User Manual

VLM60

Version 2

ASTECH
Angewandte Sensortechnik

Remarks

The information provided in the manual have been carefully investigated and processed. Still, we cannot assume any kind of liability regarding completeness or mistakes. However, we are always grateful to get feedback and proposals.

Claims for damages are, except in the case of premeditation or negligence, in principle excluded.

As a series of versions of this product is available, deviations from the manual might occur, if applicable.

We reserve ourselves the right to implement technical modification that serves to optimize the product without related notification. Thus, it cannot be assumed that subsequent product versions show the same properties as the one on hand.

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VLM60 – User Manual V2

VLM60 as of hardware version V2 (07/2021), Firmware Version from V1.2

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Revision history

Revision	Date	Changes
2	09.05.2022	Chapter about FBFE added
1	12.01.2022	First release

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1 Device description

The VLM60 is a sensor for detecting the speed of moving objects and measuring the length. It is intended for use in industrial environments. The measuring principle is based on a correlation method. Even the slightest movements can be detected in this way. A white light LED with focusing optics illuminates the surface of the measuring object at an angle. Due to the oblique illumination, the surface structure is reflected into the receiving optics and received by the primary sensor. The sensor signals are further processed in the evaluation electronics.

The sensor enables 2D measurement, i.e. the movement of a target can be measured in both directions, x and y. The output of the velocity components is done via two independent *pulse generators* (encoder emulation) with two phases each. If required, the VLM60 can be equipped with an additional *fieldbus interface*. A *programming interface* is used to set the behavior of the device by means of parameters.

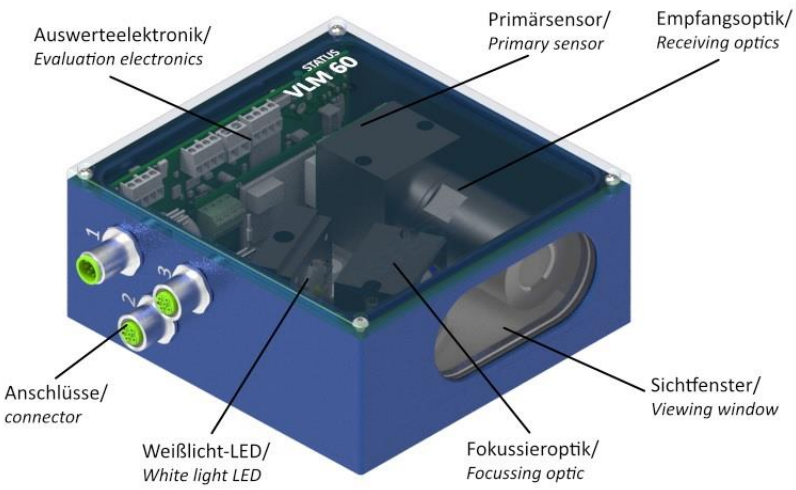


Figure 1: Structure of a VLM60

The measuring device is mounted in parallel alignment at the prescribed working distance above or below the measuring object and automatically detects its movement. The object to be measured must be placed in the optical axis. Triggered length measurements can also be made by means of an external switching signal. In addition to the length, the sensor can also output a quality signal "measuring rate R" (0...100%), which allows an evaluation of the current signal acquisition. Mounting or installation should always be carried out in such a way that the measuring rate reaches a maximum.

The VLM60 has a white light LED as the illumination source. LEDs are classified with regard to their photobiological hazard potential; not according to the criteria of laser protection. The standard to be applied for LEDs is EN/IEC 62471 "*Photobiological safety of lamps and lamp systems*". The LED illuminant used in the VLM60 is assigned to risk class RG-2 (moderate risk). This means that the illuminant does not pose a risk in use due to the normal behavior of the user (i.e., turning the head away as the natural reaction when looking into a bright light source). The following note should nevertheless be observed.

It is recommended not to look directly into the illumination source at any time, when the device is powered on.

Machine directive 2006/42/EC

In the sense of the EU directive “2006/42/EC” the VLM60 is not a machine. Hence there is no conformity declaration available for the device. The directive 2006/42/EC regularizes the requirements on machines. Here, a machine is meant to be the entity of connected parts or mechanisms (see also EN 292-1, section 3.1). The VLM60 is part of the electrical and sensor equipment of a machine. The machine manufacturer must consider the VLM60 in its process for the declaration of conformity.

2 Operating notes

2.1 Installation

Correct mounting of the VLM60 decisively improves the measurement quality. Therefore, the following instructions must be strictly observed. See also Figure 2 and Figure 3.

The device must be mounted with the viewing window parallel to the object surface. Under normal measuring conditions, the pitch and roll angles are 0°. The maximum permissible tolerance of these two angles is ±2°. Since the VLM60 can measure velocity in both the X-direction and the Y-direction, the yaw angle is arbitrary. It should be noted that the velocities are recorded with a sign. It is recommended to mount the device with a yaw angle of 0° so that the device orientation corresponds to the main forward movement of the target, i.e. from the bottom of the housing in the direction to the cover. This is the positive Y-direction and speed respectively.

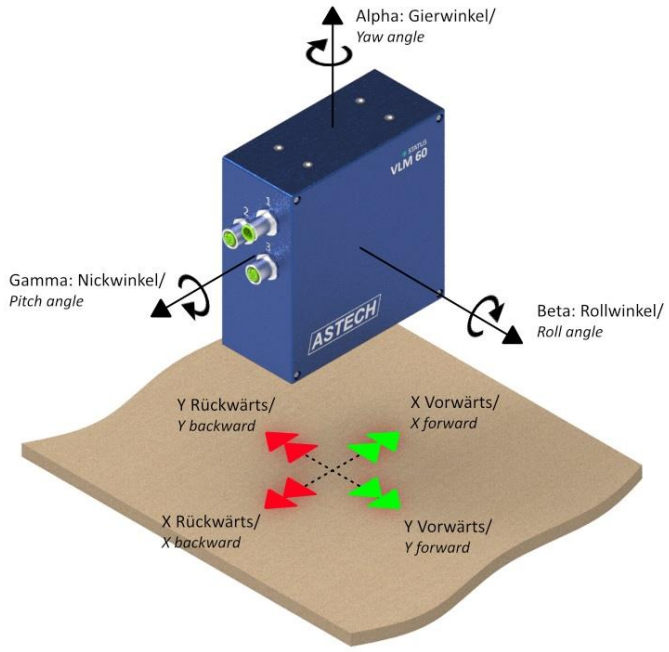


Figure 2: Mounting orientation of the VLM60

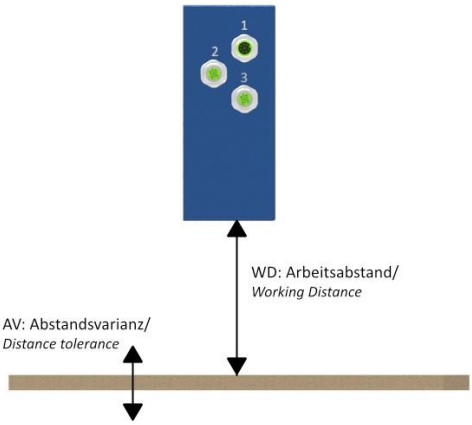


Figure 3: Working distance of the VLM60

The nominal working distance WD for the VLM60 is 100 mm. This distance is measured directly from the window side to the measuring surface. The permissible tolerance (distance variance) is ±10 mm. If the VLM60 is purchased as a set from the manufacturer, a positioning aid is included in the scope of delivery with which the working distance can be checked.

