
User manual

VLM500-DG

Version 1.4



ASTECH
Angewandte Sensortechnik

Remarks

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

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

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VLM500-DG – User manual V1.4

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1 General information

1.1 Introduction

This manual describes the software and hardware of the VLM500 – DG skin pass measuring system. It is a supplementary manual for the VLM500 speed and length measuring gauge.

The DG system consists of up to three VLM500 devices that are wired to one another and that automatically calculate and output differential values. This system was specially developed for use in skin-pass, stretching and rolling stands in the steel and aluminum industries.

The system consists of a master VLM500 (DG master) and at least one slave (DG slave 1), as shown in Figure 1. Optionally, a second slave (DG slave 2) can be connected in order, to additionally determine the degree of stretching. The calculations of the differential values (skin-pass and stretching degree) are carried out in the DG-Master. The calculations are based on lengths, not on velocities. This leads to more accurate values, because fluctuations in speed are considered. A separate evaluation unit is not required. During the communication between the DG-Master and the DG-Slave and the calculation of the mass flow values, the busy LED in the cover of the DG-Master lights up yellow.

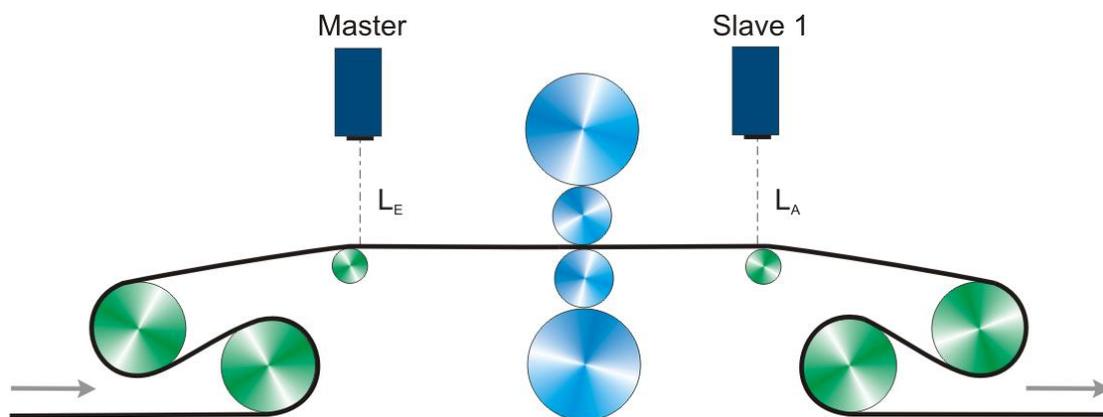


Figure 1: Principle of a skin pass mill with the VLM500-DG system

It is recommended to place the DG-master in the infeed of the system. DG-slave 1 comes to the outfeed. In case that a second slave device is installed, it is placed in the further / subsequent outfeed. The parameter "SYNCBASIS" can be used to set which device the calculated values refer to, i.e. whether they refer to the infeed or the outfeed.

For the calculation of the mass flow values, it is irrelevant whether the respective VLM500 is mounted in the direction of movement¹ or against the direction of movement. In the case the VLM500 is mounted reversely (against the direction of movement), the "DIRECTION" parameter of the corresponding VLM must be adapted. If, for example, the DG master is installed reversely, the "DIRECTION" parameter must be set to the value 1 in the master. Otherwise 0. Both VLM500 are programmed to "DIRECTION 0" by default. If possible, it is recommended to install the devices in the direction of movement.

¹ direction of movement means that the measurement object moves from the housing base to the housing cover of the VLM.

1.2 Mode of operation

Start of calculation

After all devices are connected and switched on, the "SYNCSTART" command must be executed in the DG-Master. This can be achieved in two ways: in the case of a Profinet connection, bit 2 ("SYNCSTART") must be set in the control byte (see section 2). Or the command can send to the DG slave via the programming interface. If the skin pass measurement and the optional degree of stretching measurement are to take place automatically after the devices are switched on, the parameter SYNCAUTO must be set to "1" and permanently saved in the DG-Master.

When SYNCSTART is executed, all devices connected to the master receive a start trigger pulse. As soon as the object to be measured (e.g. steel strip) starts moving, all devices record the length of the material passed in their field of vision (like a normal VLM500). If the measured length in the DG-Master is greater than or equal to the configured refresh length (command SYNCREFRESH), another trigger pulse is output synchronously to all connected devices. These save the length recorded up to that point and immediately start a new length measurement. In the meantime, the DG-Master queries the saved lengths from the slave devices one after the other. The length segments are added to the previous length values and stored in a ring memory. The integration takes place until the parameterized total length (command Synclength) is reached. The ring buffer is treated according to the FIFO (First In First Out) principle. Figure 2 shows an example of a circular buffer with 12 fields. With each update step, a new total length that is one update length longer is inserted into the ring buffer and the oldest value is removed. The size n of the ring memory results from the quotient of the total length to the update length.

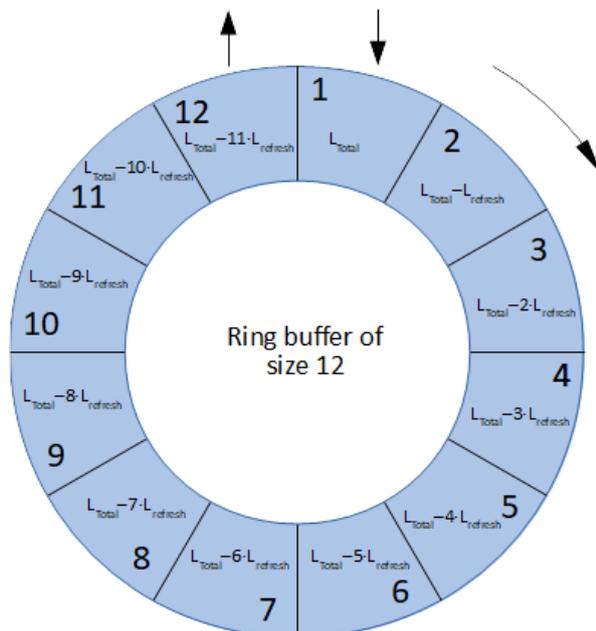


Figure 2: Example of a ring buffer of size 12

Filter behavior of the ring buffer

The principle of the ring buffer corresponds to that of a low-pass filter. This means that changes to the skin pass characteristics are delayed by the VLM500-DG depending on the dynamics. To estimate the delay time, which is actually a length, the following simplified approach applies:

