WACHENDORFF
The Encoder Experts

Technical Manual
speedMATE

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Legal information

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Comments:

Should you have any corrections, notes or requests for changes, please send them to us. Send your comments to: wdg@wachendorff.de

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1 Introduction

1.1 About this manual

This technical manual describes the configuration and installation options for the non-contact optical incremental encoder speedMATE from Wachendorff Automation. It is a supplement to the other public Wachendorff Automation documents, such as the data sheets, assembly instructions, supplements, catalogues, and flyers.

Read the manual before commissioning. Check beforehand that you have the latest version of the manual.

When reading, pay particular attention to the information, important notes and warnings marked with the corresponding symbols (see 1.1.1).

This manual is intended for persons with technical knowledge of sensors, incremental interfaces, and automation elements. If you have no experience with this topic, first seek the help of experienced persons.

Keep the information supplied with our product in a safe place so that you can obtain further information later if necessary.

- The contents of this manual are arranged in a practical manner.
- All the information in the following chapters is required for optimum use of the device and should be read carefully.

1.1.1 Symbols

	• The INFO symbol indicates a section that contains particularly important information for advanced use of the device.
	• The IMPORTANT symbol is shown next to a section of text that describes a method for solving a particular problem.
	• The WARNING symbol indicates that the adjacent instructions must be observed to ensure correct use of the device and to protect the user against hazards.

1.1.2 Not covered by this manual:

- Basic information about automation technology
- System planning
- Risks (availability, safety)
- Shielding concepts
- Reflections
- Repeaters
- Network configuration
- Bus cycle times
- FMA management services
- Transmission services
- Telegram types

1.2 Product assignment

This manual relates to the following encoder types produced by Wachendorff Automation:

Contactless optical incremental encoder:

- speedMATE

- Wachendorff's speedMATE product range can be found on our website: www.wachendorff-automation.com

1.3 Specifications

An encoder is a sensor for detecting speeds and lengths, for example. The measurement data and the variables derived from it are processed by the encoder and provided as electrical output signals for the downstream peripherals.

The encoders whose article descriptions are listed in section 1.2 have an incremental interface.

1.4 Scope of delivery

The scope of delivery depends on the product variants and the details of your order. Before commissioning, check the contents of the delivery for completeness.

As a rule, the speedMATE product range includes the following items:

- speedMATE
- Assembly instructions

- The corresponding configuration software and data sheet can be downloaded from the internet:

  www.wachendorff-automation.com

2 Safety information

2.1 General safety information

- When commissioning the encoder, ensure that you observe the assembly instructions, manual and data sheet.
- Failure to observe the safety instructions may lead to malfunctions, property damage and personal injury!
- Observe the operating instructions provided by the machine's manufacturer.

2.2 Intended use

Encoders are components that are intended for installation in machines. Before commissioning (operation in accordance with the intended use), it must be determined that the machine as a whole corresponds to the EMC and Machine Directive.

An encoder is a sensor that is designed to detect angular positions and revolutions and must only be used for this purpose! Wachendorff Automation manufactures and distributes encoders for use in non-safety-relevant industrial applications.

The speedMATE is used for the non-contact detection of moving objects. It uses a VCSEL class 1 laser with dot matrix detection.

Any other use or modifications to the product will invalidate any warranty claims against Wachendorff Automation GmbH & Co. KG

- The output of the incremental signal is a relation to the speed. The units (pulses/mm, m/min & mm) can only be used after the sensor has been calibrated (correction factor).
- The encoder must not be operated outside the specified limit parameters (see associated data sheet).

2.3 Safe working

The installation and mounting of the encoder must only be carried out by a qualified electrician.

For the construction of electrical installations, all relevant national and international regulations must be strictly observed.

Failure to commission the encoder correctly may result in malfunction or failure.

- All electrical connections must be tested before commissioning.
- Not a safety component according to the EU Machinery Directive. The use of this product is prohibited if it has a direct impact on personal safety.
- Appropriate safety measures must be taken to ensure that no persons are harmed and no damage to the system or operating equipment occurs in the event of a failure or malfunction.