The unit is mounted either from the rear panel or the right-hand side panel. There are four M6 threaded holes on both sides. The manufacturer offers the MPL5 mounting plate (part no.: 12-1069-00), which simplifies the mounting process. The correct working distance can be adjusted with the help of long holes.

If the measuring surface is highly reflective or low-contrast, it may be necessary to tilt the VLM60 by the roll angle (beta) of a few degrees. Care must be taken to re-adjust the working distance if necessary.

Figure 4: VLM60 with mounting plate

By combining the MPL5 mounting plate with the RPL5 swivel plate (available from the manufacturer as set *RMPL5* under part number 12-1071-00), the inclination can be easily adjusted (Figure 5).

If the VLM60 is tilted, the tilt angle (roll angle beta) must be set into the device software so that the velocities continue to be measured correctly. See the "TILT" command in chapter 4.2 "Parameters".

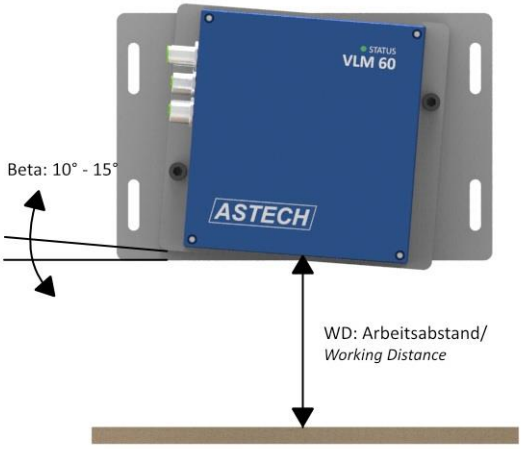


Figure 5: VLM60 with rotating plate

2.2 Connections

The VLM60 has screwable M12 device connections that are led out on the left side of the housing.

The A-coded, 8-pin flange plug (**connection 1**) is a combined supply/signal connection. The assignment (view flange connector) is shown in the following table.

Pin	Signal	Color
1	pulse output 1, Phase A	White
2	pulse output 1, Phase B	Brown
3	pulse output 2, Phase A	Green
4	pulse output 2, Phase B	Yellow
5	Trigger input	Grey
6	Switching output	Pink
7	GND	Blue
8	U_S (12…30V)	Red

Table 1: Configuration of connection 1

Figure 6: Connections

The D-coded, 4-pole flange socket (**connection 2**) is the connection for the optional fieldbus interface. The connection is led out if the VLM60 is equipped with a fieldbus interface ex works. Otherwise, a blind plug is located there. The USB programming connector (**connector 3**) is an A-coded, 5-pin flange socket. The pin assignment is shown in the following two tables. The contact arrangement (device side view) for all three connections is shown in Figure 7.

Connectors must not be plugged or unplugged under voltage. All connection work may only be carried out without voltage!

Pin	Signal	Color
1	T+	Yellow
2	R+	White
3	T-	Orange
4	R-	Blue

Table 2: Configuration of connection 2

Pin	Signal	Color
1	V_{Bus}	Brown
2	D-	White
3	GND	Blue
4	D+	Black
5	n/c	

Table 3: Configuration of connection 3

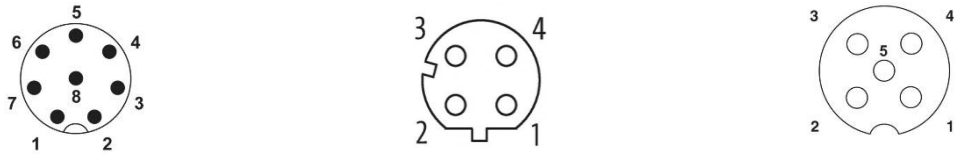


Figure 7: Pin arrangement of the connections, seen from device side

Voltage supply and grounding (Connection 1, Pin 7 and 8)

The electrical connection of the VLM60 may only be carried out by trained specialist personnel.

The VLM60 is supplied with 24 V_{DC}. The power consumption is typically 5 W. If the device is equipped with a fieldbus interface, the power consumption is typically 7 W. The permissible voltage range is 12 ... 30 V.

The shield of the 8-pin cable at connection 1 must be connected to the device ground on the device side. One fixing hole each on the rear side of the device and on the right side of the device serves as grounding point. Before the VLM60 is connected to the power supply, an electrically conductive connection must be established between at least one grounding point and the device holder. The device holder must also be grounded with low resistance!

A missing or insufficient grounding of the measuring device can lead to malfunctions or damage of the electronics in case of overvoltage!

Connection 1 is a combined supply/signal connection. According to the applied EMC test standard it follows that the DC power supply for the VLM60 must be designed locally. The device must not be connected to a DC distribution network! It is the user's responsibility to establish the cabling accordingly.

Encoder interface (Connection 1, Pin 1 to 4)

The VLM600 provides a high-resolution 5V TTL pulse output with two phases A and B with 90° phase shift for each direction of motion (X and Y). The usable frequency range is 0.2 Hz to 1 MHz. The resolution and the maximum error are 8 ns. The output resistance is 20 Ohms. The maximum output current is ± 50 mA per phase per channel. No external power supply is required. The outputs are equipped with a shutdown fuse in case of thermal overload (e.g. due to too high current). Furthermore, the outputs are ESD protected. The pulse sequences of both channels are independent of each other.

Figure 8 shows a typical pulse train for the case where velocity is detected in both the X and Y directions.

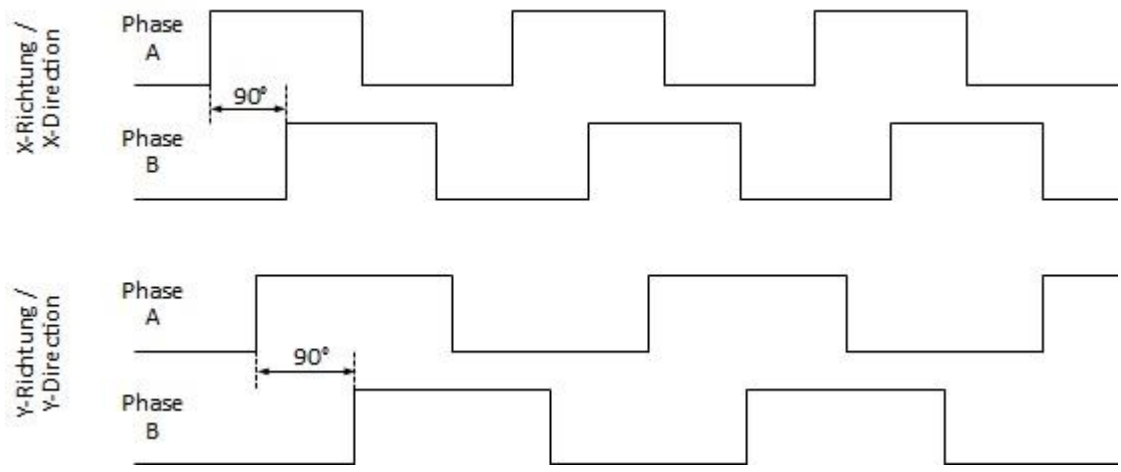


Figure 8: Pulse sequence of the encoder interface

Switching in- and output (Connection 1, Pin 5 and 6)

The **switching input** (trigger input) can be used to perform accurate internal length measurements[1]. The permissible voltage range of the externally applied switching signal is 0...7 V (LOW) or 10...30 V (HIGH). The switching input is opto-isolated and has a maximum current consumption of 3 mA.

The behavior of the **switching output** can be programmed via a parameter. By default, the output switches when a serious error is present in the device. Other functions are possible. The output is a transistor output, short-circuit proof, supplies a maximum of 100 mA and has a HIGH level of U_S-1 V. A load resistor must be connected to GND, e.g. 1.2 kOhm for a current of 20 mA at 24 V supply voltage.

