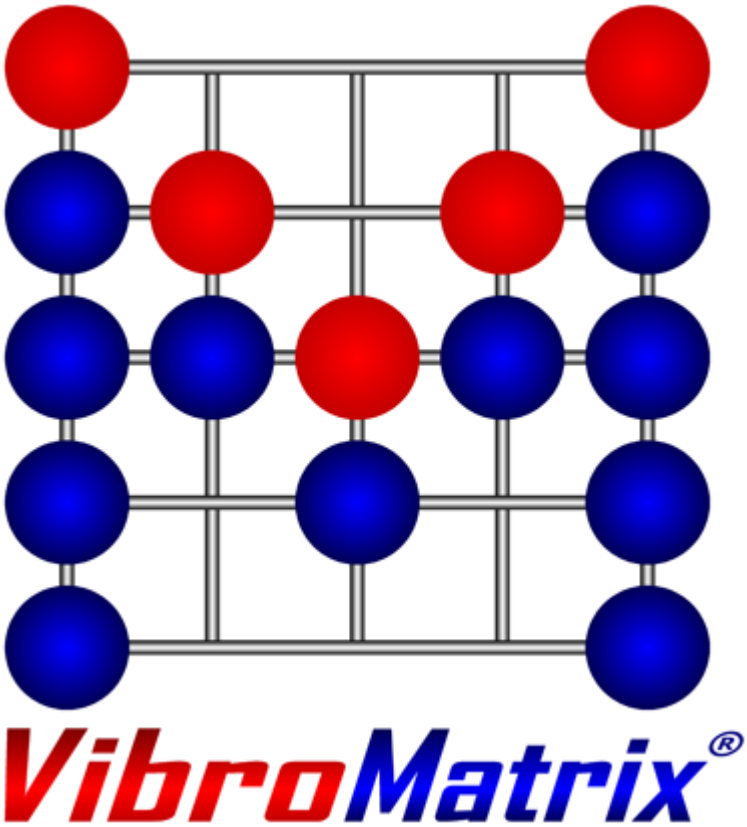


VibroMatrix® 1.8.0

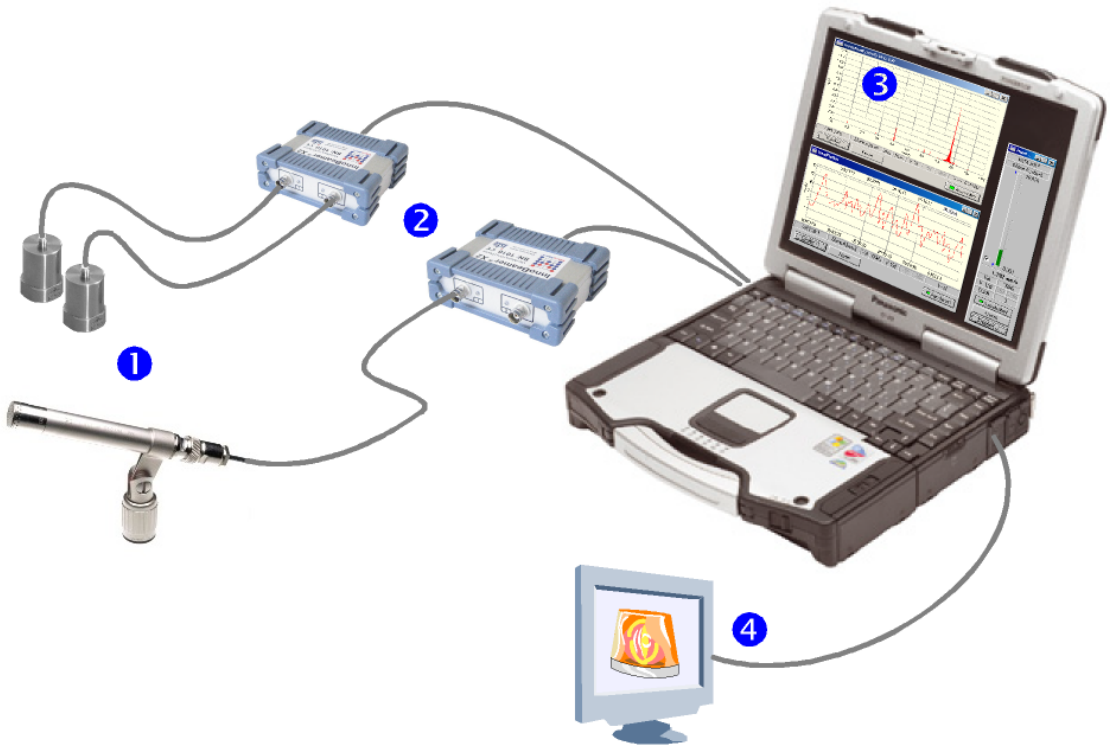
User manual
2014

Content

VibroMatrix® 1.8.0

VibroMatrix is a high-quality tool for the precise real-time measurement of vibrations, sound and further alternating quantities. Users in research and development, service and maintenance, engineering and consultant offices receive the required measurement information quickly and uncomplicatedly by means of VibroMatrix.

Set-up



1. Sensors with voltage output are directly connected to data converters.
2. Data converters type InnoBeamer condition and digitize the sensor signals.
3. A conventional computer generates measurement information from the digital signals at once.
4. Convenient for unattended measurements: Messages can be generated, e.g. if limit values are exceeded.

Overview

- There is a rich supply of vibration accelerometers, measurement microphones, current clamps and other types when it comes to the sensors. Sensor technologies like integrated amplifier (IEPE) or integrated data sheet (TEDS) are directly supported by the data converter. The complete measurement equipment is supplied by USB - an additional mains adapter is not required.

- VibroMatrix is modular. It can be operated with one sensor but also with several sensors at the same time. One or many measurement programs can run on the screen. Everything simultaneously and live. VibroMatrix can be adapted exactly to the demands of your measurement task and be extended if required.

- For the user, his instruments are the most important tool. These measurement programs can be started at once and display the measurement information on the screen in real-time.

- Since many sensors, InnoBeamers and instruments can run simultaneously, the InnoMaster helps you to keep track of everything. It is the control center of VibroMatrix.

VibroMatrix including its application is described in detail on the following pages. Usually, you will not read this document sequentially, but press the F1 button in VibroMatrix to request help. This file will be opened on the suitable page then.

Software Instruments

Software instruments accept signals acquired by sensors and digitized by the InnoBeamer X2 or LX2 electronics and provide you with real-time value displays, graphic displays and further information for various applications of vibration measurement.

General Purpose Instruments

InnoMeter®	Displays RMS and peak of vibration and sound, rotation speed, frequency as number values.
InnoPlotter®	Displays RMS and peak of vibration and sound, rotation speed, frequency as time graph.
InnoLogger®	Records RMS and peak of vibration and sound, rotation speed, frequency into a file.
InnoScope®	Displays real-time vibration sensor signals in time domain with high resolution.
InnoAnalyzer®	Displays real-time vibration sensor signals in frequency domain with high resolution.
InnoAnalyzer® Speed	Order analysis of vibration sensor signals.

Special Purpose Instruments

InnoBalancer®	Balancing system
InnoMeter® HVM 2631	Whole-body vibration measurement acc. to ISO 2631-1:1997, ISO 2631-2:2003, ISO 2631-4:2001
InnoMeter® HVM 5349	Hand-Arm vibration measurement acc. to ISO 5349, VDI 2057-2
InnoMeter® HVM 6954	Measurements of vibrations with regard to habitability on passenger and merchant ships acc. to ISO 6954:2000
InnoMeter® 4150-2	Measurement and evaluation of vibrations in buildings acc. to DIN 4150-2 for the determination of their effects on persons
InnoMeter® 4150-3	Measurement and evaluation of vibrations in buildings acc. to DIN 4150-3 for the determination of their effects on structures
InnoMeter® 3834	Measurement and evaluation of vibrations of wind energy plants acc. to VDI 3834

Similarities

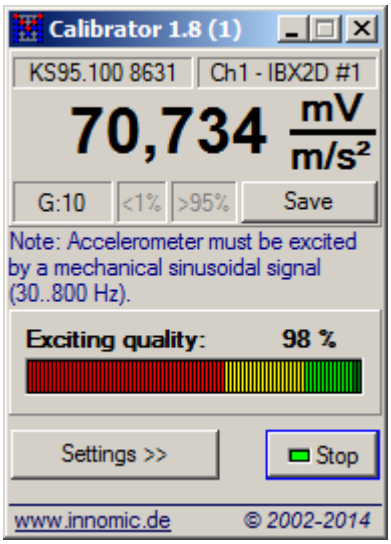
Where it is possible, the instruments use a uniform operation and display.

Versions

Many instruments are available in at least two versions. The most powerful version is always described (indicated by 'Pro'). The other versions of the instruments do not have all features of the most powerful one.

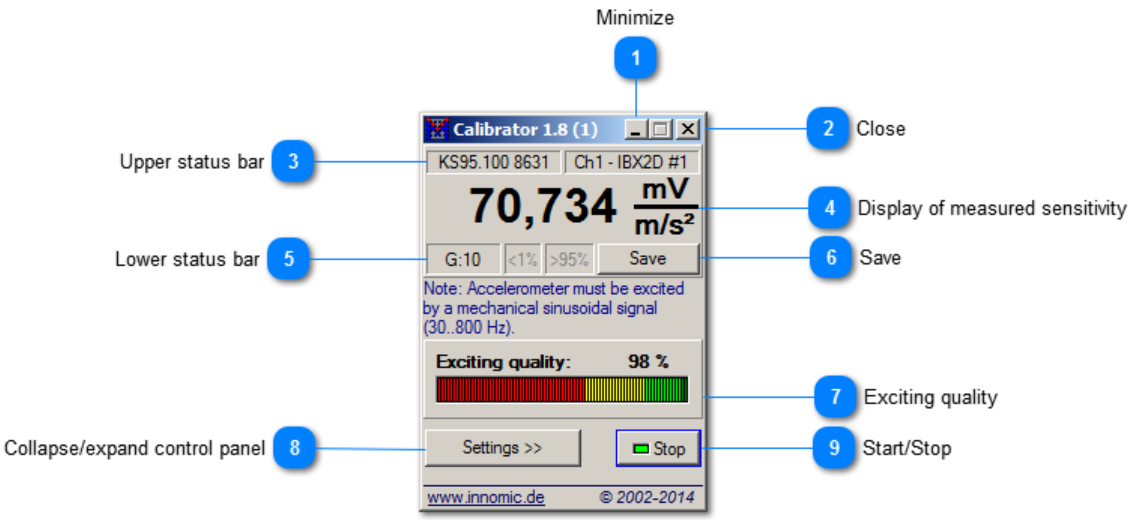
Calibrator

With the calibrator, the sensors are calibrated centrally.



The calibration information is then immediately available to all instruments. The accelerometer must be excited by a sinusoidal calibration signal in the range between 30 .. 800 Hz. The levels of several calibration sources are preset. Additionally, an individual level can be defined.

Display area



1 Minimize

This button minimizes the Calibrator.

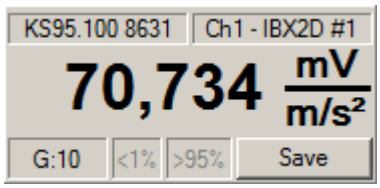
2 Close

This button closes the Calibrator.

3 Upper status bar

Shows the connected sensor and input channel.

4 Display of measured sensitivity



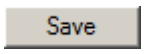
The measured sensitivity is always displayed in mV/m/s². The display is updated 1..4 times a second.

5 Lower status bar

Shows

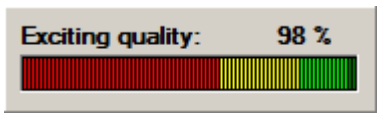
- gain
- underload
- overload

6 **Save**



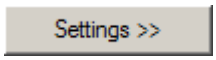
This button saves the currently measured sensor sensitivity in the sensor database.

7 **Exciting quality**



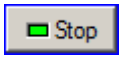
The exciting quality of the mechanical reference signal is monitored during calibration using the sensor to be calibrated so that the calibration is performed correctly. Exciting quality is defined as the absence of frequencies next to the calibration signal. The purer the sinusoidal signal supplied by the vibration calibrator, the higher the exciting quality. It is displayed numerically and a a bar chart.

8 **Collapse/expand control panel**



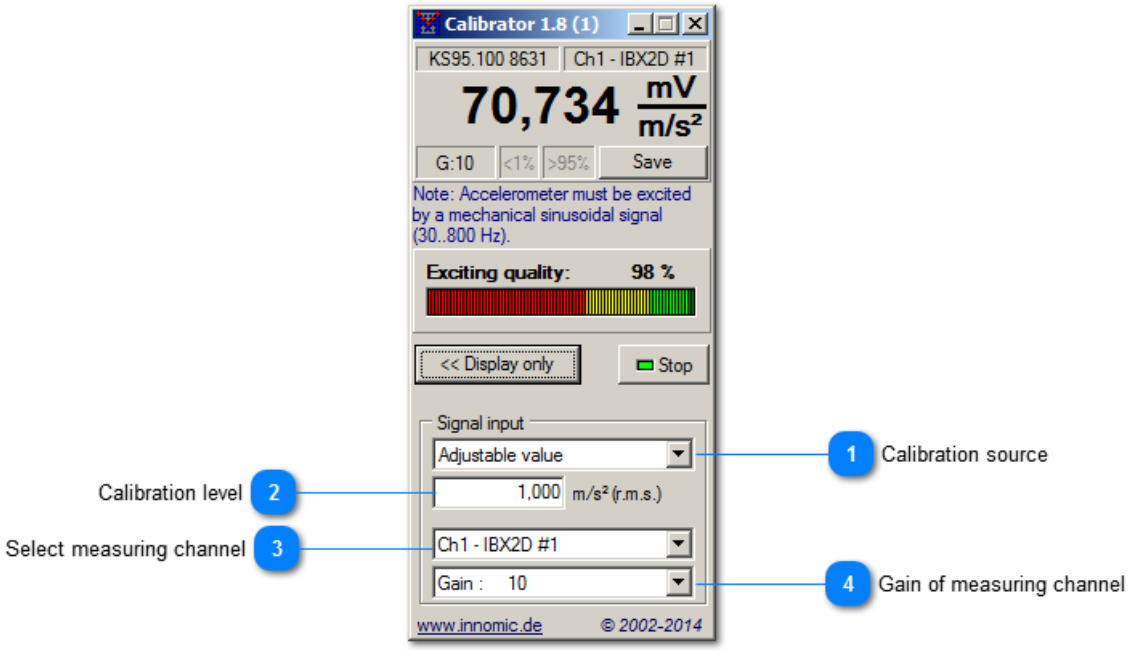
Opens and closes the setup menu.

9 **Start/Stop**

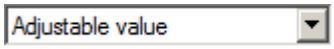


Starts and stops measurement.

Setup area



1 Calibration source

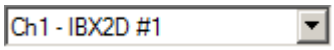


Several types of vibration calibrators can be adjusted as calibration source. These produce a sinusoidal signal with a different amplitude each. The amplitudes that meet the sinus signals with rms between 1 m/s² and 10 m/s² are available. In addition, the first entry offers the possibility to insert an individual calibration level.

2 Calibration level

If Adjustable value is selected as calibration level, a command is accessible into this field. The rms of the excitation signal can be inserted. The permitted range is 0,001 .. 1000 m/s².

3 Select measuring channel



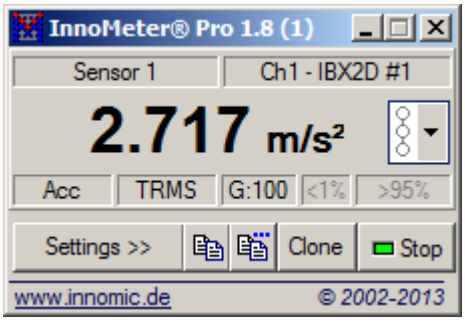
Selecting measuring channel.

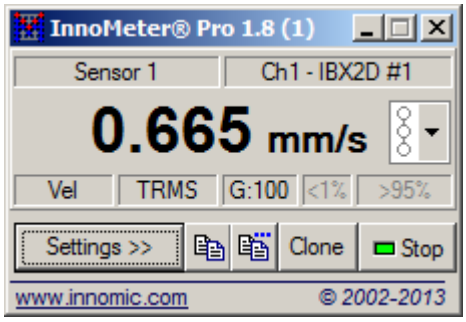
4 Gain of measuring channel

Adjust gain of the measuring channel.

InnoMeter® (Pro)

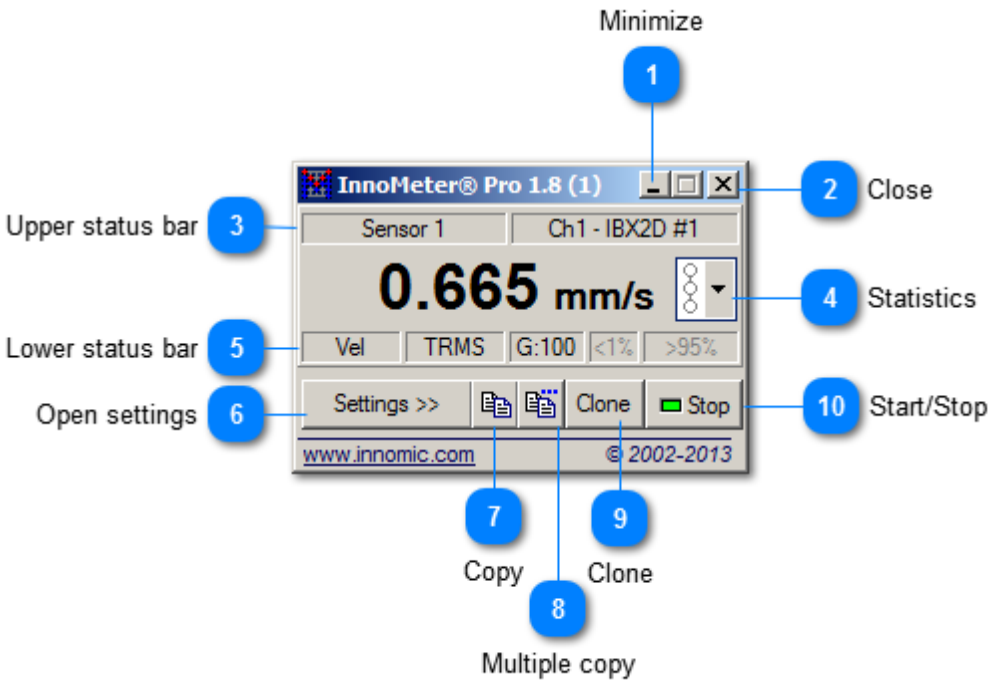
The InnoMeter displays RMS and peak of vibration and sound, rotation speed, frequency as number values.





Display area

In this section you see measuring values and status indicators.



1 Minimize

This button minimizes the InnoMeter.

2 Close

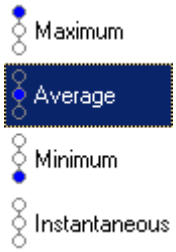
This button closes the InnoMeter.

3 Upper status bar

Shows the connected sensor and input channel.

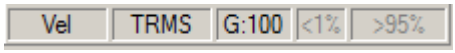
4 Statistics

Choose between instantaneous, average, maximum and minimum value. All four values are always measured in the background.



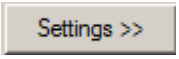
- Statistics will help you to detect instability.

5 **Lower status bar**



Shows selected vibration measurand and characteristic, gain, underload and overload.

6 **Open settings**



Opens and closes the setup menu.

7 **Copy**

Copies value and unit into the clipboard.

8 **Multiple copy**

Copies value and unit of all opened InnoMeter windows into the clipboard.

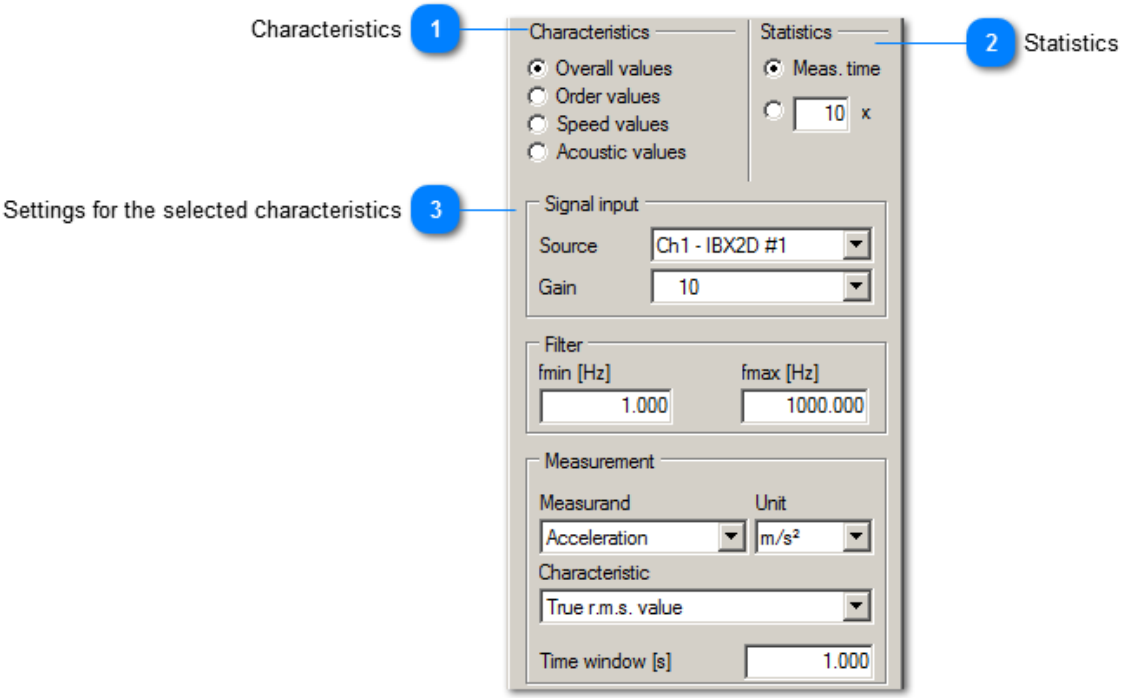
9 **Clone**

Generates an additional InnoMeter with the same settings. The newly generated InnoMeter can be configured freely.

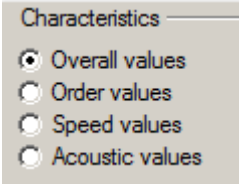
10 **Start/Stop**

Starts and stops measurement.

Setup area

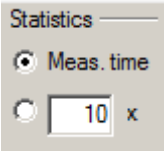


1 Characteristics



Overall values	Band filtering of a vibration signal and calculation of one measuring value.
Order values	Narrow band filtering of a vibration signal and calculation of one measuring value.
Speed values	Processes the the digital input signals from the InnoBeamer.
Acoustic values	Frequency weighting of a microphone signal and calculation of one measuring value.

2 Statistics



Selects between:

- Current value
- Minimum value
- Maximum value
- Average value

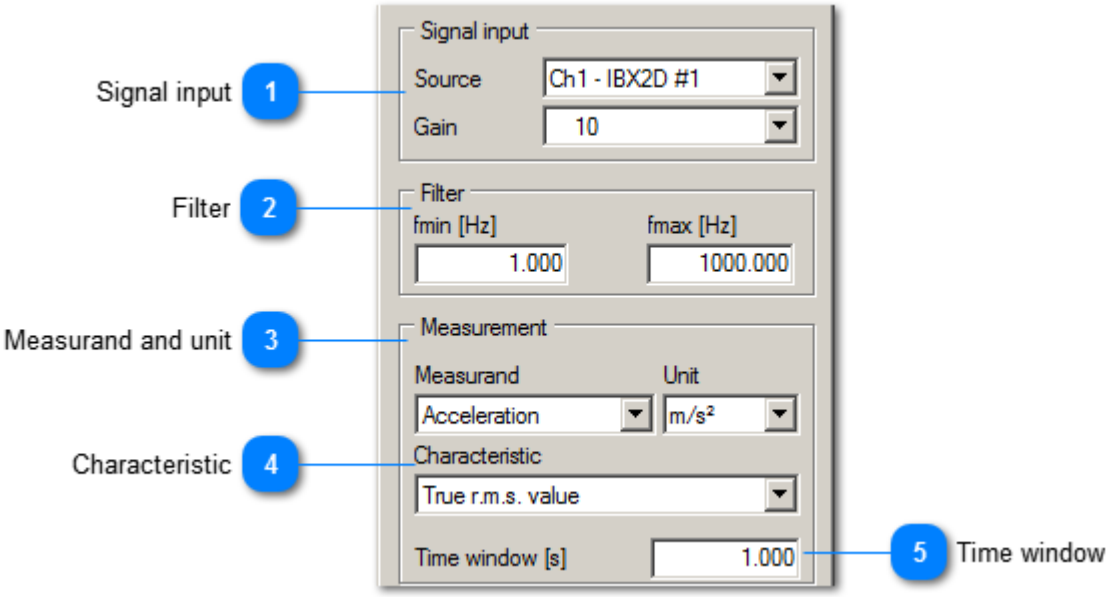
Statistics can be performed over the entire measuring time or a defined number of measurements.

3 Settings for the selected characteristics

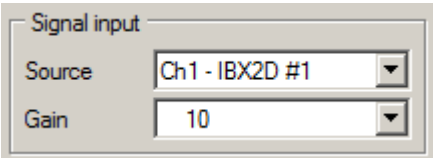
The controls depend on the selected characteristics.

Overall values

These values are calculated from the analog inputs of the InnoBeamer.

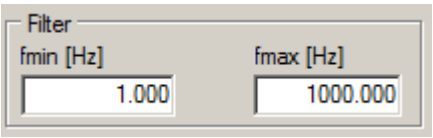


1 Signal input



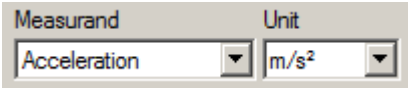
Selects the physical input and the gain of the USB device InnoBeamer.

2 Filter



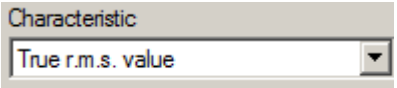
Here you adjust the frequency range of the displayed value fmin to fmax.

3 Measurand and unit



The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration.

4 Characteristic



The following options are available:

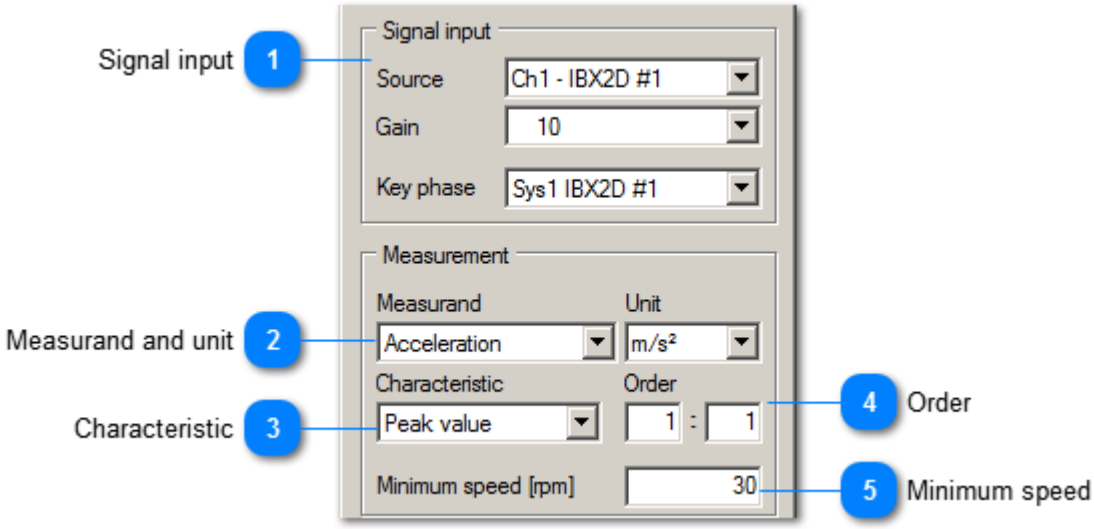
4 peak values:	Positive, negative, absolute, peak-to-peak
True RMS:	Root mean square value
Main frequency:	Frequency with the highest magnitude
THD	Total harmonic distortion, deviation from pure sine-wave
Crest factor:	Ratio of absolute peak and RMS

5 Time window

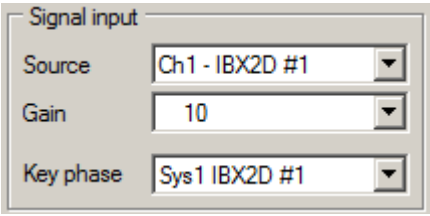
Time interval for calculating the characteristic value.

Order values

Order values are frequency selective. Only the signal at one frequency is measured. This frequency is determined by the key phase (rpm) input of the InnoBeamer. You can also measure at multiples or fractions of this frequency.



1 Signal input

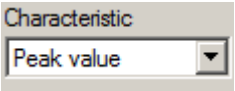


Selects the physical input and the gain of the USB device InnoBeamer.
Key phase selects the input of the digital rpm sensor.

2 Measurand and unit

The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration.

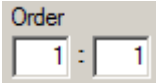
3 Characteristic



A pure sine-wave signal remains after narrow-band filtering. The following display options are available:

Peak value	Shows the magnitude
RMS	Root mean square value
Phase angle	Phase shift between the sine-wave magnitude and the low-high slope of the digital rpm signal

4 Order

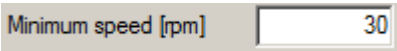


Selects multiples or fractions of the rotation frequency for band filtering.

Examplese:

Rotation frequency	1 : 1
Triple rotation frequency	3 : 1
Half rotation frequency	1 : 2
13/5 rotation frequency	13 : 5

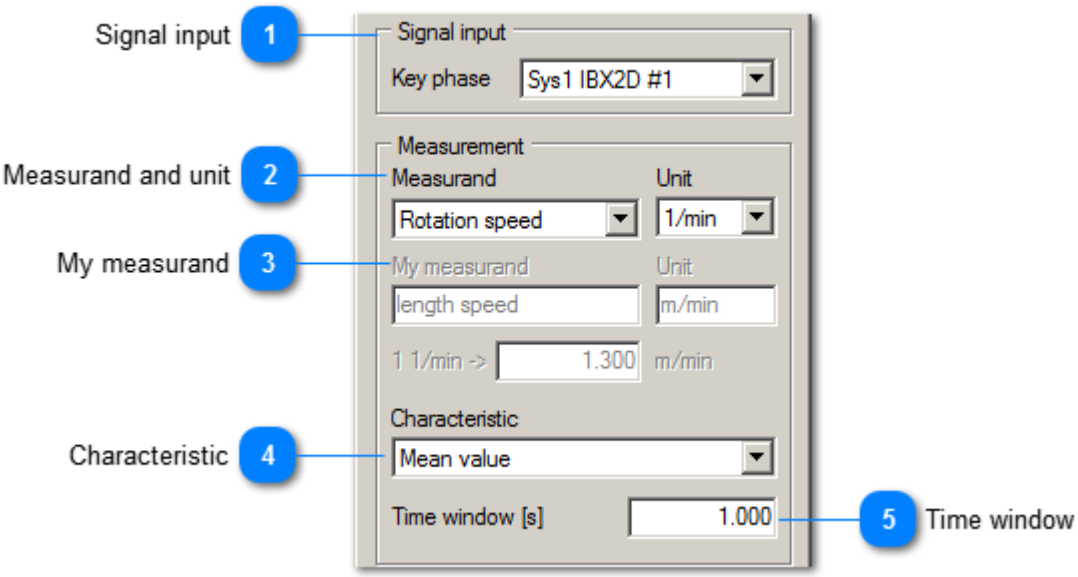
5 Minimum speed



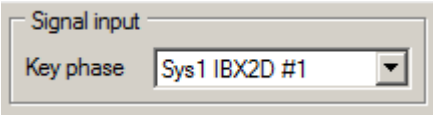
The InnoBeamers X2 and LX2 are capable of detecting down to 6 1/min. However, it may take up to 10 seconds to detect standstill. To shorten this detection time you may increase the minimum speed value. For example at 30 1/min detection will be finished after 2 second. Frequencies below 30 1/min will then be suppressed.

Speed values

Speed values are measured at the digital input of the InnoBeamer.



1 Signal input



Selects the source for the rotation speed signal from the connected InnoBeamer devices.

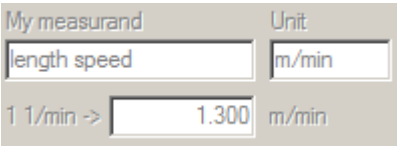
2 Measurand and unit

Choose between:

Rotation speed:	Shows the rotation frequency with the selected unit.
User-defined:	See My measurand.

