

Data Sheet for Angle Sensors



Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K



Family Key Features:

- 3D Hall magnetic gradient-based signal capturing
- μ Processor controlled digital signal processing
- Housing made of glass-fibre reinforced thermo-plastic
- Magnet included in delivery
- Only 8 mm housing depth
- IP67
- Operating temperature range $-40..85^{\circ}\text{C}$
- Measuring range up to 360° singleturn, 72000° multiturn
- Electrical connection: 0.15 m flat ribbon cable or 1 m roundcable
- Low budget version without encapsulated electronics
- Programmable

Applications:

- Apparatus construction
- Angular measurements
- Speed measurement
- With low operational speeds [up to 100 rpm]
- Simple up to medium environmental requirements
- High requirements on the lifetime
- Applications with increased vibrations
- Requirements to an user defined signal output function

Output electronics:

- Analogue singleturn: voltage - also redundant, current, PWM
- Analogue multiturn: voltage
- Incremental: AB+index (Z) up to 1024 ppr (4096 steps)
- Digital: SPI - also redundant, SER

Rotary encoders with shaft and shaft bearing:

Our ETx25K rotary encoder product family is based exclusively on state-of-the-art 3D Hall gradient-based μ Processors with digital signal processing. ETx25K angle encoders use the well-established rotary encoder platform from the hugely popular ETx25 highrunner rotary encoder family from Megatron.

The ETx25K Kit Encoder concept focuses on applications with low to medium environmental requirements. Due to the missing shaft bearing, ETx25K kit encoders are economically very attractive kit encoders with an extremely long lifespan.

For measurement value detection, a magnet which is part of delivery is placed on a shaft in the application. The ETx25K is facing the magnet. The shaft can have basically any diameter.

With ETx25K kit encoders, there is no mechanical connection to the shaft of the application. Due to this non-existent mechanical connection, the ETx25K is decoupled thermally and from vibrations. A galvanic separation between measurement evaluation and signal processing is also easy to implement. This is also favoured by the plastic housing of the ETx25K kit encoder.

ETx25K kit encoders are widely resistant to temperature changes, external magnetic fields, shocks and vibrations.

Megatron implements customer-specific adaptations in a timely manner starting from small series on the basis of a clearly structured price model. The signal output function of single-turn rotary encoders with analogue signal output can be programmed ex works according customer's wishes. Our combined single-/multiturn-absolute-encoder ETA25K PM allows also the programming of the encoder by the customer according to the needs of his application.

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Information about the ETx25K rotary encoder series: (electrical data, order codes, pin assignments)	
Singleturn rotary encoder (measuring range up to 360°):	
Analogue output not redundant:	
ETA25K voltage/current	13/14
Analogue output redundant:	
ETA25K X voltage	15/16/17
Analogue PWM output not redundant:	
ETP25K PWM	18/19
Incremental output not redundant:	
ETI25K incremental	20/21/22
Digital output not redundant:	
ETS25K SER, SPI	23/24
Digital output redundant:	
ETS25K X SPI	25/26/27
Multiturn/singleturn rotary encoder, programmable (measuring range up to 72000°):	
Analogue output not redundant:	
ETA25K PM voltage	28/29/30/31

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Quick overview		Singleturn absolute kit encoders with analog output		
1	Series	ETA25K	ETA25K X	ETA25K PWM
2	Technology	Magnetic gradient-based signal capturing, with μ Processor controlled digital signal processing		
3	Not redundant / redundant	Not redundant	Redundant	Not redundant
4	Output signal	1 x Analogue, absolute	2 x Analogue, absolute	1 x Analogue, absolute
5	Operating temperature range	-40..+85 °C		
6	Protection grade	Standard IP67		
7	Effective electrical angle of rotation	360°		
8	Supply voltage / output signal	VSUP=5 V (4.5...5.5 V) / OUT=0...5 V (ratiometric)	VSUP=5 V (4.5...5.5 V) / OUT=0...5 V (ratiometric)	VSUP=5 V (4.5...5.5 V) / OUT=5 V / 244 Hz / PWM 10-90 %
9		VSUP=24 V (15...30 V) / OUT=0...10 V	VSUP=24 V (15...30 V) / OUT=0...10 V	-
10		VSUP=24 V (9...30 V) / OUT=4...20 mA	-	-
11		Option: VSUP=24 V (9...30 V) / OUT=0...5 V	-	-
12	Electrical connection	Standard: flat ribbon cable 0.15 m, option: round cable 1 m, AWG26		
13	Programmable by customer	NO	NO	NO
14	Programmable ex works	YES	YES	YES
15	Detailed information about the series see pages	13/14	15/16/17	18/19

General

Drawing

Mechanical Data

Analogue ETA25K

Incremental ET125K

Serial ETS25K

Multiturn ETA25K PM

Magnet Holder

Accessory

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Quick overview		Singleturn incremental rotary encoder, rotary encoder with digital output		
1	Series	ETI25K	ETS25K	ETS25K X
2	Technology	Magnetic gradient-based signal capturing, with μ Processor controlled digital signal processing		
3	Not redundant / redundant	Not redundant	Redundant	Redundant
4	Output signal	1 x Incremental	1 x Digital	2 x Digital
5	Operating temperature range	-40..+85 °C		
6	Protection grade	Standard IP67		
7	Effective electrical angle of rotation	360°		
8	Supply voltage / output signal	VSUP=24 V (10...30 V) / OUT=A, B, Z, Push-Pull	5 VDC \pm 10% / SPI 14 Bit	5 VDC \pm 10% / SPI 14 Bit
9		VSUP=24 V (10...30 V) / OUT=Open Collector	5 VDC \pm 10% / SER 12 Bit	-
10		VSUP=5 V \pm 10% / OUT=A, B, Z, TTL	-	-
11		-	-	-
12	Electrical connection	Standard: flat ribbon cable 0.15 m, option: round cable max. 0.6 m, AWG26		Flat ribbon cable 0.15 m, AWG26
13	Programmable by customer	NO	NO	NO
14	Programmable ex works	YES	YES	YES
15	Detailed information about the series see pages	20/21/22	23/24	25/26/27

