Your Global Automation Partner

TURCK

# Analog Encoders
## RM-97/98/115

Manual

# 1 Technical details and encoder characteristics

**Mechanical values**

**RM-97/RM-98**
Shock resistance acc. to EN 60068-2-27 2500 m/s2, 6 ms
Vibration resistance acc. to EN 60068-2-6 300m/s2, 10 … 2000 Hz

**RM-115**
Shock resistance acc. to EN 60068-2-27 5000 m/s2, 6 ms
Vibration resistance acc. to EN 60068-2-6 300m/s2, 10 … 2000 Hz

**Working temperature range**
-40…+85°C

**Supply voltage and current consumption**
Output: 4 … 20mA: 10 … 30 VDC max. 30.0 mA
0 … 10V: 15 … 30 VDC max. 30.0 mA
0 … 5V: 10 … 30 VDC max. 30.0 mA

**Load at the output / max. output current**
Output: 4 … 20mA: at 10 VDC max. 200 Ohm
at 24 VDC max. 900 Ohm
at 30 VDC max. 1200 Ohm

0 … 10V / 0 … 5V: min. 1kOhm load resistance / max. output current: 10mA

**Hardware characteristics**

| | |
|---|---|
| Singleturn technology | Magnetic 2 axes Hall sensor |
| Resolution (DA converter) | 12 bits |
| Singleturn accuracy (at 25 °C) | +/-1.00° |
| Temperature coefficient | < 100 ppm/K |
| Repeatability (at 25 °C) | +/-0.2° |
| Update rate | 1 ms |
| Power ON time | < 1 sec. |
| Settling time | < 1 ms |
| Multiturn technology | Magnetic revolution counter |
| Multiturn resolution | Maximum 65536 revolutions |
| Multiturn range (default) | 16 revolutions |
| Direction of rotation (default) | CW |
| Smallest measuring range | 22.5° |

Function display and diagnostics by means of LEDs.

**Supported standards and functions**

**RM-97/RM-98, Output '7A'**
Output: 4 … 20mA
Resolution: 12 bits
Max. measuring range: 65536 revolutions
Min. measuring range: 22.5°
Zero point display: 0 … 1°
(The measuring range is factory-set and cannot be modified by the user)

**RM-115, Output '7A'**

Output: 4 … 20mA
Resolution: 12 bits
Max. measuring range: 65536 revolutions
Min. measuring range: 22.5°
Zero point display: 0 … 1°
(The measuring range is factory-set and cannot be modified by the user)

**RM-97/RM-98, Output '8B'**

Output: 0 … 10 VDC
Resolution: 12 Bit
Max. measuring range: 65536 revolutions
Min. measuring range: 22,5°
Zero point display: 0 … 1°
(The measuring range is factory-set and cannot be modified by the user)

**RM-115, Output '8B'**

Output: 0 … 10 VDC
Resolution: 12 Bit
Max. measuring range: 65536 revolutions
Min. measuring range: 22,5°
Zero point display: 0 … 1°
(The measuring range is factory-set and cannot be modified by the user)

**RM-97/RM-98, Output 'BA'**

Output: 0 … 5 VDC
Resolution: 11 bits
Max. measuring range: 65536 revolutions
Min. measuring range: 22.5°
Zero point display: 0 … 1°
(The measuring range is factory-set and cannot be modified by the user)

**RM-115, Output 'BA'**

Output: 0 … 5 VDC
Resolution: 11 bits
Max. measuring range: 65536 revolutions
Min. measuring range: 22.5°
Zero point display: 0 … 1°
(The measuring range is factory-set and cannot be modified by the user)

**Optional functions**

- 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.)

## 2 Electrical installation

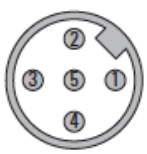
This chapter contains information about the electrical installation, commissioning of the absolute encoder RM-97/RM-98/RM-115 analog.

**Electrical installation**

| | |
|---|---|
| | **Switch off the plant!**<br>Make sure that the whole plant remains switched off during the whole electrical installation. |

Electrical installation requires connectors or connection cables

**Terminal assignment**
**Top view of mating side, male contact base**




M12 connector, 5-pole

| Interface | Connection type | Cable (isolate unused wires individually before commissioning) | | | | | |
|---|---|---|---|---|---|---|---|
| 7A (current) | C*M/CA*M | Signal: | 0 V | +V | +I | SET 1[1]) | Set 2[1]) |
| | | Cable color: | WH | BN | GN | GY | PK |

| Interface | Connection type | M12 connector, 5-pole | | | | | |
|---|---|---|---|---|---|---|---|
| 7A (current) | H1*51 | Signal: | 0 V | +V | +I | SET 1[1]) | Set 2[1]) |
| | | Pin: | 3 | 1 | 2 | 4 | 5 |

| Interface | Connection type | Cable (isolate unused wires individually before commissioning) | | | | | |
|---|---|---|---|---|---|---|---|
| 8B/BA (voltage) | C*M/CA*M | Signal: | 0 V | +V | +I | SET 1[1]) | Set 2[1]) |
| | | Cable color: | WH | BN | GN | GY | PK |

| Interface | Connection type | M12 connector, 5-pole | | | | | |
|---|---|---|---|---|---|---|---|
| 8B/BA (voltage) | H1*51 | Signal: | 0 V | +V | +I | SET 1[1]) | Set 2[1]) |
| | | Pin: | 3 | 1 | 2 | 4 | 5 |

