK's existing encoder portfolio, offer an amazing solution far surpassing any competitor's offering. For example, combining a DFS60 programmable encoder with the wire-draw mechanism, the zero position, resolution and electrical interface can be programmed in seconds.

These encoders can be used in a variety of applications, including automated guided vehicles, storage and conveying systems, presses, handling systems, medical applications and many others. Plus, its compact design makes it ideal for applications with limited installation space.

BKS/PKS/XKS Wire-Draw Encoders
In these compact wire-draw encoders, the encoder is integrated into the wire-draw mechanism to minimize the size of the unit.

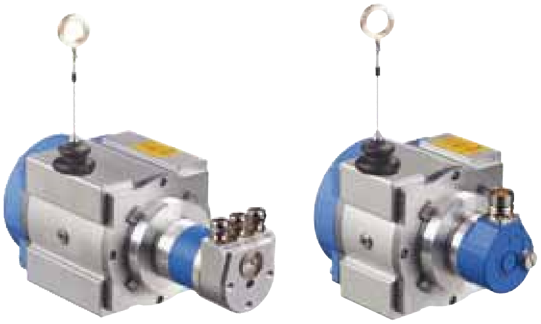
The number of drum rotations, which is proportional to the length being measured, is counted by an encoder and converted to a standard encoder output signal. This provides high-resolution position or distance information for linear measurement paths, even under difficult mounting conditions.

Precise linear guidance, as required for other length measurement systems, is not necessary.

The choice between absolute and incremental wire-draw encoders enables made-to-measure solutions for many applications: SSI interface for absolute wire-draw encoders, TTL interface for incremental wire-draw encoders. Both interfaces are common in automation technology and meet its exacting requirements.

The measuring lengths up to 5 m cover most of the possible applications, for example in:

Presses, punching and injection machines, storage technology, wood and sheet metal processing machines, construction machinery, medical technology and many other industries.



BTF/PRF Wire-Draw Encoders
The BTF and PRF wire-draw encoders are heavy-duty systems usually used in rugged environmental conditions for distance measurements up to 50 m. Wire-draw encoders are linear-to-rotational, industrial motion conversion modules, coupled with encoder feedback, to provide cost-effective linear position measurement solutions that precisely fit your requirements. These systems are housed in rugged industrial enclosures, and contain a stainless steel or thermoplastic composite cable wound on a precise, constant-diameter spool. The cable is attached to the apparatus whose position is being measured, and is extended and retracted as the apparatus moves. A spring on the spool maintains cable tension. Position feedback is provided by a standard incremental or absolute rotary shaft encoder.

These position transducers allow very flexible measuring paths, since the cable can be guided around obstacles using pulleys, etc. The heavy-duty enclosure of the encoder and spool housing provide excellent protection against contaminants, shock and other abuses.

Linear Encoders Selection Guide

Non-Contact Linear Encoders

Non-Contact Linear Encoders

	TTK 70	L 230 Lincoder
Resolution	SSI: 1 µm Fieldbus: 3.906 µm HIPERFACE:	SSI: 1 micron with calibrated tape, 10 micron with uncalibrated tape; HIPERFACE: 156.25 micron
Reproducibility	±10 µm	± 10 micron
Measuring Length/Speed	4m/ 10m/s	40 m max, 6 m/sec
Interface	SSI[1], HIPERFACE	SSI, HIPERFACE
Supply Voltage	SSI: 10...32 V; HIPERFACE: 7...12 V	SSI: 10...32 V; HIPERFACE: 7...12 V
Measurement Scale Type	Stationary magnetic tape with or without adhesive	Stationary magnetic tape with or without adhesive
Protection Class	IP 65	IP 65
Electrical Connections	M12 8-pin connector	M23 12-pin connector

[1] DeviceNet, CanOpen and Profibus outputs possible with fieldbus adapter.

	KH 53 Pomux	KH 53 Pomux Advanced
Resolution	0.1 mm	0.1 mm
Reproducibility	± 0.3 mm	± 1.00 mm
Accuracy Within a Measuring Element	± 1000 + ME (Tu -25°C) TK micron	± 2000 + ME (Tu -25°C) TK micron
Positional Tolerance	± 10 mm	± 20 mm
Operating Temperature	-20° to 60°C	-30° to 70°C
Measuring Length/Speed	1700 m max, 6.6 m/sec	54 m or 548 m, 6.6 m/sec
Interface	SSI, Profibus DP (07hex), Class 2	SSI, Profibus DP (07hex), Class 2
Supply Voltage	10...32 V	10...32 V
Measurement Scale Type	Stationary Omega profiles with embedded magnets	Stationary Omega profiles with embedded magnets
Protection Class	IP 66	IP 66
Electrical Connections	SSI: M23 12-pin connectors; Profibus: 3 PG cable glands	SSI: M23 12-pin connectors; Profibus: 3 PG cable glands

Wire-Draw Encoders

Wire-Draw Encoders

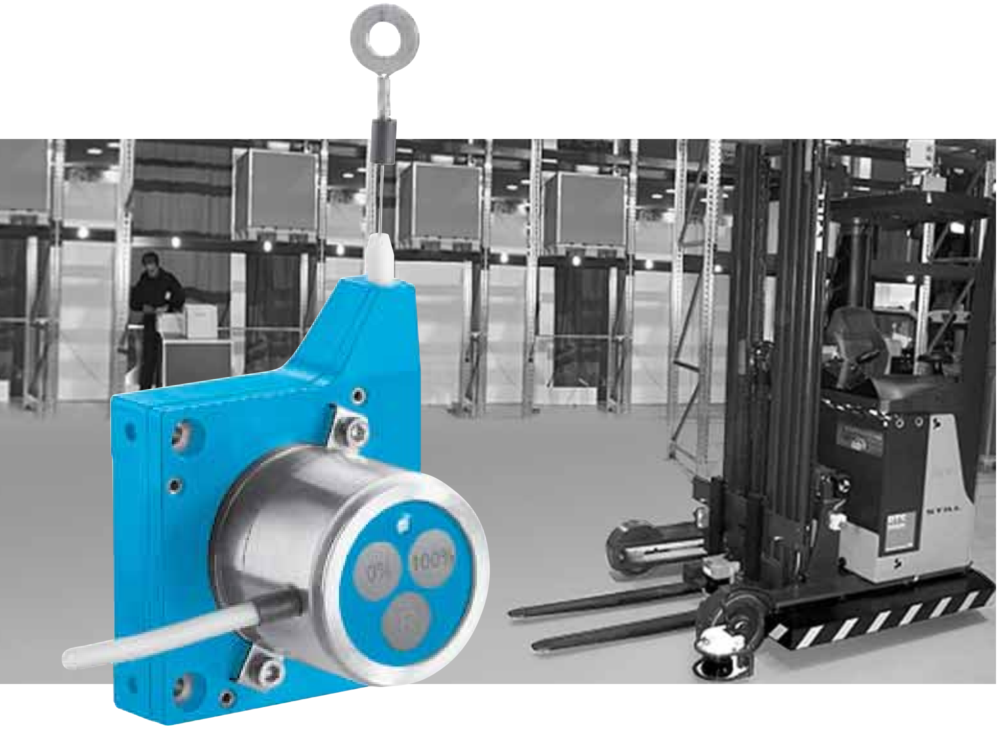
	BCG	BKS	BTF	PKS	PRF
	(Absolute)	(Absolute)	(Absolute)	(Incremental)	(Incremental)
Resolution	0.03 – 0.09 mm	0.05 mm	0.025 mm	0.05 mm	0.025 mm
Reproducibility	± 0.05%	± 3 measuring step	± 1 measuring step	± 3 measuring step	± 1 measuring step
Measuring Length/Speed	1.25, 3 and 5 m	5 m max, 3.5 m/sec	50 m max, 4 m/sec	5 m max, 3.5 m/sec	50 m max, 4 m/sec
Interface	Analog 4-20 mA 0...10 V	SSI	SSI, Profibus, DeviceNet, CANopen	TTL	TTL/RS 422 HTL push-pull
Supply Voltage	19...33 V	12...30 V	10...32 V	4.5...5.5 V	5 V or 10...32 V
Measurement Scale Type	Integrated encoder	Integrated encoder	Includes multiturn absolute encoder, model ATM 60	Integrated encoder	Includes incremental encoder, model DRS 60
Protection Class	IP 65	IP 52	IP 64	IP 52	IP 64
Electrical Connections	Shielded cable	M23 12-pin connector	SSI: M23 12-pin connector; Profibus, DeviceNet and CANopen: Separate bus adapter with connectors or PG glands	M23 12-pin connector	M23 12-pin connector

Linear Encoders Selection Guide

Wire-Draw Mechanisms

	Wire-Draw Mechanisms	
	MRA-F	**MRA-G**
Total Measuring Length	50 m	3 m, 5 m
Measuring Length/Turn	2 m, 3 m, 5 m, 10 m, 20 m, 30 m, 50 m	3 m, 5 m
Accuracy/Repeatability (% of full stroke)	0.05% drum precision	0.05% drum precision
Wire Diameter/Type	1.35 mm or 0.81 mm stranded stainless steel	1.4401/ PA coated
Encoder Options	Any 60 mm incremental or absolute servo mount encoder	Any incremental or absolute with 6 mm shaft and servo mount flange
Housing	Anodized aluminum	Plastic, Noryl
Options	Cable guides	Cable guides

BCG/MRA:
EcoLine Wire Draw Encoder for measuring lengths up to 5 m



4 to 20 mA
0 to 10 V
Absolute Wire Draw Encoders

SICK's new EcoLine of wire draw encoders is a cost-effective solution for precise length/distance measurement applications. It is easy to set up and install and offers several advanced features that save time and reduce costs.

The analog output is scalable with an easy push button feature that allows the user to configure the unit for different lengths.

This series also offers two versions of standalone wire draw mechanisms that when combined with SICK's existing encoder portfolio, offers an amazing solution set that far surpasses any of competitor's offering. For example, combining a DFS60 programmable encoder with the wire draw mechanism, the zero position, resolution and electrical interface can be programmed in just a matter of seconds.

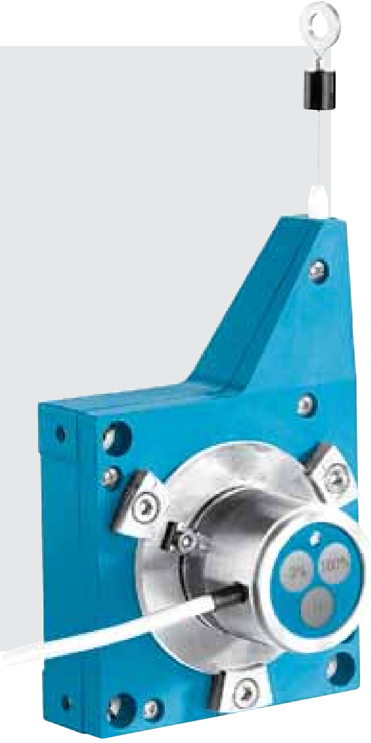
The mechanical design is compact, making it ideal for applications with limited installation space.

With all of the powerful features of the new EcoLine series, there are numerous applications for these encoders in many industries, such as automated guided vehicles, storage and conveying systems, presses, handling systems, medical applications and many other industries.

4 to 20 mA
0 to 10 V

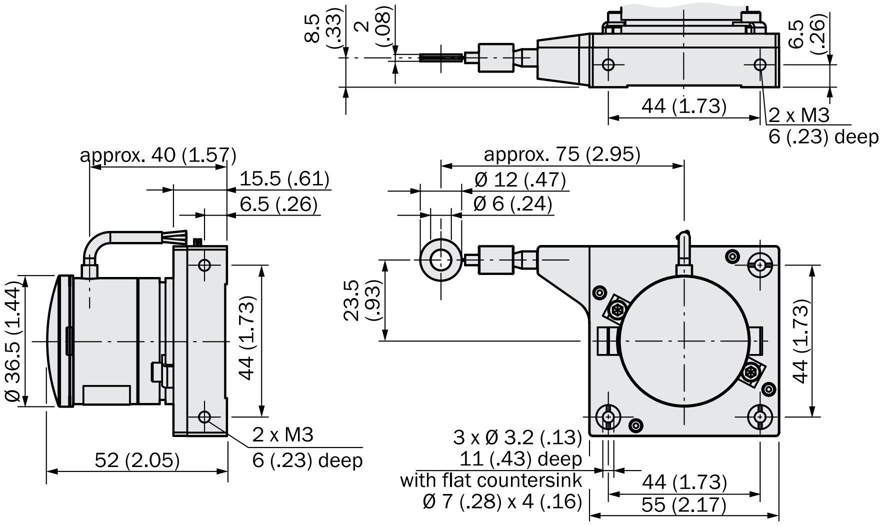
Absolute Wire Draw Encoders

- Compact dimensions
- Light plastic housing
- Analog interfaces
  4 to 20 mA
  0 to 10 V
- Easy push button teach
- LED indication during teach process along with protective cover for the push buttons
- Connection via 1.5 m cable



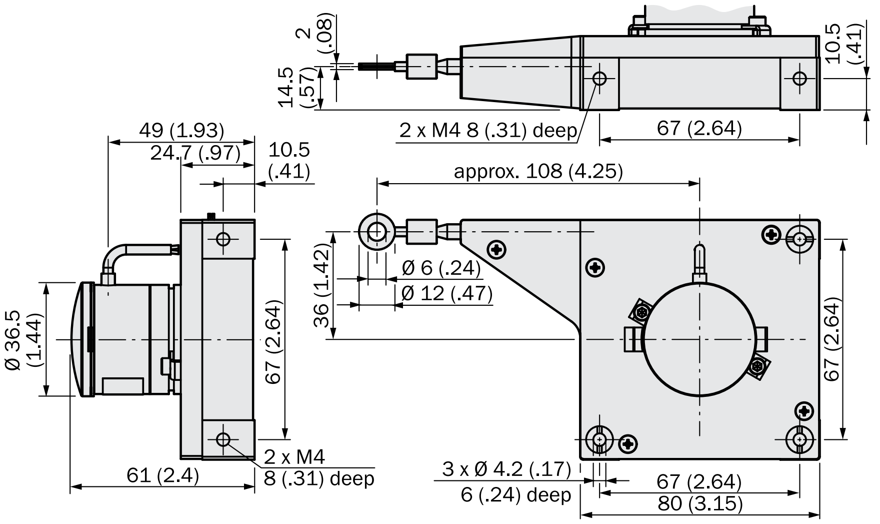
Accessories – see pages 410-448

Measuring length 1.25 m



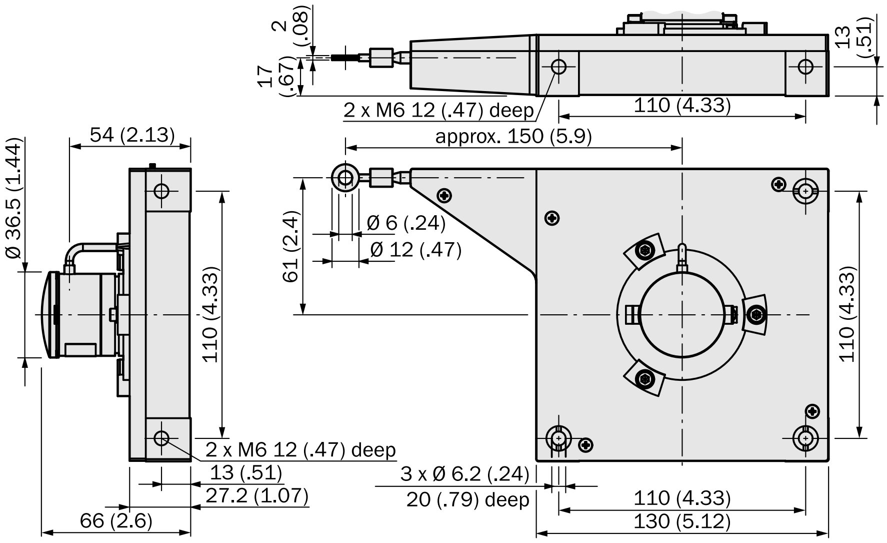
All dimensions in mm (inch)

Measuring length 3 m



All dimensions in mm (inch)

Measuring length 5 m



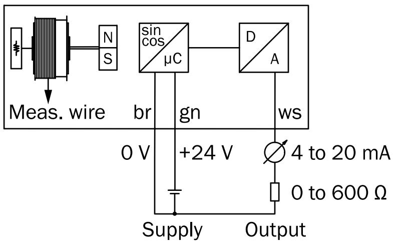
All dimensions in mm (inch)

Technical data	EcoLine Analog Wire Draw Encoder BCG	05	08	13
Measuring length	1.25 m	■		
	3 m		■	
	5 m			■
Working range	Configurable via Teach-In	■	■	■
Default	0 to 1 m	■		
	0 to 3 m		■	
	0 to 5 m			■
Drum circumference	150 mm	■		
	230 mm		■	
	385 mm			■
Wire diameter	0.45 mm	■		
	0.55 mm		■	■
Weight (without cable)	180 g	■		
	350 g		■	
	900 g			■
Spring return force[1]	Approx. 1 N to 1.4 N	■		
	Approx. 5 N to 6.3 N		■	
	Approx. 4,5 N to 7 N			■
Linearity	± 0.2 %	■	■	■
Reproducability	± 0.05 %	■	■	■
Operating speed	4 m/sec.	■	■	■
Material housing	Plastic, Noryl	■	■	■
Material wire	1.4401 / PA-coated	■	■	■
Protection class (Sensor) to IEC 60529	IP 65	■	■	■
Working temperature range	–20 °C to +70 °C	■	■	■
Current output	4 to 20 mA, RL ≤ 600 Ω; 3-wire connection, no galvanic isolation	■	■	■
Voltage output	0 to 10 V, RL ≥ 10 kΩ; 3-wire connection, no galvanic isolation	■	■	■
Operating voltage	DC 19 to 33 V	■	■	■
Max. current consumption	80 mA	■	■	■
Resistance				
to shocks to DIN EN 60068-2-27	50 g, 6 ms	■	■	■
to vibration to DIN EN 60068-2-6	4 g Sine 5 Hz to 100 Hz	■	■	■
EMC	DIN EN 61000-6-2; DIN EN 61000-6-3	■	■	■

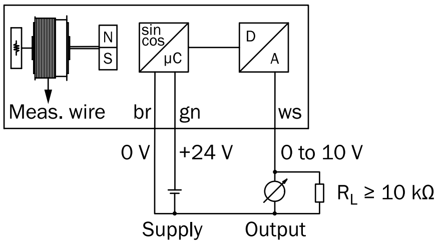
[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

Electrical connection

Current output 4 to 20 mA



Voltage output 0 to 10 V



Order information

EcoLine Analog Wire Draw Encoders, cable outlet 1.5 m

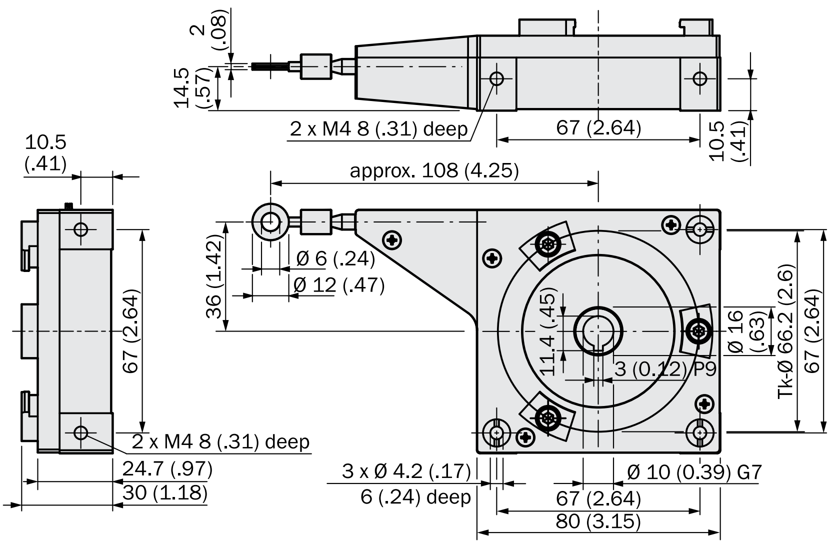
Type	Part no.	Description
BCG05-K1KM01PP	6039745	Meas. lengths 1.25 m, 4 to 20 mA
BCG05-L1KM01PP	6039746	Meas. lengths 1.25 m, 0 to 10 V
BCG08-K1KM03PP	6039747	Meas. lengths 3 m, 4 to 20 mA
BCG08-L1KM03PP	6039748	Meas. lengths 3 m, 0 to 10 V
BCG13-K1KM05PP	6039749	Meas. lengths 5 m, 4 to 20 mA
BCG13-L1KM05PP	6039750	Meas. lengths 5 m, 0 to 10 V

- Compact dimensions
- Light plastic housing
- All servoflange encoders suitable:
  AFM60 SSI,
  ATM60 PROFIBUS,
  ATM60 CANopen®,
  ATM60 DeviceNet,
  DFS60,
  SKM36 HIPERFACE® via
  flange adapter

CE

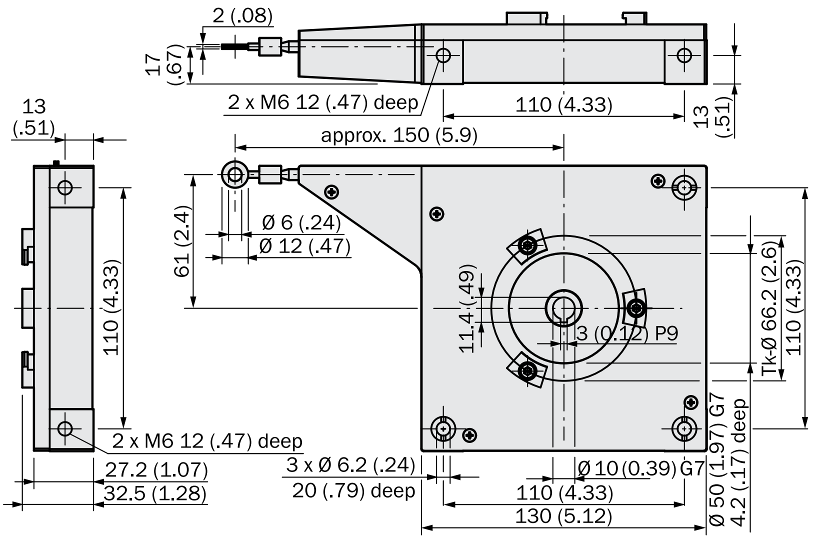
Accessories – see pages 410-448

Measuring length 3 m



All dimensions in mm (inch)

Measuring length 5 m



All dimensions in mm (inch)

Technical data	EcoLine Wire Draw Mechanism MRA-	G080	G130
Measuring range	3 m	■	
	5 m		■
Drum circumference	230 mm	■	
	385 mm		■
Wire diameter	0.55 mm	■	■
Weight	250 g	■	
	800 g		■
Spring return force[1]	Approx. 5 N to 6,3 N	■	
	Approx. 4.5 N to 7 N		■
Linearity	± 0.1 %	■	■
Reproducability	± 0.05 %	■	■
Life of Wire Draw Mechanism[2]	1 Mio. cycles	■	■
Operating speed	4 m/sec.	■	■
Material Housing	Plastic, Noryl	■	■
Material Wire	1.4401 / PA-coated	■	■
Working temperature range	–20 °C to +70 °C	■	■

[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading.

Order information

EcoLine Wire Draw Mechanism incl. mounting assembly for Encoders with Servo Flange

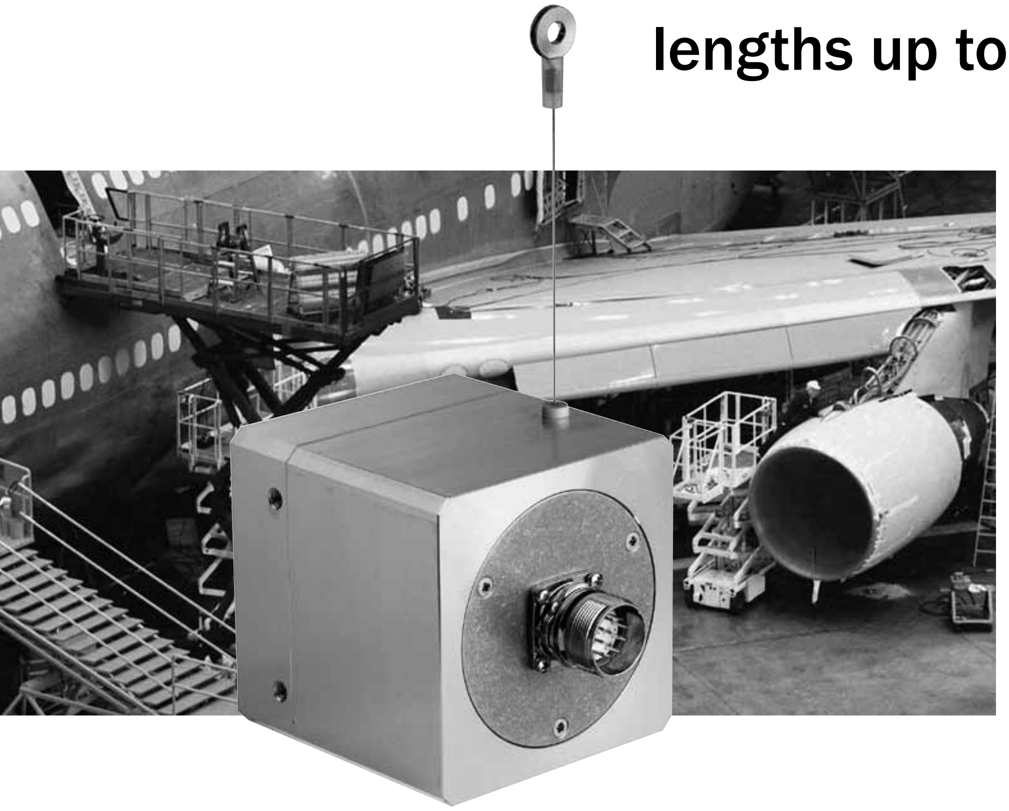
Type	Part no.	Description
MRA-G080-103D3	5322778	Measuring length 3 m
MRA-G130-105D3	5322779	Measuring length 5 m

Encoder selection

Type	Part no.	Description
AFM60B-S1AC08192	1037863	AFM60 SSI/Gray, M12, Resolution 13 x 12 Bit
ATM60-P1H13X13 + AD-ATM60-KA3PR	1030014 + 2029225	ATM60 PROFIBUS + adapter KA3 3 x PG
ATM60-C1H13X13 + AD-ATM60-KR2CO	1030025 + 2029232	ATM60 CANopen® + adapter KR2 2 x PG
ATM60-D1H13X13 + AD-ATM60-KR2DN	1030018 + 2029229	ATM60 DeviceNet + adapter KR2 2 x PG
DFS60B-S1PK10000 + PGT-08-S	1036756 + 1036616	DFS60 programmable, 1.5 m cable + Programming Tool
SKM36-HVV0-K02 + BEF-FA-025-050	1035601 + 2032622	SKM36 HIPERFACE® + flange adapter

Wire Draw Mechanism with already mounted Encoder on request.

BKS/XKS/PKS: Compact Absolute and Incremental Wire Draw Encoders for measuring lengths up to 5 m



Resolution 0.05 mm
Absolute Wire Draw Encoders

128 sine-/ cosine periods
Absolute Wire Draw Encoders

Resolution 0.05 mm
Incremental Wire Draw Encoders

In these compact Wire Draw Encoders, the encoder is integrated into the wire draw mechanism to minimise the size of the unit.

The number of drum rotations, which is proportional to the length, is counted by an encoder and converted to a measuring signal. This provides high-resolution position or distance information for linear measurement paths, even under difficult mounting conditions.

Precise linear guidance, as required for other length measurement systems, is not necessary.

The choice between Absolute and Incremental Wire Draw Encoders manufactured by SICK enables made-to-measure solutions for many application profiles.

- SSI and HIPERFACE® interfaces for Absolute Wire Draw Encoders and Profibus interface via the HIPERFACE® Profibus Adapter

- TTL interface for Incremental Wire Draw Encoders

are common interfaces in automation technology and meet its exacting requirements.

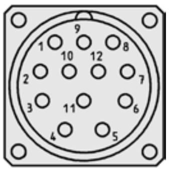
The measuring lengths of 2 m and 5 m cover most of the possible applications, for example in:

Presses, punching and injection machines, storage technology, wood and sheet metal processing machines, machinery construction, medical technology and many other industries.

Resolution 0.05 mm

Absolute Wire Draw Encoders

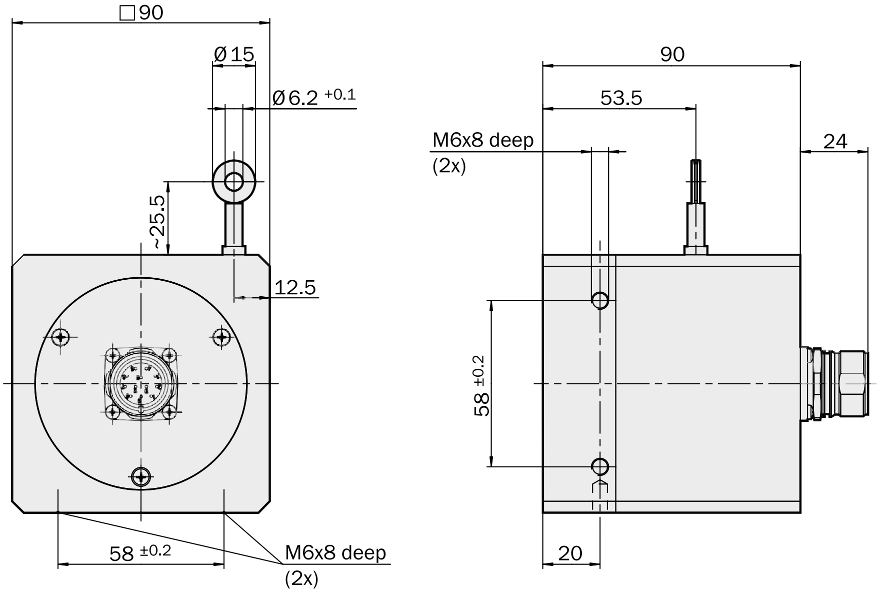
- Extremely compact construction
- High resolution
- Easy to mount
- High-precision measurement drum
- Stable spring return
- Highly flexible steel wire
- Robust aluminium housing



View of the M23 connector on the encoder

Accessories – see pages 410-448

Dimensional drawing of Absolute Wire Draw Encoders BKS09 SSI, measuring lengths 2 m and 5 m



General tolerances to DIN ISO 2768-mk

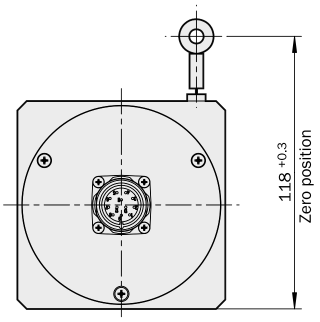
PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Interface signals
3	Clock +	yellow	Interface signals
4	N. C.	grey	Not connected
5	N. C.	green	Not connected
6	N. C.	pink	Not connected
7	N. C.	black	Not connected
8	U_s	red	Operating voltage
9	N. C.	orange	Not connected
10	Data –	brown	Interface signals
11	Clock –	lilac	Interface signals
12	N. C.	orange/black	Not connected
	Screen		Housing potential

Caution! PINs labelled “N. C.” must not be connected!

Technical data	BKS09 SSI	2 m	5 m								
Housing	Aluminium	■	■								
Measuring wire (stainless)	Highly flexible stranded steel, Ø 0.6 mm (PA 12 sheathed)	■	■								
Measuring length	2 m max.	■									
	5 m max.		■								
Mass	1.5 kg approx.	■	■								
Type of code	24 Bit/Gray	■	■								
Path of code	Rising at wire pull-out	■	■								
Measuring step	0.05 mm	■	■								
Linearity	≤ ± 0.7 mm	■	■								
Repeatability	± 3 measuring steps	■	■								
Operating speed	3.5 m/sec. max.	■	■								
Wire acceleration	20 m/s² max.	■	■								
Position forming time	0.1 ms	■	■								
Spring return force (typ.)											
Start/finish [1]	5 N/6 N	■									
Start/finish [1]	4 N/6 N		■								
Working temperature range	–10 ... +70 °C	■	■								
Storage temperature range	–20 ... +80 °C	■	■								
Permitted relative humidity [2]	90 %	■	■								
Life of wire draw mechanism [3]	800,000 cycles	■	■								
EMC [4]		■	■								
Resistance											
to shocks [5]	20/6 g/ms	■	■								
to vibration [6]	10 g (10 ... 2,000 Hz)	■	■								
Protection to IEC 60529 [7]	IP 52	■	■								
Operating voltage range (U_S)	12 ... 30 V	■	■								
Power consumption (no load)	1.5 W	■	■								
Initialisation time [8]	200 ms	■	■								
Interface signals											
Clock +, Clock –, Data +, –	SSI max. clock frequency 1.0 MHz	■	■								
	or min. LOW level (Clock +): 500 ns	■	■								

Zero position



[1] These values were measured at an ambient temperature of 25 °C. There may be variations at other temperatures.

[2] Condensation not permitted

[3] Average values, which depend on the application. At high operating speeds over great lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[4] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[5] To DIN EN 60068-2-27

[6] To DIN EN 60068-2-6

[7] Note required mounting position

[8] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

Order information

BKS09; U_S 12 ... 30 V; connector M23, 12-pin

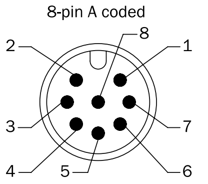
24 Bit SSI, Gray code, Measuring range starts at 0

Type	**Part no.**	**Description**
BKS09-ATBM0220	1035240	SSI, measuring length 2 m
BKS09-ATBM0520	1035241	SSI, measuring length 5 m

128 sine-/ cosine periods

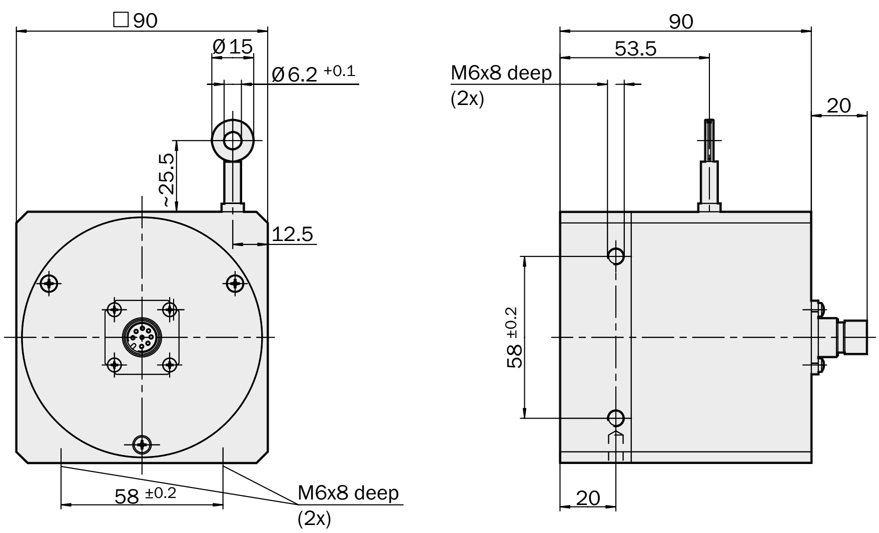
Absolute Wire Draw Encoders

- Extremely compact construction
- High resolution
- Easy to mount
- High-precision measurement drum
- Stable spring return
- Highly flexible steel wire
- Robust aluminium housing



Accessories – see pages 410-448

Dimensional drawing of Wire Draw Encoders XKS09 HIPERFACE®, measuring lengths 2 m and 5 m



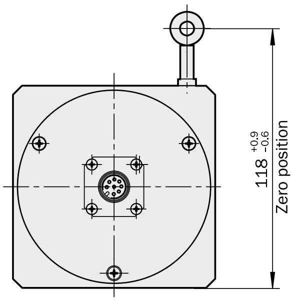
General tolerances to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours	Explanation
1	REFSIN	brown	Process data channel
2	+ SIN	white	Process data channel
3	REFCOS	black	Process data channel
4	+ COS	pink	Process data channel
5	Data +	yellow	RS 485 Parameter channel
6	Data –	lilac	RS 485 Parameter channel
7	GND	blue	Earth connection
8	+ U_S	red	7 ... 12 V Operating voltage

Technical data	XKS09 HIPERFACE®	2 m	5 m								
Housing	Aluminium	■	■								
Measuring wire (stainless)	Highly flexible stranded steel, Ø 0.6 mm	■	■								
	(PA 12 sheathed)										
Measuring length	2 m max.	■									
	5 m max.		■								
Mass	1.5 kg approx.	■	■								
Type code for the absolute value	Binary	■	■								
Path of code	Rising at wire pull-out	■	■								
Length of period	1.1953 mm	■	■								
Measuring step after generating arctan		■	■								
with 12 bit resolution	0.295 µm	■	■								
	(4096x128) steps/153 mm length	■	■								
Linearity	≤ ± 0.7 mm	■	■								
Non linearity within sine/cosine period	± 0.01 mm	■	■								
Repeatability	± 0.15 mm	■	■								
Operating speed	3.5 m/sec. max.	■	■								
Wire acceleration	20 m/s^2 max.	■	■								
Output frequency for sine/cosine signals	0 ... 65 kHz	■	■								
Spring return force (typ.)											
Start/finish [1]	5 N/6 N	■									
Start/finish [1]	4 N/6 N		■								
Working temperature range	–10 ... +70 °C	■	■								
Storage temperature range	–20 ... +80 °C	■	■								
Permitted relative humidity [2]	90 %	■	■								
Life of wire draw mechanism [3]	800,000 cycles	■	■								
EMC [4]		■	■								
Resistance											
to shocks [5]	20/6 g/ms	■	■								
to vibration [6]	10 g (10 ... 2,000 Hz)	■	■								
Protection to IEC 60529 [7]	IP 52	■	■								
Operating voltage range	7 ... 12 V	■	■								
Recommended supply voltage	8 V	■	■								
Operating power consumption (no load)	60 mA	■	■								
Available memory area within EEPROM 2048	1.792 Byte	■	■								
Interface signals											
Process data channel = SIN, REFSIN, COS, REFCOS	Analogue, differential	■	■								
Parameter channel = RS 485	Digital	■	■								

Zero position



Order information

XKS09; U_s 7 ... 12 V; connector M12, 8-pin		
Type	**Part no.**	**Description**
XKS09-HTBM0227	1035436	HIPERFACE®, measuring length 2 m
XKS09-HTBM0527	1035437	HIPERFACE®, measuring length 5 m

[1] These values were measured at an ambient temperature of 25 °C. There may be variations at other temperatures.

[2] Condensation not permitted

[3] Average values, which depend on the application. At high operating speeds over great lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[4] To DIN EN 61000-6-2 and DIN 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth. Users must perform their own tests when other screen designs are used.

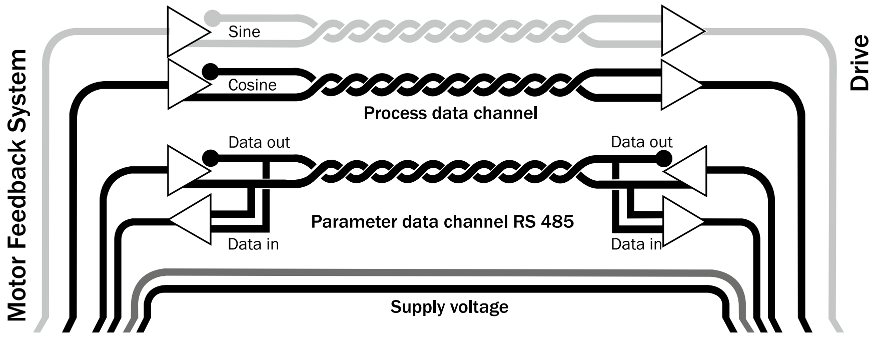
[5] To DIN EN 60068-2-27

[6] To DIN EN 60068-2-6

[7] Note required mounting position

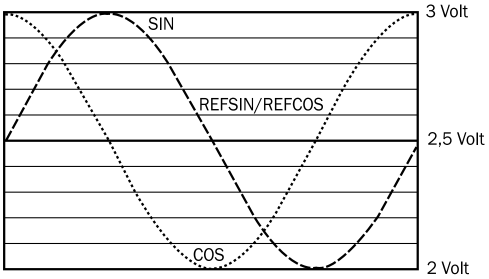
Electrical interface

- **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

Signal diagram for clockwise rotation of the shaft, looking in direction “A”



1 period = 360° : 128

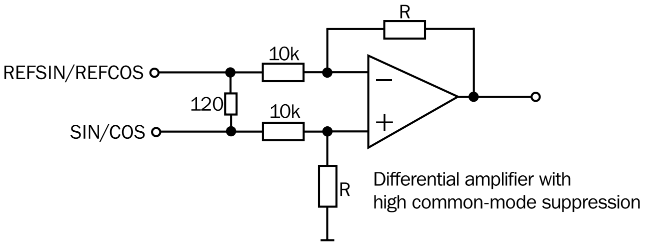
Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always “online”. When the supply voltage is applied, the speed controller has access to this information at any time.

Sophisticated technology guarantees stable amplitudes of the analogue signals across all specified environmental conditions, with a maximum variation of only 30 %.

Characteristics applicable to all permissible environmental conditions

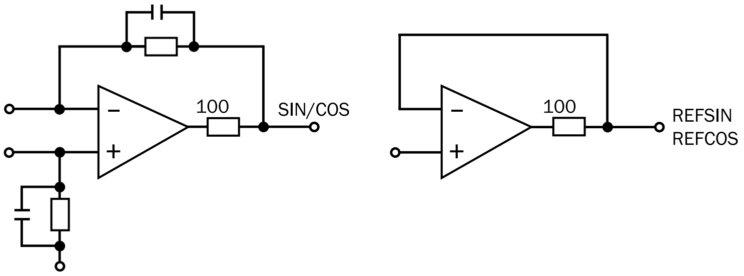
Signal	Value/Units
Signal peak, peak V_{SS} of SIN, COS	0.8 ... 1.1 V
Signal offset REFSIN, REFCOS	2.2 ... 2.8 V

Recommended receiver circuit for sine and cosine signals



Accessories – see pages 410-448

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



Type-specific settings	XKS09
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			XKS09
Command byte	**Function**	**Code 0** [1]	**Comments**
42h	Read position		
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	●	

Overview of status messages			
Error type	**Status code**	**Description**	**XKS09**
	00h	The encoder has recognised no error	●
Initialisation	01h	Faulty compensating data	●
	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	07h	Encoder reset occurred as a result of program monitoring	●
	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	●
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	01h	Analogue signals outside specification	
	1Fh	Speed too high, no position formation possible	
	20h	Singleturn position unreliable	●
	21h	Positional error Multiturn	●
	22h	Positional error Multiturn	●
	23h	Positional error Multiturn	●
Other	1Ch	Monitoring the value of the analogue signals (process data)	
	1Dh	LED current critical (dirt, LED breakage)	●
	1Eh	Encoder temperature critical	●
	08h	Counter overflow	●

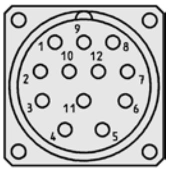
---

[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.

Resolution 0.05 mm

Incremental Wire Draw Encoders

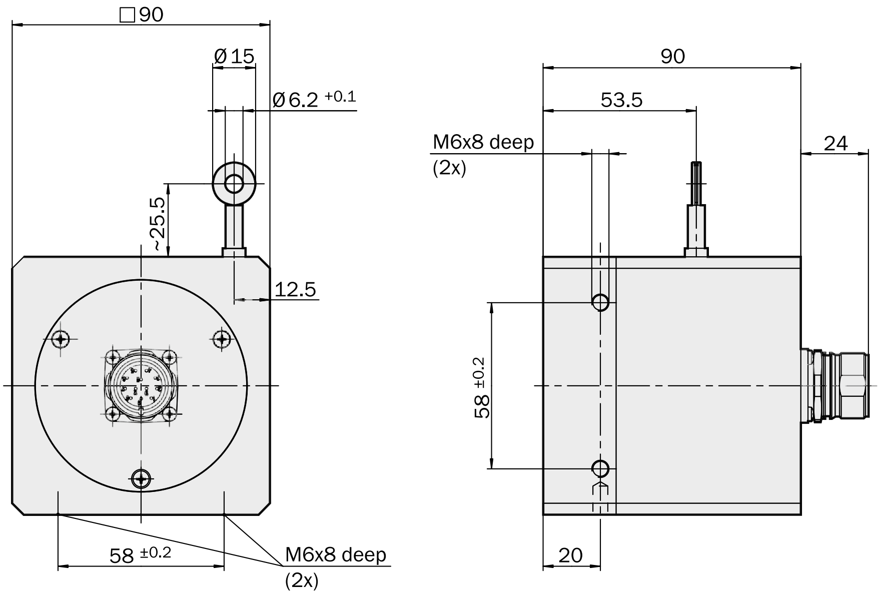
- Extremely compact construction
- High resolution
- Easy to mount
- High-precision measurement drum
- Stable spring return
- Highly flexible steel wire
- Robust aluminium housing



View of the M23 connector on the encoder

Accessories – see pages 410-448

Dimensional drawing of Wire Draw Encoders PKS09 TTL, measuring lengths 2 m and 5 m



General tolerances to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	$\overline{A}$	black	Signal line
2	N. C.	grey	Not connected
3	Z	lilac	Signal line
4	$\overline{Z}$	yellow	Signal line
5	B	white	Signal line
6	$\overline{B}$	brown	Signal line
7	N. C.		Not connected
8	A	pink	Signal line
9	Screen		Housing potential
10	GND	blue	Earth connection
11	N. C.	green	Not connected
12	U_S	red	Supply voltage [1]

[1] Potential-free to housing

Caution! PINs labelled “N. C.” must not be connected!

Technical data	PKS09 TTL	2 m	5 m
Housing	Aluminium	■	■
Measuring wire (stainless)	Highly flexible stranded steel, Ø 0.6 mm (PA 12 sheathed)	■	■
Measuring length	2 m max.	■	
	5 m max.		■
Mass	1.5 kg approx.	■	■
Electrical interfaces	TTL/RS 422, 6 channels	■	■
Measuring step	0.05 mm ①	■	■
Reference signal	Number off 1/765 measuring steps	■	■
Linearity	≤ ± 0.7 mm	■	■
Repeatability	± 3 measuring steps	■	■
Operating speed	3.5 m/sec. max.	■	■
Wire acceleration	20 m/s^2 max.	■	■
Spring return force (typ.)			
Start/finish 1)	5 N/6 N	■	
Start/finish 1)	4 N/6 N		■
Working temperature range	–10 ... +70 °C	■	■
Storage temperature range	–20 ... +80 °C	■	■
Permitted relative humidity 2)	90 %	■	■
Life of wire draw mechanism 3)	800,000 cycles	■	■
EMC 4)		■	■
Resistance			
to shocks 5)	20/6 g/ms	■	■
to vibration 6)	10 g (10 ... 2000 Hz)	■	■
Protection to IEC 60529 7)	IP 52	■	■
Operating voltage range (U_S)			
TTL/RS 422, 4,5 ... 5,5 V load current	20 mA max.	■	■
Operating current (no load)			
at 5 V	60 mA typ.	■	■
Initialisierungszeit nach Power on	40 ms	■	■

1) These values were measured at an ambient temperature of 25 °C. There may be variations at other temperatures.

2) Condensation not permitted

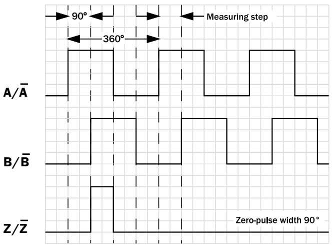
3) Average values, which depend on the application. At high operating speeds over great lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

4) To DIN EN 61000-6-2 and DIN EN 61000-6-3

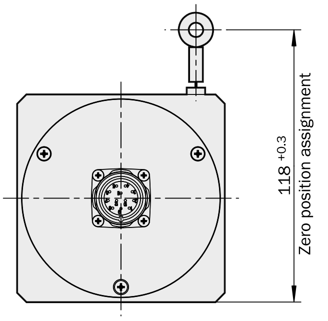
5 To DIN EN 60068-2-27

6) To DIN EN 60068-2-6

7) Note required mounting position



Zero pulse assignment



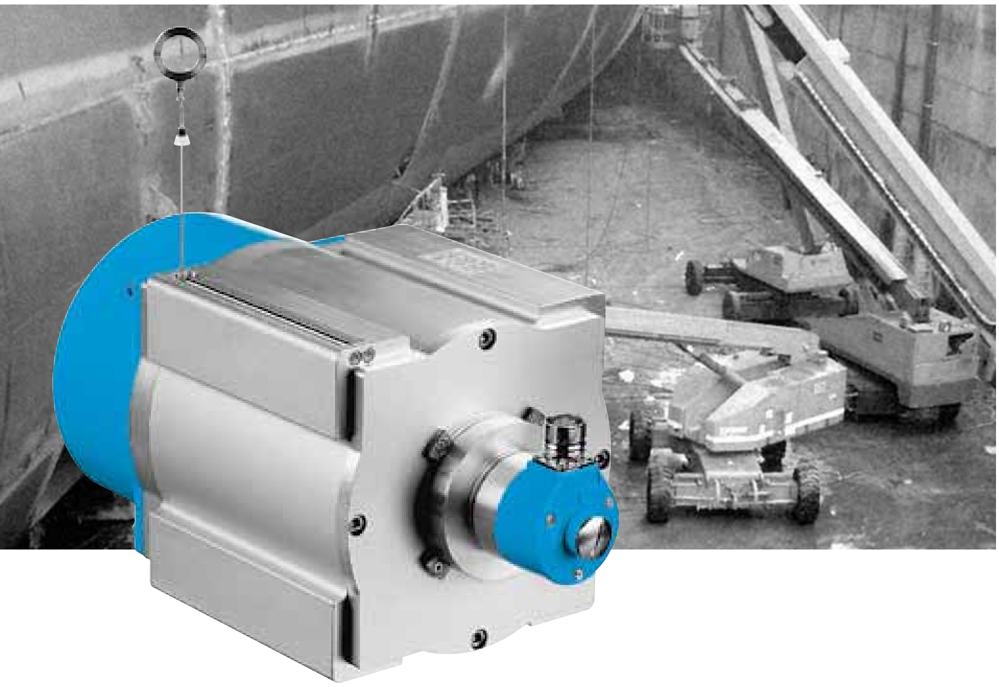
① Based on the control/counter evaluating the edges of the A+B pulses.

Order information

PKS09; connector M23, 12-pin

Type	Part no.	Description
PKS09-ATBM0220	1035242	TTL 4.5 ... 5.5 V; measuring length 2 m
PKS09-ATBM0520	1035243	TTL 4.5 ... 5.5 V; measuring length 5 m

BTF/PRF:
Absolute and Incremental Wire Draw Encoders for measuring lengths up to 50 m



Resolution up to 0.025 mm
Absolute Wire Draw Encoders

Resolution up to 0.025 mm
Incremental Wire Draw Encoders

Wire draw encoders consist of wire draw mechanism and an encoder.

The rotation of the drum is proportional to the length being measured. This movement is counted by an encoder and converted to a measuring signal. This provides high-resolution position or distance information for linear measurement paths, even under difficult ambient conditions.
Precise linear guidance, as required for other length measurement systems, is not necessary.

The combination of the wire draw mechanism and absolute or incremental encoders manufactured by SICK enables made-to-measure solutions for almost any application profile.

To comply with the exacting demands of automation technology, these wire draw encoders offer the correct interface for every application:

- SSI, Profibus, CANopen or DeviceNet field bus technology for absolute encoders
- HTL or TTL interfaces for incremental encoders.

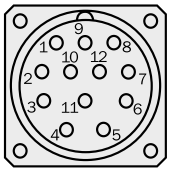
For example, this product can be utilised in many applications including:

- Crane, drilling and excavator systems
- Presses, punching and injection machines
- Weir systems and locks
- High-bay shelving and theatre stages
- Woodworking and stone processing machines
- Machinery construction, medical technology and many other industries.

Resolution up to 0.025 mm

Absolute Wire Draw Encoders

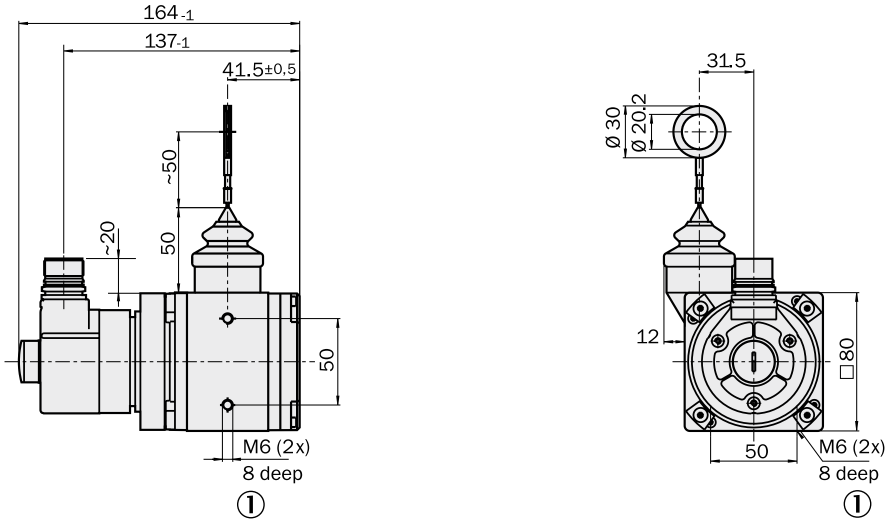
- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel



View of the connector M23 fitted to the encoder body

Accessories – see pages 410-448

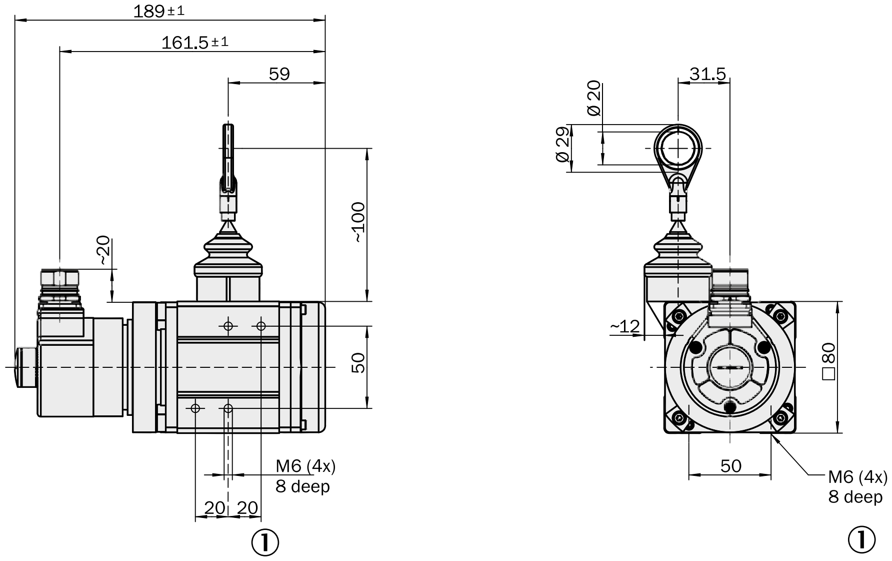
Dimensional drawing wire draw encoder BTF08 SSI, measuring length 2 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

Dimensional drawing wire draw encoder BTF08 SSI, measuring length 3 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Interface signals
3	Clock +	yellow	Interface signals
4	R x D +	grey	RS422 programming line
5	R x D –	green	RS422 programming line
6	T x D +	pink	RS422 programming line
7	T x D –	black	RS422 programming line
8	U_S	red	Supply voltage
9	SET	orange	Electronic adjustment
10	Data –	brown	Interface signals
11	Clock –	lilac	Interface signals
12	N. C.	orange/black	Not connected
	Screen		Housing potential

Caution! PINs labelled "N. C." must not be connected.

Technical data	BTF08	SSI 2 m	SSI 3 m
Drum housing	Anodised Aluminium	■	■
Spring housing	Die-cast zinc	■	■
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	■	■
Measuring length	2 m max.	■	
	3 m max.		■
Mass	1.8 kg approx.	■	
	2.0 kg approx.		■
Code type	25 bit/Gray	■	■
Code sequence	Increasing in direction of measurement	■	■
Measuring step	0.025 mm	■	■
Linearity	0.05 % typ.	■	■
Repeatability	± 1 measuring step	■	■
Operating speed	4 m/sec.	■	■
Position forming time	0.15 ms	■	■
Spring return force (typ.)			
start/finish [1]	6 N/14 N	■	■
Working temperature range	–20 ... +70 °C	■	■
Storage temperature range	–40 ... +100 °C	■	■
Life of wire draw mechanism [2]	1 million cycles	■	■
EMC [3]		■	■
Resistance			
to shocks [4]	100/6 g/ms	■	■
to vibration [5]	20/10 ... 2,000 g/Hz	■	■
Protection to IEC 60529	IP 64 (wire draw mechanism)	■	■
	IP 67 (encoder)	■	■
Operating voltage range (U_s)	10 ... 32 V	■	■
Power consumption max.	0.8 W	■	■
Initialisation time [6]	1,050 ms	■	■
Interface signals			
Clock +, Clock –, Data +, Data – [7]	SSI max. clock freqency 1 MHz i.e. min.	■	■
	duration LOW level (Clock +): 500 ns	■	■
T x D +, T x D –, R x D +, R x D –	RS422	■	■
SET (electronic adjustment)	H-active (L ≙ 0 - 4.7 V; H ≙ 10 - U_s V)	■	■

[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

[7] For higher clock frequencies, choose synchronous SSI.

Order information		
BTF08; U_s 10 ... 32 V; connector M23, 12 pin		
25 bit SSI, Gray-Code, Set = 1,000		
Type	**Part no.**	**Description**
BTF08-A1AM0240	1034299	SSI, measuring length 2 m
BTF08-A1AM0340	1034892	SSI, measuring length 3 m

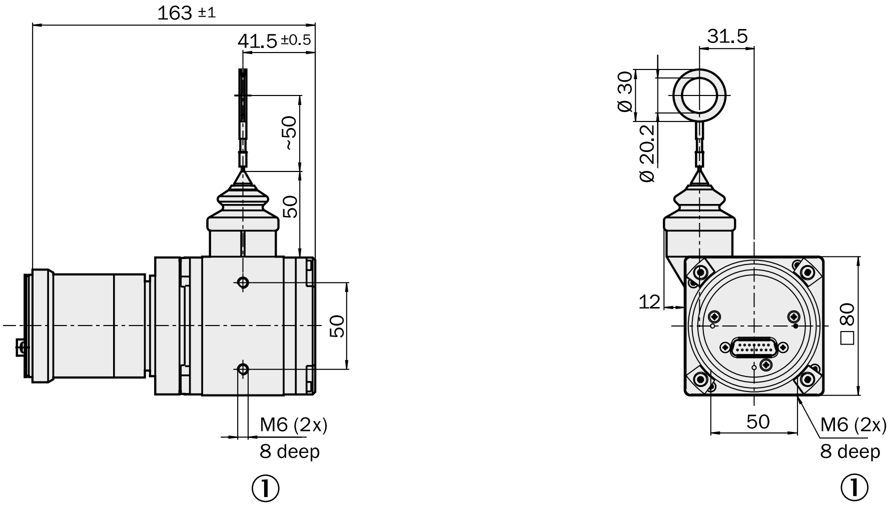
Resolution up to 0.025 mm

Absolute Wire Draw Encoders

- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel

CE

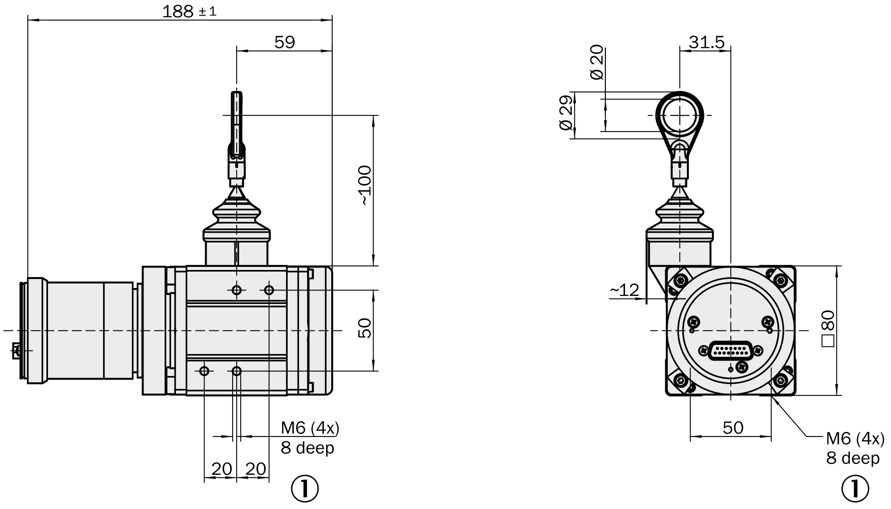
Dimensional drawing wire draw encoder BTF08 Profibus, CANopen, DeviceNet, measuring length 2 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

Dimensional drawing wire draw encoder BTF08 Profibus, CANopen, DeviceNet, measuring length 3 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

Accessories – see pages 410-448

Technical data	BTF08	PB 2 m	CO 2 m	DN 2 m	PB 3 m	CO 3 m	DN 3 m				
Drum housing	Anodised Aluminium	■	■	■	■	■	■				
Spring housing	Die-cast zinc	■	■	■	■	■	■				
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	■	■	■	■	■	■				
Measuring length	2 m max.	■	■	■							
	3 m max.				■	■	■				
Mass	1.9 kg approx.	■	■	■							
	2.1 kg approx.				■	■	■				
Measuring step (recommended)	0.025 mm ①	■	■	■	■	■	■				
Linearity	0.05 % typ.	■	■	■	■	■	■				
Repeatability	± 1 measuring step	■	■	■	■	■	■				
Operating speed	4 m/sec.	■	■	■	■	■	■				
Position forming time	0.25 ms	■	■	■	■	■	■				
Spring return force (typ.)											
start/finish [1]	6 N/14 N	■	■	■	■	■	■				
Working temperature range	–20 ... +70 °C	■	■	■	■	■	■				
Storage temperature range	–40 ... +100 °C	■	■	■	■	■	■				
Life of wire draw mechanism [2]	1 million cycles	■	■	■	■	■	■				
EMC [3]		■	■	■	■	■	■				
Resistance											
to shocks [4]	100/6 g/ms	■	■	■	■	■	■				
to Vibration [5]	20/10 ... 2,000 g/Hz	■	■	■	■	■	■				
Protection to IEC 60529	IP 64 (wire draw mechanism)	■	■	■	■	■	■				
	IP 67 (encoder)	■	■	■	■	■	■				
Operating voltage range (U_s)	10 ... 32 V	■	■	■	■	■	■				
Power consumption max.	2.0 W	■	■	■	■	■	■				
Initialisation time [6]	1,250 ms	■	■	■	■	■	■				
Bus interface											
Electronic adjustment (Number SET)	Via PRESET switch or protocol	■	■	■	■	■	■				
Bus termination [7]	Via DIP switch	■	■	■	■	■	■				
Electrical connection	Connection adapter	■	■	■	■	■	■				
Electrical interface [8]	RS485	■			■						
Electrical interface [9]	ISO-DIS 11898		■	■		■	■				
Protocol	Profile for encoders (07_{hex}) – Class 2	■			■						
	Communication Profile DS 301 V4.0		■			■					
	Device Profile DSP 406 V2.0		■			■					
	DeviceNet Specification, Release 2.0			■			■				
Address setting (node no.)	0 ... 127 (DIP switch or protocol)	■			■						
Address setting (Node ID)	0 ... 63 (DIP switch or protocol)		■	■		■	■				
Data transmission rate (Baud rate) [10]	9.6 kBaud ... 12 MBaud	■			■						
(DIP switch or protocol)	(10, 20, 50, 125, 250, 500) kB, 1 MB		■			■					
(DIP switch or protocol)	(125, 250, 500) kB			■			■				
Status information	Running (LED green), bus activity (LED red)	■			■						
	2-coloured LED for CAN Controller Status		■			■					
	Network status LED (NS), 2-coloured			■			■				

① When the customer configures the encoder to 8,000 steps x 16 revolutions, via the Bus Master. (Factory entry in GSD or EDS file: 8,192 steps x 8,192 revolutions).

Order information

BTF08; U_s 10 ... 32 V; field buses

Type	**Part no.**	**Description**
BTF08-P1HM0241	1034305	Profibus, measuring length 2 m
BTF08-D1HM0241	1034311	DeviceNet, measuring length 2 m
BTF08-C1HM0241	1034317	CANopen, measuring length 2 m
BTF08-P1HM0341	1034893	Profibus, measuring length 3 m
BTF08-D1HM0341	1034894	DeviceNet, measuring length 3 m
BTF08-C1HM0341	1034895	CANopen, measuring length 3 m

Please note: connection adapter must be ordered separately (see accessories section)

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[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

[7] Connection for terminal device only

[8] To EN 50 170-2 (DIN 19245 parts 1-3), galvanically separated using an opto-coupler

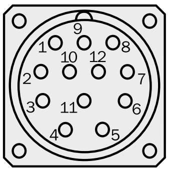
[9] (CAN High Speed) and CAN specification 2.0 B, galvanically separated

[10] Automatic detection

Resolution up to 0.025 mm

Absolute Wire Draw Encoders

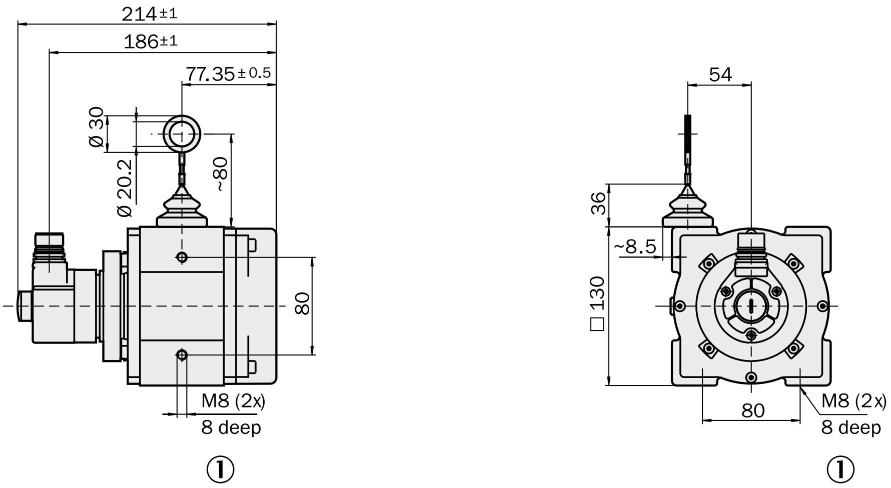
- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel



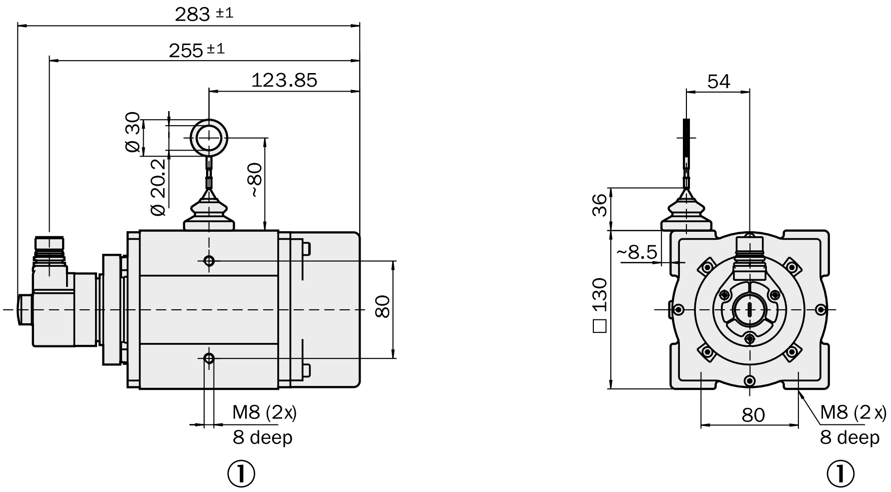
View of the connector M23 fitted to the encoder body

Accessories – see pages 410-448

Dimensional drawing wire draw encoder BTF13 SSI, measuring length 5 m



Dimensional drawing wire draw encoder BTF13 SSI, measuring length 10 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Interface signals
3	Clock +	yellow	Interface signals
4	R x D +	grey	RS422 programming line
5	R x D –	green	RS422 programming line
6	T x D +	pink	RS422 programming line
7	T x D –	black	RS422 programming line
8	U_S	red	Supply voltage
9	SET	orange	Electronic adjustment
10	Data –	brown	Interface signals
11	Clock –	lilac	Interface signals
12	N. C.	orange/black	Not connected
	Screen		Housing potential

Caution! PINs labelled "N. C." must not be connected.

Technical data	BTF13	SSI 5 m	SSI 10 m								
Drum housing	Anodised Aluminium	■	■								
Spring housing	Plastic	■	■								
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	■	■								
Measuring length	5 m max.	■									
	10 m max.		■								
Mass	3.3 kg approx.	■									
	4.0 kg approx.		■								
Code type	25 bit/Gray	■	■								
Code sequence	Increasing in direction of measurement	■	■								
Measuring step	0.05 mm	■	■								
Linearity	0.05 % typ.	■	■								
Repeatability	± 1 measuring step	■	■								
Operating speed	4 m/sec.	■	■								
Position forming time	0.15 ms	■	■								
Spring return force (typ.)											
start/finish [1]	15 N/20 N	■									
start/finish [1]	10 N/20 N		■								
Working temperature range	–20 ... +70 °C	■	■								
Storage temperature range	–40 ... +100 °C	■	■								
Life of wire draw mechanism [2]	1 million cycles	■	■								
EMC [3]		■	■								
Resistance											
to shocks [4]	100/6 g/ms	■	■								
to vibration [5]	20/10 ... 2,000 g/Hz	■	■								
Protection to IEC 60529	IP 64 (wire draw mechanism)	■	■								
	IP 67 (encoder)	■	■								
Operating voltage range (U_s)	10 ... 32 V	■	■								
Power consumption max.	0.8 W	■	■								
Initialisation time [6]	1,050 ms	■	■								
Interface signals											
Clock +, Clock –, Data +, Data – [7]	SSI max. clock freqency 1 MHz i.e. min.	■	■								
	duration LOW level (Clock +): 500 ns	■	■								
T x D +, T x D –, R x D +, R x D –	RS422	■	■								
SET (electronic adjustment)	H-active (L ≙ 0 - 4.7 V; H ≙ 10 - U_S V)	■	■								

[1] These values were measured at an ambient temperature of 25 °C.
The values may be different at other temperatures.

[2] Average values, which depend on the loading.
At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

[7] For higher clock frequencies, choose synchronous SSI.

Order information

BTF13; U_s 10 ... 32 V; connector M23, 12 pin

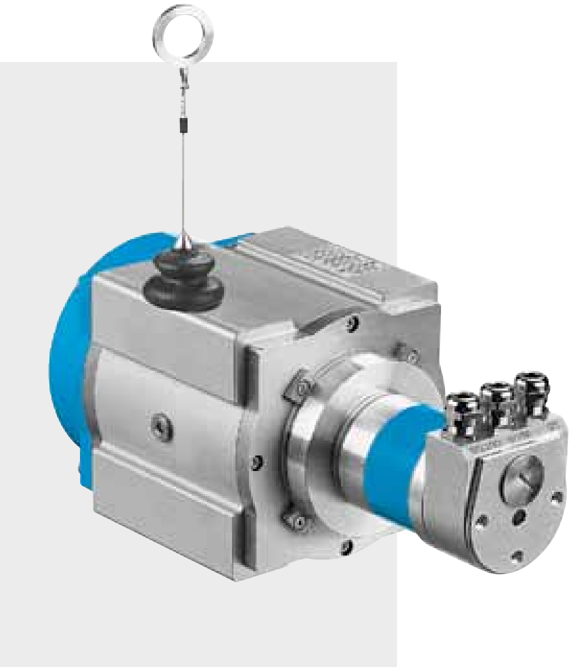
25 bit SSI; Gray-Code, Set = 1,000

Type	Part no.	Description
BTF13-A1AM0520	1034300	SSI, measuring length 5 m
BTF13-A1AM1020	1034301	SSI, measuring length 10 m

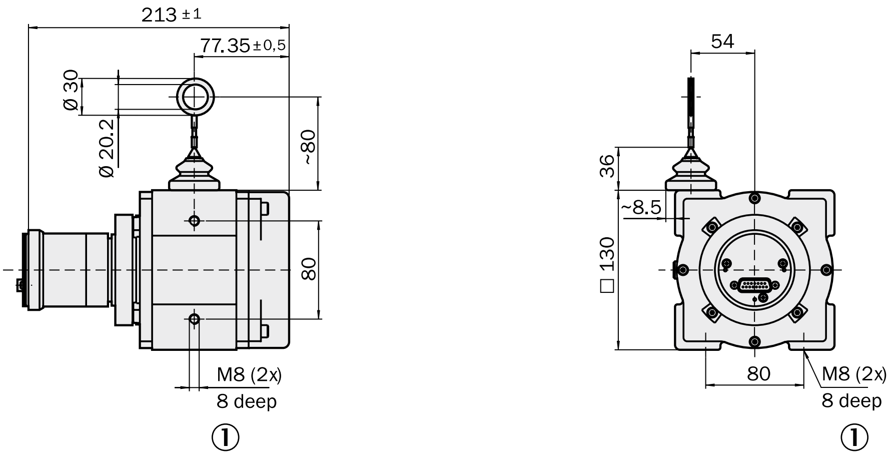
Resolution
up to 0.025 mm

Absolute Wire Draw Encoders

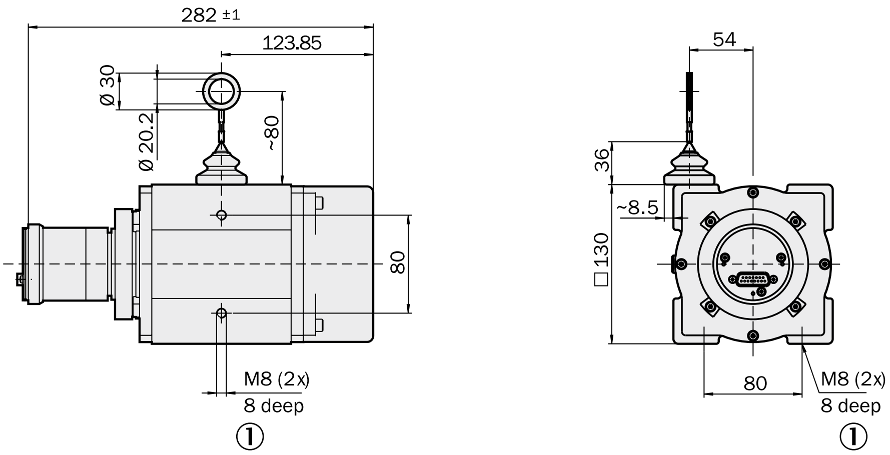
- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel



Dimensional drawing wire draw encoder BTF13 Profibus, CANopen, DeviceNet, measuring length 5 m



Dimensional drawing wire draw encoder BTF13 Profibus, CANopen, DeviceNet, measuring length 10 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

Accessories – see pages 410-448

Technical data	BTF13	PB 5 m	CO 5 m	DN 5 m	PB 10 m	CO 10 m	DN 10 m				
Drum housing	Anodised Aluminium	■	■	■	■	■	■				
Spring housing	Plastic	■	■	■	■	■	■				
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	■	■	■	■	■	■				
Measuring length	5 m max.	■	■	■							
	10 m max.				■	■	■				
Mass	3.4 kg approx.	■	■	■							
	4.1 kg approx.				■	■	■				
Measuring step (recommended)	0.05 mm ①	■	■	■	■	■	■				
Linearity	0.05 % typ.	■	■	■	■	■	■				
Repeatability	± 1 measuring step	■	■	■	■	■	■				
Operating speed	4 m/sec.	■	■	■	■	■	■				
Position forming time	0.25 ms	■	■	■	■	■	■				
Spring return force (typ.)											
start/finish [1]	15 N/20 N	■	■	■							
start/finish [1]	10 N/20 N				■	■	■				
Working temperature range	–20 ... +70 °C	■	■	■	■	■	■				
Storage temperature range	–40 ... +100 °C	■	■	■	■	■	■				
Life of wire draw mechanism [2]	1 million cycles	■	■	■	■	■	■				
EMC [3]		■	■	■	■	■	■				
Resistance											
to shocks [4]	100/6 g/ms	■	■	■	■	■	■				
to vibration [5]	20/10 ... 2,000 g/Hz	■	■	■	■	■	■				
Protection to IEC 60529	IP 64 (wire draw mechanism)	■	■	■	■	■	■				
	IP 67 (encoder)	■	■	■	■	■	■				
Operating voltage range (U_s)	10 ... 32 V	■	■	■	■	■	■				
Power consumption max.	2.0 W	■	■	■	■	■	■				
Initialisation time [6]	1,250 ms	■	■	■	■	■	■				
Bus interface											
Electronic adjustment (Number SET)	Via PRESET switch or protocol	■	■	■	■	■	■				
Bus termination [7]	Via DIP switch	■	■	■	■	■	■				
Electrical connection	Connection adapter	■	■	■	■	■	■				
Electrical interface [8]	RS485	■			■						
Electrical interface [9]	ISO-DIS 11898		■	■		■	■				
Protocol	Profile for encoders (07_{hex}) – Class 2	■			■						
	Communication Profile DS 301 V4.0		■			■					
	Device Profile DSP 406 V2.0		■			■					
	DeviceNet Specification, Release 2.0			■			■				
Address setting (node no.)	0 ... 127 (DIP switch or protocol)	■			■						
Address setting (Node ID)	0 ... 63 (DIP switch or protocol)		■	■		■	■				
Data transmission rate (Baud rate) [10]	9.6 kBaud ... 12 MBaud	■			■						
(DIP switch or protocol)	(10, 20, 50, 125, 250, 500) kB, 1 MB		■			■					
(DIP switch or protocol)	(125, 250, 500) kB			■			■				
Status information	Running (LED green), bus activity (LED red)	■			■						
	2-coloured LED for CAN Controller Status		■			■					
	Network status LED (NS), 2-coloured			■			■				

[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

[7] Connection for terminal device only

[8] To EN 50 170-2 (DIN 19245 parts 1-3), galvanically separated using an opto-coupler

[9] (CAN High Speed) and CAN specification 2.0 B, galvanically separated

[10] Automatic detection

① When the customer configures the encoder to 6,680 steps x 32 revolutions, via the Bus Master. (Factory entry in GSD or EDS file: 8,192 steps x 8,192 revolutions).