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Mechanical Data

Analogue ETA25K

Incremental ETI25K

Serial ETS25K

Multiturn ETA25K PM

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Quick overview		Single/- multiturn- rotary encoder with analogue output programmable from the customer
1	Series	ETA25K PM
2	Technology	Magnetic gradient-based signal capturing, with μ Processor controlled digital signal processing
3	Not redundant / redundant	Not redundant
4	Output signal	1 x Analogue, absolute
5	Operating temperature range	-40...+85 °C
6	Protection grade	Standard IP40 from shaft side, optional IP55M
7	Effective electrical angle of rotation	up to 72000°
8	Supply voltage / output signal	VSUP=24 V (9...30 V) / OUT=0...5 V
9		VSUP=24 V (15...30 V) / OUT=0...10 V
10		-
11		-
12	Electrical connection	Standard: flat ribbon cable 0.15 m, option: round cable 1 m, AWG26
13	Programmable by customer	YES
14	Programmable ex works	YES
15	Detailed information about the series see pages	28/29/30/31

General

Drawing

Mechanical Data

Analogue ETA25K

Incremental ET125K

Seriell ETS25K

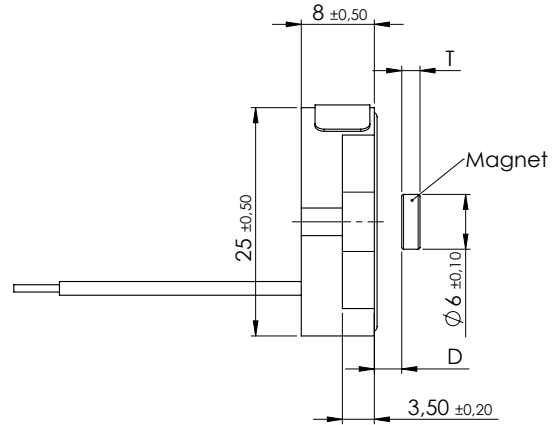
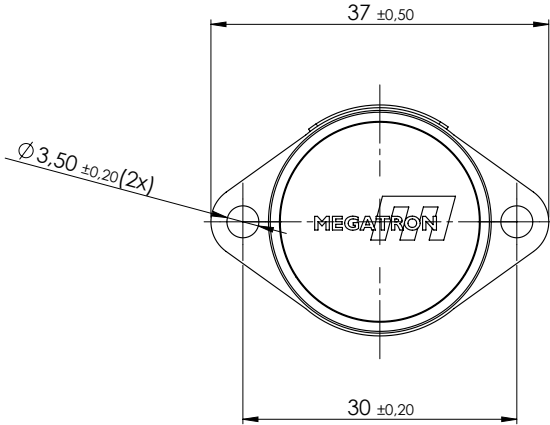
Multiturn ETA25K PM

Magnet Holder

Accessory

Customizing

Drawings ETx25K Family



Important hint:

The correct mounting distance D of the magnet to the surface of the kit encoder housing is crucial for the function or the malfunction of the kit encoder. The correct position of the magnet in dependency to the center axis of the kit encoder is relevant for its accuracy and the function or malfunction of the kit encoder.

Mounting distance D of the magnet in dependency to the rotary encoders surface

Electronics	D = Mounting distance of the Magnet in dependency to the kit encoders surface
All analogue singleturn/ multiturn electronics PWM, SER, SPI	1 mm +/- 0,15
All Incremental electronics	0,2 mm +/- 0,15

Angular error in dependency to the deviation of the magnet to the center axis

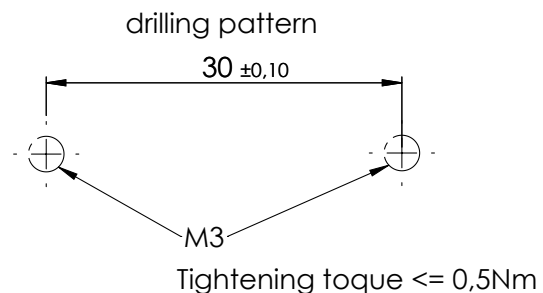
Deviation to the center axis	Angular error
0,5 mm	0,6°
0,75 mm	1,2°

Thickness T of the magnet in dependency to the sensor electronics

Electronics	Thickness T of the magnet
Analogue not redundant: ETA25K, ETP25K	2 mm
Analogue redundant, Serial redundant: ETA25K X, ETS25K X	2,5 mm
Incremental: ETI25K	4 mm

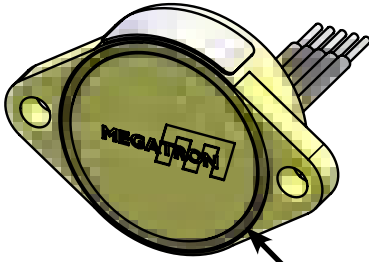
planarity of installation surface 0,1

roughness of installation surface \sqrt{Ra} 6,3



Drawings ETx25K Family

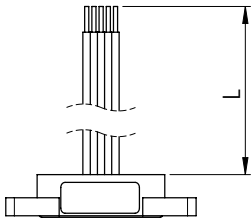
Option D (With O-ring)



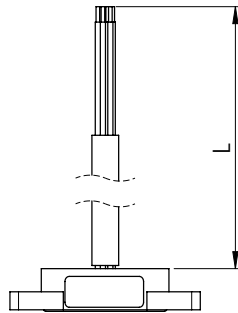
Option D
O-Ring included in delivery
for sealing between sensor front
and installation surface

Option F Flat ribbon cable

red marking = PIN 1



Option R Round cable



Option	Standard Cable Length L	Cable Cross Section	Allowed Tolerance(*)
R	1000 mm	AWG26	-20 mm...+40 mm
F	150 mm	AWG26	-10 mm...+25 mm
Cables without cable shield			

(*) Tolerances according IPC Association

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Mechanical and Environmental Data, Miscellaneous - ETx25K Family