Fieldbus interface (Connection 2)

The VLM60 optionally can be equipped with an additional fieldbus interface. This is done ex works. For subsequent installation, the device must be sent to the manufacturer. An additional board is installed inside the device and a device flange at connection 2. Three Ethernet-based interfaces are available for selection:

- Ethernet (UDP, TCP),
- Profinet IO,
- Ethernet/IP.

Information such as data structure or update time of the individual interfaces can be found in chapter 3.

Programming interface (Connection 3)

With the help of the USB programming interface, the VLM60 can be parameterized via a computer. Furthermore, the interface can be used for data recording or for a firmware update.

The signals '5V' (V_{Bus}), 'D-', 'D+' and 'GND' are used. The USB interface is an internal RS-232 interface. The VLM60 contains an integrated circuit (FT230X) from Future Technology Devices International (FTDI). This circuit provides a virtual serial interface (Virtual COM-Port) on the PC. The operation is the same as with a normal RS232 port. To ensure this functionality, a driver must be installed on a Windows PC. This driver can be found on the USB stick,

[1] Within the measurement accuracy specified in the technical data.

which is part of the delivery. It can also be downloaded from the ASTECH website. The standard baud rate of the VLM60 is 115200baud (8N1).

For the installation of the driver, Windows must be fully started and the VLM60 must not be connected to the PC. Now the driver installation (an executable EXE file) can be done. Afterwards the VLM60 can be connected to the PC. It is recommended to connect the cable end to the VLM60 first and then the other cable end to the PC. Windows should now recognize the new hardware and use the previously installed FTDI driver. When the installation is complete, a new COM port will appear in the Ports section of the Windows Device Manager. This COM port must be selected later when using the VLMTool for communication.

If the VLMTool is installed, the user is automatically offered to install the IUSB driver as well. For this purpose, it is recommended not to connect the VLM60 to the PC. The VLM60 may only be connected to the PC after the VLMTool and driver have been completely installed.

Programming cables can be obtained in various lengths from the manufacturer.

2.3 Signal-LED

There is a two-color LED in the lid of the VLM60. This indicates the current operating state of the device. Table 4 shows the possible states.

Color	Light condition	Event
Red	continuous or blinking	Very bad measurement condition, very bad motion detection
Orange	Continuous or blinking	Moderate measurement condition, moderate motion detection
Green	Continuous or blinking	Optimal measurement condition, optimal motion detection

Table 4: Light conditions of the signal LED

Furthermore, serious internal error faults are represented by a red pulse sequence. In this case, the manufacturer needs to contacted.

2.4 Maintenance and Cleaning

The VLM60 is maintenance-free. For proper and long-lasting operation, the viewing window should be checked at regular intervals and, if necessary, cleaned of dirt. If the viewing window is cracked or broken, it must be replaced. The replacement is carried out exclusively by the manufacturer.

A damp, lint-free cloth should be used to clean the viewing window. If the viewing window is very dusty, it is recommended to remove the dust particles with compressed air or a brush beforehand to avoid scratches on the glass. Do not use any aggressive agents for cleaning.

3 Fieldbus interface (Option)

The VLM60 can be equipped with an optional fieldbus interface. The following are available:

- Ethernet (UDP, TCP),
- Profinet IO,
- Ethernet/IP.

The use of a fieldbus interface enables communication between evaluation units (e.g. PLC) and the measuring device over long distances using standardized network components. In addition to the transmission of the measured speed, the recorded lengths can also be transferred. Furthermore, it is possible to trigger measurements in the VLM60 with the help of a control byte. Furthermore, VLM60 parameters can be set via the bus.[2]

3.1 FBFE – Fast Ethernet interface

The interface card FBFE connects the VLM60 series with Ethernet networks (10BaseT/100BaseTX). This enables a communication between evaluation units and the measuring device over long distances by using standardized network components. The interface supports Auto-MDI/MDI-X, Auto-Negotiation (Full-duplex and Half-duplex).

By using the network protocol Telnet, the Ethernet interface can be used like the programming interface of the device. The known command syntax is used for setting the parameters. The current measuring values can be output permanently and trigger-synchronous. With the UDP-channel it is possible to transmit VLM measurement data to a selectable network address. This is also possible with the available TCP-channel, which can be reached from the whole network. This transmission is useful to log measurement data of the VLM over long time.

For setup and monitoring, existing VLM60 devices with an Ethernet interface can be searched for in the network via a defined UDP broadcast. By default, the IP-Address of the device is: 192.168.000.051 and the subnet mask is: 255.255.255.000. If this IP-address is not available in the network, the IP can be changed by two different ways. The first way is to set up a P2P-network with a notebook-computer or something similar. The second way is to put the Ethernet interface of the VLM60 into the configuration mode, to use a Telnet client afterwards. Putting the FBFE into the configuration mode is done with VLM command “update f” or by calling the update menu item from the VLMTool.

Communication parameter

Internal

- VLM60 parameterization:
  - *SO2Interface 115200 N D*
  - *SO2FORMAT z:e* (For the use of the UDP and/or TCP channel)
  - *SO2TIME 100* (Refresh time of data output)
  - *SO2ON* 1: (For permanent data output of the UDP- and/or TCP-channel)

External

- UDP
  - One UDP channel for output of actual measurement data
  - Free selectable configuration of the destination IP-address and port number
  - One separate UDP channel to search for devices in the network via broadcast telegram

[2] Only available with Profinet.

- Reading out device type, serial number, IP address and connection status
- List port with VLM60 = 33003
- Identification for ASTECH devices = 0x05
- Response data: Type, Version, Serial number, IP address, MAC address, Connection status

- TELNET
  - Connection oriented 8Bit-ASCII communication via TCP/IP
  - Connection establishment caused by the Client
  - List port = 23
  - Command syntax as on serial interface
  - Use of conventional Telnet-Client program possible (e.g. ASTECH *Ethertool*, Hyperterm)
  - Only one connection per time
  - By default, with password protection against unauthorized use
  - Standard password is “wega” (can be changed in the Telnet menu)
  - Configuration mode for FBFE parameter
- TCP
  - one TCP/IP channel for output of actual measurement data
  - device acts as a server and can be accessed anywhere from the network
  - Standard port of VLM60 = 33005
  - Same IP-address (VLM60)
  - Change of port and IP address via Telnet possible

By default, the interface for the output of the actual measurement data is activated. As soon as you log in via Telnet, you will see the raw data sent from the VLM. It´s strongly recommended to deactivate the interface via the command *SO2ON 0* before you change any VLM parameter or use of the configuration mode. By doing so, the communication of the UDP channel will be interrupted as long as the data output is activated with the command *SO2ON 1* again.

Configuration

The configuration of the FBFE is done in a separate configuration mode via Telnet. Interface specific parameters as the IP address to be used or the subnet mask can be used via simple commands here. Furthermore, it is possible to protect the adjusted parameters against unauthorized access by using a password. The configuration mode can be called via the normal Telnet connection by entering *#*. The setting of the two UDP channels can be adjusted via Telnet or can be adjusted with the use of a configuration file via FTP. It´s recommend adjusting the settings via Telnet. The destination IP-address, the port number and the selection of the channel activation can be made.

The input of the data for the UDP channels must correspond to the following format:
IP-address: xxx.xxx.xxx.xxx
Portnumber: xxxxx

The FTP-channel of the interfacce will be only activated by the use of the update mode (see the command update). The configuration file is located in the flash storage and neither the name of the file nor the data format is allowed to be changed.

