



Manual

Encoders with
analog interface

Analog
output

Table of Contents

1	Document	3
2	General Information.....	4
2.1	Target Group.....	4
2.2	Symbols used / Classification of the Warnings and Safety instructions.....	4
3	Product Description	6
3.1	Technical Data	6
3.1.1	Technical Data Sendix M36xx, M36xxA, M58xx, M58xxA.....	6
3.2	Supported Standards and Protocols	8
3.2.1	Supported functions	8
3.3	Interface Description	9
3.3.1	Analog	9
4	Installation	10
4.1	Electrical Installation	10
4.1.1	General Information for the Connection	10
4.1.2	Information for EMC-Compliant Installation	10
4.2	Terminal Assignment	11
4.2.1	Terminal Assignment M36, M58	11
5	Commissioning and Operation	13
5.1	Function and Status LED	13
5.2	Quick Start Guide.....	15
5.2.1	Default Settings.....	15
5.2.2	Setting of the main parameters	17
6	Contact	21
	Glossary	22

1 Document

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2 General Information






Please read this document carefully before working with the product, mounting it or starting it up.

2.1 Target Group

The device may only be planned, mounted, commissioned and serviced by persons having the following qualifications and fulfilling the following conditions:

- Technical training.
- Briefing in the relevant safety guidelines.
- Constant access to this documentation.
- In case of electrical equipment for potentially explosive atmospheres, the specialized personnel needs knowledge about the ignition protection category concept.
- For facilities in potentially explosive atmospheres, the authorized person must comply with the applicable country-specific regulations.

2.2 Symbols used / Classification of the Warnings and Safety instructions

 DANGER	<p>Classification:</p> <p>This symbol, together with the signal word DANGER , warns against immediately imminent threat to life and health of persons.</p> <p>The non-compliance with this safety instruction will lead to death or severe adverse health effects.</p>
 WARNING	<p>Classification:</p> <p>This symbol, together with the signal word WARNING , warns against a potential danger to life and health of persons.</p> <p>The non-compliance with this safety instruction may lead to death or severe adverse health effects.</p>
 CAUTION	<p>Classification:</p> <p>This symbol, together with the signal word CAUTION , warns against a potential danger for the health of persons.</p> <p>The non-compliance with this safety instruction may lead to slight or minor adverse health effects.</p>

ATTENTION	Classification:
	The non-compliance with the ATTENTION note may lead to material damage.
NOTICE	Classification:
	Additional information relating to the operation of the product, and hints and recommendations for efficient and trouble-free operation.

3 Product Description

3.1 Technical Data

3.1.1 Technical Data Sendix M36xx, M36xxA, M58xx, M58xxA

Mechanical characteristics for the Sendix M36xx, M36xxA encoders

Maximum rotary speed IP65 IP67	6000 min ⁻¹ , 3000 min ⁻¹ (continuous operation) 4000 min ⁻¹ , 2000 min ⁻¹ (continuous operation)
Starting torque (at 20 °C) IP65 IP67	< 0,007 Nm < 0,01 Nm
Permissible shaft load radial axial	40 N 20 N
Protection level acc. to EN 60529	IP65, IP67
Working temperature range	-40 °C ... +85 °C
Materials Shaft/Hollow shaft Flange Housing Cable	Stainless steel Aluminum Die-cast zinc PVC
Shock resistance according to EN 60068-2-27	2500 m/s ² , 6 ms
Vibration resistance according to EN 60068-2-6	300 m/s ² , 10 ... 2000 Hz

Mechanical characteristics for the Sendix M58xx M58xxA encoders

Maximum rotary speed IP65	6000 min ⁻¹ , 3000 min ⁻¹ (continuous operation)
Starting torque (at 20 °C) IP65	< 0,01 Nm
Permissible shaft load radial axial	80 N 40 N
Protection level acc. to EN 60529	IP65
Working temperature range	-40 °C ... +85 °C
Materials Shaft/Hollow shaft Flange Housing Cable	Stainless steel Aluminum Die-cast zinc PVC
Shock resistance according to EN 60068-2-27	5000 m/s ² , 6 ms
Vibration resistance according to EN 60068-2-6	300 m/s ² , 10 ... 2000 Hz

