

# Programmable absolute multi-turn shaft encoders

## BMC/BMD

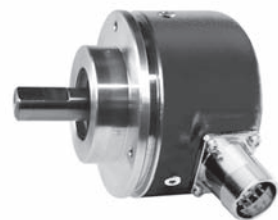
### SSI

#### features

- multi-turn encoders up to
  - 13 bit single-turn
  - 12 bit multi-turn
- SSI interface
- Gray and binary code
- programmable
- counting direction setting input
- zero setting input



BMC



BMD

#### general data

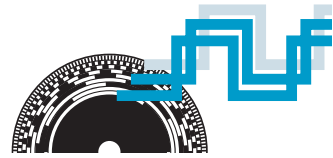
voltage supply	10 - 30 VDC with reverse polarity protection
supply current	50 mA (at 24 VDC)
max. resolution single-turn	13 bit (1 step = 2' 38") resolution from 2 to 8'192 steps/rev as desired
multi-turn	12 bit (4'096 revolutions) from 1 to 4'096 rev. in two exponential steps
max. error limit	±1/2 step
input signal	clock input SSI, F/R-input, zero setting input
max. clock frequency	800 kHz
clock frequency SSI	min. 62,5 kHz to max. 1,5 MHz (depending on cable length)

#### mechanical data

max. revolutions	mech. 10'000 rpm electr. 6'000 rpm
moment of inertia	$2 \times 10^{-6} \text{ kgm}^2$
torque	≤ 0,010 Nm (without sealing ring) ≤ 0,015 Nm (with sealing ring)
max. shaft load	axial: 20 N      radial: 40 N
max. protection class	IP 65
material	housing: steel flange: aluminum
weight	approx. 600 g

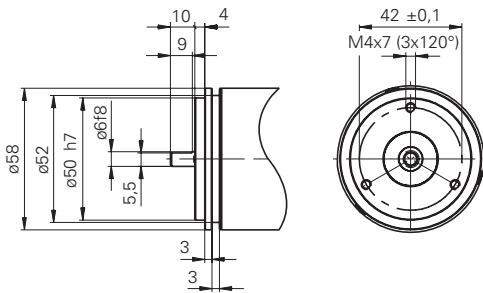
#### ambient conditions

temperature range	-25...+85 °C
relative humidity	max. 95% non condensing
vibration	DIN EN 60068-2-6 (≤ 100 m/s <sup>2</sup> / 16 - 2'000 Hz)
shock	DIN EN 60068-2-27 (≤ 2'000 m/s <sup>2</sup> / 6 ms)
noise immunity	DIN EN 61000-6-2
emitted interference	DIN EN 61000-6-4