2.4 Disposal

Devices that are no longer needed or are defective must be disposed by the user in proper compliance with the country-specific laws. It must be taken into consideration that this is a special waste of electronics, and that disposal is not permitted via normal household waste.

There is no obligation by the manufacturer to take the device back. If you have any questions regarding proper disposal, contact a disposal specialist in your area.

3 Device description

3.1 Equipment

3.1.1 Overview

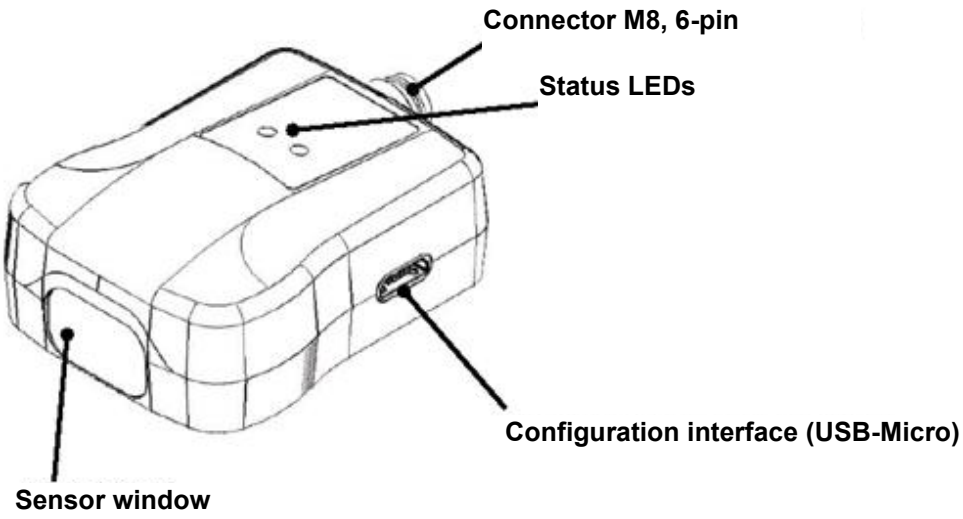


Figure 3.1: Overview speedMATE

3.1.2 Redundancy

Two sensors are installed behind the sensor window. If the difference between the two measured values is too great, this is output as an error. The permissible error tolerance is set in the speedMATE Connect software (error threshold in the advanced settings).

3.1.3 Encoder update

Specifies which sensor's values are used to calculate the encoder signal. (Default value: Sensor 1)

	• Both sensors always measure simultaneously to enable error monitoring. Switching is not normally necessary. Changing the sensor may be useful if the error indicator shows red continuously, e.g. due to: ○ Contamination or scratches on the sensor window ○ Incorrect positioning of the sensor (too close to the edge) In such cases, selecting the other sensor can help to narrow down the cause.

	• Changing measurement distances (e.g. due to convex or concave surfaces) and/or materials lead to different measurement results!

3.1.4 Scanning direction/measurement alignment

The scanning direction is set in the advanced configuration in speedMATE Connect. It is determined by the conveying direction of the product or the position of the sensor.

Figure 3.2: Setting the scanning direction

3.1.5 Trigger

If the sensor detects that the measurement object starts to move from a standstill, a trigger signal is generated.

- The output delay of this trigger signal is defined in millimetres.
- The setting is made in speedMATE Connect.
- The sensitivity ("standstill threshold") can be adjusted separately (e.g. for ambient noise, vibration with foils, etc.).

Trigger 2 can be used for triggering a second system (e.g. camera, cutter, etc.).

