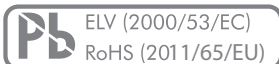


## Product description

### MAIN FEATURES

HIGH PERFORMANCE, HALL-SENSED SWITCH WITH VARIOUS INTERFACES

- › 12, 24 or 47/48 positions with selectable end stop
- › Switching torque: 1.5 to 20 Ncm
- › Switching cycles: Up to 1 Million
- › Absolut or incremental version
- › Analog, PWM, Parallel and UART output
- › With or without push button function
- › Operating voltage: 3.2 to 5.5 VDC
- › Operating temperature range: -30 to +85 °C
- › IP60 or IP68 sealing
- › Qualified by MIL-STD-202G and MIL-STD-810F



### PRODUCT VARIETY

- Output incremental or absolut
- Shaft length
- IP60 or IP68 front panel sealing
- Push force
- Switching torque

### POSSIBLE CUSTOMIZATIONS

- Shaft types
- Number of detents
- Mechanical interface: Connector type, cable connection and pin assignment
- Electrical interface: Operating voltage, data bus

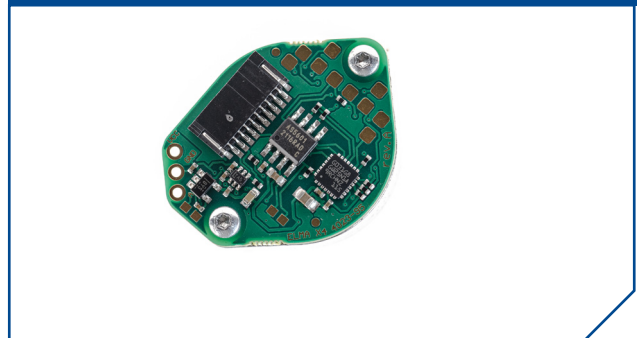
### TYPICAL APPLICATIONS

- Construction site
- Transportation controls
- Machine tools
- Defense applications
- Industrial applications
- Plant construction

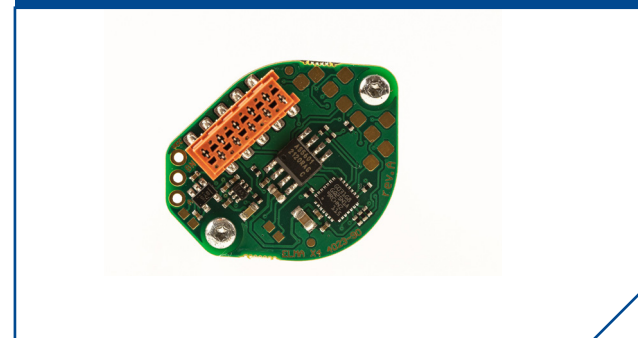
#### X4



#### X4 with FFC connector

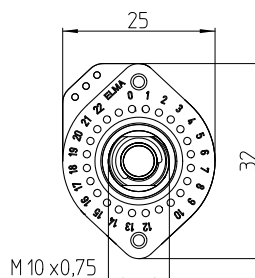
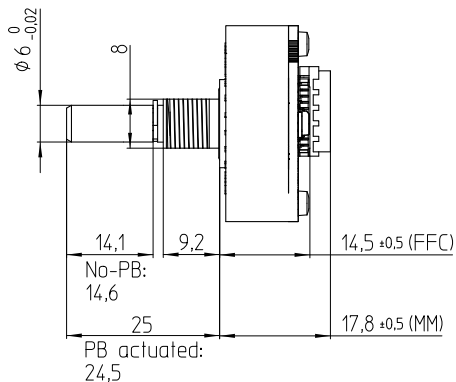


#### X4 with Micro-MaTch socket



**Dimensions and pin assignment**

**SWITCH DESIGN**



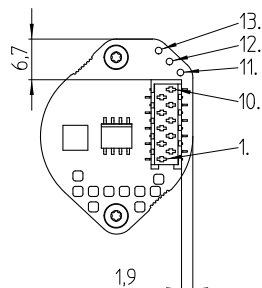
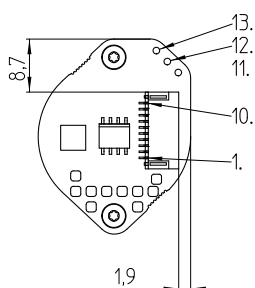
**PIN ASSIGNMENT**