Data output UDP/TCP

If all parameters are set correctly, the data stream shown in Table 5 is sent via the UDP and TCP interface. All values are absolute values! The sign of the speed and length is encoded in the *device status*.

Value (MSB to LSB)	Size	Comment
Counter	2 Byte	Life counter, independent of data output
Resulting velocity	4 Byte	Scaling: 0,00001 m/s
Measuring rate	2 Byte	Scaling: 0,1%
Resulting length [1)]	4 Byte	Scaling: 0,0001 m
Velocity x-component	4 Byte	Scaling: 0,00001 m/s
Length x-component [1)]	4 Byte	Scaling: 0,0001 m
Velocity y-component	4 Byte	Scaling: 0,00001 m/s
Length y-component [1)]	4 Byte	Scaling: 0,0001 m
VLM- error code	1 Byte	
Device status	1 Byte	structure see below
Device temperature	1 Byte	

Table 5: UDP/TCP- data stream of the Ethernet interface

[1)] Because of the data size of 32 bit, a maximum length value of 429.496,7295 m can be transmitted. If this value is exceeded, it jumps back to zero. However, the internal length measurement continues.

Device status

The device status (status byte) is transferred as one byte. The byte has the following content:

Bit	Status	Meaning
0	Error	1 – Error present 0 – No error
1	Measurement	1 – Measurement active 0 – No measurement
2	Sign of velocity x	1 – Sign present (Velocity < 0) 0 – No sign
3	Sign of length x	1 – Sign present (Length < 0) 0 – No sign
4	Sign of velocity y	1 – Sign present (Velocity < 0) 0 – No sign
5	Sign of length y	1 – Sign present (Length < 0) 0 – No sign
6	Trigger input	1 – Trigger active 0 – No trigger
7	Sign of device temperature	1 – Sign present (Temperature < 0) 0 – No sign

Control byte (only possible with TCP)

The VLM500 can be controlled by setting the control byte. All functions are enabled with the respective bit switching its status from 0 to 1. Multiple functions can be initiated at the same time. The control byte has the following content:

Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
reserved	Reserved	Reserved	Restart VLM [1)]	Clear Error	Reset Length	Stop Length	Start Length

[1)] After setting bit 4 (restart VLM) only the VLM60 will be restarted. The connection between Ethernet interface and the network client will be kept alive.

To prevent from unintentionally or unauthorized access to the VLM60 via the control byte the following data sequence must be considered.

Byte 1	Byte 2	Byte 3
character „*“ 0X2A	Control byte	character „EOF“ 0x04

3.2 FBPN – Profinet interface

The Profinet interface is available soon.

3.3 FBEI – Ethernet/IP interface

The Ethernet/IP interface is available soon.

4 Parameterization

4.1 Command input and VLMTool

The parameterization or command input can be done with any terminal program (e.g. HTerm). For parameterization of the VLM60, connection 3 is connected to a USB interface of a Windows PC via a programming cable..

In the command line, enter as many characters as necessary until the syntax is unambiguous. In the following command documentation, the characters that must be entered at least for one command are printed in bold. Parameters are separated from the command by spaces. The decimal point is used to separate places before and after the decimal point. When entering commands without parameters, the current value of this parameter is displayed. In order to save parameter changes permanently, the *store* command must be used.

The VLMTool is installed under Windows 10/11. The installation data is located on the USB stick included in the scope of delivery or can be downloaded from the Internet at https://www.astech.de/en/download.html. The program starts with 9600 baud. The standard baud rate of the VLM60 is 115200 baud. When the software is started for the first time, the COM port and the baud rate must be set in the VLMTool. If these settings have been made correctly, the serial number and the firmware version are displayed at the top of the program window.

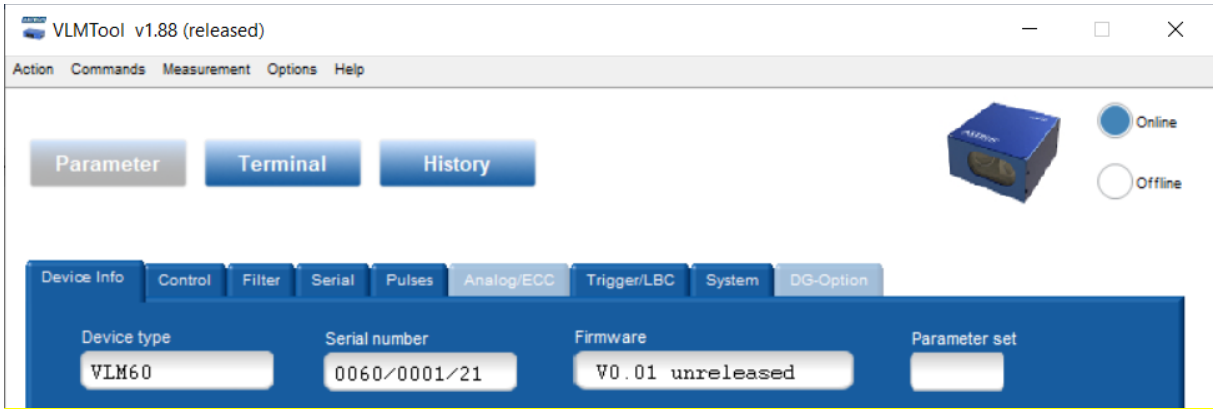


Figure 9: VLMTool

4.2 Parameter

The following overview contains all parameters available in the VLM60. The first line describes the parameter in each case. The second line shows the syntax, the permitted value range and the default setting (ex works). In the third line, if necessary, remarks to the respective parameter are noted.

The following characters will be used:

n	integer	s	string
f	floating point number	[ ]	optional
c	character		

The following abbreviation will be used for measured variable:

V	velocity	R	measuring rate
L	length		

Average

Serves to set the averaging time for the velocity calculation. The internal calculation of the length is independent of the set averaging time! In the time defined by *Average*, all accruing signals are condensed to an average value.

average [n]	n = 1.0 ... 10000 (unit: ms)	default: 30

The value should be selected as large as the process dynamics allow. Usual values are 5 to 50 ms. A value that is too large leads to a delayed reaction to velocity changes. If *Average* is too small, the measured velocity value fluctuates more strongly. As a result, vibrations from the measuring object or the measuring device, for example, are visible in the signal curve.

Baudrate

Serves to set the transmission speed (baud rate) between the VLM60 and the connected PC.

baudrate [n]	n: 9600; 19200; 38400; 57600; 115200	default: 115200

The parameterized baud rate must match the setting of the terminal program (or the VLMTool) so that parameterization of the VLM is possible.

Calfactor

Serves to set the calibration factor and the correction factor respectively.

calfactor [f]	f = ±0.750000 ... ±1.250000	default: 1.000000

If the calibration factor is entered with a negative sign, the sign is reversed when the velocity and length are output. The use of the *Calfactor* for scaling of an output channel is not allowed, for this the PO1Factor and PO2Factor commands are used.

Holdtime

Serves to set a time period in which the last detected velocity value continues to be output on the pulse output. After that, zero is output.

holdtime [n]	n = 10 ... 65535 (unit: ms)	default: 250

If signal failures occur during a measuring process, this parameter can be used to prevent the pulse output from being continuously switched on and off. The value for Holdtime should normally be greater than or equal to Average.

Illumination

Serves to control the intensity of the white light LED. A fixed value or automatic mode can be set.

illumination [n]	n = 0 ... 30 – fest, a – automatic	default: a (automatic)

The parameter should be left at the Automatic setting. If the parameter is set incorrectly, measurement failures due to over- or under-control are possible.

