



HTx25 PG



HTx25 M8



HTx25 PGR



HTx25 M8R

### Key features

- Ø25 mm aluminium metal housing
- Maximum life time expectation
- High continuous actuation shaft speeds
- Magnetic, gradient-based signal evaluation
- Digital signal processing
- Double ball bearings
- Ø4 or Ø6 mm stainless steel shaft
- Shaft bearings IP65, housing IP68
- Operating temperature range -30..85°C
- Measurement range up to 360° singleturn, 72000° multiturn
- Electrical connections M8 plug or round cable
- Programmable signal output function (factory or field programmable with option PM)
- Cable/connector outlet radial or axial

### Applications

- Plant engineering
- Mechanical engineering
- Equipment manufacturing
- Motor commutation
- Driverless transport systems
- Medical equipment
- Special vehicles
- High requirements on the lifetime
- Requirements of a user-defined signal output function

### Output variants

<p>Singleturn absolute encoders</p>	<ul style="list-style-type: none"> <li>▪ Analogue voltage or current loop output</li> <li>▪ Analogue PWM output</li> <li>▪ Digital outputs SPI (also redundant), SER or SSI</li> <li>▪ Absolute linearity up to 0.6%</li> </ul>
<p>Programmable Multi- or singleturn absolute encoders</p>	<ul style="list-style-type: none"> <li>▪ Analogue voltage or current loop output (12 bit resolution)</li> <li>▪ Not True-Power-On, max. 200 revolutions (72000°)</li> </ul>
<p>Incremental encoders</p>	<ul style="list-style-type: none"> <li>▪ 1 to 1024 Impulses per revolution (ppr.)</li> <li>▪ Outputs TTL, Push-Pull, Open Collector or Linedriver</li> </ul>

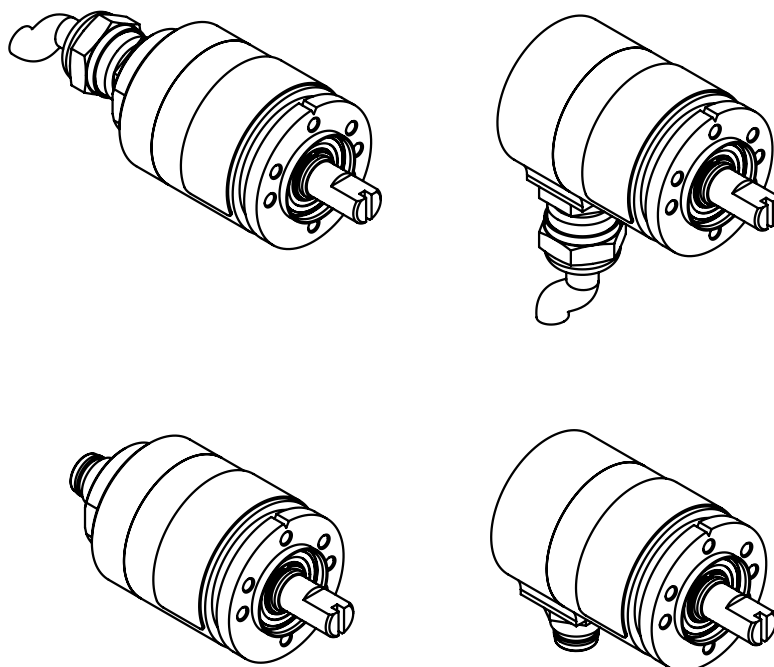
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### HTx25 encoders – robust and compact

The encoders of the HTx25 series are specially designed for applications in demanding environments with limited space. The contactless encoders in the Ø25 mm metal housing can be precisely matched to the respective area of application thanks to their numerous electronic and mechanical options. Whether as incremental or absolute value encoders, they cover a wide range of applications and, depending on the output electronics, are used in systems, laboratory devices and medical devices, for example.

The HTx25 is the smallest metal-housed rotary encoder in the MEGATRON product range. They feature a solid aluminium housing, a high IP protection and a stainless steel shaft pivoted by two ball-bearings that allow for high actuation speeds. The signal processing is digital and based on latest Hall sensor technology that ensure reliable magnetic recording of measured values. The gradient-based evaluation ensures high interference immunity, e. g. against temperature fluctuations and EMC influences. The encoders are designed for maximum service life and even surpass optical data acquisition. The number of defects or failures in rotary encoders with this technological design is practically zero, even after decades of use.

In addition to many standard options, the modular system of the HTx25 encoders enables optimal adaptation to the respective requirements of the application. In addition, the concept also allows timely customer-specific adjustments (even in small series) based on a clearly structured price model. Typical modifications are, for example, customer-specific shaft geometries, custom signal output functions, special cable lengths or individually assembled electrical connection cables.



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### Series overview

>>Please refer to the following sections for details

		Singleturn					Multiturn	
Series		HTI25	HTS25	HTS25X	HTA25	HTA25X	HTP25	HTA25PM
Electronics redundant		NO	NO	YES	NO	YES	NO	NO
Output signal(s)		Incremental A, B, Z Optional: A, A/, B, B/, Z, Z/, UVW	Digital absolute <b>SSI:</b> 12 bit, UVW <b>SPI:</b> 14 bit <b>SER:</b> 12 bit	Digital absolute <b>SPI:</b> 14 bit	Analogue absolute 0 to 5 V 0 to 10 V 4 to 20 mA	Analogue absolute 0 to 5 V 0 to 10 V	PWM absolute 5 V / 244 Hz / PWM 10-90 %	Analogue absolute 0 to 5 V 0 to 10 V 4 to 20 mA
Effective electrical angle of rotation		360°			7° ≤ α ≤ 360° (programmable in factory)		7° ≤ α ≤ 360° (programmable in factory)	0-10° to 0-72000° (programmable by user) factory programming 0 to 3600°
Resolution		-	<b>SSI:</b> 12 bit <b>SPI:</b> 14 bit <b>SER:</b> 12 bit	<b>SPI:</b> 14 bit	12 bit			
Supply voltage(s)	Output type	Push-Pull, open collector	SPI, SER	SPI	Analogue 0 to 5 V	Analogue 0 to 5 V	PWM	Analogue 0 to 5 V
	Supply voltage	24 V (10 to 30 V)	5 V ± 10%	5 V ± 10%	5 V ± 10% (ratiometric) or 24 V (9 to 30 V)	5 V ± 10%	5 V ± 10%	24 V (9 to 30 V)
	Output type	TTL	SSI		Analogue 0 to 10 V	Analogue 0 to 10 V		Analogue 0 to 10 V
	Supply voltage	5 V ± 10%	24 V (10 to 30 V)		24 V (15 to 30 V)	24 V (15 to 30 V)		24 V (15 to 30 V)
	Output type				Current loop 4 to 20 mA			Current loop 4 to 20 mA
	Supply voltage				24 V (9 to 30 V)			24 V (11 to 30 V)
<b>Programming options</b>								
Programmable by customer		NO	NO	NO	NO	NO	NO	YES
Programmable ex works		YES	YES	YES	YES	YES	YES	YES

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### Series HTA25

#### Key features HTA25:

- Analogue outputs 0 to 5 V, 0 to 10 V, 4 to 20 mA
- Redundant versions available – see separate section
- Several factory programming possibilities
- Supply voltages: 5 VDC  $\pm 10\%$ , 15 to 30 VDC, 9 to 30 VDC



### Electrical data

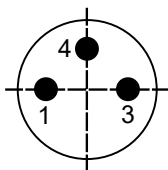
Effective electrical angle of rotation 1.)	$7^\circ \leq \alpha \leq 360^\circ$ (programmable in factory), $\pm 0.5^\circ$		
Independent linearity (best straight line) 1.)	$\pm 0.3\%$ @ 360°		
Absolute Linearity 1.)	$\pm 0.6\%$ @ 360°		
Output signal	0 to 5 V ratiometric	0 to 10 V	4 to 20 mA
Resolution	12 Bit		
Update rate	200 $\mu$ s		
Supply voltage	5 V $\pm 10\%$	15 to 30 V	9 to 30 V
Power consumption (no load)	$\leq 18$ mA		
Output load	$\geq 5$ kOhm		$\leq 500$ Ohm
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min		
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min		
MTTF (EN29500-2005-1)	1173a	965a	379a

1.) According IEC 60393

### Wire colour/pin assignment

Function:	Option PG(R)	Option M8(R)
OUT	brown	Pin 3
VSUP	red	Pin 1
GND	black	Pin 4

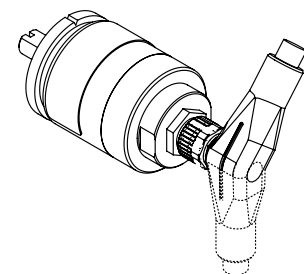
### Plug M8 (R) – pin assignment for 3-pin connector



Pin-Numbering of socket connector in the encoder housing

The orientation of the connector relative to the encoder housing is not defined and differs from one encoder to the next. When using angled connectors in combination with axial outlet, the orientation of the cable outlet is thus not defined.