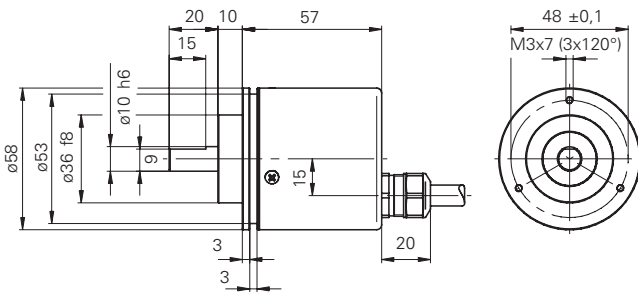
dimensions and connection dimensions

BMC

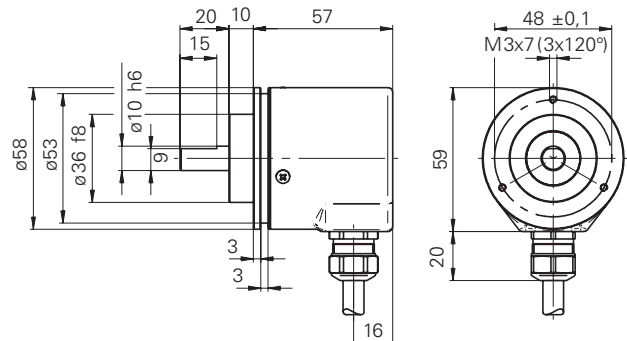


BMD

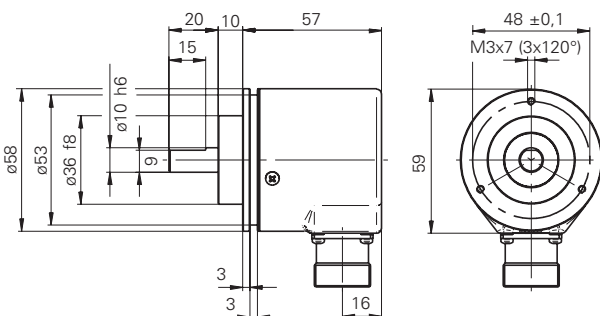
-4



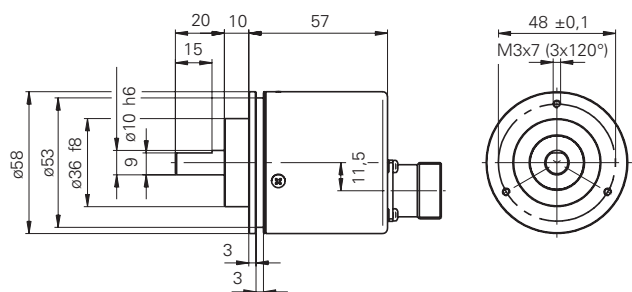
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-A



-B



# Programmable absolute multi-turn shaft encoders

## BMC/BMD

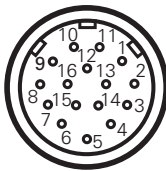
### SSI

#### assignment

Designation SSI		
cable	connector	signal
color	16-pin	
violet	1	data+
brown/white	2	data-
green/white	3	n.c.
yellow/white	4	TxD
grey/white	5	RxD
white/pink	6	clock+
blue/white	7	clock-
red/white	8	output 1
black/white	9	Preset-OUT: output 2
brown/green	10	output 3
green/grey	11	output 4
blue	12	GND
green	13	Preset-IN
brown	14	F/R UP/DOWN
red	15	+Vs
pink	16	n.c.

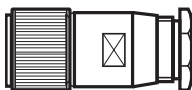
Screen: In the case of encoders with cable output, the screen is connected to the housing.

#### connector encoder M23 male



seen from outside

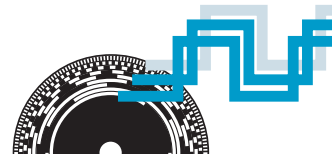
#### connector 16-pin M23



#### signals for serial input interface

- 1 data+ Positive serial data output of differential line driver. A HIGH level at the output logically corresponds to 1 in positive logic.
- 2 data- Negative serial data output of differential line driver. A HIGH level at the output logically corresponds to 0 in positive logic.
- 3 n.c. Connection without function
- 4 TxD Transmission output of encoder for the RS-232 programming interface.
- 5 RxD Receiver input of encoder for the RS-232 programming interface.
- 6 clock+ Positive SSI pulse input. Clock+ produces a current loop together with clock-. A current of approximately 7 mA in direction of the input Pulse + generates a logical 1 in positive logic.
- 7 clock- Negative SSI pulse input. Clock- produces a current loop together with clock+. A current of approximately 7 mA in direction of the input Pulse - generates a logical 0 in positive logic.
- 8, 10, 11 output 1,3,4 The special outputs 1,3 and 4 may be optionally assigned, by programming, to the specialfunctions preselection 1, preselection 2, speed monitoring or diagnosis.
- 9 Preset-OUT output 2 Special output for preset monitoring. Cannot be optionally programmed.
- 12 GND Housing contact of encoder. The specific GND voltage is +Vs.
- 13 Preset-IN Preset input for setting a preset anywhere within entire resolution. The preset setting is triggered by a HIGH pulse (pulse duration  $\geq 100$  ms).
- 14 F/R UP/DOWN Input for counting up and down. If open-circuited, it is set to HIGH. UP/DOWN HIGH means increasing output data if shaft rotates clockwise when looking at the flange. UP/DOWN LOW means increasing values if shaft rotates counter-clockwise when looking at the flange.
- 15 +Vs Voltage supply of encoder
- 16 GND-PRG Ground for programmable interface. Internally not connected with GND.

