User Manual

VLM 250

Firmware version 7

Version 2.1

ASTECH
Angewandte Sensortechnik

Notes

The information contained in this manual has been thoroughly researched and prepared. Nevertheless, we cannot assume liability for omissions or errors of any nature whatsoever. We would, however, be grateful for your comments or suggestions.

We shall not accept any claims for damages, except for those resulting from intent or gross negligence.

As this product is available in several designs, there might be deviations between the descriptions and instructions in hand and the product supplied.

We reserve the right to make technical changes, which serve to improve the product, without prior notification. Thus, it cannot be assumed that subsequent versions of a product will have the same features as those described here.

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VLM 250 - User manual V2.1e

VLM 250 series from hardware version 2006 with FB2, firmware version from V7.5

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Notes regarding this manual

Commands and functions are in italics. Upper and lower case writing is used to improve legibility:

e.g. *S2On* (command used to initiate output to the serial interface S2).

The abbreviated notations recommended for input of commands are printed in bold print:

e.g. ***S1F**ormat* (command for the programming of the serial interface 1).

Designations are enclosed in single quotes:

e.g. 'SW1' (switch SW1).

The following symbols are used:

n	Numerical value	s	Character string
c	Character	[ ]	Optional

The following abbreviations are used for measurements:

V	Velocity	N	Object counter value
L	Length	R	Measuring rate

The following symbols are used to emphasise particularly important instructions:

! Caution!

H Note!

I Information!

F+S VLM 250 F and S series

1 Introduction

The VLM 250 measuring device for velocity and length is suitable for taking measurements on a wide variety of materials. The VLM 250 is a very versatile and can be used in connection with many different process automation applications. Typical uses include the length measurement of materials that come in lengths and the cutting control or subsequent checking of sheet metal, profiles and tubes. The VLM 250 is used together with rewinders, calanders and extruders, as well as with rolling and temper mills.

The VLM 250 operates optically without contact and implements the physical principle of the spatial filter via the use of a CCD sensor: An image of the optically resolvable material surface structures is produced on the CCD sensor. The sensor converts the movement into a frequency from which the velocity of the movement can be calculated. An external or internal integrated unit calculates the length. The integration unit can be controlled by an external signal (start/stop signal through trigger input).
The velocity is calculated and the length is integrated based on the positive or negative sign. The direction can be controlled by an external signal. An automatic direction detection device is available as an option.

The output signals are generated by a processor. The VLM 250 can be connected to an existing control and process data capturing system. All inputs and outputs are opto-isolated. A RS 232 serial interface(serial interface 1) is provided as a programming interface.
The VLM 250 basic model is equipped with an AB3 connection card featuring four outputs: one Lamp OK output and two programmable Pulse outputs (phases A and B). The fourth output is used for the Status signal and is programmable. There are three inputs (Standby mode, Direction and Trigger input).

Additional serial interfaces, an analog output, various high-resolution pulse outputs and a number of bus interlaces are available as options (interface cards).

The system is located in an IP 65 casing. It is powered with 230 V AC. The device is also available for 24 V DC and 115 V AC power supply.

The VLM 250 is based on the well-established VLM 200 model. It combines the features of the VLM 250 with a number of additional advantages:

- Significantly improved signal processing capacity and optimised firmware, allowing for measurements on virtually all surfaces from high-gloss to matte black. The system is automatically adapted to the surfaces. Materials that were not suitable for measurement by optical systems can now be measured!
- Velocity measuring range easily adjustable by means of *Vmax* parameter,
- Improved reproducibility,
- Considerably increased reliability (e.g. no circuit sockets, various mechanical fuses),
- Update/upgrade of the firmware via PC (flash and bootloader),
- Light source monitoring (error code and switch output 'OUT0'),
- Temperature monitoring (error code),
- Input for standby mode ('IN0').

2 Function

2.1 Physical principle

The VLM 250 operates optically without contact, and implements the principle of the spatial filter by means of a CCD sensor. Spatial filter is the generic term used to describe a measuring principle for the non-contact determination of the velocity and length of moving materials. The spatial filter is based on the filtering effect of grid-like structures (grid modulation).

The function of the VLM 250 can be described as follows:

The lens is oriented towards the moving measuring object, the object producing an image on the CCD line. The CCD line is operated as an optical grid (no image pickup). To illuminate the measuring object, a white light source is used. External light is effectively suppressed with this method. Due to the grid modulation, the movement of the object generates a frequency, which is proportional to its velocity, i.e. the structure of the measuring object (brightness contrast) generates a signal. This signal is hereinafter known as a burst. These bursts are evaluated by the system, i.e. the signal frequency is measured, and the velocity calculated thereof.
There are several control circuits that enable automatic adjustment to the most varied of materials (material surface structure and brightness).

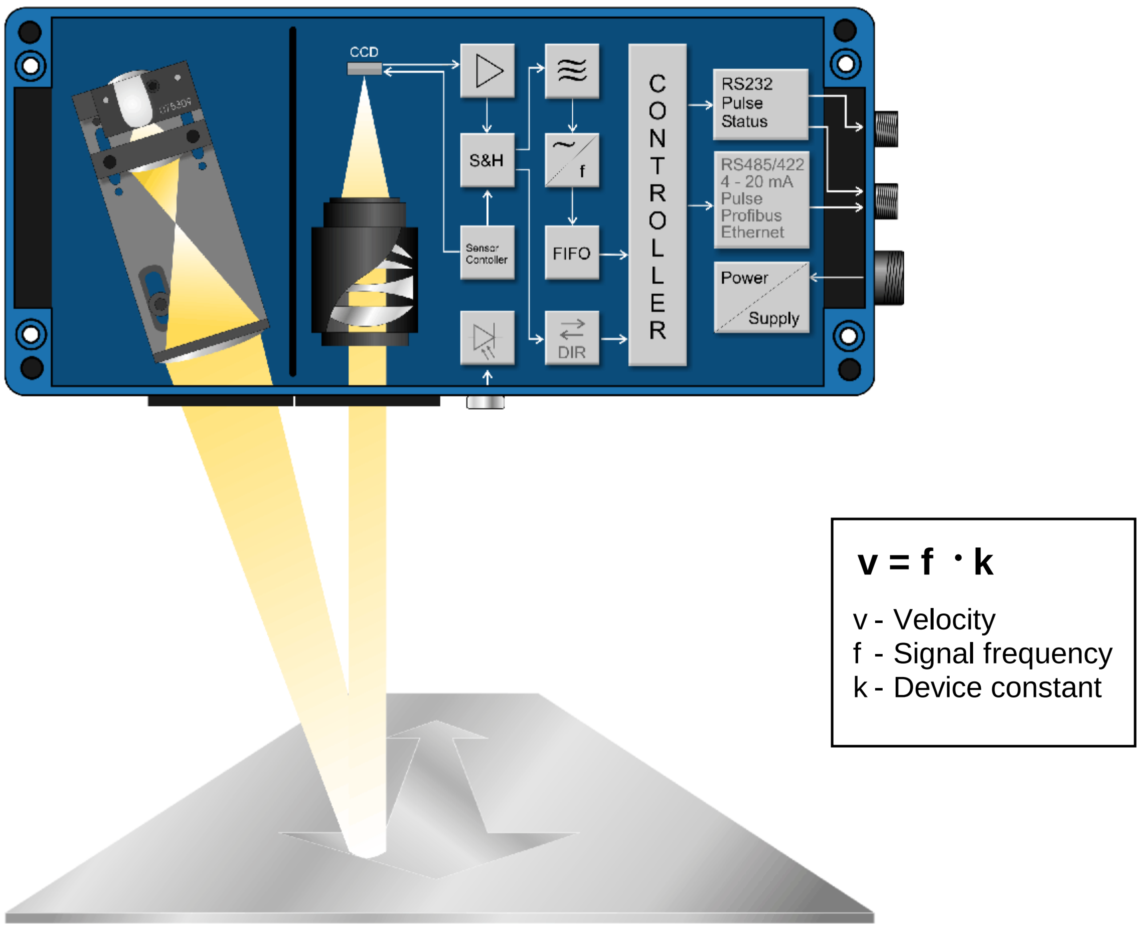


Fig. 1 Design of the VLM 250

2.2 Evaluation

The signal frequency (burst frequency) is determined by the VLM 250's electronic evaluation system. It implements a short-time frequency measurement via the evaluation of individual periods. The velocity is calculated by multiplying the frequency with the device constant and the calibration factor. The integration unit allows for the calculation of the object length based on the velocity (not included in F and S series). The integration unit can be controlled by an external signal (trigger).
The device also calculates the measuring rate, which can be used for the optimisation of the device installation and the monitoring of the measuring function.

2.3 Interfaces

The VLM 250 is equipped with various opto-isolated interfaces (of which some are optional). The measured values can be output through the serial interfaces to a PC, a control unit (PLC) or a printer. Different pulse outputs are available for the connection of the counters. The device also caters for optional analog output.

The standard version includes the following interfaces (connection card AB3):

- RS 232 (serial interface S1, programming interface)
- High-resolution pulse outputs with A/B phase
- Status signal output
- Lamp OK output
- Input for standby mode, directional signal and trigger signal

As an option, the system can be equipped with the following interfaces (interface cards):

- Second serial interface S2 on IF1 interface card (RS 232, RS 422/RS 485)
- IF1 analog output (4 to 20 mA, other ranges optional)
- IF2 series interface card with two high-resolution pulse outputs and analog output (optional)
- ECC2 shaft encoder coupling with optional serial interface S2 (RS485)
- Ports for network connection via IFPROFI (Profibus DP) or IFETHER (UDP/IP, TCP/IP)

All interfaces are distinguished by high flexibility (programmable scaling and output time) and can be easily configured.

2.4 Configuration

All settings can be made through the serial interface S1 (RS 232) using a PC and a terminal program. The user-friendly VLMTERM terminal program is provided free of charge. The individual commands of the VLM 50 are described in chapter "Programming" .
The set parameters can be protected with a password. Any changes made are lost after switching off the device, unless they were saved with the password-protected **Store* command.

3 Device models

The device is available in various designs (series), which are compatible with each other both electrically and as regards their connections. Most of the optional equipment (interface cards, mounting accessories, etc.) can be used with all designs.
Differences in the available measuring range, the working distance and the distance variance result from the different optical equipment of the A, L and D series.

F+S The devices of the F and S series feature fast signal evaluation. The resulting differences as regards programming are explained in a separate chapter and clearly marked in the text with the F+S symbol.

The devices of the A, L and D series are fully compatible and can be combined into VLM 250 FA or VLM 250 FD devices.
Option /h has been specifically designed for use on glowing surfaces.

Do not operate the measuring devices at velocities that are above the range specified in the data sheet, as this could result in inaccurate readings. Please note that the maximum permissible velocity is directly affected by the *Direction* parameter. The *Vmax* parameter must thus be adjusted to match the actual maximum plant velocity. A safety margin of 10% is already taken into account in the device.

3.1 VLM 250 A series

The VLM 250 A caters for a working distance of 185 ± 7.5 mm. It is designed as a universal device catering for the **measuring of a wide range of different materials.** The device can be automatically adjusted to the reflection, colour and structure of the material surface in an extremely wide range.
By altering the *DIRECTION* parameter (see chapter "Programming") the working distance range can be extended; i.e. the range, in which the material to be measured must be located. The extended working distance range of the A series is 185 ± 15 mm.

3.2 VLM 250 F series

The devices of the F series have been developed for **highly dynamic velocity measurements** in the production process and are especially well suited for **closed control loops**. The F series has been upgraded with an averaging processor. It calculates the floating average value, weighted according to the signal quality. A ring memory with 1 or 8 averaging cycles is used. Compared with the VLM 250 A, it is possible to achieve a significantly higher update rate, whereby the minimum update time of the two outputs is 2 ms. The internal calculation of the length and the automatic direction detection is thereby not possible (for more details, see the chapters covering the F and S series, and the notes in the text).
Due to the high calculation performance the use of the F series is recommended for higher velocities.

3.3 VLM 250 D series

The models VLM 250 D and VLM 250 FD are specially designed for applications on **metallic surfaces** as well as for a large distance variance. They realise a working distance of 240 ± 7.5 mm and are distinguished by a high reproducibility of ≤ 0.02 % with a working range of 240 ± 7.5 mm.
Measurement of **velocities of less than 0.033 m/s** (2 m/min) is possible.
The devices of the D series can, if necessary, be configured for a wide range of the distance variance (see table).

3.4 VLM 250 L series

The models VLM 250 L and VLM 250 FL have a working distance of 170 ± 7.5 mm. They are primarily used for the **measurements of small speeds**, as they cater for a **minimum speed of 0.008 m/s** (0.5 m/min).
The devices of the L series have an extended working range of 170 ± 10 mm.
Note: A special model of the VLM 250 VL with FB2L filter for 0.004 m/s (0.25 m/min) to 0.25 m/s (30 m/min) is also available. Apart from the minimum and maximum speeds, this model is identical with the VLM 250 FL.

3.5 VLM 250 S series

Devices of the S series correspond to those of the F series, however, they also allow the **synchronisation of the averaging processor** and therefore of the complete system via an external clock signal.
If two measuring devices of the VLM 250 SD type are controlled by the same clock signal, the complete processing of the measuring value of both devices is synchronous to the set clock signal. Using this configuration it is then possible, for example, to carry out highly precise and dynamic **differential velocity measurements** (for further details, refer to chapter on the F and S device series).
The VLM 250 SD measuring devices are distinguished by an especially high reproducibility rate of ≤ 0.02 % for a working range of 240 ± 7.5 mm.

3.6 Option /h for VLM 250

Based on the previously named devices, the /h option has been specifically designed for the measuring on **glowing tubes, wires and profiles** in steel, copper, brass, etc.
The optics of the h/ series are adapted for use on glowing surfaces. The models can however also be used for measurements on other materials.
Depending on the actual ambient conditions, it might be necessary to ensure sufficient cooling (e.g. with CB5 cooling and protecting case and AC5 air supply).

3.7 Overview of device designs

	VLM 250 A	VLM 250 FA	VLM 250 SA	VLM 250 D	VLM 250 FD	VLM 250 SD	VLM 250 L	VLM 250 FL	VLM 250 SL
Velocity range in m/min	**4 to 400 m/min**	**4 to 1500 m/min**	**4 to 1500 m/min**	**2 to 400 m/min**	**2 to 900 m/min**	**2 to 900 m/min**	**0.5 to 50 m/min**	**0.5 to 100 m/min**	**0.5 to 100 m/min**
Velocity range in m/s	0.07 to 6.7 m/s	0.07 to 25 m/s	0.07 to 25 m/s	0.03 to 6.7 m/s	0.03 to 15 m/s	0.03 to 15 m/s	0.008 to 1.7 m/s	0.008 to 1.7 m/s	0.008 to 1.7 m/s
Accuracy DIN 1319 / ISO 3534	**0.1 %**	**0.1 %**	**0.1 %**	**0.1 %**	**0.1 %**	**0.05 %**	**0.1 %**	**0.1 %**	**0.05 %**
Repeatability	≤ 0.05 %	≤ 0.05 %	≤ 0.05 %	≤ 0.02 %	≤ 0.02 %	≤ 0.02 %	≤ 0.02 %	≤ 0.02 %	≤ 0.02 %
in range	185 ± 7.5 mm	185 ± 7.5 mm	185 ± 7.5 mm	240 ± 7.5 mm	240 ± 7.5 mm	240 ± 7.5 mm	170 ± 5 mm	170 ± 5 mm	170 ± 5 mm
Distance range	**185 ± 7.5 mm**	**185 ± 7.5 mm**	**185 ± 7.5 mm**	**240 ± 15 mm**	**240 ± 15 mm**	**240 ± 7.5 mm**	**170 ± 7.5 mm**	**170 ± 7.5 mm**	**170 ± 7.5 mm**
Internal length range	200 km	-	-	200 km	-	-	200 km	-	-
Extended velocity range in m/min *)	**8 to 800 m/min**	**8 to 3000 m/min**	**8 to 3000 m/min**	**4 to 800 m/min**	**4 to 1800 m/min**	**4 to 1800 m/min**	**1 to 100 m/min**	**1 to 200 m/min**	**1 to 200 m/min**
Extended velocity range in m/s*)	0.14 to 13.3 m/s	0.14 to 50 m/s	0.14 to 50 m/s	0.07 to 13.3 m/s	0.07 to 30 m/s	0.07 to 30 m/s	0.016 to 3.3 m/s	0.016 to 3.3 m/s	0.016 to 3.3 m/s
Extended distance range *)	**185 ± 15 mm**	**185 ± 15 mm**	**185 ± 15 mm**	**240 ± 30 mm**	**240 ± 30 mm**	**240 ± 15 mm**	**170 ± 10 mm**	**170 ± 10 mm**	**170 ± 10 mm**
Accuracy in extended range *)	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.1 %	0.2 %	0.2 %	0.1 %
Averaging and updating	≥ 8 ms	≥ 2 ms (floating)	≥ 2 ms (floating)	≥ 8 ms	≥ 2 ms (floating)	≥ 2 ms (floating, synchronisable)	≥ 8 ms	≥ 2 ms (floating)	≥ 2 ms (floating, synchronisable)
Optional automatic detection of direction	yes	-	-	yes	-	-	yes	-	-
Material	Almost all surfaces	Almost all surfaces	Almost all surfaces	Metallic surfaces	Metallic surfaces	Metallic surfaces	Metallic and other surfaces	Metallic and other surfaces	Metallic and other surfaces
Application	Universal	Universal	Difference measurement	Universal	Universal	Difference measurement	Low velocity	Low velocity	Difference measurement at low velocity

Table 1 Device models, part 1

*) VLM 250 parameter DIRECTION 4 ... 8, special models available

	VLM 250 A /h	VLM 250 FA /h	VLM 250 SA /h	VLM 250 D /h	VLM 250 FD /h	VLM 250 SD /h	VLM 250 L /h	VLM 250 FL /h	VLM 250 SL /h
Velocity range in m/min	**4 to 400 m/min**	**4 to 1500 m/min**	**4 to 1500 m/min**	**2 to 400 m/min**	**2 to 900 m/min**	**2 to 900 m/min**	**0.5 to 50 m/min**	**0.5 to 50 m/min**	**0.5 to 50 m/min**
Velocity range in m/s	0.07 to 6.7 m/s	0.07 to 25 m/s	0.07 to 25 m/s	0.03 to 6.7 m/s	0.03 to 15 m/s	0.03 to 15 m/s	0.008 to 0.83 m/s	0.008 to 0.83 m/s	0.008 to 0.83 m/s
Accuracy DIN 1319 / ISO 3534	**0.1 %**	**0.1 %**	**0.1 %**	**0.1 %**	**0.1 %**	**0.05 %**	**0.1 %**	**0.1 %**	**0.05 %**
Repeatability	≤ 0.05 %	≤ 0.05 %	≤ 0.05 %	≤ 0.03 %	≤ 0.03 %	≤ 0.03 %	≤ 0.03 %	≤ 0.03 %	≤ 0.03 %
in range	185 ± 7.5 mm	185 ± 7.5 mm	185 ± 7.5 mm	240 ± 7.5 mm	240 ± 7.5 mm	240 ± 7.5 mm	170 ± 5 mm	170 ± 5 mm	170 ± 5 mm
Distance range	**185 ± 7.5 mm**	**185 ± 7.5 mm**	**185 ± 7.5 mm**	**240 ± 15 mm**	**240 ± 15 mm**	**240 ± 7.5 mm**	**170 ± 7.5 mm**	**170 ± 7.5 mm**	**170 ± 7.5 mm**
Internal length range	200 km	-	-	-	-	-	200 km	-	-
Extended velocity range in m/min *)	**8 to 800 m/min**	**8 to 3000 m/min**	**8 to 3000 m/min**	**4 to 800 m/min**	**4 to 1800 m/min**	**4 to 1800 m/min**	**1 to 100 m/min**	**1 to 100 m/min**	**1 to 100 m/min**
Extended velocity range in m/s*)	0.14 to 13.3 m/s	0.14 to 50 m/s	0.14 to 50 m/s	0.07 to 13.3 m/s	0.07 to 30 m/s	0.07 to 30 m/s	0.016 to 1.7 m/s	0.016 to 1.7 m/s	0.016 to 1.7 m/s
Extended distance range *)	**185 ± 15 mm**	**185 ± 15 mm**	**185 ± 15 mm**	**240 ± 30 mm**	**240 ± 30 mm**	**240 ± 15 mm**	**170 ± 10 mm**	**170 ± 10 mm**	**170 ± 10 mm**
Accuracy in extended range *)	0.2 %	0.2 %	0.2 %	0.2 %	0.2 %	0.1 %	0.2 %	0.2 %	0.1 %
Averaging and updating	≥ 8 ms	≥ 2 ms (floating)	≥ 2 ms (floating)	≥ 8 ms	≥ 2 ms (floating)	≥ 2 ms (floating, synchronisable)	≥ 8 ms	≥ 2 ms (floating)	≥ 2 ms (floating, synchronisable)
Optional automatic directional-detection	yes	-	-	yes	-	-	yes	-	-
Material	Metallic and glowing surfaces	Metallic and glowing surfaces	Metallic and glowing surfaces	Metallic and glowing surfaces	Metallic and glowing surfaces	Metallic and glowing surfaces	Metallic and glowing surfaces	Metallic and glowing surfaces	Metallic and glowing surfaces
Application	Universal	Universal	Difference measurement	Universal	Universal	Difference measurement	Low velocity	Low velocity	Difference measurement at low velocity

