VibroLine® 5.0

2021

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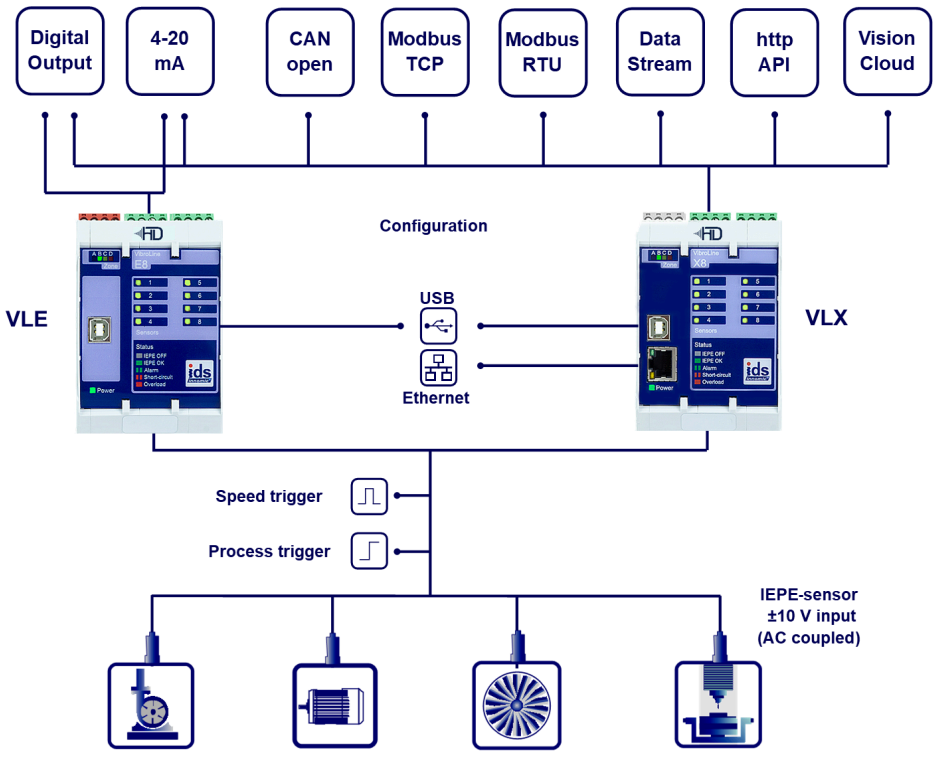
VibroLine® - Intended use

The condition monitoring devices of the VibroLine series are designed for continuous vibration monitoring and analysis on machines and facilities. For this purpose, vibration signals as well as speed and process information are evaluated. For monitoring, characteristic values of vibration acceleration, velocity and displacement are formed channel by channel. The VLX devices can output the sensor signal in raw format or display the monitored characteristic values in the Vision Cloud. Current machine conditions are evaluated with an alarm management..The following device variants are available with the following interfaces for data transfer:

Interface	VLX HD	VLE HD
Digital output	yes	yes
4-20 mA current loop	yes	yes
CANopen	yes	-
Modbus TCP	yes	-
Modbus RTU	yes	-
HTTP API	yes	-
DataStream	yes (*)	-
VibroLine.Vision	yes (*)	-

(*) Device option

Setup



Possible applications are for instance:

- Vibration parameter monitoring according to DIN ISO 10816 / DIN ISO 20816
- Condition-oriented maintenanceUnbalance monitoring
- Order characteristic value monitoring
- Tool breakage/crash detection (when using the impact characteristics)
- Continuous bearing monitoring (4 bearing characteristics available)
- Vibration measurement on EOL test benches
- Vibration measurement for quality assurance

With predefined parameter sets or your own specifications, the devices can be set up quickly and easily for the measuring tasks. The devices are addressed by a configuration software via the USB interface.
The freely parameterizable monitoring parameters can be combined in four groups:

- **Total characteristic values**
- **Order parameters**
- **Impact characteristics**
- **Rolling bearing characteristics**

Order and bearing characteristics with components rotating at different speeds are formed with three speed trigger inputs. The process trigger allows the selective starting and stopping of vibration monitoring from remote.

The alarm management includes the four zone classification according to ISO 20816. Furthermore, two alarms can be freely defined per channel. Different alarm modes and switch-on and switch-off delays (holding time) can be set.

The digital outputs and the change-over relay (VLE HD only) signal alarm and error conditions. The currently formed characteristic values and error states are provided per channel as a 4-20 mA current loop. The same applies to the three bus interfaces (CAN open, Modbus RTU/TCP and HTTP API). For the VLX HD devices the raw signal of the connected vibration sensors can furthermore be output via a **DataStream** interface. With the **DataInspect** option, it is possible to evaluate the raw data with the VibroMatrix software suite from IDS Innomic Schwingungsmesstechnik GmbH.

Safety information

- This manual must be read and understood in full before installation and operation.

- This device may only be installed and adjusted by skilled and competent personnel. This includes in particular persons who have sufficient knowledge of the EMC and low-voltage directives.
- Changes to the electrical connections may only be made to the de-energized device. This also includes output load circuits.
- The protection against accidental contact according to IP20 only exists after all terminals have been completely plugged in.

- The device may only be operated under the conditions specified in the data sheet.
- All peripheral devices (sensors, devices at the interfaces to digital and relay outputs) must be designed for operation with VibroLine devices. The responsibility for this lies with the operator.
- Any unauthorized modification of the VL devices (e. g. opening of the housing, repair or replacement of components or PCBs) will void the warranty.
- The manufacturer accepts no liability for damage caused by non-observance of this manual.
- If there are any uncertainties or malfunctions, please contact the manufacturer.

Installation, connection and start-up

Installation and start-up may only be carried out by qualified personnel.

All VibroLine devices are designed for mounting on DIN-rail systems. For mounting, the VL devices are placed on top of the DIN rail and locked in place with a rotary movement and light pressure downwards. The upper and lower sides of the unit must be left at least 5 cm free space to ensure the necessary air circulation. For disassembly, pull the metal tab on the underside of the device downwards and turn the device upwards. It can then be detached from the DIN rail.

After installation, the following steps should be carried out according to the connection diagram:

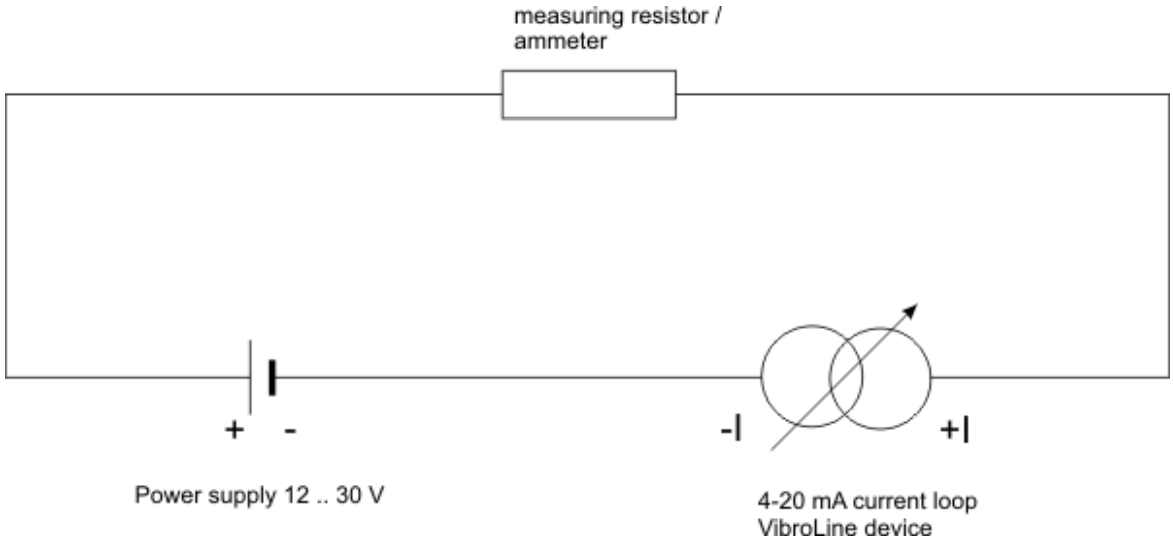
- Connection of the sensors (green connectors, max. cable length 250 m)
- Connection of the speed input (grey connector)
- Connection of the current loop outputs (orange connector, 12..30 V voltage source required to supply the current sink, max. cable length 1000 m)
- Connection of digital outputs 1+2 (red connector) and change-over relay (grey connector), only VL-devices
- Connection of the bus interface (blue connectors or RJ45 connector)
- Connection of the 24 V power supply and digital output (red plug connector)

The individual inputs and outputs are protected against polarity reversal. The device can be destroyed if the connectors are interchanged.

Before switching on the power supply, the correct cabling must be checked.

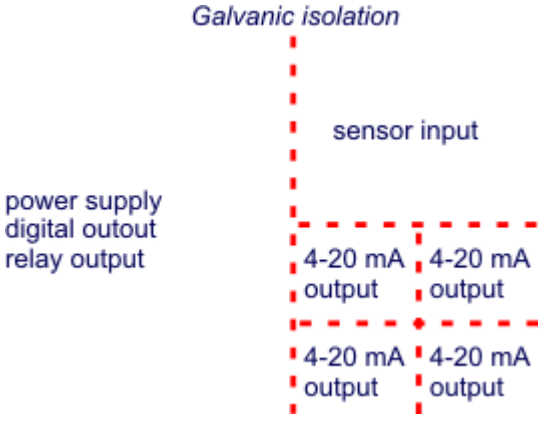
Connection of the 4-20 mA current loop

The 4-20 mA current loop is passive, i.e. operates as a current sink. An external supply with 12 ... 30 V DC voltage is required. The 4-20 mA output terminals of the VibroLine devices must be supplied with > 12 V (consider voltage drop via measuring resistors!).
The following scheme illustrates the correct connection of peripherals to the current loop outputs of the VibroLine devices:



Galvanic concept

In order to prevent earth loops, all VibroLine devices have a galvanic isolation between the *voltage supply / digital outputs / relays* and the s*ensor inputs*. Furthermore, each *current output* is electrically isolated from the rest of the circuitry. The following figure illustrates the mass concept of the VibroLine devices:



The following also applies to 6 and 8 channel devices: The sensors 6, 7 and 8 are also galvanically isolated from the rest of the circuitry.

Start-up

After installation and connection, the device is first started up. For this purpose, the device must be connected to a computer via the enclosed USB cable. The computer is equipped with the supplied software VibroLine Configurator and the device driver for the VibroLine devices. After starting the software, the device can be parameterized accordingly. Parameterization is described in the Configuration section. Once all configuration parameters have been defined, the device operates autonomously and reports the current machine status.

Electrical and mechanical data

Electrical data:

n=number measurement channel	VLX*n*	VLE*n*
Variant	HD	HD
Measuring input		
measuring range	± 10 V AC, IEPE supply selectable	
number of channels	1, 2, 4, 6, 8	
gain (switchable)	1, 25	
noise (0,1 .. 40000 Hz / 13333 Hz), RMS	< 250 µV (gain 1), < 15 µV (gain 25)	
noise (10 .. 1000 Hz), RMS	< 60 µV (gain 1), < 5 µV (gain 25)	
measuring error	< 4 %	
Digital trigger input		
standard configuration	input for speed signals (3x), process trigger (1x)	input for speed signals (1x), process trigger (1x)
level	0 .. 24 V	
number	4	2
switching threshold High-Low	0.5 .. 24 V selectable	
minimum pulse length	12 µs	
Signal processing (channelwise selectable)		
A/D conversion	24 Bit, 96.000 Hz	24 Bit, 96.000 Hz
filtering	Butterworth, 40/60 dB/Dekade	
frequency range	0,1 .. 40000 Hz	0,1 .. 40000 Hz
order filter	whole und fractional orders	
measurand	acceleration, velocity, displacement	
characteristics	RMS-, peak-, peak-peak-value	
alarmmanagement	2 alarms and 4 zones per channel	
cycle time	8 ms (0,333 ms für crash detection	
Digital output		
outout High	24 V, 100 mA	
output Low	high impedance	
number	1	3
tripping and hold delay	0,0 .. 60,0 s	
Analog output		
curren loop (isolated)	4-20 mA	
number	1, 2, 4, 6, 8	
Relay output		
type	-	changeover contact
max. switching voltage	-	60 V
max. switching current	-	2 A
number	-	1
tripping and hold delay	-	0,0 .. 60,0 s
Display		

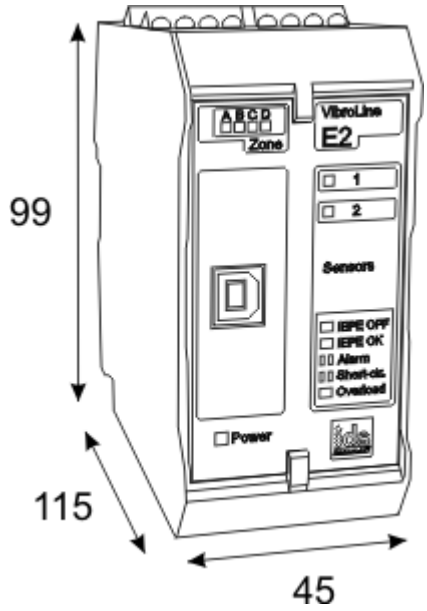
per channel	1x power supply and 4x zone	
per device	IEPE OK, short ciruit, no sensor, overload	
Interface		
USB 2.0	yes	
CAN open	yes	-
Modbus RTU	yes	-
Modbus TCP	yes	-
HTTP API	yes	-
DATA STREAM	yes (*)	-
Vision.Cloud	yes (*)	
Power supply		
voltage	24 V DC ± 20 %	
current	max. 500 mA	

(*) Device Option

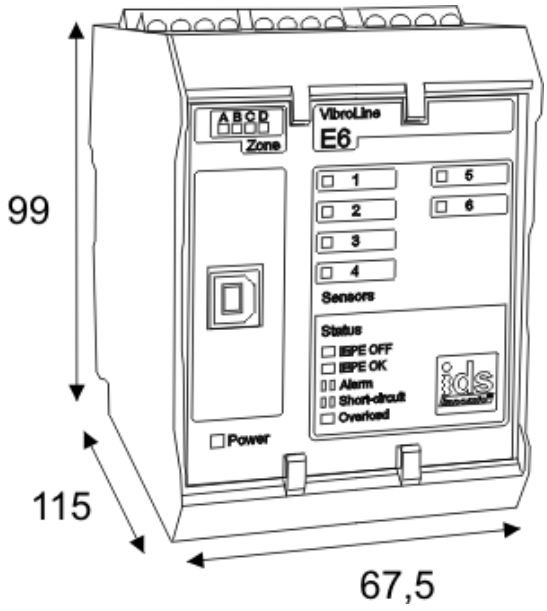
Mechanical data:

n=number of measuring channels	VLE*n*
Mechanical Data	
enclosure material	polyamide
color	grey
flammability class according to UL94	V0
dimensions (W x D x H, in mm)	45 x 114,5 x 99 (1 - 4 channel) 67,5 x 114,5 x 99 (6 -8 channel)
mass	250 g (1 - 4 channel) 380 g (6 -8 channel)
mounting	DIN rail
Environmental conditions / standards	
protection grade	IP20
ambient temperature during operation	-20 ..60 ºC
relative humidity, no condensation	5..95 %
certification	CE

enclosure dimensions (in mm):



VLX1 .. VLX4
VLE1 .. VLE4

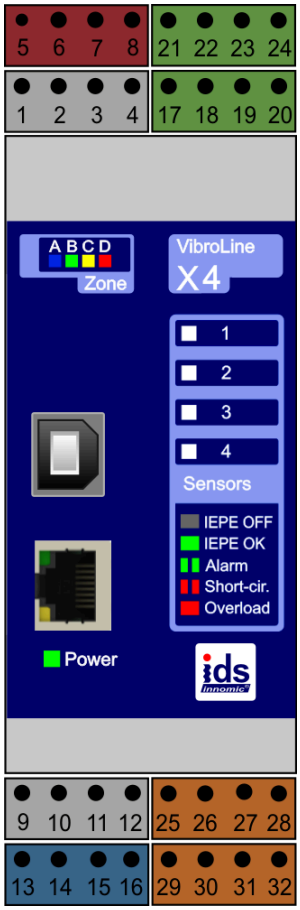


VLX6 .. VLX8
VLE6 .. VLE8

Connection diagram

The electrical connections of the VibroLine devices are located on the upper and lower side of the housing. The individual terminals can be removed from the VibroLine devices for easy connection.

VLX devices:

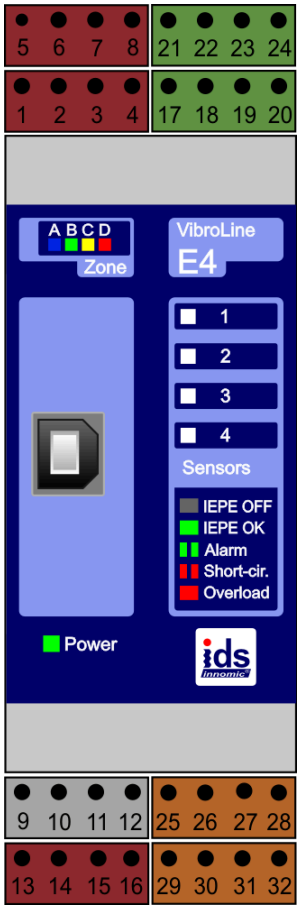


The numbering indicates the following connections:

1	Speed trigger 1	25	Positive 4-20 mA current loop S1
2	GND Trigger 1	26	Negative 4-20 mA current loop S1
3	Speed trigger 2	27	Positive 4-20 mA current loop S2
4	GND Trigger 2	28	Negative 4-20 mA current loop S2
5	Digital output	29	Positive 4-20 mA current loop S3
6	GND DO	30	Negative 4-20 mA current loop S3
7	Power supply 24 V	31	Positive 4-20 mA current loop S4
8	GND	32	Negative 4-20 mA current loop S4
9	Speed trigger 3	33	Measuring input Sensor 5 (IEPE / ±10 V)
10	GND Trigger 3	34	GND S5
11	Process trigger	35	Measuring input Sensor 6 (IEPE / ±10 V)
12	GND process trigger	36	GND S6

13 RS485 A (Modbus RTU)
14 RS485 B (Modbus RTU)
15 CAN LOW
16 CAN High
17 Measuring input Sensor 1 (IEPE / ±10 V)
18 GND S1
19 Measuring input Sensor 2 (IEPE / ±10 V)
20 GND S2
21 Measuring input Sensor 3 (IEPE / ±10 V)
22 GND S3
23 Measuring input Sensor 4 (IEPE / ±10 V)
24 GND S4
37 Measuring input Sensor 7 (IEPE / ±10 V)
38 GND S7
39 Measuring input Sensor 8 (IEPE / ±10 V)
40 GND S8
41 Positive 4-20 mA current loop S5
42 Negative 4-20 mA current loop S5
43 Positive 4-20 mA current loop S6
44 Negative 4-20 mA current loop S6
45 Positive 4-20 mA current loop S7
46 Negative 4-20 mA current loop S7
47 Positive 4-20 mA current loop S8
48 Negative 4-20 mA current loop S8

VLE devices:



The numbering indicates the following connections:

1 Digital output 1
2 GND DO1
25 Positive 4-20 mA current loop S1
26 Negative 4-20 mA current loop S1

3	Digital output 2
4	GND DO2
5	Digital output 3
6	GND DO3
7	Voltage supply (24 V)
8	GND
9	Speed trigger
10	GND speed trigger
11	Process trigger
12	GND process trigger
13	Changeover contact NO (Normally open)
14	COM
15	Changeover contact NC (Normally closed)
16	COM
17	Measuring input Sensor 1 (IEPE / ±10 V)
18	GND S1
19	Measuring input Sensor 2 (IEPE / ±10 V)
20	GND S2
21	Measuring input Sensor 3 (IEPE / ±10 V)
22	GND S3
23	Measuring input Sensor 4 (IEPE / ±10 V)
24	GND S4
27	Positive 4-20 mA current loop S2
28	Negative 4-20 mA current loop S2
29	Positive 4-20 mA current loop S3
30	Negative 4-20 mA current loop S3
31	Positive 4-20 mA current loop S4
32	Negative 4-20 mA current loop S4
33	Measuring input Sensor 5 (IEPE / ±10 V)
34	GND S5
35	Measuring input Sensor 6 (IEPE / ±10 V)
36	GND S6
37	Measuring input Sensor 7 (IEPE / ±10 V)
38	GND S7
39	Measuring input Sensor 8 (IEPE / ±10 V)
40	GND S8
41	Positive 4-20 mA current loop S5
42	Negative 4-20 mA current loop S5
43	Positive 4-20 mA current loop S6
44	Negativer 4-20 mA current loop S6
45	Positive 4-20 mA current loop S7
46	Negative 4-20 mA current loop S7
47	Positive 4-20 mA current loop S8
48	Negative 4-20 mA current loop S8

Configuration

The VibroLine devices are parameterized by means of the configuration software. All parameters required for operation can be set. In addition, it is possible to display the current vibration signal in order to define input amplifications, alarms and process variable outputs (4-20 mA) appropriately (test measurement). All settings can be collected and saved individually as templates for further parameterization. In addition to these user-defined templates, there are also templates created by the manufacturer to simplify parameterization in accordance with DIN ISO 10816/20816.

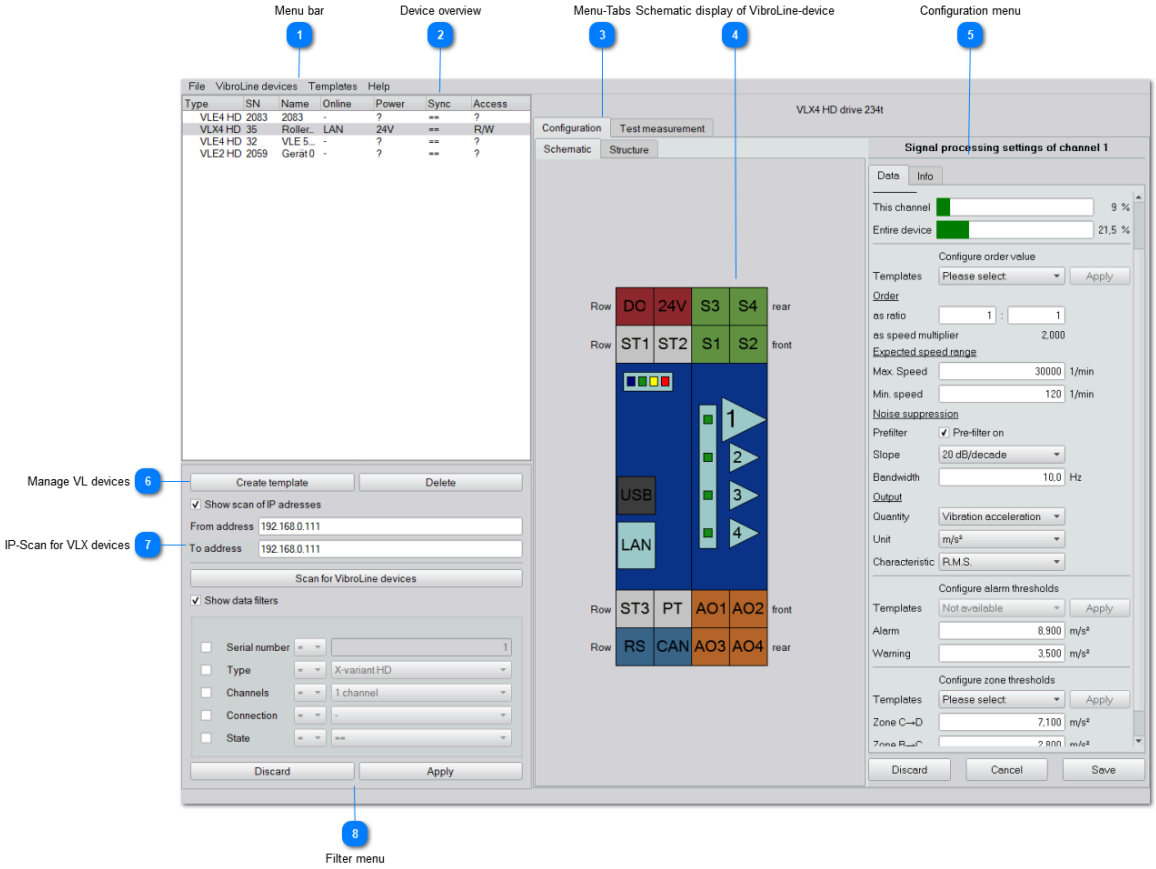
The configuration software is described in detail below:

- Overview
- Device overview and status
- Device configuration
- Test measurement
- Template creation and management

Overview

After starting the program, the VibroLine Configurator opens as shown below. The program window is divided into three areas:

- VibroLine device overview with data filter function (left)
- Schematic display of the VibroLine device (central)
- Configuration menu for all device properties (right).



1 Menu bar

All program menus can be selected in the menu bar. The following submenus can be selected by clicking on the individual items:

File

- Settings
- Close

- Open Settings
- End software

VibroLine devices

- Configuration

- VibroLine configuratio

Templates

- Complete devices
- Sensor inputs
- Trigger input
- Analog outputs
- Analog error output
- Digital outputs
- Relay
- Bandpass filter (general)
- Bandpass filter (impact)
- Order filter
- Overall values
- Order characteristics
- Impact characteristics
- Alarm thresholds
- Zone thresholds

- Template management

Help

- Show Help F1
- About ...

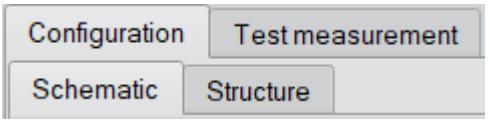
- Show software manual
- Show software information

2 Device overview

Type	SN	Name	Online	Power	Sync	Access
VLE4 HD	2083	2083	-	?	==	?
VLX4 HD	35	Roller_	LAN	24V	==	R/W
VLE4 HD	32	VLE 5_	-	?	==	?
VLE2 HD	2059	Gerät 0	-	?	==	?

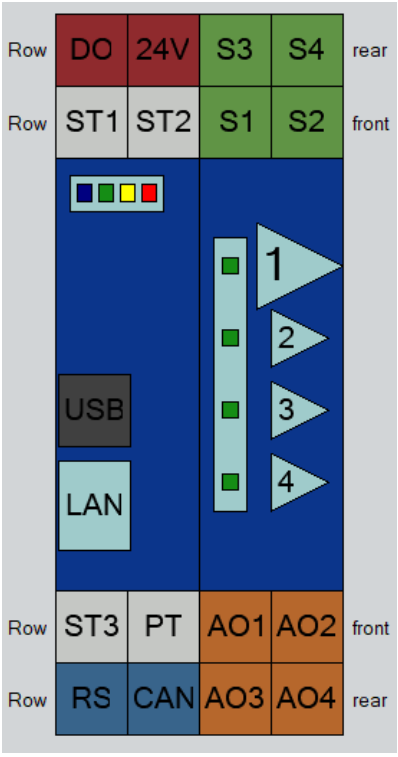
The device overview on the left side of the window lists all VibroLine devices in the program database and their communication status.

3 Menu-Tabs



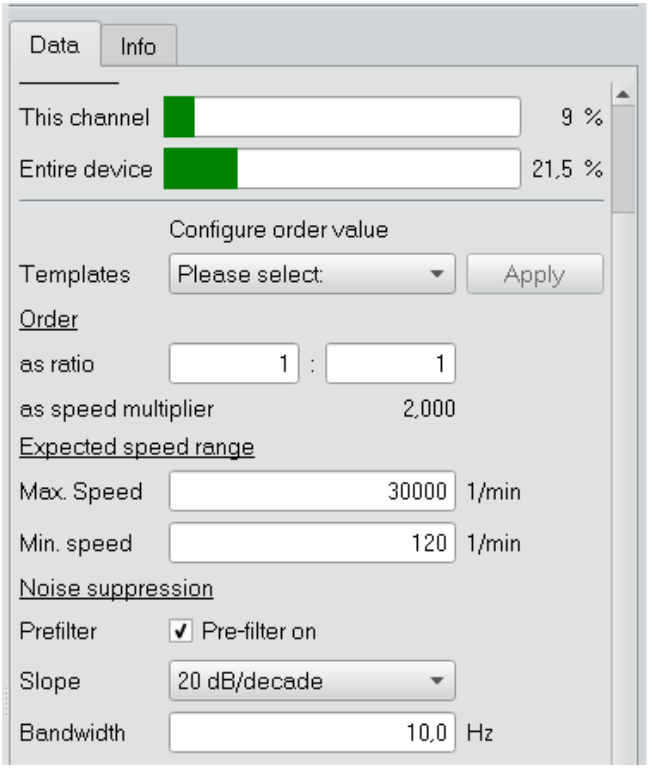
The configuration can be done by means of the schematic display of the VibroLine device or in the structure view. A live measurement function can also be selected (test measurement).

4 Schematic display of VibroLine-device



A schematic display of the VibroLine device selected from the device overview is shown centrally. For configuration, click on the respective input/output (or device property) in the display. The corresponding properties menu opens. At the same time, the positioning of the inputs and outputs on the VibroLine device can be taken from the illustration.

5 Configuration menu

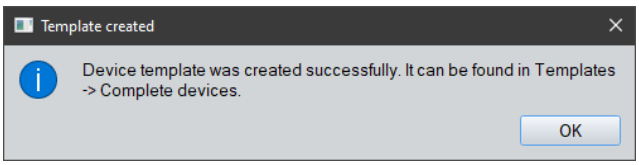


Setting options related to the content are arranged in separate configuration menus. These are oriented to the right edge of the window. The menu content change depending on the selected device properties. All configuration menus are explained in the section "Device Configuration".

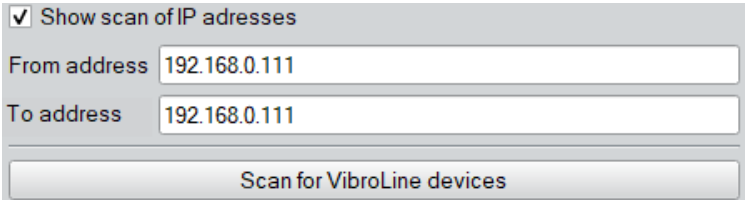
6 Manage VL devices

Devices in the list can be deleted. Depending on the connection status, the devices then reconnect themselves after a few seconds.

A device template can be created from existing devices. This contains the complete device settings. The created device templates can be found in the template menu:

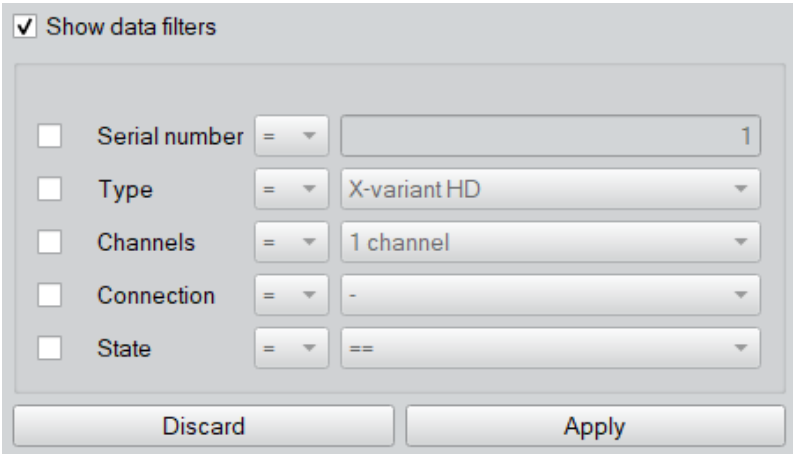


7 IP-Scan for VLX devices



VibroLine devices of the type VLX can also be connected and parameterized via an Ethernet (LAN) connection. To search for available VLX devices, an IP range can be entered here. By clicking **Scan for VibroLine devices**, the VLX devices found in the entered range are displayed. The activation of this function in the LAN menu is a condition.

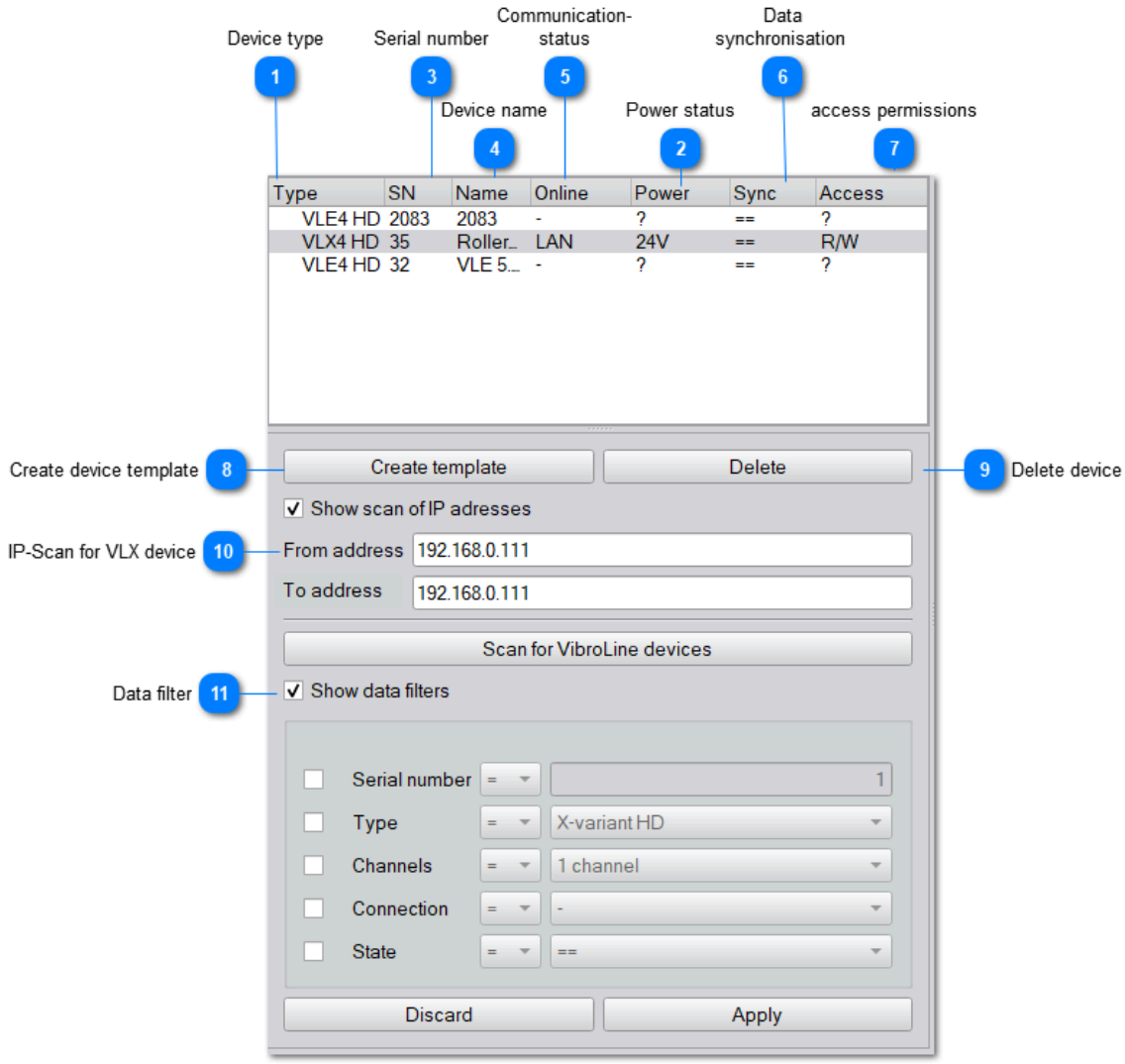
8 Filter menu



A selection of all listed VibroLine devices can be reached with the filter menu. The desired filter category is activated by checking the box and the desired criterion and a comparison operator are selected. Clicking on **Apply** sets the filter, **Discard** resets the filter selection.

Device overview and status

The device overview shows all VibroLine devices in the program database. This includes currently connected devices as well as previously connected devices. Important device and status information is displayed for the VibroLine devices.



1 Device type

Type
VLE4 HD

The device type is displayed. The name is given according to the pattern:

VLX6 HD = VibroLine X version HD + 6 measuring channels.

Depending on the number of channels VLX1, VLX2, VLX4, VLX6 or VLX8 and according VLE1, VLE2, VLE4, VLE6 or VLE8 is displayed.

2 Power status

Power
?

The VibroLine units can be parameterized with supply via USB. However, the 24V supply voltage must be connected to obtain measurement functionality. The current device supply type is displayed here.

3 **Serial number**

Serial number of the VibroLine device assigned by the manufacturer.

4 Device name

Name
2083

User selectable description of the VibroLine device.

5 Communication-status

Online
-

Depending on the communication status,"**USB**" (connected via USB) or "**-**" (not connected) is displayed here.

6 Data synchronisation

Sync
==

The status of the data synchronisation between the device and the program database is displayed:

PW	The parameter set in the device is password-protected (not readable).
Def!	The parameter set in the device is faulty.
Ver!	The version of the parameter set in the device is newer than it can be processed by the software. Configuration cannot be read out.
==	The parameter set in the database and device is the same.
<>	The parameter set in the database and device is different.
0	Empty parameter set in database (e. g. if there are no reading rights due to password protection).

Note: The data synchronization between database and device includes all settings made. The following applies to passwords: The selected status (password use or not) is compared, but for security reasons the assigned passwords are excluded from the comparison.

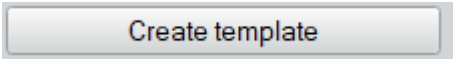
7 access permissions

Access
?

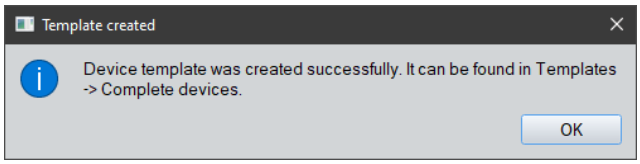
The access permission level is displayed:

-	no access permissions, password invalid
?	Device not connected, rights status unknown
R	Read-only rights
R/W	read and write permissions

8 Create device template



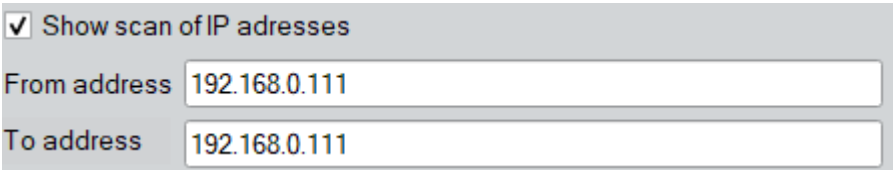
The entire configuration of the selected VibroLine device can be saved as a template by clicking on "**Create template**". The template creation and management section describes the subject of templates in more detail. The created device templates can be found in the template menu:



9 Delete device

The selected device can be deleted from the program database. If it is reconnected at a later time, all set parameters are reconstructed from the VibroLine device. (=, >, <, >=, <=, <>)

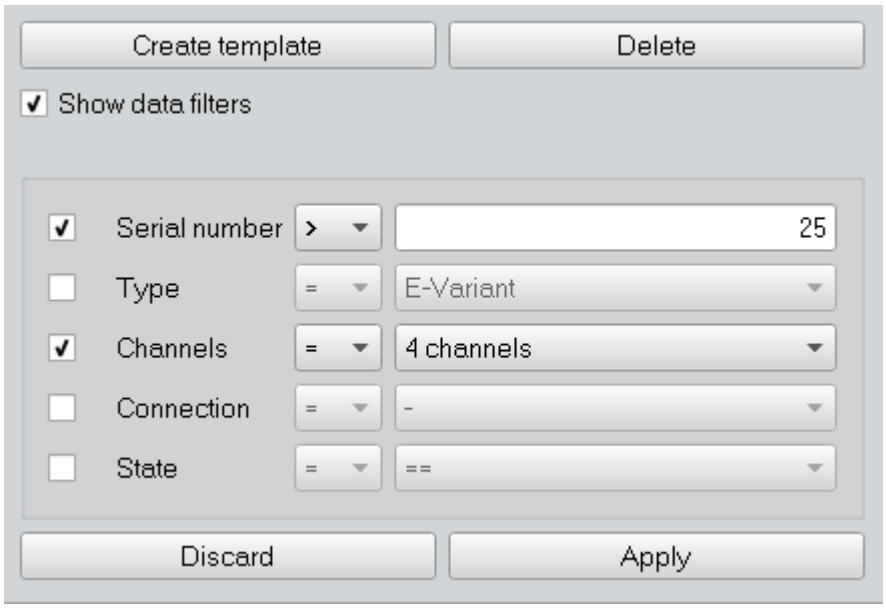
10 IP-Scan for VLX device



VibroLine devices of the type VLX can also be connected and parameterized via an Ethernet (LAN) connection. To search for available VLX devices, an IP range can be entered here. By clicking **Scan for VibroLine devices**, the VLX devices found in the entered range are displayed. The activation of this function in the LAN menu is a condition.

11 Data filter

A data filter can be set to obtain a selection of the displayed VibroLine devices. To do this, check the box **Show data filter**. The filter criteria (see picture) can be provided with comparison operators (=, >, <, >=, <=, <>). To perform filtering, select **Apply**. Reset the filter by clicking **Discard**.