Available units are: Hz, 1/s, 1/min, 1/h

3 My measurand



By multiplication with a factor the frequency signal can be transformed into another quantity, for example a track speed.

4 Characteristic

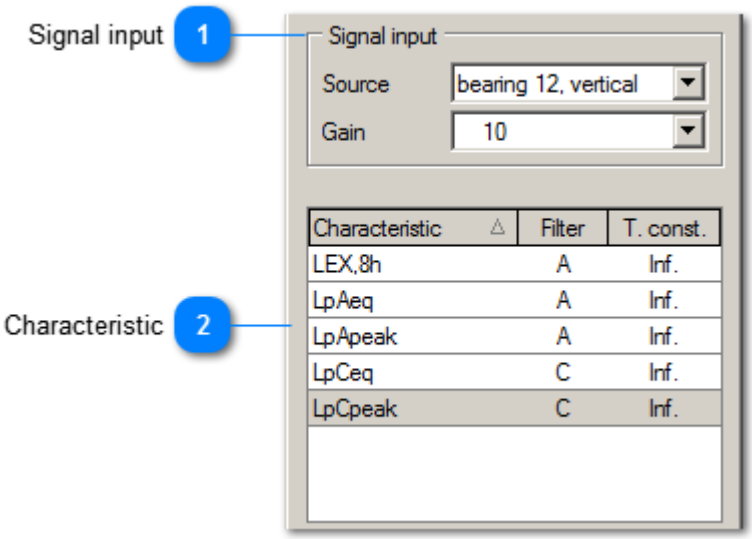
The only option is mean value.

5 Time window

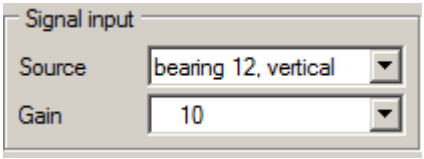
Time window for calculating the mean value. Down to 0.1 Hz can be measured which requires 10 seconds measuring time.

Acoustic values

For this mode a microphone has to be connected to at least one of the InnoBeamer inputs.

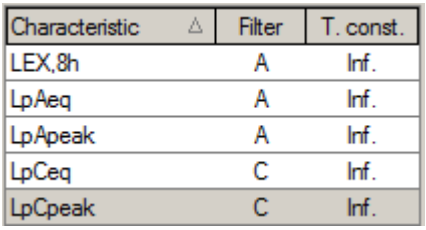


1 Signal input



Selects the physical input and the gain of the USB device InnoBeamer. The connected sensor has to be a microphone (sound pressure sensor). Otherwise acoustic measurement will be disabled.

2 Characteristic



Selects the weighting filter and automatically sets the time constant

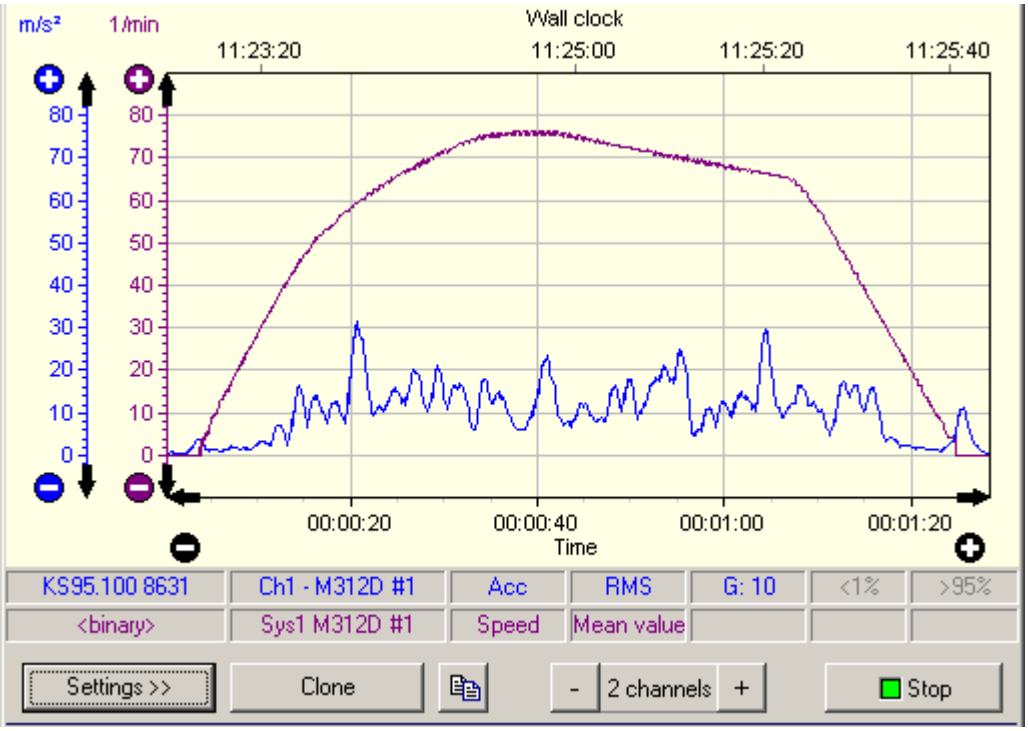
LEX,8h	Daily exposure level
LpAeq	Equivalent A-weighted continuous sound pressure level
LpApeak	Peak sound pressure level, A-weighted
LpCeq	Equivalent C-weighted continuous sound pressure level
LpCpeak	Peak sound pressure level, C-weighted

InnoPlotter® (Pro)

The InnoPlotter measures and graphically displays characteristics of

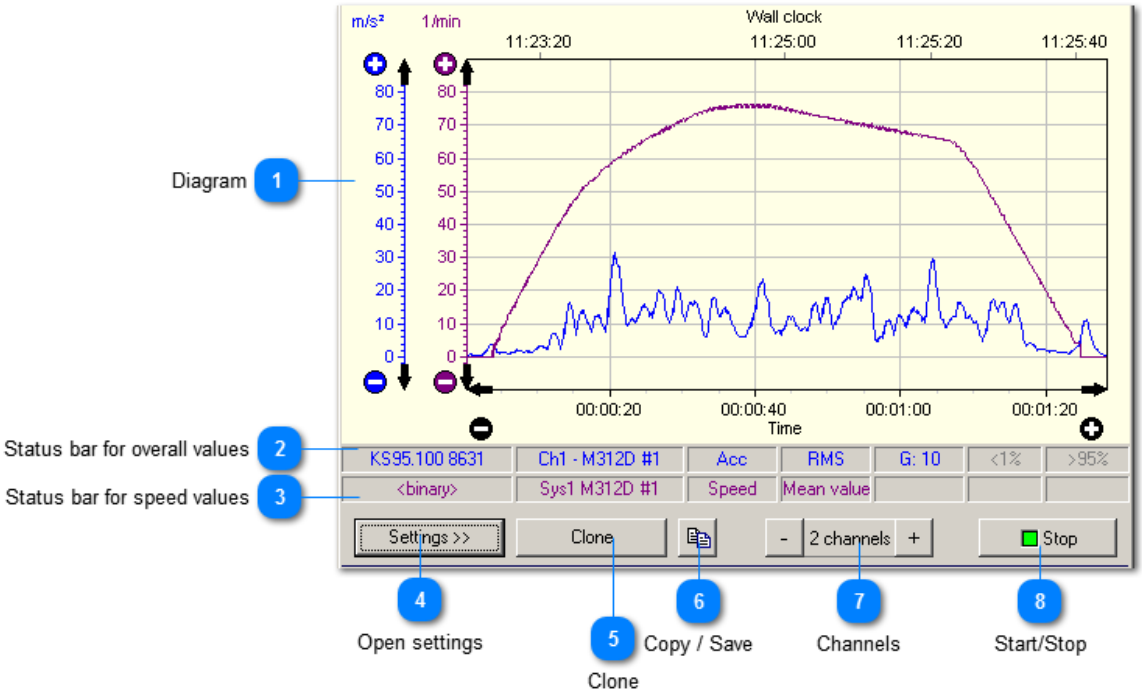
- alternating quantities, like vibration acceleration, velocity and displacement
- frequency selective quantities, like phase and magnitude of acceleration
- digital signals, like rotation speed and frequency

These characteristics draw a y/t diagram.

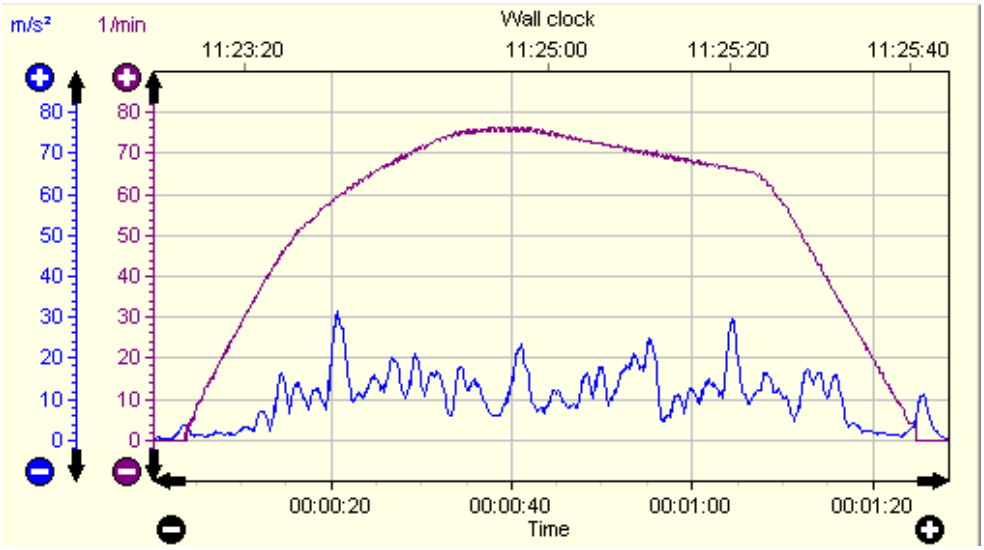


Such characteristics allow a quick evaluation of a process. The characteristic can be compared with a warning and alarm limit. External alarm devices can be tripped.

Display area



1 Diagram



The diagram shows the measured characteristic versus time. Two time axes are drawn:
upper: The clock time
lower: The elapsed time since since start

For each channel a curve is drawn in a different color. Each curve has its own y axis with individual scaling and zero shifting.

For changing the axis scaling the buttons ⊕ and ⊖ are used. Shifting can be done by clicking the arrows.
Alternatively you may shift the axis with presses left mouse button and scale with right mouse button pressed.

2 Status bar for overall values

KS95.100 8631	Ch1 - M312D #1	Acc	RMS	G: 10	<1%	>95%

This status bar appears if you chose to measure overall values on the respective channel. It shows

- Sensor
- Measuring channel
- Measurand
- Characteristic
- Gain
- Underload
- Overload

3 Status bar for speed values

<binary>	Sys1 M312D #1	Speed	Mean value			

This status bar appears if you chose to measure speed values on the respective channel. It shows

- <binary> in the sensor field to mark a frequency input
- digital measuring channel
- measurand
- characteristic

4 Open settings

Settings >> Opens and closes the setup menu.

5 Clone

Clone Opens a new window with the same settings which can be modified.

6 Copy / Save

Copies the diagram data into the clipboard or saves it on hard disk. Different file formats can be chosen.

7 Channels

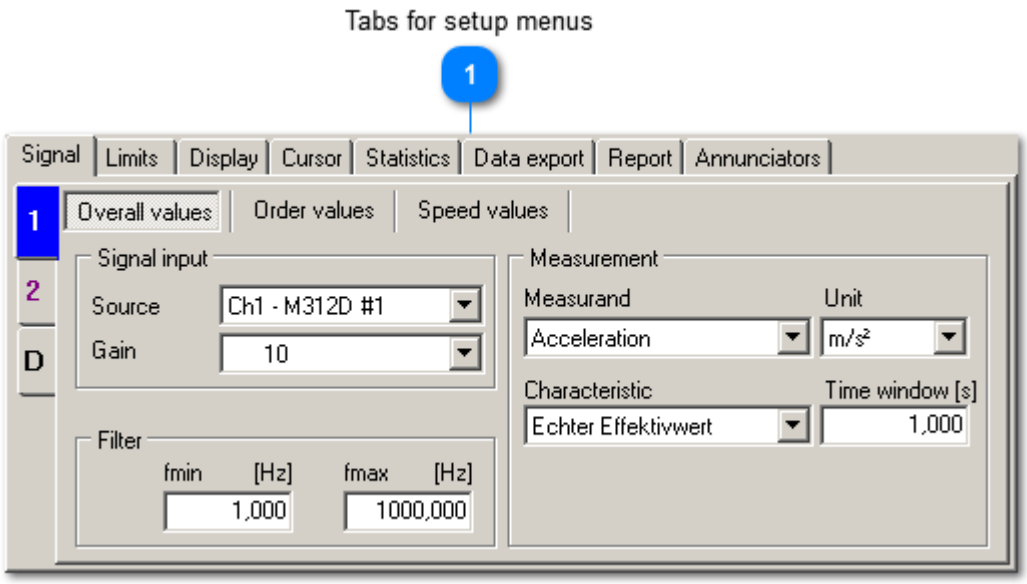
- 2 channels + Increase or decrease the number of measuring channels (and curves). One to four channels are possible.

8 Start/Stop

Stop Starts and stops measurement.

Setup area

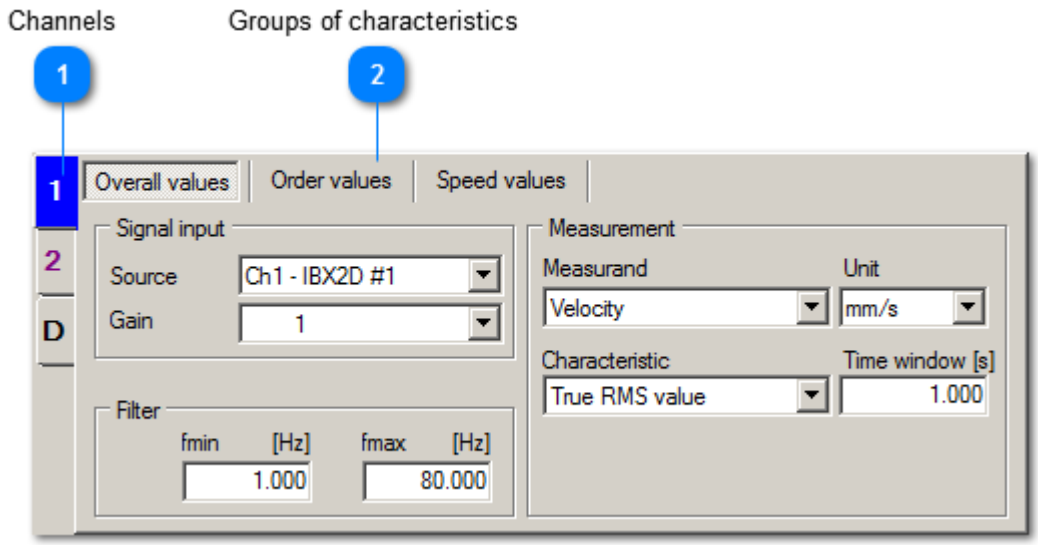
The setup menu opens after clicking the Settings button.



1 Tabs for setup menus

Signal: Settings for the signal source
Limits: Settings for the warning and alarm limits
Display: Settings for curve scaling and grids
Cursor: Cursor enable / disable, cursor readout
Statistics: Maximum, minimum and average values for each channel
Data export: Settings for the copy / save button
Report: Settings for report printing
Annunciators: Settings for external alarm devices

Signal

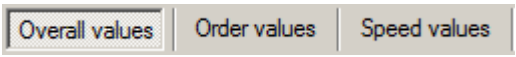


1 Channels

All settings can be entered independently for each channel. Different parameters, like vibration and frequency can be mixed in one diagram.

- The number of tabs depends on the number of active channels.
- Channel D will be always visible. It has a special function.

2 Groups of characteristics



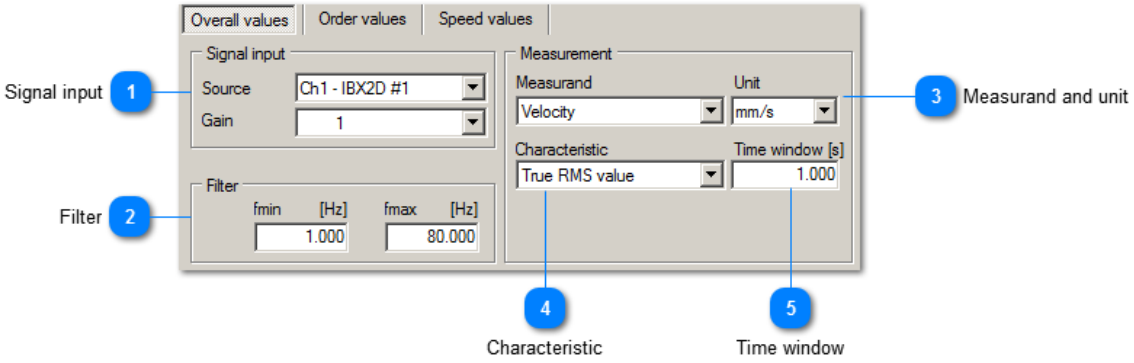
The selectable characteristics are arranged in the following groups:

Overall values	Vibration signals with high pass and low pass filtering and peak or RMS detection
Order values	Vibration signals with narrow-band filtering and peak or RMS detection
Speed values	Signals from the digital inputs of the InnoBeamer.

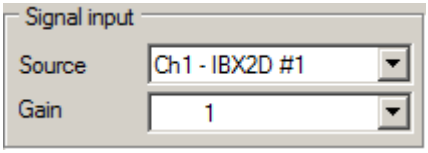
Changing a characteristic results in a restart of measurement.

Overall values

For overall vibration values the InnoPlotter measures analog input signals from the InnoBeamer devices.

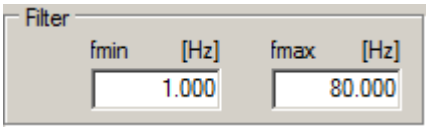


1 Signal input



Selects the physical input and the gain of the USB device InnoBeamer.

2 Filter

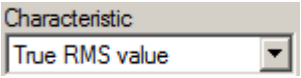


Here you adjust the frequency range of the displayed value fmin to fmax.

3 Measurand and unit

The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration (InnoPlotter Pro only).

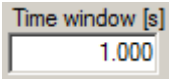
4 Characteristic



The following options are available:

4 peak values:	Positive, negative, absolute, peak-to-peak
True RMS:	Root mean square value
Main frequency:	Frequency with the highest magnitude
THD	Total harmonic distortion, deviation from pure sine-wave
Crest factor:	Ratio of absolute peak and RMS

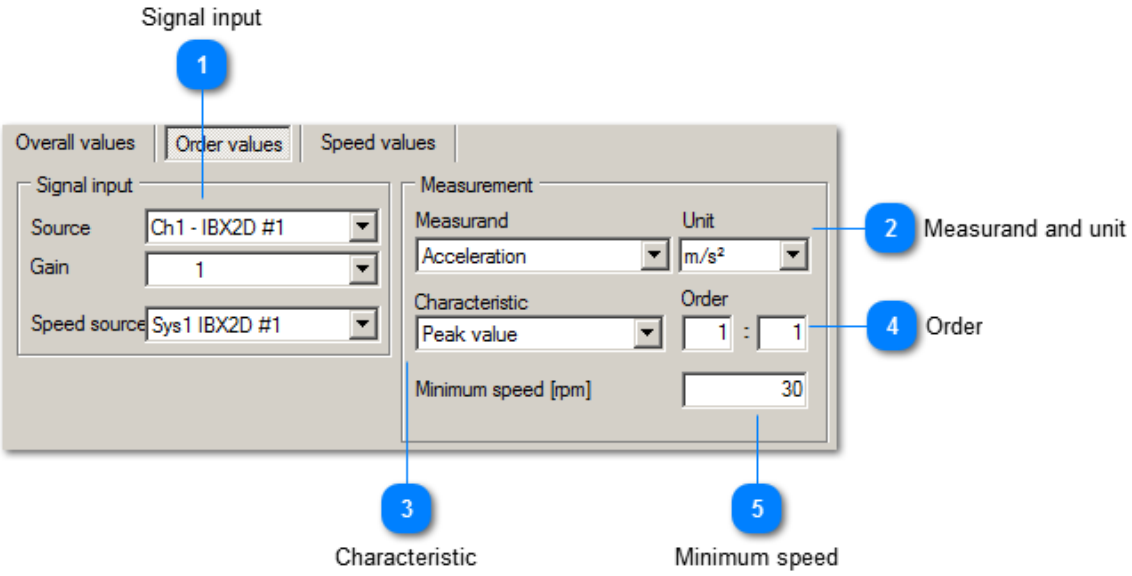
5 Time window



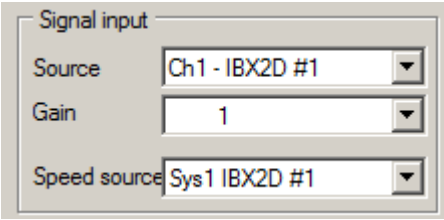
Time interval for calculating the characteristic value.

Order values

Order values are frequency-selective vibration values. The frequency of the bandpass filter is measured at the digital input of an InnoBeamer. The bandpass filter can also be set at multiples or fractions (orders) of this frequency.



1 Signal input

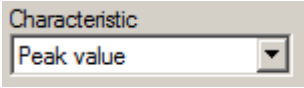


Selects the physical input and the gain of the USB device InnoBeamer for the analog signal and the digital input for frequency measurement.

2 Measurand and unit

The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration (InnoPlotter Pro only).

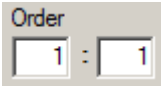
3 Characteristic



After passing the bandpass filters a sine-wave signal will remain. The following characteristics can be measured to characterize it:

Peak value	Magnitude
RMS	Root mean square value
Phase angle	Phase shift between the sine-wave magnitude and the low-high slope of the digital rpm signal

4 Order

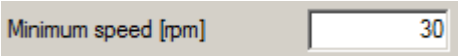


Selects multiples or fractions of the rotation frequency for bandpass filtering.

Examples:

Rotation frequency	1 : 1
Triple rotation frequency	3 : 1
Half rotation frequency	1 : 2
13/5 rotation frequency	13 : 5

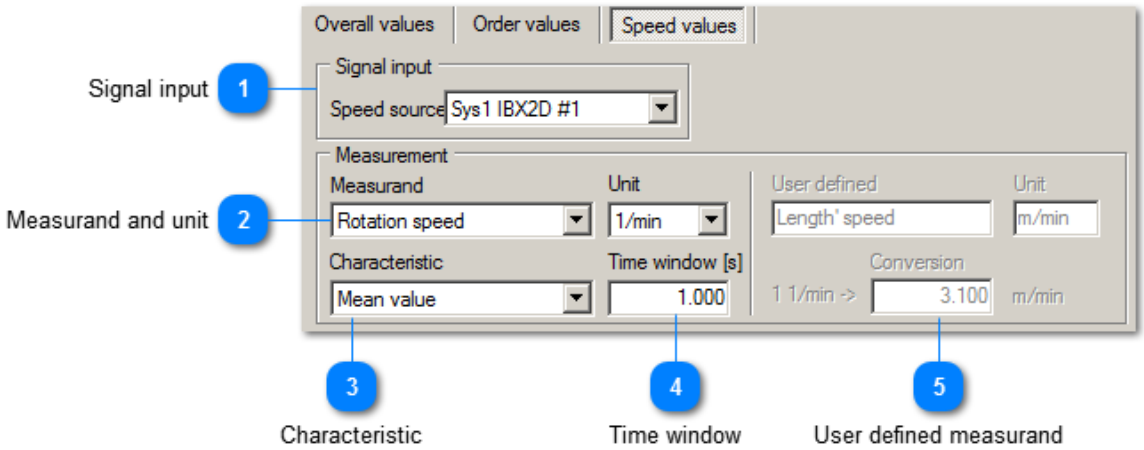
5 Minimum speed



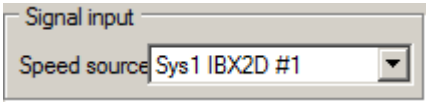
The InnoBeamers X2 and LX2 are capable of detecting down to 6 1/min. However, it may take up to 10 seconds to detect standstill. To shorten this detection time you may increase the minimum speed value. For example at 30 1/min detection will be finished after 2 second. Frequencies below 30 1/min will then be suppressed.

Speed values

Speed values are measured at the digital inputs of the InnoBeamer devices.



1 Signal input



Selects the digital input

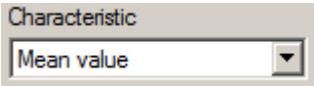
2 Measurand and unit

Choose between:

Rotation speed:	Shows the rotation frequency with the selected unit.
User measurand:	See User defined measurand.

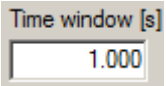
Available units are: Hz, 1/s, 1/min, 1/h

3 Characteristic



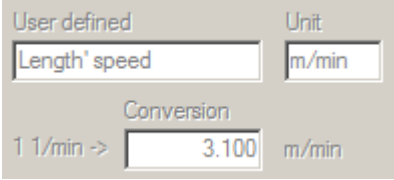
The only option is mean value.

4 Time window



Time window for calculating the mean value. Down to 0.1 Hz can be measured which requires 10 s measuring time.

5 User defined measurand



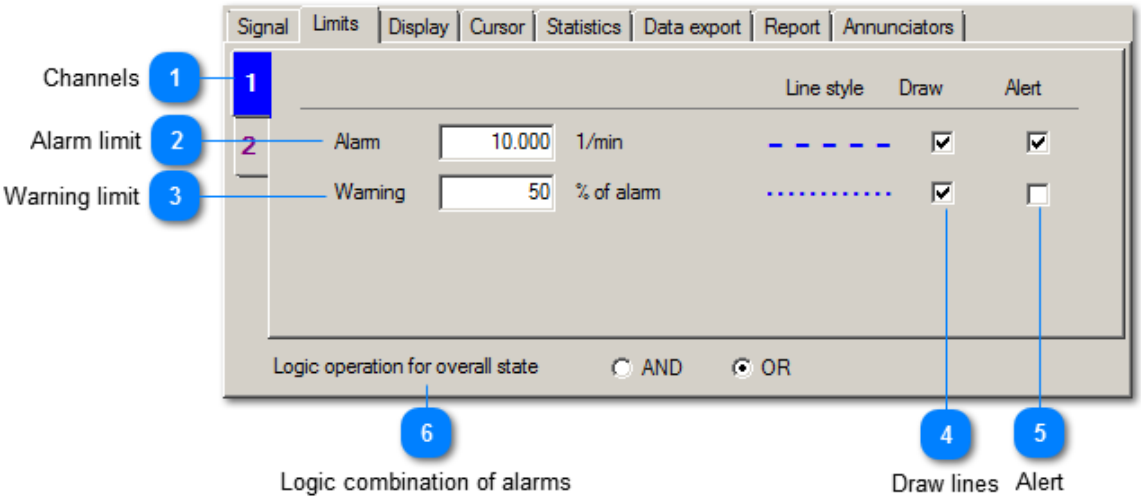
By multiplication with a factor the frequency signal can be transformed into another quantity, for example a track speed.

After selecting User measurand in the Measurand menu you may enter:

User defined	the name of your measurand.
Unit	measuring unit
1 1/min ->	conversion factor

Limits

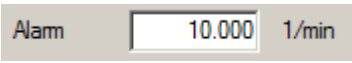
The measurand can be compared with warning and alarm limits. These limits can be displayed as lines in the diagram.



1 Channels

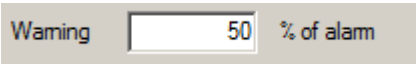
All settings can be entered independently for each channel. The number of tabs depends on the number of active channels.

2 Alarm limit



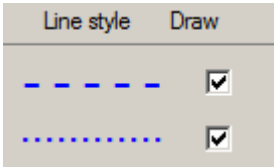
The alarm limit is entered in measuring units according to the channel settings.

3 Warning limit



The warning limit is entered in percent of the alarm limit.

4 Draw lines



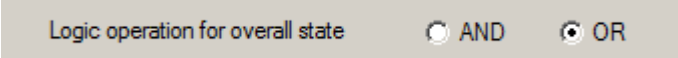
If the checkboxes are activated the alarm limits will be drawn as lines in the diagram.

5 Alert

When the measuring signal crosses a limit line the InnoPlotter can perform the following actions:

- Saving the measured data on disk
- controlling external alarm devices

6 Logic combination of alarms

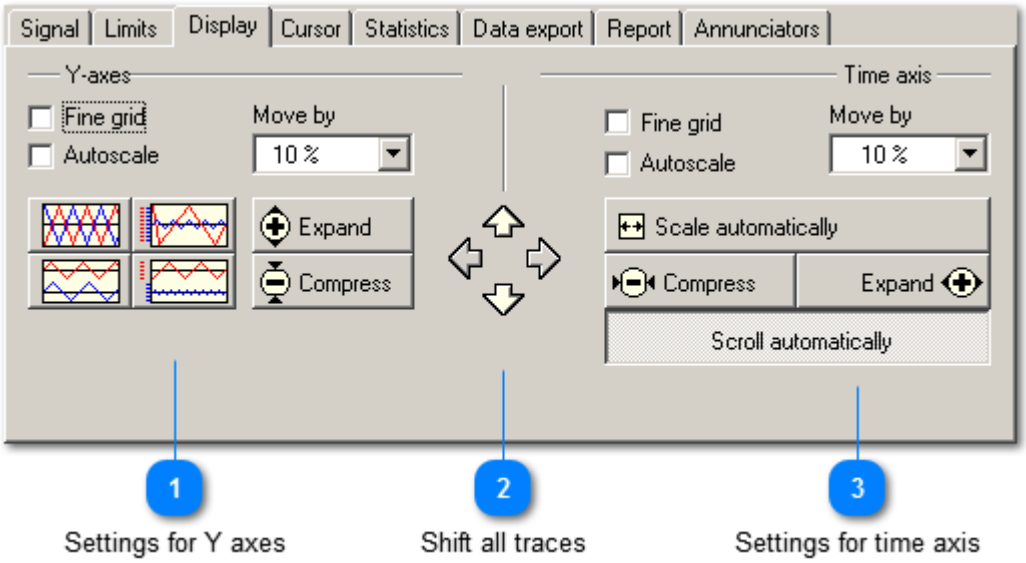


Each channel may have the following conditions:

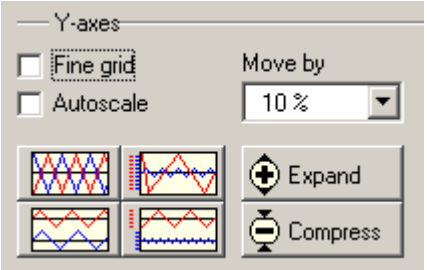
- below warning limit: OK
- above warning limit: Warning
- above alarm limit: Alarm

These channel status conditions can be combined to an overall status (channel O) by means of logic operations.

Display of traces

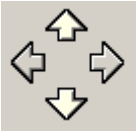


1 Settings for Y axes



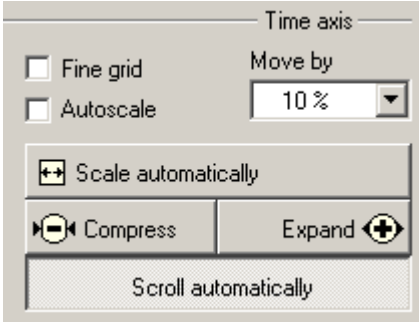
These settings change vertical scaling and arrangement of traces in the diagram.

2 Shift all traces



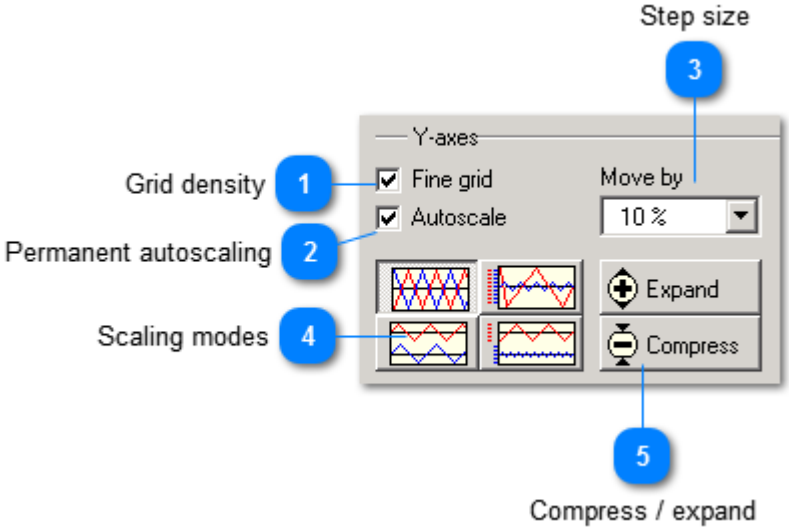
Shifts all traces together into the desired direction.

