

# Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

MADE IN GERMANY



**Optimized design for the food industry  
Resistant against acids and alkalis**

## Product Features:

- EHEDG: Tested hygienic design
- Salt mist resistant according to DIN EN 60068-2-11
- Ecolab certified - robust against detergents and disinfectants
- IP67 + IP69k allows high pressure /steam jet cleaning
- Ø58 mm housing, Ø10 mm solid shaft
- Stainless steel housing specially surface-finished
- System accuracy <math>< 0.35^\circ</math> (singleturn)
- Gap-less PTFE shaft sealing element
- Singleturn resolution from 1 to 16 bit
- Battery-less and gear-less energy harvesting multi-turn true-power-on electronics with 32 bit  $\mu$ Processor
- Multiturn resolution from 1 to 43 bits

## HTB58, HTS58 absolute rotary encoders:

- Battery-less and gear-less true-power-on multiturn-rotary-encoder
- Also available as single-turn rotary encoder
- Singleturn resolution selectable from 1 to 16 bit
- Multiturn resolution selectable from 1 to 43 bit
- System accuracy  $\pm 0,0878^\circ$  ( $\leq 12$  Bit) singleturn
- HTB58 CANopen, CAN SAE J1939 interface

## HTI58 optical incremental rotary encoder:

- Optical incremental encoder => Please see separate data sheet

## Popular Applications:

- Onshore/offshore applications in a high salinity atmosphere
- Food processing industry
- Medical applications
- Machines with a high degree of contamination

FHx58 rotary encoders are the most robust rotary encoders in the MEGATRON encoder program.

The mechanical/housing design of the FHx58 encoders is optimized for:

- Quick and easy cleaning with water or steam with or without chemical additives
- Applications with high hygiene requirements (e.g. medicine-, food- applications)
- Coastal regions near the sea, or at sea
- Withstand of high radial and axial shaft loads

The electronics of the FHx58 represent what technically is feasible today for magnetic rotary encoders. They are based on patented technologies for multiturn measure value processing and to achieve the very high system accuracy. To ensure the high system accuracy, each encoder is automatically matched to a normal (=reference) in the factory.

The contactless magnetic measurement technology in combination with the robust mechanic design is a warrant for a very long lifespan.

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# Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

## Quick overview FHx58 series - magnetic absolute rotary encoders

1	Series	FHB58 CANopen (this data sheet)	FHB58 CAN SAE J1939 (this data sheet)	FHB58 SSI (this data sheet)
2	Technology	Magnetic, gradient-based signal capturing with $\mu$ Processor-controlled digital signal processing Multiturn: battery- and gear-less, energy harvesting		
3	Electronics not redundant / redundant	Not redundant	Not redundant	Not redundant
4	Output signal	1 x CANopen Communication profile CiA 301	1 x CAN SAE J1939 ISO11898 (High Speed CAN)	SSI Gray or SSI Binary
5	Bearing	Ball bearing		
6	Shaft material	Stainless steel solid shaft		
7	Shaft diameter	Standard: $\varnothing$ 10 mm		
8	Max. operational shaft speed	3600 rpm		
9	Lifetime	100% shaft load 1x10E9 shaft revolutions 80% shaft load 1x10E10 shaft revolutions 20% shaft load 1x10E11 shaft revolutions		
10	Operating temperature range	-20..+80 °C		
11	Protection grade	Shaft bearing IP67 Housing IP69k		
12	Effective electrical angle of rotation, resolution	Singleturn 360°, resolution 1 up to 16 Bit (programmable ex works) Multiturn 1 up to 43 Bit (programmable ex works)		
13	Accuracy	Singleturn $\pm 0,0878^\circ$ ( $\leq 12$ Bit), repeatability $\pm 0,0878^\circ$ ( $\leq 12$ Bit)		
14	Supply voltage	VSUP = 10 V..32 V		
15	Electrical connection	Cable gland (TPE), axial or radial cable output, Shielded roundcable, 2 m, AWG24 or AWG26, cable endings tinned		
16	MTTF	1000a	1000a	1000a
17	Programmable ex works	Yes	Yes	Yes
18	Detailed information about the series see pages	11-14		15-17

# Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

## Quick overview FHx58 series - optical incremental rotary encoder

1	Series	FHI58 Incremental (Please see separate data sheet)
2	Technology	Optical signal capturing
3	Electronics not redundant / redundant	Not redundant
4	Output signal	Incremental, HTL, TTL
5	Bearing	Ball bearing
6	Shaft material	Stainless steel solid shaft
7	Shaft diameter	Standard: Ø10 mm
8	Max. operational shaft speed	3600 rpm
9	Lifetime	100% shaft load 1x10E9 shaft revolutions 80% shaft load 1x10E10 shaft revolutions 20% shaft load 1x10E11 shaft revolutions
10	Operating temperature range	-20..+80 °C
11	Protection grade	Shaft bearing IP67 Housing IP69k
12	Effective electrical angle of rotation, resolution	Singleturn 360°, resolution 1 up to 16 Bit (programmable ex works) Multiturn 1 up to 43 Bit (programmable ex works)
13	Pulse frequency	TTL, HTL up to 5000 rpm max. 200 kHz TTL HF up to 1200 rpm max. 2 MHz HTL HF up to 1200 rpm max. 600 kHz
14	Supply voltage	VSUP = 10 V..32 V
15	Electrical connection	Cable gland (TPE), axial or radial cable output, shielded roundcable, 2 m, AWG24 or AWG26, cable endings tinned
16	MTTF	200a
17	Detailed information about the series see pages	Please see separate data sheet

# Data Sheet for Angle Sensors

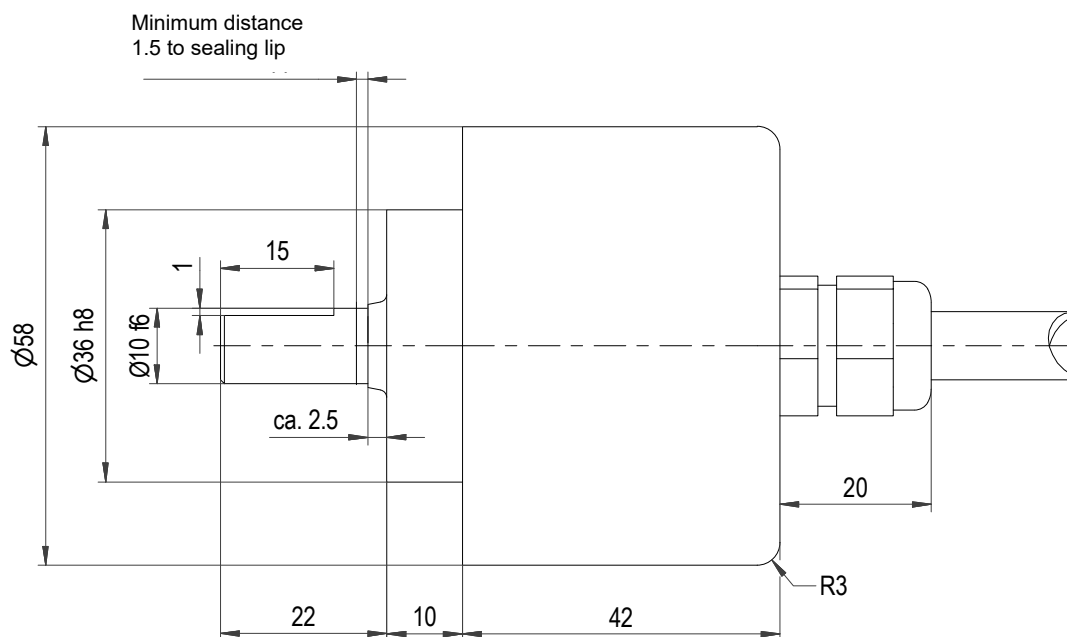
Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