If you need a defined orientation of the cable outlet, please choose our housings with radial cable outlet and use straight mating connectors.



Orientation will vary when using angled connectors.

**For details on zero point definition and output programming see page 26.**

Order Code HTA25 – singleturn, analogue output, not redundant					
Description	Selection: standard= <b>black/bold</b> , possible options= <i>grey/italic</i>				
<b>Series</b>	<b>HTA25</b>				
<b>Shaft diameter, shaft length:</b> Shaft diameter $\varnothing$ 6 mm, shaft length 12 mm <i>Shaft diameter <math>\varnothing</math> 4 mm, shaft length 10 mm</i> <i>Custom shaft dimensions [mm] <math>\varnothing \leq 6.35</math> mm</i>		<b>6x12</b> <i>4x10</i> <i>XxXX</i>			
<b>Supply voltage / output signal:</b> VSUP=5 V (4.5 to 5.5 V) / OUT=0 to 5 V ( <i>ratiometric</i> ) VSUP=24 V (15 to 30 V) / OUT=0 to 10 V VSUP=24 V (9 to 30 V) / OUT=4 to 20 mA <i>VSUP=24 V (9 to 30 V) / OUT=0 to 5 V</i>			<b>0505</b> <b>2410</b> <b>2442</b> <i>2405</i>		
<b>Sense of rotation:</b> (when looking at the shaft, from the front) <b>Clockwise</b> <i>Counterclockwise</i>				<b>CW</b> <i>CCW</i>	
<b>Rotation angle* in [°]:</b> <b>360</b> <i>320</i> <i>270</i> <i>180</i> <i>90</i> <i>Custom rotation angle (<math>\geq 7^\circ</math>, positive integer)</i>				<b>360</b> <i>320</i> <i>270</i> <i>180</i> <i>90</i> <i>XXX</i>	
<b>Electrical connection, cable length:</b> <b>1 m round cable, axial</b> <i>1 m round cable, radial</i> <b>Plug M8, axial</b> <i>Connector M8, radial</i> <i>Round cable, customer-specific cable length [X,XX m], axial</i> <i>Round cable, customer-specific cable length [X,XX m], radial</i>					<b>PG</b> <i>PGR</i> <b>M8</b> <i>M8R</i> <i>PGX,XX</i> <i>PGRX,XX</i>

\* For details see page 27.

**Order example HTA25**
**Requirements:**

Shaft  $\varnothing$  6.00 mm, shaft length 12 mm, VSUP=5 V / OUT=0 to 5 V, sense of rotation CW, rotation angle 360°  
round cable 1.00 m

**Example for order code:**

HTA25 6x12 0505 CW360 PG

### Series HTA25X – singleturn, analogue output, redundant

#### Key features HTA25X :

- Independent signal processing. The HTA25X rotary encoder electronics are based mainly on one Hall IC in which two semiconductor dies independently capture, evaluate and output the measured values
- Supply voltage, signal output and ground are galvanically insulated => separate electrical connections
- Supply voltages: 2 x 5 VDC or 2 x 15 to 30 VDC
- Signal outputs: 2 x 0 to 5 V or 2 x 0 to 10 V

### Electrical data HTA25X – singleturn, analogue output, redundant

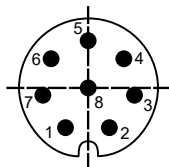
Effective electrical angle of rotation 1.)	7° ≤ α ≤ 360° (programmable at factory), ±0.5°	
Independent linearity (best straight line) 1.)	±0.3% @ 360°	
Absolute Linearity 1.)	±0.6% @ 360°	
Output signal	0 to 5 V ratiometric	0 to 10 V
Resolution	12 Bit	
Update rate	200 μs	
Supply voltage	5 V ±10%	15 to 30 V
Power consumption (no load)	≤ 23 mA	
Output load	≥ 5 kOhm	
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min	
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min	
MTTF (EN29500-2005-1)	613a	202a

1.) According IEC 60393

### Cable and pin assignment HTA25X – singleturn, analogue output, redundant

Function:	Option PG(R)	Option M8(R)
VSUP 1	red	1
OUT 1	brown	2
GND 1	black	3
GND 2	green	4
OUT 2	yellow	5
VSUP 2	orange	6
n/c	-	7
n/c	-	8

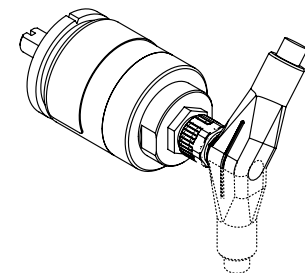
### Plug M8 (R) – pin assignment for 8-pin connector



Pin-Numbering of socket connector in the encoder housing

The orientation of the connector relative to the encoder housing is not defined and differs from one encoder to the next. When using angled connectors in combination with axial outlet, the orientation of the cable outlet is thus not defined.

If you need a defined orientation of the cable outlet, please choose our housings with radial cable outlet and use straight mating connectors.



Orientation will vary when using angled connectors.

**For details on zero point definition and output programming see page 26.**

Order Code HTA25X – redundant, singleturn, analogue output					
Description	Selection: standard= <b>black/bold</b> , possible options= <i>grey/italic</i>				
<b>Series</b>	<b>HTA25X</b>				
<b>Shaft diameter, shaft length:</b> Shaft diameter Ø 6 mm, shaft length 12 mm <i>Shaft diameter Ø 4 mm, shaft length 10 mm</i> <i>Custom shaft dimensions [mm] Ø ≤ 6.35 mm</i>		<b>6x12</b> <i>4x10</i> <i>XxXX</i>			
<b>Supply voltage / output signal:</b> VSUP=5 V (4.5 to 5.5 V) / OUT=0 to 5 V (ratiometric) VSUP=24 V (15 to 30 V) / OUT=0 to 10 V			<b>0505</b> <b>2410</b>		
<b>Sense of rotation:</b> (when looking at the shaft, from the front) <b>Clockwise/Clockwise (ganging)</b> <i>Clockwise/Counterclockwise (counterrotational)</i>				<b>CW CW</b> <i>CW CCW</i>	
<b>Rotation angle* in [°]:</b> <b>360</b> <i>320</i> <i>270</i> <i>180</i> <i>90</i> <i>Custom rotation angle (≥7°, positive integer)</i>					<b>360</b> <i>320</i> <i>270</i> <i>180</i> <i>90</i> <i>XXX</i>
<b>Electrical connection, cable length:</b> <b>1 m round cable, axial</b> <i>1 m round cable, radial</i> <b>Plug M8, axial</b> <i>Connector M8, radial</i> <i>Round cable, customer-specific cable length [X,XX m], axial</i> <i>Round cable, customer-specific cable length [X,XX m], radial</i>					<b>PG</b> <i>PGR</i> <b>M8</b> <i>M8R</i> <i>PGX,XX</i> <i>PGRX,XX</i>

\* For details see page 27.