3 Settings for time axis



These settings change horizontal scaling and scrolling of traces in the diagram.

Y axis settings



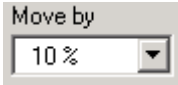
1 Grid density

If you activate this checkbox, the InnoPlotter will show grid lines at all graduation marks of the Y-axis.

2 Permanent autoscaling

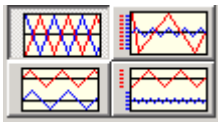
Rescales the diagram after each update with the last scaling mode.

3 Step size



The step width in percent of full scale length for shifting the signal trace.

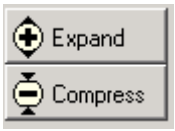
4 Scaling modes



There are four scale modes:

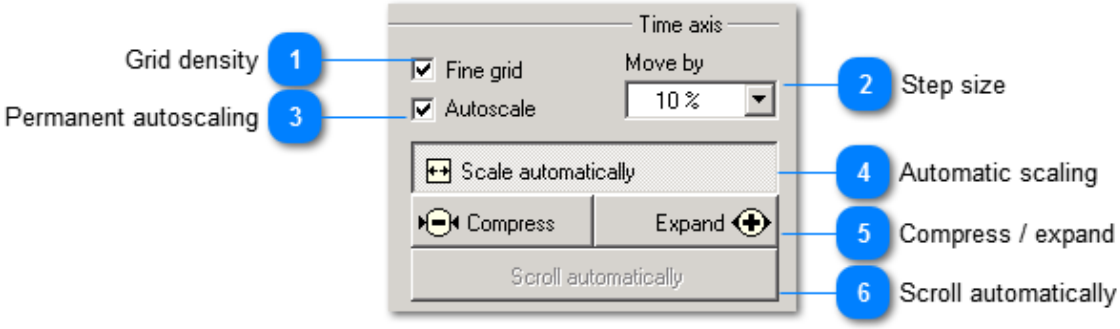
- All curves are maximized.
- Same scale for all curves.
- All curves are maximized and stacked with their own area.
- All curves use the same scale, they are stacked with their own area.

5 Compress / expand



These buttons expand or compress all traces in Y direction.

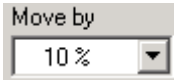
Time axis settings



1 Grid density

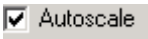
If you activate this checkbox, the InnoPlotter will show grid lines at all graduation marks of the Y axis.

2 Step size



The step size (shown in scale lengths) by which measurement curves and scale are shifted during a movement. For instance, 10% means that the measurement curves are moved by 1/10 of the frequency axis.

3 Permanent autoscaling



Scales the trace always in a way that always the complete measuring time will be visible.

4 Automatic scaling

Scales the trace once in a way that the complete measuring time is visible.

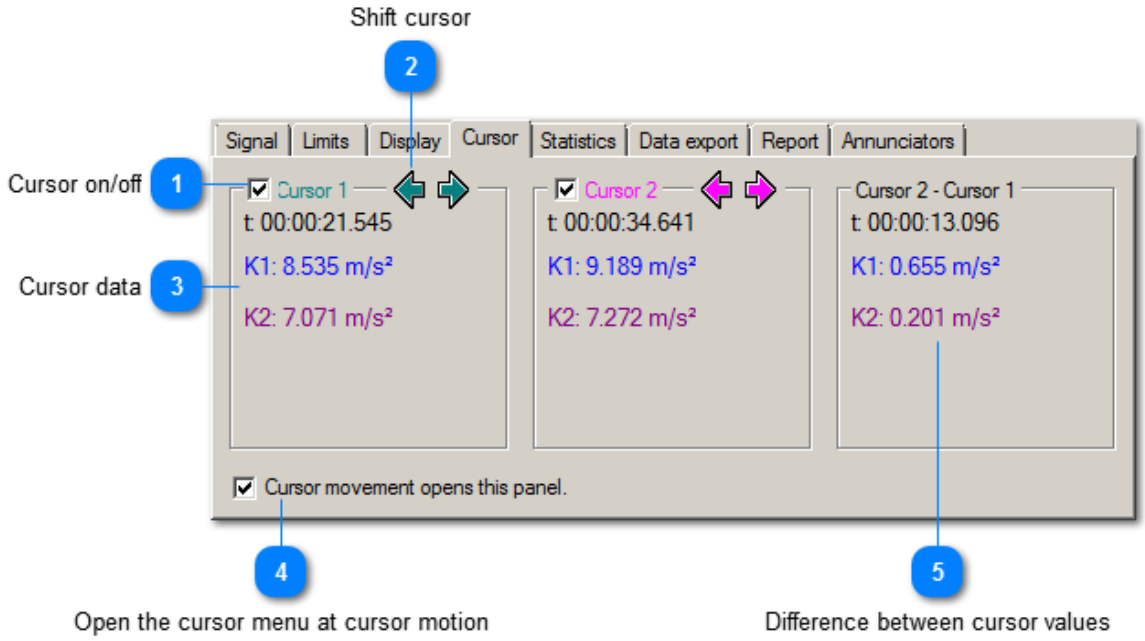
5 Compress / expand

These buttons expand or compress all measurement curves in time direction.

6 Scroll automatically

Shifts the curve left if it reaches the right edge so that always the current value will be shown.

Cursors

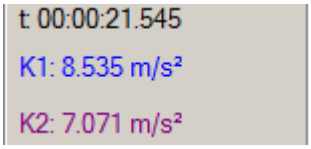


1 Cursor on/off

2 Shift cursor

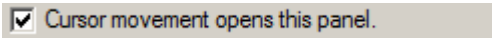
Shift the cursor in the direction of the time axis. Shifting is also possible by dragging the cursor line directly.

3 Cursor data



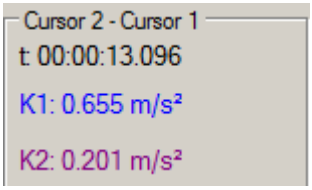
Cursor time position and measuring value for each trace at this moment.

4 Open the cursor menu at cursor motion



When this option is selected the cursor tab will open automatically when the position of the cursor line is moved by the mouse.

5 Difference between cursor values



Shows the difference of magnitude and time between the two cursors.

Statistics

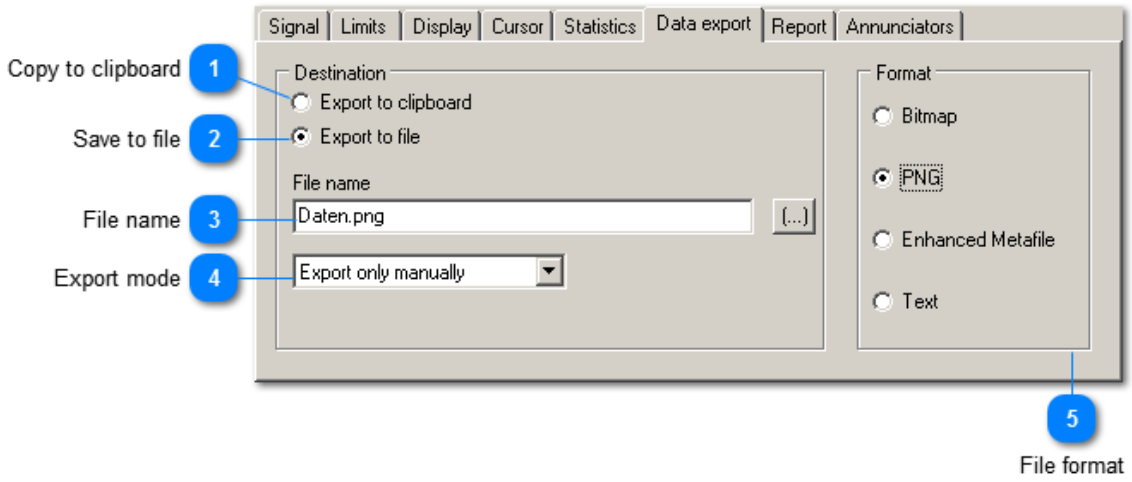
Shows statistic parameters for the currently displayed time section.

Signal | Limits | Display | Cursor | Statistics | Data export | Report | Annunciators

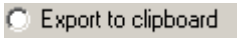
	Ch1 - IBX2D #1	Ch2 - IBX2D #1
	mm/s	km/h
Maximum	31.281	76.347
Mean value	10.190	50.338
Minimum	0.154	0.000

Data export

These settings control the action after clicking the copy / save button.



1 Copy to clipboard



Selects the Copy function.

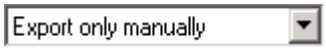
2 Save to file

Selects the Save function. In addition periodic saving can be activated.

3 File name

Enter the name of the file to be saved. The file name may include variables, like date, time, channel etc.

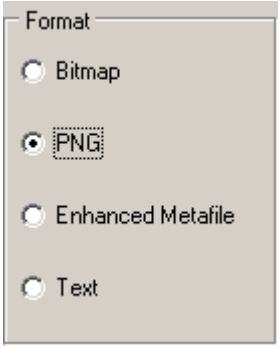
4 Export mode



The following modes are available:

- Export only manually — Data is only saved when clicking the Save button
- Export periodically — Data is saved in time intervals. In addition manual saving is possible.
- Export event controlled — Data is saved when a trace crosses a limit line. In addition manual saving is possible.

5 File format

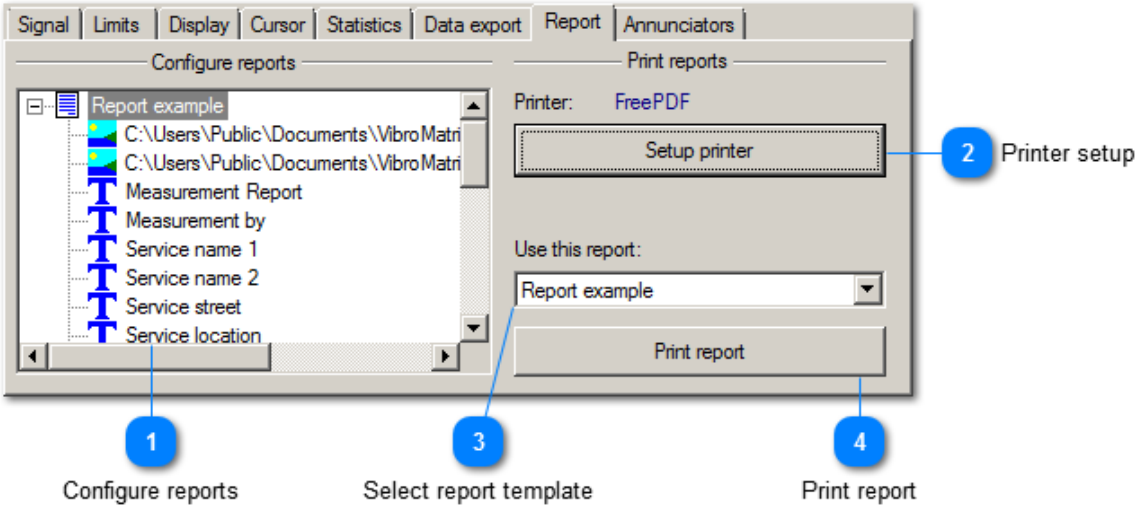


The following formats can be chosen for the export file

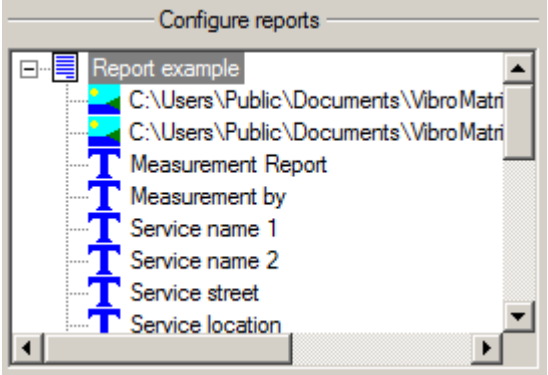
- Bitmap — raster graphics file format
- PNG — raster graphics file format, less than 10 % of bitmap file size without loss of quality
- Enhanced Metafile — Windows enhanced metafile format, allow later changes of characters
- Text — data is saved in a text table format including header which allows later processing by table calculation software

Report

Here the settings are made for printing reports including text information, diagrams, logos etc. After designing the report layout you may save these settings.



1 Configure reports



In this tree view you find the available report templates. Some sample reports are provided. You may adapt them to your needs.

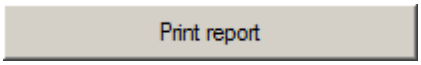
2 Printer setup

Opens the printer configuration menu.

3 Select report template

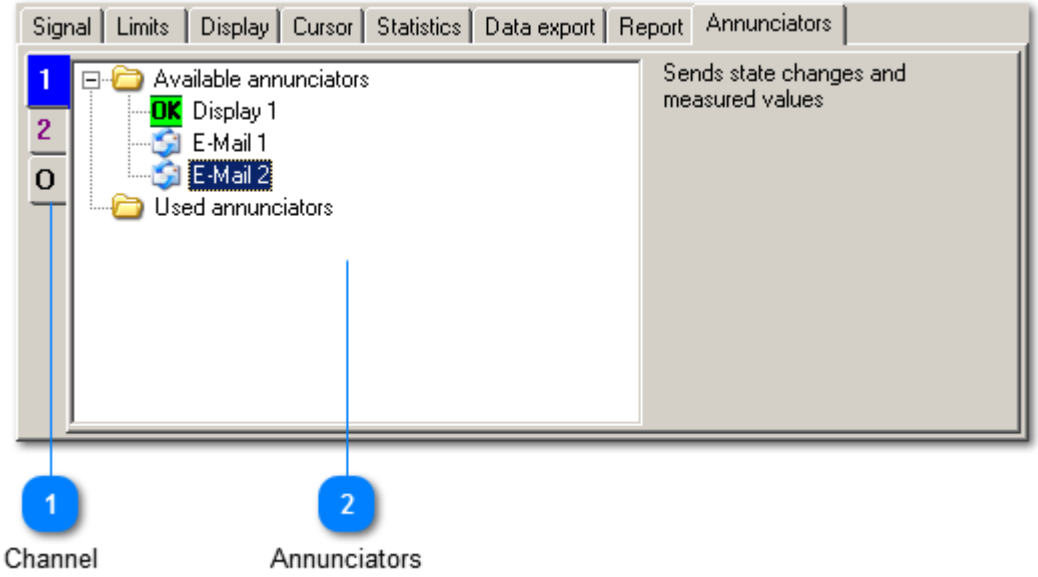
You can select one of the report templates for printing.

4 Print report



Annunciators

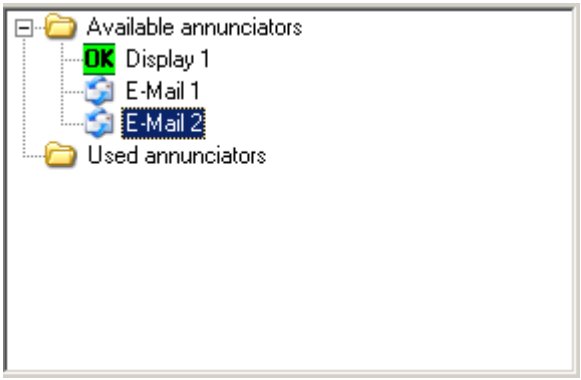
VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.



1 Channel

For each channel the annunciators can be assigned separately. For logic combinations of channel events use channel O.

2 Annunciators



Shows a list of available and used annunciators.

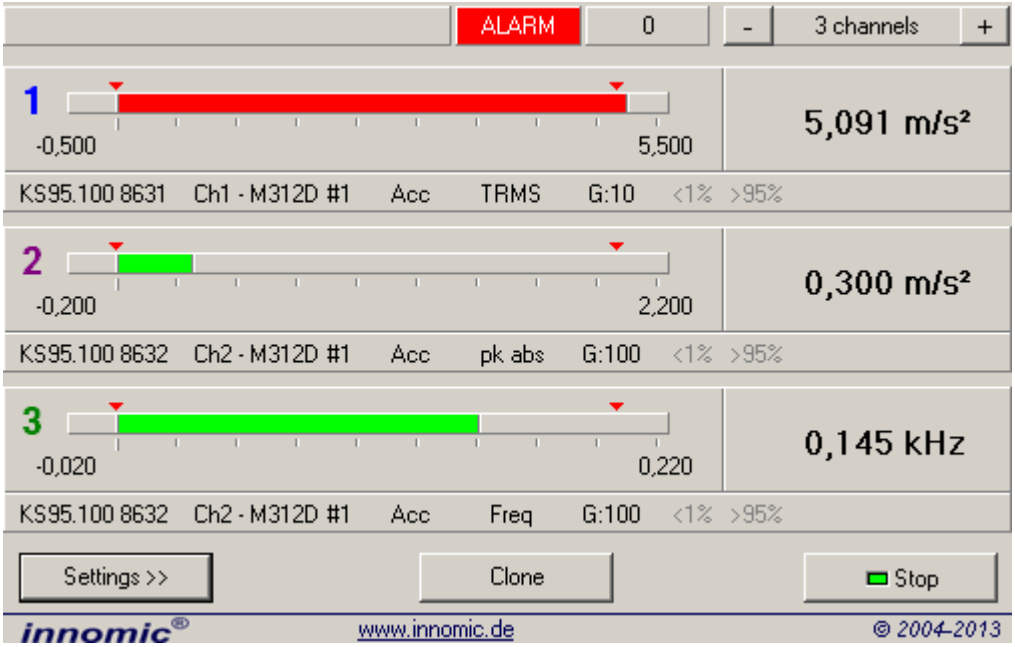
InnoLogger® (Pro)

The InnoLogger measures and records characteristics of

- alternating quantities, like vibration acceleration, velocity and displacement
- frequency selective quantities, like phase and magnitude of acceleration
- digital signals, like rotation speed and frequency

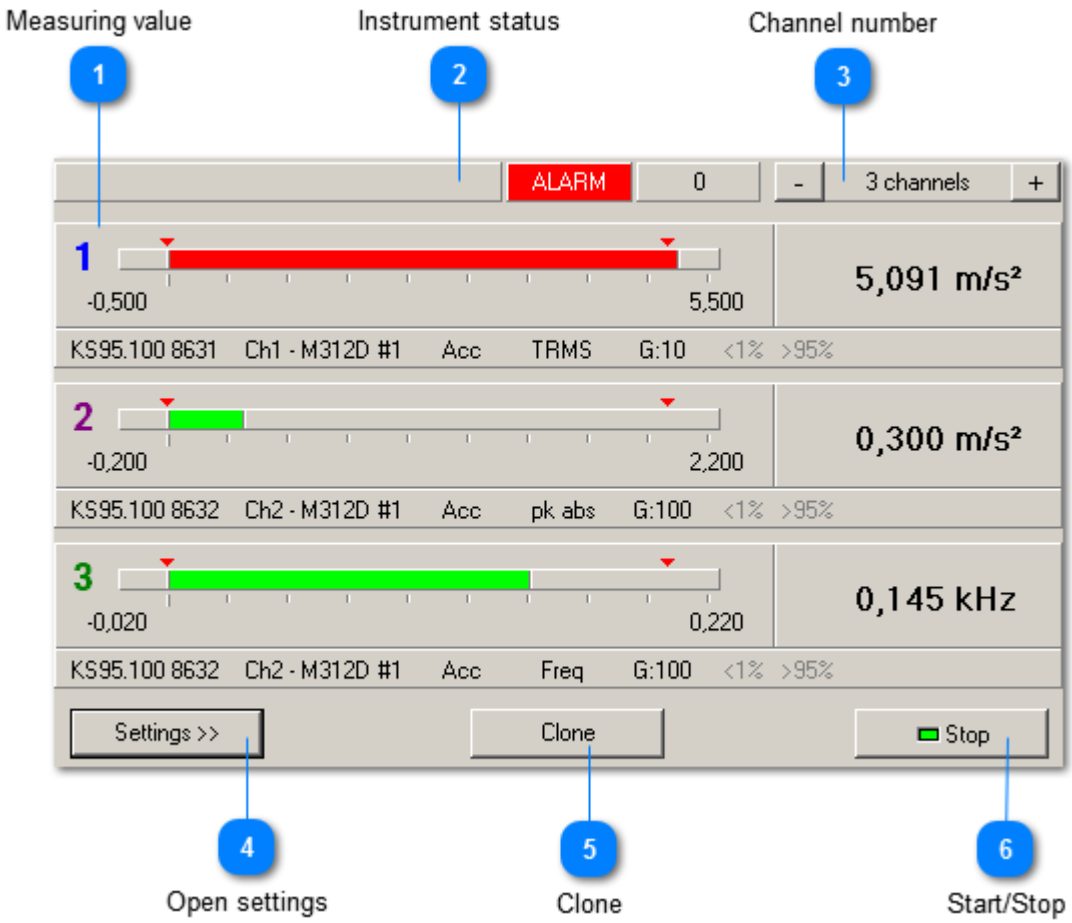
In addition it records real-time signals for later processing by other software.
Recorded data is saved in a file.
The current measuring value is shown as bar graph and number.

Recording is triggered when the measurand exceeds the entered limit value.

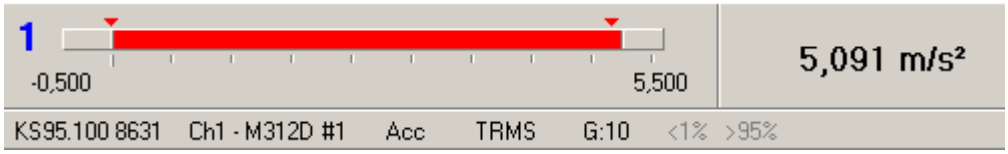


Display area

This section shows the most important status and signal data.



1 Measuring value



The InnoLogger displays the measuring value and status information for each channel. The channel number can be found on the left side. There is a bar graph and a number display for the measuring value.
Below is a status bar giving information about

- connected sensor
- used input channel
- selected measurand
- selected characteristic
- gain, underload and overload.

2 Instrument status

If pre-trigger memory is filling with data a bar graph will indicate the fill level. The colored indicator in the middle shows the instrument status:

OK	No limit value exceeded
TRIG	Limit value exceeded but alarm delay not yet elapsed
ALARM	Limit value exceeded and alarm delay elapsed

The field on the right side indicates the number of records.

3 Channel number

Increase or decrease the number of measuring channels (and curves). One to four channels are possible.

4 Open settings

Opens and closes the setup menu.

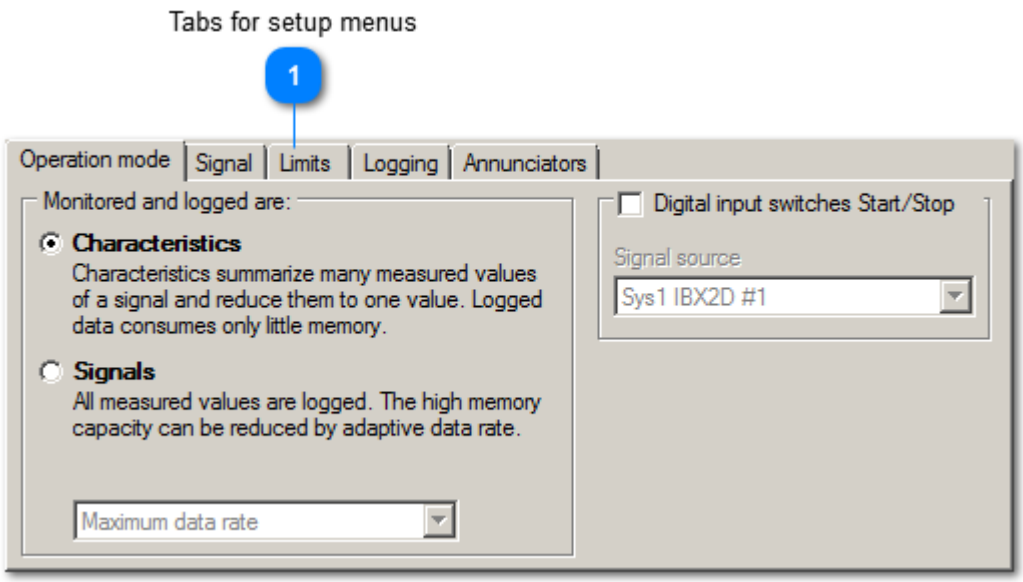
5 Clone

Opens a new window with the same settings which can be modified.

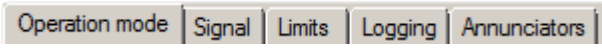
6 Start/Stop

Starts and stops measurement. When stopping the measurement during a recording, the current log file is deleted. Therefore, it is recommended to arrange several short recordings instead of one long recording.

Setup area

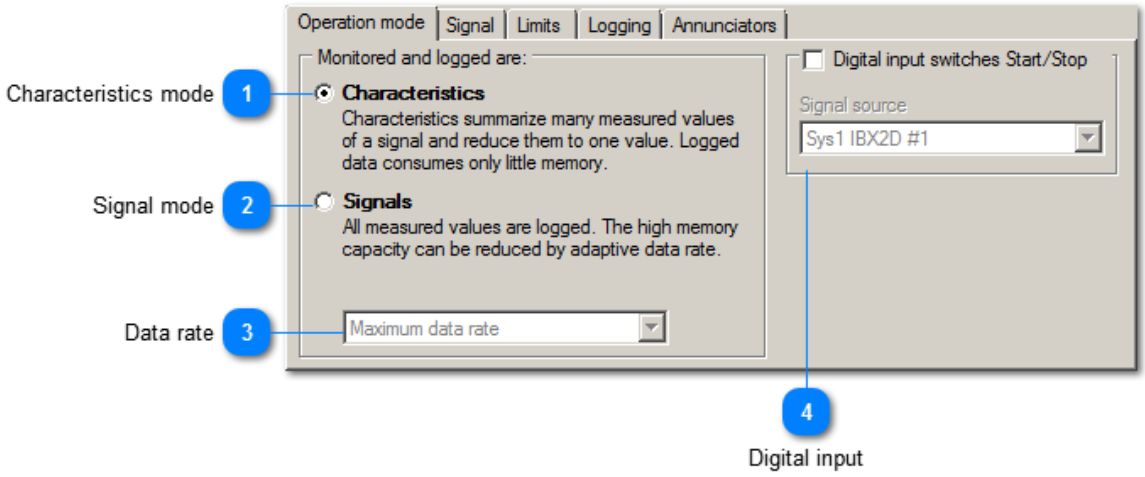


1 Tabs for setup menus

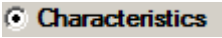


Operation mode	Choose between characteristics or signals
Signal	Signal settings
Limits	Limit values for recording
Logging	Settings for record length and stop conditions
Annunciators	Settings for external alarm devices

Operation mode



1 Characteristics mode



Records compressed values like RMS or peak.

2 Signal mode

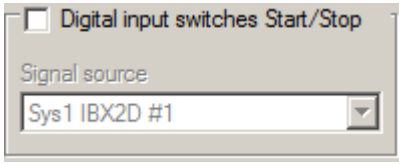
Records real-time signals with the chosen data rate. Since these values may be very fluctuating the bar graph will show only the highest magnitude with the respective sign.

3 Data rate

In Signal mode you can decide whether the signals are recorded with maximum or with adaptive data rate.

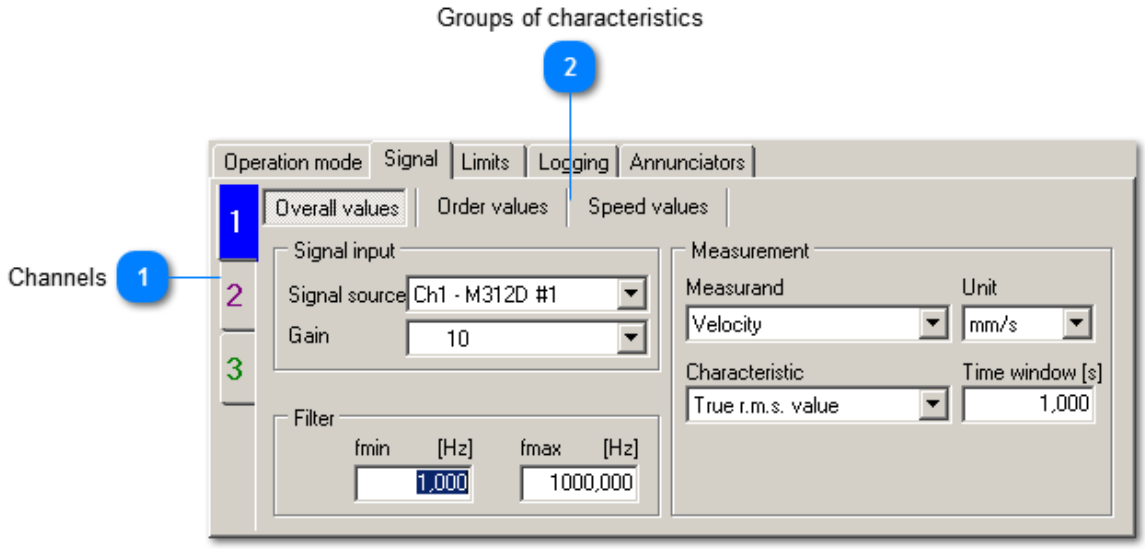
Maximum data rate	The full sampling rate of the InnoBeamer will be used for recording: • 10 kHz for InnoBeamer L2 • 8 kHz for InnoBeamer LX2 • 96 kHz for InnoBeamer X2
Adaptive data rate	The recording data rate is set according to the used low pass filters. The sampling rate will be sufficiently high to meet the Nyquist criterion. Example: All channels use a 10 Hz low pass. It is not necessary to sample with the full rate of 96 000 Hz. The sampling rate can be reduced to < 1000 Hz which will reduce the amount of data by 99 % without loss of information.

4 Digital input



For automated test systems it can be advantageous to control the InnoLogger by an external trigger, which is a digital input of the InnoBeamer devices. The InnoLogger starts when logic high level is detected and stops at low level.

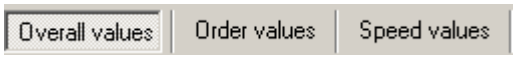
Signal



1 Channels

All settings can be entered independently for each channel. Different parameters, like vibration and frequency can be mixed in one diagram. The number of tabs depends on the number of active channels.

2 Groups of characteristics

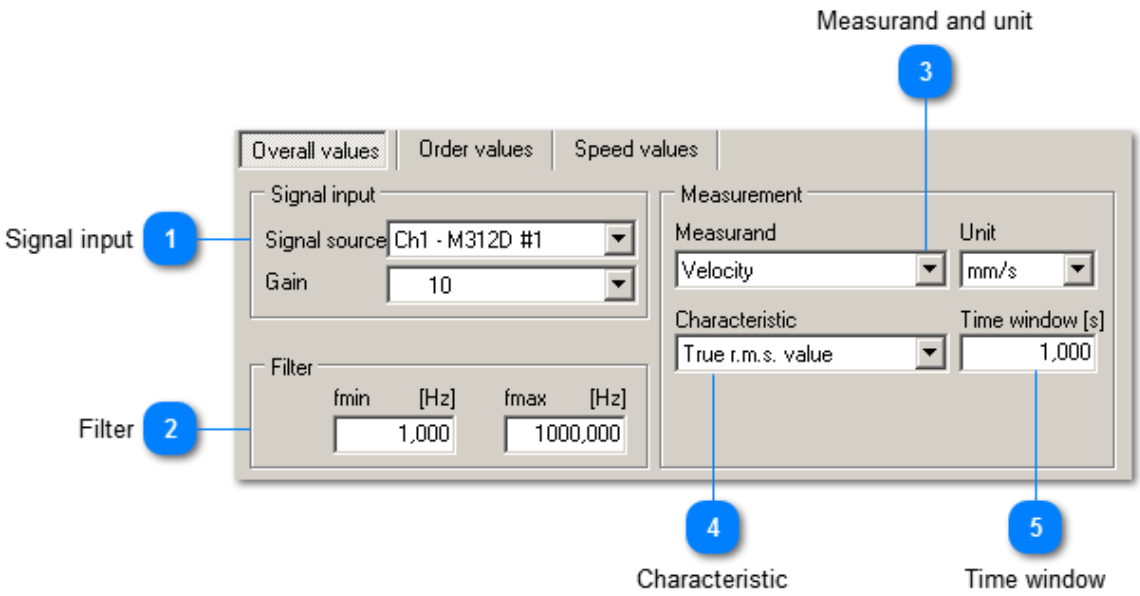


The selectable characteristics are arranged in the following groups:

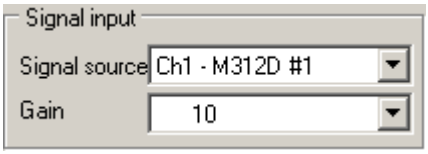
Overall values	Vibration signals with high pass and low pass filtering and peak or RMS detection
Order values	Vibration signals with narrow-band filtering and peak or RMS detection
Speed values	Signals from the digital inputs of the InnoBeamer.