Table 2 Device models, part 2

*) VLM 250 Parameter DIRECTION 4 ... 8, special models available

4 Technical data

Velocity range [1] [2]	0.008 to 50 m/s corresponding to 0.5 to 3000 m/min (depending on individual device type)
Working distance [2]	170, 185 or 240 mm (depending on individual device type)
Length measuring range (internal)	< 1 m ... 200 km (except with F and S series)
Detector / measuring principle	CCD sensor / spatial filter
Lighting [2]	White light, LED (older devices with 10 W halogen lamp)
Programming interface [3]	RS 232 (opto-isolated)
Opto-isolated outputs [3]	OUT0, OUT1, OUT2, OUT3
Function	OUT0: Lamp OK OUT1, OUT2: Pulse output with 2 phases, shaft encoder emulation OUT3: Signal status
Frequency for pulse output	0.4 Hz - 25 kHz (2 phases, resolution 20 ns) (2 optional high resolution pulse outputs available, see below)
Type / max. output current	PNP / 40 mA with AB3, with optional AB4 active push/pull 24V ±20 mA
Opto-isolated inputs [3]	IN0, IN1, IN2
Function	IN0: Standby IN1: External directional signal IN2: Trigger signal (for signals 0/24 V, 0/20 mA or ± 20 mA, R_i approx. 1 kOhm)
Voltage level	> 8 V for HIGH (for IN1 and IN2 switchable to > 3 V)
Input current	approx. 20 mA at 24 V
Power supply	230 V / 50 Hz optional 115 V / 60 Hz optional 24 V / DC (20 to 30 V)
Power consumption	< 50 W
Temperature range	0 to 50 °C
Protection type	IP 65
Weight	Approx. 5.8 kg
EMC [4]	Industrial standard in compliance with CE
Dimensions without connections [2]	360 mm x 160 mm x 90 mm

Options

- Analog output IF1 4 to 20 mA or 0 to 20 mA (16-bit resolution opto-isolated)
- Different digital interfaces IFI (RS485/RS422, RS232, opto-isolated)
- Network connection IF-PROFI (Profibus DP), IF-ETHER (UDP/IP and TCP/IP)
- High resolution pulse output IF2 0.4 Hz to 25 kHz, IF2/PP 0.4 Hz to 50 kHz and IF2F/5V or IF2F/422 0.4 to 500 kHz (2 x 2 phases, resolution 20 ns)
- Light barriers, direction detection (not for F/S series), real-time clock, different counters and displays
- Mounting accessories, linear units, protection casing, blowing device

[1]) parameterisable with FB2 through *VMax*
[2]) standard design, other versions available
[3]) max. voltage 50 V/DC, 36V/AC
[4]) tested by accredited institute

5 Installation

The installation is carried out transversally to the direction of movement of the measuring object (see drawing in the appendix, special designs possible). The standard direction of movement (forwards) is determined from the bottom of the casing to the casing cover (special designs possible). The direction of movement (plus means forwards) is identified by an arrow on the device.

> Installation can take place either in positive or negative direction. Only the *Direction* parameter must be set accordingly (see chapter "Programming")!

The device does not need to be opened for installation. It is secured with four M6 hexagon socket screws.
It is necessary to maintain the correct working distance (distance between lens window and material surface) and the range variation specified by the manufacturer (see rating plate of VLM 250).

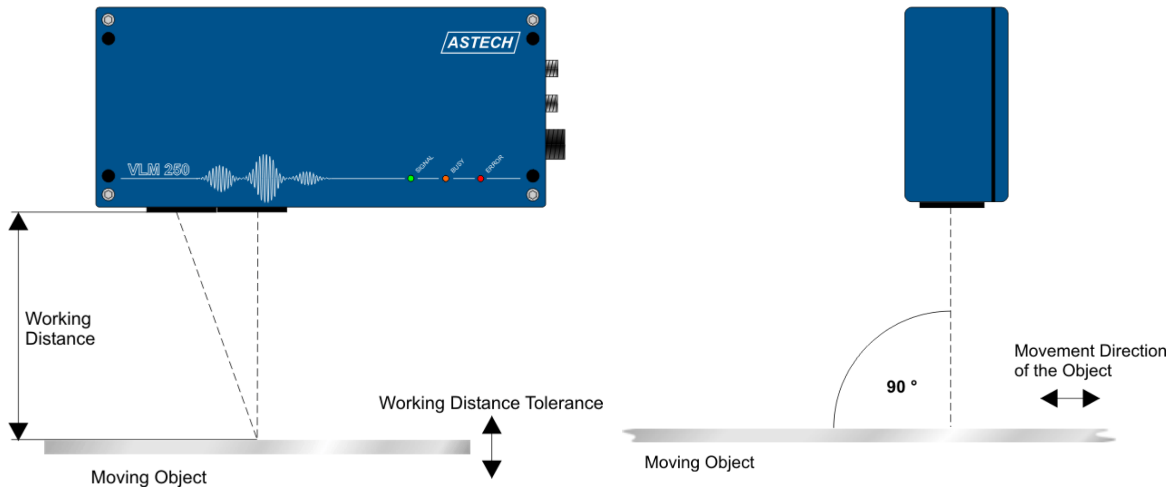
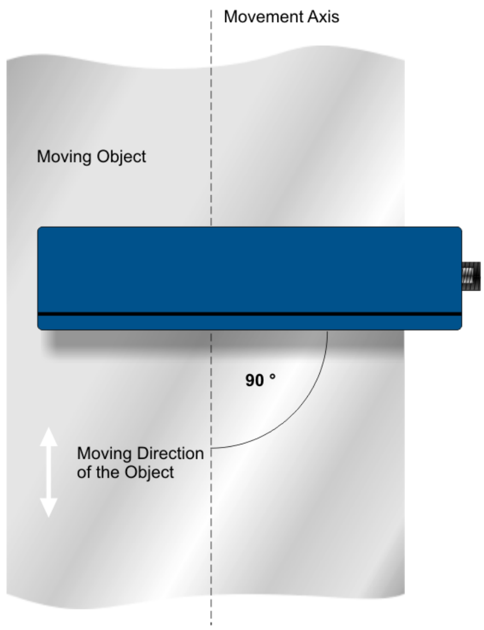


Fig. 2 Working distance (see rating plate) and alignment relative to surface



Angle with max. tolerance of ± 1°

Fig. 3 Alignment to vector of velocity

> ⚠ The installation is carried out at right angles to the direction of movement of the material **with a maximum tolerance of ± 1°**. If the alignment tolerance is exceeded, a measuring error can occur.

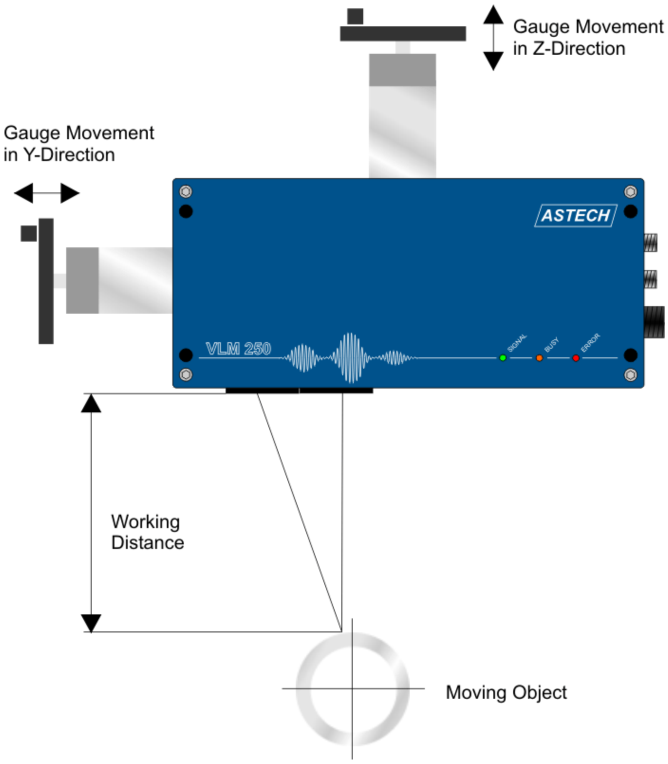


Fig. 4 VLM 250 with LJ2 linear unit

Optional linear units continue to allow an adjustment in the case of changing material distance (LJ1 for an axis) or for round surfaces, such as e.g. pipes, wires and profiles (LJ2 for two axes).

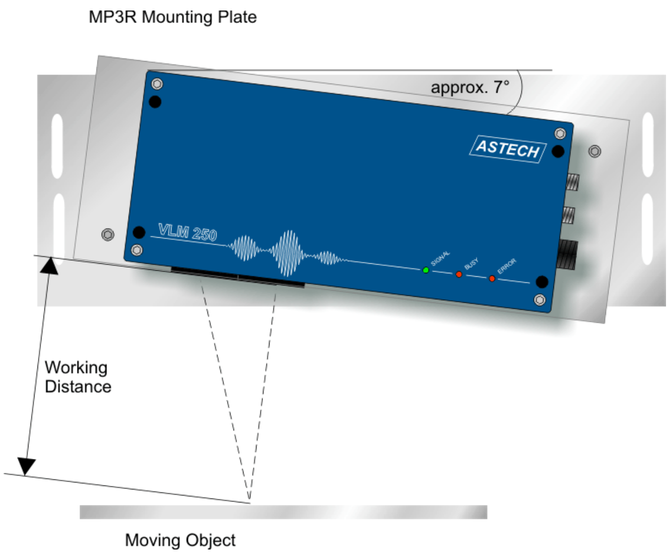


Fig. 5 VLM 250 with MP3R mounting plate

A tilting by the velocity vector is possible when using the MP3R mounting plate. This does not result in a vectorial measuring error. The tilting is necessary in the case of measurements on highly reflective materials and some plastic surfaces.

An optimisation of the alignment by means of the *Test* command in the case of reflective and domed surfaces is useful following connection of the power supply, the programming cable and a PC. Here, the measuring rate output value should take the greatest value.

6 Connection

The VLM 250 is equipped with screwable device connections. There is an earth screw, a connection for the programming interface, a connection for the signalling lines (inputs and outputs) and a connection for the power supply. Two additional signalling line connections are optional.

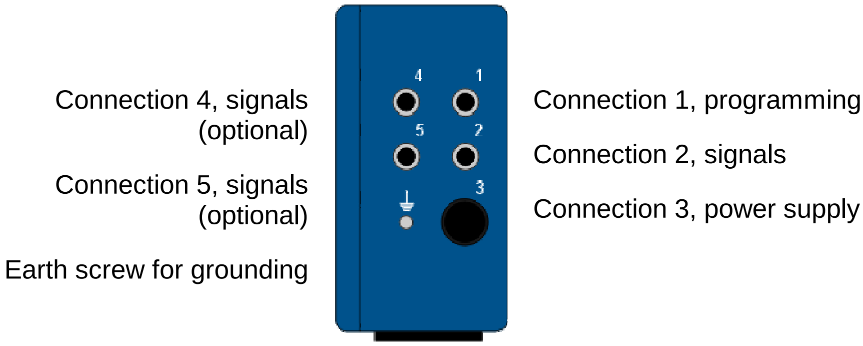


Fig. 6 VLM 250 device connections

6.1 Power supply and grounding

The standard VLM 250 model is designed for 230 V / 50 Hz AC power supply. 24 V DC (20 – 30 V) or 115 V / 60 Hz AC power supply are available as options. The power is supplied through device connection 3.
A mains cable with removable grounding contact connector is included in the delivery in Germany. All terminals in the cable connectors can be screwed (except DSUB9 at the programming cable). The user should perform the cabling according to the appropriate regulations.

Before connecting the VLM 250 to the power supply, a connection has to be made between the grounding screw and the device holder with the aid of the grounding cable included in the delivery. The device holder also has to be low resistance earthed!

> ⚠ Missing or insufficient grounding of the measuring device can cause malfunctions or damage to the electronics in case of surge!

6.2 Signalling lines

The device contains a connection card (AB3) with screwed terminal as standard and an optional interface card (IF1, IF2 and others) with screwed terminal, which are accessible after removal of the casing cover. Prior to opening the casing, always disconnect the device from the power supply. There are different possibilities for the connection assignment (refer to appendix). As these assignments can be modified by either the manufacturer or the user, they should be inspected prior to connection.

Only screened connectors and cables should be used for signal transmission (device connections 1, 2, 4 and 5). The programming cable (device connection 1) must be removed once programming has been completed. The shielding must be earthed always. Connectors and cables can be purchased from the manufacturer.
The device connections 4 and 5 are optional. Unassigned device connections should be protected against the penetration of dirt by dummy plugs.

> The device connections 2, 4 and 5 are wired according to customer specifications. Please note that they are not reverse polarity protected. A wiring diagram is enclosed with every device!

Some wiring examples can be found in the appendix. You will also find more detailed explanations of the individual interfaces there.

It must be ensured that the potential differences between the output and input signals to the ground conductor (PE) are less than 42 V. It is recommended that the GND cable of the system voltage be connected with the earth or the PE conductor via a potential compensation.

> The protective switches integrated on the connection and interface cards transmit in the case of voltage differences of > 42 V between the signals or to the ground conductor. The derivation of the surge can lead to the protection switching transmitting and thus to the short-term failure of the signal concerned!

6.3 AB3 connection card

The terminal of the AB3 connection card contains the connections for the serial interface 1 (programming interface), the 'RxD', 'TxD' and 'GND', the inputs 'IN0', 'IN1' and 'IN2' and the outputs 'OUT0' to 'OUT3'. The 'BR1' and 'BR2' terminals are only connected with each other and can be used as a bridge.

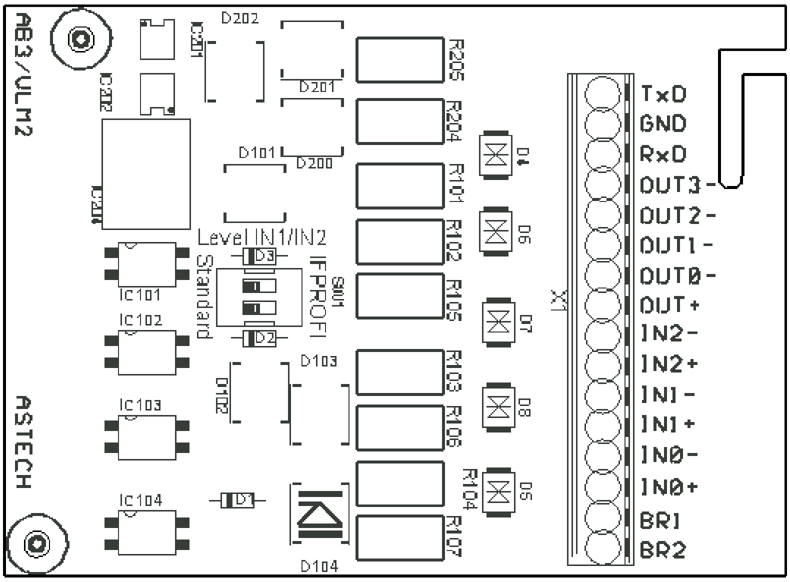


Fig. 7 AB3 connection card

6.3.1 Serial interface 1

A serial interface according to the RS 232 standard is used. It serves to program the device and can also be used for data transfer. The 'RxD', 'TxD' and 'GND' connections are available (device connection 1).

Baud rate, protocol type and parity are set via the *S1Interface* command. The VLM 250 is equipped with automatic baud rate identification, which can be switched on via the *S1Interface* command. The format is preset to 8 data bits and 1 stop bit. Standard parameters are 9600 baud, no parity and XON/XOFF protocol.

The connection is made at the terminals identified by 'GND', 'RxD' and 'TxD'. The interface is opto-isolated to all other connections.

6.3.2 'OUT' outputs

The three outputs 'OUT0', 'OUT1' and 'OUT2' (AB3 connection card) are also electrically isolated by optical couplers. They are transistor outputs sharing a collector connection.

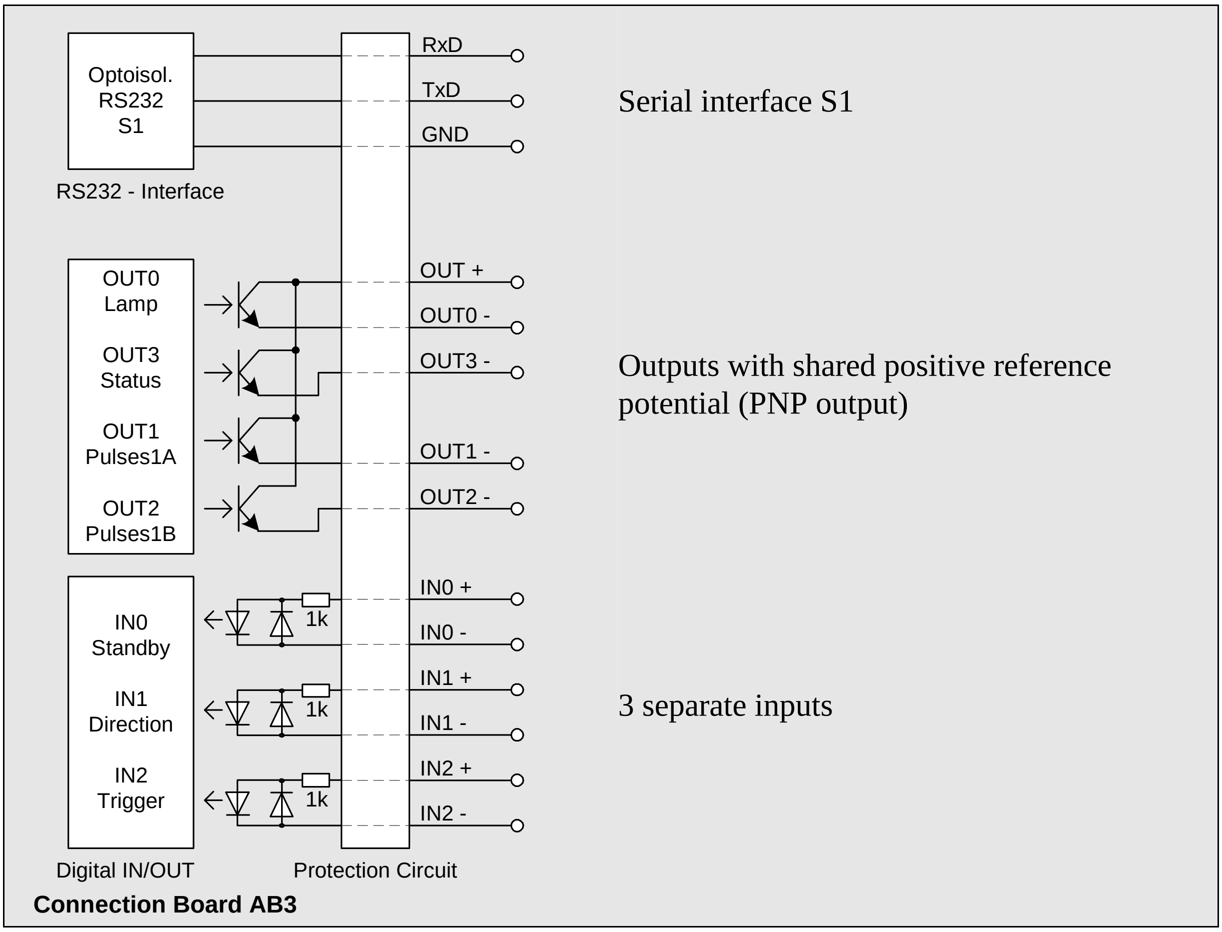


Fig. 8 General design of AB3 connection board

The shared OUT+ connection is normally powered from an external source with 10 to 30 V (e.g. 24 V). The load at the outputs OUT0- to OUT3- is connected to 0 V.