Order example HTA25X – redundant, singleturn, analogue output	
<b>Requirement:</b> Redundant, shaft Ø 6.00 mm, shaft length 12 mm, VSUP=5 V /OUT=0...5 V, signal 1 sense of rotation CW, signal 2 sense of rotation CW, electrical rotation 360° signal 1 and 2, M8 plug radial, 8 pin	
<b>Example for order code:</b> HTA25X 6x12 0505 CW CW 360 M8R	



### Series HTP25 – singleturn, PWM output, not redundant

#### Key features HTP25:

- PWM signal output
- Frequency 244 Hz (constant)
- Pulse width (duty cycle) 10% (0°) to 90% (360°)
- Supply voltage: 5 VDC +/-10%



### Electrical data HTP25 – singleturn, PWM output, not redundant

Effective electrical angle of rotation 1.)	$7^\circ \leq \alpha \leq 360^\circ$ (programmable in factory), $\pm 0.5^\circ$
Independent linearity (best straight line) 1.)	$\pm 0.4\%$ @ 360°
Absolute Linearity 1.)	$\pm 0.6\%$ @ 360°
Output signal	PWM (pulse width modulation)
Output signal voltage	5 V
Carrier frequency	244 Hz (constant)
Minimum duty cycle	10%, equal to app. 0.4 ms
Maximum duty cycle	90%, equal to app. 3.5 ms
Resolution	12 Bit
Supply voltage	5 V $\pm 10\%$
Power consumption (no load)	$\leq 10$ mA
Output load	$\geq 5$ kOhm
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min
MTTF (EN29500-2005-1)	1267a

1.) According IEC 60393

### Function description PWM signal output HTP25

The HTP25 provides a constant carrier frequency with 244 Hz at the signal output, with HIGH and LOW signal levels which have a constant signal amplitude. A constant carrier frequency means a constant length of the period duration. The duty cycle and thus the pulse width changes in dependency of the rotating angle between 10% to 90% relative to the signal period. If the CW option is selected, the duty cycle increases clockwise when turning the shaft clockwise. If the CCW option is selected, the duty cycle decreases clockwise if the shaft is turned clockwise. Normally no signal conversion is required for further processing of the output signal, because many  $\mu$ Controllers already have an input for PWM signals.

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Redundant Serial (HTS25)

Incremental (HTI25)

Multiturn HTA25PM

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Order Code HTP25 – singleturn, PWM output, not redundant				
Description	Selection: standard= <b>black/bold</b> , possible options= <i>grey/italic</i>			
<b>Series</b>	<b>HTP25</b>			
<b>Shaft diameter, shaft length:</b> Shaft diameter $\varnothing$ 6 mm, shaft length 12 mm <i>Shaft diameter <math>\varnothing</math> 4 mm, shaft length 10 mm</i> <i>Custom shaft dimensions [mm] <math>\varnothing \leq 6.35</math> mm</i>		<b>6x12</b> <i>4x10</i> <i>XxXX</i>		
<b>Supply voltage / output signal:</b> <b>VSUP=5 V (4.5 to 5.5 V) / OUT=5 V / 244 Hz / PWM 10-90%</b>			<b>5PWM</b>	
<b>Sense of rotation:</b> (when looking at the shaft, from the front) <b>Clockwise</b> <i>Counterclockwise</i>			<b>CW</b> <i>CCW</i>	
<b>Rotation angle* in [°]:</b> <b>360</b> <i>320</i> <i>270</i> <i>180</i> <i>90</i> <i>Custom rotation angle (<math>\geq 7^\circ</math>, positive integer)</i>				<b>360</b> <i>320</i> <i>270</i> <i>180</i> <i>90</i> <i>XXX</i>
<b>Electrical connection, cable length:</b> <b>1 m round cable, axial</b> <i>1 m round cable, radial</i> <b>Plug M8, axial</b> <i>Connector M8, radial</i> <i>Round cable, customer-specific cable length [X,XX m], axial</i> <i>Round cable, customer-specific cable length [X,XX m], radial</i>				<b>PG</b> <i>PGR</i> <b>M8</b> <i>M8R</i> <i>PGX,XX</i> <i>PGRX,XX</i>

\* For details see page 27.

Order example HTP25 – singleturn, PWM output, not redundant	
<b>Requirement:</b>	Shaft $\varnothing$ 6.36 mm, shaft length 12 mm, VSUP=5 V / OUT=244 Hz, sense of rotation CW, rotation angle 360°, M8 connector
<b>Example for order code:</b>	HTP25 6,35x12 5PWM CW 360 M8

Cable and pin assignment		
Function	Option PG(R)	Option M8(R)
OUT	brown	Pin 3
VSUP	red	Pin 1
GND	black	Pin 4

Plug M8 (R) – pin assignment for 3-pin connector	
<p>Pin-Numbering of socket connector in the encoder housing</p>	<p>The orientation of the connector relative to the encoder housing is not defined and differs from one encoder to the next. When using angled connectors in combination with axial outlet, the orientation of the cable outlet is thus not defined.</p> <p>If you need a defined orientation of the cable outlet, please choose our housings with radial cable outlet and use straight mating connectors.</p>
	<p>Orientation will vary when using angled connectors.</p>

**For details on zero point definition and output programming see page 26.**

### Series HTS25 – singleturn, digital output, not redundant

#### Key features HTS25:

- SSI, SPI or SER interface
- SSI interface: Option UVW signal output for motor commutation of DC motors selectable from 1 to 16 pole pairs
- SPI, SER interfaces: Signal transmission only possible via short signal cables
- Supply voltage SSI: 24 VDC (9 to 30 V), SER and SPI: 5 VDC +/-10%



### Electrical data HTS25 – singleturn, digital output, not redundant

Output signal	SER	SPI	SSI
Effective electrical angle of rotation 1.)	360°		
Independent linearity (best straight line) 1.)	±0,4% @ 360°	±0,3% @ 360°	
Absolute linearity 1.)	±0,8% @ 360°	±0,6% @ 360°	
Resolution	12 Bit	14 Bit	12 Bit
Update rate	96 µs	200 µs	100 µs
Supply voltage	5 VDC ±10 %		24 VDC (9 to 30 V)
Power consumption (no load)	≤ 14 mA	≤ 12 mA	≤ 20 mA
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min		
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min		
MTTF (EN29500-2005-1)	1267a	2046a	535a

1.) According IEC 60393

**For details on zero point definition and output programming see page 26.**

Order Code HTS25 – singleturn, digital output, not redundant			
Description	Selection: standard= <b>black/bold</b> , possible options= <i>grey/italic</i>		
<b>Series</b>	<b>HTS25</b>		
<b>Shaft diameter, shaft length:</b> Shaft diameter Ø 6 mm, shaft length 12 mm <i>Shaft diameter Ø 4 mm, shaft length 10 mm</i> <i>Custom shaft dimensions [mm] Ø ≤ 6.35 mm</i>		<b>6x12</b> <i>4x10</i> <i>XxXX</i>	
<b>Supply voltage / output signal:</b> 24 VDC (9 to 30 V) / SSI (12 Bit) 5 VDC ± 10% / SPI (14 Bit) 5 VDC ± 10% / SER (12 Bit) (no zero point definition possible)			<b>24SSI</b> <b>05SPI</b> <b>05SER</b>
<b>Electrical connection, cable length:</b> 1 m round cable, axial <i>1 m round cable, radial</i> <b>Plug M8, axial</b> <i>Connector M8, radial</i> <i>Round cable, customer-specific cable length [X,XX m], axial</i> <i>Round cable, customer-specific cable length [X,XX m], radial</i>			<b>PG</b> <i>PGR</i> <b>M8</b> <i>M8R</i> <i>PGX,XX</i> <i>PGRX,XX</i>

Order example HTS25 – singleturn, digital output, not redundant	
<b>Requirement:</b> Shaft Ø 6.00 mm, shaft length 12 mm, 14 Bit/5 VDC/SPI, round cable 1 m, radial	
<b>Example for order code:</b> HTS25 6x12 05SPI PGR	

Please pay attention to the limiting factors in the cable lengths / transmission limits of the serial communication.  
Baud rate/clock frequency must be adjusted to account for cable length/transmission issues.