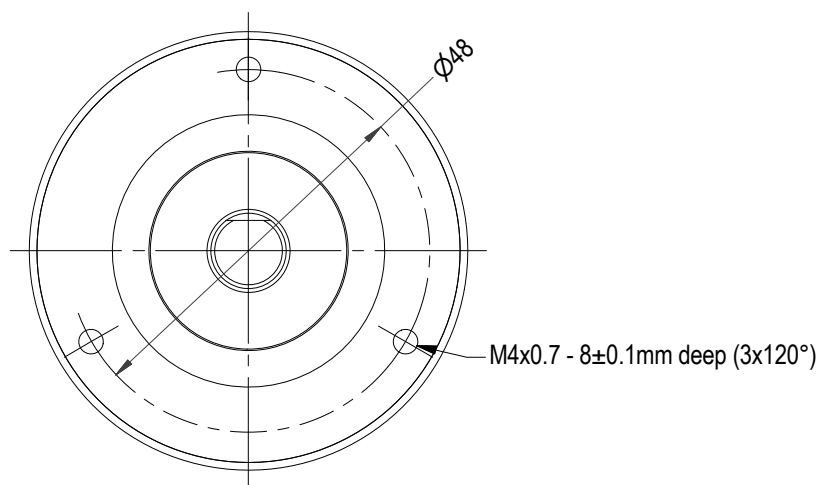
## Drawings FHx58

### Option **PG** - cable gland, axial orientation

#### Side view:



#### Front view:







# Data Sheet for Angle Sensors

## Hall-Effect Absolute Rotary Encoders FHB58, FHS58

## Family FHx58

### Mechanical and Environmental Data, Miscellaneous - FHx58 family

Shaft type	Solid shaft
Mechanical angle of rotation 1.)	Endless
Lifetime 2.)	@100 % from max. permissible radial load >1x10E9 shaft revolutions @80 % from max. permissible radial load >1x10E10 shaft revolution @20 % from max. permissible radial load >1x10E11 shaft revolutions
Bearing	2 pcs. precision ball bearings
Max. operational speed (with shaft sealing)	3600 rpm
Operational torque: (@ room temperature and 10 rev/min)	≥ 2 Ncm
Operating temperature range	-20..+80 °C
Storage temperature range	-20..+80 °C
Protection grade (IEC 60529) front side	From shaft side: IP67
Protection grade (IEC 60529) rear side	IP69k
Vibration (DIN EN 60068-2-6)	30 g / 10 bis 2000 Hz
Shock (DIN EN 60068-2-27)	100 g / 6 ms
Housing diameter	Ø58 mm
Housing depth	Wit electrical connection position (in dependency to the shaft): ▪ axial 42 mm ▪ radial 53 mm
Shaft diameter	Ø10 mm Other shaft diameters on request
Max. radial load (HTx36E S)	100 N (load point 80% - in dependency to the visible shaft length)
Max. axial load	100 N (axial force initiation at the shaft end)
Mass	app. 600 g
Connection type	▪ Cable glands, axial or radial ▪ Shielded round cable 2 m, VSUP AWG22, signal cable AWG26, TPE cable sheath, cable endings tinned
Connection position	Axial or radial
Sensor mounting	3 pcs. screws M4x0,7
Fastening parts included in delivery	None
Fastening torque per screw to fastening the rotary encoder	2 Nm
Material shaft	Stainless steel
Material flange	Stainless steel
Material housing lid	Stainless steel
Material cable gland	TPE

1.) According IEC 60393

2.) Determined by climatic conditions according to IEC 68-1, para. 5.3.1 without load collectives







## Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

### Possible Options - FHx58 Family

#### Options for project business (higher quantities) - FHx58 Family

Cable assembly	<ul style="list-style-type: none"> <li>▪ Special cable style</li> <li>▪ Cable with plug</li> </ul>
Shaft	<ul style="list-style-type: none"> <li>▪ Other shaft diameter</li> <li>▪ Other shaft length</li> <li>▪ Special shaft flattening</li> <li>▪ Screwdriver slot</li> </ul>
Mounting	<ul style="list-style-type: none"> <li>▪ Other rotary encoder fixation</li> </ul>
Miscellaneous	<ul style="list-style-type: none"> <li>▪ Application-specific parameterization of PDOs, scaling, heartbeat, node ID, baud rate, etc. (CAN-open)</li> <li>▪ Commissioning support</li> </ul>
Everything else	<ul style="list-style-type: none"> <li>▪ On request</li> </ul>

#### MEGATRON support

Department	Request:	E-Mail:	Phone:
Sales	<ul style="list-style-type: none"> <li>▪ Technical support</li> <li>▪ Application support</li> <li>▪ Prices</li> <li>▪ Delivery time</li> </ul>	sales@megatron.de	+49 89 46094-520
Order processing	<ul style="list-style-type: none"> <li>▪ Order</li> <li>▪ Delivery time</li> <li>▪ Return (RMA)</li> </ul>	order@megatron.de	+49 89 46094-100
Further information material / accessories:	<p><b>Available on the MEGATRON homepage <a href="https://www.megatron.de/">https://www.megatron.de/</a></b></p> <ul style="list-style-type: none"> <li>▪ Free 3D-models in STEP format</li> <li>▪ EDS file for encoders with CAN interface</li> <li>▪ Instruction manual for FHx58 series with CAN interface</li> </ul> <p>Accessories:</p> <ul style="list-style-type: none"> <li>▪ Counter ICs for incremental rotary encoder FHI58</li> <li>▪ Shaft coupling for all FHx58 rotary encoders</li> </ul>		

# Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

## Series FHB58 - Single- /Multiturn rotary encoder with CAN interface

### Key-features FHB58:

- Interface: CANopen, CAN SAE J 1939
- Resolution singleturn up to 16 Bit, multiturn up to 43 Bit
- Single-or multiturn rotary encoder
- Battery and gear-less multiturn technology (energy harvesting)
- Singleturn accuracy  $\pm 0,0878^\circ$  ( $\leq 12$  Bit), repeatability  $\pm 0,0878^\circ$  ( $\leq 12$  Bit)
- Supply voltage: 10..32 VDC

## Electrical Data FHB58 - Single- /Multiturn rotary encoder with CAN interface

Output signal	CANopen	CAN SAE J1939
Effective electrical angle of rotation 1.)	Singleturn 360° Multiturn up to 43 Bit	Singleturn 360° Multiturn up to 32 Bit
Singleturn accuracy	$\pm 0,0878^\circ$ ( $\leq 12$ Bit)	
Singleturn repeatability	$\pm 0,0878^\circ$ ( $\leq 12$ Bit)	
Resolution	1 up to 16 Bit singleturn 1 up to 43 Bit multiturn	1 up to 16 Bit singleturn 1 bis 32 Bit multiturn
Update rate	$\leq 600 \mu\text{s}$	
Supply voltage	10..32 VDC	
Power consumption (no load)	max. 0.5 W	
MTTF	1000a	

1.) According IEC 60393

## CANopen Specifications

Protocol	CANopen <ul style="list-style-type: none"> <li>▪ Communication profile CiA 301</li> <li>▪ Device profile for encoder CiA 406 V3.2 class C2</li> </ul>
Node number	1 up to 127 (default 127)
Baud rate	10 kBaud up to 1 MBaud with automatic bit rate detection
Ex works parameters / adaptations	The default settings as well as the customer-specific adaptation in the software can be changed via LSS (CiA 305) and the SDO protocol, e.g. PDOs, scaling, heartbeat, node ID, baud rate, etc.
Programmable CAN transfer modes	<b>Synchronous mode:</b> When receiving a synchronization telegram (SYNC) from another bus participant PDOs will be sent out autonomous <b>Asynchronous mode:</b> An internal event triggers a PDO message (e.g. change of measured value, internal timer or similar)