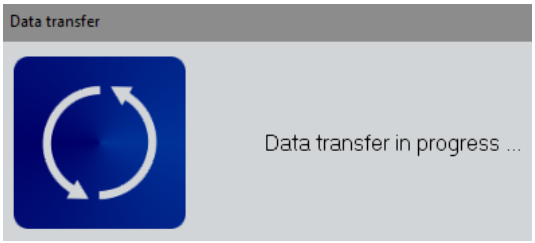

Create template
Delete
Show data filters
Serial number
>
25
Type
=
E-Variant
Channels
=
4 channels
Connection
=
-
State
=
==
Discard
Apply

Device configuration

The VibroLine devices can be comprehensively configured. The configuration is possible in the following ways:

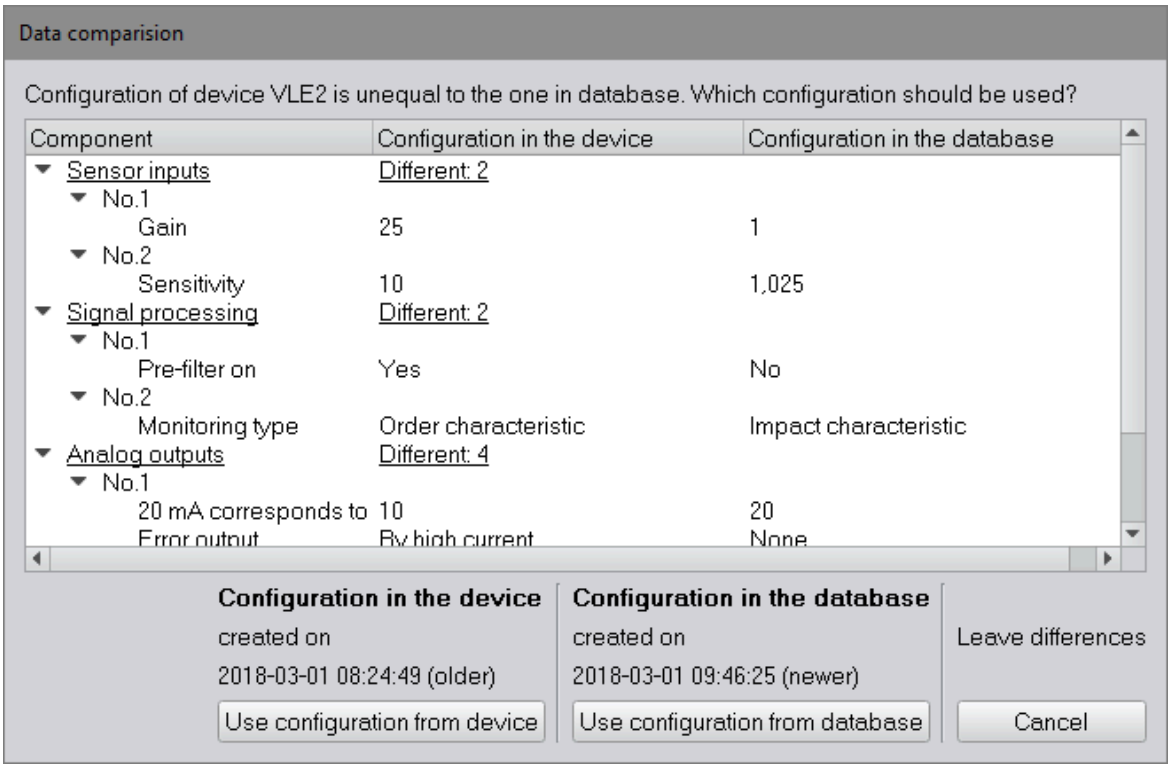
Configuration of connected devices

Here, changed parameters are written directly to the connected device. The writing process is indicated by a corresponding window.

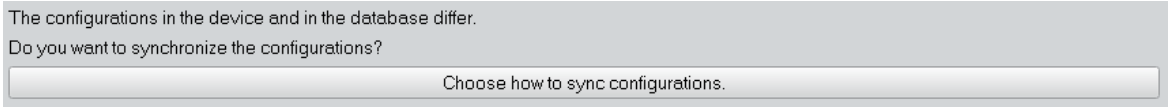


Configuration of disconnected devices

Here, the changed parameters are first saved in the software database. If the corresponding device is connected, a dialog box appears in order to select between the configuration from the *device* and the configuration from *database*. All differences are clearly listed.



If Cancel is selected, the differences remain. The data synchronization dialog can be reopened by using the button under Information text at the bottom of the window:

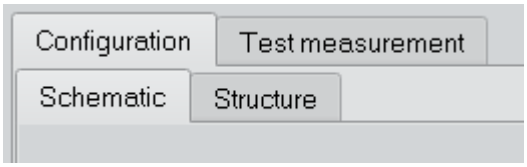


Executing the configuration

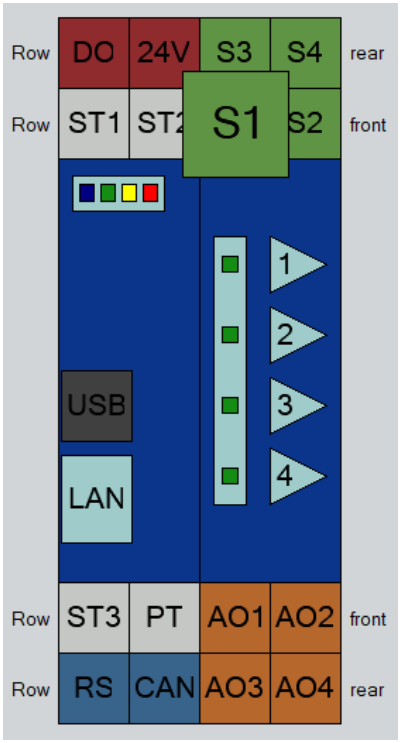
Parameters of the VibroLine device can be changed in three different ways:

1. Schematic display of the VibroLine device

To do this, select the "Configuration" tab and then the "Schema" tab:

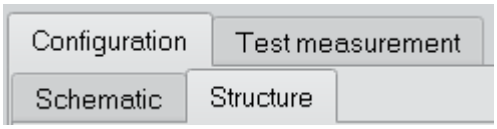


The device properties and parameters of the individual inputs and outputs can be selected by clicking on the schematic representation of the VibroLine devices. The property currently being edited is highlighted:



2. Structure view of the VibroLine device

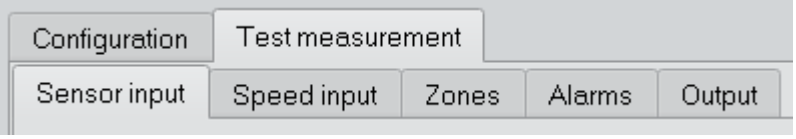
To do this, select the "Configuration" tab and then the "Structure" tab:



All device parameters can be modified from the structure view.

3. Test measurement

To do this, select the "Test measurement" tab:



The test measurement can be used to change the measurement gain, zone and alarm limits, and the 4-20 mA scaling of the analog output.

The following describes the parameterization options of the device using the schematic display of the VibroLine device:

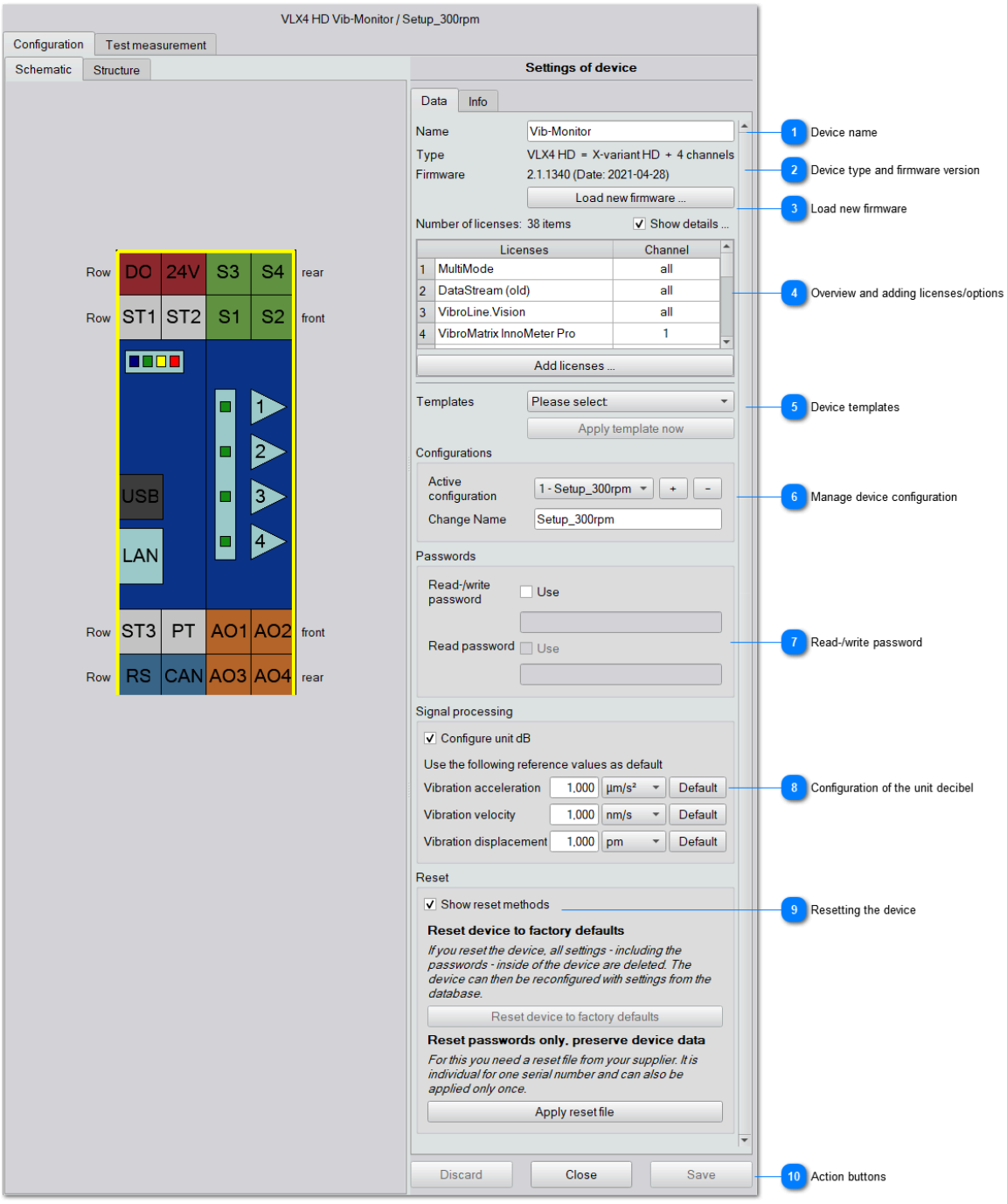
- Device properties
- Measurement input
- Triggerinput
- Signalprocessing
- LAN Interface
- RS485 Interface
- CAN Interface
- Analog output
- Digital output
- Relay output
- Sensor-Status-LED
- Zone-Status-LED

Each dataset is provided with information on the creation/change date and access level. For details, refer to the section dataset information.

Device properties

The device properties can be edited by clicking on the blue area of the displayed VibroLine device. The active editing option is indicated by the yellow frame.

All device settings are also listed in the structure view and can be edited from there.



1 Device name

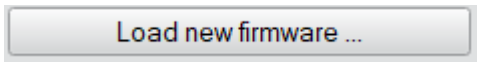
The device name can be entered here. Up to 40 characters are available.

2 **Device type and firmware version**

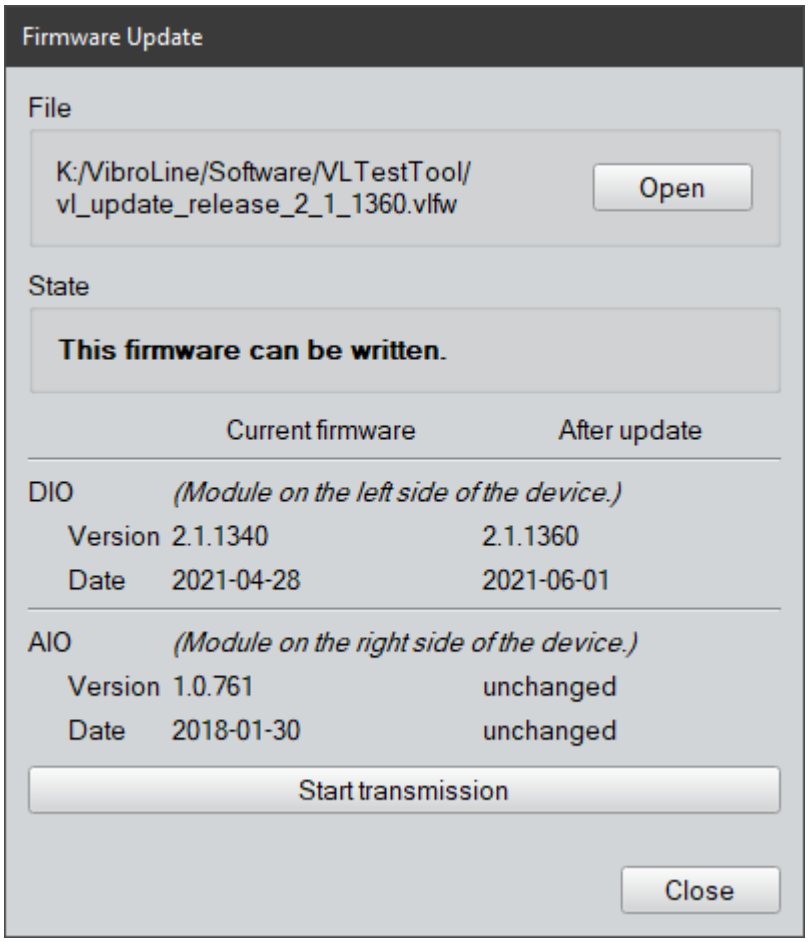
Type	VLX4 HD = X-variant HD + 4 channels
Firmware	2.1.1340 (Date: 2021-04-28)

Display of the device type and the currently used firmware version.

3 Load new firmware



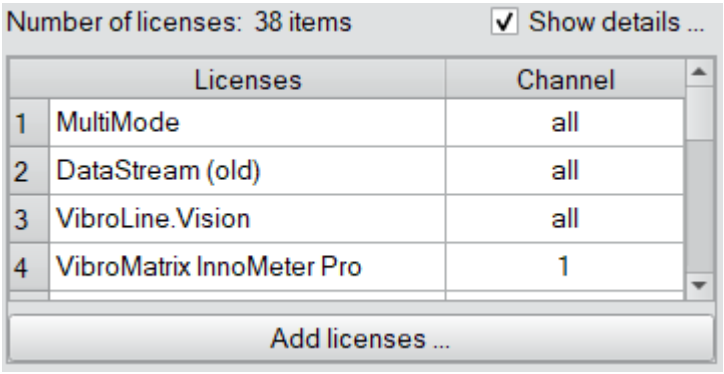
The devices can be provided with a new firmware via USB or LAN connection. The following dialog opens:



The previous firmware versions of all installed modules are displayed. Also, whether an update is necessary. If the update is to be carried out, click on Start transfer. After a few seconds, a message appears confirming the successful firmware update.

New firmware versions must be requested from the manufacturer IDS Innomic Schwingungsmesstechnik GmbH and are provided in the form of a firmware file (*.vlfw).

4 Overview and adding licenses/options

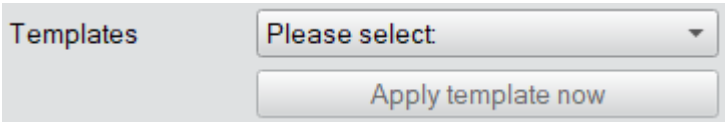


The VibroLine devices can be equipped with options, e.g.

Multimode	Define up to 3 characteristic values per channel, running simultaneously and in real time. Define up to 8 overall configurations and switch via fieldbus (CANopen, Modbus, HTTP API).
DataStream	Real-time data stream of the sensor signals. High quality digitization with 24 bit, 96 kHz for each channel. API for connection to own applications.
DataInspect	Log real-time data stream in ids file. Analyze ids file with VibroMatrix Replay. No own software for the analysis necessary.
VibroLine.Vision	Record and visualize measured values and events in the VibroLine.Vision cloud. Complete overview of all measuring points, notification and reporting.

The subsequent activation of the options is done via license file (*.vlkey). With a click on Add licenses... this license file can be selected in the file dialog. The addition of the license is acknowledged accordingly.
Simply call IDS Innomic Schwingungsmesstechnik GmbH for additional information and prices for available options and extensions.

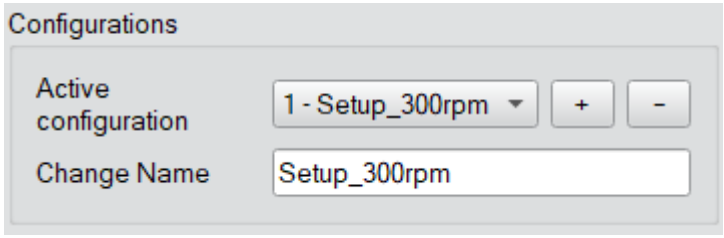
5 Device templates



Complete device configurations can be saved in a template. If templates are available, they can be selected from the selection field ("Please select"). The transfer of a device template to the connected device is confirmed by clicking Apply template now.

If no template is available, "None available" is displayed in the selection field.

6 Manage device configuration



This feature requires the *MultiMode* option.

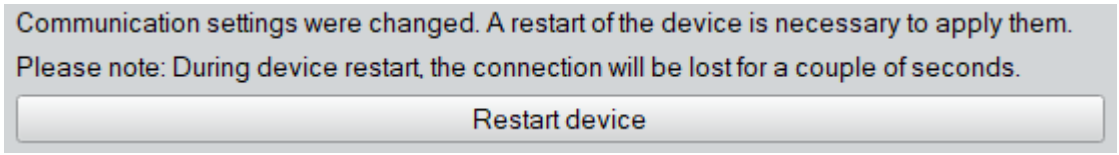
Up to 8 different device configurations can be stored in the VibroLine device. A device configuration includes all settings made, except for the communication settings. This means that different measurement configurations can be kept ready for different applications and can be changed immediately without the need for time-consuming reconfiguration.

The change of the measuring configuration is done by configuration software or automated via the interfaces Modbus TCP, Modbus RTU, CANopen or the HTTP API.

Applications are e.g:

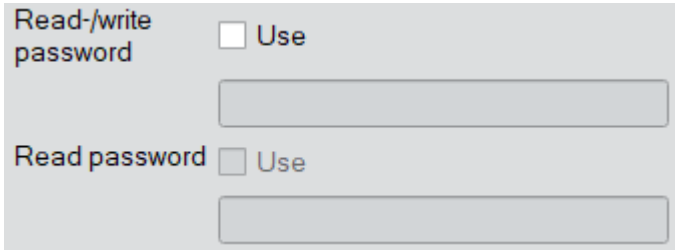
- Use in the test field. Different DUTs are tested according to different specifications. The test software selects the correct measurement configuration depending on the DUT.
- Depending on the operating condition (e.g. speed or running product) a different measuring configuration can be used.

Note: After changing the **number** of available configurations in the device, a device restart is necessary.



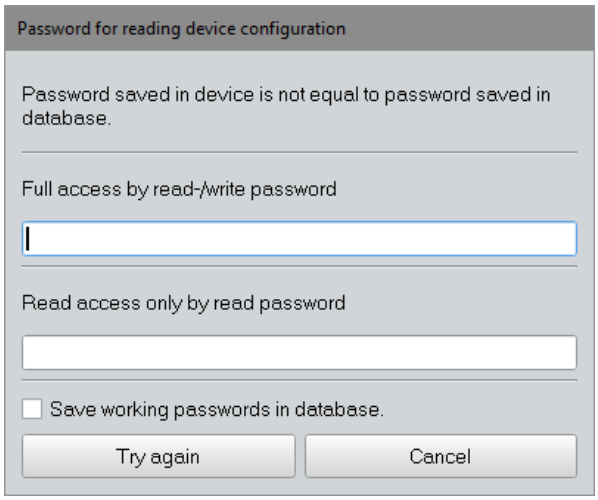
Loading a new configuration is done without restarting.

7 Read-/write password



The devices can be equipped with a read/write or read password to prevent unauthorized access an manipulation. To use the respective password you have to set the corresponding check mark and enter a password.

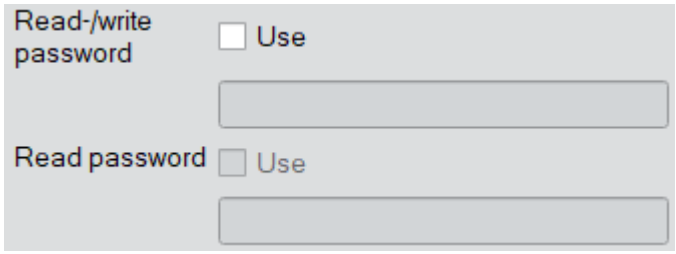
When using the password, the following dialog box appears when you connect the device to your computer:



After entering a read/write or read password, all device parameters can be either edited or only read For easier handling, the passwords can be saved in the (encrypted) software database. Authenticati is then performed automatically. If the device is used on an empty database (other computer, empty database), the password must be re-entered.

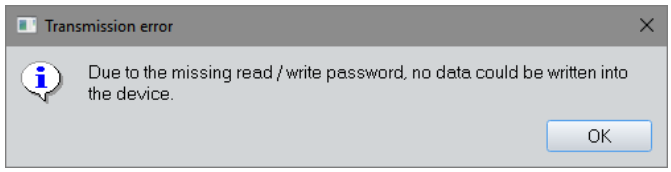
You can change the access level in the following ways:

- New registration of the device (disconnect and reconnect USB connection or delete device).
- Enter and save the corresponding password when the device is connected.

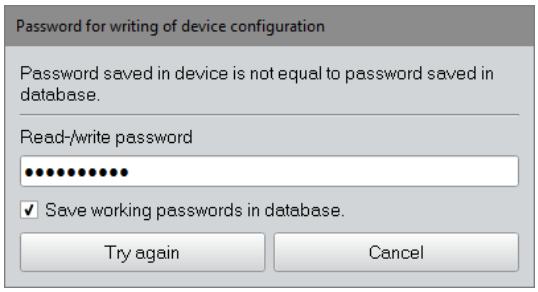


As long as the device is connected, there is authorized access. After disconnecting the device, the respective password must be re-entered.

- If only a read password has been entered and data in the device is to be changed, a message appears indicating that the access rights are insufficient:

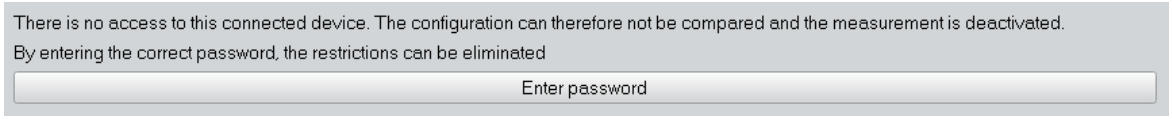


Clicking on **OK** opens a password dialog to enter the corresponding read/write password:



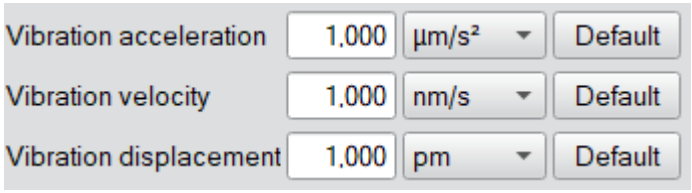
- If **Cancel** is selected, the previous access level (read only) is retained.

- If no password was entered when connecting the device (**Cancel** button), an entry can be made using the **Enter Password** button underneath the schematic display. It also informs you of the current access status:



8 Configuration of the unit decibel

For overall characteristic values, order characteristic values and bearing characteristic values the unit decibel (dB) can be selected. Decibel is a relative unit, i.e. it is related to a reference level. The reference level is defined for each measured variable in the following input mask:



Click on the "ISO" button to set the default reference levels.

9 Resetting the device

The VibroLine devices can be reset using the configuration software. This can be particularly useful in cases such as password not found, invalid device configuration or in the case of a desired device reset. Two methods are offered:

Reset to feactory defaults:

Reset device to factory defaults

If you reset the device, all settings - including the passwords - inside of the device are deleted. The device can then be reconfigured with settings from the database.

Note: This reset method is only possible in USB connection mode, as the network settings are also deleted during deletion.

Reset password only:

Reset passwords only, preserve device data

For this you need a reset file from your supplier. It is individual for one serial number and can also be applied only once.

To request such a password reset file, please contact IDS Innomic Schwingungsmesstechnik GmbH.

10 **Action buttons**

The action buttons can be used to change the configuration:

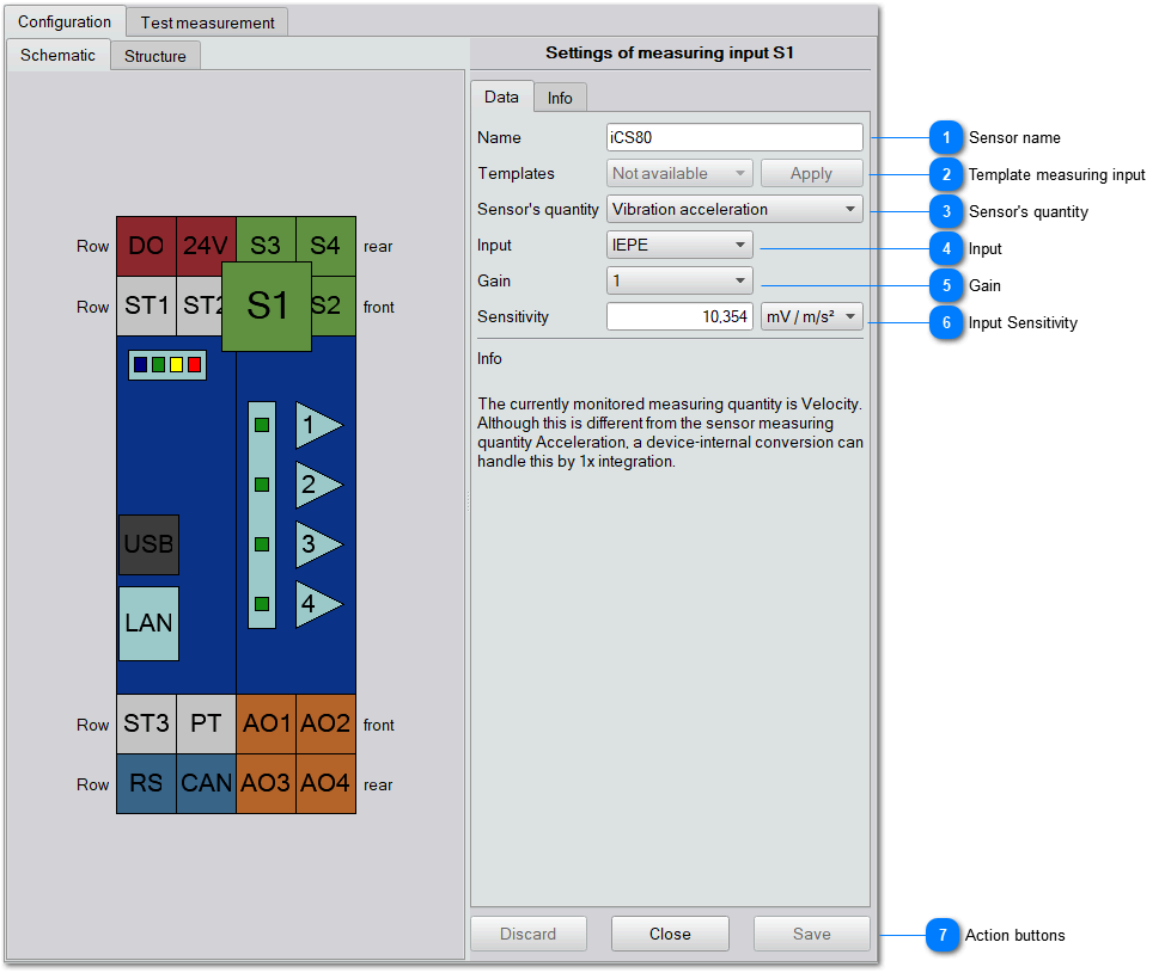
Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Measurement input

The properties of the sensor and the measuring input can be changed by clicking on a measuring input (S1 .. S8, green). The displayed configuration is carried out for each measuring channel individually.

All measurement input settings are also listed in the structure view and can be edited from there.



1 Sensor name

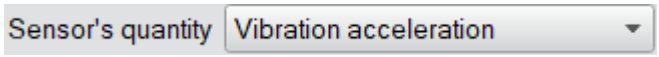
The name of the sensor and, if necessary, its serial number can be entered here. For triaxial transducers, the measuring direction can be made clear by adding -X, -Y, -Z. Up to 40 characters are available.

2 Template measuring input

Sensor configurations can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a sensor template is confirmed by clicking **Apply**. If the selected template is to be transferred to the device,

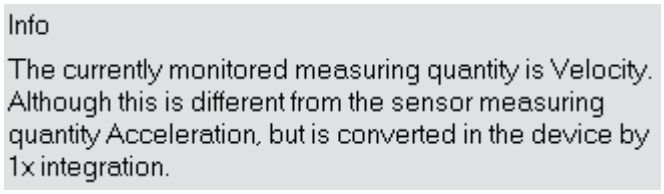
the button **Save** must be pressed. If no template exists, "Not available" is displayed in the selection field.

3 Sensor's quantity

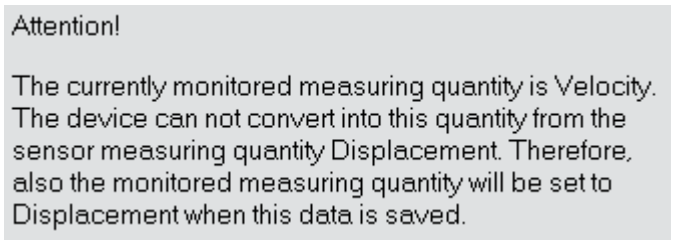


Here the actual (physical) measurement quantity of the sensor can be selected. Vibration acceleration, velocity and displacement are available.

Note: The desired monitoring measurement type is selected during configuration of the signal processing. If, for example, an accelerometer is connected and the vibration velocity is to be monitored, the sensor data are integrated once. A message summarizes the respective situation between sensor and monitoring measurement type:



Only integrated or directly used monitoring quantities can be used. Differentiation (e. g. vibration displacement to vibration velocity) is currently not supported. In order to keep the data consistent, the monitoring measurement type is then adjusted. A message appears:



4 Input

The VibroLine devices support IEPE (also called ICP® or Deltatron®) and a +/- 10 V AC input. The current status of the sensors is indicated by the sensor status LED.

5 Gain

For each measuring channel the internal gain can be increased from 1 to 25. This increases the digitizing quality for permanently small signals. By increasing the gain, naturally the dynamic range of the measuring channel decreases, also by a factor of 25. The Test measurement of the input can also be used to determine the appropriate gain factor.

6 Input Sensitivity

The sensor sensitivity indicates which electrical voltage corresponds to an acceleration value of 1 m/s² (or 1 g) and is thus the conversion between mechanical and electrical quantities. The sensitivity value is usually given in the sensor data sheet.
Note: Please note the correct unit (mV/m/s² or mV/g). The following applies: 1 mV/m/s² = 9.81 mV/g.

The sensitivity value should be checked at regular intervals (calibration). Please contact the sensor manufacturer or IDS Innomic Schwingungsmesstechnik GmbH.

7 Action buttons

The action buttons can be used to change the configuration:

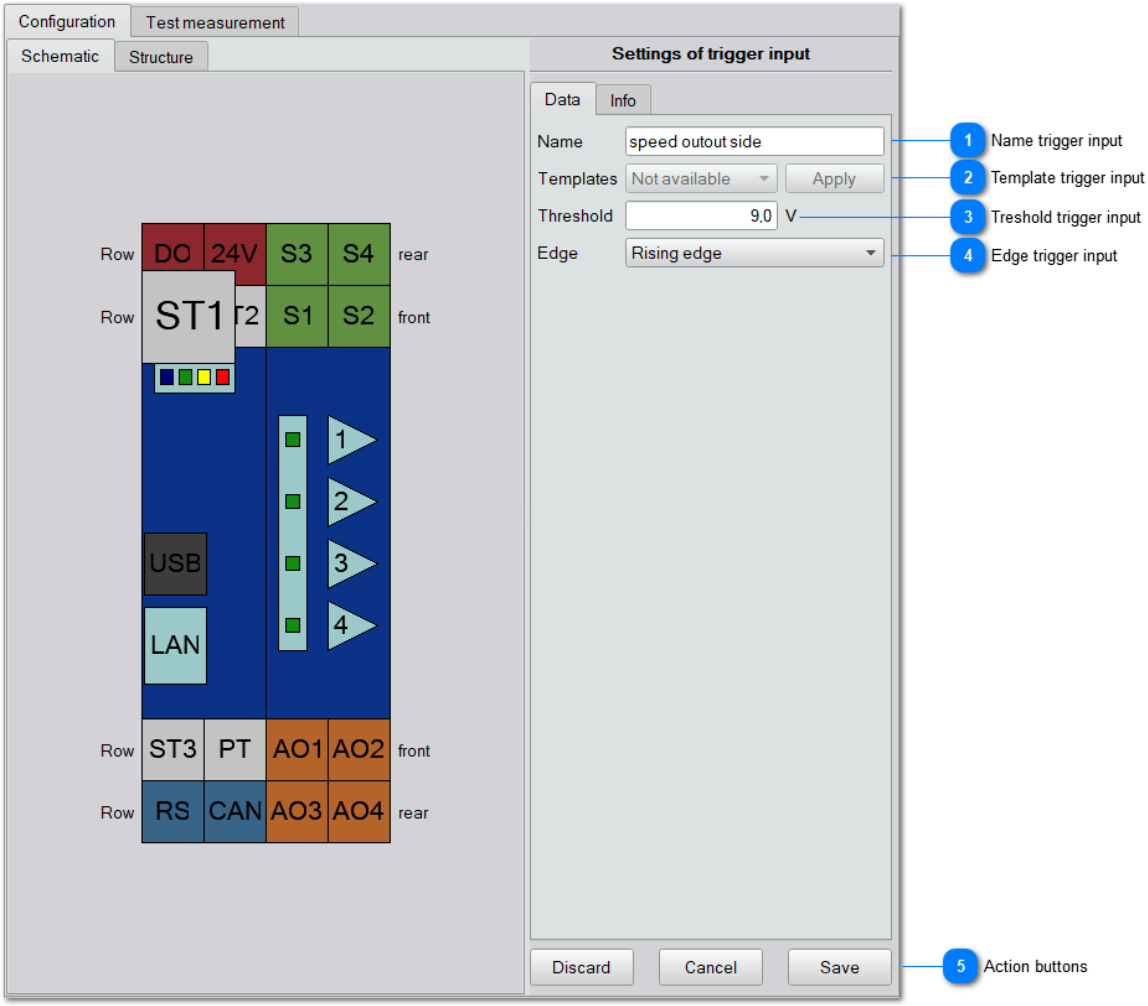
Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

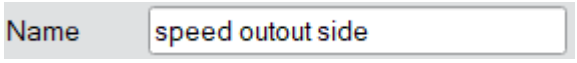
Speed trigger input

The menu for editing the settings of the trigger inputs is accessed via the grey ST1 .. ST3 buttons (VLE only one speed trigger input ST1). A speed signal can be fed in via the trigger input. This is, for example, the basis for the order characteristic.

All settings are also listed in the structure view and can be edited from there.



1 Name trigger input



The trigger input configured here can be named accordingly. Up to 40 characters are available.

2 Template trigger input

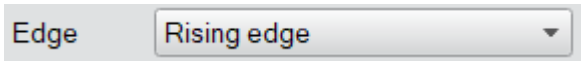
Trigger input settings can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal trigger template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the

action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

3 **Treshold trigger input**

Input of the trigger input threshold. For the change from *low* to *high*, values of 0.5... 24V can be specified. The hysteresis of the trigger input is approx. 0.5 V.

4 **Edge trigger input**



The trigger input can switch with *rising* or *falling edge*. The selection is made here.

5 **Action buttons**

The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Process trigger input

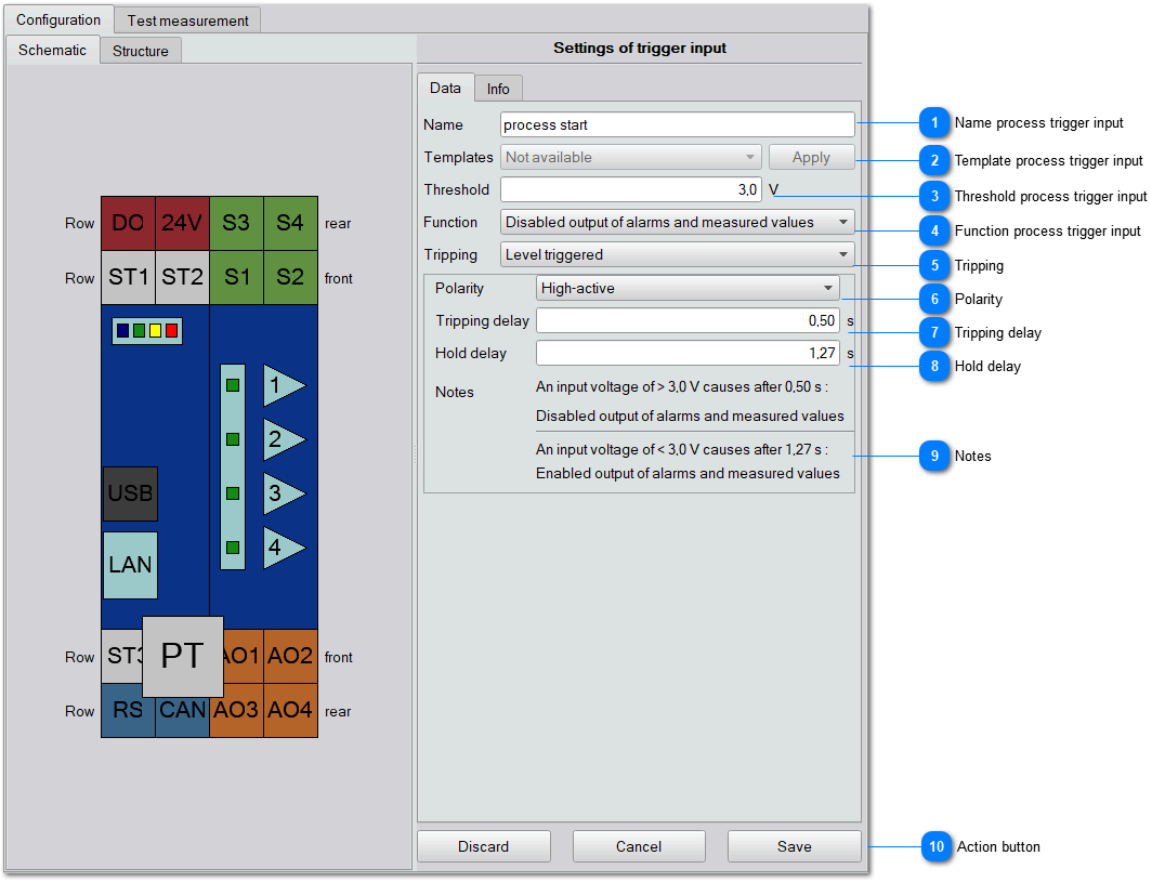
The menu for editing the settings of the process trigger input is reached via the grey PT button.
The VibroLine units have a process trigger input. This can be used to enable or disable alarms and/or measured value transmission via an external control signal. When this function is activated, the alarm and/or measurement value transmissions on the following interfaces become inactive or active:

- Digital output
- 4-20 mA current loop
- Changeover relay (only VLE HD)

additionally for VLX:

- CAN Bus
- Modbus TCP
- Modbus RTU
- HTTP API
- DATA STREAM
- VibroLine-Vision Cloud

All settings are also listed in the structure view and can be edited from there.



1 Name process trigger input

The process trigger input configured here can be named accordingly. Up to 40 characters are available.

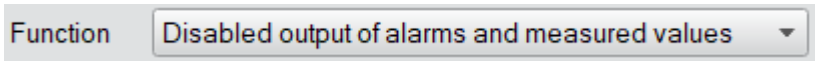
2 Template process trigger input

Process trigger input settings can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a process trigger template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

3 Threshold process trigger input

Input of the switching threshold of the trigger input. For the change from low to high, values from 0.5 ... 24V can be defined. The hysteresis of the trigger input is approx. 0.5 V.

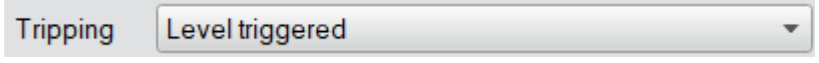
4 Function process trigger input



Folgende Funktionen können ausgewählt werden:

Normal operation	The process trigger is not evaluated.
Disabled ouput of alarms	When the switching threshold is reached, the alarm outputs are disabled.
Disabled ouput of measured values	When the switching threshold is reached, the measured value outputs are disabled.
Disabled ouput of alarms and measured values	When the switching threshold is reached, the alarm and measured value outputs are disabled.
Enabled ouput of alarms and measured values	When the switching threshold is reached, the alarm outputs are enabled.
Enabled ouput of measured values	When the switching threshold is reached, the measured value outputs are enabled.
Enabled ouput of alarms	When the switching threshold is reached, the alarm and measured value outputs are enabled.

5 Tripping



Level triggered	When the switching threshold is reached, the selected function is processed.
Edge triggered	If the voltage rises above the switching threshold, the selected function is executed.

6 **Polarity**

The switching logic can be inverted. This means that if the logic is positive, the function is activated when it is exceeded. For the negative logic the same applies when the value falls below the limit.
For the triggering condition edge-triggered, a **rising** or **falling** edge can be selected accordingly.

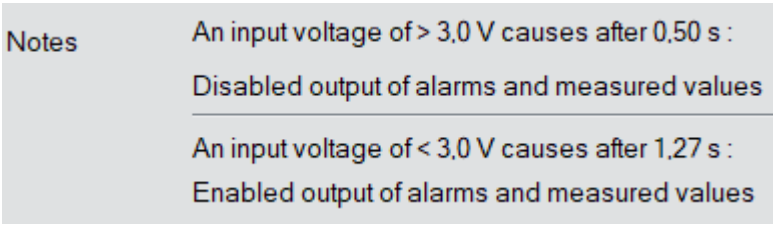
7 **Tripping delay**

The activation of the function can be delayed by a time interval if a triggering condition exists. This is defined here. Values between 0s and 60s can be specified.

8 **Hold delay**

After the trigger condition is over, the function can still be active for a selected period of time. This time period can be entered here with values between 0 s and 60 s.