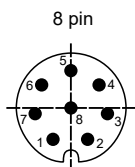
Cable and pin assignment for option 05SPI, not redundant		
Function:	Option PG(R), round signal cable	Option M8(R), 8 pin
VSUP	red	1
GND	black	2
CS, MOSI	yellow	3
CLK	green	4
DATA	orange	5
-	brown n/c	6 n/c
-	-	7 n/c
-	-	8 n/c

**Cable and pin assignment for option 05SER**

Function:	Option PG(R), round signal cable	Option M8(R), 8 pin
VSUP	red	1
Ground (GND)	black	2
Chipselect (CSN)	yellow	3
Clock (CLK)	green	4
Data out (DO)	orange	5
-	brown n/c	6 n/c
-	-	7 n/c
-	-	8 n/c

**Cable and pin assignment for option SSI interface**

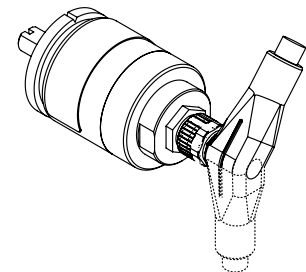
Function:	Option PG(R), round signal cable	Option M8(R), 8 pin
GND	black	1
VSUP	red	2
CLK+	brown	3
CLK-	orange	4
DATA+	yellow	5
DATA-	green	6
-	-	7 n/c
-	-	8 n/c

**Plug M8 (R) – pin assignment for 8-pin connectors**


Pin-Numbering of socket connector in the encoder housing

The orientation of the connector relative to the encoder housing is not defined and differs from one encoder to the next. When using angled connectors in combination with axial outlet, the orientation of the cable outlet is thus not defined.

If you need a defined orientation of the cable outlet, please choose our housings with radial cable outlet and use straight mating connectors.



Orientation will vary when using angled connectors.

### Series HTS25X – singleturn, SPI output, redundant

#### Key features HTS25X:

- Independent signal processing. The HTS25X rotary encoder electronics are based on one Hall IC in which two semiconductor elements independently capture, evaluate and output measured values
- Supply voltage, signal output and ground are galvanically insulated => separate electrical connections
- Supply voltage: 2 x 5 VDC ±10%
- Signal output: 2 x SPI

### Electrical data HTS25X – singleturn, SPI output, redundant

Effective electrical angle of rotation 1.)	360°
Sense of rotation (when looking at the shaft, from the front)	Clockwise/clockwise (ganging)
Independent linearity (best straight line) 1.)	±0.4% @ 360°
Absolute linearity 1.)	±0.8% @ 360°
Output signal	SPI
Resolution	14 Bit
Update rate	200 µs
Supply voltage	5 VDC ±10%
Power consumption (no load)	≤ 24 mA
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min
MTTF (EN29500-2005-1)	2046a

1.) According IEC 60393

### Cable and pin assignment HTS25X

Function:	Option PG(R), round signal cable	Option M8(R), 12 pin
VDD 1	red	1
GND 1	black	2
MOSI 1	yellow	3
SCLK 1	green	4
SS 1	orange	5
VDD 2	white	6
GND 2	blue	7
MOSI 2	violet	8
SCLK 2	brown	9
SS 2	grey	10
-	-	11 n/c
-	-	12 n/c

Further information regarding the signal outputs can be found in the data sheet of the IC manufacturer.

#### SPI-Interface

MLX90316EDC DUAL (redundant version)

URL: [www.melexis.com](http://www.melexis.com)

**For details on zero point definition and output programming see page 26.**

Order Code HTS25X – redundant, singleturn, digital output			
<b>Description</b>	Selection: standard= <b>black/bold</b> , possible options= <i>grey/italic</i>		
<b>Series</b>	<b>HTS25X</b>		
<b>Shaft diameter, shaft length:</b> Shaft diameter Ø 6 mm, shaft length 12 mm <i>Shaft diameter Ø 4 mm, shaft length 10 mm</i> <i>Custom shaft dimensions [mm] Ø ≤ 6.35 mm</i>		<b>6x12</b> <i>4x10</i> <i>XxXX</i>	
<b>Supply voltage / output signal:</b> 5 VDC ± 10% / SPI (14 Bit), redundant			<b>05SPI</b>
<b>Electrical connection, cable length:</b> 1 m round cable, axial <i>1 m round cable, radial</i> <b>Plug M8, axial</b> <i>Connector M8, radial</i> <i>Round cable, customer-specific cable length [X,XX m], axial</i> <i>Round cable, customer-specific cable length [X,XX m], radial</i>			<b>PG</b> <i>PGR</i> <b>M8</b> <i>M8R</i> <i>PGX,XX</i> <i>PGRX,XX</i>

Order example HTS25X
<b>Specifications:</b> Shaft Ø 6.00 mm, shaft length 12 mm, 14 Bit/5 VDC/SPI, M8 connector, radial
<b>Example for order code:</b> HTS25X 6x12 05SPI M8R

**Please pay attention to the limiting factors in the cable lengths / transmission limits of the serial communication. Baud rate/clock frequency must be adjusted to account for cable length/transmission issues.**

### Plug M8 – pin assignment for 12-pin connector

Pin-Numbering of socket connector in the encoder housing

The orientation of the connector relative to the encoder housing is not defined and differs from one encoder to the next. When using angled connectors in combination with axial outlet, the orientation of the cable outlet is thus not defined.

If you need a defined orientation of the cable outlet, please choose our housings with radial cable outlet and use straight mating connectors.

Orientation will vary when using angled connectors.

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## Series HTI25 – singleturn, incremental output, not redundant

### Key features HTI25:

- Channels: A, B and index signal Z. Option differential signal output A, A/, B, B/, Z, Z/
- TTL, Push-Pull or Open Collector electronics
- Maximum number of pulses per channel 1024 pulses per revolution (4096 steps)
- Option: ex works programmable number of pulses from 1 to 1024 pulses per revolution in one pulse step width

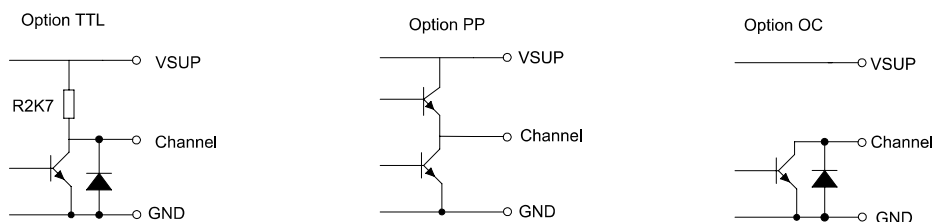


## Electrical data HTI25 – singleturn, incremental output, not redundant

Output Signal	TTL	Push-Pull	Open Collector
Number of pulses	1 to 1024 ppr		1 to 360 ppr
Differential signal output (A, A/, B, B/, Z, Z/)	optional		
Limit frequency	100 kHz		10 kHz
Switch-on delay	20 ms		
Supply voltage	5 VDC ±10%	10 to 30 V	10 to 30 V
Power consumption (no load)	≤ 15 mA	≤ 50 mA	≤ 25 mA
Output load	≥ 5 kOhm		
Max. pull-up voltage	-		30 VDC
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min		
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min		
MTTF (EN29500-2005-1)	473a	462a	570a

1.) According to IEC 60393

## Output circuit HTI25 per channel



**For details on zero point definition and output programming see page 26.**



**Order Code HTI25 – singleturn, incremental output**

Description	Selection: standard= <b>black/bold</b> , possible options= <i>grey/italic</i>			
<b>Series</b>	<b>HTI25</b>			
<b>Shaft diameter, shaft length:</b> <b>Shaft diameter Ø 6 mm, shaft length 12 mm</b> <i>Shaft diameter Ø 4 mm, shaft length 10 mm</i> <i>Custom shaft dimensions [mm] Ø ≤ 6.35 mm</i>		<b>6x12</b> <i>4x10</i> <i>XxXX</i>		
<b>Number of pulses (ppr):</b> 32 64 128 256 <i>512 (only for TTL and push-pull)</i> <b>1024 (only for TTL and push-pull)</b> <i>User-defined number of pulses 1 to 1024, step-width 1 pulse</i> <i>(&gt;360 pulses only for TTL and Push-Pull)</i>			32 64 128 256 <b>512</b> <b>1024</b> <i>0XXX</i>	
<b>Supply voltage / output signal:</b> <b>VSUP=24 V (10 to 30 V) / OUT=push-pull A, B, Z</b> <b>VSUP=5 V ± 10% / OUT=TTL A, B, Z</b> <b>VSUP=24 V (10 to 30 V) / OUT=open collector A, B, Z</b> <i>VSUP=24 V (10 to 30 V) / OUT=open collector differential A, A/, B, B/, Z, Z/</i> <i>VSUP=24 V (10 to 30 V) / OUT=push-pull differential A, A/, B, B/, Z, Z/</i> <i>VSUP=5 V ± 10% / OUT=TTL differential A, A/, B, B/, Z, Z/</i>				<b>24BZPP</b> <b>05BZTTL</b> <b>24BZOC</b> <i>24BZOC N</i> <i>24BZPP N</i> <i>05BZTTL N</i>
<b>Electrical connection, cable length:</b> <b>1 m round cable, axial</b> <i>1 m round cable, radial</i> <b>Plug M8, axial</b> <i>Connector M8, radial</i> <i>Round cable, customer-specific cable length [X,XX m], axial</i> <i>Round cable, customer-specific cable length [X,XX m], radial</i>				<b>PG</b> <i>PGR</i> <b>M8</b> <i>M8R</i> <i>PGX,XX</i> <i>PGRX,XX</i>