The time constant τ is used from the analysis of linear dynamic systems. τ is the time after which the response of a system has reached 63% of a sudden change at the input (step response). Translated to the VLM500-DG system, this means: τ is the length after that 63% of changes in the skin pass characteristics have been processed by the internal processor. Based on this relationship an appropriate setting of the total calculation length (parameter SYNCLength) can be estimated by dividing the desired length by 0.63.

Example: If the user wants to see changes in the skin pass characteristics after 30m processed length, the setting for SYNCLength should be $30\text{m} : 0.63 = 47.6\text{m}$ approx. 48m.



Attention! The effect of changes in the skin pass characteristic on the material is immediate. However, the metrological acquisition is delayed.

Calculation

The total lengths L_{Master} , $L_{Slave 1}$ and $L_{Slave 2}$ are used to calculate the skin-pass or degree of stretching. The total length results from $L = L_{total} - (L_{total} - x \cdot L_{total})$. The oldest length value from the ring buffer is subtracted from the newest measured length value.

All three length values are now used to calculate the skin-pass or degree of stretching using the formula:

$$DG = \frac{L_{Master} - L_{Slave 1}}{L_{Master}} \cdot 100\%$$

$$RG = \frac{L_{Slave 1} - L_{Slave 2}}{L_{Slave 1}} \cdot 100\%$$

Where DG is the skin pass level and RG is the degree of stretching.

In this calculation DG and RG are referenced to the infeed of the mill. See Figure 3.

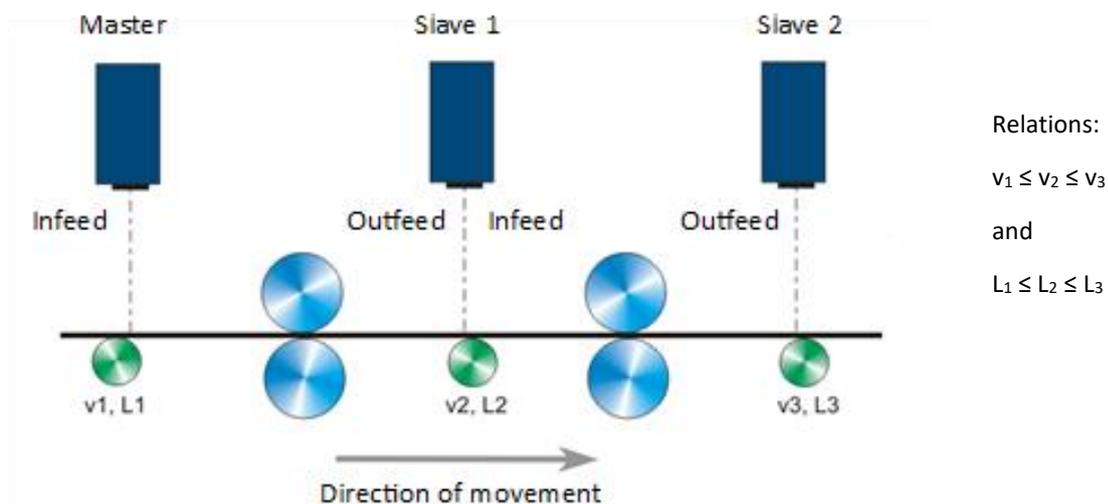


Figure 3: Position of devices

To reference the calculation (DG and RG) to the outfeed, the parameter SYNCBASIS must be set accordingly.

Process monitoring

There is permanent monitoring of the communication between the devices. If a DG-slave does not send the requested data to the DG-master within 500 ms, an internal communication error counter is incremented. If this happens the length values from the last successful communication are then used to calculate the mass flow values. If 10 communication errors occur in succession with a DG-slave, error E70 (for DG slave 1) or error E71 (for DG slave 2) is output on the DG-master. After that the error counter is reset. The communication error counter is also reset each time the communication with a DG-slave was successful.

The DG master also permanently monitors the lengths received from the DG-slaves. If length values are not in the expected interval of $0,5 \cdot L_{refresh} < L_{Slave} < 1,5 \cdot L_{refresh}$, error E72 (for DG slave 1) or error E73 (for DG slave 2) is output on the DG master.

Stop of calculation

In order to end the calculation of the mass flow values in a targeted manner, the "STOP" command must be called. This is done via Profinet by setting bit 1 in the control byte or by sending the command to the programming interface. In order to restart a calculation, the "STOP" command and then the "SYNCSTART" command must always be executed. In this way the contents of the ring buffers are deleted. If there is a measurement failure with the DG-Master, the contents of the ring buffers are also deleted.

Band start-up

Due to its principle, a VLM500 cannot acquire the "standstill" state of a measurement object. A minimum speed is required that can be measured by the sensor. It cannot be predicted at what speed a VLM500 will start measuring. The minimum speeds specified in the datasheet are to be understood as guaranteed values from which the VLM500 can record signals in any case. In order to still be able to achieve synchronicity of the DG master and the DG slave in the event of a measurement object moving from standstill, the parameter VMIN is used. VMIN is set the same for all VLM500 devices. As soon as the DG master can measure this speed, it sends a synchronization pulse to the DG slave.