# Data Sheet for Angle Sensors

**Hall-Effect Absolute Rotary Encoders FHB58, FHS58**
**Family FHx58**
**CAN SAE J1939 specifications**

CAN physical layer	ISO 11898 (High Speed CAN)
Protocol	ISO 11898 (High Speed CAN)
Baud rate	Auto-Baud-Detection
Standard factory programming: (*)	
Direction of counting	View on the shaft side, CCW (counter clockwise)
ECU-adress	0x 0A
Process data identifier	0x18FF000A
PGN	0xFF00
Process data mapping	Byte 0-3 32 Bit position value Byte 4 8 Bit error register PDU timer and position preset can be set by PGN configuration 0xEF00 (Prop. A)
PDU-Time	50 ms (default)
Configurations-PGN	0x EF 00 (prop. A)
Byte 0	0x 01
Byte 1	0x FF
Byte 2	PDU Time LSB
Byte 3	PDU Time MSB
Byte 4	Preset LSB
Byte 5, 6	Preset

(\*) Other programmings on request

Further information/manual for FHB58 series with CAN interface are available in the download area of the FHB58 product site <https://www.megatron.de/>

- CAN-Manual for FHB58 series
- Manual: FHB58 CANopen setting Node ID
- Startup instruction manuals



## Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

### Order Code FHB58 - single- /multiturn rotary encoder with CAN interface

Selection: standard=black/bold, possible options=grey/cursive

<b>Series FHB58</b>	<b>FHB58</b>											
<b>Shaft type:</b> <b>Solid shaft</b>	<b>S</b>											
<b>Single- or Multiturn:</b> <b>Singleturn</b> (If 0 Bit is selected as multiturn resolution) <b>Multiturn</b> (If ≥ 1 Bit is selected as multiturn resolution)		<b>-</b> <b>PM</b>										
<b>Shaft diameter:</b> <b>Shaft diameter Ø6 mm</b> Option: user defined shaft diameter [mm] (*)				<b>10</b> <b>XX</b>								
<b>Multiplication symbol [x]:</b>					<b>x</b>							
<b>Shaft length of the rotary encoder:</b> <b>Shaft length 22 mm</b> Option: user defined shaft length for Option S [mm] (*)						<b>22</b> <b>-</b> <b>XX</b>						
<b>Supply voltage / output signal:</b> <b>VSUP=24 V (10...32 V) / CANopen</b> <b>VSUP=24 V (10...32 V) / CAN SAE J1939</b>								<b>24CA</b> <b>24CJ</b>				
<b>Terminating resistor:</b> <b>Without terminating resistor</b> Option: integrated 120 Ohm terminating resistor (Integrated in the rotary encoder)									<b>-</b> <b>T</b>			
<b>Singleturn resolution:</b> <b>Singleturn resolution 12 Bit</b> Option: singleturn resolution 1 up to 16 Bit									<b>12</b> <b>XX</b>			
<b>Multiturn resolution:</b> <b>Resolution 12 Bit (=4096 turns)</b> Option: resolution 0 Bit (=singleturn rotary encoder) Option: resolution ≥ 1 Bit (=Multiturn rotary encoder) (Maximum multiturn resolution 43 Bit for CANopen, 32 Bit for CAN SAE J1939)										<b>12</b> <b>0</b> <b>XX</b>		
<b>Electrical connection, cable length, position:</b> <b>2 m round cable, cable gland, axial</b> <b>2 m round cable, cable gland, radial</b> Option: customer specific cable length, cable gland, axial (*) Option: Customer specific cable length, cable gland, radial (*)											<b>PG</b> <b>PGR</b> <i>PG X,XX</i> <i>PGR X,XX</i>	

(\*) This option is linked to a minimum order quantity (MOQ)

## Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

### Order example 1: FHB58 - singleturn-rotary encoder with CANopen interface

**Requirement:**

Solid shaft Ø10 mm, shaft length 22 mm, VSUP=24 V / OUT=CANopen, without integrated 120 Ohm termination resistor, singleturn resolution 12 Bit (=resolution per turn, thus  $360^\circ/4096=0.088^\circ$ ), multiturn resolution 0 Bit (0 Bit stands for singleturn rotary encoder), round cable 2 m, cable outlet position axial (in dependency to the shaft)

**Example for order code:**

FHB58 S 10x22 S 24CA 12 0 PG

### Order example 2: FHB58 PM - multiturn-rotary encoder with CANopen interface

**Requirement:**

Solid shaft Ø10 mm, shaft length 22 mm, VSUP=24 V / OUT=CANopen, without integrated 120 Ohm termination resistor, singleturn resolution 12 Bit (=resolution per turn, thus for  $360^\circ \Rightarrow 360^\circ/4096=0.088^\circ$ ), multiturn resolution 12 Bit ( $4096 \text{ turns} \times 360^\circ = 1.474.560^\circ$  effective electrical angle), round cable 2 m, cable outlet position axial (in dependency to the shaft)

**Example for order code:**

FHB58 S PM 10x22 24CA 12 12 PG

### Cable- and pin-assignment FHB58 single- /multiturn rotary encoder with CANopen or CAN SAE J1939 interface, not redundant

Function:	Option PG(R), CVR
VSUP	brown
GND	orange
CANHigh	green
CANLow	yellow
CANGND / Shield (*)	shield

(\*) The cable shield is conductively connected to the rotary encoder housing

# Data Sheet for Angle Sensors

**Hall-Effect Absolute Rotary Encoders FHB58, FHS58**
**Family FHx58**
**Series FHS58 - single- /multiturn rotary encoder with SSI interface**
**Key-features FHS58 with SSI interface:**

- Signal output: SSI, binary- or Gray- code
- Resolution singleturn up to 16 Bit, Multiturn up to 43 Bit
- Single- or multiturn rotary encoder
- Battery and gear-less multiturn technology (energy harvesting)
- Singleturn accuracy  $\pm 0,0878^\circ$  ( $\leq 12$  Bit), repeatability  $\pm 0,0878^\circ$  ( $\leq 12$  Bit)
- Supply voltage: 10..32 VDC or 4.75 V..5.5 VDC

**Electrical data FHS58 single- /multiturn rotary encoder with SSI output**

Effective electrical angle of rotation 1.)	Singleturn 360°, multiturn up to 43 Bit	
Singleturn accuracy	$\pm 0,0878^\circ$ ( $\leq 12$ Bit)	
Singleturn repeatability	$\pm 0,0878^\circ$ ( $\leq 12$ Bit)	
Output signal	SSI binary or SSI Gray	
Resolution	1 up to 16 Bit singleturn, 1 up to 43 Bit multiturn	
Update rate	$\leq 600 \mu\text{s}$	
Supply voltage	10..32 V	4.75..5.5 V
Current consumption (no load)	typ. 50 mA	typ. 80 mA
Power consumption	max. 0.44 W	max. 0.5 W
MTTF	1000a	

1.) According IEC 60393

**SSI specifications**

Clock input	Via opto-coupler
Clock frequency	100 kHz up to 500 kHz (*)
Data output	RS485/RS422 compatible
Output code	Binary or Gray
SSI-output	Angular-/position value
Parity bit	Optional (even/odd)
Error bit	Optional
Turn on time	< 1.5 s
Configuration inputs	DIR = GND => CW
Positive direction of counting (view on shaft)	DIR = VSUP => CCW
Set to zero	Set: preset = VSUP for 2 sec Deactivate: preset = GND