9 **Notes**



The selected triggering conditions, delays and actions are summarized here.

10 **Action button**

The action buttons can be used to change the configuration:

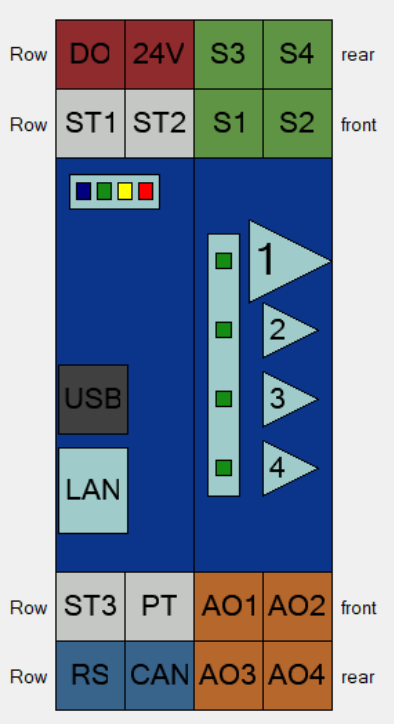
Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

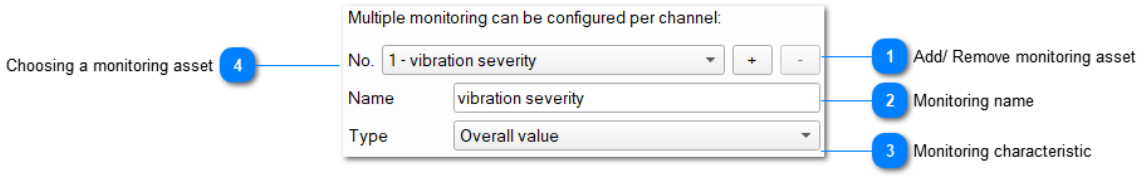
Signal processing

By clicking on signal processing (1... 8, triangles) the properties of the signal processing can be specified. The displayed configuration is carried out for each measuring channel individually.

All signal processing settings are also listed in the structure view and can be edited from there.



With the *MultiMode* option it is possible to monitor up to three characteristic values on one measuring channel at the same time. For this purpose, monitoring assets can be added in the respective settings of the signal processing of a measuring channel:



1 Add/ Remove monitoring asset

Click on **+** to add another monitoring on the measuring channel. The currently selected monitoring is duplicated.
Clicking on **-** deletes the currently selected monitoring.

2 Monitoring name

The monitoring configured here can be named accordingly. Up to 40 characters are available.

Note: The name assigned here is also used to name the monitoring in the Vison Cloud.

3 Monitoring characteristic

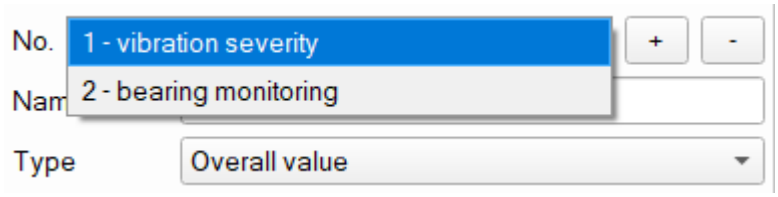
The characteristic value type can be set individually for each monitoring.
The selection is made via the menu.The configuration options for the characteristic values are explained in subsections:

- Overall value
- Order characteristic
- Impact characteristic
- Bearing characteristic
- None

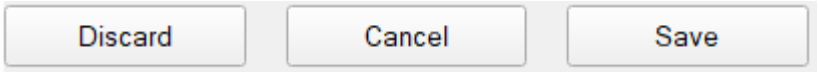
Depending on the number of characteristic values and settings, the digital signal processing (DSP) of the VibroLine device is more or less required. The current utilization of the selected measuring channel as well as the total utilization of the device are displayed. If the utilization value of the entire device reaches > 100%, deviating settings must be made in individual channels (e.g. less steep filters, less fast response time, switch off pre-filtering for order characteristic values, ...). If configurations with > 100% utilization are to be written to the device, a message appears which indicates that data transfer has not taken place. The appearance of the message can be suppressed. The message can be reactivated in the settings.

4 Choosing a monitoring asset

Switching between the configured monitoring is done using the selection menu.

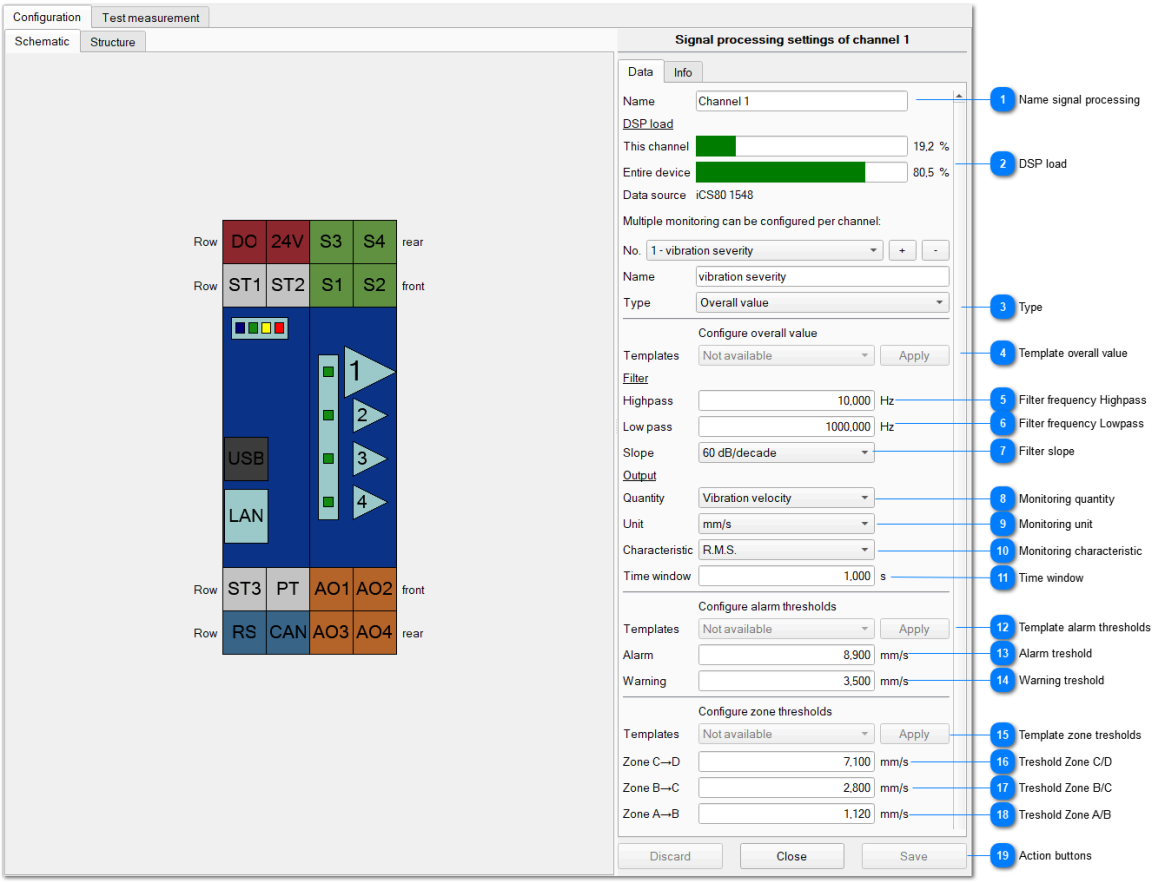


Note: After making changes to individual monitoring, save them, otherwise the changes are discarded.



Overall value

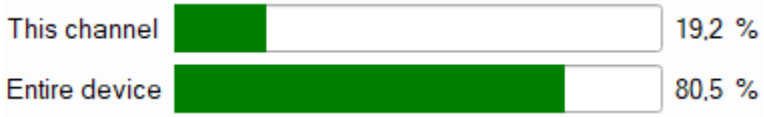
Overall values enable monitoring of vibrations over a wide frequency range. This may allow different machine errors to be detected at the same time. Monitoring in accordance with ISO 10816/20816 includes the monitoring of unbalance, misalignments, coupling errors, and much more. . If free monitoring is configured, high-frequency shocks, such as those occurring in the case of rolling bearing faults, can be detected (frequency range e. g. 10 - 20 kHz).



1 Name signal processing

The signal processing configured here can be named accordingly. Up to 40 characters are available.

2 DSP load



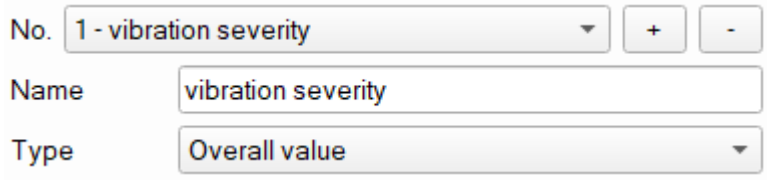
Depending on the vibration characteristic settings, the digital signal processing (DSP) of the ViboLine device is more or less requested. The current load of the selected measurement channel and the total load of the device are displayed. If the load value of the entire device reaches > 100%, different settings must be made in individual channels (e. g. lower filter slope, less fast response time, switch off pre-filtering for order characteristic values,...). If

configurations with > 100% load are to be written into the device, a message will appear indicating that no data transfer has been carried out. The occurrence of the message can be suppressed. The message can be reactivated in the settings.

3 Type

Selection of the characteristic value to be monitored. Here it is the overall value.

With the *MultiMode* option it is possible to monitor up to three characteristic values on one measuring channel at the same time. For this purpose, monitoring assets can be added in the respective settings of the signal processing of a measuring channel:



4 Template overall value

Overall values can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

For many parts of ISO 10816, the required monitoring measurement variables are already included in the software, so that a fast and convenient selection of the measurement variables conforming to standards can be made.

5 Filter frequency Highpass

The vibration signal to be monitored can be limited to a frequency range. The high pass is used to set the lower frequency limit. The minimum value is 0.1 Hz. Butterworth filters are used, so the specified frequency corresponds to a signal drop of -3 dB.

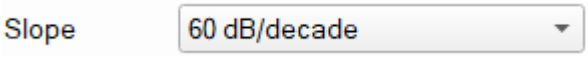
Note: The combination of very small high-pass values (< 1 Hz) with correspondingly integrated measurement variables (vibration velocity, vibration displacement) leads to longer filter transient times, which can be quite a few seconds depending on the setting. The settling process can be observed in the test measurement.

Note: Also note the (physically caused) 1/f noise at very low frequencies and integrated measurands. Particularly when using a low filter slope (e. g. 40 dB/decade) the noise levels can exceed the expected measurement signal. For these applications, the noise levels should be compared with the signal levels actually expected using the test measurement.

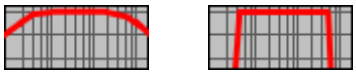
6 Filter frequency Lowpass

The vibration signal to be monitored can be limited to a frequency range. The low pass is used to set the higher frequency limit. The minimum value is 40 kHz. Butterworth filters are used, so the specified frequency corresponds to a signal drop of -3 dB.

7 Filter slope



The filter slope of the specified high and low pass filter can be selected. You can choose between 40 dB/decade and 60 dB/decade (filter order 2 or 3). The steeper the filter is (higher filter order) the fewer contributions apart from the set filter limits are considered:



flat filter steep filter

Note: If low-frequency vibrations are to be monitored, it is recommended to use the 60 dB/decade filter slope. Thus noise contributions of the 1/f noise are suppressed more efficiently.

8 Monitoring quantity

Vibration acceleration, vibration velocity and displacement can be selected as the monitoring measurement variable. Depending on the sensor measurement type used, the signal is integrated accordingly (e. g. double integration of vibration acceleration after displacement).

9 Monitoring unit

The unit of the monitoring measurement quantity can be defined here. Metric and non-metric units are available.

10 Monitoring characteristic

The following characteristics can be selected for the monitoring measured variable:

RMS	Formation by means of squaring, averaging and root extraction (square mean value, True RMS)
Peak	Peak value from the maximum of the amounts of plus and minus peak value
Peak - Peak	Maximum from the values of positive and negative peak values

11 Time window

Time span in seconds over which the characteristic value is formed. A minimum of 0.1 s and a maximum of 100 s can be specified.

12 Template alarm thresholds

Alarm thresholds can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

Note: Only templates of alarm thresholds are displayed whose assigned overall value corresponds to the overall value selected above. If this is not the case, the selection field of the alarm limit value templates is greyed out.

13 Alarm treshold

Setting a limit value for the alarm. This value must be determined individually for each machine. In many parts of ISO 20816 it is suggested that the switch-off value should not be higher than 1.25 x zone C/D limit value.

14 Warning treshold

Setting a limit value for warning. This value must be determined individually for each machine. In many parts of DIN ISO 20816 it is suggested to determine the alarm value according to the following rule:

Alarm = baseline + *p* x threshold Zone B/C.
Note: 0 < p < 1.

The baseline depends on the respective machine, the measuring location and the measuring direction. It must be determined individually for each monitoring channel. A determination can be made conveniently via the level deviation displayed in the alarm test measurement for a "run-in" machine.

In general, the alarm value should not be higher than 1.25 zone limit B/C.

15 Template zone tresholds

Zone thresholds can be saved in a template too. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"None exists" is displayed in the selection field.

For many parts of DIN ISO10816, the corresponding zone limits are included in the software upon delivery and can thus be selected quickly and conveniently.

Note: Only templates of zone thresholds are displayed whose assigned overall value corresponds to the overall value selected above. If this is not the case, the selection field of the alarm limit value templates is greyed out.

16 Treshold Zone C/D

Entering the zone boundary between zones C and D. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

17 Treshold Zone B/C

Entering the zone boundary between zones B and C. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

18 Treshold Zone A/B

Entering the zone boundary between zones A and B. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

19 **Action buttons**

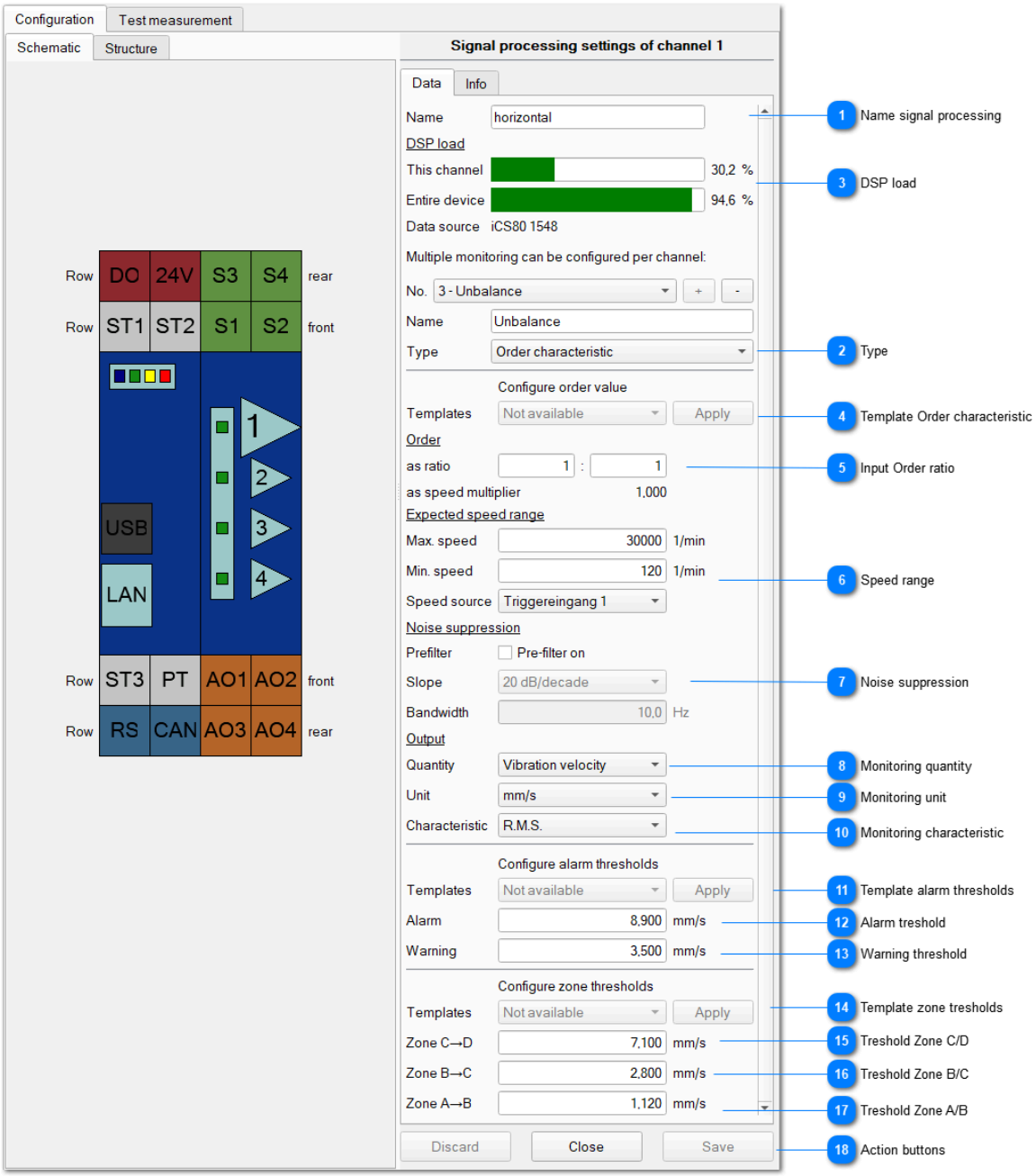
The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Order characteristic

Ordering characteristic are narrow-band characteristic which measures the vibrations at speed or at multiples of rpm. To measure order characteristic, a speed signal must be present at the trigger input of the VibroLine device. In particular for unbalance monitoring (vibration at speed, order 1:1) or transmission monitoring (vibration at speed multiplied by the number of teeth x of a gear wheel, order[f_n*x]). 1) order characteristics are very helpful.



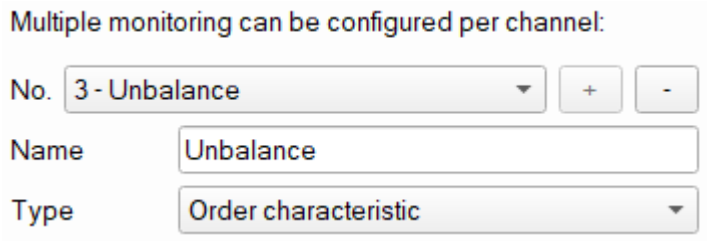
1 Name signal processing

The signal processing configured here can be named accordingly. Up to 40 characters are available.

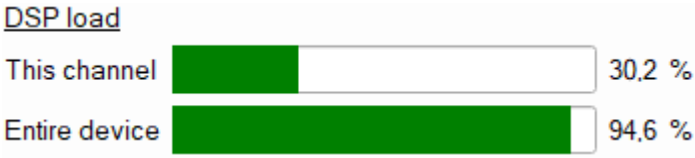
2 Type

Selection of the characteristic value to be monitored. Here it is the order characteristic.

With the *MultiMode* option it is possible to monitor up to three characteristic values on one measuring channel at the same time. For this purpose, monitoring assets can be added in the respective settings of the signal processing of a measuring channel:



3 DSP load

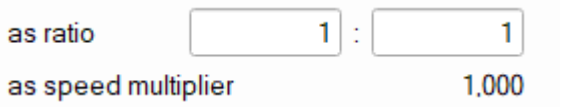


Depending on the vibration characteristic settings, the digital signal processing (DSP) of the ViboLine device is more or less requested. The current load of the selected measurement channel and the total load of the device are displayed. If the load value of the entire device reaches > 100%, different settings must be made in individual channels (e. g. lower filter slope, less fast response time, switch off pre-filtering for order characteristic values,...). If configurations with > 100% load are to be written into the device, a message will appear indicating that no data transfer has been carried out. The occurrence of the message can be suppressed. The message can be reactivated in the settings.

4 Template Order characteristic

Order characteristics can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

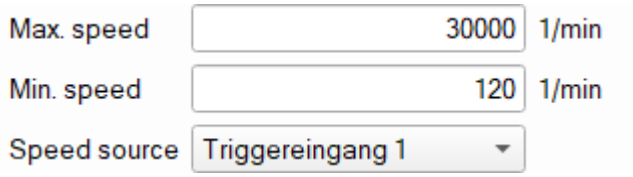
5 Input Order ratio



The VibroLine devices can monitor arbitrary orders. Multiples and broken orders can be defined

First Order	1 : 1
Thrid Order	3 : 1
Half Order	1 : 2
13/5 Order	13 : 5

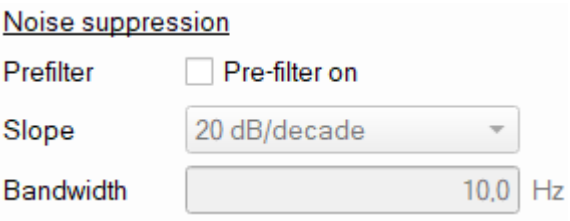
6 Speed range



In principle, the VibroLine devices are able to detect speeds from 6 rpm. However, it will then take up to 10 seconds to detect standstill.If faster detection is desired, the minimum speed can be increased. For example, at 30 rpm the detection is given after 2 seconds. However, speeds below 30 rpm are then not detected. By entering the maximum available speed, the calculation effort for the DSP is reduced because the maximum possible speed (4500 Hz) does not have to be expected.

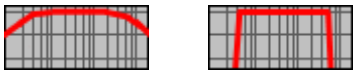
If the valid speed window is left, "0" is output as measured value to signal that no meaningful result can be calculated. In addition, an error can be output when leaving the speed range ("Signal measurement problem").

7 Noise suppression



The order signal is filtered in such a way that it indicates the oscillations at speed or the selected speed order. If an even sharper delimitation to adjacent frequency ranges is required, the pre-filter can be activated. This may be necessary, for example, if strong amplitudes occur at nearby frequencies, but the characteristic order value is to be measured with the correct amplitude.

The **slope** of the pre-filter can be defined by means of the selection field. You can choose between 20, 40 and 60 dB/decade.

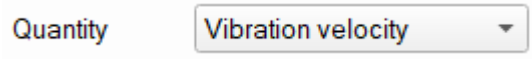


flat filter steep filter

The bandwidth determines how wide the pre-filter is applied around the selected speed order. At e. g. 5 Hz bandwidth, the pre-filter extends by 2.5 Hz to lower or higher frequencies around the selected order. The bandwidth can be adjusted from 2 to 100 Hz.

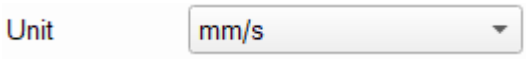
Note: The activated pre-filter (especially with high slope) results in high DSP load for the VibroLine device. For multi-channel applications, the total load of the device should therefore be taken into account when configuring the pre-filters.

8 Monitoring quantity



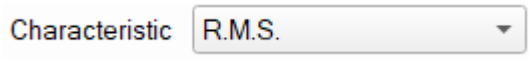
Vibration acceleration, vibration velocity and displacement can be selected as the monitoring measurement variable. Depending on the sensor measurement type used, the signal is integrated accordingly (e. g. double integration of vibration acceleration after displacement).

9 Monitoring unit



The unit of the monitoring measurement quantity can be defined here. Metric and non-metric units are available.

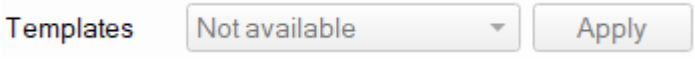
10 Monitoring characteristic



The following characteristics can be selected for the monitoring measured variable:

RMS	Formation by means of squaring, averaging and root extraction (square mean value, True RMS)
Peak	Peak value from the maximum of the amounts of plus and minus peak value
Peak - Peak	Maximum from the values of positive and negative peak values

11 Template alarm thresholds



Alarm thresholds can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

Note: Only templates of alarm thresholds are displayed whose assigned overall value corresponds to the overall value selected above. If this is not the case, the selection field of the alarm limit value templates is greyed out.

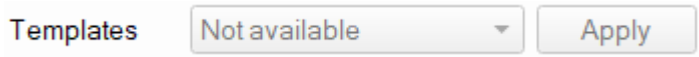
12 Alarm treshold

Setting a limit value for the alarm. This value must be determined individually for each machine..

13 Warning threshold

Setting a limit value for the warning. This value must be determined individually for each machine.

14 Template zone tresholds



Zone thresholds can be saved in a template too. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"None exists" is displayed in the selection field.

Note: Only templates of zone thresholds are displayed whose assigned overall value corresponds to the overall value selected above. If this is not the case, the selection field of the alarm limit value templates is greyed out.

15 Treshold Zone C/D

Entering the zone boundary between zones C and D. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

16 Treshold Zone B/C

Entering the zone boundary between zones B and C. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

17 Treshold Zone A/B

Entering the zone boundary between zones A and B. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

18 **Action buttons**

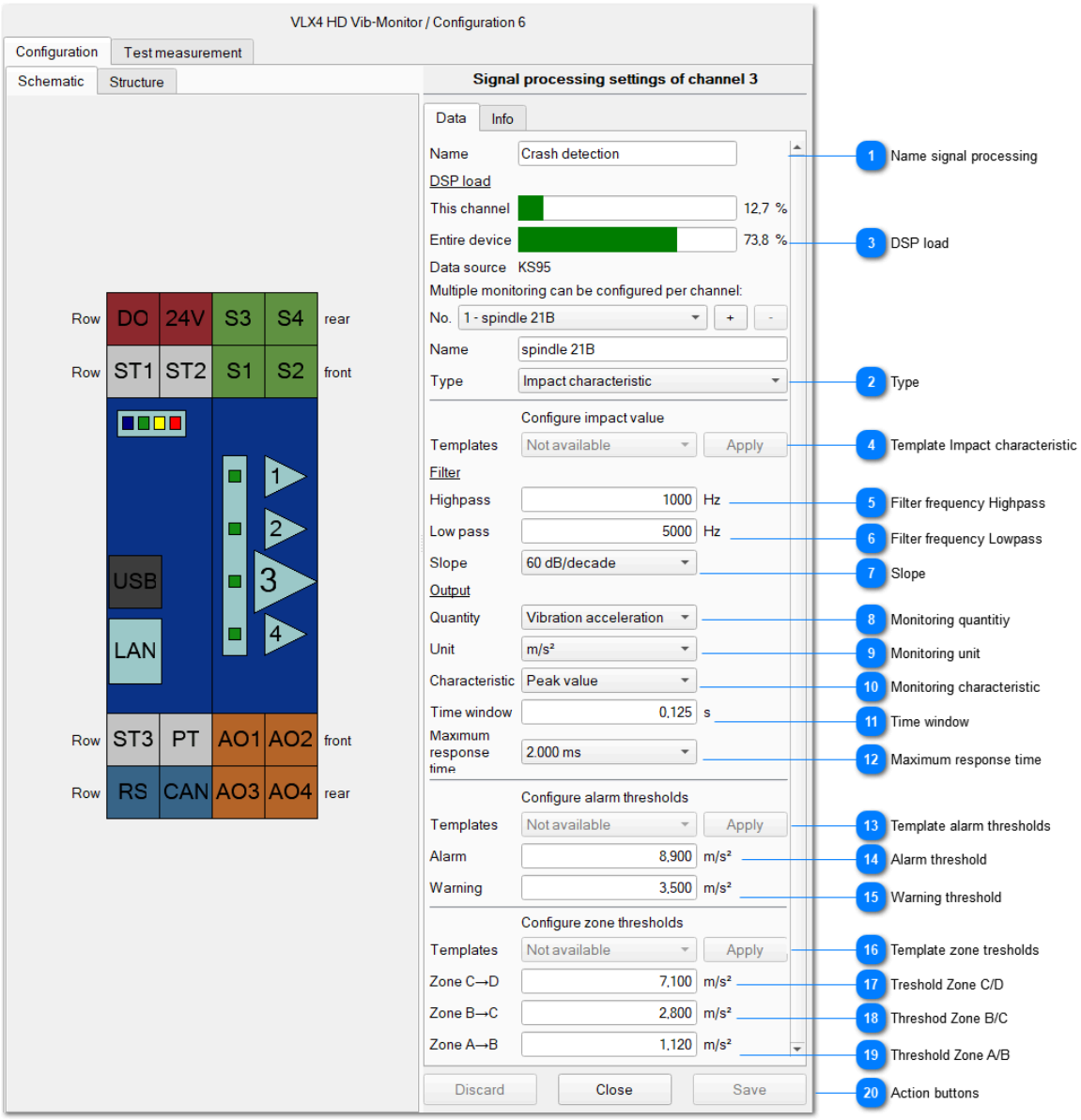
The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

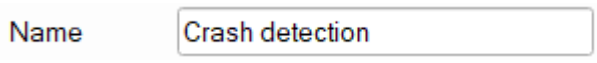
If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Impact characteristic

Impact characteristic values are overall values with a very fast response time of up to < 0.666 ms of the digital and relay outputs. Especially in applications such as tool breakage or crash detection, shock parameters can be used for very fast shut-off of the machine. Tool breakages, for example, generate a wide frequency signal extending into the kHz range (see Diraq shock). By monitoring this high-frequency range, unwanted machine states can be detected and stopped very quickly.

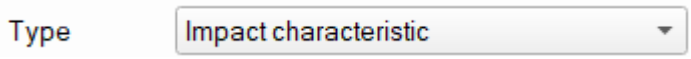


1 Name signal processing



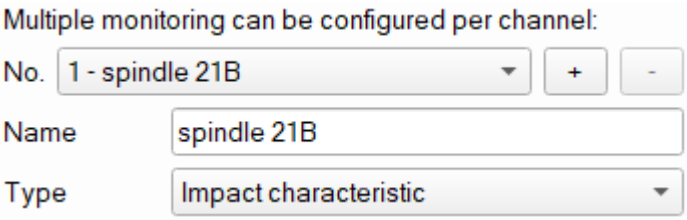
The signal processing configured here can be named accordingly. Up to 40 characters are available.

2 Type



Selection of the characteristic value to be monitored. Here it is the impact characteristic.

With the *MultiMode* option it is possible to monitor up to three characteristic values on one measuring channel at the same time. For this purpose, monitoring assets can be added in the respective settings of the signal processing of a measuring channel:



3 DSP load

Depending on the vibration characteristic settings, the digital signal processing (DSP) of the ViboLine device is more or less requested. The current load of the selected measurement channel and the total load of the device are displayed. If the load value of the entire device reaches > 100%, different settings must be made in individual channels (e. g. lower filter slope, less fast response time, switch off pre-filtering for order characteristic values,...). If configurations with > 100% load are to be written into the device, a message will appear indicating that no data transfer has been carried out. The occurrence of the message can be suppressed. The message can be reactivated in the settings.

4 Template Impact characteristic

Impact characteristics can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

5 Filter frequency Highpass

The vibration signal to be monitored can be limited to a frequency range. The high pass is used to set the lower frequency limit. The minimum value is 100 Hz. Butterworth filters are used, so the specified frequency corresponds to a signal drop of -3 dB.

6 Filter frequency Lowpass

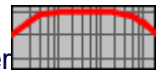
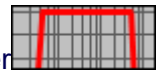
Low pass 5000 Hz

The vibration signal to be monitored can be limited to a frequency range. The low pass is used to set the higher frequency limit. The minimum value is 40 kHz. Butterworth filters are used, so the specified frequency corresponds to a signal drop of -3 dB.

7 Slope

Slope 60 dB/decade

The filter slope of the specified high and low pass filter can be selected. You can choose between 40 dB/decade and 60 dB/decade (filter order 2 or 3). The steeper the filter is the fewer contributions apart from the set filter limits are considered:

flat filter  steep filter 

8 Monitoring quantitiy

Quantity Vibration acceleration

Vibration acceleration, vibration velocity and displacement can be selected as the monitoring measurement variable. Depending on the sensor measurement type used, the signal is integrated accordingly (e. g. double integration of vibration acceleration after displacement).

Note: Impact characteristic values can only be measured from 100 Hz. Frequency ranges in the kHz range are required for many applications (e. g. tool breakage detection). Therefore, for such high-frequency measurements it is essential to use vibration acceleration as a monitoring measurement parameter, otherwise the high-frequency components will be underestimated.

9 Monitoring unit

Unit m/s²

The unit of the monitoring measurement quantity can be defined here. Metric and non-metric units are available.

10 Monitoring characteristic

Characteristic Peak value

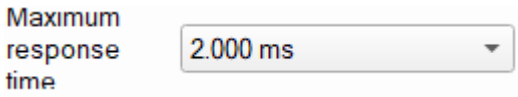
The peak value (amount peak value from the maximum of the amounts of plus and minus peak value) is defined for the monitoring measurement quantity, since the fast response times of < 0.66 ms can only be achieved by means of peak value detection.

11 Time window

Time window 0,125 s

Time span in seconds over which the characteristic value is formed. A minimum of 0.1 s and a maximum of 100 s can be specified.

12 Maximum response time



The impact characteristics have been developed for very fast detection of peak values. This makes it possible, for example, to detect crash- or breakage of tools. The dropdown box sets the response time of the digital outputs and the relay output. 0.666, 1, 2 or 4 ms can be selected.

13 Template alarm thresholds

Alarm thresholds can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

Note: Only templates of alarm thresholds are displayed whose assigned overall value corresponds to the overall value selected above. If this is not the case, the selection field of the alarm limit value templates is greyed out.

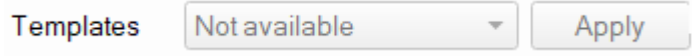
14 Alarm threshold

Setting a limit value for the alarm. This value must be determined individually for each machine.

15 Warning threshold

Setting a limit value for the warning. This value must be determined individually for each machine.

16 Template zone tresholds



Zone thresholds can be saved in a template too. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"None exists" is displayed in the selection field.

Note: Only templates of zone thresholds are displayed whose assigned overall value corresponds to the overall value selected above. If this is not the case, the selection field of the alarm limit value templates is greyed out.

17 **Treshold Zone C/D**

Entering the zone boundary between zones C and D. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

18 Threshod Zone B/C

Entering the zone boundary between zones B and C. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

19 Threshold Zone A/B

Entering the zone boundary between zones A and B. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

20 Action buttons

The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Bearing characteristic

Rolling bearings can be monitored with wideband characteristic values. If a defect develops in the rolling bearing, e.g. damage to the running surface in the outer ring (pitting), each rolling element experiences an impact as it passes through this defect and generates a wide excitation band in the surrounding area of the bearing (see Diraq impact). Due to this very wide excitation band, e.g. natural frequencies of nearby components are present or the natural frequency of the sensor itself is excited.

Since bearing damage is usually represented in amplitudes in the high frequency range, vibration acceleration is used as the measured variable. Vibration velocity and displacement would be underestimated.

Characteristic values on a wide frequency band measure these excessive values caused by bearing damage. The frequency range from 1000 Hz upwards is considered as a preference in order to remove speed-proportional components.

For the bearing characteristics, higher amplitudes mean a higher extent of damage in the rolling bearing. It can only be determined whether damage has occurred. Which rolling bearing component is exactly affected (outer ring, inner ring, rolling element, retainer) requires in-depth analysis with other measuring tools (e.g. envelope curve analysis with VibroMatrix). Detailed information on rolling bearing diagnosis on machines can be found in VDI 3832 "Measurement of structure-borne sound of rolling element bearings in machines and plants for evaluation of condition.

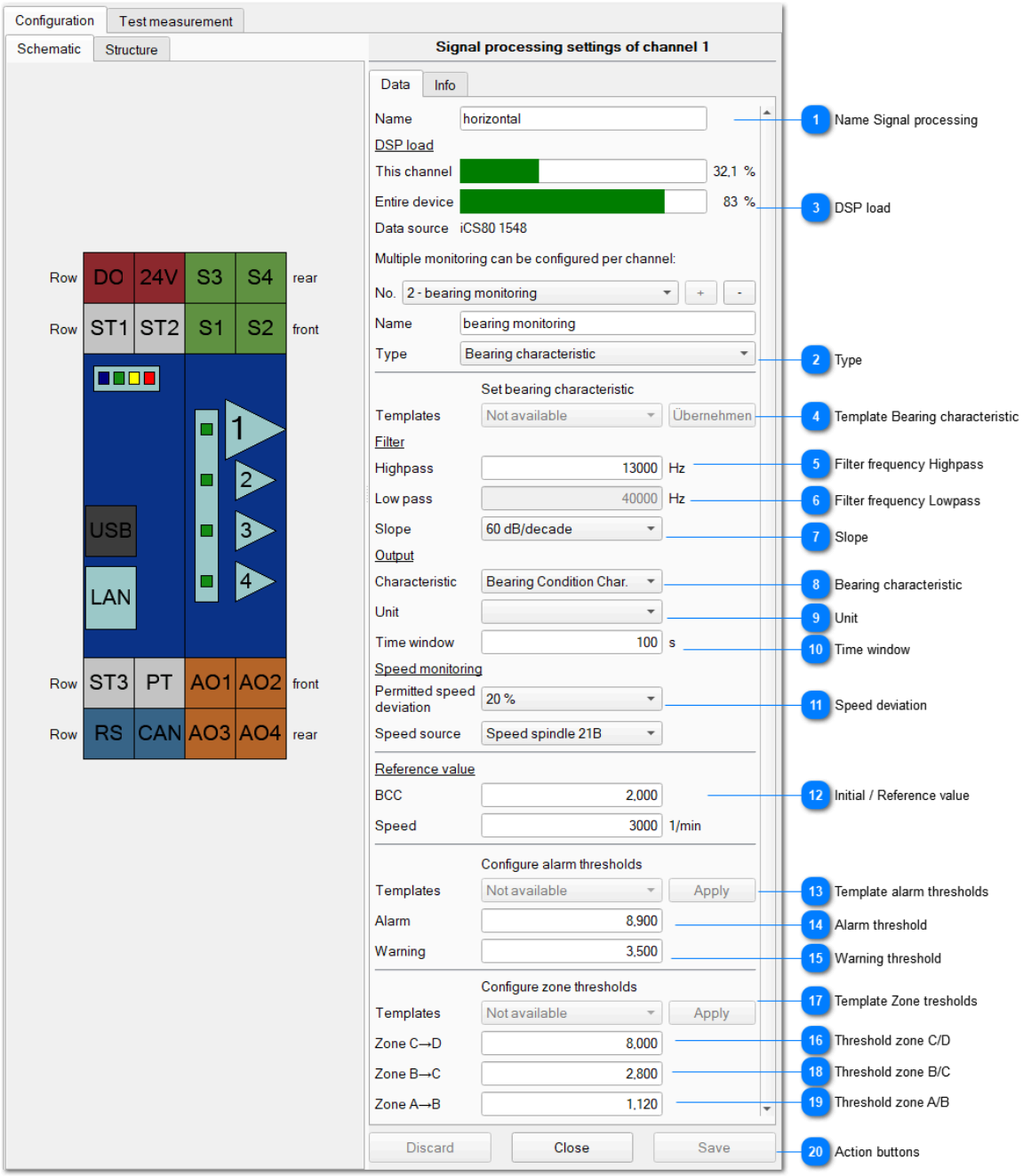
The **bearing characteristics** implemented in VibroLine are regarded as **relative values**. This means that the current measured value is always compared with an initial or reference value. The initial value corresponds to the undamaged condition of the bearing. The actual measured **value** represents a unitless **deviation from the reference value**. This procedure is useful (and suggested by VDI 3832) because the characteristic values of bearings can be very different and therefore the good condition must always be known for the good/bad evaluation (initial value). Furthermore, bearing characteristic values can be strongly dependent on the speed, therefore a speed band can be specified in the VibroLine devices in which the bearing characteristic value is determined.

The following bearing characteristics are available:

- relative r.m.s value
- relative peak value
- 1/k(t)
- Bearing condition characteristic (BCC)

A detailed explanation of the characteristics is given below.

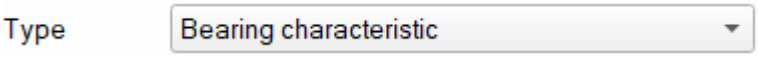
To measure the bearing characteristics , "screw connection" should be used for the accelerometer in order to minimize the disturbing influence of coupling resonances.



1 Name Signal processing

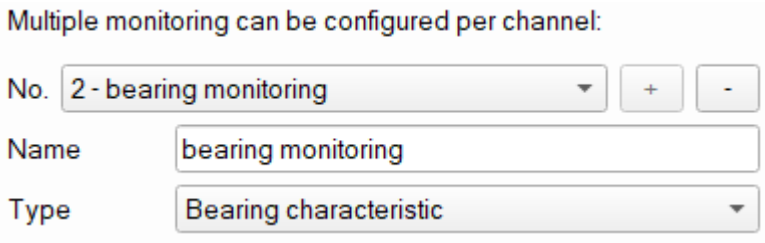
The signal processing configured here can be named accordingly. Up to 40 characters are available.

2 Type

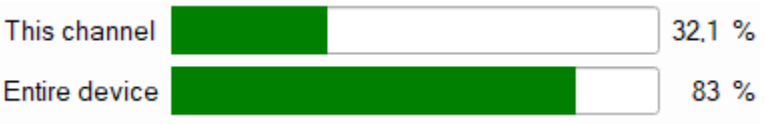


Selection of the characteristic value to be monitored. Here it is the bearing characteristic.

With the *MultiMode* option it is possible to monitor up to three characteristic values on one measuring channel at the same time. For this purpose, monitoring assets can be added in the respective settings of the signal processing of a measuring channel:

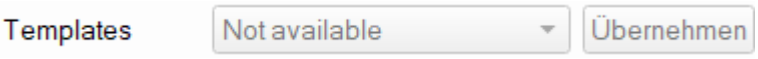


3 DSP load



Depending on the vibration characteristic settings, the digital signal processing (DSP) of the ViboLine device is more or less requested. The current load of the selected measurement channel and the total load of the device are displayed. If the load value of the entire device reaches > 100%, different settings must be made in individual channels (e. g. lower filter slope, less fast response time, switch off pre-filtering for order characteristic values,...). If configurations with > 100% load are to be written into the device, a message will appear indicating that no data transfer has been carried out. The occurrence of the message can be suppressed. The message can be reactivated in the settings.