Electrical characteristics for the Sendix M36xx, M36xxR, M36xxA, M36xxAR, M58xx, M58xxA encoders

Supply voltage	10 ... 30 V DC
Current consumption	Max. 30 mA (without load)
Singleturn technology	Magnetic
Multiturn technology	Magnetic, electronic counter, Energy Harvesting
Singleturn resolution (MUR)	Max. 12 bits (default 12 bits)
Multiturn resolution (NDR)	Max. 16 bits (default 4 bits)
Multiturn resolution (TMR)	Max. 28 bits (default 16 bits)
Accuracy	± 1° (over the whole temperature range)
Repeatability	± 0.2°

Mechanical characteristics for the Sendix M36xxR encoders

Maximum rotary speed IP67	4000 min ⁻¹ , 2000 min ⁻¹ (continuous operation)
Starting torque (at 20 °C) IP67	< 0,01 Nm
Permissible shaft load radial axial	80 N 40 N
Protection level acc. to EN 60529	IP65, IP67, IP69k
Working temperature range	-40 °C ... +85 °C
Materials Shaft/Hollow shaft Flange Housing Cable	V2A / V4A Stainless steel V4A / Aluminum V4A / Die-cast zinc PVC
Shock resistance according to EN 60068-2-27	5000 m/s ² , 4 ms
Vibration resistance according to EN 60068-2-6	300 m/s ² , 10 ... 2000 Hz

3.2 Supported Standards and Protocols**3.2.1 Supported functions****Multiturn - Sendix M36xx, M3661R, M58xx**

Output	4 ... 20 mA	0 ... 10 VDC	0 ... 5 VDC
Resolution	12 bits	12 bits	11 bits
Max. measuring range:	65536 revolutions	65536 revolutions	65536 revolutions
Min. measuring range	22.5°	22.5°	22.5°
Zero point display	0 ... 1°	0 ... 1°	0 ... 1°

Singleturn - Sendix M36xxA, M3651AR, M58xxA

Output	4 ... 20 mA	0 ... 10 VDC	0 ... 5 VDC
Resolution	12 bits	12 bits	11 bits
Max. measuring range:	360°	360°	360°
Measuring ranges	45°, 90°, 180°, 360°	45°, 90°, 180°, 360°	45°, 90°, 180°, 360°
Zero point display	0 ... 1°	0 ... 1°	0 ... 1°

Optional functions**Multiturn**

- Measuring range scaling via scaling inputs (max. 10,000 cycles)
- Limit switch function.

- Direction of rotation: CCW (is factory-set and cannot be modified by the user).

Singleturn

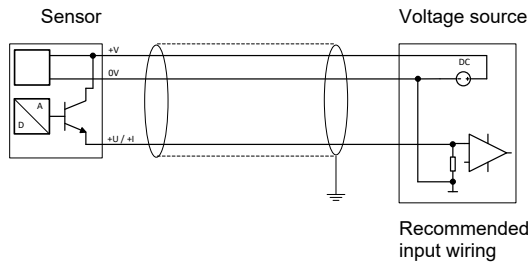
- Direction of rotation: CCW (is factory-set and cannot be modified by the user).
- Zero set via SET 1 input

3.3 Interface Description

3.3.1 Analog

Analog interfaces transfer signal values which, unlike digital signals, can continuously take on values over time. While SinCos signals also belong to the analog signals, the purely analog interface distinguishes itself by the fact that the original SinCos signals are converted into continuous analog signals.

The purely analog signals are generally transmitted as a current signal (4 ... 20 mA) or a voltage signal (0 ... 10 VDC or 0 ... 5 VDC).



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Performance

Since the analog interface does not require any protocol for transmission, it is particularly performant. The interface has simply 3 signal lines for signal transmission. Its connection is thus efficient and simple. Its resolution is typically less high than that of comparable interfaces, e.g. such as SinCos.