SSI



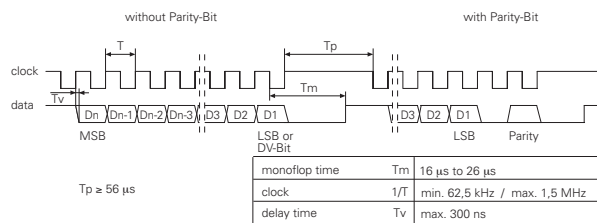
**inputs F/R and ZERO**

One control signal F/R for selection of positive direction of rotation and ZERO for zeroing in any position.

input voltage	(Vs = 10 - 30 VDC)
HIGH level	0,7 Vs up to Vs
LOW level	0 up to 0,3 Vs

Wiring:  
Inputs with 10 kΩ to Vs for F/R and with 10 kΩ to GND for ZERO.

**signal characteristic, SSI serial output**



**output 1...4**

Outputs push-pull short-circuit protected

HIGH level	≥ Vs -3,5 V (at I = -20 mA)
LOW level	≥ 0,5 V (at I = 20 mA)

DV for error display can be programmed to one of the outputs. LOW level indicates an error.

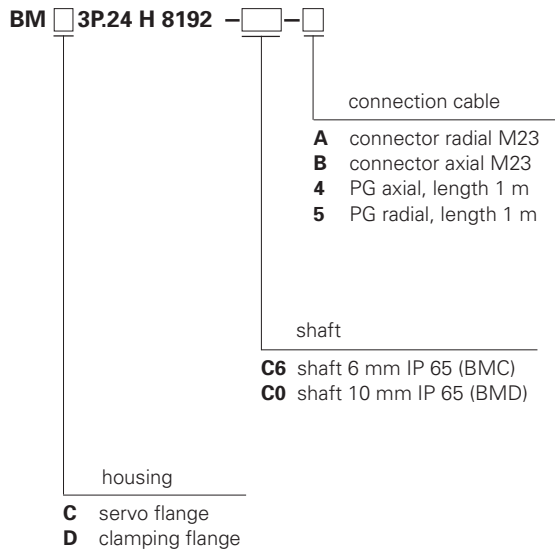
**parity bit programmable**

For simple error detection during data transmission, an additional parity bit can be transmitted. Two additional clocks are required for transmission (by MT various).  
Parity bit = „1“ for odd number of HIGH levels in the data word (without parity bit).  
Parity bit = „0“ for even number of HIGH levels in the data word (without parity bit).

**data validity bit (DV) programmable**

The DV bit can be transmitted after the LSB (D 1).  
The transmitted DV bit is HIGH active, that is to say if a HIGH level is transmitted, the data information is invalid. The data are valid where DV bit = LOW.

**order designation**



**preconditions for programming**

- PC with RS 232 interface and Windows operating system
  - programming software ProGeber, manual
  - programming cable connection, connecting the absolute encoder with the PC
- Order separately under chapter accessories if necessary.