4 Template Bearing characteristic



Bearing characteristics can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

5 Filter frequency Highpass

The vibration signal to be monitored can be limited to a frequency range. The high pass is used to set the lower frequency limit. The minimum value is 1000 Hz. Butterworth filters are used, so the specified frequency corresponds to a signal drop of -3 dB.

6 Filter frequency Lowpass

The vibration signal to be monitored can be limited to a frequency range. The low pass is used to set the higher frequency limit. The minimum value is 40 kHz. Butterworth filters are used, so the specified frequency corresponds to a signal drop of -3 dB.
For the characteristic value Bearing Condition Characteristic (BCC), the low-pass filter is permanently set to 40 kHz.

7 Slope

The filter slope of the specified high and low pass filter can be selected. You can choose between 40 dB/decade and 60 dB/decade (filter order 2 or 3). The steeper the filter is the fewer contributions apart from the set filter limits are considered.

8 Bearing characteristic

The VibroLine devices have 4 characteristic values for rolling bearing monitoring. The selection is made here.
The characteristic values mean in detail:

Characteristic	Formation	Behavior
relative r.m.s value	The relative r.m.s of the vibration acceleration usually measured in the linear frequency range of the sensor. Reference is made to the initial r.m.s value.	If there is bearing damage, the general signal level rises (see above resonance increase) and thus the r.m.s.
relative peak value	Peak value of the vibration acceleration usually measured in the linear frequency range of the sensor. Reference is made to the initial peak value.	In the event of bearing damage, the signal becomes more peak-containing due to the shocks that occur. This peaking quality is determined by the relative peak value.
1/k(t)	The 1/k(t)-Value is calculated as follows: $\frac{1}{k(t)} = \frac{a_{rms}(t) \cdot a_{peak}(t)}{a_{rms}(0) \cdot a_{peak}(0)}$ So the products of the r.m.s and peak values of the vibration acceleration are used. In each case at the current time t and the reference measurement (t= 0). The r.m.s or peak values are determined in the linear frequency range of the sensor.	The amplitudes for the r.m.s. and peak values increase with bearing damage (see above). This results in increasing values for the product as well.. The 1/k(t) value thus has higher values in the event of damage.
Bearing Condition Characteristic BCC	The bearing condition characteristic BCC is determined in the resonance range of the sensor (typically > 13 kHz). However, the component-related	With increasing severity of the damage, the intensity of the shocks increases. The BCC value then shows higher values.

	resonances < 13 kHz can also be included in the calculation. The shocks caused by the bearing damage are measured amplified by the resonance(s) present The **Bearing Condition Characteristic BCC** (with 13 kHz high pass) behaves similarly to the **Bearing Condition Unit (BCU)**.	

9 **Unit**

The measured value (deviation of the current value from the reference or initial value) can be specified in absolute quantities percent or in dB.

Example:

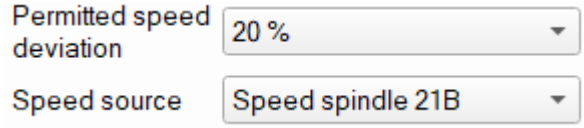
Initial value	Measured value	Actual value
5 m/s²	15 m/s²	3
5 m/s²	15 m/s²	300 %

The unit set here must be considered in particular for the correct definition of the alarm and zone limit values.

10 **Time window**

Time span in seconds over which the characteristic value is formed. A minimum of 1 s and a maximum of 3600 s can be entered. For fluctuating characteristic values (e.g. peak values, 1/k(t)) it is recommended to keep the standard 100s.

11 **Speed deviation**



Bearing characteristic values can only be compared with values under the same operating conditions, i.e. at the same speed. Therefore, the deviation by which the current speed may deviate from the speed when the initial values are recorded can be defined here.
If the valid speed window is left, "0" is output as measured value to signal that no meaningful result can be calculated. In addition, an error can be output when leaving the speed range ("Signal measurement problem").

If measured values are also to be calculated at any speed, the selection "ignore" can be made (not recommended).

12 Initial / Reference value

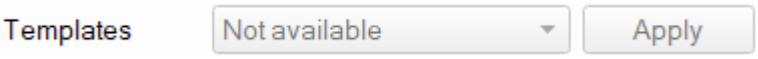
The initial/reference values are entered in this input field. Depending on the selected characteristic value, r.m.s., peak values, the product of effective value and peak value or BCC values must be entered.
The speed during the acquisition of the initial values should also be logged.
The test measurement function can also be used to simplify the definition of reference values.

Notes on defining the initial values:
The initial values should be obtained in the OK state of the bearing at operating speed. This OK state is usually present after the running-in phase following bearing assembly. In the running-in phase, the vibration behaviour of the bearing can temporarily degrade, but this does not necessarily indicate bearing damage (assuming correct mounting and grease distribution).

If no data on the OK state of the bearing is available, typical values for the bearing characteristic values can be collected for identical machines. It is important to collect several data sets or to examine several other machines.

After defining the reference value, this value is left unchanged for the lifetime of the bearing and current measured values are normalized to the reference value (quotient = bearing characteristic value).

13 Template alarm thresholds



Alarm thresholds can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

Note: Only templates of alarm thresholds are displayed whose assigned overall value corresponds to the overall value selected above. If this is not the case, the selection field of the alarm limit value templates is greyed out.

14 Alarm threshold

Enter a limit value for the alarm. The deviation from the initial value is entered in absolute values (multiples) or in percent, depending on the selection.

Setting a limit value for the alarm. This value must be determined individually for each machine.

15 Warning threshold

Enter a limit value for the warning. The deviation from the initial value is entered in absolute values (multiples) or in percent, depending on the selection.
Setting a limit value for the alarm. This value must be determined individually for each machine

16 Threshold zone C/D

Entering the zone boundary between zones C and D. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

17 Template Zone tresholds

Zone thresholds can be saved in a template too. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"None exists" is displayed in the selection field.

Note: Only templates of zone thresholds are displayed whose assigned overall value corresponds to the overall value selected above. If this is not the case, the selection field of the alarm limit value templates is greyed out.

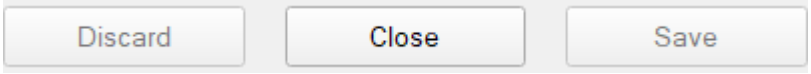
18 Threshold zone B/C

Entering the zone boundary between zones B and C. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

19 Threshold zone A/B

Entering the zone boundary between zones A and B. The zone system proposed in ISO 20816 is used for this purpose. The zone corresponding to the current machine status is indicated by a coloured LED on the front of the housing.

20 Action buttons



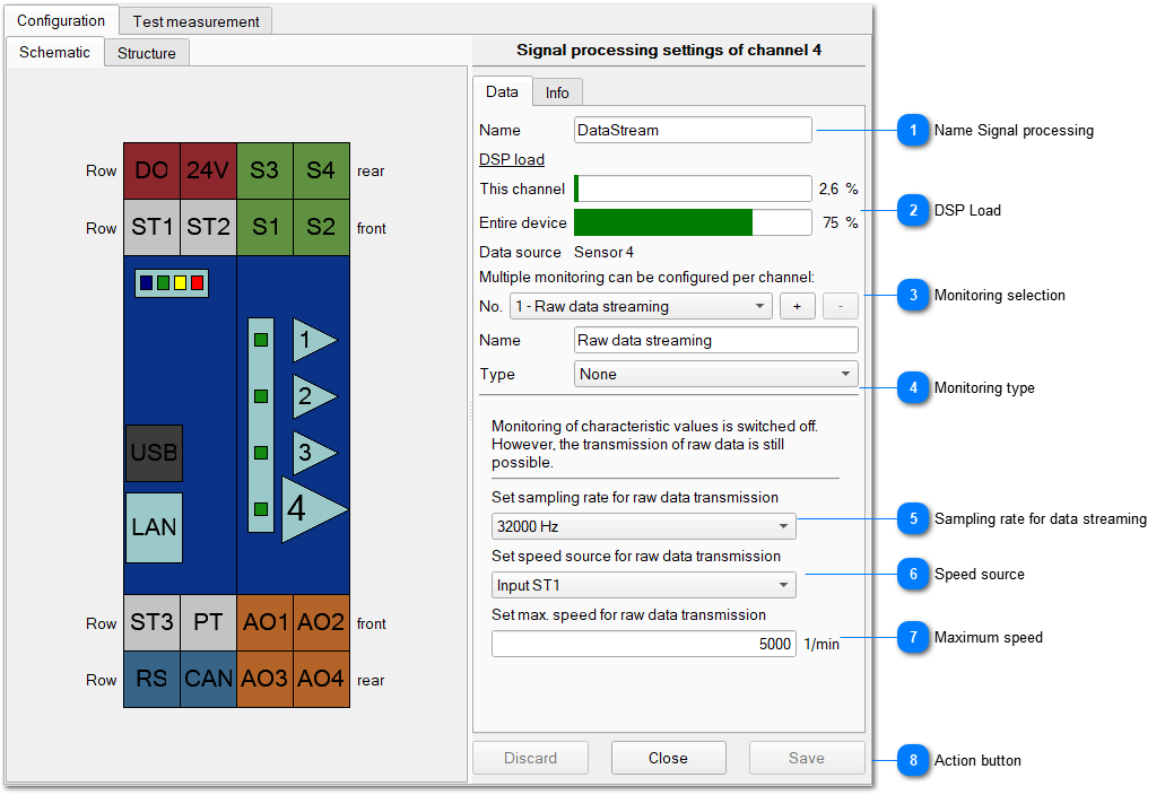
The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

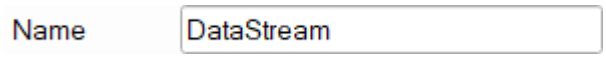
If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

No signal processing

Instead of computing a characteristic value, signal processing on individual measuring channels can also be switched off completely. This reduces e.g. the processor load by unused measuring channels. Furthermore the VibroLine can be used for exclusive transmission of raw data (option: DataStream). If monitoring is deactivated, the transmitted raw data can be configured with regard to sampling rate and speed detection.Note: The signal processing can only be deactivated if no other monitoring measurand is active on the same measuring channel anymore.

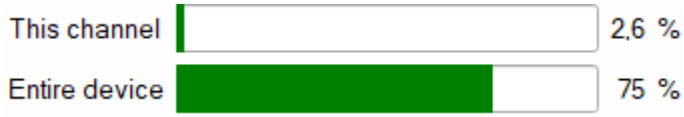


1 Name Signal processing



The signal processing configured here can be named accordingly. Up to 40 characters are available.

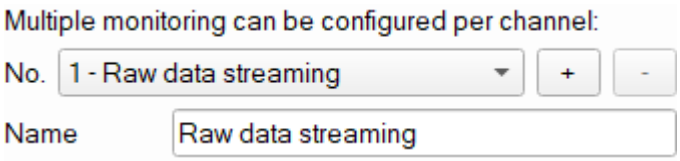
2 DSP Load



Depending on the vibration characteristic settings, the digital signal processing (DSP) of the ViboLine device is more or less requested. The current load of the selected measurement channel and the total load of the device are displayed. If the load value of the entire device reaches > 100%, different settings must be made in individual channels (e. g. lower filter slope, less fast response time, switch off pre-filtering for order characteristic values,...). If configurations with > 100% load are to be written into the device, a message will appear

indicating that no data transfer has been carried out. The occurrence of the message can be suppressed. The message can be reactivated in the settings.

3 Monitoring selection

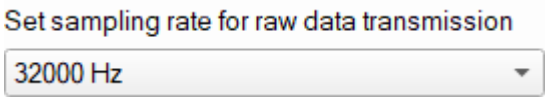


In order to deactivate the signal processing, no other monitoring measured quantity may be active on the same measuring channel any more. To delete any existing monitoring, press the **-** key. The deactivated monitoring can be named accordingly.

4 Monitoring type

In the selection box, the entry None is selected to deactivate signal processing. Thereby the input possibilities for characteristic value parameterizations disappear and the raw data output can be configured.

5 Sampling rate for data streaming



For raw data transmission with the DataStream option, the used sampling rate of the vibration signals can be defined. This is done individually for each measuring channel.

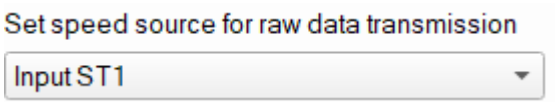
The following options are available:

- Off
- 32 000 Hz
- 48 000 Hz
- 96 000 Hz.

However, the configuration program uses this setting only as a recommendation. If, for example, other channels require a higher sampling rate, channels for which a lower value was initially set here will also be set to the higher value. In order to reliably obtain a low sampling rate, this low sampling rate must be defined for all channels of a channel group. Channels 1 to 4 form one channel group and channels 5 to 8 form a second group.

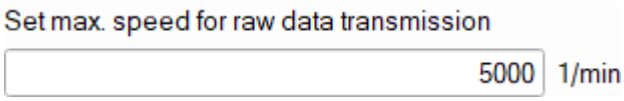
Reducing the sampling rate also effectively reduces the amount of data during raw data transmission.The sampling rate can also be set completely to zero (Off). Then no more computing load is requested from this channel. The setting can be used, for example, to completely deactivate the fourth channel for triaxial measurements.

6 Speed source



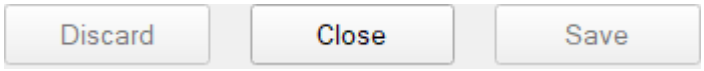
In addition to the vibration signals, a speed signal can also be transmitted in the raw data. The selection (or deselection) of the speed source is done via this drop-down menu.

7 Maximum speed



In order to save computing load and to keep the amount of data during transmission as low as possible, the maximum occurring speed can be defined here. Speeds above this value are no longer recognized and transmitted. The maximum speed is 180 000 rpm.

8 Action button



The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Digital communications interfaces

The communication interfaces LAN, Modbus RTU/TCP and CANopen are only available in the VLX device version.

In detail, the following functionalities are available with the bus protocols:

- Transfer of device information
- Transfer of characteristic values calculated for all measuring channels
- Transfer of alarms
- Transfer of errors (sensor, device, ...)

The HTTP API interface provides a possibility to read out characteristic values and device information via http.

The optional DataStream interface provides a VLDAQ API which is used to transfer sensor data in raw format, i.e. without further signal processing (filtering, integration, ...), sensor information (e.g. sensitivity) as well as trigger signals (speed trigger 1-3).

When using the optional Vision Cloud function, monitoring parameters are sent to the online condition monitoring system VibroLine-Vision. The data is displayed there over time for each measuring point and can be accessed from any location and device.

The following sections describe the device-side settings of the interfaces:

- LAN (Modbus TCP, HTTP API, DataStream, Vision Cloud)
- Modbus RTU
- CAN open

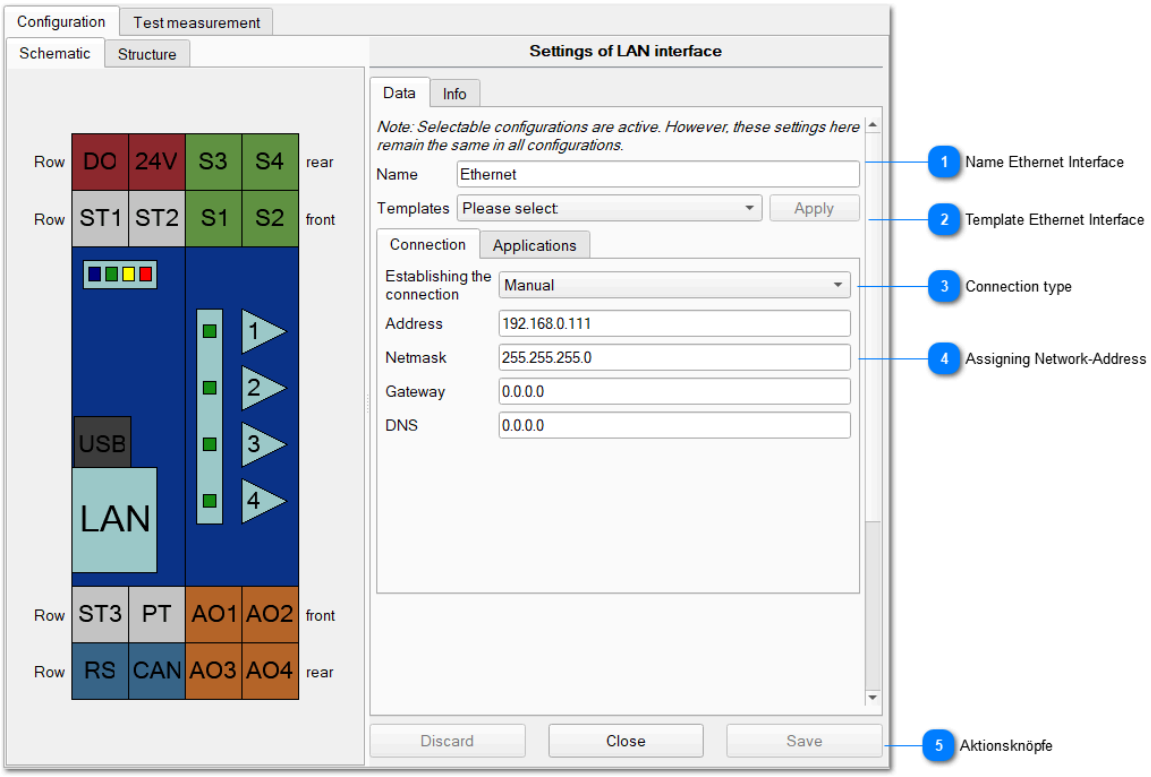
A detailed description of the bus protocols (e.g. implemented functions, registers used, program examples, ...) is given in the section Documentation Bus Interfaces.

The following applies to the use of the bus interfaces: Only one protocol can be used at a time, i.e. the simultaneous use of several buses (e.g. CAN + Modbus) is not possible. Parallel to the bus protocols, however, the use of DataStream is possible.

LAN-Interface

The LAN interface is used to implement the communication types Modbus TCP, HTTP API, DataStream and VibroLine.Vision Cloud. This enables the transfer of characteristic values or raw data to following processes/systems.

All settings are also listed in the structure view and can be edited from there.



1 Name Ethernet Interface

The ethernet interface configured here can be named accordingly. Up to 40 characters are available.

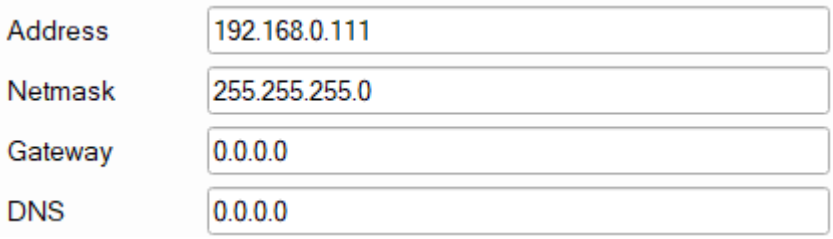
2 Template Ethernet Interface

Ethernet interface settings can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a ethernet interface template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

3 Connection type

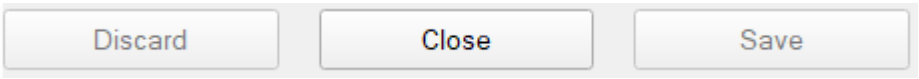
The network address of the device can be assigned automatically (Dynamic Host Configuration Protocol, DHCP) or set manually.

4 Assigning Network-Address



For the manual definition of the network address, the IP address, netmask and gateway can be entered here. If DHCP is selected, the input field is locked.

5 Aktionsknöpfe



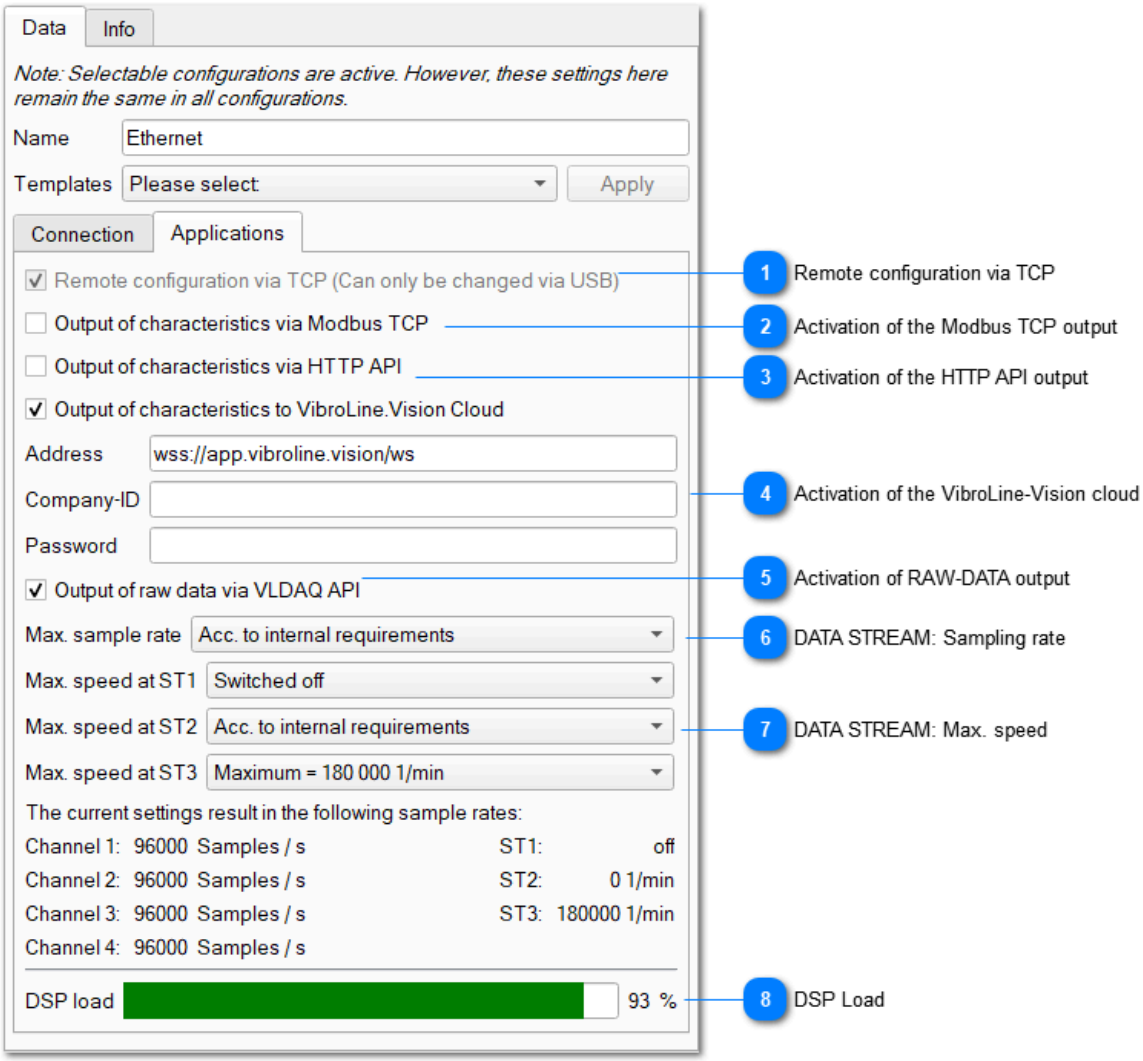
The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Application LAN

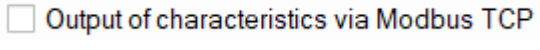
The following outputs can be configured via the LAN interface:



1 Remote configuration via TCP

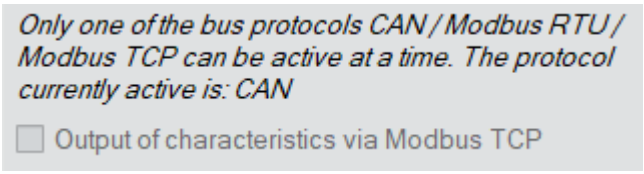
The VibroLine VLX devices can be configured via TCP. Activating/deactivating this setting is only possible with the device connected via USB. The configuration program then searches for devices connected via TCP and connects automatically. If the device is also connected via USB in addition to the TCP connection, the USB connection is preferred.

2 Activation of the Modbus TCP output

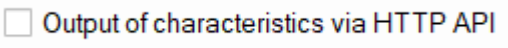


Here, the calculated characteristic values are transmitted from all available measuring channels. The Modbus TCP protocol is described in detail in the section Documentation Bus interfaces. The characteristic value output can be controlled externally with the help of the process trigger (also reporting of error states).

By setting the check mark, the parameter output is activated via Modbus TCP. If a parameter output via another interface is already active, the selection is deactivated and a corresponding note appears:

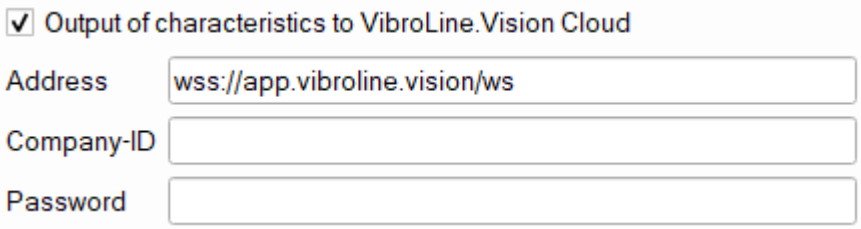


3 Activation of the HTTP API output



The output of characteristic values and device information via the HTTP API interface is activated here. The HTTP API protocol is described in detail in the Bus interfaces documentation section. The output can be controlled externally using the process trigger (also reporting of error states).

4 Activation of the VibroLine-Vision cloud

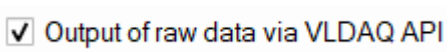


The VibroLine VLX devices can connect to the VibroLine.Vision Cloud to automatically transfer characteristic values and notifications. These can then be accessed from anywhere and from any end device in the browser. The login data for the Vision Cloud will be sent to you by IDS Innomic Schwingungsmesstechnik GmbH and entered here.

The transfer of identification values to the vision cloud can also be controlled externally using the process trigger (as can the reporting of error states).

Note: The **VibroLine.Vision** option is required to use this feature.

5 Activation of RAW-DATA output



The output of the raw data via VLDAQ API is activated here. The raw data output is possible simultaneously to a selected bus protocol.

Here the raw data of the connected sensors are transmitted via a UDP protocol without further signal processing. In addition, the signals of the trigger inputs 1-3 are transmitted. With the help of the raw data, signal evaluations and analyses can be carried out in external systems. The user does not need to handle the UDP protocol. He conveniently uses an API

provided by the manufacturer in the form of a DLL. A description of this is available in the section Documentation Bus Interfaces.

To use the DataInspect option for analysis of vibration data in VibroMatrix, the raw data output via VLDAQ API must also be activated. The subsequent logging of the raw data into a *.ids file is done with the VibroLine software VLRecorder.

6 **DATA STREAM: Sampling rate**

Max. sample rate: Acc. to internal requirements

VibroLine executes both processes - monitoring in real time and raw data output - simultaneously. For this purpose, it is necessary to clarify how the sampling rate is to be set, because the internal signal processing is still active so that bus protocols, digital outputs and current loops can still be used.

The maximum internal sampling rate can be set as follows:

According to internal sampling rate • This setting provides the lowest processor load. If the user considers the internally specified sampling rate to be sufficient for his raw data, this setting is optimal.	The sampling rate is dynamically adapted to the selected signal processing. The current values are displayed in the list: Channel 1: 48000 Samples / s Channel 2: 48000 Samples / s Channel 3: 48000 Samples / s Channel 4: 48000 Samples / s Minimally, the sampling rate can also be 0 measured values/s (monitoring switched off, sampling deactivated). If None is selected as signal processing, the raw data transmission selected sampling rate is used.
Maximum on all channels • This setting causes a high processor load.	The maximum sampling rate of 96000 samples / s is used on all measuring channels.

7 **DATA STREAM: Max. speed**

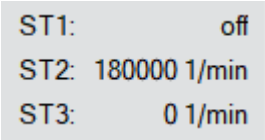
Max. speed at ST1: Switched off

Max. speed at ST2: Acc. to internal requirements

Max. speed at ST3: Maximum = 180 000 1/min

For raw data output, the maximum speed is related to the internal signal processing. Although only raw data is transferred via the DATA STREAM interface, the internal signal processing is still active so that bus protocols, digital outputs and current outputs can still be used.

The maximum expected speeds of the individual speed inputs can be defined as follows:

According to internal requirements	The maximum speed is dynamically adapted to the selected signal processing. In the list, the actual values are displayed: 
Maximum = 180 000 1/min	The speed input detects speeds up to 180 00 rpm (3000 Hz).

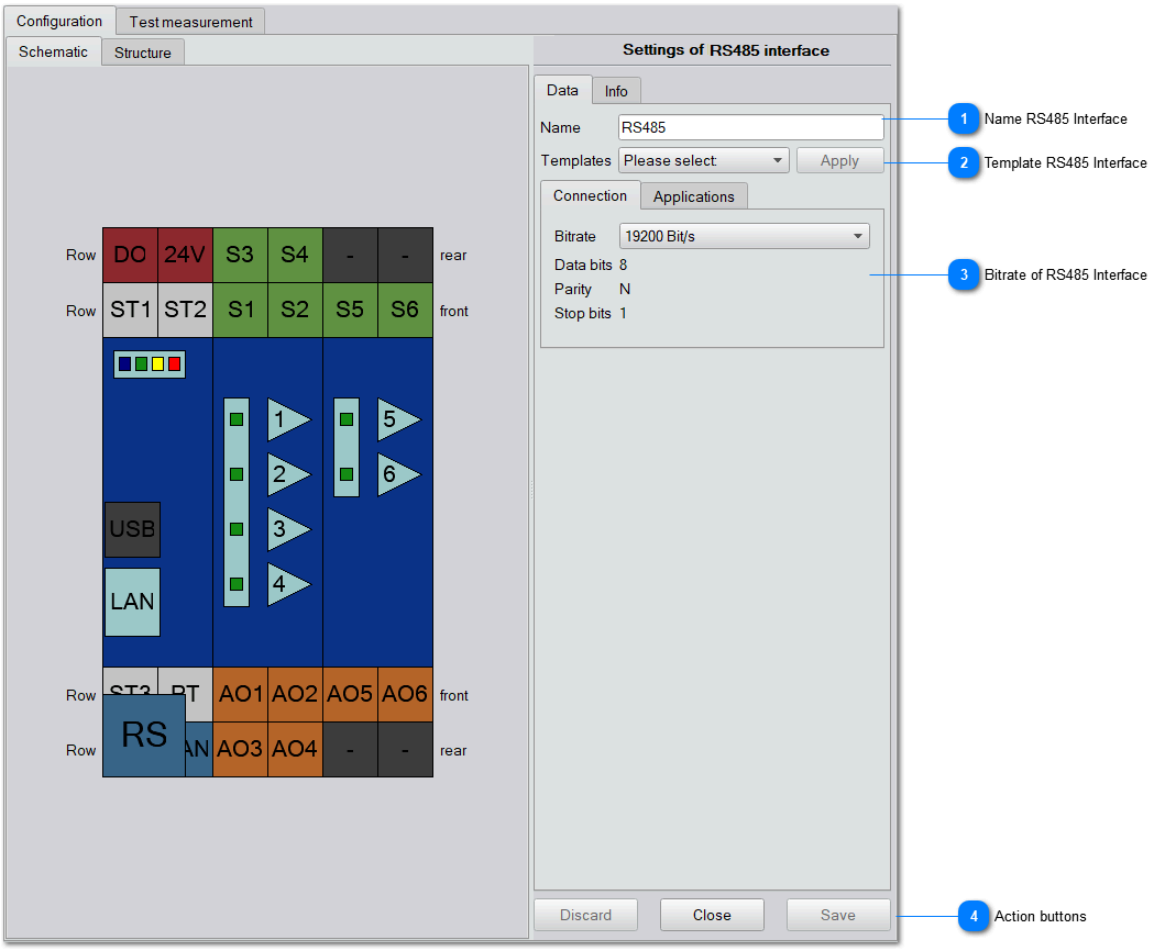
8 **DSP Load**

Depending on the characteristic value settings plus settings for data transmission, the digital signal processing (DSP) of the ViboLine unit is more or less required. The current load of the device is displayed. If the load value of the entire device reaches > 100%, different settings must be made. As a measure, for example, the sampling rate can be changed from maximum to internal sampling rate or different settings can be made in the signal processing of the individual measuring channels.
If configurations with > 100% utilization are to be written to the device, a message appears indicating that such a configuration will not be transferred to the device. The appearance of the message can be disabled. The message can be reactivated in the settings.

RS485 Interface

The Modbus RTU bus protocol can be used via the RS485 interface. With the use of this protocol, characteristic values, alarms and status messages calculated according to signal processing can be read from the device.

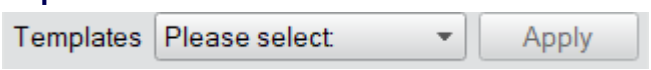
All settings are also listed in the structure view and can be edited from there.



1 Name RS485 Interface

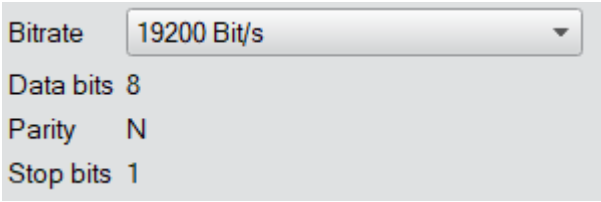
The RS485 interface configured here can be named accordingly. Up to 40 characters are available.

2 Template RS485 Interface



RS485 interface settings can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a RS485 interface template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

3 Bitrate of RS485 Interface

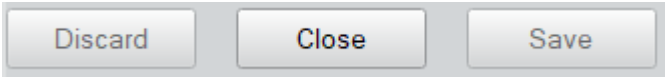


The bit rate of the serial interface can be set here. The following are available:

- 9600 Bit/s
- 19200 Bit/s
- 38400 Bit/s
- 57600 Bit/s

Fixed is 8 data bits, no parity and 1 stop bit (8, N, 1).

4 Action buttons



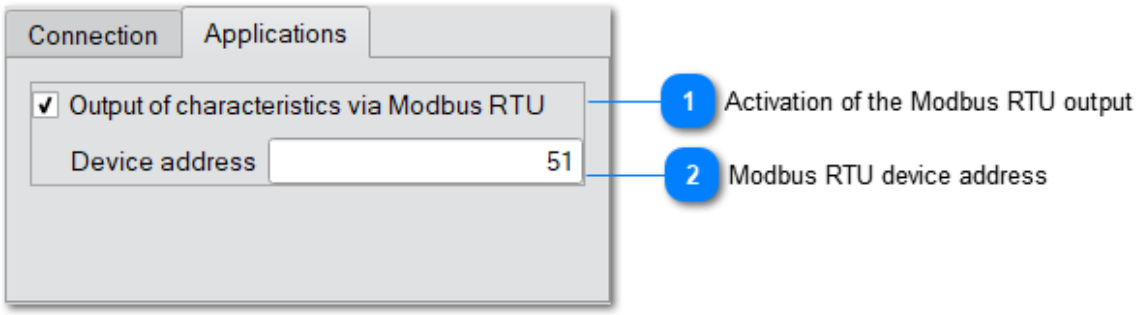
The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

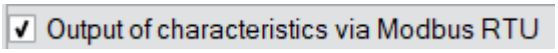
If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

RS485 Application

The characteristic values calculated are transmitted from all available measuring channels. The Modbus RTU protocol is described in detail in the section Documentation Bus Interfaces. The characteristic value output can be controlled externally using the process trigger (as well as error notification).



1 Activation of the Modbus RTU output



If the box is checked, the output of the characteristic values is activated via Modbus RTU. If a output via another interface is already active, the selection is deactivated and a corresponding message appears:

Only one of the bus protocols CAN / Modbus RTU / Modbus TCP can be active at a time. The protocol currently active is: Modbus TCP

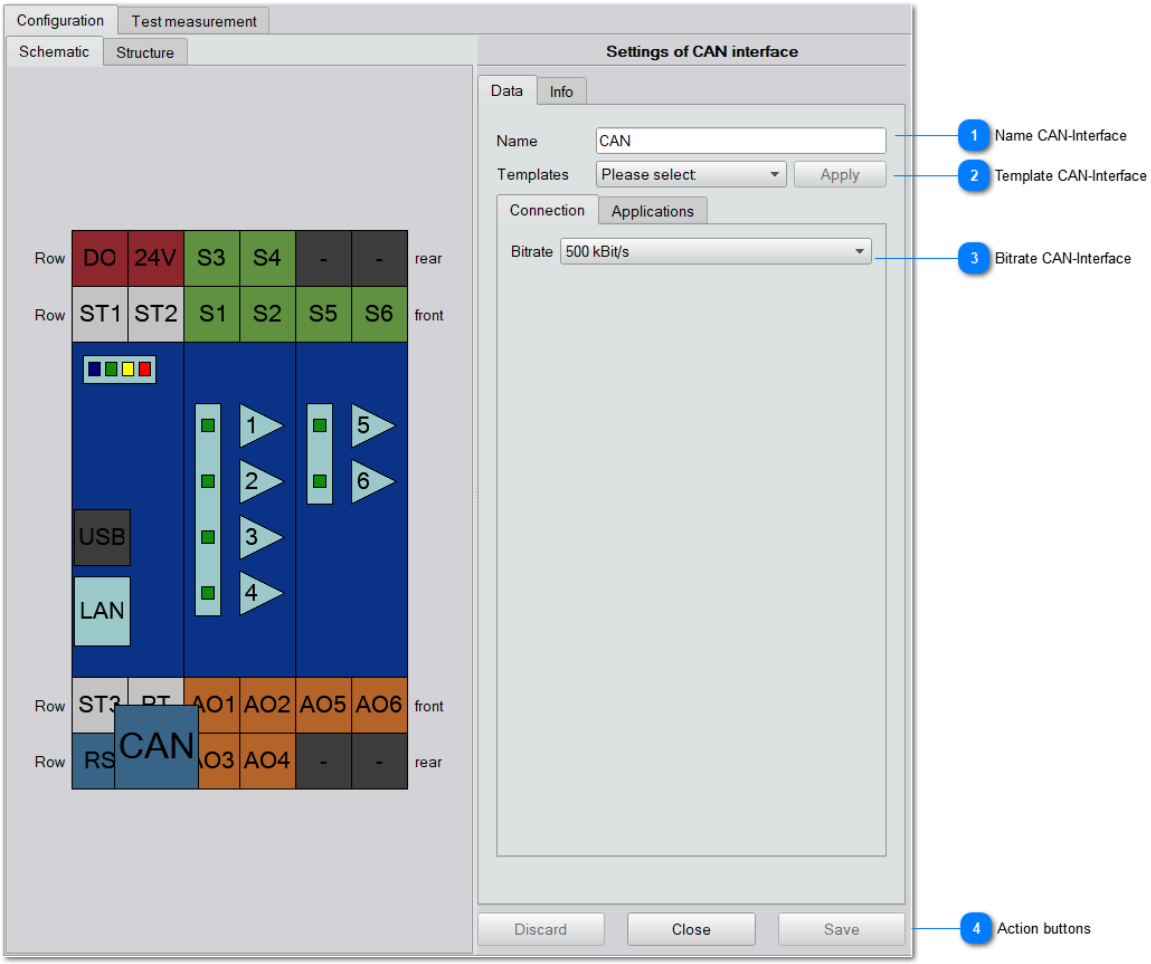
2 Modbus RTU device address

Enter the Modbus slave address. Values from 1 ... 247 are valid.

CAN Interface

The CANopen bus protocol can be used via the CAN interface. With the use of this protocol, characteristic values, alarms and status messages calculated according to signal processing can be read from the device.

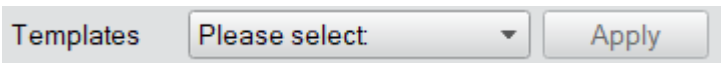
All settings are also listed in the structure view and can be edited from there.



1 Name CAN-Interface

The CAN interface configured here can be named accordingly. Up to 40 characters are available.

2 Template CAN-Interface



CAN interface settings can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a CAN interface template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the

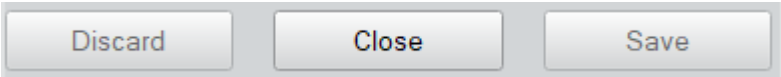
action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

3 **Bitrate CAN-Interface**

The bit rate of the serial interface can be set here. The following are available:

- 50 kBit/s
- 125 kBit/s
- 250 kBit/s
- 500 kBit/s
- 1 MBit/s

4 **Action buttons**



The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

CAN Application

Here, the calculated characteristic values and alarm states can be transmitted from all available measuring channels. On the protocol layer VibroLine follows the CANopen standard. The CAN protocol is described in detail in the section Documentation Bus Interfaces. The settings available here control the transmission of values via TPDOs. These Transmission Process Data Objects are very fast and can be transmitted in real-time.

