

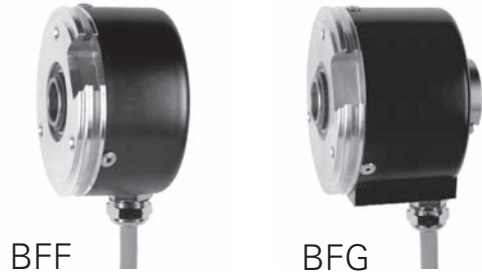
Absolute single-turn hollow shaft encoders

BFF/BFG

parallel

features

- flat hollow shaft housing
- end shaft mounting (BFF)
- through shaft mounting (BFG)
- 12 bit resolution
- high noise immunity



general data

voltage supply	5 VDC $\pm 5\%$ (05N) 10 - 30 VDC (24K)
max. supply current no load	120 mA (at 5 VDC) (05N) 70 mA (at 24 VDC) (24K)
output signal	parallel 5 VDC, parallel 10 - 30 VDC
steps/rev	see order designation
max. error limit	12 bit (1 step relates to 5' 16")
pulse tolerance	$\pm 1/2$ step
max. switching frequency	50 kHz

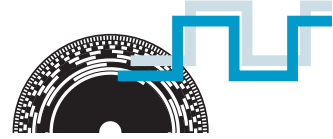
mechanical data

max. revolutions	mech. 12'000 rpm (IP 42) mech. 6'000 rpm (IP 65) electr. dep. on number of steps
moment of inertia	BFF typ. $18,4 \times 10^{-7}$ kgm ² BFG typ. $23,8 \times 10^{-7}$ kgm ²
torque	
BFF	typ. 0,9 cNm IP 42 typ. 3,7 cNm IP 65
BFG	typ. 1,75 cNm IP 42 typ. 4,7 cNm IP 65 (3'000 rpm / 20 °C)
product life	depending on ambient conditions (typ. 10^9 revolutions)
max. protection class	IP 65
material	housing: aluminum BFF with connection ref. -5 : steel flange: aluminum
weight	approx. 300 g

ambient conditions

temperature range	-20...+85 °C
relative humidity	max. 95% non condensing
vibration	IEC 60068-2-6 (≤ 100 m/s ² / 10 - 2'000 Hz)
shock	IEC 60068-2-27 (≤ 500 m/s ² / 11 ms)
noise immunity	EN 61000-6-2
emitted interference	EN 61000-6-3