**Order example HTI25 – singleturn, incremental output**

<b>Requirement:</b> Shaft Ø 6.00 mm, shaft length 12 mm, number of pulses 1024 TTL output, VSUP=5 V/TTL, round cable 1 m
<b>Example for order code:</b> HTA25 6x12 1024 05BZTTL PG

**Cable and pin assignments – single outputs**

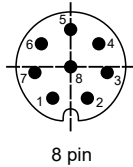
Pin-No.	Option M8(R), 8 pin		Option PG(R), round cable	
	Function	Wire colour	Function	Wire colour
Pin 1	VSUP	red	VSUP	red
Pin 2	GND	black	GND	black
Pin 3	A	brown	A	brown
Pin 4	B	orange	B	orange
Pin 5	Z	yellow	Z	yellow
Pin 6	n/c	green	n/c	green
Pin 7	n/c			
Pin 8	<b>n/c</b>			

**Cable and pin assignments – differential outputs**

Function:	Option M8(R), 8 pin
GND	Pin 1
VSUP	Pin 2
Z	Pin 3
B	Pin 4
A	Pin 5
Z/ (optional)	Pin 6
B/ (optional)	Pin 7
A/ (optional)	Pin 8

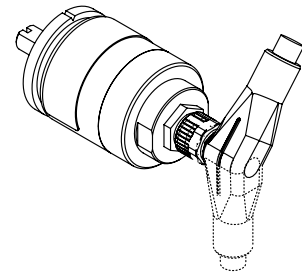
**Plug M8 – pin assignment for 8-pin connector**

Pin-Numbering of socket connector in the encoder housing



The orientation of the connector relative to the encoder housing is not defined and differs from one encoder to the next. When using angled connectors in combination with axial outlet, the orientation of the cable outlet is thus not defined.

If you need a defined orientation of the cable outlet, please choose our housings with radial cable outlet and use straight mating connectors.

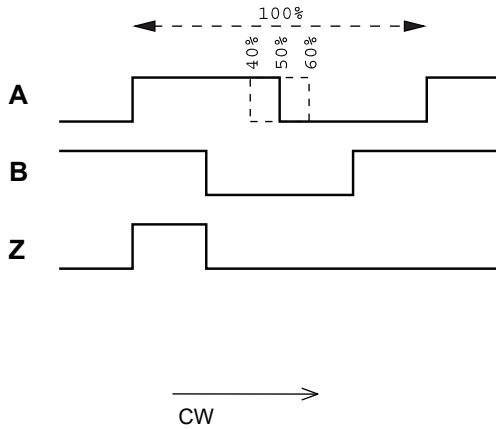


Orientation will vary when using angled connectors.

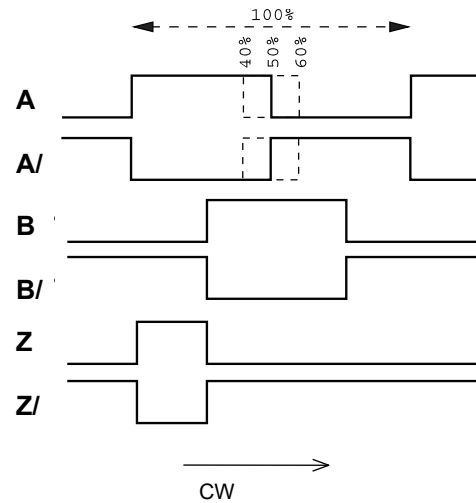
Signal details

Incremental signal output pattern:

A, B, Z (Standard)



Option differential signal output  
A, A/, B B/, Z Z/



The percentage information describes the proportion of a pulse in dependency to the duration of one period

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### Series HTA25PM – multi-/singleturn, programmable, analogue output, not redundant

#### Key features HTA25PM :

- Measuring range 10° to max. 72000° (200 shaft revolutions)
- Programmable by the user. Programmable are the sense of rotation (CW/CCW) and the effective electrical angle [°]
- Programmable up to 10000 times
- Can also be used as a programmable singleturn rotary encoder
- Maximum rotation of the shaft in a voltage-free state without loss of the angle information +/-179°
- Factory programming (ex works): effective electrical angle of rotation 3600° (10 shaft revolutions), sense rotation CW
- Supply voltage: 9 to 30 VDC, 15 to 30 VDC
- Output signal: 4 to 20 mA, 0 to 5 V, 0 to 10 V



### Electrical data HTA25PM – multi-/singleturn, programmable, analogue output, not redundant

Effective electrical angle of rotation 1.)	0 to 10° - 0 to 72000° (max. 200 turns) Start point, endpoint and sense of rotation programmable by the customer. Ex works the angle is set to 3600°. For detecting absolute position >360° the sensor should not be turned more than ±179° without supply voltage.		
Independent linearity (best straight line) 1.)	±0.05% @ 3600°		
Absolute Linearity 1.)	±0.1% @ 3600°		
Output signal	0 to 5 V	0 to 10 V	4 to 20 mA
Resolution 1.)	12 Bit		
Update rate	3 ms		
Supply voltage	9 to 30 V	15 to 30 V	11 to 30 V
Power consumption (no load)	< 10 mA		< 14 mA
Output load	≥ 5 kOhm		≤ 500 Ohm
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min		
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min		
Max. number of programming cycles	10000		
MTTF (EN29500-2005-1)	224a		229a

1.) According IEC 60393

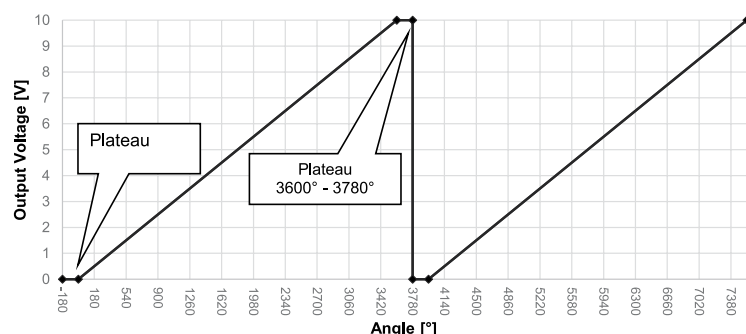
### Signal output function (factory programming). Automatic function for inserting signal plateaus

The function represents the relationship between the zero degree marking on the rotary encoder housing in dependency to the 0° position of the shaft and the resulting output signal in the state of delivery, when turning the shaft clockwise (sense of rotation CW). The effective electrical angle of rotation is 3600° ex works. Before and after the linearly rising output signal for 3600° the HTA25PM integrates automatically signal plateaus for a rotation angle of each 180°.