Mechanical angle of rotation 1.)	Endless
Lifetime 2.)	Mechanically unlimited
Max. operational speed	The maximum actuation speed is not limited mechanically. The maximum permissible actuation speed [rev./min] is calculated in relation to the resolution. For absolute encoders:
	$\text{rev./min. (@max. resolution)} = \frac{1}{2^{\text{Resolution in Bit}} * \text{Update rate in s}} * 60s$
	For incremental encoders:
	$\text{Max. rev./min.} = \frac{\text{Limit Frequency } \frac{1}{s} * 60s}{\text{Number of Pulses}}$
Operational torque without / with shaft sealing	0.1 ≤ M ≤ 0.6 Ncm / 0.3 ≤ M ≤ 1.3 Ncm (@ RT, 10 rpm)
Operating temperature range	-40..+85 °C (fixed cable)
Storage temperature range	-40..+105 °C
Protection grade front side (IEC 60529) (encoder housing is facing the shaft in the application)	IP67
Protection grade rear side (IEC 60529) With encapsulated electronics (standard) Option: without encapsulated electronics	IP67 (end of cable excluded) IP00
Vibration (IEC 68-2-6, Test Fc)	±1.5 mm / 20 g / 10 bis 2000 Hz / 16 frequency cycles (3x4 h)
Mechanical shock (IEC 68-27, Test Ea)	50 g / 11 ms / halfsine (3x6 shocks)
Housing diameter / length	25 mm (dimensions of the mounting flange, height: 37 mm, width 25 mm)
Housing depth	8 mm
Shaft diameter	No limitation
Mass	Option F (0.15 m flat ribbon cable) app. XX g Option R (1.00 m round cable) app. XX g
Connection type	Flat ribbon cable AWG26, 0.15 m with tinned cable endings Round cable, AWG26, 1 m with tinned cable endings Other connection types on request Cables are not shielded
Connection position	Axial
Sensor mounting	Flange, by means of two pieces of screws M3
Delivery content	Standard: <ul style="list-style-type: none"> ▪ Kit Encoder ▪ Magnet (screws for fastening the rotary encoder are not part of the scope of delivery) With option D: <ul style="list-style-type: none"> ▪ Additional o-ring included in delivery
Fastening parts included in delivery	None When ordering option D, a sealing element (o-ring) for sealing between the mounting plate and the rotary encoder is scope of delivery
Fastening torque per screw or nut	≤ 0.5 Nm
Housing material	Glass-fibre reinforced thermoplastic

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Analogue ETx25K

Incremental ET125K

Serial ETS25K

Multiturn ETx25K PM

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Compliance - ETx25K Family

Immunity

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

Electrostatic Discharge - ETx25K Family

EN 61000-4-2 ESD	Class B
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REACH - ETx25K Family

REACH Regulation (EC) 1907/2006 including the SVHC list

RoHS - ETx25K Family

RoHS Directive 2011/65/EU

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ETA25K

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ET125K

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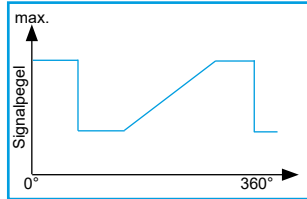
Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Possible options - ETx25K Family

Standard options starting from small series - ETx25K Family

- Output signal :
- Changed sense of rotation (CW/CCW)
 - Change of the effective electrical angle [XXX°]
 - Signal output function with max. 5 signal changes - ETA25F (X)



- Changed amount of increments ETI 25F

- Signal cable:
- Changed cable length

Options for project business (higher quantities) - ETx25K Family

- Cable assembly:
- Special cable style
 - Cable with plug
- Housing:
- Customer-specific housing design
 - Other housing material
 - MU-metal shielding
- Electronics:
- Other supply voltages
 - Changed update-rate
 - Redundant electronics with common supply voltage and ground
 - Electronics without encapsulation, visible from housing backside, without particle and liquid protection, IP00
- Magnets:
- Magnet with higher field strength for the enlargement of assembly distances between magnet and kit encoder housing
- Everything else:
- On request

Megatron support

Department:	Request:	E-Mail:	Phone:
Sales:	<ul style="list-style-type: none"> ▪ Technical support ▪ Application support ▪ Prices ▪ Delivery time 	sales@megatron.de	+49 89 46094-520
Order processing:	<ul style="list-style-type: none"> ▪ Order ▪ Delivery time ▪ Return (RMA) 	order@megatron.de	+49 89 46094-100
Further Information material:	Available on the Megatron homepage https://www.megatron.de/ <ul style="list-style-type: none"> ▪ Free 3D-models in STEP format ▪ Programming manual for series ETA25F PM ▪ Accessories: programmer, counter-/quadrature- ICs, shaft couplings 		

Push-On Magnet Holder for ETx25K Family

Magnets

Information about Magnets:

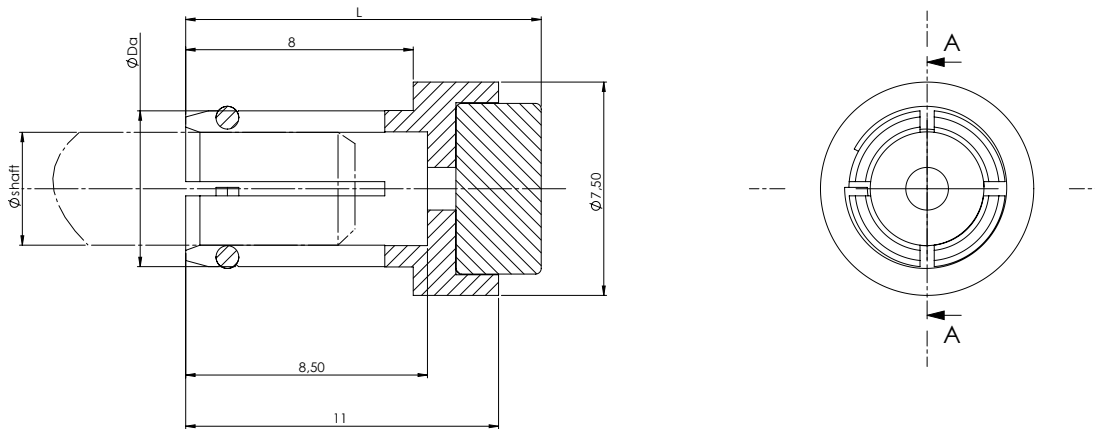
The magnet is required to operate the kit encoder. The magnet is part of the scope of delivery for ETx25K kit encoders and does not need to be ordered separately.