Order information

BTF13; U_s 10 ... 32 V; field buses

Type	Part no.	Description
BTF13-P1HM0525	1 034 306	Profibus, measuring length 5 m
BTF13-D1HM0525	1 034 312	DeviceNet, measuring length 5 m
BTF13-C1HM0525	1 034 318	CANopen, measuring length 5 m
BTF13-P1HM1025	1 034 307	Profibus, measuring length 10 m
BTF13-D1HM1025	1 034 313	DeviceNet, measuring length 10 m
BTF13-C1HM1025	1 034 319	CANopen, measuring length 10 m

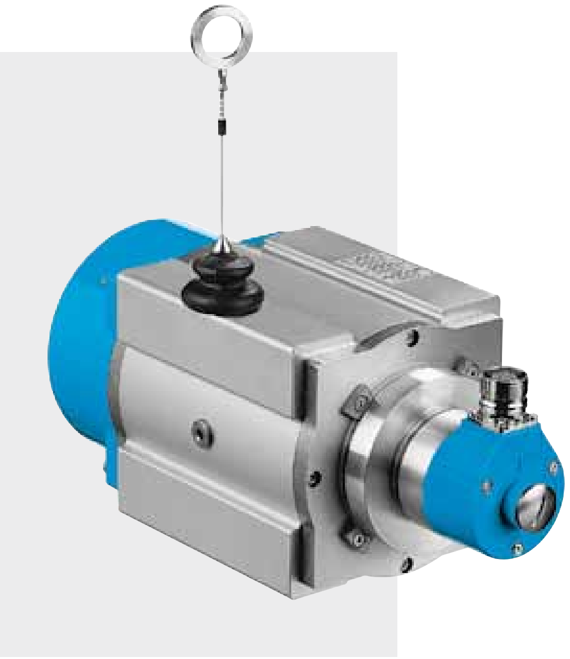
Please note: connection adapter must be ordered separately (see accessories section)

Absolute Wire Draw Encoders BTF13 SSI, Measuring Lengths from > 10 m to 30 m

Resolution up to 0.025 mm

Absolute Wire Draw Encoders

- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel



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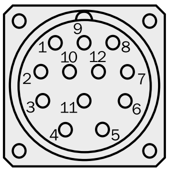
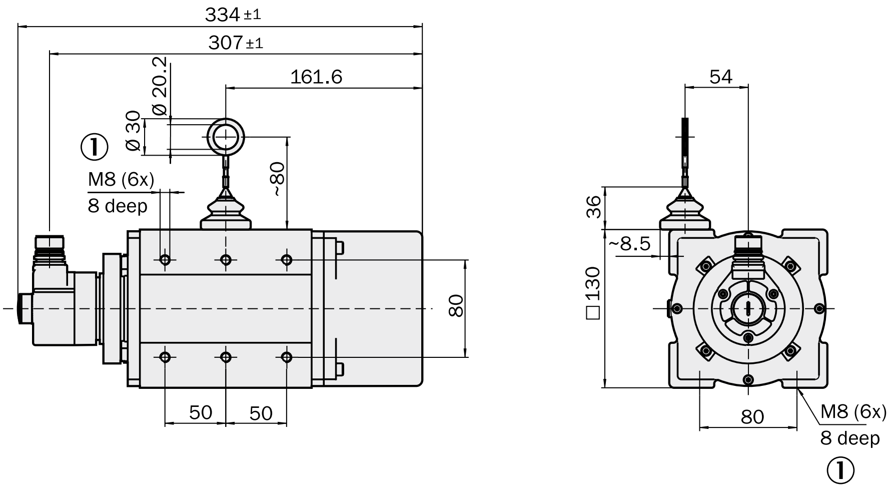


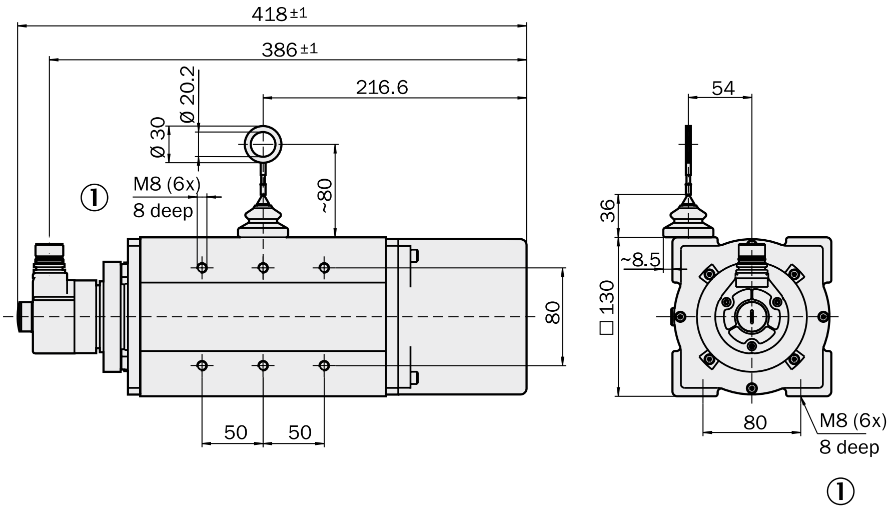
View of the connector M23 fitted to the encoder body

Accessories – see pages 410-448

Dimensional drawing wire draw encoder BTF13 SSI, measuring length 20 m



Dimensional drawing wire draw encoder BTF13 SSI, measuring length 30 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Interface signals
3	Clock +	yellow	Interface signals
4	R x D +	grey	RS422 programming line
5	R x D –	green	RS422 programming line
6	T x D +	pink	RS422 programming line
7	T x D –	black	RS422 programming line
8	U_s	red	Supply voltage
9	SET	orange	Electronic adjustment
10	Data –	brown	Interface signals
11	Clock –	lilac	Interface signals
12	N. C.	orange/black	Not connected
	Screen		Housing potential

Caution! PINs labelled "N. C." must not be connected.

Technical data	BTF13	SSI 20 m	SSI 30 m
Drum housing	Anodised Aluminium	■	■
Spring housing	Plastic	■	■
Measuring wire (stainless)	Highly flexible stranded steel, Ø 0.81 mm	■	■
Measuring length	20 m max.	■	
	30 m max.		■
Mass	5.3 kg approx.	■	
	6.5 kg approx.		■
Code type	25 bit/Gray	■	■
Code sequence	Increasing in direction of measurement	■	■
Measuring step	0.05 mm	■	■
Linearity	0.05 % typ.	■	■
Repeatability	± 1 measuring step	■	■
Operating speed	4 m/sec.	■	■
Position forming time	0.15 ms	■	■
Spring return force (typ.)			
start/finish [1]	10 N/20 N	■	■
Working temperature range	–20 ... +70 °C	■	■
Storage temperature range	–40 ... +100 °C	■	■
Life of wire draw mechanism [2]	1 million cycles	■	■
EMC [3]		■	■
Resistance			
to shocks [4]	100/6 g/ms	■	■
to vibration [5]	20/10 ... 2,000 g/Hz	■	■
Protection to IEC 60529	IP 64 (wire draw mechanism)	■	■
	IP 67 (encoder)	■	■
Operating voltage range (U_S)	10 ... 32 V	■	■
Power consumption max.	0.8 W	■	■
Initialisation time [6]	1,050 ms	■	■
Interface signals			
Clock +, Clock –, Data +, Data – [7]	SSI max. clock freqency 1 MHz i.e. min.	■	■
	duration LOW level (Clock +): 500 ns	■	■
T x D +, T x D –, R x D +, R x D –	RS422	■	■
SET (electronic adjustment)	H-active (L ≙ 0 - 4.7 V; H ≙ 10 - U_S V)	■	■

[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

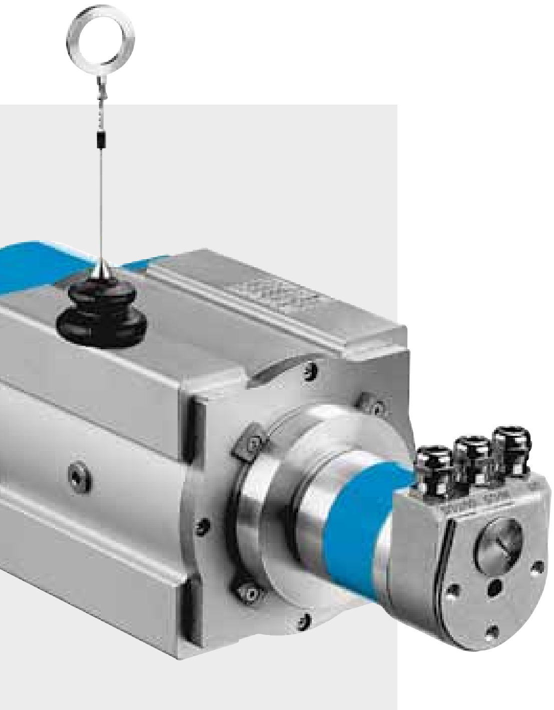
[7] For higher clock frequencies, choose synchronous SSI.

Order information		
BTF13; U_S 10 ... 32 V; connector M23, 12 pin		
25 bit SSI; Gray-Code, Set = 1,000		
Type	**Part no.**	**Description**
BTF13-A1AM2020	1034302	SSI, measuring length 20 m
BTF13-A1AM3020	1034303	SSI, measuring length 30 m

Resolution up to 0.025 mm

Absolute Wire Draw Encoders

- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel



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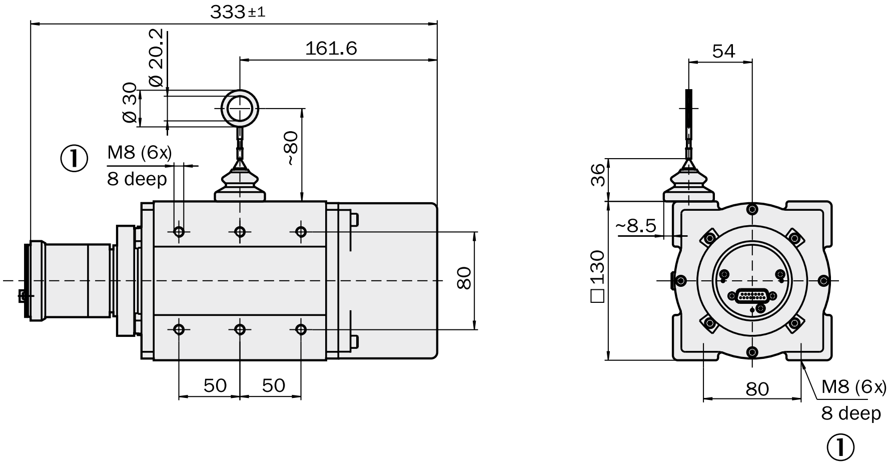
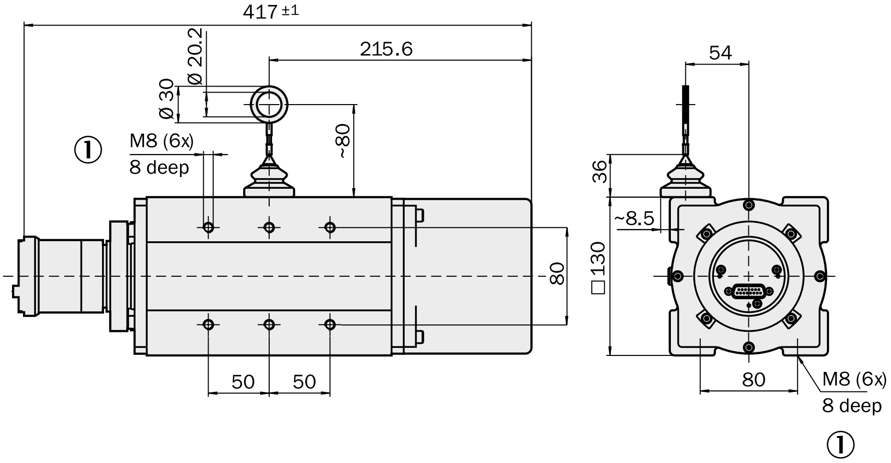
Dimensional drawing wire draw encoder BTF13 Profibus, CANopen, DeviceNet, measuring length 20 m



Dimensional drawing wire draw encoder BTF13 Profibus, CANopen, DeviceNet, measuring length 30 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

Accessories – see pages 410-448

Technical data	BTF13	PB 20 m	CO 20 m	DN 20 m	PB 30 m	CO 30 m	DN 30 m
Drum housing	Anodised Aluminium	■	■	■	■	■	■
Spring housing	Plastic	■	■	■	■	■	■
Measuring wire (stainless)	Highly flexible stranded steel, Ø 0.81 mm	■	■	■	■	■	■
Measuring length	20 m max.	■	■	■			
	30 m max.				■	■	■
Mass	5.4 kg approx.	■	■	■			
	6.6 kg approx.				■	■	■
Measuring step (recommended)	0.05 mm ①	■	■	■	■	■	■
Linearity	0.05 % typ.	■	■	■	■	■	■
Repeatability	± 1 measuring step	■	■	■	■	■	■
Operating speed	4 m/sec.	■	■	■	■	■	■
Position forming time	0.25 ms	■	■	■	■	■	■
Spring return force (typ.)							
start/finish [1]	10 N/20 N	■	■	■	■	■	■
Working temperature range	–20 ... +70 °C	■	■	■	■	■	■
Storage temperature range	–40 ... +100 °C	■	■	■	■	■	■
Life of wire draw mechanism [2]	1 million cycles	■	■	■	■	■	■
EMC [3]		■	■	■	■	■	■
Resistance							
to shocks [4]	100/6 g/ms	■	■	■	■	■	■
to vibration [5]	20/10 ... 2,000 g/Hz	■	■	■	■	■	■
Protection to IEC 60529	IP 64 (wire draw mechanism)	■	■	■	■	■	■
	IP 67 (encoder)	■	■	■	■	■	■
Operating voltage range (U_s)	10 ... 32 V	■	■	■	■	■	■
Power consumption max.	2.0 W	■	■	■	■	■	■
Initialisation time [6]	1,250 ms	■	■	■	■	■	■
Bus interface							
Electronic adjustment (Number SET)	Via PRESET switch or protocol	■	■	■	■	■	■
Bus termination [7]	Via DIP switch	■	■	■	■	■	■
Electrical connection	Connection adapter	■	■	■	■	■	■
Electrical interface [8]	RS485	■			■		
Electrical interface [9]	ISO-DIS 11898		■	■		■	■
Protocol	Profile for encoders (07_{hex}) – Class 2	■			■		
	Communication Profile DS 301 V4.0		■			■	
	Device Profile DSP 406 V2.0		■			■	
	DeviceNet Specification, Release 2.0			■			■
Address setting (node no.)	0 ... 127 (DIP switch or protocol)	■			■		
Address setting (Node ID)	0 ... 63 (DIP switch or protocol)		■	■		■	■
Data transmission rate (Baud rate) [10]	9.6 kBaud ... 12 MBaud	■			■		
(DIP switch or protocol)	(10, 20, 50, 125, 250, 500) kB, 1 MB		■			■	
(DIP switch or protocol)	(125, 250, 500) kB			■			■
Status information	Running (LED green), bus activity (LED red)	■			■		
	2-coloured LED for CAN Controller Status		■			■	
	Network status LED (NS), 2-coloured			■			■

① When the customer configures the encoder to 6,646 steps x 128 revolutions, via the Bus Master. (Factory entry in GSD or EDS file: 8,192 steps x 8,192 revolutions).

Order information		
BTF13; U_s 10 ... 32 V; field buses		
Type	**Part no.**	**Description**
BTF13-P1HM2025	1034308	Profibus, measuring length 20 m
BTF13-D1HM2025	1034314	DeviceNet, measuring length 20 m
BTF13-C1HM2025	1034320	CANopen, measuring length 20 m
BTF13-P1HM3025	1034309	Profibus, measuring length 30 m
BTF13-D1HM3025	1034315	DeviceNet, measuring length 30 m
BTF13-C1HM3025	1034321	CANopen, measuring length 30 m

Please note: connection adapter must be ordered separately (see accessories section)

[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

[7] Connection for terminal device only

[8] To EN 50 170-2 (DIN 19245 parts 1-3), galvanically separated using an opto-coupler

[9] (CAN High Speed) and CAN specification 2.0 B, galvanically separated

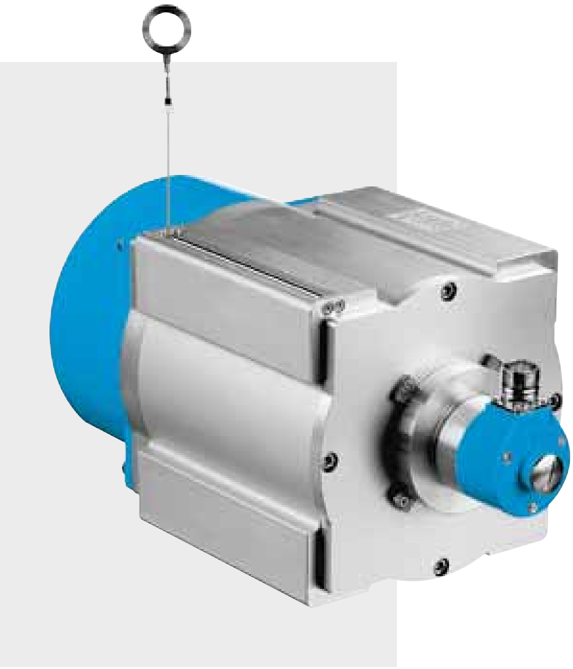
[10] Automatic detection

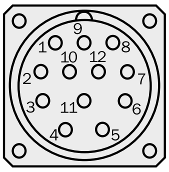
Absolute Wire Draw Encoders BTF19 SSI, Measuring Lengths from > 30 m to 50 m

Resolution up to 0.025 mm

Absolute Wire Draw Encoders

- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire

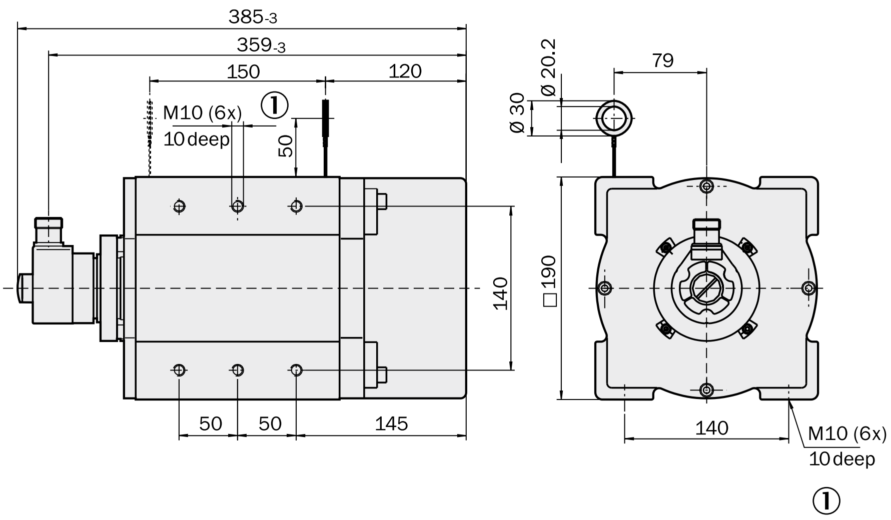




View of the connector M23 fitted to the encoder body

Accessories – see pages 410-448

Dimensional drawing wire draw encoder BTF19 SSI, measuring length 50 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Interface signals
3	Clock +	yellow	Interface signals
4	R x D +	grey	RS422 programming line
5	R x D –	green	RS422 programming line
6	T x D +	pink	RS422 programming line
7	T x D –	black	RS422 programming line
8	U_s	red	Supply voltage
9	SET	orange	Electronic adjustment
10	Data –	brown	Interface signals
11	Clock –	lilac	Interface signals
12	N. C.	orange/black	Not connected
	Screen		Housing potential

Caution! PINs labelled "N. C." must not be connected.

Technical data	BTF19	SSI 50 m
Drum housing	Anodised Aluminium	■
Spring housing	Die-cast zinc	■
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	■
Measuring length	50 m max.	■
Mass	16.8 kg approx.	■
Code type	25 bit/Gray	■
Code sequence	Increasing in direction of measurement	■
Measuring step	0.1 mm	■
Linearity	0.05 % typ.	■
Repeatability	± 1 measuring step	■
Operating speed	4 m/sec.	■
Position forming time	0.15 ms	■
Spring return force (typ.)		
start/finish 1)	18 N/37 N	■
Working temperature range	–20 ... +70 °C	■
Storage temperature range	–40 ... +100 °C	■
Life of wire draw mechanism 2)	1 million cycles	■
EMC 3)		■
Resistance		
to shocks 4)	100/6 g/ms	■
to vibration 5)	20/10 ... 2,000 g/Hz	■
Protection to IEC 60529	IP 31 (wire draw mechanism)	■
	IP 67 (encoder)	■
Operating voltage range (U_s)	10 ... 32 V	■
Power consumption max.	0.8 W	■
Initialisation time 6)	1,050 ms	■
Interface signals		
Clock +, Clock –, Data +, Data – 7)	SSI max. clock freqency 1 MHz i.e. min.	■
	duration LOW level (Clock +): 500 ns	■
T x D +, T x D –, R x D +, R x D –	RS422	■
SET (electronic adjustment)	H-active (L ≙ 0 - 4.7 V; H ≙ 10 - U_s V)	■

1) These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

2) Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

3) To DIN EN 61000-6-2 and DIN EN 61000-6-3

4) To DIN EN 60068-2-27

5) To DIN EN 60068-2-6

6) From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

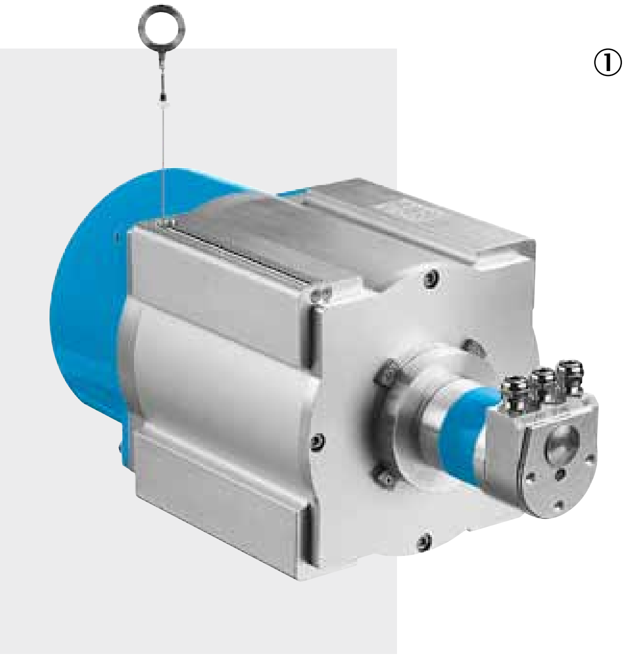
7) For higher clock frequencies, choose synchronous SSI.

Order information		
BTF19; U_s 10 ... 32 V; connector M23, 12 pin		
25 bit SSI, Gray-Code, Set = 1,000		
Type	**Part no.**	**Description**
BTF19-A1AM5010	1034304	SSI, measuring length 50 m

Resolution up to 0.025 mm

Absolute Wire Draw Encoders

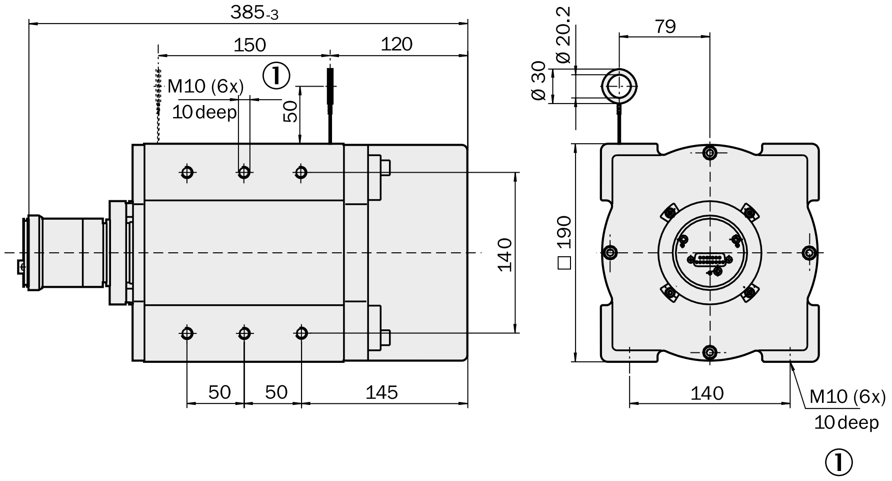
- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire



CE

Accessories – see pages 410-448

Dimensional drawing wire draw encoder BTF19 Profibus, CANopen, DeviceNet, measuring length 50 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

Technical data	BTF19	PB 50 m	CO 50 m	DN 50 m
Drum housing	Anodised Aluminium	▨	▨	▨
Spring housing	Die-cast zinc	▨	▨	▨
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	▨	▨	▨
Measuring length	50 m max.	▨	▨	▨
Mass	16.9 kg approx.	▨	▨	▨
Measuring step (recommended)	0.1 mm ①	▨	▨	▨
Linearity	0.05 % typ.	▨	▨	▨
Repeatability	± 1 measuring step	▨	▨	▨
Operating speed	4 m/sec.	▨	▨	▨
Position forming time	0.25 ms	▨	▨	▨
Spring return force (typ.)				
start/finish [1]	18 N/37 N	▨	▨	▨
Working temperature range	–20 ... +70 °C	▨	▨	▨
Storage temperature range	–40 ... +100 °C	▨	▨	▨
Life of wire draw mechanism [2]	1 million cycles	▨	▨	▨
EMC [3]		▨	▨	▨
Resistance				
to shocks [4]	100/6 g/ms	▨	▨	▨
to vibration [5]	20/10 ... 2,000 g/Hz	▨	▨	▨
Protection to IEC 60529	IP 31 (wire draw mechanism)	▨	▨	▨
	IP 67 (encoder)	▨	▨	▨
Operating voltage range (U_s)	10 ... 32 V	▨	▨	▨
Power consumption max.	2.0 W	▨	▨	▨
Initialisation time [6]	1,250 ms	▨	▨	▨
Bus interface				
Electronic adjustment (Number SET)	Via PRESET switch or protocol	▨	▨	▨
Bus termination [7]	Via DIP switch	▨	▨	▨
Electrical connection	Connection adapter	▨	▨	▨
Electrical interface [8]	RS485	▨		
Electrical interface [9]	ISO-DIS 11898		▨	▨
Protocol	Profile for encoders (07_{hex}) – Class 2	▨		
	Communication Profile DS 301 V4.0		▨	
	Device Profile DSP 406 V2.0		▨	
	DeviceNet Specification, Release 2.0			▨
Address setting (node no.)	0 ... 127 (DIP switch or protocol)	▨		
Address setting (Node ID)	0 ... 63 (DIP switch or protocol)		▨	▨
Data transmission rate (Baud rate) [10]	9.6 kBaud ... 12 MBaud	▨		
(DIP switch or protocol)	(10, 20, 50, 125, 250, 500) kB, 1 MB		▨	
(DIP switch or protocol)	(125, 250, 500) kB			▨
Status information	Running (LED green), bus activity (LED red)	▨		
	2-coloured LED for CAN Controller Status		▨	
	Network status LED (NS), 2-coloured			▨

① When the customer configures the encoder to 4,900 steps x 128 revolutions, via the Bus Master. (Factory entry in GSD or EDS file: 8,192 steps x 8,192 revolutions).

---

[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] From the moment the supply voltage is applied, this is the time which elapses before the data word can be correctly read in.

[7] Connection for terminal device only

[8] To EN 50 170-2 (DIN 19245 parts 1-3), galvanically separated using an opto-coupler

[9] (CAN High Speed) and CAN specification 2.0 B, galvanically separated

[10] Automatic detection

Order information

BTF19; U_s 10 ... 32 V; field buses

Type	**Part no.**	**Description**
BTF19-P1HM5017	1034310	Profibus, measuring length 50 m
BTF19-D1HM5017	1034316	DeviceNet, measuring length 50 m
BTF19-C1HM5017		CANopen, measuring length 50 m

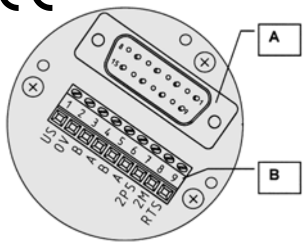
Please note: connection adapter must be ordered separately (see accessories section)

Resolution up to 0.025 mm

Absolute Wire Draw Encoders

- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel

CE

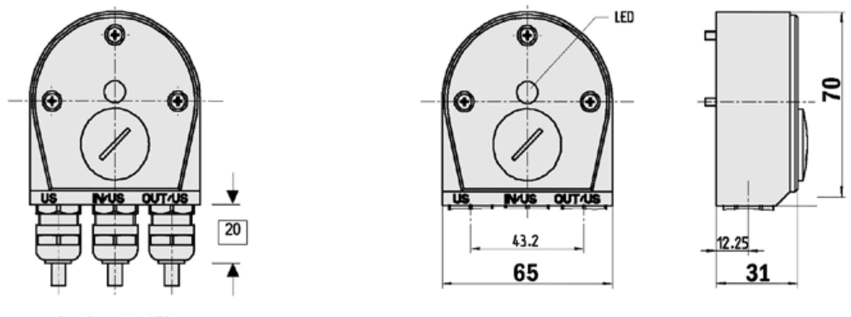


A Internal plug connection to the encoder
B External connection to the bus

Accessories – see pages 410-448

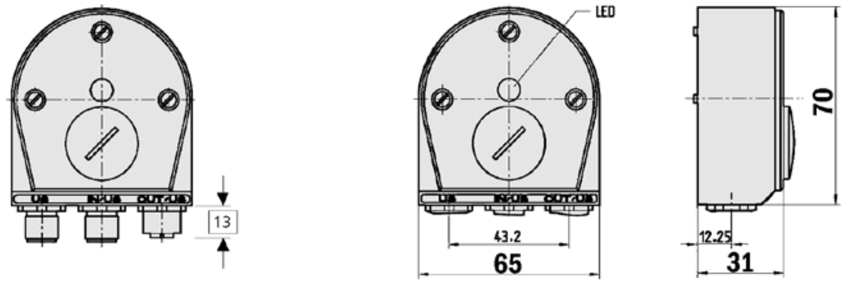
① Encoders with a Profibus adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the Profibus adapter is unscrewed from the complete device. The figure shows the pin allocation within the bus connection.

Dimensional drawing Profibus adapter KA3



General tolerances to DIN ISO 2768-mk

Dimensional drawing Profibus adapter SR3



General tolerances to DIN ISO 2768-mk

Order information

BTF Profibus adapter

Type	Part no..	Description
AD-ATM60-KA3PR	2029225	Bus adapter KA3, 3 x PG
AD-ATM60-SR3PR	2031985	Bus adapter SR3, 1 x M12, 4 pin 2 x M12, 5 pin

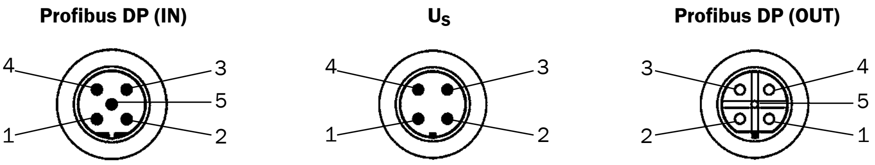
① PIN and wire allocation for Profibus adapter

Terminal strip	Connector 4 pin	Connector 5 pin	Conn. female 5 pin	Signal	Explanation
1	1	–	–	U_S (24 V)	Supply voltage 10 ... 32 V
2	3	–	–	0 V (GND)	Ground (0 V)
3	–	–	4	B	Profibus DP B line (out)
4	–	–	2	A	Profibus DP A line (out)
5	–	4	–	B	Profibus DP B line (in)
6	–	2	–	A	Profibus DP A line (in)
7	–	–	1	2P5 [1]	+ 5 V (DC isolated)
8	–	–	3	2M [1]	0 V (DC isolated)
9	–	–	–	RTS [2]	Request To Send
–	2	1	–	N. C.	–
–	4	3	–	N. C.	–
–	–	5	5	Screen	Housing potential

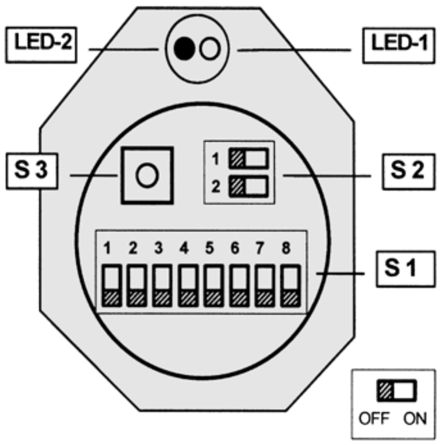
[1] Use for external bus termination or to supply the transmitter/receiver of an optical transmission link.

[2] Signal is optional, used to detect the direction of an optical connection.

Connector M12 (at Bus adapter)



Switch settings



Switch settings

Access to the switches is gained by opening the removable screw cap (PG) on the rear of the bus adapter. Use of the following elements.

S 1 (1-7)	Address setting (0 ... 127)
S 1 (8-8)	Counting direction (CW/CCW)
S 2	Bus termination
S 3	Preset push button (Number SET)

Status information via LEDs

LED-1	Operating voltage (green)
LED-2	Bus activity (red)

Implementation

DP Functionalities
in accordance with the Profibus DP basic functions

DP services
- Data interchange (Write_Read_Data)
- Address allocation (Set_Slave_Address)
- Control commands (Global_Control)
- Read the inputs (Read_Inputs)
- Read the outputs (Read_Outputs)
- Read diagnostic data (Slave_Diagnosis)
- Send configuration data (Set_Param)
- Check configuration data (Chk_Config)

Communication
- Cyclic master – slave data traffic

Protective mechanisms
- Data transfer with HD = 4
- Time monitoring of the data traffic

Configuration
Settings in accordance with Encoder Profile
- Counting direction (CW, CCW)
- Class-2 functionality (ON, OFF)
- Scaling function (ON, OFF)
- Steps per turn (1 ... 8192)
- Total resolution (GA) – 1 ... 67,108,864 steps, with GA = 2^n x SpU. – (n=0 ... 13)
- "Activation of SSA-service" [2]
- Selection of the station address [2]

Configuration
Setting the formats (IN/OUT)
for the cyclic data interchange via
configuration byte (K-1)

2 words IN/OUT data (I-1/O-1) [1]
4 words IN/OUT data (I-1, I-2, I-3/O-1) [2]

Data interchange: - Input Data (IN)

I-1	Position value [1]	4 bytes
I-2	Speed (rev/min) [2]	2 bytes
I-3	Time stamp [2]	2 bytes

Data interchange: - Output data (OUT)

O-1	PRESET Value [1]	4 bytes

Diagnostic information
- Station-related diagnosis (63 bytes in acc. with Encoder Profile Class 2)

Setting: - PRESET value
The PRESET function is used for set into operation and to allocate a specific position value to the current physical angular position.
The following settings are possible:
- by hardware (PRESET push button: S3)
- by software: – (see Output data)

Setting: - Counting direction
- by hardware via DIP switch S1-(8)
- by software via Telegram

Counting direction increasing:
Rotation of the shaft in the clockwise direction (CW) as viewed on the shaft

Setting: - Station address
- by hardware via DIP switch S1
- by software via Telegram

The setting by software is carried out only if the "SSA-service" has been previously activated.

Setting: - Bus termination
The 2-way DIP switch (S2) permits an internal bus termination to be switched in and out (ON/OFF).
If the bus is terminated externally, switch S2 must be in the OFF position.

Device-specific file (GS.)
For the purpose of automatic set into operation of the encoder, use is made of the GS file.
All the characteristic features of the device are defined in it.

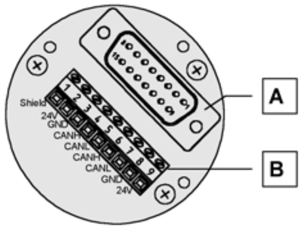
STEG 5952.GSD	German
STEG 5952.GSE	English

[1] As per Encoder Profile
[2] Manufacturer specific function

Resolution up to 0.025 mm

Absolute Wire Draw Encoders

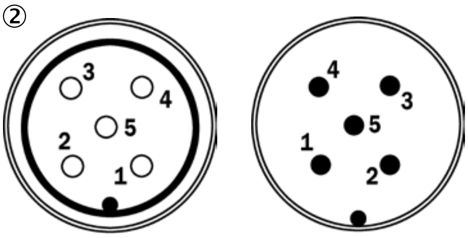
- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel



A Internal plug connection to the encoder
B External connection to the bus

Accessories – see pages 410-448

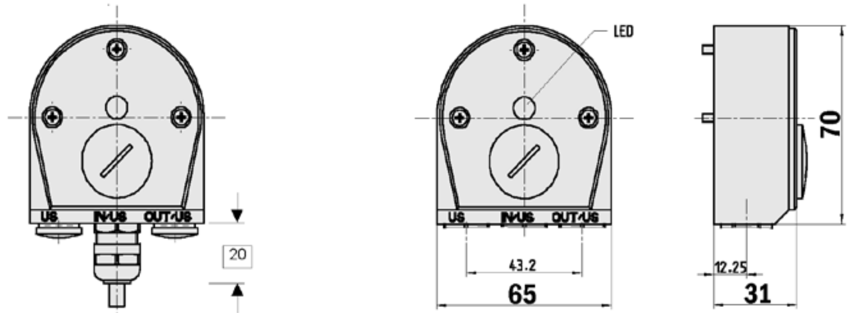
②



OUT/U_S (female) IN/U_S (male)

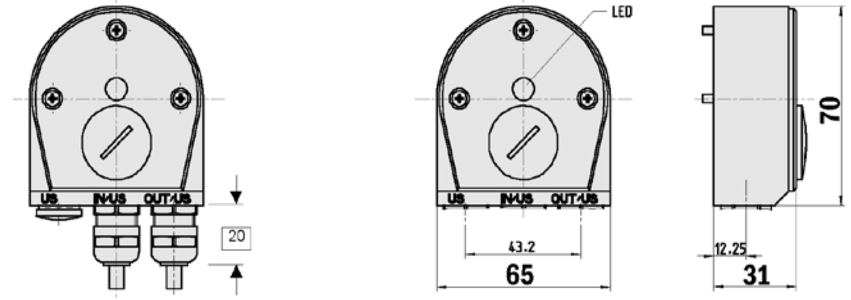
Connector M12 (Bus adapter)

Dimensional drawing CANopen adapter KR1



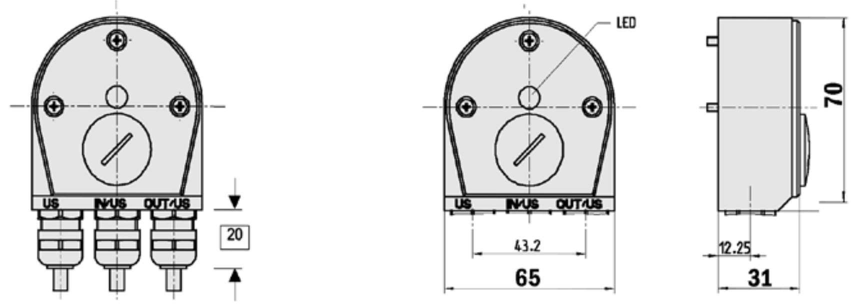
General tolerances to DIN ISO 2768-mk

Dimensional drawing CANopen adapter KR2



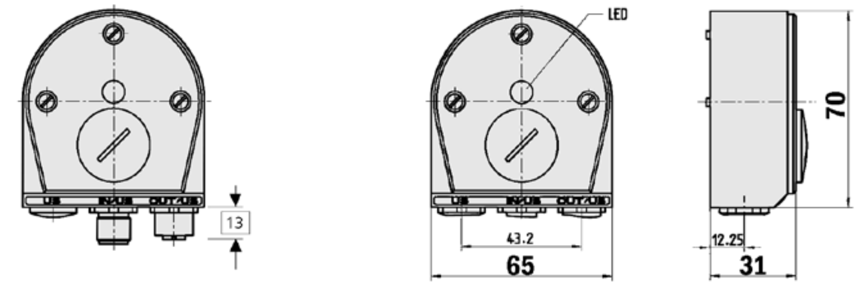
General tolerances to DIN ISO 2768-mk

Dimensional drawing CANopen adapter KR3



General tolerances to DIN ISO 2768-mk

Dimensional drawing CANopen adapter SR2



General tolerances to DIN ISO 2768-mk

Order information

BTF CANopen adapter

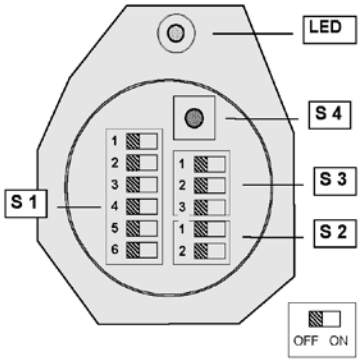
Type	Part no.	Description
AD-ATM60-KR1CO	2029230	Bus adapter KR1, 1 x PG
AD-ATM60-KR2CO	2029231	Bus adapter KR2, 2 x PG
AD-ATM60-KR3CO	2029232	Bus adapter KR3, 3 x PG
AD-ATM60-SR2CO	2020935	Bus adapter SR2, 2 x M12, 5 pin

① PIN and wire allocation for CANopen adapter

Terminal Strip	Connector	Signal	Explanation
1	1	Shield	Screen
2	2	U_S (24 V)	Supply voltage 10 ... 32 V
3	3	GND (COM)	0 V (Gnd)
4	4	CAN$_\text{H}$	CAN-Bus-Signal HIGH
5	5	CAN$_\text{L}$	CAN-Bus-Signal LOW
6		CAN$_\text{H}$	CAN-Bus-Signal HIGH
7		CAN$_\text{L}$	CAN-Bus-Signal LOW
8		GND (COM)	0 V (Gnd)
9		U_S (24 V)	Supply voltage 10 ... 32 V

① Encoders with a CANbus adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the CANbus adapter is unscrewed from the complete device. The figure shows the pin allocation within the bus connection.

Switch settings



Switch settings

Access to the switches is gained by opening the removable screw cap (PG) on the rear of the bus adapter. Use of the following elements.

S 1	Address setting (Node ID)
S 2	Bus termination
S 3	Baud rate setting (Data Rate)
S 4	Preset push button (Number zero SET)

Status information via LED

LED	2-colour red/green CAN Controller status

Implementation

CANopen Functionality

Predefined Connection Set
- Sync Object
- Emergency Object
- NMT Network Object (Error Control services, Boot-Up service)
- One Service Data Object (SDO)
- Two Process Data Object (PDO)

I/O-Operating Modes
- Synchronic: -- Depends on Sync Object
- Asynchronous. -- No reference to Sync Object. Triggered by "Timer" (Cyclic) or by event (COS)
- Remote Transmission (RTR)

Encoder Parameters

according the Device Profile for Encoders:
- Code direction (CW, CCW)
- Scaling function (ON, OFF)
- PRESET value
- Steps per revolution (CPR) - 1 ... 8,192
- Total resolution (TR) -- 1 ... 67,108,864 steps, with TR = 2^n x CPR -- (n = 0 ... 13)
- Limits for the working range
- Cycle Timer for asynchronous PDOs
- 8 programmable cams with HIGH/LOW limits and hysteresis
- General Diagnostic parameters (Offset Value, Alarms, Warnings, version of profile and software)

Manufacturer specific Profile:
- Node commissioning. -- Location and values for Node-ID and Baud rate
- Hysteresis to position change required for Async PDOs with COS mode
- Limits and display format for the speed and acceleration values

PDO Data Mapping

Mapping of up to four data objects to each of the two Transmit PDOs. The resulting data length within one PDO is limited to 8 Byte.

(1) Object 1/Pos Val[1] I-1

(n) Object 2 ... Object 4 I-1 to I-7

Input Data Objects

I-1	Position value [Pos Val]	4 Byte
I-2	Status of cam	1 Byte
I-3	Status of working range	1 Byte
I-4	Alarms	1 Byte
I-5	Warnings	1 Byte
I-6	Speed value	4 Byte
I-7	Acceleration value	4 Byte

Setting: - Address (Node ID)

0 to 63 by Hardware (DIP Switch) or EEPROM

Setting: - Baud rate

10kb, 20kb, 50kb, 125kb, 250kb, 500kb, 1 MB by Hardware (DIP Switch) or EEPROM

Setting: - Bus Termination

The DIP-Switch (S2) is used to switch on/ off an internal bus termination (ON/OFF).
Not used (OFF) in case of using an external termination of the network

Setting: - PRESET Value

The Preset function supports adaptation of the encoder zero point to the mechanical zero point of the encoder system. The factory PRESET value is zero [0]
The adjustment is carried out in 2 ways:
- by Hardware (PRESET push button)
- by Software (CANopen Protocol)

Equipment Configuration

Configuring parameters of the encoder can be achieved by a configuration tool in conjunction with an EDS file (Electronic Data Sheet). It contains all the characteristics of the encoder.

---

[1] Setting cannot be changed

Resolution up to 0.025 mm

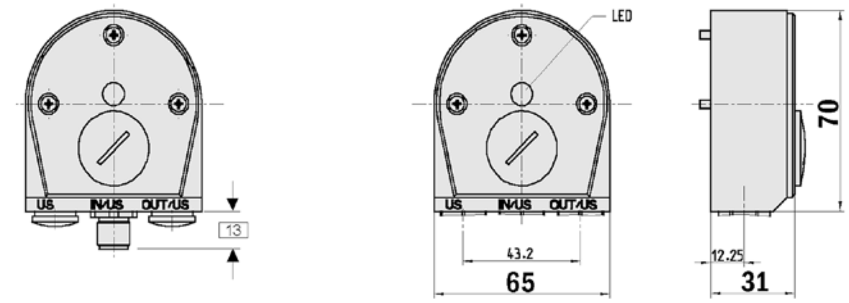
Absolute Wire Draw Encoders

- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel

CE

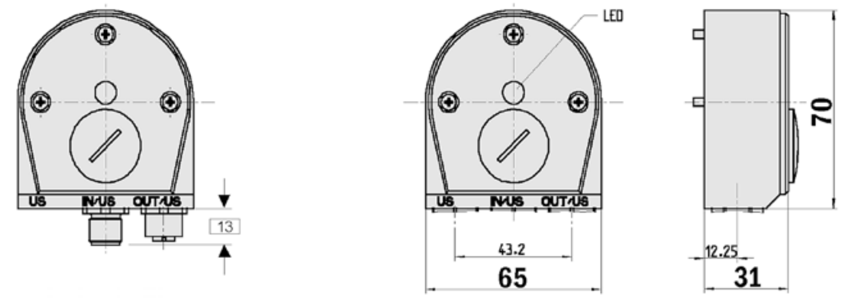
Accessories – see pages 410-448

Dimensional drawing DeviceNet adapter SR1



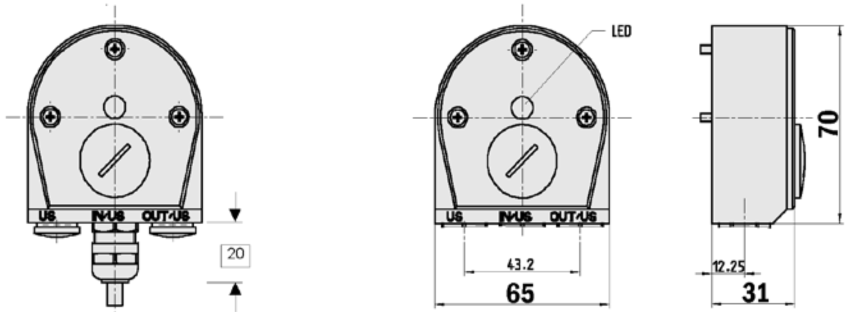
General tolerances to DIN ISO 2768-mk

Dimensional drawing DeviceNet adapter SR2



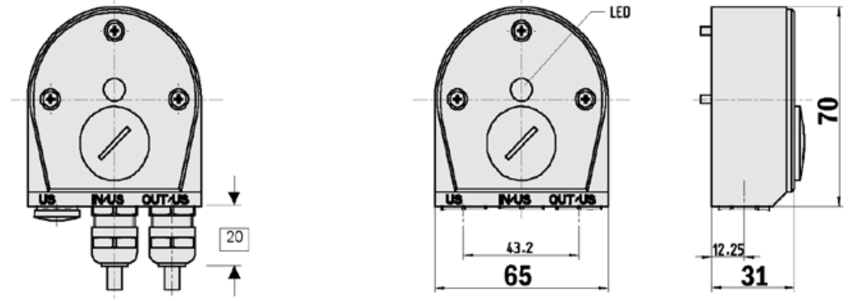
General tolerances to DIN ISO 2768-mk

Dimensional drawing DeviceNet adapter KR1



General tolerances to DIN ISO 2768-mk

Dimensional drawing DeviceNet adapter KR2



General tolerances to DIN ISO 2768-mk

Order information

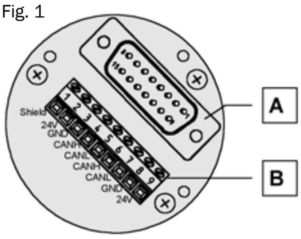
BTF DeviceNet adapter

Type	Part no.	Description
AD-ATM60-SR1DN	2029226	Bus adapter SR1, 1 x M12, 5 pin
AD-ATM60-SR2DN	2029227	Bus adapter SR2, 1 x M12, 5 pin
AD-ATM60-KR1DN	2029228	Bus adapter KR1, 1 x PG
AD-ATM60-KR2DN	2029229	Bus adapter KR2, 2 x PG

① PIN and wire allocation for DeviceNet adapter

Terminal Strip	② Connector	Signal	Explanation
1	1	Shield	Screen
2	2	U_S (24 V)	Supply voltage 10 ... 32 V
3	3	GND (COM)	0 V (Gnd)
4	4	CAN$_H$	CAN-Bus signal HIGH
5	5	CAN$_L$	CAN-Bus signal LOW
6		CAN$_H$	CAN-Bus signal HIGH
7		CAN$_L$	CAN-Bus signal LOW
8		GND (COM)	0 V (Gnd)
9		U_S (24 V)	Supply voltage 10 ... 32 V

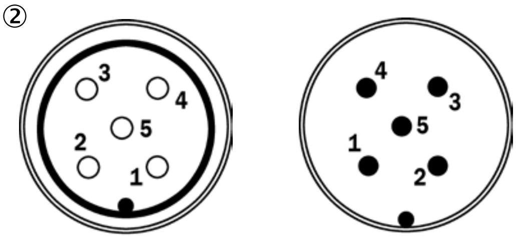
Fig. 1



① Encoders with a DeviceNet adapter have a terminal strip for connecting the bus and supply lines. In order to connect the lines, the DeviceNet adapter is unscrewed from the complete device. The figure shows the pin allocation within the bus connection.

A Internal plug connection to the encoder
B External connection to the bus

②

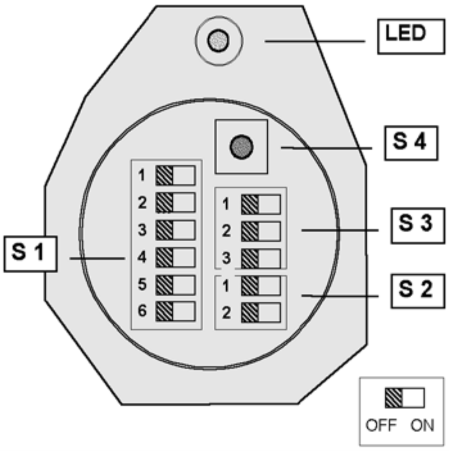


OUT/U_S (female)

IN/U_S (male)

Connector M12 (Bus adapter)

Switch settings



Switch settings

Access to the switches is gained by opening the removable screw cap (PG) on the rear of the bus adapter. Use of the following elements.

S 1	Address setting (Node ID)
S 2	Bus termination
S 3	Baud rate setting (Data Rate)
S 4	Preset push button (Number zero SET)

Status information (NS) via LED

LED	2-colour red/green
	Network communication status

Implementation

DN Functionality

Object model

- Identity Object
- Message Router Object
- DeviceNet Object
- Assembly Object
- Connection Object
- Acknowledge Handler Object
- Encoder Object

I/O-Operating Modes

- Polling
- Change of State/Cyclic
- Bits Strobe

Encoder Parameters

according the Device Profile for Encoders:

- Code direction (CW, CCW)
- Scaling function (ON, OFF)
- PRESET value
- Hysteresis to position change of required for COS communication
- Steps per revolution (CPR) - 1 ... 8,192
- Total resolution (TR) -- 1 ... 67,108,864 steps, with TR = 2^n x CPR -- (n=0 ... 13)
- Limits for the working range (software limit switches)
- Limits and display format for the speed and acceleration values
- 8 programmable cams with HIGH/LOW limits and hysteresis
- General Diagnostic parameters (Offset Value, Alarms, Warnings, version of profile and software)

Manufacturer specific parameters:

- Assignment of the I/O Data Assembly to the different I/O operating modes
- Diagnostic data indicating the current maximum results of the encoder
- Device-specific data

I/O Data Assembly

1)	Pos Val (Position Value) 1)	I-1
2)	Pos Val + Flag	I-1, I-2
3)	Pos Val + Speed	I-1, I-3
4)	Pos Val + Status of Cam	I-1, I-4

Input Data Objects

I-1	Position value [Pos Val]	4 Byte
I-2	Flag (Alarm, Warning)	1 Byte
I-3	Speed	4 Byte
I-4	Status of cam	1 Byte

Setting: - Address (Node ID)

0 to 63 by Hardware (DIP Switch)

Setting: - Baud rate

125kb, 250kb, 500kb by Hardware (DIP Switch)

Setting: - Bus Termination

The DIP Switch (S2) is used to switch on/ off an internal bus termination (ON/OFF).
Not used (OFF) in case of using an external termination of the network

Setting: - PRESET Value

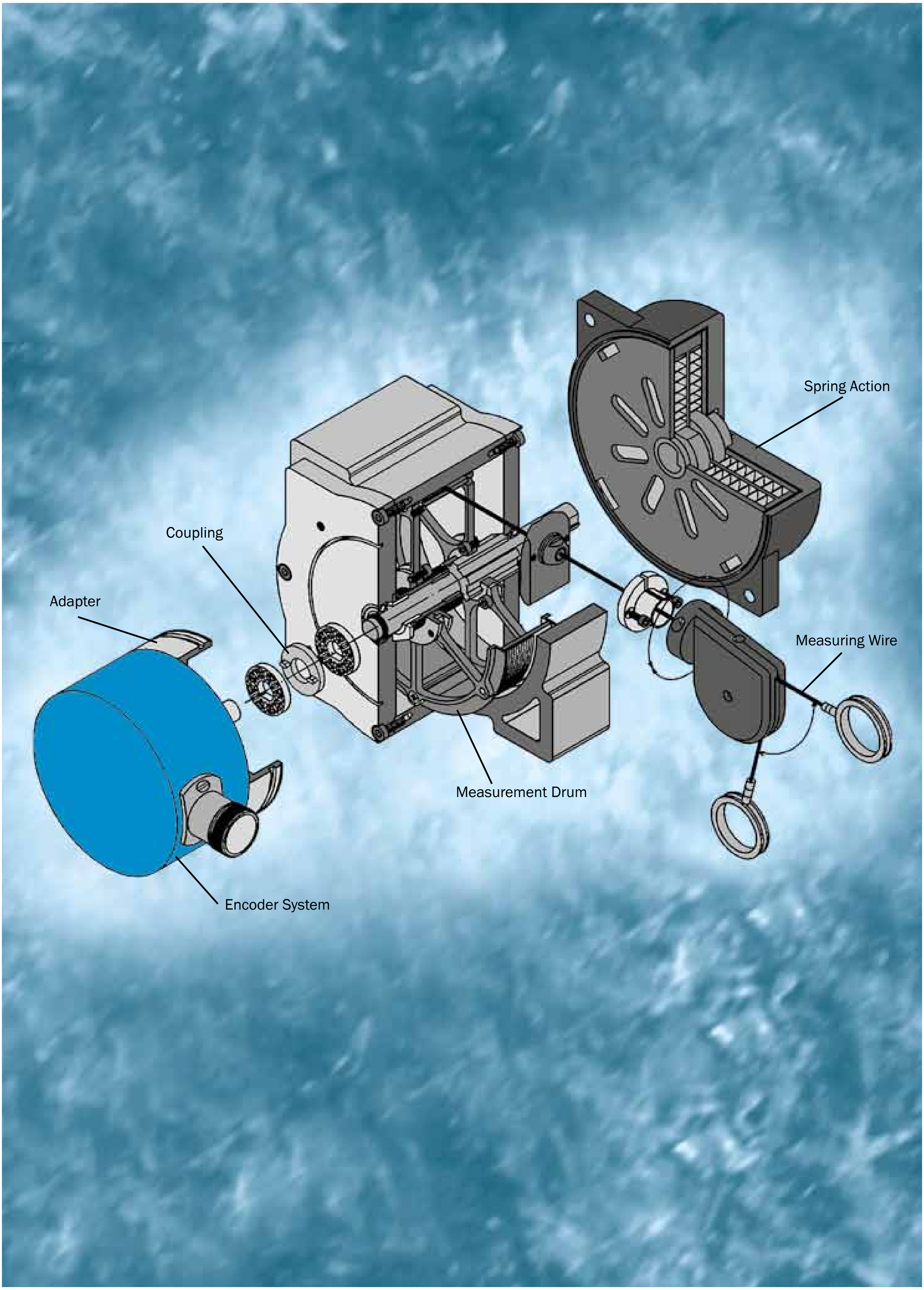
The Preset function supports adaptation of the encoder zero point to the mechanical zero point of the encoder system. The factory PRESET value is zero [0]
The adjustment is carried out in 2 ways:

- by Hardware (PRESET push button)
- by Software (DeviceNet Protocol)

Equipment Configuration

Configuring parameters of the encoder can be achieved by a configuration tool in conjunction with an EDS file (Electronic Data Sheet). It contains all the characteristics of the encoder.

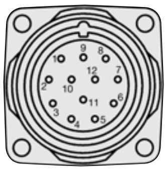
1) Setting cannot be changed


Spring Action
Coupling
Adapter
Measuring Wire
Measurement Drum
Encoder System

Resolution up to 0.025 mm

Incremental Wire Draw Encoders

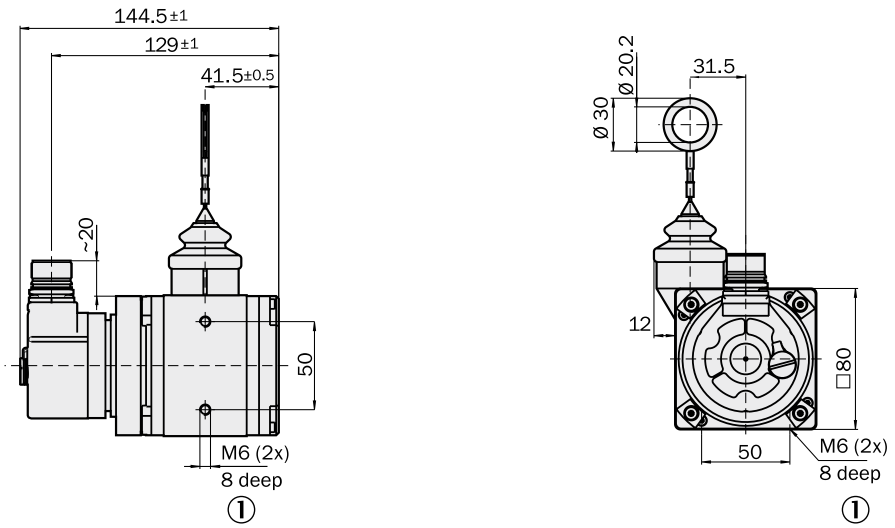
- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel



View of the connector M23 fitted to the encoder body

Accessories – see pages 410-448

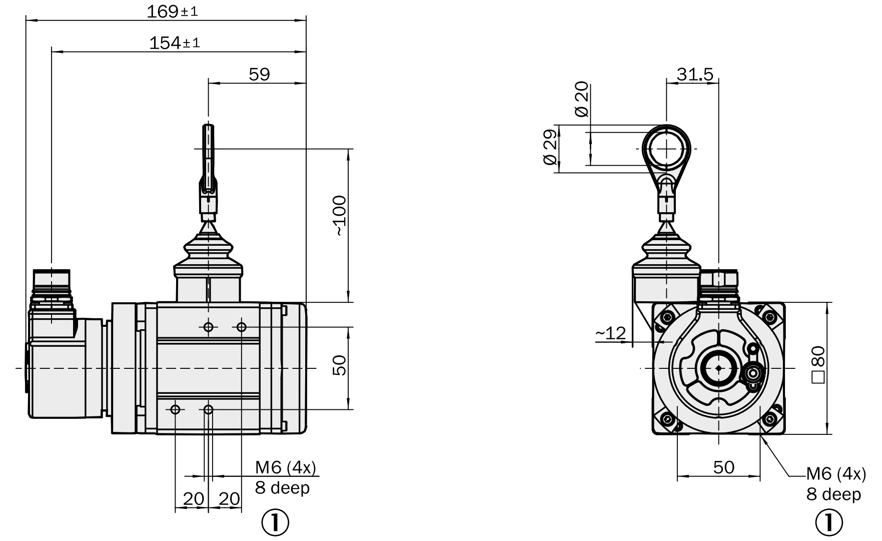
Dimensional drawing wire draw encoder PRF08 TTL, HTL, measuring length 2 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

Dimensional drawing wire draw encoder PRF08 TTL, HTL, measuring length 3 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	$\overline{A}$	black	Signal line
2	Sense +	grey	Connected internally to U_s
3	Z	lilac	Signal line
4	$\overline{Z}$	yellow	Signal line
5	B	white	Signal line
6	$\overline{B}$	brown	Signal line
7	N. C.		Not connected
8	A	pink	Signal line
9	Screen		Housing potential
10	GND	blue	Earth connection
11	Sense –	green	Connected internally to GND
12	U_s	red	Supply voltage [1]

[1] Volt-free to the housing

N. C. = Not connected

Technical data	PRF08	TTL 2 m	TTL 2 m	HTL 2 m	TTL 3 m	TTL 3 m	HTL 3 m				
Drum housing	Anodised Aluminium	▨	▨	▨	▨	▨	▨				
Spring housing	Die-cast zinc	▨	▨	▨	▨	▨	▨				
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	▨	▨	▨	▨	▨	▨				
Measuring length	2 m max.	▨	▨	▨							
	max. 3 m				▨	▨	▨				
Mass	1.6 kg approx.	▨	▨	▨							
	ca. 1,8 kg				▨	▨	▨				
Electrical Interfaces	TTL/RS422, 6 channels	▨	▨		▨	▨					
	HTL/push-pull, 6 channels			▨			▨				
Measuring step	0.025 mm ①	▨	▨	▨	▨	▨	▨				
Reference signal	Number: 1/position 90 °	▨	▨	▨	▨	▨	▨				
Linearity	0.05 % typ.	▨	▨	▨	▨	▨	▨				
Repeatability	± 1 measuring step	▨	▨	▨	▨	▨	▨				
Operating speed	4 m/sec.	▨	▨	▨	▨	▨	▨				
Spring return force (typ.)											
start/finish 1)	6 N/14 N	▨	▨	▨	▨	▨	▨				
Working temperature range	–20 ... +70 °C	▨	▨	▨	▨	▨	▨				
Storage temperature range	–40 ... +100 °C	▨	▨	▨	▨	▨	▨				
Life of wire draw mechanism 2)	1 million cycles	▨	▨	▨	▨	▨	▨				
EMC 3)		▨	▨	▨	▨	▨	▨				
Resistance											
to shocks 4)	50/11 g/ms	▨	▨	▨	▨	▨	▨				
to vibration 5)	20/10 ... 150 g/Hz	▨	▨	▨	▨	▨	▨				
Protection to IEC 60529	IP 64 (wire draw mechanism)	▨	▨	▨	▨	▨	▨				
	IP 65 (encoder)	▨	▨	▨	▨	▨	▨				
Operating voltage range (U_s)											
load TTL/RS422, 4.5 ... 5.5 V	20 mA max.	▨			▨						
current TTL/RS422, 10 ... 32 V	20 mA max.		▨			▨					
HTL/push-pull, 10 ... 32 V	60 mA max.			▨			▨				
Operating current, no load											
at 5 V	120 mA typ.	▨			▨						
at 10 ... 32 V	100 mA typ.		▨	▨		▨	▨				
Operating Set button 6)	≥ 100 ms	▨	▨	▨	▨	▨	▨				
Initialisation time after power on	40 ms	▨	▨	▨	▨	▨	▨				

1) These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

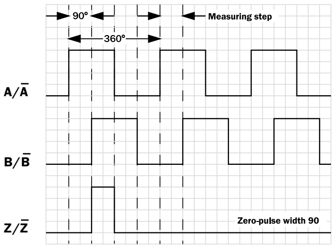
2) Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

3) To DIN EN 61000-6-2 and DIN EN 61000-6-3

4) To DIN EN 60068-2-27

5) To DIN EN 60068-2-6

6) For stationary shaft only.



① Based on the control/counter evaluating the flanks of the A+B pulses.

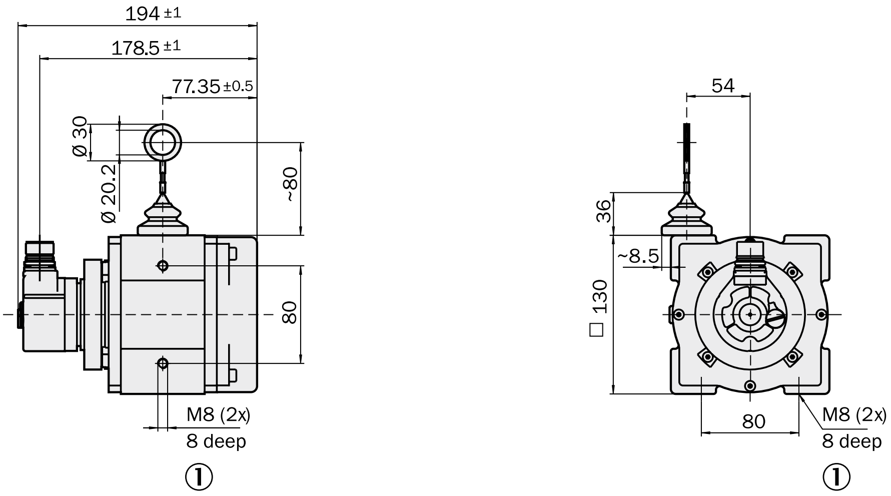
Order information		
PRF08; connector M23, 12 pin		
Type	**Part no.**	**Description**
PRF08-A1AM0240	1034323	TTL 4.5 ... 5.5 V; measuring length 2 m
PRF08-C1AM0240	1034329	TTL 10 ... 32 V; measuring length 2 m
PRF08-E1AM0240	1034335	HTL 10 ... 32 V; measuring length 2 m
PRF08-A1AM0340	1034896	TTL 4.5 ... 5.5 V; measuring length 3 m
PRF08-C1AM0340	1034897	TTL 10 ... 32 V; measuring length 3 m
PRF08-E1AM0340	1034898	HTL 10 ... 32 V; measuring length 3 m

Resolution up to 0.025 mm

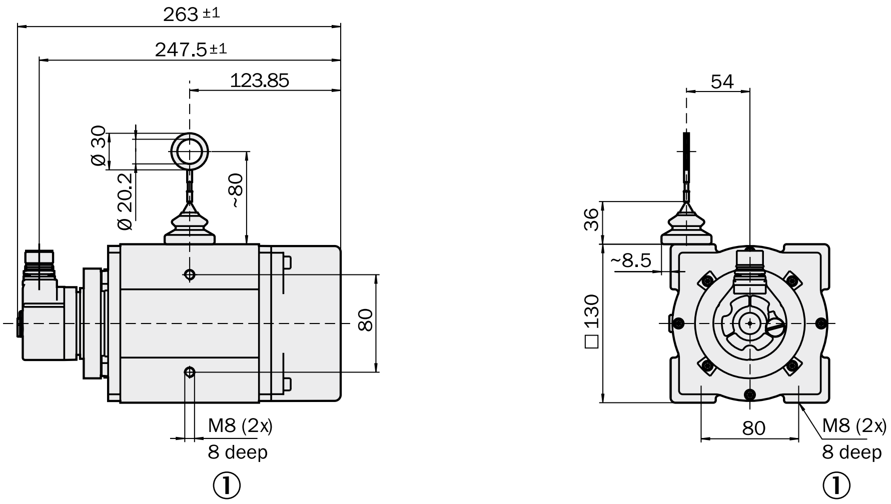
Incremental Wire Draw Encoders

- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel

Dimensional drawing wire draw encoder PRF13 TTL, HTL, measuring length 5 m

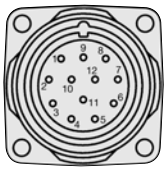


Dimensional drawing wire draw encoder PRF13 TTL, HTL, measuring length 10 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk



View of the connector M23 fitted to the encoder body

Accessories – see pages 410-448

PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	$\overline{A}$	black	Signal line
2	Sense +	grey	Connected internally to U_S
3	Z	lilac	Signal line
4	$\overline{Z}$	yellow	Signal line
5	B	white	Signal line
6	$\overline{B}$	brown	Signal line
7	N. C.		Not connected
8	A	pink	Signal line
9	Screen		Housing potential
10	GND	blue	Earth connection
11	Sense –	green	Connected internally to GND
12	U_S	red	Supply voltage [1]

[1] Volt-free to the housing

N. C. = Not connected

Technical data	PRF13	TTL 5 m	TTL 5 m	HTL 5 m	TTL 10 m	TTL 10 m	HTL 10 m				
Drum housing	Anodised Aluminium	■	■	■	■	■	■				
Spring housing	Plastic	■	■	■	■	■	■				
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	■	■	■	■	■	■				
Measuring length	5 m max.	■	■	■							
	10 m max.				■	■	■				
Mass	3.1 kg approx.	■	■	■							
	3.8 kg approx.				■	■	■				
Electrical Interfaces	TTL/RS422, 6 channels	■	■		■	■					
	HTL/push-pull, 6 channels			■			■				
Measuring step	0.05 mm ①	■	■	■	■	■	■				
Reference signal	Number: 1/position 90 °	■	■	■	■	■	■				
Linearity	0.05 % typ.	■	■	■	■	■	■				
Repeatability	± 1 measuring step	■	■	■	■	■	■				
Operating speed	4 m/sec.	■	■	■	■	■	■				
Spring return force (typ.)											
start/finish [1]	15 N/20 N	■	■	■							
start/finish [1]	10 N/20 N				■	■	■				
Working temperature range	–20 ... +70 °C	■	■	■	■	■	■				
Storage temperature range	–40 ... +100 °C	■	■	■	■	■	■				
Life of wire draw mechanism [2]	1 million cycles	■	■	■	■	■	■				
EMC [3]		■	■	■	■	■	■				
Resistance											
to shocks [4]	50/11 g/ms	■	■	■	■	■	■				
to vibration [5]	20/10 ... 150 g/Hz	■	■	■	■	■	■				
Protection to IEC 60529	IP 64 (wire draw mechanism)	■	■	■	■	■	■				
	IP 65 (encoder)	■	■	■	■	■	■				
Operating voltage range (U_S)											
load TTL/RS422, 4.5 ... 5.5 V	20 mA max.	■			■						
current TTL/RS422, 10 ... 32 V	20 mA max.		■			■					
HTL/push-pull, 10 ... 32 V	60 mA max.			■			■				
Operating current, no load											
at 5 V	120 mA typ.	■			■						
at 10 ... 32 V	100 mA typ.		■	■		■	■				
Operating Set button [6]	≥ 100 ms	■	■	■	■	■	■				
Initialisation time after power on	40 ms	■	■	■	■	■	■				

[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

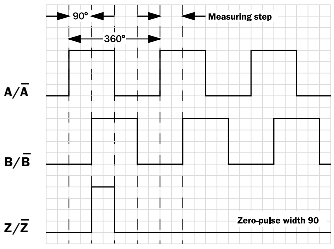
[2] Average values, which depend on the loading.
At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] For stationary shaft only.



① Based on the control/counter evaluating the flanks of the A+B pulses.

Order information

PRF13; connector M23, 12 pin

Type	Part no.	Description
PRF13-A1AM0520	1034324	TTL 4.5 ... 5.5 V; measuring length 5 m
PRF13-C1AM0520	1034330	TTL 10 ... 32 V; measuring length 5 m
PRF13-E1AM0520	1034336	HTL 10 ... 32 V; measuring length 5 m
PRF13-A1AM1020	1034325	TTL 4.5 ... 5.5 V; measuring length 10 m
PRF13-C1AM1020	1034331	TTL 10 ... 32 V; measuring length 10 m
PRF13-E1AM1020	1034337	HTL 10 ... 32 V; measuring length 10 m

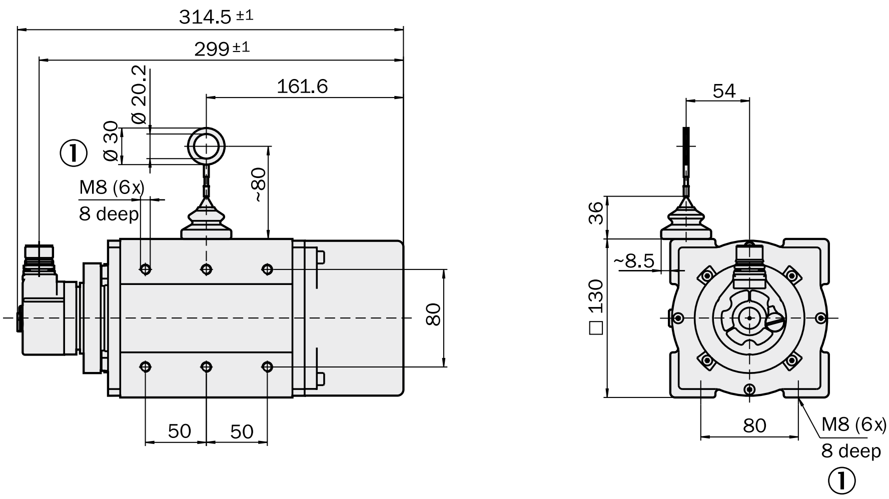
Incremental Wire Draw Encoders PRF13 TTL/HTL, Measuring Lengths from > 10 m to 30 m

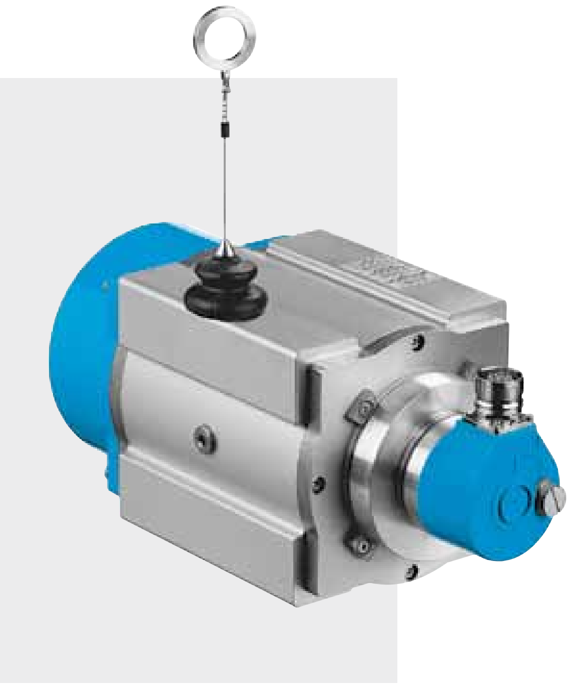
Resolution up to 0.025 mm

Incremental Wire Draw Encoders

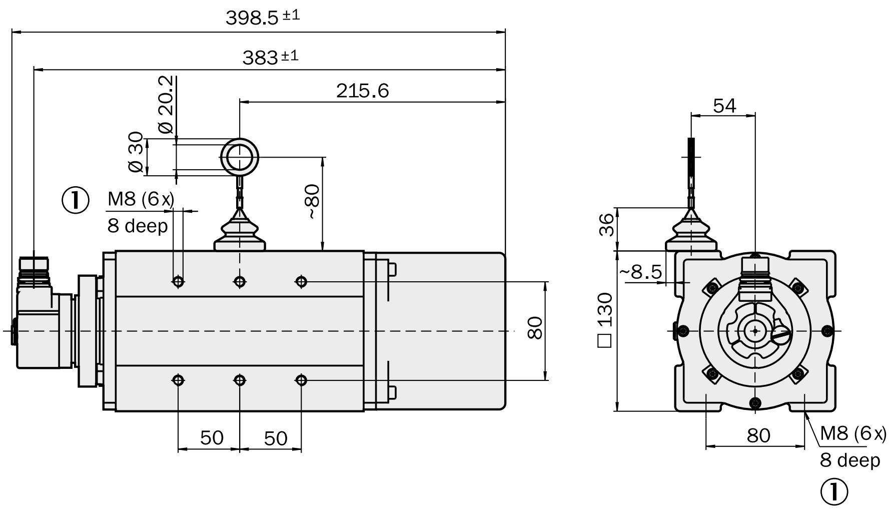
- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire
- Dirt remover made of steel

Dimensional drawing wire draw encoder PRF13 TTL, HTL, measuring length 20 m



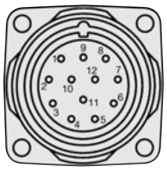


Dimensional drawing wire draw encoder PRF13 TTL, HTL, measuring length 30 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk



View of the connector M23 fitted to the encoder body

Accessories – see pages 410-448

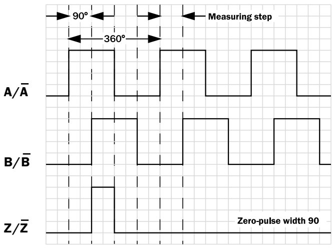
PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	$\overline{A}$	black	Signal line
2	Sense +	grey	Connected internally to U_S
3	Z	lilac	Signal line
4	$\overline{Z}$	yellow	Signal line
5	B	white	Signal line
6	$\overline{B}$	brown	Signal line
7	N. C.		Not connected
8	A	pink	Signal line
9	Screen		Housing potential
10	GND	blue	Earth connection
11	Sense –	green	Connected internally to GND
12	U_S	red	Supply voltage [1]

[1] Volt-free to the housing

N. C. = Not connected

Technical data	PRF13	TTL 20 m	TTL 20 m	HTL 20 m	TTL 30 m	TTL 30 m	HTL 30 m				
Drum housing	Anodised Aluminium	●	●	●	●	●	●				
Spring housing	Plastic	●	●	●	●	●	●				
Measuring wire (stainless)	Highly flexible stranded steel, Ø 0.81 mm	●	●	●	●	●	●				
Measuring length	20 m max.	●	●	●							
	30 m max.				●	●	●				
Mass	5.3 kg approx.	●	●	●							
	6.5 kg approx.				●	●	●				
Electrical Interfaces	TTL/RS422, 6 channels	●	●		●	●					
	HTL/push-pull, 6 channels			●			●				
Measuring step	0.05 mm ①	●	●	●	●	●	●				
Reference signal	Number: 1/position 90 °	●	●	●	●	●	●				
Linearity	0.05 % typ.	●	●	●	●	●	●				
Repeatability	± 1 measuring step	●	●	●	●	●	●				
Operating speed	4 m/sec.	●	●	●	●	●	●				
Spring return force (typ.)											
start/finish [1]	10 N/20 N	●	●	●	●	●	●				
Working temperature range	–20 … +70 °C	●	●	●	●	●	●				
Storage temperature range	–40 … +100 °C	●	●	●	●	●	●				
Life of wire draw mechanism [2]	1 million cycles	●	●	●	●	●	●				
EMC [3]		●	●	●	●	●	●				
Resistance											
to shocks [4]	50/11 g/ms	●	●	●	●	●	●				
to vibration [5]	20/10 … 150 g/Hz	●	●	●	●	●	●				
Protection to IEC 60529	IP 64 (wire draw mechanism)	●	●	●	●	●	●				
	IP 65 (encoder)	●	●	●	●	●	●				
Operating voltage range (U_S)											
load TTL/RS422, 4.5 … 5.5 V	20 mA max.	●			●						
current TTL/RS422, 10 … 32 V	20 mA max.		●			●					
HTL/push-pull, 10 … 32 V	60 mA max.			●			●				
Operating current, no load											
at 5 V	120 mA typ.	●			●						
at 10 … 32 V	100 mA typ.		●	●		●	●				
Operating Set button [6]	≥ 100 ms	●	●	●	●	●	●				
Initialisation time after power on	40 ms	●	●	●	●	●	●				



① Based on the control/counter evaluating the flanks of the A+B pulses.

