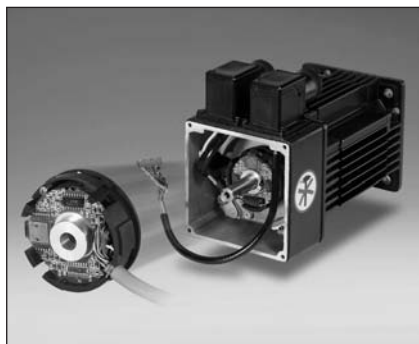


for AC Synchronous & BLDC Motors



- Incremental + commutation
- Modular hollow shaft encoder as feedback for Brushless DC (BLDC) Servos, DC Servos and Step Motors
- Outside diameter 53 mm (2.1")
- Hub diameters 6 ... 12 mm (1/4" ... 1/2")
- Height 20 mm (0.8")
- Resolution 500 ... 2048 lines
- Standard Operating temperature -40 ... +120 °C
- Maximum speed 12000 RPM
- Easy installation and alignment

NUMBER OF PULSES

500, 1000, 1024, 2000, 2048;
optional 4, 6, 8, 10, 12 or 16 pole commutation signals

TECHNICAL DATA mechanical

Weight	28 g without cover, 43 g with cover
Dimensions	
Outside diameter	53 mm with cover, 51 mm without cover
Depth	20.3 mm with cover excluding connector 17.9 mm without cover
Hub shaft diameters	6 mm / 8 mm / 10 mm / 12 mm sowie 6.35 mm (1/4") / 9.52 mm (3/8") / 11.11 mm (7/16") / 12.7 mm (1/2")
Hollow shaft tolerance	+0.026 mm ... -0.000 mm
Shaft misalignment	axial endplay: +0.13 mm ¹ ... -0.38 mm radial runout: 0.05 mm (incl. angular misalignment)
Mating shaft length	min. 16.5 mm max. 19 mm when used with closed cover
Alignment of encoder channels to motor windings	coarse alignment: index mark on the housing and disc/hub fine alignment: ±15° mechanical alignment range
Max. speed	12000 min ⁻¹
Moment of inertia	4.7 gcm ²
Protection class (EN 60529)	IP40 ² when mounted with cover
Operating temperature	-40 ... +120 °C
Storage temperature	-40 ... +120 °C
Vibration resistance (IEC 68-2-6)	25 m/s ² (5 ... 2000 Hz)
Shock resistance (IEC 68-2-27)	500 m/s ² (11 ms)
Connection	shielded cable radial or dual row connector ³
Housing	glassfibre reinforced plastic

¹ + indicates away from mounting face (cover)

² IP50 on request

³ 10 pins for version incremental only, 14 pins for version incremental +commutation