The output transistors can drive a maximum current of 40 mA each. If an external voltage of 24 V is to be used, load resistors of 1200 Ohm each should be used to reach 20 mA. The load might consists of an optical coupler (see Fig. 9 Wiring example for the outputs of the AB3

). The outputs OUT0 to OUT3 are short-circuit proof and surge-proof.

For high-ohmic inputs, an additional load resistor (e.g. 1.2 kOhm) must be connected in parallel to the input.

The 'OUT0' output (Lamp OK) indicates that there is a current to the lamp or LED.

A clock, out of phase by 90°, is made available at the pulse outputs 'OUT1' (phase A) and 'OUT2' (phase B) (see pulse generation, pulse output 1).

By default, output 'OUT3' (status) indicates that measuring values are available; the function of the output corresponds to that of the 'SIGNAL' LED on the front panel of the device. If the LED is green, 'OUT3' is switched through. The output can be programmed with either the Minrate command or the ECC control.

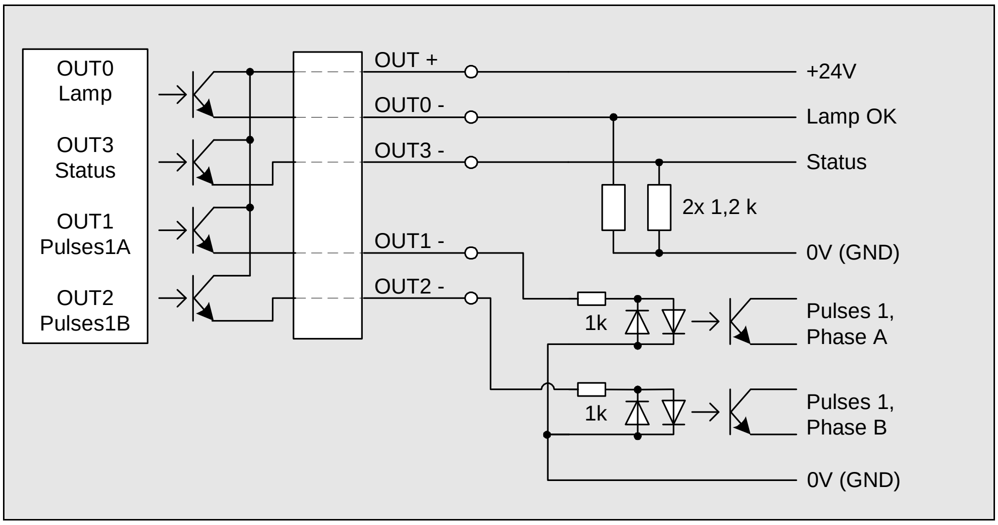


Fig. 9 Wiring example for the outputs of the AB3[2]

AB 4/PP connection board with push-pull outputs

The AB 4/PP card can be installed instead of the AB1 in the VLM 250.
The push-pull outputs OUT0, OUT1, OUT2 and OUT3 provide ±20 mA per output at a 24 V level.

6.3.3 Inputs 'IN0', 'IN1' and 'IN2'

The inputs 'IN0' (standby), 'IN1' (external directional input) and 'IN2' (trigger) on the AB3 connection card are electrically isolated by optical couplers. An input current of -40 to +0.3 mA or an input voltage of < +2 V corresponds to the L level; an input current of +5 to +40 mA or a voltage of > +10 V corresponds to the H level. Using the switch, the H level for 'IN1' and 'IN2' can be reduced to > +3 V (required for use of IFPROFI).

The maximum input frequency may not exceed 10 Hz in the case of a mark-space ratio of 1 : 1. For F series devices, the maximum permitted frequency at the IN2 trigger input is 500 Hz..

The input signals must be absolutely free off contact bounce (chatter). The use of relay contacts is not allowed!

[2] The wiring example shows connections with passive load resistors and optical couplers.

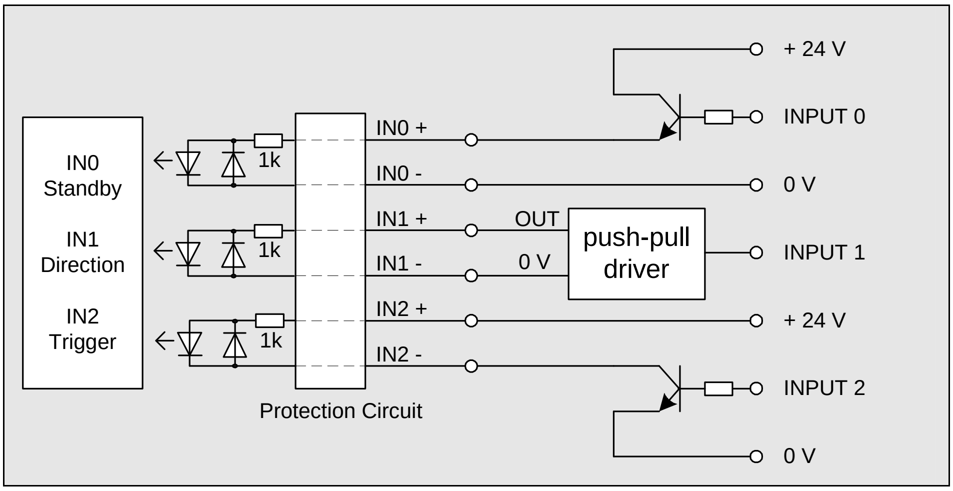


Fig. 10 Wiring example for the inputs of the AB3[3]

6.3.3.1 Input 'IN0'

A H level at this input switches the device to standby mode. This function corresponds to the **Standby* command (see chapter "Commands").

6.3.3.2 Input 'IN1'

The input for the directional signal can be activated at H or L level. It is programmed with the *Direction* command. The connection of an external directional transducer to 'IN1' should be given preference over an internal direction detection (option FB2DIR).

6.3.3.3 Input 'IN2'

The IN2 is the trigger input. It is used for the control of the length calculation (not F or S series). It is programmed by means of the *Trigger* parameter (H or L level or edge) and implements the start and stop of the device-internal length integration unit. The output channels can be synchronised to the trigger (e.g. *S1OUTPUT 1* parameter switches the data output of the serial S1 interface to be synchronised with the trigger).
In the case of the internal laser light barrier option for the measurement of individual parts, 'IN2' is connected to the laser light receiver integrated in the measuring device.
In devices of the S series, the IN2 input serves to switch on the synchronisation clock.

> ⚠ The signals for the inputs must be de-bounced! Mechanical contacts (switches and relays) may be used only if the signals are switched when the measured object is at a standstill!

6.4 IF1 interface card

The optional IF1 interface card provides, depending on the components, an additional interface (serial interface 2: RS 232 with handshake signals, RS 422/RS 485 each opto-isolated) and/or an analog output (16 bit resolution, 4 to 20 mA or 0 to 20 mA).

[3] The wiring example shows connections to PNP, push-pull and NPN outputs.

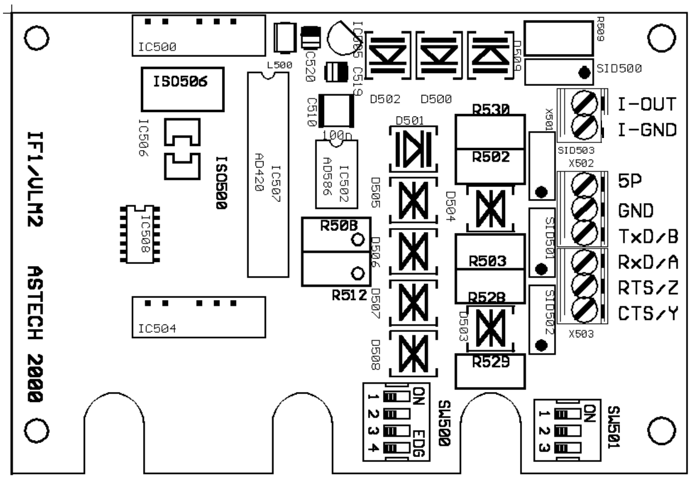


Fig. 11 IF1 interface card

The DIL switches serve to switch over between RS485 or RS422 and to switch the terminating resistors. There are no DIL switches in the RS232 component variant.

It should be observed that the RS485 interface must be terminated at both cable ends with 120 Ohm and the RS 422 interface with 100 Ohm at the last receiver.

Positions of 4-fold DIL switch (RS485/422)	SW500-1	SW500-2	SW500-3	SW500-4
RS 485 (default settings)	ON	ON	OFF	OFF
RS422 with receiver open-circuit fail-save	OFF	OFF	ON	ON
RS422 without receiver open-circuit fail-save	OFF	OFF	OFF	OFF

Positions of 3-fold DIL switch (termination)	SW501-1	SW501-2	SW501-3
RS 485 with 120 Ohm terminating resistor	ON	ON	OFF
RS 485 without termination (default settings)	OFF	OFF	OFF
RS 422 with 100 Ohm terminating resistor	OFF	ON	ON
RS 422 without termination	OFF	OFF	OFF

Table 3 Assignment of the IF1 DIL switch

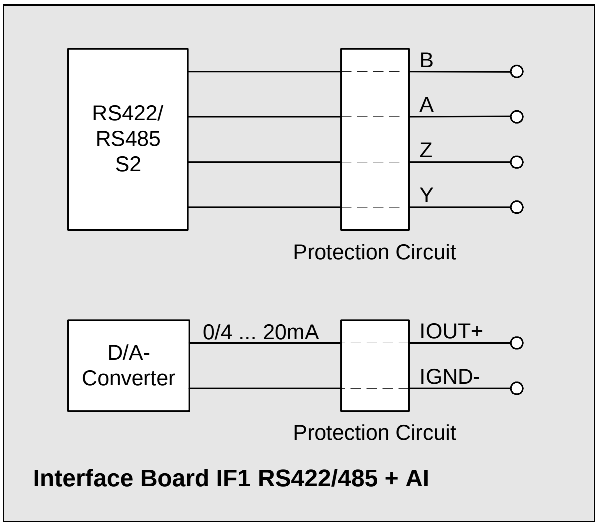


Fig. 12 Principle IF1/RS422 circuit diagram with analog output option

6.5 IF2 interface card

The optional IF2 interface card provides two high resolution pulse outputs, each with 2 phases and a frequency range of 0.4 Hz up to 25 kHz. Resolution and error each equal 20 ns. The maximum cable length is 50 m. Additionally, an opto-isolated analog output (16 bit resolution, 4 to 20 mA or 0 to 20 mA) can be assembled.

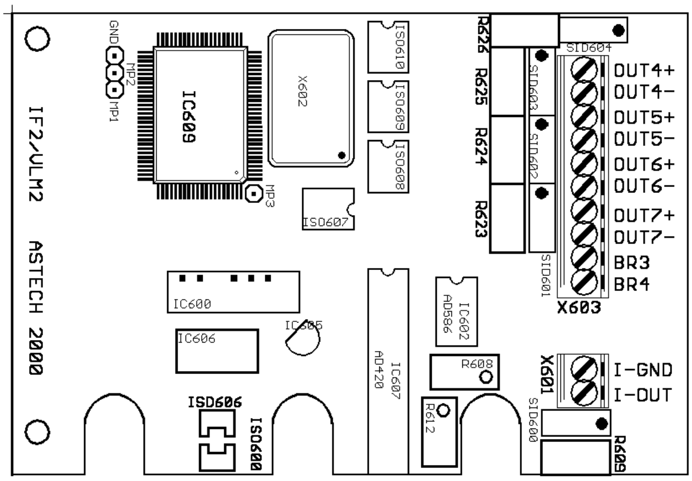


Fig. 13 IF2 interface card

The four outputs 'OUT4' to 'OUT7' are electrically isolated by optical couplers. The OUT4/5 and OUT6/7 outputs can be scaled independently. NPN transistors are used. The necessary external voltage equals 24 V. A clock, out of phase by 90°, is provided (refer also to programming of the pulse output).

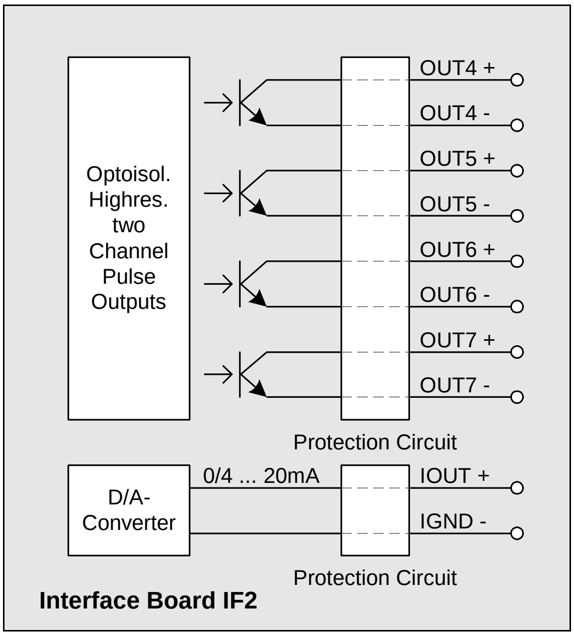


Fig. 14 Principle IF2 circuit diagram with analog output option

6.6 IF2/PP interface card

The optional IF2/PPinterface card provides two high resolution pulse outputs, each with 2 phases and a frequency range of 0.4 Hz up to 50 kHz. Resolution and error each equal 20 ns.

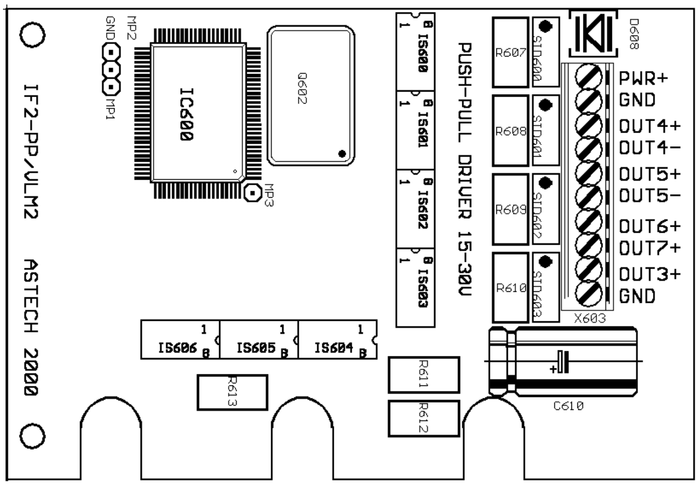


Fig. 15 IF2/PP interface card

The seven outputs 'OUT3' to 'OUT7' are electrically isolated by optical couplers. The outputs are designed as balanced driver stages (HP3120A driver). The maximum output current is ±100 mA per channel. The maximum cable length is 200 m. The necessary external voltage equals +15 to +30 V. OUT4+ is the pulse output A2, OUT4- is /A2, OUT5+ is B2, OUT5- is /B2, OUT6+ is A3 and OUT7+ is B3. The OUT3 status output is available too (see chapter "Outputs" and "Programming of the pulse output"). The card needs an **external supply voltage of 15 to max. 30 V.**

> The outputs of the IF2F/PP interface card are only short-circuit protected against GND. Connection to the operating voltage can lead to destruction of the relevant channel!

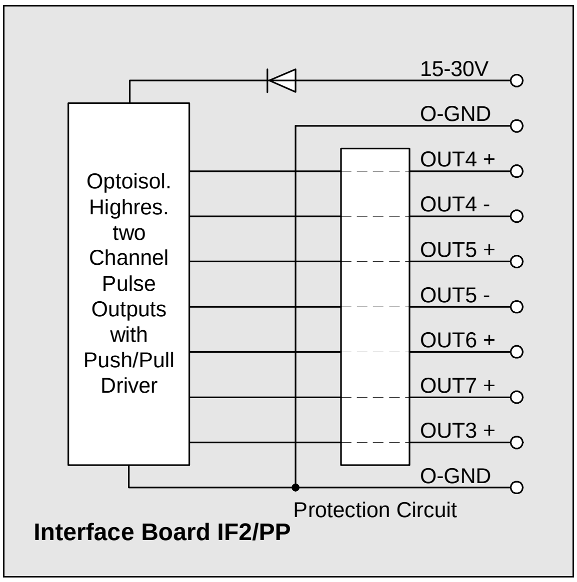


Fig. 16 Principle IF2/PP circuit diagram

6.7 IF2F/5V interface card

The optional IF2F/5V interface card provides two high resolution pulse outputs, each with 2 phases and a frequency range of 0.4 to 500 kHz. Resolution and error equal 20 ns. Additionally, an opto-isolated analog output (16 bit resolution, 4 to 20 mA or 0 to 20 mA) can be mounted.
The four eight 'OUT4' to 'OUT7' are electrically isolated by optical couplers, but have the same reference potential. The OUT4/5 and OUT6/7 outputs can be scaled independently. A clock, out of phase by 90°, is provided (refer also to “Programming of the pulse output”).
The outputs are designed as 5 V driver steps (74ACT04 interface driver). OUT4+ is the pulse output A2, OUT4- is /A2, OUT5+ is B2, OUT5- is /B2, OUT6+ is A3 and so on. The maximum output current is ±24 mA per channel. The maximum cable length for asymmetrical operation (reference potential O-GND) is 200 m; for output frequencies below 50Hz, it is 500 m.
The card can be used to drive RS 422 outputs with a terminating resistor of 100 Ohm. In this case, the pick-off is symmetrical between OUT+ and OUT-, while the O-GND is not connected. When using twisted pair shielded cables (e.g. CAT5), the maximum cable length for RS 422 is 500 m.

> ⚠ The outputs of the IF2F/5V interface card are only protected against ESD but not against surges.

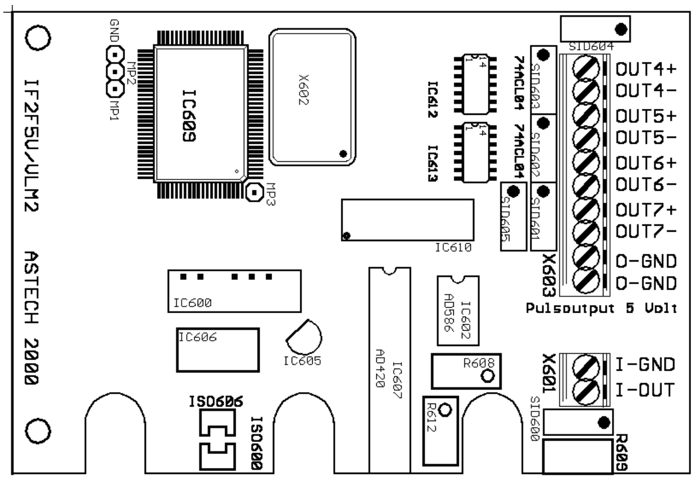


Fig. 17 IF2F/5V interface card

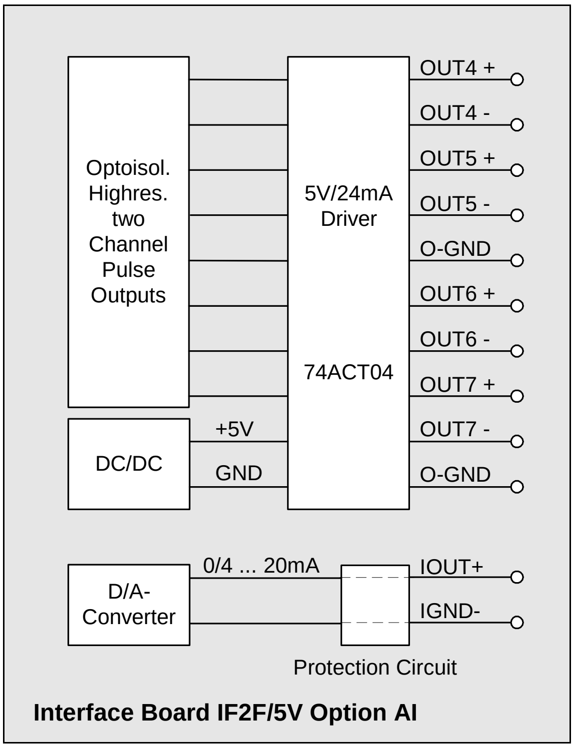


Fig. 18 Principle IF2F/5V circuit diagram with analog output option

6.8 IF-PROFI and IF-ETHER interface card

The optional IF-PROFI interface card allows for IF-PROFI direct connection to Profibus DP. The IF-ETHER interface card provides 10 Mbit Ethernet communication with UDP/IP and TCP/IP protocol.
Please refer to the additional information included with the cards and provided on the Internet at www.astech.de.