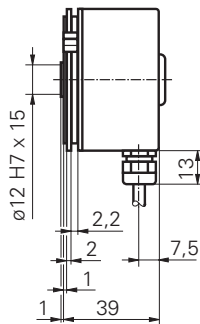
parallel



dimensions and connection dimensions

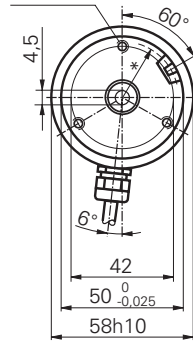
BFF

-5



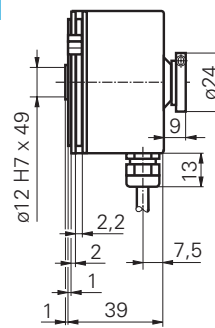
*R=22 ±1,5 / ø4 mm

M4 x 6
3 x 120°



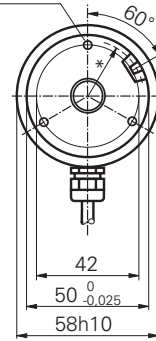
BFG

-5

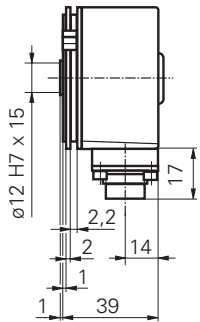


*R=22 ±1,5 / ø4 mm

M4 x 6
3 x 120°

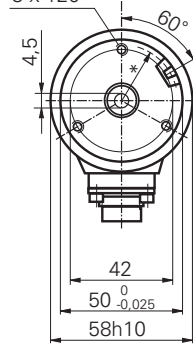


-9

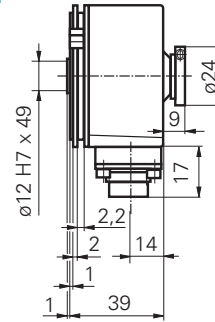


*R=22 ±1,5 / ø4 mm

M4 x 6
3 x 120°

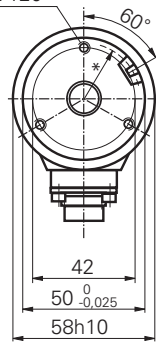


-9

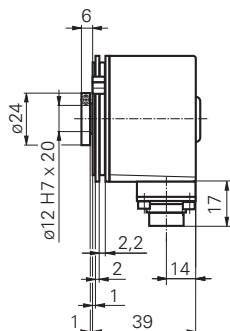


*R=22 ±1,5 / ø4 mm

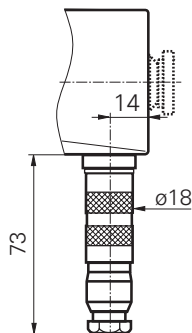
M4 x 6
3 x 120°



-E2 with clamping ring



-9



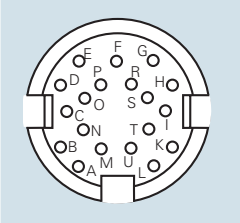
Note

Mounting drawings see end of chapter.

Absolute single-turn hollow shaft encoders BFF/BFG parallel

assignment male

pin assignment 19-pin



looking at the encoder

cable color	connector 19-pin	resolution		
		4'096	1'024	360/512
white	A	0 V	0 V	0 V
brown	B	+Vs	+Vs	+Vs
green	D	bit 1 LSB	bit 1 LSB	bit 1 LSB
yellow	E	bit 2	bit 2	bit 2
grey	F	bit 3	bit 3	bit 3
pink	G	bit 4	bit 4	bit 4
blue	H	bit 5	bit 5	bit 5
red	I	bit 6	bit 6	bit 6
black	K	bit 7	bit 7	bit 7
violet	L	bit 8	bit 8	bit 8
grey/pink	M	bit 9	bit 9	bit 9 MSB
white/green	N	bit 10	bit 10 MSB	n.c.
brown/green	O	bit 11	n.c.	n.c.
yellow/brown	P	bit 12 MSB	n.c.	n.c.
white/yellow	R	¹⁾ bit 12 MSB inv.	¹⁾ bit 10 MSB inv.	¹⁾ bit 9 MSB inv.
red/blue	-	n.c.	n.c.	n.c.
screen	C	housing	housing	housing
cable		16 x 0,14 mm ²		

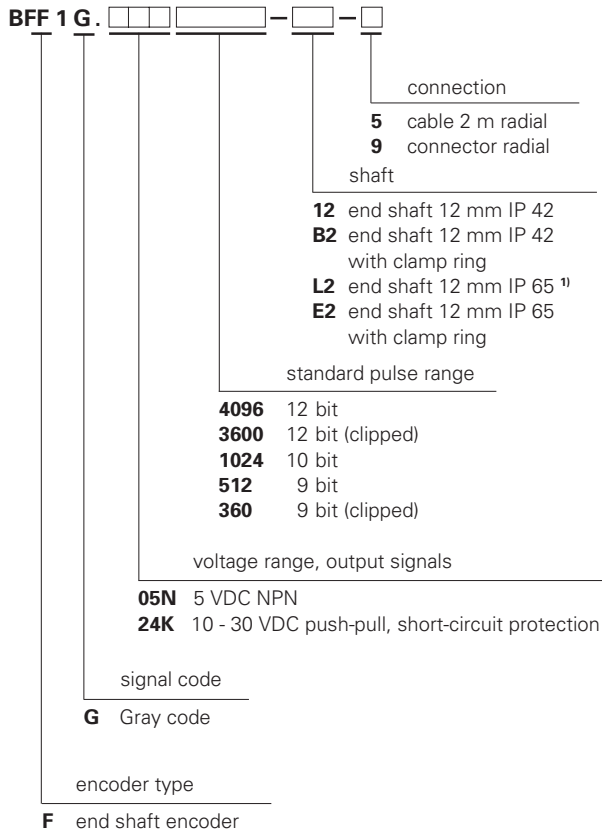
direction of rotation

¹⁾The direction of rotation from encoders using a Gray code can be defined by connecting the MSB or inverted MSB. Both signals are available as an output. If the MSB is connected, the encoder counts up as the shaft rotates clockwise. If the MSB inv. is connected, the encoder counts up if the shaft rotates counter clockwise.