PO1Factor

Used to set a scaling factor for the first pulse output (see chapter 2.2). With a value of 1, a frequency of 100 Hz is output at a speed of 0.1 m/s.

po1factor [f]	f = -2500.0 ... 2500.0, <> 0	default: 1.000000

The factor corresponds to the specification pulses per millimeter of object movement.

PO1Hold

Serves to set the hold behavior (freezing) of the first pulse output. A time dependency can be set (in 100 ms steps) or a dependency on the switching input (TRIGGER). With time dependence, the set time is added to *Holdtime*. With the dependence on the switching input, the last velocity value is held regardless of a running measurement or a signal failure as long as the switching signal is set.

po1hold [n]	n = 0, 3, 4, 10 ... 255	default: 0

0 off (no freezing of the pulse output)
3 HIGH-Level at switching input (TRIGGER)
4 LOW-Level at switching input (TRIGGER)
10 1 s + holdtime

…

255 25,5 s + holdtime

PO1On

Serves to set on or off the first pulse output.

po1on [n]	n = 0 (off), 1 (on)	default: 1

This parameter does not influence the measuring activity, but only the activity of the first pulse output.

PO1Sync

Serves to set output frequency of the first pulse output.

po1sync [n]	n = 0, 1	default: 0

0 average-synchronous. The update is synchronous with the duration of the speed averaging (Parameter *Average*).

1 trigger-synchronous. The update is synchronous with the clock at the switching input (TRIGGER).

PO1Value

Serves to set the output value of the first pulse output.

po1value [c]	c = v, v:x, v:y, a, r	default: v

v resulting velocity, vector from x- and y-direction

v:x velocity of x-component

v:y velocity of y-component

a angle between the two velocity components, value range: -180 … +180 · PO1Factor

r Measurement Rate (Quality of velocity measurement)

PO2Factor

Used to set a scaling factor for the second pulse output (see chapter 2.2). With a value of 1, a frequency of 100 Hz is output at a speed of 0.1 m/s.

po2factor [f]	f = -2500.0 ... 2500.0, <> 0	default: 1.000000

The factor corresponds to the specification pulses per millimeter of object movement.

PO2Hold

Serves to set the hold behavior (freezing) of the second pulse output. A time dependency can be set (in 100 ms steps) or a dependency on the switching input (TRIGGER). With time dependence, the set time is added to *Holdtime*. With the dependence on the switching input, the last velocity value is held regardless of a running measurement or a signal failure as long as the switching signal is set.

po2hold [n]	n = 0, 3, 4, 10 ... 255	default: 0

0 off (no freezing of the pulse output)

3 HIGH-Level at switching input (TRIGGER)

4 LOW-Level at switching input (TRIGGER)

10 1 s + holdtime

…

255 25,5 s + holdtime

PO2On

Serves to set on or off the second pulse output.

po2on [n]	n = 0 (off), 1 (on)	default: 1

This parameter does not influence the measuring activity, but only the activity of the second pulse output.

PO2Sync

Serves to set output frequency of the second pulse output.

po2sync [n]	n = 0, 1	default: 0

0 average-synchronous. The update is synchronous with the duration of the speed averaging (Parameter *Average*).

1 trigger-synchronous. The update is synchronous with the clock at the switching input (TRIGGER).

PO2Value

Serves to set the output value of the second pulse output.

po2value [c]	c = v, v:x, v:y, a, r	default: v

v resulting velocity, vector from x- and y-direction

v:x velocity of x-component

v:y velocity of y-component

a angle between the two velocity components, value range: -180 … +180 · PO2Factor

r Measurement Rate (Quality of velocity measurement)

Resolution

Serves to set the resolution of the primary sensor.

resolution [n]	n = 100, 200, 300, …, 8200	default: 5000

This parameter influences the behavior of the primary sensor. Changes should only be made in consultation with the manufacturer.

Scantime

Controls the internal temporal resolution of the primary sensor.

scantime [n]	n = 0 … 65535 (unit: ms)	default: 0

This parameter influences the behavior of the primary sensor. Changes should only be made in consultation with the manufacturer.

Silent

Serves to set the behavior of the VLM60 command line (terminal). It can be set whether the entered command is sent back to the terminal (echo) or not.

silent [n]	n = 0, 1	default: 0

0 echo on

1 echo off

When using the VLMTool to parameterize the VLM60, this parameter should be set to 0.

SO1FORMAT

The S1 programming interface can be used not only for parameterization but also for data output. The transmission format can be specified within wide limits with this parameter. The output takes place as ASCII characters. The individual switches can be separated by space, comma or point. However, the separators between the parameters can also be omitted.

so1format [s]	(s – string of switches, max. 42 characters)	default: v*60:6:2'm/min'

Switch	**Meaning**
'...'	string enclosed in quotation marks
0...9	Numbers (0 to 255) that are not enclosed in quotation marks are interpreted as ASCII Code and output as the corresponding ASCII character
h	device temperature °C
i	lamp intensity (0 to 30)
l	current resulting length (in m) from x- and y- movement
l:x	current length (in m) from movement in x direction
l:y	current length (in m) from movement in y direction
n	status of the object counter (0 to 65535)
r	measuring rate (0 to 100)
s	fixed: resulting velocity in m/s * 100000 <SPACE> measurement rate * 10 (Hex-coded)
t	disables the standard identifier CR LF of the output string
v	current resulting velocity (in m/s) from x- and y-direction
v:x	current velocity (in m/s) from x-direction
v:y	current velocity (in m/s) from y-direction
x	last error number
z	like "s" with the addition: <SPACE> last error number

Supplementary information on the SO1FORMAT parameter

Each of the above switches can be additionally combined. ('a' stands for any switch)

a+x Adds the value a (V, L, F, ...) with the offset x
a*x Multiplies the value a (V, L, F, ...) with x
a:H[:n] Returns the value a (V, L, F, ...) as hexadecimal number with n characters
a:n[:m] Returns the value a (V, L, F, ...) as formatted number with n places and m decimal places

All format specifications can be combined with each other as desired and can only be applied to numerical parameters (excluding s and z). The principle of dot calculation takes precedence over dash calculation.

If no format is specified, the output is left-justified and leading zeros are suppressed (except for hexadecimal output). With format specifications, the output is padded with blanks. If the value of a format specification exceeds the possible number of digits, the output is expanded to the necessary number of digits. The decimal point and any sign (only for negative numbers) also occupy one place.

If numbers are used in the format string which are not enclosed in quotation marks, these are interpreted as ASCII code and output as a corresponding ASCII character. Each ASCII code must be separated by a space, comma or period.

The default end identifier of the output string is CR LF (13 10 or 0x0D 0x0A). With the switch T this can be switched off and it is possible to define the end identifier at the end of the format string itself. The position of the switch T in the string for switching off the end identifier is not relevant. However, a self-defined end identifier must always be at the end of the format string!

Examples

so1format v ' m/s'	velocity and String “m/s”, CR LF	*2.52 m/s*
so1format v:x,' ',r	x-velocity, SPACE, measurement rate, CR LF	*1.27 94*
so1format v 20 r	velocity, SPACE, measurement rate, CR LF	*2.52 94*
*so1format v*60,' m/min;',l,' m'*	velocity, m/min, length, m, CR LF	151.2 m/min;6.7 m
*so1format l*10+12.345*	length in dm + offset (input in dm)	79.456
so1format s t l:h 10	special format *s*, length hexadecimal and LF	00013b 05e 0000029f
so11format 72 97 108 108 111	for string in ASCII-input	Hallo
so1format v 13 10	velocity and additional CR LF	2.52

SO1Interface

Serves for the configuration of the programming interface S1. The baud rate, protocol type, parity and flow control are set. The setting can be made for each switch individually or for all switches simultaneously. The order of the switches does not matter. Switches that are not specified will not be changed. The format is fixed with eight data bits and one stop bit. When parity is enabled, the eighth data bit is replaced by the parity bit.