- The magnet shall be mounted on a non-magnetic carrier (e.g. shaft) in the application
- For fixation of the magnet, the recommendation is to provide a cylindrical mount for the magnet in the application on which the magnet can be glued
- Optionally, Megatron offers magnet holders incl. already fixed magnets, which can be pushed on the shaft in the application

Key features Push-On Magnet Holder for ETx25K Family:

- Available for the most common shaft diameters
- The magnet is already integrated and fixed in the push-on magnet holder
- Plug&Play - by simple push-on of the magnet holder onto the shaft in the application
- Allows the operation of the magnet on a magnetic shaft
- Material: stainless steel

Drawing push-on magnet holder series MAK



Dimensions			
Ø shaft in application [mm] Tolerance band g7 / f7	Ø Da [mm] magnet holder	L magnet holder for kit encoder with single electronic [mm]	L magnet holder for kit encoder with redundant electronic [mm]
4	5.5	12	12.5
6	7.5	12	12.5
6.35	7.5	12	12.5
8	9.5	12	12.5
12	13.5	16.5	16

An adhesive, such as 2K-EP, may be suitable for a permanent fixation of the position of the magnet holder on the shaft. For the reliable operation of the kit encoder, please refer regarding to the specified installation distances of the magnet in relation to the sensor housing, as described in the drawings of the ETx25K Kit Encoder series.

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order code for push-on magnet holder incl. magnet - Series MHA

Description	Order code			Minimum Order Quantity [pcs.]
Series: MHA	MAGNETHALTER AUFSTECKBAR			
Shaft diameter:				
Ø 4 mm		DM4		10
Ø 6 mm		DM6		1
Ø 6.35 mm (1/4")		DM6,35		10
Ø 8 mm		DM8		10
Ø 12 mm		DM12		10
Version Magnet:				
Single-Electronic			MAG 6x3	
Redundant Electronic			MAG 6x2,5	

Order examples push-on magnet holder:

Example 1, requirement:

Shaft Ø 6 mm with single electronic

Example 1, order code:

MAGNETHALTER AUFSTECKBAR DM6 MAG 6x3

Example 2, requirement:

Shaft Ø 4 mm with redundant electronic

Example 2, order code :

MAGNETHALTER AUFSTECKBAR DM4 MAG 6x2,5

General

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Mechanical Data

Analogue ETA25K

Incremental ET125K

Seriell ETS25K

Multiturn ETA25K PM

Magnet Holder

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Series ETA25K - Singleturn, analogue output, not redundant

Key features ETA25K :

- Supply voltage: 5 VDC $\pm 10\%$, 15..30 VDC, 9..30 VDC
- Signal output: 0..5 V, 0..10 V, 4..20 mA

Electrical Data ETA25K - Singleturn, analogue output, not redundant

Effective electrical angle of rotation 1.)	$15^\circ \leq \alpha \leq 360^\circ$ (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...5 V ratiometric	0...10 V	4...20 mA
Resolution	14 Bit for $15^\circ \leq \alpha < 90^\circ$ resp. 12 Bit for $90^\circ \leq \alpha < 360^\circ$		
Update rate	200 μ s		600 μ s
Supply voltage	5 V $\pm 10\%$	15...30 V	9...30 V
Power consumption (no load)	≤ 16 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		

1.) According IEC 60393

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Analogue ETA25K

Incremental ET125K

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order Code ETA25K - Singleturn, analogue output, not redundant

Description		Selection: standard=black/bold, possible options=grey/cursive					
Series ETA25K	ETA25K						
Supply voltage / Output signal: VSUP=5 V (4.5...5.5 V) / OUT=0...5 V (ratiometric) VSUP=24 V (15...30 V) / OUT=0...10 V VSUP=24 V (9...30 V) / OUT=4...20 mA VSUP=24 V (9...30 V) / OUT=0...5 V		0505 2410 2442 2405					
Sense of rotation: Sense of rotation CW (output signal increases clockwise) Option: CCW (output signal increases counter clockwise)			CW CCW				
Electrical angle: Electrical angle 360° (positive integer) Option: user defined rotation angle (≥15°, positive integer)				360 XXX			
O-Ring (standard without o-ring): Option: o-ring for sealing between the sensor front and the installation surface					<i>D</i>		
Electrical connection, cable length: Flat ribbon cable standard length 0.15 m Option round cable 1 m [x.xx m]						F0,15 R1,00	
Electrical connection, cable length (Options): Electrical connection: Option: flat ribbon cable Option: round cable Cable length: Option: cable length in user-defined length [x,xx m]					<i>F</i> <i>R</i>		X,XX
Variant without potted electronics (Option): Minimum order quantity 1000 pcs. (IP protection grade: housing from rear side IP00, housing front IP67, the electronics are visible and without particle and liquid protection)							V1

Order example ETA25K - Singleturn, analogue output, not redundant

Requirement: VSUP=5 V / OUT=0...5 V, sense of rotation CW, rotation angle 360°, without o-ring, flat ribbon cable 0.15 m
Example for order code: ETA25K 0505 CW360 F0,15
Note: The magnet suitable for the encoder is always part of the scope of delivery and does not have to be ordered separately. Push-on magnet holders incl. magnet are available optionally.

Cable- and pin-assignment ETA25K - Singleturn, analogue output, not redundant

Function:	Option F	Option R
OUT	Lead 2	brown
VSUP	Lead 1 (red)	red
GND	Lead 3	black

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Series ETA25K X - Singleturn, analogue output, redundant

Key features ETA25K X :

- Independent signal processing: The ETA25K X rotary encoder electronics are based mainly on one 3D-Hall IC in which two semiconductor chips independently capture, evaluate and output the measured values
- Supply voltage, signal output and ground are galvanically insulated => separate electrical connections
- Supply voltage: 5 VDC or 15..30 VDC
- Signal output: 0..5 V or 0..10 V

Electrical Data ETA25K X - Singleturn, analogue output, redundant

Effective electrical angle of rotation 1.)	15° ≤ α ≤ 360° (programmable in factory), ±0.5°	
Independent linearity (best straight line) 1.)	±0.3% @ 360°	
Absolute Linearity 1.)	±0.6% @ 360°	
Output signal	0...5 V ratiometric	0...10 V
Resolution	14 Bit for 15° ≤ α < 90° resp. 12 Bit for 90° ≤ α < 360°	
Update rate	200 μs	
Supply voltage	5 V ±10%	15...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	