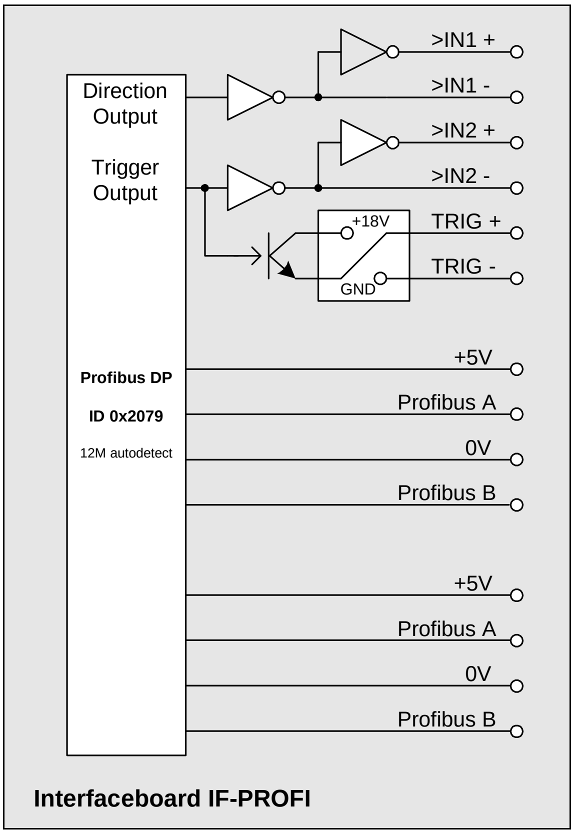


Fig. 19 Principle IFPROFI circuit diagram

6.9 ECC2 interface card

The optional ECC2 interface card allows the connection of an external shaft encoder or a second VLM 250 velocity measuring device. When the value falls below a selectable velocity or the measuring rate, the pulse output is switched over to the shaft encoder or the second measuring device. The two outputs 'COU1' and "COU2' are electrically isolated by optical couplers. They correspond in function and programming to the outputs 'OUT1' and 'OUT2' (default setting for DIL switch output). The criteria for switching over are programmable (refer to ECC control). The switch-over is implemented by the status signal, which can be picked up parallel to 'OUT3' and then indicates which measuring device is active.
A direction signal is generated from the phase direction of the 'INC' inputs. This can be picked up via the lateral terminal and be connected with the IN1 input of the AB3 interface card.
The DIL switch controls the 'COU2' output. It is possible to switch between phase B or direction output.
Additionally, the second serial interface (S2 as RS232 or RS485) can be mounted.

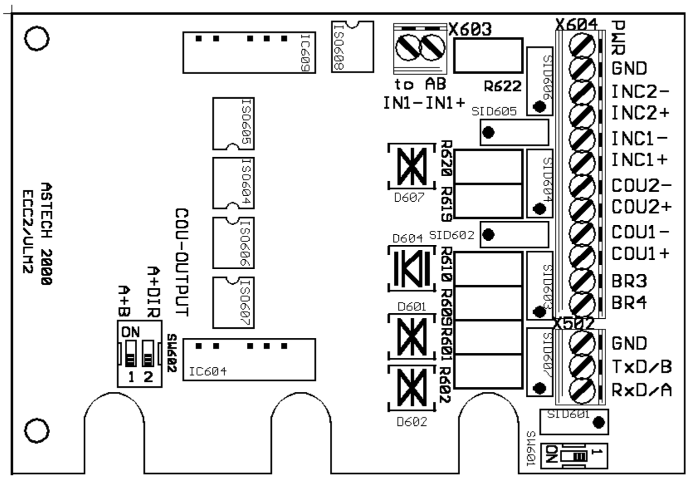


Fig. 20 ECC2 interface card

Position of DIL switch termination (for RS 485 option)	SW601.1
RS 485 with 120 Ohm terminating resistor *) RS 485 without termination	ON OFF

Position of DIL switch output	SW602.1	SW602.2
Phase A and phase B *) Phase A and direction	ON OFF	OFF ON

*) default settings

Table 4 Assignment of the DIL switch ECC2

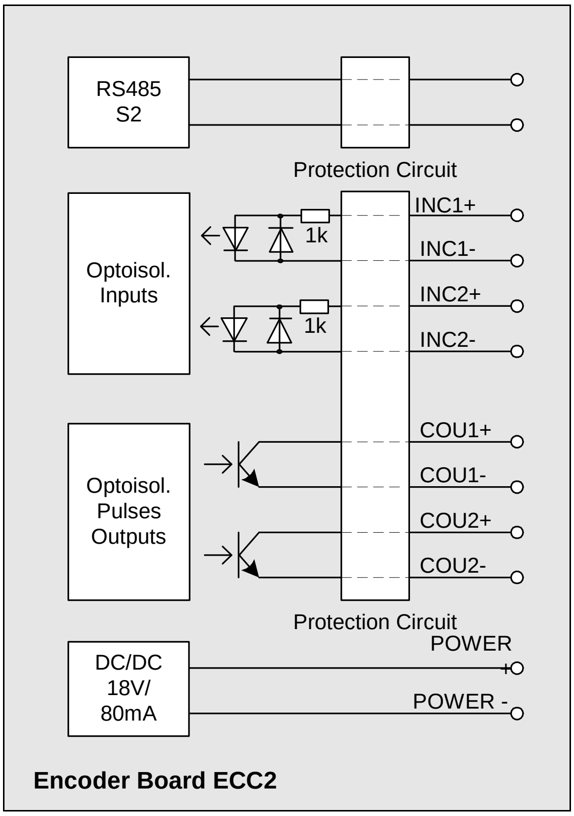


Fig. 21 Principle ECC1 circuit diagram with RS485 option

Note: When using the IF1, IF2 or IF2F interface cards, the function of the ECC2 interface card can be realised by the ECC1 designed as an independent device (IP65). The ECC1 allows the above described switch-over function and additionally provides a power supply of 24 V, e. g. for the shaft encoder. The ECC1 is controlled by the 'OUT3' status output.

7 Operating instructions

The VLM 250 operates autonomously after programming and requires only very little maintenance. If need be, the maintenance is limited to the cleaning of the windows and the replacement of the halogen lamp (see chapter "Maintenance").
During operation the *Test* and *Error* commands can be used for diagnostic purposes (see chapter "Programming").
The different modes of operation are indicated by LEDs, with the following meaning:

LED	Colour	Meaning
Signal LED	green	Signal exists or is good, see also *Minrate* and *ECCOn*
Signal LED	red	Signal does not exist or is below the defined threshold, see also *Minrate* and *ECCOn*
Signal LED	yellow	Device is being initialised
Busy LED	yellow	Command processing, also in the case of calibration, simulation, standby and offline measuring
Error LED	red	Flashes in the case of a fatal error (refer to appendix) Flashes briefly in the case of a critical error (refer to appendix)

Table 5 LED signals

Signal LED
In the case of a moving measuring object and adequate signal quality the LED is green. A red LED indicates a poor signal quality. A red signal LED can be caused by various things:
1. No measuring object exists, measuring object outside the VLM 250 operating range
2. Measuring object is at a standstill or is out of velocity range
3. Measuring object has insufficient structure
4. Measuring object too bright or too dark
5. Dirty window (refer to chapter "Maintenance")
6. Measuring rate is too low
   (only if measuring rate monitoring is switched on, see *Minrate* command)
7. Velocity or measuring rate outside the permissible range
   (only if ECC function is switched on, see *ECCOn* command).

'OUT3' (status) output is switched together with the signal LED. If the LED is green, 'OUT3' is switched through.
During initialisation after switching on the device or after the **Restart* command the signal LED is yellow.

Busy LED
This LED is yellow while processing commands (see chapter "Programming"), during calibration (refer to *Calibrate* command) or during offline measurement (see chapter "Offline"). While the busy LED is yellow, the output channels are not addressed or addressed with a delay!

Error LED
If the red error LED constantly flashes, there is a technical defect. If it flashes at short intervals or constantly during operation, certain parameters are incorrectly set or there were transmission errors. In all cases, the cause should be determined using a PC and the *Error* command and then eliminated, as otherwise errors in the measuring results are possible.

8 Maintenance

8.1 Windows

The VLM 250 is an optical device. This means that the object to be measured must be "seen" by the device. Therefore, it is necessary to check the windows at regular intervals and, if necessary, to clean them. The windows should be cleaned with a soft, lint-free cloth and a normal detergent for windows.

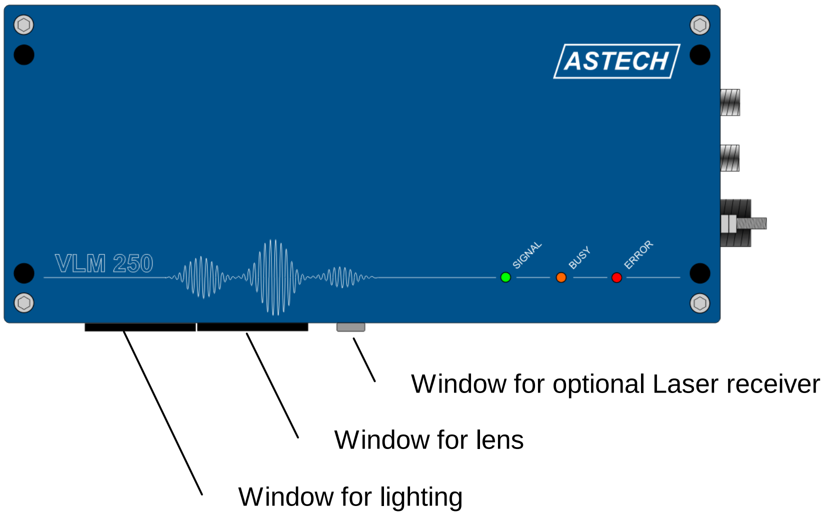


Fig. 22 VLM 250 windows

Replace damaged windows without delay. To do this the device has to be dismantled from the plant and cleaned. The window may only be replaced in a clean environment. The 4 hexagon socket screws (key width 2.0) must be loosened. The window can be lifted off the seal with a flat screwdriver. Neither the inside of the window nor the lenses may be touched! The new window should be secured with 4 screws. The screws should be cleaned first, moistened with very little screw lubricant and screwed in.

Device	Replacement window lens	Replacement window lighting
VLM 250 /h measuring device	OW 4	OW 3
Option stainless steel window	OWRM	OWRM
All other VLM 250 models	**OW 2**	**OW 2**

Table 6 Order codes for replacement windows

The windows OW 2 and OW 3 consist of special glass with high transmission. The OW 4 window reflects infrared rays. The windows OW 3 and OW 4 have an increased temperature resistance. The optional window OWRM is resistant to oil, gasoline and kerosene and is mechanically more stable than the OW series.

If the windows need to be cleaned often or if they wear quickly, protective measures may be necessary (e.g. PA2 free blowing unit or CB5 cooling and protecting case with AC5 air generation).

8.2 Lighting

8.2.1 Actual type with LED

The VLM 250 is using a special LED with high light output. But the brightness is reducing with the operating time. The manufacturer gives an average reduction of 70 percent after 50,000 hours at 80 °C chip temperature. **Thus an replacement of the LED every 20,000 operating hours is recommended.** T

he LED chip is adjusted and fixed on an aluminum block. The block is hold in the lighting unit of the VLM 250 through two pass pens and with a socket screw (3 mm). The electrical contact is made with cable connectors. This allows fast and simple replacement.

8.2.2 Older type witch halogen lamp

Older VLM 250 are equipped with a special 6 V halogen lamp, whose service life is of course limited. The lamp should therefore be replaced every 2000 operating hours. Strong vibrations and improper handling may lead to premature lamp failure.

Switch-on time per day	Hours per year	Replacement interval for lamp
8 hours (single-shift operation)	2920	8 months
16 hours (double-shift operation)	5840	4 months
24 hours (three-shift operation)	8760	2.5 months

Table 7 Replacement cycle for lamp

The actual halogen lamp is aligned and secured in an aluminum block. The block is led through two set pins in the VLM 250 and held with a hexagon socket screw (cylinder head, M3 x 10 mm). The electrical contact is made with cable connectors. This allows fast and simple replacement.

8.2.3 General hints

The light source must be purchased either from your dealer or directly from the manufacturer. The ordering designation can be found in the VLM 250 casing lid and on the packaging of the light source. It is imperative that you observe the **instructions for light source change**:

⚠ Non-installed light sources are very sensitive. Please handle these with extreme care. Do not touch the glass body of the new light source!

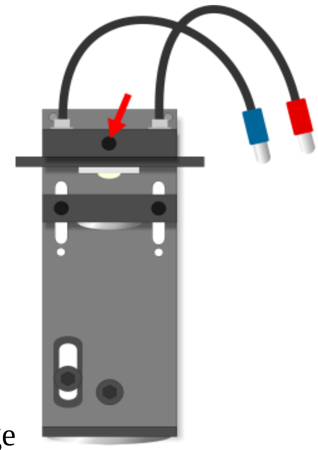
New light sources may only be stored in their original packaging. Do not remove the light source from the packaging until just before you are about to install it. If your fingers touch the bodies of the glass, this can cause a drastic reduction in the life of the light source.

⚠ Please ensure that no damage is caused to the structural components on the circuit board when the cover is open. No dirt may contaminate into the device!

Instructions for light source change

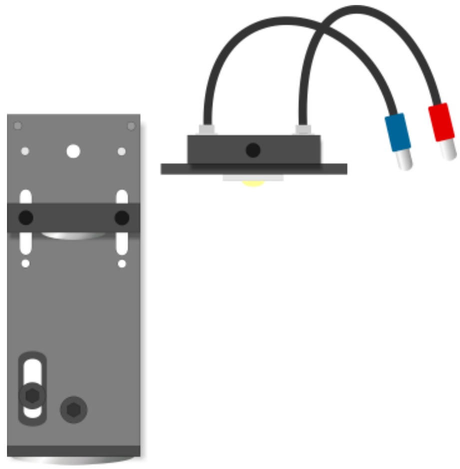
1. **The device must be cleaned from outside before replacing the light source.** In case of extremely bad environment conditions, the device should be removed from the plant prior to light source replacement, in order to be able to carry out the replacement in a clean place.
2. After **disconnecting the unit from the power supply**, release the four hexagon socket screws and remove the cover of the VLM 250.
3. The two connectors as well as the hexagon socket screw (see arrow) must be loosened. The old light source block can then be removed (Caution: high temperature!).
4. The new light source block should be inserted very carefully. Be sure that nothing gets wedged**. Do not touch the glass of the new light source!**
5. The hexagon socket screw should then be fixed and the two connectors connected until they lock together. The cables may not lie in the optical path of the lighting unit!
6. Close the device properly and then reconnect the power supply.

LED



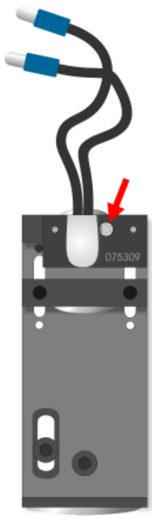
change

Illumination unit with LED light source and mounting screw (arrow)

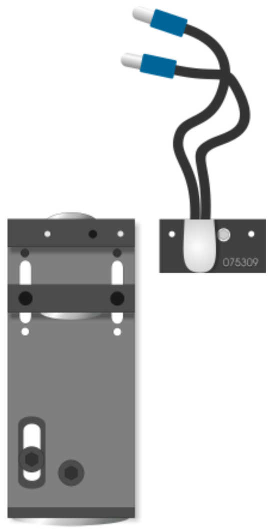


Illumination unit with dismounted LED

Halogen lamp



Illumination unit with lamp light source and mounting screw (arrow)



Illumination unit with dismounted Lamp

Fig. 23 Replacement of the light source

9 Programming

For programming the VLM 250 programming interface (serial interface 1, RS232) should be connected to the serial interface of a PC via an interface cable.
Install the VLMTERM terminal program for Windows 98/2000, NT and XP from the CD included in the scope of delivery. The program operates with 9600 baud, no parity and XON/XOFF software protocol (9600, 8N1, software).

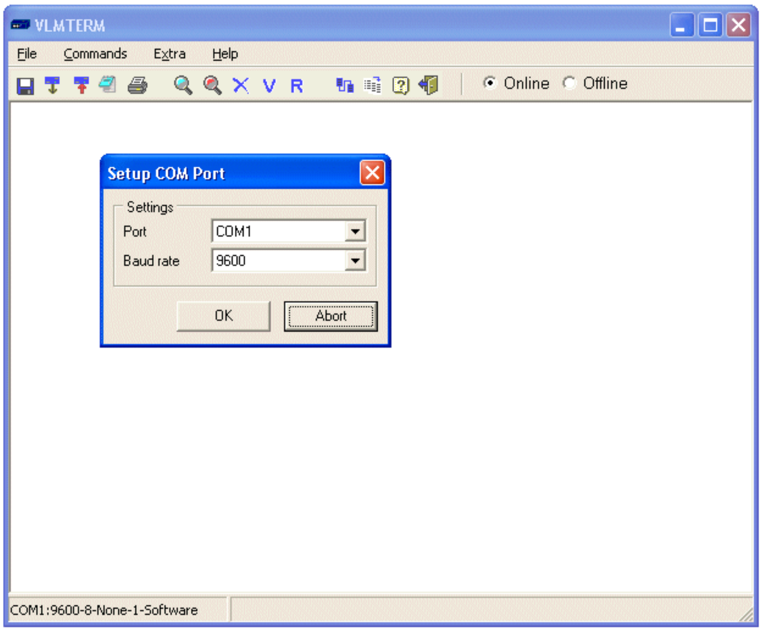


Fig. 24 VLMTERM program

If the settings of the serial interface correspond to those of the terminal program, the VLM 250 responds with the following display after switching on:

VLM 250 ...
(C) by ASTECH Rostock ...
ROM-DATE ...
S/N ...
Option …
Board …
->

If data transfer is switched on at the serial interface 1 (refer to *S1On* command), this information will be suppressed. The details can however be called up at any time with the *Info* command.
The connection has been made to the device and programming can begin. Commands can be entered in abbreviated form. Input as many characters as necessary to make the syntax unique. The VLM 250 does not differentiate for commands between upper and lower case letters. Parameters are separated by space characters. Figures before and after the decimal point are separated by the decimal point. If the command is called without an optional parameter, the current value of this parameter is displayed. All commands described here are listed again in the appendix. The default value specified there may already have been adjusted.

> During the processing of most commands the actual measuring function is interrupted or delayed and the data transmission to serial interface 1 is stopped! This status is indicated by the yellow BUSY LED.

The modified parameters are lost, if they were not stored by **Store* prior to switching off the measuring device.

> F+S Please note that some parameters have a different meaning in connection with devices of the F and S series.