4 Installation

4.1 Electrical Installation

4.1.1 General Information for the Connection

ATTENTION	Destruction of the device
	Before connecting or disconnecting the signal cable, always disconnect the power supply and secure it against switching on again.
NOTICE	General safety instructions
	Make sure that the whole plant remains switched off during the electrical installation.
	Make sure that the operating voltage is switched on or off simultaneously for the device and the downstream device.
NOTICE	Traction relief
	Always mount all cables with traction relief.

4.1.2 Information for EMC-Compliant Installation

Requirements for cables

- Use exclusively shielded twisted-pair cables to connect the device.
- Comply with the maximum permissible connection cables length.

EMC acc. to EN 61326-1	Criterion A The device operates trouble-free, user data transmission proceeds without disturbance, internally stored data and configurations remain preserved	Criterion B During a failure, a disturbed transmission of the user data is allowed, internally stored data and configurations remain preserved
Interference immunity	Is achieved with a shielded line	Is not achieved with a shielded line
	Class A Industrial environment The device has a radiation according to Class A	Class B Living area The device has a radiation according to Class B
Radiation	Is not achieved with a shielded line	Is achieved with a shielded line

NOTICE	Grounding of the encoder housing
	<p>The cable shield is connected internally to the encoder housing. When using a stator coupling for installation, make sure that this coupling is sufficiently conductive. Otherwise, the housing should be directly connected to a protective earth.</p> <ul style="list-style-type: none"> • For this purpose, also provide alternative measures, as described in chapter Information for EMC-Compliant Installation [► 10].

Shielding and equipotential bonding

- Apply the cable shield on a large contact area - ideally 360°. Use e. g. a shield terminal to this purpose.
- Pay attention to proper cable shield fastening.
- Preferably connect the shield on both sides with low impedance to the protective earth (PE), e.g. on the device and/or on the evaluation unit. In the event of potential differences, the shield must only be applied on one side.
- If shielding is not possible, appropriate filtering measures must be taken.
- If the protective earth should be connected to the shield on one side only, it must be made sure that no short-time overvoltages can appear on the signal and supply voltage lines.

Kübler offers a wide range of connection cables in various versions and lengths, see

www.kuebler.com/connection-technology.

Kübler offers various solutions for EMC-compliant installation, e.g. shield terminals for the electrical cabinet, see www.kuebler.com/accessories.

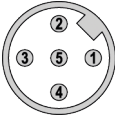
4.2 Terminal Assignment

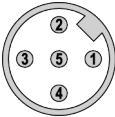
4.2.1 Terminal Assignment M36, M58

NOTICE	SET inputs
	The additional input SET 2 is only available on multiturn devices.

Interface	Type of connection	Cable					
3 Current	1, 2, A, B	Signal	0 V	+ V	+ I	SET 1	SET 2
		Color	WH	BN	GN	GY	PK

Interface	Type of connection	Cable					
4, 5 Voltage	1, 2, A, B	Signal	0 V	+ V	+ U	SET 1	SET 2
		Color	WH	BN	GN	GY	PK

Interface	Type of connection	M12 connector, 5-pole						Connector
		Signal	0 V	+ V	+ I	SET 1	SET 2	
3 Current	3, 4	Pin	3	2	1	5	4	

Interface	Type of connection	M12 connector, 5-pole						Connector
		Signal	0 V	+ V	+ U	SET 1	SET 2	
4, 5 Voltage	3, 4	Pin	3	2	1	5	4	

+V: Encoder supply voltage +V DC

+U: Voltage

+I: Current

0 V: Encoder ground GND (0 V)

SET 1: Set input for teach point 1 with multiturn devices / Zero set with singleturn devices

SET 2: Set input for teach point 2 - Only with multiturn devices

5 Commissioning and Operation

**DANGER**

Risk of injury due to rotating shafts

Hair and loose clothing can be caught by rotating shafts.











- Prepare all work as follows:
 - ⇒ Switch the operating voltage off and stop the drive shaft.
 - ⇒ Cover the drive shaft if the operating voltage cannot be switched off.

5.1 Function and Status LED

The device is equipped with a two-color LED for displaying status and error messages.