3.2 Connection assignment speedMATE

3.2.1 M8 – 6 pins

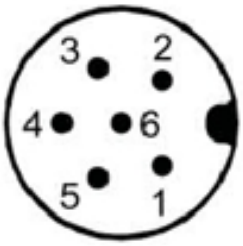
Pin-assignment	
	
UB+	1
TR1	2
GND	3
TR2/ERR/DIR	4
A	5
B	6

Table 3.1: Pin-assignment

- A faulty connection can lead to the destruction of the sensor or to functional problems with connected machines.
- Never connect wire 1 (brown) to one of the other wires!

3.2.1.1 UB+
Power supply +5...32 VDC, (40 mA at 12V)

3.2.1.2 TR1
Trigger signal 1 (e.g. printer)

3.2.1.3 GND
Ground

3.2.1.4 TR2/ERR/DIR
Function can be selected in the speedMATE Connect software.

- TR2: Trigger signal 2 (e.g. camera, cutting device)

- ERR: Error - difference between the two sensors exceeds the permissible limit

- DIR: Direction (see Table 3.2) - The current status is maintained at standstill

X	Y	DIR level
+	+	High
-	-	Low

Table 3.2: DIR level

3.2.1.5 A
Encoder track A

3.2.1.6 B
Encoder track B

3.2.2 Dimensions

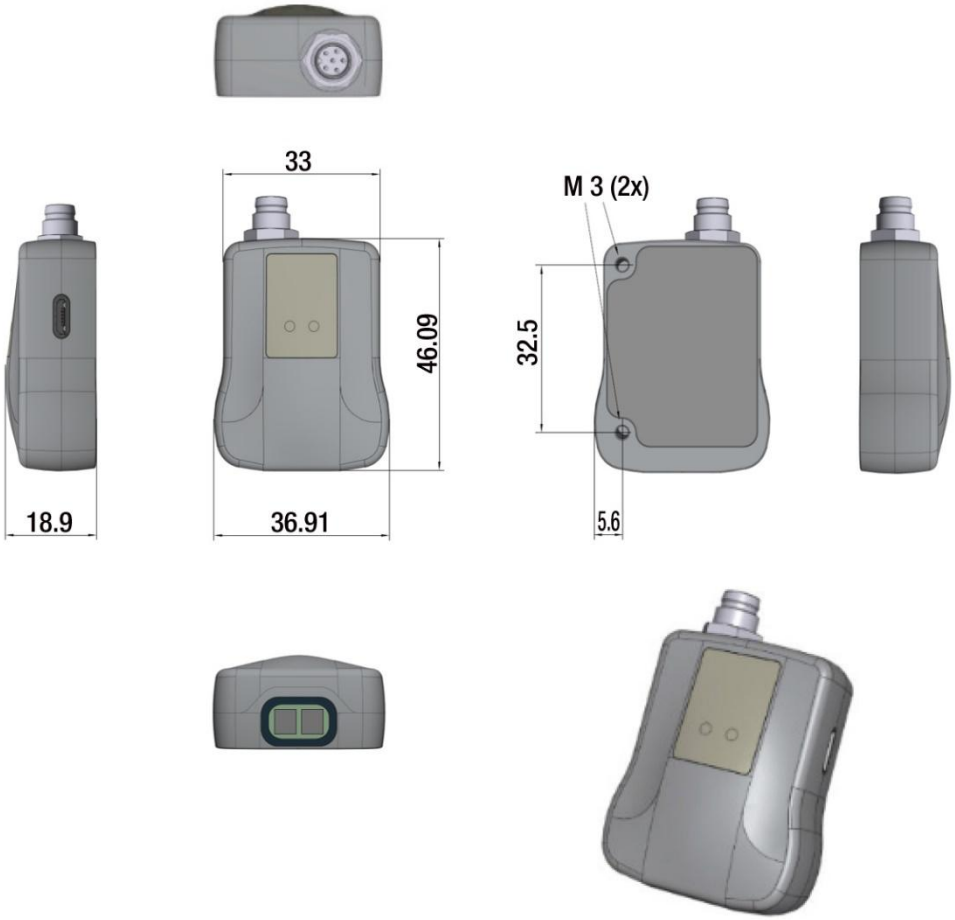


Figure 3.3: Dimensions

3.3 LEDs and signaling

Two status LEDs signal various sensor states and support diagnostics and troubleshooting in the field (see Table 3.3).