Overall values

For overall vibration values the InnoPlotter measures analog input signals from the InnoBeamer devices.

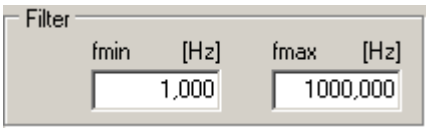


1 Signal input



Selects the physical input and the gain of the USB device InnoBeamer.

2 Filter

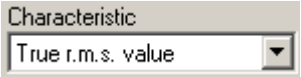


Here you adjust the frequency range of the displayed value fmin to fmax.

3 Measurand and unit

The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration (InnoLogger Pro only).
The unit should be selected in a way that the measuring value does not drop below 0.001 permanently.

4 Characteristic



The following options are available:

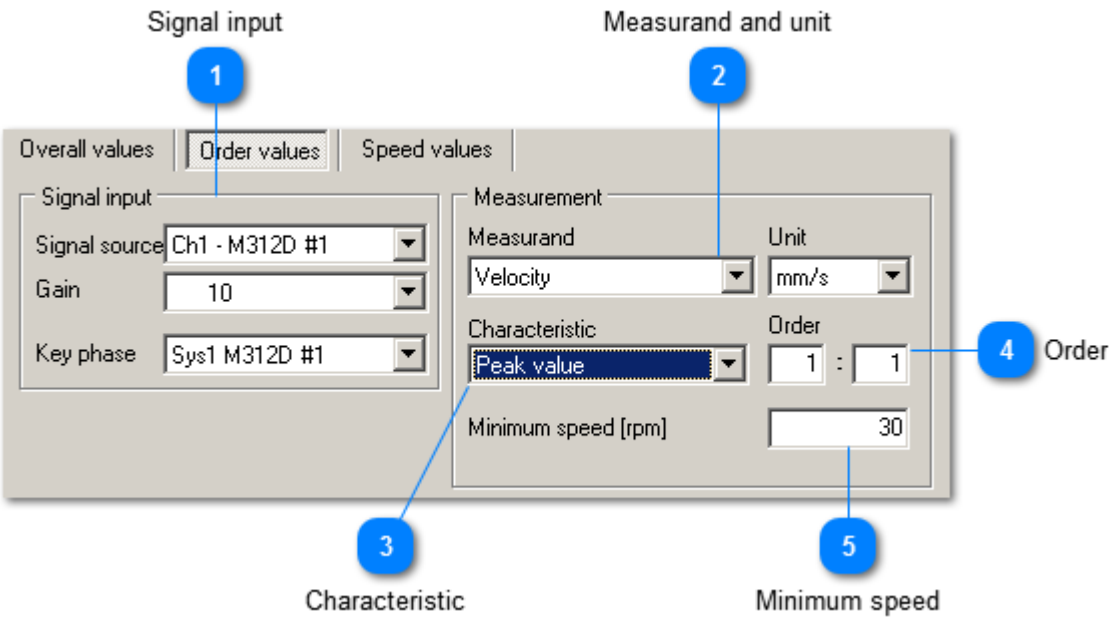
4 peak values:	Positive, negative, absolute, peak-to-peak
True RMS:	Root mean square value
Main frequency:	Frequency with the highest magnitude
THD:	Total harmonic distortion, deviation from pure sine-wave
Crest factor:	Ratio of absolute peak and RMS

5 Time window

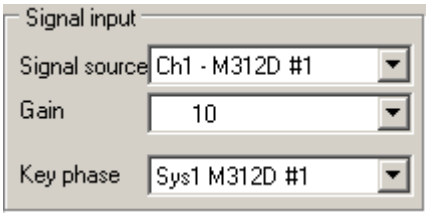
Time interval for calculating the characteristic value.

Order values

Order values are frequency-selective vibration values. The frequency of the bandpass filter is measured at the digital input of an InnoBeamer. The bandpass filter can also be set at multiples or fractions (orders) of this frequency.



1 Signal input



Selects the physical input and the gain of the USB device InnoBeamer for the analog signal and the digital input for frequency measurement.

2 Measurand and unit

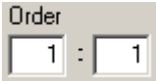
The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration (InnoLogger Pro only).

3 Characteristic

After passing the bandpass filters a sine-wave signal will remain. The following characteristics can be measured to characterize it:

Peak value	Magnitude
RMS	Root mean square value
Phase angle	Phase shift between the sine-wave magnitude and the low-high slope of the digital rpm signal

4 Order



Selects multiples or fractions of the rotation frequency for bandpass filtering.

Examples:

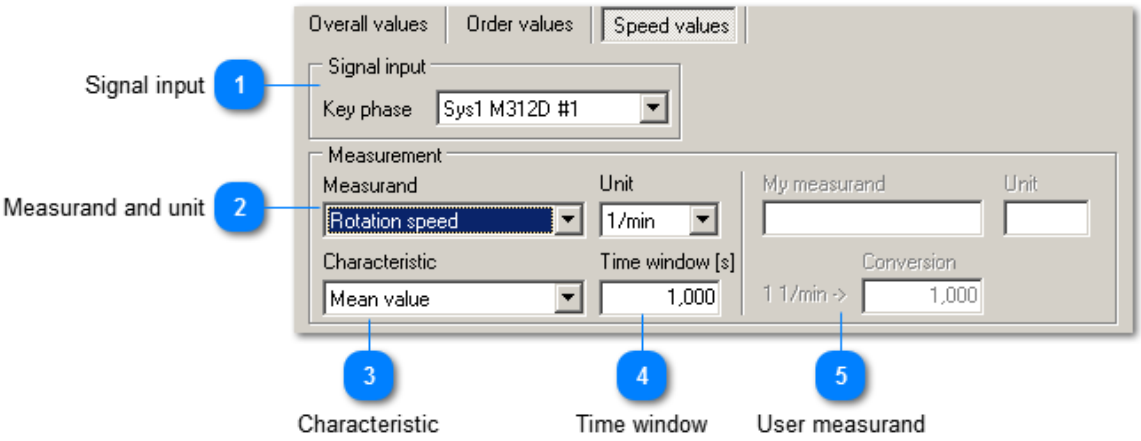
Rotation frequency	1 : 1
Triple rotation frequency	3 : 1
Half rotation frequency	1 : 2
13/5 rotation frequency	13 : 5

5 Minimum speed

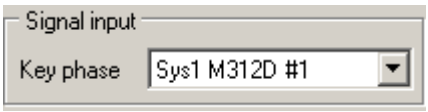
The InnoBeamers X2 and LX2 are capable of detecting down to 6 1/min. However, it may take up to 10 seconds to detect standstill. To shorten this detection time you may increase the minimum speed value. For example at 30 1/min detection will be finished after 2 second. Frequencies below 30 1/min will then be suppressed.

Speed values

Speed values are measured at the digital input of the InnoBeamer.



1 Signal input



Selects the digital input

2 Measurand and unit

Choose between:

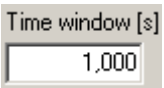
Rotation speed:	Shows the rotation frequency with the selected unit.
User measurand:	See User defined.

Available units are: Hz, 1/s, 1/min, 1/h

3 Characteristic

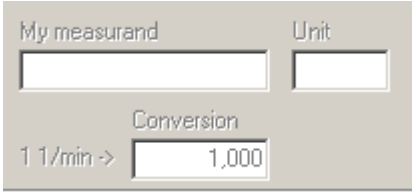
The only option is mean value.

4 Time window



Time window for calculating the mean value. Down to 0.1 Hz can be measured which requires 10 s measuring time.

5 User measurand



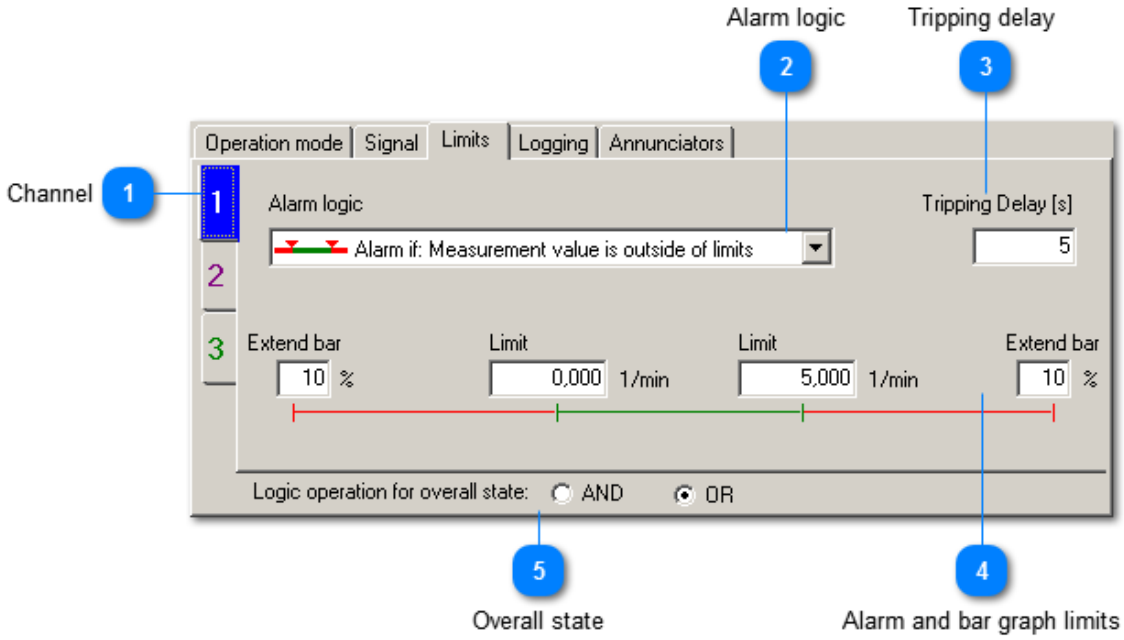
By multiplication with a factor the frequency signal can be transformed into another quantity, for example a track speed.

After selecting User measurand in the Measurand menu you may enter:

User defined	the name of your measurand.
Unit	measuring unit
1 1/min ->	conversion factor

Limits

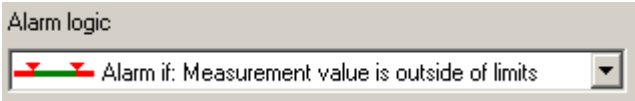
Recording is triggered when a limit was exceeded. The limits can be entered for each channel separately.



1 Channel

All settings can be entered independently for each channel. Different parameters, like vibration and frequency can be mixed in one diagram. The number of tabs depends on the number of active channels.

2 Alarm logic



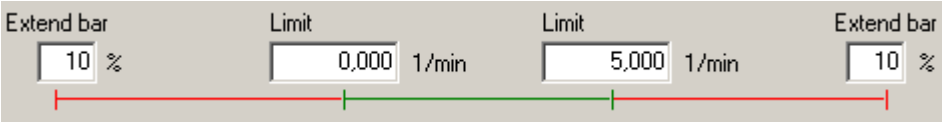
You may decide whether recording is triggered if

- the signal is inside the limits
- the signal is outside the limits

3 Tripping delay

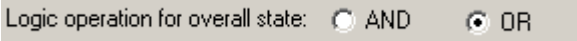
If short signal peeks shall not start a recording you may enter here a minimum duration. The alarm condition must persist during this time before recording is triggered.

4 Alarm and bar graph limits



You can enter here a lower and an upper alarm limit. The limits are indicated by red markers above the bar graph. At the same time the alarm limits set the length of the bar graph. The length can be entered in percent above / below the alarm limit.

5 Overall state

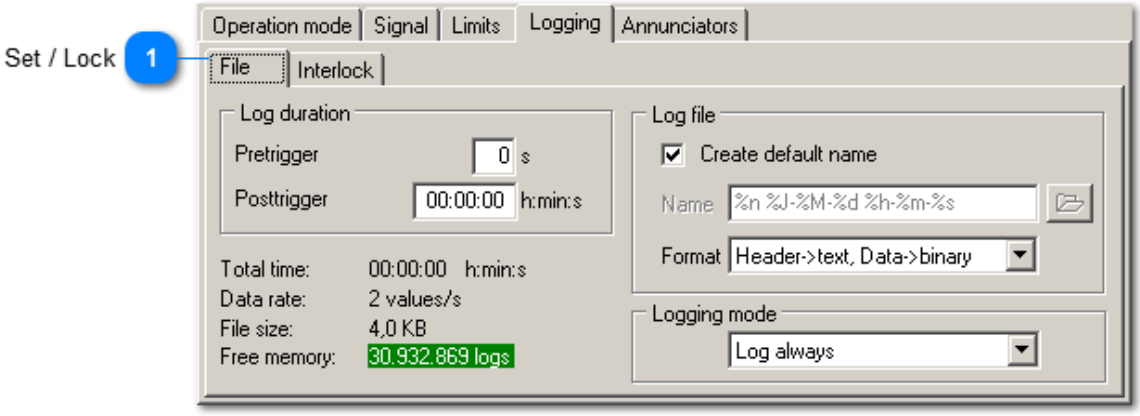


The individual alarm settings of each channel determine whether an alarm event is detected. After the tripping delay is over the alarm will be set. In overall state you may select whether a single channel alarm or all alarms need to be set in order to trigger recording:

- AND: all channels need to be in alarm condition to trigger recording
- OR: recording is triggered by an alarm condition at any channel

Logging (Recording)

These settings control how measuring data is saved on hard disk.

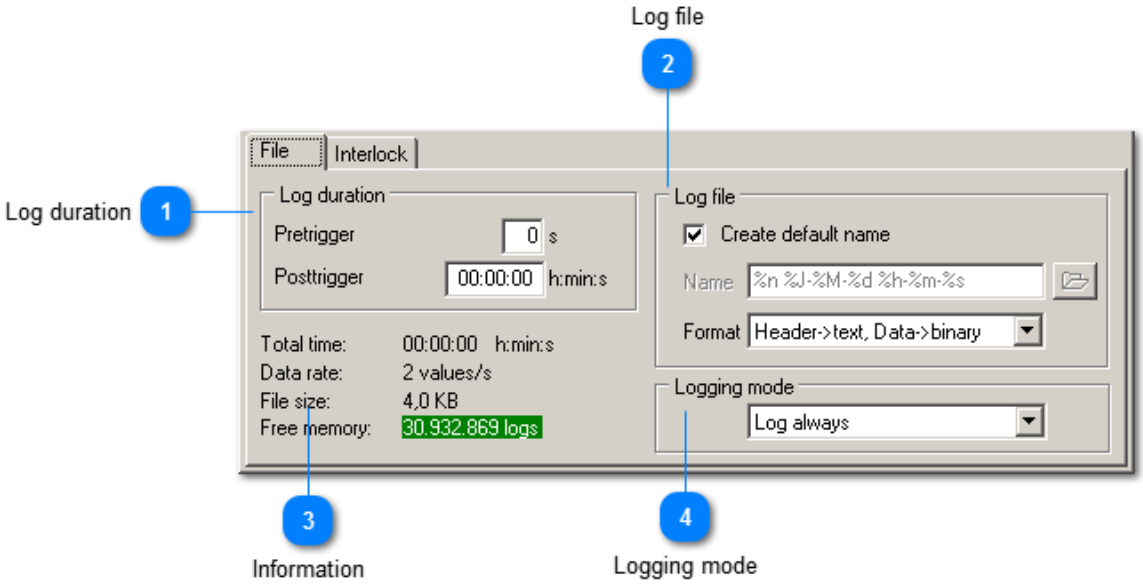


1 Set / Lock

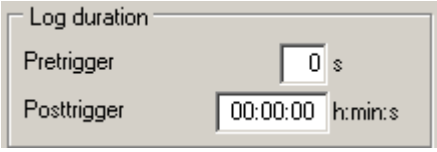
These tabs provide settings for

- Recording
- Criteria for stopping the InnoLogger

File settings

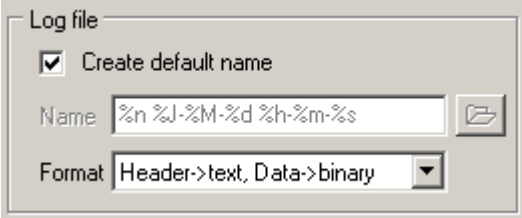


1 Log duration



Pretrigger allows to record signals that occur before the actual trigger event. It can be up to 30 seconds.
Posttrigger sets the duration of recording after the trigger event. Maximum value is 24 hours.

2 Log file



Here you enter file name, folder and file type.
The option *Create default name* automatically generates a file name as follows: year-month-day-hour-minute-second InnoLogger ID. The default folder is <your VibroMatrix folder>\Data\InnoBeamer serial number.
Alternatively you can enter your own file name, including variables.

These are the available file formats:

Header>text, Data->binary	A single file is generated with header data in text format and recording data in binary format.
Header->text, Data->text	Both header and data are saved in text format in a single file.
1: Header->text, 2: Data->binary	Two files are generated, one containing the header data as text, the other containing binary data.

Header example:

`Version=1.8`
InnoLogger version number

`Pretrigger=5`
Pretrigger time in seconds

`Posttrigger=30`
Posttrigger time in seconds.

`SampleRate=10000`
SampleRate in samples per second

`NumChannels=3`
Number of active channels

Channel settings
Settings for channel 1, identified by ending "_1".

`InputID_1=K1 - IBL2 #1000`
channel number, device type and serial number

`InputName_1=Lager 12`
Channel name

`Sensor_1=KS80 3346`
Sensor name

`Measurand_1=0`
Index of the selected measurand in the menu, starting with 0

`MeasurandName_1=acceleration`
Measurand as text

`Unit_1=1`
Index of the selected unit in the menu, starting with 0

`UnitName_1=mm/s²`
Unit as text

`Parameter_1=5`
Index of the selected characteristic in the menu, starting with 0

`ParameterName_1=Echter Effektivvalue`
Characteristic as text

`fmin_1=0.3`
Lower filter frequency

`fmax_1=200`
Upper filter frequency

`LimitMax_1=75`
Upper alarm limit

`LimitMin_1=0`
Lower alarm limit

`UpperAdd_1=10`
Upper bar graph extension in percent

`LowerAdd_1=0`
Lower bar graph extension in percent

After channel 1 follow the settings of the other active channels (NumChannels), marked with "_2" etc.

Measuring data
These fields specify the data format:

`DataType=binary`
binary or text format

`DataStart=1024`
Byte position of the first data byte in binary mode, first text line in text mode

`DataSize=4`
Data type, 4 = 4 byte floating point numbers (float), 8 = 8 byte floating point numbers (double)
There is no DataSize in text format where the values are separated by line separators.

After this the actual data follows in the order of channels (example for 3 channels):
value 1, channel 1; value 1, channel 2; value 1, channel 3;
value 2, channel 1; value 2, channel 2; value 2, channel 3;
value 3, channel 1; value 3, channel 2; value 3, channel 3;
value 4, channel 1; value 4, channel 2; value 4, channel 3;
...
To program external software for the reading of data you need to check DataType to identify the type of data (binary / text). DataStart is used to set the pointer to the start position. DataSize determines the size (float/double). With this information reading can be performed. Header data, like MeasurandName and UnitName, can be used for diagram text etc. Time axis information is derived from SampleRate.
To calculate the amount of data, add Pretrigger and Posttrigger from the header and multiply by SampleRate and NumChannels.

3 Information

Total time:	00:00:00 h:min:s
Data rate:	2 values/s
File size:	4,0 KB
Free memory:	30.932.869 logs

Here you are informed about the expected file size. The colors mean:

Space left for more than 10 files

Space left for 1 to 10 files

Disk full

4 Logging mode

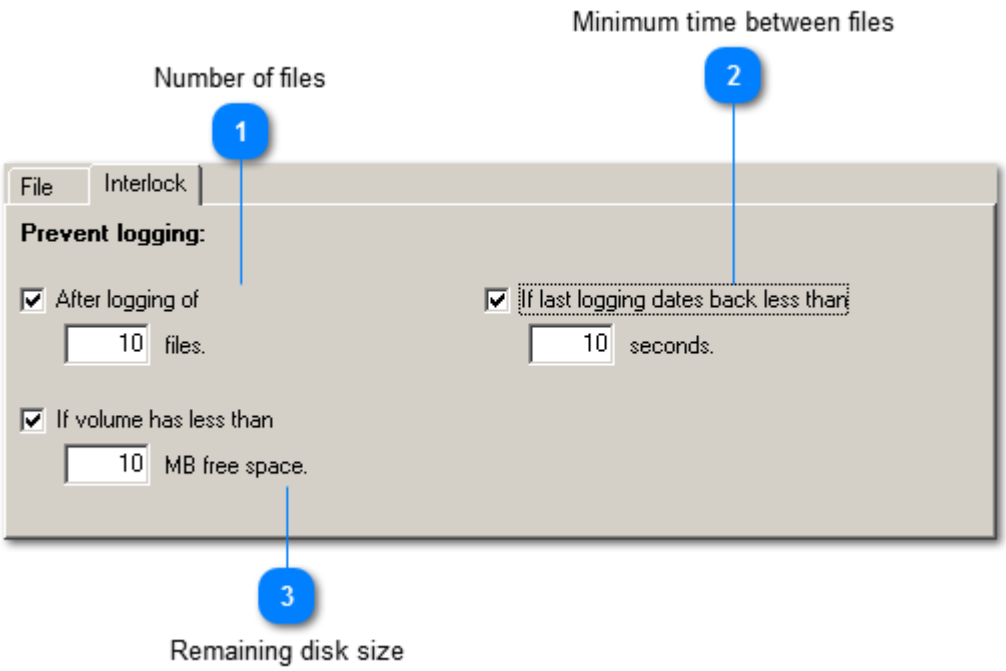
Logging mode

Log always

Usually recording will be triggered by an overall status event. Sometimes immediate recording after start is desired. This feature is often used in combination with external start.

Interlock

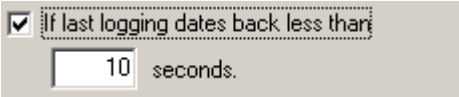
The InnoLogger is often used in remote places to capture unpredictable events. In this case it may be useful to determine when logging shall be stopped. Three criteria are selectable in any combination. Recording is stopped if any of the conditions is met.



1 Number of files

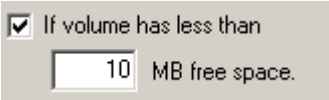
The InnoLogger stops after the specified number of files.

2 Minimum time between files



Sets the minimum time between two files.

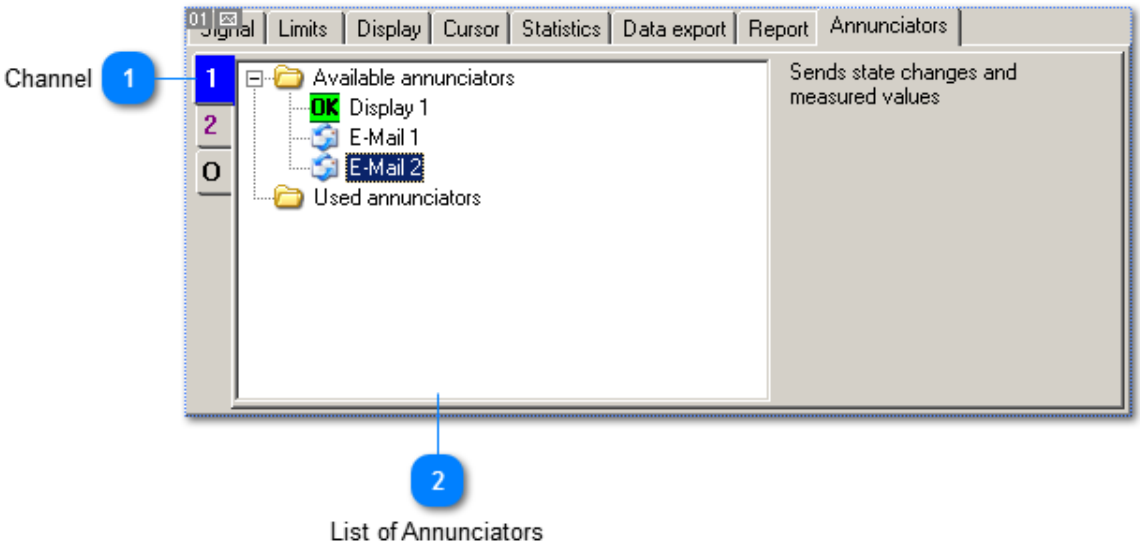
3 Remaining disk size



If the remaining disk space drops below the entered value the InnoLogger will be stopped.

Annunciators

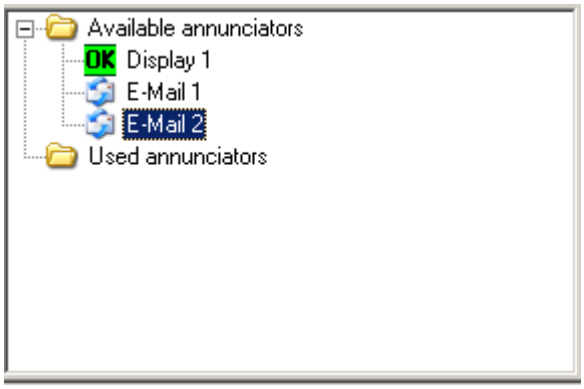
VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.



1 Channel

For each channel the annunciators can be assigned separately. For logic combinations of channel events use channel O.

2 List of Annunciators

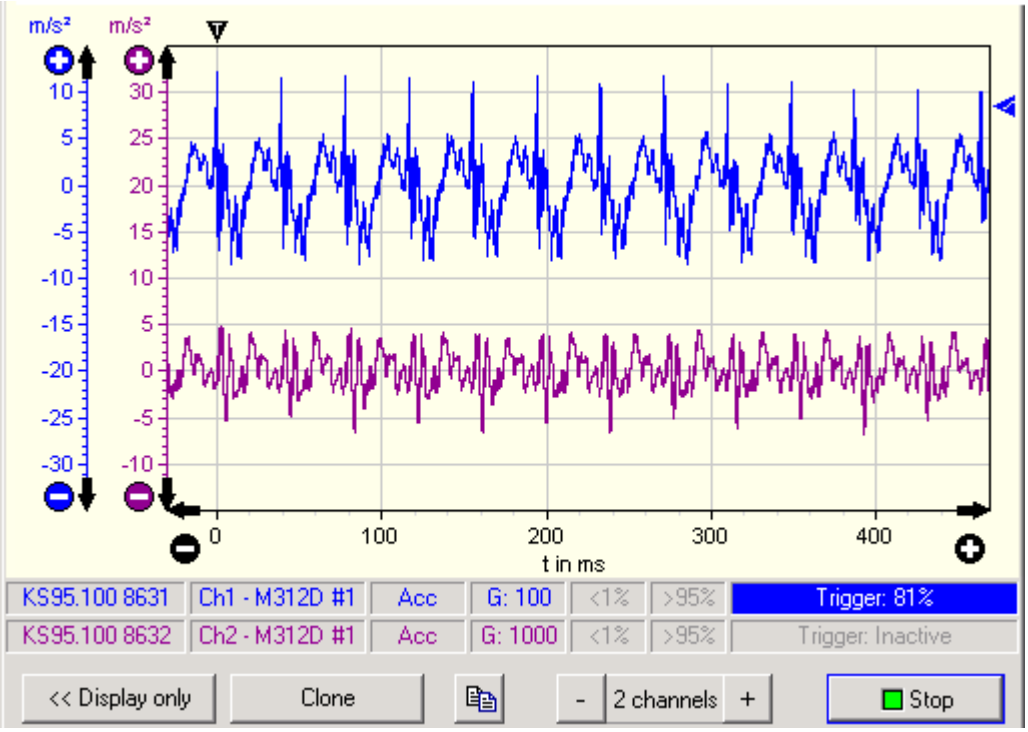


Shows a list of available and used annunciators.

InnoScope® (Pro)

The InnoScope is a versatile tool for the observation of vibration and shock transients in time domain. It can help to answer questions like

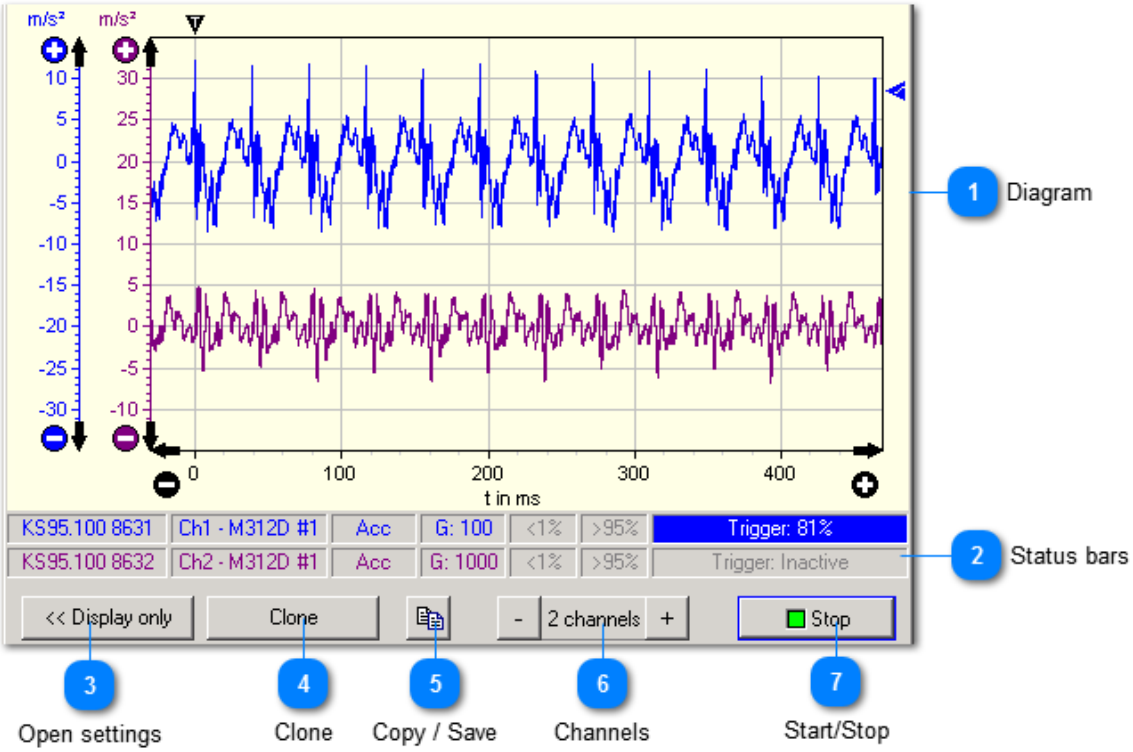
- Is the vibration composed of several frequencies or is it just one?
- Are the shock components?
- Are there beat frequencies?
- What is the peak amplitude?
- How long is the shock duration?



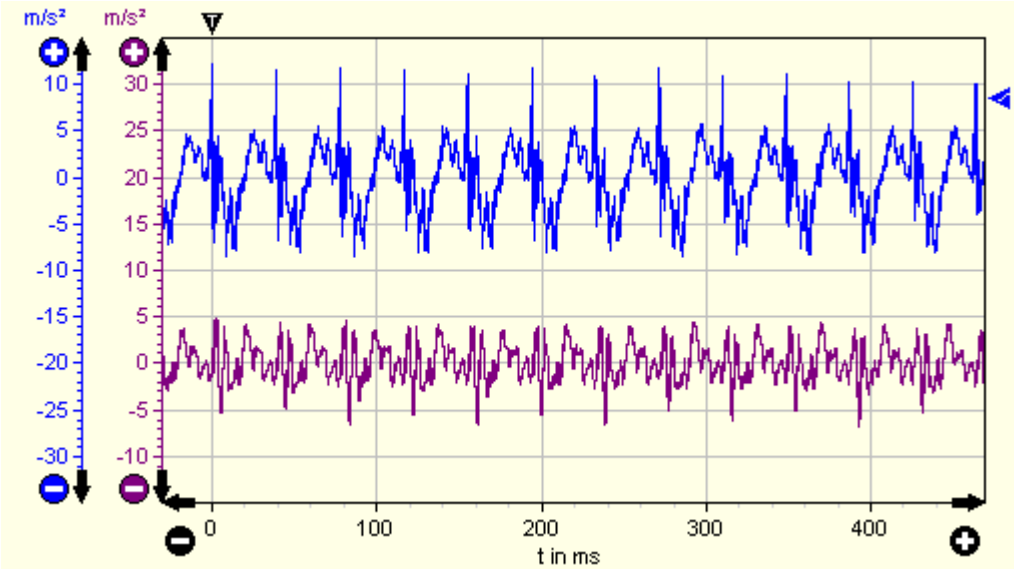
The InnoScope data memory holds 10 million samples per channel. The time graph can be exported as text or graphics.