Accuracy of measurement

The absolute error of the calculation of the skin pass level is equal to the sum of the relative errors of the two measuring devices. In the data sheet of the VLM500, the relative error specified under laboratory conditions is given as $\pm 0.025\%$. Thus, the absolute error of the skin pass system is $\pm 0.05\%$. The measurement curve in the following figure shows the spread under laboratory conditions. The set skin pass level is close to zero.

The spread is approximately $\pm 0.05\%$. This distribution would also occur in the case of skin pass levels deviating from zero. The absolute error remains the same.

Under real conditions, absolute errors in the skin pass system of $\pm 0.2\%$ are to be expected for total lengths of up to 50 m. Larger skin pass levels can therefore be acquired more precisely than smaller ones because the absolute error remains the same.

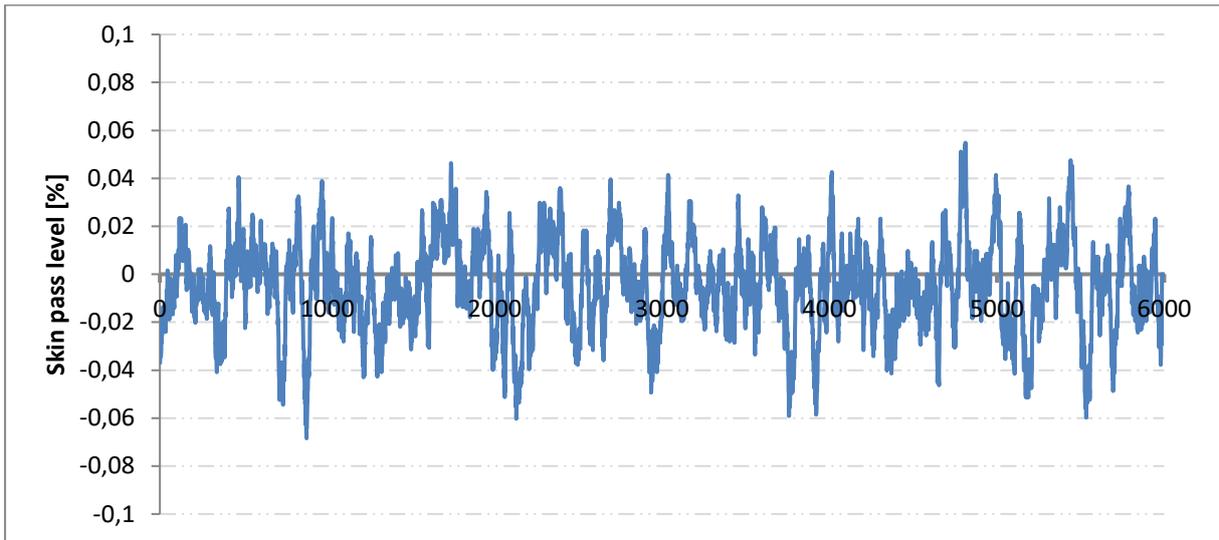


Figure 4: Measurement accuracy under laboratory conditions

2 Data transmission

2.1 Profinet

The VLM500-DG system can be equipped with a Profinet interface. The associated IFPN interface card is installed in the DG master and connects it to the network. This enables the communication between a PLC and the DG master over large distances using standardized network components. The current mass flow measured values can be output synchronously with the trigger. It is also possible to send control commands to the master via Profinet. A small webserver is also available providing a website showing status information about the measuring device (Figure 5).

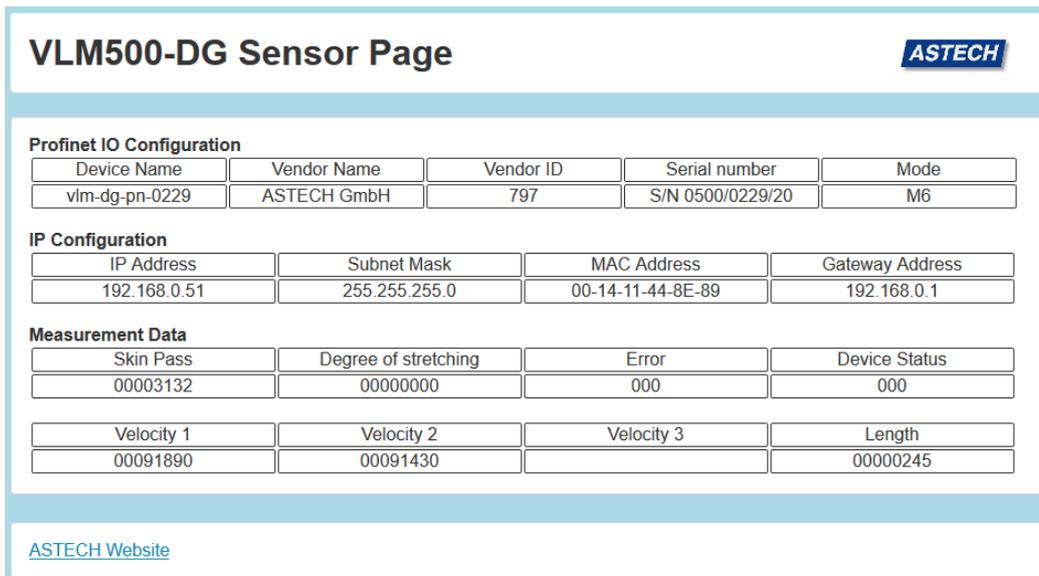


Figure 5: Status page of the integrated webserver

Output mode

The Profinet interface is configured via the Profinet master (Profinet IO controller). Interface-specific parameters such as the IP address to be used, the subnet mask, the gateway, the name or the mode can be changed.

There are 7 modes for data exchange with the IO controller (see table 1) available. For correct communication, the data output mode set in the master must match that in the Profinet IO controller. The data output mode in the master VLM is set with the SYNCOUTPUT command. The same mode must be selected in the controller (PLC). The provided GSDML file supports all 7 modes.