***so1i**nterface* [n] [c] [c] [c]	(n = baud rate, c = protocol, parity, ...)	default: 115200 N D

Switch	**Meaning**
9600	baud rate 9600 (or 19200; 38400; 57600; 115200)
'-'	no protocol
'N'	no parity
'O'	odd parity
'E'	even parity
'D'	full duplex

SO1On

Serves to switch on and off the data output on the programming interface S1.

so1on [n]	n = 0 (off), 1 (on)	default: 0

During command input and processing the output of the data is interrupted!

SO1Sync

Serves for setting the output update on the programming interface S1. It can be set whether the output should be synchronous to a selectable time interval (command *SO1Time*) or at an event at the switching input (TRIGGER).

***so1sy**nc* [n]	n = 0, 1	default: 0

0 Time-synchronous. The update is synchronous to the time interval SO1Time.

1 Trigger synchronous. Updating is synchronous to the clocking at the switching input (TRIGGER).

SO1Time

Used to set the time interval for regular output to the programming interface S1.

so1time [n]	n = 1 ... 65535 (unit: ms)	default: 100

If the time interval is set smaller than the *Average* parameter, it must be noted that there is no updated speed value because the time of *Average* has not yet expired.

SO2FORMAT

For the correct function of the fieldbus interface, the internal communication interface S2 must be parameterized accordingly. There are predefined switch combinations for this, which are shown in chapter 3.

Nevertheless, the internal communication interface S2 can be parameterized in the same way as the programming interface S1. Information on this can be found in the *SO1Format* parameter.

so2format [s]	(s – string of ‚switches', max. 42 characters)	default: v:x:h:6 v:y:h:6 r:h:3 x:h:2

See parameter *SO1Format*.

SO2Interface

For correct function of the fieldbus interface, the internal communication interface S2 must be parameterized accordingly. Only the baud rate 57600 is permissible.

Nevertheless, the internal communication interface S2 can be parameterized in the same way as the programming interface S1. Information on this can be found in the SO1Interface parameter.

***so2i**nterface* [n] [c] [c] [c]	(n = baud rate, c = protocol, parity, ...)	default: 57600 N D

See parameter *SO1Interface*.

SO2On

Serves to switch on and off the data output on the internal communication interface S2.

so2on [n]	n = 0 (off), 1 (on)	default: 0

For correct operation of the fieldbus interface, this parameter must be set to 1.

SO2Sync

Serves to set the output update on the internal communication interface S2. It can be set whether the output is to be synchronized to a selectable time interval (SO2Time command) or when an event occurs at the switching input (TRIGGER).

***so2sy**nc* [n]	n = 0, 1	default: 0

0 Time-synchronous. The update is synchronous to the time interval SO2Time.

1 Trigger synchronous. Updating is synchronous to the clocking at the switching input (TRIGGER).

Both options are permitted for the use of the fieldbus interface. The respective application decides on the setting.

SO2Time

Used to set the time interval for regular output to the internal communication interface S2.

so2time [n]	n = 1 ... 65535 (unit: ms)	default: 30

If the time interval is set smaller than the *Average* parameter, it must be noted that there is no updated speed value because the time of *Average* has not yet expired.

Tilt

Serves to set angle specifications corresponding to the inclination/rotation of the mounting position of the VLM60. For better reflection of the surface contrasts, a correction of the mounting position may be necessary. This angle correction only applies to flat measuring surfaces!

tilt [f1] [f2]	f1 = 1.000 ... 45.000 f2= 1.000 … 45.000 (unit: degree)	default: 0.000 0.000

f1 corresponds to the angle of inclination in the x-direction, i.e. the roll angle beta. *f2* corresponds to the angle of inclination in the y-direction, i.e. the pitch angle gamma. For the angle designation, compare Figure 2.

Trigger

Used to configure the switching input (TRIGGER) for internal length measurement.

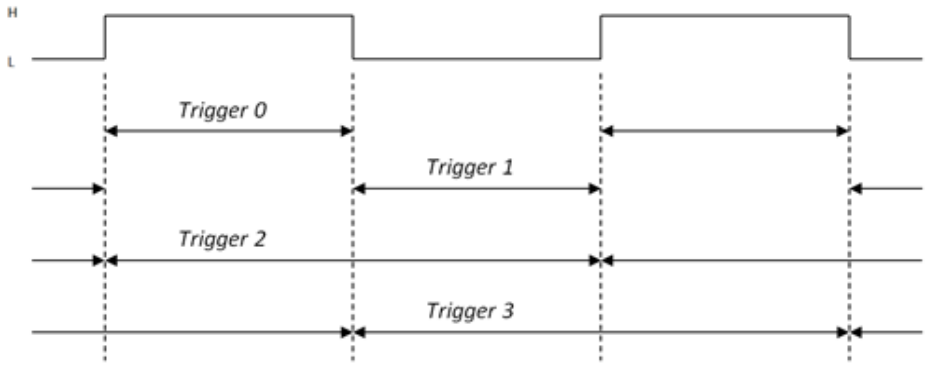
trigger [n]	n = 0 …3	default: 0

n	**Event**	**Usage**
0	H-Level	single part measurement
1	L-Level	single part measurement
2	L/H-Transition	continuous measurement
3	H/L-Transition	continuous measurement

Single part measurement: If the signal goes to the active level, the length measurement is started and stopped at the next level change.

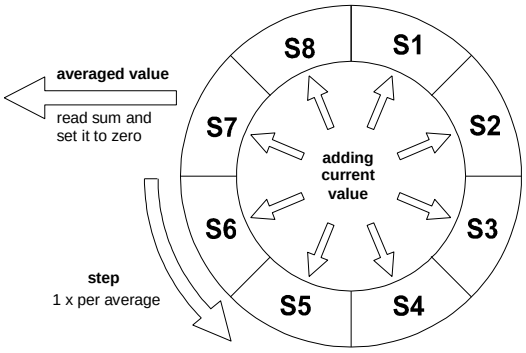
Continuous measurement: A continuous measurement is performed. A trigger edge stops the measurement and simultaneously triggers the next measurement.

Simultaneously with a stop of the length measurement, the affected output channel is updated in case of trigger-synchronous output (see PO1Sync, PO2Sync, SO1Sync and SO2Sync commands).



Window

Serves to set the size of the ring buffer for the moving average of the velocity. This parameter is intended for highly dynamic speed measurements in the production process and for control tasks. One ring buffer element corresponds to the time length of the parameter *Average*. This means that velocity changes of the measuring object are completely processed after a time of *Window* · *Average* at the output.



window [n]	n = 1 … 32	default: 8

If the process dynamics are high, the *Window* parameter should be set small. For the majority of applications, the default setting can be used.

4.3 Additional commands

Via the command line not only parameters can be changed (see previous section) but also other commands can be entered. The following overview shows all available commands.

Clear

Resets the measured length value(s) back to zero.

clear		

During an ongoing length measurement, this command can be used to set the length value reached up to that point to zero.

Constant

Outputs the device constant programmed at the factory.

constant		

This constant contains various calculation factors for the speed that result from different lenses and imaging scales. The default setting is made at the factory and cannot be changed.

Error

The command displays the last error code that occurred.

Error		

The output 'E00 No error' means that no errors have occurred. The complete error list can be found in chapter 6.

Help

Lists all available commands of the VLM60 or outputs information about a specific command.

help [s]	s = <an available command>	alternative: **?**

Example: *help average*

Info

Outputs information about the device type, the serial number and the software version.

info		

When the device is started, this information is output automatically.