Green = status

Red = error

Display	LED	Meaning	Error cause	Note
No LED on		Encoder not in operation	Faulty supply voltage Encoder is not operational	Check the voltage supply and the wiring
Green LED flashes in 250 ms cycles		Service mode	The encoder is in Service mode	Contact the service department of the manufacturer. Contact [► 21]
Green LED constantly on		Encoder in operation		
Red and green LEDs flashing alternately in 250 ms cycles		System error Error	Internal system error	Contact the service department of the manufacturer. Contact [► 21]
Red and green LEDs flashing alternately in 500 ms cycles		Wire break (only for current output)	Load at the output too low Connection with the control interrupted.	Check the wiring
Green and red LED constantly on		Reference point display		
Green LED flashes 1x		Activation of SET 1 input detected and confirmed.		
Green LED flashes 3x		Activation of SET 2 input detected. The new measuring range has been taken over.		
Red LED flashes 3x		Error during the scaling operation. The new measuring range has not been taken over.	Selected measuring range < 22.5° or > 65536 revolutions	Scale another measuring range
Green / red / green sequence		Reset of the scaled measuring range. Default measuring range is loaded. Preset is carried out at the current position. Zero set function confirmed with singleturn devices.		

5.2 Quick Start Guide

5.2.1 Default Settings

5.2.1.1 Measuring range and direction of rotation

As a standard, the output signal (4 ... 20 mA, 0 ... 10 V, 0 ... 5 V) is output scaled over the set measuring range.

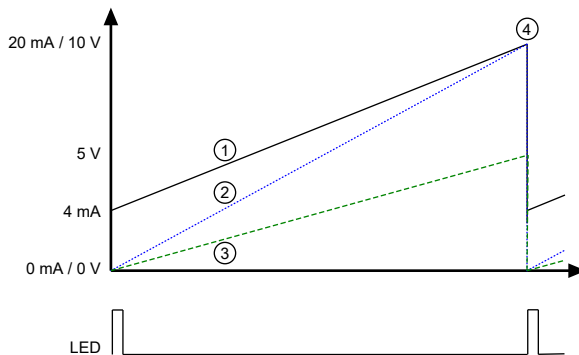
Depending on the configuration, the measuring range can be as follows:

- For singleturn devices: 1 revolution
- For multiturn devices: 16 revolutions (factory setting)

If supported by the device, the measuring range can also be freely scaled.

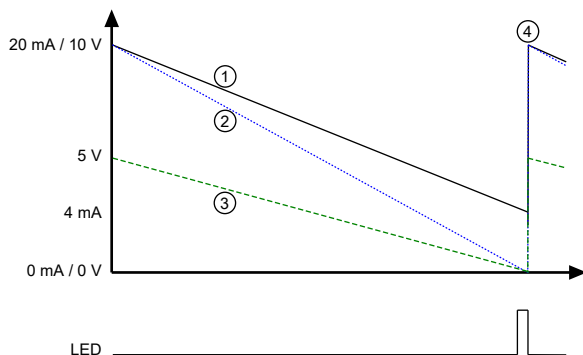
Also the direction of rotation depends on the configuration of the used device. It affects the signal path.

The possible configurations are listed below.



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1	Variant 4 ... 20 mA	3	Variant 0 ... 5 V
2	Variant 0 ... 10 V	4	Rollover