**accessories**

connector 16-Pol M23	part nr. 117731
<b>type BMC servo flange</b>	
mounting	part nr. 125058
screws and servo clamps	part nr. 117668
<b>type BMD clamping flange</b>	
mounting bracket	part nr. 117698
programming software	
cable and manual	part nr. 117729

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# Programmable absolute multi-turn shaft encoders

## BMC/BMD

### parallel

#### features

- multi-turn encoders up to
  - 12 bit single-turn
  - 12 bit multi-turn
- parallel interface
- Gray, BCD and binary code
- programmable
- counting direction setting input
- zero setting input



BMC



BMD

#### general data

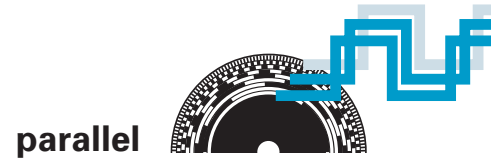
supply voltage	10 - 30 VDC with reverse polarity protection
supply current	50 mA (at 24 VDC)
max. resolution single-turn	12 bit (1 step = 5' 16") resolution from 1 to 4'096 steps/rev as desired
multi-turn	12 bit (4'096 revolutions) from 1 to 4'096 rev. in two exponential steps
max. error limit	±1/2 step
input signal	F/R-input, STORE/ENABLE, zero setting input
max. switching frequency	400 kHz

#### mechanical data

max. revolutions	mech. 10'000 rpm electr. 6'000 rpm
moment of inertia	$2 \times 10^{-6} \text{ kgm}^2$
torque (3'000 rpm / 20 °C)	≤ 0,010 Nm (without sealing ring) ≤ 0,015 Nm (with sealing ring)
max. shaft load	axial: 20 N      radial: 40 N
max. protection load	IP 65
material	housing: steel flange: aluminum
load	approx. 600 g

#### ambient conditions

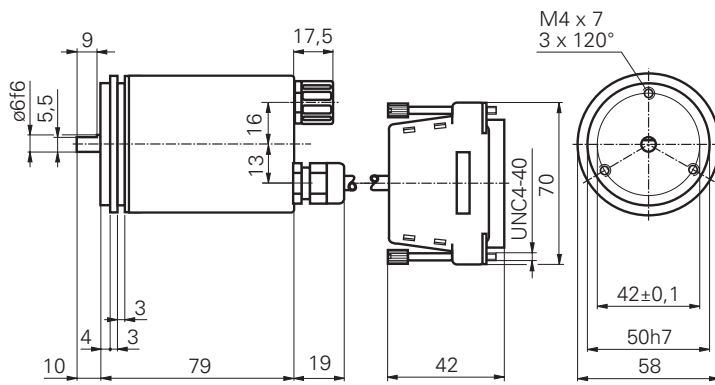
temperature range	-25...+70 °C
relative humidity	max. 95% non condensing
vibration	DIN EN 60068-2-6 (≤ 100 m/s <sup>2</sup> / 16 - 2'000 Hz)
shock	DIN EN 60068-2-27 (≤ 2'000 m/s <sup>2</sup> / 6 ms)
noise immunity	DIN EN 61000-6-2
emitted interference	DIN EN 61000-6-4