parallel



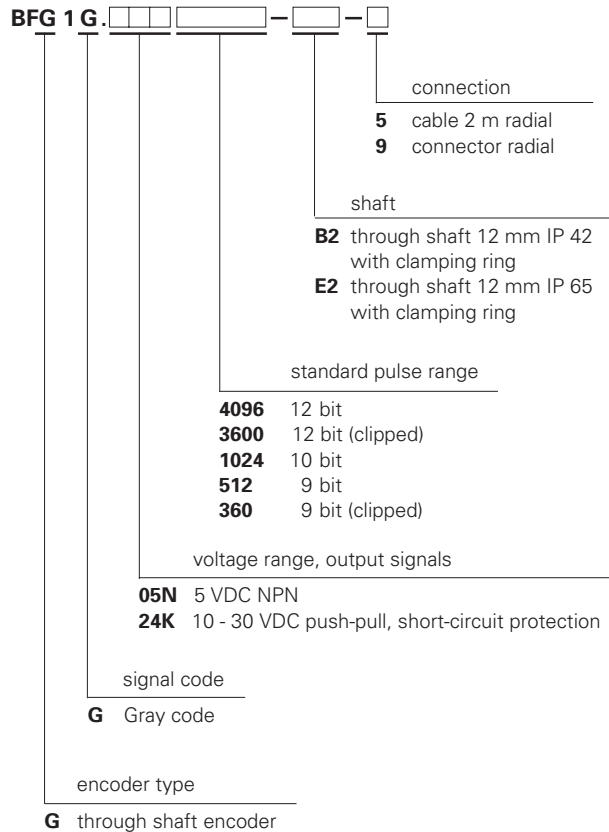
order designation BFF



¹⁾ shaft adapter must be ordered separately

Other versions on request.

order designation BFG



Other versions on request.

accessories

connector female 19-pin	part nr. 111837
cable with connector female (pre-assembled)	
2 m	part nr. 130370
5 m	part nr. 130371
clamp set	part nr. 110616
torque pin	part nr. 107540
torque spring ²⁾	part nr. 109520
spring plate set	part nr. 136635
coupling and shaft adapters	see chapter accessories
clamping ring set	
12 mm hollow shaft	part nr. 142556

²⁾ encoder is delivered with fixed rubber torque spring

Absolute single-turn hollow shaft encoders

BFF/BFG

SSI

features

- SSI interface
- 13 bit resolution



BFF



BFG

general data

voltage supply	10 - 30 VDC
max. supply current no load	typ. 70 mA (at 24 VDC)
output circuit	SSI, complementary RS 422, DV (data valid)
steps/rev	see order designation
max. measuring step	13 bit (1 step relates to 2' 38'')
max. error limit	±1/2 step
max. switching frequency	250 kHz
max. clock frequency	1 MHz
input signal	F/R*-input, clock input

mechanical data

max. revolutions	mech. 12'000 rpm (IP 42) mech. 6'000 rpm (IP 65) electr. dep. on number of steps
moment of inertia	BFF typ. $18,4 \times 10^{-7}$ kgm ² BFG typ. $23,8 \times 10^{-7}$ kgm ²
torque	
BFF	typ. 0,9 cNm IP 42 typ. 3,7 cNm IP 65
BFG	typ. 1,75 cNm IP 42 typ. 4,7 cNm IP 65 (3'000 rpm / 20 °C)
product life	depending on ambient conditions (typ. 10 ⁹ revolutions)
max. protection class	IP 65
material	housing: aluminum BFF with connection ref. -5 : steel flange: aluminum
weight	approx. 300 g

ambient conditions

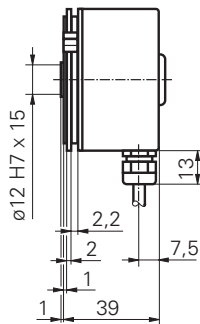
temperature range	-20...+85 °C
relative humidity	max. 95% non condensing
vibration	IEC 60068-2-6 (≤ 100 m/s ² / 10 - 200 Hz)
shock	IEC 60068-2-27 (≤ 500 m/s ² / 11 ms)
noise immunity	EN 61000-6-2
emitted interference	EN 61000-6-3