The update time or minimum output time (time until new data is put on the bus) can be estimated using the formula $t = S_{refresh}/v_{object}$. Due to internal communication and data processes in the DG-master, the update time is restricted.

Table 2 shows typical configurations of SYNCREFRESH and the object speed. The minimum output time must be greater than 45 ms when operating with one DG slave or greater than 75 ms when operating with two DG slaves.

SYNCREFRESH should be adjusted or the object speed should be reduced in order to guarantee the required times. Table 2 shows permissible configurations with one DG slave in yellow and black. Permissible times for two DG slaves are shown in black. Prohibited configurations are shown in red.



If the update time is undershot, loss of data can occur.

Table 1: VLM500 Profinet modes (Profinet IN)

Mode	Structure	SYNCOUPTPUT setting
M1	16 Bit Counter 32 Bit Skin pass level 8 Bit VLM – error number 8 Bit Device status	1
M2	16 Bit Counter 32 Bit Skin pass level 8 Bit VLM - error number 8 Bit Device status 32 Bit velocity of master 32 Bit velocity of slave 1	2
M3	16 Bit Counter 32 Bit Skin pass level 8 Bit VLM - error number 8 Bit Device status 32 Bit velocity of master 32 Bit velocity of slave 1 16 Bit measurement rate of master 16 Bit measurement rate of slave 1	3
M4	16 Bit Counter 32 Bit Skin pass level 8 Bit VLM - error number 8 Bit Device status 32 Bit degree of stretching	4
M5	16 Bit Counter 32 Bit Skin pass level 8 Bit VLM - error number 8 Bit Device status 32 Bit velocity of master 32 Bit velocity of slave 1 32 Bit degree of stretching	5
M6	16 Bit Counter 32 Bit Skin pass level 8 Bit VLM - error number 8 Bit Device status 32 Bit velocity of master 32 Bit velocity of slave 1 16 Bit measurement rate of master 16 Bit measurement rate of slave 1 32 Bit degree of stretching 32 Bit processed total length ¹⁾	6
M7	16 Bit Counter 32 Bit Skin pass level 8 Bit VLM - error number 8 Bit Device status 32 Bit velocity of master 32 Bit velocity of slave 1 32 Bit velocity of slave 2 16 Bit measurement rate of master 16 Bit measurement rate of slave 1 16 Bit measurement rate of slave 2 32 Bit degree of stretching 32 Bit processed total length	7

Remarks on table 1

The output of the numerical values via Profinet is always unsigned! The sign is coded in the status byte (see below).

The scaling factors of the different values are:

- velocity: 0,00001 m/s,
- skin pass level / degree of stretching: 0,00001 %,
- measurement rate: 0,1 %,
- length²: 0,001 m.

Device status

In every mode the device status is transmitted as a byte. The single bits have the following meaning:

Bit 7 - 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
<reserved>	sign of RG	Sign of DG	sign of velocity	< reserved >	Status of output ERROR
	0 ... positive 1 ... negative	0 ... positive 1 ... negative	0 ... positive 1 ... negative		

Control byte (Profinet OUT)

In addition to the data transmission from the DG-master to the Profinet IO controller, the DG-master can be controlled by the Profinet IO controller. A control byte is available for this. By setting individual bits, specific events can be triggered in the DG master. The meaning of the individual bits is as follows:

Table 2: Control byte for Profinet OUT

Bit	meaning	type	remark
0	Standby	Level	LOW- level: <nothing> HIGH- level: Standby
1	Syncstop	Edge	rising edge: stop calculation falling edge: < nothing >
2	Syncstart	Edge	rising edge: start calculation falling edge: < nothing >
3	Restart	Edge	rising edge: device restart falling edge: < nothing >
4	Error	Edge	rising edge: reset VLM errors falling edge: < nothing >
5	Length measurement	Level	LOW- level: no length calculation, HIGH- level: length calculation active ³
6 ⁴	Parameter set	Level	LOW- level: Parameter set 0 HIGH- level: Parameter set 1
7	Enable Restore	Edge	rising edge: loads the parameter set defined by bit 6 falling edge: < nothing >

² Due to the size of 32 bits, a maximum length of 4,294,967.295 m (approx. 4,300 km) can be transmitted. If this value is exceeded, the value starts counting again at 0. The internal length measurement of the VLM, however, continues up to 2 million kilometers and then jumps to 0.

³ each new setting of the bit starts the length measurement at 0 m.

⁴ bit 6 is only processed by the VLM if bit 7 is set to HIGH.

Table 3: Minimum output times (all values in ms)

<i>SYNCREFRESH [m]</i>									
<i>v [m/s]</i>	<i>0,10</i>	<i>0,15</i>	<i>0,20</i>	<i>0,25</i>	<i>0,30</i>	<i>0,40</i>	<i>0,50</i>	<i>0,60</i>	<i>1,00</i>
0,5	200	300	400	500	600	800	1000	1200	2000
1,0	100	150	200	250	300	400	500	600	1000
1,5	67	100	134	167	200	267	334	400	667
2,0	50	75	100	125	150	200	250	300	500
2,5	40	60	80	100	120	160	200	240	400
3,0	34	50	67	84	100	134	167	200	333
5,0	20	30	40	50	60	80	100	120	200
6,0	17	25	34	42	50	67	84	100	167
8,0	13	19	25	32	38	50	63	75	125
10,0	10	15	20	25	30	40	50	60	100

2.2 Ethernet

The VLM500-DG system can be equipped with an Ethernet interface. The IFFE interface card connects the DG master to an Ethernet network. This enables communication between evaluation units like a PLC and the measuring device over large distances using standardized network components.

By using Telnet, the Ethernet interface can be used like the programming interface of the device when the connection is active. The same command syntax is used for parameterization. The current measured values can be output permanently and trigger-synchronously.

In addition, the IFFE offers a UDP channel for the transmission of measurement data to a freely selectable destination address in the network. A TCP channel is also available, which can be reached from anywhere in the network. This type of transmission is particularly suitable for recording the measured values of the VLM500.

