



TECHNICAL DATA

mechanical

- Practically no speed limitation, since up to 12.000 1/min
- Very good dynamic behaviour through low moment of inertia of rotor and its minimal influence on the motor
- Very good drive stiffness since no coupling is used
- Compact size
- Excellent price-performance ratio
- Increased temperature range, -40 to + 120°C
- Incomparable shaft play tolerances (to 0.7 mm axial)
- Better frequency, 200 KHz
- Flexibility, since the user can integrate in all actual motor sizes
- Simple mounting and adjustment since encoders come aligned and gapped

Weight	23 g without cover, 28 g with cover
Dimensions	
Outer diameter	39.6 mm with cover, 37.1 mm without cover
Depth	27.9 mm with cover ¹⁾ , 24.1 without cover
Hub diameters	6 mm / 8 mm / 10 mm / 3.18 mm ($\frac{1}{8}$ ") / 4.76 mm ($\frac{3}{16}$ ") / 6.35 mm ($\frac{1}{4}$ ") / 9.52 mm ($\frac{3}{8}$ ")
Hollow shaft tolerance	+0.026 mm ... -0.000 mm
Length of mounting shaft	min. 12 mm max. 22 mm when used with closed cover
Shaft misalignment	+ 0.38 mm ... - 0.38 mm axial endplay ²⁾ : + 0.13 mm ... - 0.38 mm radial runout: 0.05 mm (incl. angular misalignment)
Alignment of encoder channels to motor windings	coarse alignment: index mark on hub fine alignment: +/-15° mechanical alignment range
Maximum speed	12.000 RPM
Moment of inertia	4.7 gcm ²
Protection class (EN 60529)	IP 40 when mounted with cover
Operating temperature	-40 ... + 120 °C
Stock temperature	-40 ... + 120 °C
Vibration proof (IEC 68-2-6)	25 m/s ² (5 ... 2000 Hz)
Shock resistance /IEC 68-2-27)	500 m/s ² (11 ms)
Type of connection	shielded cable radial or dual row connector ³⁾
Housing	glassfibre reinforced plastic

¹⁾ for radial cable connection

²⁾ + means away from mounting face

³⁾ 10 pins (incremental only), 14 pins for type M 15 (incremental + commutation), 16 pins for type M 21 (incremental + commutation)

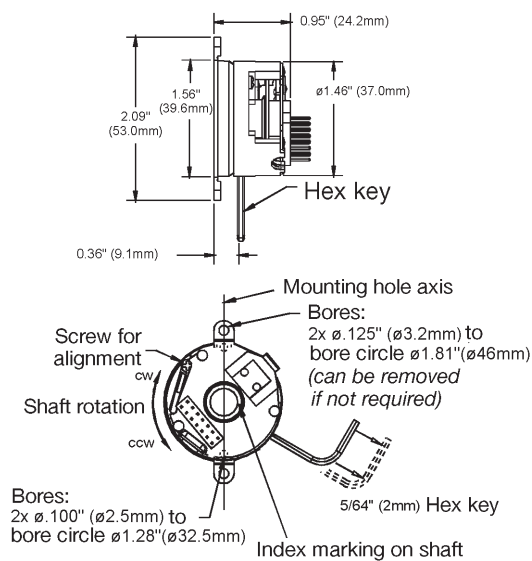
TECHNICAL DATA electrical

General design	as per DIN EN 61010, protection class III, contamination Level 2, overvoltage class II
Supply voltage	5 or 12 V DC +/- 10 % (SELV)
Intrinsic power consumption	Incremental: max. 100 mA Incremental + commutation: max. 120 mA
Recommended external fuse	T 0.125 A
Pulses	Incremental 200, 400, 500, 1000, 1024 optional 4, 6 or 8 pole commutation channels
Output circuit	NPN Open-Collector, max. 16 mA 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, $\bar{U}$, $\bar{V}$, $\bar{W}$
Tolerance	
Incremental signals	max. +/- 5 arc-mins. (edge to any edge)
Commutation signals	max. +/- 6 arc-mins.
Phasing	
Incremental signals (A to B) [° electrical]	90° +/- 18° electrical
Commutation signals [° mechanical]	8 pole: 30°, 6 pole: 40°, 4 pole: 60°
Index to U [° mechanical]	+/- 1° mechanical (index center to signal falling edge)
Pulse width	
Incremental signals [° electrical]	180° +/- 18°
Commutation signals [° mechanical]	8 pole: 45°, 6 pole: 60°, 4 pole: 90°
Max. pulse frequency	200 kHz
Noise immunity ¹⁾	as per EN 50082-2 (1995 edition)
Noise emission ¹⁾	as per EN 50081-2 (1993 edition)