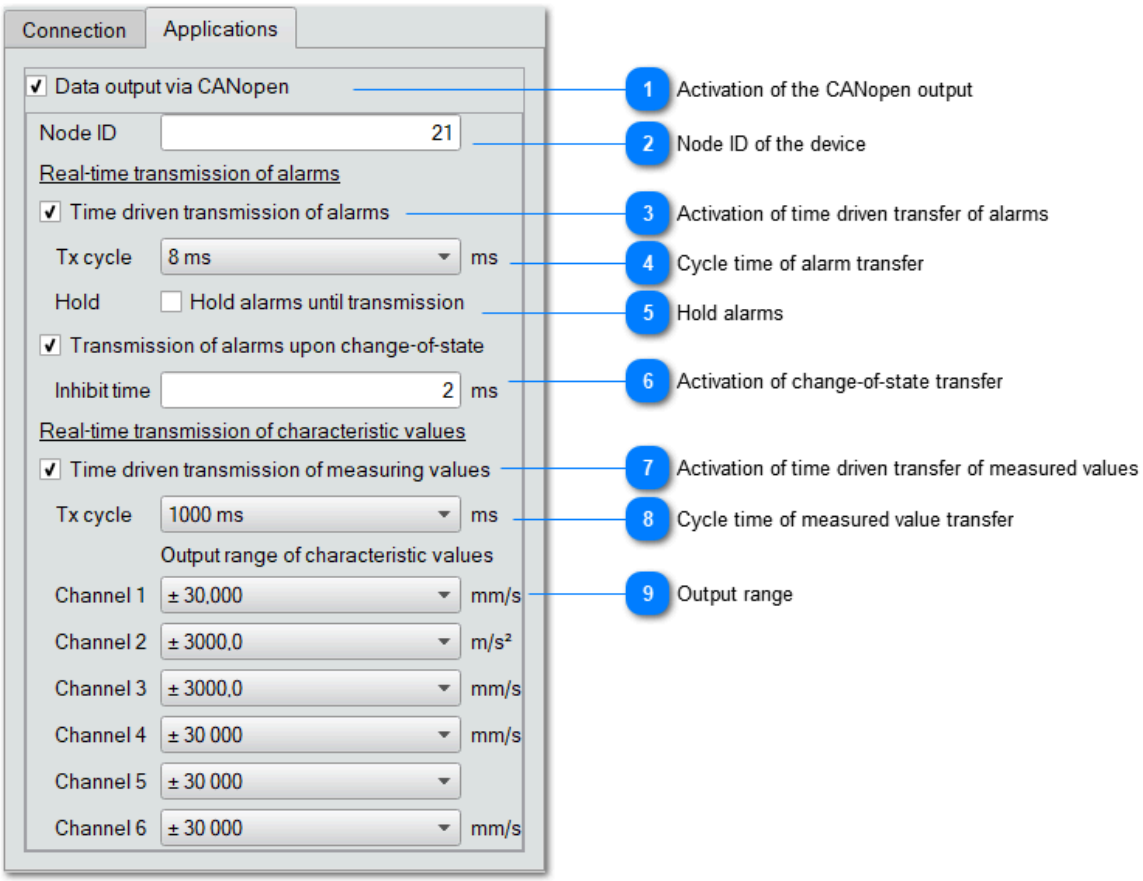
In addition to transmission via TPDOs, many other values can be queried with SDOs, the Service Data Objects. The manufacturer supplies a complete EDS (Electronic Data Sheet) for VibroLine

The output of characteristic values and alarm states can additionally be externally disabled or enabled by means of the process trigger.

Two modes are available for data transmission via TPDOs:

1. Time driven transmission
Here a transmission of measured values or pending alarms is executed in selectable, fixed time intervals.

2. Change-of-state transmission
Only when the alarm statuses are changed will a transmission be performed.



1 Activation of the CANopen output

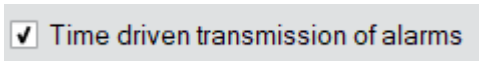
If the box is checked, the output of the characteristic values is activated via CAN Bus. If a output via another interface is already active, the selection is deactivated and a corresponding message appears:

Only one of the bus protocols CAN / Modbus RTU / Modbus TCP can be active at a time. The protocol currently active is: Modbus TCP

2 Node ID of the device

The Node ID of the device is defined here. The ID must be selected from the range 1 ... 127.

3 Activation of time driven transfer of alarms



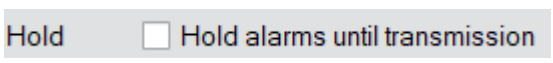
The time-driven alarm is activated here. At the defined time interval, occurring alarms are sent.

4 Cycle time of alarm transfer

The transmission cycle (time interval) of the time-controlled alarm transmission is defined here. The following are available:

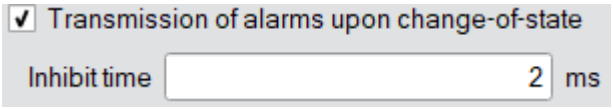
- 8 ms
- 40 ms
- 80 ms
- 200 ms
- 400 ms
- 1000 ms
- 2000 ms
- 4000 ms
- 8000 ms

5 Hold alarms



If an alarm is present within the transmission cycle, this information can be held until the next scheduled transmission of the alarm status. This function is activated here.

6 Activation of change-of-state transfer



The change-of-state transmission of alarms is activated here. An alarm is sent immediately if the alarm condition is met. To reduce the dispatch volume in case of frequently changing alarm conditions, a blocking time can be defined (flutter prevention). The next transmission of alarm messages will then only take place after the blocking time has expired. The blocking time can have values between 0 ... 10000 ms.

7 Activation of time driven transfer of measured values

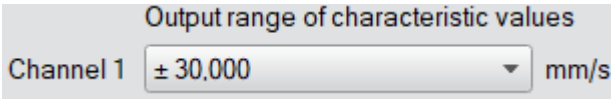
The time-driven measured value transmission is activated here. The measured values configured in signal processing are sent at the specified time interval.

8 Cycle time of measured value transfer

The transmission cycle (time interval) of the time-controlled measured value transmission is defined here. The following are available:

- 8 ms
- 40 ms
- 80 ms
- 200 ms
- 400 ms
- 1000 ms
- 2000 ms
- 4000 ms
- 8000 ms

9 Output range



TPDOs are fast and work in real time. However, their number is limited and therefore only 16-bit integer values are available for the transmission of measured values. How the measured values are represented within these 16 bit integers can be set here:

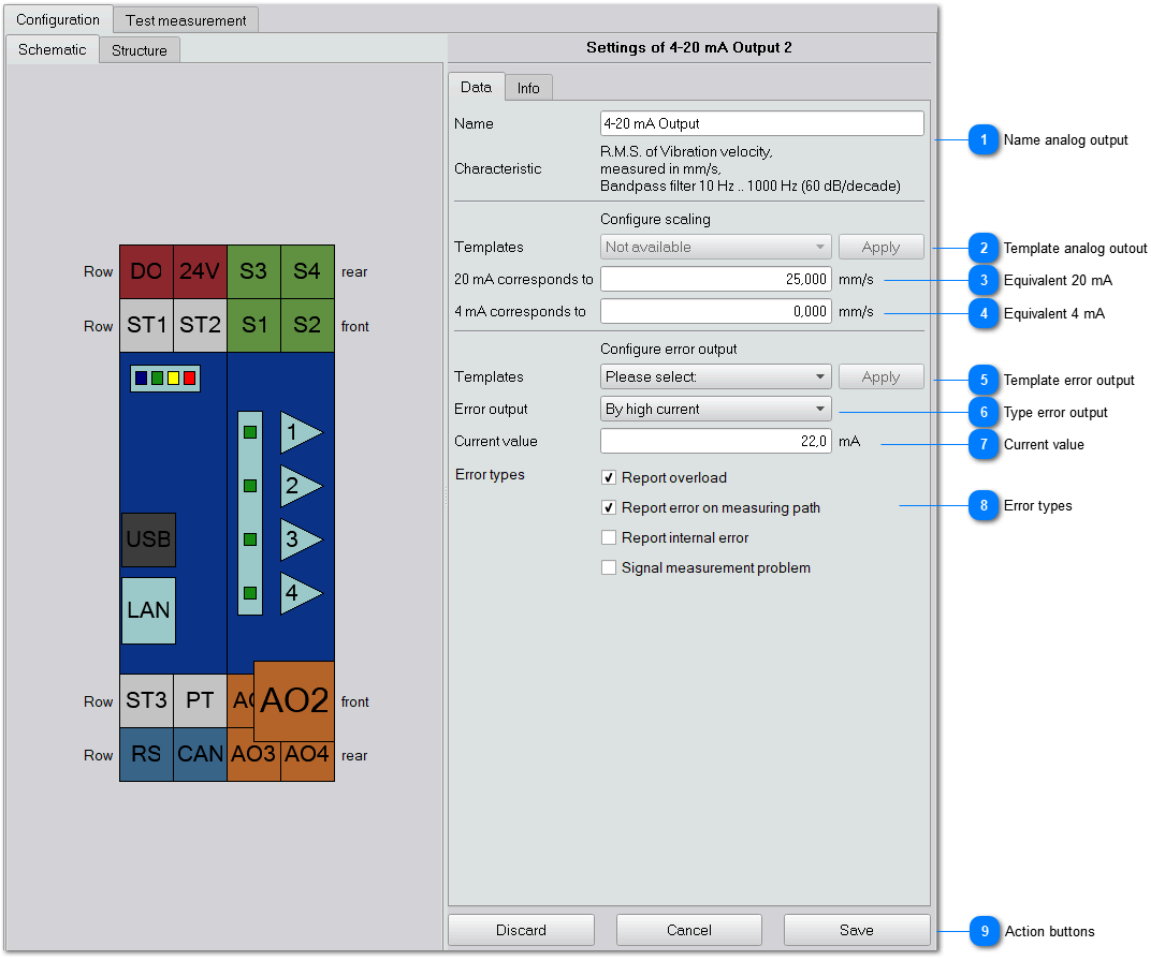
+/- 30 000	= 0 digits
+/- 3000,0	= 1 digits
+/- 300,00	= 2 digits
+/- 30,000	= 3 digits

Analog output

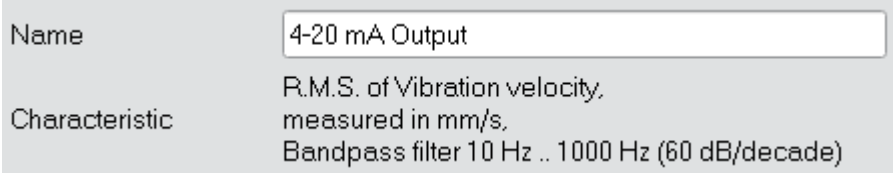
To configure the 4-20 mA analog outputs, the orange AO1... AO8 fields are selected. The displayed configuration is performed individually for each analog output channel.
A voltage source is required to operate the 4-20 mA current loops, as the outputs represent a current sink. As a supply voltage, voltages between 12 and 30 V can be used. The analog outputs are updated at the cycle time.

Using the **MulitMode** option, several characteristic values can be configured per measuring channel. However, the 4-20 mA analog output can only map one characteristic value. The 4-20 mA current output is therefore permanently set to the output of the **1st characteristic value of the respective measuring channel**.

All analog output settings are also listed in the structure view and can be edited from there.



1 Name analog output



Each configuration can be named accordingly. Up to 40 characters are available. The currently used vibration characteristic is displayed.

2 Template analog outout

Analog output configurations can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of an analog output template is confirmed by clicking **Apply**. If the selected template is to be transferred to the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

3 Equivalent 20 mA

The scaling of the analog output can be set. The value of the measured quantity set in signal processing is determined, which corresponds to a current of 20 mA.

4 Equivalent 4 mA

The scaling of the analog output can be set. The value of the measured quantity set in signal processing is determined, which corresponds to a current of 4 mA.

5 Template error output

Error output configurations can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of an error output template is confirmed by clicking **Apply**. If the selected template is to be transferred to the device, the action button **Save** must be pressed. If no template exists,"None exists" is displayed in the selection field.

6 Type error output

In addition to the 4-20 mA current loop, faults can be reported to the subsequent evaluation electronics by means of low or high current. The selection is made via the selection field.

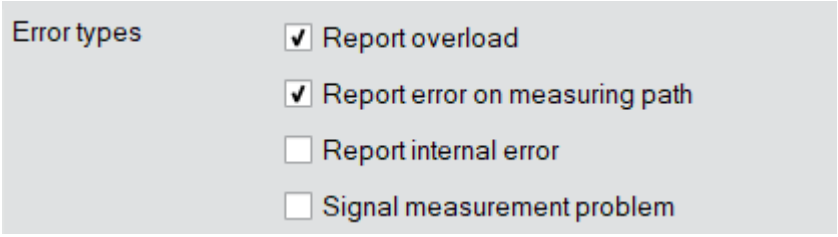
7 Current value

In the event of an error, the low or high current value specified here is used. The output currents can be freely selected within the following limits:

Low current	2,0 .. 3,5 mA

High current 20,5 .. 24 mA

8 Error types



The following error types can be reported by means of the high or low current output (multiple selection possible):

Overflow	The input level exceeds the specified range. Analog-to-digital conversion cannot be performed with precision. A reduction of the gain must be checked (alternatively: use of a sensor with lower sensitivity).
Error on measuring path	Only for IEPE sensors. Short circuit or cable breakage in the sensor cable is detected.
Internal error	Error of the VibroLine device. An inspection and diagnosis by the manufacturer may be necessary. Note: If an internal error occurs, the zone LEDs all flash simultaneously.
Signal measurement problem	Relevant for order characteristic and bearing characteristic. Error is activated when the valid speed window is left.

9 Action buttons

The action buttons can be used to change the configuration:

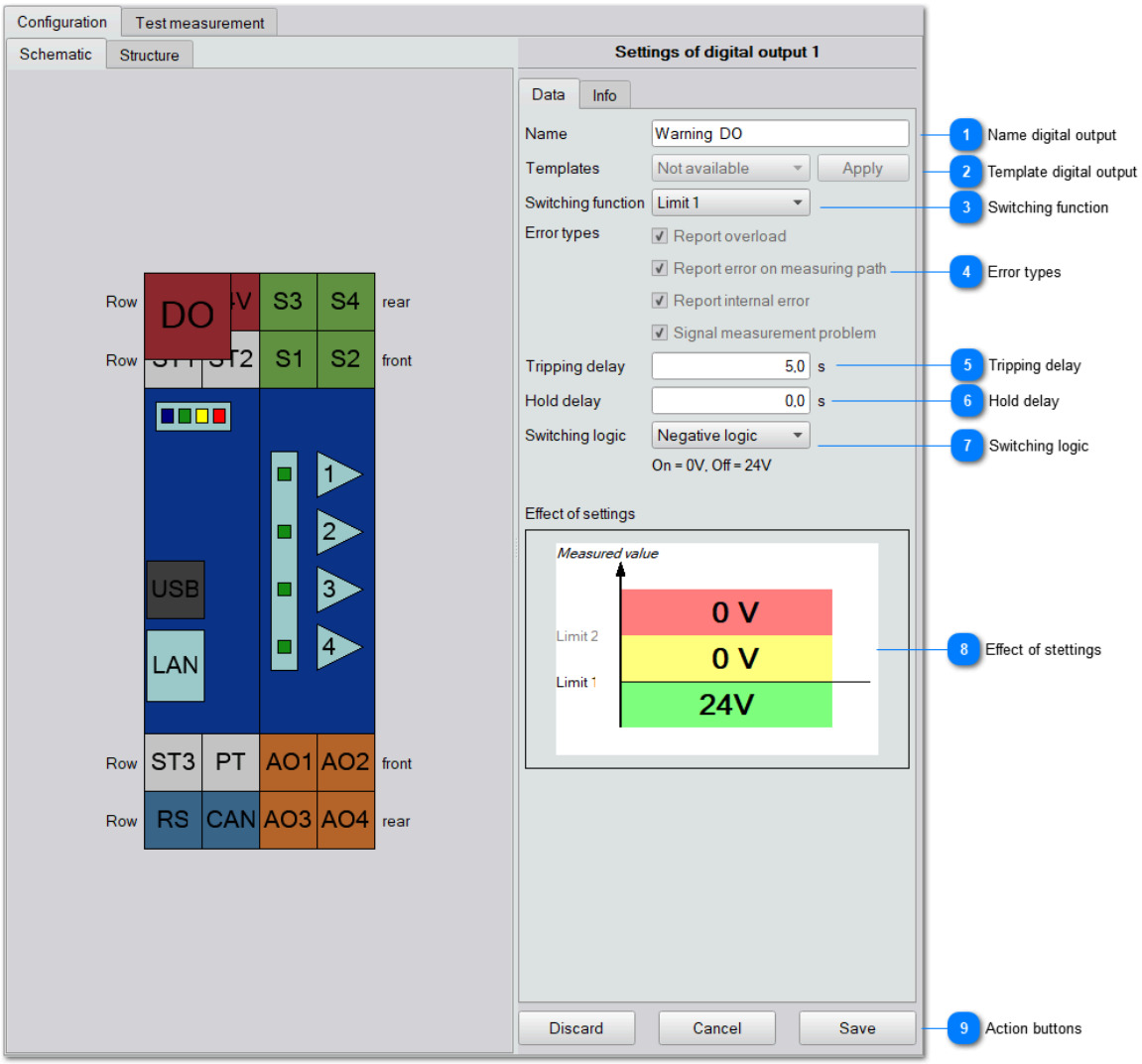
Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

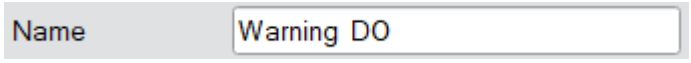
Digital output

The digital outputs can be accessed by clicking on the red DO1.. DO3 fields. Each digital output is parameterized individually.

All settings are also listed in the structure view and can be edited from there.



1 Name digital output



The digital output configured here can be named accordingly. Up to 40 characters are available.

2 Template digital output

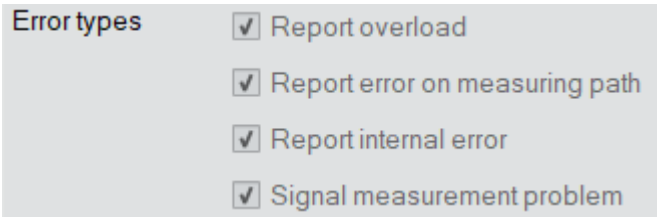
Digital output settings can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

3 Switching function

Each digital output can be used for different switching functions:

Always OFF	The digital output is permanently switched to OFF (can be used as an alive signal depending on the switching logic).
Always ON	The digital output is permanently switched to ON (can be used as an alive signal depending on the switching logic).
Zone A	When values are within zone A, it is switched to ON.
Zone B	When values are within zone B, it is switched to ON.
Zone C	When values are within zone C, it is switched to ON.
Zone D	When values are within zone D, it is switched to ON.
Zone A -> B	The transition from zone A to B switches to ON.
Zone B -> C	The transition from zone B to C switches to ON.
Zone C -> D	The transition from zone C to D switches to ON.
Limit 1	When the warning level is reached, it switches to ON.
Limit 2	When the larm level is reached, it switches to ON.
Outside	When values are outside the range from Limit 1 to Limit 2, it is switched to ON.
Error	In the event of an error, it switches to ON.

4 Error types



If an error is to be reported via the digital output, the following error types are available (multiple selection possible):

Overflow	The input level exceeds the specified range. Analog-to-digital conversion cannot be performed with precision. A reduction of the gain must be checked (alternatively: use of a sensor with lower sensitivity).
Error on measuring path	Only for IEPE sensors. Short circuit or cable breakage in the sensor cable is detected.
Internal error	Error of the VibroLine device. An inspection and diagnosis by the manufacturer may be necessary. Note: If an internal error occurs, the zone LEDs all flash simultaneously.
Signal measurement problem	Relevant for order characteristic and bearing characteristic. Error is activated when the valid speed window is left.

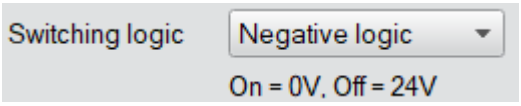
5 Tripping delay

The switching of the digital output can be delayed by a definable period of time after the switching condition has been reached. Values between 0.0 and 60 s can be set. With a delay value of 0.0 s, the switching process depends on the cycle and reaction time. The minimum switch-on delay for overall values and order characteristics is 12 ms and the maximum switch-on delay is 20 ms. If shock parameters are used, the minimum switch-on delay can be reduced to 0.666 ms.

6 Hold delay

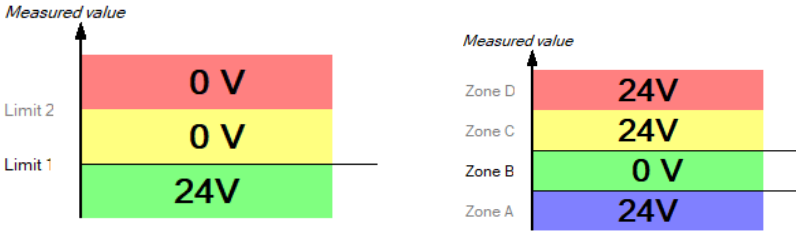
The switching of the digital output can also be delayed after the switching condition has expired. Values between 0.0 and 60 s can also be set here. With a delay value of 0.0 s, the switch-off process is carried out after the cycle time.

7 Switching logic



The switching logic of the digital output can be selected. It can be selected whether HIGH is 24 V or 0 V (for LOW correspondingly inverted).

8 Effect of stettings



The different switching functions are displayed graphically for a better overview. This makes it clear at a glance to which limits the ON or OFF condition is assigned.

9 Action buttons

The action buttons can be used to change the configuration:

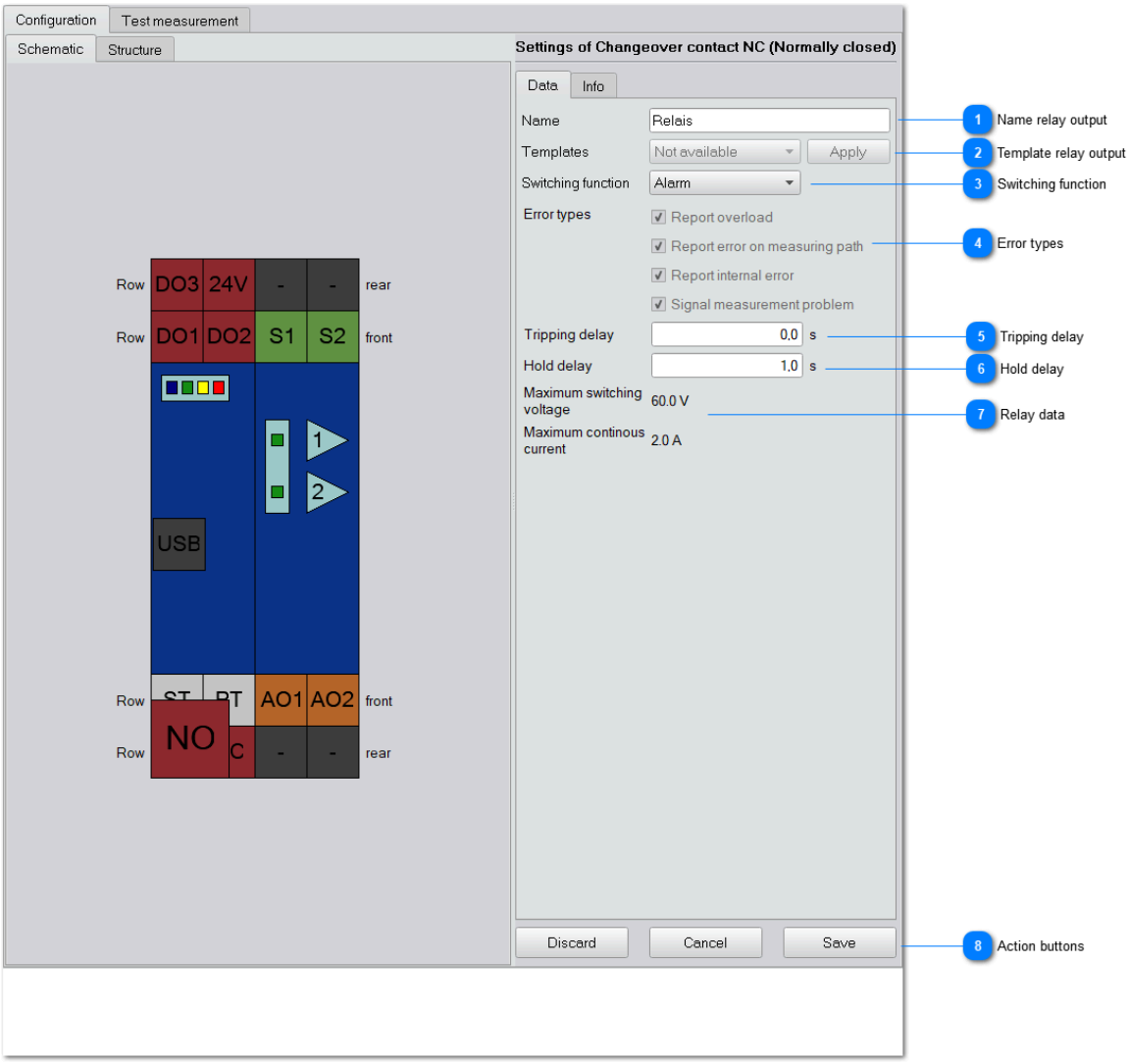
Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Relay output

The settings of the changeover relay can be selected via the grey NC or NO fields. Due to the changeover relay character, the settings for the other contact are adopted.

All settings are also listed in the structure view and can be edited from there.



1 Name relay output

The NC- and NO relais output configured here can be named accordingly. Up to 40 characters are available.

2 Template relay output

Relay output settings can be saved in a template. If templates are available, they can be selected from the selection box ("Please select"). The selection of a signal processing

template is confirmed by clicking **Apply**. If the selected template is to be written into the device, the action button **Save** must be pressed. If no template exists,"Not available" is displayed in the selection field.

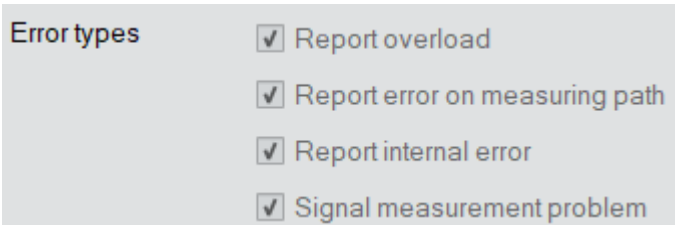
3 Switching function

The NC and NO output of the changeover relay can be used for various switching functions:

Always OFF	The output is permanently switched to OFF (can be used as an alive signal depending on the switching logic).
Always ON	The output is permanently switched to ON (can be used as an alive signal depending on the switching logic).
Zone A	When values are within zone A, it is switched to ON.
Zone B	When values are within zone B, it is switched to ON.
Zone C	When values are within zone C, it is switched to ON.
Zone D	When values are within zone D, it is switched to ON.
Zone A -> B	The transition from zone A to B switches to ON.
Zone B -> C	The transition from zone B to C switches to ON.
Zone C -> D	The transition from zone C to D switches to ON.
Limit 1	When the warning level is reached, it switches to ON.
Limit 2	When the larm level is reached, it switches to ON.
Outside	When values are outside the range from Limit 1 to Limit 2, it is switched to ON.
Error	In the event of an error, it switches to ON.

Note: Due to the change-over relay character, the switching functions are inverted on the other contact.

4 Error types



If an error is to be reported via the digital output, the following error types are available (multiple selection possible):

Overflow	The input level exceeds the specified range. Analog-to-digital conversion cannot be performed with precision. A reduction of the gain must be checked (alternatively: use of a sensor with lower sensitivity).
Error on measuring path	Only for IEPE sensors. Short circuit or cable breakage in the sensor cable is detected.

Internal error	Error of the VibroLine device. An inspection and diagnosis by the manufacturer may be necessary. Note: If an internal error occurs, the zone LEDs all flash simultaneously.
Signal measurement problem	Relevant for order characteristic and bearing characteristic. Error is activated when the valid speed window is left.

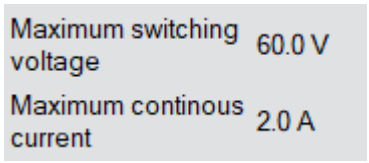
5 **Tripping delay**

The switching of the relay output can be delayed by a definable period of time after the switching condition has been reached. Values between 0.0 and 60 s can be set. With a delay value of 0.0 s, the switching process depends on the cycle and reaction time. The minimum switch-on delay for overall values and order characteristics is 12 ms and the maximum switch-on delay is 20 ms. If shock parameters are used, the minimum switch-on delay can be reduced to 0.666 ms.

6 **Hold delay**

The switching of the relay output can also be delayed after the switching condition has expired. Values between 0.0 and 60 s can also be set here. With a delay value of 0.0 s, the switch-off process is carried out after the cycle time.

7 **Relay data**



The built-in relay is a wear-free and very fast solid-state changeover relay. The NC and NO contacts can be loaded up to 60 V and 2 A.

Note: Due to the SSR character of the changeover relay, both contacts are deenergized open.

8 **Action buttons**

The action buttons can be used to change the configuration:

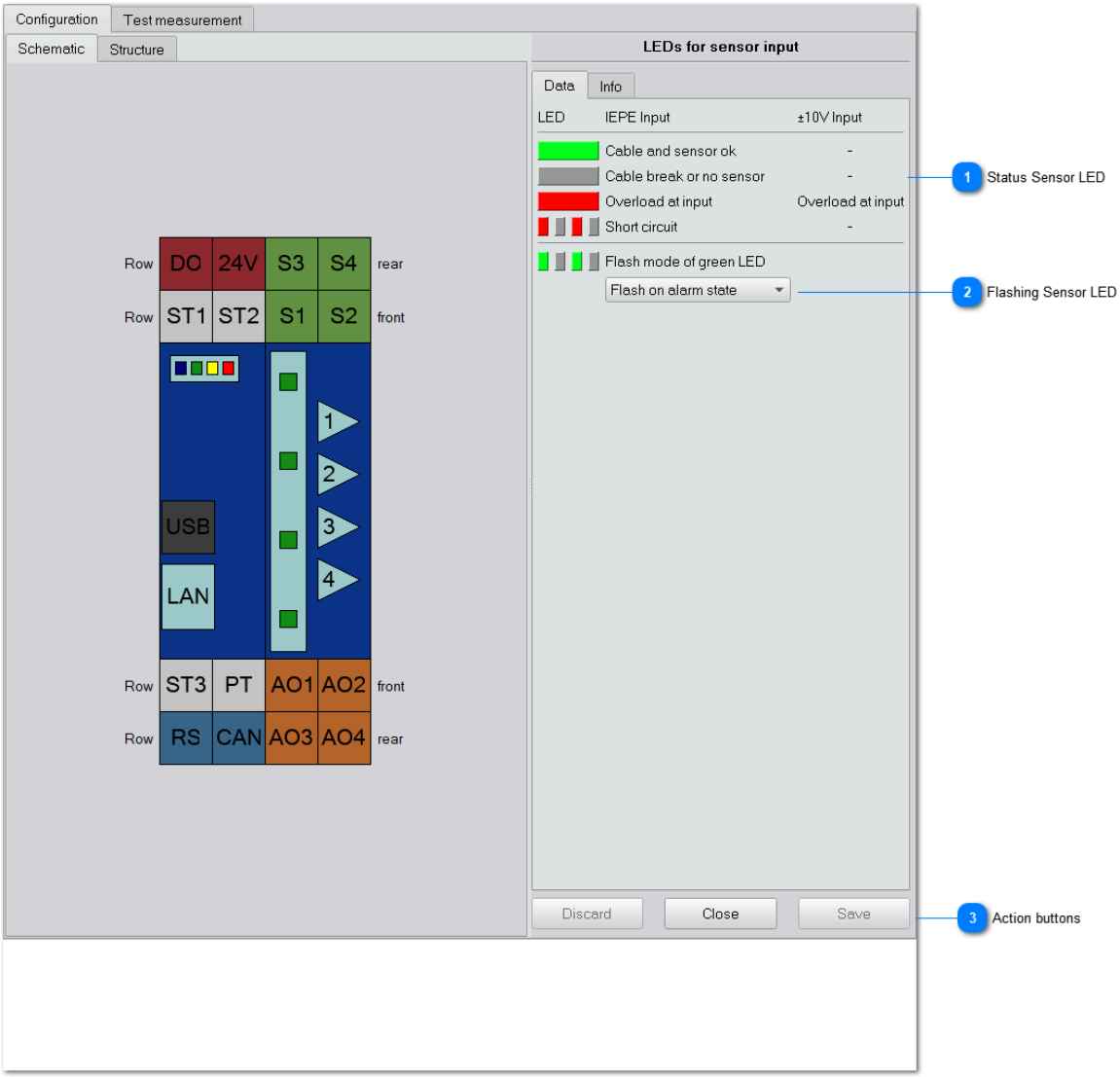
Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Status Sensor LED

To call up the information about the status LEDs of the measurement inputs, click on the LEDs shown in the schematic view. In addition to information on colour- and flashing codes, it can be specified whether a pre- or alarm limit is to be signalled as a flashing green sensor LED. The setting is made for all measuring channels at the same time.

All settings are also listed in the structure view and can be edited from there.

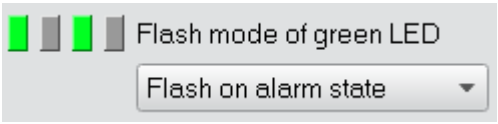


1 Status Sensor LED

LED	IEPE Input	±10V Input
	Cable and sensor ok	-
	Cable break or no sensor	-
	Overload at input	Overload at input
	Short circuit	-

The sensor LED indicates the current status of the sensor. Depending on whether the input is used as an IEPE input or +/- 10 V input, errors on the measuring section can be signalled by the LED.

2 Flashing Sensor LED



The sensor LED can also be used to detect the measuring channel with a warning or alarm violation. This setting is made for all measuring channels at the same time. In this way, exceeding a limit value can be immediately assigned to a sensor and thus to a measuring point.
If the flashing mode is not to be used, "No flashing" can be selected.

3 Action buttons

The action buttons can be used to change the configuration:

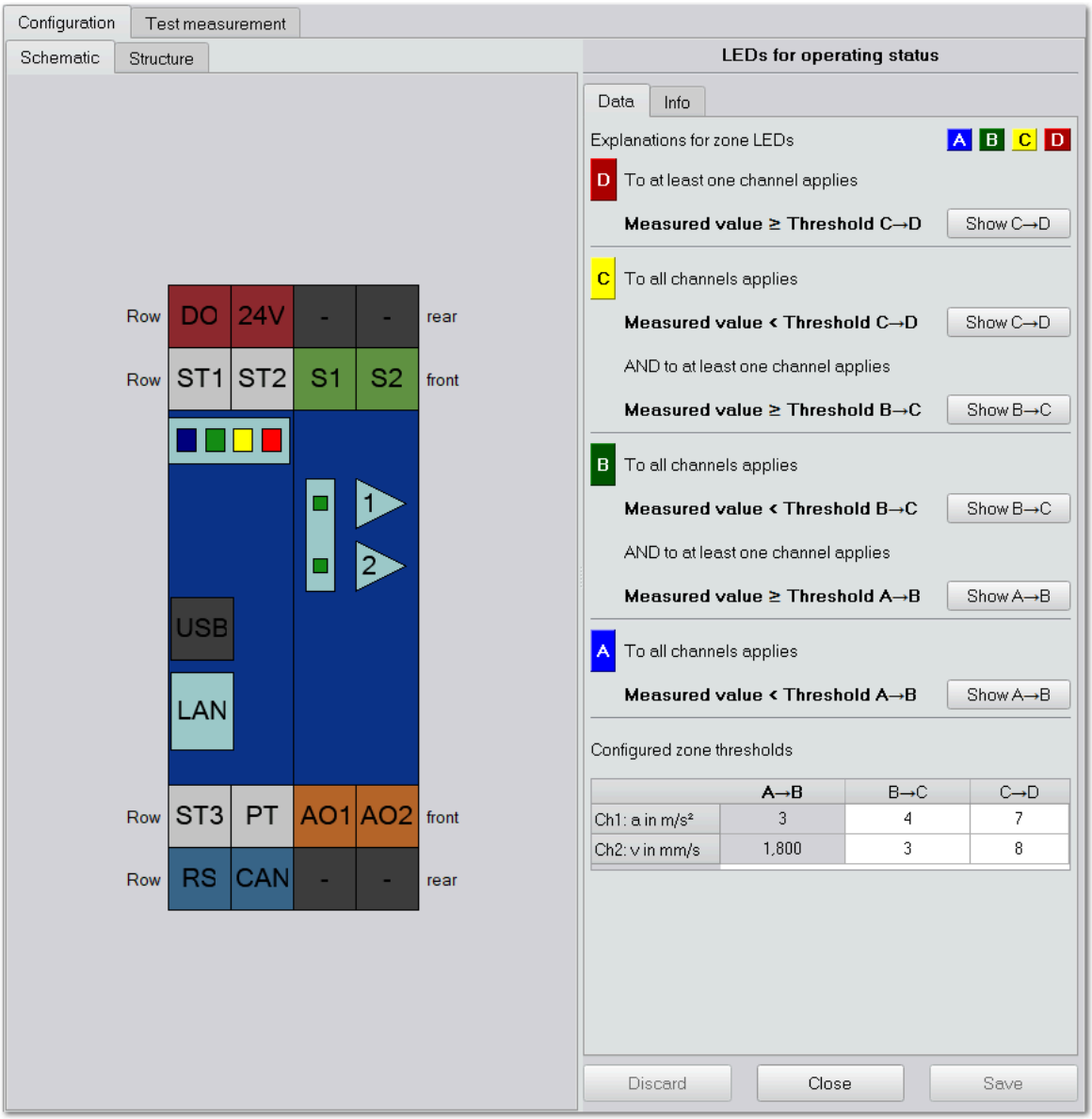
Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database and - if connected - immediately transferred to the device. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Zone-LEDs

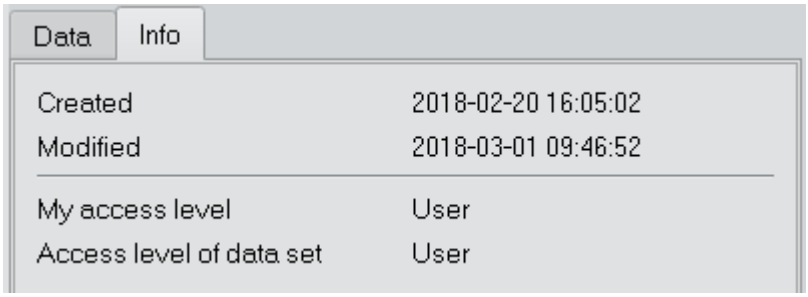
The current settings of the zone LEDs of all channels can be called up by clicking on the coloured LED series. The display is for information purposes only. No changes can be made.
The machine status represented by the zone LEDs represents the maximum value of all channels.
All zone LEDs flash at the same time when

- a data transfer from the configuration program to the device takes place
- a transient process occurs
- an internal error (e. g. overload, faulty DSP configuration).

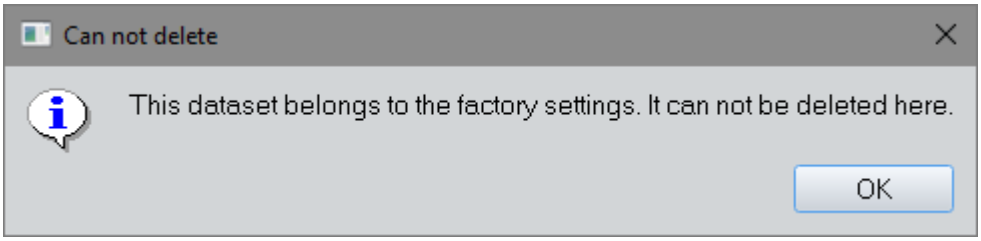


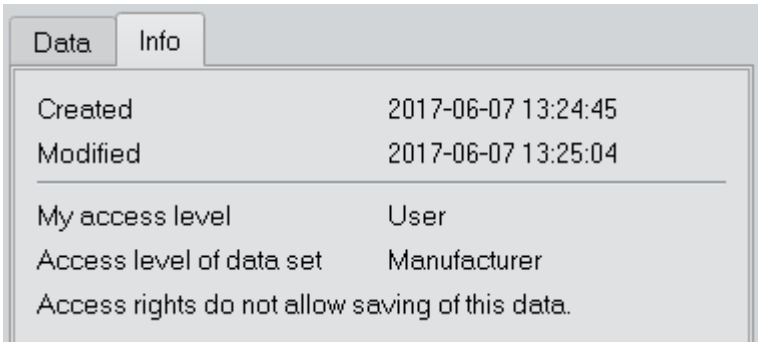
Data set information

Each properties menu contains a tab **Info**. This contains information on the creation date, change date, and the current access level of the user or dataset.