1.) According IEC 60393

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Analogue ETA25K

Incremental ET125K

Seriell ETS25K

Multiturn ETA25K PM

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order Code ETA25K X - Singleturn, analogue output, redundant

Description	Selection: standard=black/bold, possible options=grey/cursive							
Series ETA25F X (X=electric redundant)	ETA25K X							
Supply voltage / Output signal: VSUP=5 V (4,5...5.5 V) / OUT=0...5 V (ratiometric) VSUP=24 V (15...30 V) / OUT=0...10 V		0505 2410						
Sense of rotation, output 1: Sense of rotation CW (output signal increases clockwise) Option: CCW (output signal increases counter clockwise)			CW CCW					
Sense of rotation, output 2: Sense of rotation CW (output signal increases clockwise) Option: CCW (output signal increases counter clockwise)				CW CCW				
Electrical angle: Electrical angle 360° (positive integer) Option: user defined rotation angle (≥15°)					360 XXX			
O-Ring (standard without o-ring): Option: o-ring for sealing between the sensor front and the installation surface						<i>D</i>		
Electrical connection, cable length, anti rotation pin (according drawing): Flat ribbon cable standard length 0.15 m Round cable 1 m [x.xx m]							F0,15 <i>R1,00</i>	
Electrical connection, cable length, anti rotation pin (Options): Electrical connection: Option: flat ribbon cable Option: round cable Cable length: Option: cable length in user-defined length [x.xx m]						<i>F</i> <i>R</i>		<i>X,XX</i>
Variant without potted electronics (Option): Minimum order quantity 1000 pcs. (IP protection grade: housing from rear side IP00, housing front IP67, the electronics are visible and without particle and liquid protection)								<i>V1</i>

Order example ETA25K X - Singleturn, analogue output, redundant

Requirement:
Redundant electronics VSUP=5 V / OUT=0...5 V, signal 1 sense of rotation CW, signal 2 sense of rotation CW, rotation angle 360° signal 1 and 2, without o-ring, flat ribbon cable 0.15 m

Example for order code:
ETA25F X 0505 CW CW 360 F0.15

Note:
The magnet suitable for the encoder is always part of the scope of delivery and does not have to be ordered separately. Push-on magnet holders incl. magnet are available optionally.

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order example ETA25K X - Singleturn, analogue output, redundant

<u>Function:</u>	<u>Option F</u>	<u>Option R</u>
VSUP 1	Lead 1 (red)	red
OUT 1	Lead 2	brown
GND 1	Lead 3	black
GND 2	Lead 4	green
OUT 2	Lead 5	yellow
VSUP 2	Lead 6	orange

General

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Analogue
ETA25K

Incremental
ET125K

Seriell
ETS25K

Multiturn
ETA25K PM

Magnet
Holder

Accessory

Customizing

Series ETP25K - Singleturn, PWM output, not redundant

Key features ETP25K PWM:

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

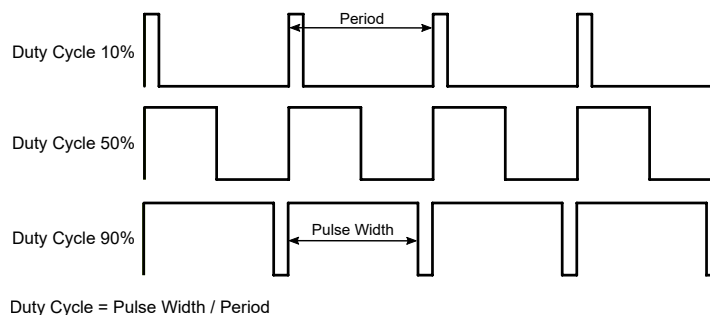
Electrical Data ETP25K - Singleturn, PWM output, not redundant

Effective electrical angle of rotation 1.)	$10^\circ \leq \alpha \leq 360^\circ$ (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)	≤ 10 mA
Output load	≥ 5 kOhm
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min

1.) According IEC 60393

Function description PWM signal output ETP25K:

The ETP25F provides a constant carrier frequency with 244 Hz on 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 μ Controllers already have an input for PWM signals..



Data Sheet for Angle Sensors



Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order Code ETP25K - Analogue, PWM output, singleturn

Description		Selection: standard=black/bold, possible options=grey/cursive					
Series ETP25K	ETP25K						
Supply voltage / Output signal: VSUP=5 V (4.5...5.5 V) / OUT=5 V / 244 Hz / PWM 10-90 %		5PWM					
Sense of rotation: Sense of rotation CW (pulse width increases clockwise) Option: CCW (pulse width increases counterclockwise)			CW CCW				
Electrical angle: Electrical angle 360° (positive integer) Option: user defined rotation angle ($\geq 10^\circ$, positive integer)				360 XXX			
O-Ring (standard without o-ring): Option: o-ring for sealing between the sensor front and the installation surface					<i>D</i>		
Electrical connection, cable length: Flat ribbon cable standard length 0.15 m Option: Round cable 1 m [x.xx m]						F0,15 R1,00	
Electrical connection, cable length (Options): Electrical connection: Option: flat ribbon cable Option: round cable Cable length: Option: cable length in user-defined length [x.xx m]					<i>F</i> <i>R</i>		<i>X,XX</i>
Variant without potted electronics (Option): Minimum order quantity 1000 pcs. (IP protection grade: housing from rear side IP00, housing front IP67, the electronics are visible and without particle and liquid protection)							<i>V1</i>

Order example ETP25K - Analogue, PWM output, singleturn

Requirement:
VSUP=5 V / OUT=244 Hz, sense of rotation CW, rotation angle 360°, without o-ring, electrical connection: flat ribbon cable 0.15 m

Example for order code:
ETP25K 5PWM CW 360 F0,15

Note:
The magnet suitable for the encoder is always part of the scope of delivery and does not have to be ordered separately. Push-on magnet holders incl. magnet are available optionally.