- The InnoScope Pro also measures velocity and displacement based on integrated acceleration.
- The InnoScope Pro also displays HIC (Head Injury Criterion) and the decay curve.
- The InnoScope can be coupled with the InnoAnalyzer to simplify the measurement of natural frequencies.

Display area



1 Diagram



The diagram shows the vibration signal versus time. There is one trace per channel. Each one has its y axis which can be independently scaled and shifted.

Scaling is done with the buttons ⊕ and ⊖. Click the arrows to shift the axis.
The time axis can be scaled and shifted directly by the mouse pointer. Hold the left mouse button to shift and the right button to zoom.

2 Status bars

The status bars show the most important channel settings:

- sensor
- measuring channel
- measured quantity
- gain setting
- underload
- overload

3 Open settings

Opens and closes the setup menu.

4 Clone

Opens a new window with the same settings which can be modified.

5 Copy / Save

Copies the diagram data into the clipboard or saves it on hard disk. Different file formats can be chosen.

6 Channels

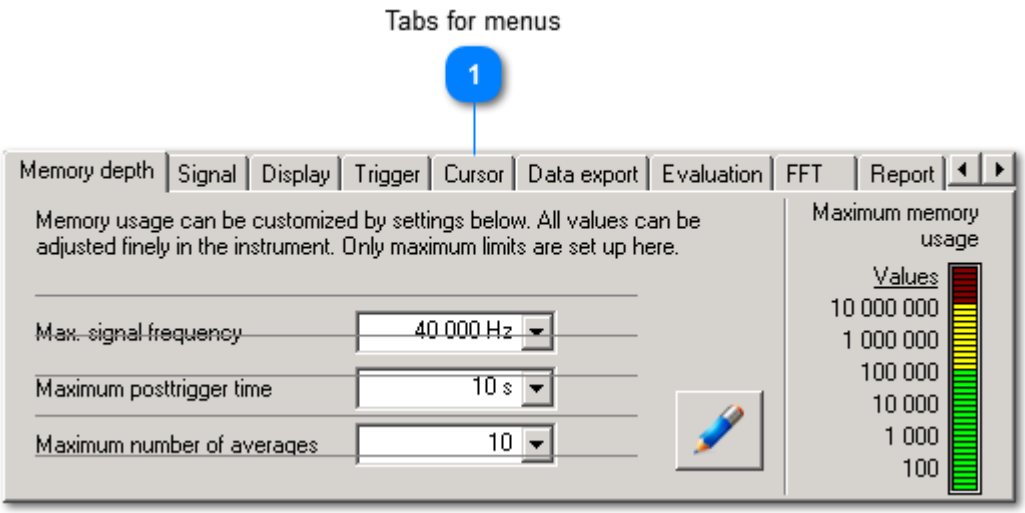
Increase or decrease the number of measuring channels (and curves). One to four channels are possible.

7 Start/Stop

Starts and stops measurement.

Setup area

The setup menu opens after clicking the Settings button.



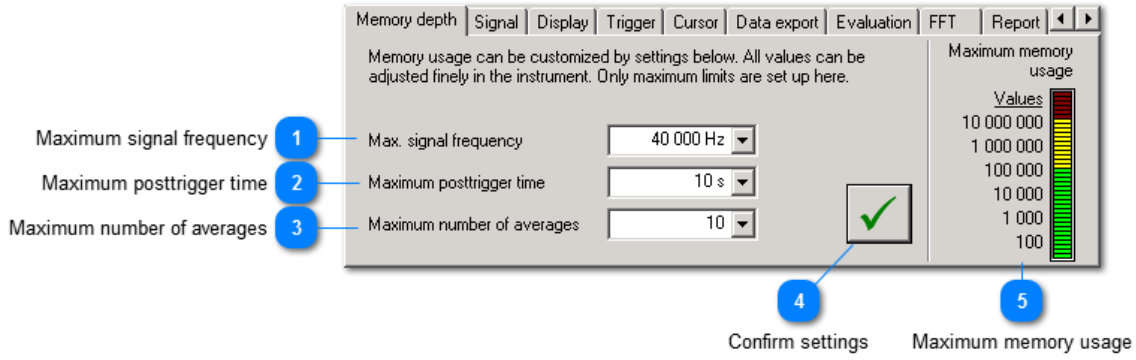
1 Tabs for menus

The submenus are:

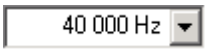
Memory depth:	Settings for the use of memory
Signal:	Settings for the signal source
Display:	Settings for curve scaling and grids
Trigger:	Trigger source, slope, pre and post trigger
Cursor:	Cursor enable / disable, cursor readout
Data export:	Settings for the copy / save button
Evaluation:	Automated evaluation of the traces
FFT	Settings for the communication with the InnoAnalyzer
Report:	Settings for report printing
Annunciators:	Settings for external alarm devices

Memory depth

The InnoScope stores 10 million samples per channel. The use of this memory can be controlled in the *Memory depth* menu. If, for example, 40 kHz bandwidth are needed, the InnoScope will store about 100,000 samples per second. We assume that the measuring time is 10 seconds which results in 1 million samples. If the InnoScope averages 10 measurements the memory of 10 million samples will be filled completely.

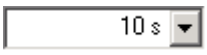


1 Maximum signal frequency



This is the highest frequency for the band filter. The band filter can always be set to lower frequencies. The InnoScope ensures that the signal will always be free of aliasing effects.

2 Maximum posttrigger time



The maximum duration of measurement starting at the trigger event. It can always be set to lower values during measurement.

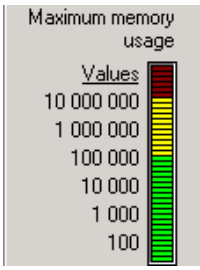
3 Maximum number of averages

Maximum number of averaged measurements. It can always be set to lower values during measurement.

4 Confirm settings

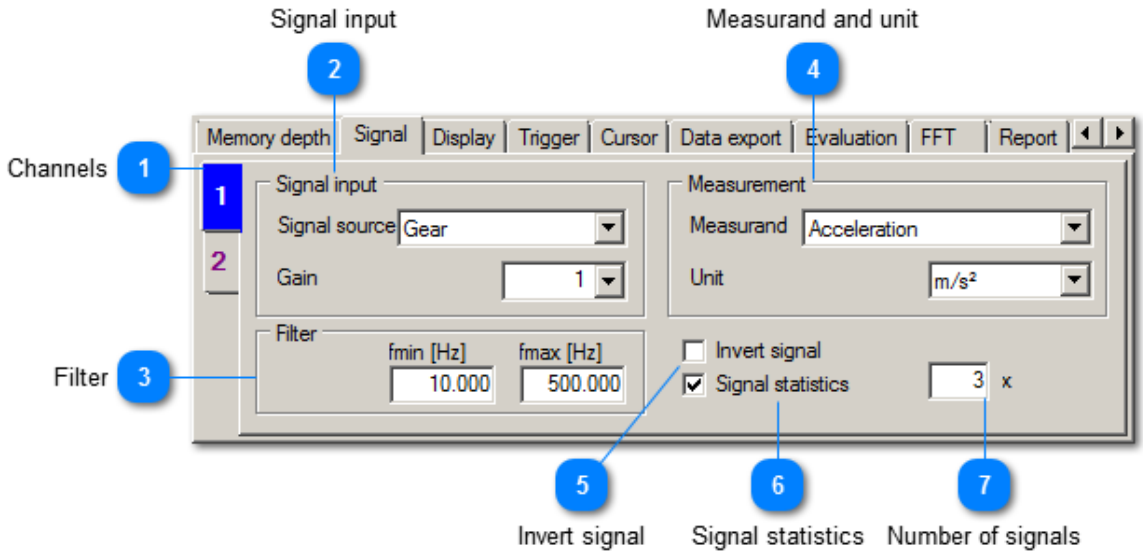
After making above settings click this button to check whether the available memory is sufficient. Measurement cannot be started before confirmation.

5 Maximum memory usage

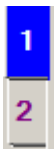


The bar graph indicates how much memory will be used with your settings.

Signal

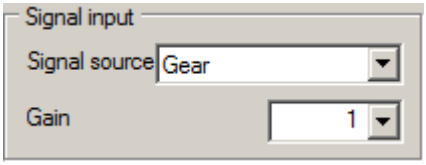


1 Channels



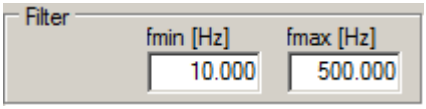
All settings can be entered independently for each channel. For example, you may use different filters. The number of tabs depends on the number of active channels.

2 Signal input



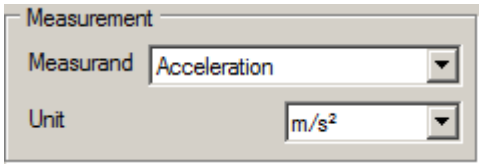
Selects the physical input and the gain of the USB device InnoBeamer.

3 Filter



Here you adjust the frequency range of the displayed value fmin to fmax.

4 Measurand and unit

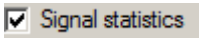


The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration (InnoScope Pro only).
The unit should be selected in a way that the measuring value does not drop below 0.001 permanently.

5 Invert signal

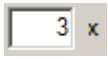
Inverts the sign of the measured signal. This can be useful, for example, to compensate the mounting direction of an accelerometer.

6 Signal statistics



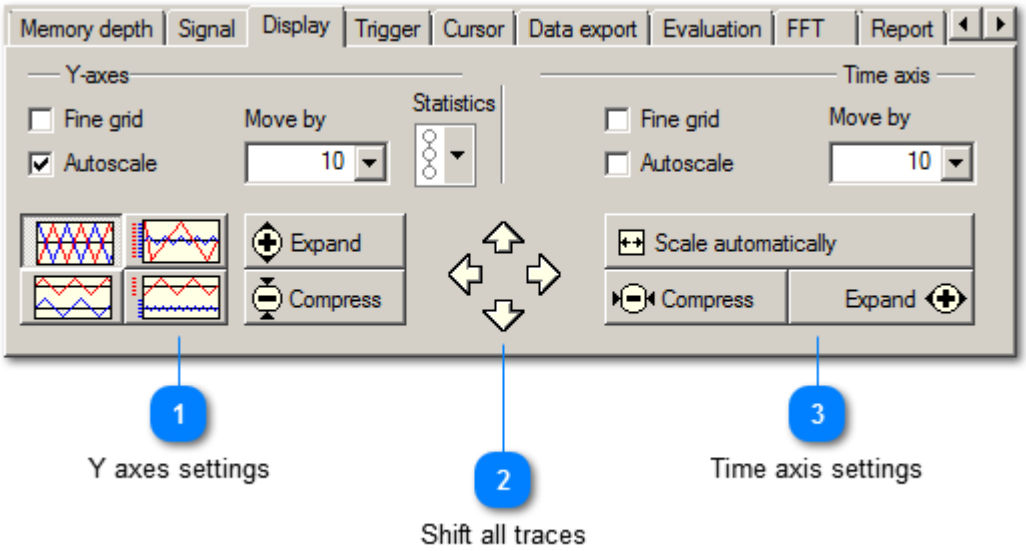
If this checkbox is activated the InnoScope will hold several subsequently triggered measurements in its memory. This will allow to select in display menu between several display modes which help to detect signal variations.

7 Number of signals

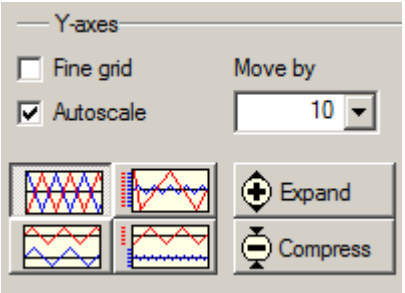


The number of signals used for statistics.

Display of traces

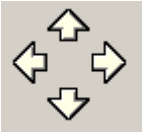


1 Y axes settings



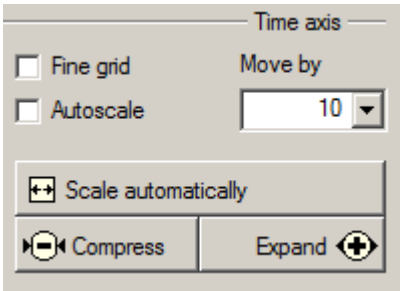
These settings change vertical scaling and arrangement of traces in the diagram.

2 Shift all traces



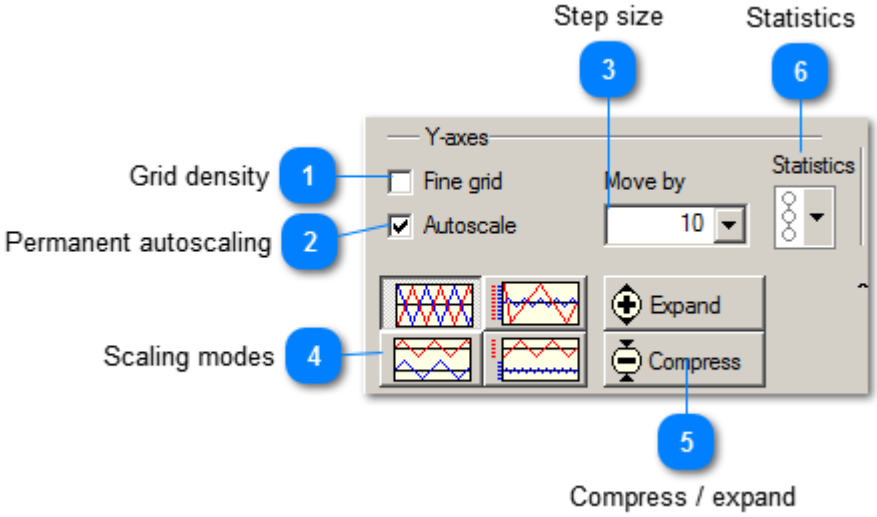
Shifts all traces together into the desired direction.

3 Time axis settings



These settings change horizontal scaling and scrolling of traces in the diagram.

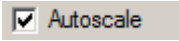
Y axis settings



1 Grid density

If you activate this checkbox, the InnoScope will show grid lines at all graduation marks of the Y axis.

2 Permanent autoscaling

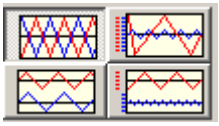


If you activate this checkbox, the InnoScope will rescale the Y-axes each time the measurement chart is refreshed, using the last scaling mode.

3 Step size

The step size (shown in scale lengths), by which measurement curves and scale are shifted during a movement. For instance, 10% means that the measurement curves are moved by 1/10 of the Y-axis.

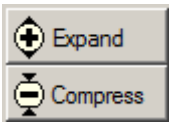
4 Scaling modes



There are four scale modes:

- All curves are maximized.
- Same scale for all curves.
- All curves are maximized and stacked with their own area.
- All curves use the same scale, they are stacked with their own area.

5 Compress / expand



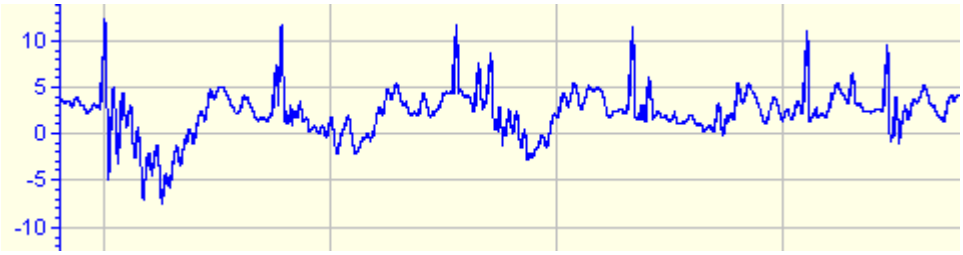
These buttons expand or compress all traces in Y direction.

6 Statistics

The *Statistics* function can be used to evaluate several subsequent measurements. You may display average value or compare the measured value with maximum and minimum values. Statistics function is activated and the number of signals is entered in the *Signal* menu.
The following statistic calculations can be performed:


Current signal

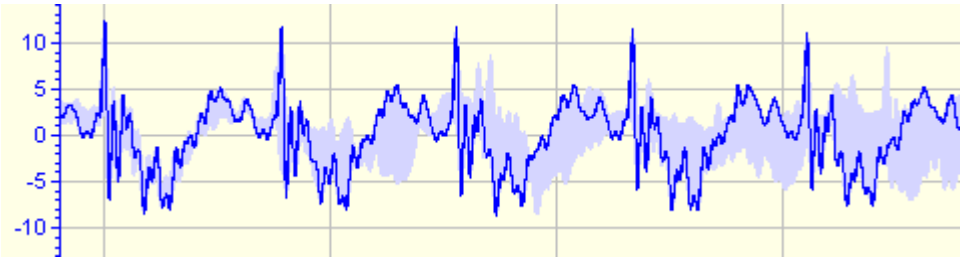

Maximum value



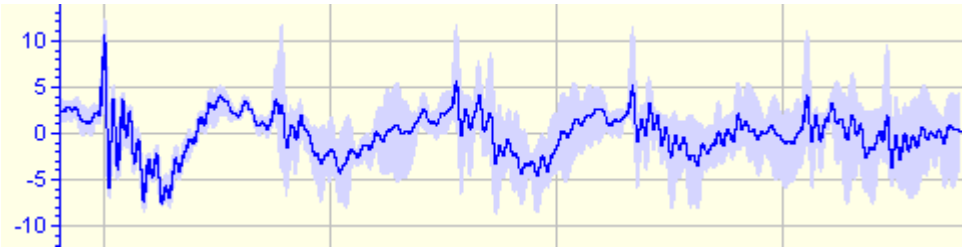

Mean value


Minimum value

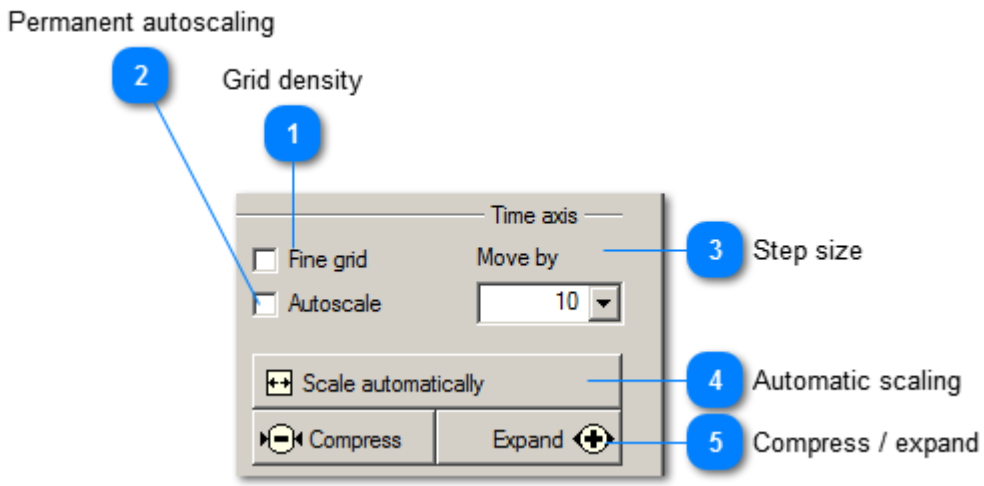

Current signal with maximum and minimum values




Mean value with maximum and minimum values



Time axis settings



1 Grid density

Fine grid — If you activate this checkbox, the InnoScope will show grid lines at all graduation marks of the time axis.

2 Permanent autoscaling

Autoscale — Scales the time axis automatically so that always three periods of the dominant signal are shown.

3 Step size

Move by 10 — The step size (shown in scale lengths) by which measurement curves and scale are shifted during a movement. For instance, 10% means that the measurement curves are moved by 1/10 of the frequency axis.

4 Automatic scaling

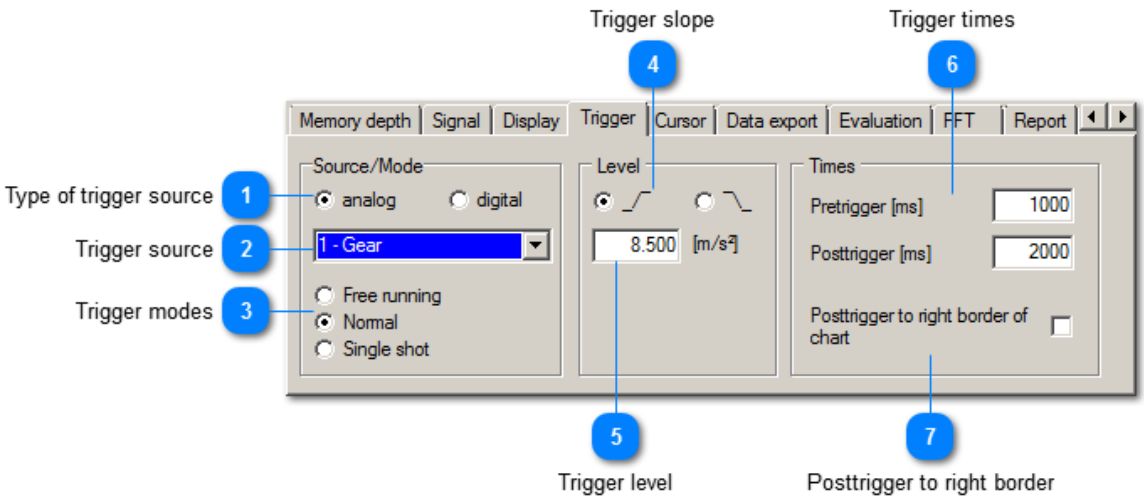
Scale automatically — Scales the time axis once so that three periods of the dominant signal are shown.

5 Compress / expand

Compress / Expand — These buttons expand or compress all measurement curves in time direction.

Trigger

The trigger settings determine the starting conditions for a new measurement.



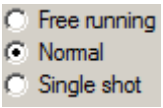
1 Type of trigger source

Trigger sources can be the analog input signals or the digital inputs of the InnoBeamer devices.

2 Trigger source

This drop-down list shows all trigger sources of the selected type, e.g. all channels of the instrument.

3 Trigger modes



Behavior after recording:

- Free running: The trace will continue to run trough the diagram
- Normal: The trace will freeze till the next trigger event
- Single: The InnoScope stops, freezes the trace and does not trigger again.

4 Trigger slope

Triggering at rising (_/‾) or falling (‾_) signal slope

5 Trigger level

8.500 [m/s²] Trigger level for analog sources

6 Trigger times

Pretrigger [ms]	1000
Posttrigger [ms]	2000

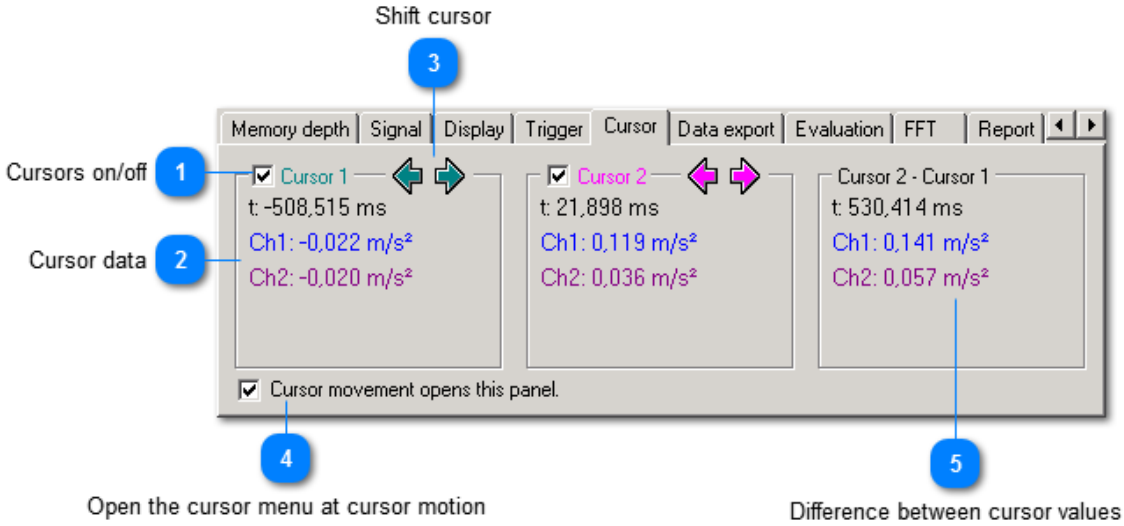
Length of recording before and after the trigger event

7 Posttrigger to right border

Posttrigger to right border of chart ☐ Activate this checkbox to set the posttrigger time automatically to the right end of the time axis.

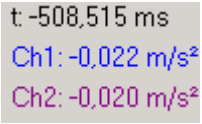
If this feature is not activated recording duration can be manually set by the posttrigger and the signal trace may reach outside the visible diagram range.

Cursors



1 Cursors on/off

2 Cursor data



Cursor time position and measuring value for each trace at this moment.

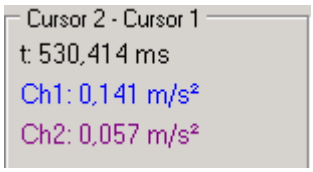
3 Shift cursor

Shift the cursor in the direction of the time axis. Shifting is also possible by dragging the cursor line directly.

4 Open the cursor menu at cursor motion

When this option is selected the cursor tab will open automatically when the position of the cursor line is moved by the mouse.

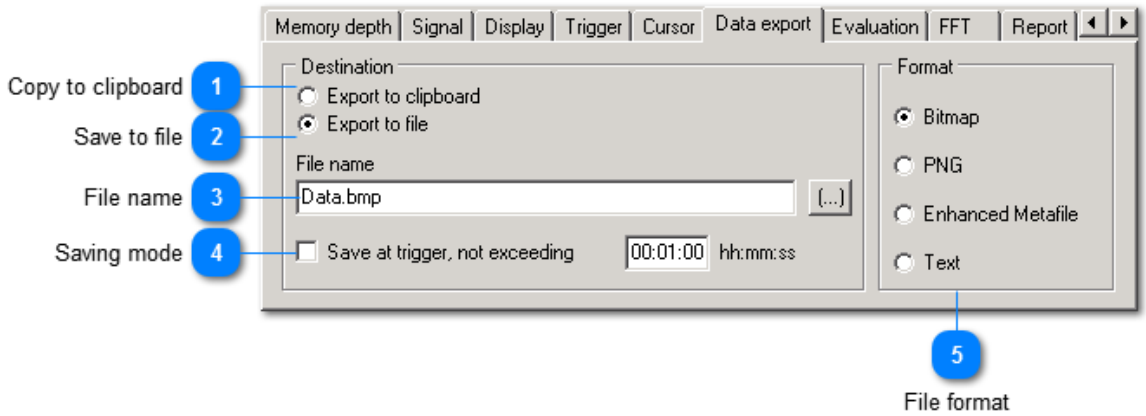
5 Difference between cursor values



Shows the difference of magnitude and time between the two cursors.

Data export

These settings control the action after clicking the copy / save button.



1 Copy to clipboard

Selects the Copy function.

2 Save to file

Selects the Save function. In addition trigger controlled saving can be activated.

3 File name

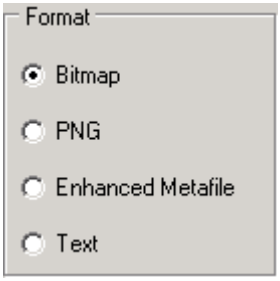
Enter the name of the file to be saved. The file name may include variables, like date, time, channel etc.

4 Saving mode

Two modes are available:

- Manually (unchecked) — The InnoScope only saves when clicking the save button.
- At trigger (checked) — The InnoScope starts saving at a trigger event. The maximum saving time can be entered.

5 File format

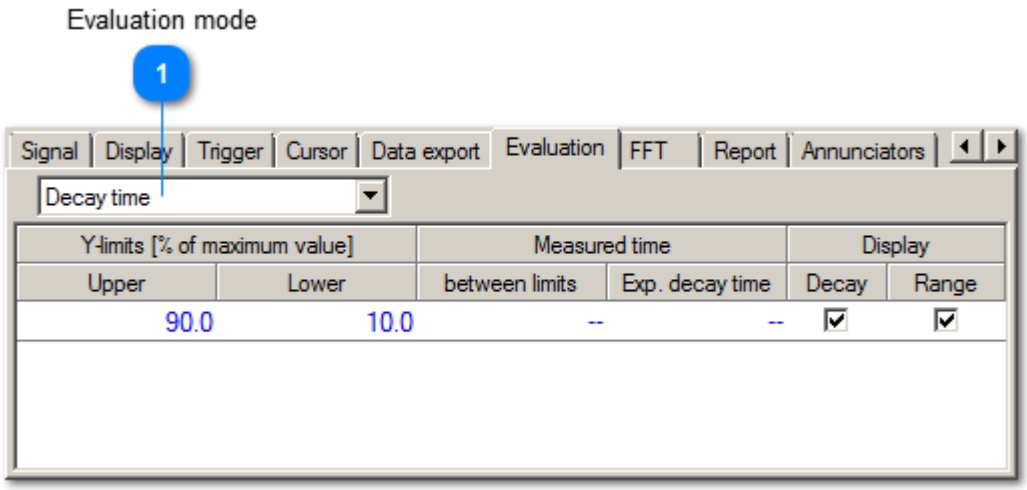


The following formats can be chosen for the export file

- Bitmap — raster graphics file format
- PNG — raster graphics file format, less than 10 % of bitmap file size without loss of quality
- Enhanced Metafile — Windows enhanced metafile format, allow later changes of characters
- Text — data is saved in a text table format including header which allows later processing by table calculation software

Evaluation

The InnoScope Pro offers the evaluation of the measured traces in terms of HIC (Head Injury Criterion) and decay time.



1 Evaluation mode

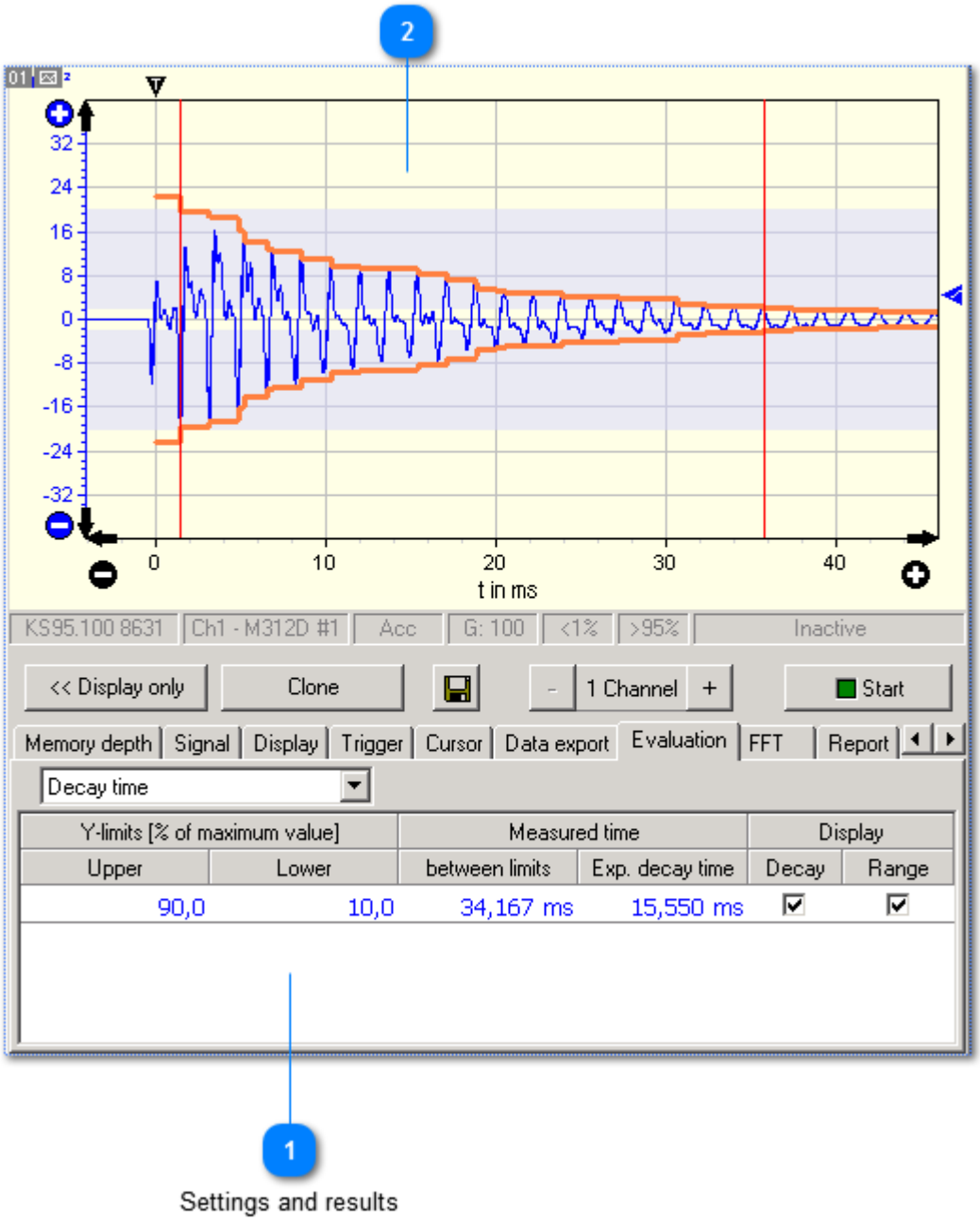
The available evaluation options are

- No evaluation
- Decay time
- Head Injury Criterion (HIC)

Decay curve

If a signal trace is measured after triggering the InnoScope Pro can envelope the signal automatically and draw a decay curve. Decay time and exponential decay time are displayed.