9.1 General commands

9.1.1 The *Average* command

This command serves to set the averaging time for velocity and measuring rate calculation. The internal length calculation is independent of the set averaging time! In devices with integrated FB2 and *Tracking* <> 0, the signal processing upon acceleration is adjusted in the *Average* time base.
Within the time determined by *Average*, all signals (bursts) occurring are compressed into an average value. The average value can then be output to the respective interfaces. The command without parameter indicates the averaging time.
The value selected should be as large as the process dynamic allows. Common values are 10 to 50 ms (100 to 250 ms for VLM 250 of the L series).
A too long *Average* causes a delayed reaction to speed changes. At very high speed changes it can in rare cases lead to signal failures. Is *Average* too short, the measured value fluctuates more, however you can find vibration of the object or measuring device in the measured signal.

Syntax: ***Average*** [n] (n = 5 ... 65535) Unit: ms

> F+S Devices of the F and S series are not equipped for internal length measurement. The value of *Average* should be chosen between 2 and 250 ms. Common values are 5 to 10 ms (50 to 100 ms for VLM 250 of the L series). The *Windows* parameter allows for a floating average across 4 or 8 values. Select *Windows 1* to switch off the floating averaging function.
>
> With devices of the S series, it is possible to use value 0. In this case, the averaging time is determined by the synchronisation clock at the IN2 input (trigger).

9.1.2 The *Calfactor* command

This command allows a calibration factor to be entered manually or to be displayed. The value of the calibration factor is usually close to 1.

Syntax: ***Calf****actor* [n] (n = 0.950000 ... 1.050000)

Calculation of the calibration factor based on the length or velocity indicated by the VLM 250 and the actual values:

$$NeuerKalibrierfaktor = AlterKalibrierfaktor * \frac{TatsächlicherWert}{AngezeigterWert}$$

9.1.3 The *Calibrate* command

This command performs a calibration of velocity or length. For this purpose, 3 parameters must be entered in the following sequence:

c: V - velocity calibration, L - length calibration,
n1: duration of the measurement in the case of velocity calibration in seconds or quantity of objects to be measured in the case of length calibration,
n2: exact value of velocity or length to be calibrated (set value).

For the calibration only amounts are used, i.e. negative velocity or length values are converted into positive values.
During calibration, the measurement progress is indicated in percent and the BUSY LED is yellow. Press the ESC key to abort the process. After the measurement has been completed, the new calibration factor is indicated. The value is saved by **Store* as are all other parameter modifications!

The calibration factor is calculated according to the following formula:

$$Kalibrierfaktor = \frac{Sollwert}{Istwert}$$

Syntax: ***Calib****rate* c, n1, n2 (c = V, L)
(n1 = 1 ... 65535)
(n2 = 0.0001 ... 10000)

Units: n1 - s (seconds) for velocity calibration
n (quantity) for length calibration
n2 - m/s for velocity calibration
m for length calibration

In order to improve the accuracy of the calibration, set *Signalerror* to 1; this ensures that the velocity cannot be 0. Use *Minrate* to define the minimum measuring rate. If the value falls below this, an error message occurs (refer to appendix).

F+S Devices of the F and S series do not feature parameter c. In these devices, a velocity calibration is completed by default.

9.1.4 The *Chold* command

This command is used to freeze the control circuits for adjustment to the brightness of the material surface and/or the pulse outputs 1 and 2, depending on the level at the 'IN2' trigger input (*Chold 2* or *3*, level see command *Trigger*) or only the pulse outputs on H-level at ´IN1´ (*Chold 4*). There are different kinds of application:

Application for individual parts measurement only:
With the *Chold 1* or *3* command, the control circuits can be blocked for the period in which no part is located in the measuring window (trigger level inactive), i.e. the values for exposure time and light source brightness valid at the end of a part are freezeed until the beginning of the next part. If the individual parts have different colours or surface properties, *Chold* should be deactivated.
Chold 3 can be used in connection with individual part measurements in order to freeze the pulse outputs 1 and 2 while the control circuits are freezeed. This function is useful, if the pulse outputs are used for the control of the removal velocity. This ensures that the material is moved on at constant velocity, even it is not located under the measuring device.

Syntax: ***Chold*** [n] (n=0 - off, 1 and 3 - n)

Application example: test lines and flying saws:
For *Chold 2* or *3*, the pulse outputs 1 (standard pulse output at AB2) and output 2 (first IF2 pulse output) are freezed on an inactive trigger level. In connection with flying saws, with clamping (saw control is connected to pulse outputs 1 or 2), this function can be used to prevent subsequent regulation when the clamping is active (i.e. cutting length is determined). This prevents technical control errors.
As already mentioned, another application is the freeze of pulse outputs in order to get a constant removal velocity after the measuring object has left the measuring window.

Syntax: ***Chold*** [n] (n=0 - off, 2 and 3 - on)
Pulse output 3 (second IF2 pulse output) issues the currently measured velocity while the other two pulse outputs are freezeed. It can thus be used for the connection of testing equipment. The analog output and the serial interface are not affected by this.

Application example: test lines with internal length measurement
For *Chold 4*, the pulse outputs 1 (default pulse output at AB) and 2 (first IF2 pulse output) are freezeed on H-level at ´IN1´ in order to achieve a constant removal velocity after the measuring object has left the measuring window.
The trigger input ´IN2´ (see command Trigger) control now the internal length measurement independent of the hold function is using input ´IN1´. With control of the length measurement by using multiple photoelectric sensors linked to input 'IN2' (e.g. light barriers Controller LBC2) the hold function for pulse outputs can only be realized witch *Chold 4* and 'IN1'.
A simultaneous external directional control on 'IN1' and parameter 2, 3, 7 and 8 for *Direction* with *Chold 4* is not appropriate.

Syntax: ***Chold*** [4] (n=0 - off, 4 - on)

9.1.5 The *Clock* command

Clock displays and sets the time for devices with a real time clock (RTC). *Clock* without parameter displays the time in the hh:mm:ss format. The real time clock is optionally available.

Syntax: ***Clock*** [hh:mm:[ss]]

9.1.6 The *Date* command

Date displays and sets the date for devices with a real time clock (RTC). *Date* without parameter displays the date in the dd.mm.yy format. The real time clock is optionally available.

Syntax: ***Date*** [dd,mm,yy]

9.1.7 The *Direction* command

This command determines the source of the directional switch-over. If the direction of movement of the measuring object and the direction specified by an arrow on the device coincide, the movement is defined as forwards. For units without the optional direction detection, *Direction 4* is not permissible!

⚠	If a direction is incorrectly set this causes corrupt messages. The error can increase with greater speed!

The codes 5, 6, 7 and 8 have the same function as the codes 0, 1, 2 and 3 (see table 7). Please note that, in the case of *Direction 4* to *8*, the velocity range and technical data change (see chapter " Device models").
The use of the codes 5, 6, 7 and 8 can be useful to adjust the optical resolution of the device to the surface of the measured object. Thus, a higher signal rate can be achieved in the case of rough structures (e.g. rough steel, wood, paper with back light illumination). At higher velocities, they might even be mandatory (see chapter "Device models").

Syntax: ***Direction*** [n] (n = 0 ... 8)

Code	Meaning		
0	Forward		
1	Back		
2	External to 'IN1'	-40 to + 0.3 mA: +5 to + 40 mA:	forward back
3	External to 'IN1'	-40 to + 0.3 mA: +5 to + 40 mA:	back forward
4	Automatic, double grid constant (device with direction detection, optional)		
5	As 0, forward, double grid constant (see above)		
6	As 1, back, double grid constant		
7	As 2, external to 'IN1', external, doubled grid constant		
8	As 3, external to 'IN1', external negated, doubled grid constant		

Table 8 Direction settings

For devices with FB1 filter board (command *INFO* shows no FB2), the maximum frequency of the filter board is issued when new values for *VMAX* and *DIR* are entered. If the displayed frequency does not correspond to that printed on the FB1 board, adjust *VMAX* until the two frequencies coincide.

9.1.8 The *Error* command

This command indicates and then deletes the last error code (refer to appendix). Code 'E00 No ERROR' indicates that there is no error. In the event of fatal errors starting from 'E40', the device must be repaired.

Syntax: ***Error***

9.1.9 The *Help* command

This command outputs a help text containing a list of all commands with short explanations. The output can be interrupted with 'Escape' (ESC) and continued by pressing any other key.

Syntax: ***Help*** or ***?***

9.1.10 The *Holdtime* command

This command sets the hold time, which is to be bridged in the case of signal failures, i.e. the last velocity value is output at the appropriate interfaces over this time. If the signal fails for longer than *Holdtime*, a zero or an error is output (refer to *Signalerror*). A signal failure is indicated by a red signal LED after the hold time has expired.

⚠	Normally, *Holdtime* should be greater or equal to *Average*. Common values for *Holdtime* are 50 to 1000 ms. By using the internal length measurement *Holdtime* must be less than the minimum time interval between two individual parts!

Syntax: ***Hold****time* [n] (n = 10 ... 65535) Unit: ms

9.1.11 The *Info* command

This command displays the device information with software version and serial number, as after switching on the unit. The available software options (section starting with "Option") and the detected assemblies (starting with "Board") are displayed.

Syntax: ***Info***

9.1.12 The *Minrate* command

The measuring rate monitoring function can be activated by means of the *Minrate* command and a parameter greater than 0. *Minrate* without parameter returns the set value.
If the set measuring rate drops below this value, the signal LED is red and the OUT3 (status) output is opened (see chapter "Outputs").
The *Minrate* can for example be used to program a dirt check of the windows. Useful values for *Minrate* are 5 to 20. The measuring rate is always monitored after the time set by the *Average* command. In the case of low velocities, ensure that the *Average* is not set too low. Note that the OUT3 output is open, also in case of a material standstill or if no material is located in the working range. Then, the signal LED is red.
If the measuring rate monitoring is activated and *Signalerror* set to 1, the measuring value is marked as incorrect if the value drops below the minimum measuring rate; in this case, E.EEE might be issued (see *Signalerror* command).

When switching on the ECC control (see *ECCOn* command), the measuring rate monitoring function is deactivated with *Minrate*.

Syntax: ***Min**rate* [n] (n = 0 - off, n = 1 ... 99 - on)

9.1.13 The *Number* command

This command sets the object counter to value n. *Number* without parameter returns the counter value. Switching off the unit resets the counter to zero. Each trigger event increases the counter by one (see *Trigger* command).
The object counter is used to measure individual parts for the parts count.

Syntax: ***Num**ber* [n] (0 ... 65535)

9.1.14 The *Parameter* command

Lists the current setting of the parameters. There are separate commands for the parameter display of the output channels.

Syntax: ***Para**meter*

9.1.15 The *Readpara* command

This command reads out the parameter setting of the device. The following commands are automatically executed: *Serialnumber, Parameter, PInc, PAn, PAl, PECC, POff, PS1* and *PS2*. The command is used by the VLMTERM program in order to read the parameter values (menu option 'Read parameters'). The stored parameter file can be used for reconfiguration, as the parameters can be written to the measuring devices with the 'Write parameters' command, thus facilitating the fast configuration of the VLM 250 (save values with **Store*).

Syntax: ***Read**para*

9.1.16 The *REM* command

All following characters are ignored. *REM* is used to insert comment lines into parameter files, which can be sent via the programming interface to the measuring device to program the VLM 250.
The characters ';' (semicolon), '*S/N*' and '->' have the same function as *REM*. It is thus possible to send parameter settings read by means of the *Readpara* command back to the device.

Syntax: ***REM*** [s]

9.1.17 The *Serialnumber* command

This command displays the serial number of the unit.

Syntax: ***Serial**number*

9.1.18 The *Signalerror* command

This command influences the error handling in the case of signal failures, the parameter 1 causing the output of an error after a signal failure and the exceeding of *Holdtime*, i.e. the velocity and length values are marked as incorrect, and E.EEE is output for example. The same effect is achieved with switched-on measuring rate monitoring (refer to *Minrate* command), if the value falls below the selected measuring rate.
In the case of parameter 0 no error is recognised, but instead the velocity is output as zero and length integration is stopped. This also allows a standstill of the measuring object.
The Signal LED and the status output (OUT3) are not influenced by the *Signalerror* command.

Syntax: ***Sig***_nalerror_ [n] (n = 0, 1)

Code	Value
0	Signal failures permitted
1	Error, if no signal

Table 9 Signal error

9.1.19 The *Start* command

The effect of the *Start* command depends on the *Trigger* command, which determines whether an individual part measurement or a continuous measurement occur. For the measuring of individual parts, the length integration is started from length value zero. With continuous measurement, the length integration is stopped and restarted.

Syntax: ***Start***

9.1.20 The *Stop* command

The effect depends on the *Trigger* command. Only in the case of an individual part measurement is the integration of the length stopped.

Syntax: ***Stop***

F+S The commands *Start* and *Stop* are not available with devices of the F and S series, as they do not include an integrated length measuring system.

9.1.21 The *Temperature* command

The temperature inside the device is indicated in °C. If the temperature exceeds 75 °C, error E31 "Over temperature detected!" is triggered (see *Error* command).

Syntax: ***Temp***_erature_

9.1.22 The *Test* command

This command displays a number of values, which provide information about the system functionality. The following values are displayed: velocity, length, measuring rate, IN1, IN2 inputs and lighting (incl. "Over" for overdrive of the sensor). The display is updated every 333 ms. During the test procedure, the S1 output is blocked!
The procedure can be aborted with ESC, otherwise the command terminates automatically after 60 seconds. The automatic abort can be stopped by specifying the *C* parameters.

```
-> TEST
V(m/s)        L (m) RATE IN1 IN2 EXPOSURE
-99.999 -99999.999  99   1   0    3
->
```

Fig. 25 Screen text of *Test* command

Syntax: ***Test*** [C] (Parameter C suppresses the automatic abort)

The test command can possibly delay the output to other channels. Therefore, it should only be called when necessary.

F+S With devices of the F and S series, the value for length is omitted, as these devices are not equipped with an integrated length measuring system.

9.1.23 The *TestAn* command

This command displays a number of values, which provide information about the analogue output. The following values are displayed continually: velocity, measuring rate, output current in percent und load. With no load is connected (max. 500 ohms) or no analogue interface card is installed the value for load is zero.
The display is updated every 333 ms. During the test procedure, the S1 output is blocked!
The procedure can be aborted with ESC.

```
-> TESTAN
ANON       1
ANMIN      0.000
ANMAX     10.000
  V(m/s)   Rate  IOUT(%) LOAD
   3.623    98    36.2     1
->
```

Fig. 26 Screen text of *TestAn* command

Syntax: ***TestAn***

The test command can possibly delay the output to other channels. Therefore, it should only be called when necessary.

9.1.24 The *Tracking* command

The *Tracking* command determines the type of adjustment of the signal processing to the current speed. It is only effective in devices equipped with a FB2 filter board or higher (an installed FB2 filter board is listed in the initial screen text after switching on the device; alternatively, use the *Info* command to view a list of mounted components).

Syntax: ***Tracking*** [n] (n = 0, 1, 2, 3. 4)

> For proper measuring, ensure that the settings for direction made with the *Direction* command and the maximum plant velocity configured with the *VMax* command are correct.

Default settings: *Tracking 1*. ***Tracking 1* is suitable for most measuring tasks**. Other tracking values should be chosen only for special applications. For details, refer to the value table for *Tracking.*

Code	Meaning	Typical application
0	Broadband signal processing (corresponds to previous model FB1)	**Special applications**, e.g. individual part measuring with long hold time and (!) high acceleration (*Holdtime is* greater than the distance between two parts!)
1	In line with velocity from *VMax* / 8; up to this point: broadband	**Continuous measurement with high acceleration from zero** (e.g. conveyor units for metals); suitable for most measuring tasks
2	In line with velocity from zero	**Individual part measuring or continuous measurement, with low acceleration from zero** (measuring object enters unit at a velocity greater than zero, or is slowly accelerated from zero)
3	In line with velocity from VMax / 8; with additional search function for poor signals	**Continuous measurement for unstructured non-metallic surfaces with high acceleration from zero** (e.g. conveyor plants for plastics or coated materials, reeling machines for papers)
4	In line with velocity from zero; with additional search function for poor signals	**Continuous processes for non-structured non-metallic surfaces** (extruders, paper machines)

Table 10 Parameters for *Tracking*

9.1.25 The *Trigger* command

The *Trigger* command serves to determine the type of trigger signal. Each trigger event increases the object counter by 1 (refer to *Number* command).

Syntax: ***Trigger*** [n] (n = 0, 1, 2, 3)

Code	Trigger event at	Level at 'IN2'	Application
0	H level	high: +5 to +40 mA	Individual part measurement; Command *CHOLD*
1	L level	low: -40 to + 0.3 mA	Individual part measurement; Command *CHOLD*
2	L/H edge	Low/high edge	Continuous measurement
3	H/L edge	High/low edge	Continuous measurement

Table 11 Trigger type

Individual part:

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

Continuous measurement:

Measurements are made continuously. A trigger edge stops the measurement and simultaneously triggers the next measurement.

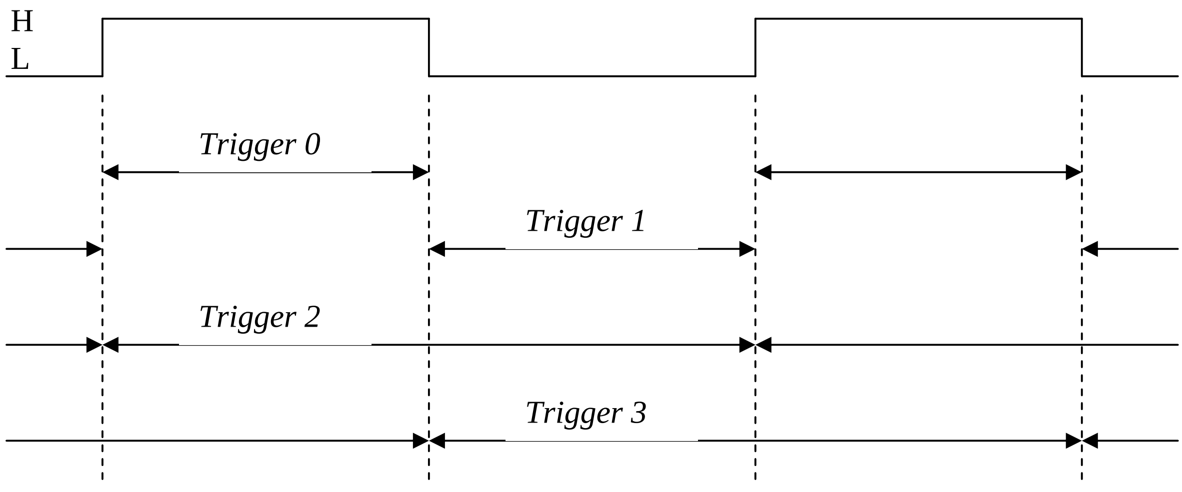


Fig. 27 Active length measurement respectively active trigger signal based on command *Trigger* and 'IN2' level

Together with a stop of the length measurement, the relevant output channel is updated in the case of a trigger synchronous output (see commands *ANOutput*, *INCOutput*, *S1Output*).

9.1.26 The *VMax* command

The *VMax* command is used to adjust the maximum plant velocity in m/s. For optimised operation, the value for ***VMax* must be adjusted to the actual conditions**. To ensure that the automatic adjustments are made accurately, it should not be too high or too low.

Syntax: ***VM**ax* [n] (n = 0.01 … 99.99 m/s)

H	For proper measuring, ensure that the settings for direction made with the *Direction* command and the maximum plant velocity configured with the *VMax* command are correct.

For devices with FB1 filter board (command *INFO* shows no FB2), the maximum frequency of the filter board is issued when new values for *VMAX* and *DIR* are entered. If the displayed frequency does not correspond to that printed on the FB1 board, adjust *VMAX* until the two frequencies coincide.

!	Do not operate the measuring devices at velocities that are above the range specified in the data sheet, as this could result in inaccurate readings. Please note that the maximum permissible velocity is directly affected by the *Direction* parameter. The *Vmax* parameter must thus be adjusted to match the actual maximum plant velocity. A safety margin of 10% is already taken into account in the device.