LED 1	Meaning
●	Error threshold was exceeded (difference between sensor 1 & 2)
○	Trigger is active (the LED goes off and on again once for each trigger)

LED 2	Meaning
○	Standstill
✸	Movement (frequency corresponding to the speed)
●	Image quality good
●	Poor image quality Change distance if necessary.
●	Poor image quality Change distance if necessary.

Table 3.3: LED signaling

Explanation of the symbols and asterisks:

● LED off ○/●/●/● LED on ✸/✸ LED blinking

4 speedMATE Connect

4.1 Functions

- Visualization of the data generated by the sensor.
- Configuration of the sensors
- Saving the configuration
- Mirroring the configuration

4.2 Requirements

Compatible with Windows 10 / 11

Available languages: German, English, Spanish, French, Polish

Requires a micro-USB to USB-A adapter cable to connect to the computer (Art. No. SPEEDMATEUSB)

4.3 Download

You can find the software at www.wachendorff-automation.de "Downloads“.

4.4 Installation

Execution of the file "speedmate_connect_setup_X_X_X.exe"

4.5 Configuration

Figure 4.1: speedMATE Connect – Settings 1

1. reload, refreshes the list of connected devices.
2. select the COM port to which the speedMATE is connected.
3. connect, connects the software to the speedMATE sensor
4. speed signals of the two sensors are displayed graphically
5. select the language