Signal trace with time limits and decay curve



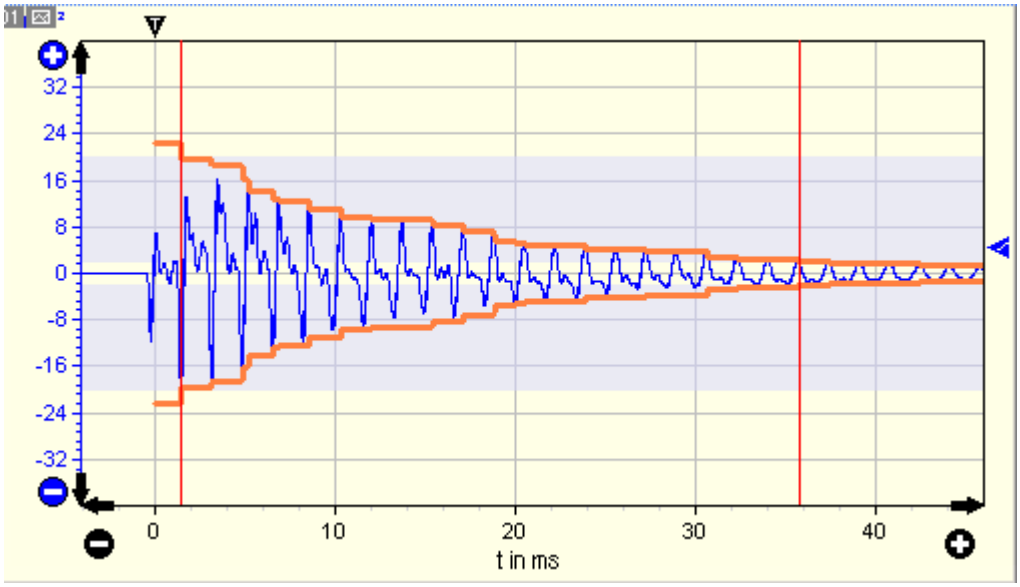
Settings and results

1 Settings and results

Y-limits [% of maximum value]		Measured time		Display	
Upper	Lower	between limits	Exp. decay time	Decay	Range
90,0	10,0	34,167 ms	15,550 ms	☑	☑

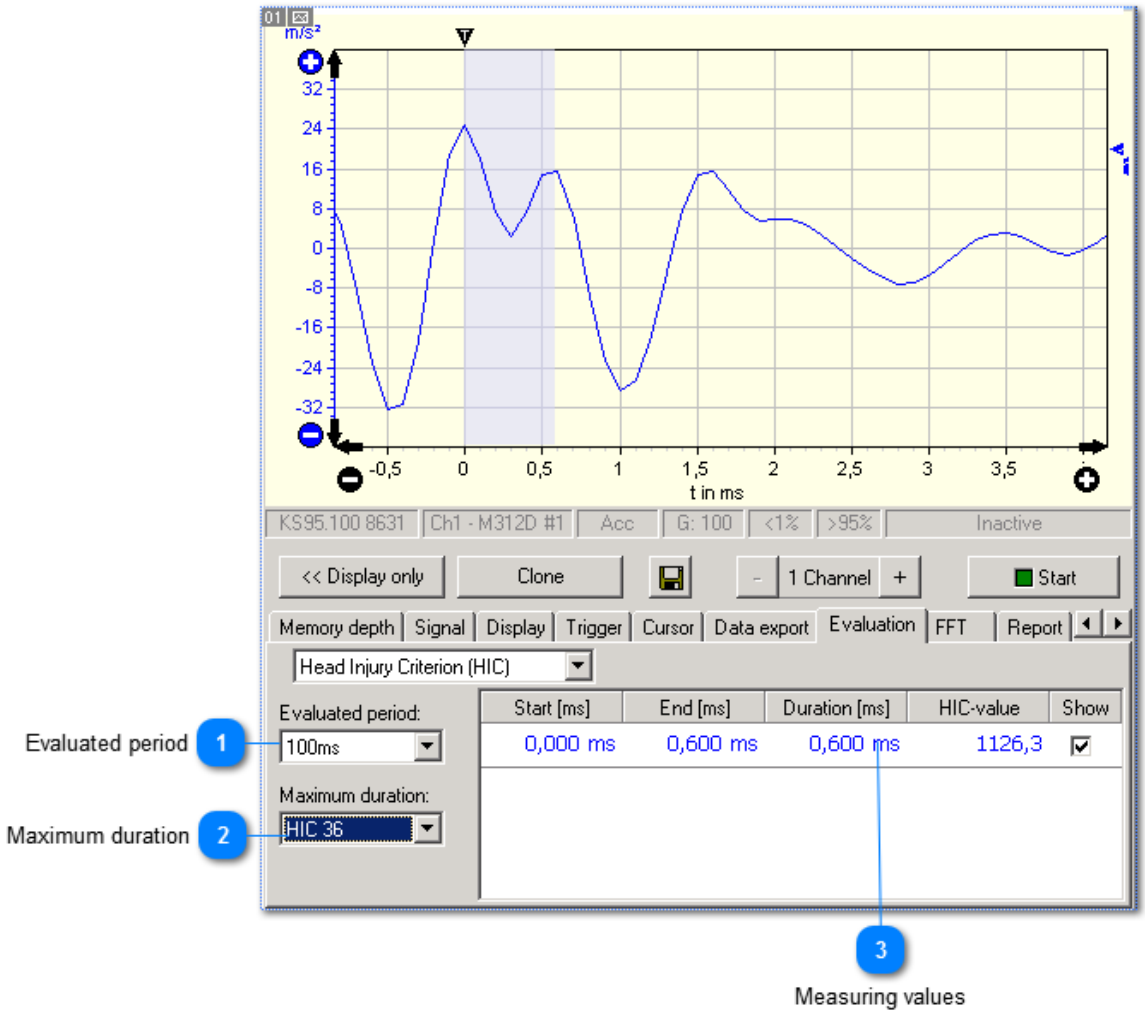
Two limits can be set for decay time measurement. They mark the magnitudes limits between which the InnoScope Pro calculates the decay time. The table shows the magnitudes on both ends in percents of the maximum magnitude and the time between them. The limits and the curves can be displayed in the diagram.

2 Signal trace with time limits and decay curve

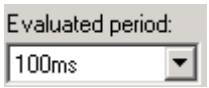


Head Injury Criterion (HIC)

Head Injury Criterion or Head Impact Criterion (HIC) is a measure of the likelihood of head injury arising from an impact. The HIC can be used to assess safety related to vehicles, personal protective gear, and sport equipment.

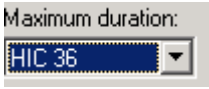


1 Evaluated period



Selects the part of the trace to be evaluated. This can be the time between trigger event and first zero crossing or a fixed time interval.

2 Maximum duration



The time interval for HIC calculation. Common values are 15 and 36 ms(HIC15 and HIC36).

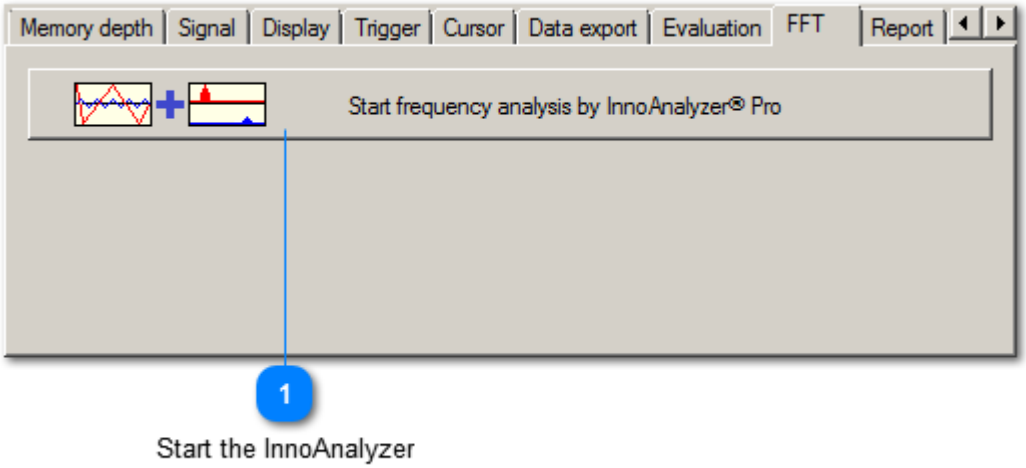
3 Measuring values

0,000 ms	0,600 ms	0,600 ms	1126,3	☑

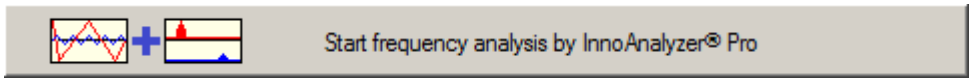
The values found by HIC calculation are listed for each channel. They can be displayed in the diagram.

Frequency analysis

The InnoScope can control the frequency analyzer InnoAnalyzer for an event triggered analysis.

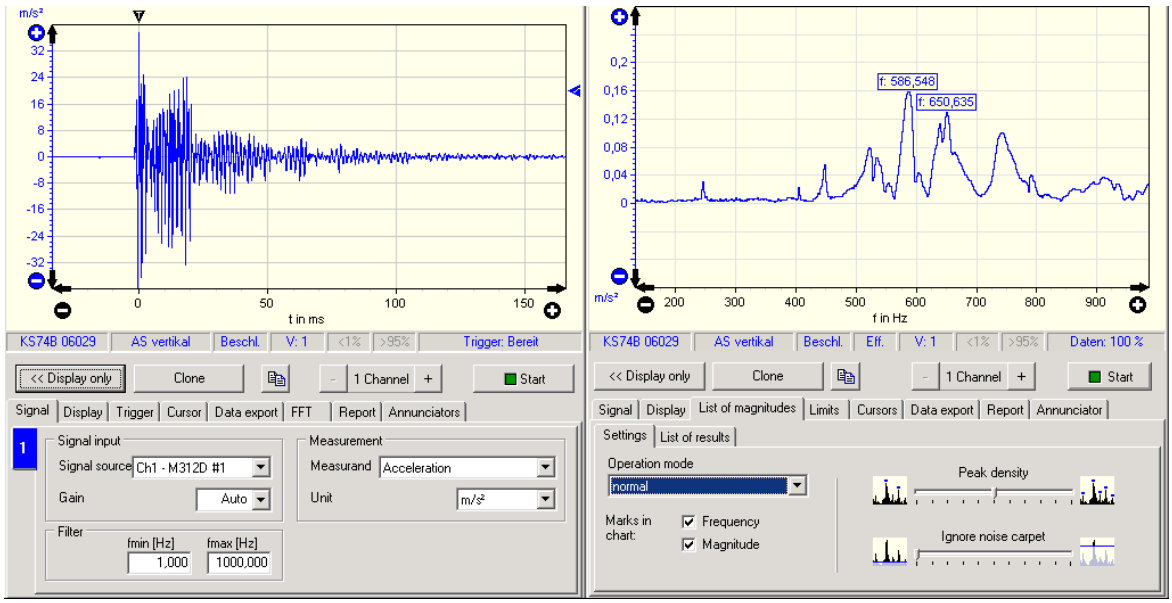


1 Start the InnoAnalyzer



The connection between InnoScope and InnoAnalyzer (if licensed) is established by clicking this button.

An InnoAnalyzer window will be placed on the right side of the InnoScope. The InnoAnalyzer is controlled by the InnoScope and will analyze the shown time range.

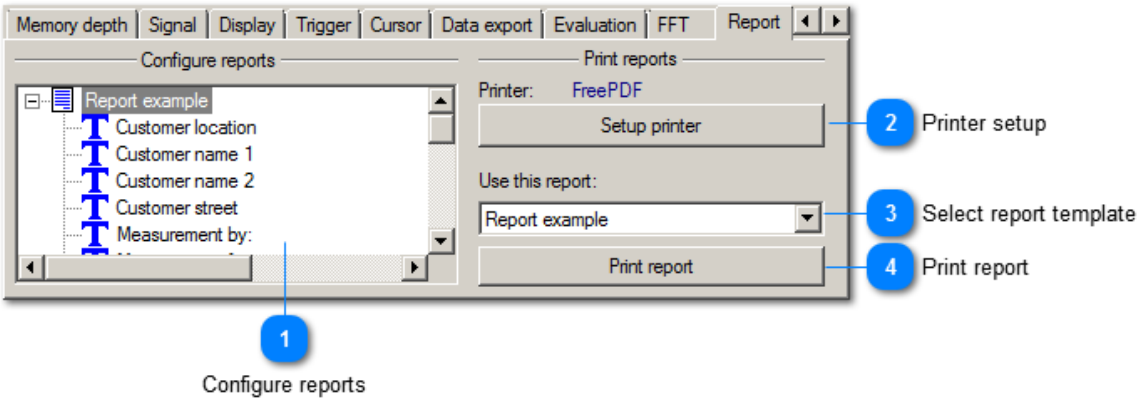


There are the following dependencies:

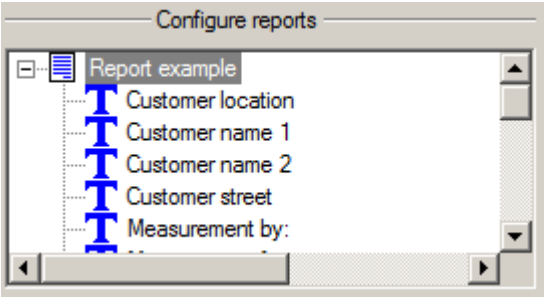
- The InnoScope starts the InnoAnalyzer.
- The InnoAnalyzer stops if the InnoScope is stopped.
- The InnoAnalyzer is moved together with the InnoScope window.
- The analysis in the InnoAnalyzer is triggered by the InnoScope.
- If the InnoScope is waiting for a trigger no analysis is performed.
- If the InnoScope is closed the InnoAnalyzer also closes.
- Changing the signal source in the InnoScope changes also the signal source in the InnoAnalyzer provided that the InnoAnalyzer is licensed for this channel.
- Changing the measurand in the InnoScope changes the measurand in the InnoAnalyzer. The units can be set independently.
- Changing the band filter in the InnoScope sets the maximum frequency in the InnoAnalyzer.
- The settings for pre and post trigger in the InnoScope determine the time interval for analysis. Since an FFT only allows discrete time windows at a certain sample rate it may occur that the InnoAnalyzer will fill missing values with zeros.
- Conflicts caused by certain InnoAnalyzer settings are marked yellow.

Report

Here the settings are made for printing reports including text information, diagrams, logos etc. After designing the report layout you may save these settings.

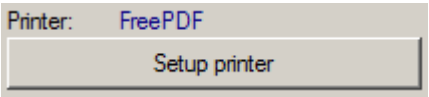


1 Configure reports



In this tree view you find the available report templates. Some sample reports are provided. You may adapt them to your needs.

2 Printer setup

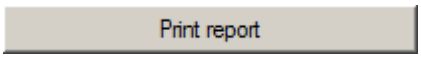


Opens the printer configuration menu.

3 Select report template

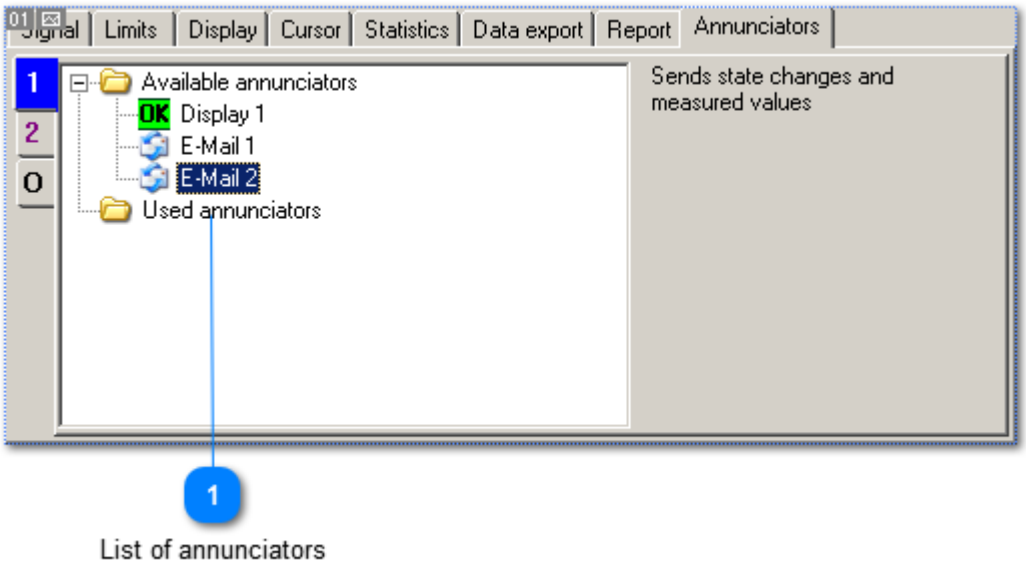
You can select one of the report templates for printing.

4 Print report

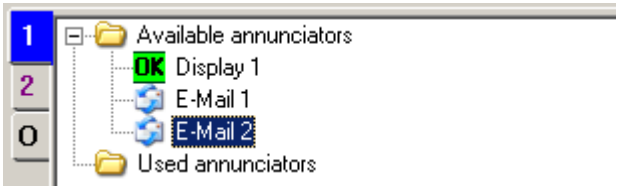


Annunciators

VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.



1 List of annunciators

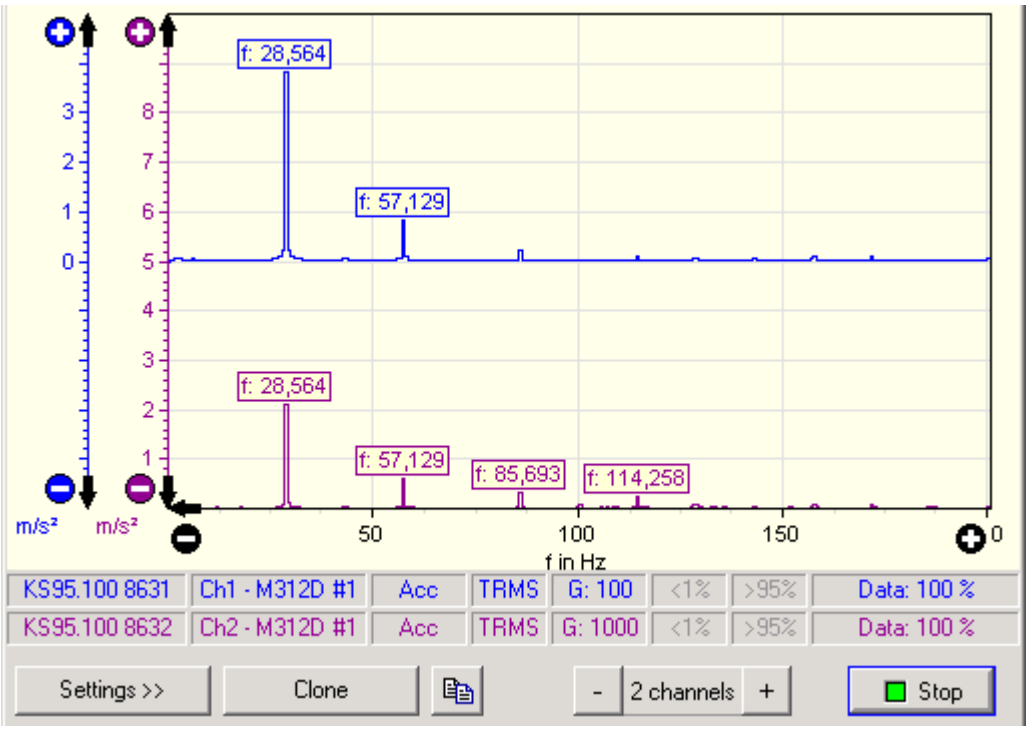


Shows a list of available and used annunciators.

InnoAnalyzer® (Pro)

Vibrations mostly consist of a mix of different frequencies. The InnoAnalyzer decomposes this mix into its different frequencies and thus allows the detection of causes for the different vibration frequencies. It is also used to detect the natural frequencies of bodies or damages on rolling bearings.

The InnoAnalyzer offers more than one million lines and a resolution better than 0.01 Hz.



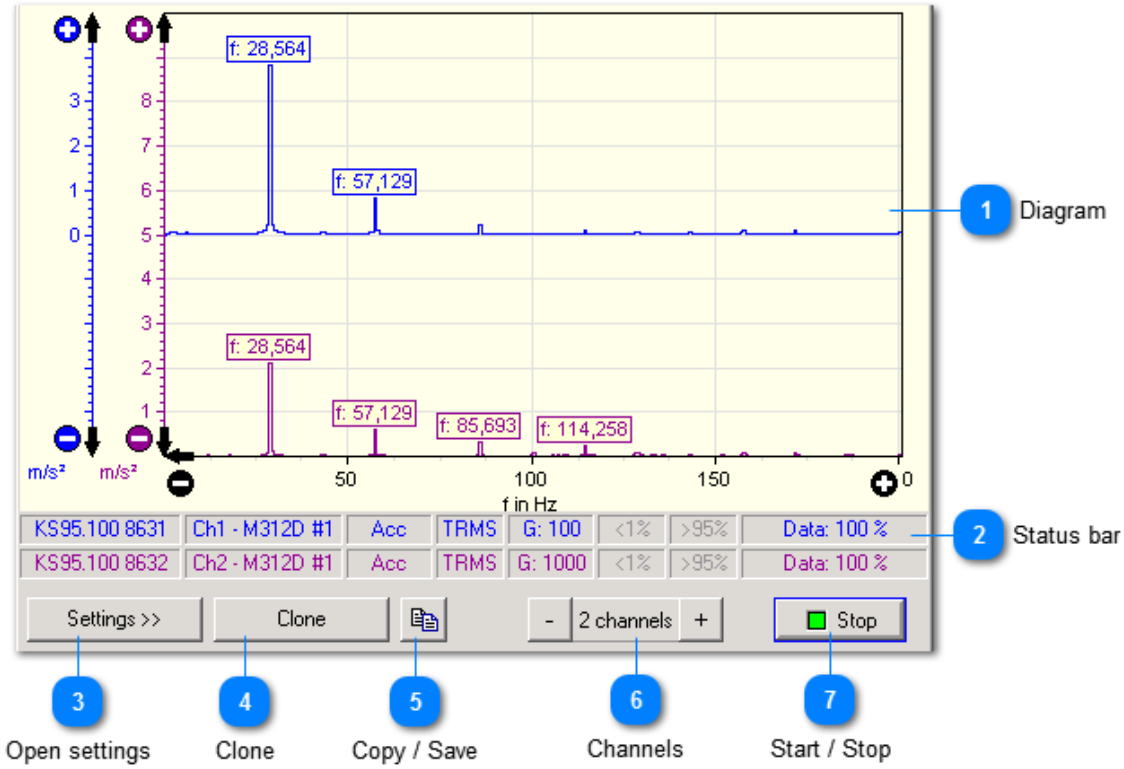
The InnoAnalyzer simplifies the setup process by presets for typical applications. Even users with less experience will quickly be able to perform an FFT with optimum resolution.
Experienced users may change all relevant settings like, for example, window functions and averaging techniques.

With its trigger function or in combination with the InnoScope single or uncontinuous events can be analyzed. An example is resonance finding by an impulse hammer.

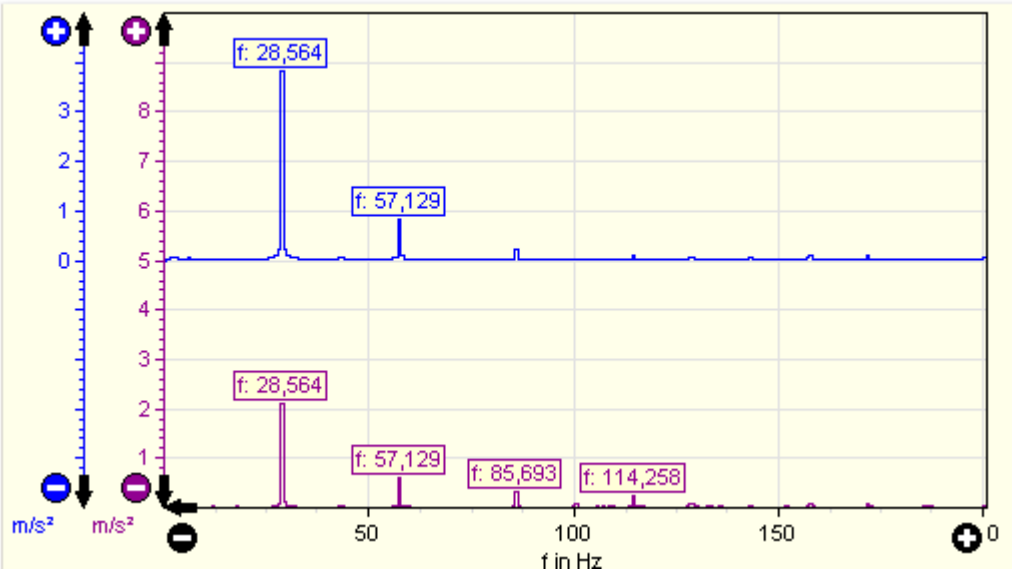
The InnoAnalyzer Pro features an envelope function for bearing analysis.

For stochastic signals power spectral density analysis (PSD) may be useful.

Display area



1 Diagram



The magnitudes at the different frequencies are displayed in the diagram. One curve is displayed for each measuring channel. Each curve has its own y-axis which can be scaled and scrolled independently.
Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows. The display control panel contains more settings for the measurement chart.
By means of the mouse, the measurement chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

2 Status bar

The status bar indicates the most important settings for the respective channel of the instrument:

- Sensor
- Measuring channel
- Measurand
- Characteristic
- Gain
- Underload
- Overload
- Progress of read time data

3 Open settings

Opens and closes the setup menu.

4 Clone

Opens a new window with the same settings which can be modified.

5 Copy / Save

Copies the diagram data into the clipboard or saves it on hard disk. Different file formats can be chosen.

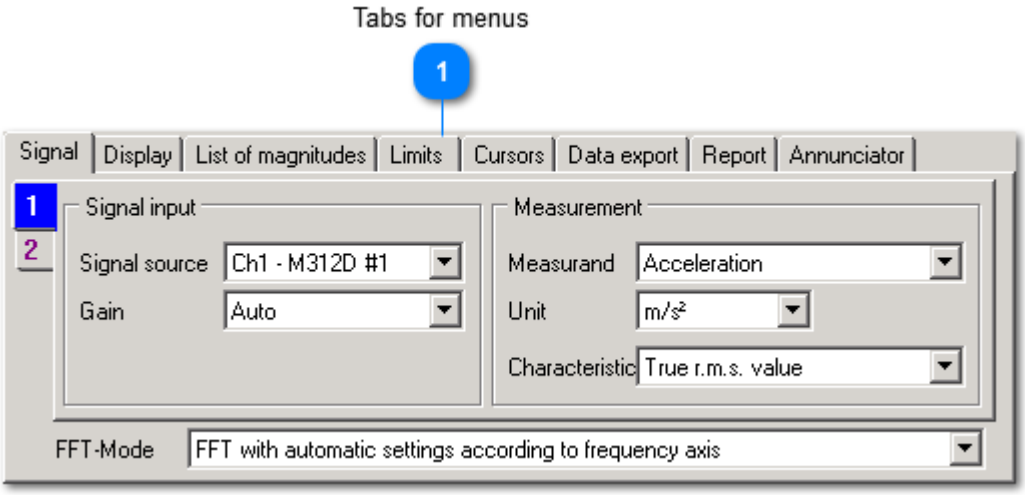
6 Channels

Increase or decrease the number of measuring channels (and curves). One to four channels are possible.

7 Start / Stop

Starts and stops measurement.

Setup area

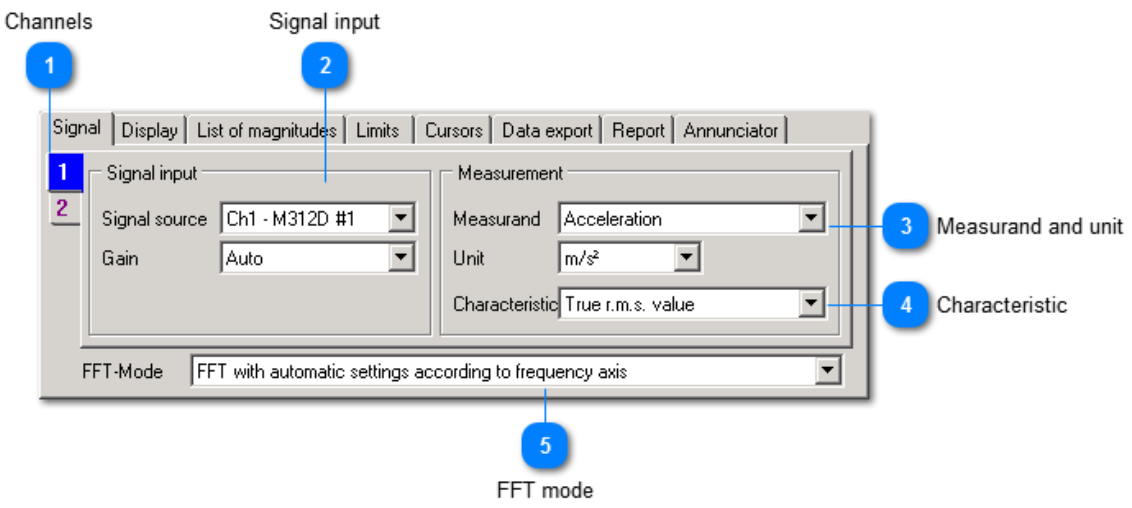


1 Tabs for menus

The submenus are:

Signal:	Signal processing settings to condition the signal
Trigger:	Settings to analyze processes with defined starting points
FFT:	Extended settings for frequency analysis
Bearing diagnosis:	Diagnosis of damages on rolling bearings
Display:	Settings for the display of measurement curves
List of magnitudes:	Automatic detection of magnitudes, display and half width identification
Limits:	Settings for limit curves
Cursors:	Activation/deactivation of cursors, display of measurement data at the cursor position
Data export:	Settings for destination, time and formats of data to be saved
Report:	Settings for report printing
Annunciator:	Settings for actions of annunciators, e.g. in case of limit exceedance

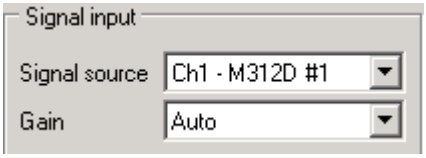
Signal



1 Channels

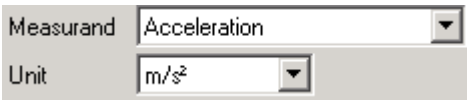
All settings can be entered independently for each channel. For example, you may use different filters. The number of tabs depends on the number of active channels.

2 Signal input



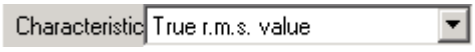
Selects the physical input and the gain of the USB device InnoBeamer.

3 Measurand and unit



The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration (InnoAnalyzer Pro only).
The unit should be selected in a way that the measuring value does not drop below 0.001 permanently.

4 Characteristic



Selects peak or RMS spectrum.

5 FFT mode

The InnoAnalyzer can be operated in different modes:

Automatic mode
In this mode, the setting of the FFT parameters is carried out automatically. You only select the desired frequency range. Based on this setting, the InnoAnalyzer determines the line density. The time window is automatically set in a way that each displayed line is covered by a calculated line. The Flattop window is used for weighting in time domain. It displays magnitudes in a very exact way. Overlapping is 0.
Since the selected frequency range is the base for the FFT parameters, the FFT is set anew in case of changing the frequency range.