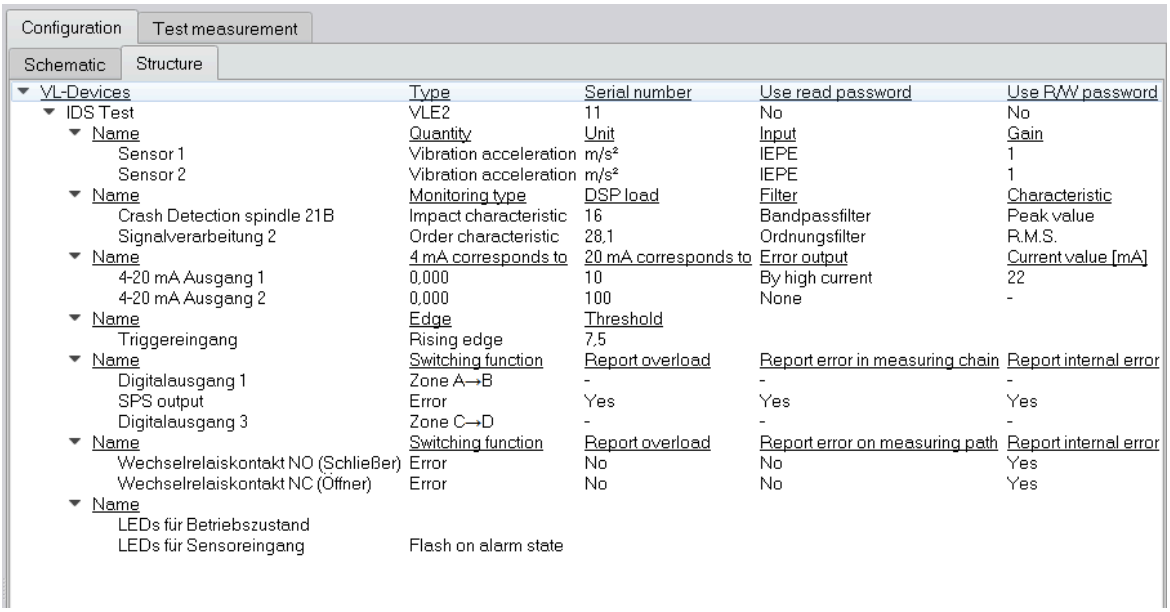
Data records can have the access levels **User** and **Manufacturer**. You cannot change or delete data records of type **Manufacturer** with access level **User**. This applies to the factory settings of the templates for filters, characteristic values and zone limits saved in the program. The program indicates this accordingly:





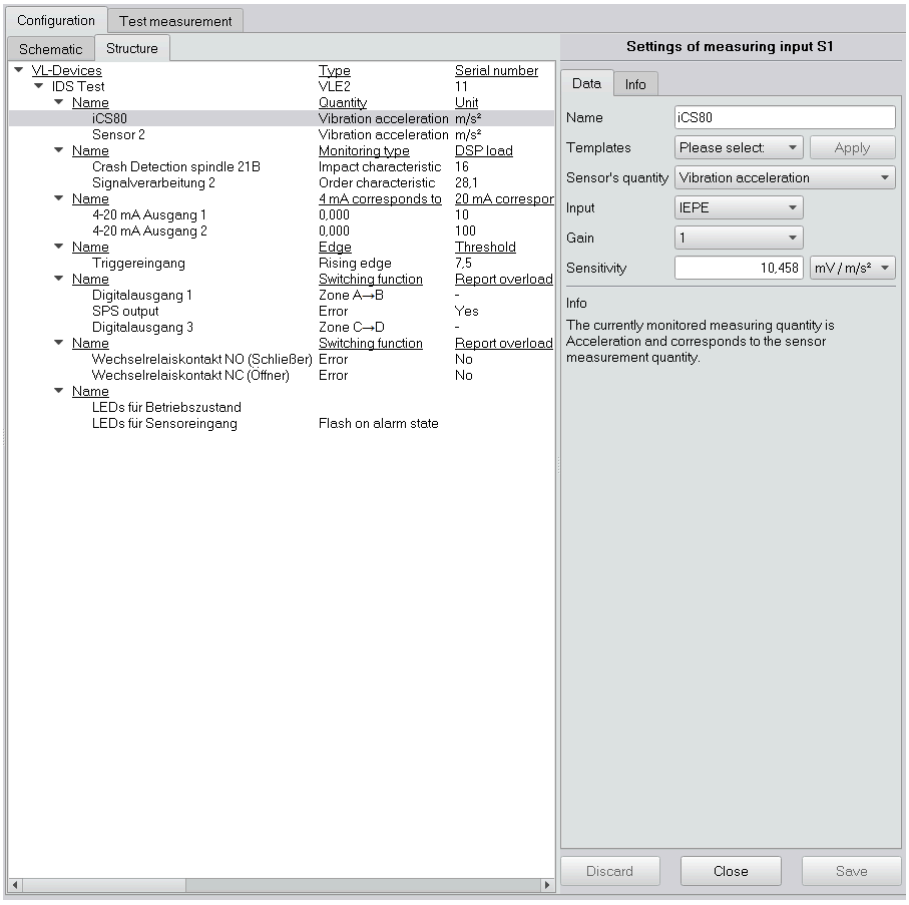
Structure view

All the settings made can are clearly shown in the structure view. The current settings are displayed for each configuration menu (sensor inputs, signal processing, analog outputs, etc.). In this way, the parameterization of many channels can be compared or controlled at a glance.



VL-Devices	Type	Serial number	Use read password	Use R/W password
IDS Test	VLE2	11	No	No
Name	Quantity	Unit	Input	Gain
Sensor 1	Vibration acceleration	m/s²	IEPE	1
Sensor 2	Vibration acceleration	m/s²	IEPE	1
Name	Monitoring type	DSP load	Filter	Characteristic
Crash Detection spindle 21B	Impact characteristic	16	Bandpassfilter	Peak value
Signalverarbeitung 2	Order characteristic	28,1	Ordnungsfilter	R.M.S.
Name	4 mA corresponds to	20 mA corresponds to	Error output	Current value [mA]
4-20 mA Ausgang 1	0,000	10	By high current	22
4-20 mA Ausgang 2	0,000	100	None	-
Name	Edge	Threshold		
Triggereingang	Rising edge	7,5		
Name	Switching function	Report overload	Report error in measuring chain	Report internal error
Digitalausgang 1	Zone A→B	-	-	-
SPS output	Error	Yes	Yes	Yes
Digitalausgang 3	Zone C→D	-	-	-
Name	Switching function	Report overload	Report error on measuring path	Report internal error
Wechselrelaiskontakt NO (Schließer)	Error	No	No	Yes
Wechselrelaiskontakt NC (Öffner)	Error	No	No	Yes
Name				
LEDs für Betriebszustand				
LEDs für Sensoreingang	Flash on alarm state			

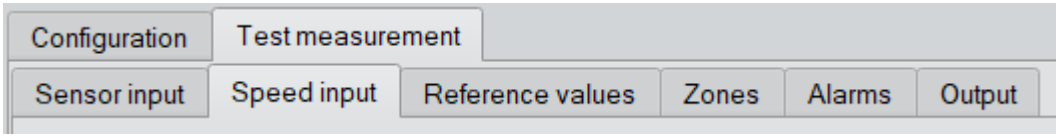
You can also change settings directly from the structure view. The line to be changed is selected and the corresponding configuration menu opens. The individual menus are explained in the sub-sections of the device configuration.



Test measurement

With the help of the VibroLine Konfigurator it is possible to obtain a live display of the currently measured vibration values. Prior to the autonomous operation of the VibroLine devices, the measuring channel amplifications, speeds or trigger states, zone and alarm limits as well as the scaling of the 4-20 mA analog output can be checked and, if necessary, adapted. During operation, the current vibration values can be displayed by means of the test measurement function.

The test measurement function is selected by selecting the "Test measurement" tab:

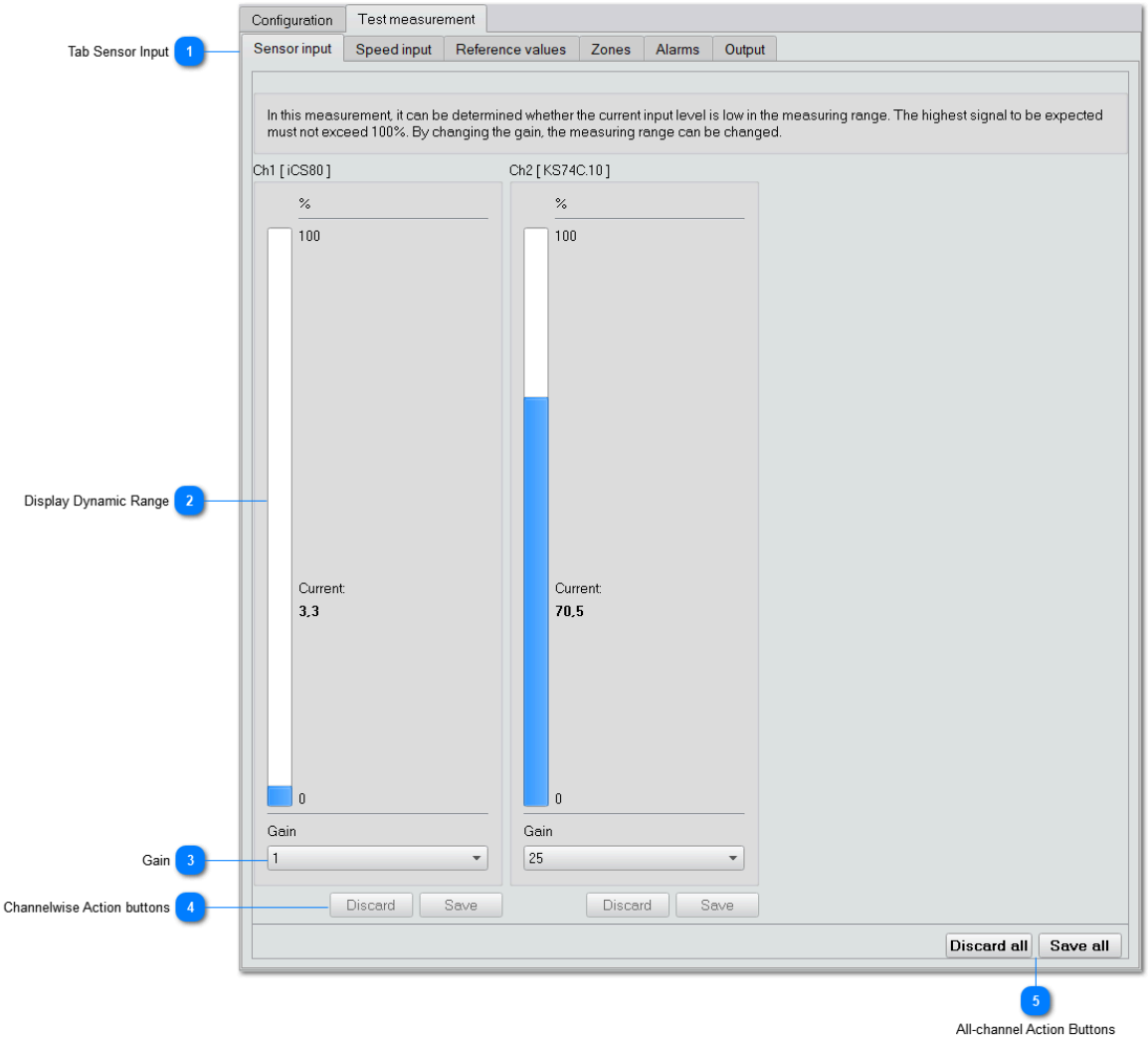


The following options are possible:

- Sensor input
- Speed input
- Reference values
- Zones
- Alarms
- Output

Sensor input

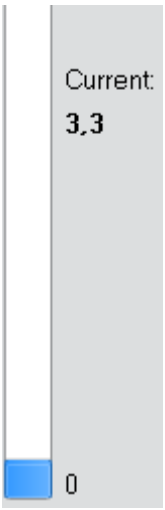
The suitability of the currently selected gain factor can be checked quickly and easily via the level indicators. The current input level is displayed for all measuring channels. If the level is too low or too high despite a change in gain, a sensor with higher or lower sensitivity should be used.
The amplification can be determined individually for each measuring channel.



1 Tab Sensor Input

The "Sensor Input" tab is selected to display the current level of all measurement channels.

2 **Display Dynamic Range**



The bar graph display shows the current level taking into account the selected gain of each measuring channel. This corresponds to 100% of the maximum voltage level of each input channel. The display sets this to 0.1. 40000 Hz band limited input signal (= maximum frequency range of the VibroLine devices). If very high (> 95%) or very small (< 1%) values are continuously displayed during operation, it is advisable to adjust the gain. If this is not possible, a sensor with lower or higher sensitivity should be used.

3 **Gain**

For each measuring channel the internal gain can be increased from 1 to 25. This increases the digitizing quality for very small signals. By increasing the gain, the dynamic range of the measuring channel decreases naturally, also by a factor of 25.

4 **Channelwise Action buttons**

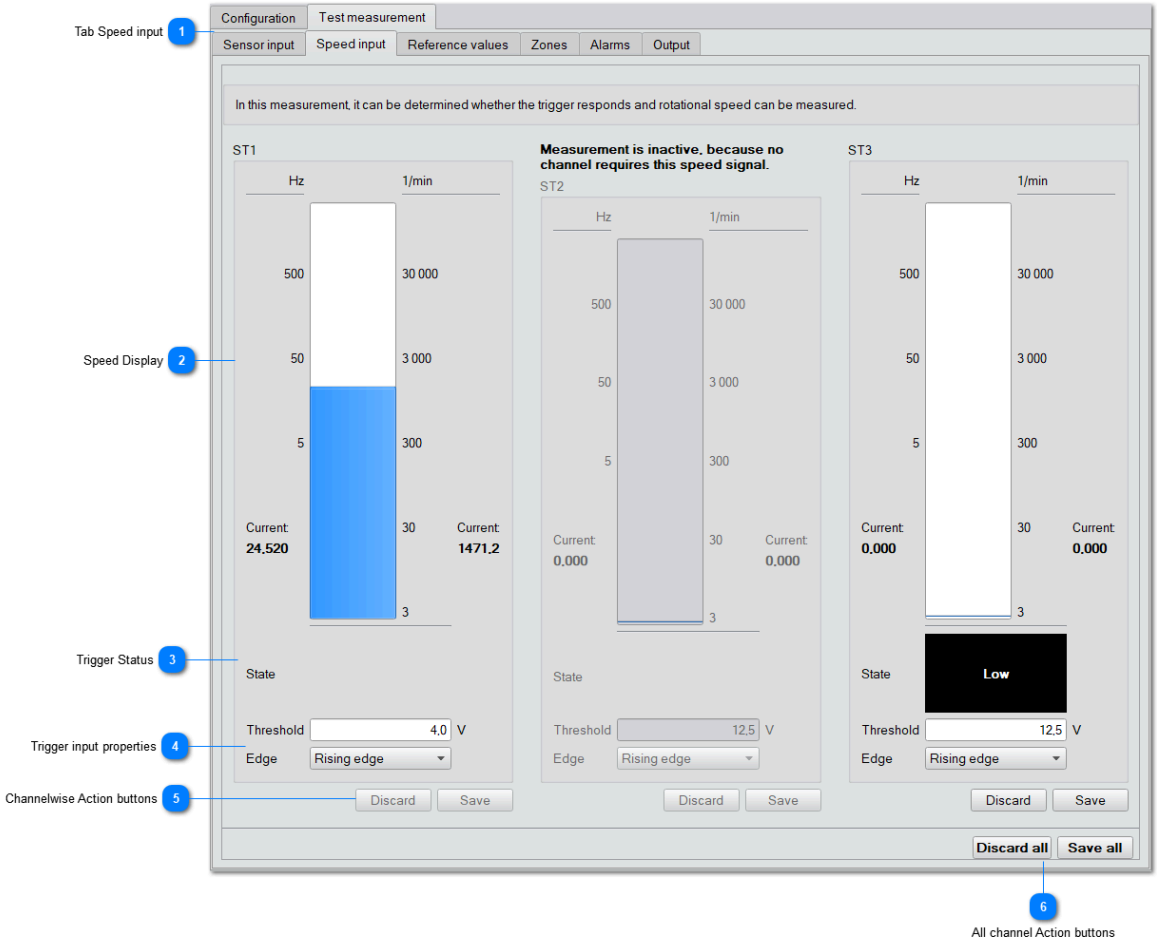
For each measuring channel, the change of the gain can be stored individually. If you want to cancel the change, you can choose Discard.

5 **All-channel Action Buttons**

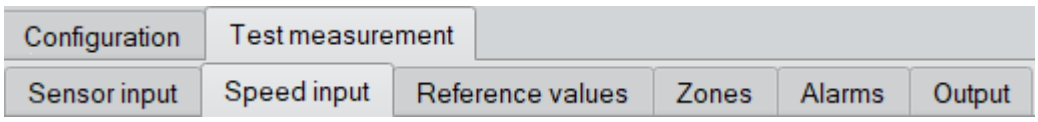
To save or discard the changes for all channels at the same time, the all-channel action buttons are used.

Speed input

The current speed or trigger state is displayed here together with the setting options of the trigger input on the VibroLine device.

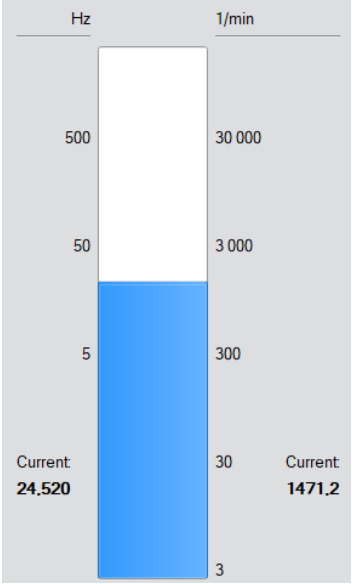


1 Tab Speed input



The "Speed input" tab is selected to display the current speed.

2 Speed Display

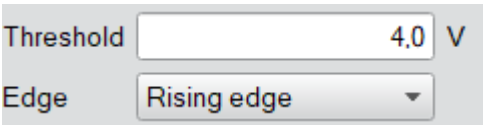


In the bar graph, the current speed is displayed numerically and as level. The speed is output in Hertz (Hz, left) and revolutions per minute (1/min, right). Please note that the bar graph is logarithmically scaled.

3 Trigger Status

If RPM are detected, the status field is empty. If no speed is detected, the current status of the trigger input is displayed (High - Low according to switching threshold):

4 Trigger input properties



The trigger input can be configured for different digital signals, so that the switching threshold or the switching edge can be easily adjusted in the measuring menu.

5 Channelwise Action buttons

Saves the settings. If you want to cancel the change, you can choose Discard.

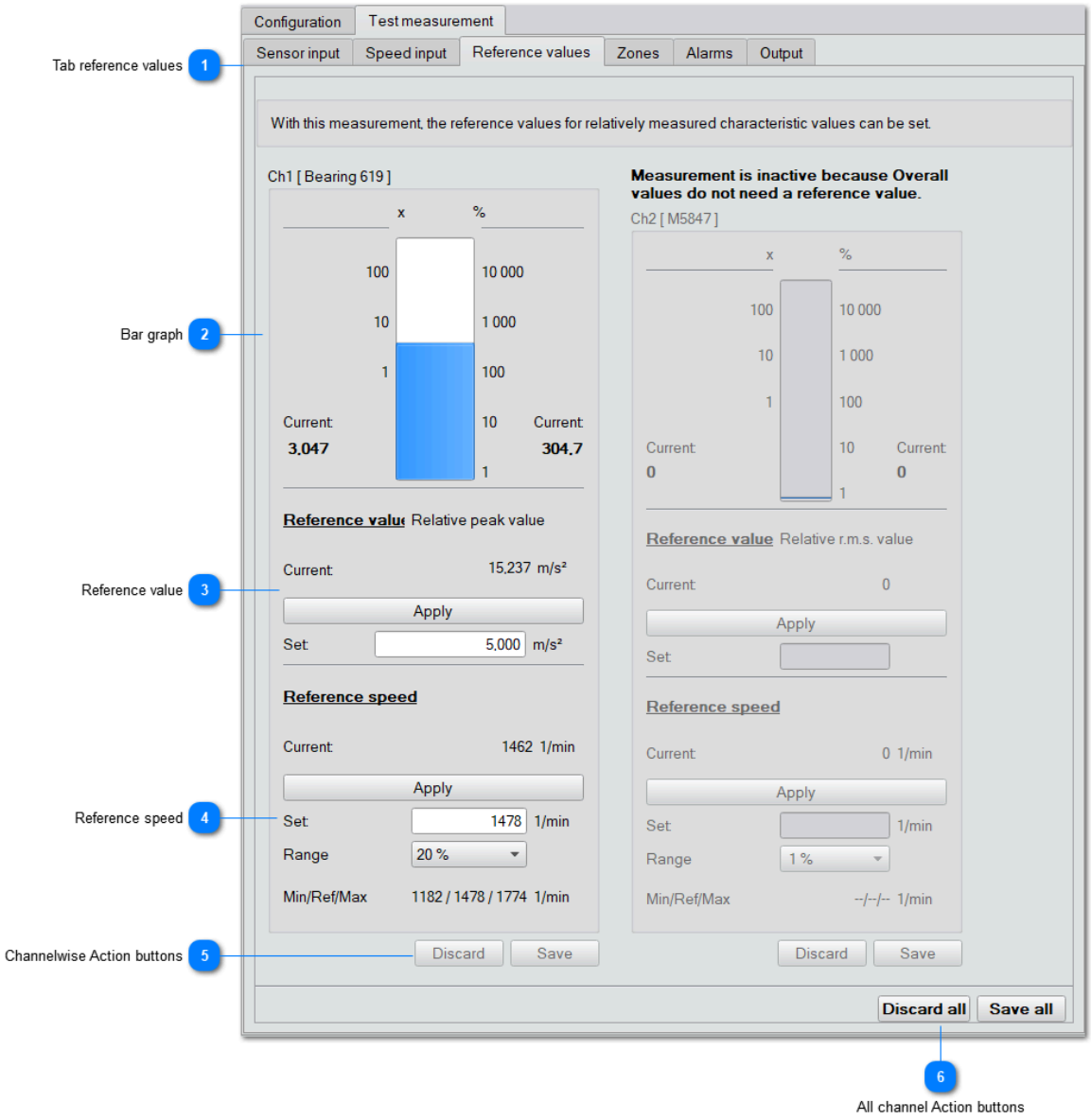
6 **All channel Action buttons**

To save or discard the changes for all channels at the same time, the all-channel action buttons are used.

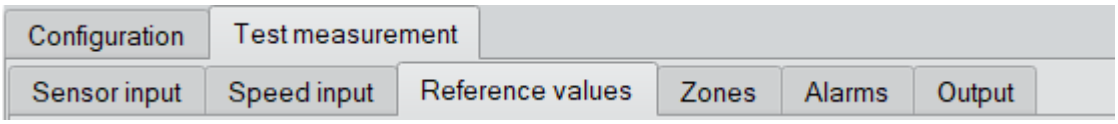
Reference values

Rolling bearing values are set in relation to initially set or measured values. The test measurement function "Reference values" enables the practical measurement of these values. The measurement procedure should be carried out with the bearing run in and undamaged. The reference speed can also be saved at the same time as the reference value is acquired (rolling bearing characteristic values can only be compared under the same operating conditions).

The bar graph also serves to graphically display the current rolling bearing characteristics.

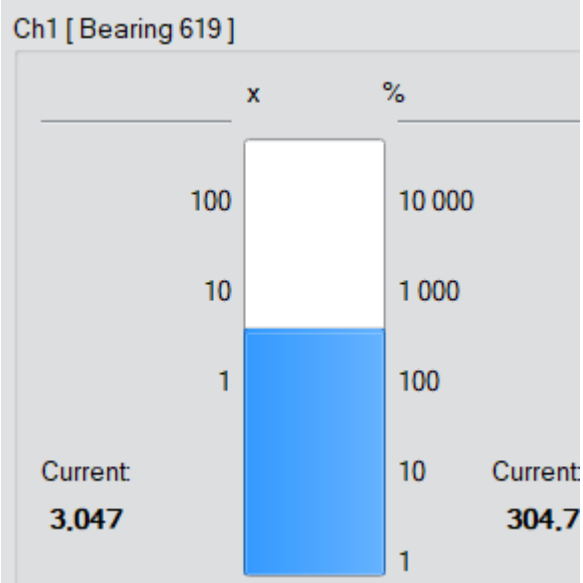


1 Tab reference values



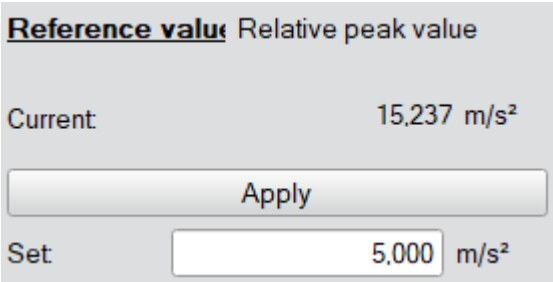
The "Reference value" tab is selected to display the current reference values.

2 Bar graph



The bar graph shows the current value of the bearing characteristic. Here a triple increase (304%) of the reference value would be present. The absolute value is shown on the left and the value in % on the right. Note that the axis scaling is logarithmic.

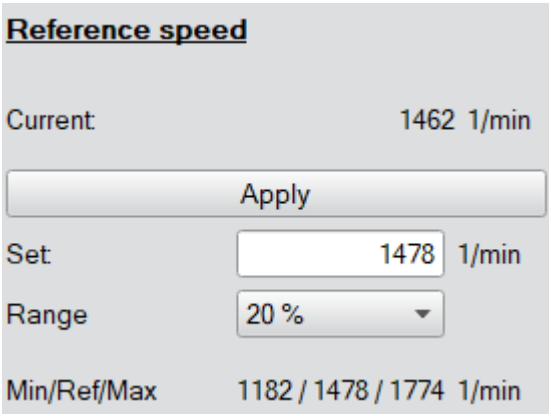
3 Reference value



Bearing characteristics are always referred to one value (reference value). The display shows the type of the current bearing characteristic (here relative peak value) and its current measured value (here 15.24 m/s²). If the OK state of the bearing is to be aligned with the current measured value, only click on *Apply*. The input box *Set* then accepts the current measured value. Of course, a reference value can also be entered numerically.

After defining the reference value, this value is left unchanged for the lifetime of the bearing and current measured values are normalized to the reference value (ratio = bearing characteristic value).

4 Reference speed



The formation of the bearing characteristic (that is, the comparison of the current values with the reference value) only makes sense if both values were recorded under the same operating conditions (speed, load, ...). For the VibroLine devices the parameter speed is saved. The value is saved either numerically in the input field *Set* or in the signal processing or via the test measurement function shown here. To do this, just click on the *Apply* button after entering the reference value (see above). The current speed is taken.

Since speeds are not arbitrarily constant, a speed range (in percent around the nominal speed) can be defined.

If the valid speed window is left, "0" is output as measured value to signal that no meaningful result can be calculated. In addition, an error can be output when leaving the speed range ("Signal measurement problem").

If measured values are also to be calculated at any speed, the selection "ignore" can be made (not recommended).

5 Channelwise Action buttons

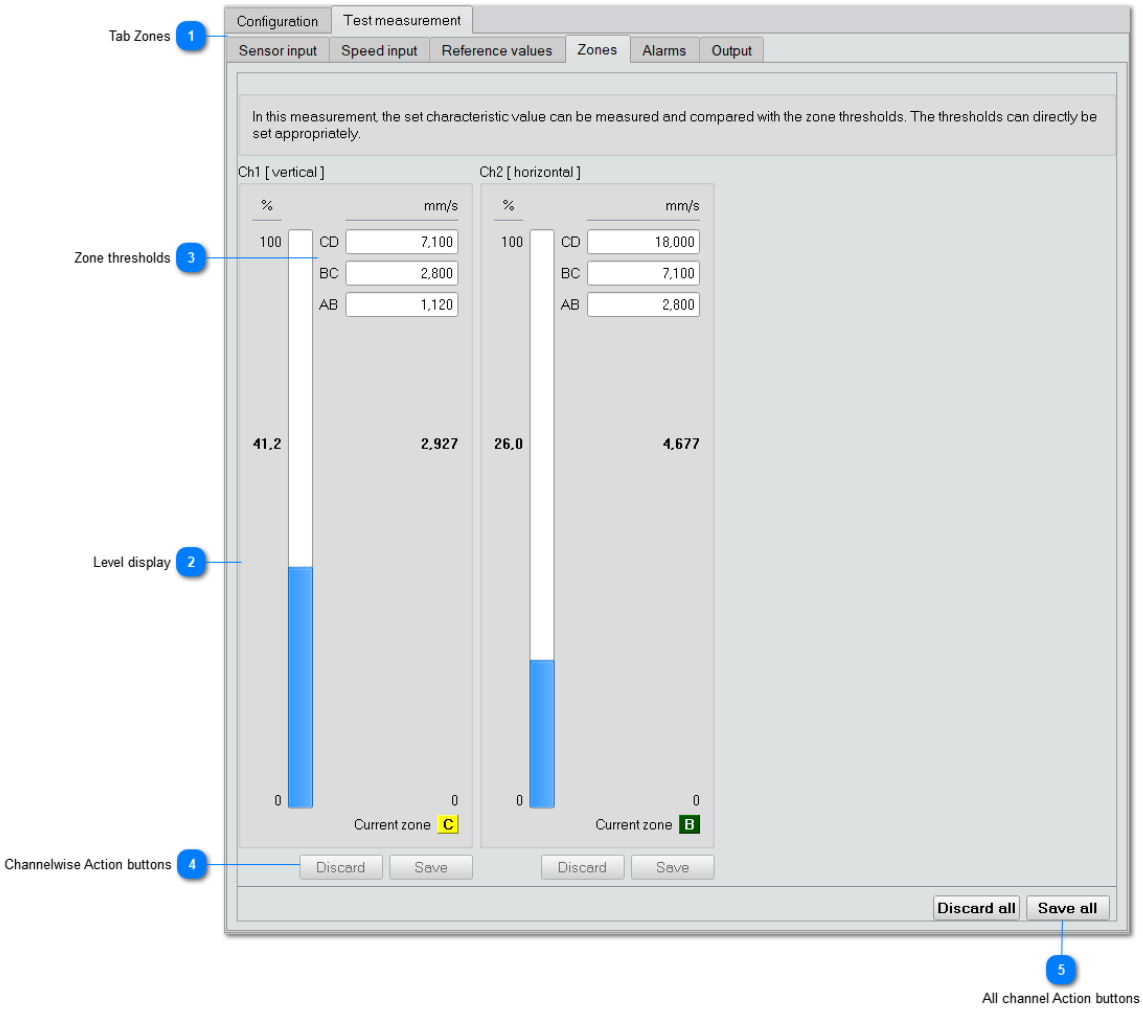
Saves the settings. If you want to cancel the change, you can choose Discard.

6 All channel Action buttons

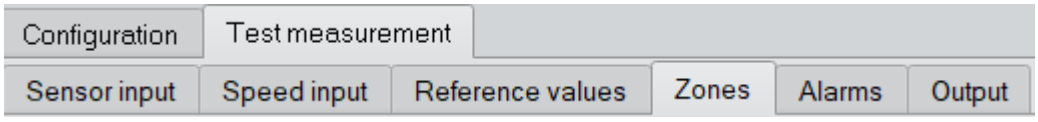
To save or discard the changes for all channels at the same time, the all-channel action buttons are used.

Zones

The zone limits are displayed here together with the current vibration level. In this way, zone classification can be done at a glance. If necessary, the zone limits can be adjusted. Individual zone limits can be defined for each measuring channel.

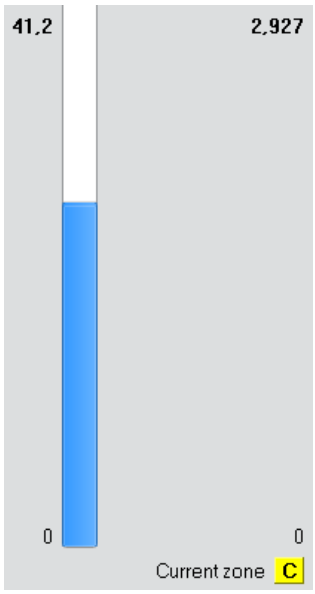


1 Tab Zones



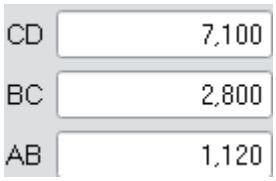
The "Zones" tab is selected to display the current vibration level of all measurement channels.

2 Level display



The level display shows the currently measured value of the characteristic value of the configured signal processing. On the left the value is given in %, on the right in the unit of the selected characteristic value. 100% correspond to the zone transition C/D. The evaluation zone corresponding to the current amplitude is displayed at the bottom right.

3 Zone thresholds



The currently set zone limits are shown here. For machine classes outside the relevant standards (e. g. ISO 10816 / 20816) or if free zone limits are selected, the values can be adjusted here with regard to the current vibration levels.

4 Channelwise Action buttons

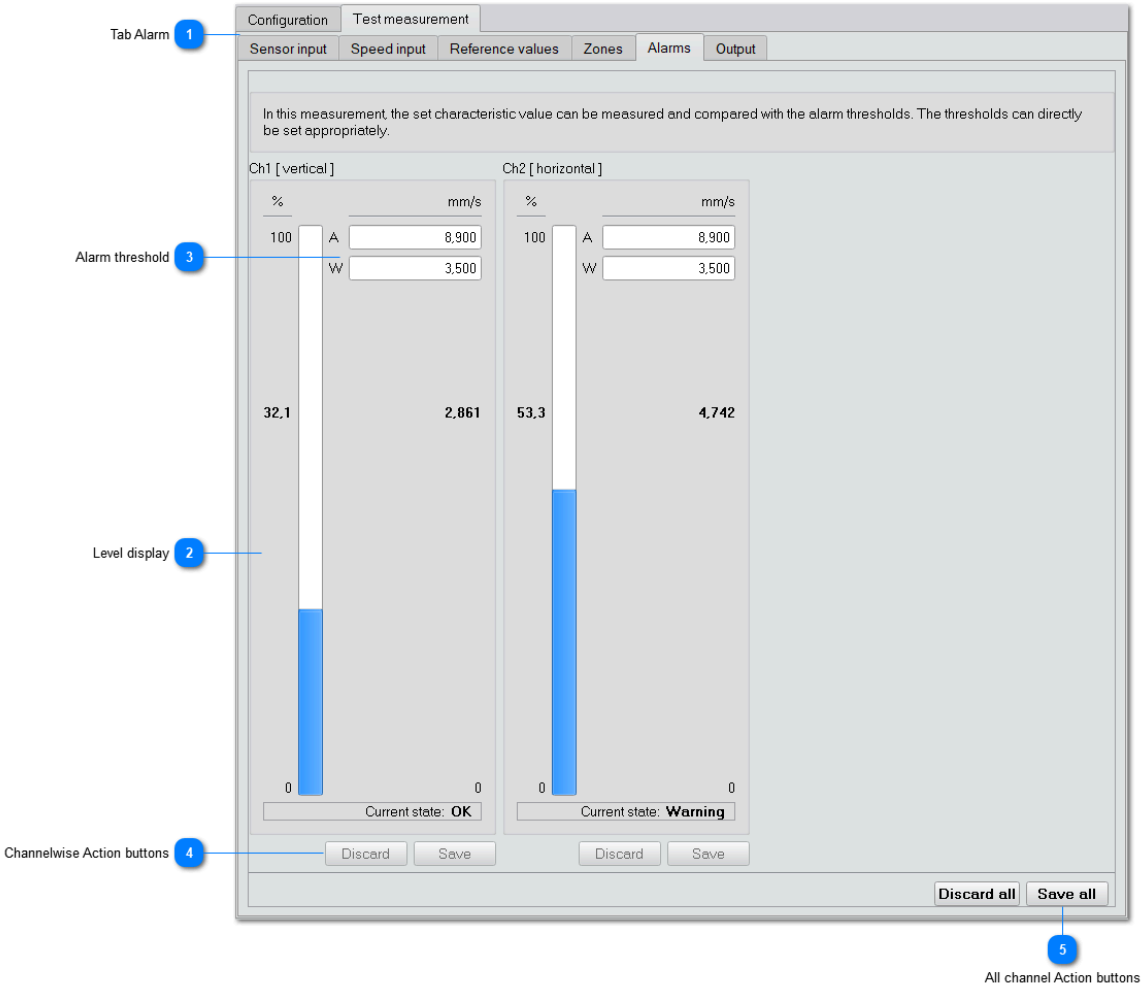
For each measuring channel, the change of the zone limits can be saved individually. If you want to cancel the change, you can choose Discard.

5 All channel Action buttons

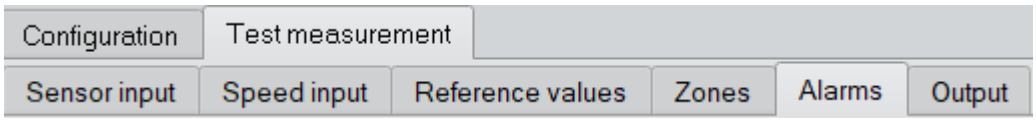
To save or discard the changes for all channels at the same time, the all-channel action buttons are used..

Alarms

The currently occurring vibration level is displayed in the alarm calibration menu together with the defined alarm limits. In this way, the determination of the baseline (see below) which is necessary for determining the alarm can easily take place. Individual alarm limits can be set for each channel.

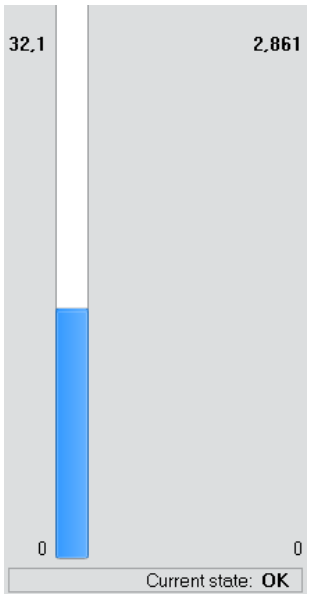


1 Tab Alarm



The "Alarms" tab is selected to display the current vibration levels of all measurement channels.

2 Level display



The level display shows the currently measured value of the characteristic value of the configured signal processing. On the left the vibration level is given in %, on the right in the unit of the selected characteristic value. 100% corresponds to the value of the main alarm (HA). The alarm assignments corresponding to the current amplitude are displayed in the lower area.

3 Alarm threshold

The values for the warning (W) and the alarm (A) can be adjusted here with regard to the current vibration levels.

Alarm:
This value must be determined individually for each machine. In many parts of ISO 10816 it is suggested that the switch-off value should not be higher than 1.25 x zone C/D limit value.

Warning:
This value must be determined individually for each machine. In many parts of DIN ISO 10816 it is suggested to determine the alarm value according to the following rule:

Alarm = baseline + *p* x threshold Zone B/C.
Note: $0 < p < 1$.

The baseline depends on the respective machine, the measuring location and the measuring direction. It must be determined individually for each monitoring channel.

In general, the alarm value should not be higher than 1.25 zone limit B/C.

4 **Channelwise Action buttons**

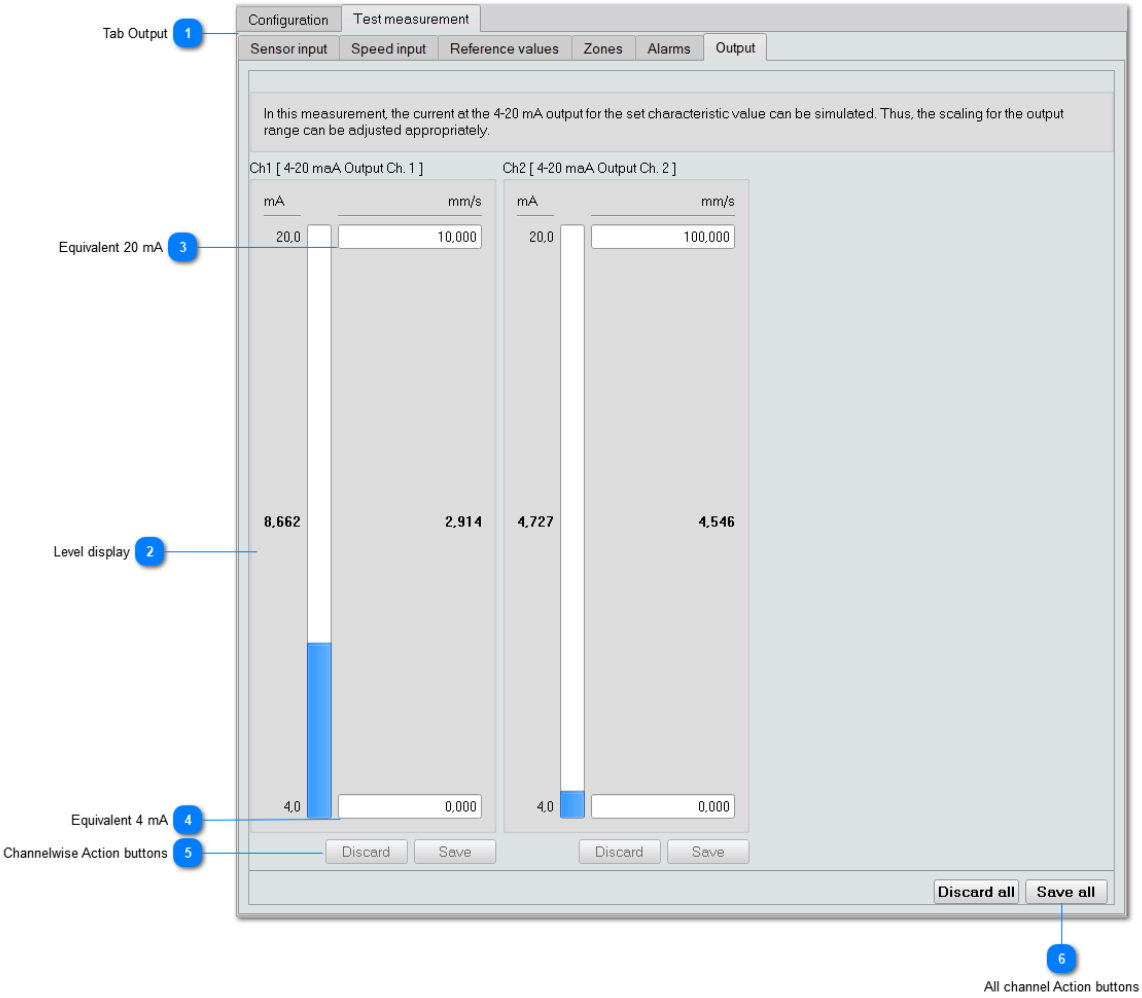
For each measuring channel, the changes of the alarm values can be stored individually. If you want to cancel the change, you can choose Discard.

5 **All channel Action buttons**

To save or discard the changes for all channels at the same time, the all-channel action buttons are used.

Output

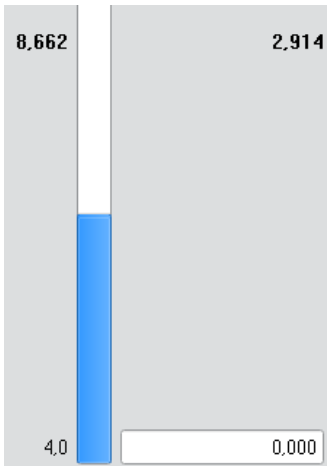
The scaling of the 4-20 mA analog output can be adapted to the available vibration values. The level indicator allows you to quickly and easily determine the 4 or 20 mA equivalents of the vibration signal. The scaling can be carried out individually for each measuring channel.



1 Tab Output

The "Output" tab is selected to display the current vibration levels and the 4-20 mA scaling of all measuring channels.

2 **Level display**



The level display shows the currently measured value of the characteristic value of the configured signal processing. On the left the deflection is given in mA, on the right in the unit of the selected characteristic value.

3 **Equivalent 20 mA**

The scaling of the analog output can be set. The value of the measured variable set in signal processing is defined, which corresponds to a current of 20 mA.

4 **Equivalent 4 mA**

The scaling of the analog output can be set. The value of the measured variable set in signal processing is defined, which corresponds to a current of 4 mA.

5 **Channelwise Action buttons**

The change of the current outputs can be saved individually for each measuring channel. If you want to cancel the change, you can choose Discard.