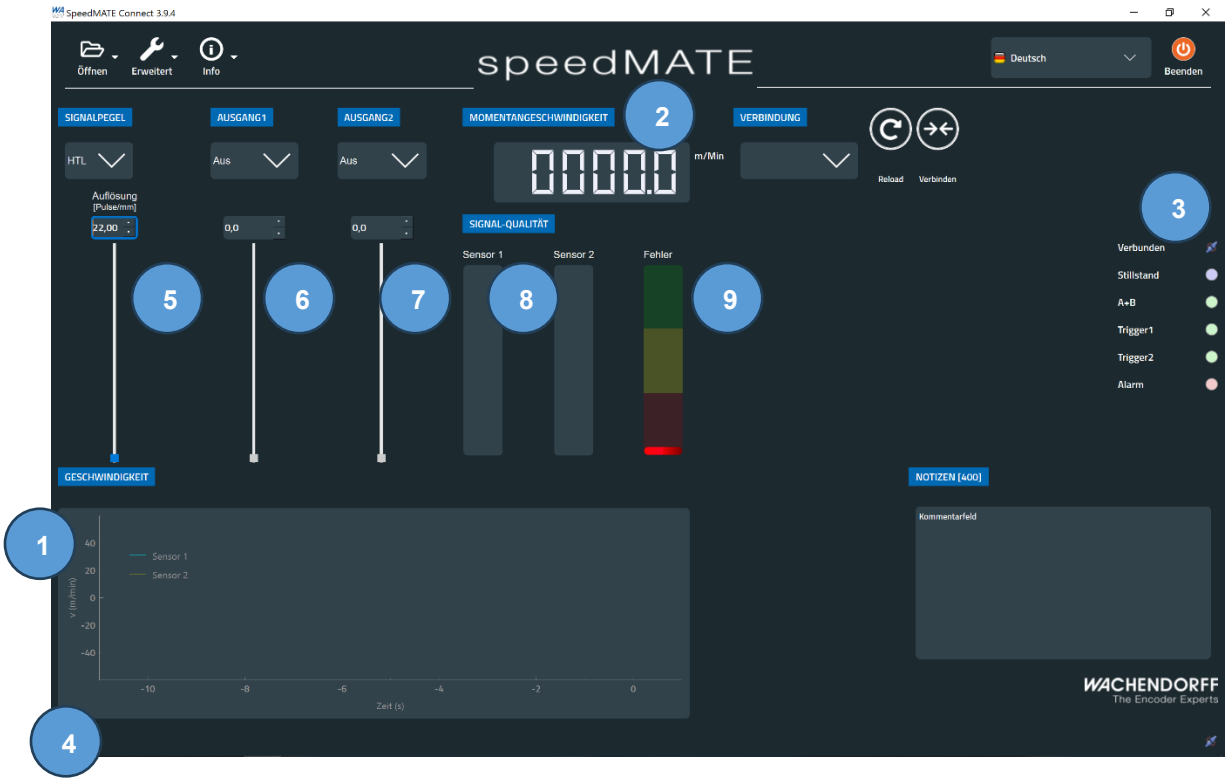


Figure 4.2: speedMATE Connect – Settings 2

1. Speed diagram of the values of both sensors
2. Current speed in m/min
3. Status bar
4. Parameters saved - Confirms changes to the configuration
5. Resolution in pulses / mm
6. Start distance trigger 1 in mm (if active)
7. Start distance trigger 2 in mm (if active)
8. Signal quality - Image quality of sensor 1 and sensor 2
9. Error threshold value