A very helpful function when setting up and monitoring the VLM500-DG with Ethernet interface is the search for the measuring devices available in the network via a specified UDP broadcast.

By default, the device has the IP address: 192.168.000.051 and the subnet mask: 255.255.255.000. If this address is not available, a P2P connection must be established in order to change the address via the Telnet client.

Communication

- General settings of the serial interface SO2 in the DG-master
 - Serial interface SO2 of the VLM must be set to defined parameters
 - Speed setting: *SO2Interface 57600 N D*
 - To guarantee an ongoing data output: *SO2ON 1*
 - The output interval is synchronous with the refresh length: *SO2SYNC 1*
 - The output format is: *SO2FORMAT G and SYNCOUTPUT 6*
- UDP
 - One UDP channel for the output of the current measured values
 - Freely selectable configuration of destination IP address and port number
 - A separate UDP channel for searching for devices in the network via broadcast telegram

- Listen-Port of VLM500 = 33003
- identification for ASTECH-devices = 0x05
- response data: type, version, serial number, IP-address, MAC-address, connection status
- TELNET
 - Service related 8-bit ASCII communication via TCP/IP
 - Client is establishing the connection
 - Listen-Port = 23
 - Command syntax the same as with the programming interface
 - Use of conventional Telnet client programs is possible (e.g. ASTECH Ethertool or third-party application like HTerm⁵)
 - Only one connection possible at the same time
 - Password protected access by default
 - Standard password: „wega“, can be changed via TELNET
 - Configuration mode for the parameter of the IFFE interface
- TCP
 - One TCP/IP channel for the output of the current measured values
 - Device acts as a server and can be accessed from anywhere on the network
 - Standard port of VLM500 = 33005
 - IP-address is the same as the VLM500 address
 - Port can be changed via TELNET



The SO2 interface for outputting the measurement data is activated by default. If you log in via TELNET, the raw data sent by the VLM are visible. To change VLM parameters or to use the configuration mode, we recommend deactivating the interface with the SO2ON 0 command. However, the communication of the individual channels is temporarily deactivated! When exiting configuration mode, the SO2 interface is automatically reactivated.

Configuration of the UDP/TCP-data transmission

The UDP and TCP are configured in a separate configuration mode via TELNET. Interface-specific parameters, such as the IP address to be used and the subnet mask, can be changed using simple menu. It is also possible to protect the TELNET connection against unauthorized access with the help of a password. To enter the configuration mode via the normal TELNET connection simply enter the # character. The TELNET connection can now be used, to set up the two channels.



The input of the data for the channels must always correspond to the following format:

IP-Address: xxx.xxx.xxx.xxx

Port number: xxxxx

⁵ www.der-hammer.info

```

[Information]
Type       : VLM500E
S/N       : 0500/0191/19
IP Address : 192.168.0.51
Subnet Mask : 255.255.0.0
MAC Address : 00-14-11-84-E7-B3
Software   : V1.0 DG
UDP IP     : 192.168.0.13
UDP Port   : 33003
Enable UDP (0-No 1-Yes) : 1
TCP Port   : 33005
Enable TCP (0-No 1-Yes) : 0

[Selection]
1 - Set IP Address of Device
2 - Set Subnet Mask of Device
3 - Set Password for Telnet
4 - Edit UDP Channel
5 - Edit TCP Server
6 - Edit ON/OFF
7 - Reboot
8 - Quit

```

Figure 6: Telnet menu to configure the UDP and TCP channel



When the IFFE module software is updated, the password for the Telnet connection is overwritten regardless if it is used or not. It is therefore strongly recommended that the manufacturer accompanies the update process.

After setting up all parameters and settings, the following data stream can be streamed via the UDP interface.

Table 4: VLM500-DG Data stream via UDP

Size	Value	Data field
16 Bit	Counter	1
32 Bit	Skin pass level	2
8 Bit	Error (DG-master)	3
8 Bit	Device status	4
32 Bit	Velocity of master	5
32 Bit	Velocity of slave 1	6
16 Bit	Measurement rate of master	7
16 Bit	Measurement rate of slave	8
32 Bit	Degree of stretching	9
32 Bit	Processed total length	10

Remarks on Table 4

The output of the numerical values via Profinet is always unsigned! The sign is coded in the status byte (see below). The scaling factors of the different values are:

- velocity: 0,00001 m/s,
- skin pass level / degree of stretching: 0,00001 %,
- measurement rate: 0,1 %,
- length⁶: 0,001 m.

⁶ Due to the size of 32 bits, a maximum length of 4,294,967.295 m (approx. 4,300 km) can be transmitted. If this value is exceeded, the value starts counting again at 0. The internal length measurement of the VLM, however, continues up to 2 million kilometers and then jumps to 0.

Device status

The fourth data field (one byte) transmits the device status. The single bits have the following meaning:

Bit 7 - 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
<reserved>	sign of RG	Sign of DG	sign of velocity	< reserved >	Status of output ERROR
	0 ... positive	0 ... positive	0 ... positive		
	1 ... negative	1 ... negative	1 ... negative		

Control byte (can only be used with TCP)

The TCP control byte has the same structure and meaning like the Profinet control byte. Refer Table 2 for more information.

To prevent unauthorized and unintentional access to the device by the control byte, it must be sent in the following format:

Table 5: Format control byte TCP

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

3 Programming

3.1 Tunnel mode and VLMTTool

The devices of the VLM500-DG system are programmed with the VLMTTool. It is running under Microsoft Windows. This application is provided by ASTECH for free. After setting up the right communication port in the program options the VLMTTool detects the connected VLM500-DG system. The DG system supports a group of additional commands and parameters. The VLMTTool shows a special tab for the parameters as shown in the screenshot (Figure 7).