Cable-Assignment

ETP25K - Analogue, PWM output, singleturn

Function:	Option F	Option R
OUT	Lead 2	brown
VSUP	Lead 1 (red)	red
GND	Lead 3	black

Data Sheet for Angle Sensors



Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Series ETI25K - Singleturn, incremental output, not redundant

Key features ETI25K:

- Channels A, B and Index signal Z
- Signal output TTL, Push-Pull, Open Collector
- Maximal number of pulses per channel 1024 pulses per revolution (=4096 steps)
- Option: User defined number of pulses per revolution request 1..128 pulses per revolution - ex works programmable

Electrical Data ETI25K - Singleturn, incremental output, not redundant

Output Signal	TTL	Push-Pull	Open Collector
Number of pulses	1024, 512, 256, 1-128 Imp./Rev.		
Limit frequency	100 kHz		
Switch-on delay	20 ms		
Supply voltage	3,3 VDC ±10%	5 VDC ±10%	10...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		

1.) According IEC 60393

General

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Mechanical Data

Analogue ETx25K

Incremental ETI25K

Serial ETS25K

Multiturn ETA25K PM

Magnet Holder

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order Code ETI25F - singleturn, incremental output, not redundant

Description		Selection: standard=black/bold, possible options=grey/cursive					
Series ETI25K	ETI25K						
Number of pulses (pulses per revolution): 1024 Option: 512 Option: 256 Option: 128 Option: user defined pulses (<128)		1024 <i>0512</i> <i>0256</i> <i>0128</i> <i>0XXX</i>					
Supply voltage / Output signal: VSUP=24 V (10...30 V) / OUT=A, B, Z, Push-Pull VSUP=24 V (10...30 V) / OUT=Open Collector VSUP=5 V ± 10% / OUT=A, B, Z, TTL			24BZPP 24BZOC 05BZTTL				
Electrical connection, cable length, anti rotation pin: Flat ribbon cable standard length 0.15 m Round cable 1 m [x.xx m]						F0,15 <i>R1,00</i>	
O-Ring (standard without o-ring): Option: o-ring for sealing between the sensor front and the installation surface				<i>D</i>			
Electrical connection, cable length (options): Electrical connection: Option: flat ribbon cable Option: round cable Cable length: Option: cable length in user-defined length [x.xx m]					<i>F</i> <i>R</i>	<i>X,XX</i>	
Variant without potted electronics (Option): Minimum order quantity 1000 pcs. (IP protection grade: housing from rear side IP00, housing front IP67, the electronics are visible and without particle and liquid protection)							<i>V1</i>

Order example ETI25K - singleturn, incremental output, not redundant

Requirement:

Number of pulses 1024 TTL output, VSUP=5 V/TTL, no o-ring, flat ribbon cable 0.15 m

Example for order code:

ETA25F 1024 05BZTTL F0.15

Note:

The magnet suitable for the encoder is always part of the scope of delivery and does not have to be ordered separately. Push-on magnet holders incl. magnet are available optionally.

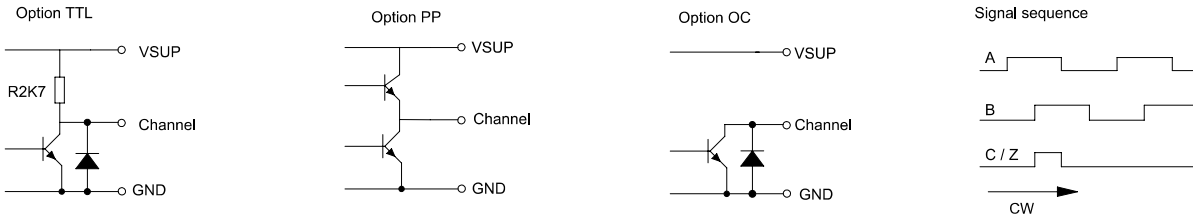
Data Sheet for Angle Sensors



Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Output circuits of the angle ETI25K encoder per channel - singleturn, incremental output, not redundant



Cable and pin assignment for option R ETI25K - Singleturn, incremental output, not redundant

Option R	Function: Push-Pull, TTL, OC
red	VSUP
black	GND
brown	A
orange	B
yellow	Z
green	NC

Cable and pin assignment for option F ETI25K - Singleturn, incremental output, not redundant

Option F	Function: OC, TTL	Function: Push-Pull
Lead 1 (red)	VSUP	VSUP
Lead 2	GND	Z
Lead 3	A	B
Lead 4	B	A
Lead 5	Z	GND

Data Sheet for Angle Sensors



Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Series ETS25K - Singleturn, digital output, not redundant

Key features ETS25K:

- Signal output SPI or SER
- Supply voltage 5 VDC +/-10%
- Maximum allowed signal cable length 0.6 m

Electrical Data ETS25K - Singleturn, digital output, not redundant

Effective electrical angle of rotation 1.)	360°	
Independent linearity (best straight line) 1.)	±0.4% @ 360°	
Absolute linearity 1.)	±0.8% @ 360°	
Output signal	SER	SPI
Resolution	12 Bit	14 Bit
Update rate	96 µs	600 µs
Supply voltage	5 VDC ±10%	
Power consumption (no load)	≤ 14 mA	≤ 12 mA
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min	
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min	

1.) According IEC 60393

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Analogue ETS25K

Incremental ET125K

Seriell ETS25K

Multiturn ETA25K PM

Magnet Holder

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Data Sheet for Angle Sensors



Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order Code ETS25K - Singleturn, digital output, not redundant

Description: Effective electrical angle: 360° Sense of rotation: CW (by rotating the shaft clockwise the output signal rises)	Selection: standard=black/bold, possible options=grey/cursive						
Series ETS25K	ETS25K						
Supply voltage / Output signal: 14 Bit / 5 VDC ± 10% / SPI 12 Bit / 5 VDC ± 10% / SER			05SPI 05SER				
O-Ring (standard without o-ring): Option: o-ring for sealing between the sensor front and the installation surface				<i>D</i>			
Electrical connection, cable length: Flat ribbon cable standard length 0.15 m						F0,15	
Electrical connection, cable length (Options): Electrical connection: Option: flat ribbon cable Option: round cable Cable length: Option: cable length in user-defined length [x.xx m] (maximum cable length 0.6 m)					<i>F</i> <i>R</i>	<i>X,XX</i>	
Variant without potted electronics (Option): Minimum order quantity 1000 pcs. (IP protection grade: housing from rear side IP00, housing front IP67, the electronics are visible and without particle and liquid protection)							<i>V1</i>

Order example ETS25K - Singleturn, digital output, not redundant

Requirement: Electronics 14 Bit/5 VDC/SPI, without o-ring, flat ribbon cable 0.15 m
Example for order code: ETS25K 05SPI F0,15
Note: The magnet suitable for the encoder is always part of the scope of delivery and does not have to be ordered separately. Push-on magnet holders incl. magnet are available optionally

Cable and pin assignment ETS25K Singleturn, digital output, not redundant

Function:	Option F:	Option R:
VSUP	Lead 1 (rot)	red
GND	Lead 2	black
Data	Lead 3	brown
Clock	Lead 4	yellow
Chipselect	Lead 5	green

For details regarding the interfaces, please refer to the data sheets of the IC manufacturers.