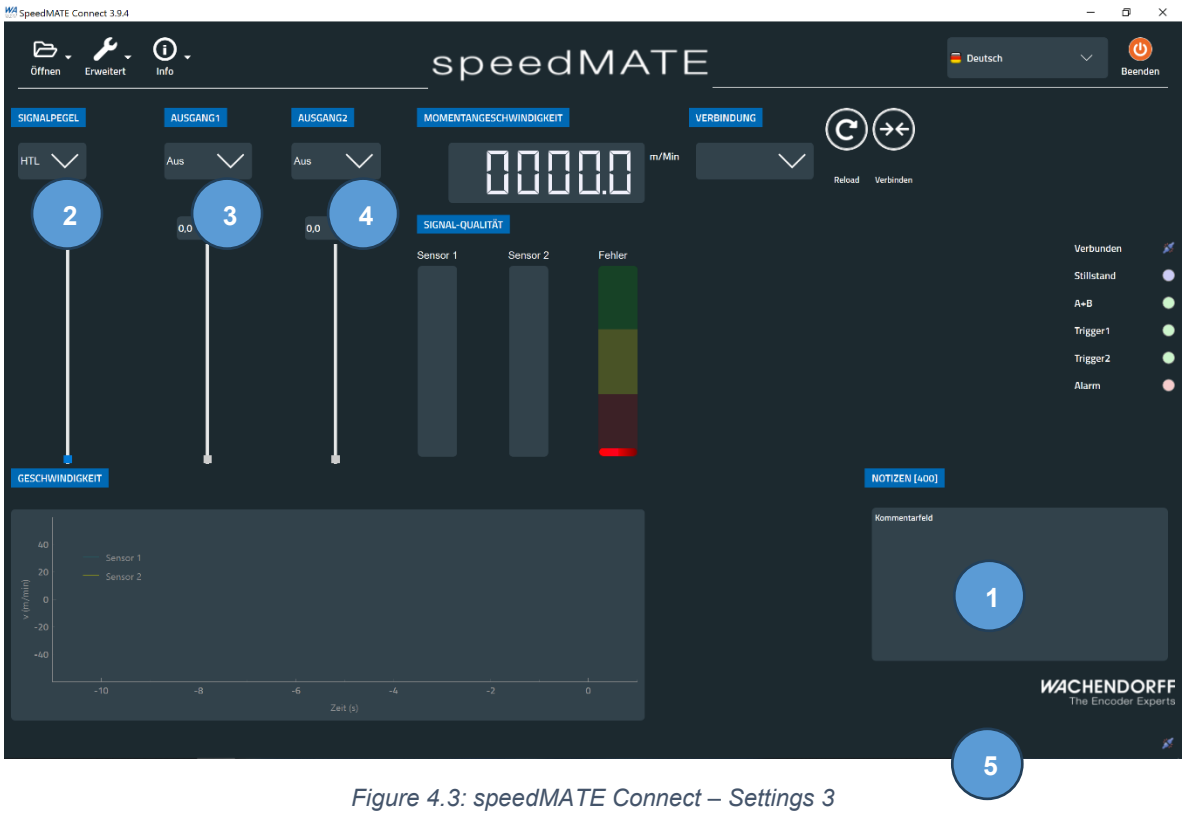


Figure 4.3: speedMATE Connect – Settings 3

1. Customer notes which are saved on the device
2. Switching level, configuration of the encoder signal (HTL /TTL)
3. Output 1, switching trigger 1 on/off
4. Output 2, switching on/off of trigger 2 or alarm or direction signal
5. Version, displays the hardware/software version.

4.6 Advanced configuration

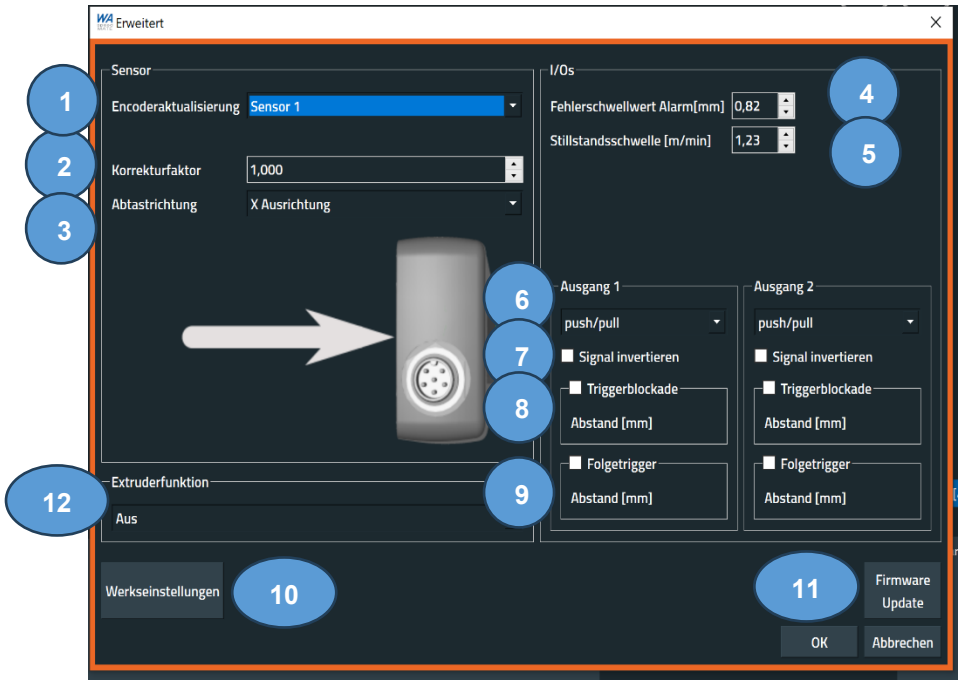


Figure 4.4: speedMATE Connect - Advanced configuration

1. Evaluation of the respective sensor. (For higher speeds or accelerations, operation with only one sensor is recommended)
2. Calibration of the sensor to the exact speed.
3. Change between scanning directions X/Y
4. Limit value for triggering the error output if the difference between sensor 1 and 2 exceeds the set error threshold value.
5. Sensor sensitivity at standstill
6. Signal type trigger (npn / pnp / pushpull)
7. Change of trigger signal (high / low)
8. Suppresses all pulses within the specified distance that would be caused by a standstill.
9. Outputs trigger pulses consecutively, even without a standstill.
10. After resetting to factory settings, the sensor must be restarted by acknowledging the message.
11. After the update, the sensor must be restarted by acknowledging the message.
12. Extruder direction (see 4.6.1)

4.6.1 Extruder function

The direction of movement for the product must be defined (see Table 4.1). If the product moves in the opposite direction to the set movement direction, the number of increments is counted internally, but no pulses are output at the signal output. Once the product moves back in the defined direction of movement, the previously stored number of increments is first counted down. During this time, no pulses are output at the signal output. Afterward, the product is exactly at the position before the reverse movement, and the regular output of increments resumes.