[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading. At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] For stationary shaft only.

Order information

PRF13; connector M23, 12 pin

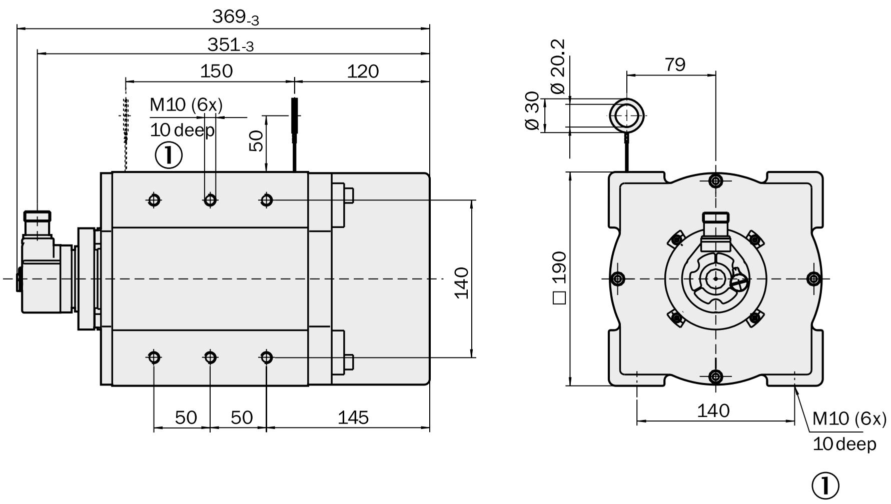
Type	Part no.	Description
PRF13-A1AM2020	1034326	TTL 4.5 … 5.5 V; measuring length 20 m
PRF13-C1AM2020	1034332	TTL 10 … 32 V; measuring length 20 m
PRF13-E1AM2020	1034338	HTL 10 … 32 V; measuring length 20 m
PRF13-A1AM3020	1034327	TTL 4.5 … 5.5 V; measuring length 30 m
PRF13-C1AM3020	1034333	TTL 10 … 32 V; measuring length 30 m
PRF13-E1AM3020	1034339	HTL 10 … 32 V; measuring length 30 m

Resolution up to 0.025 mm

Incremental Wire Draw Encoders

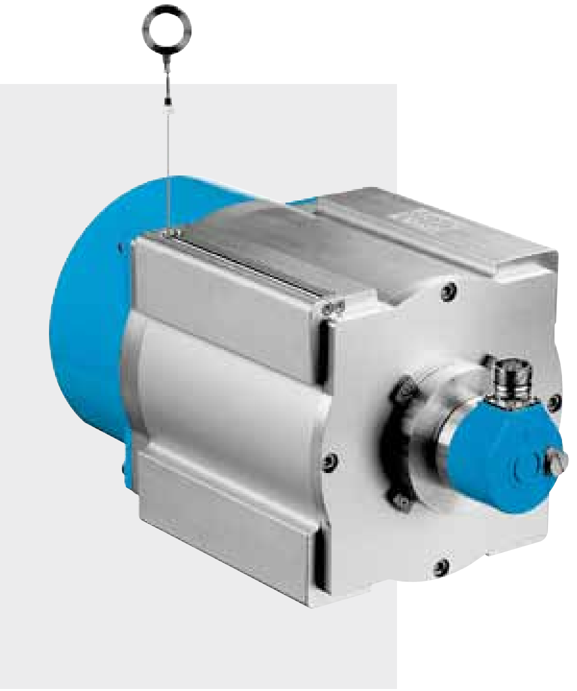
- Linear path measurement using a wire draw mechanism
- High resolution
- Easy to mount
- High-precision measurement drum
- Extremely stable spring return
- Highly flexible steel wire

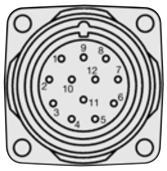
Dimensional drawing wire draw encoder PRF19 TTL, HTL, measuring length 50 m



① Threaded blind hole for mounting

General tolerances to DIN ISO 2768-mk





View of the connector M23 fitted to the encoder body

Accessories – see pages 410-448

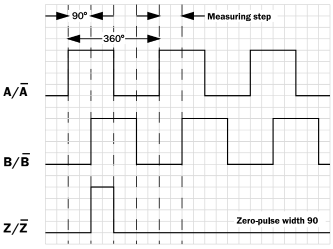
PIN and wire allocation

PIN	Signal	Wire colours (cable outlet)	Explanation
1	$\overline{A}$	black	Signal line
2	Sense +	grey	Connected internally to U_S
3	Z	lilac	Signal line
4	$\overline{Z}$	yellow	Signal line
5	B	white	Signal line
6	$\overline{B}$	brown	Signal line
7	N. C.		Not connected
8	A	pink	Signal line
9	Screen		Housing potential
10	GND	blue	Earth connection
11	Sense –	green	Connected internally to GND
12	U_S	red	Supply voltage [1]

[1] Volt-free to the housing

N. C. = Not connected

Technical data	PRF19	TTL 50 m	TTL 50 m	HTL 50 m
Drum housing	Anodised Aluminium	■	■	■
Spring housing	Die-cast zinc	■	■	■
Measuring wire (stainless)	Highly flexible stranded steel, Ø 1.35 mm	■	■	■
Measuring length	50 m max.	■	■	■
Mass	16.8 kg approx.	■	■	■
Electrical Interfaces	TTL/RS422, 6 channels	■	■	
	HTL/push-pull, 6 channels			■
Measuring step	0.1 mm ①	■	■	■
Reference signal	Number: 1/position 90°	■	■	■
Linearity	0.05 % typ.	■	■	■
Repeatability	± 1 measuring step	■	■	■
Operating speed	4 m/sec.	■	■	■
Spring return force (typ.)				
start/finish [1]	18 N/37 N	■	■	■
Working temperature range	–20 ... +70 °C	■	■	■
Storage temperature range	–40 ... +100 °C	■	■	■
Life of wire draw mechanism [2]	1 million cycles	■	■	■
EMC [3]		■	■	■
Resistance				
to shocks [4]	50/11 g/ms	■	■	■
to vibration [5]	20/10 ... 150 g/Hz	■	■	■
Protection to IEC 60529	IP 31 (wire draw mechanism)	■	■	■
	IP 65 (encoder)	■	■	■
Operating voltage range (U_S)				
load TTL/RS422, 4.5 ... 5.5 V	20 mA max.	■		
current TTL/RS422, 10 ... 32 V	20 mA max.		■	
HTL/push-pull, 10 ... 32 V	60 mA max.			■
Operating current, no load				
at 5 V	120 mA typ.	■		
at 10 ... 32 V	100 mA typ.		■	■
Operating Set button [6]	≥ 100 ms	■	■	■
Initialisation time after power on	40 ms	■	■	■



① Based on the control/counter evaluating the flanks of the A+B pulses.

Order information		
PRF19; connector M23, 12 pin		
Type	**Part no.**	**Description**
PRF19-A1AM5010	1034328	TTL 4.5 ... 5.5 V; measuring length 50 m
PRF19-C1AM5010	1034334	TTL 10 ... 32 V; measuring length 50 m
PRF19-E1AM5010	1034340	HTL 10 ... 32 V; measuring length 50 m

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[1] These values were measured at an ambient temperature of 25 °C. The values may be different at other temperatures.

[2] Average values, which depend on the loading.
At high operating speeds over long lengths, this figure can decrease; at slow operating speeds over short lengths, it can increase.

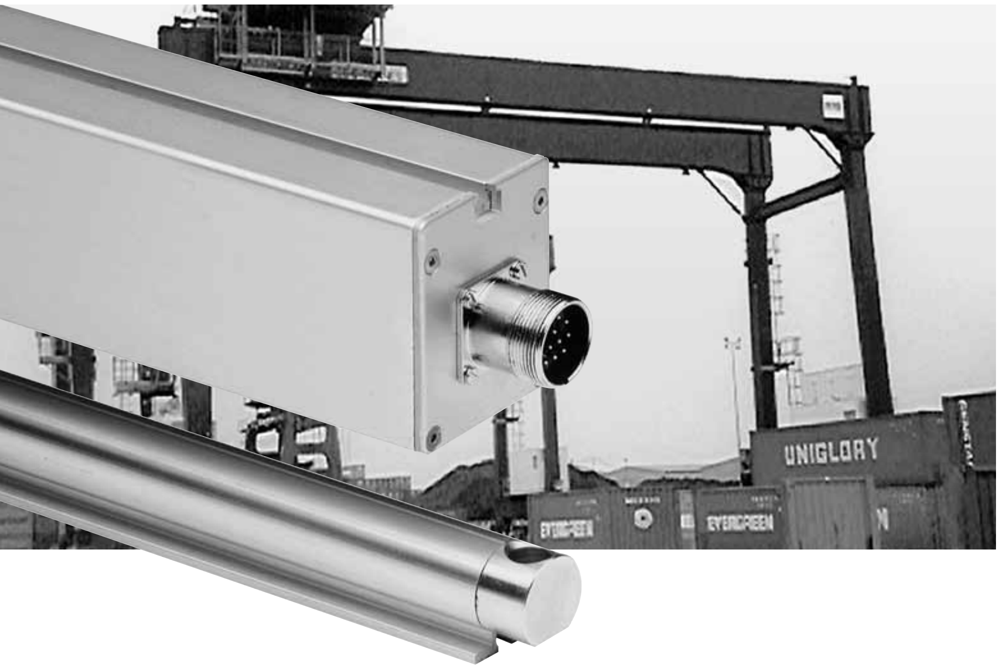
[3] To DIN EN 61000-6-2 and DIN EN 61000-6-3

[4] To DIN EN 60068-2-27

[5] To DIN EN 60068-2-6

[6] For stationary shaft only.

KH53/KH53 Advanced: Non-Contact Linear Encoders. Wear-free for rough environmental conditions



Resolution 0.1 mm

Non-Contact Linear Encoders

POMUX®

The POMUX KH53 Non-Contact Linear Encoder functions on the transmitter/receiver principle. Because of the absolute position detection, an initialising reference run is not necessary.

The measuring method: A read head determines without contact, the absolute position of a series of scale sections, which are mounted along the measurement section.
The read head consists of a series of magnetoresistive sensors, which can always detect the position of at least 3 permanent magnets to determine the absolute position.

The measuring elements are manufactured from aluminium and are referred to as measuring elements: These are mounted in a row at fixed intervals with the aid of a mounting gauge until the desired measuring length is reached. Fitted within each measuring element are permanent magnets, whose spacing from one another represents the unique encoding of a portion of the measurement section. The read head moves parallel to these measuring elements. The separation of read head and measuring element is 25 mm resp. 55 mm.

With a measuring length of up to 1,700 m, the KH53 is particularly suitable for use in cranes, in storage and conveyor engineering and on rail-bound vehicles. As a result of the non-contact principle of operation, this system operates without wear even under the harshest environmental conditions.

Resolution
0.1 mm

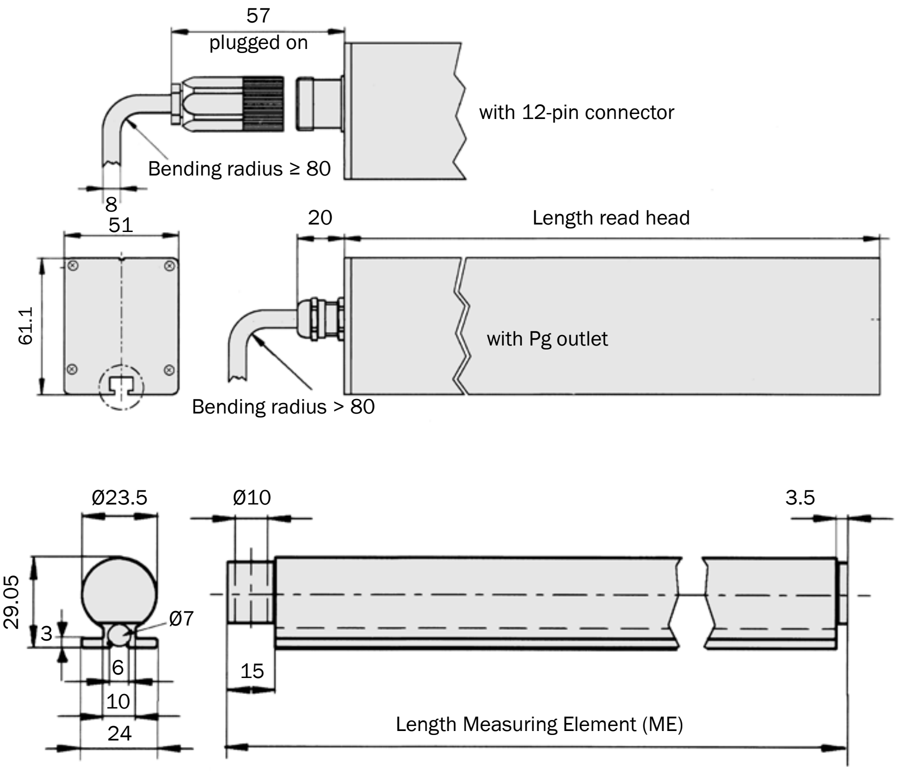
Non-Contact Linear Encoders

- Measuring length up to 1.7 km
- Non-contact length measuring system, wear free
- Absolute position measurement no initialising reference run
- Choice of electrical interfaces
- Position sampling time independent of length
- Degree of protection up to IP 66

CE

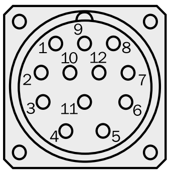
Accessories – see pages 410-448

Dimensional drawing Linear Encoder KH53 SSI



PIN and wire allocation SSI Interface [1)]

PIN	Signal	Colour of wires (cable outlet)	Explanation
1	GND	blue	Earth (ground) connection
2	data +	white	Interface signal
3	clock +	yellow	Interface signal
4	R x D +	grey	RS 422 Programming lines
5	R x D –	green	RS 422 Programming lines
6	T x D +	pink	RS 422 Programming lines
7	T x D –	black	RS 422 Programming lines
8	+ U_S	red	Supply voltage
9	N. C.	orange	Not connected
10	data –	brown	Interface signal
11	clock –	violet	Interface signal
12	N. C.	–	Not connected



View of the connector M23 fitted to the encoder body SSI

[1)] Other Interfaces on request

Technical data	SSI	KH53	KH53 Advanced
System resolution	0.1 mm	■	■
Reproducibility	0.3 mm	■	
	1.0 mm		■
Measurement accuracy [1]	± 1000 + ME (Tu −25 °C) Tk µm	■	
	± 2000 + ME (Tu −25 °C) Tk µm		■
Position tolerances	± 10 mm	■	
	± 20 mm		■
Coefficient of thermal expansion Tk	28 µm/°C/m	■	■
Mass			
Read head 38	2.4 kg	■	
107	2.7 kg	■	
354	3.6 kg	■	
1700	5.2 kg	■	
54	4.4 kg		■
548	6.7 kg		■
Measuring element	Approx. 0.5 kg/m	■	
	Approx. 0.65 kg/m		■
Material			
Read head	AlMgSiPbF28	■	■
Measuring element	AlMgSi0.5F22	■	■
Resistance to shocks [2]			
Read head	30/10 g/ms	■	■
Measuring element	50/10 g/ms	■	■
Resistance to vibration [3]			
Read head	10/20 ... 250 g/Hz	■	■
Measuring element	30/20 ... 250 g/Hz	■	■
Working temperature range	−20 ... +60 °C	■	
	−30 ... +70 °C		■
Storage temperature range			
Read head	−40 ... +85 °C	■	■
Protection class acc. IEC 60529			
Read head head with cable	IP 66	■	■
Read head with srew-in system	IP 65 [4]	■	■
Max. movement speed [5]	6.6 m/s	■	■
Initialisation time	2 s	■	■
Position forming time	0.8 ms	■	■
Supply voltage	10 ... 32 V	■	■
Operating current SSI	120 mA	■	■
Interface for parameterising			
Four wire transmission, asynchrony, full duplex		■	■
Data format: 1 start bit, 8 data bits, 1 stop bit, no parity		■	■
Data protocol: ASCII, Baud rate 9600	RS 422	■	■
Interface digital, serial	SSI 24 bits format	■	■
Standart (Default setting SSI standard)	RS 422 OFF	■	■
Electrical connection	Cable outlet	■	■
	Screw-in connector system M23	■	■

[1] If the read head and measuring element are mounted within ± 1 mm of the nominal mounting distance in the N and Y directions. The figures quoted related to the accuracy within a measuring element with reference to the start of that measuring element.
ME = length measuring element
Tu = Ambient temperature °C

[2] According DIN EN 61000-2-27

[3] According DIN EN 61000-2-6

[4] With mating connector fitted

[5] If the max. movement speed is exceeded or the read head cannot detect a measuring element the error message FF FF FE Hex is produced.

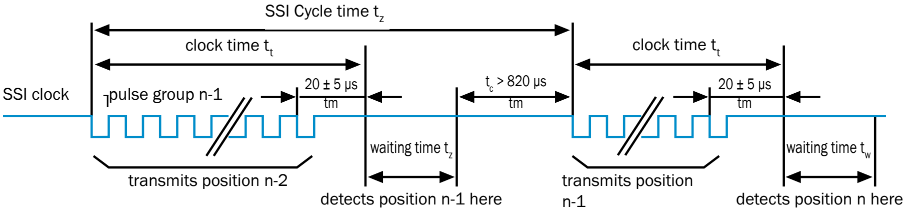
Resolution
0.1 mm

Non-Contact Linear Encoders

- Measuring length up to 1.7 km
- Non-contact length measuring system, wear free
- Absolute position measurement no initialising reference run
- Choice of electrical interfaces
- Position sampling time independent of length
- Degree of protection up to IP 66

Accessories – see pages 410-448

Interface description



tm = Monoflop time
tc = Read head scanning interval with deactivated asynchronous interface (Default).

A number of special features must be observed for use of this interface in POMUX KH53 :

Standard operation
The digital angle information cannot be read directly from a coding disc but is formed by complex computation algorithm from a number of analog voltages, it is not possible to detect the position value associated with this time when first trailing edge of the clock signal occurs.

During standard operation, the KH53 forms a position value cyclically every 800 µs irrespective of the SSI read cycle, and places this value in the output register provided for this purpuse, for recovery by the interface. Since the SSI read cycle and the position forming cycle can never be the same, this results in a continuous shift in the time position assignment.

In other words:
The time assignment of the position value fluctuates from 5 µs to 800 µs in this operating mode.

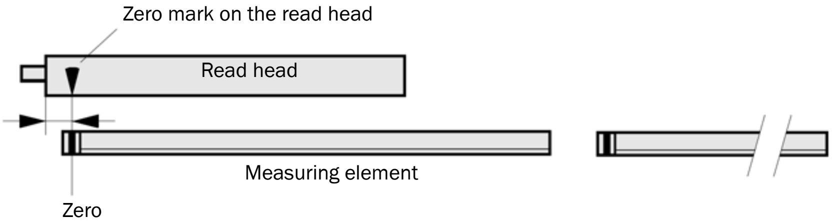
Synchronous SSI-Operation
The synchronous SSI operating mode can be connected via the parametrising interface in order to avoid the fluctuation of the time position assignment, which can lead to highly unpredictable behaviour of the control loop. In this operating mode, position detection is started on the first trailing edge of the SSI pulse, and the position is detected using the last pulse group. In order to keep the delay time of between position measurement and position transmission as short as possible, the position measurement can be delayed by parameterising a waiting time. This ensures that the current position is measured as shortly as possible before the SSI clock group.

The waiting time t_w must be less than the SSi cycle time t_z minus the clock time t_t minus 820 µs.

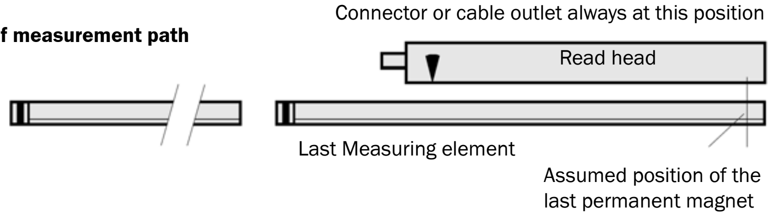
Waiting time condition
$t_w < t_z - t_t - t_c$
$t_c = 820$ µs

Position tolerances

Start of measuring path

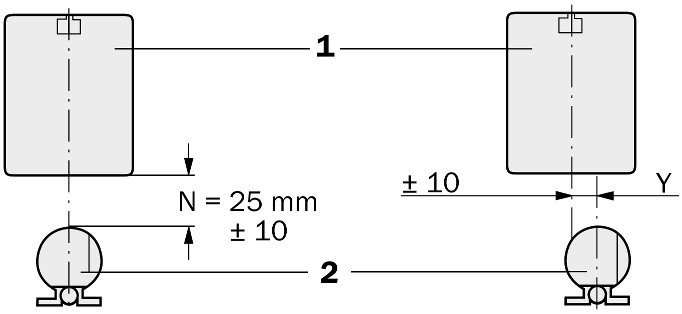


End of measurement path



KH53

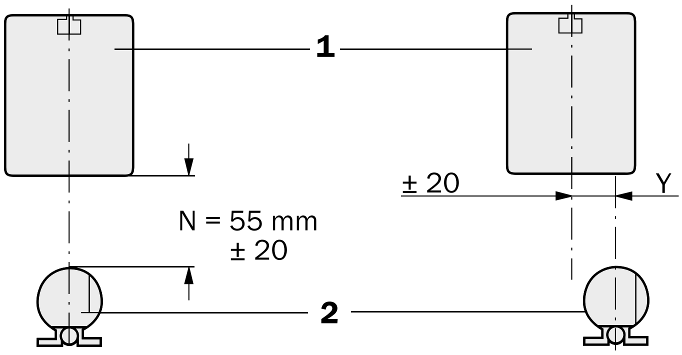
1 Read head
2 Measuring element



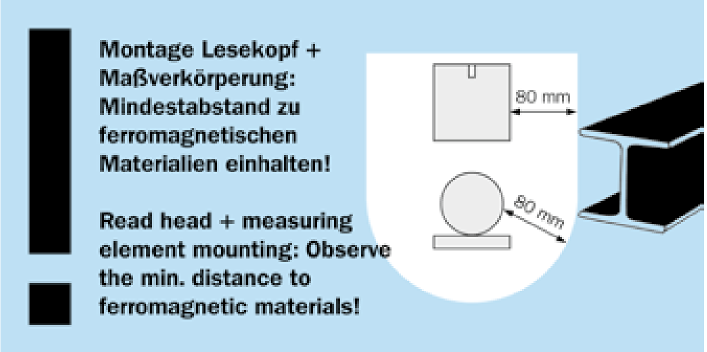
The reliability and accuracy of the measuring system are dependent upon maintaining the mounting tolerances! Magnetic and materials that can be magnetised, are not allowed within a radius of 80 mm of the measuring elements and the sensing face of the encoder.

KH53 Advanced

1 Read head
2 Measuring element



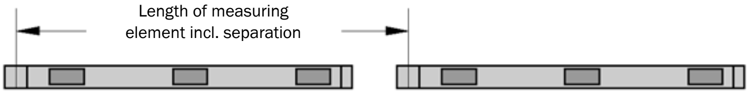
The reliability and accuracy of the measuring system are dependent upon maintaining the mounting tolerances! Magnetic and materials that can be magnetised, are not allowed within a radius of 80 mm of the measuring elements and the sensing face of the encoder.



Montage Lesekopf + Maßverkörperung: Mindestabstand zu ferromagnetischen Materialien einhalten!

Read head + measuring element mounting: Observe the min. distance to ferromagnetic materials!

Order information



Dimension and calculation table KH53

Measuring length up to	Read head length	Length of measuring element incl. separation	Mounting equipment per measuring element (proposed)
39.90 m	0.886 m	2.304 m Identification letters A1 ... ≤ A18	4 Spacer supports or 8 Fastening clamps
107.40 m	1.051 m	1.8688 m Identification letters B1 ... ≤ B58	3 Spacer supports or 6 Fastening clamps
351.20 m	1.376 m	2.5088 m Identification letters C1 ... ≤ C141	4 Spacer supports or 8 Fastening clamps
1676.40 m	2.026 m	1.9072 m Identification letters D1 ... ≤ D880	3 Spacer supports or 6 Fastening clamps

Dimension and calculation table KH53 Advanced

Measuring length up to	Read head length	Length of measuring element incl. separation	Mounting equipment per measuring element (proposed)
53.50 m	1.58 m	1.408 m Identification letters F1 ... ≤ F39	3 Spacer supports or 6 Fastening clamps
546.40 m	2.506 m	2.3552 m Identification letters G1 ... ≤ G233	4 Spacer supports or 8 Fastening clamps

The dimensions given are slightly rounded.

Order information

Calculation example for a measuring length of 100 m

Choose the system with a max. measuring length of 107 m

$$\textbf{Number of measuring elements required} = \frac{\textbf{Measuring length + Read head length}}{\textbf{Length of measuring element (according to table above)}}$$

Number of measuring element = 101,051 m/1.8688 m = **54.07**

Ordering quantity is therefore **55** pcs **measuring elements** and **55 * 3 = 165 spacer supports**

If **two separate measuring lengths** are required, then please order as **2 x 55** measuring elements (**not 110** measuring elements)

Caution! For valid position determination, the reading head must not travel over the end of the last measuring element.

Length measuring systems

Length measuring system KH53 - absolute, linear; measuring length up to 38 m

Type	Part no.	Measuring element length
KHK53-AXR00038	1030048	Read head 38, SSI, cable 1.5 m
KHK53-AXS00038	1030049	Read head 38, SSI, cable 3.0 m
KHK53-AXT00038	1030050	Read head 38, SSI, cable 5.0 m
KHK53-AXU00038	1030051	Read head 38, SSI, cable 10.0 m
KHK53-AXB00038	1030052	Read head 38, SSI, connector M23, 12-pin
KHT53-XXX00038	1030055	Measuring element up to 38 m, coded
KHU53-XXX00038	1030056	Measuring element up to 38 m, universal, configurable [1]
KHM53-XXX00038	1030057	Mounting gauge 38

[1] For temporary replacement of damaged measuring elements

Order information

Length measuring systems KH53

Length measuring system KH53 – absolute, linear; measuring length up to 107 m		
Type	**Part no.**	**Explanation**
KHK53-AXR00107	1030058	Read head 107, SSI, cable 1.5 m
KHK53-AXS00107	1030059	Read head 107, SSI, cable 3.0 m
KHK53-AXT00107	1030060	Read head 107, SSI, cable 5.0 m
KHK53-AXU00107	1030061	Read head 107, SSI, cable 10.0 m
KHK53-AXB00107	1030062	Read head 107, SSI, connector M23, 12-pin
KHT53-XXX00107	1030065	Measuring element up to 107 m, coded [1]
KHU53-XXX00107	1030066	Measuring element up to 107 m, universal, configurable [2]
KHM53-XXX00107	1030067	Mounting gauge 107

Length measuring system KH53 – absolute, linear; measuring length up to 354 m		
Type	**Part no.**	**Explanation**
KHK53-AXR00354	1030068	Read head 354, SSI, cable 1.5 m
KHK53-AXS00354	1030069	Read head 354, SSI, cable 3.0 m
KHK53-AXT00354	1030070	Read head 354, SSI, cable 5.0 m
KHK53-AXU00354	1030071	Read head 354, SSI, cable 10.0 m
KHK53-AXB00354	1030072	Read head 354, SSI, connector M23, 12-pin
KHT53-XXX00354	1030075	Measuring element up to 354 m, coded [1]
KHU53-XXX00354	1030076	Measuring element up to 354 m, universal, configurable [2]
KHM53-XXX00354	1030077	Mounting gauge 354

Length measuring system KH53 – absolute, linear; measuring length up to 1700 m		
Type	**Part no.**	**Explanation**
KHK53-AXR01700	1030078	Read head 1700, SSI, cable 1.5 m
KHK53-AXS01700	1030079	Read head 1700, SSI, cable 3.0 m
KHK53-AXT01700	1030080	Read head 1700, SSI, cable 5.0 m
KHK53-AXU01700	1030081	Read head 1700, SSI, cable 10.0 m
KHK53-AXB01700	1030082	Read head 1700, SSI, connector M23, 12-pin
KHT53-XXX01700	1030085	Measuring element up to 1700 m, coded [1]
KHU53-XXX01700	1030086	Measuring element up to 1700 m, universal, configurable [2]
KHM53-XXX01700	1030087	Mounting gauge 1700

Length measuring systems KH53 Advanced

Length measuring systems KH53 Advanced – absolute, linear; measuring length up to 54 m		
Type	**Part no.**	**Explanation**
KHK53-AXT00054	1035442	Read head 54, SSI, cable 5.0 m
KHK53-AXB00054	1035443	Read head 54, SSI, connector M23, 12-pin
KHT53-XXX00054	1035445	Measuring element up to 54 m, coded [1]
KHU53-XXX00054	1035446	Measuring element up to 54 m, universal, configurable [2]
KHM53-XXX00054	1035447	Mounting gauge 54

Length measuring systems KH53 Advanced – absolute, linear; measuring length up to 548 m		
Type	**Part no.**	**Explanation**
KHK53-AXT00548	1035448	Read head 548, SSI, cable 5.0 m
KHK53-AXB00548	1035449	Read head 548, SSI, connector M23, 12-pin
KHT53-XXX00548	1035451	Measuring element up to 548 m, coded [1]
KHU53-XXX00548	1035452	Measuring element up to 548 m, universal, configurable [2]
KHM53-XXX00548	1035453	Mounting gauge 548

[1] When placing a repeat order for particular defective measuring elements, please indicate the corresponding code number of the measuring element.

[2] For temporary replacement of damaged measuring elements

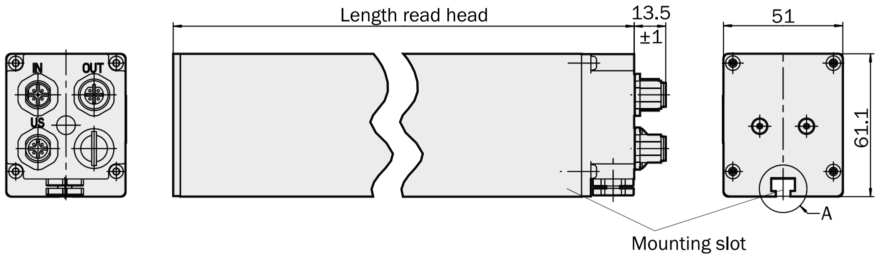
Resolution 0.1 mm

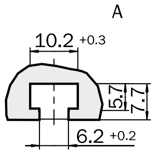
Non-Contact Linear Encoders

- Measuring length up to 1.7 km
- Non-contact length measuring system, wear free
- Absolute position measurement no initialising reference run
- Choice of electrical interfaces
- Position sampling time independent of length
- Degree of protection up to IP 67

Accessories – see pages 410-448

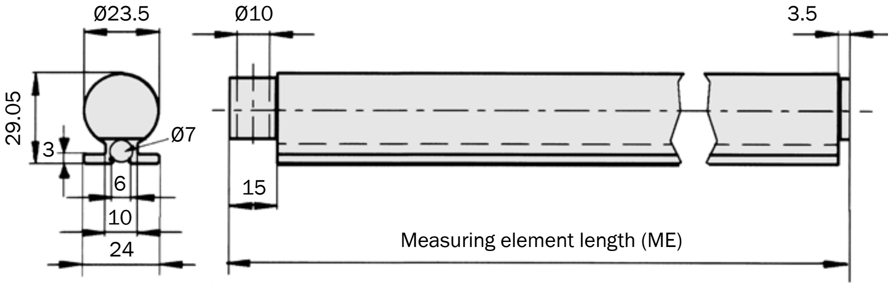
Dimensional drawing read head





Mounting slot designed for non-magnetic M6 DIN 933 screws.

Dimensional drawing measuring element

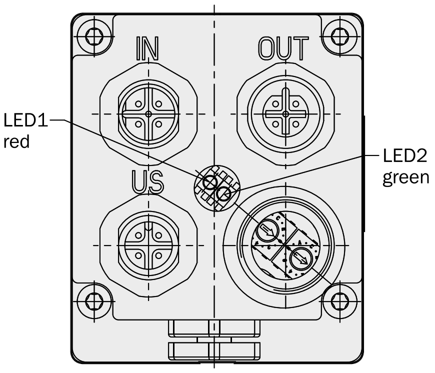


PIN allocation for Profibus interface

Connect. 4-pin (Male)	Connect. 5-pin (Male)	Connect. 5-pin (Female)	Signal	Explanation
1	–	–	Us (24 V)	Supply voltage 10 ... 32 V
3	–	–	0 V (GND)	Ground (0 V)
–	–	4	B	B-cable Profibus DP (OUT)
–	–	2	A	A-cable Profibus DP (OUT)
–	4	–	B	B-cable Profibus DP (IN)
–	2	–	A	A-cable Profibus DP (IN)
–	–	1	2P5 [1]	+ 5 V (potential free)
–	–	3	2M [1]	0 V (potential free)
–	–	–	RTS [2]	Request to Send
2	1	–	N. C.	–
4	3	–	N. C.	–
–	5	5	Screen	Housing potential

[1] For the connection of external bus termination or to supply the transmitter/receiver of a fibre optic data transfer system.

[2] This signal is optional for the direction acknowledgement for a fibre optic connection.



Technical data	Profibus	**KH53**	**KH53 Advanced**
System resolution	0.1 mm	●	●
Reproducibility	0.3 mm	●	
	1.0 mm		●
Measurement accuracy 1)	± 1000 + ME (Tu −25 °C) Tk µm	●	
	± 2000 + ME (Tu −25 °C) Tk µm		●
Position tolerances	± 10 mm	●	
	± 20 mm		●
Coefficient of thermal expansion Tk	28 µm/°C/m	●	●
Mass		●	
Read head 38	2.4 kg	●	
107	2.7 kg	●	
354	3.6 kg	●	
1700	5.2 kg	●	
54	4.4 kg		●
548	6.7 kg		●
Measuring element	Approx. 0.5 kg/m	●	
	Approx. 0.65 kg/m		●
Material			
Read head	AlMgSiPbF28	●	●
Measuring element	AlMgSi0.5F22	●	●
Resistance to shocks 2)			
Read head	30/10 g/ms	●	●
Measuring element	50/10 g/ms	●	●
Resistance to vibration 3)			
Read head	10/20 … 250 g/Hz	●	●
Measuring element	30/20 … 250 g/Hz	●	●
Working temperature range	−20 … +60 °C	●	
	−30 … +70 °C		●
Storage temperature range			
Read head	−40 … +85 °C	●	●
Protection class acc. IEC 60529			
Read head with link connector	IP 67 4)	●	●
Max. movement speed 5)	6.6 m/s	●	●
Initialisation time	2 s	●	●
Position forming time	1.1 ms	●	●
Supply voltage	10 … 32 V	●	●
Operating power consumption	2.0 W	●	●
Bus interface Profi-Bus DP		●	●
Elektrische interface 6)	RS 485	●	●
Protokoll	Profibus DP basic functions	●	●
	Profile for Encoders (07hex) – Class 2	●	●
Address setting (node number)	0 … 127 (Hex switches or Protocol)	●	●
Data transmission rate (baud rate)	9.6 kBaud … 12 MBaud	●	●
	automatic detection	●	●
Electronic adjustment (number SET)	Via Protocol	●	●
Status information	Operation (green LED), bus activity (red LED)	●	●
Bus termination 7)	Via external switches	●	●
Electrical connection	Screw-in connector system M23 (3x)	●	●

1) If the read head and measuring element are mounted within ± 1 mm of the nominal mounting distance in the N and Y directions. The figures quoted related to the accuracy within a measuring element with reference to the start of that measuring element.
ME = length measuring element
Tu = Ambient temperature °C

2) According DIN EN 61000-2-27

3) According DIN EN 61000-2-6

4) With mating connectors fitted

5) If the max. movement speed is exceeded or the read head cannot detect a measuring element an error message is produced.

6) Acc. EN 50 170-2 (DIN 19245 part 1-3) DC isolated via opto-couplers

7) Activation only at the last bus subscriver of the line.

Implementation

DP Functionalities
In acc. with the Profibus DP basic functions.

DP services
- Data interchange (Write_Read_Data)
- Address allocation (Set_Slave_Address)
- Control commands (Global_Control)
- Read the inputs (Read_Inputs)
- Read the outputs (Read_Outputs)
- Read diagnostic data (Slave_Diagnosis)
- Send configuration data (Set_Param)
- Check configuration data (Chk_Config)

Communication
- Cyclic Master-Slave Data transfer

Protective mechanisms
- Data transfer with HD = 4
- Time monitoring of the data traffic

Configuration
Settings in accordance with encoder profile
- Counting direction (CW, CCW)
- Class-2 functionality (ON, OFF)
- Scaling function (ON, OFF)

- „Activation of SSA-service“ [2]
- Selection of the station address [2]

Configuration
Setting the formats (IN/OUT) for the cyclic-data interchange via one configuration byte (K-1).

2 words IN/OUT data (I-1/O-1) [1]
4 words IN/OUT data (I-1, I-2, I-3/O-1) [2]

Data interchange: - Input Data (IN)
I-1 Position value [1] 4 bytes
I-2 Speed (0,1m/min) [2] 2 bytes
I-3 Time stamp [2] 2 bytes

Data interchange: - Output data (OUT)
O-1 PRESET Value [1] 4 bytes

Diagnostic information
Station-related diagnosis (63 bytes in accordance with Encoder Profil Class-2)

Setting: - PRESET value
The PRESET function is used for commissioning, and to allocate a specific position value to the current physical position.
The following settings are possible:
- by software: -- (see Output data)

Setting: - Counting direction
- by hardware via Hex switch S2
- by software via telegram

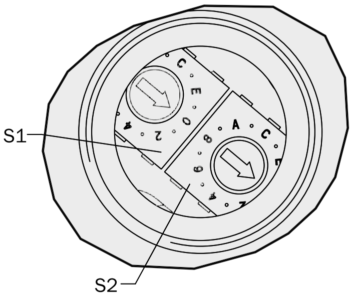
Counting direction increasing:
When the encoder travels in the direction of measuring element n to measuring element n+1.

Setting: - Station Address
- by hardware via Hex switch S1/S2
- by software via telegram

The setting by software is carried out only if the „SSA-service“ has been previously activated.

Device specific file (*.GS_)
For the purpose of automatic commissioning of the encoder, use is made of the *.GS_-file. All the characteristic features of the device are defined in it.

STEG05F6.GSD	German
STEG05F6.GSE	English



Accessories – see pages 410-448

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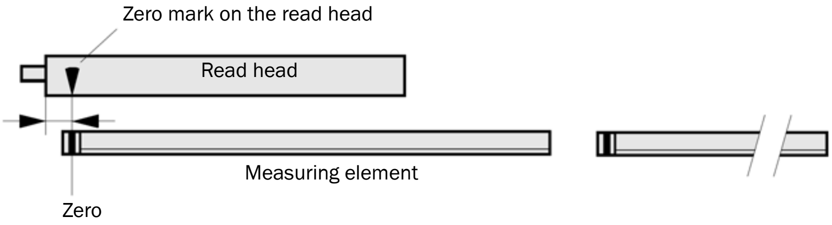
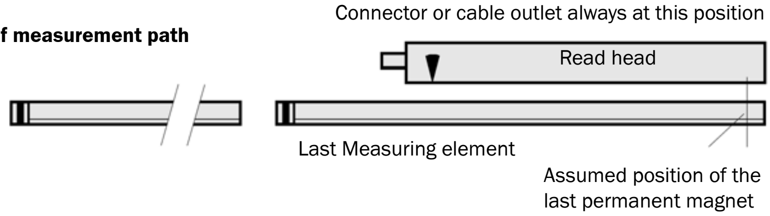
[1] As per Encoder Profile
[2] Manufacturer-specific function

Position tolerances

Start of measuring path

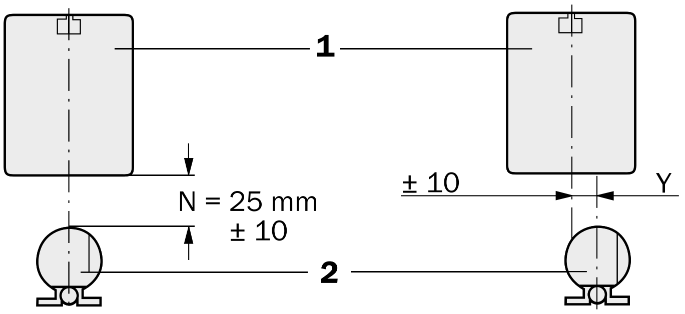


End of measurement path


Connector or cable outlet always at this position
Read head
Last Measuring element
Assumed position of the last permanent magnet

KH53

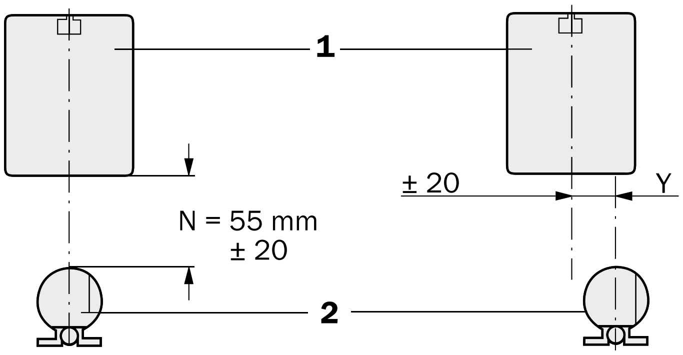
1 Read head
2 Measuring element



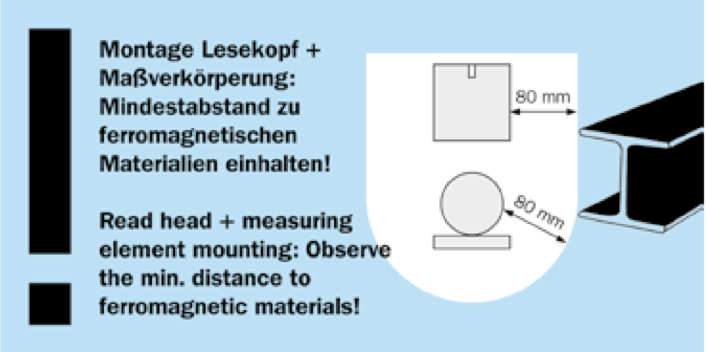
The reliability and accuracy of the measuring system are dependent upon maintaining the mounting tolerances! Magnetic and materials that can be magnetised, are not allowed within a radius of 80 mm of the measuring elements and the sensing face of the encoder.

KH53 Advanced

1 Read head
2 Measuring element



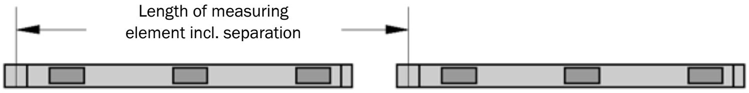
The reliability and accuracy of the measuring system are dependent upon maintaining the mounting tolerances! Magnetic and materials that can be magnetised, are not allowed within a radius of 80 mm of the measuring elements and the sensing face of the encoder.



Montage Lesekopf + Maßverkörperung: Mindestabstand zu ferromagnetischen Materialien einhalten!

Read head + measuring element mounting: Observe the min. distance to ferromagnetic materials!

Dimensional drawing and order information



Dimension and calculation table KH53

Measuring length up to	Read head length	Length of measuring element incl. separation	Mounting equipment per measuring element (proposed)
39.90 m	0.905 m	2.304 m Identification letters A1 ... ≤ A18	4 Spacer supports or 8 Fastening clamps
107.40 m	1.070 m	1.8688 m Identification letters B1 ... ≤ B58	3 Spacer supports or 6 Fastening clamps
351.20 m	1.395 m	2.5088 m Identification letters C1 ... ≤ C141	4 Spacer supports or 8 Fastening clamps
1676.40 m	2.045 m	1.9072 m Identification letters D1 ... ≤ D880	3 Spacer supports or 6 Fastening clamps

Dimension and calculation table KH53 Advanced

Measuring length up to	Read head length	Length of measuring element incl. separation	Mounting equipment per measuring element (proposed)
53.50 m	1.599 m	1.408 m Identification letters F1 ... ≤ F39	3 Spacer supports or 6 Fastening clamps
546.40 m	2.525 m	2.3552 m Identification letters G1 ... ≤ G233	4 Spacer supports or 8 Fastening clamps

The dimensions given are slightly rounded.

Order information

Calculation example for a measuring length of 100 m

Choose the system with a max. measuring length of 107 m

$$\textbf{Number of measuring elements required} = \frac{\textbf{Measuring length + Read head length}}{\textbf{Length of measuring element (according to table above)}}$$

Number of measuring element = 101,070 m/1.8688 m = **54.08**

Ordering quantity is therefore **55** pcs **measuring elements** and **55 * 3 = 165 spacer supports**

If **two separate measuring lengths** are required, then please order as **2 x 55** measuring elements (**not 110** measuring elements)

Caution! For valid position determination, the reading head must not travel over the end of the last measuring element.

Order information

Length measuring system

Length measuring system KH53 – absolute, linear; measuring length up to 38 m		
Type	**Part no.**	**Explanation**
KHK53-PXF00038	1036163	Read head 38, Profibus DP
KHT53-XXX00038	1030055	Measuring element up to 38 m, coded (1)
KHU53-XXX00038	1030056	Measuring element up to 38 m, universal, configurable (2)
KHM53-XXX00038	1030057	Mounting gauge 38

Length measuring system KH53 – absolute, linear; measuring length up to 107 m		
Type	**Part no.**	**Explanation**
KHK53-PXF00107	1036164	Read head 107, Profibus DP
KHT53-XXX00107	1030065	Measuring element up to 107 m, coded (1)
KHU53-XXX00107	1030066	Measuring element up to 107 m, universal, configurable (2)
KHM53-XXX00107	1030067	Mounting gauge 107

Length measuring system KH53 – absolute, linear; measuring length up to 354 m		
Type	**Part no.**	**Explanation**
KHK53-PXF00354	1036165	Read head 354, Profibus DP
KHT53-XXX00354	1030075	Measuring element up to 354 m, coded (1)
KHU53-XXX00354	1030076	Measuring element up to 354 m, universal, configurable (2)
KHM53-XXX00354	1030077	Mounting gauge 354

Length measuring system KH53 – absolute, linear; measuring length up to 1700 m		
Type	**Part no.**	**Explanation**
KHK53-PXF01700	1036166	Read head 1700, Profibus DP
KHT53-XXX01700	1030085	Measuring element up to 1700 m, coded (1)
KHU53-XXX01700	1030086	Measuring element up to 1700 m, universal, configurable (2)
KHM53-XXX01700	1030087	Mounting gauge 1700

Length measuring system KH53 Advanced

Length measuring system KH53 Advanced – absolute, linear; measuring length up to 54 m		
Type	**Part no.**	**Explanation**
KHK53-PXF00054	1036167	Read head 54, Profibus DP
KHT53-XXX00054	1035445	Measuring element up to 54 m, coded (1)
KHU53-XXX00054	1035446	Measuring element up to 54 m, universal, configurable (2)
KHM53-XXX00054	1035447	Mounting gauge 54

Length measuring system KH53 Advanced – absolute, linear; measuring length up to 548 m		
Type	**Part no.**	**Explanation**
KHK53-PXF00548	1036168	Read head 548, Profibus DP
KHT53-XXX00548	1035451	Measuring element up to 548 m, coded (1)
KHU53-XXX00548	1035452	Measuring element up to 548 m, universal, configurable (2)
KHM53-XXX00548	1035453	Mounting gauge 548

(1) When placing a repeat order for particular defective measuring elements, please indicate the corresponding code number of the measuring element.

(2) For temporary replacement of damaged measuring elements

Switch settings

The following settings are possible via Hex switch:

S1/S2	Address setting (0 ... 127)
S2	Counting direction (CW/CCW)

Access is provided via a screw cap on the connector side of the read head.

Status Information via LEDs

LED-1	Bus activity (red)
LED-2	Operating voltage (green)

General

The KH53 Profibus is an absolute length measuring system with a resolution of 100 µm. The Bus coupling is realised within the encoder and is a Profibus DP slave in accordance with EN 50170 Vol. 2. The realisation of the Profibus interface is performed by the Profibus ASIC SPC3 from Siemens.

The KH53 Profibus encompasses all Class 2 functions in accordance with Encoder Profile (1.1)

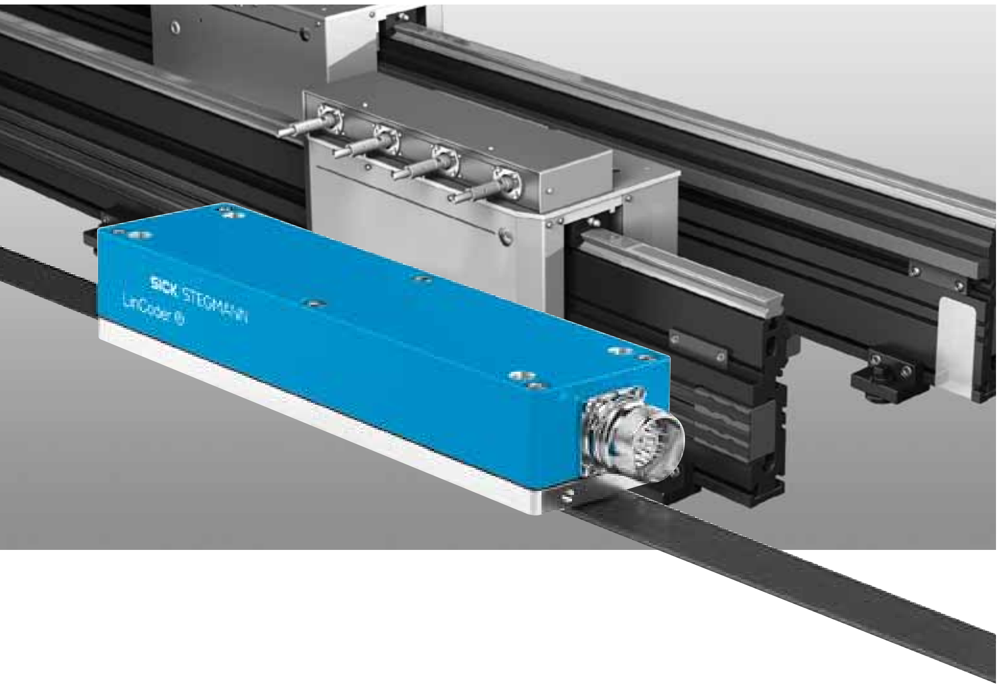
The encoder is implemented as a DP slave with general DP functions.

The conformance of the encoder with Profibus DP was verified by the PNO certified test centre.

The following options are available:
- Screw-in connnector system M12

Accessories – see pages 410-448

LinCoder® L230: Absolute, Non-Contact Length Measuring System



Resolution up to 1 µm

Non-Contact Linear Encoders

SYNCHRONOUS SERIAL INTERFACE

HIPERFACE® by SICK | STEGMANN

The LinCoder® measuring system comprises a magnetic tape and a read head. The magnetic tape constitutes the scale for a measuring section up to 40 metres long. The absolute information is magnetised onto the tape in a 12-bit sequential code. To achieve the highest possible resolution and accuracy, an additional incremental track has been magnetised onto the magnetic tape, i. e. the north and south poles always alternate. The manufacturer laminates the magnetic tape onto a ferromagnetic tape (steel tape) which, on the one hand, acts as a magnetic base and, on the other hand, as a form-stabilising assembly aid.

The magnetic tape can thus be bonded using adhesive directly to a ferromagnetic support, without any influence on the magnetisation.

A non-contact magnetic read head with integrated evaluation electronics and appropriate interface is guided over the measuring section, and its position is output up to 40 m.

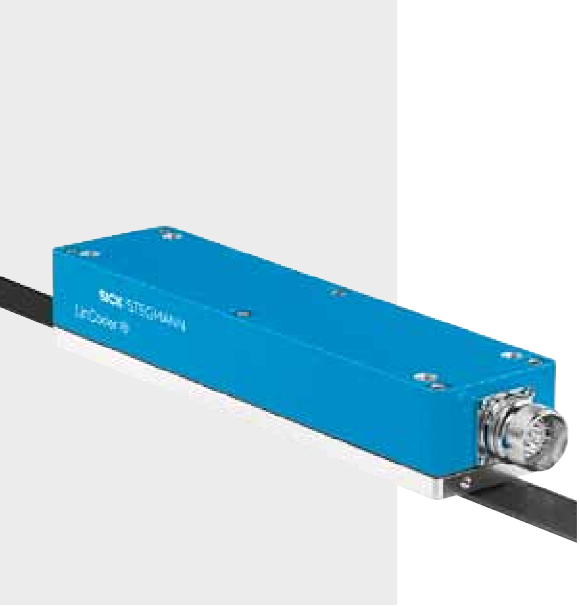
Areas of use:
- in wood working and glass working
- on paper machines
- in-feed axes
- portal robots
- linear motors
- presses
- palletizers

and anywhere where high travel speed, small dimensions and simple mounting determine the requirements for a reliable measuring system.

Resolution up to 1 µm

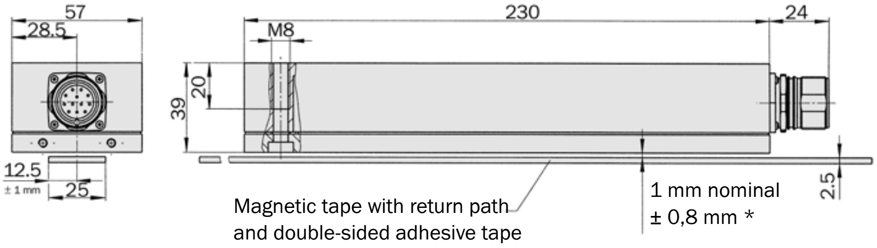
Non-Contact Linear Encoders

- Measurement lengths up to 40 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Different Interfaces
- Length-independent position sensing time
- Electronically adjustable
- Protection class up to IP 65

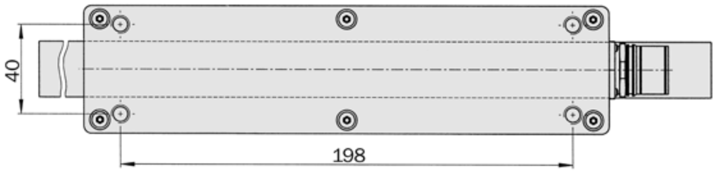


Accessories – see pages 410-448

Dimensions and positional tolerances; Absolute Length Measuring System L230 SSI


57
28.5
12.5
± 1 mm
25
39
20
M8
230
24
2.5
Magnetic tape with return path and double-sided adhesive tape
1 mm nominal
± 0,8 mm *

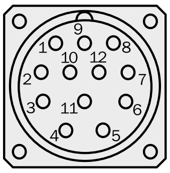
* Between ± 1.8 and ± 3.5 mm, position errors are undefined, at > 3.5 mm an error message is produced



General tolerances according to DIN ISO 2768-mk

PIN and wire allocation SSI Interface

PIN	Signal	Wire colours (cable outlet)	Explanation
1	GND	blue	Earth connection
2	Data +	white	Signal line
3	Clock +	yellow	Signal line
4	RS 485 +	grey	Must not be connected by customer
5	RS 485 –	green	Must not be connected by customer
6	N. C.	–	Not connected
7	N. C.	–	Not connected
8	+ U_s	red	Supply voltage
9	SET [1]	orange	Electronical adjustment
10	Data –	brown	Signal line
11	Clock –	lilac	Signal line
12	cw/$\overline{\text{ccw}}$ [2]	orange/black [3]	Counting sequence (increasing/decreasing)



View of the connector M23 fitted to the encoder body
SSI

Caution! PINs labelled "N. C." must not be connected.

Screening via plug housing

[1] This input is used for electronic adjustment. By means of a high signal (U_S) > 20 ms on this connection, the LinCoder position is set to 0.

[2] This output programs the counting direction of the LinCoder. If not connected, this input is »high«. If the LinCoder is moved from the start to the end of the magnetic tape, then it counts in a rising sequence. If the LinCoder is to count in a rising sequence from the end to the start of the magnetic tape, then this terminal must be connected continuously to »low« GND.

[3] If there is no orange/black core, then black (if orange/black does exist, black must not be used instead!)

Technical data according to DIN 32878		L230	SSI									
Measurement length		Max. 40 m	▨									
Magnetic strip length		Measurement length + 130 [1] mm	▨									
Position resolution	0 ... 8.35 m [2]	1 or 10 µm	▨									
	> 8.35 ... 40 m	10 µm	▨									
Reproducibility		± 10 µm	▨									
Measurement accuracy		Typ. ± 0.3 mm/m at 20 °C	▨									
Temperature expansion coefficient Tk		16 µm/°C/m	▨									
Mass	read head	0.685 kg	▨									
	magnetic tape	0.160 Kg/m	▨									
Material	read head	AlMgSiPbF28	▨									
	magnetic tape	Tromaflex 928	▨									
	stainless steel tape	no. 1.4435	▨									
Resistance to shocks [3]												
read head		30/10 g/ms	▨									
Resistance to vibration [4]												
read head		10/20 ... 250 g/Hz	▨									
Working temperature range		0 ... + 70 °C	▨									
Storage temperature range		– 40 ... + 100 °C	▨									
Protection class [5]		IP 65	▨									
Max. speed of travel [6]		6 m/s	▨									
Initialisisation time		3500 ms	▨									
Position repetition time		750 µs	▨									
Supply voltage		10 ... 32 V	▨									
Operating current consumption (without load)		4.8 W	▨									

[1] Technical necessary constant

[2] Longer measurement lengths on request

[3] To DIN EN 61000-2-27

[4] To DIN EN 61000-2-6

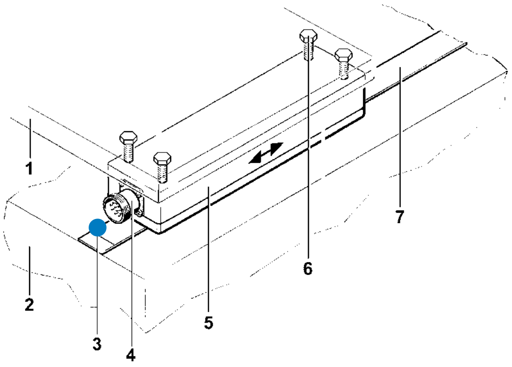
[5] With mating connector inserted

[6] When exceeding the maximum travel speed limit or when leaving the surface of the measuring element the corresponding error message is produced: 7F FF FF hex

Caution:
External magnetic fields should not exceed 64 mT (640 Oe; 52kA/m) on the surface of the gauge, since this can damage the coding on the gauge. Magnetic fields > 1 mT at the measuring system affect the measurement accuracy.

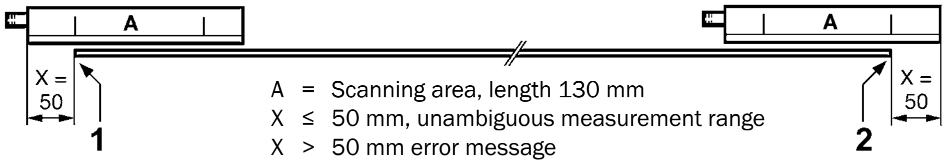
Initial commissioning
The measurement path can start at any position between 0 m and 40 m. Therefore it will be helpful, prior to initial commissioning, to align the electrical zero point to your intended mechanical position. When operating with the SSI interface, this can be performed via the SET input, for HIPERFACE® variants, this can be programmed via software.

Mounting arrangement



1 Support for the read head (customer)
2 Support for the magnetic tape (customer)
3 Identification – zero point of the start of the magnetic tape
4 Plug outlet from the read head
5 Read head
6 Fastening of the read head from above or below
7 Magnetic tape

Caution:
The mounting arrangement must ensure that the sensor can overtravel the start and finish of the magnetic tape by at least 50 mm; this enables the complete measurement length of the tape to be registered. The start of the tape is marked by a coloured dot (●).
Due to the way the system operates, the magnetic tape is always 130 mm longer than the measurement length required.



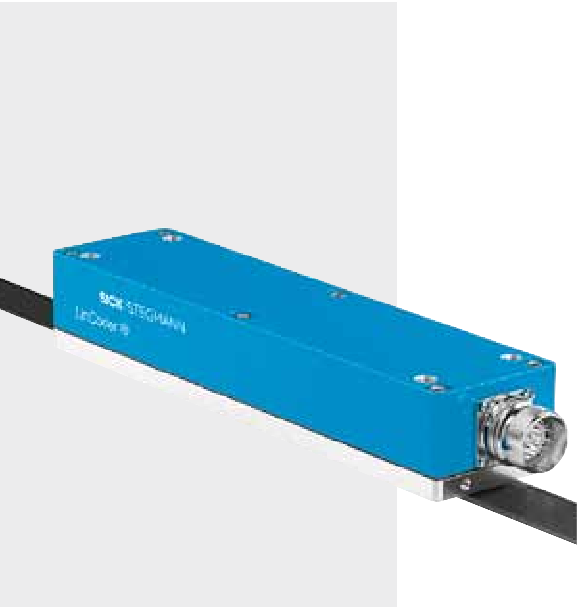
A = Scanning area, length 130 mm
X ≤ 50 mm, unambiguous measurement range
X > 50 mm error message

1 Start of tape
2 End of tape

Resolution up to 1 µm

Non-Contact Linear Encoders

- Measurement lengths up to 40 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Different Interfaces
- Length-independent position sensing time
- Electronically adjustable
  Protection class up to IP 65



Accessories – see pages 410-448

SSI interface description

The LinCoder® with SSI interface outputs the serial data in Gray code with a word length of 24 bits and a clock frequency of 100 kHz to 1 MHz. In the length measurement device, the clock signal is galvanically separated from the encoder supply voltage, by an optocoupler. When using this interface in the LinCoder®, some specific features need to be noted:

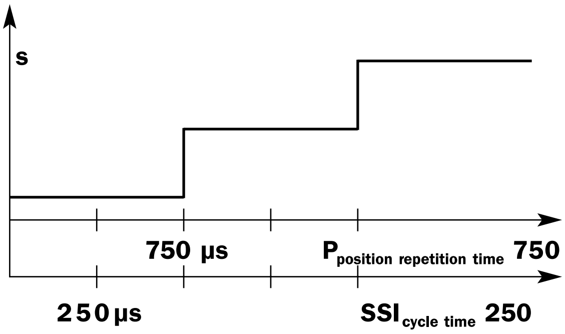
Supplement to SSI standard operation
The diagram alongside shows a calculated position waveform under continuous acceleration. It can clearly be seen that, during one SSI cycle ($\text{SSI}_{\text{cycle}}$ = control cycle for reading and processing the current value once) of 250 µs, the identical travel information from the measurement system is read at least once, max. 4 times, before a new position is available. The position repetition time of 750 µs of the LinCoder® and the rapid read-out and processing of the control system produce an oscillatory behaviour of the system connected downstream, as a result of the asynchronous response of the two systems (controller and measuring system).

If the sensor travels more than 50 mm beyond the start of the tape or the end of the tape, the error message 7F FF FF hex is output.

In standard operation, the LinCoder® forms a position value every 0.75 milliseconds, cyclically and independently of the SSI read cycle, and places this value in the output register provided for this, to be retrieved by the interface. Since the SSI read cycle and the position formation cycle can never be identical, there will be a continuous displacement of the time/position relationship. In other words:

In this mode of operation, the time/position value relationship fluctuates from 2 to 750 µs.

SSI standard operation



NOTE: The SSI cycle (cyclic access to the LinCoder® by controller/regulator) of 250 µs is assumed here.

Real-time compensated SSI operation

In order to avoid any fluctuation in the time/position relationship, which may lead to very unconventional behaviour in the control loop, the real-time compensated SSI mode of operation has been developed by SICK (installed as standard). In the case of length measuring systems controlled by microcontrollers, the so-called dead time of a measuring system is greater than in a pure “hardware“-based measuring systems as a result of the time which is needed by the microcontroller in order to calculate the position.

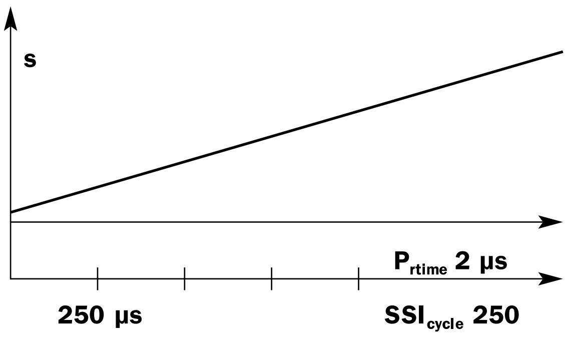
In order to implement the formation of a position which is as real-time compatible as possible, even with a length measuring system controlled by a microcontroller, a hardware logic unit is connected downstream of the microcontroller and takes over this sequence. As distinct from the SSI standard operation, the circuit is loaded with the difference from the last position rather than with the calculated position. The logic circuit then adds this position difference to the last position value. In order that this position calculation cycle of the microcontroller is compensated for, the logic circuit then permanently adds the last-loaded difference to the position value, in a cycle of about 2 µs, until after about 750 µs a newly calculated difference is available from the microcontroller and is accepted by the logic unit.

The synchronisation of the position output to the controller takes place with the first falling flank of the SSI clock signal which causes the output register to be loaded. In parallel with the loading of the outputregister, the addition of the difference to the position value is passed on by the circuit. The dead time for forming the position in the LinCoder® is thus restricted to a maximum of 2 µs (gate propagation time of the logic circuit).

With a real-time compensated position repetition time (P_{rtime}), the position waveform of the LinCoder® runs linearly up to the 2 µs position repetition time (dead time), given uniform acceleration.

If the current value from the LinCoder® is then read by a regulator or controller at a uniform cycle time of 250 µs, the position has been updated more than 100 times by the logic circuit. There is thus a synchronous relationship between the length measuring system and the downstream control system.

Real-time compensated SSI operation



Order information		
Absolute Length Measuring System L230 SSI		
Type	**Part no.**	**Explanation**
L230-P580A7K15300	1033569	Read head SSI; resolution 1 µm; 5.0 m cable (Magnetic tape max. 8.35 m)
L230-P580A7S00000	1033534	Read head SSI; resolution 1 µm; connector M23, 12-pin (Magnetic tape max. 8.35 m)
L230-P580B7S00000	1033533	Read head SSI; resolution 10 µm; connector M23, 12-pin (Magnetic tape max. 40 m)

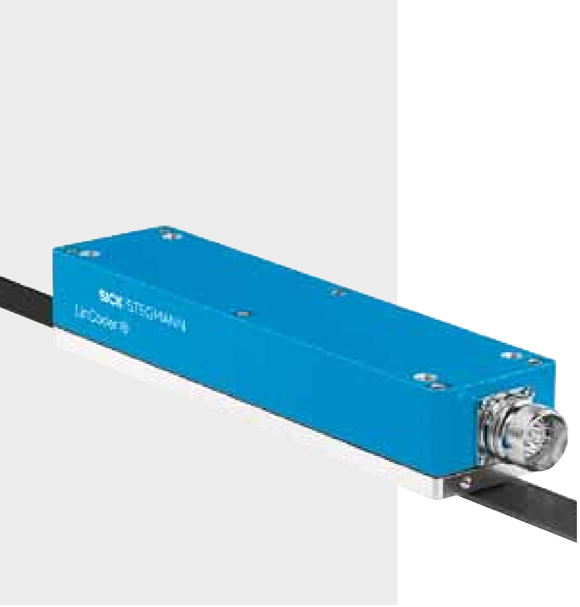
Magnetic tapes		
Type	**Part no.**	**Explanation**
Magnetic tape	2030642	With adhesive backing (supplied by the metre) *)
Magnetic tape	5313643	Without adhesive backing (supplied by the metre) *)
Magnetic tape	2030646	With adhesive backing, length 10.0 m
Magnetic tape	2031275	With adhesive backing, length 12.0 m
Magnetic tape	2031288	With adhesive backing, length 16.0 m

*) The magnetic tape must be ordered by the metre (material representation), at least 0.5 m … 40 m.
Where not otherwise specified, the magnetic tape is supplied to match read heads with a resolution of 10 µm. For read heads with a resolution of 1 µm, this MUST be specified when ordering the magnetic tape.

Resolution up to 1 µm

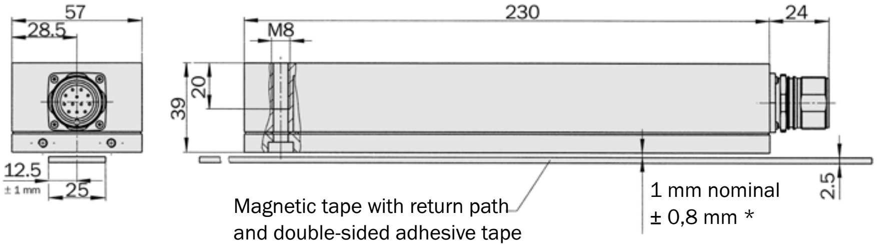
Non-Contact Linear Encoders

- Measurement lengths up to 40 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Different Interfaces
- Length-independent position sensing time
- Electronically adjustable
- Protection class up to IP 65

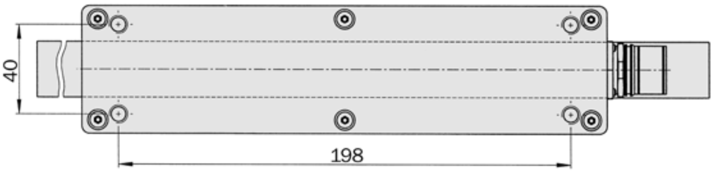


Accessories – see pages 410-448

Dimensions and positional tolerances; Absolute Length Measuring System L230 SSI


57
28.5
M8
230
24
39
20
12.5
± 1 mm
25
2.5
Magnetic tape with return path and double-sided adhesive tape
1 mm nominal
± 0,8 mm *

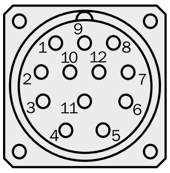
* Between ± 1.8 and ± 3.5 mm, position errors are undefined, at > 3.5 mm an error message is produced



General tolerances according to DIN ISO 2768-mk

PIN and wire allocation HIPERFACE® interface

PIN	Signal	Wire colours (cable outlet)	Explanation
1	REFCOS	black	Processs data channel
2	Data +	grey or yellow	RS485 parameter channel
3	N. C.	–	Not connected
4	N. C.	–	Not connected
5	SIN	white	Processs data channel
6	REFSIN	brown	Processs data channel
7	Data –	green or purple	RS485 parameter channel
8	COS	pink	Processs data channel
9	N. C.	–	Not connected
10	GND	blue	Earth connection
11	N. C.	–	Not connected
12	+ U_S	red	Supply voltage



View of the connector M23 fitted to the encoder body HIPERFACE®

Caution! PINs labelled “N. C.” must not be connected.

Screening via plug housing

Electronically adjustable via Programming Tool

Technical data according to DIN 32878		L230 HIPERFACE ®
Measurement length		Max. 40 m
Magnetic strip length		Measurement length + 130 [1] mm
Position resolution [2]		156.25 µm
Reproducibility		± 10 µm
Measurement accuracy		Typ. ± 0.3 mm/m at 20 °C
Temperature expansion coefficient Tk		16 µm/°C/m
Mass	read head	0.685 kg
	magnetic tape	0.160 Kg/m
Material	read head	AlMgSiPbF28
	magnetic tape	Tromaflex 928
	stainless steel tape	no. 1.4435
Resistance to shocks [3]		
read head		30/10 g/ms
Resistance to vibration [4]		
read head		10/20 ... 250 g/Hz
Working temperature range		0 ... + 70 °C
Storage temperature range		– 40 ... + 100 °C
Protection class [5]		IP 65
Max. speed of travel [6]		6 m/s
Position repetition time		750 µs
Initialisisation time		2500 ms
Supply voltage		7 ... 12 V
Operating current consumption (without load)		4.3 W
Interface signals		
Process data channel		
SIN, COS		0.9 ... 1.1 Vpp
REFSIN, REFCOS2.2 ...2.8 V		
Non-linearity within one sine/cosine cycle, differential non-linearity		± 50 µm
Parameter channel		To EIA 485

---

[1] Technical necessary constant

[2] Period length/32 = 5 mm/32

[3] To DIN EN 61000-2-27

[4] To DIN EN 61000-2-6

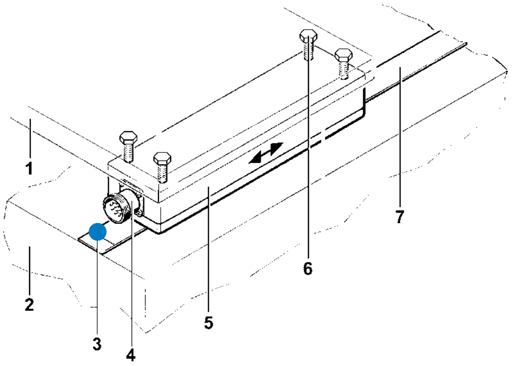
[5] With mating connector inserted

[6] When exceeding the maximum travel speed limit or when leaving the surface of the measuring element the corresponding error message is produced: 7F FF FF hex

Caution:
External magnetic fields should not exceed 64 mT (640 Oe; 52kA/m) on the surface of the gauge, since this can damage the coding on the gauge. Magnetic fields > 1 mT at the measuring system affect the measurement accuracy.

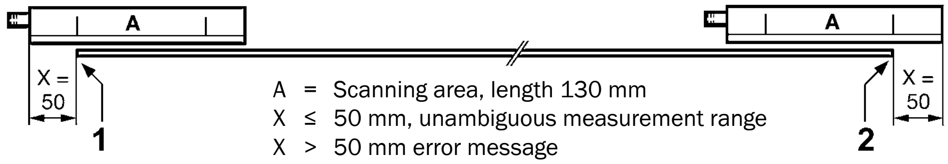
Initial commissioning
The measurement path can start at any position between 0 m and 40 m. Therefore it will be helpful, prior to initial commissioning, to align the electrical zero point to your intended mechanical position. When operating with the SSI interface, this can be performed via the SET input, for HIPERFACE® variants, this can be programmed via software.

Mounting arrangement



1 Support for the read head (customer)
2 Support for the magnetic tape (customer)
3 Identification – zero point of the start of the magnetic tape
4 Plug outlet from the read head
5 Read head
6 Fastening of the read head from above or below
7 Magnetic tape

Caution:
The mounting arrangement must ensure that the sensor can overtravel the start and finish of the magnetic tape by at least 50 mm; this enables the complete measurement length of the tape to be registered. The start of the tape is marked by a coloured dot (●).
Due to the way the system operates, the magnetic tape is always 130 mm longer than the measurement length required.



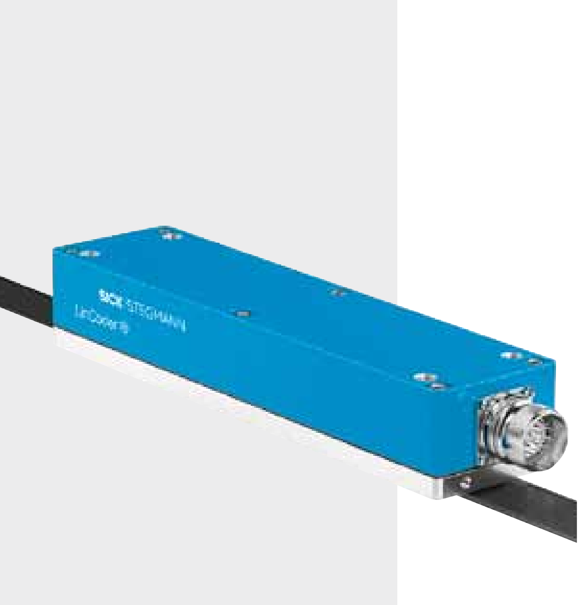
A = Scanning area, length 130 mm
X ≤ 50 mm, unambiguous measurement range
X > 50 mm error message

1 Start of tape
2 End of tape

Resolution up to 1 µm

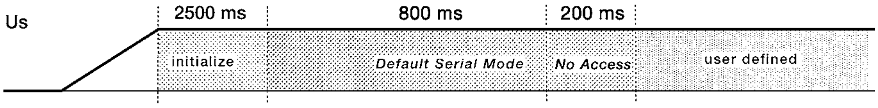
Non-Contact Linear Encoders

- Measurement lengths up to 40 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Different Interfaces
- Length-independent position sensing time
- Electronically adjustable
- Protection class up to IP 65



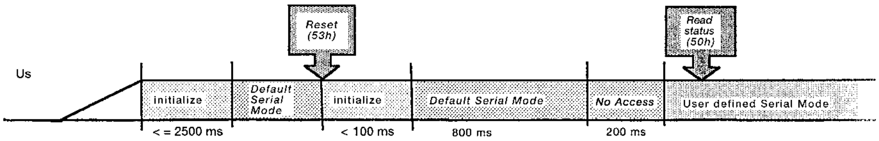
Accessories – see pages 410-448

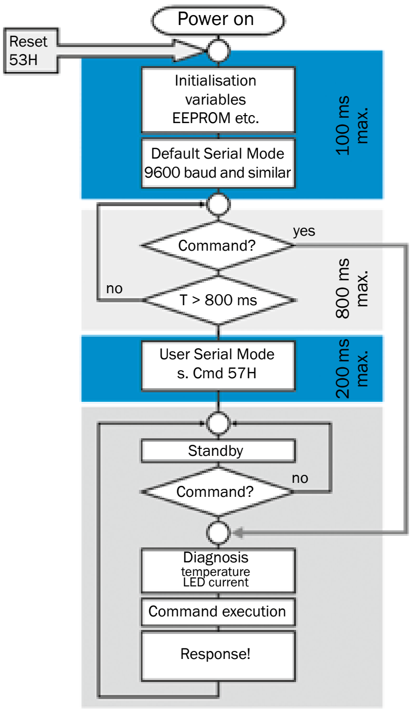
Restart



Default Serial Mode = E4h
see Command 57h

In special cases, an unfavourable operating voltage 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 > 2500 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).





CAUTION:
During the phases highlighted in blue, **no RS485** communication is possible!

Type-specific settings	L230
Type ID (command 52h)	82h
Free EEPROM [bytes]	128
Address	40h
Mode_485	E4h
Codes 0 ... 3	55h
Counter	0

Overview of the commands supported			L230
Command byte	**Function**	**Code 0 1)**	**Comments**
42h	Read position 2)		
43h	Set position 2)	●	
44h	Read analogue value		Channel number 48 h
			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 data		
4Fh	Change access code		
50h	Read encoder status		
52h	Read out name plate		Encoder type = 82h
53h	Encoder reset		
55h	Allocate encoder address	●	
56h	Read serial number and program version		
57h	Configure serial interface	●	

Overview of the status messages			L230
Error type	**Status code**	**Description**	
	00h	The encoder has recognised no error	●
Initialisation	05h	Internal I^2C-bus not operational	●
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	●
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	●
Others	1Ch	Monitoring the value of the analogue signals (process data)	●
	1Eh	Encoder temperature critical	
	08h	Counter overflow	●

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.

2) The position is defined as a signed long integer value.

Order information

Absolute Length Measuring System L230 HIPERFACE

Type	Part no.	Explanation
L230-P580C2S00000	1033532	Read head HIPERFACE®; resolution 156.25 µm; connector M23, 12-pin

Magnetic tapes

Type	Part no.	Explanation
Magnetic tape	2030642	With adhesive backing (supplied by the metre) *)
Magnetic tape	5313643	Without adhesive backing (supplied by the metre) *)
Magnetic tape	2030646	With adhesive backing, length 10.0 m
Magnetic tape	2031275	With adhesive backing, length 12.0 m
Magnetic tape	2031288	With adhesive backing, length 16.0 m

*) The magnetic tape must be ordered by the metre (material representation), at least 0.5 m ... 40 m.

TTK70 with SSI and field bus interfaces: Compact, Non-Contact Absolute Linear Encoder for automation technology

Resolution up to 1 µm

Non-Contact Linear Encoders

The TTK70 Linear Encoder consists of a compact reading head and a magnetic tape. The magnetic tape is magnetically encoded and forms the measurement scale.

The encoding consists of an incremental and an absolute track (twin-track tape). To calculate the absolute position value, the reading head captures both the absolute and the incremental component – without making contact.

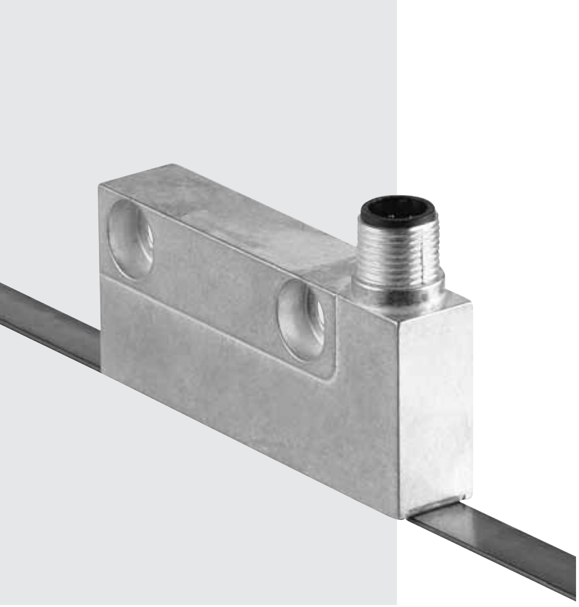
The position value thus formed is made available for further processing ... directly for the SSI version and, for the field bus versions, via an interface adapter module. PROFIBUS DP, CANopen® or DeviceNet is available as an interface at the output of the corresponding interface adapter module. Thus, the TTK70 meets the demanding requirements of automation technology in both plant engineering and mechanical engineering. Because of the very compact configuration and non-contact data acquisition of the TTK70 in conjunction with the interface adapter module, a wide range of applications can be supported in automation technology.

Such as in applications which
- require a small encoder type due to the restricted installation space
- require a field bus interface in conjunction with a compact linear encoder
- predominantly feature ambient conditions such as dirt, temperature extremes, shock or vibration.

Resolution
1 µm

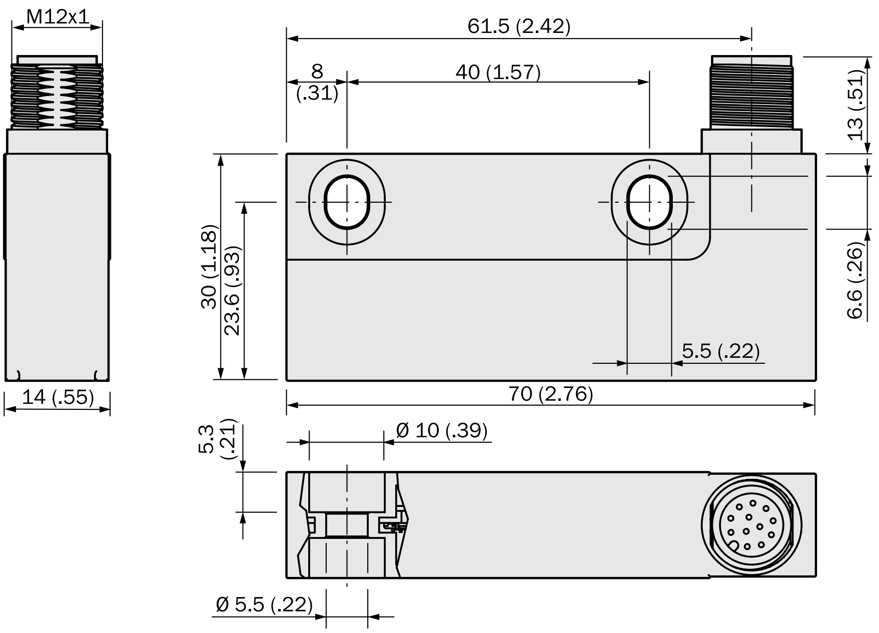
Non-Contact Linear Encoders

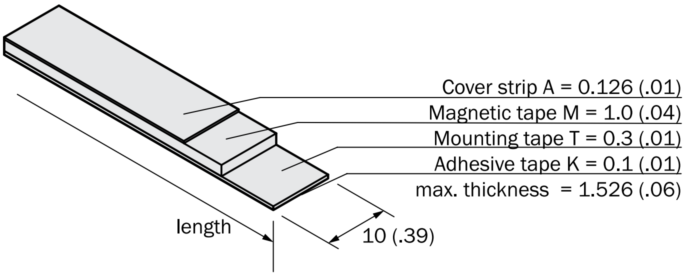
- Measurement length up to 4 m
- Non contact length measuring system, wear-free
- Absolute position determination, no reference run
- Length-independent position sensing time
- With sin/cos output

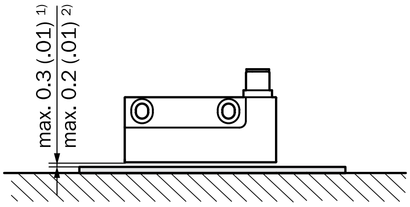


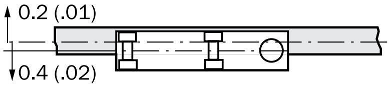
Accessories – see pages 410-448

Dimensions and positional tolerances




Cover strip A = 0.126 (.01)
Magnetic tape M = 1.0 (.04)
Mounting tape T = 0.3 (.01)
Adhesive tape K = 0.1 (.01)
max. thickness = 1.526 (.06)
length
10 (.39)



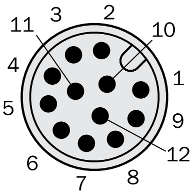


[1] Without cover strip

[2] With cover strip

All dimensions in mm (inch).
General tolerances acc. to DIN ISO 2768-mk

PIN- and wire allocation



PIN	Signal	Description
1	Balancing	–
2	SSI Data +	Signal line
3	SSI Data –	Signal line
4	SSI Clock –	Signal line
5	$+U_S$	Supply voltage
6	Sin	Signal line
7	/Sin	Signal line
8	Cos	Signal line
9	/Cos	Signal line
10	Config	–
11	SSI Clock +	Signal line
12	GND	Ground connection

Technical data acc. DIN 32878		TTK70 SSI
Max. measurement length		4,000 mm
Magnetic tape length		Measurement length + 80 mm (min. 200 mm)
Dimensions		mm (see dimensional drawing)
Max. distance of the sensor to the magnetic tape		
without cover strip		0.3 mm
with cover strip		0.2 mm
Mass	Read head	0.08 kg
Material	Read head	Zinc die-casting
Code type fort the absolute value		Binary
Resolution		1 µm
System accuracy		± 10 µm
Repeatability		Max. ± 2 µm
Travelling speed – static operation		< 1.0 m/s
Travelling speed – dynamic operation (sin/cos)		< 10 m/s
Permitted mounting tolerances		See drawing
Working temperature range		–30 to +85 °C
Storage temperature range (without packaging)		–40 to +100 °C
Permissible relative humidity		100 % (condensation permitted)
Maximum permitted ambient field strength to guarantee compliance with the quoted accuracy values[1]		< 3 to 4 kA/m (3.8 to 5 mT)
Resistance (Read head)		
to shocks acc. to EN 60068-2-27		30 g/6 ms
to vibration acc. to EN 60068-2-6		20 g/10 to 2,000 Hz
Protection class acc. to IEC 60529[2]		IP 65
EMC to EN 61000-6-2 and EN 61000-6-3		
Operating voltage range		DC 4.5 V to 30 V
Max. operating current, no load		< 55 mA
Interface signals		
SSI		24 bit[3]
Sin/cos–output[4]		

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

[2] With mating plug mounted.

[3] In case of distance error (to the sensor tape), the TTK70 SSI outputs the value 99999999 as the position value to enable the error to be detected. In addition, bit 25 is set in the SSI data stream. When exceeding or going below the temperature range of the sensor (< –30 °C or > +85 °C), bit 26 is set in the SSI data stream. The bits are reset as soon as the error condition no longer exists. To be able to use these additional bits, the control(ler) must be able to read in at least 26 bits of data.

[4] Speed-proportional signal output for real-time requirements.

Ordering information

Length measuring system TTK70 SSI

Type	Part no.	Description
TTK70-AXA0-K02	1038033	Read head

Resolution
3.906 µm

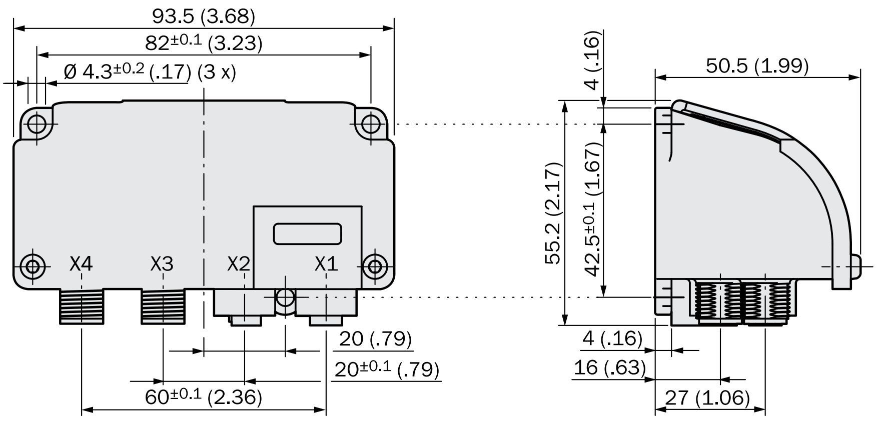
Non-Contact Linear Encoders

- Measurement length up to 4 m
- Non contact length measuring system, wear-free
- Absolute position determination, no reference run
- Length-independent position sensing time
- PROFIBUS Interface

Accessories – see pages 410-448

Dimensional drawing and positional tolerances of the reading head

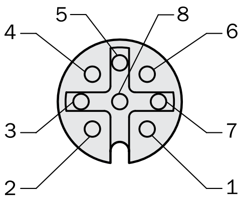
Dimensional drawing PROFIBUS Interface Adapter Module



All dimensions in mm (inch)

PIN and wire allocation encoder input (X1)

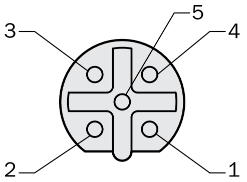
8-pin A-coded



PIN	Color 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	yellow	Data +	RS 485 parameter channel
6	violet	Data –	RS 485 parameter channel
7	blue	GND	Ground connection
8	red	$+U_S$	Encoder supply voltage via the adapter
	Screen		Housing potential

PIN and wire allocation PROFIBUS DP (out) (X2)

5-pin B-coded

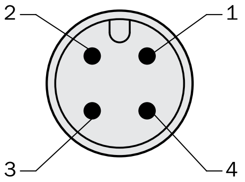


PIN	Signal	Explanation
1	2PS	+5 V (potential-free isolated)
2	A	A-cable PROFIBUS DP
3	2M	0 V (potential-free isolated)
4	B	B-cable PROFIBUS DP
5	Screen	Housing potential

[1] For external bus connection or supply to the sender/receiver of an LWL connection

PIN and wire allocation supply voltage U_S (X3)

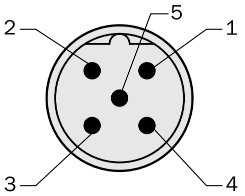
4-pin A-coded



PIN	Signal	Explanation
1	U_S	Supply voltage
2	N. C.	–
3	GND	0 V (Mass)
4	N. C.	–

PIN and wire allocation PROFIBUS DP (in) (X4)

5-pin B-coded



PIN	Signal	Explanation
1	N. C.	–
2	A	A-cable PROFIBUS DP
3	N. C.	–
4	B	B-cable PROFIBUS DP
5	Screen	Housing potential

Technical data acc. DIN 32878	TTK70 PROFIBUS	
Max. measurement length	4,000 mm	
Magnetic tape length	Measurement length + 80 mm (min. 200 mm)	
Dimensions	mm (see dimensional drawing)	
Max. distance of the sensor to the magnetic tape		
without cover strip	0.3 mm	
with cover strip	0.2 mm	
Mass	**Read head**	**Interface adapter**
	0.08 kg	Approx. 0.4 kg
Material	Zinc die-casting	
Resolution	3.906 µm	
System accuracy	± 10 µm	
Repeatability	**Unidirectional**	**Bidirectional**
	< 5 µm	< 15 µm
Max. operating speed	10 m/s	
Permitted mounting tolerances	See drawing	
Working temperature range	**Read head**	**Interface adapter**
	–30 to +85 °C	–20 to +60 °C
Storage temperature range (without packaging)	–40 to +100 °C	–25 to +85 °C
Permissible relative humidity	100 % (condensation permitted)	90 % (condensation not permitted)
Maximum permitted ambient field strength to guarantee compliance with the quoted accuracy values[1]	< 3 to 4 kA/m (3.8 to 5 mT)	
Resistance	**Read head**	**Interface adapter**
to shocks acc. to EN 60068-2-27	30 g/6 ms	70 g/6 ms
to vibration acc. to EN 60068-2-6	20 g/10 to 2,000 Hz	
Protection class acc. to IEC 60529[2]	IP 65	IP 64
EMC to EN 61000-6-2 and EN 61000-6-3		
Operating voltage range	DC 10 V to 30 V	
Recommended supply voltage	24 V	
Operating current	2.64 W	
Throughput time[3]	125 µs	
Initialization time	Typ. 850 ms	
Output interface PROFIBUS DP		
Electrical interface	RS 485 with DC isolation	
Protocol	DP V0 + isochronous Mode (DP V2); encoder profile Class 1 and 2	
Address settings	1 to 125 DIP switches; 126 EEPROM addressing via protocol	
Data transfer rate (baud rate)	9.6 kBaud to 12 MBaud; automatic detection	
Electronic adjustment (number set)	Via bus protocol and DIP switches	
Status information	Encoder input status (LED yellow) PROFIBUS status (LED red) and (LED bicolor red/green)	
Error value output	In accordance with bus diagnostic function	
Bus termination[4]	Via external terminating resistor	
Electrical connection to control (PROFIBUS)	Signal line via 5-pin male device connector (bus IN) and 5-pin female device connector (bus OUT) as well as 4-pin male device connector (U_S), potential-free to the housing	

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

[2] With mating plug mounted.

[3] In isochronous mode and without scaling, otherwise < 1 ms.

[4] Activation only at the last bus subscriber of the line.

Ordering information		
Length measuring system TTK70 PROFIBUS		
Type	**Part no.**	**Description**
TTK70-PXH0-K02	1037875	Read head and interface adapter

Connecting cable from reading head to interface adapter: please order separately

Resolution
3.906 µm

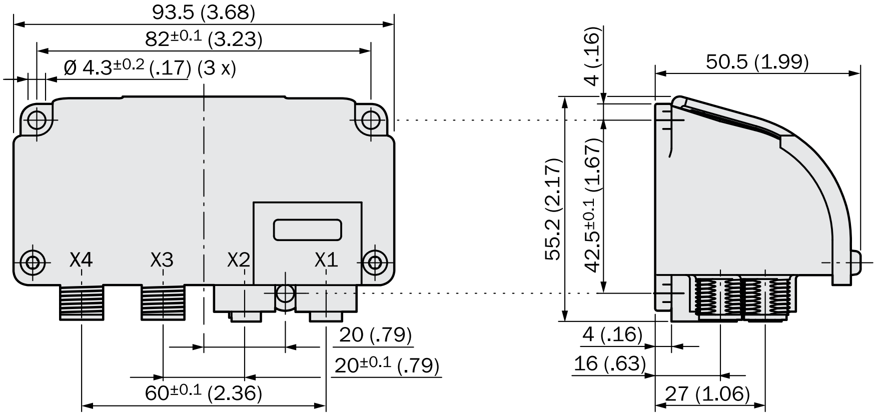
Non-Contact Linear Encoders

- Measurement length up to 4 m
- Non contact length measuring system, wear-free
- Absolute position determination, no reference run
- Length-independent position sensing time
- DeviceNet Interface

Accessories – see pages 410-448

Dimensional drawing and positional tolerances of the reading head

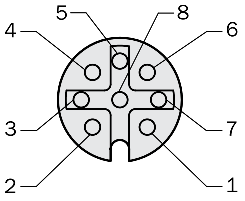
Dimensional drawing DeviceNet Interface Adapter Module



All dimensions in mm (inch)

PIN and wire allocation encoder input (X1)

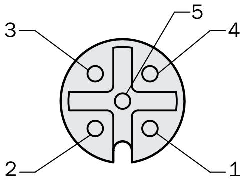
8-pin A-coded



PIN	Color 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	yellow	Data +	RS 485 parameter channel
6	violet	Data –	RS 485 parameter channel
7	blue	GND	Ground connection
8	red	$+U_S$	Encoder supply voltage via the adapter
	Screen		Housing potential

PIN and wire allocation DeviceNet (out) (X2)

5-pin A-coded

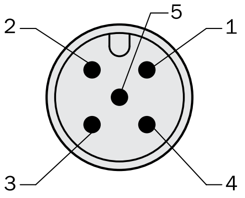


PIN	Signal	Explanation
1	Drain/Screen	Bus Drain/Screen must not have any connection to the housing
2	V +	Supply voltage via the bus
3	V –	Ground connection (GND)
4	CAN_H	CAN High
5	CAN_L	CAN Low

PIN and wire allocation (X3) – not connected

PIN and wire allocation DeviceNet (in) (X4)

5-pin A-coded



PIN	Signal	Explanation
1	Drain/Screen	Bus Drain/Screen must not have any connection to the housing
2	V +	Supply voltage via the bus
3	V –	Ground connection (GND)
4	CAN_H	CAN High
5	CAN_L	CAN Low

Technical data acc. DIN 32878	TTK70 DeviceNet	
Max. measurement length	4,000 mm	
Magnetic tape length	Measurement length + 80 mm (min. 200 mm)	
Dimensions	mm (see dimensional drawing)	
Max. distance of the sensor to the magnetic tape		
without cover strip	0.3 mm	
with cover strip	0.2 mm	
Mass	**Read head**	**Interface adapter**
	0.08 kg	Approx. 0.4 kg
Material	Zinc die-casting	
Resolution	3.906 µm	
System accuracy	± 10 µm	
Repeatability	**Unidirectional**	**Bidirectional**
	< 5 µm	< 15 µm
Max. operating speed	10 m/s	
Permitted mounting tolerances	See drawing	
Working temperature range	**Read head**	**Interface adapter**
	–30 to +85 °C	–20 to +60 °C
Storage temperature range (without packaging)	–40 to +100 °C	–25 to +85 °C
Permissible relative humidity	100 % (condensation permitted)	90 % (condensation not permitted)
Maximum permitted ambient field strength to guarantee compliance with the quoted accuracy values1)	< 3 to 4 kA/m (3.8 to 5 mT)	
Resistance	**Read head**	**Interface adapter**
to shocks acc. to EN 60068-2-27	30 g/6 ms	70 g/6 ms
to vibration acc. to EN 60068-2-6	20 g/10 to 2,000 Hz	
Protection class acc. to IEC 60529 2)	IP 65	IP 64
EMC to EN 61000-6-2 and EN 61000-6-3		
Operating voltage range	DC 10 V to 30 V	
Recommended supply voltage	24 V	
Operating current	2.64 W	
Throughput time	< 1 ms	
Initialization time	Approx. 2 sec. (incl. duplicates MAC-ID-Check)	
Output interface DeviceNet		
Electrical interface3)	To ISO 11898 CAN-High Speed to CAN-specification 2.0B, DC-isolated	
Protocol	DeviceNet protocol specification Release 2.0 Vol. 1 and 3; Device Profiles (Encoder Device Type 22_h)	
Address settings (node no.)	0 to 63 DIP switches or addressing via bus protocol	
Data transfer rate (baud rate)	125, 250, 500 kBaud via DIP switches, bus protocol or Autobaud	
Electronic adjustment (number set)	Via bus protocol and DIP switches	
Status information	Encoder input status (LED yellow) Supply voltage (LED green) Bus status (LED bicolor red/green)	
Error value output	Analysis of the alarms and warnings	
Bus termination4)	Via external terminating resistor	
Electrical connection to control (DeviceNet)	Signal connector (bus IN) and 5-pin female device connector (bus OUT) potential-free to the housing (supply voltage via bus cable)	

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

2) With mating plug mounted.

3) To ISO 11898 CAN-High Speed to CAN-specification 2.0B, DC-isolated.

4) Activation only at the last bus subscriber of the line.

Ordering information		
Length measuring system TTK70 DeviceNet		
Type	**Part no.**	**Description**
TTK70-DXH0-K02	1037876	Read head and interface adapter

Connecting cable from reading head to interface adapter: please order separately

Resolution
3.906 µm

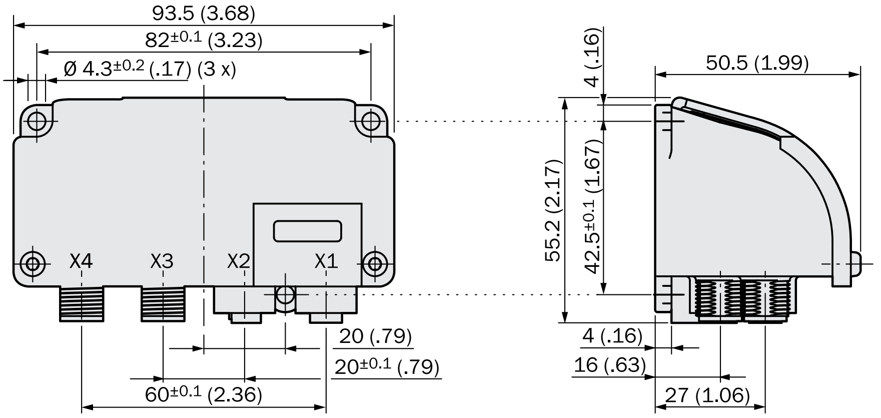
Non-Contact Linear Encoders

- Measurement length up to 4 m
- Non contact length measuring system, wear-free
- Absolute position determination, no reference run
- Length-independent position sensing time
- CANopen® Interface

Accessories – see pages 410-448

Dimensional drawing and positional tolerances of the reading head

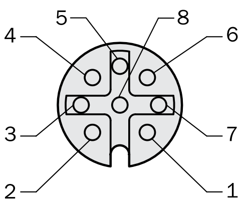
Dimensional drawing CANopen® Interface Adapter Module



All dimensions in mm (inch)

PIN and wire allocation encoder input (X1)

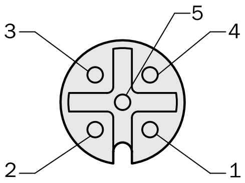
8-pin A-coded



PIN	Color 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	yellow	Data +	RS 485 parameter channel
6	violet	Data –	RS 485 parameter channel
7	blue	GND	Ground connection
8	red	$+U_S$	Encoder supply voltage via the adapter
	Screen		Housing potential

PIN and wire allocation CANopen® (out) (X2)

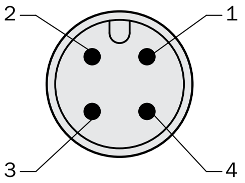
5-pin A-coded



PIN	Signal	Explanation
1	Drain/Screen	Housing potential
2	V +	Supply voltage via the bus
3	V –	Ground connection (GND)
4	CAN_H	CAN High
5	CAN_L	CAN Low

PIN and wire allocation supply voltage U_S (X3)

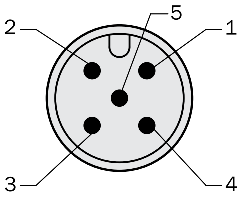
4-pin A-coded



PIN	Signal	Explanation
1	U_S	Supply voltage
2	N. C.	–
3	GND	0 V (Mass)
4	N. C.	–

PIN and wire allocation CANopen® (in) (X4)

5-pin A-coded



PIN	Signal	Explanation
1	Drain/Screen	Housing potential
2	V +	Supply voltage via the bus
3	V –	Ground connection (GND)
4	CAN_H	CAN High
5	CAN_L	CAN Low

Technical data acc. DIN 32878	TTK70 CANopen®	
Max. measurement length	4,000 mm	
Magnetic tape length	Measurement length + 80 mm (min. 200 mm)	
Dimensions	mm (see dimensional drawing)	
Max. distance of the sensor to the magnetic tape		
without cover strip	0.3 mm	
with cover strip	0.2 mm	
Mass	**Read head**	**Interface adapter**
	0.08 kg	Approx. 0.4 kg
Material	Zinc die-casting	
Resolution	3.906 µm	
System accuracy	± 10 µm	
Repeatability	**Unidirectional**	**Bidirectional**
	< 5 µm	< 15 µm
Max. operating speed	10 m/s	
Permitted mounting tolerances	See drawing	
Working temperature range	**Read head**	**Interface adapter**
	–30 to +85 °C	–20 to +60 °C
Storage temperature range (without packaging)	–40 to +100 °C	–25 to +85 °C
Permissible relative humidity	100 % (condensation permitted)	90 % (condensation not permitted)
Maximum permitted ambient field strength to guarantee compliance with the quoted accuracy values[1]	< 3 to 4 kA/m (3.8 to 5 mT)	
Resistance	**Read head**	**Interface adapter**
to shocks acc. to EN 60068-2-27	30 g/6 ms	70 g/6 ms
to vibration acc. to EN 60068-2-6	20 g/10 to 2,000 Hz	
Protection class acc. to IEC 60529[2]	IP 65	IP 64
EMC to EN 61000-6-2 and EN 61000-6-3		
Operating voltage range	DC 10 V to 30 V	
Recommended supply voltage	24 V	
Operating current	2.64 W	
Throughput time	< 1 ms	
Initialization time	< 1,250 ms	
Output interface CANopen®		
Electrical interface	To ISO 11898 CAN-High-Speed to CAN-Specification 2.0B, DC-isolated	
Protocol	CANopen® communication profile DS301 V4.01, Device Profile acc. CIA DS 406 V3.1 Device Profile for encoder (Class 2)	
Address settings (node no.)	1 to 63 DIP switches	
Data transfer rate (baud rate)	28 to 1000 kBaud via DIP switches, bus protocol or Autobaud	
Electronic adjustment (number set)	Via bus protocol and DIP switches	
Status information	Encoder input-status (LED yellow) Supply voltage (LED red) Bus status (LED bicolor red/green)	
Error value output	Analysis of the alarms and warnings	
Bus termination[3]	Via external terminating resistor	
Electrical connection to control (CANopen®)	Signal line via 5-pin male device connector (bus IN) and 5-pin female device connector (bus OUT) and 4-pin male device connector (U_S), potential-free to the housing	

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

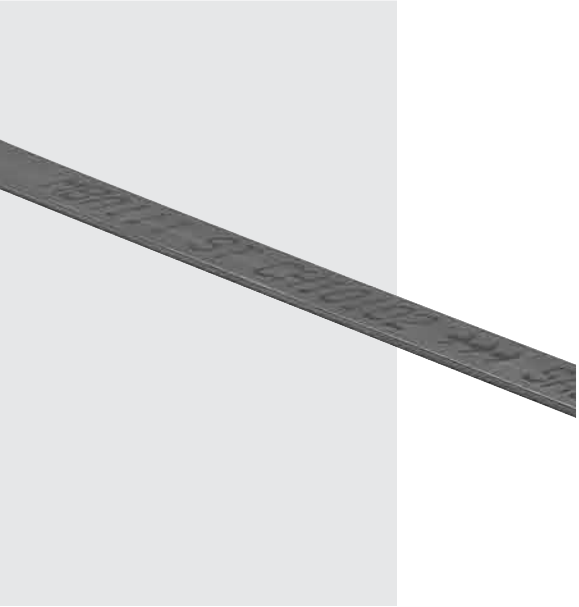
[2] With mating plug mounted.

[3] Activation only at the last bus subscriber of the line.

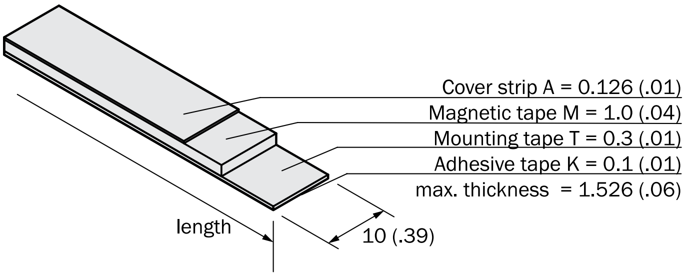
Ordering information		
Length measuring system TTK70 CANopen®		
Type	**Part no.**	**Description**
TTK70-CXH0-K02	1037877	Read head and interface adapter

Connecting cable from reading head to interface adapter: please order separately

- Measurement length up to 4 m
- Tape width 10 mm
- Absolute encoding
- Easy mounting



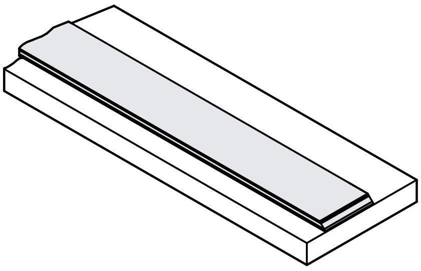
Dimensional drawing and construction

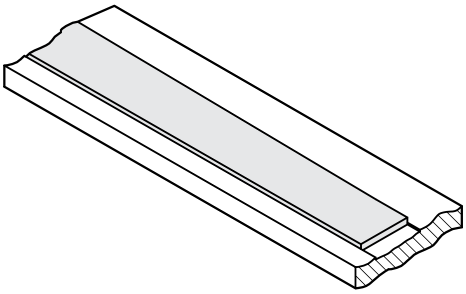

Cover strip A = 0.126 (.01)
Magnetic tape M = 1.0 (.04)
Mounting tape T = 0.3 (.01)
Adhesive tape K = 0.1 (.01)
max. thickness = 1.526 (.06)
length
10 (.39)

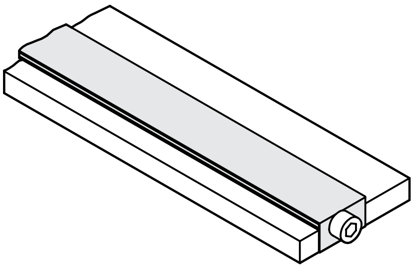
Technical data Magnetic Tape

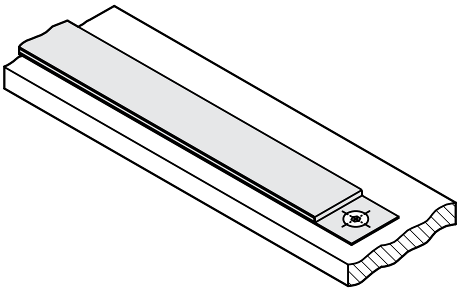
Period length	1 mm
Measurement length	Max. 4,000 mm
Tape width	10 mm
Tape thickness (without cover strip)	1.4 mm
Temperature coefficient	(11 ± 1) x 10^{-6}/K
Working temperature range	–20 to +70 °C
Storage temperature range (without packaging)	–30 to +80 °C
Permissible relative humidity	100 % (condensation permitted)
Mounting method (prepared for double-sided adhesive tape)	Adhesive bond
Material mounting tape	Stainless steel
Material magnetic tape	17410 Hard ferrite 9/28 P
Mass	0.18 kg/m
Maximum permitted field strength to ensure that the magnetic tape is not permanently damaged	< 150 kA/m (< 190 mT)

Mounting options


Mounting with chamfered ends


Mounting in a groove


Tightly screwed-on carrier tape/cover strip


Tightly screwed-on carrier tape/cover strip

Accessories – see pages 410-448

Resistance to chemicals, dirt and liquids

Tape materials	
Carrier tape	VA spring steel (corrosion-free stainless steel tape)
Magnetic material	Plastic-bound ferrite (17410 hard ferrite 9/28P)
Cover strip	Stainless steel

Chemical	Classification[1]	Chemical	Classification[1]
Acetic acid, 20 %	B	Metal dust/chips	A
Acetic acid, 30 %	B	Mineral oil	A
Acetic acid, glacial acetic acid	B	n-hexane	A
Acetone	B	Nitric acid, 70 %	C
Acetylene	B	Nitric acid, red, fuming	C
Ammonia, anhydrous	B	Nitrobenzene	C
Aromatic hydrocarbons	C	Oleic acid	B
Benzene	C	Paint solvent	C
Carbon tetrachloride	C	Petrol	B
Cottonseed oil	A	Sea water	B
Drilling emulsions	C	Soybean oil	A
Formaldehyde 40 %	A	Steam	B
Formic acid	A	Stearic acid	A (70 °C)
Glycerine	A (98 °C)	Stone flour	A
Hydrochloric acid, 37 %	C (93 °C)	Tetrahydrofuran	C
Inorganic acids (HCL, H_2SO_4)	C	Toluene	C
Isooctane	A	Trichloroethylene	C
Isopropyl ether	B	Turpentine	C
Kerosine	B	Vegetable oils	A
Ketones	C	Water/water vapour	A
Lactic acid	A	Wood dust/chippings	A
Linseed oil	A	Xylene	C

[1] Rating scale:
A = no or little effect
B = weak to medium effect
C = strong effect

Note:
The compatibility also depends on variables such as temperature, air supply, duration of exposure, stability of the liquid and various other factors. Therefore, it is recommended to always test the material under actual operating conditions.

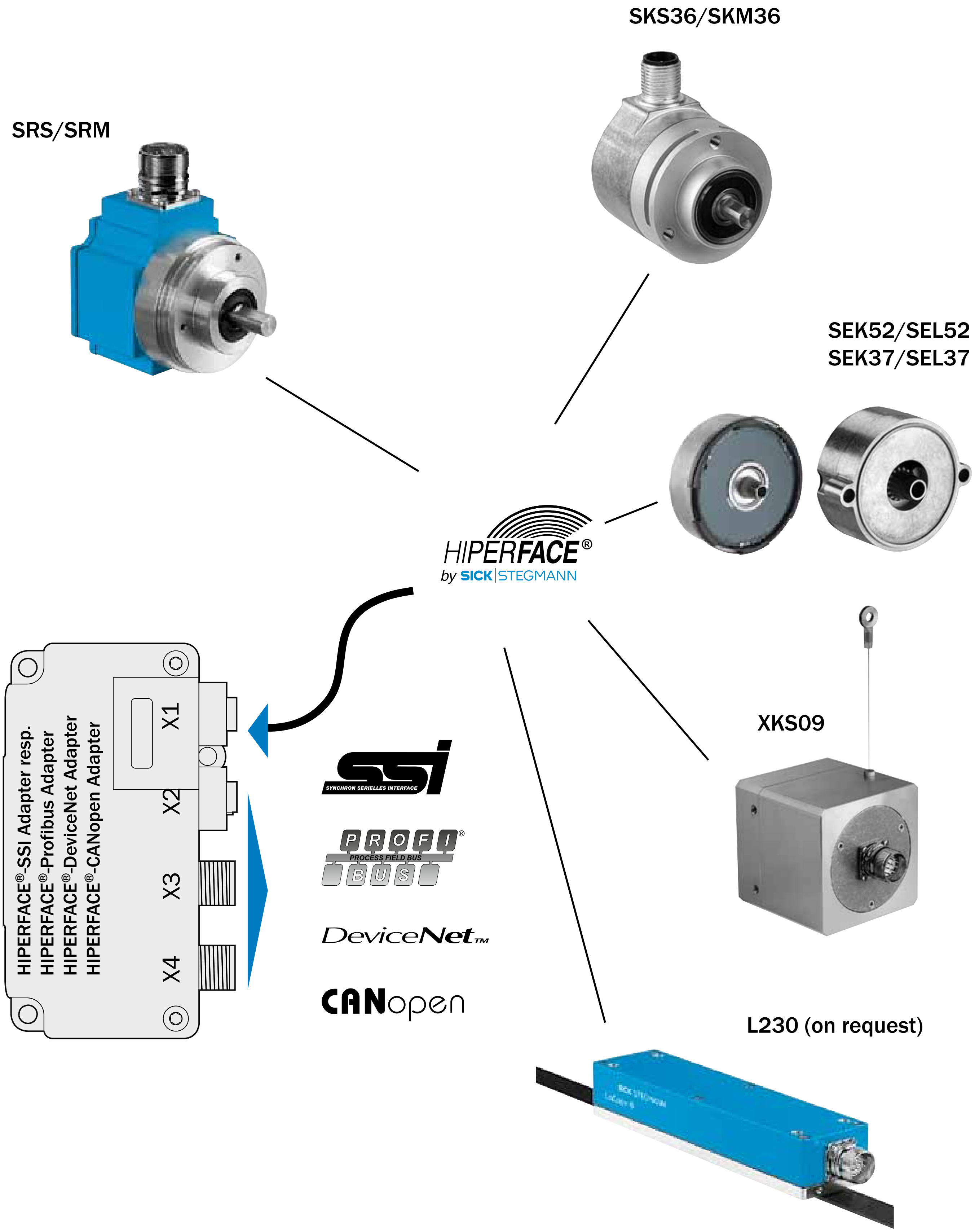
Ordering information		
Magnetic tape with adhesive tape and cover strip incl.		
Type	**Part no.**	**Description**
MVM-0M5-2MC-MKLB	6037415	Magnetic tape 0.5 m
MVM-01M-2MC-MKLB	6037417	Magnetic tape 1.0 m
MVM-1M5-2MC-MKLB	6037418	Magnetic tape 1.5 m
MVM-02M-2MC-MKLB	6037419	Magnetic tape 2.0 m
MVM-2M5-2MC-MKLB	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

Adapter

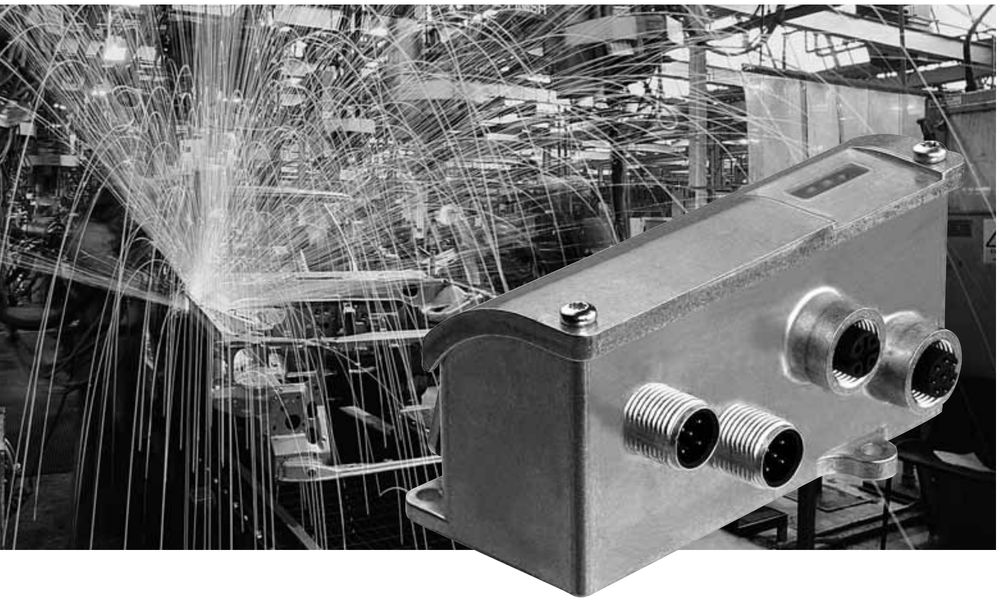
Adapter

Interface Adapter Module

Functional Diagram of Interface Adapter Module



HIPERFACE®-SSI Adapter, HIPERFACE®-Profibus Adapter, HIPERFACE®-DeviceNet Adapter and HIPERFACE®-CANopen Adapter: robust, flexible and versatile



Interface Adapter Module

Interface Adapter Module

Interface Adapter Module

Interface Adapter Module

The use of interface adapter modules for connecting up singleturn or multiturn encoders with the HIPERFACE® interface opens up a variety of application options in all areas of automation technology.

Encoders with the HIPERFACE® interface are being designed as Motor Feedback systems for drive technology. This creates an extremely compact design. In addition to encoders integrated into drives, stand-alone designs are also available.

In conjunction with interface adapter modules, these can also be used in a broad range of applications in automation technology, for example in applications where

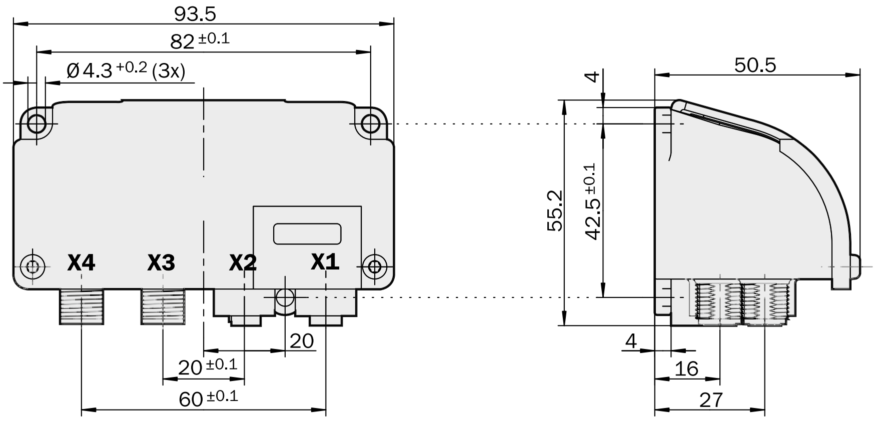
- space is very limited at the location of the installation
- environmental conditions such as dirt, temperature, shock and/or vibration must be isolated from a large part of the electronics
- customer-specific encoder flange and housing options are required, which must be realised quickly and at low-cost
- high encoder resolutions are necessary, which can be generated easily in the interface adapter via interpolation of the Hiperface® encoder signals.

At the output of the interface adapter modules, SSI, Profibus DP, DeviceNet und CANopen are available, interfaces that fulfil the high requirements of automation technology. In line with future-oriented trends, M12 connectors are used for the interface adapter modules. The diverse range of possible combinations of interface adapter modules and encoders provides a high level of flexibility, as well as low part replacement and stocking costs for our customers.

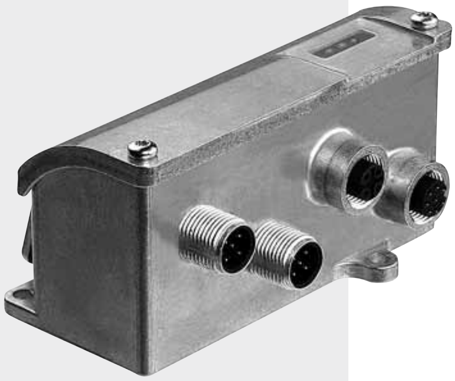
Interface Adapter Module

- SSI Output
- Automatic encoderer detection
- Elektronically adjustable
- Enclosure rating IP 64

Dimensional drawing HIPERFACE®-SSI Adapter



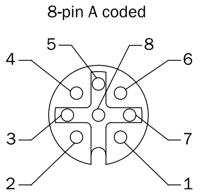
General tolerances to DIN ISO 2768-mk



Listed accessory which is to use with
listee's listed GmbH encoders.
For use in NFPA 79 applications only.
Interconnection cables and accessories are
available from SICK

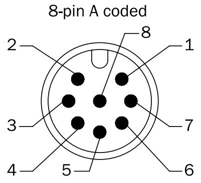
Accessories – see pages 410-448

PIN and wire allocation HIPERFACE® input (X1)



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	yellow	Data +	RS 485 Parameter channel
6	violet	Data –	RS 485 Parameter channel
7	blue	GND	Ground connection
8	red	+ U_S	Encoder Supply voltage via the Adapter
	Screen		Housing potential

PIN and wire allocation SSI output, incl. U_S (X3)



PIN	Colour of wires	Signal	Explanation
1	brown	Data –	Interface signals
2	white	Data +	Interface signals
3	black		N. C.
4	pink		N. C.
5	yellow	Clock +	Interface signals
6	violet	Clock –	Interface signals
7	blue	GND	Ground connection
8	red	+ U_S	Operating voltage
	Screen		Housing potential

Connections X2 and X4 on the HIPERFACE®-SSI Adapter not allocated.

The following encoders with a HIPERFACE® interface are detected by the HIPERFACE®-SSI Adapter:

Designation/ encoder series [1]	Number of revs.	Steps/rev. [2] Standard/DEFAULT	Max. steps/rev. [3]
SRS...	1	4096	32 768 (15-bit)
SCK...	1	4096	32 768 (15-bit)
SKS...	1	4096	32 768 (15-bit)
SEK...	1	4096	4096 (12-bit)
SRM...	4096	4096	32 768 (15-bit)
SCL...	4096	4096	32 768 (15-bit)
SKM...	4096	4096	32 768 (15-bit)

Output on the adapter – Gray code, right-justified to the 12th single bit.

[1] Valid for all standard encoders from the relevant product range.

[2] Factory default setting

[3] Max. possible steps/rev. that can be configured at the factory on request.

Technical data		SSI
Housing	Die-cast zinc	■
Mass	Approx. 350 g	■
Supported encoders	See encoder table	■
Configuration of the adapter of the encoder connected	Automatically by using the electronic name plate	■
Code type 1)	GRAY	■
Count direction cw/$\overline{\text{ccw}}$	Via DIP switches	■
Measurement step (rotary Encoder)	360°/step count per revolution	■
Steps per revolution 1)	See encoder table	■
Number of revolutions	See encoder table	■
Error limits	See encoder data sheet	■
Reproducibility	See encoder data sheet	■
Data format for singleturn encoders 1)	12-bit (right-justified)	■
Data format for multiturn encoders 1)	24-bit (right-justified)	■
Position sample time	100 µs	■
Working temperature range	–20 ... +70 °C	■
Storage temperature range	–25 ... +85 °C	■
Permissible relative humidity 2)	90 %	■
EMC 3)		■
Resistance		
to shocks 4)	70 g/6 ms	■
to vibration 5)	20 g/10 ... 2000 Hz	■
Protection to IEC 60529 6)	IP 64	■
Operating voltage range (U_S)	10 ... 30 V DC	■
Encoder operating voltage via the adapter	8 V DC ± 10 % (max. 500 mA)	■
Power consumption (without encoder)	1.6 W	■
Initialisation time 7)	Typ. 200 ms (50 ms after encoder-ready signal)	■
Input interface HIPERFACE®		
Electrical connection to the encoder (HIPERFACE®)	Signal line via 8-pin female device connector, potential-free to the housing	■
Output interface SSI		
Interface signals		■
Clock +, Clock –, Data +, Data –	SSI max. clock frequency 1.0 MHz or min. LOW level (Clock +): 500 ns	■
Electrical interface	RS422 for SSI	■
DC isolation at the output to PLC	No	■
Electronic adjustment (number set) 8)	Via DIP switches	■
Status information	HIPERFACE® status (LED yellow) Adapter status (LED green)	■
Error value output	No	■
Electrical connection to control (SSI)	Signal line via 8-pin male device connector, potential-free to the housing	■

1) Additional data formats, output codes and resolutions on request

2) Condensation not permissible

3) **EN 61000-6-2**
EN 61000-4-2
EN 61000-4-3
EN 61000-4-4
EN 61000-4-5
EN 61000-4-6
EN 61000-6-3
EN 55011

4) To EN 60068-2-27

5) To EN 60068-2-6

6) With mating connector fitted

Exposure to direct sunlight over an extended period is not permissible

7) The time that elapses after connection of the supply voltage until the data word can be correctly read in

8) Set to zero (0) at the factory, other numbers set on request

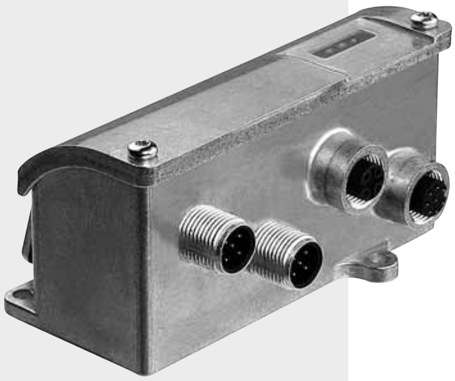
Ordering information

HIPERFACE®-SSI Adapter

Type	Part no.
AD-HFSSIS2	1035482

Interface Adapter Module

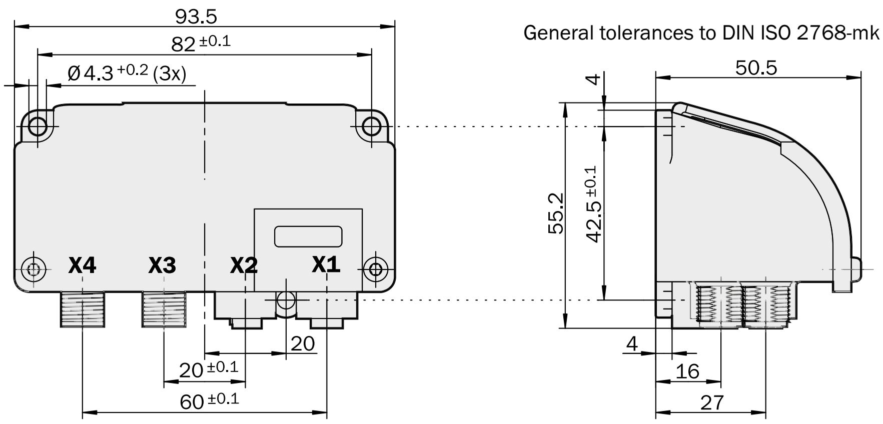
- Bus link RS 485 according to Profibus DP specification
- Automatic encoder detection
- Electronically adjustable, configurable resolution
- Enclosure rating IP 64



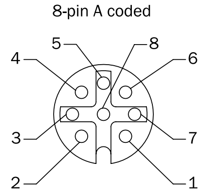
Listed accessory which is to use with listee's listed GmbH encoders.
For use in NFPA 79 applications only.
Interconnection cables and accessories are available from SICK

Accessories – see pages 410-448

Dimensional drawing HIPERFACE®-Profibus Adapter

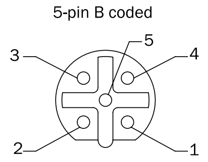


PIN and wire allocation HIPERFACE® input (X1)



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	yellow	Data +	RS 485 Parameter channel
6	violet	Data –	RS 485 Parameter channel
7	blue	GND	Ground connection
8	red	+ U_S	Encoder Supply voltage via the Adapter
	Screen		Housing potential

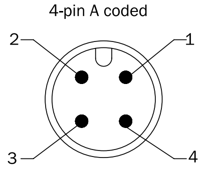
PIN and wire allocation Profibus DP (out) (X2)



PIN	Signal	Explanation
1	2PS	+ 5 V (potential-free isolated) 1)
2	A	A-cable Profibus DP
3	2M	0 V (potential-free isolated) 1)
4	B	B-cable Profibus DP
5	Screen	Housing potential

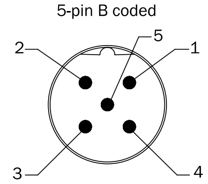
1) For external bus connection or supply to the sender/receiver of an LWL connection.

PIN and wire allocation Operating voltage U_S (X3)



PIN	Signal	Explanation
1	U_S	Operating voltage
2	N. C.	–
3	GND	0 V (ground)
4	N. C.	–

PIN and wire allocation Profibus DP (in) (X4)



PIN	Signal	Explanation
1	N. C.	–
2	A	A-cable Profibus DP
3	N. C.	–
4	B	B-cable Profibus DP
5	Screen	Housing potential

The following encoders with a HIPERFACE® interface are detected by the HIPERFACE®-Profibus Adapter:

Designation/encoder series 1)	Max. number of revs. 2)	Max. steps/rev. 2)
SRS...	1	262 144 (18-bit)
SCK...	1	262 144 (18-bit)
SKS...	1	32 768 (15-bit)
SEK...	1	4096 (12-bit)
SRM...	4096	262 144 (18-bit)
SCL...	4096	262 144 (18-bit)
SKM...	4096	32 768 (15-bit)
Designation/encoder series 1)	**Resolution 2)**	
L230	on request	
XKS...	0.05 mm	

1) Valid for all standard encoders from the relevant product range.

2) Scaling via bus protocol. Default values in EDS file = maximum values.

Technical data		Profib.									
Housing	Die-cast zinc	■									
Mass	Approx. 400 g	■									
Supported encoders	See encoder table	■									
Configuration of the adapter of the encoder connected	Automatically by using the electronic name plate	■									
Count direction cw/$\overline{\text{ccw}}$	Via bus protocol	■									
Measurement step (rotary Encoder)	360°/step count per revolution	■									
Steps per revolution [1]	See encoder table	■									
Number of revolutions	See encoder table	■									
Error limits	See encoder data sheet	■									
Reproducibility	See encoder data sheet	■									
Position sample time	100 µs	■									
Working temperature range	–20 ... +60 °C	■									
Storage temperature range	–25 ... +85 °C	■									
Permissible relative humidity [2]	90 %	■									
EMC [3]		■									
Resistance											
to shocks [4]	70 g/6 ms	■									
to vibration [5]	20 g/10 ... 2000 Hz	■									
Protection to IEC 60529 [6]	IP 64	■									
Operating voltage range (U_S)	10 ... 30 V DC	■									
Encoder operating voltage via the adapter	8 V DC ± 5 % (max. 650 mA)	■									
Power consumption (without encoder)	2.2 W	■									
Initialisation time [6]	Typ. 360 ms (50 ms after encoder-ready signal)	■									
Input interface HIPERFACE®											
Electrical connection to the encoder (HIPERFACE®)	Signal line via 8-pin female device connector, potential-free to the housing	■									
Output interface Profibus DP											
Electrical interface [7]	RS485 with DC isolation	■									
Protocol	DP V0 + isochronous Mode (DP V2) Encoderprofile Class 1 and 2	■									
Address setting (node no.)	1 ... 125 DIP switches 126 EEPROM addressing via protocol	■									
Data transfer rate (baud rate)	9.6 kBaud ... 12 MBaud automatic detection	■									
Electronic adjustment (number set)	Via bus protocol and DIP switches	■									
Status information	HIPERFACE® status (LED yellow) PROFIBUS status (LED red) and (LED bi-color red/green) [alternatively: green]	■									
Error value output	In accordance with bus diagnostic function	■									
Bus termination [8]	Via external terminating resistor	■									
Electrical connection to control (PROFIBUS)	Signal line via 5-pin male device connector (bus IN) and 5-pin female device connector (bus OUT) as well as 4-pin male device connector (U_S), potential-free to the housing	■									

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[1] Condensation not permissible

[2] **EN 61000-6-2**
EN 61000-4-2
EN 61000-4-3
EN 61000-4-4
EN 61000-4-5
EN 61000-4-6
EN 61000-6-3
EN 55011

[3] To EN 60068-2-27

[4] To EN 60068-2-6

[5] With mating connector fitted

Exposure to direct sunlight over an extended period is not permissible

[6] For encoders with type code FF, the initialisation time is typ. 240 ms

[7] To EN 50170-2 (DIN 19245 Part 1-3) DC-isolated via opto-couplers

[8] Activation only at the last bus subscriber of the line.

Ordering information	
HIPERFACE®-Profibus Adapter	
Type	**Part no.**
AD-HFPRLS4	1035483

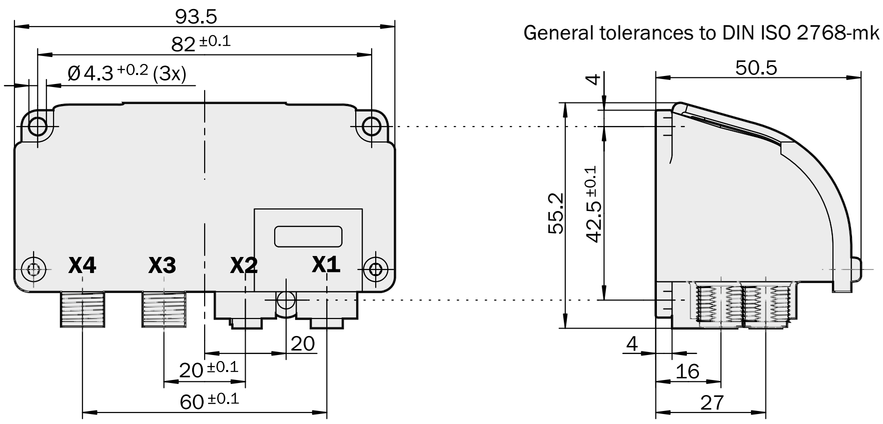
Interface Adapter Module

- Bus link to ISO11898 CAN-High Speed to CAN Specification 2.0B
- Automatic encoder detection
- Electronically adjustable, configurable resolution
- Enclosure rating IP 64

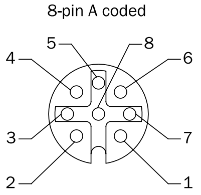
Listed accessory which is to use with listee's listed GmbH encoders.
For use in NFPA 79 applications only.
Interconnection cables and accessories are available from SICK

Accessories – see pages 410-448

Dimensional drawing HIPERFACE®-DeviceNet Adapter

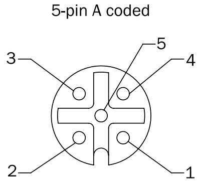


PIN and wire allocation HIPERFACE® input (X1)



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	yellow	Data +	RS 485 Parameter channel
6	violet	Data –	RS 485 Parameter channel
7	blue	GND	Ground connection
8	red	$+ U_S$	Encoder Supply voltage via the Adapter
	Screen		Housing potential

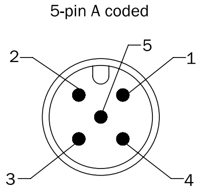
PIN and wire allocation DeviceNet (out) (X2)



PIN	Signal	Explanation
1	Drain/ Screen	Bus Drain/Screen must not have any connection to the housing
2	V +	Supply voltage via the Bus
3	V –	Ground connection (GND)
4	CAN_H	CAN High
5	CAN_L	CAN Low

PIN and wire allocation (X3) – not connected

PIN and wire allocation DeviceNet (in) (X4)



PIN	Signal	Explanation
1	Drain/ Screen	Bus Drain/Screen must not have any connection to the housing
2	V +	Supply voltage via the Bus
3	V –	Ground connection (GND)
4	CAN_H	CAN High
5	CAN_L	CAN Low

The following encoders with a HIPERFACE® interface are detected by the HIPERFACE®-DeviceNet Adapter:

Designation/encoder series [1]	Max. number of revs. [2]	Max. steps/rev. [2]
SRS...	1	262 144 (18-bit)
SCK...	1	262 144 (18-bit)
SKS...	1	32 768 (15-bit)
SEK...	1	4096 (12-bit)
SRM...	4096	262 144 (18-bit)
SCL...	4096	262 144 (18-bit)
SKM...	4096	32 768 (15-bit)
Designation/encoder series [1]	**Resolution [2]**	
L230	on request	
XKS...	0.05 mm	

[1] Valid for all standard encoders from the relevant product range.
[2] Scaling via bus protocol. Default values in EDS file = maximum values.

Technical data		DN									
Housing	Die-cast zinc	▨									
Mass	Approx. 400 g	▨									
Supported encoders	See encoder table	▨									
Configuration of the adapter of the encoder connected	Automatically by using the electronic name plate	▨									
Count direction cw/$\overline{\text{ccw}}$	Via bus protocol	▨									
Measurement step (rotary Encoder)	360°/step count per revolution	▨									
Steps per revolution	See encoder table	▨									
Max. Number of revolutions	See encoder table	▨									
Error limits	See encoder data sheet	▨									
Reproducibility	See encoder data sheet	▨									
Position sample time	< 1 ms	▨									
Working temperature range	–20 ... +60 °C	▨									
Storage temperature range	–25 ... +85 °C	▨									
Permissible relative humidity [1]	90 %	▨									
EMC [2]		▨									
Resistance											
to shocks [3]	70 g/6 ms	▨									
to vibration [4]	20 g/10 ... 2000 Hz	▨									
Protection to IEC 60529 [5]	IP 64	▨									
Operating voltage range (U_S)	10 ... 30 V DC	▨									
Encoder operating voltage via the adapter	8 V DC ± 5 % (max. 500 mA)	▨									
Power consumption (without encoder)	2.2 W	▨									
Initialisation time	Appr. 2 s (incl. Duplicates MAC-ID-Check)	▨									
Input interface HIPERFACE®		▨									
Electrical connection to the encoder (HIPERFACE®)	Signal line via 8-pin female device connector, potential-free to the housing	▨									
Output interface DeviceNet		▨									
Electrical interface [6]		▨									
Protocol [7]		▨									
Address setting (node no.)	0 ... 63 DIP switches or addressing via bus protocol	▨									
Data transfer rate (Baudrate)	100 ... 500 kBaud via DIP switches, bus protocol or Autobaud	▨									
Electronic adjustment (number set)	Via bus protocol and DIP switches	▨									
Status information	HIPERFACE® status (LED yellow) Supply voltage (LED green) Bus status (LED bicolor red/green)	▨									
Error value output	Analysis of the alarms and warnings	▨									
Bus termination [8]	Via external terminating resistor	▨									
Electrical connection to control (DeviceNet)	Signal line via 5-pin male device connector (bus IN) and 5-pin female device connector (bus OUT) potential-free to the housing (Supply voltage via Bus-cable)	▨									

[1] Condensation not permissible

[2] **EN 61000-6-2**
EN 61000-4-2
EN 61000-4-3
EN 61000-4-4
EN 61000-4-5
EN 61000-4-6
EN 61000-6-3
EN 55011

[3] To EN 60068-2-27

[4] To EN 60068-2-6

[5] With mating connector fitted

Exposure to direct sunlight over an extended period is not permissible

[6] To ISO 11898 CAN-High Speed to CAN-specification 2.0B, DC-isolated

[7] DeviceNet protocol specification Release 2.0 Vol. 1 and 3; Device Profiles (Encoder Device Type 22_h)

[8] Activation only at the last bus subscriber of the line.

Ordering information	
HIPERFACE®-DeviceNet Adapter	
Type	**Part no.**
AD-HFCDNS3	1035646

Interface Adapter Module HIPERFACE®–CANopen

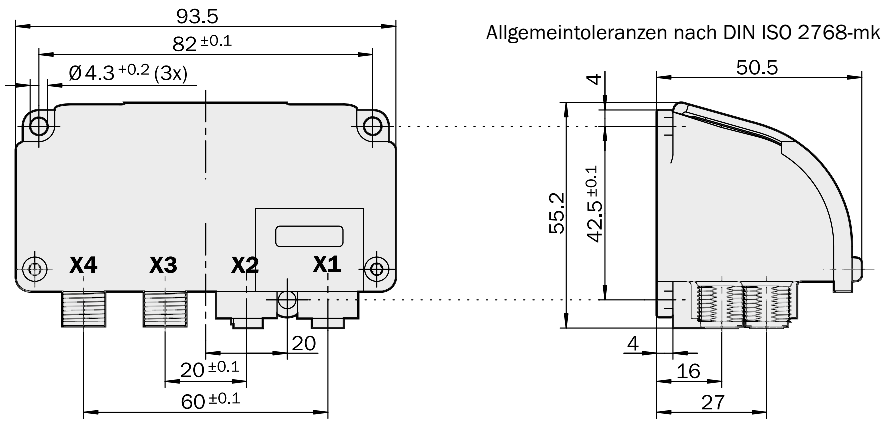
Interface Adapter Module

- Bus link to ISO11898 CAN-High Speed to CAN Specification 2.0B
- Automatic encoder detection
- Electronically adjustable, configurable resolution
- Enclosure rating IP 64

Listed accessory which is to use with listee's listed GmbH encoders.
For use in NFPA 79 applications only.
Interconnection cables and accessories are available from SICK

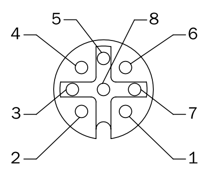
Accessories – see pages 410-448

Dimensional drawing HIPERFACE®-CANopen Adapter



PIN and wire allocation HIPERFACE® input (X1)

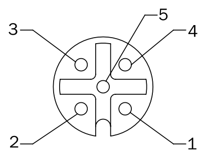
8-pin A coded



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	yellow	Data +	RS 485 Parameter channel
6	violet	Data –	RS 485 Parameter channel
7	blue	GND	Ground connection
8	red	+ U_s	Encoder Supply voltage via the Adapter
	Screen		Housing potential

PIN and wire allocation CANopen (out) (X2)

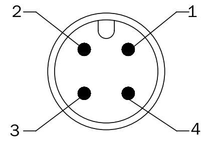
5-pin A coded



PIN	Signal	Explanation
1	Drain/ Screen	Housing potential
2	V +	Supply voltage via the Bus
3	V –	Ground connection (GND)
4	CAN_H	CAN High
5	CAN_L	CAN Low

PIN and wire allocation Operating voltage U_s (X3)

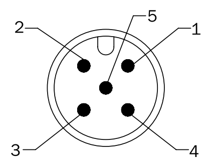
4-pin A coded



PIN	Signal	Explanation
1	U_s	Operating voltage
2	N. C.	–
3	GND	0 V (ground)
4	N. C.	–

PIN and wire allocation CANopen (in) (X4)

5-pin A coded



PIN	Signal	Explanation
1	Drain/ Screen	Housing potential
2	V +	Supply voltage via the Bus
3	V –	Ground connection (GND)
4	CAN_H	CAN High
5	CAN_L	CAN Low

The following encoders with a HIPERFACE® interface are detected by the HIPERFACE® CANopen Adapter:

Designation/encoder series [1]	Max. number of revs. [2]	Max. steps/rev. [2]
SRS...	1	262 144 (18-bit)
SCK...	1	262 144 (18-bit)
SKS...	1	32 768 (15-bit)
SEK...	1	4096 (12-bit)
SRM...	4096	262 144 (18-bit)
SCL...	4096	262 144 (18-bit)
SKM...	4096	32 768 (15-bit)
Designation/encoder series [1]	**Resolution [2]**	
L230	on request	
XKS...	0.05 mm	

[1] Valid for all standard encoders from the relevant product range.

[2] Scaling via bus protocol. Default values in EDS file = maximum values.

Technical data		CAN
Housing	Die-cast zinc	▨
Mass	Approx. 400 g	▨
Supported encoders	See encoder table	▨
Configuration of the adapter of the encoder connected	Automatically by using the electronic name plate	▨
Count direction cw/$\overline{\text{ccw}}$	Via bus protocol	▨
Measurement step (rotary Encoder)	360°/step count per revolution	▨
Steps per revolution	See encoder table	▨
Max. Number of revolutions	See encoder table	▨
Error limits	See encoder data sheet	▨
Reproducibility	See encoder data sheet	▨
Position sample time	< 1 ms	▨
Working temperature range	–20 ... +60 °C	▨
Storage temperature range	–25 ... +85 °C	▨
Permissible relative humidity 1)	90 %	▨
EMC 2)		▨
Resistance		
to shocks 3)	70 g/6 ms	▨
to vibration 4)	20 g/10 ... 2000 Hz	▨
Protection to IEC 60529 5)	IP 64	▨
Operating voltage range (U_S)	10 ... 30 V DC	▨
Encoder operating voltage via the adapter	8 V DC ± 5 % (max. 500 mA)	▨
Power consumption (without encoder)	2.2 W	▨
Initialisation time	< 1250 ms	▨
Input interface HIPERFACE®		▨
Electrical connection to the encoder (HIPERFACE®)	Signal line via 8-pin female device connector, potential-free to the housing	▨
Output interface CANopen		▨
Electrical interface 6)		▨
Protocol 7)		▨
Address setting (node no.)	1 ... 63 DIP switches	▨
Data transfer rate (Baudrate)	100 ... 1000 kBaud via DIP switches, bus protocol or Autobaud	▨
Electronic adjustment (number set)	Via bus protocol and DIP switches	▨
Status information	HIPERFACE® status (LED yellow) Supply voltage (LED green) Bus status (LED bicolor red/green)	▨
Error value output	Analysis of the alarms and warnings	▨
Bus termination 8)	Via external terminating resistor	▨
Electrical connection to control (CANopen)	Signal line via 5-pin male device connector (bus IN) and 5-pin female device connector (bus OUT) and 4-pin male device connector (U_S), potential-free to the housing	▨

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1) Condensation not permissible

2) **EN 61000-6-2**
EN 61000-4-2
EN 61000-4-3
EN 61000-4-4
EN 61000-4-5
EN 61000-4-6
EN 61000-6-3
EN 55011

3) To EN 60068-2-27

4) To EN 60068-2-6

5) With mating connector fitted

Exposure to direct sunlight over an extended period is not permissible

6) To ISO 11898 CAN-High Speed to CAN-Specification 2.0B, DC-isolated

7) CANopen communication profile DS301 V4.01, Device Profile acc. CIA DS 406 V3.1 Device Profile for Encoder (Class 2)

8) Activation only at the last bus subscriber of the line.

Ordering information	
HIPERFACE®-CANopen Adapter	
Type	**Part no.**
AD-HFCANS4	1035645

Motor Feedback Systems

Motor Feedback Systems
(SinCos® series STAND ALONE)*
Selection Guide

The Innovative HIPERFACE® Interface

Today's high-performance digital servo drive systems require absolute feedback for position control and high-resolution incremental feedback for speed control. Both are available.

Our SinCos family of servo motor feedback devices combines communication, speed regulation, and position information in a single device.

Motor Feedback Systems

	SKS/SKM36	SRS/SRM50	SRS/SRM64
	STAND ALONE	STAND ALONE	STAND ALONE
	128 sine/cosine periods	1,024 sine/cosine periods	1,024 sine/cosine periods
	• Solid shaft 6 mm • Absolute position 4,096 steps per revolution • 4,096 revolutions can be measured (Multiturn) • Programming of the positional value • Electronic type label	• Solid shaft 6 or 10 mm • Absolute position with a resolution of 32,768 steps per revolution • 4,096 revolutions can be measured (Multiturn) • Programming of the positional value • Electronic type label	• Hollow shaft • Absolute position with a resolution of 32,768 steps per revolution • 4,096 revolutions can be measured (Multiturn) • Programming of the positional value • Electronic type label
Number of sine/cosine periods per revolution	128	1,024	1,024
Total number of steps	Single SKS 4,096 Multi SKM 16.777.216 = 4.096 x 4.096	Single SRS 32,768 Multi SRM 134.217.728 = 32.768 x 4.096	Single SRS 32,768 Multi SRM 134.217.728 = 32.768 x 4.096
Non linearity	± 120 angular seconds	± 52 angular seconds	± 45 angular seconds
Working speed	6,000 min^{-1}	6,000 min^{-1}	6,000 min^{-1}
Working temp range	-20 ... 100° C	-20 ... 85° C	20 ... 115° C
Operating voltage range	7 ... 12 V	7 ... 12 V	7 ... 12 V
Type ID	Single SKS = 32h Multi SKM = 37h	Single SRS = 22h Multi SRM = 27h	Single SRS = 22h Multi SRM = 27h

*Only standalone versions of the motor feedback encoders are available. For other versions, please contact our team of application engineers.

VFS60: Motor Feedback System for installation on asynchronous motors

Photo: Wieland Werke AG

Number of lines up to 65.536

Motor Feedback Systems

RoHS 2002/95/EC

c UL us

CE

The VFS60 is a high-resolution incremental hollow shaft encoder in a 60 mm housing.

Excellent concentricity and exceptional robustness are achieved thanks to the large distance between the ball bearings which support the encoder shaft

VFS60 series encoders have been designed for arduous applications in harsh industrial environments, and especially for mounting to asynchronous motors.

Select the motor feedback system to suit your individual requirements. Possible product variations:

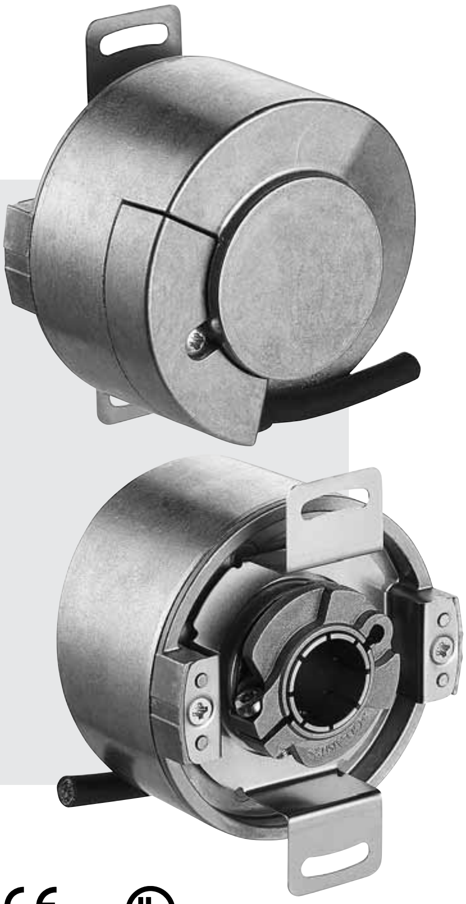
- Through hollow or blind hollow shaft
- Cable outlet universal 0.5 m or 1.5 m
- Number of lines from 1 up to 65.536
- Interfaces TTL or HTL and versions with programmable level of output signals
- Zero pulse width programmable by customer

An Electrically insulating hollow shaft clamping arrangement is available for special applications, significantly increasing the interference immunity.

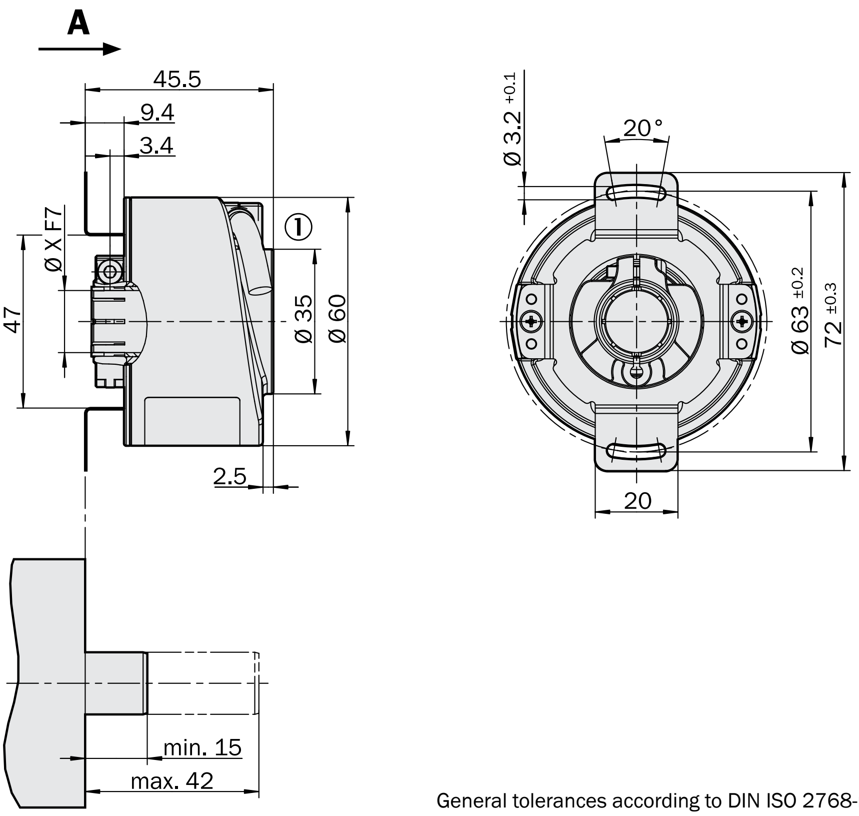
Number of lines up to 65.536

Motor Feedback Systems

- Cable outlet
- Protection class IP 65
- Electrical interfaces TTL, HTL



Dimensional drawing blind hollow shaft, cable outlet



General tolerances according to DIN ISO 2768-mk

Customer-side

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Wire allocation, cable 8-core

Color of wires	Signal TTL, HTL	Explanation
Brown	$\overline{A}$	Signal line
White	A	Signal line
Black	$\overline{B}$	Signal line
Pink	B	Signal line
Yellow	$\overline{Z}$	Signal line
Lilac	Z	Signal line
Blue	GND	Ground connection of the encoder
Red	$+U_S$	Supply voltage 1)
Screen	Screen	Screen 2)

1) Potential free to housing

2) Screen on the encoder side connected to the housing. On the control side connected to earth.

Accessories – see pages 410-448

Technical data to DIN 32878		VFS60 blind hollow shaft			
Type			**E**	**B**	**A**
Shaft diameter		8, 10, 12, 14, 15 mm a. 3/8", 1/2", 5/8"			
Electrical interface		4.5 ... 5.5 V, TTL/RS422			
		10 ... 32 V, TTL/RS422			
		10 ... 32 V, HTL/push-pull			
		4,5 ... 32 V, TTL/HTL programmable			
Number of lines per revolution			1000, 1024,	1000, 1024, 2000,	1 ... 8192
			2000, 2048	2048, 4096, 8192	16384, 32768
				16384, 32768, 65536	65536
Mass		0.2 kg			
Moment of inertia to the rotor		40 gcm^2			
Measuring step		90° electric/number of lines			
Reference signal	**Number**	1			
	Position	90° electr., gated with A and B			
Error limits			± 0.3°	± 0.05°	± 0.03°
Measuring step deviation			± 0.2°	± 0.01°	± 0.01°
Max. output frequency		TTL/RS422	300 kHz	600 kHz	820 kHz
		HTL/push-pull	300 kHz	600 kHz	820 kHz
		TTL/HTL programmable			820 kHz
Operating speed 1)			6,000 min^{-1}	6,000 min^{-1}	6,000 min^{-1}
Angular acceleration		5 x 10^5 rad/s^2			
Operating torque	**at 20 °C**	0.6 Ncm			
Starting torque	**at 20 °C**	0.8 Ncm			
Permissible shaft loading					
radial		Static/dynamic	± 0.3/± 0.1 mm	± 0.3/± 0.1 mm	± 0.3/± 0.05 mm
axial		Static/dynamic	± 0.5/± 0.2 mm	± 0.5/± 0.2 mm	± 0.5/± 0.01 mm
Bearing lifetime		3 x 10^9 revolutions			
Working temperature range			–20 ... + 100 °C	–20 ... + 100 °C	–20 ... + 100 °C
Storage temperature range (without package)			–40 ... + 100 °C	–40 ... + 100 °C	–40 ... + 100 °C
Permissible relative humidity 2)		90 %			
EMC 3)					
Resistance		To shocks 4)	50 g/6 ms	70 g/6 ms	60 g/6 ms
		To vibration 5)	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529					
Shaft side			IP 65	IP 65	IP 65
Housing side		Cable outlet	IP 67	IP 67	IP 67
Load current		4.5 ... 5.5 V, TTL/RS422	max. 30 mA	max. 30 mA	max. 30 mA
		10 ... 32 V, TTL/RS422	max. 30 mA	max. 30 mA	max. 30 mA
		10 ... 32 V, HTL/push-pull	max. 30 mA	max. 30 mA	max. 30 mA
		4,5 ... 32 V, TTL/HTL programmable			max. 30 mA
No-load operating current		4.5 ... 5.5 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, HTL/push-pull	40 mA	40 mA	40 mA
		4,5 ... 32 V, TTL/HTL programmable			60 mA
Initialization time after power on		4.5 ... 5.5 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, HTL/Push pull	40 ms	40 ms	40 ms
		4,5 ... 32 V, TTL/HTL programmable			max. 30 ms

1) Self-warming 3.3k/1,000 min^{-1}
when applying, note working temperature range

2) Condensation of the optical scanning not permitted

3) To EN 61000-6-2 and EN 61000-6-4

4) To EN 60068-2-27

5) To EN 60068-2-6

Order information TTL and HTL interface

Motor Feedback System VFS60, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**		**–**	**B**								

Type
E
B

Mechanical interface	
Blind hollow shaft 8 mm	= **B**
Blind hollow shaft 3/8"	= **C**
Blind hollow shaft 10 mm	= **D**
Blind hollow shaft 12 mm	= **E**
Blind hollow shaft 1/2"	= **F**
Blind hollow shaft 14 mm	= **G**
Blind hollow shaft 15 mm	= **H**
Blind hollow shaft 5/8"	= **J**

Electrical interface	
4.5 ... 5.5 V, TTL/RS422	= **A**
10 ... 32 V, TTL/RS422	= **C**
10 ... 32 V, HTL/Push pull	= **E**

Connection type	
Cable 8-core, universal 0.5 m [1]	= **J**
Cable 8-core, universal 1.5 m [1]	= **K**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Type E – Number of lines per revolution

01000	01024	02000	02048

Others on request

Type B – Number of lines per revolution

01000	02000	04096	16384	65536
01024	02048	08192	32768	

Others on request

Order example Motor Feedback System VFS60, type E, blind hollow shaft 10 mm, Electrical interface 10 ... 32 V, HTL/push-pull, cable 8-core, universal 0.5 m, number of lines 1024

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**	**E**	**–**	**B**	**D**	**E**	**J**	**0**	**1**	**0**	**2**	**4**

Order information TTL or HTL programmable

Motor Feedback System VFS60, blind hollow shaft

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**		**–**	**B**								

Type
A

Mechanical interface	
Blind hollow shaft 8 mm	= **B**
Blind hollow shaft 3/8"	= **C**
Blind hollow shaft 10 mm	= **D**
Blind hollow shaft 12 mm	= **E**
Blind hollow shaft 1/2"	= **F**
Blind hollow shaft 14 mm	= **G**
Blind hollow shaft 15 mm	= **H**
Blind hollow shaft 5/8"	= **J**

Electrical interface	
4,5 ... 32 V, TTL/HTL programmable	= **P**

Connection type	
Cable 8-core, universal 0.5 m [1]	= **J**
Cable 8-core, universal 1.5 m [1]	= **K**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Factory-programmed to 1024

Order example Motor Feedback System VFS60, type A, blind hollow shaft 8 mm, programmable number of lines from 1 ... 8192, Electrical interface 5 ... 32 V, cable 8-core, universal 0.5 m

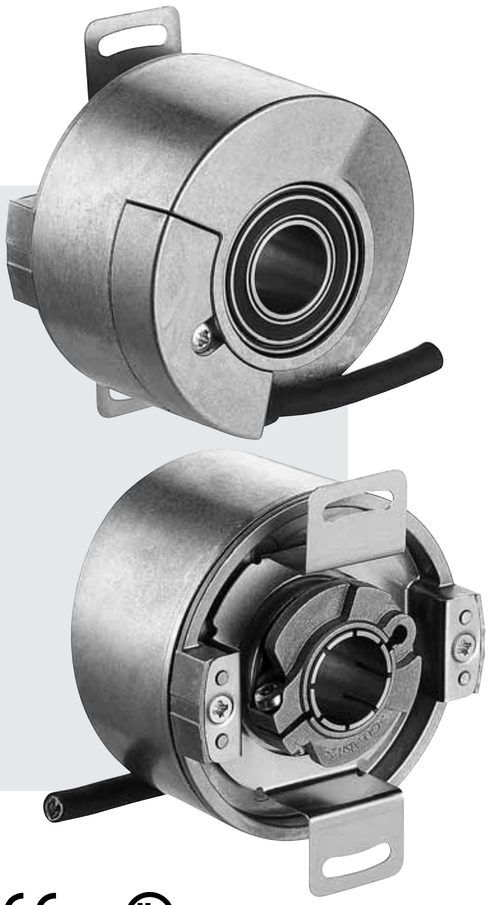
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**	**A**	**–**	**B**	**B**	**P**	**J**	**0**	**1**	**0**	**2**	**4**

Factory-programmed number of lines: 1024, level of output signal: TTL

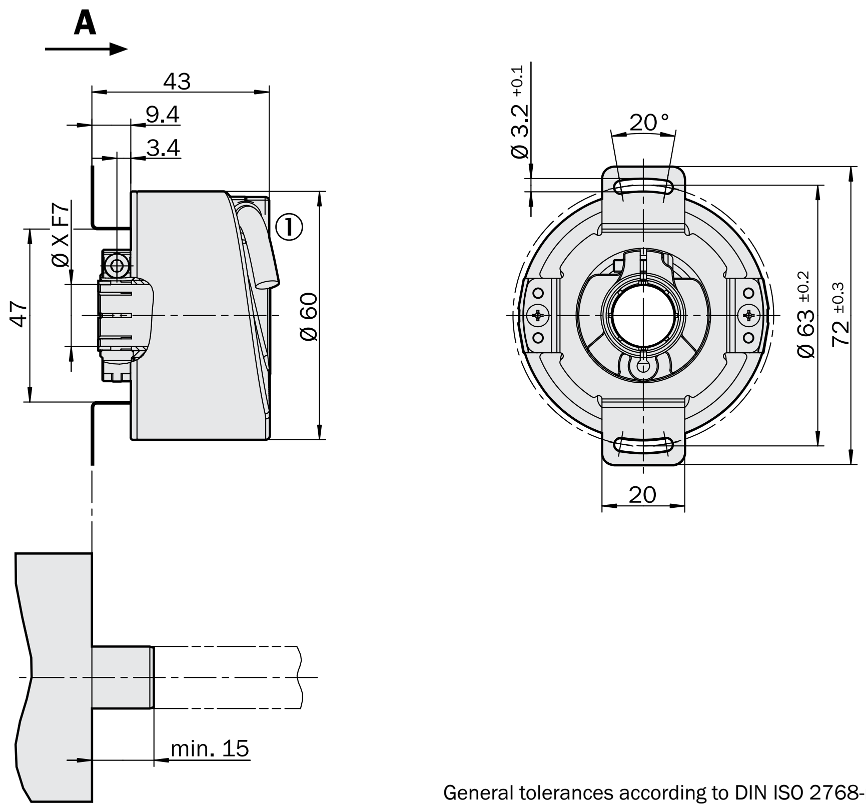
Number of lines up to 65.536

Motor Feedback Systems

- Cable outlet
- Protection class IP 65
- Electrical interfaces TTL, HTL



Dimensional drawing through hollow shaft metal, cable outlet



Customer-side

General tolerances according to DIN ISO 2768-mk

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Wire allocation, cable 8-core

Color of wires	Signal TTL, HTL	Explanation
Brown	$\overline{A}$	Signal line
White	A	Signal line
Black	$\overline{B}$	Signal line
Pink	B	Signal line
Yellow	$\overline{Z}$	Signal line
Lilac	Z	Signal line
Blue	GND	Ground connection of the encoder
Red	$+U_S$	Supply voltage [1]
Screen	Screen	Screen [2]

[1] Potential free to housing

[2] Screen on the encoder side connected to the housing. On the control side connected to earth.

Accessories – see pages 410-448

Technical data to DIN 32878		VFS60 through hollow shaft metal			
Type			**E**	**B**	**A**
Shaft diameter		8, 10, 12, 14, 15 mm a. 3/8", 1/2", 5/8"			
Electrical interface		4.5 ... 5.5 V, TTL/RS422			
		10 ... 32 V, TTL/RS422			
		10 ... 32 V, HTL/push-pull			
		4,5 ... 32 V, TTL/HTL programmable			
Number of lines per revolution			1000, 1024,	1000, 1024, 2000,	1 ... 8192
			2000, 2048	2048, 4096, 8192	16384, 32768
				16384, 32768, 65536	65536
Mass		0.2 kg			
Moment of inertia to the rotor		40 gcm^2			
Measuring step		90° electric/number of lines			
Reference signal	**Number**	1			
	Position	90° electr., gated with A and B			
Error limits			± 0.3°	± 0.05°	± 0.03°
Measuring step deviation			± 0.2°	± 0.01°	± 0.01°
Max. output frequency		TTL/RS422	300 kHz	600 kHz	820 kHz
		HTL/push-pull	300 kHz	600 kHz	820 kHz
		TTL/HTL programmable			820 kHz
Operating speed [1]			9,000 min^{-1}	9,000 min^{-1}	9,000 min^{-1}
Angular acceleration		5×10^5 rad/s^2			
Operating torque	**at 20 °C**	0.6 Ncm			
Starting torque	**at 20 °C**	0.8 Ncm			
Permissible shaft loading					
radial		Static/dynamic	± 0.3/± 0.1 mm	± 0.3/± 0.1 mm	± 0.3/± 0.05 mm
axial		Static/dynamic	± 0.5/± 0.2 mm	± 0.5/± 0.2 mm	± 0.5/± 0.01 mm
Bearing lifetime		3×10^9 revolutions			
Working temperature range			–20 ... + 100 °C	–20 ... + 100 °C	–20 ... + 100 °C
Storage temperature range (without package)			–40 ... + 100 °C	–40 ... + 100 °C	–40 ... + 100 °C
Permissible relative humidity [2]		90 %			
EMC [3]					
Resistance		To shocks [4]	50 g/6 ms	70 g/6 ms	60 g/6 ms
		To vibration [5]	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529					
Shaft side			IP 65	IP 65	IP 65
Housing side		Cable outlet	IP 65	IP 65	IP 65
Load current		4.5 ... 5.5 V, TTL/RS422	max. 30 mA	max. 30 mA	max. 30 mA
		10 ... 32 V, TTL/RS422	max. 30 mA	max. 30 mA	max. 30 mA
		10 ... 32 V, HTL/push-pull	max. 30 mA	max. 30 mA	max. 30 mA
		4,5 ... 32 V, TTL/HTL programmable			max. 30 mA
No-load operating current		4.5 ... 5.5 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, HTL/push-pull	40 mA	40 mA	40 mA
		4,5 ... 32 V, TTL/HTL programmable			60 mA
Initialization time after power on		4.5 ... 5.5 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, HTL/Push pull	40 ms	40 ms	40 ms
		4,5 ... 32 V, TTL/HTL programmable			max. 30 ms

[1] Self-warming 3.3k/1,000 min^{-1}
when applying, note working temperature range

[2] Condensation of the optical scanning not permitted

[3] To EN 61000-6-2 and EN 61000-6-4

[4] To EN 60068-2-27

[5] To EN 60068-2-6

Order information TTL and HTL interface

Motor Feedback System VFS60, through hollow shaft metal

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**		**–**	**T**								

Type
E
B

Mechanical interface	
Through hollow shaft	
Metal 8 mm	= **B**
Metal 3/8"	= **C**
Metal 10 mm	= **D**
Metal 12 mm	= **E**
Metal 1/2"	= **F**
Metal 14 mm	= **G**
Metal 15 mm	= **H**
Metal 5/8"	= **J**

Electrical interface	
4.5 ... 5.5 V, TTL/RS422	= **A**
10 ... 32 V, TTL/RS422	= **C**
10 ... 32 V, HTL/push-pull	= **E**

Connection type	
Cable 8-core, universal 0.5 m [1]	= **J**
Cable 8-core, universal 1.5 m [1]	= **K**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Type E – Number of lines per revolution

01000	01024	02000	02048

Others on request

Type B – Number of lines per revolution

01000	02000	04096	16384	65536
01024	02048	08192	32768	

Others on request

Order example Motor Feedback System VFS60, type E, through hollow shaft 10 mm, Electrical interface 10 ... 32 V, HTL/push-pull, cable 8-core, universal 0.5 m, number of lines 1024

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**	**E**	**–**	**T**	**D**	**E**	**J**	**0**	**1**	**0**	**2**	**4**

Order information TTL or HTL programmable

Motor Feedback System VFS60, through hollow shaft metal

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**		**–**	**T**								

Type
A

Mechanical interface	
Through hollow shaft	
Metal 8 mm	= **B**
Metal 3/8"	= **C**
Metal 10 mm	= **D**
Metal 12 mm	= **E**
Metal 1/2"	= **F**
Metal 14 mm	= **G**
Metal 15 mm	= **H**
Metal 5/8"	= **J**

Electrical interface	
4,5 ... 32 V, TTL/HTL programmable	= **P**

Connection type	
Cable 8-core, universal 0.5 m [1]	= **J**
Cable 8-core, universal 1.5 m [1]	= **K**

No. of lines
Factory-programmed to 1024

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

Order example Motor Feedback System VFS60, type A, through hollow shaft 8 mm, programmable number of lines from 1 ... 8192, Electrical interface 5 ... 32 V, cable 8-core, universal 0.5 m

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**	**A**	**–**	**T**	**B**	**P**	**J**	**0**	**1**	**0**	**2**	**4**

Factory-programmed number of lines: 1024, level of output signal: TTL

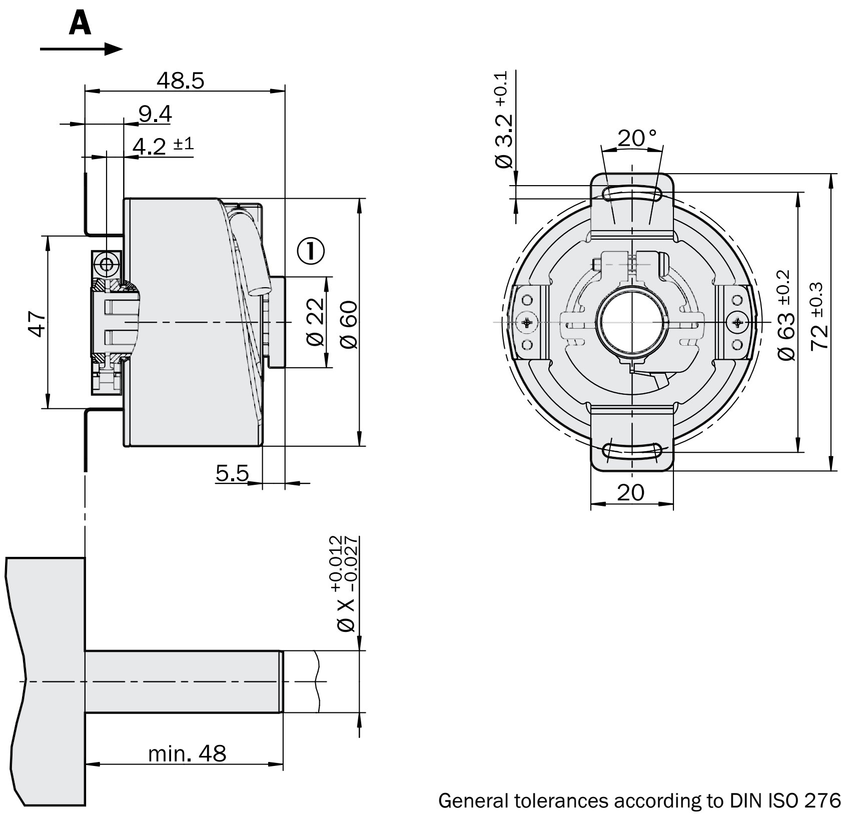
Number of lines up to 65.536

Motor Feedback Systems

- Insulating hollow shaft clamping
- Cable outlet
- Protection class IP 65
- Electrical interfaces TTL, HTL

Accessories – see pages 410-448

Dimensional drawing through hollow shaft plastic, cable outlet



General tolerances according to DIN ISO 2768-mk

Customer-side

① Cable-Ø = 5.6 ± 0.2 mm
Bending radius R = 30 mm

Wire allocation, cable 8-core

Color of wires	Signal TTL, HTL	Explanation
Brown	$\overline{A}$	Signal line
White	A	Signal line
Black	$\overline{B}$	Signal line
Pink	B	Signal line
Yellow	$\overline{Z}$	Signal line
Lilac	Z	Signal line
Blue	GND	Ground connection of the encoder
Red	$+U_S$	Supply voltage [1]
Screen	Screen	Screen [2]

[1] Potential free to housing

[2] Screen on the encoder side connected to the housing. On the control side connected to earth.

Technical data to DIN 32878		VFS60 through hollow shaft plastic			
Type			**E**	**B**	**A**
Shaft diameter		10, 12, 14, 15 mm and 3/8", 1/2"			
Electrical interface		4.5 ... 5.5 V, TTL/RS422			
		10 ... 32 V, TTL/RS422			
		10 ... 32 V, HTL/push-pull			
		4,5 ... 32 V, TTL/HTL programmable			
Number of lines per revolution			1000, 1024,	1000, 1024, 2000,	1 ... 8192
			2000, 2048	2048, 4096, 8192	16384, 32768
				16384, 32768, 65536	65536
Mass		0.2 kg			
Moment of inertia to the rotor		40 gcm^2			
Measuring step		90° electric/number of lines			
Reference signal	**Number**	1			
	Position	90° electr., gated with A and B			
Error limits			± 0.3°	± 0.05°	± 0.03°
Measuring step deviation			± 0.2°	± 0.01°	± 0.01°
Max. output frequency		TTL/RS422	300 kHz	600 kHz	820 kHz
		HTL/push-pull	300 kHz	600 kHz	820 kHz
		TTL/HTL programmable			820 kHz
Operating speed 1)			9,000 min^{-1}	12,000 min^{-1}	12,000 min^{-1}
Angular acceleration		5 x 10^5 rad/s^2			
Operating torque	**at 20 °C**	0.6 Ncm			
Starting torque	**at 20 °C**	0.8 Ncm			
Permissible shaft loading					
radial		Static/dynamic	± 0.3/± 0.1 mm	± 0.3/± 0.1 mm	± 0.3/± 0.05 mm
axial		Static/dynamic	± 0.5/± 0.2 mm	± 0.5/± 0.2 mm	± 0.5/± 0.01 mm
Bearing lifetime		3 x 10^9 revolutions			
Working temperature range			–20 ... + 100 °C	–20 ... + 100 °C	–20 ... + 100 °C
Storage temperature range (without package)			–40 ... + 100 °C	–40 ... + 100 °C	–40 ... + 100 °C
Permissible relative humidity 2)		90 %			
EMC 3)					
Resistance		To shocks 4)	50 g/6 ms	70 g/6 ms	60 g/6 ms
		To vibration 5)	20 g/10 ... 2000 Hz	30 g/10 ... 2000 Hz	20 g/10 ... 2000 Hz
Protection class to IEC 60529					
Shaft			IP 65	IP 65	IP 65
Housing side		Cable outlet	IP 65	IP 65	IP 65
Load current		4.5 ... 5.5 V, TTL/RS422	max. 30 mA	max. 30 mA	max. 30 mA
		10 ... 32 V, TTL/RS422	max. 30 mA	max. 30 mA	max. 30 mA
		10 ... 32 V, HTL/push-pull	max. 30 mA	max. 30 mA	max. 30 mA
		4,5 ... 32 V, TTL/HTL programmable			max. 30 mA
No-load operating current		4.5 ... 5.5 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, TTL/RS422	40 mA	40 mA	40 mA
		10 ... 32 V, HTL/push-pull	40 mA	40 mA	40 mA
		4,5 ... 32 V, TTL/HTL programmable			60 mA
Initialization time after power on		4.5 ... 5.5 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, TTL/RS422	40 ms	40 ms	40 ms
		10 ... 32 V, HTL/Push pull	40 ms	40 ms	40 ms
		4,5 ... 32 V, TTL/HTL programmable			max. 30 ms

1) Self-warming 3.3k/1,000 min^{-1}
when applying, note working temperature range

2) Condensation of the optical scanning not permitted

3) To EN 61000-6-2 and EN 61000-6-4

4) To EN 60068-2-27

5) To EN 60068-2-6

Order information TTL and HTL interface

Motor Feedback System VFS60, through hollow shaft plastic

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**		**–**	**T**								

Type
E
B

Mechanical interface	
Through hollow shaft	
Plastic 3/8"	= **3**
Plastic 10 mm	= **4**
Plastic 12 mm	= **5**
Plastic 1/2"	= **6**
Plastic 14 mm	= **7**
Plastic 15 mm	= **8**

Electrical interface	
4.5 ... 5.5 V, TTL/RS422	= **A**
10 ... 32 V, TTL/RS422	= **C**
10 ... 32 V, HTL/Push pull	= **E**

Connection type	
Cable 8-core, universal 0.5 m [1]	= **J**
Cable 8-core, universal 1.5 m [1]	= **K**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Always 5 characters in clear text

Selection depending on the type, see below.

Type E – Number of lines per revolution

01000	01024	02000	02048

Others on request

Type B – Number of lines per revolution

01000	02000	04096	16384	65536
01024	02048	08192	32768	

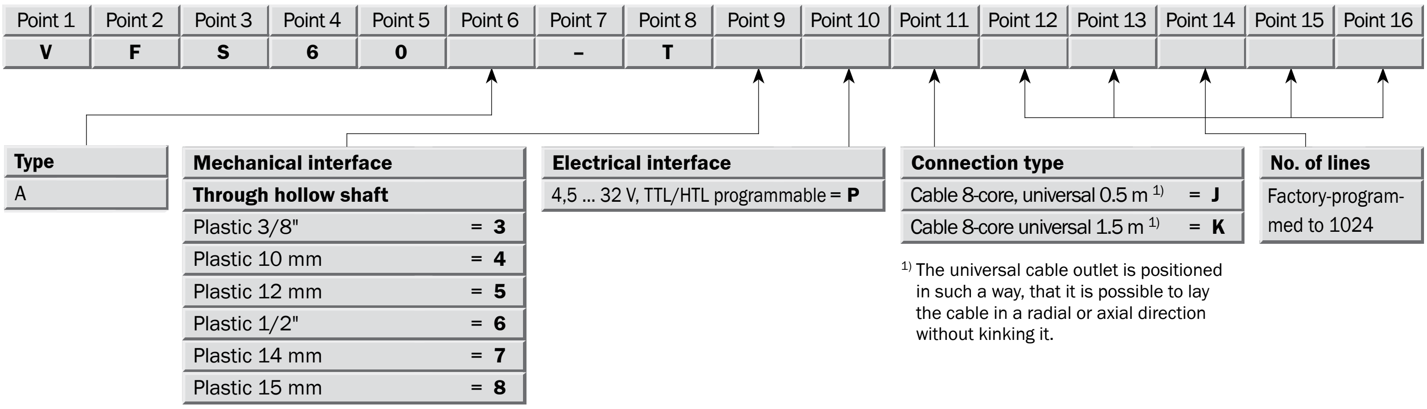
Others on request

Order example Motor Feedback System VFS60, type E, through hollow shaft 10 mm, Electrical interface 10 ... 32 V, HTL/push-pull, cable 8-core, universal 0.5 m, number of lines 1024

Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**	**E**	**–**	**T**	**4**	**E**	**J**	**0**	**1**	**0**	**2**	**4**

Order information TTL or HTL programmable

Motor Feedback System VFS60, through hollow shaft plastic



Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**		**–**	**T**								

Type
A

Mechanical interface	
Through hollow shaft	
Plastic 3/8"	= **3**
Plastic 10 mm	= **4**
Plastic 12 mm	= **5**
Plastic 1/2"	= **6**
Plastic 14 mm	= **7**
Plastic 15 mm	= **8**

Electrical interface	
4,5 ... 32 V, TTL/HTL programmable	= **P**

Connection type	
Cable 8-core, universal 0.5 m [1]	= **J**
Cable 8-core universal 1.5 m [1]	= **K**

[1] The universal cable outlet is positioned in such a way, that it is possible to lay the cable in a radial or axial direction without kinking it.

No. of lines
Factory-programmed to 1024

Order example Motor Feedback System VFS60, type A, through hollow shaft 14 mm, programmable number of lines from 1 ... 8192, Electrical interface 5 ... 32 V, cable 8-core, universal 0.5 m

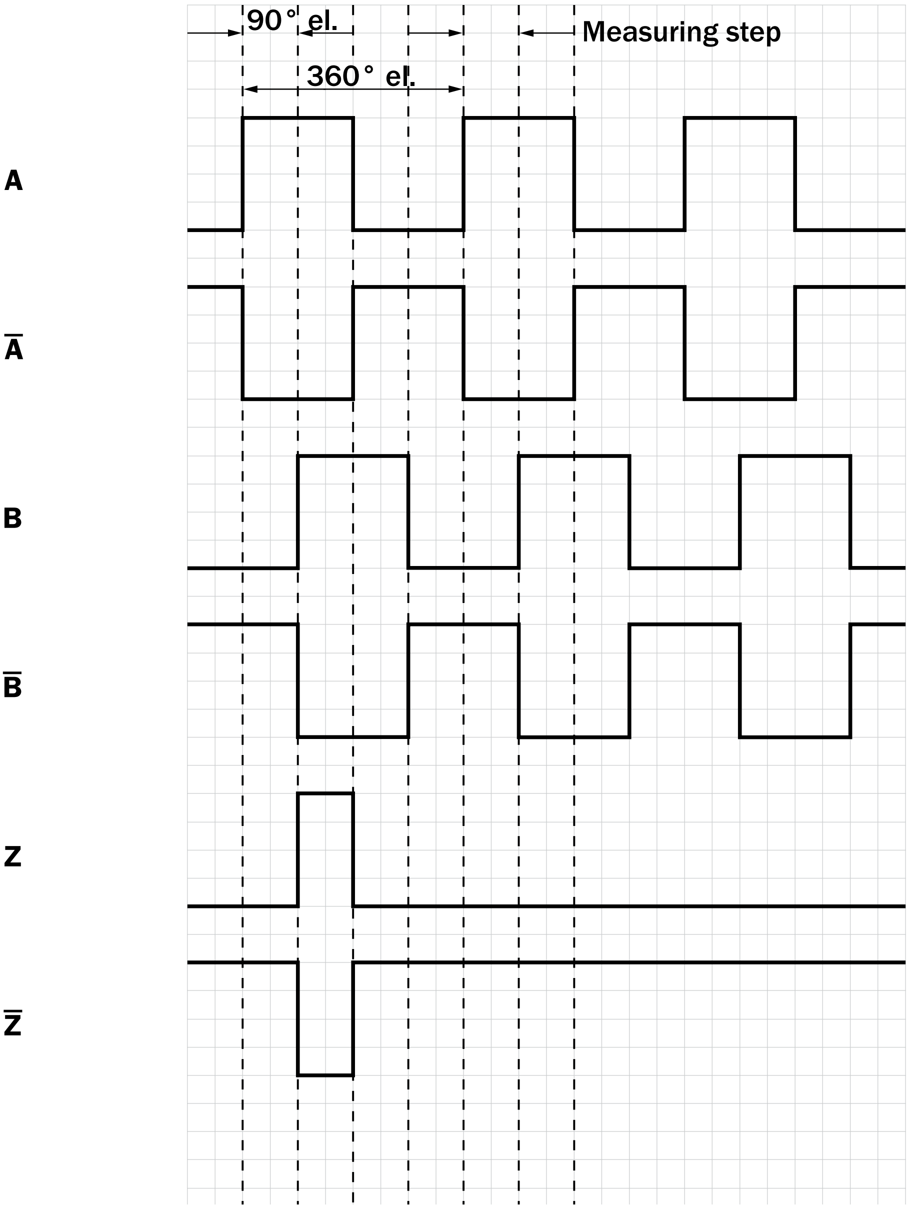
Point 1	Point 2	Point 3	Point 4	Point 5	Point 6	Point 7	Point 8	Point 9	Point 10	Point 11	Point 12	Point 13	Point 14	Point 15	Point 16
V	**F**	**S**	**6**	**0**	**A**	**–**	**T**	**7**	**P**	**J**	**0**	**1**	**0**	**2**	**4**

Factory-programmed number of lines: 1024, level of output signal: TTL

Interfaces

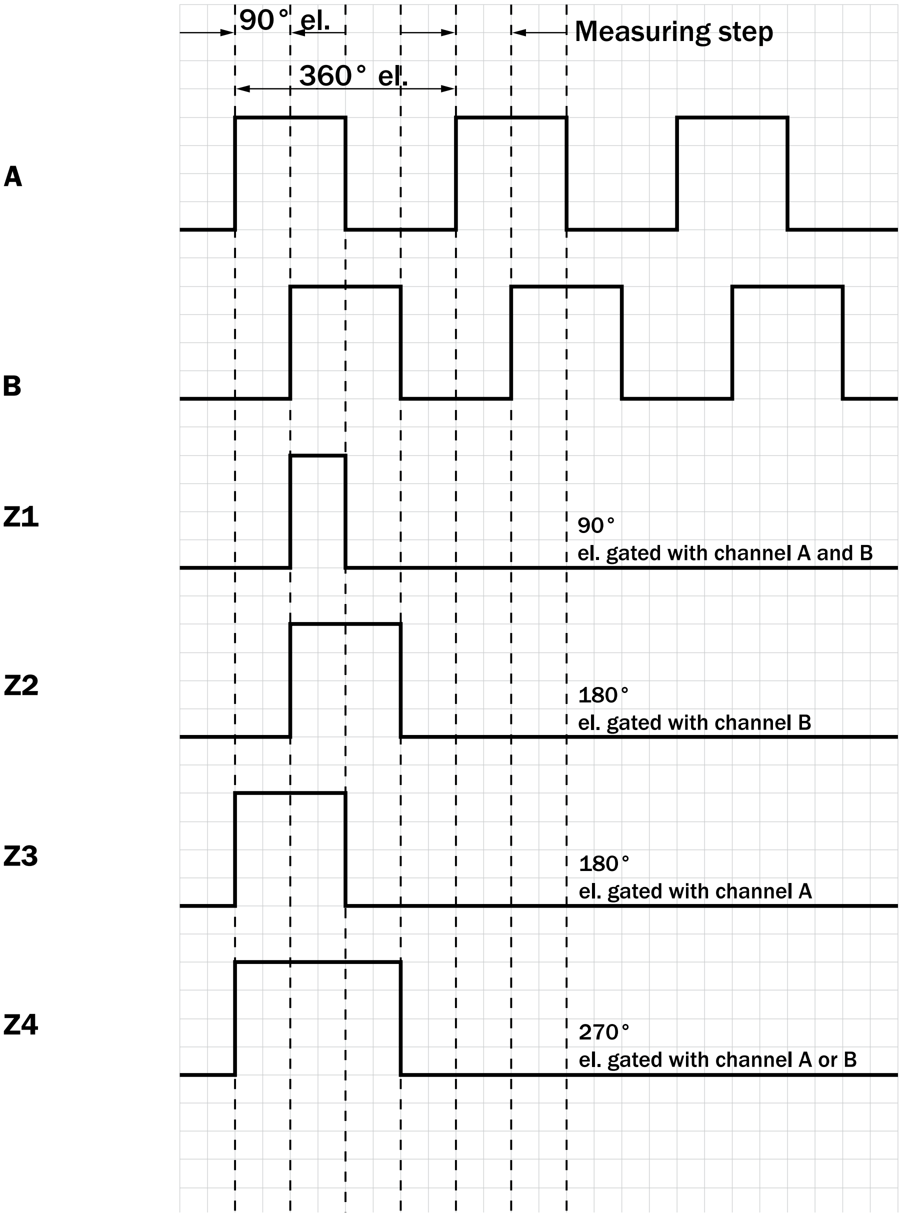
Electrical interfaces				
Supply voltage	4.5 ... 5.5 V	10 ... 32 V	10 ... 32 V	5 ... 32 V
Output	TTL/RS422	TTL/RS422	HTL/push-pull	HTL/TTL programmable

Incremental pulse diagram



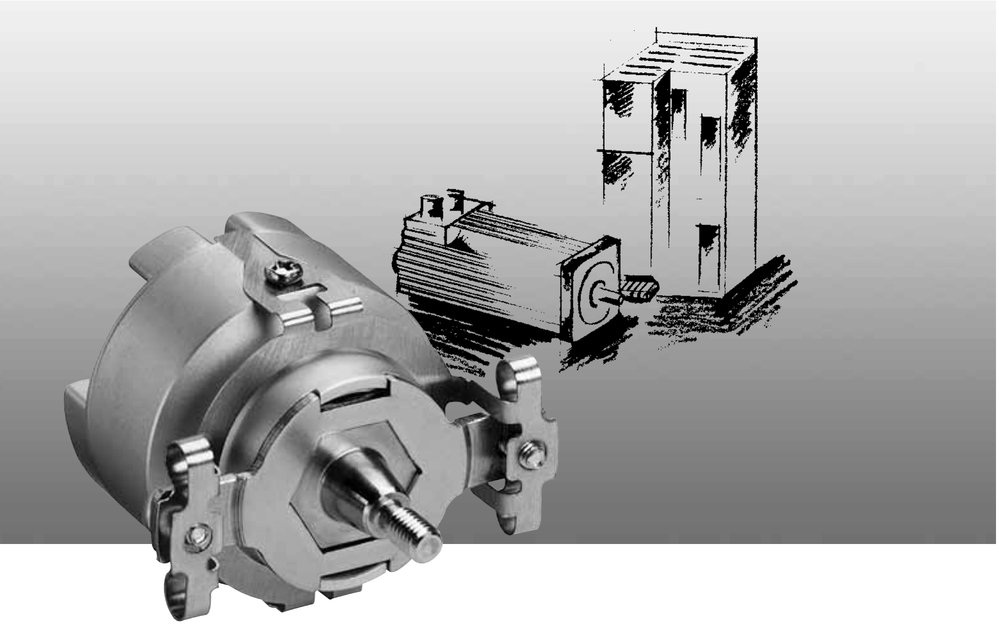
CW with view on the encoder shaft in direction “A”, see dimensional drawing.

Zero pulse width 90°, 180° or 270° programmable



CW with view on the encoder shaft in direction "A"

DiCoder® CKS36: Programmable Motor Feedback System for Installation in Electric Motors



Number of lines up to 2,048, 1-32 pole pairs

Motor Feedback Systems

The CKS36 Encoders belongs to a new generation of optical encoders.

What they all have in common is the new mini-disc (MiDi) technology.

This generation has a special feature: a very small code disc with a code track radius of only 2 mm permitting holistic (integral) scanning and at the same time providing high shock and vibration resistance.

In doing so, the system compensates for the eccentricity errors of the code disc, ball bearing and shaft, which are unavoidable in conventional systems.

By arranging the code disc in the centre of the rotational axis, high angular velocities are no longer limited by the code disc. The encoder size is essentially determined by the mechanical and electrical interfaces.

Technologies such as “Chip On Board” are used to achieve this.

The number of components is reduced to a minimum.

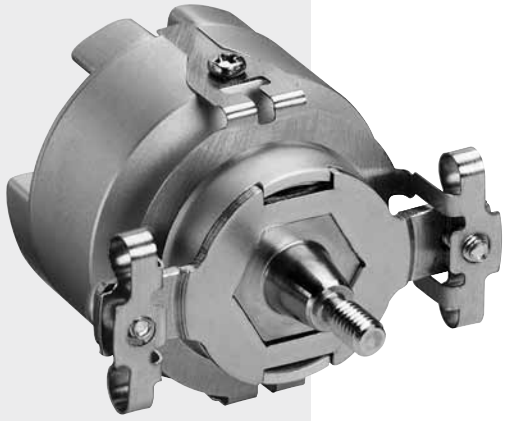
Incremental signals with resolutions of up to 2,048 lines per revolution and commutation signals of up to 32 pole pairs are available.

A freely user-programmable version is also available.

Number of lines up to 2,048, 1-32 pole pairs

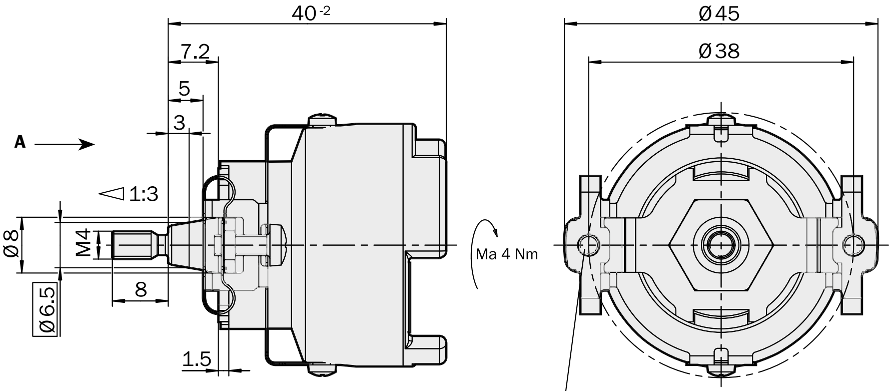
Motor Feedback Systems

- Resolution up to 2,048 pulses per revolution
- Number of pole pairs: from 1 to 32
- Zero pulse 90° or 180°
- Working temperature range –20 °C to +110 °C
- Programmable



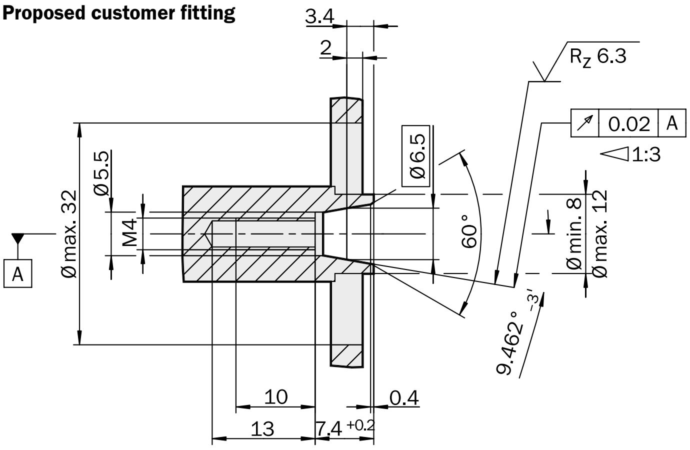
Accessories – see pages 410-448

Dimensional drawing CKS36



Lense screw M3x8 (2x) DIN 7985
with Torx head
Thread tapped to DIn 7500

Proposed customer fitting



General tolerances to DIN ISO 2768-mk

PIN and core allocation

PIN	Signal	Color of cores	Explanation
1	Z	violet	Reference signal
2	$\overline{Z}$	yellow	Reference signal inverted
3	A	white	Incremental signal
4	$\overline{A}$	brown	Incremental signal inverted
5	B	pink	Incremental signal
6	$\overline{B}$	black	Incremental signal inverted
7	R	white/green	Commutation signal
8	$\overline{R}$	white/pink	Commutation signal inverted
9	S	white/yellow	Commutation signal
10	$\overline{S}$	white/blue	Commutation signal inverted
11	T	white/grey	Commutation signal
12	$\overline{T}$	white/red	Commutation signal inverted
13	U_S	red	Supply voltage 5 V ± 10%
14	GND	blue	Ground connection
15	U_S	–	Sense + [1]
16	GND	–	Sense – [1]
17	N. C.	–	Not connected [1]
18	SET	–	Signal input for zero adjustment ① All output signals are adjusted to the position of the zero pulse. A level of > 2.5 V ≤ U_S must be maintained for at least 220 µs in order to execute this function. [1]
19	SDA	–	Data signal of the parameterization interface [1]
20	SCL	–	Clock pulse signal of the parameterization interface [1]

① Electrical zero adjustment

[1] (not in stranded cable)

Caution: Pins labelled N. C. must not be occupied!

7028241 / 2010-02-01
Subject to change without notice

Technical data to DIN 32878		CKS36	CKS
Lines per revolution		1 ... 2,048	
Commutation signales		1 ... 32 pole pairs	
Dimensions		mm (see dimensional drawing)	
Mass		0.065 kg	
Moment of inertia of the rotor		4.5 gcm^2	
Measurement step		90°/number of lines	
Reference signal	Number	1	
	Position	configurable 90° or 180° electr., logically linked with A and B	
Error limits			
„binary" number of lines [1]		± 0.09 degrees	
„non-binary" number of lines [2]		± 0.13 degrees	
Measurement step deviation			
„binary" number of lines [1]		± 0.035 degrees	
„non-binary" number of lines [2]		± 0.07 degrees	
Operating speed [3] + [3.1]		12,000 min^{-1}	
Max. output fequency	TTL/RS 422	400 KHz	
Max. angular acceleration		5 x 10^5 rad/s^2	
Operating torque		0.2 Ncm	
Starting torque		0.3 Ncm	
Permissible shaft movement			
static	radial/axial	± 0.1 mm/± 0.2 mm	
dynamic	radial/axial	± 0.05 mm/± 0.1 mm	
Bearing lifetime		3.6 x 10^9 revolutions	
Working temperature range		–20 ... +110 °C	
Storage temperature range [4]		–40 ... +125 °C	
Permissible relative humidity [5]		90 %	
Resistance			
to shocks [6]		100 g (6 ms)	
to vibration [7]		50 g (10 ... 2000 Hz)	
Protection class acc. IEC 60529 [8]		IP 50	
EMC [9]			
Operating voltage range		5 V ± 10 %	
Max. operating current, no load		60 mA	
Interface signals:			
Incremental and commutation signals		to EIA 422	
Parameterization interface		IIC Bus	

[1] "Binary" number of lines
2^n, n is a whole number

[2] "Non binary" number of lines
2^n, n is not a whole number

[3] In the case of a higher speed, the output signals may be incorrect.

[3.1] Self warming 1,1K/1000 min^{-1}
when applying, note working temperature range.

[4] Without packaging

[5] Condensation not permissible

[6] To DIN EN 60068-2-27

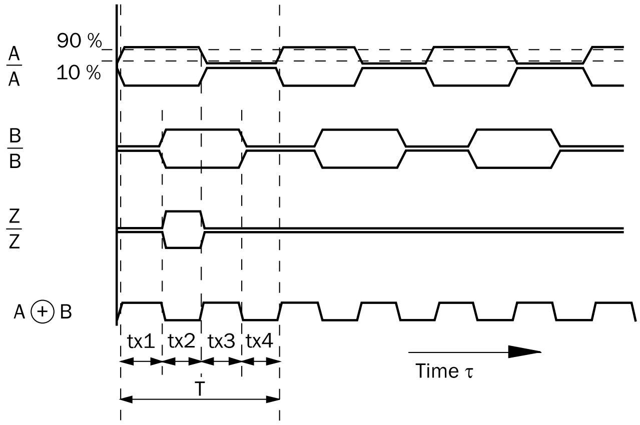
[7] To DIN EN 60068-2-6

[8] With mating connector inserted and closed cover

[9] To DIN EN 61000-6-2 and DIN 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

Incremental signals

At constant speed, looking at the input shaft, and clockwise rotation.



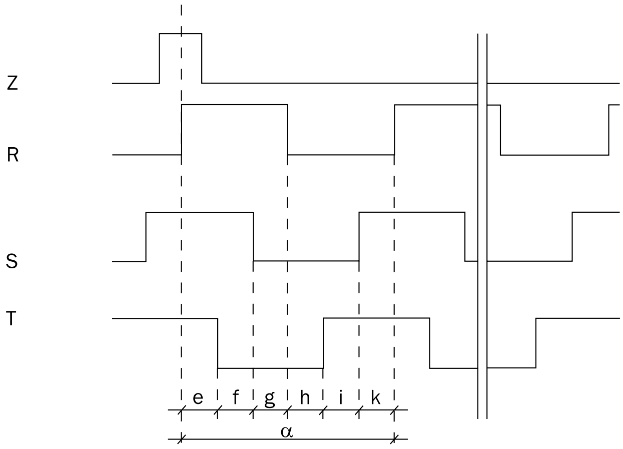
By linking the two signals A and B, an output signal is created whose cycle durations tx1 ... tx4 have different sizes.

The differences are determined:

1. by the mark/space ratio tolerance of the individual channels
2. by the tolerance in the 90° phase shift between A and B
3. by the frequency

Ideally, the times tx1 ... tx4 should always be 1/4 of the cycle duration T.

Pulse-time diagram



Pole pairs	Number of poles	e, f, g, h, i, k	□
Example: 2	4	30°	180°
n	n · 2	360°/6n	360°/n

n = 1 ... 32

The angular data is related to a mechanical shaft rotation.

Precision of the signals R, S, T ± 1°.

Programmable version of the CKS36 (type: CKS36-PFBPROGR; part no. 1035370)

This product option of the CKS36 can be freely programmed by the user. With the programming and adjustment tool (PGT-06-S), the following values can be individually programmed.

	Adjustable values	Default settings
Zero puls width	90° or 180°	90°
Number of pole pairs	1 to 32	32
Number of lines	1 to 2,048	2,048

Caution!

In the case of CKS36 ordered with fixed defined values (e. g. 90° zero pulse width, 1,024 lines, 4 pole pairs), these parameters can not be modified.

Ordering information CKS36

Motor Feedback System CKS36 – freely programmable

Type	Part no.	Description
CKS36-PFBPROGR	1035370	Motor Feedback System CKS36 – programmable

Delivery settings:
90° zero pulse width, 2,048 lines, 32 pole pairs

Motor Feedback System CKS36 – fixed defined values (these values cannot be modified by the user)

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**K**	**S**	**3**	**6**	**–**		**F**	**B**					

Electrical interfaces	
5 V, RS 422, 90° zero pulse width	= **A**
5 V, RS 422, 180° zero pulse width	= **B**

Lines per revolution	
128	= **080**
256	= **100**
512	= **200**
1024	= **400**
2048	= **800**
500	= **1F4**
1000	= **3E8**
2000	= **7D0**

Pole pairs	
1 pole pair	= **01**
2 pole pairs	= **02**
3 pole pairs	= **03**
4 pole pairs	= **04**
6 pole pairs	= **06**
8 pole pairs	= **08**
10 pole pairs	= **10**
12 pole pairs	= **12**
16 pole pairs	= **16**

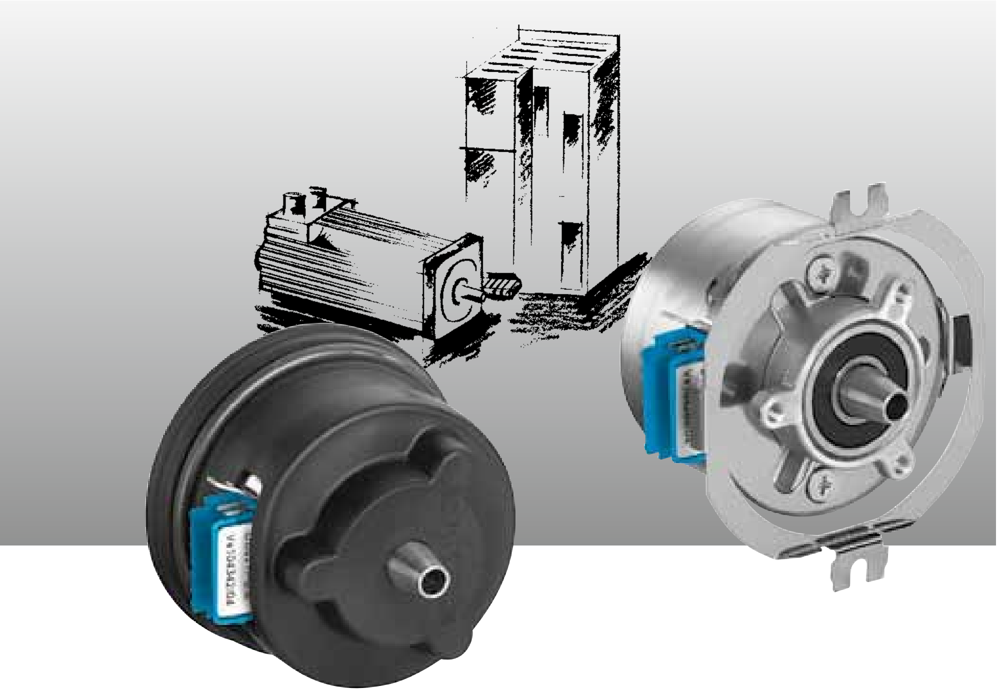
Ordering example: Motor Feedback System CKS36
90° zero pulse width, 2,048 number of lines, 4 pole pairs

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**K**	**S**	**3**	**6**	**–**	**A**	**F**	**B**	**8**	**0**	**0**	**0**	**4**

Please enter your individual encoder here

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**K**	**S**	**3**	**6**	**–**		**F**	**B**					

DiCoder® CNS50:
Motor Feedback System for installation in electric motors



DiCoder CNS50 series of motor feedback systems are used worldwide in many different applications and environments.

Incremental signals with resolutions up to 4,096 lines per revolution and commutation signals are available. Select the motor feedback system to suit your individual requirements.

Possible product variations:

- Plug-in shaft or tapered shaft with different stator supports
- 2 to 8 pole pairs

Number of lines
1,000 up to 4,096

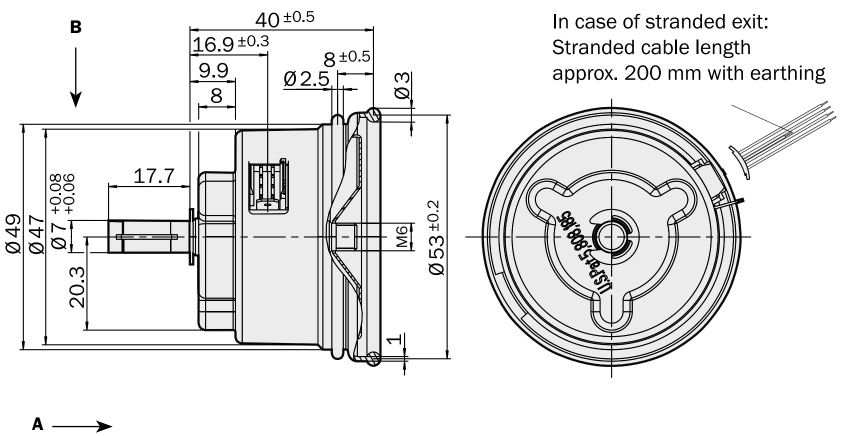
Motor Feedback Systems

Number of lines
1,000 up to 4,096

Motor Feedback Systems

- Output driver for incremental signals and commutation signals to EIA 422
- Working temperature range up to +100 °C
- Two square-wave signals (90° offset), reference pulse and the respective inverted signals
- Commutation signals R, S, T

Dimensional drawing CNS50, rubber support Ø 50



In case of stranded exit:
Stranded cable length
approx. 200 mm with earthing

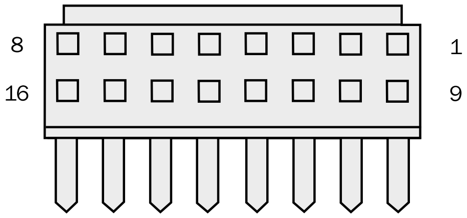
General tolerances to DIN ISO 2768-mk

PIN and wire allocation/16-pin connector

PIN	Signal	Color of Wires	Explanation
1	GND	blue	Ground connection
2	R	white/green	Commutation signal
3	S	white/yellow	Commutation signal
4	T	white/grey	Commutation signal
5	Z	violet	Reference signal
6	B	pink	Incremental signal
7	A	white	Incremental signal
8	N. C.	–	Not connected
9	U_S	red	Supply voltage 5 V ± 10 %
10	$\overline{R}$	white/pink	Commutation signal inverted
11	$\overline{S}$	white/blue	Commutation signal inverted
12	$\overline{T}$	white/red	Commutation signal inverted
13	$\overline{Z}$	yellow	Reference signal inverted
14	$\overline{B}$	black	Incremental signal inverted
15	$\overline{A}$	brown	Incremental signal inverted
16	N. C.	–	Not connected

Caution: Pins labelled “N. C.” must not be occupied!

The encoder housing must be connected to the screen. Use the screen connection strand (200 mm, supplied) for this. It is included in the supply.



View of the plug-in face

Accessories – see pages 410-448

Technical data according to DIN 32878		Plug-in Shaft CNS50	CNS								
Number of lines per revolution		1,000, 1,024, 2,000, 2,048, 4,000, 4,096	■								
Commutation signals		(See diagram) other	■								
		commutation on request	■								
Dimensions		mm (see dimensional drawing)	■								
Mass		0.1 kg	■								
Inertial rotor moment		10 gcm^2	■								
Measurement step		90 °/number of lines	■								
Reference signal	No. off	1	■								
	Position	90 ° electr., logically linked with A and B	■								
Max. operating speed		9,000 min^{-1}	■								
Working speed		6,000 min^{-1}	■								
Max. angular acceleration		0.2×10^6 $1/s^2$	■								
Operating torque		0.2 Ncm	■								
Starting torque		0.4 Ncm	■								
Permissible shaft movement											
static	radial/axial	± 0.5 mm/± 0.75 mm	■								
dynamic	radial/axial	± 0.05 mm/± 0.25 mm	■								
Angular motion, perpendicular to the rotational axis											
static		± 0.005 mm/mm	■								
dynamic		± 0.0025 mm/mm	■								
Life of ball bearings		3.6×10^9 revolutions	■								
Working temperature range		0 ... +100 °C	■								
Storage temperature range [1]		–40 ... +125 °C	■								
Permissible relative humidity [2]		90 %	■								
Resistance											
to shocks [3]		100/10 g/ms	■								
to vibration [4]		20/10 ... 2000 g/Hz	■								
Protection class acc. IEC 60529 [5]		IP 40	■								
EMC [6]			■								
Operating voltage range		5 V ± 10 %	■								
Max. operating current, no load		50 mA	■								
Interface details:			■								
Output driver		EIA Standard RS 422	■								
Output signal sequence		See pulse-time diagram	■								
Signal tolerance											
t_{x1} ... $t_{x4\,max.}$ at 300 kHz		1.5 x 1/4 T	■								

[1] Without packaging

[2] Condensation not permissible

[3] To DIN EN 60068-2-27

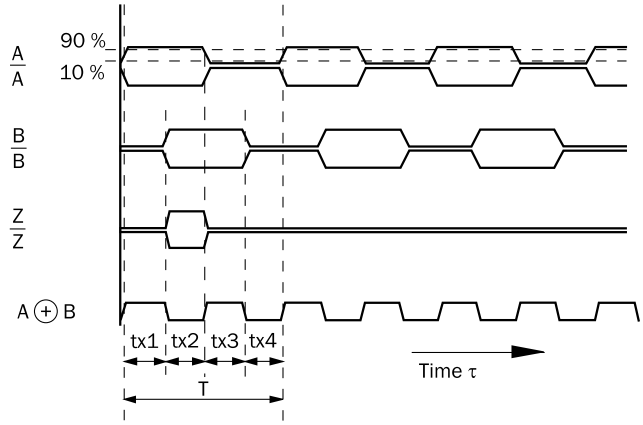
[4] To DIN EN 60068-2-6

[5] With mating connector inserted

[6] To DIN EN 61000-6-2 and DIN 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

Incremental signals

At constant speed, looking at the input shaft, and clockwise rotation.



By linking the two signals A and B, an output signal is created whose cycle durations tx1 ... tx4 have different sizes.

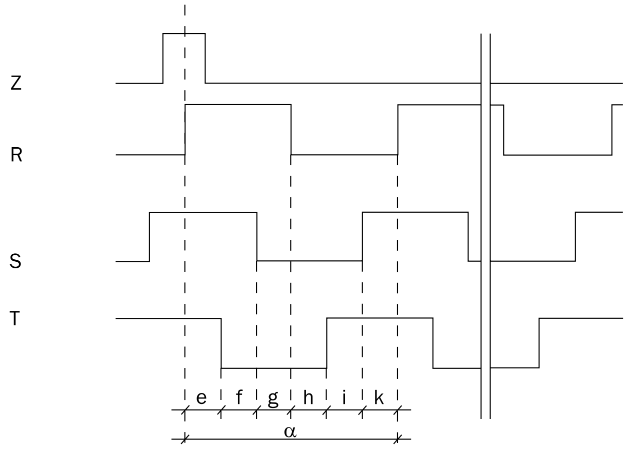
The differences are determined:

1. by the mark/space ratio tolerance of the individual channels
2. by the tolerance in the 90° phase shift between A and B
3. by the frequency

Ideally, the times tx1 ... tx4 should always be 1/4 of the cycle duration T.

The typical output frequency of the encoder is defined such that the max. time tx is smaller than 1.5 x T/4.

Pulse-time diagram



Pole pairs	Number of poles	e, f, g, h, i, k	□
2	4	30°	180°
3	6	20°	120°
4	8	15°	90°
6	12	10°	60°
8	16	7,5°	45°

Accessories – see pages 410-448

The angular data is related to a mechanical shaft rotation.

Precision of the signals R, S, T ± 1°.

Ordering information CNS50

Motor Feedback System CNS50 with plug-in shaft, diameter 7 mm

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**A**				**X**		

Type of connection	
Connector	= **A**
Stranded cable	= **V**

Lines per revolution	
1,000	= **01**
1,024	= **10**
2,000	= **02**
2,048	= **11**
4,000	= **04**
4,096	= **12**

Pole pairs	
2 pole pairs	= **02**
3 pole pairs	= **03**
4 pole pairs	= **04**
6 pole pairs	= **06**
8 pole pairs	= **08**

Ordering example: Motor Feedback System CNS50, plug-in Shaft 7 mm, rubber support Ø 50
4,096 lines, 3 pole pairs, connector exit

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**A**	**A**	**1**	**2**	**X**	**0**	**3**

Please enter your individual encoder here

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**A**				**X**		

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**A**				**X**		

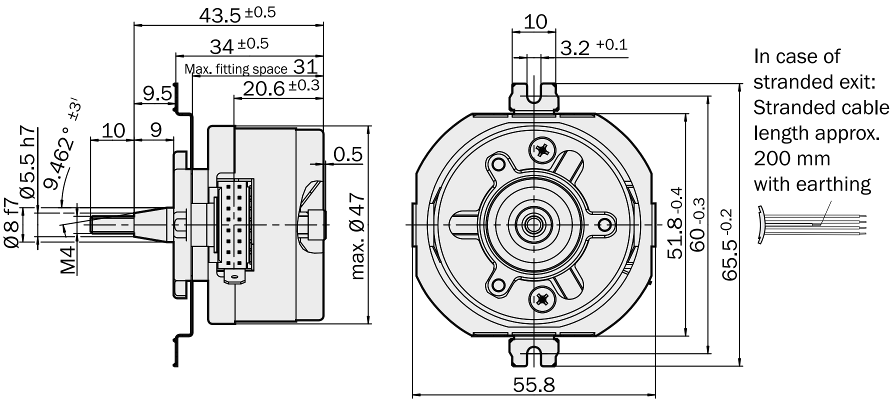
Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**A**				**X**		

Number of lines
1,000 up to 4,096

Motor Feedback Systems

- Output driver for incremental signals and commutation signals to EIA 422
- Working temperature range up to +100 °C
- Two square-wave signals (90° offset), reference pulse and the respective inverted signals
- Commutation signals R, S, T

Dimensional drawing CNS50, spring mounting support Ø 66



In case of stranded exit: Stranded cable length approx. 200 mm with earthing

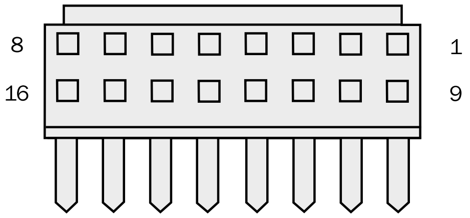
General tolerances to DIN ISO 2768-mk

PIN and wire allocation/16-pin connector

PIN	Signal	Color of Wires	Explanation
1	GND	blue	Ground connection
2	R	white/green	Commutation signal
3	S	white/yellow	Commutation signal
4	T	white/grey	Commutation signal
5	Z	violet	Reference signal
6	B	pink	Incremental signal
7	A	white	Incremental signal
8	N. C.	–	Not connected
9	U_S	red	Supply voltage 5 V ± 10 %
10	$\overline{R}$	white/pink	Commutation signal inverted
11	$\overline{S}$	white/blue	Commutation signal inverted
12	$\overline{T}$	white/red	Commutation signal inverted
13	$\overline{Z}$	yellow	Reference signal inverted
14	$\overline{B}$	black	Incremental signal inverted
15	$\overline{A}$	brown	Incremental signal inverted
16	N. C.	–	Not connected

Caution: Pins labelled "N. C." must not be occupied!

The encoder housing must be connected to the screen. Use the screen connection strand (200 mm, supplied) for this. It is included in the supply.



View of the plug-in face

Accessories – see pages 410-448

Technical data according to DIN 32878		Tapered Shaft CNS50	CNS									
Number of lines per revolution		1,000, 1,024, 2,000, 2,048, 4,000, 4,096	■									
Commutation signals		(See diagram) other	■									
		commutation on request	■									
Dimensions		mm (see dimensional drawing)	■									
Mass		0.1 kg	■									
Inertial rotor moment		10 gcm^2	■									
Measurement step		90°/number of lines	■									
Reference signal	No. off	1	■									
	Position	90° electr., logically linked with A and B	■									
Max. operating speed		9,000 min^{-1}	■									
Working speed		6,000 min^{-1}	■									
Max. angular acceleration		0.2 x 10^6 1/s^2	■									
Operating torque		0.2 Ncm	■									
Starting torque		0.4 Ncm	■									
Permissible shaft movement												
static	radial/axial	± 0.5 mm/± 0.75 mm	■									
dynamic	radial/axial	± 0.05 mm/± 0.25 mm	■									
Angular motion, perpendicular to the rotational axis												
static		± 0.005 mm/mm	■									
dynamic		± 0.0025 mm/mm	■									
Life of ball bearings		3.6 x 10^9 revolutions	■									
Working temperature range		0 ... +100 °C	■									
Storage temperature range 1)		–40 ... +125 °C	■									
Permissible relative humidity 2)		90 %	■									
Resistance												
to shocks 3)		100/10 g/ms	■									
to vibration 4)		20/10 ... 2000 g/Hz	■									
Protection class acc. IEC 60529 5)		IP 40	■									
EMC 6)			■									
Operating voltage range		5 V ± 10 %	■									
Max. operating current, no load		50 mA	■									
Interface details:			■									
Output driver		EIA Standard RS 422	■									
Output signal sequence		See pulse-time diagram	■									
Signal tolerance												
tx1 ... tx4$_{\text{max.}}$ at 300 kHz		1.5 x 1/4 T	■									

1) Without packaging

2) Condensation not permissible

3) To DIN EN 60068-2-27

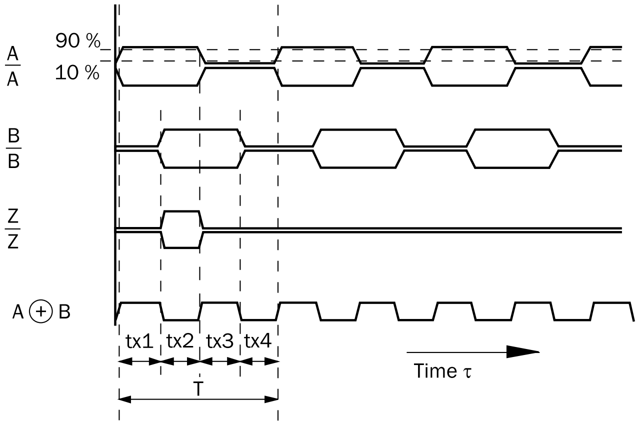
4) To DIN EN 60068-2-6

5) With mating connector inserted

6) To DIN EN 61000-6-2 and DIN 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

Incremental signals

At constant speed, looking at the input shaft, and clockwise rotation.



By linking the two signals A and B, an output signal is created whose cycle durations tx1 ... tx4 have different sizes.

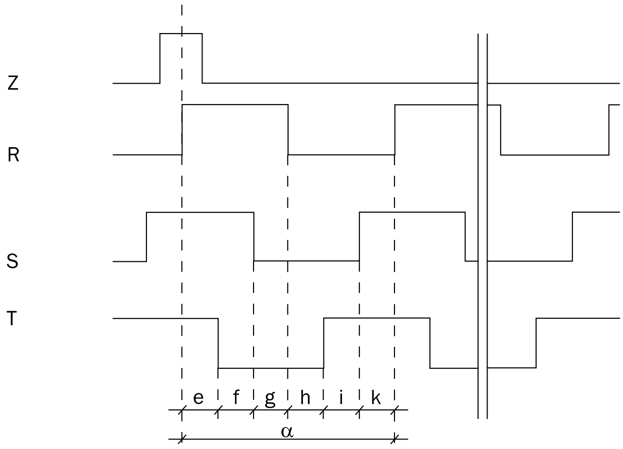
The differences are determined:

1. by the mark/space ratio tolerance of the individual channels
2. by the tolerance in the 90° phase shift between A and B
3. by the frequency

Ideally, the times tx1 ... tx4 should always be 1/4 of the cycle duration T.

The typical output frequency of the encoder is defined such that the max. time tx is smaller than 1.5 x T/4.

Pulse-time diagram



Pole pairs	Number of poles	e, f, g, h, i, k	□
2	4	30°	180°
3	6	20°	120°
4	8	15°	90°
6	12	10°	60°
8	16	7,5°	45°

The angular data is related to a mechanical shaft rotation.

Precision of the signals R, S, T ± 1°.

Accessories – see pages 410-448

Ordering information CNS50

Motor Feedback System CNS50 with tapered shaft

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**F**				**X**		

Type of connection	
Connector	= **A**
Stranded cable	= **V**

Lines per revolution	
1,000	= **01**
1,024	= **10**
2,000	= **02**
2,048	= **11**
4,000	= **04**
4,096	= **12**

Pole Pairs	
2 pole pairs	= **02**
3 pole pairs	= **03**
4 pole pairs	= **04**
6 pole pairs	= **06**
8 pole pairs	= **08**

Ordering example: Motor Feedback System CNS50, tapered shaft, spring mounting support Ø 66
4,096 lines, 3 pole pairs, connector exit

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**F**	**A**	**1**	**2**	**X**	**0**	**3**

Please enter your individual encoder here

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**F**				**X**		

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**F**				**X**		

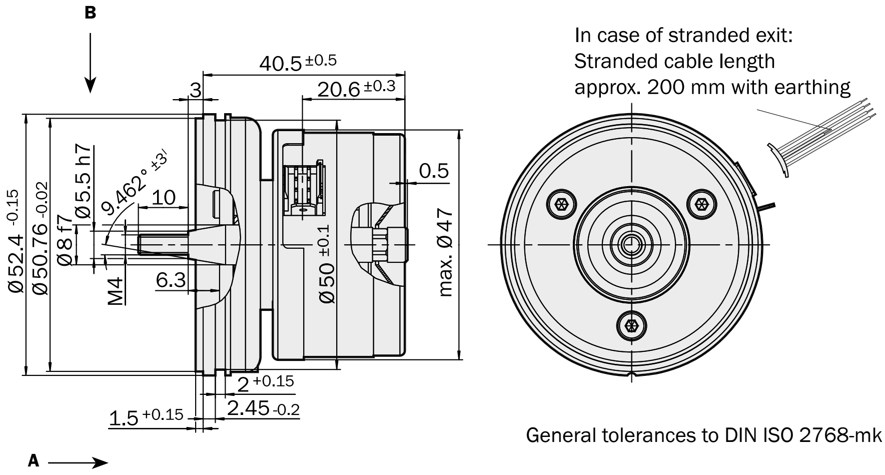
Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**F**				**X**		

Number of lines
1,000 up to 4,096

Motor Feedback Systems

- Output driver for incremental signals and commutation signals to EIA 422
- Working temperature range up to +100 °C
- Two square-wave signals (90° offset), reference pulse and the respective inverted signals
- Commutation signals R, S, T

Dimensional drawing CNS50, resolver support Ø 52



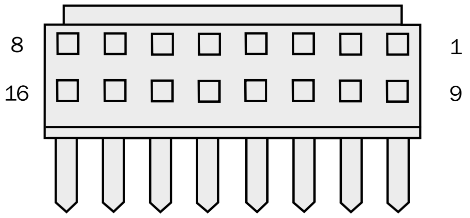
General tolerances to DIN ISO 2768-mk

PIN and wire allocation/16-pin connector

PIN	Signal	Color of Wires	Explanation
1	GND	blue	Ground connection
2	R	white/green	Commutation signal
3	S	white/yellow	Commutation signal
4	T	white/grey	Commutation signal
5	Z	violet	Reference signal
6	B	pink	Incremental signal
7	A	white	Incremental signal
8	N. C.	–	Not connected
9	U_S	red	Supply voltage 5 V ± 10 %
10	$\overline{R}$	white/pink	Commutation signal inverted
11	$\overline{S}$	white/blue	Commutation signal inverted
12	$\overline{T}$	white/red	Commutation signal inverted
13	$\overline{Z}$	yellow	Reference signal inverted
14	$\overline{B}$	black	Incremental signal inverted
15	$\overline{A}$	brown	Incremental signal inverted
16	N. C.	–	Not connected

Caution: Pins labelled “N. C.” must not be occupied!

The encoder housing must be connected to the screen. Use the screen connection strand (200 mm, supplied) for this. It is included in the supply.



View of the plug-in face

Accessories – see pages 410-448

Technical data according to DIN 32878		Tapered Shaft CNS50	CNS
Number of lines per revolution		1,000, 1,024, 2,000, 2,048, 4,000, 4,096	■
Commutation signals		(See diagram) other	■
		commutation on request	■
Dimensions		mm (see dimensional drawing)	■
Mass		0.1 kg	■
Inertial rotor moment		10 gcm^2	■
Measurement step		90°/number of lines	■
Reference signal	No. off	1	■
	Position	90° electr., logically linked with A and B	■
Max. operating speed		9,000 min^{-1}	■
Working speed		6,000 min^{-1}	■
Max. angular acceleration		0.2 x 10^6 1/s^2	■
Operating torque		0.2 Ncm	■
Starting torque		0.4 Ncm	■
Permissible shaft movement			
static	radial/axial	± 0.25 mm/± 0.75 mm	■
dynamic	radial/axial	± 0.05 mm/± 0.25 mm	■
Angular motion, perpendicular to the rotational axis			
static		± 0.005 mm/mm	■
dynamic		± 0.0025 mm/mm	■
Life of ball bearings		3.6 x 10^9 revolutions	■
Working temperature range		0 ... +100 °C	■
Storage temperature range 1)		–40 ... +125 °C	■
Permissible relative humidity 2)		90 %	■
Resistance			
to shocks 3)		100/10 g/ms	■
to vibration 4)		20/10 ... 2000 g/Hz	■
Protection class acc. IEC 60529 5)		IP 40	■
EMC 6)			■
Operating voltage range		5 V ± 10 %	■
Max. operating current, no load		50 mA	■
Interface details:			■
Output driver		EIA Standard RS 422	■
Output signal sequence		See pulse-time diagram	■
Signal tolerance			
tx1 ... tx4 $_{\text{max.}}$ at 300 kHz		1.5 x 1/4 T	■

1) Without packaging

2) Condensation not permissible

3) To DIN EN 60068-2-27

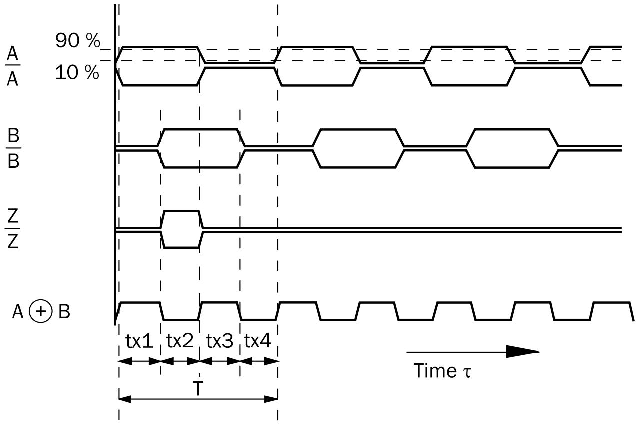
4) To DIN EN 60068-2-6

5) With mating connector inserted

6) To DIN EN 61000-6-2 and DIN 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

Incremental signals

At constant speed, looking at the input shaft, and clockwise rotation.



By linking the two signals A and B, an output signal is created whose cycle durations tx1 … tx4 have different sizes.

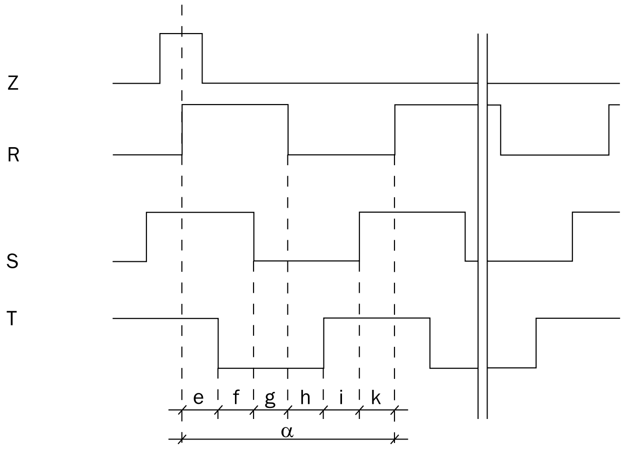
The differences are determined:

1. by the mark/space ratio tolerance of the individual channels
2. by the tolerance in the 90° phase shift between A and B
3. by the frequency

Ideally, the times tx1 … tx4 should always be 1/4 of the cycle duration T.

The typical output frequency of the encoder is defined such that the max. time tx is smaller than 1.5 x T/4.

Pulse-time diagram



Pole pairs	Number of poles	e, f, g, h, i, k	□
2	4	30°	180°
3	6	20°	120°
4	8	15°	90°
6	12	10°	60°
8	16	7,5°	45°

The angular data is related to a mechanical shaft rotation.

Precision of the signals R, S, T ± 1°.

Accessories – see pages 410-448

Ordering information CNS50

Motor Feedback System CNS50 with tapered shaft

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**G**				**X**		

Type of connection

Connector = **A**

Stranded cable = **V**

Lines per revolution

1,000 = **01**

1,024 = **10**

2,000 = **02**

2,048 = **11**

4,000 = **04**

4,096 = **12**

Pole Pairs

2 pole pairs = **02**

3 pole pairs = **03**

4 pole pairs = **04**

6 pole pairs = **06**

8 pole pairs = **08**

Ordering Example: Motor Feedback System CNS50, tapered shaft, resolver support Ø 52
4,096 lines, 3 pole pairs, connector exit

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**G**	**A**	**1**	**2**	**X**	**0**	**3**

Please enter your individual encoder here

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**G**				**X**		

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**G**				**X**		

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**G**				**X**		

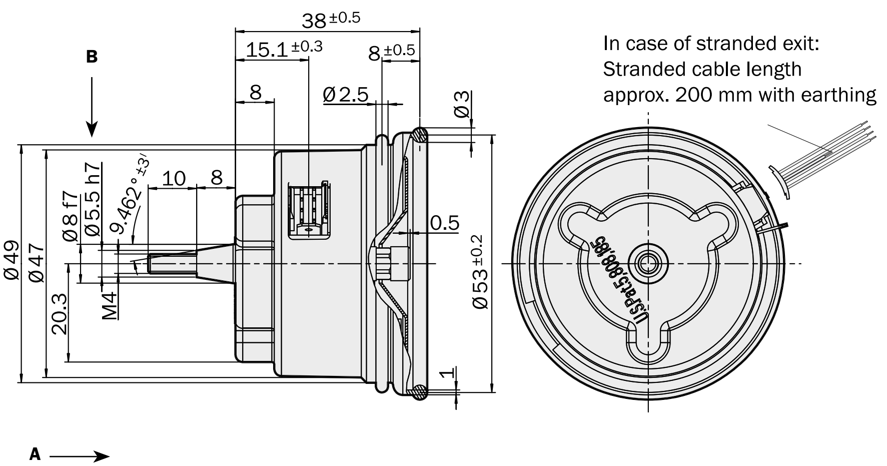
Incremental Motor Feedback Systems With Commutation CNS50, Tapered Shaft

Number of lines
1,000 up to 4,096

Motor Feedback Systems

- Output driver for incremental signals and commutation signals to EIA 422
- Working temperature range up to + 100 °C
- Two square-wave signals (90° offset), reference pulse and the respective inverted signals
- Commutation signals R, S, T

Dimensional drawing CNS50, rubber support Ø 50



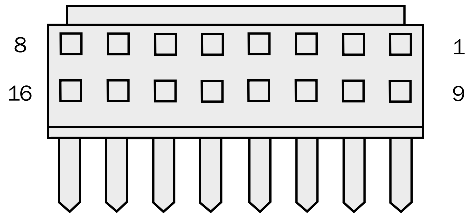
General tolerances to DIN ISO 2768-mk

PIN and wire allocation/16-pin connector

PIN	Signal	Color of Wires	Explanation
1	GND	blue	Ground connection
2	R	white/green	Commutation signal
3	S	white/yellow	Commutation signal
4	T	white/grey	Commutation signal
5	Z	violet	Reference signal
6	B	pink	Incremental signal
7	A	white	Incremental signal
8	N. C.	–	Not connected
9	U_s	red	Supply voltage 5 V ± 10 %
10	$\overline{R}$	white/pink	Commutation signal inverted
11	$\overline{S}$	white/blue	Commutation signal inverted
12	$\overline{T}$	white/red	Commutation signal inverted
13	$\overline{Z}$	yellow	Reference signal inverted
14	$\overline{B}$	black	Incremental signal inverted
15	$\overline{A}$	brown	Incremental signal inverted
16	N. C.	–	Not connected

Caution: Pins labelled “N. C.” must not be occupied!

The encoder housing must be connected to the screen. Use the screen connection strand (200 mm, supplied) for this. It is included in the supply.



View of the plug-in face

Accessories – see pages 410-448

Technical data according to DIN 32878		Tapered Shaft CNS50	CNS
Number of lines per revolution		1,000, 1,024, 2,000, 2,048, 4,000, 4,096	▨
Commutation signals		(See diagram) other	▨
		commutation on request	▨
Dimensions		mm (see dimensional drawing)	▨
Mass		0.1 kg	▨
Inertial rotor moment		10 gcm^2	▨
Measurement step		90°/number of lines	▨
Reference signal	No. off	1	▨
	Position	90° electr., logically linked with A and B	▨
Max. operating speed		9,000 min^{-1}	▨
Working speed		6,000 min^{-1}	▨
Max. angular acceleration		0.2×10^6 1/s^2	▨
Operating torque		0.2 Ncm	▨
Starting torque		0.4 Ncm	▨
Permissible shaft movement			
static	radial/axial	± 0.5 mm/± 0.75 mm	▨
dynamic	radial/axial	± 0.05 mm/± 0.25 mm	▨
Angular motion, perpendicular to the rotational axis			
static		± 0.005 mm/mm	▨
dynamic		± 0.0025 mm/mm	▨
Life of ball bearings		3.6×10^9 revolutions	▨
Working temperature range		0 ... +100 °C	▨
Storage temperature range 1)		–40 ... +125 °C	▨
Permissible relative humidity 2)		90 %	▨
Resistance			
to shocks 3)		100/10 g/ms	▨
to vibration 4)		20/10 ... 2000 g/Hz	▨
Protection class acc. IEC 60529 5)		IP 40	▨
EMC 6)			▨
Operating voltage range		5 V ± 10 %	▨
Max. operating current, no load		50 mA	▨
Interface details:			▨
Output driver		EIA Standard RS 422	▨
Output signal sequence		See pulse-time diagram	▨
Signal tolerance			
tx1 ... tx4 $_{\text{max.}}$ at 300 kHz		1.5 x 1/4 T	▨

1) Without packaging

2) Condensation not permissible

3) To DIN EN 60068-2-27

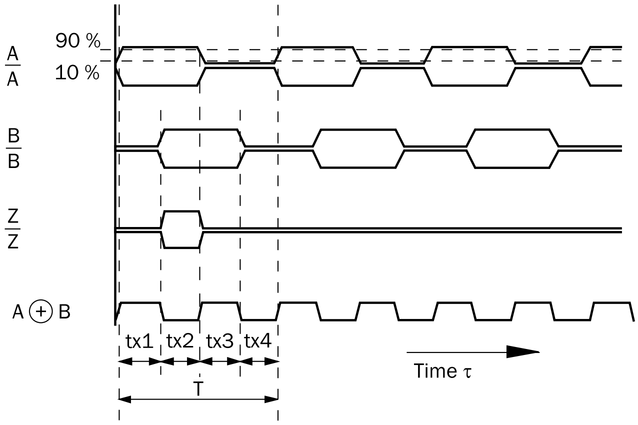
4) To DIN EN 60068-2-6

5) With mating connector inserted

6) To DIN EN 61000-6-2 and DIN 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

Incremental signals

At constant speed, looking at the input shaft, and clockwise rotation.



By linking the two signals A and B, an output signal is created whose cycle durations tx1 ... tx4 have different sizes.

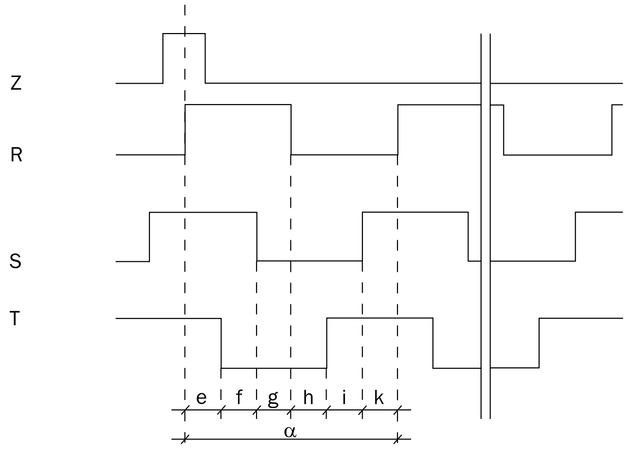
The differences are determined:

1. by the mark/space ratio tolerance of the individual channels
2. by the tolerance in the 90° phase shift between A and B
3. by the frequency

Ideally, the times tx1 ... tx4 should always be 1/4 of the cycle duration T.

The typical output frequency of the encoder is defined such that the max. time tx is smaller than 1.5 x T/4.

Pulse-time diagram



Pole pairs	Number of poles	e, f, g, h, i, k	□
2	4	30°	180°
3	6	20°	120°
4	8	15°	90°
6	12	10°	60°
8	16	7,5°	45°

The angular data is related to a mechanical shaft rotation.

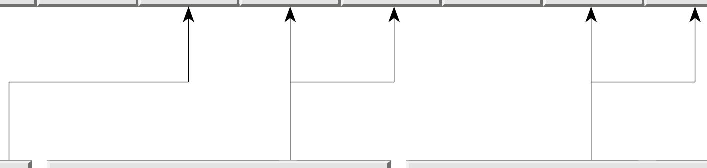
Precision of the signals R, S, T ± 1°.

Accessories – see pages 410-448

Ordering information CNS50

Motor Feedback System CNS50 with tapered shaft

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**E**				**X**		



Type of connection	
Connector	= **A**
Stranded cable	= **V**

Lines per revolution	
1,000	= **01**
1,024	= **10**
2,000	= **02**
2,048	= **11**
4,000	= **04**
4,096	= **12**

Pole Pairs	
2 pole pairs	= **02**
3 pole pairs	= **03**
4 pole pairs	= **04**
6 pole pairs	= **06**
8 pole pairs	= **08**

Ordering example: Motor Feedback System CNS50, tapered shaft, rubber support Ø 50

4,096 lines, 3 pole pairs, connector exit

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**E**	**A**	**1**	**2**	**X**	**0**	**3**

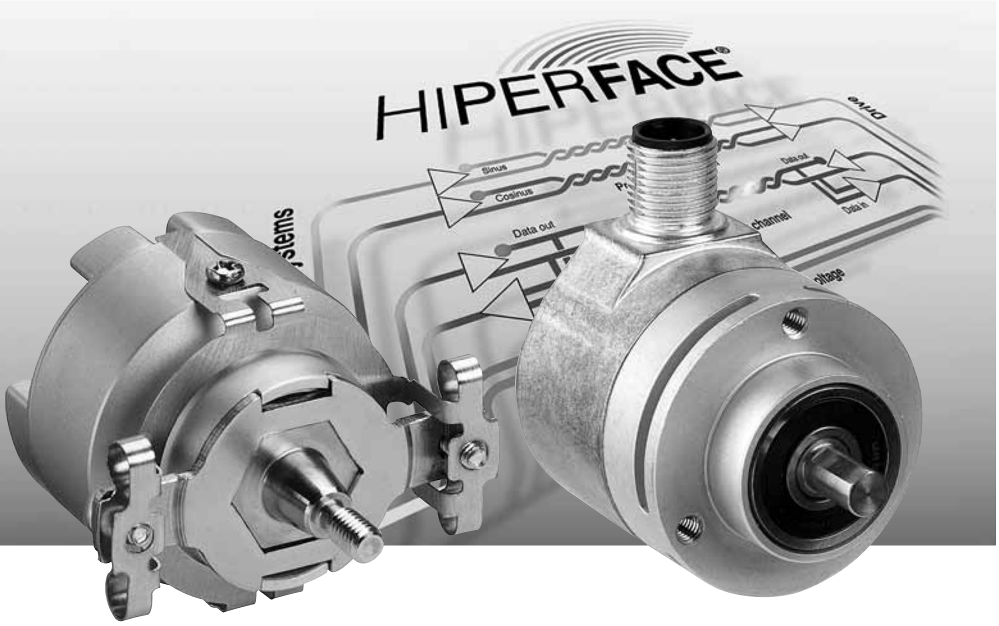
Please enter your individual encoder here

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**E**				**X**		

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**E**				**X**		

Position 1	Position 2	Position 3	Position 4	Position 5	Position 6	Position 7	Position 8	Position 9	Position 10	Position 11	Position 12	Position 13	Position 14
C	**N**	**S**	**5**	**0**	**–**	**A**	**E**				**X**		

SinCos® SKS36, SKM36, SKS36 Standalone, SKM36 Standalone: Motor Feedback Systems with HIPERFACE®-Interface for Servo Motors



128 sine/ cosine periods

Motor Feedback Systems

HIPERFACE®
by SICK | STEGMANN

The SKS/SKM36 encoder is the first member of a new generation of optical encoders within the SinCos product range.
They all share the new Mini-Disc (MiDi) technology.
The special feature of this generation: a very small code disc of only 2 mm code track radius employs holistic (full) scanning.

In doing so, the system compensates for eccentricity errors of code disc, ball bearing and shaft which are inevitably found in conventional systems.
By arranging the code disc in the middle of the rotational axis, high angular velocities are no longer limited by the code disc. The encoder size is essentially determined by the mechanical and electrical interfaces. Technologies such as “Chip On Board” are used to achieve this. The number of components is reduced to a minimum.

The small size of the SinCos SKS/SKM36 enables manufacturers of miniature and subminiature motors to significantly shorten their motors.

The standalone version is also ideally suited as master resp. slave encoder.

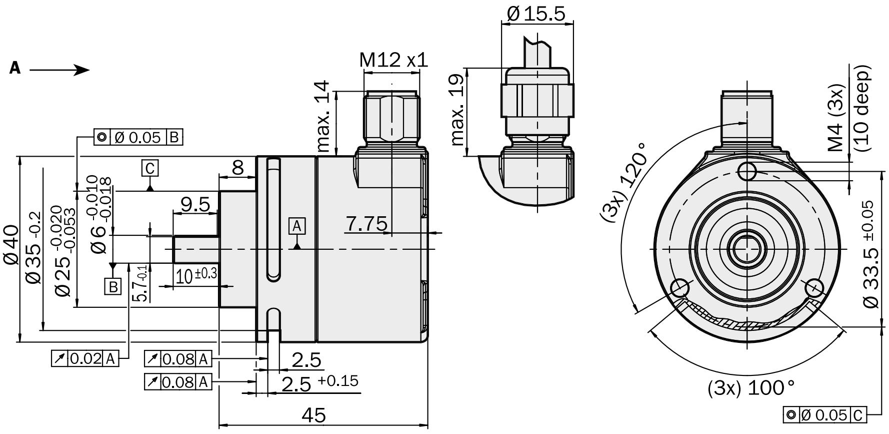
128 sine/ cosine periods

Motor Feedback Systems

- 128 sine/cosine periods per revolution
- Absolute position with a resolution of 4,096 steps per revolution
- 4,096 revolutions can be measured (multiturn)
- Programming of the positional value
- Electronic type label

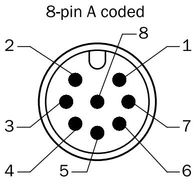
Accessories – see pages 410-448

Dimensional drawing SKS/SKM36 Standalone, Servo/Face Mount flange



General tolerances to DIN ISO 2768-mk

PIN and wire allocation

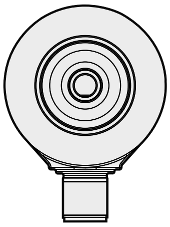


View of the plug-in face

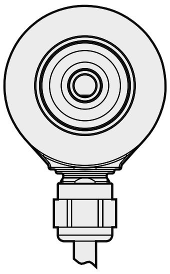
PIN	Color of wires	Signal	Explanation
1	brown	REFSIN	Process data channel
2	white	+ SIN	Process data channel
3	black	REFCOS	Process data channel
4	pink	+ COS	Process data channel
5	grey or yellow	Daten +	RS-485 Parameter channel
6	green or purple	Daten –	RS-485 Parameter channel
7	blue	GND	Ground connection
8	red	+ U_s	Encoder Supply voltage
	Screen		Housing potential

Connection type

Connector radial



Cable radial



Motor Feedback Systems with HIPERFACE® SKS36/SKM36, Solid Shaft, Servo/Face Mount Flange

Technical data to DIN 32878		Solid shaft 6 mm SKS/SKM36	SKS	SKM								
Number of sine/cosine periods per revolution		128	▨	▨								
Number of the absolute ascertainable												
revolutions	Single SKS	1	▨	▨								
	Multi SKM	4,096	▨	▨								
Dimensions		mm (see dimensional drawing)	▨	▨								
Mass		0.14 kg	▨	▨								
Inertial rotor moment		6 g/cm^2	▨	▨								
Code type for the absolute value		Binary	▨	▨								
Code sequence for clockwise shaft rotation, looking in												
direction “A” (see dimensional drawing)		Increasing	▨	▨								
Measurement step at interpolation of the sine/cosine												
signals with e. g. 12 bits		2.5 angular seconds	▨	▨								
Error limits for the digital absolute value												
via RS 485		± 320 angular seconds	▨	▨								
Error limits for evaluating the “128” signals,												
Non-linearity		± 120 angular seconds	▨	▨								
Output frequency for sine/cosine signals		0 ... 65 kHz	▨	▨								
Operating speed		6,000 min^{-1}	▨	▨								
Max. angular acceleration		5 x 10^5 rad/s^2	▨	▨								
Operating torque		0.6 Ncm	▨	▨								
Starting torque		0.9 Ncm	▨	▨								
Load capacity of shaft												
radial/axial		10 Nm/5 Nm	▨	▨								
Life of ball bearings		2 x 10^9 revolutions	▨	▨								
Working temperature range		–20 ... +100 °C	▨	▨								
Storage temperature range 1)		–40 ... +125 °C	▨	▨								
Permissible relative humidity 2)		90 %	▨	▨								
Resistance												
to shocks 3)		100 g / 6 ms	▨	▨								
to vibration 4)		50 g / 10 ... 2000 Hz	▨	▨								
Protection to IEC 60529 5)		IP 65	▨	▨								
EMC 6)			▨	▨								
Operating voltage range		7 ... 12 V	▨	▨								
Recommended supply voltage		8 V	▨	▨								
Max. operating current, no load		60 mA	▨	▨								
Available memory area within EEPROM 7)		1,792 bytes	▨	▨								
Interface signals												
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential	▨	▨								
Parameter channel = RS 485		Digital	▨	▨								

1) Without packaging

2) Condensation not permissible

3) To DIN EN 60068-2-27

4) To DIN EN 60068-2-6

5) With mating connector inserted

6) To DIN EN 61000-6-2 and DIN EN 61000-6-3

7) If applying the elctronic 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

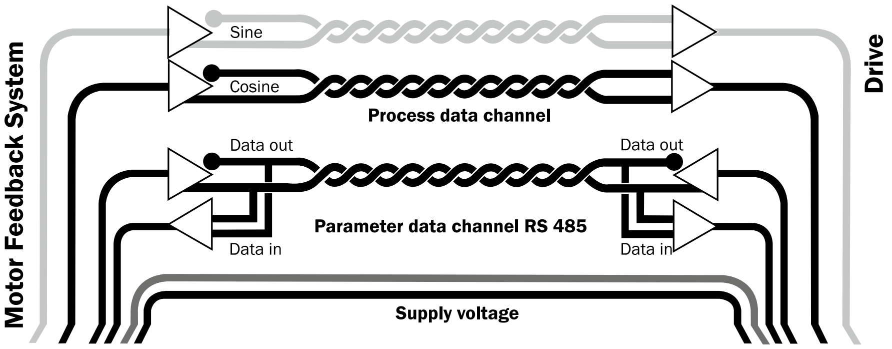
SKS/SKM36, Standalone; Solid shaft 6 mm; Servo/Face Mount Flange

Type	**Part no.**	**Description**
SKS36-HVA0-K02	1035603	Singleturn; EEPROM 2048; Connector
SKS36-HVV0-K02	1035604	Singleturn; EEPROM 2048; Cable 1.5 m
SKM36-HVA0-K02	1035601	Multiturn; EEPROM 2048; Connector
SKM36-HVV0-K02	1035602	Multiturn; EEPROM 2048; Cable 1.5 m

HIPERFACE®
by SICK|STEGMANN

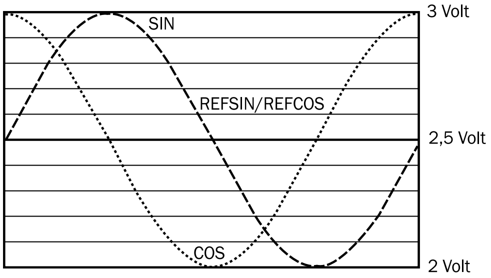
Electrical interface

- 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

Signal diagram for clockwise rotation of the shaft, looking in direction "A"



1 period = 360° : 128

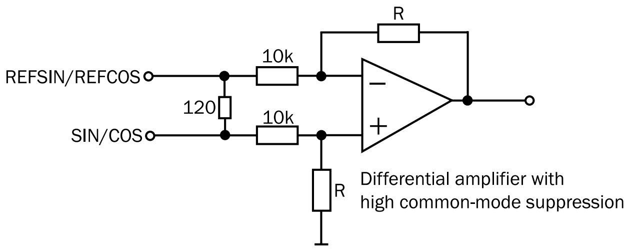
Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always "online". When the supply voltage is applied, the speed controller has access to this information at any time.

Sophisticated technology guarantees stable amplitudes of the analogue signals across all specified environmental conditions, with a maximum variation of only 30 %.

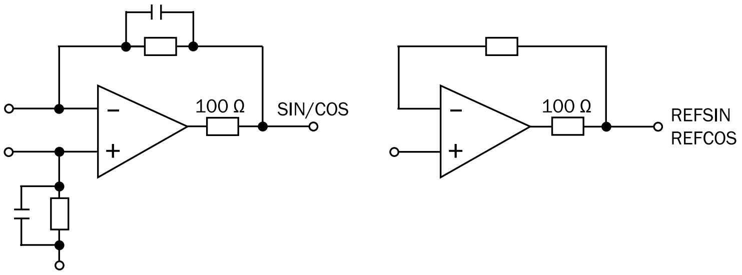
Characteristics applicable to all permissible environmental conditions

Signal	Value/Units
Signal peak, peak V_{ss} of SIN, COS	0.8 ... 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



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Type-specific settings	SKS	SKM
Type ID (command 52h)	32h	37h
Free EEPROM [bytes]	1,792	1,792
Address	40h	40h
Mode_485	E4h	E4h
Codes 0 ... 3	55h	55h
Counter	0	0

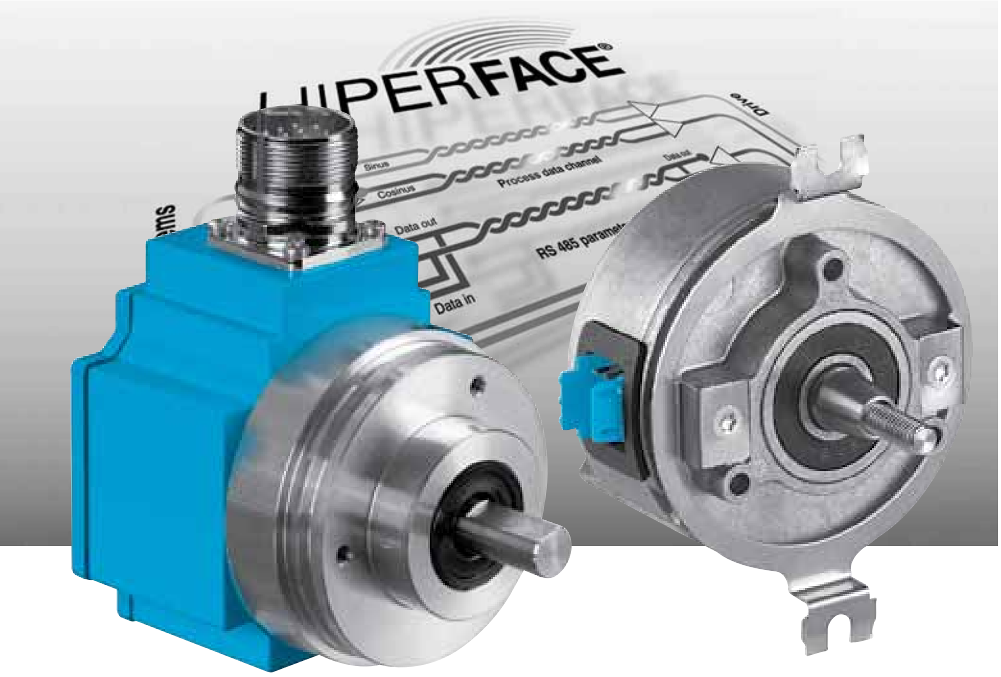
Overview of commands supported			SKS	SKM
Command byte	**Function**	**Code 0** [1]	**Comments**	**Comments**
42h	Read position			
43h	Set position	●		
44h	Read analogue value		Channel number 48h	Channel number 48h
			Temperature [°C]	Temperature [°C]
46h	Read counter			
47h	Increase counter			
49h	Reset 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 = 32h	Encoder type = 37h
53h	Encoder reset			
55h	Allocate encoder address	●		
56h	Read serial number and program version			
57h	Configure serial interface	●		

Overview of status messages				
Error type	**Status code**	**Description**	**SKS**	**SKM**
	00h	The encoder has recognised no error	●	●
Initialization	01h	Faulty compensating data	●	●
	02h	Faulty internal angular offset	●	●
	03h	Data field partitioning table damaged	●	●
	04h	Analogue limit values not available	●	●
	05h	Internal I²C bus not operational	●	●
	06h	Internal checksum error	●	●
Protocol	07h	Encoder reset occurred as a result of program monitoring	●	●
	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	●	●
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	01h	Analogue signals outside specification		
	1Fh	Speed too high, no position formation possible		
	20h	Singleturn position unreliable	●	●
	21h	Positional error Multiturn		●
	22h	Positional error Multiturn		●
	23h	Positional error Multiturn		●
Other	1Ch	Monitoring the value of the analogue signals (process data)		
	1Dh	LED current critical (dirt, LED breakage)	●	●
	1Eh	Encoder temperature critical	●	●
	08h	Counter overflow	●	●

---

[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.

SinCos® SRS50, SRM50, SRS50 Standalone, SRM50 Standalone Generation 2: Motor Feedback Systems with HIPERFACE® interface for Servo Motors



Writing motor-specific data to the electronic type label and programming are important features of these series.

Features of Generation 2:

- Shorter body reduces the encoder's installation depth
- Higher precision due to widely spaced bearings
- RoHS-compliant product range
- Reverse polarity protected

1,024 sine/ cosine periods

Motor Feedback Systems

SRS/SRM series of Motor Feedback Systems are used worldwide in many different applications and environments.
Absolute positioning with 32,768 steps per revolution and a maximum of 4,096 revolutions give a total resolution of 134,217,728 steps.

HIPERFACE®
by SICK | STEGMANN

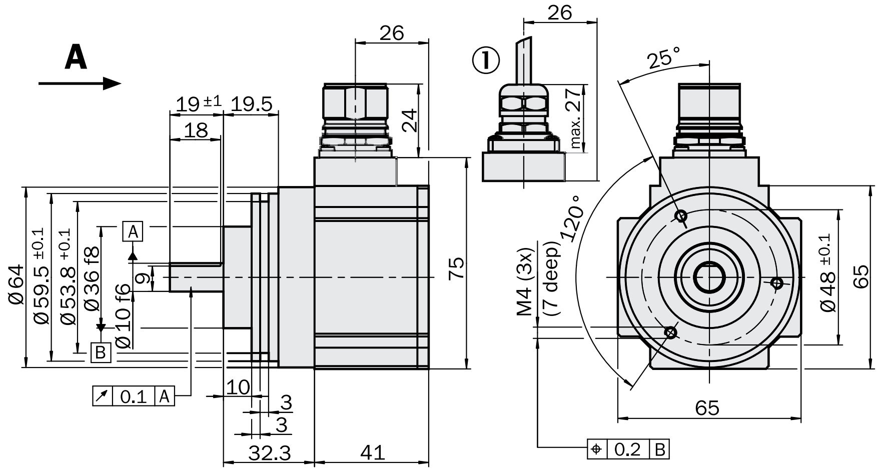
RoHS
2002/95/EC

1,024 sine/ cosine periods

Motor Feedback Systems

- 1,024 sine/cosine periods per revolution
- Absolute position with a resolution of 32,768 steps per revolution
- 4,096 revolutions measurable (Multiturn)
- Programming of the positional value
- Electronic type label

Dimensional drawing SRS50/SRM50 Standalone, rectangular housing, face mount flange

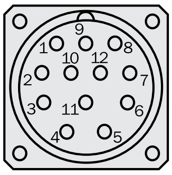


① R = min. bending radius 40 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Color of Wires	Explanation
1	REFCOS	black	Process data channel
2	Data +	grey or yellow	RS-485-parameter channel
3	N. C.	–	N. C.
4	N. C.	–	N. C.
5	SIN	white	Process data channel
6	REFSIN	brown	Process data channel
7	Data –	green or purple	RS-485-parameter channel
8	COS	pink	Process data channel
9	N. C.	–	N. C.
10	GND	blue	Ground connection
11	N. C.	–	N. C.
12	Us	red	7 ... 12 V Supply voltage



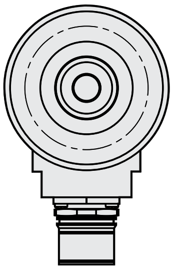
View of the plug-in face

Screen connection on connector housing

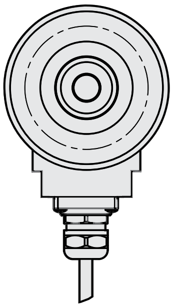
N. C. = Not connected

Type of connection

M23 Connector radial



Cable radial



Accessories – see pages 410-448

Technical data to DIN 32878		Standalone, face mount flange SRS/SRM50	SRS	SRM
Number of sine/cosine periods per revolution		1,024	■	■
Number of the absolute ascertainable revolutions	Single SRS	1	■	
	Multi SRM	4,096		■
Dimensions		mm (see dimensional drawing)	■	■
Mass		0.55 kg	■	■
Moment of inertia to the rotor		25 gcm^2	■	■
Code type for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" (see dimensional drawing)		Increasing	■	■
Measurement step at interpolation of the sine/cosine signals with e. g. 12 bits		0.3 angular seconds	■	■
Error limits for evaluating the sine/cosine signals				
integral non-linearity		± 45 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 7 angular seconds	■	■
Output frequency for sine/cosine signals		0 ... 200 kHz	■	■
Working speed up to which the absolute position can be reliably produced		6,000 min^{-1}	■	■
Max. operating speed		6,000 min^{-1}	■	■
Max. angular acceleration		0.2 x 10^6 rad/s^2	■	■
Operating torque with shaft sealing ring		1 Ncm	■	■
Starting torque with shaft sealing ring		1.5 Ncm	■	■
Load capacity of shaft	radial/axial	40 N/20 N	■	■
Life of ball bearings		3.6 x 10^9 revolutions	■	■
Working temperature range		–20 ... +85 °C	■	■
Storage temperature range		–30 ... +90 °C	■	■
Permissible relative humidity 1)		90 %	■	■
Resistance				
To shocks 2)		30 g/11 ms	■	■
To vibration 3)		20 g/10 ... 2000 Hz	■	■
Protection class to IEC 60529 4)		IP 65	■	■
EMC 5)			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		80 mA	■	■
Available memory area				
Within EEPROM 512 6)		128 bytes	■	■
Within EEPROM 2048 6)		1,792 bytes	■	■
Interface signals				
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential	■	■
Parameter channel = RS 485		Digital	■	■

Ordering information

SRS/SRM50 Standalone; solid shaft Ø 10 mm; face mount flange

Type	**Part no.**	**Decription**
SRS50-HWA0-K21	1037091	Single, 512 EEprom, connector
SRS50-HWV0-K21	1037093	Single, 512 EEprom, stranded cable
SRS50-HWA0-K22	1037092	Single, 2048 EEprom, connector
SRS50-HWV0-K22	1037094	Single, 2048 EEprom, stranded cable
SRM50-HWA0-K21	1037095	Multi, 512 EEprom, connector
SRM50-HWV0-K21	1037097	Multi, 512 EEprom, stranded cable
SRM50-HWA0-K22	1037096	Multi, 2048 EEprom, connector
SRM50-HWV0-K22	1037098	Multi, 2048 EEprom, stranded cable

1) Condensation not permitted

2) To EN 60068-2-27

3) To EN 60068-2-6

4) With mating connector inserted

5) 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

6) 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.

1,024 sine/ cosine periods

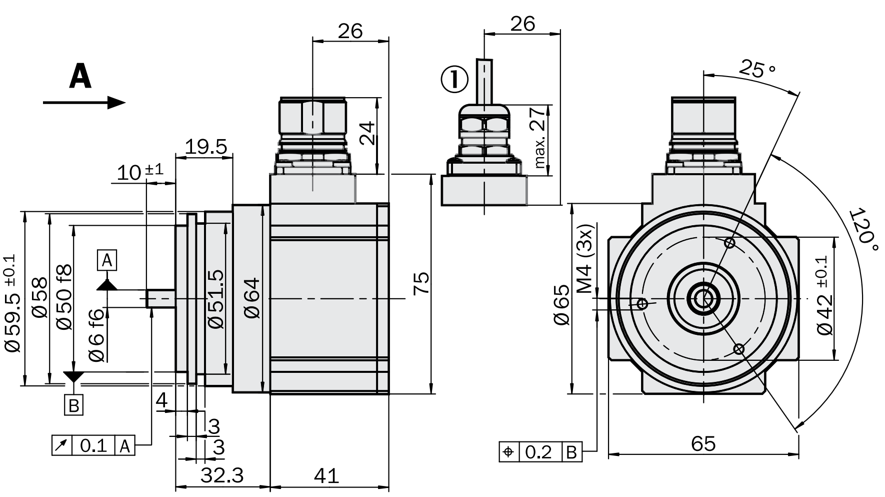
Motor Feedback Systems

- 1,024 sine/cosine periods per revolution
- Absolute position with a resolution of 32,768 steps per revolution
- 4,096 revolutions measurable (Multiturn)
- Programming of the positional value
- Electronic type label

RoHS 2002/95/EC

Accessories – see pages 410-448

Dimensional drawing SRS50/SRM50 Standalone, rectangular housing, servo flange

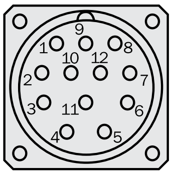


① R = min. bending radius 40 mm

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Color of Wires	Explanation
1	REFCOS	black	Process data channel
2	Data +	grey or yellow	RS-485-parameter channel
3	N. C.	–	N. C.
4	N. C.	–	N. C.
5	SIN	white	Process data channel
6	REFSIN	brown	Process data channel
7	Data –	green or purple	RS-485-parameter channel
8	COS	pink	Process data channel
9	N. C.	–	N. C.
10	GND	blue	Ground connection
11	N. C.	–	N. C.
12	Us	red	7 ... 12 V Supply voltage



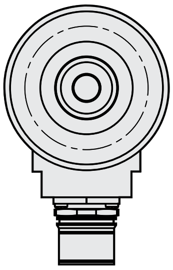
View of the plug-in face

Screen connection on connector housing

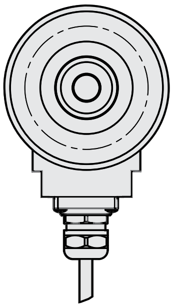
N. C. = Not connected

Type of connection

M23 Connector radial



Cable radial



Technical data to DIN 32878		Standalone, servo flange SRS/SRM50	SRS	SRM
Number of sine/cosine periods per revolution		1,024	■	■
Number of the absolute ascertainable revolutions	Single SRS	1	■	
	Multi SRM	4,096		■
Dimensions		mm (see dimensional drawing)	■	■
Mass		0.55 kg	■	■
Moment of inertia to the rotor		25 gcm^2	■	■
Code type for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" (see dimensional drawing)		Increasing	■	■
Measurement step at interpolation of the sine/cosine signals with e. g. 12 bits		0.3 angular seconds	■	■
Error limits for evaluating the sine/cosine signals				
integral non-linearity		± 45 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 7 angular seconds	■	■
Output frequency for sine/cosine signals		0 ... 200 kHz	■	■
Working speed up to which the absolute position can be reliably produced		6,000 min^{-1}	■	■
Max. operating speed		6,000 min^{-1}	■	■
Max. angular acceleration		0.2 x 10^6 rad/s^2	■	■
Operating torque with shaft sealing ring		1 Ncm	■	■
Starting torque with shaft sealing ring		1.5 Ncm	■	■
Load capacity of shaft	radial/axial	40 N/20 N	■	■
Life of ball bearings		3.6 x 10^9 revolutions	■	■
Working temperature range		–20 ... +85 °C	■	■
Storage temperature range		–30 ... +90 °C	■	■
Permissible relative humidity 1)		90 %	■	■
Resistance				
To shocks 2)		30 g/11 ms	■	■
To vibration 3)		20 g/10 ... 2000 Hz	■	■
Protection class to IEC 60529 4)		IP 65	■	■
EMC 5)			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		80 mA	■	■
Available memory area				
Within EEPROM 512 6)		128 bytes	■	■
Within EEPROM 2048 6)		1,792 bytes	■	■
Interface signals				
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential	■	■
Parameter channel = RS 485		Digital	■	■

1) Condensation not permitted

2) To EN 60068-2-27

3) To EN 60068-2-6

4) With mating connector inserted

5) 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

6) 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

SRS/SRM50 Standalone; solid shaft Ø 6 mm; servo flange

Type	**Part no.**	**Description**
SRS50-HXA0-K21	1037099	Single, 512 EEprom, connector
SRS50-HXV0-K21	1037101	Single, 512 EEprom, stranded cable
SRS50-HXA0-K22	1037100	Single, 2048 EEprom, connector
SRS50-HXV0-K22	1037102	Single, 2048 EEprom, stranded cable
SRM50-HXA0-K21	1037103	Multi, 512 EEprom, connector
SRM50-HXV0-K21	1037105	Multi, 512 EEprom, stranded cable
SRM50-HXA0-K22	1037104	Multi, 2048 EEprom, connector
SRM50-HXV0-K22	1037106	Multi, 2048 EEprom, stranded cable

Motor Feedback Systems with HIPERFACE® SRS50/SRM50, Standalone, Square Mount Flange

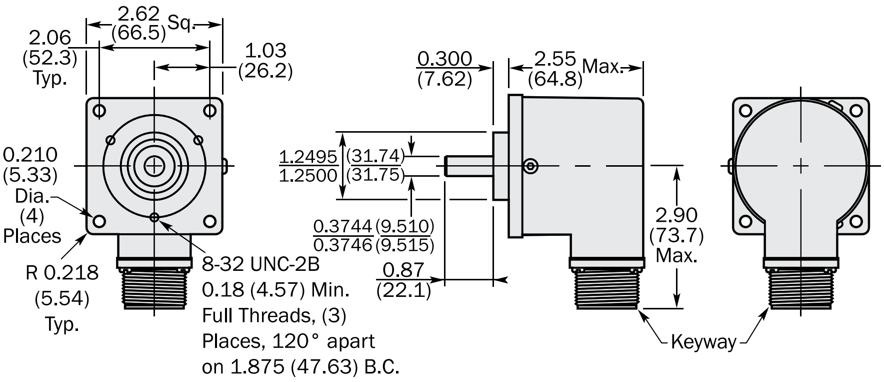
1,024 sine/ cosine periods

Motor Feedback Systems

- 1,024 sine/cosine periods per revolution
- Absolute position with a resolution of 32,768 steps per revolution
- 4,096 revolutions measurable (Multiturn)
- Programming of the positional value
- Electronic type label

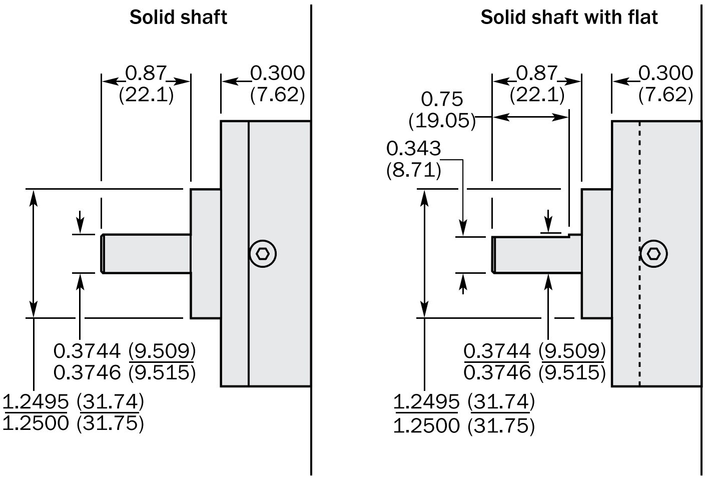
Accessories – see pages 410-448

Dimensional drawing SRS50/SRM50 Standalone, square mount flange



All dimensions in inch, dimensions within brackets in mm.

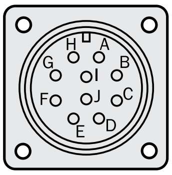
Dimensional drawing shaft options



All dimensions in inch, dimensions within brackets in mm.

PIN and wire allocation

PIN	Signal	Wire color	Explanation
A	+ U_S	red	7 ... 12 V Supply voltage
B	GND	blue	Ground connection
C	Ref SIN	brown	Process data channel
D	Ref COS	black	Process data channel
E	Data +	grey	RS-485-parameter channel
F	Data –	green	RS-485-parameter channel
G	SIN	white	Process data channel
H	COS	pink	Process data channel
I	N. C.		
J	Housing	Housing	



View of the plug-in face

Screen connection on connector housing

N. C. = Not connected

Technical data to DIN 32878 Standalone, square mount flange SRS/SRM50			SRS	SRM
Number of sine/cosine periods per revolution		1,024	■	■
Number of the absolute ascertainable revolutions	Single SRS	1	■	
	Multi SRM	4,096		■
Dimensions		mm (see dimensional drawing)	■	■
Mass		0.48 kg	■	■
Moment of inertia to the rotor		28.8 gcm^2	■	■
Code type for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" (see dimensional drawing)		Increasing	■	■
Measurement step at interpolation of the sine/cosine signals with e. g. 12 bits		0.3 angular seconds	■	■
Error limits for evaluating the sine/cosine signals				
integral non-linearity		± 45 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 7 angular seconds	■	■
Output frequency for sine/cosine signals		0 ... 200 kHz	■	■
Working speed up to which the absolute position can be reliably produced		6,000 min^{-1}	■	■
Max. operating speed without shaft sealing ring		6,000 min^{-1}	■	■
Max. operating speed with shaft sealing ring		3,000 min^{-1}	■	■
Max. angular acceleration		5×10^5 rad/s^2	■	■
Operating torque with shaft sealing ring		1 Ncm	■	■
Starting torque with shaft sealing ring		1.5 Ncm	■	■
Load capacity of shaft	radial/axial	155 N/88 N	■	■
Life of ball bearings		3.6×10^9 revolutions	■	■
Working temperature range		0 ... +75 °C	■	■
Storage temperature range		–40 ... +85 °C	■	■
Permissible relative humidity 1)		90 %		
Resistance			■	■
To shocks 2)		100 g/10 ms	■	■
To vibration 3)		20 g/10 ... 2000 Hz	■	■
Protection class to IEC 60529 4)		IP 66	■	■
EMC 5)			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		80 mA		
Available memory area			■	■
Within EEPROM 512 6)		128 bytes	■	■
Interface signals				
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential	■	■
Parameter channel = RS 485		Digital	■	■

1) Condensation not permitted

2) To EN 60068-2-27

3) To EN 60068-2-6

4) With mating connector inserted

5) 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

6) 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

SRS/SRM50 Standalone; solid shaft Ø 3/8"; square mount flange 2,5"

Type	Part no.	Description
SRS50-HTA0-K21	7127309	Single, solid shaft, connector MS/10
SRS50-HUA0-K21	7127310	Single, solid shaft with flat, connector MS/10
SRM50-HTA0-K21	7127313	Multi, solid shaft, connector MS/10
SRM50-HUA0-K21	7127311	Multi, solid shaft with flat, connector MS/10

Motor Feedback Systems with HIPERFACE® SRS50/SRM50, Standalone, Blind Hollow Shaft

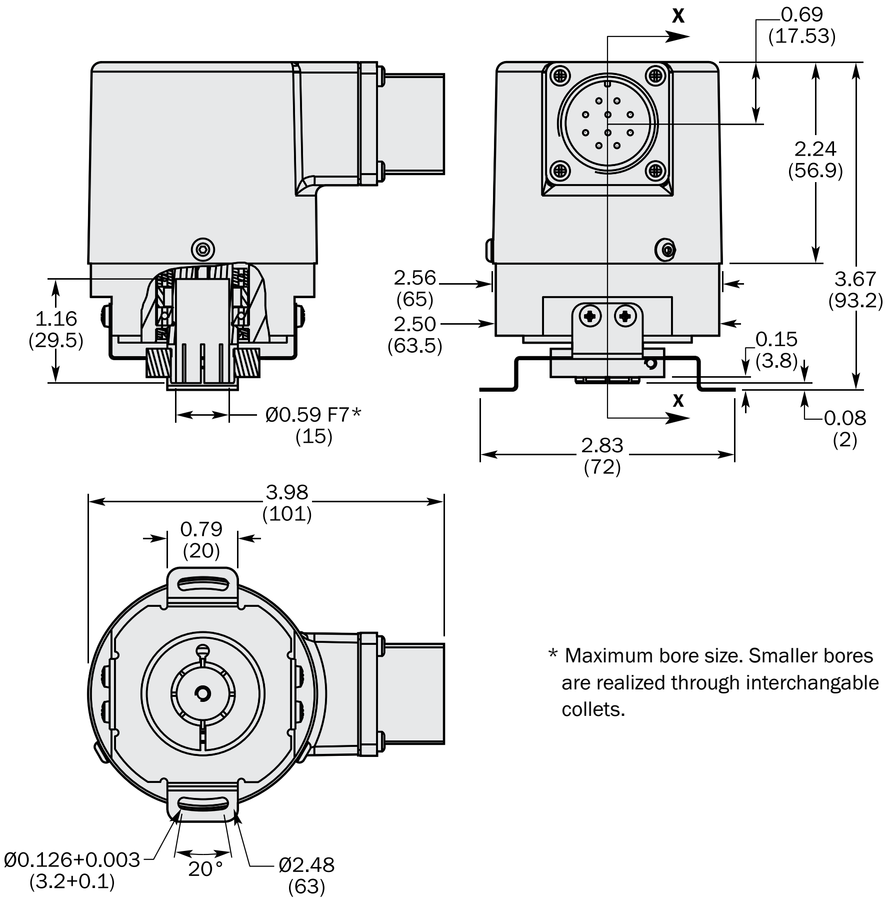
1,024 sine/ cosine periods

Motor Feedback Systems

- 1,024 sine/cosine periods per revolution
- Absolute position with a resolution of 32,768 steps per revolution
- 4,096 revolutions measurable (Multiturn)
- Programming of the positional value
- Electronic type label

Accessories – see pages 410-448

Dimensional drawing SRS50/SRM50 Standalone, blind hollow shaft

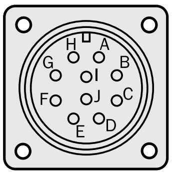


* Maximum bore size. Smaller bores are realized through interchangable collets.

All dimensions in inch, dimensions within brackets in mm.

PIN and wire allocation

PIN	Signal	Wire color	Explanation
A	+ U_S	red	7 ... 12 V Supply voltage
B	GND	blue	Ground connection
C	Ref SIN	brown	Process data channel
D	Ref COS	black	Process data channel
E	Data +	grey	RS-485-parameter channel
F	Data –	green	RS-485-parameter channel
G	SIN	white	Process data channel
H	COS	pink	Process data channel
I	N. C.		
J	Housing	Housing	



View of the plug-in face

Screen connection on connector housing

N. C. = Not connected

Technical data to DIN 32878	Standalone, blind hollow shaft SRS/SRM50		SRS	SRM
Number of sine/cosine periods per revolution		1,024	■	■
Number of the absolute ascertainable revolutions	Single SRS	1	■	
	Multi SRM	4,096		■
Dimensions		mm (see dimensional drawing)	■	■
Mass		0.48 kg	■	■
Moment of inertia to the rotor		50 gcm^2 max.	■	■
Code type for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" (see dimensional drawing)		Increasing	■	■
Measurement step at interpolation of the sine/cosine signals with e. g. 12 bits		0.3 angular seconds	■	■
Error limits for evaluating the sine/cosine signals				
integral non-linearity		± 45 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 7 angular seconds	■	■
Output frequency for sine/cosine signals		0 ... 200 kHz	■	■
Working speed up to which the absolute position can be reliably produced		3.000 min^{-1}	■	■
Max. operating speed		3.000 min^{-1}	■	■
Max. angular acceleration		5 x 10^5 rad/s^2	■	■
Max. operating torque		1.8 Ncm	■	■
Starting torque with shaft sealing ring		2.6 Ncm	■	■
Allowable runout			■	■
static/dynamic radial		± 3/± 1 mm	■	■
static/dynamic axial		± 5/± 2 mm	■	■
Working temperature range		0 ... +75 °C	■	■
Storage temperature range		–40 ... +85 °C	■	■
Permissible relative humidity [1]		90 %		
Resistance			■	■
To shocks [2]		100 g/10 ms	■	■
To vibration [3]		20 g/10 ... 2000 Hz	■	■
Protection class to IEC 60529 [4]		IP 66	■	■
EMC [5]			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		80 mA		
Available memory area			■	■
Within EEPROM 512 [6]		128 bytes	■	■
Interface signals				
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential	■	■
Parameter channel = RS 485		Digital	■	■

Ordering information

SRS/SRM50 Standalone; blind hollow shaft Ø 15 mm

Type	**Part no.**	**Description**
SRS50-HPA0-K21	7127312	Single, Aufsteckhohlwelle, Stecker MS/10
SRM50-HPA0-K21	7127314	Multi, Aufsteckhohlwelle, Stecker MS/10

Collets

Type	**Part no.**	**Size**
SPZ-006-AD-A	2029174	6 mm
SPZ-1E4-AD-A	2029175	1/4"
SPZ-008-AD-A	2029176	8 mm
SPZ-3E8-AD-A	2029177	3/8"
SPZ-010-AD-A	2029178	10 mm
SPZ-012-AD-A	2029179	12 mm
SPZ-1E2-AD-A	2029180	1/2"

Attention: Please order the Collet with required diameter separately.

[1] Condensation not permitted

[2] To EN 60068-2-27

[3] To EN 60068-2-6

[4] With mating connector inserted

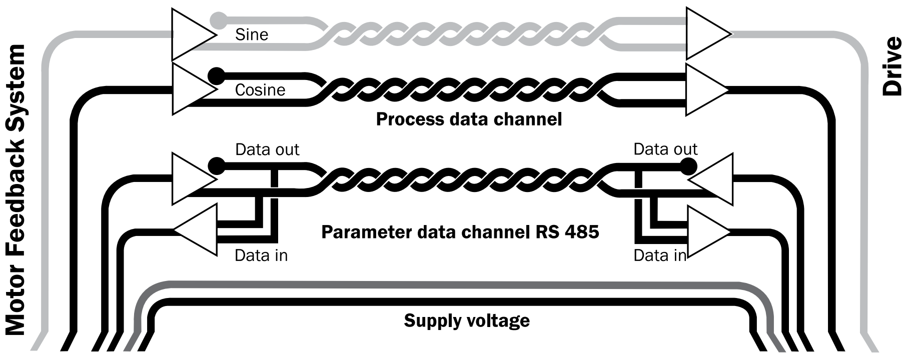
[5] To EN 61000-6-2 and EN 61000-6-3
The EMC according to the standards quoted is achieved when the motor feedback system is mounted in an electrically conductive housing, which is connected to the central earthing point of the motor controller via a cable screen. This is also where the GND (0 V) connection of the supply voltage is linked to earth.
Users must perform their own tests when other screen designs are used.

[6] 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.

HIPERFACE®
by SICK|STEGMANN

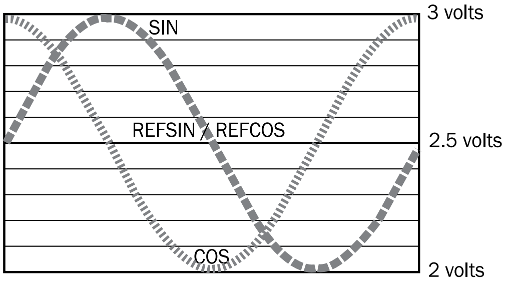
Electrical interface

- **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

Signal diagram for clockwise rotation of the shaft, looking in direction "A"



1 period = 360° : 1024

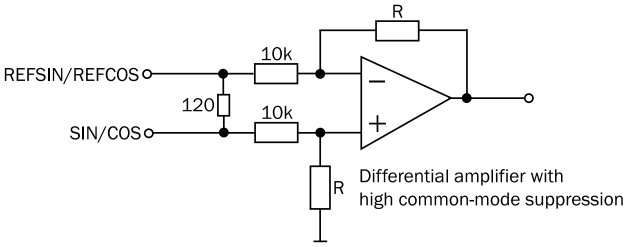
Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always "online". When the supply voltage is applied, the speed controller has access to this information at any time.

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

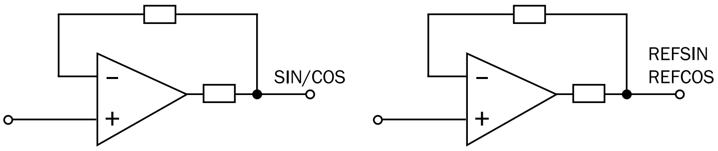
Signal	Value/Units
Signal peak, peak V_{ss} of SIN, COS	0.9 ... 1.1 V
Signal offset REFSIN, REFCOS	2.2 ... 2.8 V

Recommended receiver circuit for sine and cosine signals



Accessories – see pages 410-448

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



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

Type-specific settings	SRS	SRM
Type ID (command 52h)	22h	27h
Free EEPROM [bytes]	128/1,792	128/1,792
Address	40h	40h
Mode_485	E4h	E4h
Codes 0 ... 3	55h	55h
Counter	0	0

Overview of commands supported			**SRS**	**SRM**
Command byte	**Function**	**Code 0** [1]	**Comments**	**Comments**
42h	Read position (5 bits per sine/cosine period)		15 bits	27 bits
43h	Set position	•		
44h	Read analogue value		Channel number 48h	Channel number 48h
			Temperature [°C]	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 = 22h	Encoder type = 27h
53h	Encoder reset			
55h	Allocate encoder address	•		
56h	Read serial number and program version			
57h	Configure serial interface	•		

---

[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.

Overview of status messages				
Error type	**Statuscode**	**Description**	**SRS**	**SRM**
	00h	The encoder has recognised no error	•	•
Initialization	01h	Faulty compensating data	•	•
	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	07h	Encoder reset occurred as a result of program monitoring	•	•
	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	•	•
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	01h	Analogue signals outside specification	•	•
	1Fh	Speed too high, no position formation possible	•	•
	20h	Singleturn position unreliable	•	•
	21h	Positional error Multiturn		•
	22h	Positional error Multiturn		•
	23h	Positional error Multiturn		•
Other	1Ch	Monitoring the value of the analogue signals (process data)		
	1Dh	Transmitter current critical (dirt, transmitter breakage)	•	•
	1Eh	Encoder temperature critical	•	•
	08h	Counter overflow	•	•

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

SinCos® SRS64, SRM64: Motor Feedback Systems with HIPERFACE®-Interface for Self-Ventilated and Force-Ventilated Drives

1,024 sine/ cosine periods

Motor Feedback Systems

HIPERFACE® by SICK | STEGMANN

The SRS/SRM series of Motor Feedback Systems are used world-wide in many different applications and environments.

Absolute positioning with 32,768 steps per revolution and a maximum of 4,096 revolutions give a total resolution of 134,217,728 steps. Writing motor-specific data to the electronic type label and programming are important features of these series.

Possible product variations:

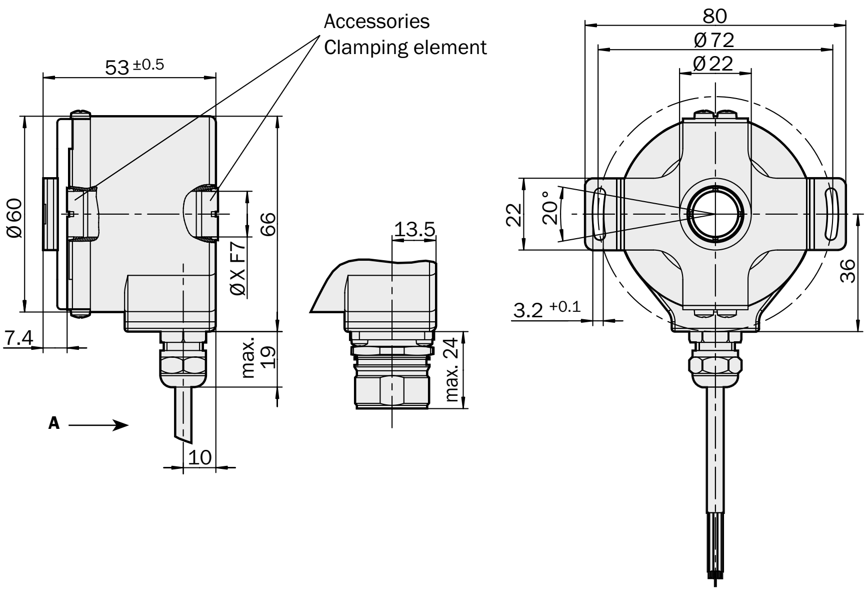
Hollow shafts up to 14 mm in diameter.

1,024 sine/ cosine periods

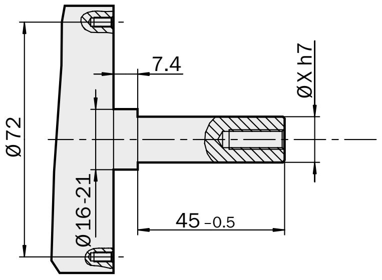
Motor Feedback Systems

- 1,024 sine/cosine periods per revolution
- Absolute position with a resolution of 32,768 steps per revolution
- 4,096 revolutions can be measured (Multiturn)
- Programming of the positional value
- Electronic type label

Dimensional drawing SRS/SRM64



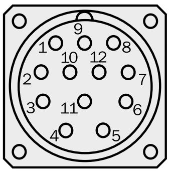
Proposed customer fitting



General tolerances to DIN ISO 2768-mk

PIN and wire allocation

PIN	Signal	Color of Wires	Explanation
1	REFCOS	black	Process data channel
2	Data +	grey or yellow	RS 485 parameter channel
3	N. C.	–	N. C.
4	N. C.	–	N. C.
5	SIN	white	Process data channel
6	REFSIN	brown	Process data channel
7	Data –	green or purple	RS 485 parameter channel
8	COS	pink	Process data channel
9	N. C.	–	N. C.
10	GND	blue	Ground connection
11	N. C.	–	N. C.
12	U_s	red	Supply voltage 7 ... 12 V



View of the plug-in face

Screen connection on connector housing

N. C. = Not connected

Accessories – see pages 410-448

Technical Data according to DIN 32878		Hollow Shaft SRS/SRM64	SRS	SRM
Number of sine/cosine periods per revolution		1,024	■	■
Dimensions		mm (see dimensional drawing)	■	■
Weight		0.3 kg	■	■
Inertial rotor moment		45 gcm^2	■	■
Type of code for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" **(see dimensional drawing)**		Increasing	■	■
Measurement step after generating arctan with 12 bit resolution		0.3 angular seconds	■	■
Total number of steps	Single SRS	32,768	■	
	Multi SRM	134,21,728 = 4,096 x 32,768		■
Error limits for the digital absolute value				
via RS 485		± 90 angular seconds	■	■
Error limits for evaluating the "1,024" signals,				
integral non-linearity		± 45 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 7 angular seconds	■	■
Output frequency for sine/cosine signals		0 ... 200 kHz	■	■
Working speed up to which the absolute position can be reliably produced		6,000 min^{-1}	■	■
Max. operating speed		9,000 min^{-1}	■	■
Max. angular acceleration		5 x 10^5 rad/s^2	■	■
Operating torque		0.2 Ncm	■	■
Starting torque		0.4 Ncm	■	■
Permissible shaft movement				
static	radial/axial	± 0.1 mm/± 2 mm	■	■
dynamic	radial/axial	± 0.05 mm/± 0,2 mm	■	■
Angular motion, perpendicular to the rotational axis				
static		34 x 10^{-3} mm/mm	■	■
dynamic		17 x 10^{-3} mm/mm	■	■
Life of ball bearings		3.6 x 10^9 revolutions	■	■
Working temperature range		–20 ... +110 °C	■	■
Storage temperature range (without packaging)		–20 ... +115 °C	■	■
Permissible relative humidity 1)		90 %	■	■
Shock resistance 2)		100/10 g/ms	■	■
Oscillation resistance 3)		20/10 ... 2000 g/Hz	■	■
Protection to IEC 60529 4)		IP 65	■	■
EMC 5)			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		< 80 mA	■	■
Available memory area				
within EEPROM 512 6)		128 bytes	■	■
within EEPROM 2048 6)		1,792 bytes	■	■
Interface signals				
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential	■	■
Parameter channel = RS 485		Digital	■	■

1) Condensation not permissible

2) To EN 60068-2-27

3) To EN 60068-2-6

4) In assembled state

5) To EN 61000-6-2 and N 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. This is also where the GND (0 V) connection of the supply voltage is linked to earth. Users must perform their own tests when other screen designs are used.

6) If applying the elctronic 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

SRS/SRM64; hollow shaft *

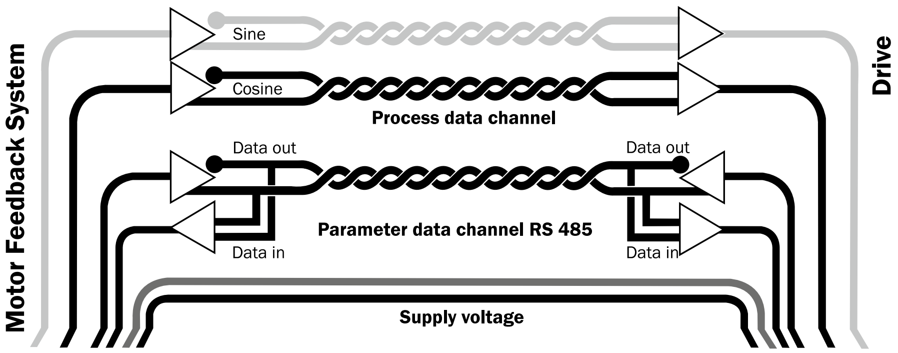
Type	**Part no.**	**Description**
SRS64-HRK0-K01	1034225	Single, 512 EEprom, cable 1.5 m
SRS64-HRA0-K01	1034223	Single, 512 EEprom, connector
SRM64-HRK0-K01	1034164	Multi, 512 EEprom, cable 1.5 m
SRM64-HRA0-K01	1034162	Multi, 512 EEprom, connector
SRS64-HRK0-K02	1034226	Single, 2048 EEprom, cable 1.5 m
SRS64-HRA0-K02	1034224	Single, 2048 EEprom, connector
SRM64-HRK0-K02	1034165	Multi, 2048 EEprom, cable 1.5 m
SRM64-HRA0-K02	1034163	Multi, 2048 EEprom, connector

*** Clamping elements for 10, 12, 14 mm and 3/8" and 1/2" as accessories separate order item.**

HIPERFACE®
by SICK | STEGMANN

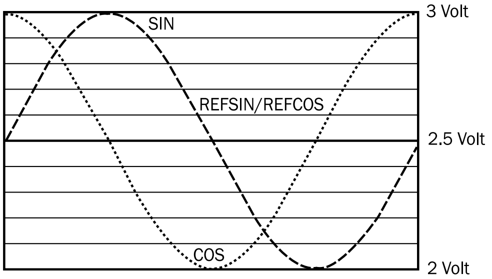
Electrical interface

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



Signal specification of the process data channel

Signal diagram for clockwise rotation of the shaft, looking in direction “A”



1 period = 360° : 1,024

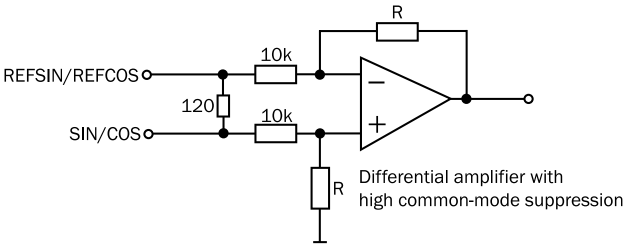
Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always “online”. When the supply voltage is applied, the speed controller has access to this information at any time.

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

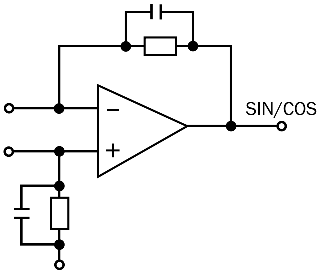
Characteristics applicable to all environmental conditions stated

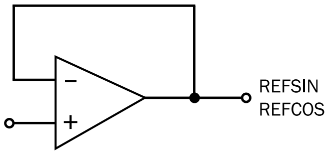
Signal	Values/Units
Signal peak, peak V_{ss} of SIN, COS	0.9 ... 1.1 V
Signal offset REFSIN, REFCOS	2.2 ... 2.8 V

Recommended receiver circuit for sine and cosine signals



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





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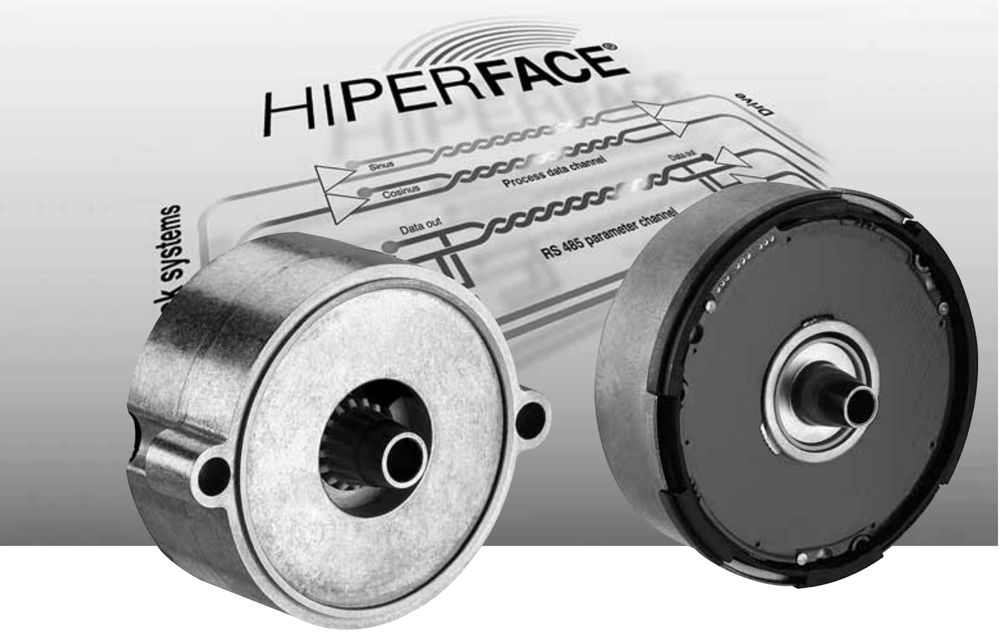
Type-specific settings	SRS	SRM
Type ID (command 52h)	22h	27h
Free EEPROM [bytes]	128/1,792	128/1,792
Address	40h	40h
Mode_485	E4h	E4h
Codes 0 ... 3	55h	55h
Counter	0	0

Overview of commands supported			SRS	SRM
Command byte	**Function**	**Code 0** [1]	**Comments**	**Comments**
42h	Read position			
43h	Set position	●		
44h	Read analogue value		Channel number 48h	Channel number 48h
			Temperature [°C]	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 = 22h	Encoder type = 27h
53h	Encoder reset			
55h	Allocate encoder address	●		
56h	Read serial number and program version			
57h	Configure serial interface	●		

[1] Code 0 is a byte inserted into the protocol, for additional safeguarding of vital system parameters against accidental overwriting.
When shipped, "Code 0" = 55h.

Overview of status messages				
Error type	**Status code**	**Description**	**SRS**	**SRM**
	00h	The encoder has recognised no error	●	●
Initialization	01h	Faulty compensating data	●	●
	02h	Faulty internal angular offset	●	●
	03h	Data field partitioning table damaged	●	●
	04h	Analogue limit values not available	●	●
	05h	Internal I²C bus not operational	●	●
	06h	Internal checksum error	●	●
Protocol	07h	Encoder reset occurred as a result of program monitoring	●	●
	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	●	●
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	01h	Analogue signals outside specification	●	●
	1Fh	Speed too high, no position formation possible	●	●
	20h	Singleturn position unreliable	●	●
	21h	Positional error Multiturn		●
	22h	Positional error Multiturn		●
	23h	Positional error Multiturn		●
Other	1Ch	Monitoring the value of the analogue signals (process data)		
	1Dh	Transmitter current critical (dirt, transmitter breakage)	●	●
	1Eh	Encoder temperature critical	●	●
	08h	Counter overflow	●	●

SinCos® SEK52/SEL52 and SEK37/SEL37: Motor Feedback Systems with HIPERFACE® interface



16 sine/ cosine periods

Motor Feedback Systems

HIPERFACE® by SICK | STEGMANN

RoHS 2002/95/EC

Extreme robustness, multiturn capability and all benefits of the HIPERFACE® interface are reflected in the new SinCos® SEK/SEL52 and SEK/SEL37 product ranges.

At the heart of these new ranges is a bearing-less, capacitive sensor element.

The holistic scanning almost completely compensates for eccentricity errors. The capacitive operating principle can function without ball bearings and is therefore extremely robust. By dispensing with wearing parts, possible error sources are largely excluded, and the motor feedback systems have a high temperature resistance previously reserved for resolvers. Moreover, the system construction allows extremely low power consumption.

The compact SEK/SEL37 products are designed for mounting onto conical shafts. In addition to the shoulder clamping used with resolvers, SEK/SEL device types in the 2.1" housing also feature hollow shaft and conical shaft types. Thus, these motor feedback systems with high resolution are particularly suited to industrial applications requiring a compact, precise and cost-effective solution.

16 sine/ cosine periods

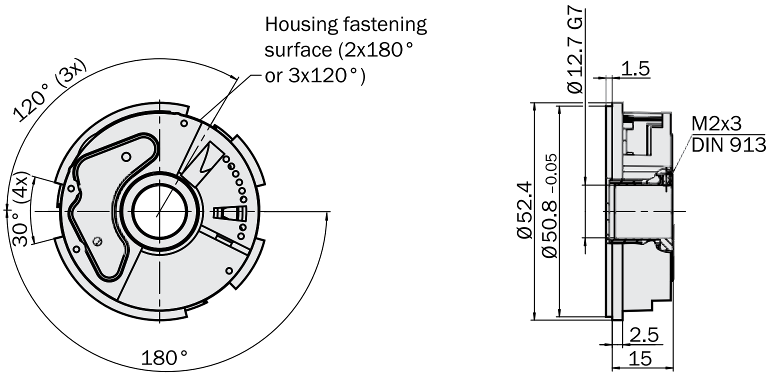
Motor Feedback Systems

- 16 sine/cosine periods per revolution
- 4,096 revolutions measurable (Multiturn)
- Programming of the positional value
- Electronic type label

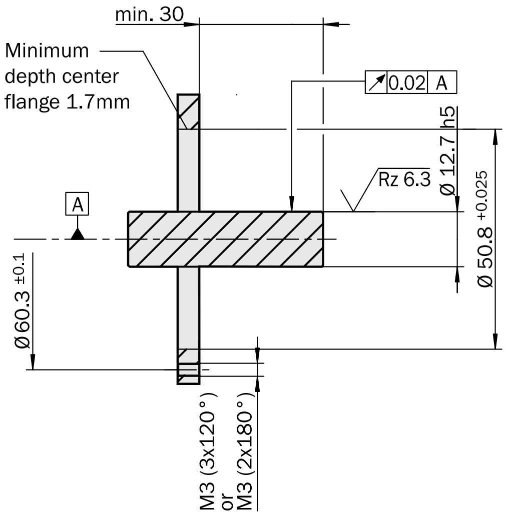
RoHS
2002/95/EC

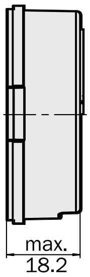
Accessories – see pages 410-448

Dimensional drawing SEK/SEL52 hollow shaft



Proposed customer fitting





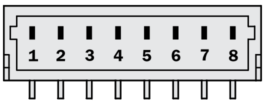
Dimensions with cover (see accessory order no. 2048232)

General tolerances according to DIN ISO 2768-mk

Pin and wire allocation

PIN	Signal	Color of wires	Explanation
1	Us	red	Supply voltage 7 ... 12 V
2	+ SIN	white	Process data channel
3	REFSIN	brown	Process data channel
4	+ COS	pink	Process data channel
5	REFCOS	black	Process data channel
6	GND	blue	Ground connection
7	Data +	grey or yellow	RS485-parameter channel
8	Data –	green or purple	RS485-parameter channel

The GND-(0V) connection of the supply voltage has no connection to the housing.



Technical data to DIN 32878		Hollow shaft SEK/SEL52	SEK	SEL
Number of sine/cosine periods per revolution		16	■	■
Number of the absolute ascertainable revolutions	Single SEK	1	■	
	Multi SEL	4,096		■
Dimensions		mm (see dimensional drawing)	■	■
Mass		0.04 kg	■	■
Mass with cover 1)		0.06 kg	■	■
Moment of inertia to the rotor		7 gcm^2	■	■
Code type for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" (see dimensional drawing)		Increasing	■	■
Measurement step at interpolation of the sine/cosine signals with e. g. 12 bits		20 angular seconds	■	■
Error limits for evaluating the sine/cosine signals				
integral non-linearity		± 288 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 72 angular seconds 2)	■	■
Working speed up to which the absolute position can be reliably produced		6,000 min^{-1}	■	■
Max. Operating speed	Single SEK	12,000 min^{-1}	■	
	Multi SEL	10,000 min^{-1}		■
Max. angular acceleration		5 x 10^5 rad/s^2	■	■
Permissible shaft movement				
axial		± 0.5 mm	■	■
radial		± 0.15 mm	■	■
Working temperature range	Single SEK	–40 ... +115 °C	■	
	Multi SEL	–20 ... +115 °C		■
Storage temperature range 3)		–50 ... +125 °C	■	■
Permissible relative humidity		90 % 4)	■	■
Resistance				
To shocks 5)		100 g/10 ms	■	■
To vibration 6)		50 g/10 ... 2000 Hz	■	■
Protection class to IEC 60529 7)		IP 40	■	■
EMC 8)			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		< 50 mA	■	■
Available memory area				
within EEPROM 2048 9)		1,792 bytes	■	■
Interface signals				
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential	■	■
Parameter channel = RS 485		Digital	■	■

1) Accessory part no. 2048232

2) At nominal position ± 0.1 mm

3) Without packaging

4) Condensation not permitted

5) To EN 60068-2-27

6) To EN 60068-2-6

7) With mating connector inserted and closed cover

8) 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 and by using the cover (see accessory part no. 2048232).
Users must perform their own tests when other screen designs are used.

9) 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

SEK/SEL52 hollow shaft

Type	**Part no.**	**Description**
SEK52-HNA0-K02	1037370	Singleturn
SEL52-HNA0-K02	1037373	Multiturn

16 sine/ cosine periods

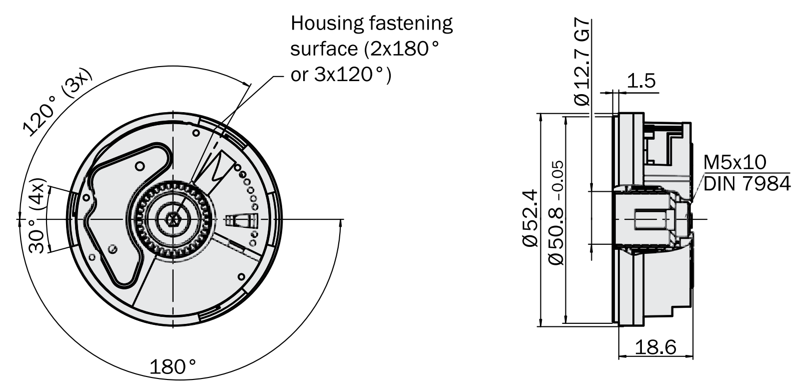
Motor Feedback Systems

- 16 sine/cosine periods per revolution
- 4,096 revolutions measurable (Multiturn)
- Programming of the positional value
- Electronic type label

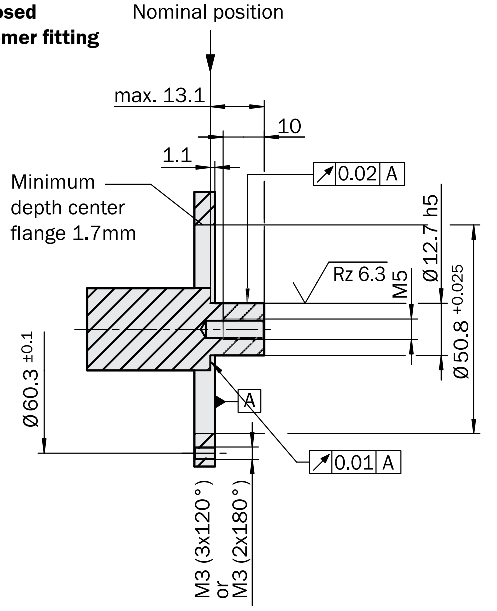
RoHS 2002/95/EC

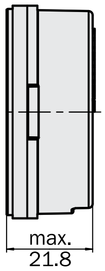
Accessories – see pages 410-448

Dimensional drawing SEK/SEL52 with shoulder clamping



Proposed customer fitting





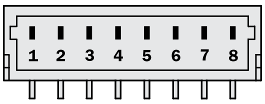
Dimensions with cover (see accessory order no. 2048234)

General tolerances according to DIN ISO 2768-mk

Pin and wire allocation

PIN	Signal	Color of wires	Explanation
1	U_S	red	Supply voltage 7 ... 12 V
2	+ SIN	white	Process data channel
3	REFSIN	brown	Process data channel
4	+ COS	pink	Process data channel
5	REFCOS	black	Process data channel
6	GND	blue	Ground connection
7	Data +	grey or yellow	RS485-parameter channel
8	Data –	green or purple	RS485-parameter channel

The GND-(0V) connection of the supply voltage has no connection to the housing.