Figure 7: VLMTTool with new tab "DG-Option"

The VLM500-DG system is a combination of two single VLM500 devices. Both gauges have their own parameter set which can be changed by the user. However, there is only one programming interface available. It is located in the slave device. To guarantee the parametrization of the DG-master, a special communication mode was added to the software. When powering up the system the connected PC or notebook is always communicating with the slave device (see Figure 8). With the command "COMSLAVE" the DG-slave can be put into a tunnel mode. Now all commands and parameters will be forwarded directly to the DG-master and will be processed there (see Figure 9). The active tunnel mode can also be identified by the cover LEDs of the slave case. Only the two direction LEDs light up.

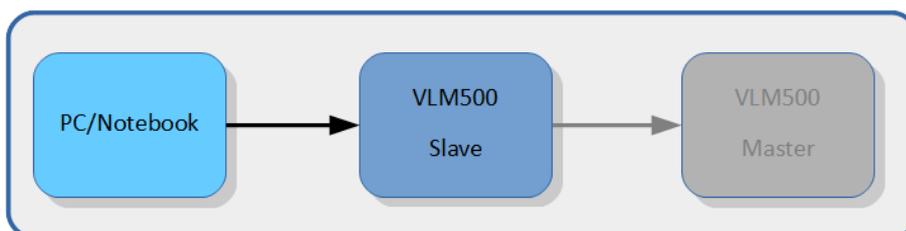


Figure 8: Tunnel mode off

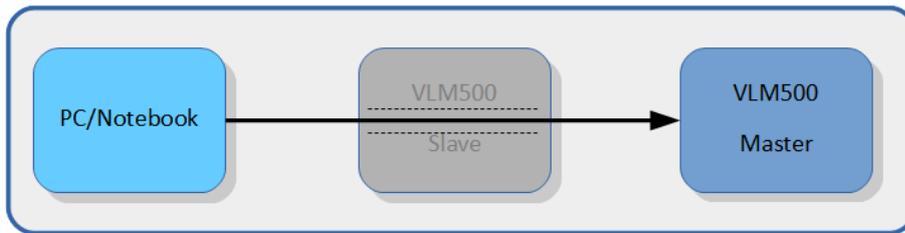


Figure 9: Tunnel mode on

The tunnel mode can also be controlled by using the respective buttons of the VLMTTool. To activate the tunnel mode button “Configure Master” must be pressed. This button now is inactive and the button “Configure Slave” is active to get back to the slave by quitting the tunnel mode.



Any parameter changes inside the DG-master need to be stored permanently, before the tunnel mode will be left. Otherwise these changes will be discarded.

When the VLM500-DG system is in progress there is a permanent data exchange between the master and the slave(s). When the user wants to change parameters inside the master by activating the tunnel mode, the DG-system is not working as long as the tunnel mode is active. In fact, it is mandatory to stop the process to guarantee a stable tunnel mode.⁷



It is strongly recommended to use the VLMTTool for parameterizing the gauges and to activate and deactivate the tunnel mode.

3.2 Commands

Comslave

The command is used to set up a direct communication channel (tunnel mode) between the DG-slave and the DG-master. In principle, the DG-master does not have a communication interface for connecting a PC or notebook. In order to still be able to parameterize the DG master, a communication channel can be established via a DG slave. After entering this command, you can communicate directly with the DG-Master. All commands entered are then received by the DG-Master and acknowledged accordingly.

Syntax: **Comslave**

The communication channel is ended by sending the ASCII character 0x0F to the DG-master. There is a corresponding button in the VLMTTool. Alternatively, the power supply for the device can be interrupted to terminate the communication channel.



Before calling “comslave”, the command “syncstop” must be called. This ends the skin pass calculation in the master. Only then is communication from the PC to the master possible.

⁷ It is save to use the VLMTTool for the tunnel model, because the system is stopped automatically.

Sync

The command outputs information that is relevant for synchronous operation. In addition to the parameter settings, there is also an indication of whether the current device is a DG master or DG slave.

Syntax: **Sync**

The type of each device is preset (by the manufacturer) and cannot be changed by the customer!

Syncstart

Calling up this command starts the skin pass and degree of stretching calculation.

Syntax: **Syncstart**

Syncstop

Calling up this command stops the skin pass and degree of stretching calculation.

Syntax: **Syncstop**

It is mandatory to call this command before entering the tunnel mode!

Syncstate

Calling this command outputs the type of the device. If it is a master the response is "1". In case of a slave the response is "0"

Syntax: **Syncstate**

In the VLM500-DG system, one device must be a master and at least one device must be a slave. Process values can only be calculated if a DG-master and a DG-slave are set correctly.

3.3 Parameters

Syncauto

This parameter sets the automatic start of the skin pass level and degree of stretching calculation after the devices are switched on.

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

The setting is irrelevant if the device is a DG-slave.

Syncbasis

This parameter sets the reference device (infeed or outfeed) for the skin pass level and degree of stretching calculation.

Syntax: **Syncbasis [n]** (n = 0, 1, 2 or 3; see Table 6)

The setting is irrelevant if the device is a DG-slave.

Depending on the position of the device inside the mill or depending on how the skin pass level or degree of stretching values are processed further, the calculation of the values differs. Table 6 shows the possible calculation methods. The table must be read in combination with Figure 10.