+V: Encoder supply voltage +V DC
0 V: Encoder ground GND (0 V)
+U: Voltage
+I: Current
SET 1: Set input for teach point 1
SET 2: Set input for teach point 2

1)For scalable variants

**Make sure that the shield of the encoder is properly connected to the shield of your plant.**
If possible, mount all cables with traction relief.
Check the maximum supply voltage on the device.

## 3 Function and status LED

The device is equipped with a two-color (green / red) LED displaying status and errors.


**LED combinations during operation**

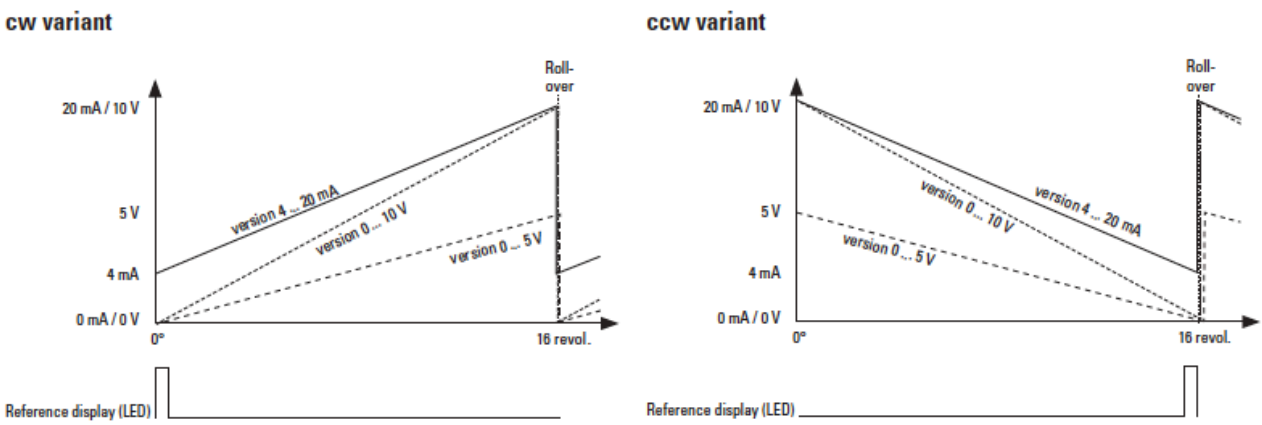
| Display | LED | Meaning | Error cause | Addition |
|---|---|---|---|---|
| No LED on | ○ | No encoder operation | Faulty supply voltage.<br>Encoder is not operational | Check the power supply and the wiring |
| Green LED flashes in 250 ms cycles | ● | Service mode | Encoder in Service mode | Please contact the service department of the manufacturer |
| Green LED constantly on | ● | Encoder in operation | | |
| Red and green LEDs flashing alternately in 250 ms cycles | ● ● | System error Error | Internal system error | Please contact the service department of the manufacturer |
| Red and green LEDs flashing alternately in 500 ms cycles | ● ● | Wire break (only for current output) | Load at the output too low.<br>Connection with the control interrupted | Check the wiring |
| Green and red LED constantly on | ● ● | Reference point display | | |

**LED combinations for scaling**

| Display | LED | Meaning | Error cause | Addition |
|---|---|---|---|---|
| Green LED flashes 1x | 1x | Activation of scaling input 1 detected and confirmed | | |
| Green LED flashes 3x | 3x | Activation of scaling input 2 detected. The new measuring range has been taken over | | |
| Red LED flashes 3x | 3x | Error during the scaling process. The new measuring range has not been taken over | Selected measuring range < 22.5° or > 65536 rev | Scale another measuring range |
| Green/red/green sequence | 1x 1x 1x | Reset of the scaled measuring range. Default measuring range is loaded. Preset is performed at the current position | | |

## 4 Standard function

As a standard, the corresponding desired output signal ( 4 … 20m A / 0 … 10 V /0 … 5 V) is linearily factory-scaled over 16 revolutions
and supplied in the CW or CCW direction of rotation according to customer requirement.
The reference point is indicated by the LED from 0 … 1°.