dimensions and connection dimensions

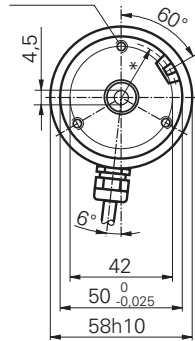
BFF

-5



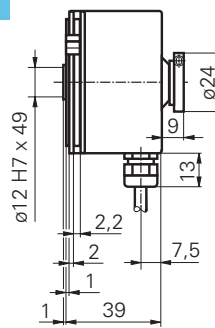
*R=22 ±1,5 / ø4 mm

M4 x 6
3 x 120°



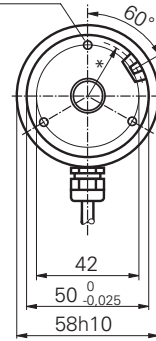
BFG

-5

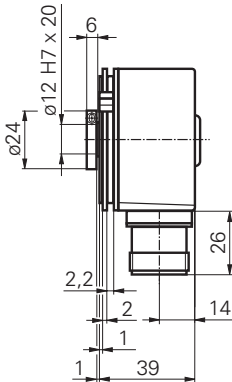


*R=22 ±1,5 / ø4 mm

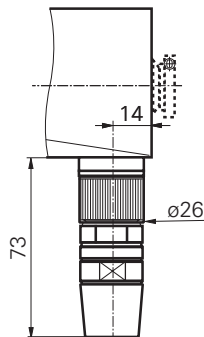
M4 x 6
3 x 120°



-E2 with clamping ring



-A



Note

Mounting drawings see end of chapter.

2

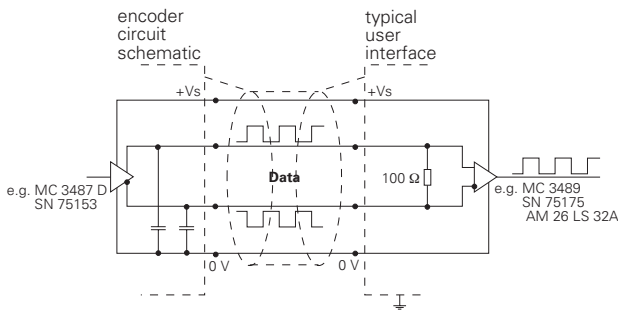
Absolute single-turn hollow shaft encoders

BFF/BFG

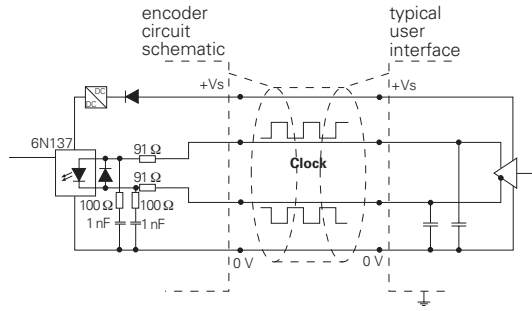
SSI

output circuits

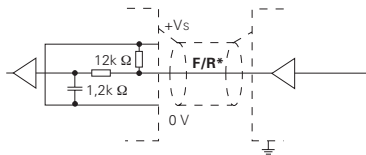
SSI output



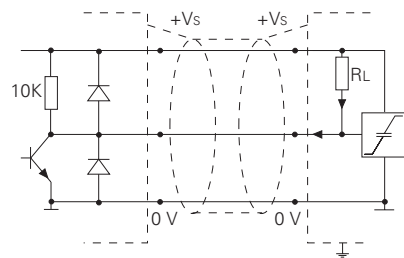
SSI clock input



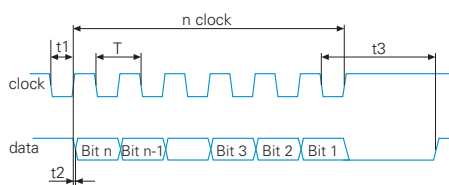
forward/reverse signal input



DV output



read out of position values



pulse times:

$$T = 1 \mu\text{s} \text{ to } 10 \mu\text{s} / t_1 = 0,5 \text{ to } 5 \mu\text{s}$$