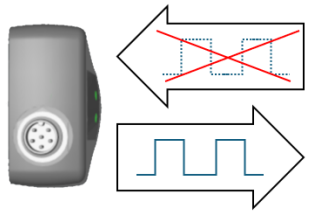
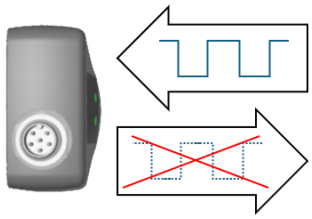
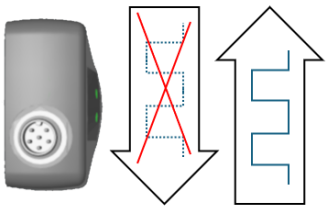
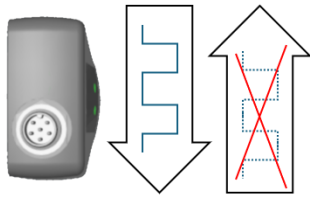
scanning direction	extruder direction	
X	1	
X	2	
Y	1	
Y	2	

Table 4.1: Extruder function

4.7 Save configuration

For the purpose of quick product changes and their adaptation, various configurations can be saved as separate files and called up again. (Symbol "Open" < > "Save as")

4.8 Correction factor

By default, the correction factor is set to 1.000 in the advanced settings.

To achieve an accurate result, this value can be adjusted using a hand tachometer or another reference source. Pay attention to your safety when doing this!

Place the hand tachometer on the moving object (e.g. shaft, conveyor belt) and compare the speed displayed there with the digital speed display in the speedMATE Connect software. Adjust the correction factor until both speeds are approximately the same.

When detecting rotating parts (shafts, axes), the following values are recommended as a guide:

Diameter of the axis/shaft	Correction factor
65 mm	0,7
100 mm	0,75
160 mm	0,8

Table 4.2: Correction factor

4.8.1 Concrete calculation of the correction factor

Measure a known length, or measure a known speed and check the output of the speedMATE. If the result deviates from the expected value, you must calculate the correction factor and enter it in the speedMATE connect software.

The calculation is as follows. Divide the current correction factor by the number of pulses actually determined and multiply the result by the value of pulses/mm set in the speedMATE Connect. The result is the new correction factor, enter this in the advanced settings.

4.8.1.1 Length:

$$\frac{Current\ correction\ factor}{Pulses\ measured} \times Impulses\ expected = New\ correction\ factor$$

4.8.1.2 Example calculation length:

You measure a distance of 1000 mm and have set 22 pulses/mm with a correction factor of 1.000. Your meter only outputs 21,750 pulses instead of the expected 22,000 pulses. Carry out the calculation and you will receive a correction factor of 1.011. Set this in the advanced settings.

Calculation:

$$\frac{1{,}000}{21750\ Pulses} \times 22000\ Pulses = 1{,}011$$

4.8.1.3 Speed:

$$\frac{Current\ correction\ factor}{Speed\ measured} \times Speed\ expected = New\ correction\ factor$$

4.8.1.4 Example calculation speed:

You measure the speed on a conveyor belt with a hand-held tachometer of 10 m/s. The speedMATE displays a value of 8.8 m/s in the software. Carry out the calculation and you will receive the new correction factor of 1.136. Set this in the software under Advanced.