Table 6: Setting range of the parameter SYNCBASIS

Value	Meaning
0	Calculation of the skin pass level based on the infeed (master) Calculation of the degree of stretching based on the infeed (slave 1)
1	Calculation of the skin pass level based on the outfeed (slave 1) Calculation of the degree of stretching based on the outfeed (slave 2)
2	Calculation of the skin pass level based on the infeed (master) Calculation of the degree of stretching based on the outfeed (slave 2)
3	Calculation of the skin pass level based on the outfeed (slave 1) Calculation of the degree of stretching based on the infeed (slave 1)

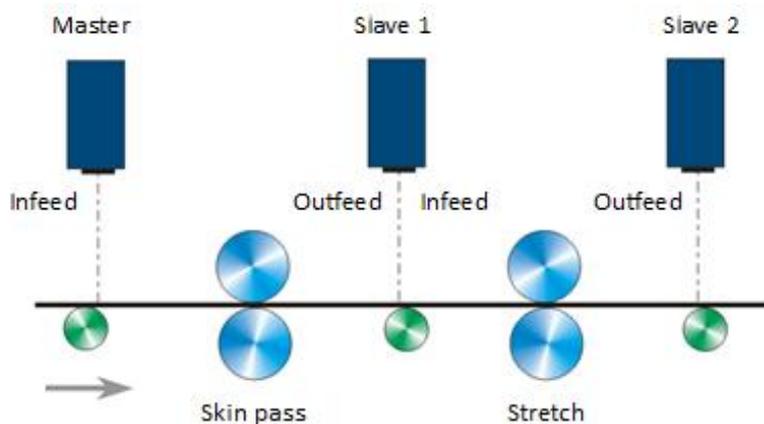


Figure 10: Reference points for process calculation

Synccalc

This parameter sets which process values are calculated.

Syntax: **Synccalc** [n] (n = 0 or 1)

Setting the parameter to "0" only the skin pass level is calculated. Setting the parameter to "1" both skin pass level and degree of stretching are calculated.

The setting is irrelevant if the device is a DG-slave.



If the parameter is set to 1 and there is only one DG-slave in the system, error E71 is generated because there is no communication between DG-master and DG-slave 2.

Synclength

This parameter sets the total length the calculation of the skin pass level and/or degree of stretching is based on. The unit is meter (integer).

Syntax: **Synclength** [n] (n = 5 ... 50 in m)

The right setting for this parameter must be made considering the dynamics of the skin pass mill. The quotient of this parameter and the parameter *Syncrefresh* define the size of the calculation buffer (ring buffer). Refer to section „Filter behavior of the ring buffer” in chapter 1.2. Synclength must be larger than Syncrefresh!

Synccoutput

This parameter sets the mode of data output to the data interface.

Syntax: **Synccoutput** [n] (n = 1 ... 7)

The setting is irrelevant if the device is a DG-slave.

If the data interface is Profinet, any mode can be selected. Table 1 shows the different output modes. If the data interface is Ethernet, mode 6 is mandatory.



If Profinet was selected as the data output interface, the new output mode must also be set after changing the Synccoutput parameter in the PLC (Profinet master).

This parameter does not activate the actual data output! This must still be done using the commands of the SO2 command group (see VLM500 user manual). The following overview shows the required settings for the SO2 command group.

Parameter	Setting*
SO2ADDRESS	0
SO2SYNC	1 (Data output takes place synchronously with the calculation of new values)
SO2TIME	The setting is irrelevant.
SO2FORMAT	g
SO2INTERFACE	57600
SO2ON	1 (activates the data output to the PLC)

* The parameters are set ex works according to the table.

Syncrefresh

This parameter sets the refresh length used to calculate the skin pass level and the degree of stretching. The unit is meter. The setting is irrelevant if the device is a DG-slave.

Syntax: **Syncrefresh** [f] (f = 0.1 ... 20.0 in m)

Each time the refresh length was processed by the mill, a new length value is put into the ring buffer, the process values are calculated and are fed to the data interface. The right setting for this parameter must be made considering the dynamics of the skin pass mill. The quotient of this parameter and the parameter *Synclength* define the size of the calculation buffer (ring buffer). Refer to section „Filter behavior of the ring buffer” in chapter 1.2. Syncrefresh must be smaller than Synclength.

4 Error messages

In addition to the normal VLM error codes, the DG option provides Table 7.

Table 7: Error list

Code	meaning	Cause of error
E70 SYNC-SLAVE 1 communication defective	Missing communication between master and slave 1.	The master did not receive an answer from slave 1.
E71 SYNC-SLAVE 2 communication defective	Missing communication between master and slave 2.	The master did not receive an answer from slave 2.
E72 SYNC-SLAVE 1 length out of range	The refresh length $L_{refresh}$ of slave 1 is not in the expected range The value is discarded and a backup value is used to calculate the current mass flow values.	The length L transmitted by slave 1 is not in the expected interval of $0,5 * L_{refresh} < L < 1,5 * L_{refresh}$
E73 SYNC-SLAVE 2 length out of range	The refresh length $L_{refresh}$ of slave 2 is not in the expected range The value is discarded and a backup value is used to calculate the current mass flow values.	The length L transmitted by slave 2 is not in the expected interval of $0,5 * L_{refresh} < L < 1,5 * L_{refresh}$
E76 MASTER last length zero	The length element last determined by the master is zero. A backup value is used to calculate the current mass flow values.	Error in the internal processing of the length segment calculation.

5 Device cabling

The following figure shows the wiring of the VLM500-DG system. The interconnection takes place in the form of a chain. The slave devices are identical and can be interchanged. Only the parameterization has to be adapted.