Number

The VLM60 has an internal object counter. The count is always incremented when a length measurement is completed. If the device is restarted, the counter falls back to zero. With this command, the counter status can be queried as well as set.

number [n]	n = 0 … 65535	

A length measurement can be terminated either by calling the command *Stop* or by an event at the switching input (according to the setting of the parameter *Trigger*).

Parameter

Outputs all parameters with the current setting.

parameter		

-

Password

Serves for setting the password for permanent saving of the set parameters. After the input, the old password must be entered first. Only then can a new password be assigned. The input must be confirmed.

password		default: wega

The password consists of up to eight characters, including upper- and lower-case letters, digits, special characters and spaces, which are represented by asterisks when entered.

PO1

Outputs the parameters and their current setting belonging to the first pulse output.

po1		

-

PO2

Outputs the parameters and their current setting belonging to the second pulse output.

po2		

-

Post

Outputs the result of the power-on-self-test).

post		

Example:

```
Mainboard hardware revision..................V2
External EEPROM..............................OK
Parameters...................................OK
Digital Potentiometer for power LED driver...OK
Temperature sensor on sensor board...........OK
Temperature sensor on main board.............OK
Power LED....................................OK
FPGA Flash for configuration.................OK
FPGA configuration...........................OK
```

If the result of an internal test is negative, the corresponding line is described with "ERROR" and an error code. If such a case occurs, the manufacturer must be contacted.

REM

The command is used to insert comment lines in parameter files, which can be sent to the VLM60 for easy parameterization. All characters after REM in the same line are ignored.

rem [s]	s = < any string of characters >	

The characters ';' (semicolon), 'S/N' and '->'' have the same effect as REM. This makes it possible to send a complete parameter file back to the device without getting error message.

Restart

This command triggers a restart of the device. The parameters are reset to the values last saved with the Store command.

restart		

-

Restore

This command loads the parameter settings as they are stored in the non-volatile memory or as they were previously stored with the *Store* command. A device restart has the same effect with regard to loading the parameters.

restart [c]	c = f	

The factory settings can be loaded with the switch 'f'.

Sid

Serves to display the serial channel (S1 or S2) via which the communication between the VLM60 and the connected PC is currently taking place.

sid	C	

-

Simulation

The command is used to simulate velocity and measuring rate at the pulse outputs of the measuring device. The actual measurement is interrupted! The device behaves externally as it was set via the parameters of the pulse outputs. It also reacts to externally applied switching signals and calculates a length based on the set speed. All three switches (x-velocity, y-velocity and rate) must be specified.

simulation f1 f2 n	f1 = -100.0 ... 100.0; x-velocity in m/s f2 = -100.0 ... 100.0; y-velocity in m/s n = 0 ... 100; measurement rate	

Sending ESC to the device aborts the simulation process.

SO1

Outputs the parameters and their current setting that belong to the programming interface.

so1		

-

SO2

Outputs the parameters and their current setting that belong to the internal communication interface.

so2		

-

Start

The command is used to start a length measurement. The effect depends on the parameter *Trigger*. In case of single part measurement, the integration of the length is started from the length value zero. In case of continuous measurement, the length integration is stopped and restarted at the same time.

start		

-

Stop

The command is used to end a length measurement. The effect depends on the *Trigger* command. Only in case of single part measurement the integration of the length is stopped.

stop		

-

Store

The command permanently saves the currently set parameters in the device. The command is protected by a password (command *Password*).

store		

Only if this command is executed, the current parameter settings are retained even after the device is switched off.

TComp

The command outputs the value for the temperature compensation in PPM/K. The compensation value is used for a temperature-independent determination of the velocity.

tcomp		

The setting is made at the factory and cannot be changed.

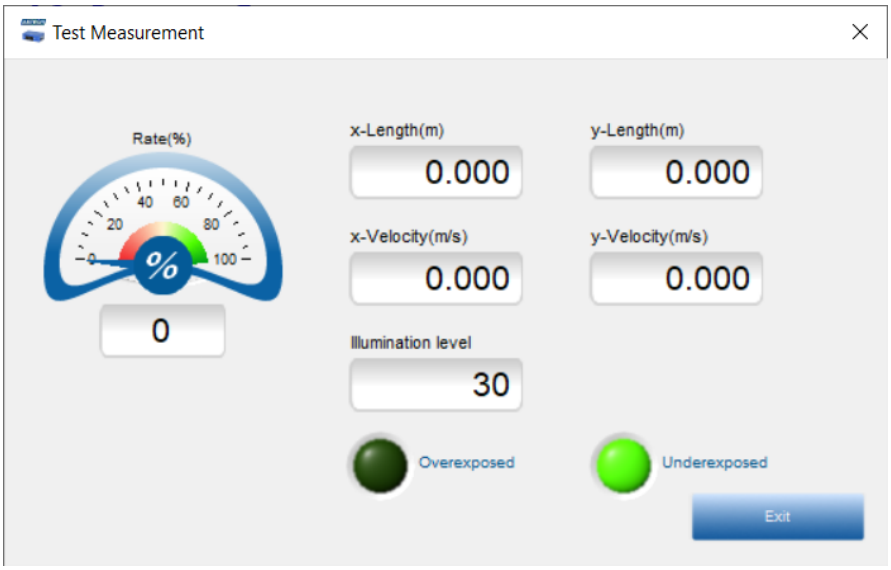
Testmeasure

The command starts a test output of the measured values. This output has a fixed structure and is composed of the values x-speed, y-speed, x-length, y-length, measuring rate, illuminance, overexposure and underexposure. The output ends automatically after 60s.

testmeasure [c]	c = c (no abort after 60 s)	

Sending ESC to the device aborts the test output. Unlike other commands, the line termination here is only a "CR" (carriage return).

When using the VLMTool, the output values are shown in a window display.



Type

The command outputs the type of the connected VLM60.

type		

The setting is made at the factory and cannot be changed.

Update

The command can be used to start a software update of an internal module. It is strongly recommended to use the VLMTool for the update. A wizard guides you through the update process.

update [c]	c = <without switch>: Update of micro controller c = 0: Update of pulse generating processor c = f: Update of fieldbus interface	

If the update fails and the firmware is damaged, the device will no longer start. In this case, the manufacturer must be contacted.

Supplementary information on updating the fieldbus interface

For the update of the fieldbus interface, in addition to the VLMTool, the program "Wingate" from the company Deutschmann Automation GmbH & Co. KG is required. By calling "update f" the VLM60 is set to establish a direct communication channel between the fieldbus module inside the VLM60 and the connected PC. The VLMTool automatically terminates the communication with the VLM, which is then taken over by Wingate. With Wingate a so-called script file is transferred to the fieldbus module. Wingate can be downloaded from the manufacturer's website (https://www.deutschmann.de/de/support/downloads/). Information on how to use the Wingate program can be found in the program help.

After the update of the script is completed, the VLM60 must be restarted.

When the module software is updated, the password for Telnet is overwritten. It is therefore recommended to let the manufacture accompany the update process.

Version

The command outputs the serial number and software version of the connected VLM60.

version		

The output is similar to that of the *Info* command.

Video

This command switches the operating mode of the primary sensor and displays a video image in the VLMTool. This function is used for the device check at the manufacturer. The measurement function is deactivated in this mode!

video		

Sending ESC to the device aborts the video mode.