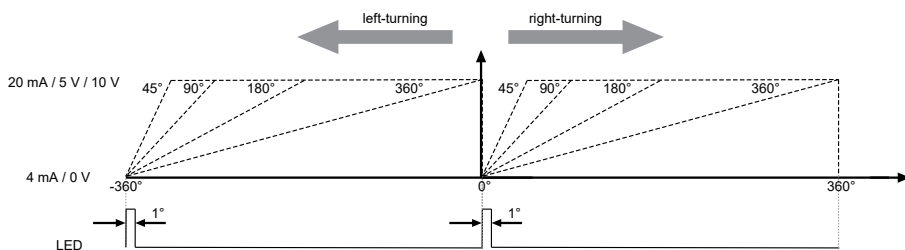


IMG-ID: 215002251

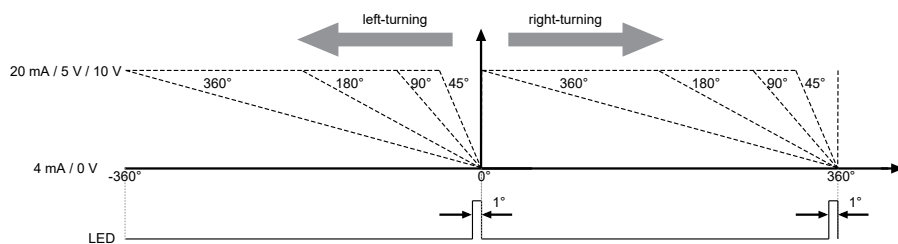
1	Variant 4 ... 20 mA	3	Variant 0 ... 5 V
2	Variant 0 ... 10 V	4	Rollover

Singleturn devices

The measuring range of the singleturn devices varies according to the version. The pictures below can be used to represent the behavior of the measuring range.



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IMG-ID: 215839243

5.2.2 Setting of the main parameters

5.2.2.1 Scaling function

Multiturn devices

The encoder is factory-set for a measuring range of 16 revolutions. Linear scaling is applied to the respective output signal.

The encoder is factory-set for a determined output range of 4 ... 20 mA / 0 ... 10 V / 0 ... 5 V. It is scaled linearly over the desired measuring range.

The two scaling inputs SET 1 and SET 2 allow the user to set a measuring range himself. The desired measuring range must be $> 22.5^\circ$ and shall not exceed 65536 revolutions. To restore the default measuring range, apply + V to both SET inputs.

NOTICE	Scaling inputs
	To trigger the scaling operation, apply the supply voltage + V to the corresponding scaling input at least 1 second.

NOTICE	Execution of the scaling function
	<p>The scaling function is limited to 10,000 cycles. Beyond this limit, the error-free scaling of the output signal cannot be guaranteed.</p> <p>Actuate the SET inputs only once the shaft has stopped.. Only this way will it be possible to take over properly the desired start and end position of the desired signal scaling.</p>

Scaling process for multiturn devices:

- ✓ Turn the shaft to the desired start position.
 - a) Apply + V to input SET 1 for at least 1 second.
 - ⇒ Green LED flashes 1x.
 - b) Turn the shaft to the desired end position.
 - c) Apply + V to input SET 2 for at least 1 second.
 - ⇒ Green LED flashes 3x. The new measuring range is active. The output signal jumps to the maximum value.

Resetting the scaled output signal for multiturn devices:

- ✓ Make sure that the shaft stands still.
 - d) Apply + V to input SET 1+2 for at least 1 second.
 - ⇒ The LED sequence green / red / green is displayed. The factory-set scaling of the output signal is available again and is set to the middle value of the measuring range at the current position.

If the inputs are not used, they must be connected to 0 V (encoder ground GND), to prevent interferences.

SET 1 input	SET 2 input	Function
0	0	Normal operating mode
1	0	Setting the start position
0	1	Setting the end position
1	1	Resetting to the default measuring range
0	0	Normal operating mode

Singleturn devices

For singleturn devices, the measuring range cannot be scaled. It is factory-preset and displayed by the reference point display. However, the measuring range can be shifted by the Zero set function. Zero set function [► 18]

Reference point display for singleturn devices:

With the factory-set "default" scaling, the LED displays the reference point of 0 ... 1°. The reference point display is no longer available if another measuring range is scaled using the scaling inputs.

5.2.2.2 Zero set function

With singleturn devices, the Zero set function allows shifting the measuring range. For this purpose, the current position is set to 0. The size of the measuring range remains unchanged.

If this input is not used, it must be connected to 0 V (encoder ground GND), to prevent interferences.

Zero set with singleturn devices:

- ✓ Turn the shaft to the desired start position.
- a) Apply + V to input SET 1 for at least 1 second.
 - ⇒ The green LED flashes 3x – green / red / green. The new measuring range is active.