Motor Feedback Systems Type M 21

for AC Synchronous & BLDC Motors

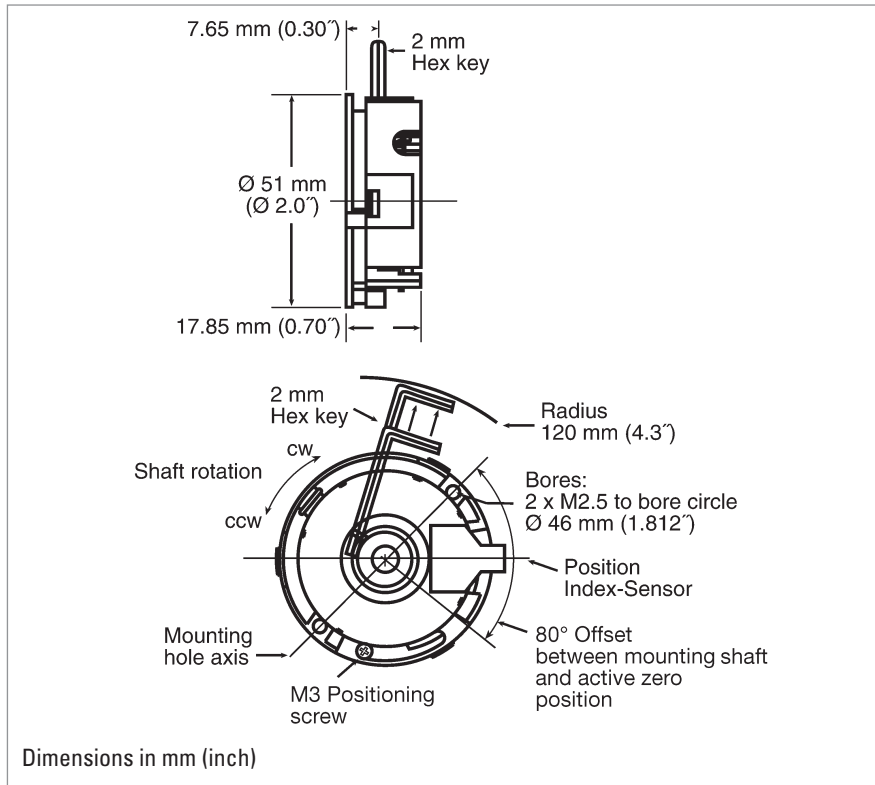
TECHNICAL DATA electrical

General design	as per DIN EN 61010-Teil 1, protection class III, contamination level 2, over voltage class II	
Supply voltage	DC 5 or 12 V $\pm 10\%$ (SELV)	
Max. current w/o load	Incremental: max. 100 mA; commutation: max. 75 mA	
recommended external fuse	2 x T 0.125 A	
Output circuit	NPN-Open Collector, max. 16 mA; Pull-up 2.0 K Ω RS 422, max. 40 mA	
Output signals		
Incremental	NPN-O.C: A, B, N	RS 422: A, B, N, \bar{A} , \bar{B} , \bar{N}
Commutation (optional):	NPN-O.C: U, V, W	RS 422: U, V, W, \bar{U} , \bar{V} , \bar{W}
Accuracy		
Incremental signals	max. ± 5 arc-mins. (edge to any edge)	
Commutation signals	max. ± 6 arc-mins.	
Phasing		
Incremental signals (A to B)	90° $\pm 18^\circ$ electrical	
Commutation signals	12 pole: 20°, 8 pole: 30°, 6 pole: 40°, 4 pole: 60° mechanical	
Index to U	$\pm 1^\circ$ mech. index pulse center to U channel edge	
Pulse width		
Incremental signals	180° $\pm 18^\circ$ electrical	
Commutation signals	12 pole: 30°, 8 pole: 45°, 6 pole: 60°, 4 pole: 90° mechanical	
Max. output frequency.	200 kHz	
Noise immunity ¹	as per EN 50082-2	
Noise emission ¹	as per EN 50081-2	

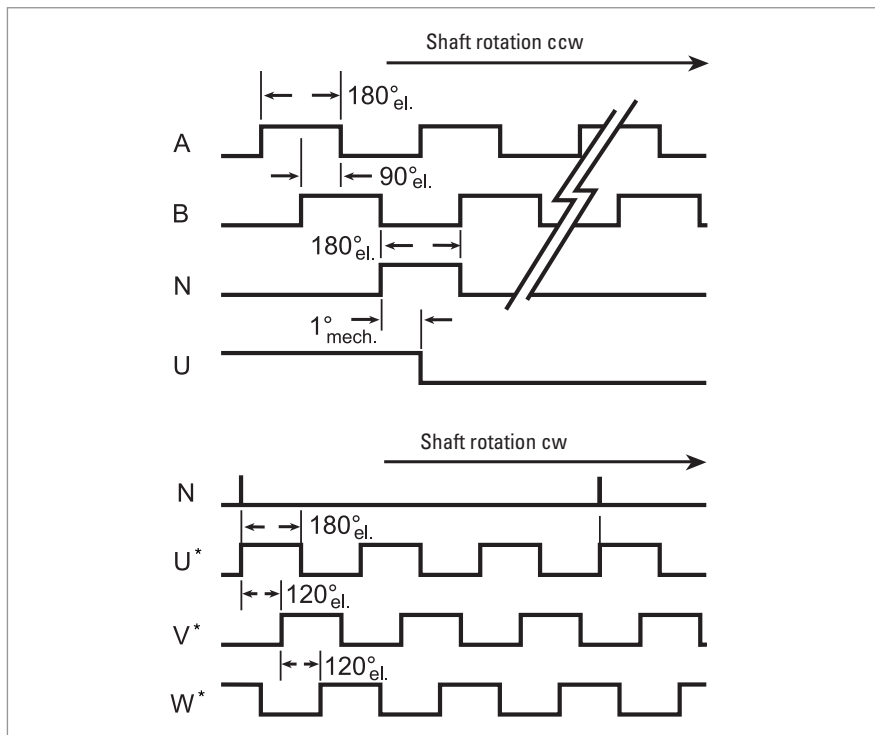
¹ EMC values are only valid for versions with output RS422 and screened cable

for AC Synchronous & BLDC Motors

DIMENSIONAL DRAWINGS



PULSE DIAGRAM



* Beispiel mit 6-poliger commutation

for AC Synchronous & BLDC Motors

CONNECTION DIAGRAM CABLE

Function	Colour for version incremental only, Code Electrical = 3	Colour for version incremental + commutation, Code Electrical = 6, 7, 9
V _{CC} com ¹		red/white ³
V _{CC} inc ¹	red	red
GND inc	black	black
GND com		black/white ³
\bar{A}	red/black	blue/black
A	green	blue
\bar{B}	white/black	green/black
B	orange	green
\bar{N}	blue	violet/black
N	white	violet
\bar{U} ²		brown/black
U		brown
\bar{V} ²		grey/black
V		grey
\bar{W} ²		white/black
W		white