The following example shows the output signal pattern when actuating the shaft in the delivery state for 11 revolutions clockwise (sense of rotation CW), starting at the 0° position:

1. 10 rotations of the shaft clockwise 0° to 3600°, linearly increasing output signal 0% to 100% FS
2. 1/2 rotation of the shaft 180° (3600° to 3780°) signal plateau 100% FS
3. 1/2 rotation of the shaft 180° (3780° to 3960°) signal plateau 0% FS

The drawing shows the signal-amplitude function for 0 to 10 V signal output



Order Code HTA25PM – singleturn or multiturn, analogue output, not redundant			
Description	Selection: standard= <b>black/bold</b> , possible options= <i>grey/italic</i>		
<b>Series</b>	<b>HTA25PM</b>		
<b>Shaft diameter, shaft length:</b> Shaft diameter Ø 6 mm, shaft length 12 mm <i>Shaft diameter Ø 4 mm, shaft length 10 mm</i> <i>Custom shaft dimensions [mm] Ø ≤ 6.35 mm</i>		<b>6x12</b> <i>4x10</i> <i>XxXX</i>	
<b>Supply voltage / output signal:</b> VSUP = 24 V (15 to 30 V) / OUT = 0 to 10 V VSUP = 24 V (9 to 30 V) / OUT = 4 to 20 mA VSUP = 24 V (9 to 30 V) / OUT = 0 to 5 V			<b>2410</b> <b>2442</b> <b>2405</b>
<b>Electrical connection, cable length:</b> <b>1 m round cable, axial</b> <i>1 m round cable, radial</i> <b>Plug M8, axial</b> <i>Connector M8, radial</i> <i>Round cable, customer-specific cable length [X,XX m], axial</i> <i>Round cable, customer-specific cable length [X,XX m], radial</i>			<b>PG</b> <i>PGR</i> <b>M8</b> <i>M8R</i> <i>PGX,XX</i> <i>PGRX,XX</i>

**Order example HTA25PM**
**Requirement:**

Shaft Ø 6.00 mm, shaft length 12 mm, VSUP=24 V / OUT=0 to 5 V, sense of rotation CW, rotation angle ex works 3600° (can be programmed by customer), round cable 1 m radial

**Example for order code:**

HTA25PM 6x12 2405 PGR

**Cable and pin assignment**

Function	Roundcable (Option R)	Option M8(R), 8 pin
DIR	orange	Pin 1
END	green	Pin 2
START	yellow	Pin 3
VSUP	red	Pin 4
OUT	brown	Pin 5
GND	black	Pin 6
-	-	Pin 7 n/c
-	-	Pin 8 n/c

**For details on output programming see page 26.**

**Order example HTA25PM programmer**

**Key features HTA25 PM programmer:**

- Programmable measuring range from 10° to max. 72000° (200 shaft revolutions)
- Programmable: sense of rotation (CW/CCW), effective electrical angle [°]
- Up to 10.000 programming cycles per rotary encoder

**Order number:**

135945

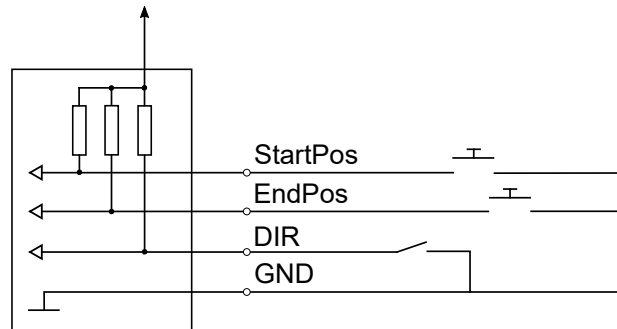
**Order code:**

Programmer Tool for ETA HTA PM

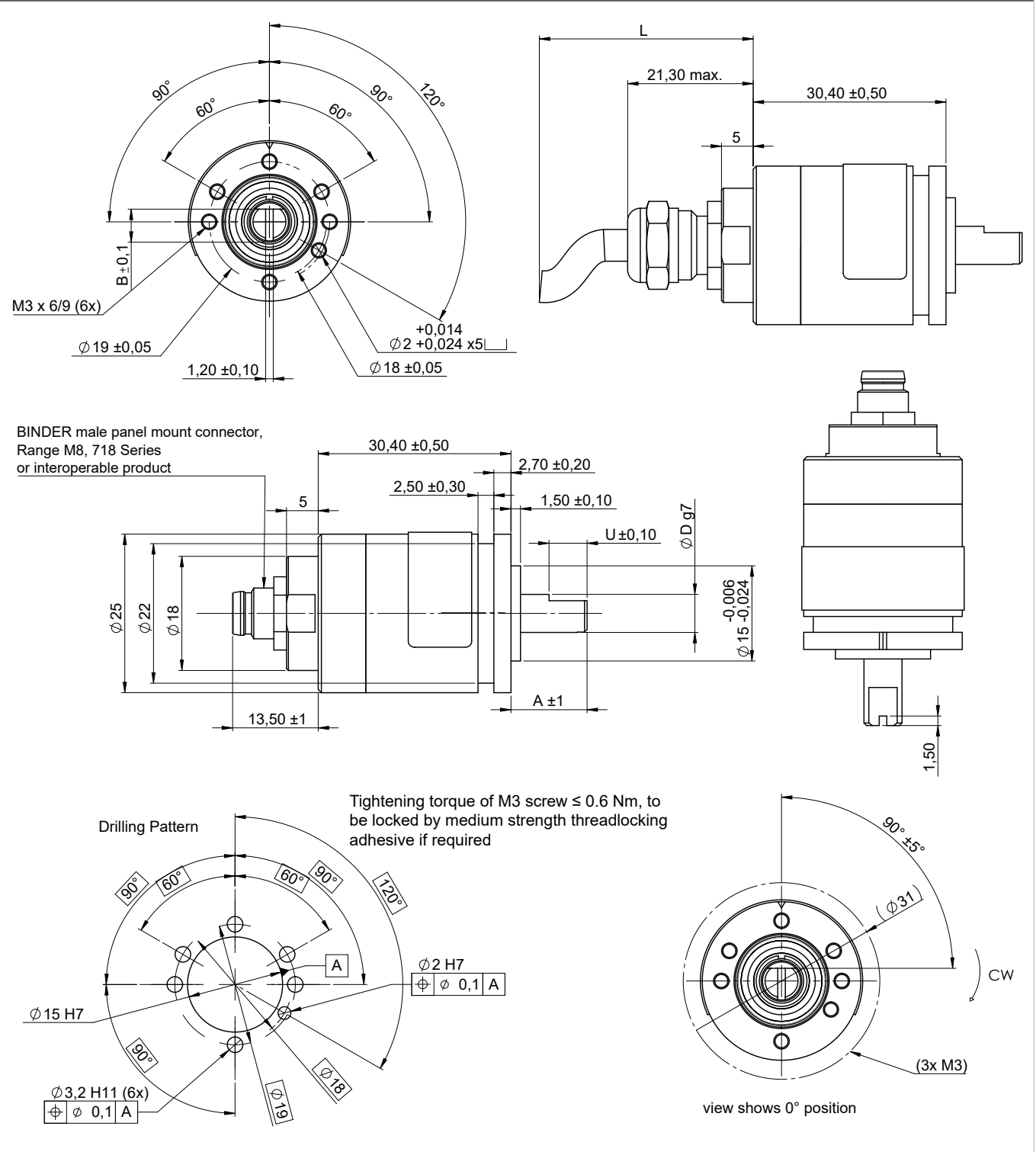
**Programming of HTA25PM**

The programming guide is available for download on the MEGATRON web page <https://www.megatron.de/>

To program the HTA25PM rotary encoder either the following circuit must be built, or the programmer must be ordered from MEGATRON.



Drawing HTx25 - axial versions (option PG and M8), shaft dimensions, drilling pattern and zero position