9.2 Analog output

In the case of an analog output (optional IF1/IF2 interface card with AI option) an analog current can be output. A digital/analog converter with 16 bit resolution is used. The range for the output of measuring values is set by the *ANMin* and *ANMax* commands. *ANMin* determines the value at which the minimum current value is output. *ANMax* applies accordingly to the maximum value.
Example: with *ANMin = 0* and *ANMax = 1* the following parameters result:

Current	Velocity	Length	Measuring rate	Object counter value
4 mA	0 m/s	0 m	0	0
12 mA	0.5 m/s	0.5 m	50	500
20 mA	1 m/s	1 m	100	1000

Table 12 Example of analog output (*ANMin = 0* and *ANMax = 1*)

If the current measuring value is less than *ANMin*, the lowest current value is output, if greater than *ANMax*, the highest current value is output. In the case of a missing measuring signal, the lowest value is output. The output is updated either after reaching *Average* or after a trigger event (refer to *ANOutput* command).

9.2.1 The *ANOn* command

This command switches the analog output on or off.

Syntax: ***ANOn*** [n] (n = 0 - off, 1 - on)

9.2.2 The *ANMin* command

This command allows for the setting of the minimum value for analog output.

Syntax: ***ANMin*** [n] (n = $-2^{30} * 10^{-3}$ ... $2^{30} * 10^{-3}$)

9.2.3 The *ANMax* command

This command allows for the setting of the maximum value for the analog output.

Syntax: ***ANMax*** [n] (n = $-2^{30} * 10^{-3}$ ... $2^{30} * 10^{-3}$)

H	Depending on the individual direction it can become necessary to set a negative value for *ANMAX*, if e.g. the device is assembled in the opposite direction to the direction of movement. Use the *Test* command to check the sign character.

9.2.4 The *ANOutput* command

This command determines whether the output value is updated after the time interval set by the *Average* command (*ANOutput 0*, refer to *Average* command) or when a trigger event occurs (*ANOutput 1*, refer to *Trigger* command).

Syntax: ***ANOutput*** [n] (n = 0, 1)

9.2.5 The *ANValue* command

This command determines whether velocity, length, number of objects or the measuring rate should be measured.

Syntax: ***ANV**alue* [c] (c = V, L, N, R)

If the option "Analog Output for Exposure" exists *) and *ANValue R* is set, at the velocity of zero the value of the exposure time is output to the analog output. This function can be used as an adjustment help in pipe and wire measurement applications.

*) The message for option "Analog Output for Exposure" is output via the S1 interface when the device is switched on.

9.2.6 The *PAN* command

Indicates all parameters of the analog output.

Syntax: ***PAN***

9.2.7 Example of analog output

In the following diagram output 4 to 20 mA is represented in a velocity range of –3 up to +3 m/s at different values for *ANMIN* and *ANMAX*. The velocity is output to the analog output (*ANValue V*).

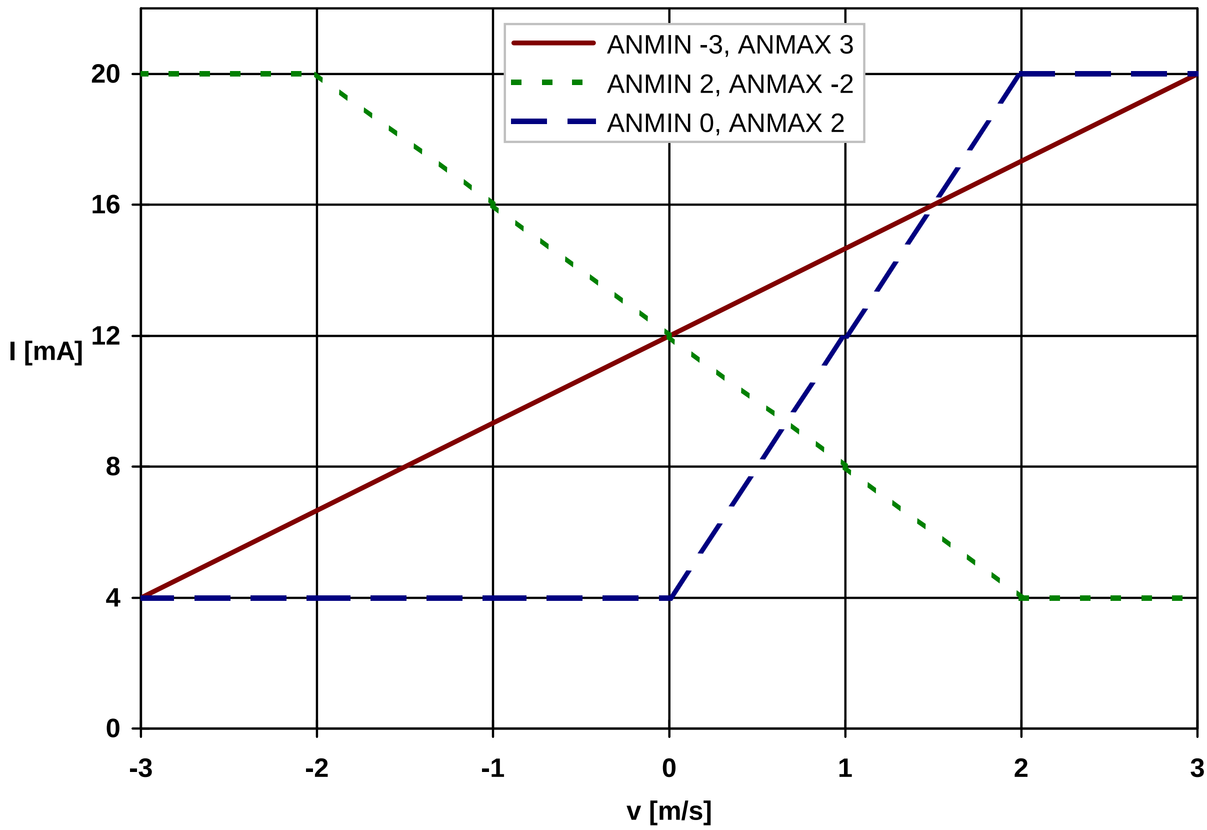


Fig. 28 Examples of analog output

⚠ I	Currents less than or greater than the range determined by the hardware (e.g. 4 to 20 mA) are not possible. If e.g. the value to be output exceeds *ANMAX*, the maximum current value is output.

9.3 ECC control

A monitoring of the measuring rate and the velocity with hysteresis can be realized via the ECC control. The ECC control represents an extension of the measuring rate monitoring with the *Minrate* command. It is required when using the ECC2 interface card or the external ECC1 switched-over device.
The ECC2 card or the external ECC1 device allow the connection of an external shaft encoder or a second VLM 250 velocity measuring device. When falling below the value of a selectable velocity or measuring rate the pulse output is switched over to the shaft encoder or the second measuring device. The switch back occurs, when velocity and measuring rate are again greater than further values that can be set.
Velocity and measuring rate are observed after reaching the average time (*Average* parameter). The switch-over occurs via the status signal. The status output 'OUT3' being updated every 10 ms. If the *Holdtime* has expired, the status signal is immediately switched. When using the ECC-control *Average* should be set to 10 ms, in order to ensure a fast switch-over.

9.3.1 The *ECCOn* command

This command switches the ECC control on or off. When activating the ECC control the measuring rate monitoring is automatically deactivated (refer to *Minrate* command).

Syntax: ***ECCOn*** [n] (n = 0 - off, 1 - on)

9.3.2 The *ECCR1* command

This command determines the minimum measuring rate at which switch-over to the external device occurs. Common values are 3 to 10.

Syntax: ***ECCR1*** [n] (n = 0 ... 99)

9.3.3 The *ECCR2* command

This command determines the measuring rate, at which switch back reoccurs. Common values are 8 to 20. The value must be greater than *ECCR1*.

Syntax: ***ECCR2*** [n] (n = 0 ... 99)

9.3.4 The *ECCV1* command

This command determines the minimum velocity at which switch-over to the external unit occurs. Common values are 0.05 to 0.2 m/s.

Syntax: ***ECCV1*** [n] (n = 0 ... $2^{31} * 10^{-4}$) Unit m/s

9.3.5 The *ECCV2* command

This command determines the velocity (amount), at which switch back reoccurs. Common values are 0.1 to 0.3 m/s. The value must be greater than *ECCV1*.

Syntax: ***ECCV2*** [n] (n = 0.0001 ... $2^{31} * 10^{-4}$) Unit m/s

9.3.6 The *PECC* command

Indicates all parameters of the ECC control.

Syntax: ***PECC***

9.4 Pulse output

The pulse output provides two clock sequences A and B, with a phase of 90° (max. phase deviation ± 10°) and with a mark-space ratio of 1:1 at the OUT1 and OUT2 outputs, electrically isolated by optical couplers. The phase shift can be controlled by the 'IN1' directional input or the internal directional identification between +90° or -90°.
Two additional pulse outputs, each with 2 phases (A, B) are optional on the interface cards of the IF2 series.
The output is updated at the next pulse edge either after reaching *Average* or after a trigger event (refer to *INCOutput* command).

9.4.1 The *INCOn* command

This command switches the pulse output on or off. When activating the pulse output the alarm output is automatically deactivated.

Syntax: ***INCOn*** [n] (n = 0 - off, 1 – on); (with IF2 series n= 1, 2, 3)

In devices with the IF2 or IF2F interface cards the n = 2 parameter means that the additional two pulse outputs are switched-on and the standard pulse output is switched-off. All 3 pulse outputs are switched-on with n = 3.

⚠	In order to minimise the load of micro processor unnecessary output channel should be switched off!

9.4.2 The *INCFactor* command

This command allows a scaling factor to be set. 100 Hz are output with a factor of 1, if the velocity is 0.1 m/s or the measuring rate 100 (refer to *INCValue* and the Programming Examples in appendix).

Syntax: ***INCFactor*** [n] (n = 0.000001 ... $2^{31} * 10^{-6}$; from Firmware 7.3 also neg.)

The possible output frequency for the pulse output ranges from 0.4 Hz to 25 kHz. If the value to be output is smaller than 0.4 Hz, no pulses are issued!

In the case of devices with the optional IF2 series interface cards 3 parameters are possible.

Syntax IF2: ***INCFactor*** [n1] [n2] [n3] (n = 0.000001 ... $2^{31} * 10^{-6}$; from V 7.3 also neg.)

The n1 up to n3 parameters set the scaling factors for the three pulse outputs. n2 and n3 are the factors for the two additional pulse outputs (IF2 interface card series). The possible frequency range of the interface card must be observed.
The additional pulse outputs always output velocity values, even if *INCValue R* is set for example (refer to *INCValue*). In this case the measuring rate is output to the standard pulse output (OUT1/OUT2) and the velocity to the high resolution pulse outputs (OUT4 to OUT7).

From Firmware Version 7.3 the *INCFactor* value could be also negative. This will invert the phase shift of the pulses (e.g. if *Direction 1* or *5* is set caused by inverse mounting).

Example without IF2: ***INCFactor*** -1.5 With IF2: ***INCFactor*** -1 -10 -12.3456

9.4.3 The *INCOutput* command

This command determines whether the output value should be updated after the time interval specified by *Average* (*INCOutput 0*, refer to *Average* command) or by a trigger event (*INCOutput 1*, refer to *Trigger* command).

Syntax: ***INCOut****put* [n] (n = 0, 1)

9.4.4 The *INCValue* command

This command determines whether the velocity or the measuring rate should be output to OUT1/2.

Syntax: ***INCV****alue* [c] (c = V, R)

> When using the IF2 series interface cards the velocity is output to the additional pulse outputs independent of the set value for *INCValue*.

9.4.5 The *PINC* command

Indicates all parameters of the pulse output.

Syntax: ***PINC***

9.5 Output via serial interface 1

9.5.1 The *S1On* command

This command switches the data output at the serial interface on or off. The data output is interrupted during command input and processing!

Syntax: ***S1O****n* [n] (n = 0 - off, 1 - on)

9.5.2 The *S1Format* command

Apart from programming, the serial interface 1 can be used for the output of data. The transfer format can be preset within wide limits. Data is output in ASCII format. The individual parameters can be separated either with commas or space characters. However, the separators between the parameters may also be omitted.

Syntax: ***S1F****ormat [s]* (s –parameter string, max. 32 characters)

Parameter	Meaning
V	Inserts the velocity in m/s
L	Inserts the length in m
L+x	Adds the offset x to the length and inserts it in m (especially used for individual part measurement with the LBC2 assembly)
N	Inserts the status of the object counter
'... '	Inserts the string enclosed in apostrophes
a[*x][:n[:m]]	Formats the value a (V, L, R…) multiplied by x as a figure with n digits and m digits after the decimal point, [3]
a[*x]:H[:n]	Outputs the value a as a hexadecimal figure with n digits[4]
S	24 Bit velocity (sign + 6 nibble, hexadecimal output, decimal 123456 means 1.23456 m/s), <SPACE>, 12 Bit measurement rate *10 (3 nibble)[5]
Z	like S, additionally error number 2 nibble
D	Inserts the current date (e.g. 31.12.99), only for units with RTC
C	Inserts the current time (e.g. 12:50:28), only for units with RTC
R	Inserts the measuring rate
E	Inserts the exposure, 0 to 14 or OVER (as in *Test* command)
B	Inserts the number of bursts since the last trigger event
T 'str'	Changes the end identifier of the output string from CR LF to 'str'
H	Inserts the temperature in °C
X	Inserts the last error number (see also *Error* command)

Table 13 Parameter for output formatting at S1

[3] If no positions are specified in the case of a numerical output, length and velocity are output with three digits after the decimal point in the standard unit (refer to appendix). All other values are output without digits after the decimal point.

[4] The hexadecimal output in a:H:n format is output with first a sign character (minus sign or space), afterwards n decimal digits. Every byte needs two decimal digits. Without parameter n, 9 characters are output for 4 bytes and the sign character (32 bit number). Leading zeros are not suppressed.

[5] The special format S realises a fast output of velocity and measurement rate.

The hexadecimal output should be preferred, if values are to be output in a time base faster than 50 ms (refer to *S1Time*), as the conversion in hexadecimal digits requires considerably less calculation time. If time base < 20 ms use only format S.

Without format indication the output is left-justified, leading zeros are suppressed, except in the case of hexadecimal output. In the case of format specifications space characters are used as fillers. If the value exceeds the possible number of the format specifications, the necessary number of places is output.
The decimal point and a possibly existing sign character (only for negative figures) also occupy one place.

The standard end identifier of the output string is CR LF (13 10 or 0DH 0AH). With the parameter T it is possible to replace the end identifier on the following string. The characters are enclosed in apostrophes or specified by the appropriate ASCII Code (for example *T 'A' 10* for 'A' LF or *T42* for '*' or *T 13 10* for CR LF). A maximum of two characters is permitted. The ASCII code must always be specified in decimals.

9.5.3 The *S1Interface* command

The *S1Interface* command configures the serial interface. Baud rate, type of protocol and parity are set. All parameters can be set individually or simultaneously. The sequence of parameters is of no significance. All unspecified parameters are reset to the preset values (no protocol, no parity). The format is determined as 8 data bits and 1 stop bit. If the parity is activated, the 8th data bit is replaced by the parity bit. A parity error is indicated by "E11 S1 parity" and a buffer overflow by "E12 S1 buffer overflow" (see Error messages in the appendix).

Syntax: ***S1I****nterface* [n] [c] [c] (n, c see below)

For the Baud rate the following values are possible:
n: 0 *); 600; 1200; 2400; 4800; 9600; 19200; 38400

Type of protocol	Code c1	Parity	Code c2
No protocol	- **)	No parity	N
Software protocol	X	Odd parity	O
(XON/XOFF codes)		Even parity	E

Table 14 RS 232 interface settings

*) Automatic baud rate detection
**) No parameter indicated

If a baud rate of 0 is entered, the VLM 250 automatically detects the baud rate after switching on. This happens however only, if the first received signals is CR (0DH).

9.5.4 The *S1Output* command

This command determines whether the measuring value should be sent either within a selectable time interval (refer to *S1Time* command), when a trigger event occurs (refer to *Trigger* command) or at each burst.

Syntax: ***S1Out****put* [n] (n = 0, 1, 2)

9.5.5 The *S1Time* command

This command determines the time interval in ms, in which the data is to be output to interface S1.
During the velocity measurement, all values occurring (bursts) are averaged in the averaging time (refer to *Average* command). The data are then output at the same intervals as the time set by *S1Time*.

Syntax: ***S1****Time* [n] (n = 5 ... 65535) Unit: ms

9.5.6 The *PS1* command

Indicates all parameters of the serial interface 1.

Syntax: ***PS1***

9.6 Output via serial interface 2

The serial interface 2 (optional interface card IF1 or ECC2) can be used for the output of data in the same way as the serial interface 1. All commands apply accordingly, provided that parameter S1 is replaced with S2.

The serial interface 2 can also be used to input command (identical to serial interface 1). The echo is always on the interface 1 regardless of the input is serial interface 1 or 2. A simultaneous typing commands on both interfaces must be avoided!

The command input can switched off by the parameter T for *S2Format*. This is absolutely necessary if a RS485 (two wires connection) is used, otherwise the output strings would be interpreted as commands.

Syntax: ***S2F****ormat s T 10 13* (s – Zeichenkette, 10 13 entsprechen CR LF)

⚠	If the S2 interface is switched to RS485 the command input must switched off by using the parameter *T* for *S2Format*, otherwise the output strings would be interpreted as commands.

In the case of the *S2Interface* command it must be observed that the baud rate is limited by the hardware depending on the interface used. The baud rate of the serial interface 2 can be set as follows: 2400; 4800; 9600; 19200; 38400 **and 57600**. The *H* parameter can be specified for the *S2Interface* command, this activates the handshake lines (only option IF1 with RS 232).

9.7 Offline measurement

9.7.1 The *OFFLine* command

In the *OFFLine* operating mode, the measuring values (as described before) are not output to an interface, but instead written into the internal memory. The operating mode serves to create the velocity/time processes and to accommodate very fast processes.

> During the offline measurement none of the output channels are updated, i.e. pulse, analog and serial specifications are not possible!

The *OFFLine* command starts the offline measurement. The optional T parameter causes a trigger event to be awaited (refer to *Trigger* command). A maximum of 15296 values (64 bit each) can be accommodated. Each value is filed as a time and measuring value (32 bits each). The BUSY LED (yellow) is on during the measurement. The measured data is only overwritten after a restart. In the event of a power failure, the measurements are lost. A premature abort is possible with ESC. An abort with ESC or at full memory causes an error message to be output (refer to Error messages in appendix).

Syntax: ***OFFL***_ine_ [T] T - wait for trigger event

9.7.2 The *OFFactor* command

This command can be used to adjust a scaling factor. It is thus for example possible to use the value 60 for the output of a measuring velocity (*OFFValue V*) in m/min. The scaling factor is however only taken into consideration in conjunction with output with *OFFRead*.

Syntax: ***OFFact***_or_ [n] (n = 0.000001 ... $2^{31} * 10^{-6}$)

9.7.3 The *OFFMeasure* command

This command sets the duration of the offline measurement in seconds.

Syntax: ***OFFM***_easure_ [n] (n = 1 ... 65535) Unit: s

9.7.4 The *OFFOutput* command

This command determines whether the measuring value is to be output to the memory in a selectable time interval (refer to *OFFTime* command), when a trigger event occurs (refer to *Trigger* command) or at each burst.

Syntax: ***OFFOut***_put_ [n] (n = 0, 1, 2)

9.7.5 The *OFFRead* command

This command outputs the measured data to serial interface 1 after an offline measurement . The reading format is fixed, i.e. the time since the measurement start is output in ms and the value with maximum resolution. The two figures are separated by a space character. A new line (CR LF) is added behind the value.
If no measurement has yet been started, a read attempt causes an error message (refer to appendix).

Syntax: ***OFFR***_ead_

In the case of premature abort with ESC an error message is output (refer to appendix).

9.7.6 The *OFFTime* command

This command determines the time interval in ms, in which the data is to be saved (refer also to *OFFOutput* command). During the velocity measurement all measuring data (bursts) captured within this time interval are compressed into an average and saved. The time set by the *Average* command is not taken into consideration in offline mode!

Syntax: ***OFFT**ime* [n] (n = 2 ... 65535) Unit: ms

9.7.7 The *OFFValue* command

This command determines whether velocity, length, number of objects or the measuring rate should be measured.