Calculation:

$$\frac{1{,}000}{8{,}8\ m/s} \times 10{,}0\ m/s = 1{,}136$$

4.9 Application tips

- The speedMATE works with 5 VDC via the programming interface and/or via the machine's supply voltage in the range of 5...32 VDC.
- The optimum distance between the speedMATE and the material/object surface is 15 - 60 mm
- The distance to the product should first be adjusted or varied until LED2 lights up green. Test both when the product is moving and when it is stationary.
- Any surface in front of the sensor window is detected. Transparent materials are also detected (but not glass panes!). However, it is not possible to measure through a material (e.g. a transparent film or glass pane).
- If the sensor detects that the object being measured starts to move from a standstill, a trigger signal is generated. The output delay of this trigger signal is defined in millimetres. The setting is made in speedMATE Connect. The sensitivity ("standstill threshold") can be adjusted separately (e.g. for ambient noise, vibration of foils, etc.).
- For marking systems, we recommend setting the resolution to around 22 pulses/mm.
- Trigger 2 can be used for triggering a second system (e.g. camera, cutter, etc.).
- Changes in product direction can be detected by comparing the A and B tracks or via output 2 (direction). It should be noted that the previous status is retained when the system is at a standstill.

5 Miscellaneous

5.1 Maintenance and cleaning

The speedMATE is maintenance-free. It is recommended to check the sensor window for damage or contamination at regular intervals. If necessary, remove dust with a brush. Then clean carefully by dabbing with a lint-free cloth soaked in alcohol. Avoid scratches or streaks. Antistatic plastic cleaner and special optical cloths are recommended for cleaning.

5.2 Notes

The greater the distance in relation to the respective surface, the smaller the measurement deviations caused by this.

Vibrations must be avoided.

The sensor must be mounted perpendicular to the surface to be measured and the measuring axis must be aligned parallel to the direction of movement - otherwise there will be a systematic deviation (see illustration)

The sensor must be mounted at a distance of between 15 and 60 mm. Depending on the surface condition, the optimum value is visualized by a "green" display on LED 2.

Figure 5.1: Directions of movement

5.3 Fault diagnosis

The sensor functions when the status LEDs on the device light up (if installed and configured correctly).

For further analysis, please contact the application consultant.

6 Technical data

6.1 Optical data

Optical data	
Measuring distance	15 … 60 mm
Wavelength	850 nm
Sampling rate	1 ms
Response time	4 ms
Accuracy	+/- 0,3% *
Speed	0,5 … 135 m/min **

Table 6.1: Optical data

6.2 Electrical data

Electrical data	
Supply voltage	5 … 32 VDC
Power consumption	40 mA (bei 12 VDC)
Output circuit	HTL/TTL 10nF/150kHz
Output circuit trigger	PNP/NPN/push-pull
Output circuit error	PNP
Reverse polarity protected	Yes
Protection class	III

Table 6.2: Electrical data

6.3 Mechanical data

Mechanical data	
Housing material	Aluminum
Full grouting	Yes
Temperature range	-10 … +60 °C
Protection class	IP67, (with mounted plug)
Connections	Connector: M8, 6-pin, Micro-USB

Table 6.3: Mechanical data

6.4 Other

Other		
Software	speedMATE Connect	
Optional accessories (Art. No.)	Mounting angle Sensor cable M8 2 meters USB-cable	(SPEEDMATEWIN) (SAK66702MATE) (SPEEDMATEUSB)

Table 6.4: Other

*)
Systematic measurement deviation according to DIN 1319 1:1995. Valid in the range 1-120 m/min.

Lower deviations are achieved below 40 m/min. Regular checking of the position, distance, and alignment of the sensor is recommended for maximum accuracy.

Accuracy is always calculated based on the total measured length or the measured speed.

**)
This value is better or worse depending on the material. The highest speed is to be expected for glossy, metallic surfaces and the lowest maximum speed for white matt paper.

7 Technical advice

Technical applications advisers

Do you have any questions about this product?

Your technical applications advisers will be happy to help you.

Tel.: +49 (0) 67 22 / 99 65 414

E-mail: support-wa@wachendorff.de

Notes: