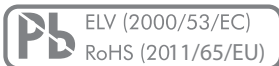


## Product description

### 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: 2.85 to 5.25 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

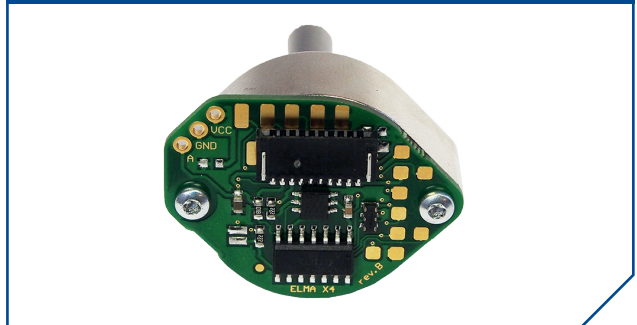
### TYPICAL APPLICATIONS

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

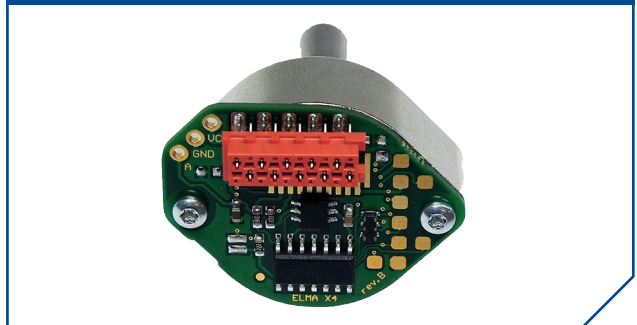
**X4**



**X4 with FFC connector**

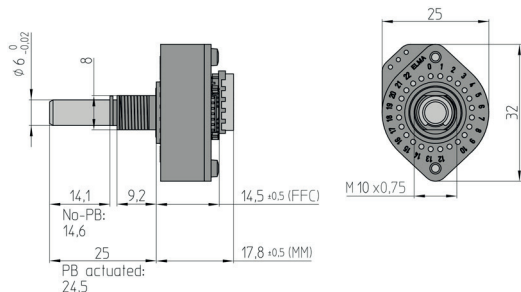


**X4 with Micro-MaTch socket**

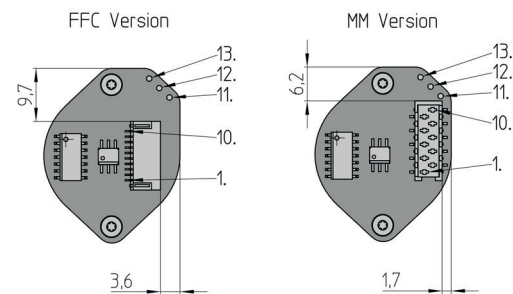


## Dimensions and pin assignment

### SWITCH DESIGN



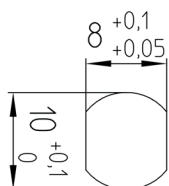
### PIN ASSIGNMENT



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. Analog out

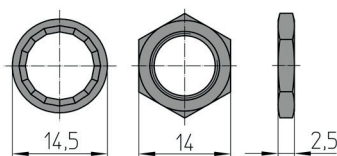
UART mode can be activated by solder bridge or UART EN (Pin #7) set to low.

### FRONT PANEL CUT OUT



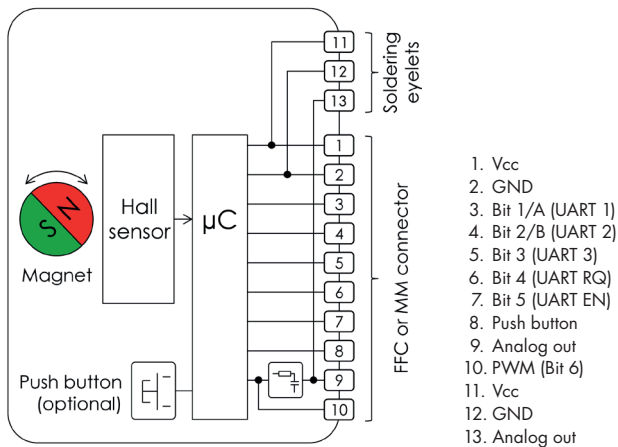
### NUT

LOCK WASHER AND HEX NUT (SUPPLIED)



## Circuit diagram

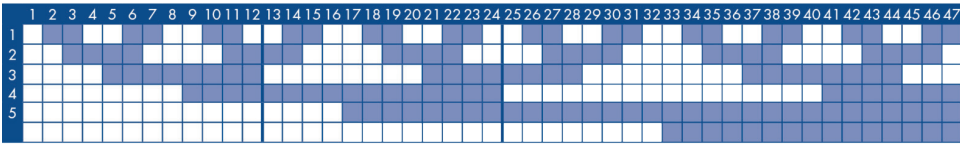
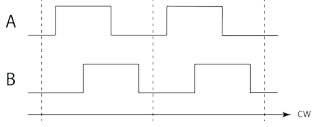
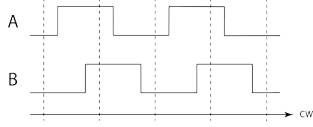
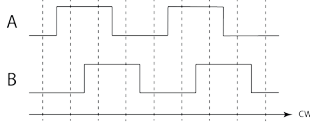
### CONNECTIONS



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 absolut 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		
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	<p>12 positions</p> 	<p>24 positions</p> 	<p>48 positions</p> 
	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

**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):	2.85 to 5.25 VDC (stabilized), with 47/48 positions 2.85 to 3.15 VDC incremental version
Current consumption:	< 25 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 = Vcc x (current position -1)   (number of positions -1), output resistance: 1 k ohm, ripple: ±1 % at room temperature
PWM output:	Absolute: PWM output = 100 % x (current position -1)   (number of positions -1), 10 bit resolution, 4 kHz, at room temperature
Output accuracy:	< ±5° 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-STD-202G, 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

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