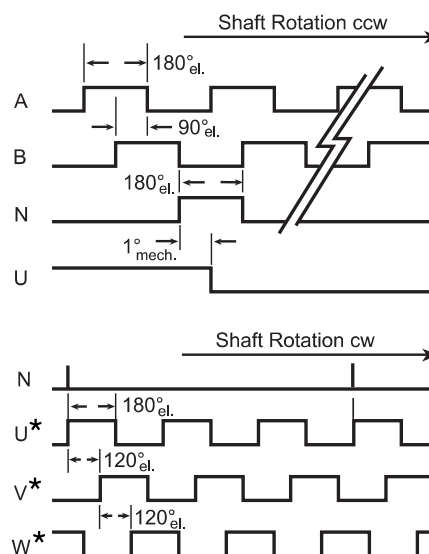
¹⁾ EMC values are only valid for versions with RS 422 output and screened cable.

DIMENSIONED DRAWING

M15



PULSE DIAGRAM



* Example with 6 pole commutation

CONNECTION DIAGRAM CABLE

Function	Colour incremental only, Code Electrical = 0, 1, 3	Colour incremental + commutation, Code Electrical = 6, 7, 9
$V_{cccom}^{1)}$		red/white ³⁾
$V_{ccinc}^{1)}$	red	red
GND inc	black	black
GND com		black/white ³⁾
$\bar{A}^{2)}$	red/black	blue/black
A	green	blue
$\bar{B}^{2)}$	white/black	green/black
B	orange	green
$\bar{N}^{2)}$	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_{cccom} resp. $V_{ccinc} = +5$ V DC or $+12$ V DC (see Ordering data Electrical)

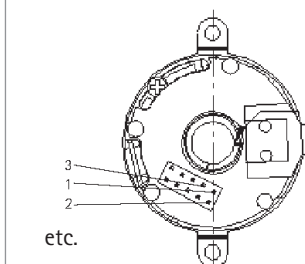
²⁾ only with Output_{inc/com} = RS 422

³⁾ hot applicable for Code 6 and 9, as here $U_{inc} = U_{com}$

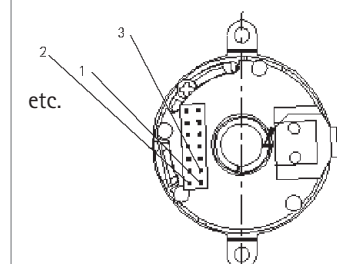
CONNECTION DIAGRAM
DUAL ROW CONNECTOR

Pin ¹⁾	10 poles Incr. only, NPN-O.C., Code Electr.= 0, 1	10 poles Incr. only,, RS422, Code Electr.= 3	14 poles Incr.+Commutation, Code Electr.= 6, 7, 9
1	A		V_{cc}
2	V_{cc}	V_{cc}	U
3	GND	GND	$\bar{U}$
4			V
5		$\bar{A}$	$\bar{V}$
6		A	W
7		$\bar{B}$	$\bar{W}$
8	B	B	$\bar{A}$
9		$\bar{N}$	A
10	N	N	B
11			$\bar{B}$
12			N
13			GND
14			$\bar{N}$

Dual row connector 10 poles



Dual row connector 14 poles



ORDERING DATA

M15 - / -

Pulses Incremental / Poles Commutation 0200/0 0400/0 0500/0 1000/0 1024/0 0500/6 1000/4 1000/6 1000/8 1024/4 1024/6 1024/8	Cover 0 no cover 1 closed cover for blind shaft 2 cover with bore for through shaft Electrical ¹⁾ only incremental: 0 $U_{inc}=5\text{ V}$; output_{inc}=NPN-O.C. 1 $U_{inc}=12\text{ V}$; output_{inc}=NPN-O.C. 3 $U_{inc}=5\text{ V}$; output_{inc}=RS 422 incremental + commutation: 6 $U_{inc}=5\text{ V}$; output_{inc}=RS 422, $U_{com}=5\text{ V}$; output_{com}=NPN-O.C. 7 $U_{inc}=5\text{ V}$; output_{inc}=RS 422, $U_{com}=12\text{ V}$; output_{com}=NPN-O.C. 9 $U_{inc}=5\text{ V}$; output_{inc}=RS 422, $U_{com}=5\text{ V}$; output_{com}=RS 422	Type of connection 0 dual row connector 1...8 connector with mating ribbon cable 1=30 cm, 2=60 cm, ... A...H screened radial cable A=30 cm, B=60 cm, ... Hub diameter 0 6.35 mm ($\frac{1}{4}$"") 1 9.52 mm ($\frac{3}{8}$"") 4 6 mm 5 8 mm 6 10 mm 8 4.76 mm ($\frac{3}{16}$"") 9 3.18 mm ($\frac{1}{8}$"")
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¹⁾ U_{inc} : supply voltage incremental
 U_{com} : supply voltage commutation (only if commutation is selected)