dimensions and connection dimensions

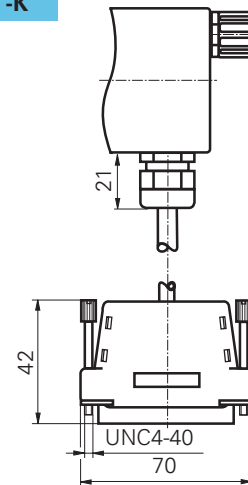
BMC

-J



cable length 1 m

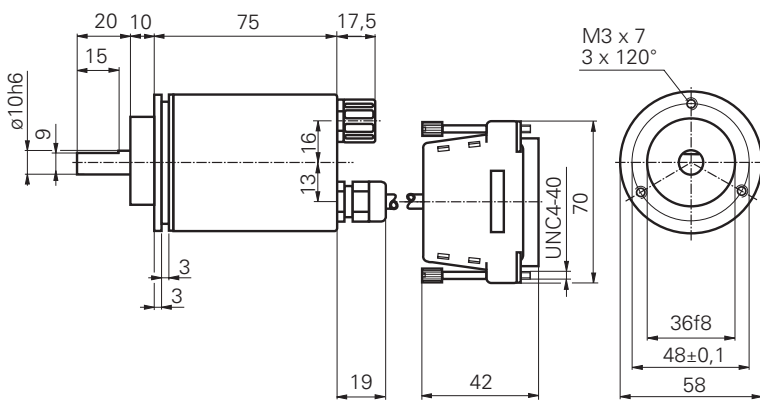
-K



cable length 1 m

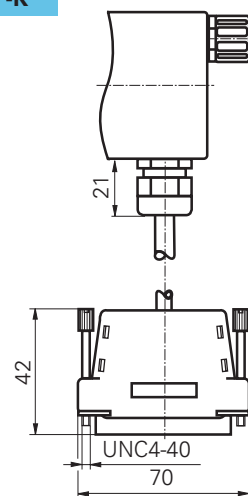
BMD

-J



cable length 1 m

-K



cable length 1 m

3

# Programmable absolute multi-turn encoders BMC/BMD parallel

## assignment

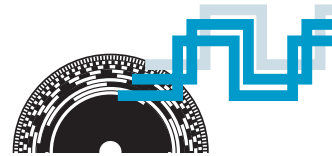
Designation parallel			
cable connector	signal	cable color	
<b>37-pin</b>			
1	D0	WH	white
2	D1	BN	brown
3	D2	GN	green
4	D3	YE	yellow
5	D4	GY	grey
6	D5	PK	pink
7	D6	BK	black
8	D7	VT	violet
9	D8	GY/PK	grey/pink
10	D9	RD/BU	red/blue
11	D10	WH/GN	white/green
12	D11	BN/GN	brown/green
13	D12	WH/YE	white/yellow
14	D13	YE/BN	yellow/brown
15	D14	WH/GY	white/grey
16	D15	GY/BN	grey/brown
17	D16	WH/PK	white/pink
18	D17	PK/BN	pink/brown
19	D18	WH/BK	white/black
20	D19	BN/BK	brown/black
21	D20	GY/GN	grey/green
22	D21	YE/GY	yellow/grey
23	D22	PK/GN	pink/green
24	D23	YE/PK	yellow/pink
25	-	-	-
26	-	-	-
27	ZERO	YE/BU	yellow/blue
28	ENABLE	BN/BU	brown/blue
29	STORE	BN/RD	brown/red
30	F/R	GN/BU	green/blue
31	-	-	-
32	-	-	-
33	-	-	-
34	GND-Sense	WH/BU	white/blue
35	Vs-Sense	WH/RD	white/red
36	+Vs	RD	red
37	GND	BU	blue

Screen: In the case of encoders with cable output, the screen is connected to the housing.

## signals for parallel input interface

1 - 24	24 parallel output signals.
D0 - D23	Data lines D0 to D23. With PNP, pull down; with NPN, 4,7 kΩ pull up resistors recommended for each data line.
27 ZERO	Zero setting input for setting a zero at any point within the programmed encoder resolution. The zero setting process is triggered by a HIGH pulse and should take place after direction of rotation selection (F/R). For maximum interference immunity after zero setting, connect to GND. Pulse duration ≥ 100 ms.
28 $\overline{\text{ENABLE}}$	If this input is at LOW level, the output drivers will be activated. On application of HIGH potential (or unconnected), the output drivers assume a HIGH-resistance state.
29 $\overline{\text{STORE}}$	By applying a LOW level, the data of the absolute encoder will be buffered. If this input is connected to HIGH potential or remains open, the current position data of the absolute encoder will be switched through to the output drivers. For reliable readout of the data, this line must be used in the case of Binary-Code.
30 F/R	By applying a HIGH potential, ascending values will be output when the shaft rotates cw (looking at shaft). If LOW potential is applied, descending values will be output.
34 GND-Sense	This contact is connected internally to GND and assists, together with VS-sense, to measure the supply voltage at the encoder via the follow-up electronic.
35 VS-Sense	This contact is connected internally to +VS. If the sensor line is not to be used, this contact must be isolated (danger of short circuit).
36 +VS	Voltage supply.
37 GND	Ground connection to encoder.