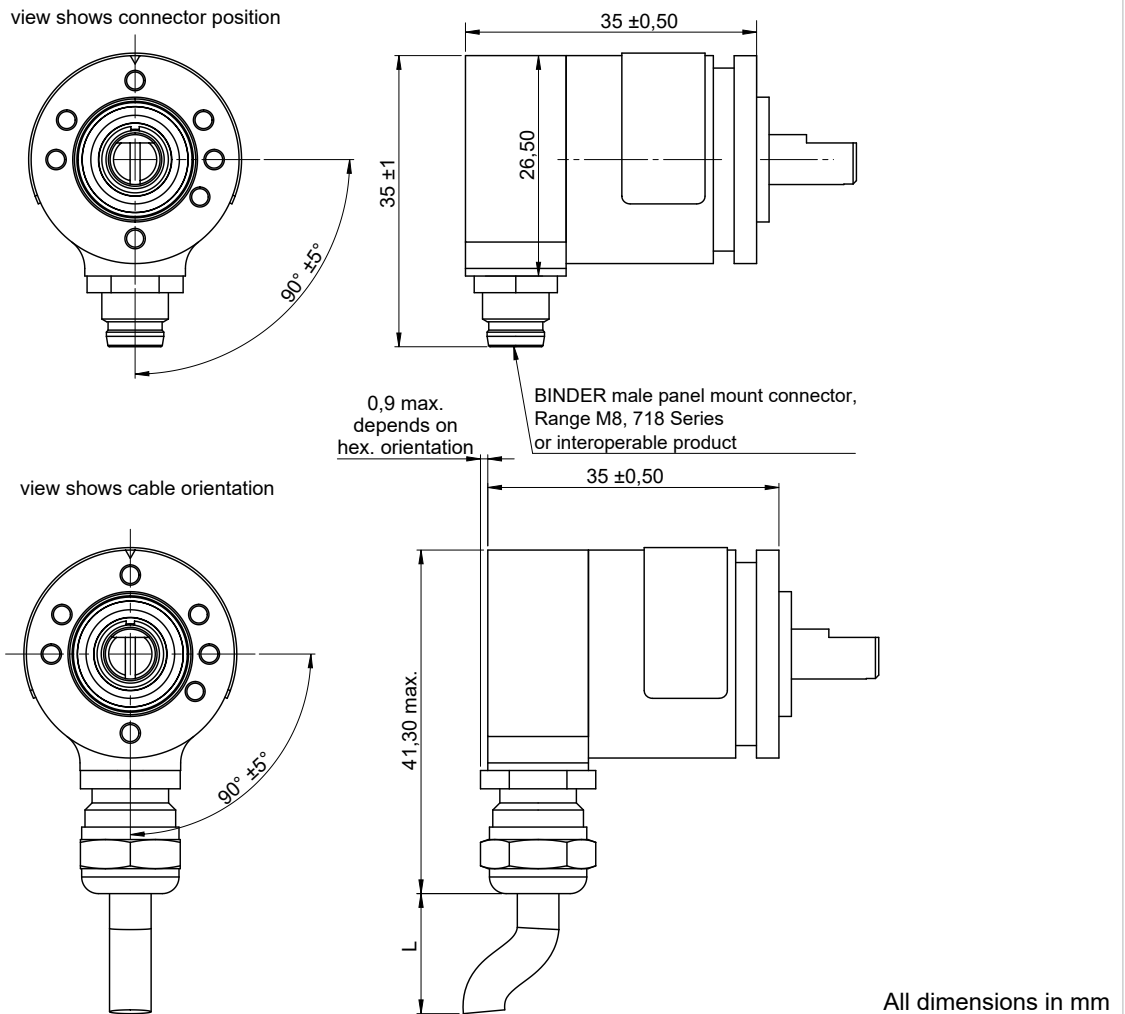
Standard shaft dimensions / tolerances

	Standard type 6 mm	Standard type 4 mm	Other types $\leq 6.35$ mm
Shaft length A	12 +/- 1 mm,	10 +/- 1 mm	A (custom length)
Shaft diameter D	6 h9 mm	4 h9 mm	D h9 (custom diameter)
Shaft flattening U length	6 +/- 0.1 mm	1 +/- 0.1 mm	6 +/- 0.1 mm
Shaft flattening B	4.5 +/- 0.1 mm	3.5 mm +/- 0.1 mm	D - 1 mm +/- 0.1 mm

All dimensions in mm

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Drawings HTx25 – Radial cable versions with orientation



Cable specs for option PG(R) (round control cable)

Option	Standard cable length L	Number of single strands (depends on electronics)	Cable sheath Ø or width	Single strands cross section	Allowed tolerance (L)	Minimum bending radius
PG PGR	Standard 1000 mm	3		AWG26	-20 mm to +40 mm	10 x D Ø (D = cable sheath diameter Ø)
		6				
		8				
		10				
		12		AWG28		

Cables without cable shield

(\*) Tolerances according IPC Association

Cable length tolerances – custom lengths

Length L	Tolerance
≤ 0.3 m	+25 mm / -20 mm
> 0.3 m - 1.5 m	+40 mm / -20 mm
> 1.5 m - 3 m	+100 mm / -40 mm
> 3 m - 7.5 m	+150 mm / -60 mm

Wire harness length measured from sensor face including connector. Minimum cable length: 0.08 m (for round cable). Please contact us for lengths > 3 m regarding handling and packaging.

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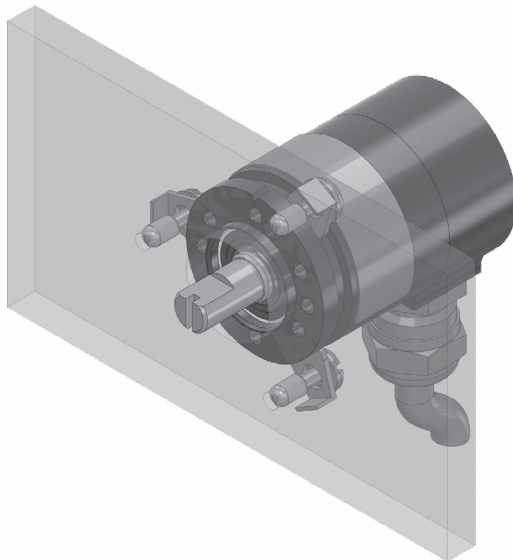
Mechanical and Environmental data	
Shaft type	Solid shaft
Mechanical angle of rotation 1.)	Endless
Lifetime 2.)	@100 % of max. permissible radial shaft load >1.4x10E8 shaft revolutions @80 % of max. permissible radial shaft load >2x10E9 shaft revolution @20 % of max. permissible radial shaft load >1.7x10E10 shaft revolutions
Bearing	2 pcs. groove ball bearings type 2RS
Max. operational speed (with shaft sealing)	max. 12.000 rpm
Operational torque: (@ room temperature and 10 rev/min)	≤ 0,3 Ncm
Operating temperature range	Option M8 (connector) ▪ -25 to +80°C Option PG (cable gland incl. cable) ▪ -30 to +85°C Kabel fest verlegt ▪ -10 to +85°C Kabel in Bewegung
Storage temperature range	-30 to +105°C
Protection grade (IEC 60529) front side	IP65S
Protection grade (IEC 60529) rear side	Option PG: IP68 (cable ends excluded) Option M8: IP67 (when mated with IP67 type M8 cable)
Vibration (DIN EN 60068-2-64:2008 + A1: 2019)	±1.5 mm / 30 g / 10 to 2000 Hz / 16 frequency cycles (3x4 h)
Shock (DIN EN 60068-2-27)	400 m/s <sup>2</sup> / 6 ms / half sine (100±5) shocks
Housing diameter	Ø 25 mm
Housing depth	In dependency to the electrical connection position: ▪ axial 51.7 mm (PG) / 43.9 mm (M8) ▪ radial 35 mm
Shaft diameter	Standards: Ø6 mm, Ø4 mm, details see drawings Option Custom diameter [mm] Ø ≤ 6,35 mm
Max. radial load	80 N (load point 80% in dependency to the visible standard shaft length)
Max. axial load	40 N (axial application of force onto the shaft end)
Masse (zirka)	HTx25 mit Stecker M8(R) 40 g HTx25 mit Kabelverschraubung und 1 m Signalkabel PG(R) 69 g

1.) According IEC 60393

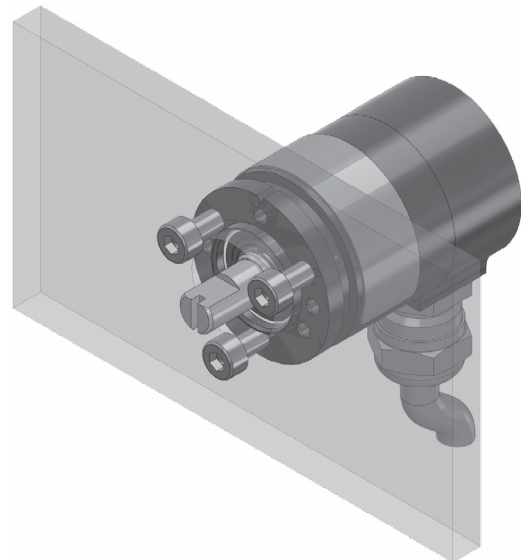
2.) Determined by climatic conditions according to IEC 68-1, para. 5.3.1 without load collectives