6 **All channel Action buttons**

To save or discard the changes for all channels at the same time, the all-channel action buttons are used.

Template creation and management

All settings of VibroLine devices can be saved as a template. This allows often used parameter sets to be quickly and easily transferred to new devices. The following parameter sets can be saved in detail:

- Complete devices

- Sensor inputs
- Trigger input
- Analog outputs
- Analog error output
- Digital outputs
- Relay

- Bandpass filter (general)
- Bandpass filter (impact)
- Bandpass filter (Bearings general)
- Bandpass filter (Bearings BCC)
- Order filter

- Overall values
- Order characteristics
- Impact characteristics
- Bearing characteristics

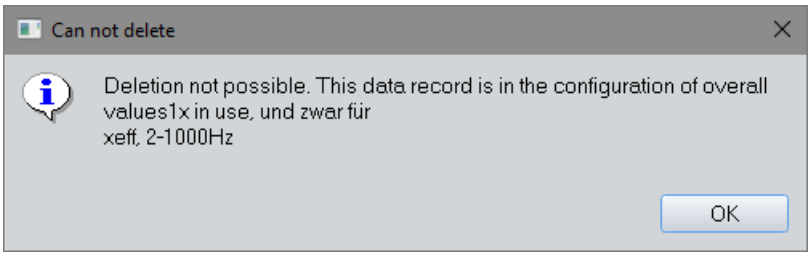
- Alarm thresholds
- Zone thresholds

- RS485
- CAN
- Ethernet

In addition, complete device templates can also be exported and imported. This means that a compiled data set can be quickly integrated into another program database.
Note: Passwords are not included in the export.

The device templates and examples of the sensor input and zone threshold templates are explained below. All other templates have a very similar processing principle.

Some templates refer to other templates. For example, overall value templates require the specification of a bandpass filter template. If you want to delete the underlying bandpass filter template, this is prevented by an indication of the actual usage:

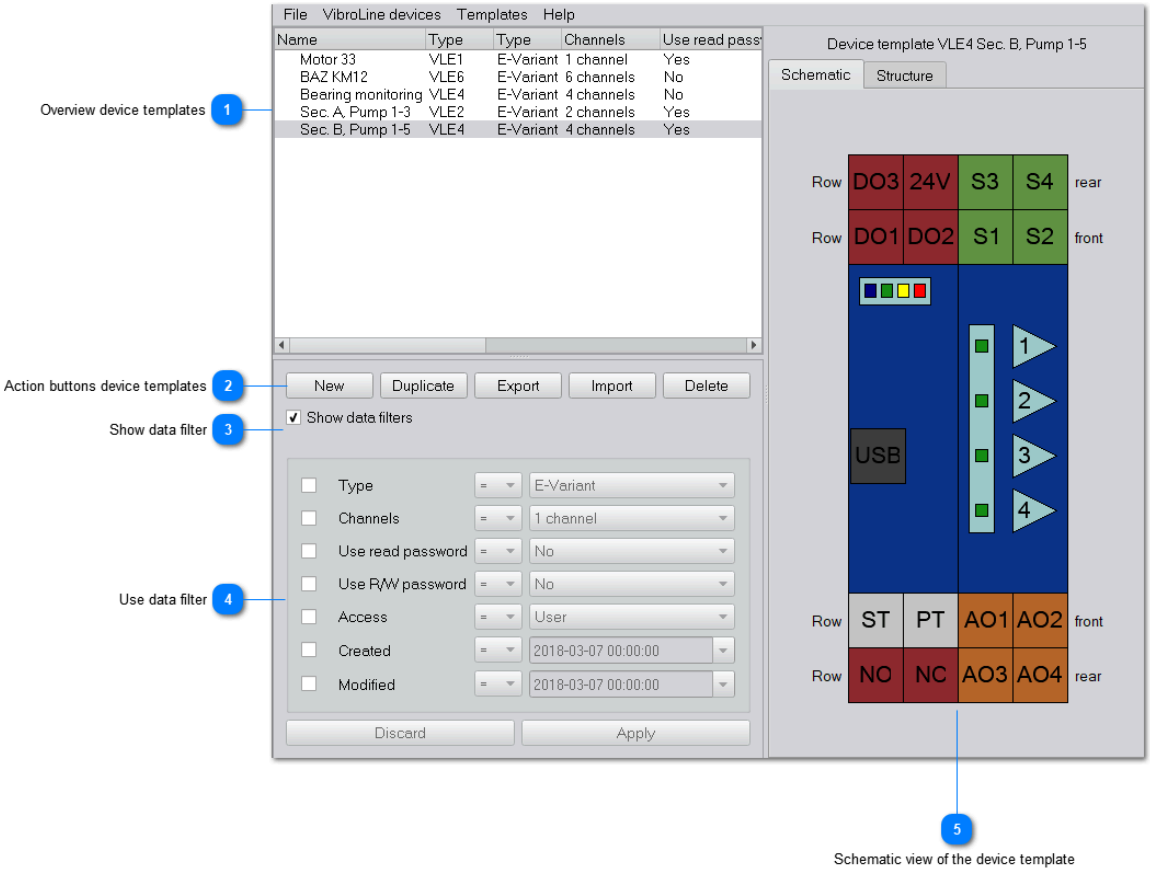


The overall value template must first be deleted.

Device Templates

Device templates reflect the complete image of a VibroLine device. For example, a consistent configuration can be quickly transferred to other VibroLine devices. All device parameters can be individually adjusted in the template.

When writing device templates to connected devices, the communication parameters (LAN settings) are not transferred. As a result, the device can still be reached on the network.



1 Overview device templates

Name	Type	Type	Channels	Use read pass
Motor 33	VLE1	E-Variant	1 channel	Yes
BAZ KM12	VLE6	E-Variant	6 channels	No
Bearing monitoring	VLE4	E-Variant	4 channels	No
Sec. A, Pump 1-3	VLE2	E-Variant	2 channels	Yes
Sec. B, Pump 1-5	VLE4	E-Variant	4 channels	Yes

The overview contains all created device templates. For this purpose, the assigned name, type, number of channels and password protection are listed.

2 Action buttons device templates

New device templates can be created as follows:

- Create device template from the device overview
- Create a new (empty) device template using the **NEW** action button
- Multiply an existing device template using the **Duplicate** action button.

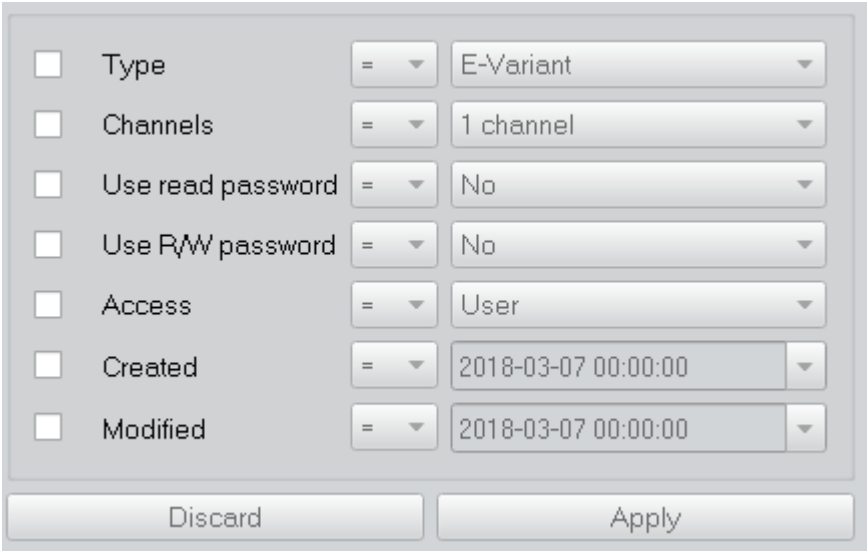
A device template is removed (without confirmation) after clicking on **Delete**.

To export a device template, select the corresponding action button (**Export**). A file dialog appears in which the file name and path of the device template file (*. vldbr) can be defined. For an import (**Import**) with the file dialog a template file is selected and opened.

3 Show data filter

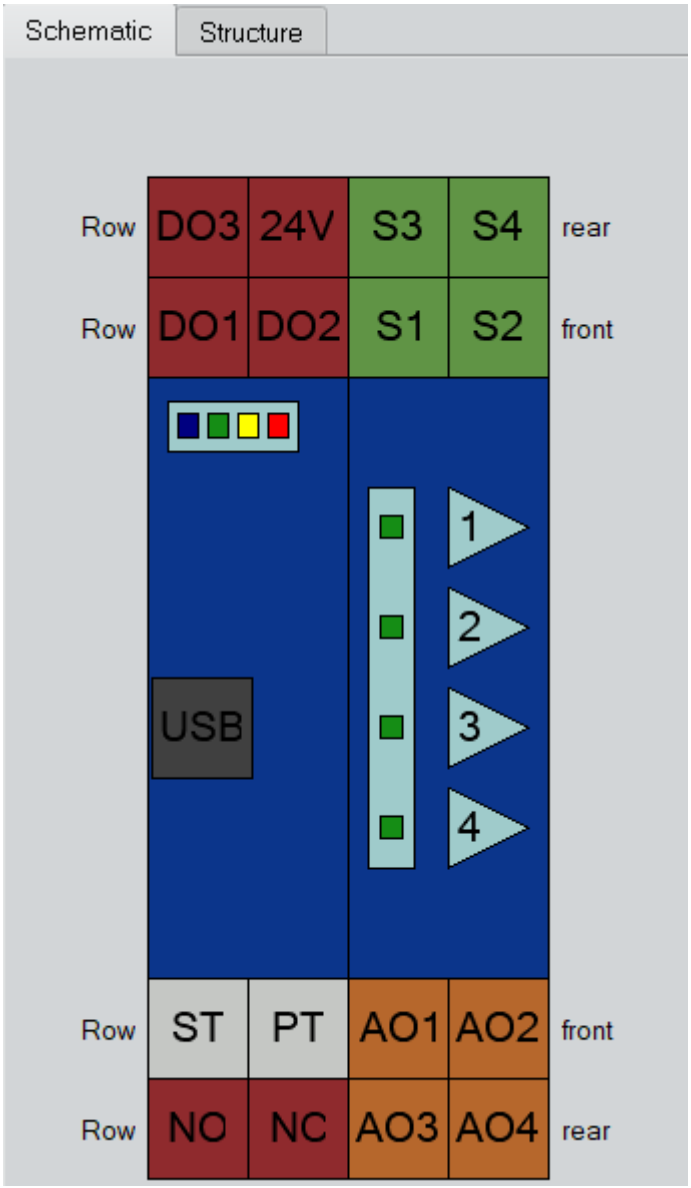
To control the selection of displayed device templates a data filter can be set by activating the check mark.

4 Use data filter



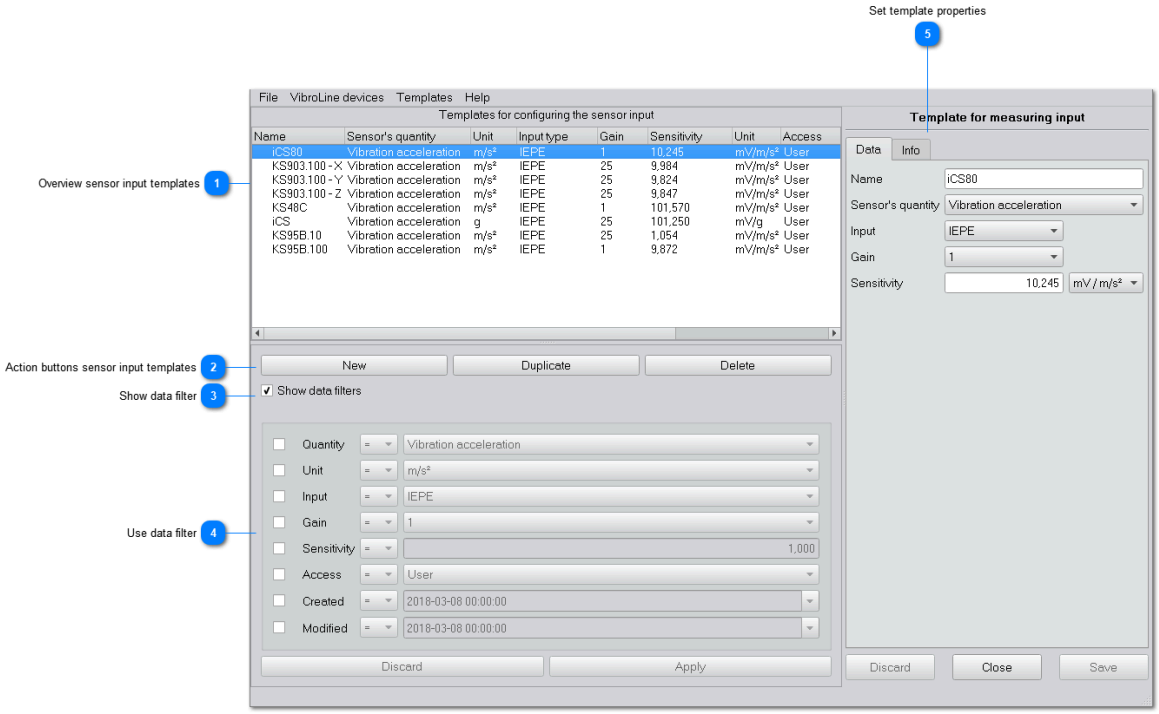
The existing device templates can be filtered according to various criteria (see picture). The desired filter category is activated by checking the box and the desired criterion and a comparison operator are selected (=, >, <, >=, <=, <>). Clicking on **Apply** sets the filter, **Discard** resets the filter selection.

5 **Schematic view of the device template**



The device template can be adapted by the schematic representation of the VibroLine device (similar to the device configuration). The structure view can also be used for viewing and editing parameters.

Example Sensor input



1 Overview sensor input templates

Name	Sensor's quantity	Unit	Input type	Gain	Sensitivity	Unit	Access
iCS80	Vibration acceleration	m/s²	IEPE	1	10,245	mV/m/s²	User
KS903.100 - X	Vibration acceleration	m/s²	IEPE	25	9,984	mV/m/s²	User
KS903.100 - Y	Vibration acceleration	m/s²	IEPE	25	9,824	mV/m/s²	User
KS903.100 - Z	Vibration acceleration	m/s²	IEPE	25	9,847	mV/m/s²	User
KS48C	Vibration acceleration	m/s²	IEPE	1	101,570	mV/m/s²	User
iCS	Vibration acceleration	g	IEPE	25	101,250	mV/g	User
KS95B.10	Vibration acceleration	m/s²	IEPE	25	1,054	mV/m/s²	User
KS95B.100	Vibration acceleration	m/s²	IEPE	1	9,872	mV/m/s²	User

The overview contains all created sensor input templates. For this purpose, the most relevant data (name, measurement type, sensitivity,...) are given.

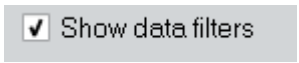
2 Action buttons sensor input templates

New sensor input templates can be created as follows:

- Create a new (empty) sensor input template using the **NEW** action button
- Multiply an existing sensor input template using the **Duplicate** action button.

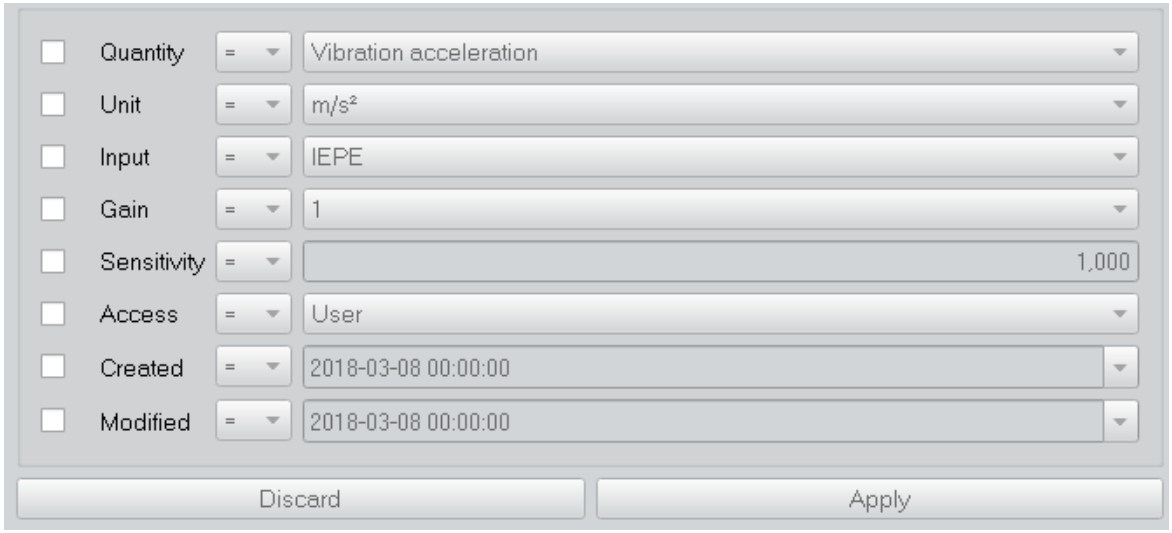
A sensor input template is deleted (without confirmation) after clicking on **Delete**.

3 Show data filter



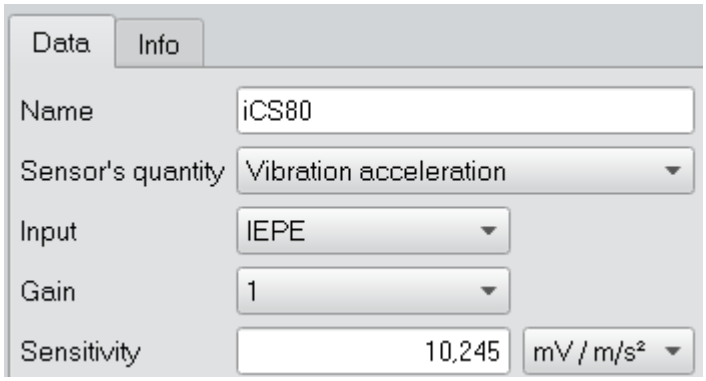
To control the selection of displayed device templates a data filter can be set by activating the check mark.

4 Use data filter



The existing templates can be filtered according to various criteria (see picture). The desired filter category is activated by checking the box and the desired criterion and a comparison operator are selected (=, >, <, >=, <=, <>). Clicking on **Apply** sets the filter, **Discard** resets the filter selection.

5 Set template properties



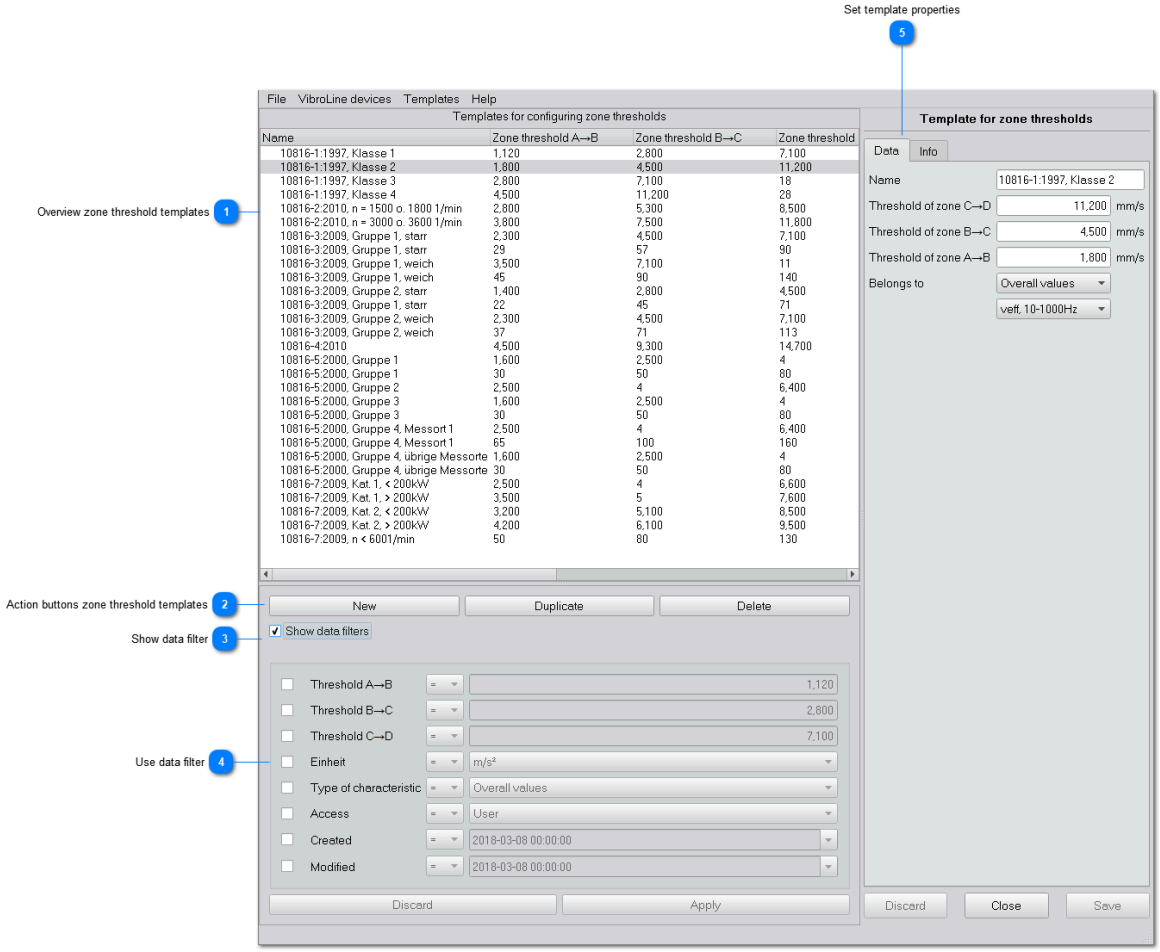
New or existing sensor input templates can be edited using this menu.

The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Example Zone thresholds



1 Overview zone threshold templates

Name	Zone threshold A→B	Zone threshold B→C	Zone threshold
10816-1:1997, Klasse 1	1,120	2,800	7,100
10816-1:1997, Klasse 2	1,800	4,500	11,200
10816-1:1997, Klasse 3	2,800	7,100	18
10816-1:1997, Klasse 4	4,500	11,200	28
10816-2:2010, n = 1500 o. 1800 1/min	2,800	5,300	8,500
10816-2:2010, n = 3000 o. 3600 1/min	3,800	7,500	11,800
10816-3:2009, Gruppe 1, starr	2,300	4,500	7,100
10816-3:2009, Gruppe 1, starr	29	57	90
10816-3:2009, Gruppe 1, weich	3,500	7,100	11
10816-3:2009, Gruppe 1, weich	45	90	140
10816-3:2009, Gruppe 2, starr	1,400	2,800	4,500
10816-3:2009, Gruppe 1, starr	22	45	71
10816-3:2009, Gruppe 2, weich	2,300	4,500	7,100
10816-3:2009, Gruppe 2, weich	37	71	113

The overview contains all created zone threshold templates. The template name and the zone limits are listed.

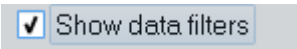
2 Action buttons zone threshold templates

New zone threshold templates can be created as follows:

- Create a new (empty) zone threshold template using the **NEW** action button
- Multiply an existing zone threshold template using the **Duplicate** action button.

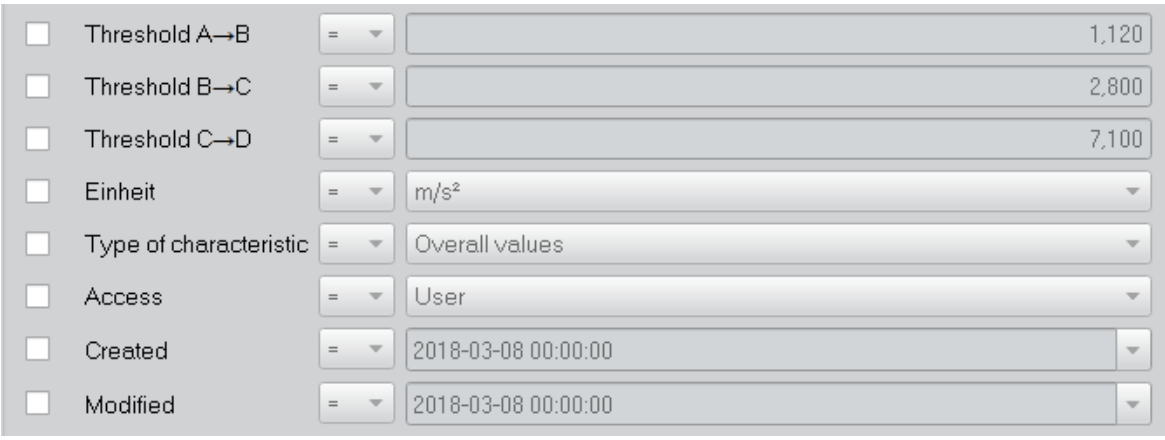
A zone threshold template is deleted (without confirmation) after clicking on **Delete**.

3 Show data filter



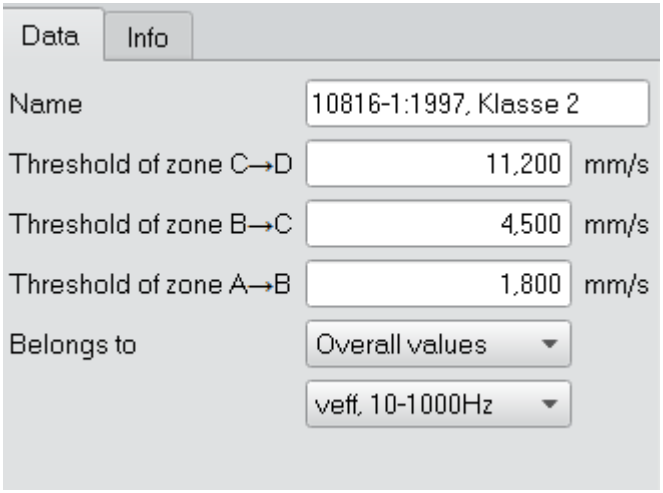
To control the selection of displayed device templates a data filter can be set by activating the check mark.

4 Use data filter



The existing templates can be filtered according to various criteria (see picture). The desired filter category is activated by checking the box and the desired criterion and a comparison operator are selected (=, >, <, >=, <=, <>). Clicking on **Apply** sets the filter, **Discard** resets the filter selection.

5 Set template properties



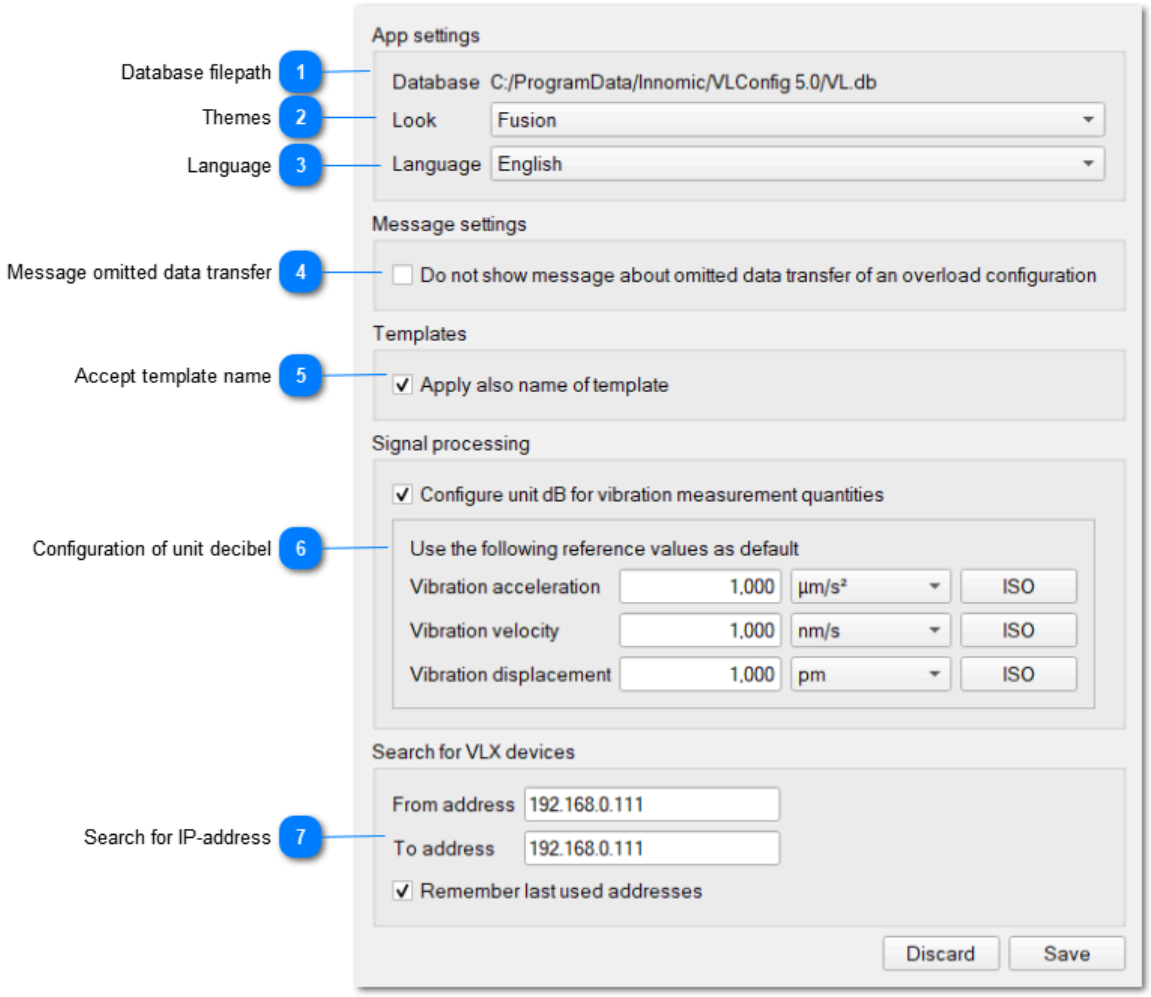
New or existing zone threshold templates can be edited using this menu. Since zone thresholds are a unit-linked variable, a reference value template must be assigned (**Belongs to**).

The action buttons can be used to change the configuration:

Discard - Restores the previous state (call up the configuration view).
Cancel / Close - All changes made are ignored and the configuration view is closed.
Save - The changes made are saved in the database. The configuration view closes.

If the entries do not mean a change in the properties stored so far, only the **Close** action is offered.

Program settings



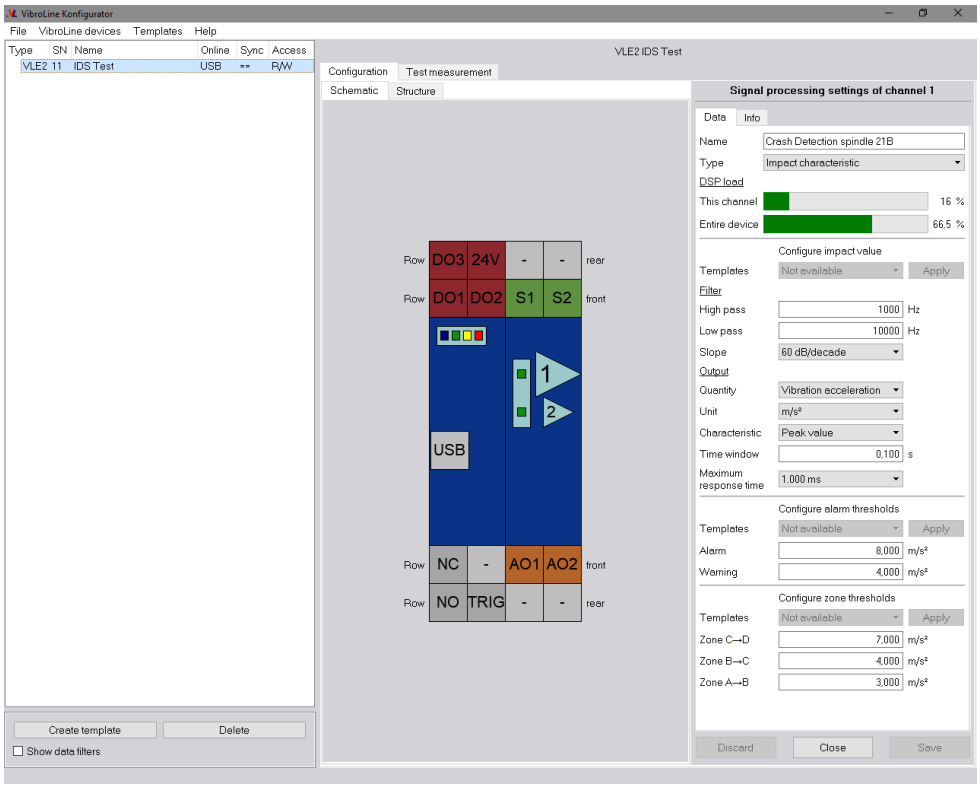
1 Database filepath

The currently used database and its file path are displayed. Access to the database with third-party programs is not possible due to encryption.

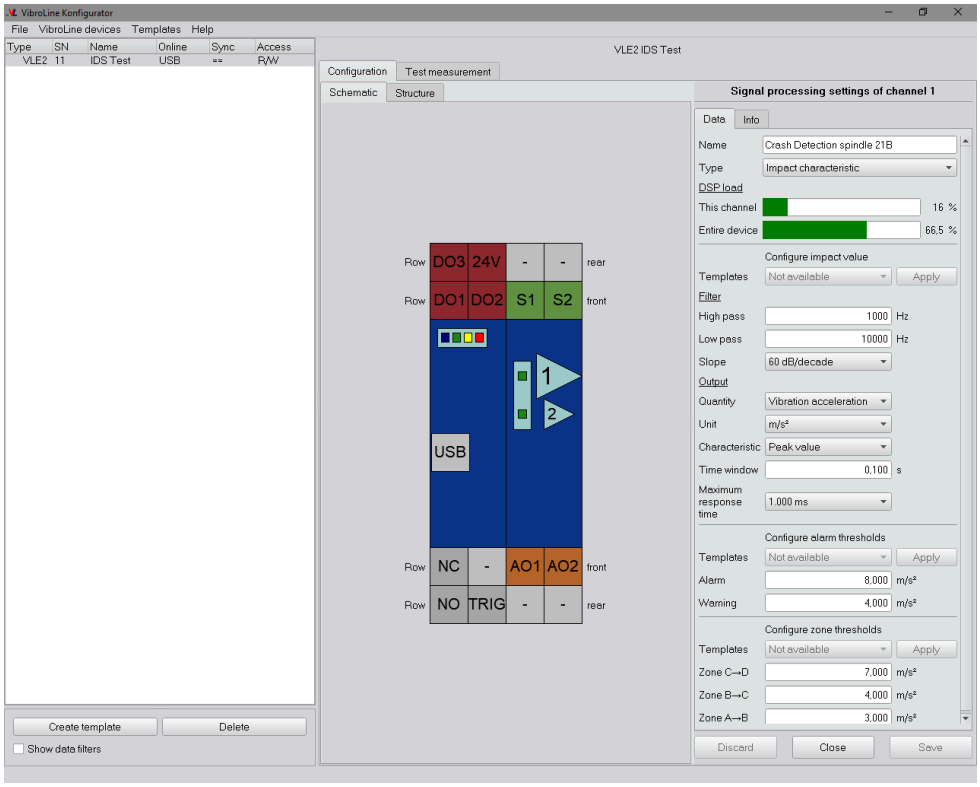
2 Themes

The appearance of the VibroLine configuration program can be adjusted.
The themes *Classic*, *Fusion* and *Stone* are available. The appearance is changed after pressing the OK button.

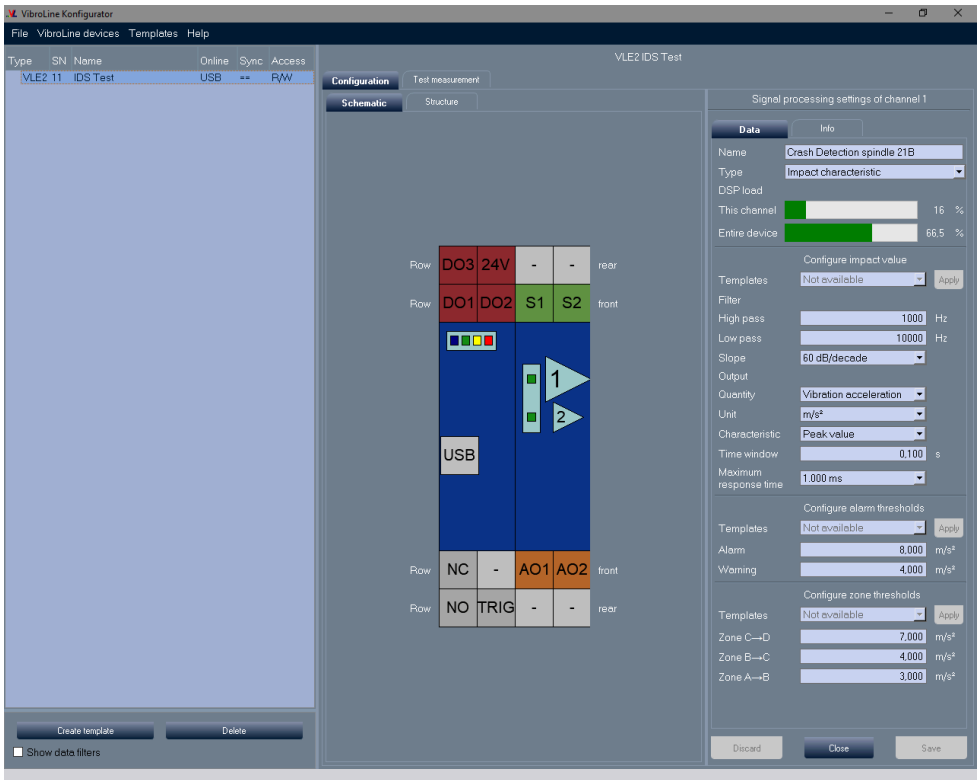
Look Classic:


VibroLine Konfigurator
File
VibroLine devices
Templates
Help
Type
SN
Name
Online
Sync
Access
VLE2 11
IDS Test
USB
--
R/W
Create template
Delete
Show data filters
VLE2 IDS Test
Configuration
Test measurement
Schematic
Structure
Row
DO3
24V
rear
DO1
DO2
S1
S2
front
USB
NC
AO1
AO2
NO
TRIG
Signal processing settings of channel 1
Data
Info
Name
Crash Detection spindle 21B
Type
Impact characteristic
DSP load
This channel
16 %
Entire device
66,5 %
Configure impact value
Templates
Not available
Apply
Filter
High pass
1000
Hz
Low pass
10000
Hz
Slope
60 dB/decade
Output
Quantity
Vibration acceleration
Unit
m/s²
Characteristic
Peak value
Time window
0,100
s
Maximum response time
1.000 ms
Configure alarm thresholds
Alarm
8,000
Warning
4,000
Configure zone thresholds
Zone C→D
7,000
Zone B→C
4,000
Zone A→B
3,000
Discard
Close
Save

Look Fusion:



Look Stone:

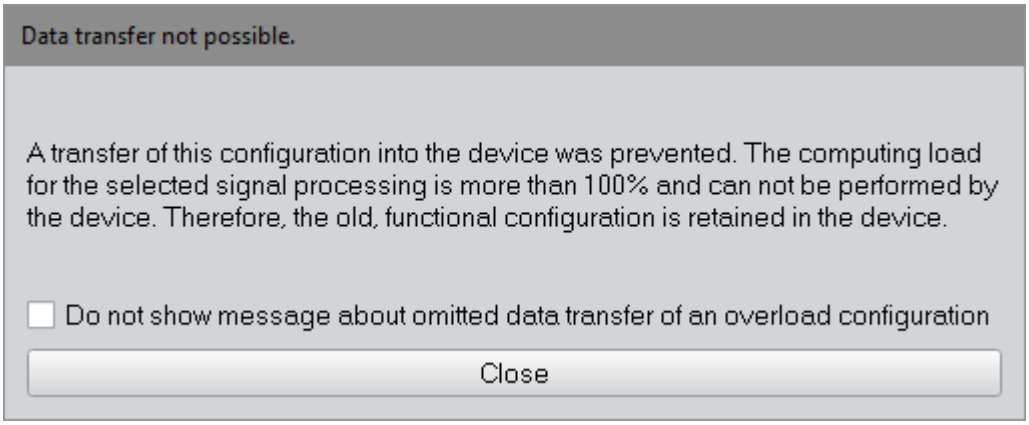


3 Language

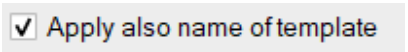
The VibroLine configurator is available in German and English. Switching is done via the dropdown box.

4 Message omitted data transfer

If a signal processing is selected that exceeds the permissible DSP load of the entire device (> 100%), a message appears that the data transfer cannot be carried out. The appearance of this message can be suppressed by setting the check mark.

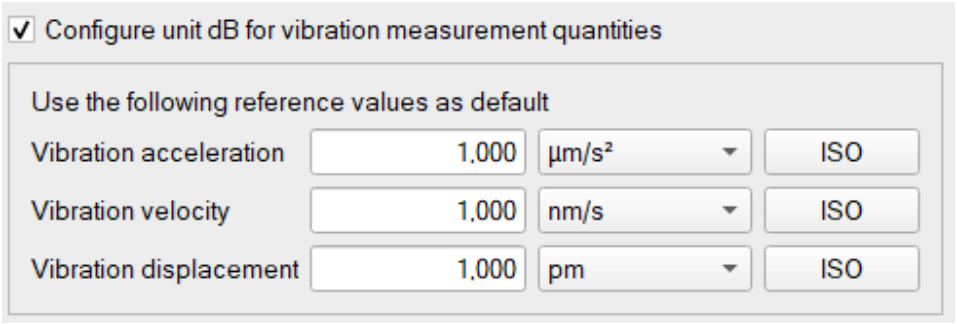


5 Accept template name



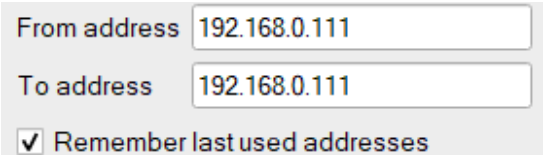
When using templates, the template name can be transferred to the active configuration.