¹ V_{CC} com resp. V_{CC} inc = + DC 5 V or + DC 12 V (see ordering data electrical)

² only for output_{com} = RS422

³ not connected for codes 6 and 9, since here U_{inc} = U_{com}

CONNECTION DIAGRAM CONNECTOR

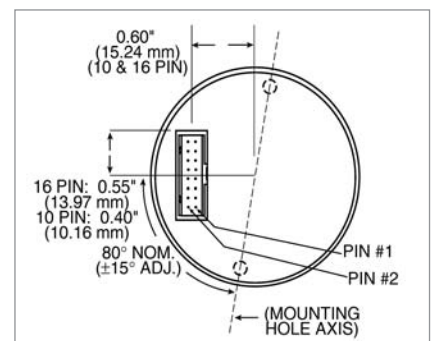
Function	10 pole only incr., NPN-O.C., Code Electr. = 0, 1	10 pole only incr., RS422, Code Electr. = 3	16 pole incr. + commutation, Code Electr. = 6, 7, 9
V _{CC} com ¹			1
V _{CC} inc ¹	2	2	2
GND inc	3	3	3
GND com			4
\bar{A} ²		5	5
A	1	1	6
\bar{B} ²		7	7
B	8	8	8
\bar{N} ²		9	9
N	10	10	10
\bar{U} ²			11
U			12
\bar{V} ²			13
V			14
\bar{W} ²			15
W			16

¹ V_{CC} com resp. V_{CC} inc = + DC 5 V or + DC 12 V (see ordering data electrical)

² only for output_{inc/com} = RS422

Pin Numbering:

For dual row connector with ribbon cable:
The cable side marked red designates Pin 1



for AC Synchronous & BLDC Motors

ORDERING INFORMATION

Type	Pulses ppr incremental ⁴	Poles commutation ⁴	Housing	Electrical ¹	Hub diameter ²	Connection
<input type="checkbox"/>	<input type="checkbox"/> / <input type="checkbox"/>	<input type="checkbox"/> - <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
M21-	0 500 0 512 1 000 1 024 2 000 2 048	0 without 4 4 pole 6 6 pole 8 8 pole A 10 pole C 12 pole X 16 pole	0 without cover 1 closed cover for blind shaft 2 cover with bore for through shaft	incremental only without commutation 0 U _{inc} =DC 5 V; output _{inc} =NPN-O.C. 1 U _{inc} =DC 12 V; output _{inc} =NPN-O.C. 3 U _{inc} =DC 5 V; output _{inc} =RS 422 incremental plus commutation signals 6 U _{inc} =DC 5 V; output _{inc} =RS 422, U _{com} =DC 5 V; output _{com} =NPN-O.C. 7 U _{inc} =DC 5 V; output _{inc} =RS 422, U _{com} =DC 12 V; output _{com} =NPN-O.C. 9 U _{inc} =DC 5 V; output _{inc} =RS 422, U _{com} =DC 5 V; output _{com} =RS 422	A 6.35 mm (1/4") B 9.52 mm (3/8") C 11.11 mm (7/16") D 12.7 mm (1/2") E 6 mm F 8 mm G 10 mm H 12 mm	0 dual row connector 1...8 dual row connector with mating ribbon cable 1=30 cm, 2=60 cm, ... A...H screened cable ³ radial, A=30 cm, B=60 cm, ...

¹ U_{inc}: Supply voltage incremental,
U_{com}: Supply voltage commutation (only if commutation is selected)
² Exposed hub clamp screw
³ only possible with output = RS 422 (Code for Electrical ≥ 3)
⁴ allowed combinations see available combinations (pulses/poles)

Available combinations (pulses/poles)

Pulses ppr	Number of poles						
	0	4	6	8	10 (=A)	12 (=C)	16 (=X)
0500	X	X	X	X		X	
0512	X			X			
1000	X	X	X	X		X	
1024	X	X	X	X		X	
2000	X	X	X	X		X	
2048	X	X	X	X	X	X	X