SER-Interface

Manufacturer: ams
IC Typ: AS5045
Web: www.ams.com

SPI-Interface

Manufacturer: Melexis
IC Typ: MLX90316EDC (not redundant version)
Web: www.melexis.com

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Mechanical Data

Analogue ETS25K

Incremental ET125K

Serial ETS25K

Multiturn ETA25K PM

Magnet Holder

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

R

Serie ETS25K X - Singleturn, digital output, redundant

Key features ETS25K X :

- Independent signal processing. The ETS25K X rotary encoder electronics are based mainly on one 3D-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 $\pm 10\%$
- Signal output: 2 x SPI
- Maximum allowed signal cable length (each) 0.6 m

Electrical Data ETS25K X - Singleturn, digital output, redundant

Effective electrical angle of rotation 1.)	360°
Independent linearity (best straight line) 1.)	$\pm 0.4\%$ @ 360°
Absolute linearity 1.)	$\pm 0.8\%$ @ 360°
Output signal	SPI
Resolution	14 Bit
Update rate	600 μ s
Supply voltage	5 VDC $\pm 10\%$
Power consumption (no load)	≤ 24 mA
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min

1.) According IEC 60393

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Incremental ET125K

Seriell ETS25K

Multiturn ETA25K PM

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order Code ETS25K X - Singleturn, digital output, redundant

Description:

Effective electrical angle: 360°
Sense of rotation: CW (by rotating the shaft clockwise the output signal rises for both signal outputs)

Selection: standard=black/bold, possible options=grey/cursive

Series ETS25F X (X=electric redundant)

ETS25F X

Supply voltage / Output signal:

14 Bit / 5 VDC ± 10% / SPI

05SPI

O-Ring (standard without o-ring):

Option: o-ring for sealing between the sensor front and the installation surface

D

Cable type, cable length:

Two 5 pol. flat ribbon cables arranged one above the other, standard cable length of each flat ribbon cable 0.15 m, anti rotation pin A

F0,15

Electrical connection, cable length (Options):

Electrical connection: flat ribbon cable

Cable length:

Option: cable length in user-defined length [x.xx m]
(maximum cable length 0.6 m)

FX,XX

Variant without potted electronics (Option):

Minimum order quantity 1000 pcs.
(IP protection grade: housing from rear side IP00, housing front IP67, the electronics are visible and without particle and liquid protection)

V1

Order example ETS25K X - Singleturn, digital output, redundant

Requirement:

Electronics 14 Bit/5 VDC/SPI, no shaft sealing, signal 1 sense of rotation CW, signal 2 sense of rotation CW, 360° effective electrical angle of rotation for signal 1 and 2, two 5 pol. flat ribbon cables arranged one above the other with cable length 0.15 m of each flat ribbon cable

Example for order code:

ETS25K X 05SPI F0,15

Note:

The magnet suitable for the encoder is always part of the scope of delivery and does not have to be ordered separately. Push-on magnet holders incl. magnet are available optionally

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Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Cable and pin assignment ETS25K X - Singleturn, digital output, redundant

<u>Function:</u>	<u>Option F:</u>	<u>Explanation:</u>
VSUP 1	Lead 1 (red)	5 pol. flat ribbon cable no. 1
GND 1	Lead 2	5 pol. flat ribbon cable no. 1
Data 1	Lead 3	5 pol. flat ribbon cable no. 1
Clock 1	Lead 4	5 pol. flat ribbon cable no. 1
Chipselect 1	Lead 5	5 pol. flat ribbon cable no. 1
VSUP 2	Lead 1 (red)	5 pol. flat ribbon cable no. 2
GND 2	Lead 2	5 pol. flat ribbon cable no. 2
Data 2	Lead 3	5 pol. flat ribbon cable no. 2
Clock 2	Lead 4	5 pol. flat ribbon cable no. 2
Chipselect 2	Lead 5	5 pol. flat ribbon cable no. 2

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ETA25K

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ETS25K

Multiturn
ETA25K PM

Magnet
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Data Sheet for Angle Sensors



Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Series ETA25K PM - Multiturn/Singleturn, programmable, analogue output, not redundant

Keyfeatures ETS25K PM :

- Measuring range 10° to max. 72000° (=200 shaft revolutions)
- Programmable by the user. Programmable are: the sense of rotation (CW/CCW), the effective electrical angle [°]
- Programmable up to 10.000 times
- Can also be used as programmable singleturn rotary encoder
- Maximum rotation of the shaft in a voltage-free state without loss of the angle information +/-179°
- Factory programming: effective electrical angle of rotation 3600° (= 10 shaft revolutions), sense rotation CW
- Supply voltage: 9..30 VDC, 15..30 VDC
- Output signal: 0..5 VDC, 0..10 V

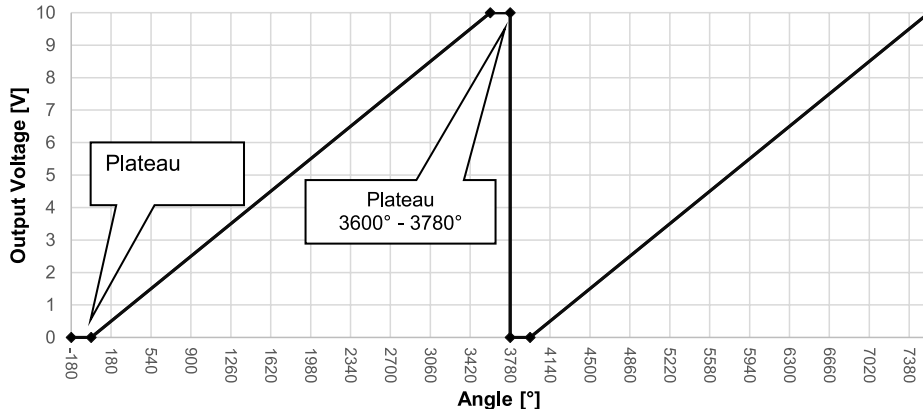
Electrical Data - ETA25K PM - Multiturn/Singleturn, programmable, analogue output, not redundant

Effective electrical angle of rotation 1.)	0...10° - 0...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...5 V	0...10 V
Resolution 1.)	12 Bit	
Update rate	3 ms	
Supply voltage	9...30 V	15...30 V
Power consumption (no load)	< 10 mA	
Output load	≥ 5 kOhm	
Insulation voltage 1.)	1000 VAC @ 50 Hz, 1 min	
Insulation resistance 1.)	2 MOhm @ 500 VDC, 1 min	
Max. number of programming cycles	10000	

1.) According IEC 60393

Automatic function for inserting signal plateaus.