Syntax: ***OFFV**alue* [c] (c = V, L, N, R)

9.7.8 The *POFF* command

Indicates all parameters for the offline measurement.

Syntax: ***POFF***

9.8 Read commands

The read commands serve to asynchronously read out the measuring values. They are especially quickly processed by the command interpreter. All read commands are entered with a letter and executed according to the following CR (0AH). The value is output with fixed formatting (see below) and terminated with CR LF (0DH 0AH).

Command	Return value	Unit	Decimals	Example
V	Velocity	m/s	5	-1.23456
L	Length	m	4	1234.5678
R	Measuring rate	-	0	45
N	Object counter	-	0	123
F	Frequency of the last burst	kHz	2	1234.45

Table 15 Read commands

The *Start* command can be abbreviated by the letter ***S*** in order to start a new length measurement.

9.9 System commands

During the execution of the system commands the actual measurement is interrupted!

9.9.1 The _*Password_ command

The system command _*Store_ is protected by a password, which can be changed by the _*Password_ command. The password consists of up to eight characters, including upper and lower case letters, figures, special and space characters, which are represented by asterisks when input. By inputting a single asterisk, the password protection is deactivated. The input can be aborted with ENTER before inputting the first character. Three failed attempts to input a password will result in the message 'Illegal use!'. 60 seconds must then elapse before the next command is accepted.
When entering the password no distinction is made between upper and lower case letters. The factory-set password is '**WEGA**'.

Syntax: **_*Pass_**_word_

9.9.2 The _*Restart_ command

This command releases a cold start. The device carries out the initialising in the same way as it does after switching-on. The parameters are reset to the values last saved by the _*Store_ command. The command must be written out.

Syntax: **_*Restart_**

9.9.3 The _*Restore_ command

This command releases a warm start. This causes the device to be reset to the parameters last saved by the _*Store_ command.

Syntax: **_*Resto_**_re_

9.9.4 The _*Simulation_ command

The command serves to simulate velocity and measuring rate to the outputs of the measuring device in the case of synchronous output (as of firmware V 6.5). It interrupts the measurement! The n1 parameter must be specified for the velocity. The second parameter for the measuring rate, n2, is optional.

Syntax: **_* Simul_**_ation_ n1 [n2] (n1 = 0 ... 100.000; velocity in m/s)
(n2 = 0 ... 99; measuring rate)

The following outputs are supported during the simulation: pulse output, analog output, output to interface S2 incl. IFPROFI and IFETHER, rate monitoring with _Minrate_ and ECC control.
The simulation is aborted with ESC.

9.9.5 The ******Standby* command

The command is used to set the device into the standby mode. The measurement function is stopped and the light source is turned off.
The command represents an H-level at the input ‘IN0 ‘.

Syntax: **** Standby***

The standby mode is aborted with ESC..

9.9.6 The **Store* command

The command saves the current settings. These settings remain stored when the device is switched off. After switching on the device or executing the **Restore* command, the last settings saved by **Store* are loaded. The command is protected by a password.
When entering the password no distinction is made between upper and lower case letters. The factory-set password is '**WEGA**'.

Syntax: ****Store***

9.9.7 The **Update* command

The command changes into the boot loader. The boot loader can update the firmware of the device. The boot loader shows the necessary steps.

There is a special device file required (Update file *. hex), only the manufacturer of the equipment can be generated on hand serial number.

Syntax: ****Update***

	We recommend the use of the program VLMTERM to perform a new firmware. About the command “File | Update Firmware” update can quickly and safely executed. It is only necessary the selection of update file.

9.10 The VLM 250 F and S device series

F+S	Compared with the description of the previous chapters the meaning of some commands in the F or S device series are different. Important modifications are marked with *) in the following section.

9.10.1 Operating principle of the F series

The F series was developed for highly dynamic velocity measurements in the production process and is especially suitable for use in closed control loops.
The F series has been extended to include an averaging processor (ASIC). This calculates the weighted gliding average value *) according to the signal quality via the frequency of the single bursts. A ring memory with 4 or 8 averaging cycles is used (see figure 18). The temporal length of a cycle is represented in figure 18 as a section and corresponds to the averaging time. The incoming individual values are asynchronously added, the result is synchronously read out once per *Average*. This allows an updating rate for the outputs 8 times higher *) than that of the VLM 250 standard. The internal calculation of the length is not possible *).

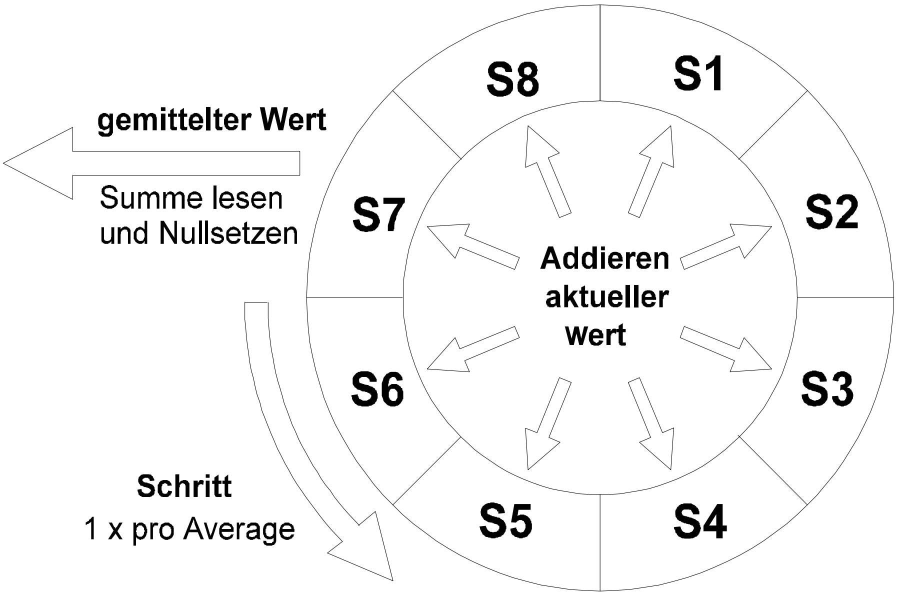


Fig. 29 Simplified operating principle of the averaging processor with 8 cycles[6]

The averaging time (set by *Average* command) is selected as high as the desired update time for the quickest output channel used. Normal values for *Average* are 4 to 20 ms *).
If only the pulse output <u>or</u> the analog output is switched-on, *Average* ≥ 2 ms is permissible. If pulse output as well as analog output are switched-on, *Average* ≥ 5 ms must be selected. If the serial output (S1 or S2) is switched on *Average* should be set to ≥ 20 ms, depending on the string length.
When using the EEC control *Average* should be set to 5 ms *).

[6] *Windows 8*, i.e. 8 floating windows (totals S1 to S8)

In order to minimise the load of micro processor unnecessary output channels should be switched off!

The gliding average can be switched off with the *WINDOW 1* *) command. *WINDOW 4* reduces the number of averaging windows to 4. *WINDOW 8* is the standard setting (from software V 6.5).

Note that all internal processes and outputs are synchronised to *Average*. Outputs, which are not released at the *Average* moment (e.g. output time differs by a multiple from *Average* or trigger controlled outputs), are only carried out after achieving the next cycle specified by *Average*.

9.10.2 Operating principle of the S series

Additionally, devices of the S series allow the synchronisation of the averaging processor and thus of the complete system via an external signal. In order to reach this a clock frequency of 30 to 500 Hz must be connected to the trigger input (IN2). The *Average* and *Trigger* parameters must be set to 0.
The commands *INCOutput 1*, *S1Output 1* etc. allow the configuration of the externally synchronised output of the velocity value.
If, for example, two or more measuring devices of the types VLM 250 S or VLM 250 SD are controlled by the same clock frequency, it is possible to carry out highly precise and dynamic differential velocity measurements.

The following conditions must be observed:

- The parameterisation of the devices is the same. The devices should be mounted in the same direction of movement and are equipped with a high resolution pulse output (IF2 or IF2F interface card) or a fast serial output.
- Serial communication requires external synchronisation.
- A necessary directional switch-over is carried out via an external signal (command *Direction* ≤ 3).

Programming examples of the S series with pulse output IF2F

Average 0	(external synchronisation)
Window 8	(8 windows)
Trigger 0	(H active)
Direction 1	(devices mounted in the opposite direction to that of movement)
Minrate 10	(programming of the monitoring output)
INCOn 2	(high resolution pulse outputs switched on)
INCFactor 1 10 10	(factor 10 pulses/mm for high resolution outputs)
INCOutput 1	(updating of the pulse output trigger-synchronous)

The 24 V cycle at the 'IN2' input - allows a maximum synchronisation frequency of 500 Hz (2 ms). A frequency of 100 up to 300 Hz is recommended. The 'OUT 3' output is used as a monitoring output and is controlled by the *Minrate* parameter. All other outputs are switched off.

9.10.3 Commands of the F and S series with significant differences

Command	Meaning	Unit	Possible values	Default value
***Av**erage*	Cycle time for averaging processor	ms	2 ... 65535 0 with S series	10 ms 0 with S series
***Win**dow*	Number of windows of the averaging processor	-	1, 4, 8	8
***Calib**rate*	Calibration n1, n2 n1 - Measuring time in s n2 - Calibration value m/s		 1 ... 65535 0.0001 ... 10000	-
Test	Test command	-	-	-

Table 16 Commands of the F series and S series with different meanings

The *Calibrate* command does not allow calibration via the length (only two numerical parameters). No length indication is carried out by the *Test* command. Output of length to the interfaces is not possible (*S1Format* and *S2Format)*.

10 Appendix

10.1 Command overview

10.1.1 General commands

Command	Meaning	Unit	Possible values	Default value
***Av**erage*	Averaging time	ms	5 ... 65535	250 ms
***Calf**actor*	Set calibration factor	-	0.950000 ... 1.050000	1.000000
***Calib**rate*	Calibration c, n1, n2 c - velocity or length n1 - meas. time in s or numbers n2 - Calibr. value m/s or m		V- Velocity L- Length 1 ... 65535 0.0001 ... 10000	-
Chold	Holding of control circuits (only with individual part measurement) and pulse outputs 1 and 2	-	0- Holding off 1- Control circuits on 2- Pulse outputs on 3- Both on with IN2 4- Pulse an with IN1	0
Clock	Indicates and sets clock time	-	hh:mm:ss	-
Date	Indicates and sets date	-	dd.mm.yy	-
***Dir**ection*	Direction	-	0- forward 1- back 2- external forward low/-40...+0.3 mA 3- external forward high/+5 ...+40 mA 4- automatic (option) 5-8 (see text)	0
***Err**or*	Indicates the last error	-	-	-
Help or ***?***	Help pages	-	-	-
***Hold**time*	Hold time	ms	10 ... 65535	250 ms
Info	Indicates the software version and the serial number	-	-	-
***Minr**ate*	Measuring rate monitoring	-	0 - off, 1 ... 99 - on	0
***Num**ber*	Sets the part counter	-	0 ... 65535	0
***Para**meters*	Indicates all general parameters	-	-	-
REM	Comments	-	-	-
***Read**para*	Indicates all parameters	-	-	-
***Serial**number*	Indicates the serial number	-	-	-
***Sig**nalerror*	Behaviour in the event of signal failure (or standstill)	-	0- No error upon failure 1- Error upon failure	0
Start	Starts length integration	-	-	-
Stop	Stops length integration	-	-	-

Command	Meaning	Unit	Possible values	Default value
Test	Test command[7]	-	-	-
TestAn	Test command for analogue output	-	-	-
TestPS	Test command for the power supply	-	-	-
***Trig**ger*	Trigger	-	0- H level (as *Dir*) 1- L level (as *Dir*) 2- L/H edge 3- H/L edge	0
***Win**dow*	Window length (F series only)	-	1, 4, 8	8

Table 17 General commands

10.1.2 Analog output commands

Command	Meaning	Unit	Possible values	Default value
***ANO**n*	On/off	-	0- off 1- on	0
***ANMi**n*	Minimum value	-	$-2^{30} * 10^{-3}$ ... $2^{30} * 10^{-6}$	0.000
***ANMa**x*	Maximum value	-	$-2^{30} * 10^{-3}$ ... $2^{30} * 10^{-6}$	1.000
***ANOut**put*	Time or trigger controlled output	-	0- Time 1- Trigger	0
***ANV**alue*	Value	-	V- Velocity L- Length N- Object counter value R- Measuring rate	V
PAN	Indicates analog parameters	-	-	-

Table 18 Commands for analog output

[7] The *Test* command is automatically interrupted after 60 seconds. The parameter *C* suppresses the automatic abort.

10.1.3 ECC control commands

Command	Meaning	Unit	Possible values	Default value
***ECCO**n*	On/off	-	0- off 1- on	0
ECCR1	Measuring rate 1	-	0 ... 99	5
ECCR2	Measuring rate 2	-	0 ... 99	10
ECCV1	Velocity 1	m/s	0 ... $2^{31} * 10^{-4}$	0.0800
ECCV2	Velocity 2	m/s	0.0001 ... $2^{31} * 10^{-4}$	0.1200
PECC	Indicates ECC parameters	-	-	-

Table 19 Commands for ECC control

10.1.4 Pulse output commands

Command	Meaning	Unit	Possible values	Default value
***INCO**n*	On/off	-	0- off 1- on (OUT1/2) 2- on (IF2/IF2F) 3- on (OUT1/2+IF2)	1
***INCF**actor*	Scaling factor(s)	-	0.000001 ... $2^{31} * 10^{-6}$ 3 values for IF2/IF2F; from Firmware V 7.3 also negative	1 1 1 1
***INCOut**put*	Time or trigger controlled output	-	0- Time 1- Trigger	0
***INCV**alue*	Value	-	V- Velocity R- Measuring rate	V
PINC	Indicates the parameters	-	-	-

Table 20 Commands for pulse output

10.1.5 Commands for output via serial interface S1

Command	Meaning	Unit	Possible values	Default value
***S1O**n*	On/off	-	0 - off 1 - on	0
***S1F**ormat*	Output format	-	See description	V*60:6:2 'm/min'
***S1I**nterface*	Settings for the serial interface	-	See description	9600 N X
***S1Out**put*	Time or trigger controlled output	-	0 - Time 1 - Trigger	0
***S1T**ime*	Output time	ms	5 ... 65535	500 ms
PS1	Indicates the S1 parameters	-	-	-

Table 21 Commands for serial interface S1

10.1.6 Commands for output via serial interface S2

Command	Meaning	Unit	Possible values	Default value
***S2O**n*	On/off	-	0 - off 1 - on	0
***S2F**ormat*	Output format	-	See description	'VL'RT42
***S2I**nterface*	Settings for the serial interface	-	See description	9600 N X
***S2Out**put*	Time or trigger controlled output	-	0 - Time 1 - Trigger	0
***S2T**ime*	Output time	ms	3 ... 65535	500 ms
PS2	Indicates the S2 parameters	-	-	-

Table 22 Commands for serial interface S2

10.1.7 Commands for offline measurement

Command	Meaning	Unit	Possible values	Default value
***OFFV**alue*	Value	-	V - Velocity L - Length N - Object counter R- Measuring rate	V
***OFFact**or*	Scaling factor	-	0.000001 ... $2^{31} * 10^{-6}$	1.000000
***OFFL**ine*	Starts the offline measurement	-	[T] awaiting trigger	-
***OFFM**easure*	Measuring time	s	1 ... 65535	10 s
***OFFOut**put*	Time of output to memory	-	0 - Time 1 - Trigger 2 - Synchronous to burst	1
***OFFR**ead*	Reading of the offline data	-	-	-
***OFFT**ime*	Averaging and storing time	ms	2 ... 65535	100 ms
POFF	Indicates the parameters for offline operation	-	-	-

Table 23 Commands for serial offline measurement

10.1.8 Read commands

Command	Return value	Unit	Decimals	Example
V	Velocity	m/s	5	-1.23456
L	Length[8]	m	4	1234.5678
R	Measuring rate	-	0	45
N	Object counter	-	0	123
F	Signal frequency	kHz	2	1234.45

Table 24 Read commands

[8] not with VLM 250 F and S series

10.1.9 System commands

Command	Meaning	Remarks
***Pass**word*	Sets password	Default password 'WEGA'
Restart	Cold start, new initialisation	Interrupts the measurement
***Resto**re*	Warm start, reset of parameters only	Interrupts the measurement
***Simul**ation*	Simulation n1, [n2] n1 - velocity in m/s n2 – measuring rate	Interrupts the measurement
Standby	Standby mode	Stops the measurement, power down the light source
***Sto**re*	Save parameters	With password protection, interrupts the measurement for a short time
Update	Update Firmware	Take advantage of the program VLMTERM instead of the command!

Table 25 System commands

10.2 Programming examples

Print protocol

A production company cuts steel plates. A VLM 250 measuring device with optional laser light barrier and real time clock is used for the final control. A print protocol is to be generated containing date, time, consecutive numbering with factory identification number and plate length.
A light barrier is connected to the 'IN2' input (trigger input), and the beginning and the end of the plates are detected. A printer with serial interface is connected to interface 1 of VLM 250 after programming.

Command line	Meaning
Trigger 0	Individual part measurement
S1Interface 9600 N	Baud rate of printer, no protocol
S1Output 1	Output at plate end (Trigger)
S1Format D ' ' C N:6 '/KW1' L:8:3	Output of date, time, counter, length
S1On 1	Switch-on
**Store*	Save with password input

Table 26 Programming example for a print protocol

The abbreviated form without space characters can also be entered for the format specification:

S1Format D' 'CN:6'/KW1'L:8:3

Pulse output

A wheel with shaft encoder is to be replaced. The shaft encoder produced 2 pulses per millimetre. Due to the process dynamics, a scan frequency of 50 ms is set. The VLM 250 shaft encoder output is connected to the existing process control unit.

Calculation:

Output frequency [in kHz] = factor [1/mm] · velocity [in m/s]

equivalent to:

Pulse number = 1000 · factor [1/mm] · length [m]

Factor = pulse number / (1000 · length [m])
= 2 / (1000 · 0,001)
Factor = 2 (i.e. direct input of pulse per mm is possible!)

Command line	Meaning
Average 50	Average time 50 ms
INCValue V	Velocity
INCOutput 0	Update in equivalent time intervals
INCFactor 2	2 pulses per mm
INCOn 1	Switch-on
**Store*	Save with password input

Table 27 Programming example for pulse output

10.3 Error messages

All error messages begin with the letter 'E' and a two-digit error number.
Starting from error code 'E10' the last error occurring during operation is intermediately saved and can be displayed via the *Error* command or deleted.
Enter parameter *X* in the format instructions *S1Format* and *S2Format* to set the system to continuous error output from 'E10'.

Code	Meaning	Cause
E00 No ERROR	No error occurred	-
E01 Missing parameter	No or insufficient parameters specified	Incorrect command input
E02 Value out of range	Figure too small or too big	Incorrect command input
E03 Invalid command	Command does not exist	Incorrect command input
E04 Invalid parameter	Parameter not allowed	Incorrect command input
E05 No data	No data	Offline measurement
E06 Memory full	Memory full	Too many measuring values during offline measurement
E07 ESC abort	Abort with ESC	Offline measurement and calibration
E08 Signalerror	Signal failure	Signal failure during calibration
E09 Illegal Use	3x incorrect password	Incorrect password entered 3 times
E20 Warning, check VMAX and DIR	Permissible range exceeded	Check *Direction* and *Vmax* settings, refer to data sheet
E21 Not supported by power supply	Command not supported by power supply	Command *TestPS*
E22 Warning, AVERAGE adjusted	Range overflow	*Average* was automatically corrects

Table 28 Errors during command input and processing

Code	Meaning	Cause
E10 S1 output error	Error upon S1 output	Output too fast
E11 S1 parity	S1 parity error	Transfer error, see *S1Interface*
E12 S1 buffer overflow	S1 buffer overflow	Transfer error, see *S1Interface*
E13 S2 output error	Error upon S2 output	Output too fast
E14 S2 parity	S2 parity error	Transfer error, see *S2Interface*
E15 S2 buffer overflow	S2 buffer overflow	Transfer error, see *S2Interface*
E17 Analog output error	Error upon analog output	Output too fast
E18 Incremental output error	Error upon pulse output	Output too fast
E19 Offline output error	Error upon offline measurement	Measurement too fast

Table 29 Errors caused by non correct parameters

Code	Meaning	Cause
E30 Periods out of range	Error in the signal processing	Invalid number of periods
E31 Over temperature detected!	Internal temperature greater than 75 °C	Immediately switch off device and allow it to cool down
E32 Lamp out of order detected!	Light source defective	Light source defective, must be replaced
E33 Watchdog timer reset!	Reset by watchdog	Processor crashed (also in the event of overload)
E34 Oscillator Watchdog timer reset!	Reset by watchdog	Processor crashed

Table 30 Critical errors

The elimination of critical errors requires changes to the program or the operating conditions.