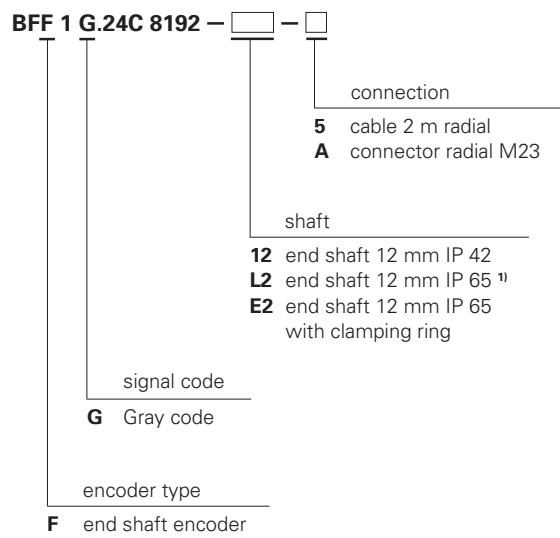
$$t_2 < 0,2 \mu\text{s} / t_3 > 12 \mu\text{s} \text{ to } 25 \mu\text{s}$$

function of the SSI

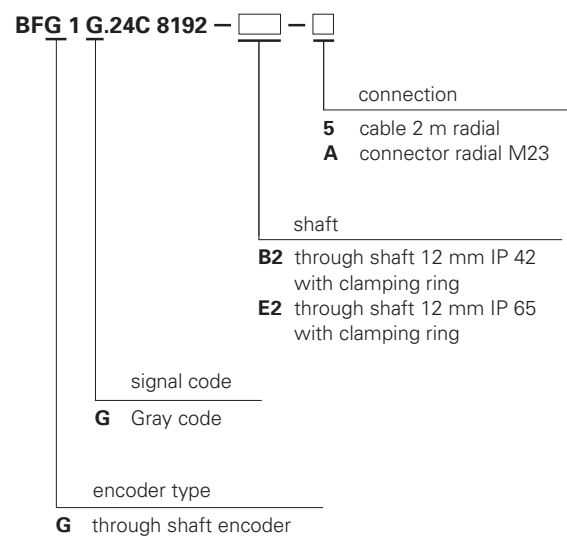
In the stand-by mode both clock and data signals are HIGH. The actual measuring value is stored during the first falling edge. The data transmission takes place with the first rising edge, starting with MSB. It needs $n+1$ rising edges to transmit the data word completely. After the last positive edge has passed, the data output stays in a LOW condition, until the angle measuring device is ready for a new transmission cycle.



order designation BFF



order designation BFG

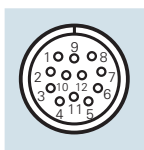


2

¹⁾ shaft adapter must be ordered separately

Other versions on request.

pin assignment cable/M23 male



24C (10 - 30 VDC)

pin number	cable color	signals
1	yellow	clock-
2	green	clock+
3	grey	data+
4	pink	data-
5	-	n.c.
6	-	n.c.
7	-	n.c.
8	blue	F/R*
9	red	DV
10	screen	housing
11	brown	+Vs
12	white	0 V

accessories

connector M23 female 12-pin reference -A	part nr. 116717
cable with connector M23 female (pre-assembled) ref. -A	
2 m	part nr. 130372
5 m	part nr. 130373
clamp set	part nr. 110616
torque pin	part nr. 107540
torque spring ²⁾	part nr. 109520
spring plate set	part nr. 136635
coupling and shaft adapters	see chapter accessories
clamping ring set	
12 mm hollow shaft	part nr. 142556

²⁾ encoder is delivered with fixed rubber torque spring

Absolute single-turn hollow shaft encoders

BFF/BFG

CANopen

features

- CANopen interface integrated
- 13 bit resolution
- programmable operating modes
- programmable preset values