**Mechanical and environmental data, miscellaneous**

Sensor mounting	<ol style="list-style-type: none"> <li>Via threaded holes integrated in the sensors head by use of stainless steel screws M3x0.5</li> <li>Via synchro flange with optional available servo mount fixing nails SFN1 incl. screws M3 x 0.5 from MEGATRON (not enclosed), recommended at angles of 120°</li> </ol>
Mounting hardware included	<p>none</p> <ul style="list-style-type: none"> <li>To attach the rotary encoder using a synchro flange, the MEGATRON SFN1 synchro clamps available as accessories</li> <li>For the electrical connection option M8 (R), cables and mating connectors are not part of the scope of delivery. M8 connectors with cables are available as accessories from MEGATRON</li> </ul>
Fastening torque per screw for fastening of the rotary encoder	<p>≤ 0.6 Nm (M3 screw, thread tensile strength class 5.6) For screw securing, the use of a medium-strength thread securing adhesive is recommended</p>
Material shaft	Stainless steel
Material housing	Aluminium
Material cable gland (PG)	Stainless steel
Material connector M8	CuZn nickel-plated



Servo mount using fixing nails SFN1  
incl. 3 screws M3 x 0.5



Flange mount using 3 screws M3

**Immunity / Electrostatic Discharge / REACH / RoHS**

EN 61000-4-3 RF sine wave	Class A
EN 61000-4-6 Conducted sine wave	Class A
EN 61000-4-8 Power frequency magnetic fields	Class A
EN 61000-4-2 ESD	Class B
REACH Regulation (EC) 1907/2006 including the SVHC list	
RoHS Directive 2011/65/EU	

**Definition of the zero position / anti-rotation pin**

**Output at the zero point:**

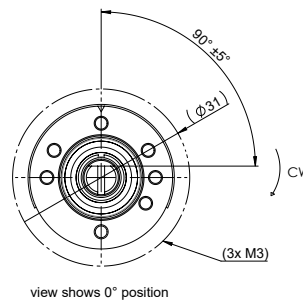
HTA25 (analogue outputs): Output signal 0% full scale (F. S.)

HTP25 (PWM output): duty cycle 10% (10% duty cycle)

HTS25 (serial output): Output signal 0% full scale (F. S.), for option 05SER no zero point alignment is available ex works

HTI25 (incremental output): The index signal is output (Z)

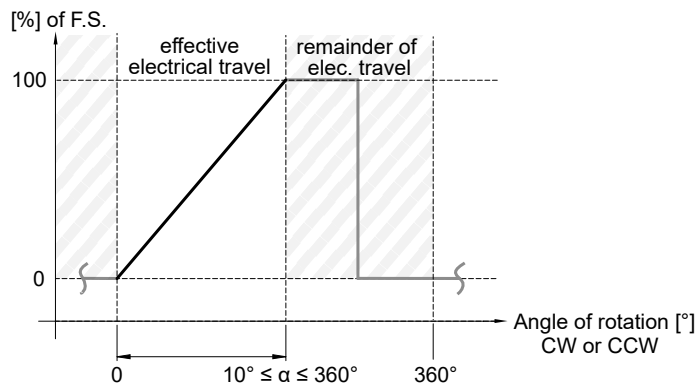
Position of the zero position see drawing below (nodge at top)



**Signal definition for custom rotation angles**

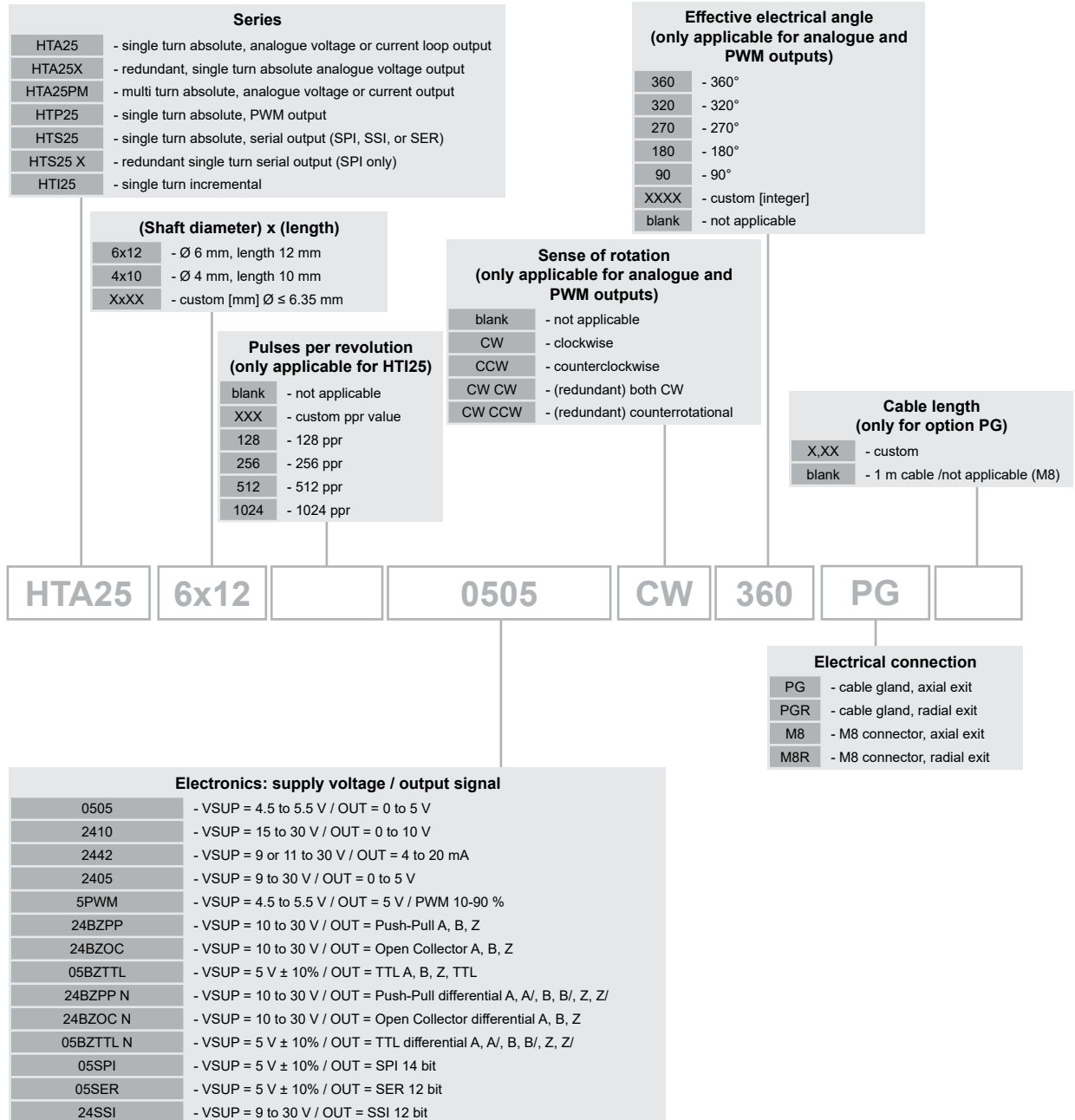
Custom angles <360°

When programming the electrical angle of rotation of <360°, the remaining non-effective range of rotation is divided equally into high and low.



Order Code – Full Overview

>>Please refer to the series sections for details and valid selection criteria



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### Shaft couplings

- Connect two shafts, even with different diameters
- Absorb larger angular and radial deviations
- Have a low inertia
- Do not cause a change in the transmission speed
- Damp torsional vibrations
- Serves as mechanical protection against oversized pairs of forces
- Made of plastic (also with metal hubs) act electrically and heat insulating



### Counter ICs for incremental encoders

- LS7083 in DIP or SOIC form factor, generates from incremental-signals quadrature-signals
- LS7166 24-Bit counter IC



LS7083/4N-S



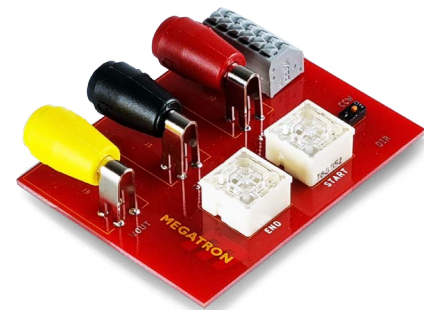
LS7166



LS7083/4N

### Programmer for programmable encoder HTA25PM

- For programming of the sense of rotation (CCW/CW)
- For programming of the effective electrical angle of rotation [°]



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