parallel



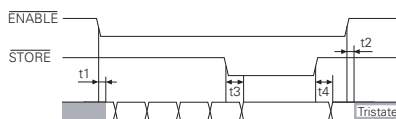
**inputs**

One control signal each  $\overline{\text{ENABLE}}$  for activation of the output driver,  $\overline{\text{STORE}}$  for storing the output data, F/R for selection at positive direction of rotation and ZERO for zeroing in any position.

input voltage	(Vs = 10 - 30 VDC)
HIGH level	0,7 Vs up to Vs
LOW level	0 up to 0,3 Vs

Wiring:  
Inputs with 10 kΩ to Vs, except zero set input with 10 kΩ to GND.

**signal characteristic  $\overline{\text{STORE/ENABLE}}$**



Signals	time typically	10 - 30 VDC
ENABLE	t1/t2	60 μs
STORE	t3/t4	200 μs

**outputs**

24 parallel output signals with  $\overline{\text{STORE}}$  and tristate function (ENABLE).  
All outputs with short-circuit protection PNP or NPN output stages (OC).

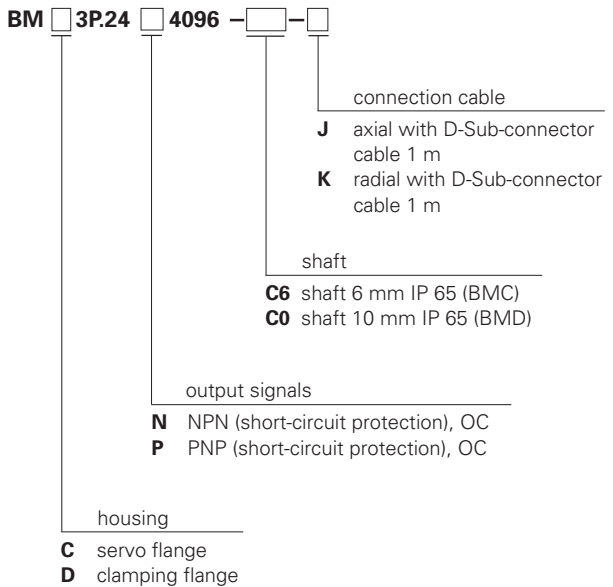
HIGH (PNP) level	$\geq +Vs - 4,5 \text{ V}$ (at I = -15 mA)
LOW (NPN) level	$\leq 3,5 \text{ V}$ (at I = 15 mA)
HIGH (PNP) load	$\leq -20 \text{ mA}$
LOW (NPN) load	$\leq 20 \text{ mA}$
tristate	$\leq 200 \mu\text{A}$

**pin assignment programming cable**

encoder-function	5-Pol. enc. plug	cable color	PC connection 9 pin D-Sub	PC connection 25 pin D-Sub
-	pin 1	brown	-	-
RxD	pin 2	white	pin 3	pin 2
GND	pin 3	blue	pin 5	pin 7
P/ $\overline{\text{R}}$ -mode	pin 4	black	pin 5	pin 7
TxD	pin 5	grey	pin 2	pin 3
-	-	-	bridge 4 - 6	bridge 4 - 5
-	-	-	bridge 7 - 8	bridge 6 - 20

Also connect encoder via device plug to voltage (+Vs and GND).

**order designation**



**preconditions for programming**

- PC with RS 232 interface and Windows operating system
  - programming software ProGeber, manual
  - programming cable connection, connecting the absolute encoder with the PC
- Order separately under chapter accessories if necessary.

**accessories**

programming software incl. cable and manual	part nr. 117666
<b>type BMC servo flange</b>	
mounting	part nr. 125051
screws and servo clamps	part nr. 117668
<b>type BMD clamping flange</b>	
mounting bracket	part nr. 117698