BFF



BFG

general data

voltage supply	10 - 30 VDC with reverse polarity protection
max. supply current no load	typ. 70 mA (at 24 VDC)
output circuit	CANopen, standard ISO/DIS 11898
signal code	binary
max. measuring step	13 bit (1 step relates to 2' 38'')
max. error limit	±1/2 step
max. switching frequency	250 kHz
operating modes	asynchronous, asynchronous-cyclic, synchronous-cyclic, synchronous-cyclic, programmable
max. baud rate	1 Mbit/s
specification	CAN 2.0B passive
protocol/profile	CANopen/CIA DSP 406, DSP 301 V.4, DSP 305 (LSS)
direction of rotation	looking at the flange, position counts up as the shaft rotates clockwise (CW), programmable

mechanical data

max. revolutions	mech. 12'000 rpm (IP 42) mech. 6'000 rpm (IP 65) electr. 1'830 rpm
moment of inertia	BFF typ. $18,4 \times 10^{-7}$ kgm ² BFG typ. $23,8 \times 10^{-7}$ kgm ²
torque	
BFF	typ. 0,9 cNm IP 42 typ. 3,7 cNm IP 65
BFG	typ. 1,75 cNm IP 42 typ. 4,7 cNm IP 65 (3'000 rpm / 20 °C)
product life	depending on ambient conditions (typ. 10 ⁹ revolutions)
max. protection class	IP 65
material	housing: aluminum flange: aluminum
weight	approx. 300 g

ambient conditions

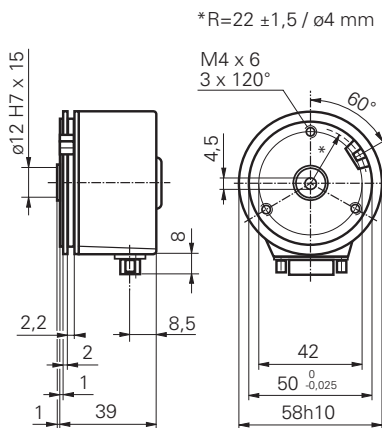
temperature range	-20...+85 °C
relative humidity	max. 95% non condensing
vibration	IEC 60068-2-6 (≤ 100 m/s ² / 10 - 200 Hz)
shock	IEC 60068-2-27 (≤ 500 m/s ² / 11 ms)
noise immunity	EN 61000-6-2
emitted interference	EN 61000-6-3



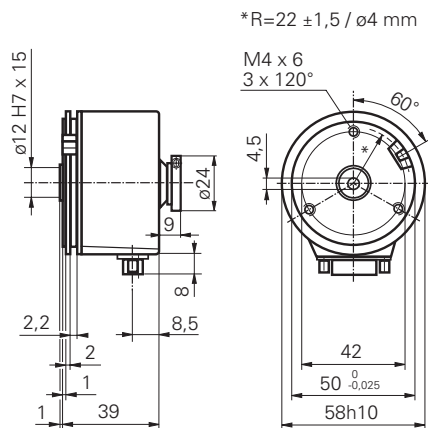
dimensions and connection dimensions

BFF

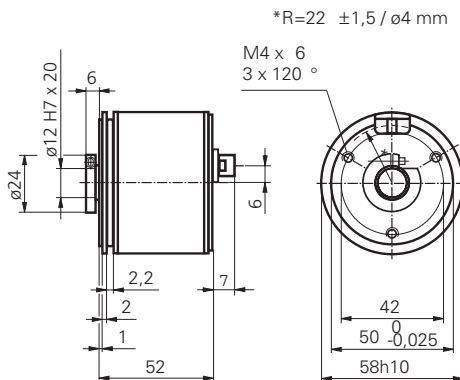
-F connector D-Sub axial



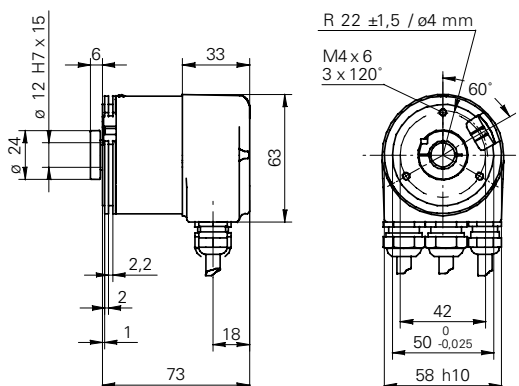
BFG



-G connector D-Sub axial



-D bus cover



Note

Mounting drawings see end of chapter.