Code	Meaning	Cause
E40 Parameter lost, service necessary!	Data in EEPROM corrupt	Fatal error, check all parameters
E41 Loading ASIC 1 failed, service necessary!	ASIC 1 failed	Fatal error, device must be repaired
E42 Loading ASIC 2 failed, service necessary!	ASIC 2 failed	Fatal error, device must be repaired
E99 Unknown error!	Unknown error	Software error

Table 31 Fatal errors, requiring a check of the device.

Code	Meaning	Cause
E80 Non valid hexfile	Non valid hexfile	Non valid file
E81 Illegal address range	Illegal address range	Non valid file
E82 User terminated	Termination occurs	User terminated the file transfer
E84 Verification error, no valid program in flash memory	Verification error after programming	Do NOT turn the device off or exit boot loader! Try again the command Update.
E85 Remove boot jumper and try again	Remove boot jumper and try again	An update is only possible with open boot jumper!
E86 Hexfile not valid for this gauge	Hexfile not valid for this gauge	Non valid file

Table 32 Errors of the boot loader

10.4 LED signals

LED	Colour	Meaning
Signal LED	green	Signal exists
Signal LED	red	Poor signal quality, refer also to *Minrate* and *ECCOn*
Signal LED	yellow	Device is being initialised
Busy LED	yellow	Command processing, also during calibration and offline measurement
Error LED	red	Flashes in case of 'E40' to 'E42' fatal errors Flashes briefly in case of 'E10' to 'E32' critical errors

Table 33 LED signals

10.5 Output value units

Parameter	Unit	Value range for output	Max. resolution
Velocity	1 m/s	± 21474	0.0001 *)
Length	1 m	± 214748 (internal: ± 360288)	0.0001 *)
Object counter	1 Stück	0 .. 65535	1
Measuring rate	none	0 .. 1000	0.1 **)

Table 34 Measuring values with units and resolution

*) Without format specification the value is output to the S1- and S2-output with three digits after the decimal point. Hexadecimal output is made with maximum resolution.

**) Without format specification the value is output to the S1- and S2-output without decimals. Hexadecimal output is made with maximum resolution.

10.6 Pin assignments

10.6.1 Device connection 1, RS 232

Pin	Colour internal	Assignment
1	brown	RxD (RS 232 interface S1)
2	white	TxD (RS 232 interface S1)
3	blue	GND (RS 232 interface S1)
4	black	GND (test signal), do not use
5	grey	Test signal (analog signal, 50 Ohm), do not use

Table 35 Device connection #1, RS232

10.6.2 Device connection 2, signal (2 examples only!)

Pin	Colour internal	Digital OUT / digital IN	Digital OUT, RS 485 assignment
1	brown	OUT +	OUT +
2	white	OUT1 - (Phase A)	OUT1 - (phase A)
3	blue	OUT2 - (Phase B)	OUT2 - (phase B)
4	black	OUT3 - (Status)	A, RS 485
5	grey	OUT0 - (Lamp OK)	B, RS 485

Table 36 Example of device connection #2

10.6.3 Device connection 3 with 230V/AC or 115V/AC power supply

Pin	Cable colour	230V/AC assignment
2	brown	Phase [9]
3	blue	Neutral
PE	green/yellow	Ground conductor

Table 37 Device connection #3, 230V/AC and 115V/AC power supply

10.6.4 Device connection 3 with 24V/DC power supply

Pin	Cable colour	24V/DC assignment
3	black 1	0 V
4	black 2	24 V
PE	green/yellow	Ground conductor

Table 38 Device connection #3, 24V/DC power supply

Caution: Before connecting the power, ground the device with the earth screw via the grounding cable.

[9] Do not confuse the phase and neutral conductor; both conductors are protected.

10.7 Distributors and assembly instructions for connectors

10.7.1 Cable connector for connection #1, RS232

Item	Manufacturer	Distributor	Type / series	Order number
Male cable connector, shielded	Binder	Esto/Börsig	Series 713	99-1437-814-05
Male angled 90° connector, shielded	Binder	Esto/Börsig	Series 713	99-1437-824-05
Male cable connector, metal, not shielded	Binder	Esto/Börsig	Series 713	99-0437-55-05
Female dual connector, not shielded	Binder	Esto/Börsig	Series 713	99-0437-142-05

10.7.2 Cable connector for connections #2, #4 and #5, signals IN/OUT

Item	Manufacturer	Distributor	Type / series	Order number
Female cable connector, shielded	Binder	Esto/Börsig	Series 713	99-1436-814-05
Female angled 90° connector, shielded	Binder	Esto/Börsig	Series 713	99-1436-824-05
Female cable connector, metal, not shielded	Binder	Esto/Börsig	Series 713	99-0436-55-05
Female dual connector, not shielded	Binder	Esto/Börsig	Series 713	99-0436-142-05

10.7.3 Cable connector for connection #3, 115V/AC, 230V/AC

Item	Manufacturer	Distributor	Type / series	Order number
Female cable connector	Hirschmann	FEC (Farnel)	CA3	99-4222-00-04
Female angled 90° connector	Binder	Esto/Börsig	Series 693	99-4222-70-04

10.7.4 Cable connector for connection #3, 24V/DC

Item	Manufacturer	Distributor	Type / series	Order number
Female cable connector	Binder	Esto/Börsig	Series 693	99-4218-00-07
Female angled 90° connector	Binder	Esto/Börsig	Series 693	99-4218-70-07

Blue: standard equipment. Subject to changes!

10.7.5 Assembly instructions for shielded connector

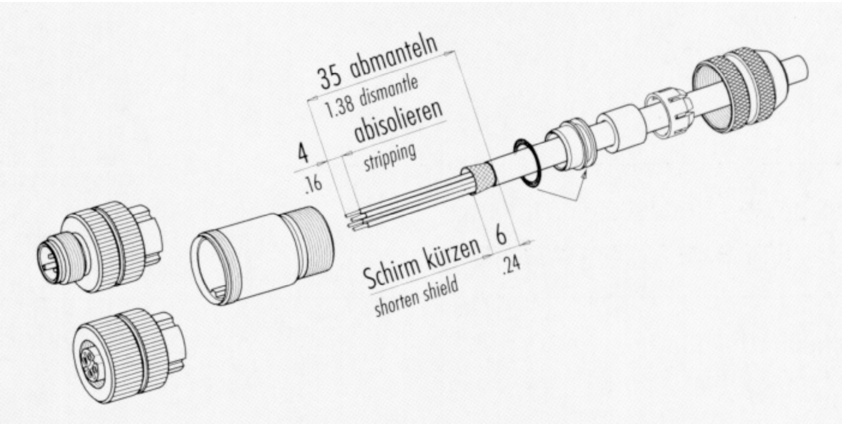


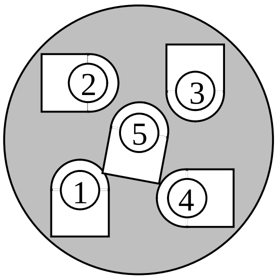
Fig. 30 Assembly instructions for shielded connector[10]

[10] These instructions apply to connections #1, #2, #4 and #5.

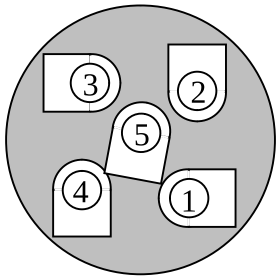
10.7.6 Pin assignment of male and female cable connectors

⚠	All drawings show the **screw side of the connectors**!

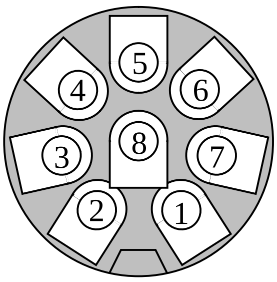
Male cable connector, 5-pin
e.g. RS 232



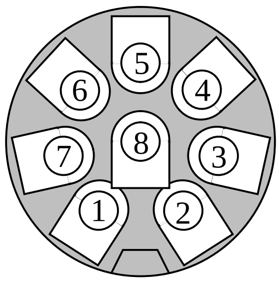
Female cable connector, 5-pin
e.g. various inputs and outputs



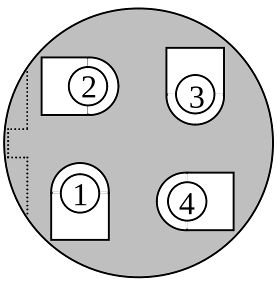
Male cable connector, 8-pin
e.g. 5 V pulse output



Female cable connector, 8-pin



Male cable connector, 4-pin
(B coding)
e.g. Ethernet and
Profibus output



Female cable connector, 4-pin
(B coding)

e.g. Profibus input

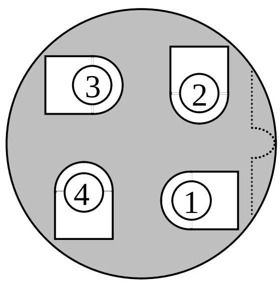


Fig. 31 Pin assignment of connectors for connections #1, #2, #4 and #5

10.8 Order codes for interface cards

Basic function / Option	RS232, output only	RS485 / RS422, output only	Analog output, 4 ... 20 mA	Analog output, 0 ... 20 mA	25 kHz pulse, 2 x 2 phases, open collector, 24 V	50 kHz pulse, 2 x 2 phases, status output balancing, 15-30 V	500 kHz pulse, 2 x 2 phases, balancing, 5 V	500 kHz pulse, 2 x 2 phases, RS422 driver	ECC2 shaft encoder controller
Without	**IF1/ RS232**	**IF1/ RS422**	**IF1-AI, 4-20 mA**	**IF1-AI, 0-20 mA**	**IF2**	**IF2 PP**	**IF2F/ 5V**	**IF2F 422**	**ECC2**
RS232 output only	-	-	IF1 / RS232 IF1-AI, 4-20 mA	IF1 / RS232 IF1-AI, 0-20 mA	-	-	-	-	ECC2 / RS232
RS485/ RS422 output only	-	-	IF1 / RS422 IF1-AI, 4-20 mA	IF1 / RS422 IF1-AI, 0-20 mA	-	-	-	-	ECC2 / RS422
Analog output, 4 ... 20mA	IF1 / RS232 IF1-AI, 4-20 mA	IF1 / RS422 IF1-AI, 4-20 mA	-	-	IF2 IF2-AI, 4-20 mA	-	IF2F / 5V IF2-AI, 4-20 mA	IF2F 422 IF2-AI, 4-20 mA	-
Analog output, 0 ... 20mA	IF1 / RS232 IF1-AI, 0-20 mA	IF1 / RS422 IF1-AI, 0-20 mA	-	-	IF2 IF2-AI, 0-20 mA	-	IF2F / 5V IF2-AI, 0-20 mA	IF2F 422 IF2-AI, 0-20 mA	-
25 kHz Pulse, 2 x 2 phases, open collector	-	-	IF2 IF2-AI, 4-20 mA	IF2 IF2-AI, 0-20 mA	-	-	-	-	-
500 kHz pulse, 2 x 2 phases, 5 V	-	-	IF2F / 5V IF2-AI, 4-20 mA	IF2F / 5V IF2-AI, 0-20 mA	-	-	-	-	-
500 kHz pulse, 2 x 2 phases, RS422	-	-	IF2F 422 IF2-AI, 4-20 mA	IF2F 422 IF2-AI, 0-20 mA	-	-	-	-	-
ECC2 encoder controller	ECC2 / RS232	ECC2 / RS422	-	-	-	-	-	-	-

Table 39 Order codes for interface cards

Function of the standard **AB3** connection board: RS232 interface; PNP: Lamp OK output, 2 phases **25 kHz pulse output**, Status output; Standby, Trigger and Directional input. Additional interface cards: IF-PROFI for Profibus DP and IF-ETHER for 10 MBit Ethernet

10.9 Description of the serial interfaces

10.9.1 RS 232 interface (AB3, IF1, ECC2)

The RS 232 interface serves to transmit serial data between two devices. As almost all computers are equipped with an RS 232 interface (COM1, COM2), the VLM 250 has an RS 232 interface (electrically isolated) for configuration.
Due to an electrical isolation the RS 232 is also suitable for an industrial environment.
The interface allows full-duplex operation, i.e. a party can simultaneously send and receive data from another party.
The TxD, RxD and GND signals are used. Data transmission is controlled via the XON/XOFF protocol (software handshake), i.e. if the receiver is not ready to receive he sends the XOFF signal to the transmitter, which then interrupts the transmission. If the receiver is ready to receive again, he sends the XON signal. The transmitter then continues the transmission.

RS 232 physical transmission parameters:

Maximum cable length	15 m (30 m with special low capacity cable)
Maximum send level	± 15 V
Minimum send level	± 5V
Minimum receive level	± 3 V
Load resistance	3 to 7 kOhm
Load capacity	≥ 2500 pF

10.9.2 RS 422 interface (IF1(422, IF2/422)

The RS 422 interface serves to transmit data over great distances. In the case of the VLM 250, the RS 422 interface is used to transmit measuring values. In addition, it can be useful to convert the programming interface (RS 232) to RS 422, in order to bridge greater distances.
The interface allows full-duplex operation, i.e. a party can send and simultaneously receive data from another party.
A maximum of 10 RS 422 receivers may be connected with a transmitter. The serial data are transmitted as voltage difference between the 2 wires of a cable.

RS 422 physical transmission parameters:

Maximum cable length	1200 m, depending on cable type and transmission rate
Maximum send level	± 5 V
Minimum send level	± 2V
Minimum receive level	± 200 mV
Load resistance	1x 100 Ohm at the cable end (receiver termination)

Encoder pulses can of course also be transmitted via an RS 422 interface, as the standard determines only the levels, impedance, etc, but not the type of data. Thus, the IF2/422 interface card provides 2 pulse output channels, each with 2 phases according to the RS 422 standard.

10.9.3 RS 485 interface (IF1, ECC2)

The RS 485 interface serves to transmit data over great distances. The interface allows only semi-duplex operation, i.e. only one party can send at a time. A maximum of 32 parties can be connected. Serial data is transmitted as voltage difference between the 2 wires of a cable.

RS 485 physical transmission parameters:

Maximum cable length	1200 m, depending on cable type and transmission rate
Maximum send level	± 5 V
Minimum send level	± 1.5 V
Minimum receive level	± 200 mV
RS 485 load resistance	120 Ohm each on both cable ends (termination) and a "receiver open-circuit fail-save" switch

In the case of the VLM 250, the S2 interface can be operated as an RS 485. It is used for the transmission of measuring values. If other parties are sending the VLM 250 must be controlled by the XON/XOFF protocol or via the trigger input (trigger synchronous output).

10.10 Installation drawing

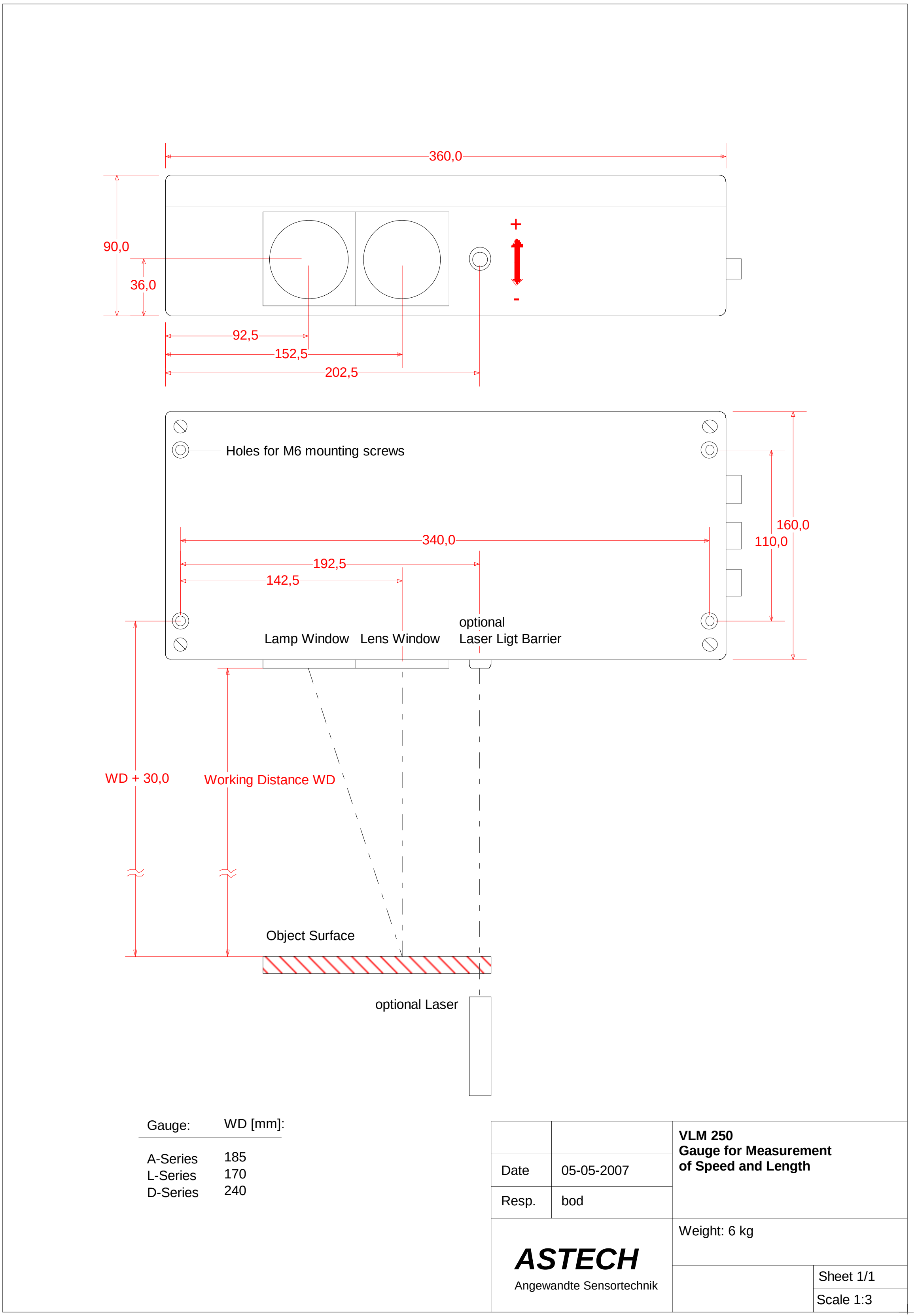


Fig. 32 Installation drawing for various designs (dimensions in mm)

11 Declaration of Conformity

Manufacturer	**ASTECH Angewandte Sensortechnik GmbH**
Address	18057 Rostock
	Schonenfahrerstr. 5
	Germany
Product name	VLM 250
Description	Optical measuring system for velocity and length

Conformity with the following standards

EN 50 081-2; interference transmission 30-230 MHz 30 dbµV/m, 230-1000 MHz 37 dbµV/m
EN 50 081-2; interference voltage 150 kHz-30 MHz
EN 50 082-2 or IEC 1000-4-2; ESD 8 kV air discharge, 4 kV contact discharge
EN 50 082-2 or IEC 1000-4-3; EMC 27-1000 MHz
EN 50 082-2 or IEC 1000-4-4; burst 2 kV
EN 50 082-2 or IEC 1000-4-6; EMC 150 kHz-80 MHz

Place Rostock

Date December 2006

ASTECH Angewandte Sensortechnik GmbH

Volker Ahrendt
Managing Director