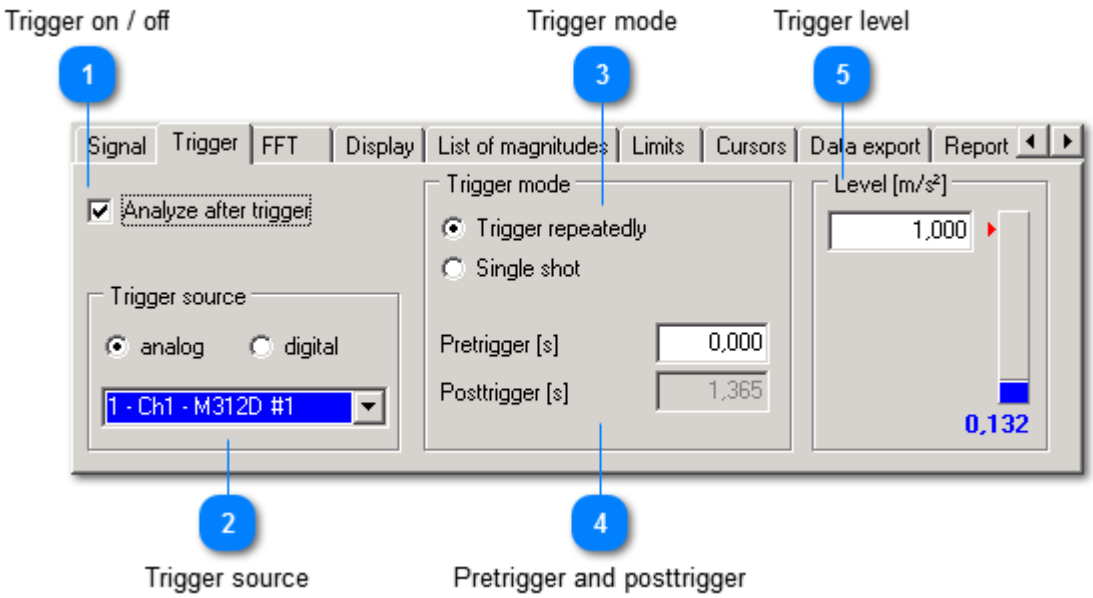
Manual settings
Two new tabs are available after having chosen this mode. Here you can configure many parameters for the FFT manually and also carry out a triggered FFT if required.

Bearing diagnosis
The two tabs for the manual configuration are available as well as an additional tab for adjusting bearing frequencies. These frequencies make it easy to assign displayed frequencies to damages on rolling bearings.

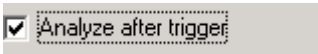
Power spectral density (PSD)
For measuring stochastic vibration processes, e.g. vibrations during the transport of goods, the power spectral density is used. A respective control panel opens when selecting this mode.

Trigger

The trigger control panel is available in all FFT modes except the automatic mode. Without trigger, the FFT is carried out continuously with the measured data from time domain. By using a trigger, the FFT only starts after defined conditions have been fulfilled. This way, the analysis can be carried out synchronized with rotation speed or shocks can be evaluated purposefully.
Use the InnoScope as trigger source if you also want to watch the respective time signal immediately.

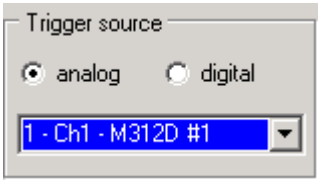


1 Trigger on / off



Enables / disables the trigger function.

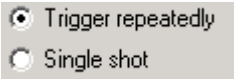
2 Trigger source



analog All channels of the instrument can be selected. If the signal in time domain exceeds the trigger level, the trigger is initiated.

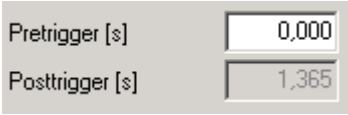
digital All digital inputs of the InnoBeamer devices with licenses for the InnoAnalyzer are available as trigger source. This way, several InnoAnalyzer channels can be fed from the same digital input. It allows for instance triggering synchronized with rotation speed in several InnoAnalyzers. The trigger is initiated if the value switches from 0 to 1.

3 Trigger mode



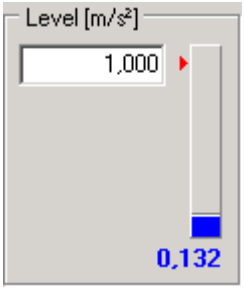
Trigger repeatedly	After a triggered FFT, the trigger is ready again. If the trigger condition is met again, a new FFT will be carried out.
Single shot	After having carried out a triggered FFT, the InnoAnalyzer stops.

4 Pretrigger and posttrigger



The beginning of the time frame to be analyzed can be shifted with regard to the start of the trigger. A pretrigger of 0 means that the start of the trigger and the beginning of the time frame to be analyzed coincide. Accordingly, the beginning of the time frame is before the start of the tigger when entering a value >0.

5 Trigger level



When selecting an analog trigger source, the level of the measurand in time domain is displayed in a bar graph. The measurand is bandpass filtered with the frequency limits entered in the FFT settings and displayed as absolute peak value.

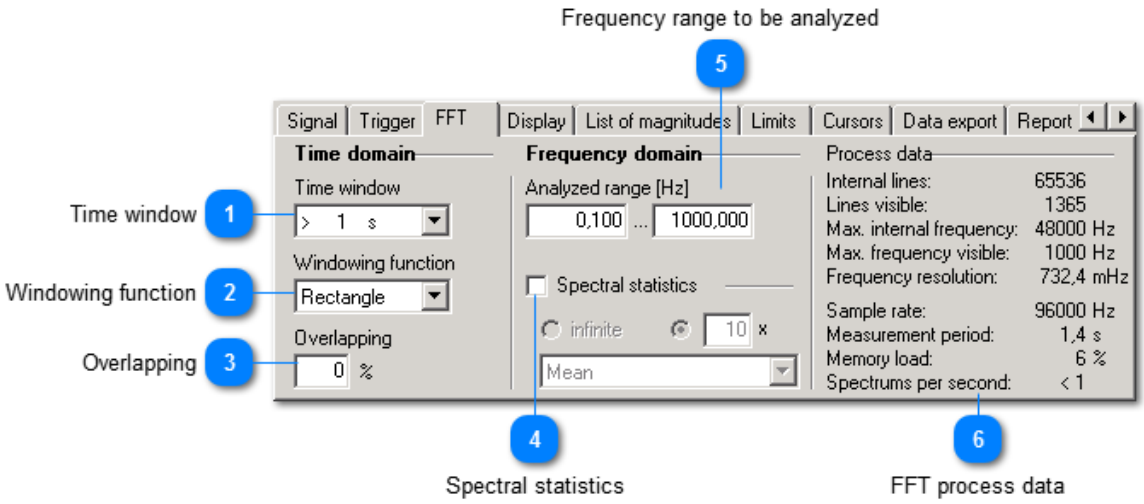
When selecting a digital trigger source, a colored field shows the current digital level.

- white level = 0
- black level = 1

FFT Settings

You can configure FFT parameters manually in all FFT modes except the automatic mode. The FFT control panel is composed of three areas:

- Signal configuration in time domain (previous to FFT)
- Signal configuration in frequency domain (after FFT)
- Process data (shows how the analysis is working internally)



1 Time window

The signal in time domain is divided into fixed time segments. Such a segment is transformed into the frequency range. The longer the time segment, the finer the resolution in frequency domain. The InnoAnalyzer always uses real measurement data and does not artificially extend with zeros (Zero pad).

2 Windowing function

An FFT is exact for discrete frequencies only. Usually, the frequencies in the measurement signal do not correspond to these discrete frequencies. As a result, there is so called leakage. To extenuate this effect, windowing functions are used. Common windowing functions are:

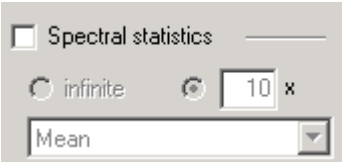
Rectangle	For analyzing shocks
Hann	For analyzing frequencies
Flattop	For analyzing magnitudes

Note: The windowing function "Hann" is also known as "Hanning". Actually it has been named after the mathematician Julius von Hann, so that "Hann" is the correct name.

3 Overlapping

The FFT can take over the different time segments successively without interruption or with an overlap. The percentage Overlapping indicates how much two successive time segments overlap. The more the time segments overlap, the more FFTs are generated in the same time - without a decrease in frequency resolution. Thus it is easier to monitor dynamic processes, for instance the start of an engine.

4 Spectral statistics

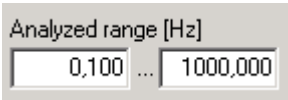


Several frequency analyses can be combined mathematically, which makes it easier, for instance, to distinguish stationary from random vibrations.
Statistics can be either carried out infinitely for the whole switch-on time or for an adjustable number of analyses. In the statistics, the frequency values of several analyses are combined. Three methods are available:

Mean	The magnitudes are averaged arithmetically.
Square mean	The magnitudes are RMS averaged.
Maximum	Maximum values are formed.

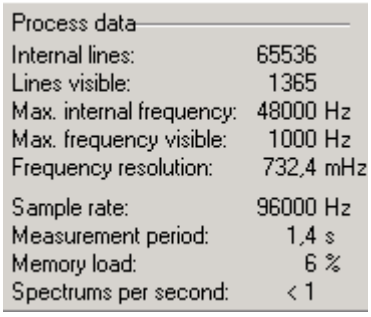
For certain statistical methods, names have been established. For instance, the permanent forming of maximum values corresponds to the function peak hold.

5 Frequency range to be analyzed



You can enter a frequency range for the analysis. The measurement chart will only show values from within this range. The FFT can be carried out with a lower CPU load when entering a lower frequency range. Furthermore, the frequency range is used as a parameter for the bandpass filter of analog trigger sources.

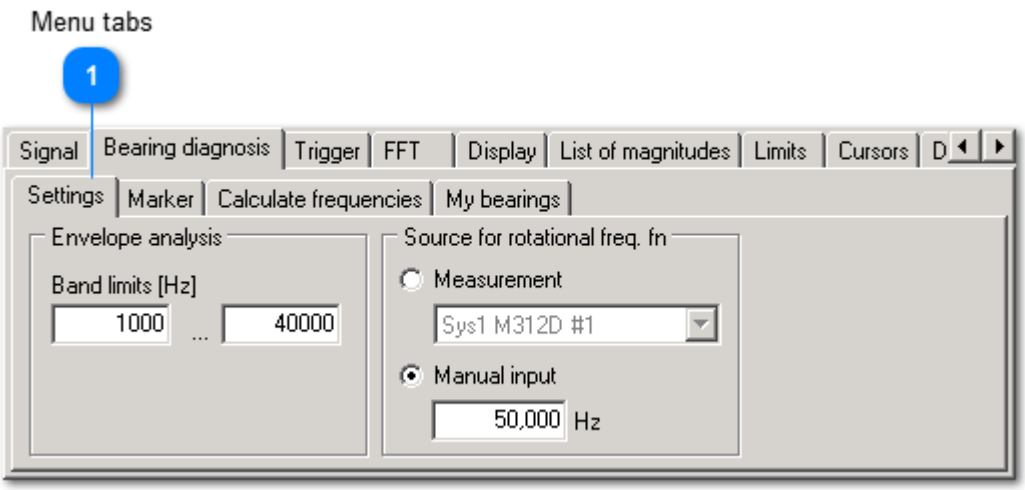
6 FFT process data



In this area, you can read of internal parameters of the FFT which result from the selected settings. This process data is for information only.

Bearing diagnosis

Bearing diagnosis uses envelope analysis to display damages. Suitable damage frequencies for the type of bearing are displayed in the measurement chart and thus allow to allocate displayed magnitudes to the damaged component.

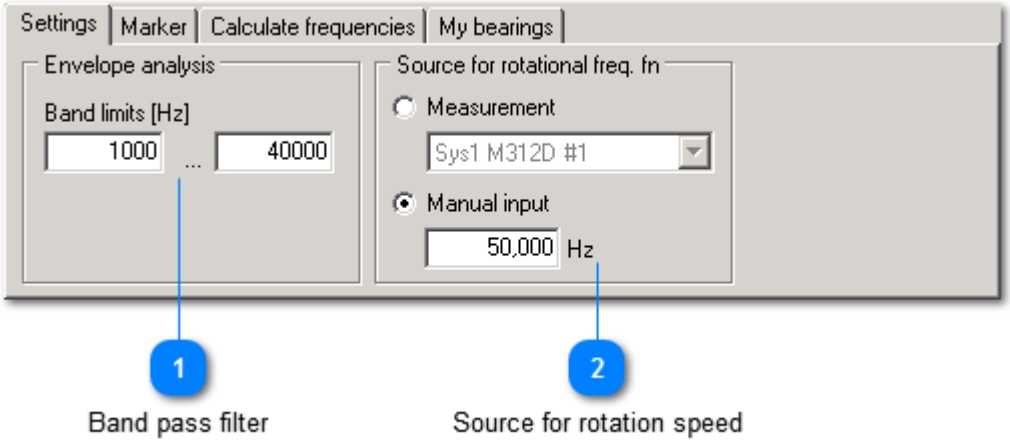


1 Menu tabs

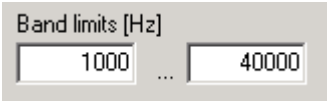
The following submenus are available:

Settings	Parameters of envelope analysis and source for rotation speed
Marker	Setting and display of markers for damage frequencies
Calculate frequencies	Calculation of damage frequencies using the dimensions of the bearing
Table of bearings	Storage for damage frequencies of bearings that are frequently used

Signal settings

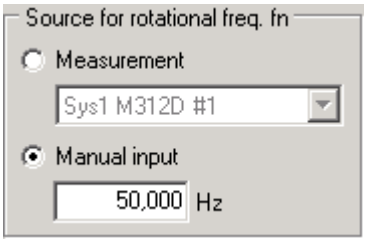


1 Band pass filter



The vibrations caused by damages on bearings occur at high frequencies. Low frequency effects, e.g. unbalance, are suppressed. The first value of the bandpass filter is a high pass value which suppresses these low frequency parts.
The upper band limit allows for instance to suppress the resonant frequency of the sensor. However, it is often taken into consideration because the sensor is particularly sensitive to bearing damages at this frequency.

2 Source for rotation speed

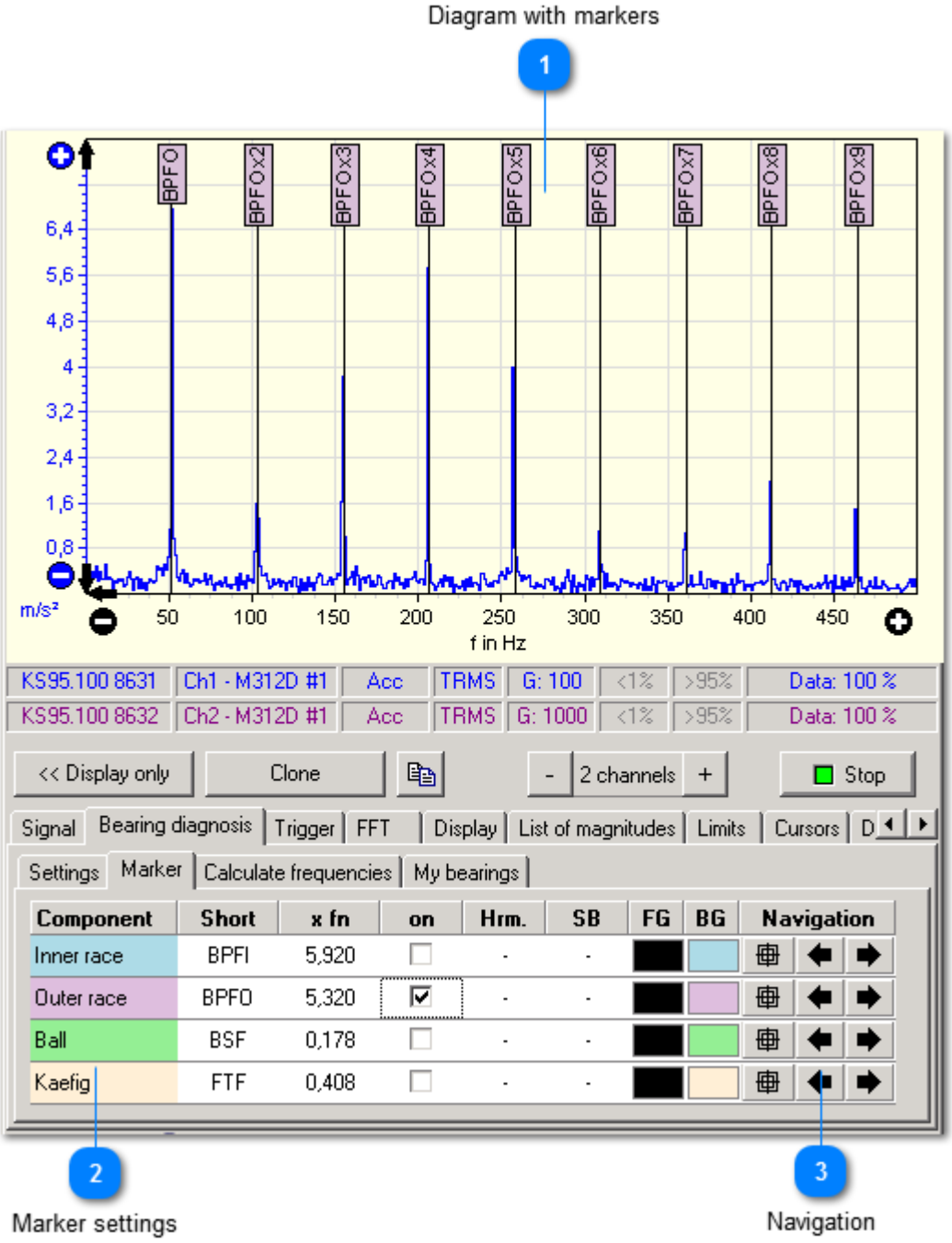


For allocating damage characteristics, it is essential to know the exact rotational frequency.

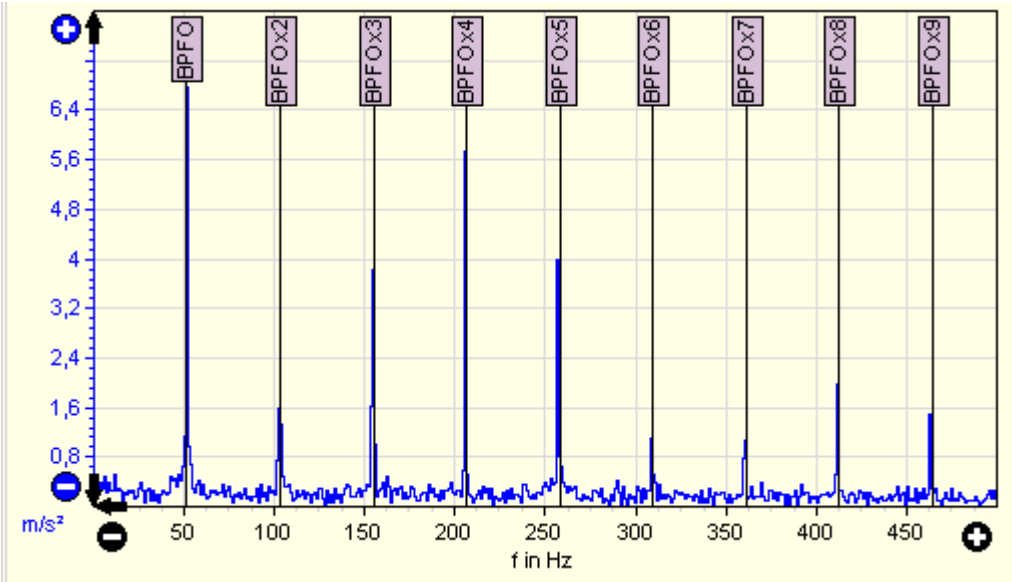
- It is especially comfortable to use an rpm sensor, which moves the damage markers in real-time. Select the option Measurement if you use such an rpm sensor.
- If the rotation speed is known and constant, you can do without measuring the rotational frequency. In this case, it is possible to enter the rotation speed manually.

Markers

Markers help to detect particular bearing faults from the spectral diagram.



1 Diagram with markers



In the spectral diagram the active markers are displayed at the positions which are set by the rotational frequency factor and the current rotational frequency. The abbreviations for the bearing components are completed by names for harmonics and side bands.

- x2: Harmonic with double fundamental frequency
- x3: Harmonic with triple fundamental frequency
- ...
-
- SB+1: first side band on the right
- SB-1: first side band on the left
- SB+2: second side band on the right
- SB-2: second side band on the left
- ...

2 Marker settings

Component	Short	x fn	on	Hrm.	SB	FG	BG	Navigation
Inner race	BPFI	5,920	☐	-	-			
Outer race	BPFO	5,320	☑	-	-			
Ball	BSF	0,178	☐	-	-			
Kaefig	FTF	0,408	☐	-	-			

The marker settings can be adjusted separately for each component of the bearing. The columns feature the following settings:

Component	This column lists up the bearing components. It cannot be changed.
Short	An abbreviation for the bearing component.
x fn	Rotational frequency factor. The damage frequency is specified as a factor to the rotation speed. This way, the damage frequency is characterized correctly for each rotation speed.
on	Activates (resp. deactivates) the marker in the measurement chart.
Hrm.	Number of harmonics to be indicated as a marker in the measurement chart.
SB	Number of side bands to be indicated in the measurement chart. Side bands can only be activated for components which technically can possess side bands.
FG	Foreground color. The text in the markers will be written in this color.
BG	Background color of the markers.
Navigation	3 navigation buttons.

3 Navigation

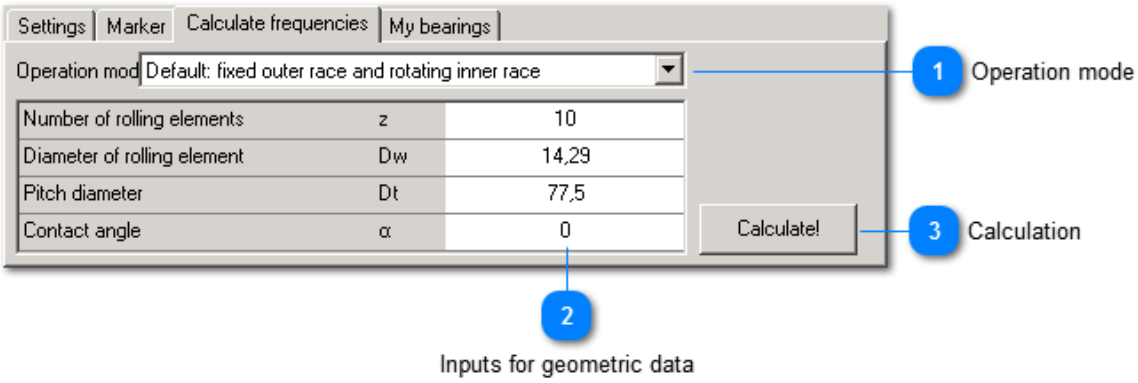
By means of the navigation buttons you can quickly select the magnitudes of the envelope analysis.

When clicking the cross hairs, the InnoAnalyzer directly zooms in on the damage frequency of the respective bearing component.

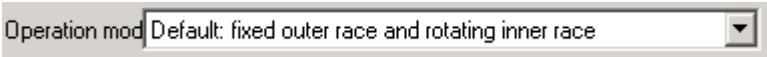
By means of the arrows, the measurement chart is set to the previous resp. next harmonic.

Calculation of damage frequencies

If you do not know the damage frequencies, but the geometric dimensions of the bearing, you can calculate the damage frequencies for the bearing at the push of a button.



1 Operation mode



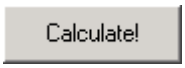
Different damage frequencies are calculated depending on whether inner or outer race rotate respectively are fixed. Calculation is integrated for both operation modes.

2 Inputs for geometric data

Number of rolling elements	z	10
Diameter of rolling element	Dw	14,29
Pitch diameter	Dt	77,5
Contact angle	α	0

You can either take over geometric data from the manufacturer's instructions or measure them at the bearing.

3 Calculation

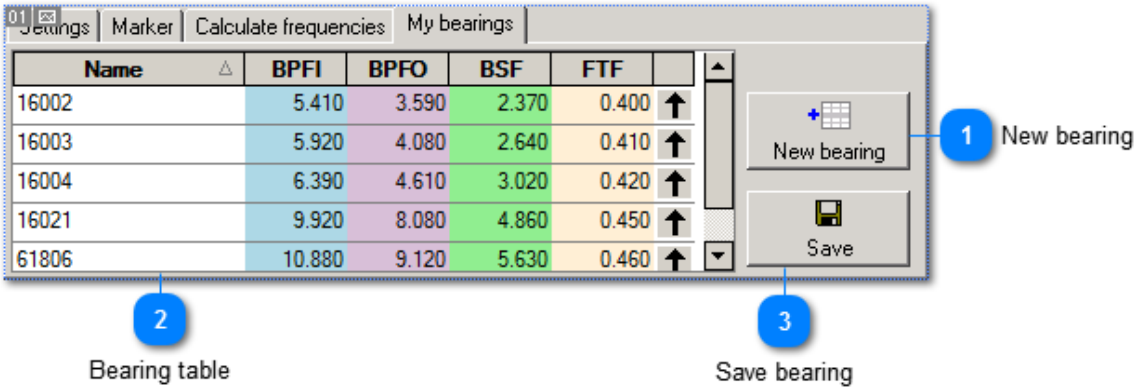


By pushing the calculation button damage frequencies are calculated and taken over into the marker table as well.

Bearing table

You can save damage frequencies for the bearings you use most in the table of bearings. You can enter values from the manufacturers' instructions here. Data can be acquired from the technical service or online, e.g. http://medias.schaeffler.de/medias/en. Furthermore, numerous series will be available for import within VibroMatrix.

The table of bearings is centrally available for all InnoAnalyzer windows on one computer. If you want to take over the table of bearing to other computers as well, just copy it. You find it here: <VibroMatrix folder>\1.8.0\Config\MyBearings.txt.



1 New bearing

Click to create a new entry.

2 Bearing table

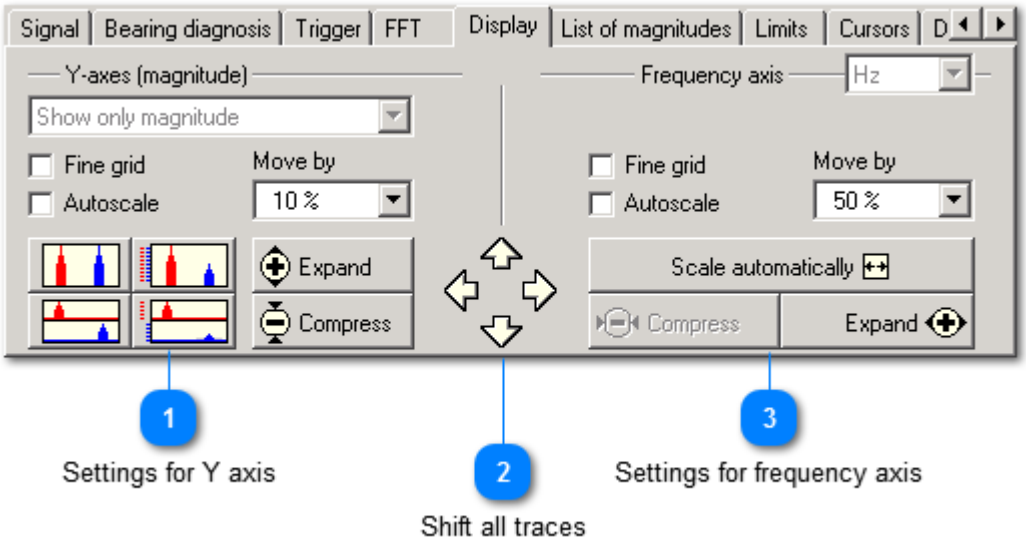
Name	BPFI	BPFO	BSF	FTF
16002	5.410	3.590	2.370	0.400
16003	5.920	4.080	2.640	0.410
16004	6.390	4.610	3.020	0.420
16021	9.920	8.080	4.860	0.450
61806	10.880	9.120	5.630	0.460

The table of bearing contains the name of the bearing and the respective damage frequencies (as multiples of the rotation speed). By pushing the button ↑, you take over the bearing into the table of markers. The table of bearings can contain up to 100 entries.
By clicking right on a row, you open a context menu which offers the deletion of a row.

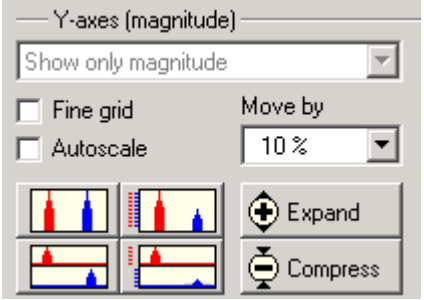
3 Save bearing

This button saves the table at a fixed location:
[VibroMatrix folder]\1.8.0\Config\MyBearings.txt.

Display of traces

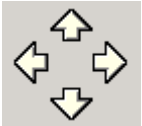


1 Settings for Y axis



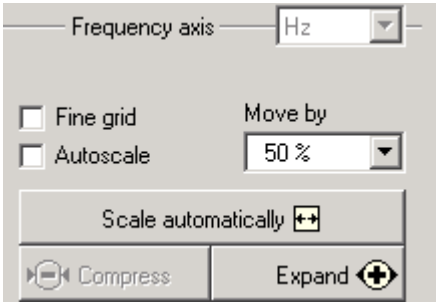
These settings change vertical scaling and arrangement of traces in the diagram.

2 Shift all traces



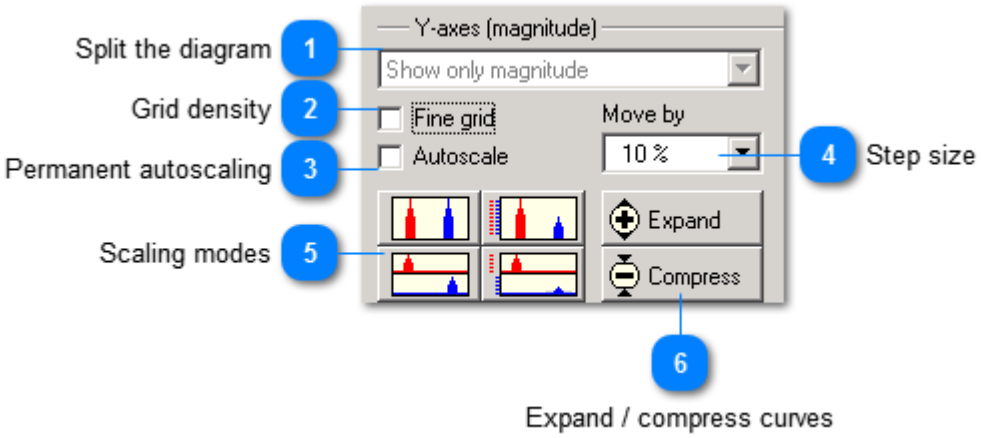
Shifts all traces together into the desired direction.

3 Settings for frequency axis



In this area, you can adjust all settings which influence the measurement curves in horizontal direction, i.e. in direction of the frequency axis.

Y axis settings



1 Split the diagram

In principle, an FFT provides magnitude and phase. Both can be displayed in the measurement chart. You can select whether one of them is to be shown mainly (using more space) or only.
In some FFT or statistics modes, phase values do not have any technical significance. In this case, only magnitudes will be displayed.

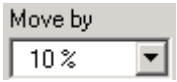
2 Grid density

If you activate this checkbox, the InnoAnalyzer will show grid lines at all graduation marks of the Y-axis.

3 Permanent autoscaling

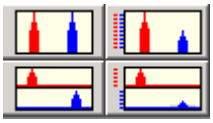
If you activate this checkbox, the InnoAnalyzer will rescale the Y-axes each time the measurement chart is refreshed, using the last scaling mode.

4 Step size



The step size (shown in scale lengths), by which measurement curves and scale are shifted during a movement. For instance, 10% means that the measurement curves are moved by 1/10 of the Y-axis.

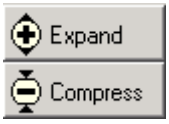
5 Scaling modes



There are four scale modes:

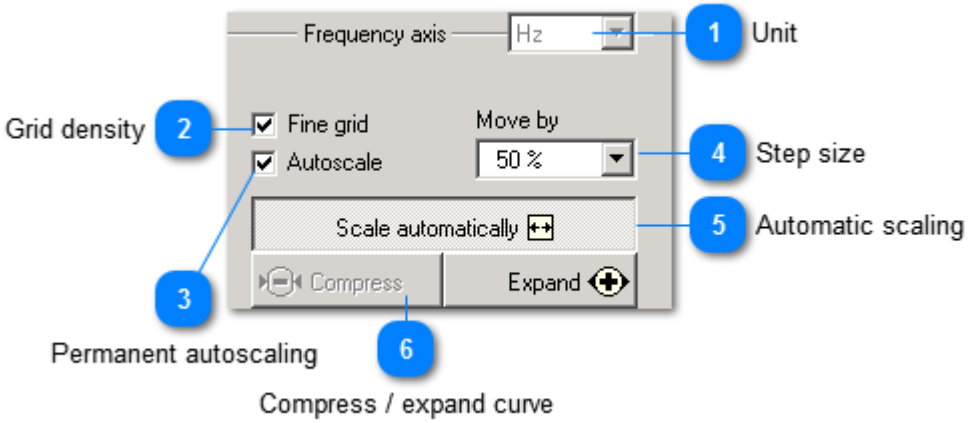
- All curves are maximized.
- Same scale for all curves.
- All curves are maximized and stacked with their own area.
- All curves use the same scale, they are stacked with their own area.