Absolute single-turn hollow shaft encoders

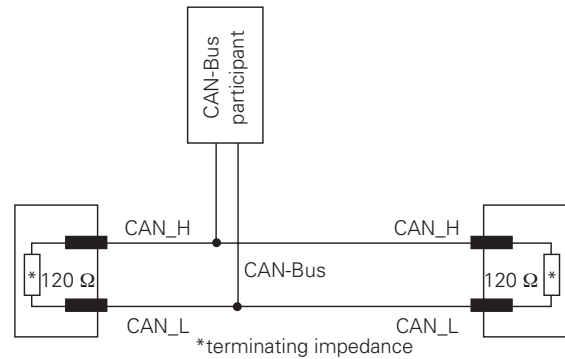
BFF/BFG

CANopen

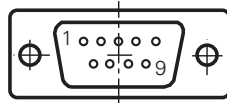
assignment connector D-Sub 9-pin male

pin	signals	description
1	n.c.	-
2	CAN_L	bus line (dominant LOW)
3	CAN_GND	0 VDC
4	n.c.	-
5	n.c.	-
6	GND	voltage supply
7	CAN_H	bus line (dominant HIGH)
8	n.c.	-
9	+Vs	voltage supply

wiring according to ISO/DIS 11898

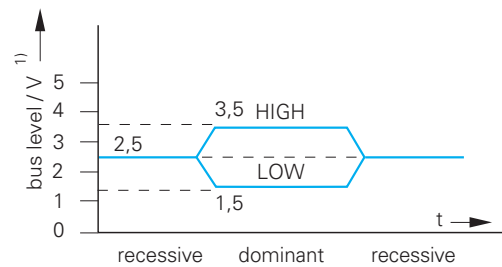


connector male



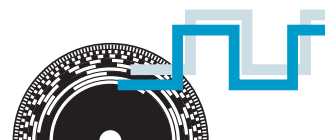
male

output level acc. to ISO/DIS 11898



1) at common-mode-current = 0 V

CANopen



CAN bus protocol

CAN protocol: CANopen

Device asynsprofile: CiA DSP 406, DSP 301 V.4,
DSP 305 (LSS)

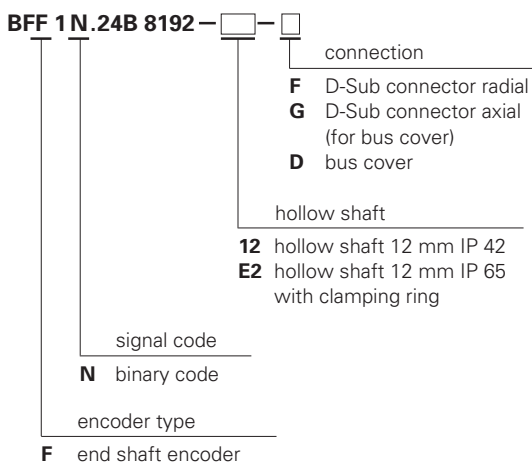
Supported operating modes:

- Polling (async), data transmission on request.
- Cyclic, data transmission periodic, asynchronous (async-cyclic) or synchronous (sync-cyclic) with sync message.
- Acyclic, data transmission if process values change, synchronous with sync message.
- LSS, layer setting service, simplified network configuration.

Note:

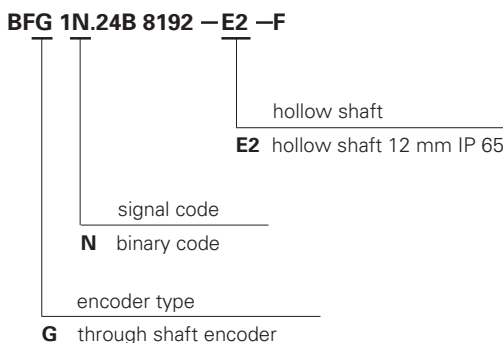
The cable screen end and the encoder housing must be connected to ground potential.

order designation BFF



Other versions on request

order designation BFG



Other versions on request.

accessories

clamp set	part nr. 110616
torque pin	part nr. 107540
torque spring ¹⁾	part nr. 109520
spring plate set	part nr. 136635
couplings and shaft adapters	see chapter accessories
CD-ROM with GSD-/EDS-/XML- files and manuals	part nr. 147362
clamping ring set 12 mm hollow shaft	part nr. 142556

¹⁾ encoder is delivered with fixed rubber torque spring