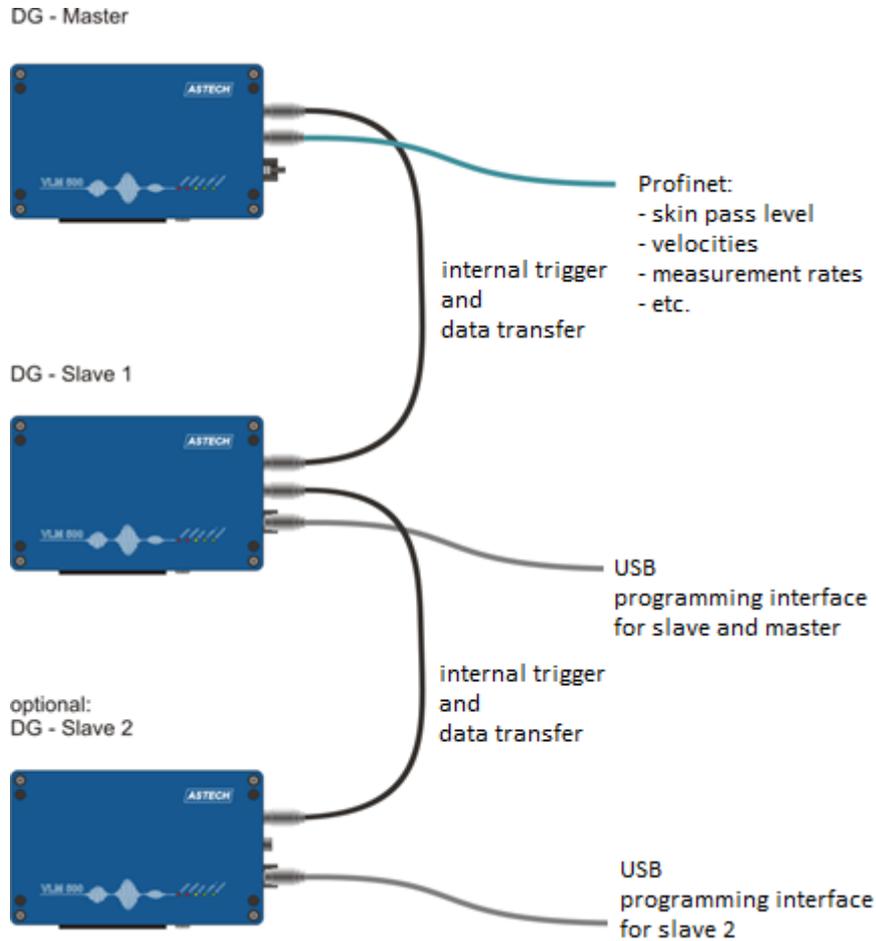


Figure 11: cabling of VLM500-DG system

6 Wiring plan

The devices are wired to one another according to a fixed scheme. Refer Figure 12.

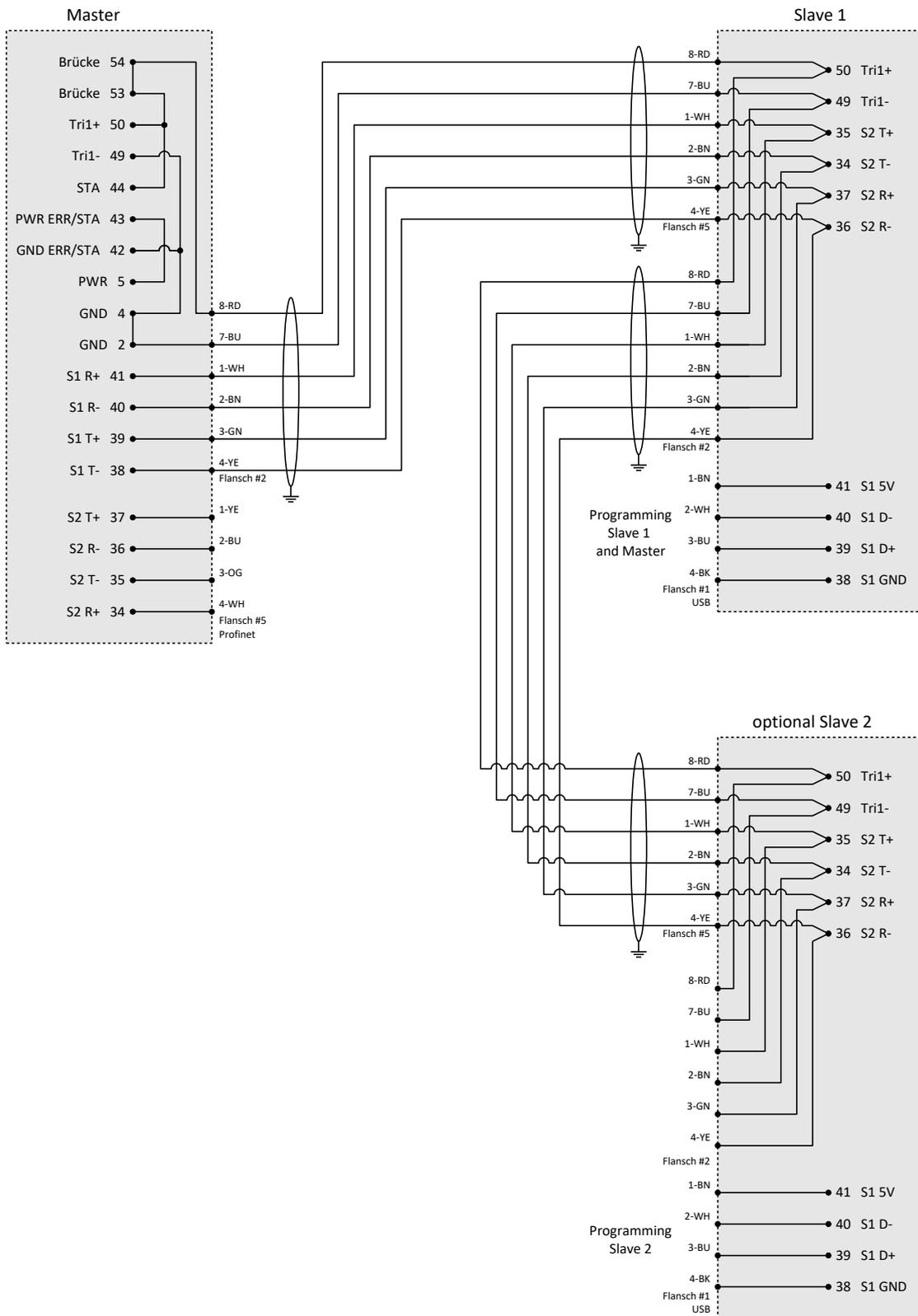


Figure 12: Wiring plan