5.2.2.3 Direction of rotation change

Multiturn devices

Fixed output levels are assigned to the scaling inputs.

SET 1 = lowest output level (current variant = 4 mA / voltage variant = 0 V)

SET 2 = highest output level (current variant = 20 mA / voltage variant = 5 or 10 V)

This means that the actuation order determines the logic of the direction of rotation. If input SET 2 is actuated first, followed by input Set 1, the new measuring range is defined with the reversed direction of rotation.

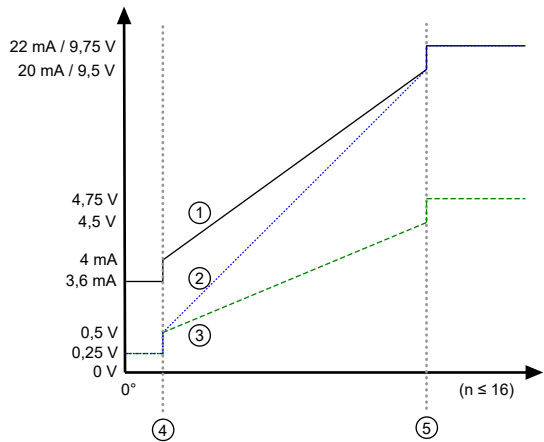
Order of the SET inputs	Absolute position	Sign
1 - 2	1 > 2 CCW	Positive
1 - 2	2 > 1 CW	Positive
2 - 1	1 > 2 CW	Negative
2 - 1	2 > 1 CCW	Negative

5.2.2.4 Limit switch function

Multiturn devices

With the limit switch function, the output signal does not remain at the last final value, but it makes a defined jump. This signal jump can be used by a control as a limit switch. The output levels of the limit switches are factory-set. The output levels are represented below for a better illustration, once with and once without the limit switch function. The picture represents the factory-set total measuring range of 16 bits (NDR = 4 bits = 16 revolutions).

Measuring ranges with limit switch function



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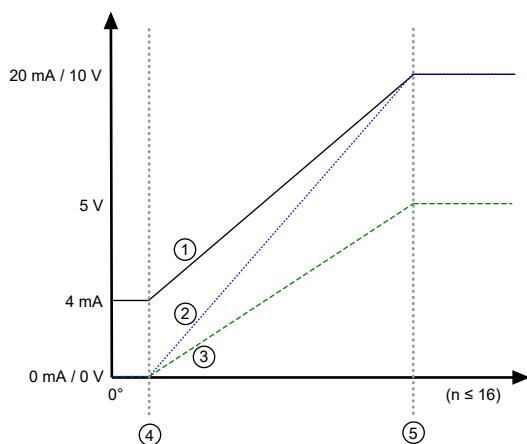
1	Variant 4 ... 20 mA	4	Teach point 1
2	Variant 0 ... 10 V	5	Teach point 2
3	Variant 0 ... 5 V		

Measuring range in delivery condition: NDR = 4 bits = 16 revolutions

Limit switch function

Variant	4 ... 20 mA	0 ... 10 V	0 ... 5 V
Limit switch low	3.6 mA	0.25 V	0.25 V
Limit switch high	22.0 mA	9.75 V	4.75 V

Measuring ranges without limit switch function



IMG-ID: 216432395

1 Variant 4 ... 20 mA

2 Variant 0 ... 10 V

3 Variant 0 ... 5 V

4 Teach point 1

5 Teach point 2

6 Contact

You want to contact us:

Technical advice

Kübler's worldwide applications team is available on site all over the world for technical advice, analysis or installation support.

International support (English-speaking)

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Kübler India +91 8600 147 280

Kübler USA +1 855 583 2537

Repair service / RMA form

In case of returns, please package the product sufficiently and attach the completed "Returns form".

www.kuebler.com/rma

Please send your return to the address below.

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Glossary

CCW

counterclockwise, counting direction

MUR

Measuring Units per Revolution

NDR

Number of Distinguishable Revolutions

TMR

Total Measuring Range



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