ETA25K PM - Multiturn/singleturn, programmable, analogue output, not redundant



The function represents the relationship between the 0° position 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 ETA25F PM automatically integrates signal plateaus for a rotation angle of each 180°.

The following example describes the output signal 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

Data Sheet for Angle Sensors



Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

Order Code ETA25K PM - Multiturn/Singleturn, programmable, analogue output, not redundant

Description: User programmable multiturn rotary encoder. Sense of rotation, rotation angle ex works: CW, 3600°	Selection: standard=black/bold, possible options=grey/cursive					
Series: ETA25K PM	ETA25K PM					
Supply voltage / Output signal: VSUP=24 V (9...30 V) / OUT=0...5 V (not available for option TS) VSUP=24 V (15...30 V) / OUT=0...10 V		2405 2410				
Shaft sealing: Standard without shaft sealing <i>Option D with shaft sealing</i>			- D			
Cable length: Two 5 pol. flat ribbon cables arranged one above the other, standard cable length of each flat ribbon cable 0.15 m, anti rotation pin A					F0,15	
Electrical connection, cable length, anti rotation pin (Options): Electrical connection: Option: flat ribbon cable Option: round cable Cable length: Option: cable length in user-defined length [x.xx m] (maximum cable length 0.6 m)				F R	X,XX	
Variant without potted electronics (Option): Minimum order quantity 1000 pcs. (IP protection grade: housing from rear side IP00, housing front IP67, the electronics are visible and without particle and liquid protection)						V1

Order example ETA25K PM - Multiturn/Singleturn, programmable, analogue output, not redundant

Requirement: Electronics VSUP=5 V / OUT=0...5 V, sense of rotation CW, effective electrical angle ex works 3600° (can be programmed by customer), no shaft sealing, flat ribbon cable 0.15 m, anti rotation pin A
Example for order code: ETA25K PM 0505 F0.15
Note: The magnet suitable for the encoder is always part of the scope of delivery and does not have to be ordered separately. Push-on magnet holders incl. magnet are available optionally

Order example ETA25K PM programmer

<p>Keyfeatures ETS25F PM programmer:</p> <ul style="list-style-type: none"> 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: 127813	Order code: Programmer MAB36APM, MAB40APM, ETA25PM

Data Sheet for Angle Sensors

Hall-Effect Kit Encoder with Flange Mounting

Family ETx25K

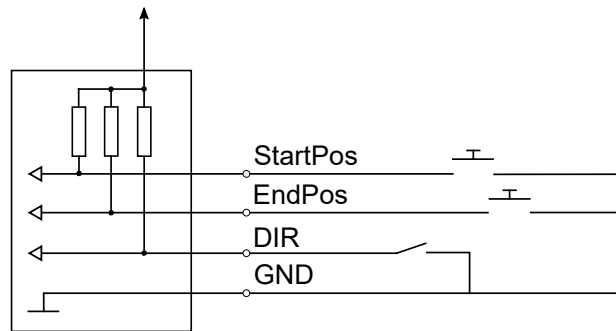
Cable and pin assignment ETA25K PM Multiturn/singleturn, programmable, analogue output, not redundant

Function:	Option F	Option R
DIR	Lead 1 (red)	orange
END	Lead 2	green
START	Lead 3	yellow
VSUP	Lead 4	red
OUT	Lead 5	brown
GND	Lead 6	black

Programming of ETA25K PM - Multiturn/singleturn, programmable, analogue output, not redundant

The programming guide is available for download on the Megatron Homepage <https://www.megatron.de/>

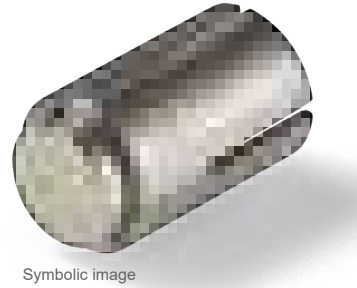
To program the ETA25K PM rotary encoder either the following circuit must be built, or the programmer must be ordered from Megatron.



Accessory for ETx25K Family

▪ Shaft Couplings from Megatron

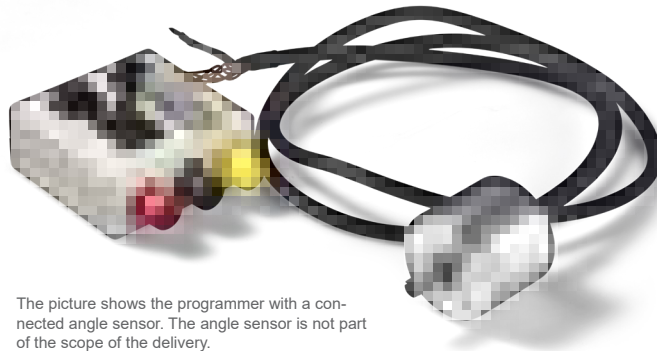
- Available for the most common shaft diameters
- The magnet is already integrated and fixed in the push-on magnet holder
- Plug&Play - by simple push-on of the magnet holder onto the shaft in the application
- Allows the operation of the magnet on a magnetic shaft
- Material: stainless steel



Symbolic image

▪ Programmer for ETA25K PM

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



The picture shows the programmer with a connected angle sensor. The angle sensor is not part of the scope of the delivery.

▪ ICs for ETI25K

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



LS7083/4N-S

LS7083/4N



LS7166