6 Configuration of unit decibel



The unit decibel (dB) can be selected for overall characteristic values, order characteristic values and bearing characteristic value. Decibel is a relative unit, i.e. it is related to a reference level. The reference level is defined for each measured variable in the following input mask.
Click on the "ISO" button to set the default reference levels.

7 Search for IP-address



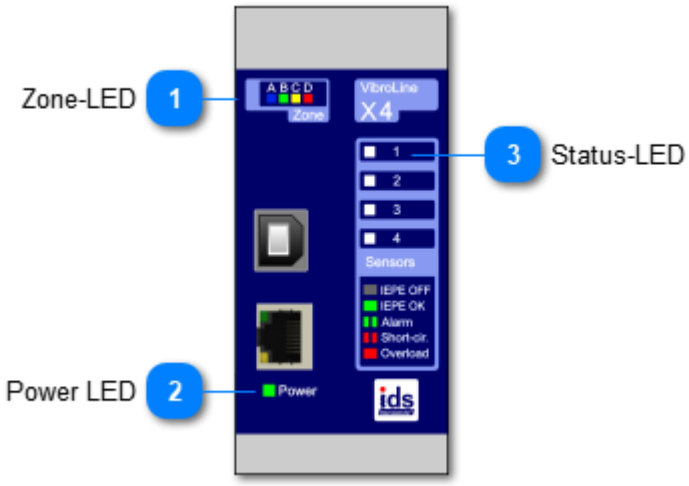
The VLX devices can be addressed via Ethernet (LAN) for configuration and data transfer. To find the devices in the network, a search range can be defined in the following input mask.

If the checkmark "Remember last used addresses" is set, the search entries in the IP scan of the device configuration are automatically transferred to the present settings menu.

Operation

When the operating voltage is switched on, the transient response of the digital filters is indicated by a fast flashing of the zone LEDs. The transient response depends on the selected high pass filter frequency value. For this period, all outputs are also deactivated to prevent false alarms (except for internal errors). However, the transient response can be monitored by means of the test measurement. **The ready-to-operate status of the VibroLine device is indicated by a single zone LED.**

During operation, all sensor inputs are analyzed and evaluated in parallel. Alarms are sent to the 3 digital outputs and/or the change-over relay in accordance with the specified limit values. The process variable outputs provide an individually configurable 4-20 mA current loop signal.
The current status of the vibration monitoring is signalled by the VL device as follows:



1 Zone-LED

The zone LEDs indicate the vibration state of the machine according to the set zone limits. The maximum of all connected channels is displayed. If all LEDs flash at the same time, the configuration is transferred to the device, a transient settling process takes place or there is an internal error (e. g. DSP configuration faulty).

2 Power LED

Indicates active power supply.

3 Status-LED

The status LED indicates the state of the sensor input:

	IEPE Mode	± 10 V Mode
OFF	No IEPE-sensor connected or cable breakage	-
Green	IEPE-sensor connected	-
Green flashing	Warning or alarm on respective channel (adjustable)	
Red	Input overload	
Red flashing	Short circuit	-

Also for channels 2-8.

Accessories

The VibroLine devices can be upgraded with accessories, e.g. to enhance the comfort of displaying the current vibration level (4-20 mA display) or to be used in hazardous areas by using ATEX accessories.

On the following pages, accessories are presented and their use described:

Displays for 4-20 mA current loop

The VibroLine devices have one 4-20 mA output per measuring channel. This output can be used to forward the process variables to other peripherals (PLC, control room, ...) and/or as an output for displays showing the current vibration level. A 4-20 mA display is required for each measuring channel. The characteristic value set in the VibroLine Configurator is shown.

IDS Innomic Schwingungsmesstechnik GmbH offers the following 4-20 mA displays as VibroLine accessories:

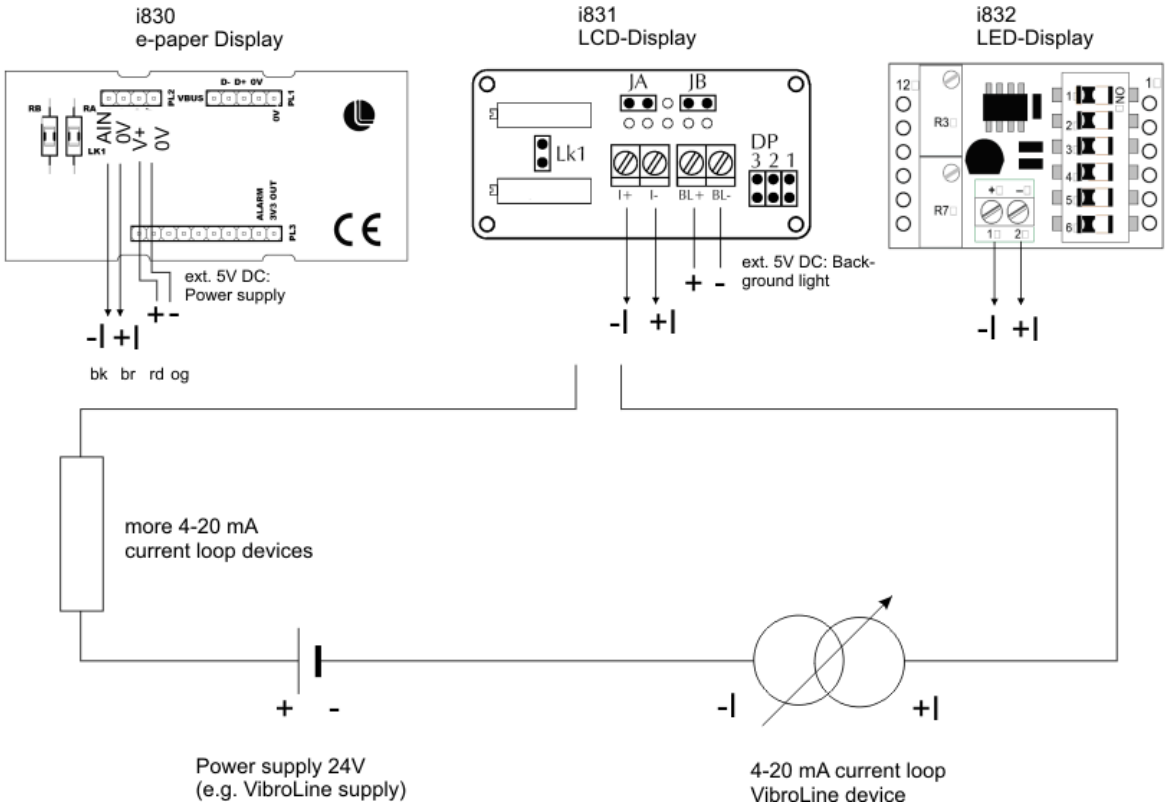
i830	2.1" E-paper Display	individual Scaling
i831	12,7 mm LCD Display	individual Scaling
i832	9,4 mm LED Display	individual Scaling

The displays are designed for front panel mounting/panel mounting. The delivery includes a pre-configured display (scaling see above) and mounting material. After connection, the displays are immediately ready for use. Changes to the scaling may only be made after consultation with IDS Innomic Schwingungsmesstechnik GmbH.

Item	Picture		dimensions (LxHxD in mm)	Power supply
i830		Design 1	housing: 73,8 x 37,5 x 17cut area: 70 x 34	• 5 V DC as power supply
		Design 2		
i831			housing: 64,5 x 34,5 x 20,7 cut area: 62 x 32	• from 4-20 mA current loop • optional 5V DC for backlighting

i832		housing: 35,1 x 24,1 x 22,4 cut area: 33 x 20,3	• from 4-20 mA current loop

Wiring:
The following diagram describes the correct wiring of the 4-20 mA displays to the VibroLine devices:



LED signalling light

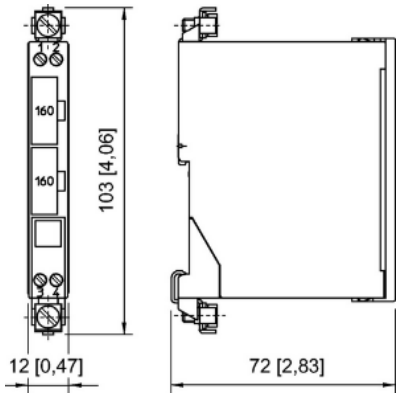
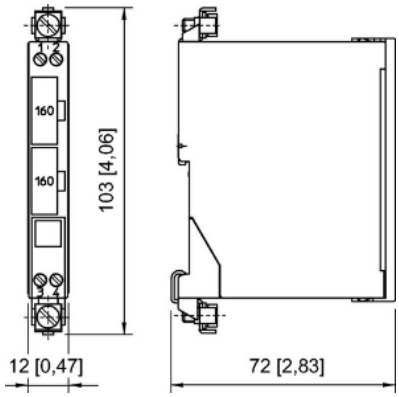
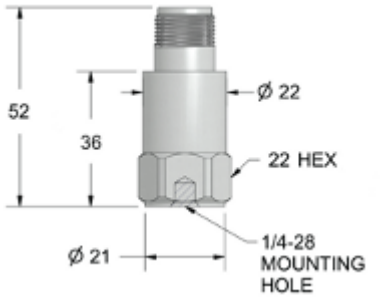
The current machine status can be displayed by means of a signal light. The lamp has several segments which can be individually parameterised in colour and flashing rhythm/continuous light. The connection is made directly to the digital outputs of the VibroLine devices. As an option, the lamp has an 85 dB acoustic alarm signal.
The devices are parameterised according to customer requirements.

Item	Description
i835	5-segment signal lamp, supply from VibroLine device, incl. connection cable and parameterisation.
i836	5-segment signal lamp (+ acoustic alarm), supply from VibroLine device, incl. connection cable and parameterisation.

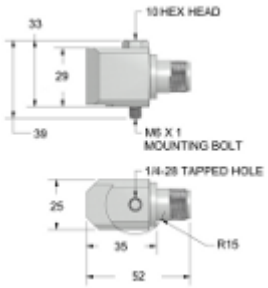
Use in ATEX areas

Accessories are required for monitoring machines in hazardous areas (ATEX zones). A specially protected accelerometer operates in the ATEX zone. Outside this zone, the sensor signal is directed through a safety barrier to intercept voltage peaks. Only then is the sensor signal transmitted to the VibroLine devices. The VibroLine devices themselves must not be operated in ATEX zones.

The following accessories are available for operation in ATEX zones:

Item	Picture	Dimensions	Description
i821			Single-channel safety barrier, 28 V, 100 mA DIN rail mounting (TS35)
i822			Two-channel safety barrier, 28 V, 93 mA DIN rail mounting (TS35)
M/ AC915-1A			• With ATEX approval Zone 0 • Insulated housing to avoid ground loops • Intrinsically safe sensor • IEPE output: Low susceptibility to interference in harsh environments; long cable lengths possible

**M/
AC915-1A**



- With ATEX approval Zone 0
- Insulated housing to avoid ground loops
- Intrinsically safe sensor
- IEPE output: Low susceptibility to interference in harsh environments; long cable lengths possible

Power supply

The VibroLine devices must be supplied with 24 V (+/- 5%) DC voltage. We offer the following power supplies as accessories:

Item	Description
i811	Plug-in power supply 24 V, 1.5 A, for up to 3 VibroLine devices
i812	DIN rail power supply 24 V, 1.25 A, for up to 2 VibroLine devices

Documentation Bus Interfaces

The following sections provide information about the implemented functions and used registers for the bus protocols and interfaces available in the VLX devices:

- Modbus TCP / Modbus RTU
- CANopen
- HTTP API
- DATA STREAM(device option)

Modbus TCP / Modbus RTU

The protocol variants *Modbus RTU* (serial interface RS485) and *Modbus TCP* (TCP/IP) are supported.

- Modbus RTU: The VibroLine units are addressed with the addresses 1..247. The addresses of the Slaves in a network must not be identical. Standard baud rate is 19200 bit/s.
- Modbus TCP: The VibroLine units are addressed via the IP address. The transmission speed is 100 Mbit/s. The port number is usually and also for the VibroLine units defined with: 502.

Functions

Implemented is the function: **`0x03: Read Holding Registers.`**
The register 200 can be read and written: **`0x06: Write Holding Registers.`**

Register

Preliminary notes

1. The **addressing** in the VibroLine units is zero-based and the following documentation also starts at address "0". If necessary, a 40 000, 40 001, 400 000 or 400 001 must be added to the address documented here on the side of the other Modbus device, so that the parameter "address" is correctly understood on both sides.
2. The **byte order** in the VibroLine device is Little-Endian. Since Modbus only defines the transmission order of the bytes of a 16-bit holding register, but not for data types with a bit width beyond that, different views for the transmission order have been established. VibroLine provides a test value at address 100: 01020304 (hex), i.e. 16,909,060 decimal. Due to the little-endian byte order (least significant byte is at the start address) the value in VibroLine's memory is represented as follows.

Modbus address 100		Modbus address 101	
04	**03**	**02**	**01**

   The value thus extends over two 16-bit holding registers. According to Modbus conventions, the higher byte of a holding register is always transmitted first. This results in the transmission sequence: 03 04 01 02. If a 32-bit value of 01020304 (hex) is read back on the side of the receiving Modbus device, the byte sequence is interpreted as intended.

Device data:

Meaning	Address	Notes
Device address	0	UNSIGNED32 - RTU: Device addess - TCP: IPv4 address
Baudrate	2	UNSIGNED32 - RTU: Bit/s - TCP: MBit/s
Serial number	4	UNSIGNED32, VibroLine serial number
Type	6	UNSIGNED32, VibroLine type number
Product Code	8	UNSIGNED32, VibroLine product code

Sensor / analog Input:

AI_Sensor_Type UNSIGNED16):
- 10 000 for accelerometer
- 10 001 for velocity sensor
- 10 002 for displacement sensor

Channel	1	2	3	4	5	6	7	8
Address	1000	1001	1002	1003	1004	1005	1006	1007

AI_ADC_Sample_Rate UNSIGNED32, Sample rate of ADC, Value in Hz

Channel	1	2	3	4	5	6	7	8
Address	1016	1018	1020	1022	1024	1026	1028	1030

AI_Scaling_Factor REAL32, Sensitivity mV/AI_Physical_Unit (see below)

Channel	1	2	3	4	5	6	7	8
Address	1048	1050	1052	1054	1056	1058	1060	1062

AI_Physical_Unit UNSIGNED32, Phys. Unit as follows (hex)

m/s²	00 55 00 00
g	00 00 00 A0
mm/s	FD 01 03 00
inch/s	00 00 00 A3
µm	FA 01 00 00
mil	FD 00 00 A5
Ratio 1	00 00 00 A6
%	FE 00 00 A6
Ration dB	00 00 00 A7

Channel	1	2	3	4	5	6	7	8
Address	1080	1082	1084	1086	1088	1090	1092	1094

AI_Status UNSIGNED16,
Bit 0 = 0: IEPE off
Bit 0 = 1: IEPE on
Bit 1 = 0: IEPE no short circuit error
Bit 1 = 1: IEPE short circuit error
Bit 2 = 0: IEPE no cable failure error
Bit 2 = 1: IEPE cable failure error
Bit 3 = 0: Gain 1
Bit 3 = 1: Gain 25
Bit 4 = 0: No overload error
Bit 4 = 1: Overload error
Bit 5..15: Reserved

Channel	1	2	3	4	5	6	7	8
Address	1112	1113	1114	1115	1116	1117	1118	1119

Analog output = Output for process values (PV)

AI_Physical_Unit UNSIGNED32, Phys. Unit as follows (hex)

m/s²	00 55 00 00
g	00 00 00 A0
mm/s	FD 01 03 00
inch/s	00 00 00 A3
µm	FA 01 00 00
mil	FD 00 00 A5
Ratio 1	00 00 00 A6
%	FE 00 00 A6
Ration dB	00 00 00 A7

Channel	1	2	3	4	5	6	7	8
Charact. 1	2000	2002	2004	2006	2008	2010	2012	2014
Charact. 2	2100	2102	2104	2106	2108	2110	2112	2114
Charact. 3	2200	2202	2204	2206	2208	2210	2212	2214

Note: Multiple characteristic values per channel are only possible with the "MultiMode" option.

AO_Process_Value (REAL32, Calculated characteristic in AO_Physical_Unit)

Channel	1	2	3	4	5	6	7	8
Charact. 1	2032	2034	2036	2038	2040	2042	2044	2046
Charact. 2	2132	2134	2136	2138	2140	2142	2144	2146
Charact. 3	2232	2234	2236	2238	2240	2242	2244	2246

Note: Multiple characteristic values per channel are only possible with the "MultiMode" option.

AO_Process_Value (INTEGER32, Calculated characteristic in AO_Physical_Unit)
Adsress : Pre-comma value
Address+1: Decimal value (part of 65536)

Channel	1	2	3	4	5	6	7	8
Charact. 1	2064	2066	2068	2070	2072	2074	2076	2078
Charact. 2	2164	2166	2168	2170	2172	2174	2176	2178
Charact. 3	2264	2266	2268	2270	2272	2274	2276	2278

Note: Multiple characteristic values per channel are only possible with the "MultiMode" option.

Alarm

Bit 0 to 10 concern alarms that result from the comparison of the characteristic value with limit values. Bit 11 to 15 concern alarms resulting from self-monitoring.

AL_State (UNSIGNED16, 16 Alarm Bits):
Bit 0 = Limit 1 (Warning) exceeded
Bit 1 = Limit 2 (Alarm) exceeded
Bit 2 = Outside Limit 1 and 2
Bit 3 = Below Limit 1
Bit 4 = Inside Limit 1 und 2
Bit 5 = Zone limit A/B exceeded
Bit 6 = Zone limit B/C exceeded
Bit 7 = Zone limit C/D exceeded (Zone D)
Bit 8 = Zone A
Bit 9 = Zone B
Bit 10 = Zone C
Bit 11 = IEPE short circuit
Bit 12 = IEPE open
Bit 13 = Overload
Bit 14 = Overflow internal or at output
Bit 15 = No speed for values that require speed

Channel	1	2	3	4	5	6	7	8
Charact. 1	3000	3001	3002	3003	3004	3005	3006	3007
Charact. 2	3100	3101	3102	3103	3104	3105	3106	3107

Charact. 3	3200	3201	3202	3203	3204	3205	3206	3207

Note: Multiple characteristic values per channel are only possible with the "MultiMode" option.

Speed signal

Speed (INTEGER32, Rotational speed [1/min]):

Trigger input	1	2	3
Address	1200	1202	1204

Note: Speed signals are only transmitted if a characteristic value with a speed reference is used (order characteristic value or bearing characteristic value with reference speed).

Switching the measuring configuration

The active measuring configuration in the device can be switched over via Modbus. Up to 8 measuring configurations are available. The measuring configurations are created with the VibroLine Configurator.

ActiveConfig (UNSIGNED16, Active device configuration, read/write): **200**

NumberOfConfig (UNSIGNED16, Available device configurations, read only): **201**

Note: Multiple characteristic values per channel are only possible with the "MultiMode" option.

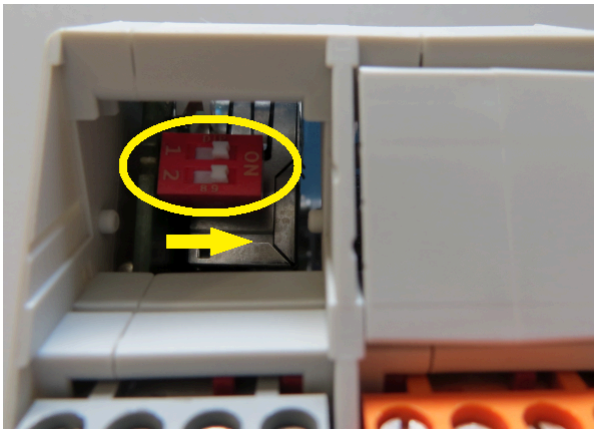
Termination

The Modbus RTU (RS485) should be terminated at the first and last device (120 Ohm resistor between RS485A and RS485B). This termination can be done on the VibroLine unit as follows:

- Remove the plastic cover on the lower left side (in front of connections 9-12

- Set dipswitch 1 to "ON".

- Put the plastic cover back on.



CANopen

VibroLine works according to CANOpen standards.

- The Vendor ID for VibroLine devices assigned by the CiA is 0x4BB.
- The device addressing for CANopen is done with the node IDs 1 ... 127.

For the transmission rates can be used: 10, 20, 50, 125, 250, 500 kBit/s or even 1 MBit/s.

A suitable device profile for condition monitoring devices is currently not standardized within CANopen. The device profile is therefore stored with 0x0. However, following the profile for measuring instruments described in CiA 404, the addresses and objects suggested there were used if they made sense for the VibroLine device. A complete EDS for VibroLine devices is available, which shows the addressing of all objects. The EDS file can be found in the VibroLine program directory in the sub-directory "CANopen".

In particular, TPDOs (Transmit Process Data Objects) are also supported. The timing is set to "manufacturer specific" and can be parameterized via the configuration.
The following transfers are available:

- Time-driven transmission of measured values
- Time-driven transmission of alarms
- Change-of-state transmission of alarms (incl. hold function)

For measured value transmission via TPDOs, the measured value range and thus the number of decimal digits after the decimal point can be defined.

Units of physical quantities

The CiA303/2 has recommendations for the notation of SI units using a 32 bit integer, divided into 4 fields of 8 bits each. VibroLine also follows these recommendations.
No procedure is described for non-SI units - which, however, are also used in the field of Condition Monitoring. However, the field "profile-specific" is available for each unit within the 32 bit integer. VibroLine therefore notes various non-SI units using this field. For the units used in VibroLine the following concrete assignment results:

Unit	Assignment (hex)
m/s²	00 55 00 00
g	00 00 00 A0
mm/s	FD 01 03 00
inch/s	00 00 00 A3
µm	FA 01 00 00
mil	FD 00 00 A5
Ratio 1	00 00 00 A6
%	FE 00 00 A6
Ratio dB	00 00 00 A7

VibroLine Data Objects

Sensor / analog Input:

Meaning	Address	Notes
AI sensor type	0x6110	UNSIGNED16: Subindex for each channel (1..8): (custom definition) - 10 000 for accelerometers - 10 001 for velocity sensors - 10 002 for displacement sensors
AI ADC sample rate	0x6114	UNSIGNED32: Subindex for each channel (1..8: Value in Hz
AI scaling factor	0x6126	REAL32: Subindex for each channel (1..8): Sensitivity in mV/AI_Physical_unit (s. next column)
AI physical unit	0x6131	UNSIGNED32: Subindex for each channel (1..8): Phys. Unit with notation acc. to CiA303/2*
AI status	0x6150	UNSIGNED8: Subindex for each channel (1..8): (Custom definition) Bit 0 = 0: IEPE off Bit 0 = 1: IEPE on Bit 1 = 0: IEPE no short circuit error Bit 1 = 1: IEPE short circuit error Bit 2 = 0: IEPE no cable failure error Bit 2 = 1: IEPE cable failure error Bit 3 = 0: Gain 1 Bit 3 = 1: Gain 25 Bit 4 = 0: No overload error Bit 4 = 1: Overload error Bit 5..15: Reserved

Analog Output = Output for process values (PV)

Meaning	Address	Notes
AO output PV	0x6300	REAL32: Subindex for each channel: 1..8: Characteristic 1 on channel 1-8 9-16: Characteristic 2 on channe 1-8 17-24: Characteristic 3 on channe 1-8 Calculated characteristic in AO_Physical_unit_PV (s. next column)
AO physical unit PV	0x6301	UNSIGNED32: Subindex for each channel: 1..8: Characteristic 1 on channel 1-8 9-16: Characteristic 2 on channe 1-8 17-24: Characteristic 3 on channe 1-8 Phys. Unit with notation acc. to CiA303/2*

AO decimal PV	0x6302	UNSIGNED8: Subindex for each channel (1..8): Number of decimal digits of the integer representation (s. next column)
AO output PV	0x7300	INTEGER16: Subindex for each channel (1..8): Calculated characteristic in AO_Physical_unit_PV

Note: Multiple characteristic values per channel are only possible with the "MultiMode" option.

Alarm

Bit 0 to 10 concern alarms that result from the comparison of the characteristic value with limit values. Bit 11 to 15 concern alarms resulting from self-monitoring.

AL_State (UNSIGNED16, 16 Alarm Bits):
Bit 0 = Limit 1 (Warning) exceeded
Bit 1 = Limit 2 (Alarm) exceeded
Bit 2 = Outside Limit 1 and 2
Bit 3 = Below Limit 1
Bit 4 = Inside Limit 1 und 2
Bit 5 = Zone limit A/B exceeded
Bit 6 = Zone limit B/C exceeded
Bit 7 = Zone limit C/D exceeded (Zone D)
Bit 8 = Zone A
Bit 9 = Zone B
Bit 10 = Zone C
Bit 11 = IEPE short circuit
Bit 12 = IEPE open
Bit 13 = Overload
Bit 14 = Overflow internal or at output
Bit 15 = No speed for values that require speed

Meaning	Address	Notes
AL 1..8 state	0x6600	UNSIGNED8, 8 Sub-indexes for the channels 1..8: Characteristic 1 on channel 1-8 9-16: Characteristic 2 on channe 1-8 17-24: Characteristic 3 on channe 1-8
AL 9..16 state	0x6601	UNSIGNED8, Sub-indexes for the channels 1..8: Characteristic 1 on channel 1-8 9-16: Characteristic 2 on channe 1-8 17-24: Characteristic 3 on channe 1-8

Note: Multiple characteristic values per channel are only possible with the "MultiMode" option.

Switching the measuring configuration

The active measuring configuration in the device can be switched over via Modbus. Up to 8 measuring configurations are available. The measuring configurations are created with the VibroLine Configurator.

Meaning	Adresse	Notes
Active device configuration	0x6f70	UNSIGNED8, Active device configuration (0 .. 7 / number of existing device configurations), read and write
Available device configurations	0x6f71	UNSIGNED8, number of existing device configurations, read only

Note: Multiple characteristic values per channel are only possible with the "MultiMode" option.

TPDO Mapping

The TPDO mapping is shown in the EDS. Specifically, the following addresses were set up:

- In TPDO 0 the characteristic values of channels 1 to 4 are transmitted as 16-bit values. These are the values of AO output PV at address 0x7300 with the subindices 01 to 04.
- In TPDO 1, the characteristic values of channels 5 to 8 are transmitted as 16-bit values. These are the values of AO output PV at address 0x7300 with the sub-indexes 05 to 08.
- In TPDO 2, the alarm states AL1 to AL8 of channels 1 to 8 are transmitted as 8-bit values. These are the values of AL 1..8 state at address 0x6600 with the sub-indexes 01 to 08.
- In TPDO 3, the alarm states AL9 to AL16 of channels 1 to 8 are transmitted as 8-bit values. These are the values of AL 9..16 state at address 0x6601 with the sub-indexes 01 to 08.

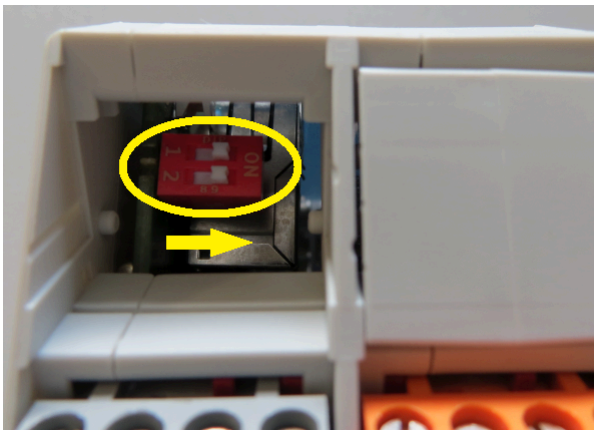
Note: Only the first characteristic value of a measuring channel can be retrieved via TPDOs

Termination

The CAN Bus should be terminated at the first and last device (120 Ohm resistor between CAN LOW and CAN High). This termination can be done on the VibroLine unit as follows:

- Remove the plastic cover on the lower left side (in front of connections 9-12

- Set dipswitch 2 to "ON".



- Put the plastic cover back on.

DataStreaming via VLDAQ API

The DATA STREAM interface provides a VLDAQ API which is used to transfer sensor data in raw format, i.e. without further signal processing (filtering, integration, ...). In addition, data such as sensor information (e.g. sensitivity) and trigger signals (speed trigger 1-3) are provided.

The VLDAQ API can be found in the VibroLine program directory in the sub-directory "VLDAQ_API".

The directory contains

- APIs for Windows and Linux
- An example program for C++
- A comprehensive documentation of all functionalities of the VLDAQ API

HTTP API

Current characteristic values and device information can be accessed using the HTTP API. The interface uses common HTTP methods (`GET`, `POST`, etc.) and resource oriented URLs. All responses use the JSON format.
The host address is the IP address of the device. All IDs use zero-based indexing (channel 1 corresponds to `channel_id` 0 for example).
All example requests use the command line tool `curl` but any program that is able to send HTTP requests would be suitable. The `GET` requests can be sent by opening the URL in a browser for example.

Available Endpoints

Device

- GET /api/info: Request general device information.
- GET /api/availableConfigurations: Request available configurations.
- GET /api/activeConfiguration: Request active configuration.
- POST /api/activeConfiguration: Switch to a different configuration.

Channels

- GET /api/channels: Request channel information for all channels.
- GET /api/channels/{channel_id}: Request channel information for a single channel.

Characteristic Values

- GET /api/channels/{channel_id}/cvs: Request all characteristic values of a channel..
- GET /api/channels/{channel_id}/cvs/{cv_id}: Request a single characteristic value of a channel.
- GET /api/channels/{channel_id}/cvs/{cv_id}/statistics: Request the statistics of one characteristic value.

Speeds

- GET /api/speeds: Request speed information for all speed trigger inputs.
- GET /api/speeds/{speed_id}: Request speed information for a single speed trigger input.

Attributes

Most attributes are numbers or strings that do not require an additional explanation. But some attributes can only take on certain values. Those attributes are described here.

`IEPE`

The attribute `IEPE` reflects the IEPE status of a channel:

Value	Description
ok	IEPE is active and there is no error.
off	IEPE is disabled.
open	No sensor is attached or the connection to the sensor is severed (due to a loose connector or cable break for example).
short	The sensor is short-circuited.

status

The attribute status represents the status of a characteristic value:

Value	Description
ok	The characteristic value is working.
IEPEError	There is an error with the IEPE sensor.
no24V	The device is not supplied with 24V power. It is possible to configure the device if it is only powered via USB but the measurement will not function.
overload	The characteristic value is overloaded.
speedError	The characteristic value is missing necessary speed data or the speed is outside of the tolerance range.
error	Some other error occurred.

unit

The attribute unit contains the unit of a value:

Value	Description
m/s^2	Meter per second squared
g	Gravitational acceleration
mm/s	Millimeter per second
imch/s	Inch per second
um	Micrometer
mil	Thousandth of an inch
dB	Decibel
%	Percent
1	Ratio
rpm	Revolutions per minute

GET /api/info

Request:
```
GET /api/info
```

Response:
A JSON object containing information about the device.

Attribute	Data Type	Description
apiVersion	string	Version of the HTTP API
type	string	Device type
firmwareVersion	string	Version of the firmware
serialNumber	number	Serial number

Example Request:
```
curl http://192.168.0.123/api/info
```

Example Response:
```
{
    "apiVersion":      "1.0",
    "type":            "VLX4 HD",
    "firmwareVersion": "2.1.1366",
    "serialNumber":    20
}
```

GET /api/availableConfigurations

Request:
`GET /api/availableConfigurations`

Response:
A JSON object containing information on the available configurations in the device.

Attribute	Data Type	Description
`availableConfigurations`	`number array`	An array containing the IDs of the available configurations.

Example Request:
```
curl http://192.168.0.123/api/availableConfigurations
```

Example Response:
```
{
    "availableConfigurations": [0, 1]
}
```

GET /api/activeConfiguration

Request:
`GET /api/activeConfiguration`

Response:
A JSON object containing information about the active configuration of the device.

Attribute	Data Type	Description
`activeConfiguration`	`number`	ID of the active configuration

Example Request:
```
curl http://192.168.0.123/api/activeConfiguration
```

Example Response:
```
{
    "activeConfiguration": 0
}
```

POST /api/activeConfiguration

This endpoint can be used to switch the active configuration of the device. `configuration_id` is the ID of the configuration that will be activated.

Request:
`POST /api/activeConfiguration`
using `Content-Type: application/json`
and the following data:

```
{
    "activeConfiguration": configuration_id
}
```

Response:
A JSON object containing information about the new active configuration of the device.

Attribute	Data Type	Description
`activeConfiguration`	`number`	ID of the new active configuration.

Example Request:

```
curl --header "Content-Type: application/json" --request POST --data
"{\"activeConfiguration\":1}" 192.168.0.113/api/activeConfiguration
```

Example Response:

```
{
    "activeConfiguration": 1
}
```

GET /api/channels

Request:
`GET /api/channels/`

Response:
An array of JSON objects that contain information about every channel on the device. Each object corresponds to one channel and has the attributes:

Attribute	Data Type	Description
`channel`	`number`	Channel ID
`IEPE`	`string`	IEPE status
`cvs`	`number array`	An array containing the IDs of the available characteristic values for this channel.

A channel will not show up if it is completely disabled.

Example Request:
```
curl http://192.168.0.123/api/channels
```

Example Response:
```
[
    {
        "channel": 0,
        "IEPE":    "ok",
        "cvs":     [0, 1]
    },
    {
        "channel": 1,
        "IEPE":    "ok",
        "cvs":     [0]
    },
    {
        "channel": 3,
        "IEPE":    "open",
        "cvs":     [0]
    }
]
```

GET /api/channels/{channel_id}

Request:
`GET /api/channels/{channel_id}`

Response:
A JSON object containing information about the channel with ID `channel_id`.

Attribute	Data Type	Description
`channel`	`number`	Channel ID
`IEPE`	`string`	IEPE status
`cvs`	`number array`	An array containing the IDs of the available characteristic values for this channel.

Example Request:
```
curl http://192.168.0.123/api/channels/0
```

Example Response:
```
{
    "channel": 0,
    "IEPE":    "ok",
    "cvs":     [0, 1]
}
```

GET /api/channels/{channel_id}/cvs

Request:
`GET /api/channels/{channel_id}/cvs`

Response:
An array of JSON objects containing information about all characteristic values of the channel with ID `channel_id`. Each object corresponds to one characteristic value and has the attributes:

Attribute	Data Type	Description
`channel`	`number`	Channel ID
`cv`	`number`	Characteristic value ID
`value`	`number`	Current characteristic value
`unit`	`string`	Unit of the characteristic value
`status`	`string`	Current status of the characteristic value

Example Request:
```
curl http://192.168.0.123/api/channels/0/cvs
```

Example Response:
```
[
    {
        "channel": 0,
        "cv":      0,
        "value":   9.990212e-01,
        "unit":    "m/s^2",
        "status":  "ok"
    },
    {
        "channel": 0,
        "cv":      1,
        "value":   1.018718e-01,
        "unit":    "g",
        "status":  "ok"
    }
]
```

GET /api/channels/{channel_id}/cvs/{cv_id}

Request:
`GET /api/channels/{channel_id}/cvs/{cv_id}`

Response:
A JSON object containing information about the characteristic value with ID `cv_id` on the channel with ID `channel_id`.

Attribute	Data Type	Description
`channel`	`number`	Channel ID
`cv`	`number`	Characteristic value ID
`value`	`number`	Current characteristic value
`unit`	`string`	Unit of the characteristic value
`status`	`string`	Current status of the characteristic value

Example Request:
```
curl http://192.168.0.123/api/channels/0/cvs/1
```

Example Response:
```
{
    "channel": 0,
    "cv":      1,
    "value":   1.019581e-01,
    "unit":    "g",
    "status":  "ok"
}
```

GET /api/channels/{channel_id}/cvs/{cv_id}/statistics

Request:
`GET /api/channels/{channel_id}/cvs/{cv_id}/statistics`

Response:
A JSON object containing statistical information about a the characteristic value with ID `cv_id` on the channel with ID `channel_id`. The statistic only takes values into account that were measured in the time between the last statistics request and the current statistics request for this characteristc value.

Attribute	Data Type	Description
`channel`	`number`	Channel ID
`cv`	`number`	Characteristic value ID
`duration`	`number`	Duration in milliseconds during which the statistics were gathered.
`avg`	`number`	Average of the characteristic value
`min`	`number`	Minimum of the characteristic value
`max`	`number`	Maximum of the characteristic value
`unit`	`string`	Unit of the characteristic value

Example Request:
```
curl http://192.168.0.123/api/channels/0/cvs/1/statistics
```

Example Response:
```
{
    "channel":  0,
    "cv":       1,
    "duration": 5624,
    "avg":      1.018815e-01,
    "min":      1.018260e-01,
    "max":      1.019429e-01,
    "unit":     "g"
}
```

GET /api/speeds

Request:
`GET /api/speeds/`

Response:
An array of JSON objects that contain information about every speed trigger input on the device. Each object corresponds to one speed trigger input and has the attributes:

Attribute	Data Type	Description
speed	number	Speed trigger input ID
value	number	Current speed
unit	string	Unit of the current speed

A speed trigger input will not show up if it is not active.

Example Request:
```
curl http://192.168.0.123/api/speeds
```

Example Response:
```
[
    {
        "speed": 0,
        "value": 3.356255e+03,
        "unit":  "rpm"
    },
    {
        "speed": 2,
        "value": 0.000000e+00,
        "unit":  "rpm"
    }
]
```

GET /api/speeds/{speed_id}

Request:
`GET /api/speeds/{speed_id}`

Response:
A JSON object containing information about the speed trigger input with ID `speed_id`.

Attribute	Data Type	Description
`speed`	`number`	Speed trigger input ID
`value`	`number`	Current speed
`unit`	`string`	Unit of the current speed

Example Request:
```
curl http://192.168.0.123/api/speeds/0
```

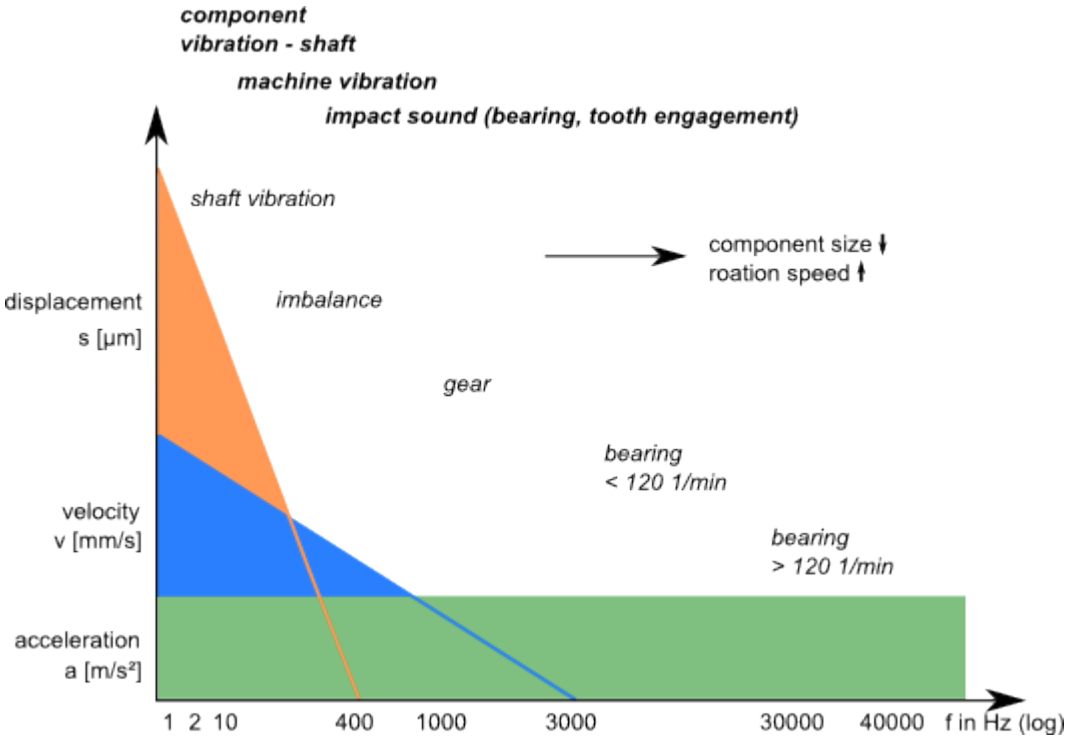
Example Response:
```
{
    "speed": 0,
    "value": 3.356231e+03,
    "unit":  "rpm"
}
```

Vibration on machines

Machines are devices with moving parts. Movement generates vibrations. Such vibrations can be unintentional or intentional in machines.

- Unwanted vibrations affect the lifetime of machines, generate noise and impair manufacturing quality.
- Vibrations are intended, for example, in vibrating screens or vibratory conveyors.

Machine vibrations extend over a wide frequency range. Vibrations from a few Hertz to 40 kHz and more can occur. The vibrations generated by machines can be roughly divided into different areas: Shaft vibrations and imbalances typically occur at low frequencies (< 1000 Hz). Interference frequencies of gearwheels and shock impulses of slow-speed gears or rolling bearings are usually found in the range up to 20 kHz, faster-speed rotating machines generate impacts at frequencies above 20 kHz.
The selection of the vibration measurement variable also depends on the frequency range to be investigated: vibration displacement of up to several hundred hertz and vibration velocities of up to approx. 2000 Hz can only be measured meaningfully; vibrations at higher frequencies must be measured as vibration acceleration. The following figure illustrates the frequency ranges.



Various characteristic values have become established for the detection of machine vibrations. In addition to vibration characteristic values (oscillation on a wide frequency band) it is also possible to measure order characteristic values (oscillations at speed or multiples thereof).
It is established to use the ISO 10816 and ISO 20816 series of standards for the measurement of vibration characteristic values for machine monitoring.