5 Technical data

Working distance and tolerance	100 ± 10 mm
Measurement range	0,0 … 300 m/min (0,0 … 5 m/s)
Measurement uncertainty [1)]	< 1 %
Reproducibility [1)]	< 1 %
Working principle	Correlation
Illumination	White light LED (life span > 5 years, exchangeable)
Supply voltage (V_{sup})	12 … 30 V DC
Power consumption	< 7 W
Temperature range	0 °C … 50 °C
Protection level	IP 65
EMC	Conformity according IEC 61326-1:2020
Weight, dimensions	ca. 1,45 kg, 132 mm x 140 mm x 60 mm (without connectors)
Programming interface	USB, for parameter adjustment and software updates
I/O signals	Status output (V_{sup}- 1 V, 100 mA max., short circuit proof) Trigger input (10 … 30 V, 3 mA max., opto- isolated)
Incremental output (Encoder)	per direction of movement two phases (A/B, 90°) 5V TTL, output frequency max. 1 MHz, max. 100 mA per phase
Fieldbus interface (optional)	Ethernet (FBFE), Profinet IO (FBPN), Ethernet/IP (FBEI)
Scope of delivery	VLM60, data cable, positioning aid, USB memory with documentation and software, printed manual

[1)] DIN 1319 / ISO 3534, of measured length, test conditions: measuring length 10 m, constant conditions in: temperature (20 °C), distance, velocity, illumination.

6 Error messages

All error messages start with the letter 'E' and a two-digit error number. The device errors are divided into different categories, depending on the degree of severity. Critical errors require a change in programming or operating conditions in most cases. Fatal errors indicate a serious hardware fault. The device must be checked.

Code	Meaning	Cause
E00 No error	No error occurred	-
E20 Serial console framing error	Data error during serial transmission	USB error, wrong communication parameter
E21 Serial console parity error	Parity error during serial transmission	USB error, wrong communication parameter
E22 Serial console overrun error	Internal buffer overflow during serial transmission	Too much data traffic
E23 Serial console break error	Physical break of serial transmission	USB error
E30 Digital potentiometer I2C error	Internal hardware error of the LED control unit	Device defective
E31 Temperature sensor I2C error	Internal hardware error of the temperature monitoring	Device defective
E32 EEPROM I2C error	Internal hardware error of the parameter memory	Device defective
E40 Power LED startup failed	LED control unit could not be initialized	Device defective or LED defective
E41 Power LED control error	LED brightness could not be controlled	Device defective
E42 Power LED voltage or current fault	Error in LED brightness controlling	LED defective
E50 Motion sensor initialization error	Initialization of primary sensor not possible	Device defective
E51 Motion sensor configuration error	Configuration of primary sensor not possible	Device defective
E52 Motion sensor burst error	Error during data transmission with primary sensor	Device defective
E53 Motion sensor frame capture error	Video mode of primary sensor erroneous	Device defective or device restart necessary

7 Dimensional and installation drawings

All dimensions in mm

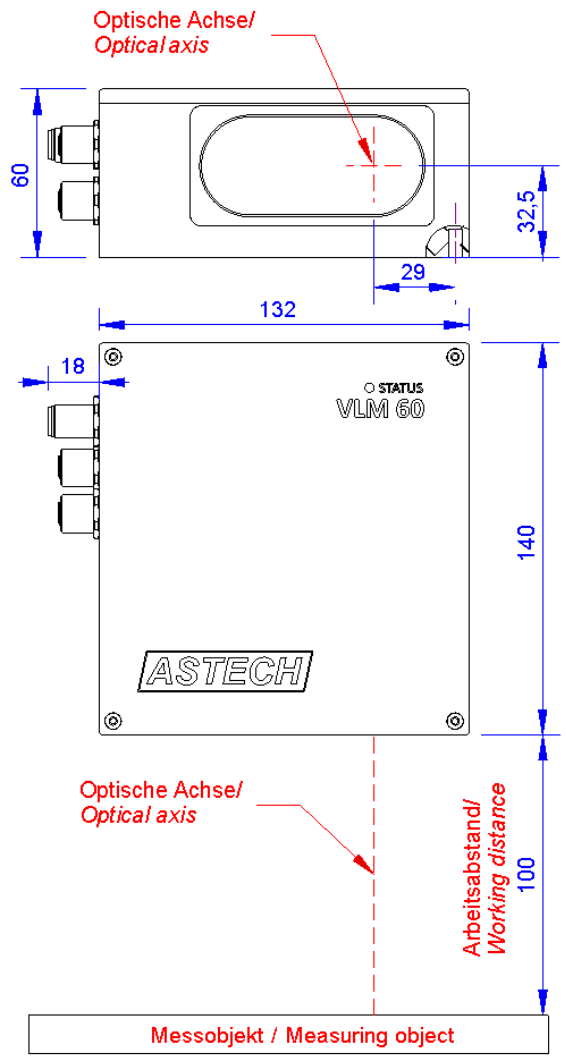


Figure 10: Housing dimensions

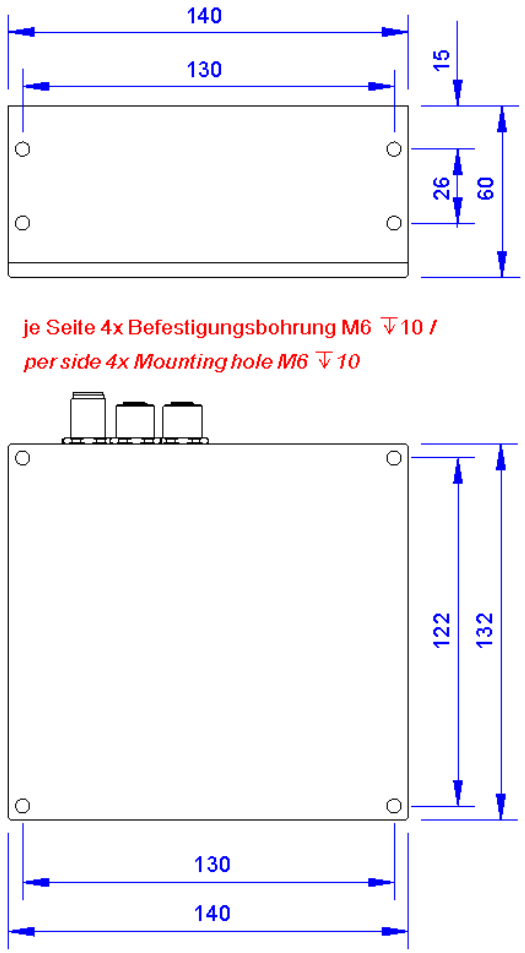


Figure 11: Mounting dimensions

The working distance (WD) is always measured starting at the edge of housing.

8 Declaration of conformity

Manufacturer	**ASTECH Angewandte Sensortechnik GmbH**
Address	18057 Rostock
	Schonenfahrerstr. 5
	Germany
Product name	VLM500
Description	Optical velocity and length measuring device

The device agrees with the following directives:

2014/30/EU Directive of Electromagnetic Compatibility

2011/65/EU RoHS Directive

Conformity with the following basic standards with respect to DIN EN 61326-1:2020

Emitted interference (classification: group 1, class A):

IEC/CISPR 11:2019; grid-bound emission

IEC/CISPR 11:2019; radiated emission

Interference immunity (classification: Industrial electromagnetic environment):

IEC 61000-4-2:2008 Electrostatic discharge (ESD)

IEC 61000-4-3:2010 Electromagnetic field

IEC 61000-4-4:2012 Electrical Fast Transient / Burst

IEC 61000-4-6:2013 Conducted disturbances induced by RF fields

IEC 61000-4-8:2009 Magnetic fields (power-frequency)

Place	Rostock
Date	Mai 2021

ASTECH Angewandte Sensortechnik GmbH

Jens Mirow

Managing director