(\*) Up to 2 MHz clock frequency on request



# Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

**Order code FHS58 - single- /multiturn rotary encoder with SSI interface**

Description		Selection: standard=black/bold, possible options=grey/cursive									
<b>Series FHS58</b>	<b>FHS58</b>										
<b>Shaft type:</b> <b>Solid shaft</b>	<b>S</b>										
<b>Single- or Multiturn:</b> <b>Singleturn</b> (If 0 Bit is selected as multiturn resolution) <b>Multiturn</b> (If ≥ 1 Bit is selected as multiturn resolution)	<b>-</b> <b>PM</b>										
<b>Shaft diameter:</b> <b>Shaft diameter Ø10 mm</b> Option: user defined shaft diameter [mm] (*)	<b>10</b> <b>XX</b>										
<b>Multiplication symbol [x]:</b>	<b>x</b>										
<b>Visible shaft length of the rotary encoder:</b> <b>Shaft length 22 mm</b> Option: user defined shaft length for Option S [mm] (*)	<b>22</b> <b>XX</b>										
<b>Supply voltage / output signal:</b> <b>VSUP=24 V (10...32 V) / SSI</b> Option: VSUP=5 V (4.75...5.5 V) / SSI	<b>24SSI</b> <i>05SSI</i>										
<b>Code:</b> <b>Binary</b> <b>Gray</b>	<b>B</b> <b>G</b>										
<b>Singleturn resolution:</b> <b>Singleturn resolution 12 Bit</b> Option: singleturn resolution 1 up to 16 Bit	<b>12</b> <b>XX</b>										
<b>Multiturn resolution:</b> <b>Resolution 12 Bit (=4096 turns)</b> Option: resolution 0 Bit (=singleturn rotary encoder) Option: resolution ≥ 1 Bit (=Multiturn rotary encoder) (Maximum multiturn resolution 43 Bit)	<b>12</b> <b>0</b> <b>XX</b>										
<b>Electrical connection, cable length, position:</b> <b>2 m round cable, cable gland, axial</b> <b>2 m round cable, cable gland, radial</b> Option: customer specific cable length, cable gland, axial (*) Option: Customer specific cable length, cable gland, radial (*)	<b>PG</b> <b>PGR</b> <i>PG X,XX</i>  <i>PGR X,XX</i>										

(\*) This option is linked to a minimum order quantity (MOQ)

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## Data Sheet for Angle Sensors

Hall-Effect Absolute Rotary Encoders FHB58, FHS58

Family FHx58

### Order example 1: FHS58 - singleturn rotary encoder with SSI interface

**Requirement:**

Solid shaft Ø10 mm, shaft length 22 mm, VSUP=24 V / OUT=SSI binary, singleturn resolution 12 Bit (=resolution per turn, thus  $360^\circ/4096=0.088^\circ$ ), multiturn resolution 0 bit (0 bit stands for singleturn rotary encoder), round cable 2 m, cable outlet position axial (in dependency to the shaft)

**Example for order code:**

FHS58 S 10x22 24SSI B 12 0 PG

### Order example 2: FHS58 PM - multiturn rotary encoder with SSI interface

**Requirement:**

Solid shaft Ø10 mm, shaft length 22 mm, VSUP=24 V / OUT=SSI binary code, singleturn resolution 12 Bit (=resolution per turn, thus for  $360^\circ \Rightarrow 360^\circ/4096=0.088^\circ$ ), multiturn resolution 12 Bit ( $4096 \text{ (turns)} \times 360^\circ = 1.474.560^\circ$  effective electrical angle), round cable 2 m, cable outlet position axial (in dependency to the shaft)

**Example for order code:**

FHS58 S PM 10x22 24SSI B 12 12 PG

### Cable- and pin assignment FHS58 - single-/multiturn rotary encoder with SSI interface, not redundant

Function:	Option PG(R)
GND	white
VSUP	brown
CLK+	green
CLK-	yellow
DATA+	grey
DATA-	pink
PRESET	blue
DIR	red
Shield	housing