**FFC CONNECTOR**

**MICRO MATCH CONNECTOR**

**MICRO MATCH / FFC CONNECTOR**

**SOLDERING EYELETS**

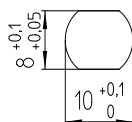


- 1. Vcc
- 2. GND
- 3. Bit 1/A (UART 1)
- 4. Bit 2/B (UART 2)
- 5. Bit 3 (UART 3)
- 6. Bit 4 (UART RQ)
- 7. Bit 5 (UART EN)
- 8. Push button
- 9. Analog out
- 10. PWM (Bit 6)

- 11. Vcc
- 12. GND
- 13. Analogausgang

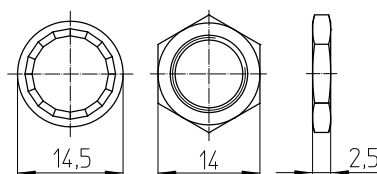
UART mode can be activated by solder bridge or UART EN (Pin #7) set to low.

**FRONT PANEL CUT OUT**



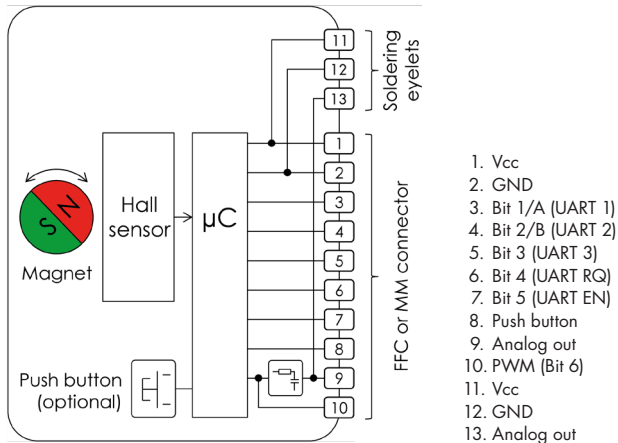
**NUT**

LOCK WASHER AND HEX NUT (SUPPLIED)



## Circuit diagram

### CONNECTIONS



External magnetic fields may interfere function.

## Output signal

### SIGNAL OVERVIEW

		INDEXING RESOLUTION		
		12 POSITIONS	24 POSITIONS	47/48 POSITIONS
Absolute	UART	At every change of position the absolute position is sent to UART 1		
	Parallel	Absolute Code Output (Gray)		
	Analog	0° ≅ GNDd to 359° = Vcc, intermediate values proportional to rotation angle		Not available
	PWM	0° ≅ 0 % to 359° = 100 %, intermediate values proportional to rotation angle		Not available
	Push button	Active high		
Incremental	UART	At every change of position a command is sent to UART 1	At every change of position a command is sent to UART 2	At every change of position a command is sent to UART 3
	Parallel	12 positions	24 positions	48 positions
	Analog	Not available		
	PWM	Not available		
	Push button	Active high		

## Ordering information

### ORDERING CODE

<b>X4</b>	-	-	-	-	--	-	-	-	-
-----------	---	---	---	---	----	---	---	---	---

**PUSH BUTTON**

**N** No  
**P** Push button 7 N  
**S** Push button 14 N

**INDEXING RESOLUTION**

**1** 12 positions (30° indexing)  
**2** 24 positions (15° indexing)  
**3** 47/48 positions (7.5° indexing)

**SWITCHING TORQUE**

**A** 1.5 Ncm  
**B** 4 Ncm (2.5 Ncm with 47/48 positions)  
**C** 8 Ncm (5 Ncm with 47/48 positions)  
**D** 15 Ncm (not available with 47/48 positions)  
**E** 20 Ncm (not available with 47/48 positions)

**END STOP**

**XX** Number of positions (for 47 positions only odd numbers: 3, 5, 7...47)  
**00** Continuously rotating (for incremental option)

**SHAFT STYLE**

**1** Round, Ø 6 mm x 25 mm  
**2** Round, Ø 6 mm x 16.5 mm

**IP SEALING**

**N** IP60  
**S** IP68

**OUTPUT | CONNECTOR TYPE**

<b>1</b> Absolute		FFC connector
<b>2</b> Absolute		Micro-MaTch socket
<b>3</b> Incremental		FFC connector
<b>4</b> Incremental		Micro-MaTch socket

### PACKAGING

ESD bag: Individual packaging (nut and lock washer mounted)