Technical Data DIN 32878		Shoulder clamping SEK/SEL52	SEK	SEL
Number of sine/cosine periods per revolution		16	■	■
Number of the absolute ascertainable revolutions	Single SEK	1	■	
	Multi SEL	4,096		■
Dimensions		mm (see dimensional drawing)	■	■
Mass		0.04 kg	■	■
Mass with cover [1]		0.07 kg	■	■
Moment of inertia to the rotor		6 gcm^2	■	■
Code type for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" (see dimensional drawing)		Increasing	■	■
Measurement step at interpolation of the sine/cosine signals with e. g. 12 bits		20 angular seconds	■	■
Error limits for evaluating the sine/cosine signals				
integral non-linearity		± 288 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 72 angular seconds [2]	■	■
Working speed up to which the absolute position can be reliably produced		6,000 min^{-1}	■	■
Max. Operating speed	Single SEK	12,000 min^{-1}	■	
	Multi SEL	10,000 min^{-1}		■
Max. angular acceleration		5×10^5 rad/s^2	■	■
Permissible shaft movement				
axial		± 0.5 mm	■	■
radial		± 0.15 mm	■	■
Working temperature range	Single SEK	–40 ... +115 °C	■	
	Multi SEL	–20 ... +115 °C		■
Storage temperature range [3]		–50 ... +125 °C	■	■
Permissible relative humidity		90 % [4]	■	■
Resistance				
To shocks [3]		100 g/10 ms	■	■
To vibration [4]		50 g/10 ... 2000 Hz	■	■
Protection class to IEC 60529 [5]		IP 40	■	■
EMC [6]			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		< 50 mA	■	■
Available memory area				
within EEPROM 2048 [7]		1,792 bytes	■	■
Interface signals				
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential	■	■
Parameter channel = RS 485		Digital	■	■

[1] Accessory part no. 2048234

[2] At nominal position ± 0.1 mm

[3] Without packaging

[4] Condensation not permitted

[5] To EN 60068-2-27

[6] To EN 60068-2-6

[7] With mating connector inserted and closed cover

[8] 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 and by using the cover (see accessory part no. 2048234).
Users must perform their own tests when other screen designs are used.

[9] 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

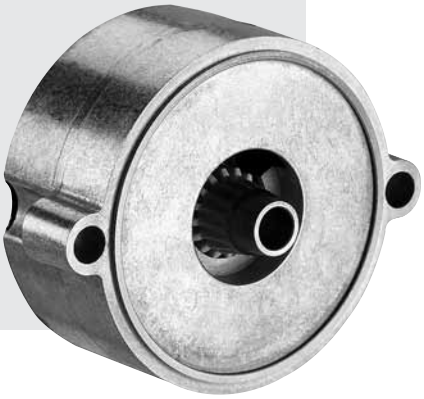
SEK/SEL52 with shoulder clamping

Type	**Part no.**	**Description**
SEK52-H1A0-K02	1037369	Singleturn
SEL52-H1A0-K02	1037372	Multiturn

16 sine/ cosine periods

Motor Feedback Systems

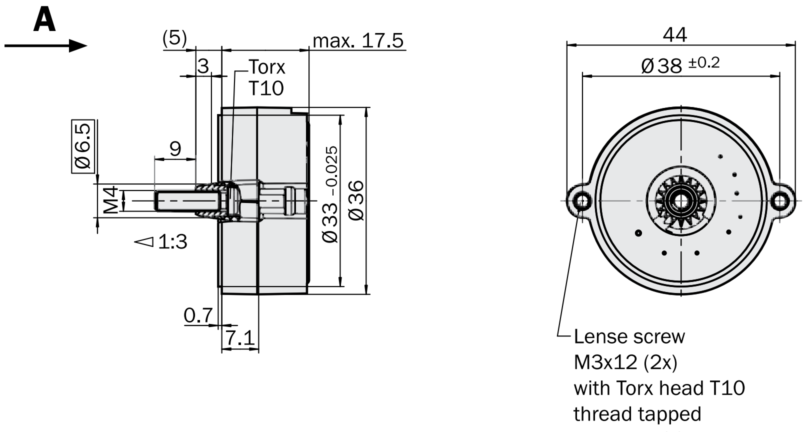
- 16 sine/cosine periods per revolution
- 4,096 revolutions measurable (Multiturn)
- Programming of the positional value
- Electronic type label



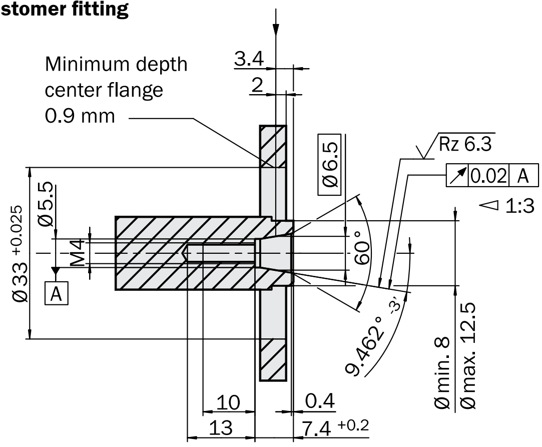
RoHS
2002/95/EC

Accessories – see pages 410-448

Dimensional drawing SEK/SEL37 radial connector


A
(5)
max. 17.5
3
Torx T10
Ø6.5
9
M4
◁1:3
Ø33 -0.025
Ø36
0.7
7.1
44
Ø38 ±0.2
Lense screw M3x12 (2x) with Torx head T10 thread tapped to DIN 7500

Proposed customer fitting

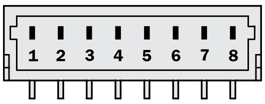


General tolerances according to DIN ISO 2768-mk

Pin and wire allocation

PIN	Signal	Color of wires	Explanation
1	U_S	red	Supply voltage 7 ... 12 V
2	+ SIN	white	Process data channel
3	REFSIN	brown	Process data channel
4	+ COS	pink	Process data channel
5	REFCOS	black	Process data channel
6	GND	blue	Ground connection
7	Data +	grey or yellow	RS485-parameter channel
8	Data –	green or purple	RS485-parameter channel

The GND-(0V) connection of the supply voltage has no connection to the housing.



Technical Data DIN 32878		SEK/SEL37 radial connector	SEK	SEL
Number of sine/cosine periods per revolution		16	■	■
Number of the absolute ascertainable revolutions	Single SEK	1	■	
	Multi SEL	4,096		■
Dimensions		mm (see dimensional drawing)	■	■
Mass		0.04 kg	■	■
Moment of inertia to the rotor		1 gcm^2	■	■
Code type for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" (see dimensional drawing)		Increasing	■	■
Measurement step at interpolation of the sine/cosine signals with e. g. 12 bits		20 angular seconds	■	■
Error limits for evaluating the sine/cosine signals				
integral non-linearity		± 288 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 144 angular seconds [1]	■	■
Working speed up to which the absolute position can be reliably produced		6,000 min^{-1}	■	■
Max. Operating speed	Single SEK and Multi SEL	12,000 min^{-1}	■	■
Max. angular acceleration		5 x 10^5 rad/s^2	■	■
Permissible shaft movement				
axial		± 0.3 mm	■	■
radial		± 0.15 mm	■	■
Working temperature range	Single SEK	–40 ... +115 °C	■	
	Multi SEL	–20 ... +115 °C		■
Storage temperature range [2]		–50 ... +125 °C	■	■
Permissible relative humidity		90 % [3]	■	■
Resistance				
To shocks [4]		100 g/10 ms	■	■
To vibration [5]		50 g/10 ... 2000 Hz	■	■
Protection class to IEC 60529 [6]		IP 20	■	■
EMC [7]			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		< 50 mA	■	■
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] At nominal position ± 0.1 mm

[2] Without packaging

[3] Condensation not permitted

[4] To EN 60068-2-27

[5] To EN 60068-2-6

[6] With mating connector inserted and closed cover

[7] 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.

[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

SEK/SEL37 radial connector

Type	Part no.	Description
SEK37-HFB0-K02	1037378	Singleturn
SEL37-HFB0-K02	1037379	Multiturn

Motor Feedback Systems with HIPERFACE® SEK37/SEL37, Axial Connector

16 sine/ cosine periods

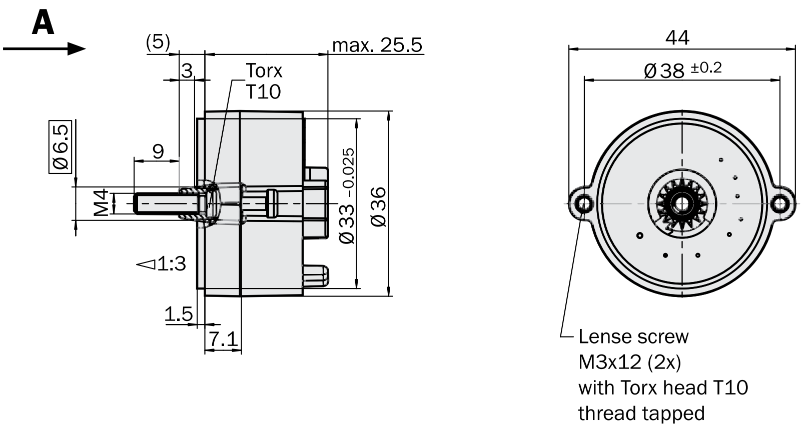
Motor Feedback Systems

- 16 sine/cosine periods per revolution
- 4,096 revolutions measurable (Multiturn)
- Programming of the positional value
- Electronic type label

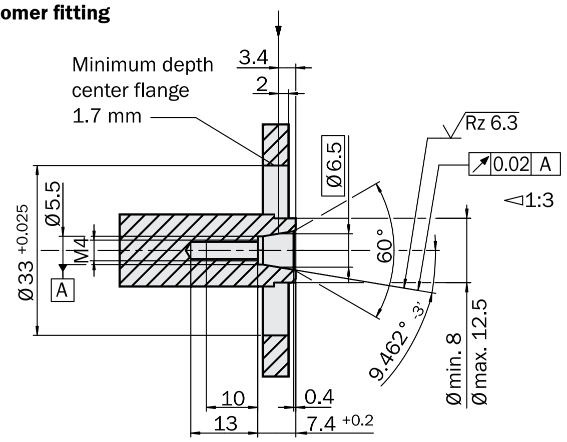
RoHS
2002/95/EC

Accessories – see pages 410-448

Dimensional drawing SEK/SEL37 axial connector



Proposed customer fitting

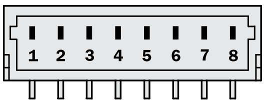


General tolerances according to DIN ISO 2768-mk

Pin and wire allocation

PIN	Signal	Color of wires	Explanation
1	U_S	red	Supply voltage 7 ... 12 V
2	+ SIN	white	Process data channel
3	REFSIN	brown	Process data channel
4	+ COS	pink	Process data channel
5	REFCOS	black	Process data channel
6	GND	blue	Ground connection
7	Data +	grey or yellow	RS485-parameter channel
8	Data –	green or purple	RS485-parameter channel

The GND-(0V) connection of the supply voltage has no connection to the housing.



Technical Data DIN 32878		SEK/SEL37 axial connector	SEK	SEL
Number of sine/cosine periods per revolution		16	■	■
Number of the absolute ascertainable revolutions	Single SEK	1	■	
	Multi SEL	4,096		■
Dimensions		mm (see dimensional drawing)	■	■
Mass		0.05 kg	■	■
Moment of inertia to the rotor		1 gcm^2	■	■
Code type for the absolute value		Binary	■	■
Code sequence for clockwise shaft rotation, looking in direction "A" (see dimensional drawing)		Increasing	■	■
Measurement step at interpolation of the sine/cosine signals with e. g. 12 bits		20 angular seconds	■	■
Error limits for evaluating the sine/cosine signals				
integral non-linearity		± 288 angular seconds	■	■
Non-linearity within a sine/cosine period				
differential non-linearity		± 144 angular seconds [1]	■	■
Working speed up to which the absolute position can be reliably produced		6,000 min^{-1}	■	■
Max. Operating speed Single SEK and Multi SEL		12,000 min^{-1}	■	■
Max. angular acceleration		5 x 10^5 rad/s^2	■	■
Permissible shaft movement				
axial		± 0.3 mm	■	■
radial		± 0.15 mm	■	■
Working temperature range	Single SEK	–40 ... +115 °C	■	
	Multi SEL	–20 ... +115 °C		■
Storage temperature range [2]		–50 ... +125 °C	■	■
Permissible relative humidity		90 % [3]	■	■
Resistance				
To shocks [4]		100 g/10 ms	■	■
To vibration [5]		50 g/10 ... 2000 Hz	■	■
Protection class to IEC 60529 [6]		IP 40	■	■
EMC [7]			■	■
Operating voltage range		7 ... 12 V	■	■
Recommended supply voltage		8 V	■	■
Max. operating current, no load		< 50 mA	■	■
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] At nominal position ± 0.1 mm

[2] Without packaging

[3] Condensation not permitted

[4] To EN 60068-2-27

[5] To EN 60068-2-6

[6] With mating connector inserted and closed cover

[7] 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.

[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.

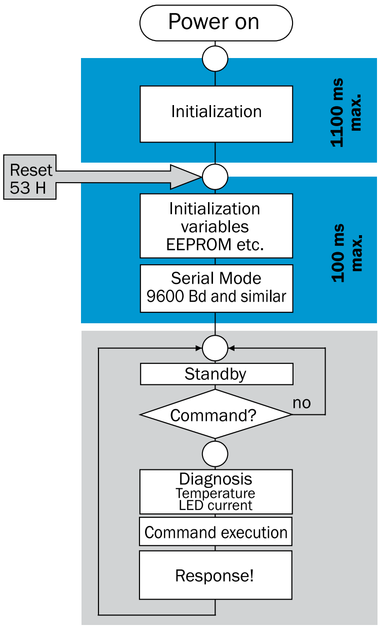
Ordering information

SEK/SEL37 axial connector

Type	**Part no.**	**Description**
SEK37-HFA0-K02	1037376	Singleturn
SEL37-HFA0-K02	1037377	Multiturn

HIPERFACE®
by SICK | STEGMANN

HIPERFACE® Starting time


Power on
Initialization
1100 ms max.
Reset 53 H
Initialization variables EEPROM etc.
Serial Mode 9600 Bd and similar
100 ms max.
Standby
Command?
no
Diagnosis Temperature LED current
Command execution
Response!

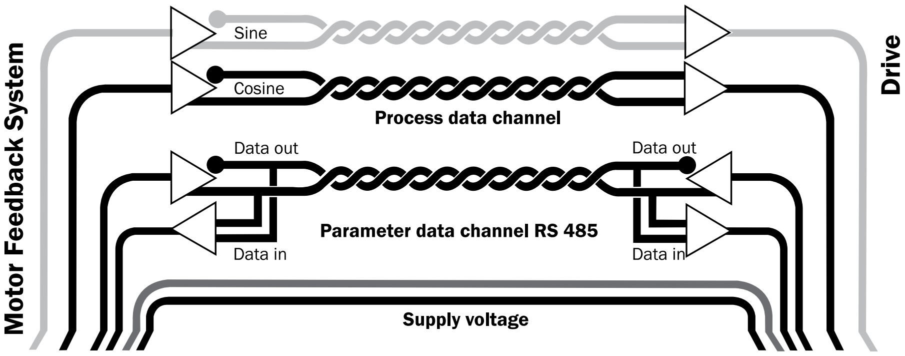
CAUTION:
No **RS485 communication**
is possible during the
phases highlighted in blue

Accessories – see pages 410-448

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

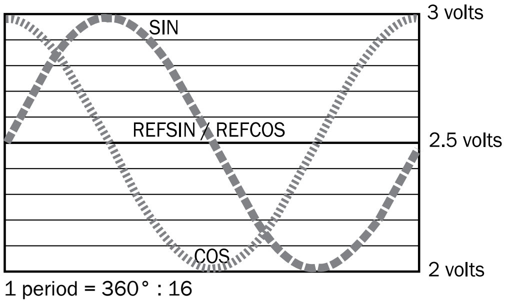
Electrical interface

- **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

Signal diagram for clockwise rotation of the shaft, looking in direction "A"



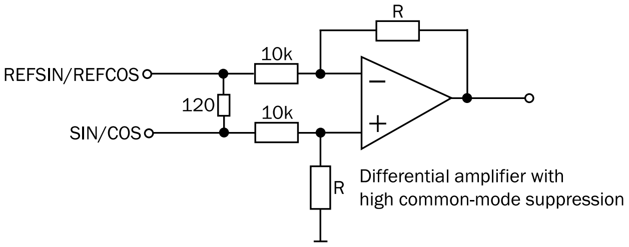
Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always "online". When the supply voltage is applied, the speed controller has access to this information at any time.

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	0.8 ... 1.2 V
Signal offset REFSIN, REFCOS	2.2 ... 2.8 V

Recommended receiver circuit for sine and cosine signals



HIPERFACE®
by SICK | STEGMANN

Type-specific settings	SEK37/SEK52	SEL37/SEL52
Type ID (command 52h)	42h	47h
Free EEPROM [bytes]	1,792	1,792
Address	40h	40h
Mode_485 [1] [2]	E4h	E4h
Codes 0 ... 3	55h	55h
Counter	0	0

Overview of commands supported			SEK37/SEK52	SEL37/SEL52
Command byte	**Function**	**Code 0 [3]**	**Comments**	**Comments**
42h	Read position (5 bits per sine/cosine period)		9 bits	21 bits
43h	Set position	•		
44h	Read analogue value		Channel number F0h [4] and 48h	Channel number F0h [4] and 48h
			Temperature [°C]	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 = 42h	Encoder type = 47h
53h	Encoder reset			
55h	Allocate encoder address	•		
56h	Read serial number and program version			

Overview of status messages				
Error type	**Status code**	**Description**	**SEK37/52**	**SEL37/52**
	00h	The encoder has recognised no error	•	•
Initialization	01h	Faulty compensating data	•	•
	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	07h	Encoder reset occurred as a result of program monitoring	•	•
	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	•	•
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	1Fh	Speed too high, no position formation possible	•	•
	20h	Singleturn position unreliable	•	•
	21h	Positional error Multiturn		•
	22h	Positional error Multiturn		•
	23h	Positional error Multiturn		•
Other	1Ch	Monitoring the value of the analogue signals (process data)	•	•
	1Eh	Encoder temperature critical	•	•
	08h	Counter overflow	•	•

[1] The baud rate 9600 is set by default. Other baud rates cannot be selected.

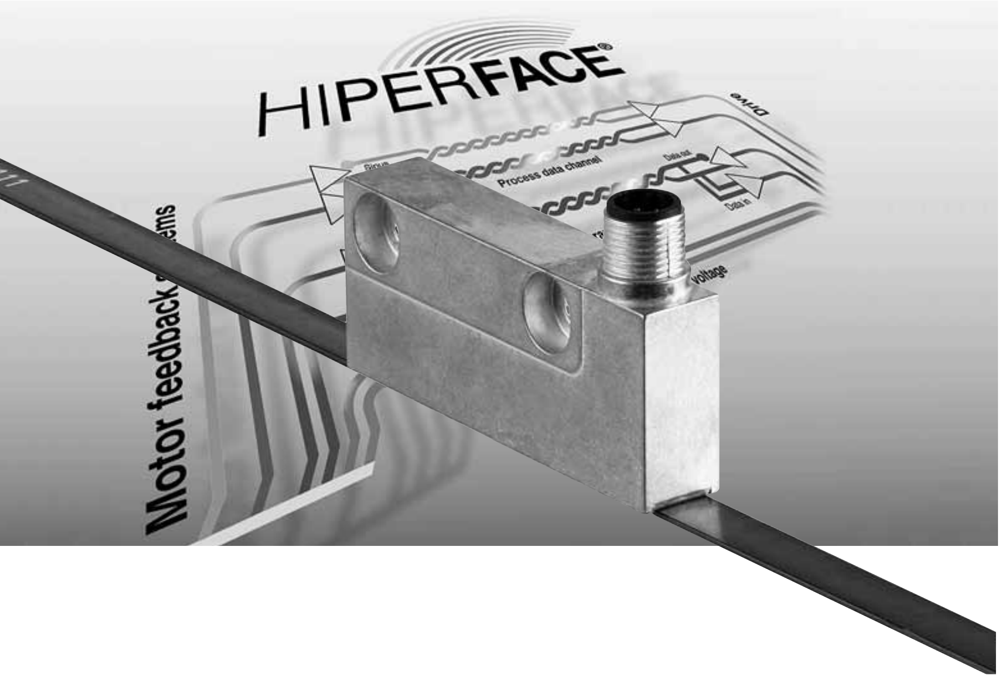
[2] When using the motor feedback systems SEK|SEL37 and SEK|SEL52, please ensure that the controller's auto-baud function is not enabled, since these motor feedback systems compensate for minor variations when transmitting at a baud rate of 9600.

[3] 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.

[4] Temperature compatible with SCx (encoder temperature [°C] *2.048 – 40)

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

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



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.

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).

Period length
1 mm

Linear Motor Feedback Systems

HIPERFACE®
by SICK | STEGMANN

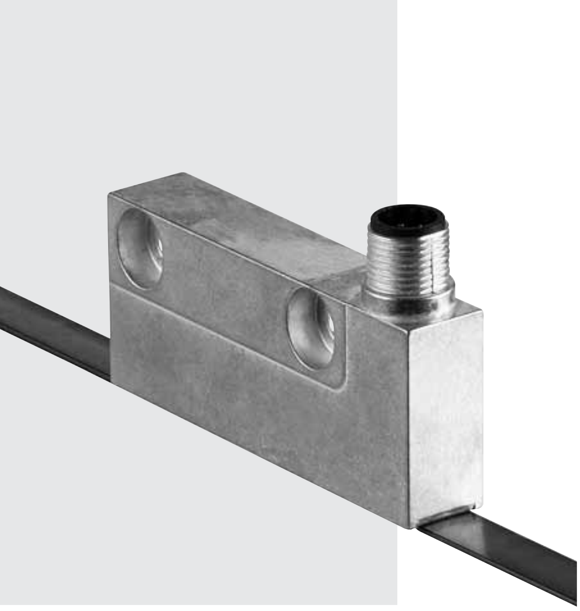
RoHS
2002/95/EC

CE

Period length 1 mm

Linear Motor Feedback Systems

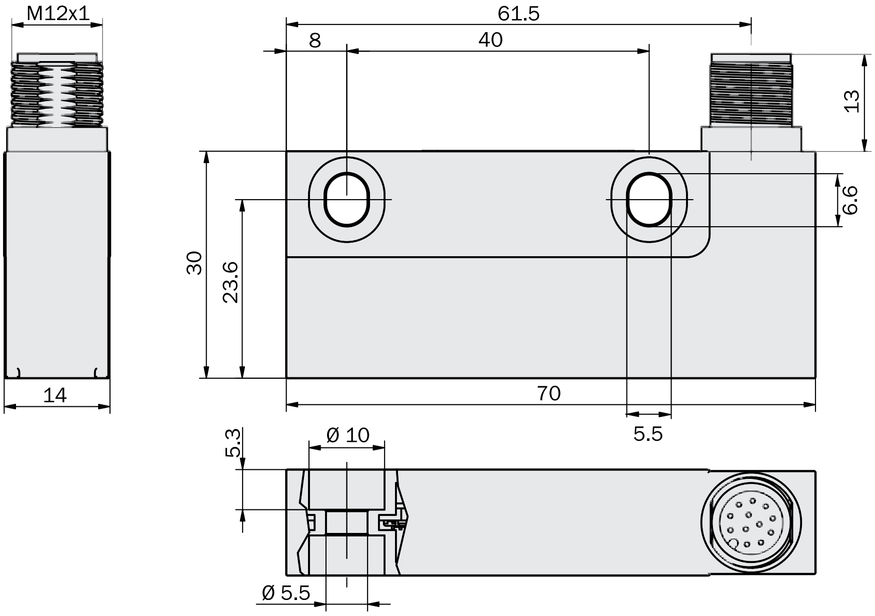
- Measurement length up to 4 m
- Non-contact length measuring system, wear-free
- Absolute position determination, no reference run
- Length-independent position sensing time
- Electronically adjustable Protection class up to IP 65

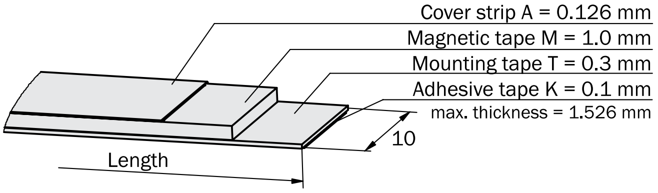


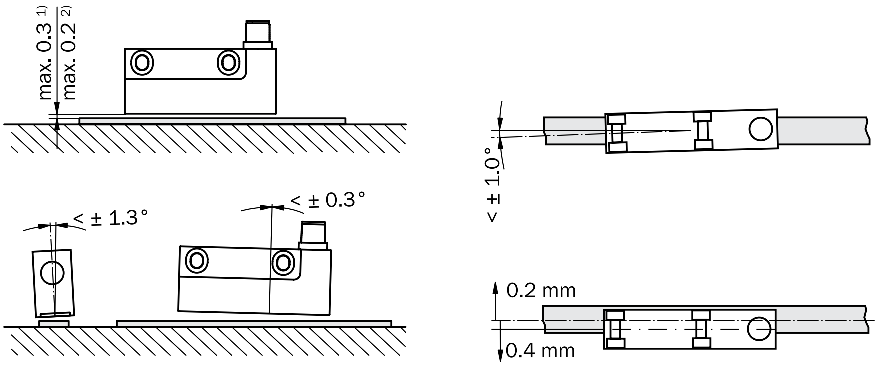
RoHS 2002/95/EC

Accessories – see pages 410-448

Dimensions and positional tolerances





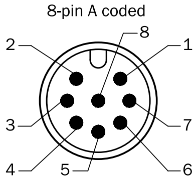


[1] Without strip band

[2] With band

General tolerances according to DIN ISO 2768-mk

PIN and wire allocation



View of the plug-in face

PIN	Color 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

7028241 / 2010-02-01
Subject to change without notice

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 of the sensor to the magnetic tape		
without cover strip		0.3 mm
with cover strip		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 absolute 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
Working temperature range		–30 ... +85 °C
Storage temperature range		–40 ... +100 °C (without packaging)
Permissible relative humidity		100 % (condensation permitted)
Temperature coefficient magnetic tape		(11 ± 1) x 10^{-6}/K
Maximum permitted ambient field strength to guarantee compliance		
with the quoted accuracy values [1]		< 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 to EN 60068-2-27		30 g/6 ms
to vibration to EN 60068-2-6		20 g/10 ... 2,000 Hz
Protection class to IEC 60529 [2]		IP 65
EMC [3]		
Operating voltage range		7 ... 12 V
Recommended supply voltage		8 V
Max. operating current, no load		< 55 mA [4]
Available memory area		
within EEPROM 2048 [5]		1,792 bytes
Interface signals		
Process data channel = SIN, REFSIN, COS, REFCOS		Analogue, differential
Parameter channel = RS 485		Digital

[1] 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.

[2] With mating plug mounted

[3] 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.
The GND (0V) connection of the supply voltage is also connected to earth there.
Users must perform their own tests when other screen designs are used.

[4] 100 mA approx. during adjustment

[5] 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.

① **Magnetic tape** Working temperature range –20 ... +70 °C
Storage temperature range –30 ... +85 °C

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. ①

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

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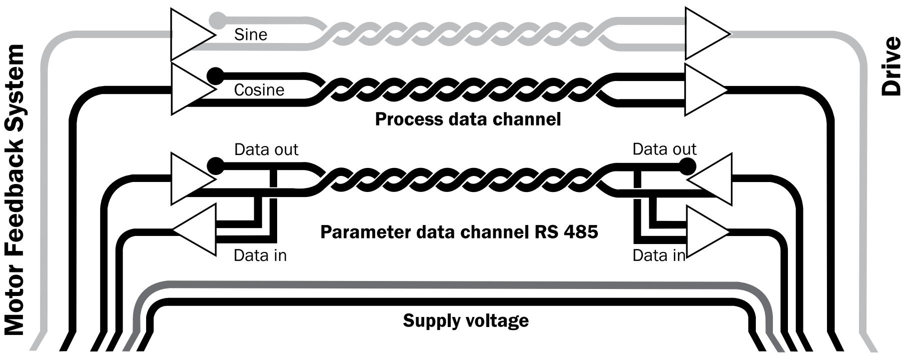
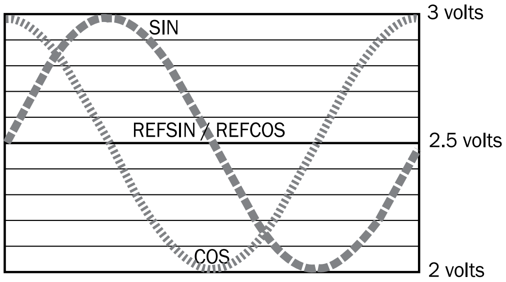
Electrical interface

- 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



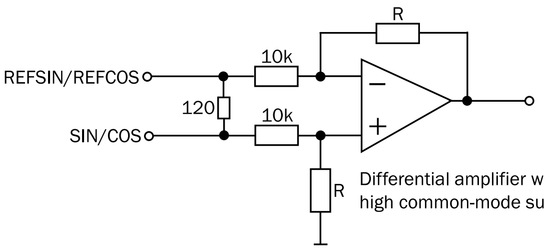
Access to the process data used for speed control, i.e. to the sine and cosine signals, is practically always "online". When the supply voltage is applied, the speed controller has access to this information at any time.

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

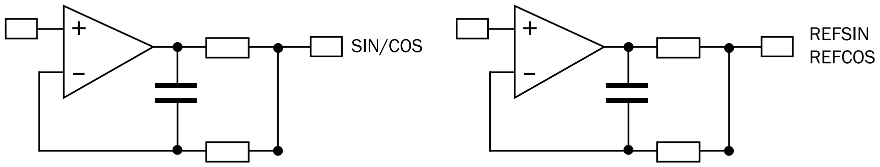
Signal	Value/Units
Signal peak, peak V_{SS} of SIN, COS	0.9 ... 1.1 V
Signal offset REFSIN, REFCOS	2.2 ... 2.8 V

Recommended receiver circuit for sine and cosine signals



Differential amplifier with
high common-mode suppression

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) *	●	

Overview of status messages			
Error type	**Status code**	**Description**	**TTK70**
	00h	The encoder has recognized no error	●
Initialisation	01h	Adjustment data faulty	●
	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	●
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	●
Other	1Ch	Monitoring the value of the analogue signals (process data)	●
	1Eh	Encoder temperature critical	●
	08h	Counter overflow	●

[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.

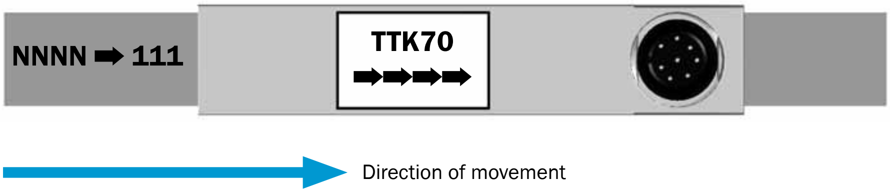
Further informations to the interface see HIPERFACE®-description part no. 8010701

Sensor adjustment 6Bh

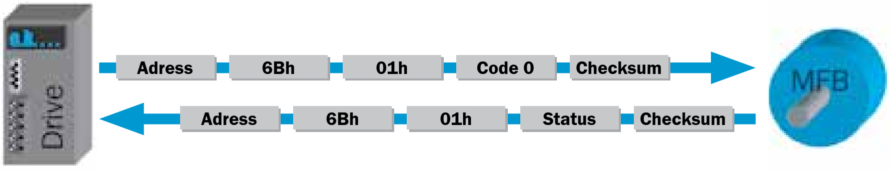
For the linear sensor TTK70 it is mandatory, prior to initial commissioning, to perform an adjustment run (calibration) in order to calibrate the sensor to the magnetic tape.

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:



Starting the sensor adjustment

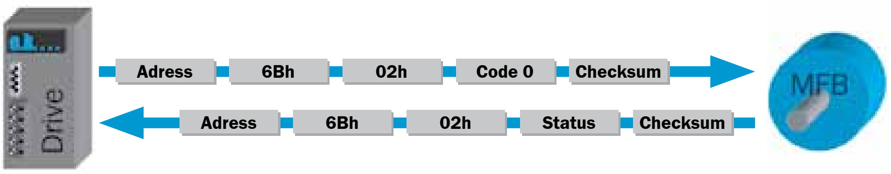


The adjustment is **not** started when the following error conditions exist:

- 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)

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.

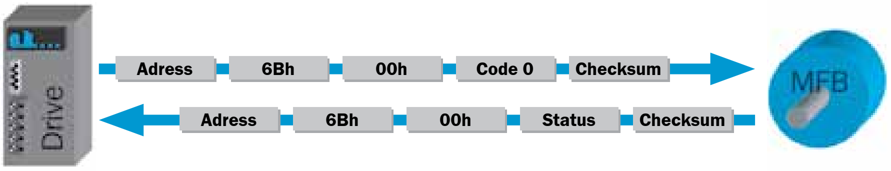
If faulty analogue values are detected during the incremental adjustment, the adjustment is aborted with an error message (ANALOG_RANGE_CHECK, 1Ch). In this situation, the sensor no longer operates correctly, and a position value cannot be calculated!

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.

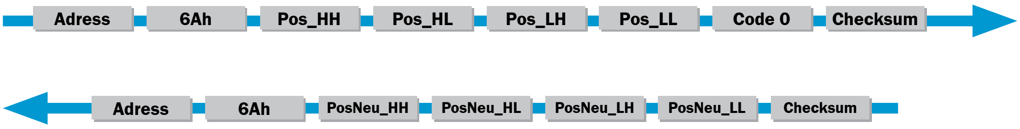


For a successfully executed adjustment, the status byte returns a value which specifies the number of adjustments performed so far. By saving the determined values in the EEPROM, the command execution time is approximately 12 ms. Immediately afterwards, the absolute position can be accessed.

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.

Set position with internal synchronization 6 Ah

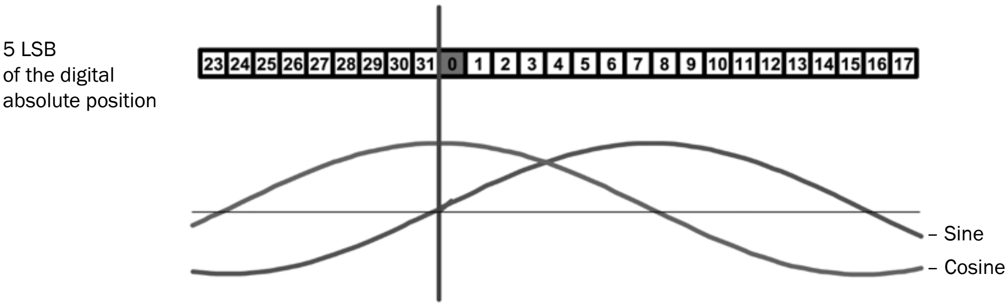


With this command, the encoder position is set such that the required position value points to the beginning of a period of the SIN signal. This is achieved by not changing, in contrast to the command “Set position” (43h), the lower 5 bits of the position value, as these are responsible for the interpolation 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.

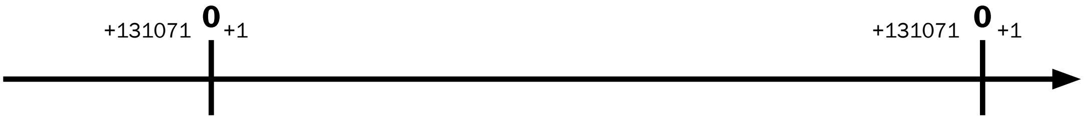
The following events trigger an error message:

- 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)



Codificatiion magnetic tape

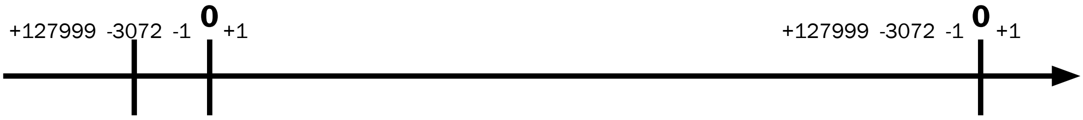
The absolute coding of the magnetic tape allows a max. measuring range of 4095.999mm. As the resolution of the position data is 1/32 mm, the resulting numeric value for the maximum measuring range is 131072.



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.

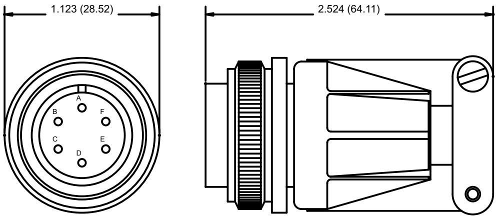
Accessories

Accessories

Screw-in system MS 6-pin for DRS20/DRS21, DRS25/DRS26, DGS21/DGS22, DGS35/DGS34, DGS20, DGS25

Cable connector MS3105 female, 6-pin, straight

Type	Part no.	Contacts
DOS-MS06-G	7102136	6



DOS-MS06-G

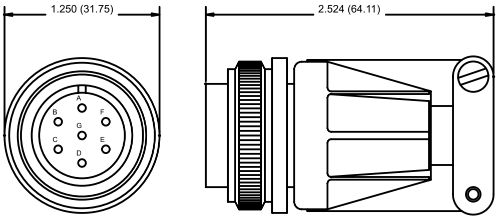
Connector MS3105 female, 6-pin, straight, cable 11-core, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm^2 with screening, cable diameter 7.5 mm

Type	Part no.	Contacts	Cable length
DOL-MS06-G1M5MA2	7102137	6	1.5 m
DOL-MS06-G03MMA2	7102138	6	3.0 m
DOL-MS06-G05MMA2	7102139	6	5.0 m
DOL-MS06-G10MMA2	7102140	6	10.0 m
DOL-MS06-G20MMA2	7102141	6	20.0 m
DOL-MS06-G30MMA2	7102142	6	30.0 m

Screw-in system MS 7-pin for DGS20, DGS25, DGS21/DGS22, DGS35/DGS34, DRS20/DRS21 and DRS25/DRS26

Cable connector MS3105 female, 7-pin, straight

Type	Part no.	Contacts
DOS-MS07-G	7102143	7



DOS-MS07-G

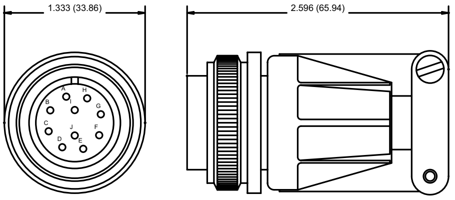
Connector M23 female, 7-pin, straight, cable 7-core, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2 with screening, capable of being dragged, cable diameter 7.5 mm

Type	Part no.	Contacts	Cable length
DOL-MS07-G1M5MA2	7102144	7	1.5 m
DOL-MS07-G03MMA2	7102145	7	3.0 m
DOL-MS07-G05MMA2	7102146	7	5.0 m
DOL-MS07-G10MMA2	7102147	7	10.0 m
DOL-MS07-G20MMA2	7102148	7	20.0 m
DOL-MS07-G30MMA2	7102149	7	30.0 m

Screw-in system MS 10-pin for DRS20/DRS21, DRS25/DRS26, DGS20, DGS25, DGS21/DGS22, DGS35/DGS34, SRS50/SRM50

Female Connector MS 3105, 10-pin, straight

Type	Part no.	Contacts
DOS-MS10-G	7102129	10



DOS-MS10-G

Connector MS3105 female, 10-pin, straight, cable 11-core, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm^2 with screening, cable diameter 7.5 mm

Type	Part no.	Contacts	Cable length
DOL-MS10-G1M5MA2	7102130	10	1.5 m
DOL-MS10-G03MMA2	7102131	10	3.0 m
DOL-MS10-G05MMA2	7102132	10	5.0 m
DOL-MS10-G10MMA2	7102133	10	10.0 m
DOL-MS10-G20MMA2	7102134	10	20.0 m
DOL-MS10-G30MMA2	7102135	10	30.0 m

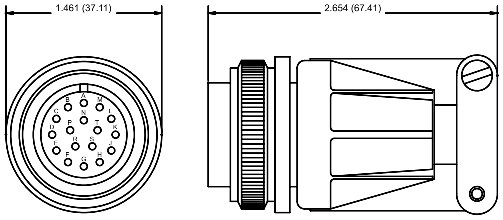
Cable and connector assembly MS/10, 10-pin, straight, cable 8-core

Type	Part no.	Cable length
DOL-MS10-G1M5MA3	7102160	1.5 m
DOL-MS10-G03MMA3	7102161	3.0 m
DOL-MS10-G05MMA3	7102162	5.0 m
DOL-MS10-G10MMA3	7102163	10.0 m
DOL-MS10-G20MMA3	7102164	20.0 m
DOL-MS10-G30MMA3	7102165	30.0 m

Screw-in system MS 17-pin for ARS20 and ARS25

Female connector MS 3106, 17-pin, straight

Type	Part no.	Contacts
DOS-MS17-G	7102122	17



DOS-MS17-G

Female connector MS 3106, 17-pin, straight, cable 22-core, 20 x 2 x 0.14 + 2 x 0.5 mm^2 with screening, capable of being dragged, cable diameter 7.8 mm

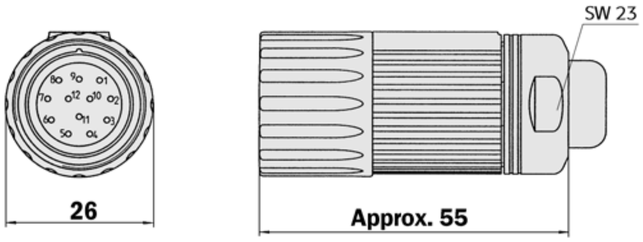
Type	Part no.	Contacts	Cable length
DOL-MS17-G1M5MA2	7102123	17	1.5 m
DOL-MS17-G03MMA2	7102124	17	3.0 m
DOL-MS17-G05MMA2	7102125	17	5.0 m
DOL-MS17-G10MMA2	7102126	17	10.0 m
DOL-MS17-G20MMA2	7102127	17	20.0 m
DOL-MS17-G30MMA2	7102128	17	30.0 m

Dimensional drawings and ordering information

Screw-in system M23, 12-pin for DFS60 encoders

Cable connector M23 female, 12-pin, straight, screened

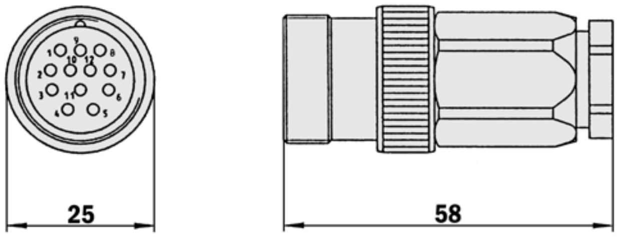
Type	Part no.	Contacts
DOS-2312-G	6027538	12



General tolerances according to DIN ISO 2768-mk

Cable connector M23 male, 12-pin, straight, screened

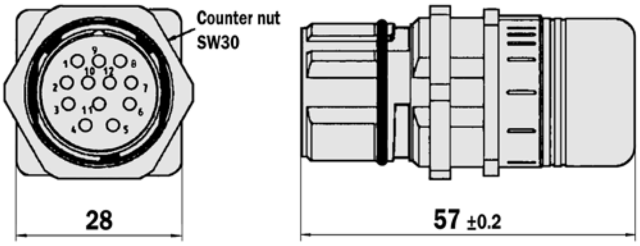
Type	Part no.	Contacts
STE-2312-G	6027537	12



General tolerances according to DIN ISO 2768-mk

Cable connector M23 male, 12-pin, straight, screened, for rear panel installation

Type	Part no.	Contacts
STE-2312-GX	6028548	12



General tolerances according to DIN ISO 2768-mk

Cable connector M23 female, 12-pin, straight, cable 11-core, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm^2 with screening, cable diameter 7.8 mm

Type	Part no.	Contacts	Cable length
DOL-2312-G02MLA3	2030682	12	2.0 m
DOL-2312-G07MLA3	2030685	12	7.0 m
DOL-2312-G10MLA3	2030688	12	10.0 m
DOL-2312-G15MLA3	2030692	12	15.0 m
DOL-2312-G20MLA3	2030695	12	20.0 m
DOL-2312-G25MLA3	2030699	12	25.0 m
DOL-2312-G30MLA3	2030702	12	30.0 m

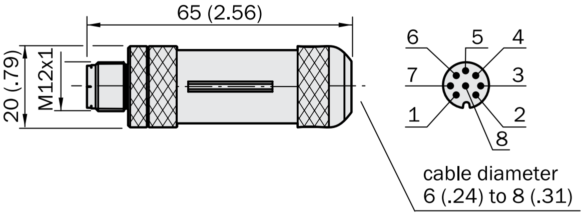
Cable connector M23 female, 12-pin, straight, cable 11-core, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2 with screening, capable of beeing dragged, cable diameter 7.8 mm

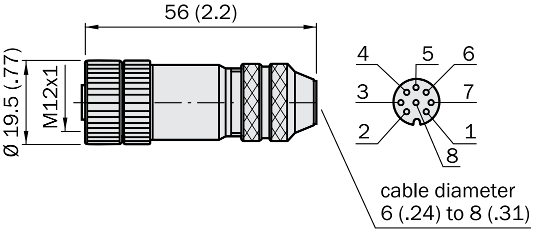
Type	Part no.	Contacts	Cable length
DOL-2312-G1M5MA3	2029212	12	1.5 m
DOL-2312-G03MMA3	2029213	12	3.0 m
DOL-2312-G05MMA3	2029214	12	5.0 m
DOL-2312-G10MMA3	2029215	12	10.0 m
DOL-2312-G20MMA3	2029216	12	20.0 m
DOL-2312-G30MMA3	2029217	12	30.0 m

Round screw system M12 DDS, TTK

Male connector M12, 8-pin, straight, screened, for field assembly		
Type	**Part no.**	**Contacts/cable diameter**
STE-1208-GA	6028370	8/4 to 8 mm

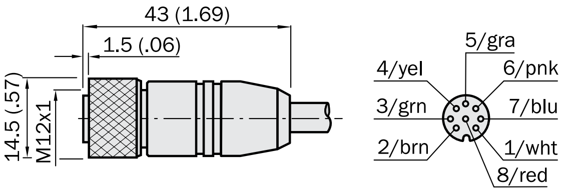
Female connector M12, 8-pin, straight, screened, for field assembly		
Type	**Part no.**	**Contacts/cable diameter**
DOS-1208-GA	6028369	8/4 to 8 mm





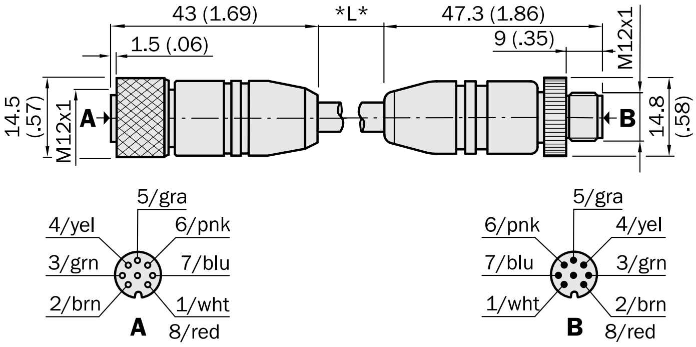
Part-assembled cables DDS, TTK

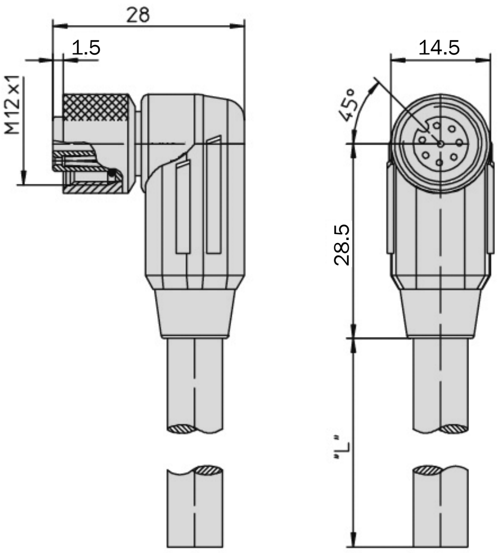
Female connector M12, 8-pin, straight, pre-wired with cable 8-wire, 4 x 2 x 0.25 mm², screened, suitable for use in a drag chain (adapter side)			
Type	**Part no.**	**Contacts**	**Cable length**
DOL-1208-G02MAC1	6032866	8	2.0 m
DOL-1208-G05MAC1	6032867	8	5.0 m
DOL-1208-G10MAC1	6032868	8	10.0 m
DOL-1208-G20MAC1	6032869	8	20.0 m



Connection cable: encoder to interface adapter module

Interconnection with male connector M12 (adapter side) and female connector M12 (encoder side), 8-pin, straight, pre-wired with cable, 8 cores, 4 x 2 x 0.25 mm², screened, suitable for use in a drag chain			
Type	**Part no.**	**Contacts**	**Cable length *L***
DSL-1208-G05MAC1	6032913	8	5.0 m



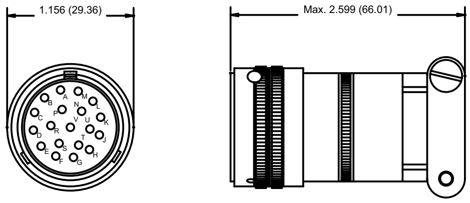


Right angled M12, 8-pin female connector, pre-wired with cable			
8 cores, 4 x 2 x 0.25mm^2, screened, suitable for use in a drag chain (adapter side)			
Type	**Part no.**	**Cores**	**Cable length „L“**
DOL-1208-W02MAC1	6037724	8	2.0 m
DOL-1208-W05MAC1	6037725	8	5.0 m
DOL-1208-W10MAC1	6037726	8	10.0 m
DOL-1208-W20MAC1	6037727	8	20.0 m

Screw-in system MS 19-pin for ARS20 and ARS25

Female connector MS 3116, 19-pin, straight

Type	Part no.	Contacts
DOS-MS19-G	7102115	19



DOS-MS19-G

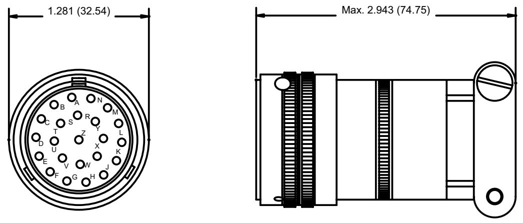
Female connector MS 3116, 19-pin, straight, cable 22-core, 20 x 2 x 0.14 + 2 x 0.5 mm^2 with screening, capable of being dragged, cable diameter 7.8 mm

Type	Part no.	Contacts	Cable length
DOL-MS19-G1M5MA2	7102116	19	1.5 m
DOL-MS19-G03MMA2	7102117	19	3.0 m
DOL-MS19-G05MMA2	7102118	19	5.0 m
DOL-MS19-G10MMA2	7102119	19	10.0 m
DOL-MS19-G20MMA2	7102120	19	20.0 m
DOL-MS19-G30MMA2	7102121	19	30.0 m

Screw-in system MS 23-pin for ARS20 and ARS25

Female connector MS3116, 23-pin, straight

Type	Part no.	Contacts
DOS-MS23-G	7102108	23



DOS-MS23-G

Female connector MS3116, 23-pin, straight, cable 22-core, 20 x 2 x 0.14 + 2 x 0.5 mm^2 with screening, capable of being dragged, cable diameter 7.8 mm

Type	Part no.	Contacts	Cable length
DOL-MS23-G1M5MA2	7102109	23	1.5 m
DOL-MS23-G03MMA2	7102110	23	3.0 m
DOL-MS23-G05MMA2	7102111	23	5.0 m
DOL-MS23-G10MMA2	7102112	23	10.0 m
DOL-MS23-G20MMA2	7102113	23	20.0 m
DOL-MS23-G30MMA2	7102114	23	30.0 m

Cables

Cable 8-core, per meter, 4 x 2 x 0.15 mm^2, with screening, cable diameter 5.6 mm

Type	Part no.	Wires
LTG-2308-MWENC	6027529	8

Cable 11-core, per meter, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm^2, with screening, cable diameter 7.5 mm

Type	Part no.	Wires
LTG-2411-MW	6027530	11

Cable 12-core, per meter, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2, with screening, capable of beeing dragged, cable diameter 7.8 mm

Type	Part no.	Wires
LTG-2512-MW	6027531	12

Cable 12-core, per meter, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2, with screening, capable of beeing dragged, cable diameter 7.8 mm

Type	Part no.	Wires	Explanation
LTG-2612-MW	6028516	12	UV and salt water resistant

Cable 8-core inc. sealing, 4 x 2 x 0.15 mm^2, with screening, cable diameter 5.6 mm, for DFS60 Encoders

Type	Part no.	Cable length
DOL-0J08-G0M5AA3	2046873	0.5 m
DOL-0J08-G1M5AA3	2046874	1.5 m
DOL-0J08-G03MAA3	2046875	3.0 m
DOL-0J08-G05MAA3	2046876	5.0 m
DOL-0J08-G10MAA3	2046877	10.0 m

Female connectors for AFS/AFM60 Encoders

Cable connector female JST inc. sealing, 8-core, 4 x 2 x 0.15 mm^2, with screening, cable diameter 5.6 mm

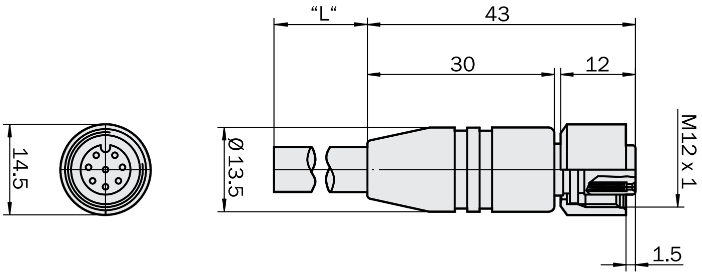
Type	Part no.	Cable length
DOL-0J08-G0M5AA6	2048589	0.5 m
DOL-0J08-G1M5AA6	2048590	1.5 m
DOL-0J08-G03MAA6	2048591	3.0 m
DOL-0J08-G05MAA6	2048593	5.0 m
DOL-0J08-G10MAA6	2048594	10.0 m

Cable connector female M23, 8-core, 4 x 2 x 0.15 mm^2, cable diameter 5.6 mm for AFS/AFM60

Type	Part no.	Cable length
DOL-2308-G0M5AA6	2048595	0.5 m
DOL-2308-G1M5AA6	2048596	1.5 m
DOL-2308-G03MAA6	2048597	3.0 m
DOL-2308-G05MAA6	2048598	5.0 m
DOL-2308-G10MAA6	2048599	10.0 m

Female connector M12, 8-pin, straight, pre-wired with cable 8-wire, 4 x 2 x 0.25 mm^2, screened, flexible (adapter side) for AFS/AFM60

Type	Part no.	Contacts	Cable length
DOL-1208-G02MAC1	6032866	8	2.0 m
DOL-1208-G05MAC1	6032867	8	5.0 m
DOL-1208-G10MAC1	6032868	8	10.0 m
DOL-1208-G20MAC1	6032869	8	20.0 m

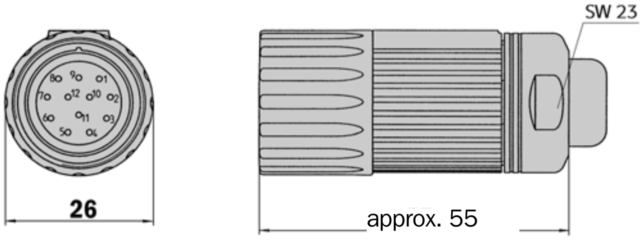


Screw-in system M23, 12-pin

For ATM60, ATM90, ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, DKV60, DKS40, KH53, HIPERFACE® Adaptor, PRF, BTF, BKS, PKS, L230, ARS20, ARS25, DFS/VFS

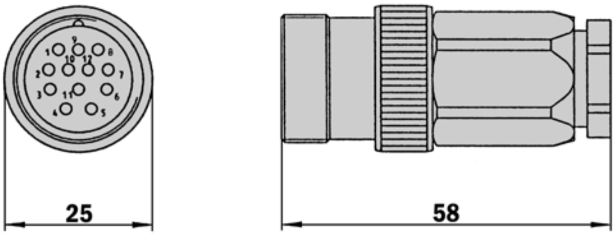
Connector M23 female, 12-pin, straight, screened

Type	Part no.	Contacts
DOS-2312-G	6027538	12



Connector M23 male, 12-pin, straight, screened

Type	Part no.	Contacts
STE-2312-G	6027537	12



Connector M23 Female, 12-pin, straight, cable 11-pin, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2 with screening, capable of being dragged, cable diameter 7.8 mm. For ARS20, ARS25, ARS60

Type	Part no.	Contacts	Cable length
DOL-2312-G1M5MA2	2029206	12	1.5 m
DOL-2312-G03MMA2	2029207	12	3.0 m
DOL-2312-G05MMA2	2029208	12	5.0 m
DOL-2312-G10MMA2	2029209	12	10.0 m
DOL-2312-G20MMA2	2029210	12	20.0 m
DOL-2312-G30MMA2	2029211	12	30.0 m

Connector M23 female, 12-pin, straight, cable 12-core, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2 screened, capable of being dragged, cable diameter 7.8 mm with SSI interface for ATM60, ATM90, KH53, BTF, BKS, L230

Type	Part no.	Contacts	Cable length
DOL-2312-G1M5MA1	2029200	12	1.5 m
DOL-2312-G03MMA1	2029201	12	3.0 m
DOL-2312-G05MMA1	2029202	12	5.0 m
DOL-2312-G10MMA1	2029203	12	10.0 m
DOL-2312-G20MMA1	2029204	12	20.0 m
DOL-2312-G30MMA1	2029205	12	30.0 m

Connector M23 female, 12-pin, straight, cable 12-core, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2 with screening, capable of being dragged, cable diameter 7.8 mm for DRS60/DRS61, DGS60, DGS65, DGS66, DKV60, DKS40, PRF, PKS, DFS/VFS

Type	Part no.	Contacts	Cable length
DOL-2312-G1M5MA3	2029212	12	1.5 m
DOL-2312-G03MMA3	2029213	12	3.0 m
DOL-2312-G05MMA3	2029214	12	5.0 m
DOL-2312-G10MMA3	2029215	12	10.0 m
DOL-2312-G20MMA3	2029216	12	20.0 m
DOL-2312-G30MMA3	2029217	12	30.0 m

Connector M23 female, 12-pin, straight, cable 11-core, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm^2 with screening, cable diameter 7.8 mm for DKV60, DKS40, PKS, DFS/VFS

Type	Part no.	Contacts	Cable length
DOL-2312-G02MLA3	2030682	12	2.0 m
DOL-2312-G07MLA3	2030685	12	7.0 m
DOL-2312-G10MLA3	2030688	12	10.0 m
DOL-2312-G15MLA3	2030692	12	15.0 m
DOL-2312-G20MLA3	2030695	12	20.0 m
DOL-2312-G25MLA3	2030699	12	25.0 m
DOL-2312-G30MLA3	2030702	12	30.0 m

Connector M23 female, 12-pin, straight, cable 11-core, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2 cable diameter 7.8 mm for wire draw encoder PKS with TTL interface

Type	Part no.	Contacts	Cable length
DOL-2312-G02MLA3	2030682	12	2.0 m
DOL-2312-G07MLA3	2030685	12	7.0 m
DOL-2312-G10MLA3	2030688	12	10.0 m
DOL-2312-G15MLA3	2030692	12	15.0 m
DOL-2312-G20MLA3	2030695	12	20.0 m
DOL-2312-G25MLA3	2030699	12	25.0 m
DOL-2312-G30MLA3	2030702	12	30.0 m

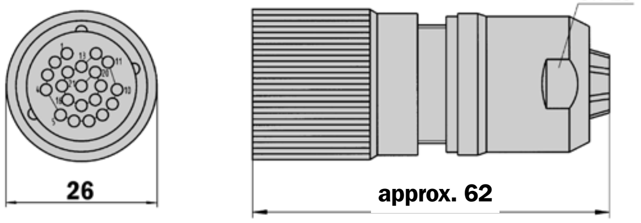
Cable connector M23 female, 12-pin, straight cable 12-core, screened, capable of being dragged, for read heads with HIPERFACE® interface for L230, SRS/SRM50, SRS64/SRM64

Type	Part no.	Contacts	Cable length
DOL-2308-G1M5JB2	2031069	12	1.5 m
DOL-2308-G03MJB2	2031070	12	3.0 m
DOL-2308-G05MJB2	2031071	12	5.0 m
DOL-2308-G10MJB2	2031072	12	10.0 m
DOL-2308-G15MJB2	2031073	12	15.0 m

Screw-in system M23, 21-pin for ARS60

Female connector M23, 21-pin, straight, screened, capable of being dragged

Type	Part no.	Contacts
DOS-2321-G	6027539	21



General tolerances according to DIN ISO 2768-mk

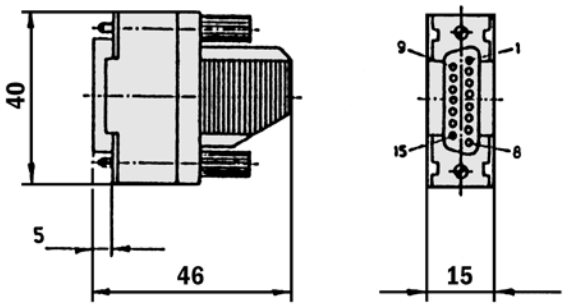
Female connector M23, 21-pin, cable 22-core, 20 x 0.14 + 2 x 0.5 mm^2 with screening, capable of being dragged, cable diameter 7.8 mm for ARS60

Type	Part no.	Contacts	Cable length
DOL-2321-G1M5PA4	2029218	21	1.5 m
DOL-2321-G03MPA4	2029219	21	3.0 m
DOL-2321-G05MPA4	2029220	21	5.0 m
DOL-2321-G10MPA4	2029221	21	10.0 m
DOL-2321-G20MPA4	2029222	21	20.0 m

Screw-in systems Sub-D for Adaptor modules

Male connector Sub-D, 15-pin, straight, screened
For ARS60, ATM60, ATM90, KH53, BTF, BKS

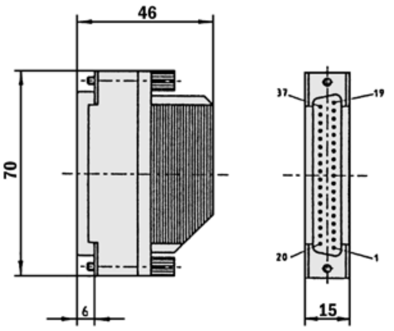
Type	Part no.	Contacts
STE-0D15-G	2029223	15



General tolerances according to DIN ISO 2768-mk

Female connector Sub-D, 37-pin, straight, screened
For ARS60, ATM60, ATM90, KH53, BTF, BKS

Type	Part no.	Contacts
DOS-0D37-G	2029224	37

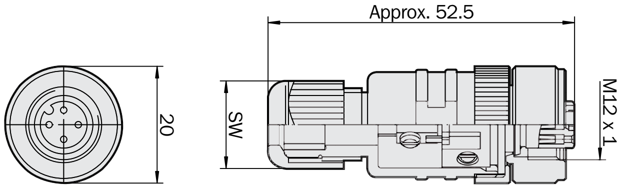


General tolerances according to DIN ISO 2768-mk

Round screw system M12 for the PROFIBUS connection (AD-HFPRLS4) for HIPERFACE® Adaptor

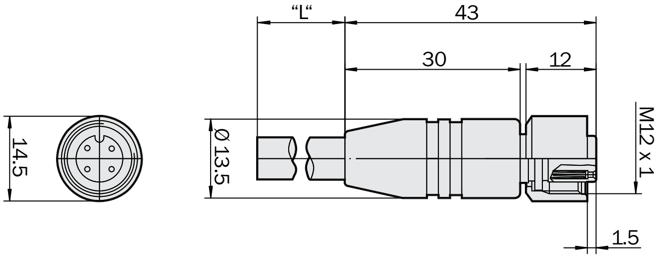
Field wireable female connector M12, 4-pin, straight, for field assembly, for operating voltage (adaptor side)

Type	Part no.	Contacts
DOS-1204-G	6007302	4



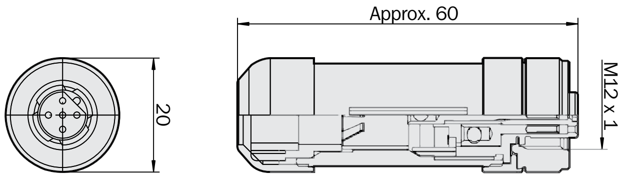
Female connection M12, 4-pin, straight, pre-wired with cable for operating voltage (adaptor side)

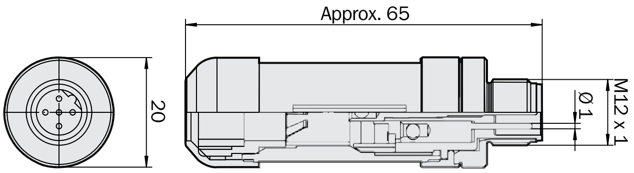
Type	Part no.	Description
DOL-1204-G05M	6009866	Cable 5 m, PVC



Field wireable female/male connector M12, 5-pin, straight, screened, for field assembly, for bus cable, B-coding (adaptor side)

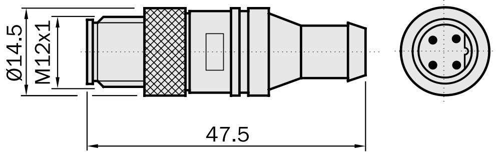
Type	Part no.	Description
PR-DOS-1205-G	6021353	PROFIBUS female connector
PR-STE-1205-G	6021354	PROFIBUS male connector





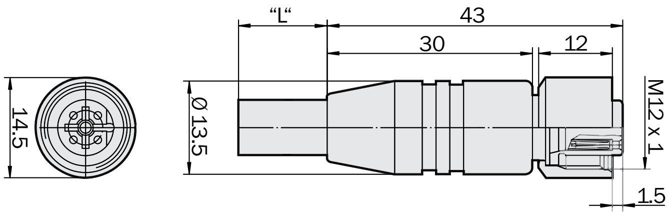
PROFIBUS terminating resistor

Type	Part no.	Description
PRE-STE-END	6021156	Connector, 4 contacts



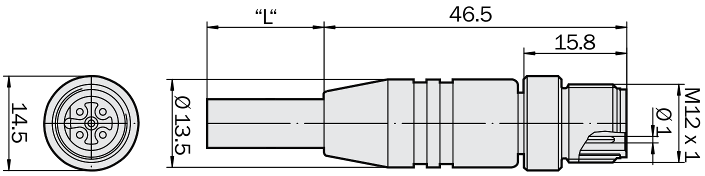
Female connector M12, 5-pin, straight, pre-wired with bus cable 2-wire, 2 x 0.22 mm², screened, B-coding (adaptor side)

Type	Part no.	Description
DOL-12PR-G05M	6026006	PROFIBUS cable 5 m
DOL-12PR-G10M	6026008	PROFIBUS cable 10 m



Male connector M12, 5-pin, straight, pre-wired with bus cable 2-wire, 2 x 0.22 mm², screened, B-coding (adaptor side)

Type	Part no.	Description
STL-12PR-G05M	6026005	PROFIBUS cable 5 m
STL-12PR-G10M	6026007	PROFIBUS cable 10 m



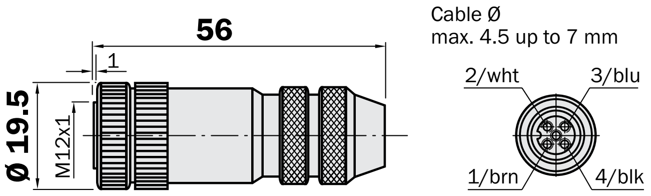
Round screw system M12 for the DeviceNet connection (AD-HFCDNS3) for HIPERFACE® Adaptor

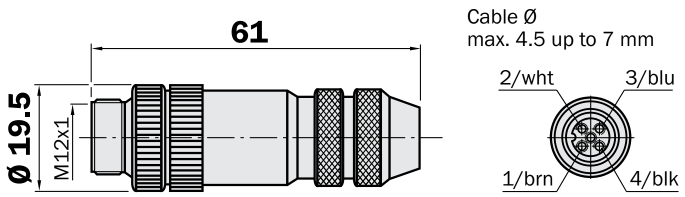
Female connector M12, 5-pin, straight, screened 360°-shield on locking nut, field assembly for bus cable

Type	Part no.
DOS-1205-GA	6027534

Male connector M12, 5-pin, straight, screened 360°-shield on locking nut, field assembly for bus cable

Type	Part no.
STE-1205-GA	6027533

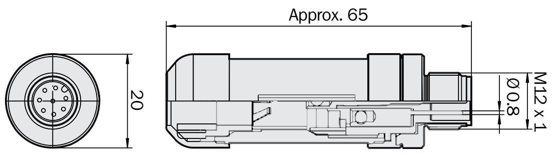




Round screw system M12/M23 for the HIPERFACE® connection (AD-HF…) for HIPERFACE® Adaptor

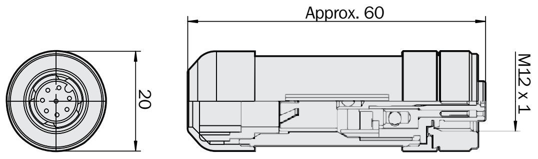
Male connector M12, 8-pin, straight, screened, for field assembly adaptor side)

Type	Part no.	Contacts/cable diameter
STE-1208-GA	6028370	8/4…8 mm



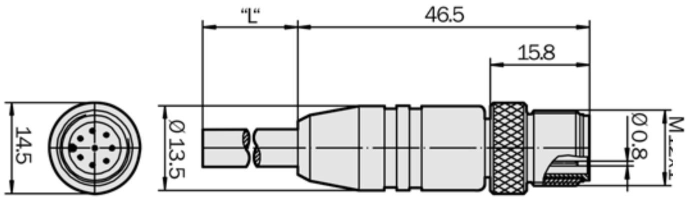
Female connector M12, 8-pin, straight, screened, for field assembly (encoder side)

Type	Part no.	Contacts/cable diameter
DOS-1208-GA	6028369	8/4…8 mm



Male connector M12, 8-pin, straight, pre-wired with cable 8-wire, 4 x 2 x 0.25 mm^2, screened, flexible (adaptor side)

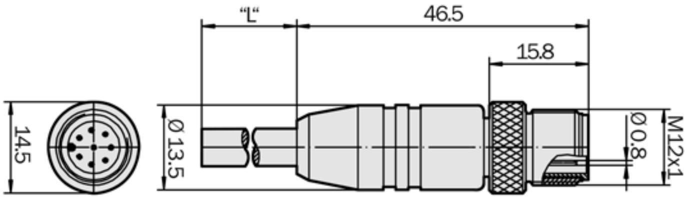
Type	Part no.	Contacts	Cable length
STL-1208-G02MAC1	6032452	8	2.0 m
STL-1208-G05MAC1	6032453	8	5.0 m
STL-1208-G10MAC1	6032454	8	10.0 m
STL-1208-G20MAC1	6032455	8	20.0 m

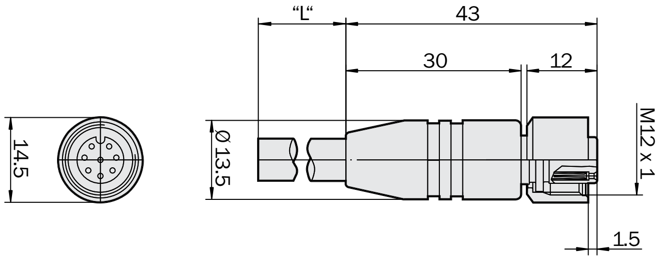


1 Max. permissible cable length between the encoder and the interface adaptor ≤ 30 m!

Male connector M12 (adaptor side) and female connector M12 (encoder side), 8-pin, straight, pre-wired with cable 8-wire 4 x 2 x 0.25 mm^2, screened, flexible

Type	Part no.	Contacts	Cable length
DSL-1208-G05MAC1	6032913	8	5.0 m

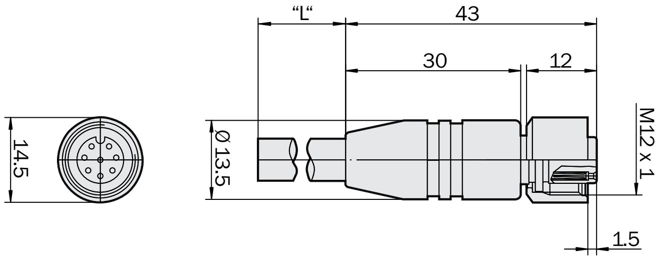




Round screw system M12 for the SSI connection (AD-HFSSIS2) FOR HIPERFACE® Adaptor and XKS with HIPERFACE® interface

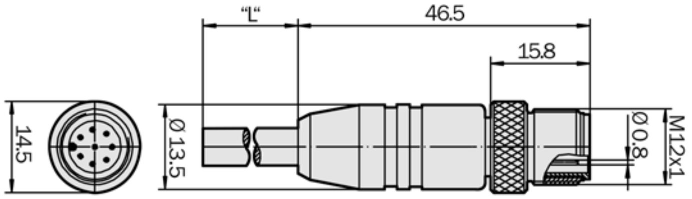
Female connector M12, 8-pin, straight, pre-wired with cable 8-core, 4 x 2 x 0.25 mm^2, screened, flexible (adaptor side)

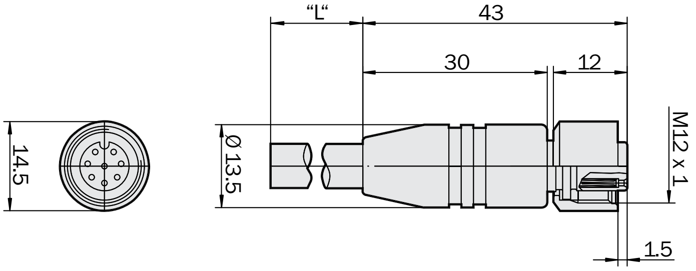
Type	Part no.	Contacts	Cable length
DOL-1208-G02MAC1	6032866	8	2.0 m
DOL-1208-G05MAC1	6032867	8	5.0 m
DOL-1208-G10MAC1	6032868	8	10.0 m
DOL-1208-G20MAC1	6032869	8	20.0 m



Male connector M12 (HIPERFACE PROFIBUS Adaptor) and female connector M12 (wire draw encoder XKS), 8-pin, straight, pre-wired with cable 8-core, 4 x 2 x 0.25 mm^2, screened, flexible

Type	Part no.	Contacts	Cable length
DSL-1208-G05MAC1	6032913	8	5.0 m





Female connector M12, right angled, 12-pin

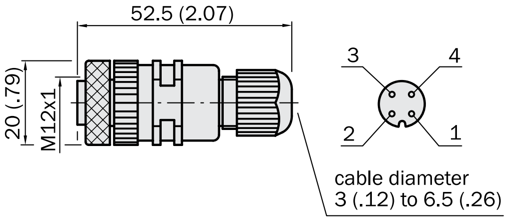
Type	Part no.	Cable length
DOL-1212-W02MAC1	6039824	2 m
DOL-1212-W05MAC1	6039825	5 m
DOL-1212-W10MAC1	6039826	10 m
DOL-1212-W20MAC1	6039827	20 m

7028241 / 2010-02-01
Subject to change without notice

Screw-in system M12 for connection encoder systems with PROFIBUS Interface

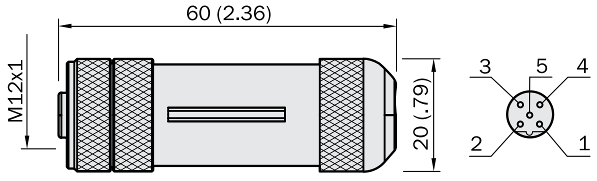
SENSICK circular connector M12, can be wired for operating voltage (ATM60, BTF, KH53 and TTK70 with PROFIBUS Interface)

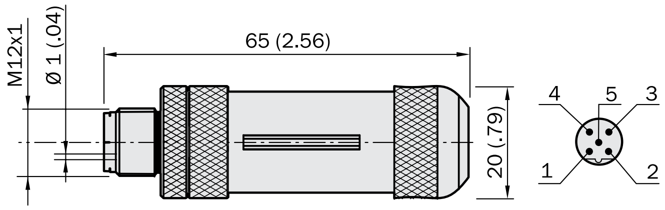
Type	Part no.	Contacts	Description
DOS-1204-G	6007302	4	Female connector, M12, 4-pin, straight



SENSICK circular connector M12, can be wired for bus cable (BTF and KH53 with PROFIBUS Interface)

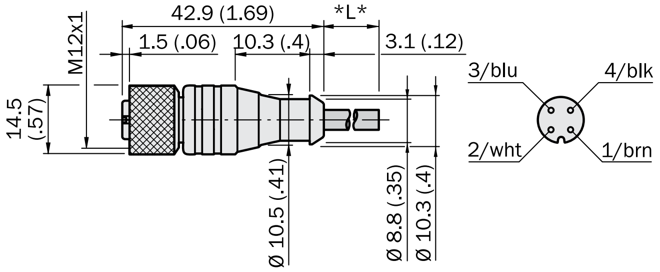
Type	Part no.	Description
PR-DOS-1205-G	6021353	PROFIBUS-female connector, M12, 5-pin, straight, shielded, B-coding
PR-STE-1205-G	6021354	PROFIBUS-male connector, M12, 5-pin, straight, shielded, B-coding





SENSICK pre-wired female M12 connector, 4-pin, straight for operating voltage (BTF, KH53 and TTK70 with PROFIBUS Interface)

Type	Part no.	Description
DOL-1204-G05M	6009866	Cable 5 m, PVC

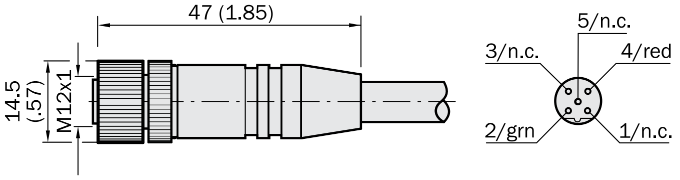


Cables for the bus communication (PROFIBUS)