**Scaling function (optional)**

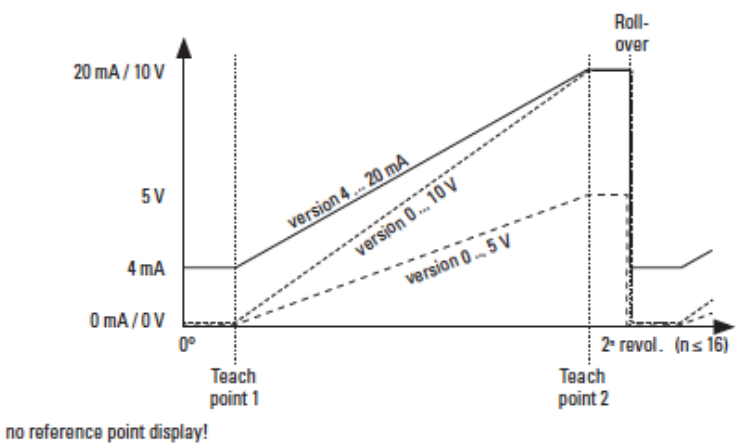
The encoder is factory-set to a measuring range of 16 revolutions over which the corresponding output signal is scaled linearily.
Two scaling inputs (set 1, set 2 - see chapter Terminal assignment) allow the user to define a desired measuring range.
The desired measuring range must be > 22.5° and shall not exceed 65536 revolutions.
The factory-set output range of 4 … 20mA / 0…10V / 0…5V is scaled linearily over the desired measuring range.
To trigger the scaling operation, the corresponding scaling input must be connected with the supply voltage + V for at least 1 second.

**Scaling process:**
1. Turn the shaft to the desired start position.
2. Connect scaling input 1 with + V for at least 1 second.
3. Green LED flashes 1x.
4. Turn the shaft to the desired end position.
5. Connect scaling input 2 with + V for at least 1 second.
6. Green LED flashes 3x. The new measuring range is active.
(The output signal assumes the highest state)

| Scaling input 1* | Scaling input 2* | 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 = GND
1 = V+ for 1 second

**Scalable variant without limit switch function**




**Roll-over through zero**
Roll-over through zero takes place at the next larger binarily divisible number of revolutions.
Example: If a measuring range is scaled over 3 revolutions, a total measuring range of 4 revolutions is set up. The scaled measuring range of 3 revolutions is centered in this measuring range, without loosing the absolute reference. This way, after reaching the maximum or minimum signal level of the scaled measuring range, the output remains in this state for 0.5 revolutions until roll-over1 through zero takes place.

**Reference point display**
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.

**Caution:**
The scaling function is limited to 10,000 cycles. Beyond this limit, the error-free scaling of the output signal cannot be guaranteed any more.

**Caution:**
Actuate the scaling inputs only once the shaft has stopped. Only this way will it be possible to take over the desired start and end position of the desired signal scaling.

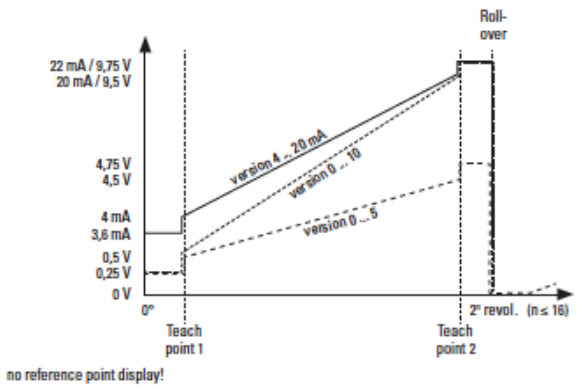
**Resetting the scaled output signal (Factory Defaults)**
1. Connect scaling inputs 1+2 with + V for at least 1 second.
2. The LED sequence green / red / green is displayed. The factory-set scaling of the output signal is available again and is set to the central value of the measuring range at the current position.

**Scaling with direction of rotation change**
Fixed output levels are assigned to the scaling inputs.
Scaling input 1 = lowest output level (current variant = 4 mA / voltage variant = 0 V)
Scaling input 2 = highest output level (current variant = 20 mA / voltage variant = 5 or 10 V)
If scaling input 2 is actuated first, followed by input 1, the new measuring range is defined with the reversed direction of rotation.

| Inputs sequence | Absolute position | Sign of the curve |
|---|---|---|
| 1 – 2 | 1 > 2 (CCW) | Positive |
| 1 – 2 | 2 > 1 (CW) | Positive |
| 2 – 1 | 1 > 2 (CW) | Negative |
| 2 – 1 | 2 > 1 (CCW) | Negative |

**Limit switch function (optional)**
Depending on the scaled measuring range, the output signal remains at the last final value of the scaled output signal until the transition through zero. 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.

**Scalable variant with limit switch function**




**Limit switch function**

| version | 0 ... 10 V | 0 ... 5 V | 4 ... 20 mA |
|---|---|---|---|
| limit switch low | 0,25 V | 0,25 V | 3,6 mA |
| limit switch high | 9,75 V | 4,75 V | 22,0 mA |

## 5 Abbreviations used

**CW** Direction of rotation: clockwise looking at the shaft.
**CCW** Direction of rotation: counterclockwise looking at the shaft.
**MT** Revolution Counter (Multi-turn).
**ST** Angle information within a revolution (Singleturn).

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