### ACCESSORIES AND SPARE PARTS

Spare nut: Part number 5622-16  
 Stop screw: Part number 5330-30

## Specifications

### MECHANICAL DATA

Detent angle   positions:	7.5° detent angle, 48 positions (absolute-version has max. 47 positions) 15° detent angle, 24 positions 30° detent angle, 12 positions
Rotary limitation   end stop:	7.5°: Configurable 15°: Configurable 30°: Configurable
Switching torque:	7.5°: 1.5, 2.5 or 5 Ncm (±30 % over life time) 15° and 30°: 1.5, 4, 8, 15 or 20 Ncm (±30 % over life time)
Rotational life:	> 1'000'000 cycles with 1.5 Ncm switching torque (tested at room temperature) > 250'000 cycles with 4 or 8 Ncm (tested at room temperature) > 50'000 cycles with 15 or 20 Ncm (tested at room temperature)
Allowed shaft load:	1'000 N push, 200 N pull and 200 N side force (static at 20 mm from supporting surface)
Rotational stop strength:	> 250 Ncm
Fastening torque of nut (front panel mounting):	M10 x 0.75: < 300 Ncm

### ELECTRICAL DATA

Electrical connection:	FFC connector (1 mm pitch, 10 pins, top contact) Micro-MaTch socket (1.27 mm pitch, 10 pins) Soldering eyelets
Operating voltage (Vcc):	3.2 to 5.5 VDC
Current consumption:	< 35 mA
Digital outputs:	< 1 mA per output
UART interface:	Configuration: 38.4 kbaud, 1 byte non-inverted, even parity, 1 stop-bit.  Absolute: 0 to 11 / 23 / 46 / 47 dec, push button actuated 100 dec. Command output approx. 500 ms after power-on, at changing position, push button actuation or upon request. For request set pin #6 low.  Incremental: Non-rotating = 21 dec   Turn left = 22 dec Turn right = 25 dec   Push button actuation adds 16 dec
Parallel output:	Absolute: 12, 24 or 47/48 positions Gray code, toggle-free Incremental: 12 PPR, A leading clockwise, toggle-free
Analog output:	Absolute: Output voltage = $V_{cc} \times (\text{current position} - 1) / (\text{number of positions} - 1)$ , output resistance: 1 k ohm, ripple: ±1 % at room temperature
PWM output:	Absolute: PWM output = $100 \% \times (\text{current position} - 1) / (\text{number of positions} - 1)$ , 10 bit resolution, 4 kHz, at room temperature
Output accuracy:	< ±1° linearity error, max. ±1° temperature drift
Response time:	< 100 ms (max. 120 rpm), push button: Max. 10 ms
Dielectric strength:	1'000 VDC during 60 s (MIL-STD-202G, method 301, pin-to-housing, pin-to-shaft)
Insulation resistance:	> 1 GΩ at 500 VDC (pin-to-housing, pin-to-shaft, in new condition)

### MATERIALS

Shaft:	Stainless steel 1.4305
Bushing   housing:	Zinc die casting (nickel plated)
Hex nut:	Brass (nickel plated)
Snap ring:	Spring steel (galvanized)
O-rings:	NBR (nitrile rubber), 70 shore A
Front panel sealing:	NBR (nitrile rubber), 75 shore A

## Specifications

### ENVIRONMENTAL DATA

Operating temperature:	-30 to +85 °C (IEC 60068-2.14)
Storage temperature:	-40 to +85 °C (IEC 60068-2-14, MIL-STD202G, method 107G, condition B-3)
Humidity:	< 93 % relative humidity (MIL-STD-202G, method 103B, condition B)
Salt atmosphere against front panel:	Only with IP68 gasket (MIL-STD-810F, method 509.4)
IP sealing against front panel:	IP60 without sealing IP68 with shaft and front panel sealing (5 bar, 4 h)
Vibration:	29 G <sub>RMS</sub> (MIL-STD-202G, method 214A, duration 15 min)
Shock:	100 G (MIL-STD-202G, method 213B, condition C)

### MECHANICAL DATA FOR PUSH BUTTON

Actuation force:	7 or 14 N (±30 % in new condition)
Travel:	0.8 (±0.3) mm
Lifecycles:	> 1'000'000 cycles with 7 N actuation force (tested at room temperature) > 500'000 cycles with 14 N actuation force (tested at room temperature)

### ELECTRICAL DATA FOR PUSH BUTTON

Contact resistance:	< 10 Ω (in new condition)
Switching current:	< 10 mA
Contact bouncing:	< 2 ms

### MATERIALS FOR PUSH BUTTON

Contact surface:	Cu alloy (Au plated)
Snap dome:	Stainless steel