Part-assembled cables

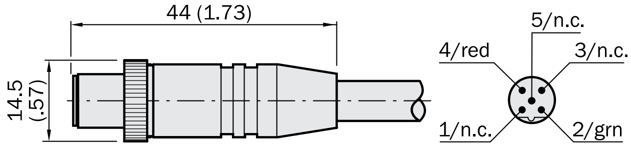
Female connector M12, 5-pin, straight, pre-wired with bus cable 2-wire, 2 x 0.22 mm^2, screened, B-coding (adapter side)

Type	Part no.	Cable length
DOL-1205-G05MQ	6026006	PROFIBUS cable 5 m
DOL-1205-G10MQ	6026008	PROFIBUS cable 10 m
DOL-1205-G12MQ	6032636	PROFIBUS cable 12 m
DOL-1205-G15MQ	6032637	PROFIBUS cable 15 m
DOL-1205-G20MQ	6032638	PROFIBUS cable 20 m
DOL-1205-G30MQ	6032639	PROFIBUS cable 30 m
DOL-1205-G50MQ	6032861	PROFIBUS cable 50 m



Male connector M12, 5-pin, straight, pre-wired with bus cable 2-wire, 2 x 0.22 mm^2, screened, B-coding (adapter side)

Type	Part no.	Cable length
STL-1205-G05MQ	6026005	PROFIBUS cable 5 m
STL-1205-G10MQ	6026007	PROFIBUS cable 10 m
STL-1205-G12MQ	6032635	PROFIBUS cable 12 m
STL-1205-G15MQ	6032898	PROFIBUS cable 15 m



Screw-in system M23, 5-pin for encoders systems with (ATM60, BTF, TTK70)

Cable connector M12 female, 5-pin, straight, screened

Type	Part no.	Contacts
DOS-1205-G	6027534	5

Cable connector M12 male, 5-pin, straight, screened

Type	Part no.	Contacts
STE-1205-G	6027533	5

Screw-in system M14 for ATM90 PROFIBUS

Type	Part no.	Explanation
DSC-1507-G	2029199	Cable connector male/female, Set 2 x male, 1 x female, M14, 7-pin, straight (screened)
STE-1507-G	6027535	Cable connector, M14 male, 7-pin, straight (screened)
DOS-1507-G	6027536	Cable connector, M14 female, 7-pin, straight (screened)

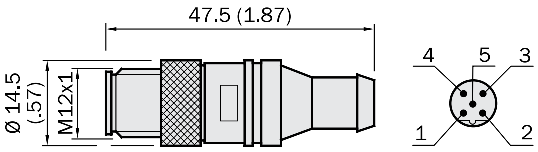
Bus cable 2-wire, per meter 2 x 0.22 mm^2, screened

Type	Part no.	Cores
LTG-2102-MW	6021355	2

Bus terminating

PROFIBUS terminating resistor

Type	Part no.	Description
PRE-STE-END	6021156	Connector, 4 contacts

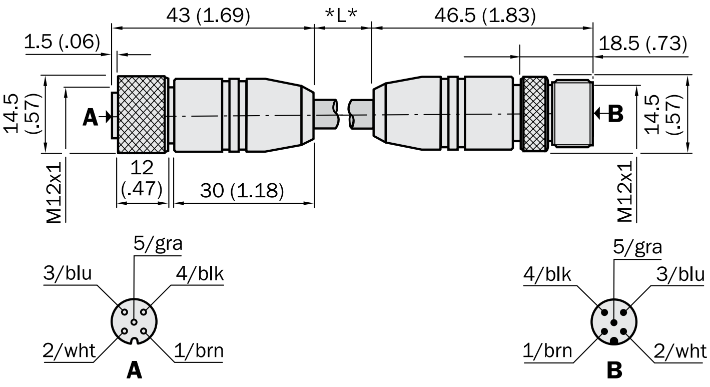


TTK70 DeviceNet: voltage supplied via the bus cable

Cables for the bus communication (DeviceNet)

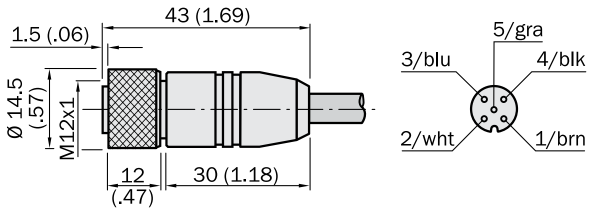
Interconnection with male connector M12, 5-pin and female connector M12, 5-pin, straight, 4-wire, 2 x 0.34 mm², 2 x 0.25 mm² twisted 2 x in pairs, drain wire 0.34 mm², shielded with AL-PT tape

Type	Part no.	Description
DSL-1205-G06MK	6028327	6 m, drop cable



Female connector M12, 5-pin, straight, field assembly for bus cable, 4-wire, 2 x 0.34 mm², 2 x 0.25 mm² twisted 2 x in pairs, drain wire 0.34 mm², shielded with AL-PT tape

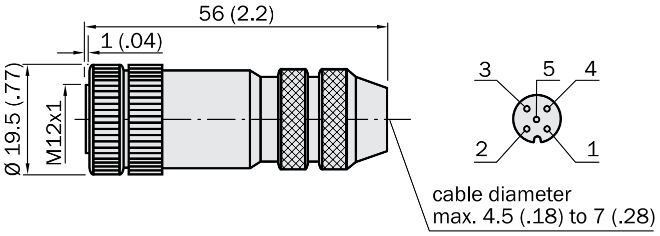
Type	Part no.	Description
DOL-1205-G06MK	6028326	6 m, drop cable



Male connector, female connector, cables

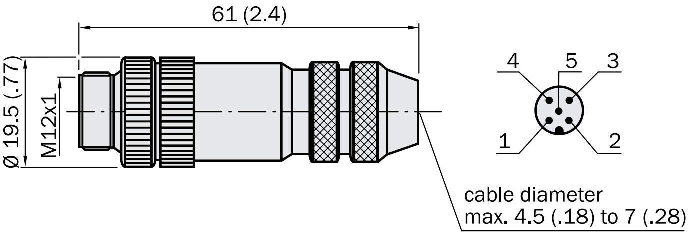
Female connector M12, 5-pin, straight, screened, 360°-shield on locking nut, field assembly for bus cable

Type	Part no.
DOS-1205-GA	6027534



Male connector M12, 5-pin, straight, screened, 360°-shield on locking nut, field assembly for bus cable

Type	Part no.
STE-1205-GA	6027533



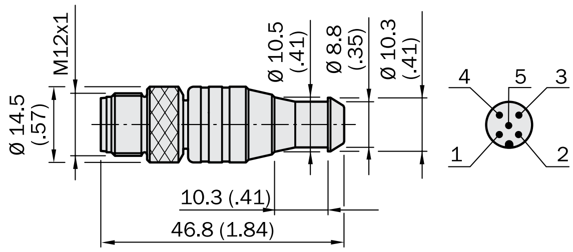
Bus cable per meter, 4 x 0,34 mm², twisted 2 x in pairs, shielded with AL-PT tape

Type	Part no.	Description
LTG-2804-MW	6028328	Cable diameter 6.9 mm

Bus terminating

CANopen® terminating resistor

Type	Part no.	Description
STE-1205-GKEND	6037193	Connector, 5 contacts



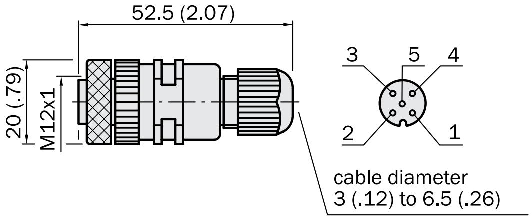
Round screw-in system M12, field attachable for BCG encoders

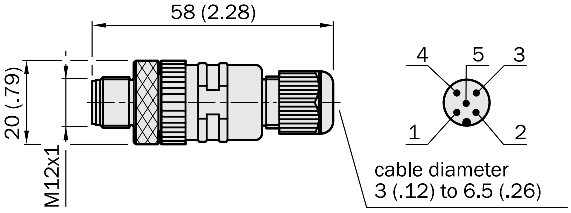
Cable connector female M12, 5-pin, straight

Type	Part no.	Contacts
DOS-1205-G	6009719	5

Cable connector male M12, 5-pin, straight

Type	Part no.	Contacts
STE-1205-G	6022083	5



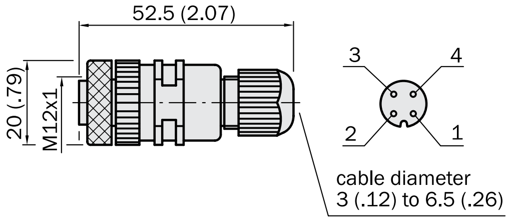


Connection systems for encoders with CANopen interface (ATM60, BTF, TTK70)

Connection TTK70 CANopen® to supply voltage

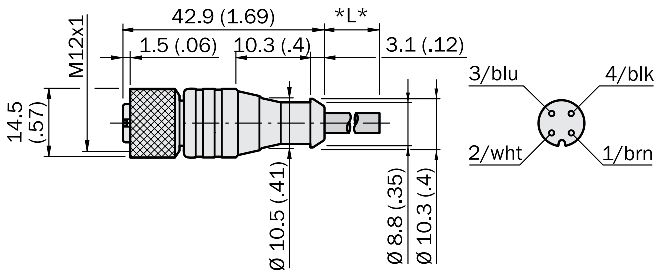
Female connector M12, 4-pin, straight, field assembly for supply voltage (adapter side)

Type	Part no.	Contacts
DOS-1204-G	6007302	4



Female connector M12, 4-pin, straight, can be assembled with cable for operating voltage (adapter side)

Type	Part no.	Description
DOL-1204-G05M	6009866	Cable 5 m, PVC



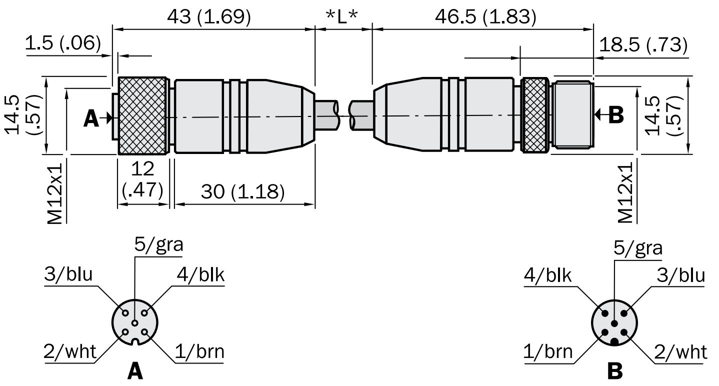
Bus cable, 2-wire, per meter 2 x 0.22 mm², screened

Type	Part no.	Cores
LTG-2102-MW	6021355	2

Cables for bus communication (CANopen®)

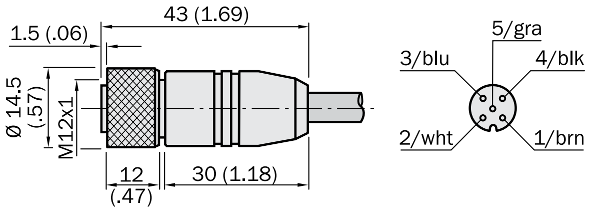
Interconnection with male connector M12, 5-pin and female connector M12, 5-pin, straight, 4-wire, 2 x 0.34 mm², 2 x 0.25 mm² twisted 2 x in pairs, drain wire 0.34 mm, shielded with AL-PT tape

Type	Part no.	Description
DSL-1205-G06MK	6028327	6 m, drop cable



Female connector M12, 5-pin, straight, field assembly for bus cable, 4-wire, 2 x 0.34 mm², 2 x 0.25 mm² twisted 2 x in pairs, drain wire 0.34 mm, shielded with AL-PT tape

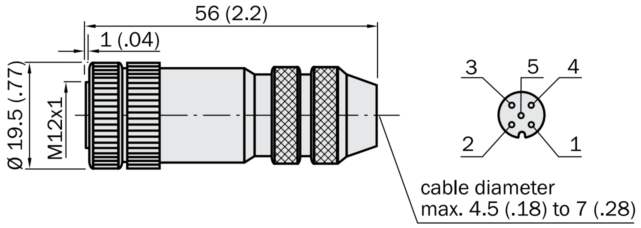
Type	Part no.	Description
DOL-1205-G06MK	6028326	6 m, drop cable



Male connector, female connector, cables

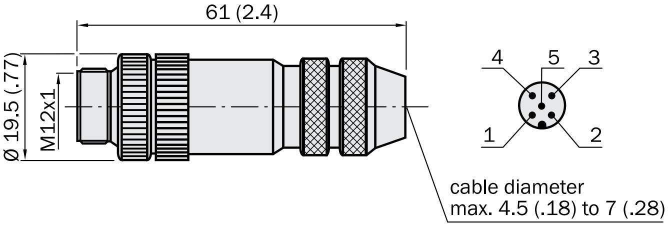
Female connector M12, 5-pin, straight, screened, 360°-shield on locking nut, field assembly for bus cable

Type	Part no.
DOS-1205-GA	6027534



Male connector M12, 5-pin, straight, screened, 360°-shield on locking nut, field assembly for bus cable

Type	Part no.
STE-1205-GA	6027533



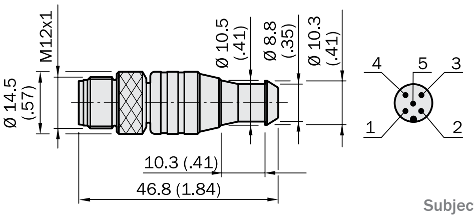
Bus cable per meter, 4 x 0.34 mm², twisted 2 x in pairs, shielded with AL-PT tape

Type	Part no.	Description
LTG-2804-MW	6028328	Cable diameter 6.9 mm

Bus terminating

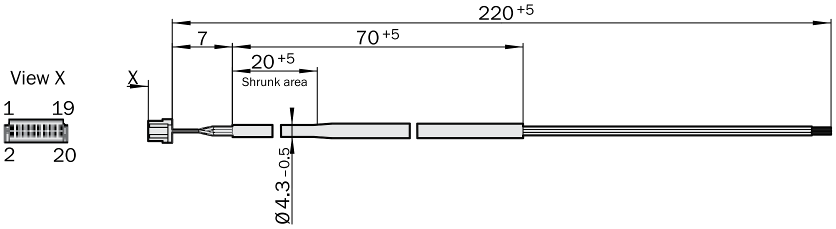
CANopen® terminating resistor

Type	Part no.	Description
STE-1205-GKEND	6037193	Connector, 5 contacts



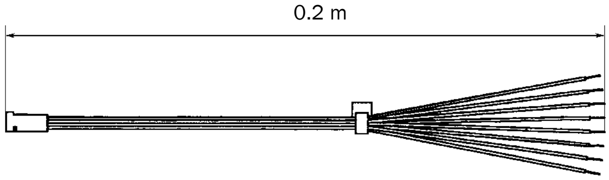
Stranded cable, straight, 14 cores, 14 x 0.15 mm^2

Type	Part no.	Contacts	Wire length
DOL-1J14-G0M2XB7	6030948	14	0.2 m



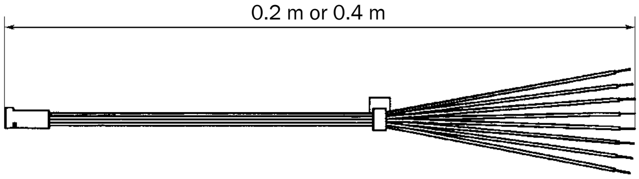
Stranded cable/connector , straight, 14 wires, 14 x 0.24 mm^2

Type	Part no.	Contacts	Wire length
DOL-0B14-G0M2XB3	2031082	16	0.2 m



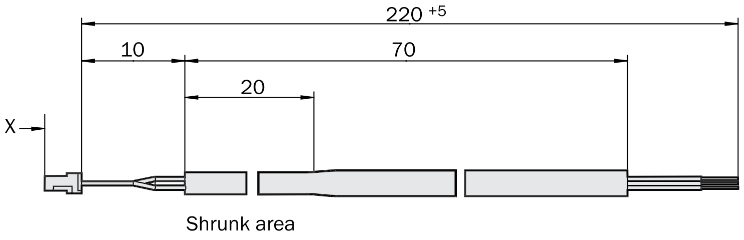
Stranded cable/connector, straight, 8 wires, 8 x 0.24 mm2

Type	Part no.	Contacts	Wire length
DOL-0B08-G0M2XB1	2031081	8	0.2 m
DOL-0B08-G0M4XB1	2031083	8	0.4 m



Stranded cable/connector, straight, 8 wires, 8 x 0.15 mm^2

Type	Part no.	Contacts	Wire length
DOL-0J08-G0M2XB6	2031086	8	0.2 m



Cables

PROFIBUS Bus cable 2-core, per meter 2 x 0.22 mm^2, screened, for HIPERFACE® Adaptor, BTF, KH53, HDA70, HRA71

Type	Part no.	Wires
LTG-2102-MW	6021355	2

DeviceNet cable 4-core, per meter, 1 x 2 x 0.34 mm^2 + 1 x 2 x 0.25 mm^2 cable diameter 6.8 mm. For HDA70, HRA71

Type	Part no.	Cores
LTG-2804-MW	6028328	4

Cable 7-core, per meter, 3 x 2.5 mm^2 + 2 x 2 x 0.34 mm^2, can be dragged, cable diameter 11 mm, for power supply for HDA70, HRA71

Type	Part no.	Cores
LTG-2907-MW	6029717	7

Cable 8-core, per meter, 4 x 2 x 0.15 mm^2 with screening, cable diameter 5.6 mm. For DKS40, DGS20, DGS25, DGS21/DGS22, DGS35/DGS34, ARS60, DFS/VFS, DGS60, DGS65, DGS66, BKS, PKS, BTF, PRF, DRS60/DRS61

Type	Part no.	Wires
LTG-2308-MWENC	6027529	8

Cable 8-core, per meter, 4 x 2 x 0.25 mm^2, screened, flexible, cable diameter 7.0 mm. For XKS, HIPERFACE® Adaptor

Type	Part no.	Wires
LTG-3208-MW	6032870	8

Cable 11-core, per meter, 4 x 2 x 0.25 + 2 x 0.5 + 1 x 0.14 mm^2 with screening, cable diameter 7.5 mm. For DKS40, DGS20, DGS25, DGS35/34, DGS21/DGS22, DGS60, DGS65, DGS66, PKS, ARS60, ARS20, ARS25, BTF, PRF, DFS/VFS, DRS60/DRS61, DKV60,

Type	Part no.	Wires
LTG-2411-MW	6 027 530	11

Cable 12-core, per meter, 4 x 2 x 0.25 + 2 x 0.5 + 2 x 0.14 mm^2 with screening, capable of being dragged, cable diameter 7.8 mm for L230 DFS/VFS, DRS60/DRS61, DGS60, DGS65, DGS66, ARS60, ARS20, ARS25, ATM60, ATM90, DGS20, DGS25, DGS21/DGS22, DGS35/DGS34, DKV60, DRS20/21, DRS25/26, DKS40, KH53, PRF, BTF, BKS, PKS

Type	Part no.	Wires
LTG-2512-MW	6 027 531	12
LTG-2612-MW*	6 028 516	12

*Resistant to saltwater and UV

Cable 22-core, per meter, 20 x 0.14 + 2 x 0.5 mm^2 with screening, cable diameter 7.8 mm for ARS60

Type	Part no.	Wires
LTG-2622-MW	6027532	22

Bus cable per meter, 4 x 0.34 mm^2, twisted 2x in pairs, shielded with AL-PT tape for HIPERFACE® Adaptor

Type	Part no.	Description
LTG-2804-MW	6028328	Cable diameter 6.9 mm

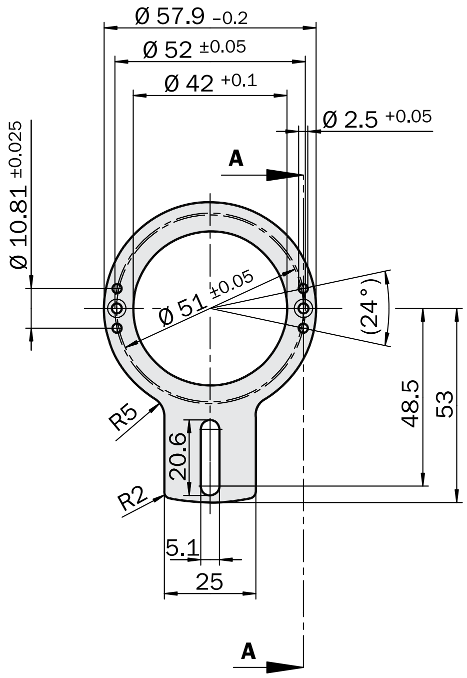
HIPERFACE® cable 8 wires, supplied by the meter, 4 x 2 x 0.15 mm^2 screened, flexible for read heads with HIPERFACE® interface

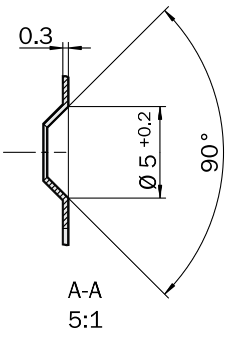
Type	Part no.	Cores
LTG-2708-MW	6028361	8

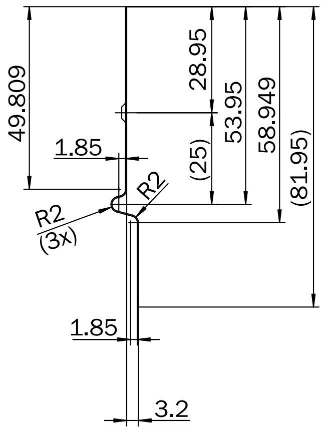
Mounting for VFS

Version 1

Type	Part no.
BEF-DS01DFS/VFS	2047428

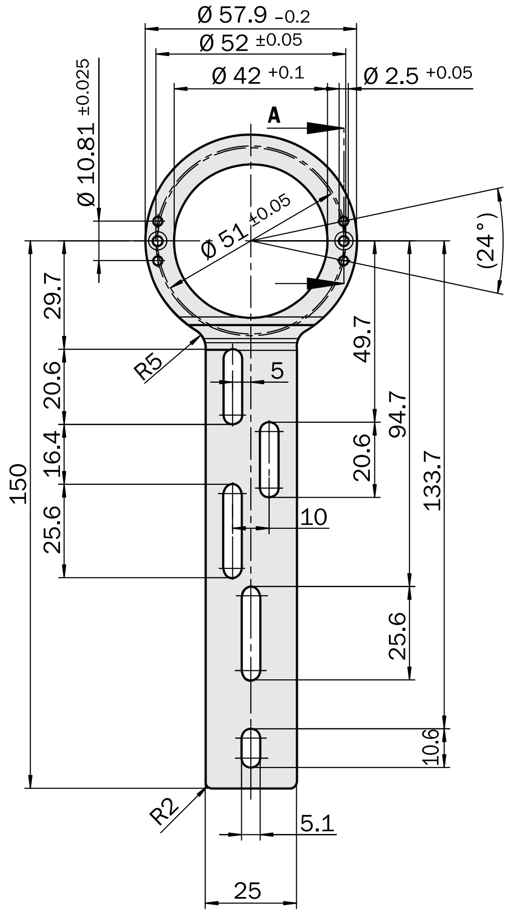


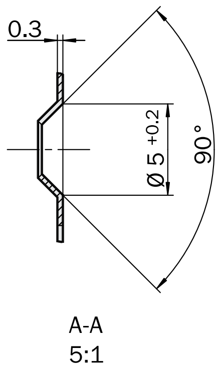


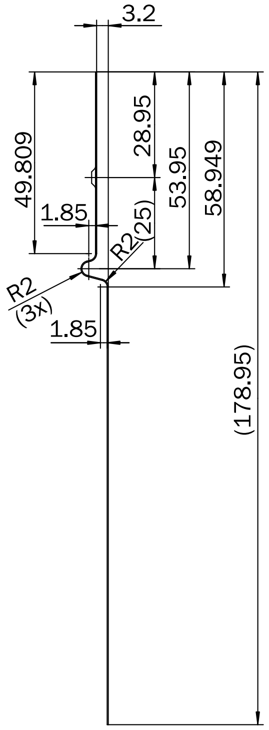


Version 2

Type	Part no.
BEF-DS02DFS/VFS	2047430



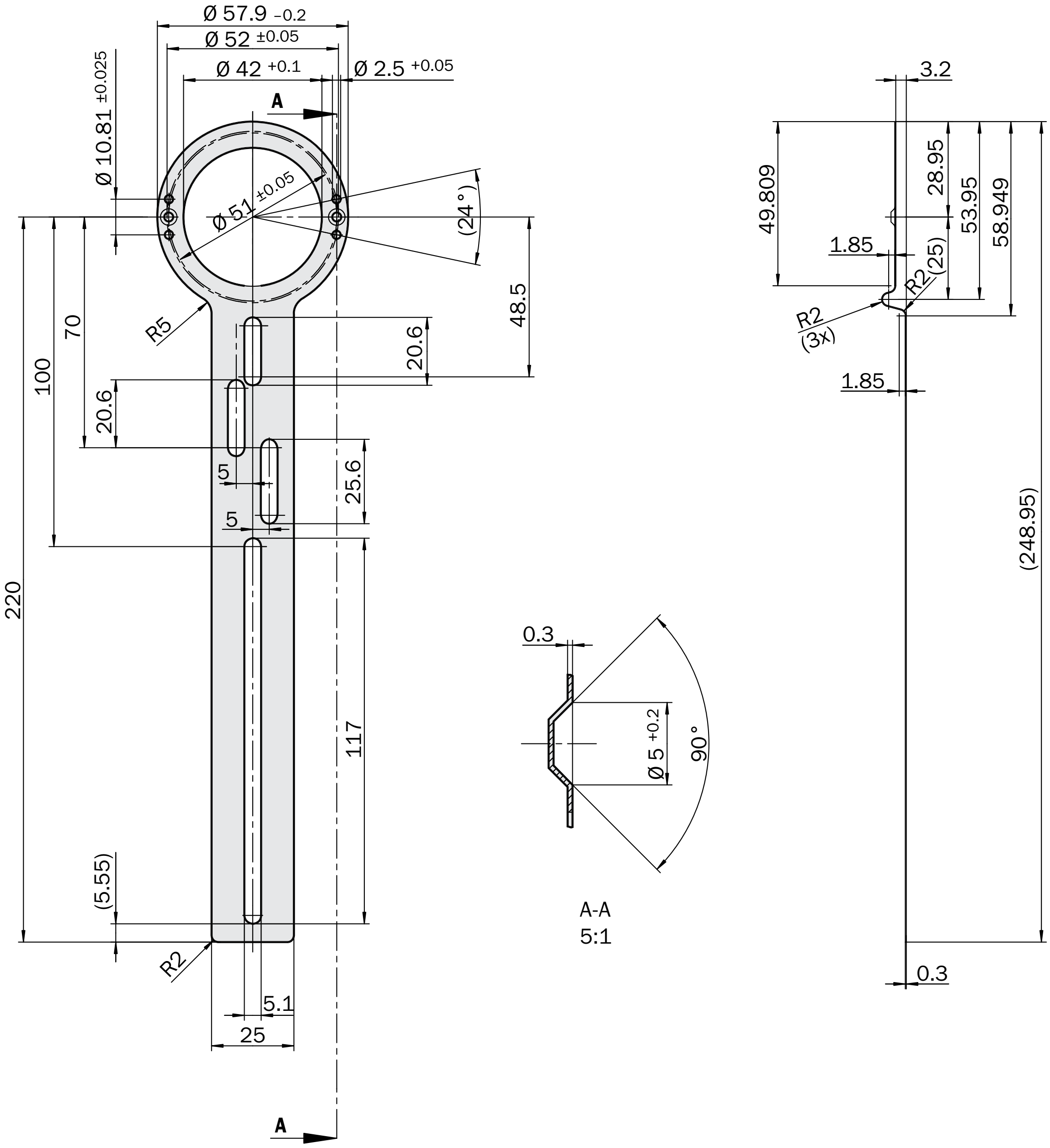




Mounting for VFS

Version 3

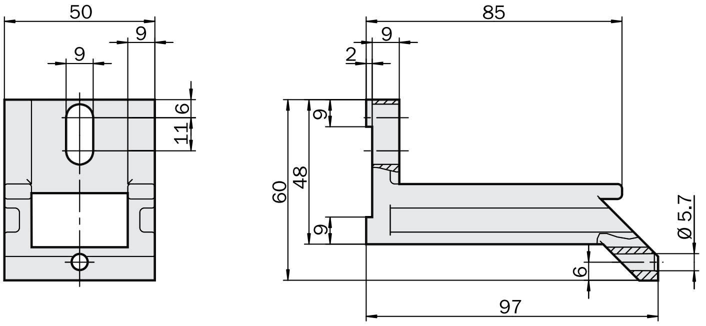
Type	Part no.
BEF-DS03DFS/VFS	2047431



Mounting systems for KH53

Spacer support for KH53, bored with srews

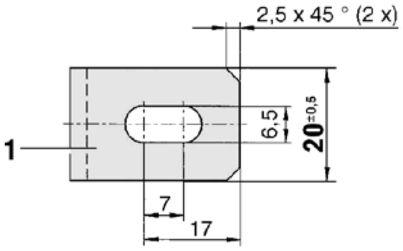
Type	Part no.
BEF-KHK-KHT53	2042468



General tolerances according to DIN ISO 2768-mk

Fastening clamp for KH53, screws not included

Type	Part no.
BEF-WK-KHT53	2029159

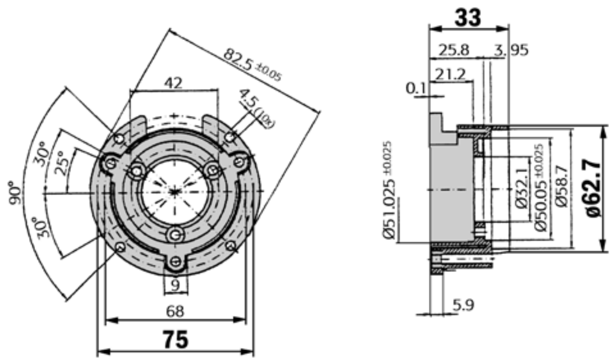


General tolerances according to DIN ISO 2768-mk

Mechanical Adaptors

Mounting bell incl. fixing set for encoder with servo flange for ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, ATM60, ATM90, DKS40 DFS60, AFS60, AFM60

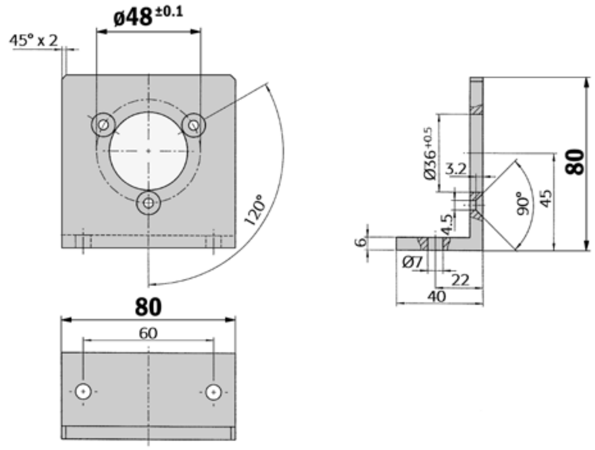
Type	Part no.	Flange spigot
BEF-MG-50	5312987	Diameter 50 mm



General tolerances according to DIN ISO 2768-mk

Mounting bell incl. fixing set for encoder with face flange mount for ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, ATM60, ATM90 DFS60, AFS60, AFM60

Type	Part no.	Flange spigot
BEF-WF-36	2029164	Diameter 36 mm

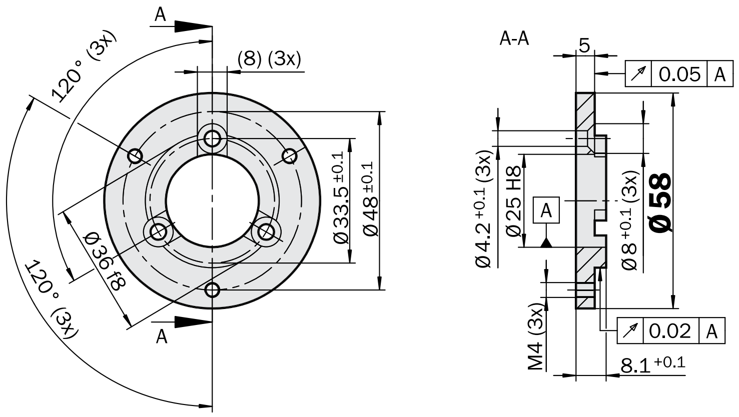


General tolerances according to DIN ISO 2768-mk

Mechanical Adaptors

Adapter flange of aluminium for face mount flange, spigot 25 mm

Type	Part no.	Adaption
BEF-FA-025-036	2034226	To 36 mm face mount flange

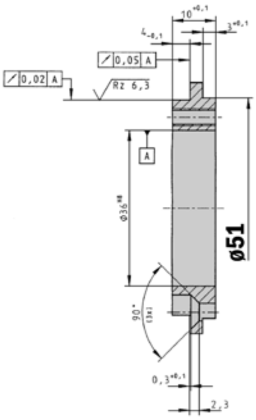


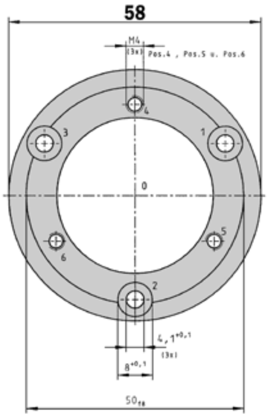
General tolerances according to DIN ISO 2768-mk

Mechanical Adaptors

Adaptor flange of aluminium for face flange mount, spigot 36 mm for ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, ATM60, ATM90 DFS60, AFS60, AFM60

Type	Part no.	Adaption
BEF-FA-036-050	2029160	To 50 mm Servo flange

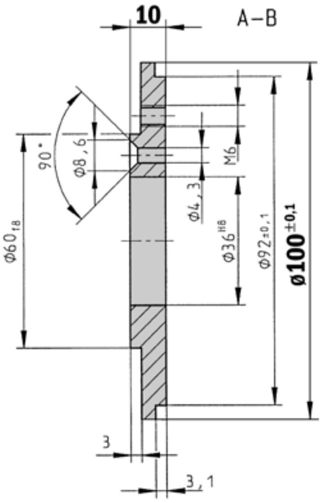


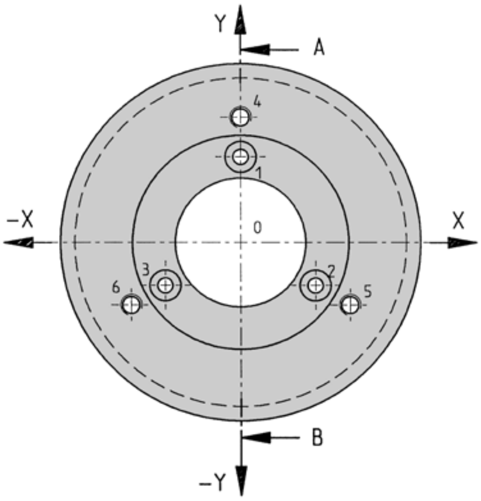


General tolerances according to DIN ISO 2768-mk

Adaptor flange of aluminium for face flange mount, spigot 36 mm for ARS60, ATM60, ATM90, DFS60, AFS60, AFM60

Type	Part no.	Adaption
BEF-FA-036-100	2029161	To 100 mm servo flange



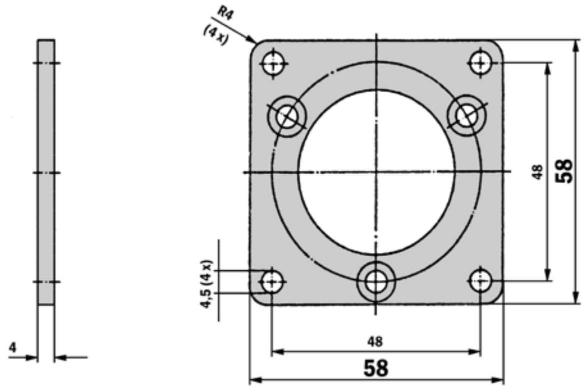


General tolerances according to DIN ISO 2768-mk

Mechanical Adaptors

Adaptor flange of aluminium for face flange mount spigot 36 mm for ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, ATM60, ATM90

Type	Part no.	Adaption
BEF-FA-036-060REC	2029162	To 60 mm square mounting plate

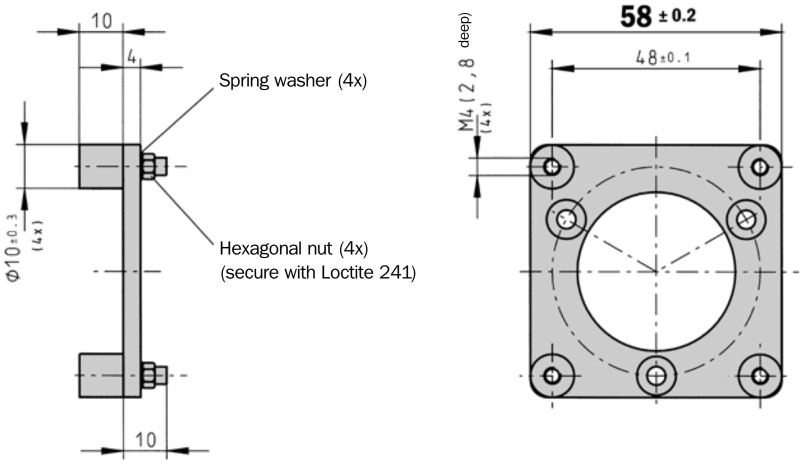


General tolerances according to DIN ISO 2768-mk

Mechanical Adaptors for DRS60/DRS61, DGS60, DGS65, DGS66, ATM60, ATM90

Adapter flange of aluminium for face flange mount, spigot 36 mm

Type	Part no.	Adaption
BEF-FA-036-060RSA	2029163	To 60 mm square mounting plate with shock absorbers

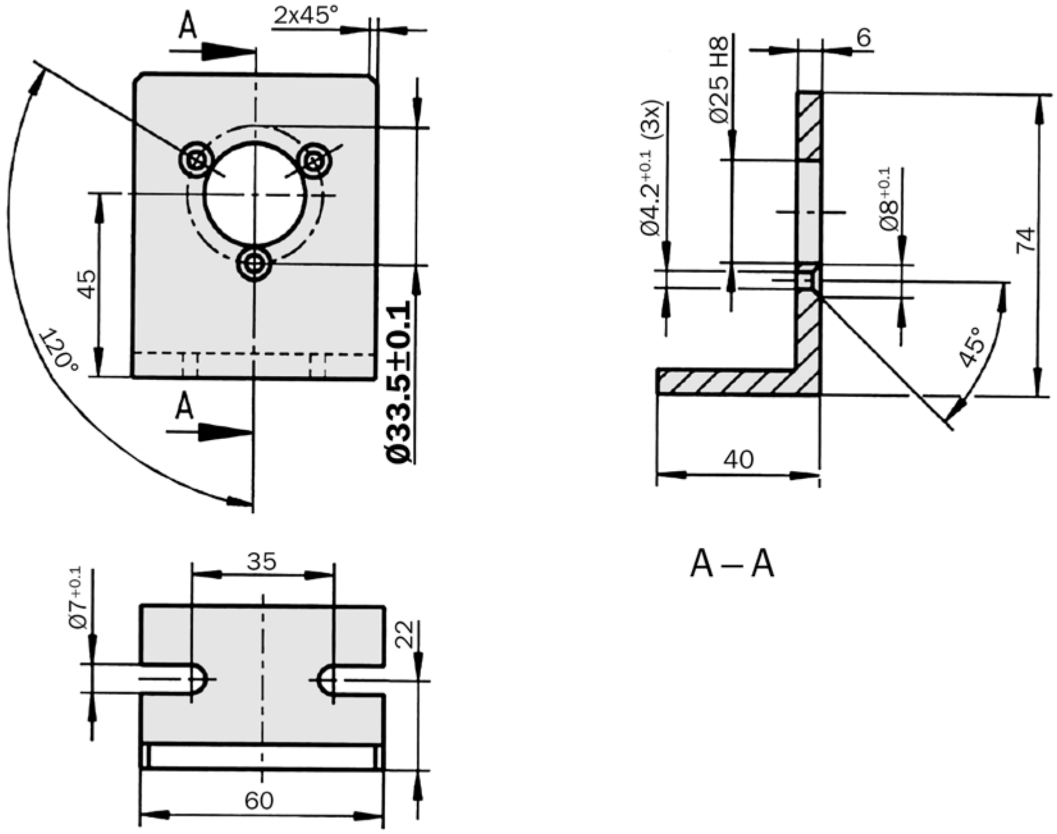


General tolerances according to DIN ISO 2768-mk

Mechanical Adaptors for DKS40

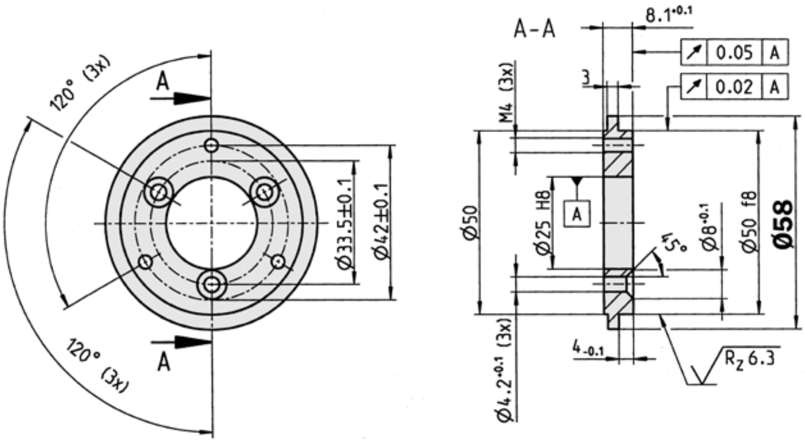
Mounting angle incl. fixing set for encoder with face flange mount for DKS40, SKX36

Type	Part no.	Flange spigot
BEF-WF-25	2032621	Diameter 25 mm



Adaptor flange of aluminium for face flange mount, spigot 25 mm for DKS40

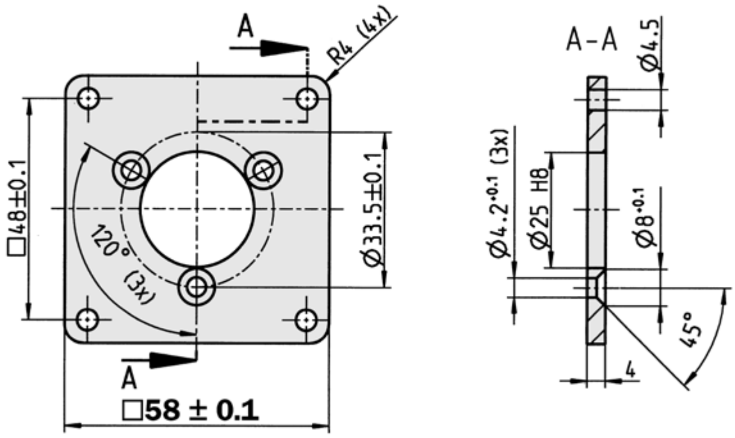
Type	Part no.	Adaption
BEF-FA-025-050	2032622	To 50 mm servo flange



General tolerances according to DIN ISO 2768-mk

Adaptor flange of aluminium for face flange mount, spigot 25 mm for DKS40

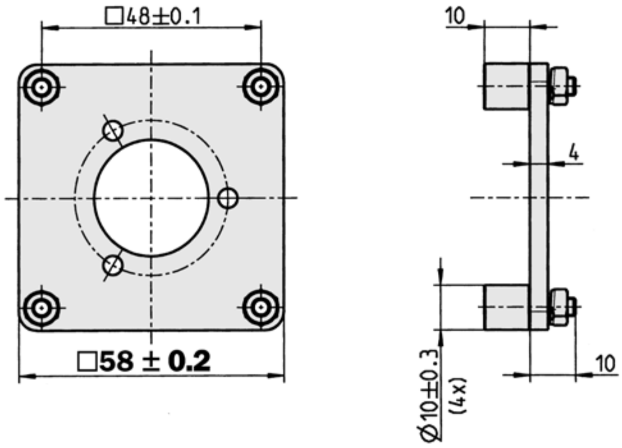
Type	Part no.	Adaption
BEF-FA-025-060RCA	2032623	To 60 mm square mounting plate



General tolerances according to DIN ISO 2768-mk

Adaptor flange of aluminium for face flange mount, spigot 25 mm for DKS40

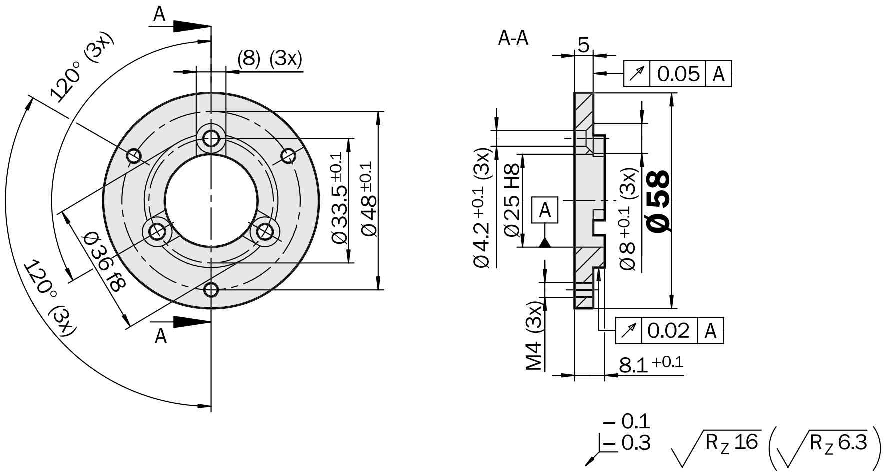
Typ	Part no.	Adaption
BEF-FA-025-060RSA	2032624	To 60 mm square mounting plate with shock absorbers



General tolerances according to DIN ISO 2768-mk

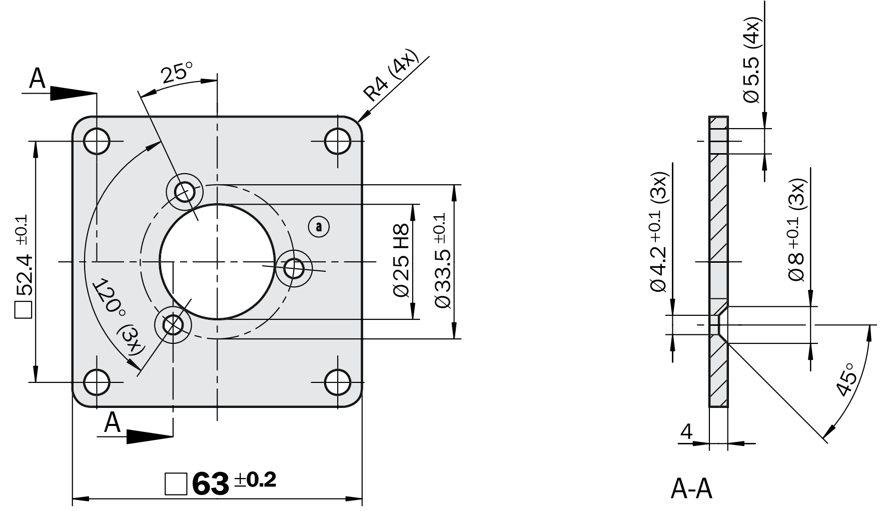
Adaptor flange of aluminium for face flange mount , spigot 36 mm for DKS40

Type	Part no.	Adaption
BEF-FA-025-036	2034226	To 50 mm face mount flange



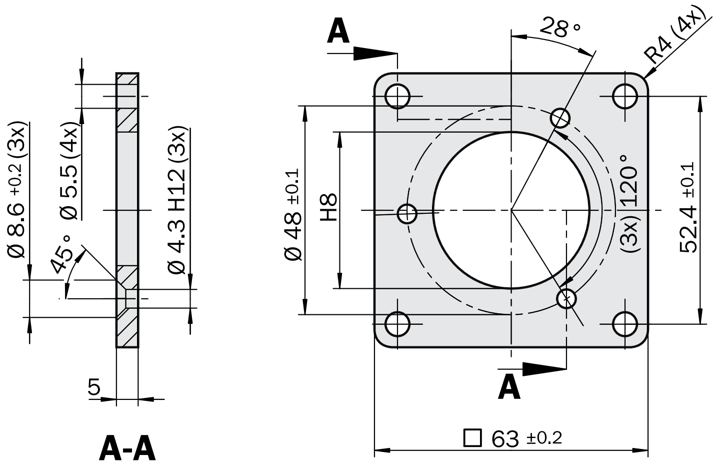
General tolerances according to DIN ISO 2768-mk

Adaptor flange of aluminium for face flange mount, spigot 25 mm for DKS40, SKX36		
Type	**Part no.**	**Adaption**
BEF-FA-025-063REC	2033631	To 63 mm square mounting plate with shock absorbers

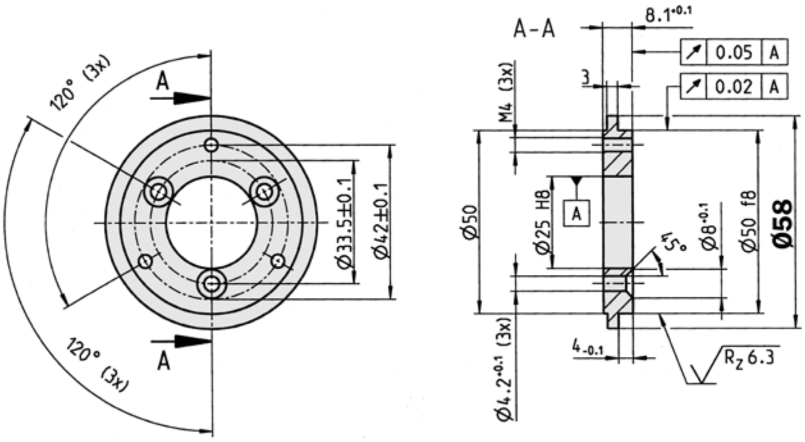


General tolerances according to DIN ISO 2768-mk

Adapter flange of aluminium for face mount flange, spigot 36 mm		
Type	**Part no.**	**Adaption**
BEF-FA-036-063REC	2034225	To 63 mm square mounting plate



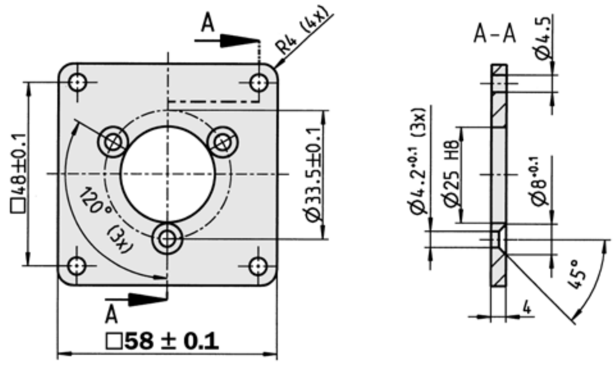
Adapter flange of aluminium for face mount flange, spigot 25 mm for SKX36		
Type	**Part no.**	**Adaption**
BEF-FA-025-050	2032622	To 50 mm servo flange



General tolerances according to DIN ISO 2768-mk

Adapter flange of aluminium for face mount flange, spigot 25 mm for SKX36

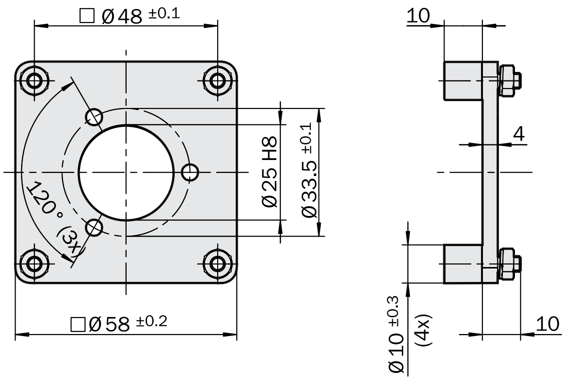
Type	Part no.	Adaption
BEF-FA-025-060RCA	2032623	To 60 mm square mounting plate



General tolerances according to DIN ISO 2768-mk

Adapter flange of aluminium for face mount flange, spigot 25 mm for SKX36

Type	Part no.	Adaption
BEF-FA-025-060RSA	2032624	To 60 mm square mounting plate with shock absorbers

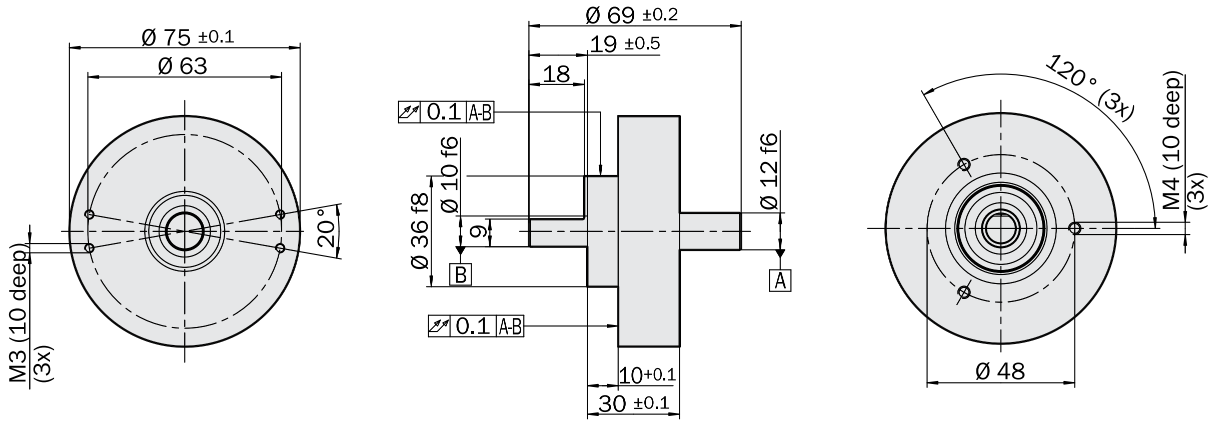


General tolerances according to DIN ISO 2768-mk

Heavy duty bearing block for very large radial and axial shaft loads

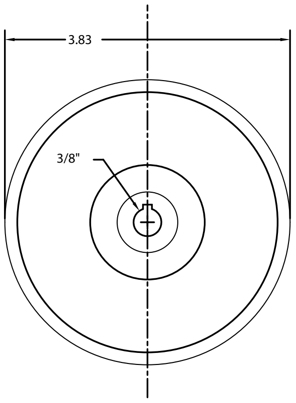
permissible shaft loading radial and axial 100 N

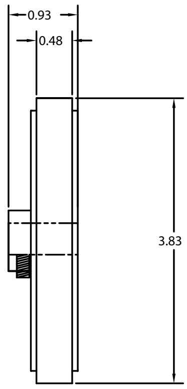
Type	Part no.
BEF-FA-B12-010	2042728



Measuring wheel for encoder shafts with 3/8" diameter for DGV31, DGS20/25, DRS20/21/25/26 and ARS20/25

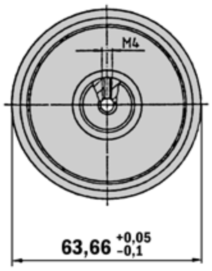
Part no.	Circumference	Surface
7130626	12"	smooth
7102396	12"	smooth
7126990	12"	smooth





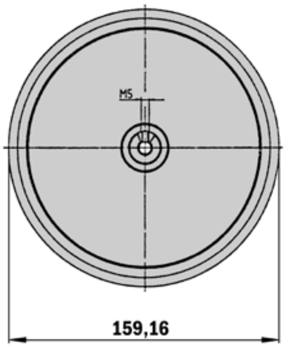
Measuring wheel for encoder shafts with diameter 10 mm, type material plastic (Hytrel), wheel material plastic with aluminium hub for DGS60, DGS65, DGS66

Type	Part no.	Circumference	Surface
BEF-MR-010020	5312988	0.2 m	smooth
BEF-MR-010020G	5318678	0.2 m	knurled



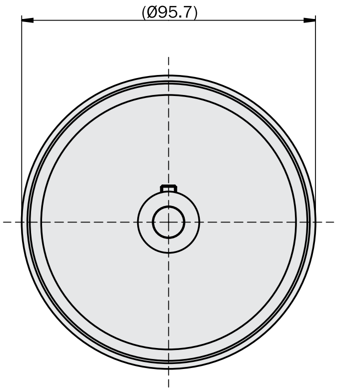
Measuring wheel for encoder shafts with diameter 10 mm, type material plastic (Hytrel), wheel material plastic with aluminium hub for DGS60, DGS65, DGS66

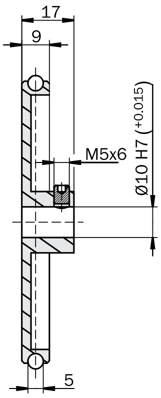
Type	Part no.	Circumference	Surface
BEF-MR-010050	5312989	0.5 m	smooth



Measuring wheel for encoder shafts with diameter 10 mm

Type	Part no.	Circumference	Surface
BEF-MR-010030	2049278	0.3 m	O-ring



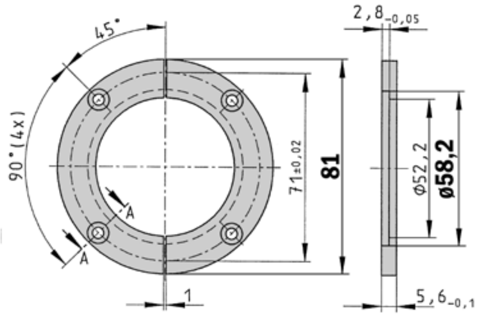


'O' ring surface EPDM (for replacement), Set (2 pieces) 55.0 x 4.0 mm

Type	Part no.
'O' ring SET DKV60	6032709

Servo clamps half ring, Set (comprises 2 pieces) for servo flanges with spigot diameter 50 mm for ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, ATM60, ATM90, DFS60, AFS60/ AFM60

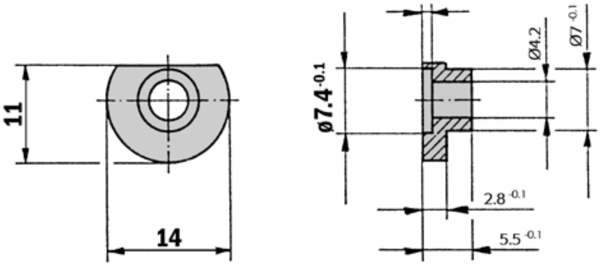
Type	Part no.
BEF-WG-SF050	2029165



General tolerances according to DIN ISO 2768-mk

Servo clamps small, Set (comprises 3 pieces) for servo flanges for ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, ATM60, ATM90, DKS40 DFS60, AFS60, AFM60, SRS50/SRM50

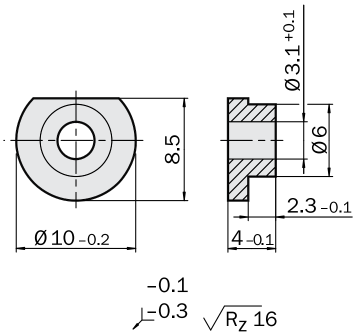
Type	Part no.
BEF-WK-SF	2029166



General tolerances according to DIN ISO 2768-mk

Servo clamps, Set (comprises 3 pieces) for SKX36, SEK/SEL52, SEK/SEL37

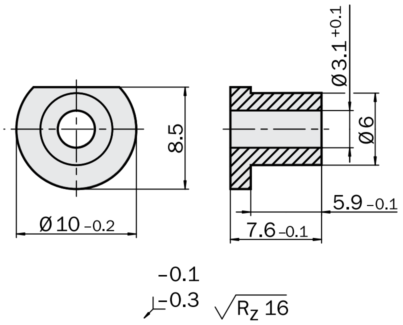
Type	Part no.	Description
BEF-WK-RESOL	2039082	Servo clamp



General tolerances according to DIN ISO 2768-mk

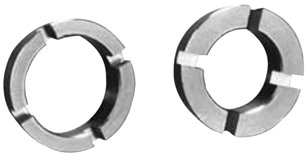
Servo clamp, Set (contents 3 off) for SEK52/SEL52, SEK37/SEL37

Type	Part no.	Description
BEF-WK-RESOL1	2048827	Servo clamp for SEK/SEL52 (Shoulder clamping)



Clamping elements, set (contents 2 off) for SRS64/SRM64

Type	Part no.	Size
BEF-MW-SR64D14	2031074	14 mm
BEF-MW-SR64D12	2031075	12 mm
BEF-MW-SR64D10	2031076	10 mm
BEF-MW-SR64D1E2	2031077	1/2"
BEF-MW-SR64D3E8	2031078	3/8"



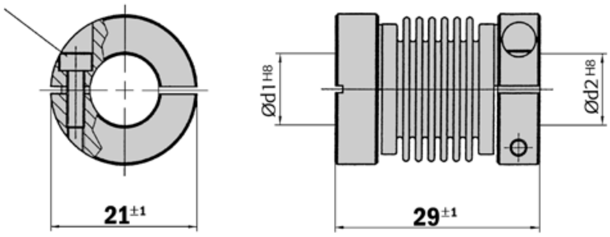
Couplings

Bellows coupling, max. shaft offset radial ± 0.3 mm, axial 0.4 mm, angle ± 4 degrees, torsion spring stiffness 120 Nm/rad, bellows of stainless steel, hubs of aluminium. For ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, DFS60, ATM60, ATM90, AFS60, SKX36

Type	Part no.	Shaft diameter
KUP-0606-B	5312981	6 mm … 6 mm
KUP-0610-B	5312982	6 mm … 10 mm
KUP-1010-B	5312983*	10 mm … 10 mm
KUP-1012-B	5312984*	10 mm … 12 mm

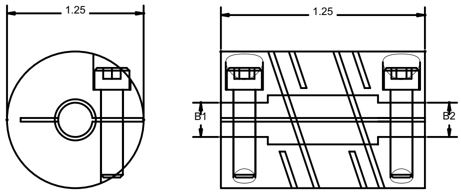
*Does not apply to SKX36

Cheese-head screw
M2,5x8 DIN912 A2



Helvetical curved beam, max. shaft offset radial 0.010 in., axial 0.012 in., torsional stiffness 0.5 lb-in/min, annodized aluminum for DGS20, DGS25, DGS21/DGS22, DRS20/DRS21, DRS25/DRS26, ARS20, ARS25

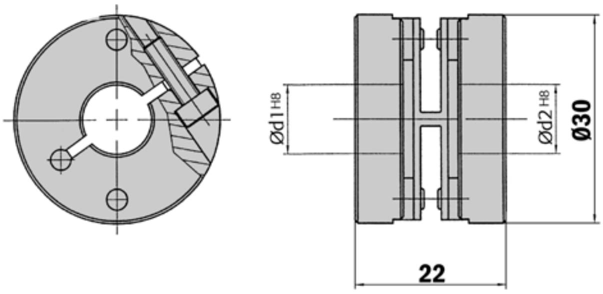
Type	Part no.	Shaft diameter
KUP-1414-H	7102150	1/4 in…1/4 in
KUP-3838-H	7102151	3/8in…3/8 in
KUP-3814-H	7102152	3/8 in…1/4 in
KUP-1038-H	7102153	10 mm…3/8 in
KUP-1010-H	7102154	10 mm…10 mm



KUP-XXXX-H

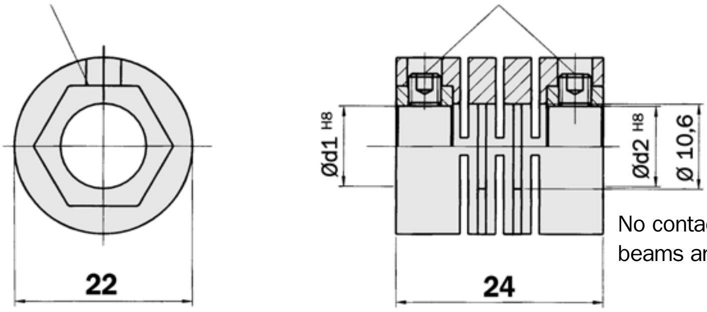
Spring-disc coupling, max. shaft offset radial ± 0.3 mm, axial 0.4 mm, angle ± 2.5 degrees, torsion spring stiffness 50 Nm/rad, flange of aluminium, spring-discs of fiberglass reinforced plastic. For ARS60, DRS60/DRS61, DGS60, DGS65, DGS66, ATM60, ATM90, DFS60, AFS60, ATM60

Type	Part no.	Shaft diameter
KUP-0610-F	5312985	6 mm … 10 mm
KUP-1010-F	5312986	10 mm … 10 mm



Beam coupling max. shaft displacement radially ± 0.3 mm, axially ± 0.2 mm, angular ± 3 degrees, torsional rigidity 38 Nm/rad, body: fiberglass reinforced polyamide, hubs made of brass for DKS40

Type	Part no.	Type shaft diameter
KUP-0608-S	5314179	6 mm … 8 mm
KUP-0808-S	5314177	8 mm … 8 mm
KUP-0810-S	5314178	8 mm … 10 mm


Shaft clamped around its circumference

Cheese-head screw M 4 x 4 DIN916

No contact between beams and shaft

Collets

Collets for blind hollow shaft ARS60, DRS60/DRS61, ATM60, ATM90 SRS50/SRM50

Type	Part no.	Shaft diameter
SPZ-006-AD-A	2029174	6 mm
SPZ-1E4-AD-A	2029175	1/4 in
SPZ-008-AD-A	2029176	8 mm
SPZ-3E8-AD-A	2029177	3/8 in
SPZ-010-AD-A	2029178	10 mm
SPZ-012-AD-A	2029179	12 mm
SPZ-1E2-AD-A	2029180	1/2 in
SPZ-014-AD-A	2048863*	1/4 mm

*Does not apply for SRS50/SRM50

Collets for DGS65 blind hollow shaft encoder

Type	Part no.	Shaft diameter
SPZ-006-DD65-A	2029181	6 mm
SPZ-008-DD65-A	2029182	8 mm
SPZ-010-DD65-A	2029183	10 mm
SPZ-011-DD65-A	2019043	11 mm
SPZ-012-DD65-A	2029184	12 mm
SPZ-3E8-DD65-A	2039227	3/8 in

Collets for through hollow shaft ARS60, DRS60/DRS61

Type	Part no.	Shaft diameter
SPZ-006-AD-D	2029192	6 mm
SPZ-1E4-AD-D	2029193	1/4 in
SPZ-008-AD-D	2029194	8 mm
SPZ-3E8-AD-D	2029195	3/8 in
SPZ-010-AD-D	2029196	10 mm
SPZ-012-AD-D	2029197	12 mm
SPZ-1E2-AD-D	2029198	1/2 in

Collets for DGS66 Encoder with blind hollow shaft

Type	Part no.	Shaft diameter
SPZ-006-DD66-A	2029185	6 mm
SPZ-008-DD66-A	2029186	8 mm
SPZ-009-DD66-A	2040980	9 mm
SPZ-010-DD66-A	2029187	10 mm
SPZ-012-DD66-A	2029188	12 mm
SPZ-1E2-DD66-A	2029189	1/2 in
SPZ-014-DD66-A	2029190	14 mm
SPZ-015-DD66-A	2029191	15 mm

Collets for DGS34 blind hollow shaft and DFS65 through hollow shaft encoders

Type for 1" Bore	Part no.	Shaft Diameter
SPZ-1E2-DD35-AD	7102155	1/2 in
SPZ-5E8-DD35-AD	7102156	5/8 in
SPZ-3E4-DD35-AD	7102157	3/4 in
SPZ-7E8-DD35-AD	7102158	7/8 in

Type for 30 mm Bore	Part no.	Shaft Diameter
SPZ-024-MD35-AD	7130587	24 mm
SPZ-025-MD35-AD	7130588	25 mm

Type for 1" Bore	Part no.	Shaft Diameter
SPZ-010-DD35-AD	7 130 582	10 mm
SPZ-012-DD35-AD	7 130 583	12 mm
SPZ-014-DD35-AD	7 130 584	14 mm
SPZ-015-DD35-AD	7 127 328	15 mm
SPZ-018-DD35-AD	7 130 585	18 mm
SPZ-020-DD35-AD	7 130 529	20 mm
SPZ-022-DD35-AD	7 130 586	22 mm

Magnetic Tape for L230

Magnetic tapes

Type	Part no.	Explanation
Magnetic tape	2030642	With adhesive backing (supplied by the meter) *)
Magnetic tape	5313643	Without adhesive backing (supplied by the meter) *)
Magnetic tape	2030646	With adhesive backing, length 10.0 m
Magnetic tape	2031275	With adhesive backing, length 12.0 m
Magnetic tape	2031288	With adhesive backing, length 16.0 m

*) The magnetic tape must be ordered by the meter (material representation), at least 0.5 m … 40 m.
Where not otherwise specified, the magnetic tape is supplied to match read heads with a resolution of 10 µm. For read heads with a resolution of 1 µm, this MUST be specified when ordering the magnetic tape.

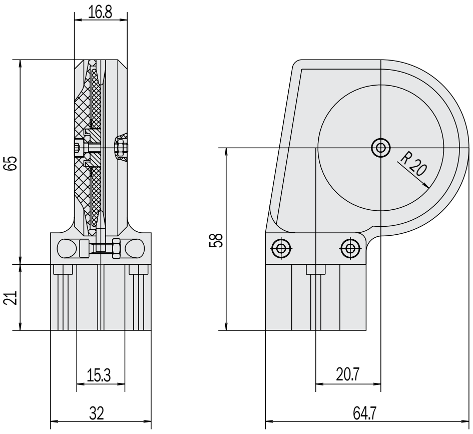
Magnetic tape with adhesive tape and cover strip incl. – TTK70 linear encoder

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

Wire draw accessories for BTF, PRF, MRA-F

Wire guiding roller for wire draw mechanism 2 m and 3 m

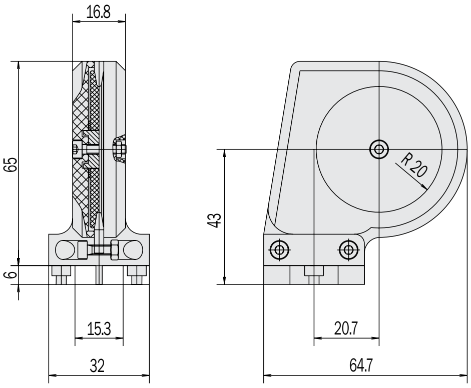
Type	Part no.
MRA-F080-R	6028632



General tolerances to DIN ISO 2768-mk

Wire guiding roller for wire draw mechanisms 5 m, 10 m, 20 m and 30 m

Type	Part no.
MRA-F130-R	6028631



General tolerances to DIN ISO 2768-mk

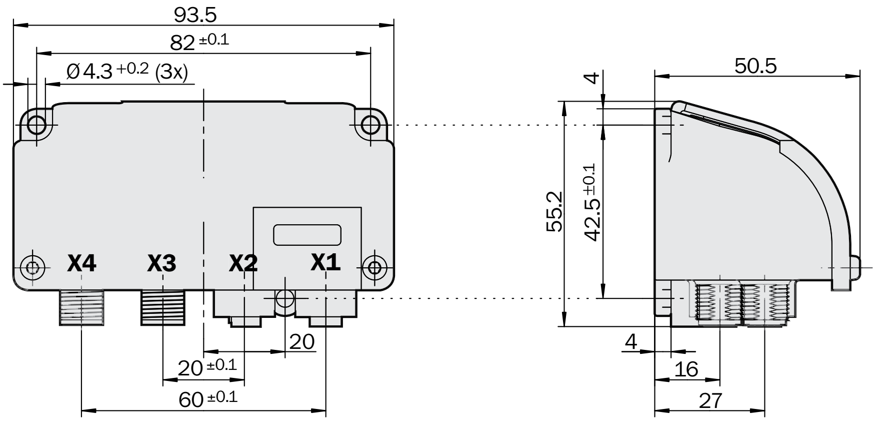
Spare parts kit for all versions of wire draw mechanisms

Type	Part no.	Description
MRA-F-K	6028633	Assembly fittings: 4 servo clamps + screws, 3 screws M4 x 8, coupling
		2 sealing rings to suit wire drive mechanisms for attaching encoders with servo flange
MRA-F-L	6030124	Assembly fittings: 4 servo clamps + screws, 3 screws M4 x 8, coupling
		2 sealing rings to suit wire drive mechanisms for attaching encoders with face flange mount

Adapter module for wire draw encoders XKS with HIPERFACE® interface

HIPERFACE® PROFIBUS Adapter 1

Type	Part no.	Description
AD-HFPRLS4	1035483	HIPERFACE® PROFIBUS Adapter



General tolerances to DIN ISO 2768-mk

Adaptor modules for SSI interface

Serial Parallel Adaptors for KH53, BTF, ARS20, ARS25, BKS, ATM60, ATM90

Type	Part no.	Explanation
AD-SSIG-PA	1030106	SSI Parallel Adaptor module, in plastic housing
AD-SSI-PA	1030107	SSI Parallel Adaptor module, without plastic housing
AD-SSIPG-PA	1030108	SSI Parallel Adaptor module, programmable, in plastic housing
AD-SSIPF-PA	1030109	SSI Parallel Adaptor module, programmable, without plastic housing, with front plate
AD-SSIP-PA	1030110	SSI Parallel Adaptor module, programmable, without plastic housing, without front plate

Programming tool for ATM60, ATM90, KH53

Type	Part no.
PGT-01-S	1 030 111

Programming tool for Serial Parallel Adaptor BTF, ATM60, ATM90, KH53

Type	Part no.
PGT-02-S	1 030 112

Programming tool (USB version) for L230, SKX36, SRS50/SRM50, SRS64/SRM64, SEK52/SEL52, SEK37/SEL37, TTK70

Type	Part no.
PGT-03-S	1034252

Programming tool (USB version) for DRS61

Type	Part no.
PGT-05-S	1035342

Programming tool for HDA70, HRA71 for SIMATIC S7

Type	Part no.	Description
PGT-05-A	2032950	Functional components for HIPERDRIVE®

Programming Tool

Programming Tool for DFS60, AFS60, AFM60

Type	Part no.
PGT-08-S	1036616

For programming SICK-STEGMANN incremental encoder with M12 or M23 connectors the following adapter cables are appropriate

Adapter cable PGT-08-S incremental with Cable connector SUB-D 9-pin male and cable connector M12 8-pin female, ready-made with cable 8-core, 4 x 2 x 0,08 mm^2, with screening, cable length 0.5 m

Type	Part no.
DSL-2D08-G0M5AC3	2046579

Adapter cable PGT-08-S incremental with Cable connector SUB-D 9-pin male and cable connector M23 12-pin female, ready-made with cable 8-core, 4 x 2 x 0,08 mm^2, with screening, cable length 0.5 m

Type	Part no.
DSL-3D08-G0M5AC3	2046580

Caution: Attempting to program a DFS60 incremental encoder with the adapter cables intended for use with the AFS/AFM60 absolute encoder will cause damage to the incremental encoder. Please ensure the correct adapter cable is used!

Adapter cable for PGT-08-S and AFS/AFM60 Absolute Encoders. Consists of male 9-pin connector and M12 8-pin inline cable connector, pre-assembled using 8-core cable, 4 x 2 x 0.08 mm^2, screened, cable length 0.5 m

Type	Part no.
DSL-2D08-G0M5AC2	2048439

Adapter cable for PGT-08-S and AFS/AFM60 Absolute Encoders. Consists of male 9-pin SUB-D connector and M23 12-pin inline cable connector, pre-assembled using 8-core cable, 4 x 2 x 0.08 mm^2, screened, cable length 0.5 m

Type	Part no.
DSL-3D08-G0M5AC2	2048440

Caution: Attempting to program an AFS/AFM60 Absolute Encoder with the adapter cables intended for use with the DFS60 incremental encoder will cause damage to the Absolute Encoder. Please ensure the correct adapter cable is used!

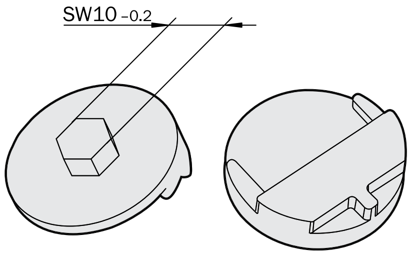
Programming- and Adjustment Tool for CKS36

Type	Part no.	Description
PGT-06-S	1035236	Programming and Adjustment Tool
		• 110-230 V power supply unit
		• USB cable
		• Sub-D to encoder connector
		• CD with programming tool software

Assembly Tools

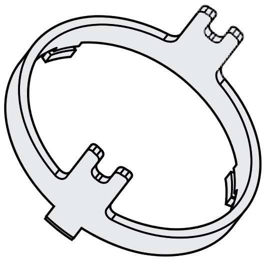
Assembly tool for CKS36, SKX36

Type	Part no.	Description
BEF-MW-SKX36	2031079	Assembly tool SKX36



Assembly tool for SEK/SEL52 hollow shaft

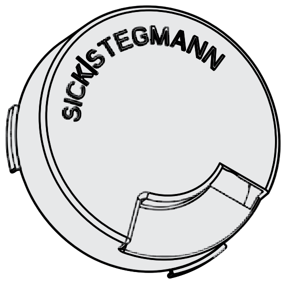
Type	Part no.	Description
BEF-MW-SEY52	2048235	Assembly tool SEK/SEL52



Covers

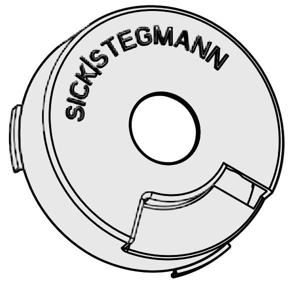
Cover SEK/SEL52 with tapered shaft or collar clamping

Type	Part no.	Description
BEF-GA-SEY52BS1	2048234	Cover closed



Cover SEK/SEL52 with hollow shaft

Type	Part no.	Description
BEF-GA-SEY52TS1	2048232	Cover opened


SICK|STEGMANN