6 Expand / compress curves



These buttons expand or compress all measurement curves in Y direction.

Frequency axis settings



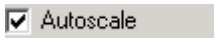
1 Unit

Switch between Hz and 1/min.

2 Grid density

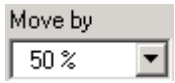
If you activate this checkbox, the InnoAnalyzer will show grid lines at all graduation marks of the frequency axis.

3 Permanent autoscaling



If you activate this checkbox, the InnoAnalyzer will scale the frequency axis permanently in a way that all lines with more than 5% of the highest magnitude are visible.

4 Step size



The step size (shown in scale lengths) by which measurement curves and scale are shifted during a movement. For instance, 10% means that the measurement curves are moved by 1/10 of the frequency axis.

5 Automatic scaling

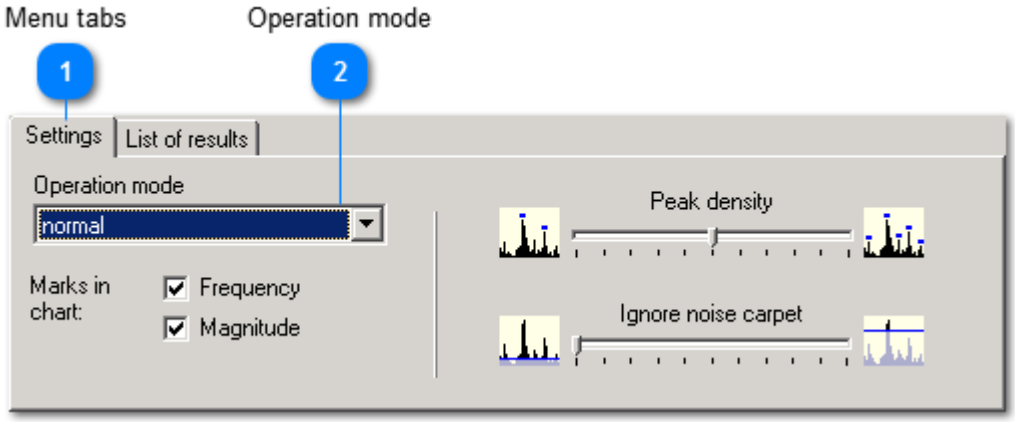
This button scales the frequency axis in a way that the signal is displayed with three periods of its main frequency.

6 Compress / expand curve

These buttons compress or expand the measurement curve.

List of magnitudes

If you activate the list of magnitudes, the InnoAnalyzer detects the magnitudes from the frequency analyze and lists them up. Optionally, it also displays the measured values in the measurement chart.



1 Menu tabs

By these tabs you can switch between setting options for the list of magnitudes and the presentation of the results. The appearance changes depending on the selected operation mode.

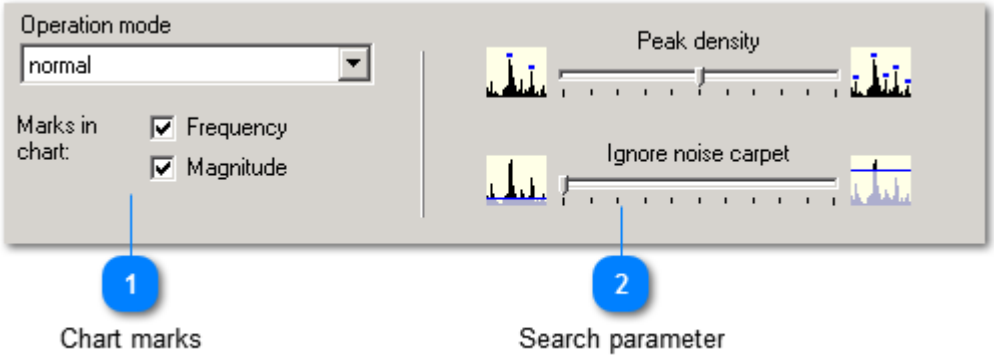
- Settings in the "normal" operation mode
- List of results in the "normal" operation mode
- Settings in the "Half-width" operation mode
- List of results in the "Half-width" operation mode

2 Operation mode

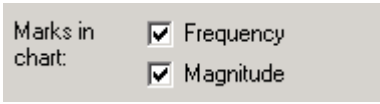
Three operation modes are available in the list of magnitudes:

- switched off — The list of magnitudes is inactive.
- normal — Magnitudes and their respective frequencies are detected.
- Half-width — Magnitudes and their respective frequencies are detected, half-width and attenuation are identified.

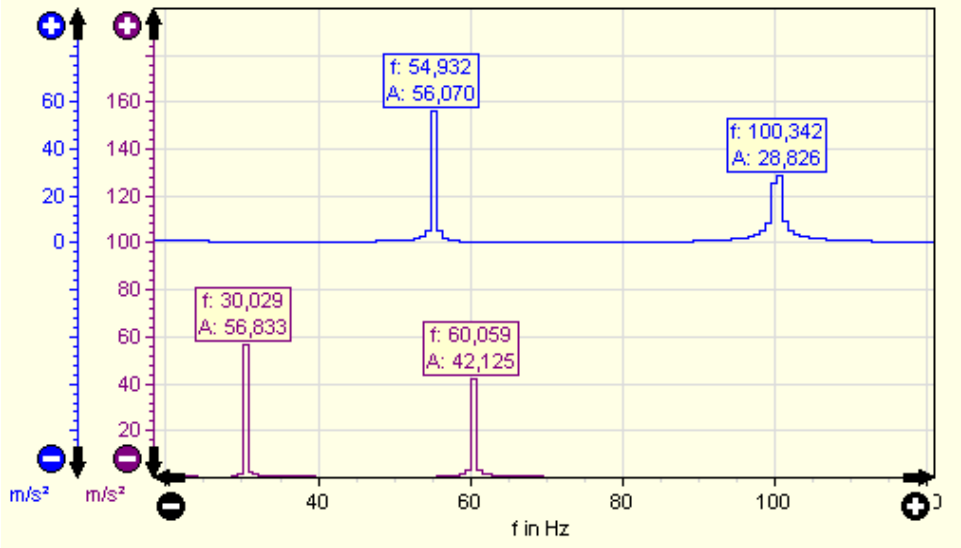
Settings in operation mode "normal"



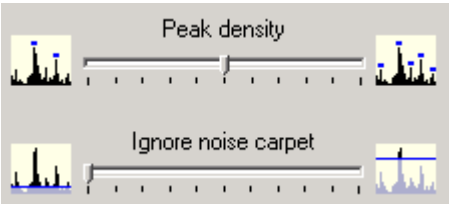
1 Chart marks



The found magnitudes can be marked in the measurement chart. You can select whether frequency and/or magnitude values are displayed numerically in the mark.



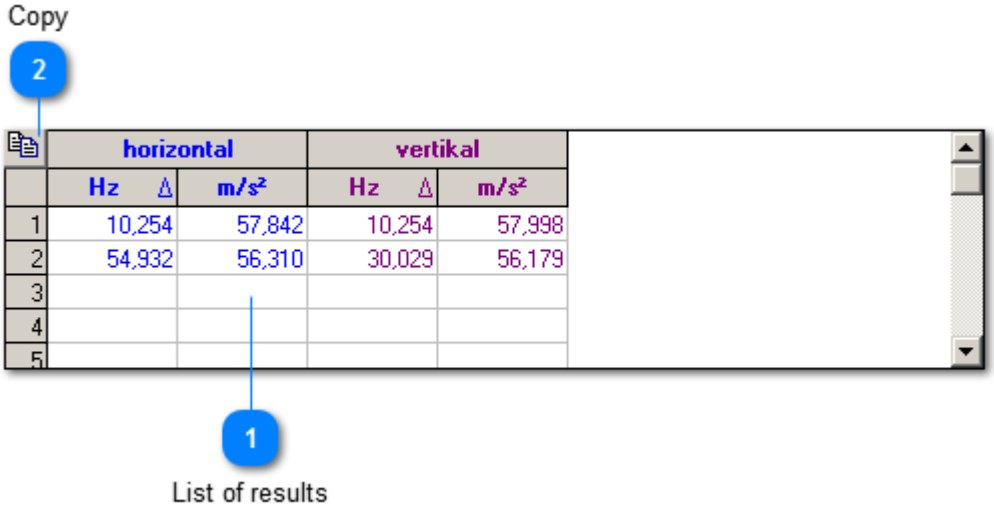
2 Search parameter



The search parameters define whether only the highest (and thus few) magnitudes or many magnitudes are to be found.

- Peak density determines the number of found magnitudes. The more you move the controller to the right side, the more magnitudes will be found.
- Ignore noise carpet determines which level is to be ignored as noise carpet during the finding of magnitudes. The more you move the controller to the right, the more is ignored and fewer magnitudes will be found.

Results in operation mode "normal"



1 List of results

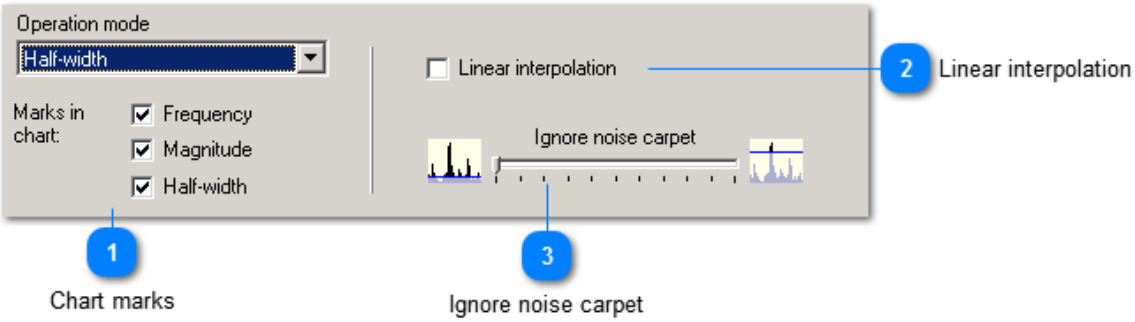
horizontal		vertikal	
Hz	m/s²	Hz	m/s²
10,254	57,842	10,254	57,998
54,932	56,310	30,029	56,179

In the list of results, frequency and magnitude are indicated for each channel of the instrument.
By clicking on the head of a column, the data is sorted. By clicking on the head of the column again, the sorting direction is reversed.
When moving the mouse pointer to an entry, this entry is shown in inverted colors. By clicking on the entry, the measurement chart automatically zooms in on the frequency of this entry.

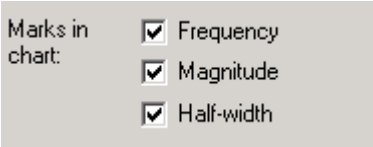
2 Copy

Copies the list of results to the clipboard (in text format).

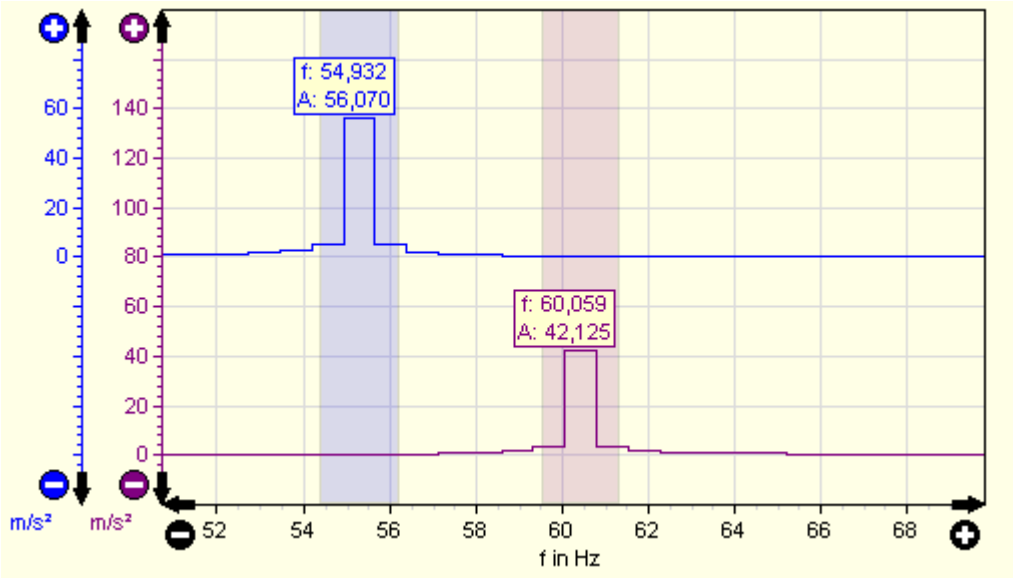
Settings in operation mode "Half-width"



1 Chart marks



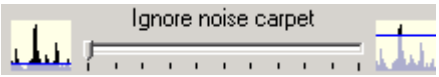
The found magnitudes can be marked in the measurement chart. You can select whether frequency and/or magnitude values are displayed numerically in the mark. Furthermore, the half-width can be marked optically.



2 Linear interpolation

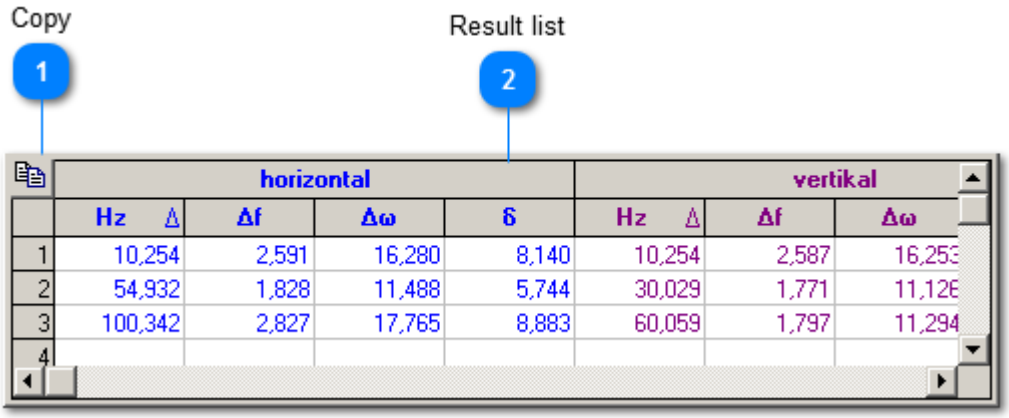
Frequency analyses by FFT show discrete frequencies. In order to make it easier to identify the half-width, the InnoAnalyzer can interpolate linearly among these frequencies.

3 Ignore noise carpet



Ignore noise carpet determines which level is to be ignored as noise carpet during the finding of magnitudes. The more you move the controller to the right, the more is ignored and fewer magnitudes will be found.

Results in operation mode "Half-width"



1 Copy

Copies the list of results to the clipboard (in text format).

2 Result list

horizontal				vertikal		
Hz	Δf	Δω	δ	Hz	Δf	Δω
10,254	2,591	16,280	8,140	10,254	2,587	16,253
54,932	1,828	11,488	5,744	30,029	1,771	11,126
100,342	2,827	17,765	8,883	60,059	1,797	11,294

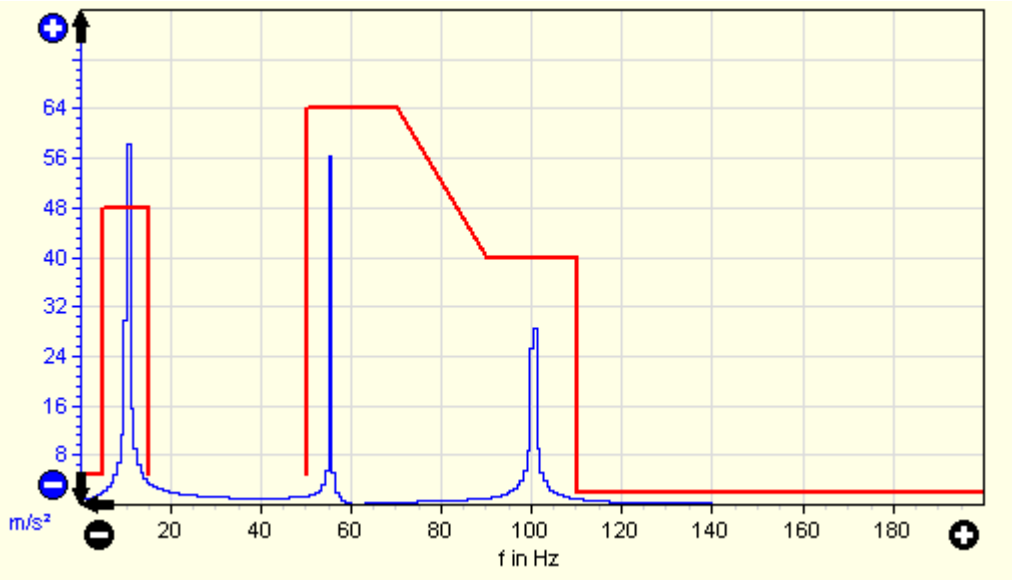
In the list of results, the following values are indicated for each channel of the instrument:

- Frequency
- Magnitude
- Half-width
- Attenuation

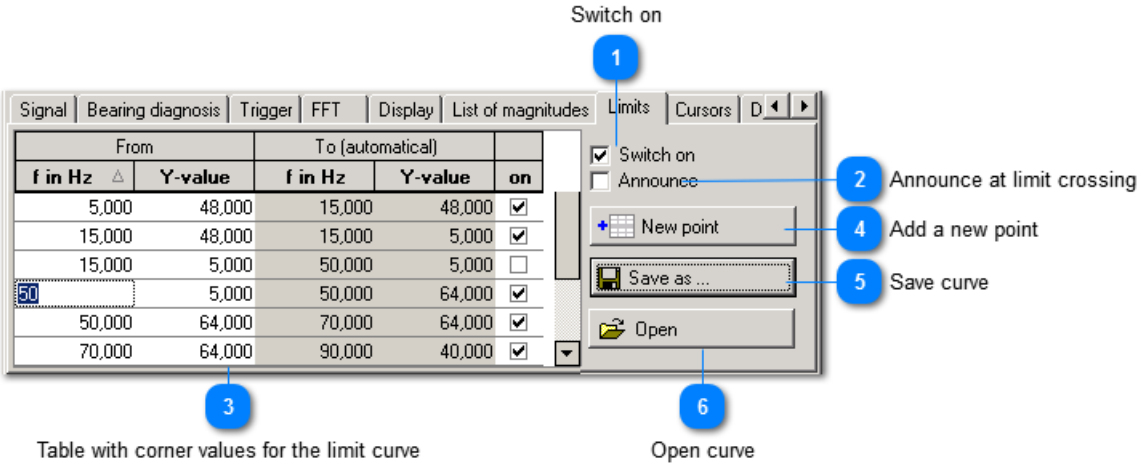
By clicking on the head of a column, the data is sorted. By clicking on the head of the column again, the sorting direction is reversed.
When moving the mouse pointer to an entry, this entry is shown in inverted colors. By clicking on the entry, the measurement chart automatically zooms in on the frequency of this entry.

Limits

You can set up a frequency-selective limit curve for the analyzed data. On the one hand, it allows a quick optical check with regard to exceedance. On the other hand, it can be used for automated annunciations as well.



The limit curve allows to set up arbitrary linear segments, also with gaps.



1 Switch on

Switch on — Activates the limit function.

2 Announce at limit crossing

Announce — If this checkbox is activated, annunciators will be activated in case of exceedance of the limit curve.

3 Table with corner values for the limit curve

From		To (automatical)		
f in Hz	Y-value	f in Hz	Y-value	on
5,000	48,000	15,000	48,000	☑
15,000	48,000	15,000	5,000	☑
15,000	5,000	50,000	5,000	☐
50	5,000	50,000	64,000	☑
50,000	64,000	70,000	64,000	☑
70,000	64,000	90,000	40,000	☑

In this table, you can set up the limit curve point by point. The table contains the columns From and To. You can only change the coordinates in column From: Click right on a field and enter the value.
In the last column you can select whether the point is to be drawn or not. This way, you can add gaps to the limit curve.
By clicking right on a row, you open a context menu which offers the deletion of a row.

4 Add a new point

This button creates a new point in the table. The new point takes over the coordinates of the previous point. You can enter new coordinates.

5 Save curve

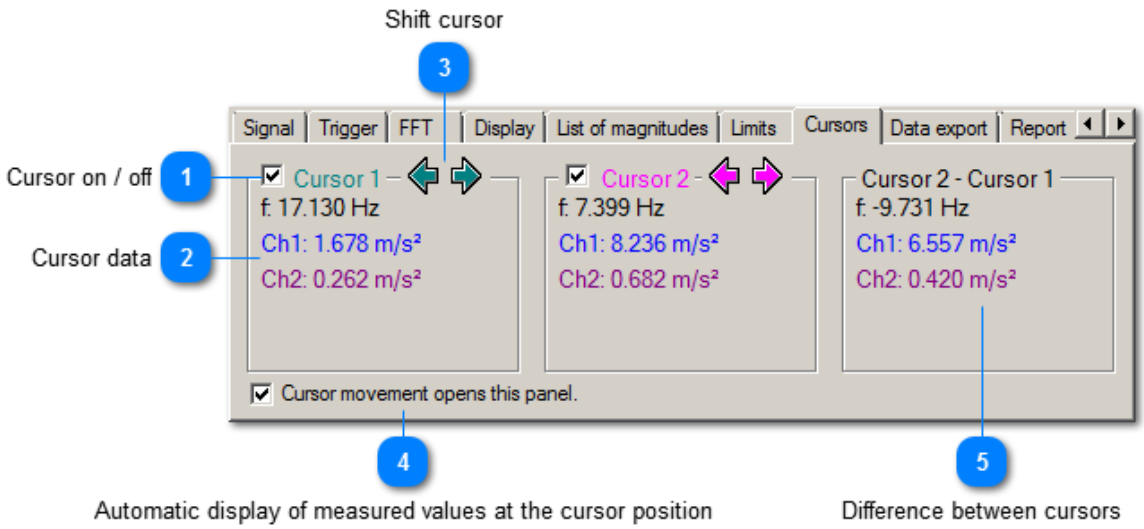
This button saves the limit curve in a file.

6 Open curve

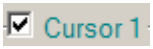
This button loads a limit curve from a file.

Cursors

You can activate 2 cursors and move them on the frequency axis. The measured values at the marked frequency are displayed.

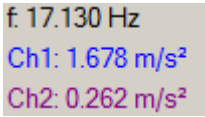


1 Cursor on / off



Activates the cusror function

2 Cursor data

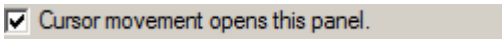


Frequency and magnitude at the cursor position.

3 Shift cursor

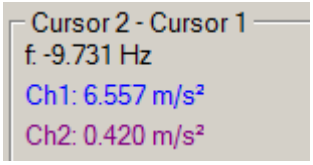
Shift the cursor in the direction of the time axis. Shifting is also possible by dragging the cursor line directly.

4 Automatic display of measured values at the cursor position



If you activate the automatic opening of the cursor control panel, the measured values at the cursor position are displayed immediately in case of cursor movement.

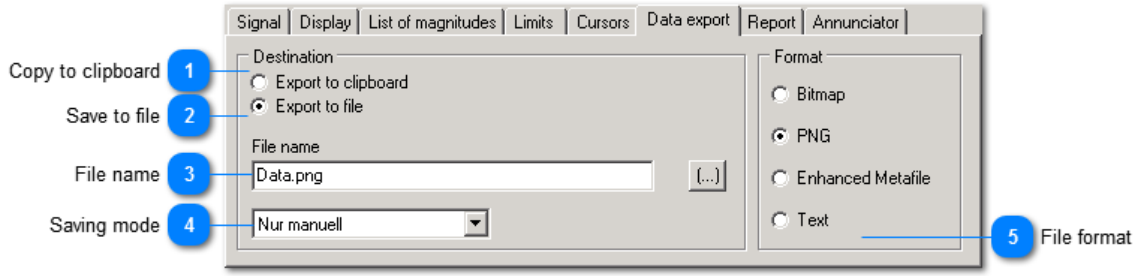
5 Difference between cursors



Shows the difference of magnitude and frequency between the two cursors.

Data export

The measurement data from the InnoAnalyzer can be exported easily. The export is started by pushing the export button.



1 Copy to clipboard

Selects the Copy function.

2 Save to file

Selects the Save function.

3 File name

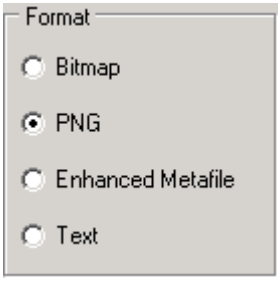
You can directly enter a file name for the data to be saved. The button (...) opens a dialog which also allows to enter a file name. Additionally, you can include placeholders in the filename which are filled when the data is saved.

4 Saving mode

Two modes are available:

Manually:	Data is saved when clicking the save button.
Periodically:	Data is saved in time intervals.

5 File format

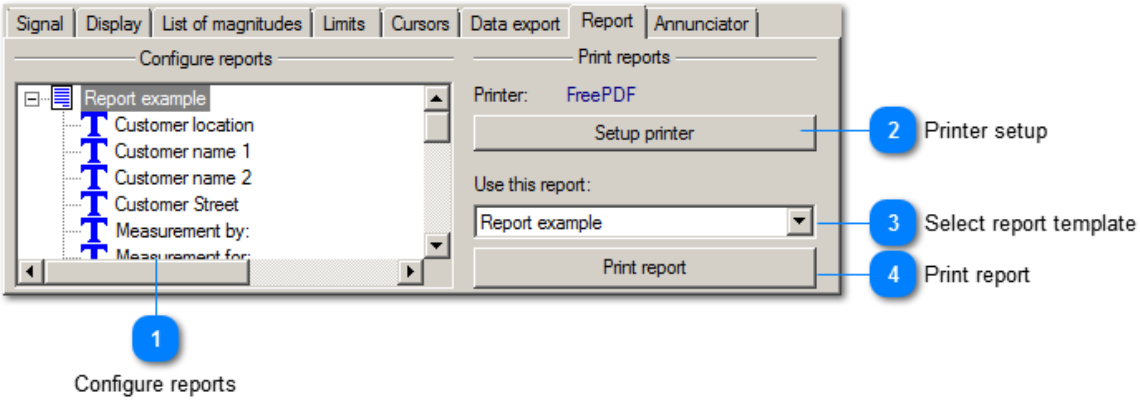


The following file formats are available:

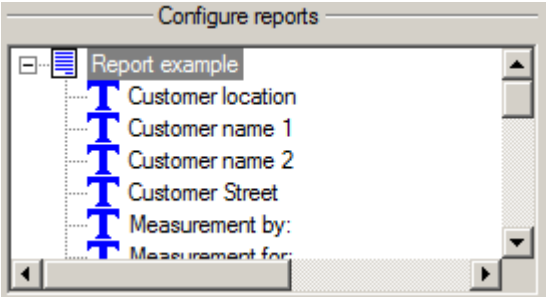
· Bitmap	raster graphics file format
· PNG	raster graphics file format, less than 10 % of bitmap file size without loss of quality
· Enhanced Metafile	Windows enhanced metafile format, allow later changes of characters
· Text	data is saved in a text table format including header which allows later processing by table calculation software

Report

Here the settings are made for printing reports including text information, diagrams, logos etc. After designing the report layout you may save these settings.

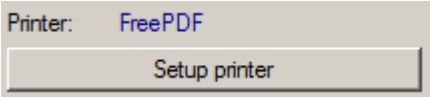


1 Configure reports



In this tree view you find the available report templates. Some sample reports are provided. You may adapt them to your needs.

2 Printer setup

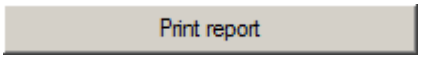


Opens the printer configuration menu.

3 Select report template

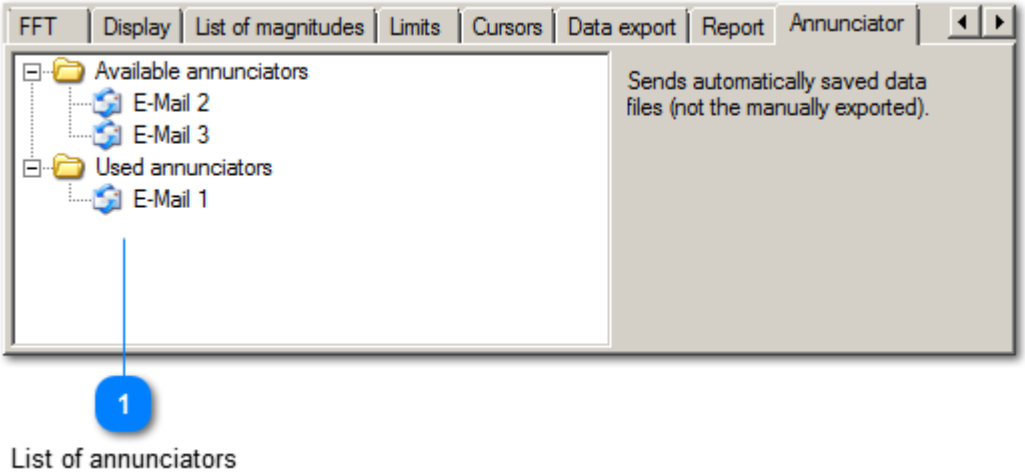
You can select one of the report templates for printing.

4 Print report



Annunciators

VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.

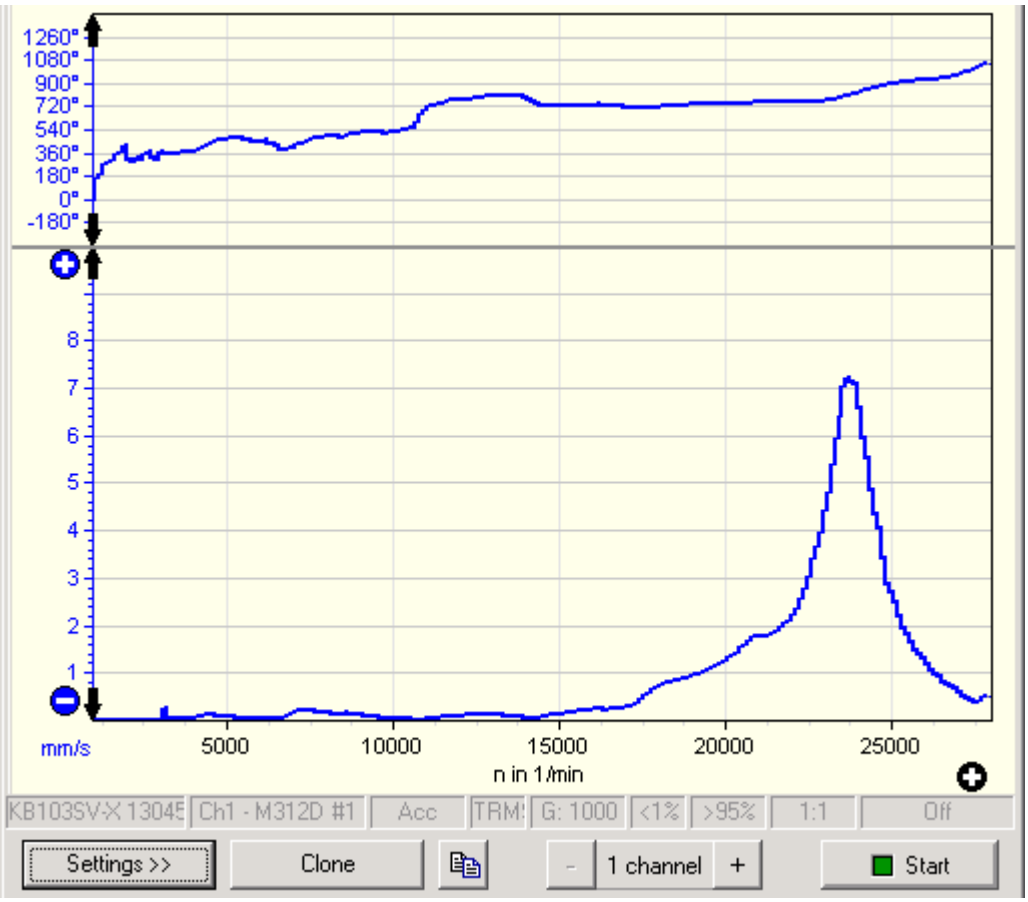


1 List of annunciators

Shows a list of available and used annunciators.

InnoAnalyzer® Speed (Pro)

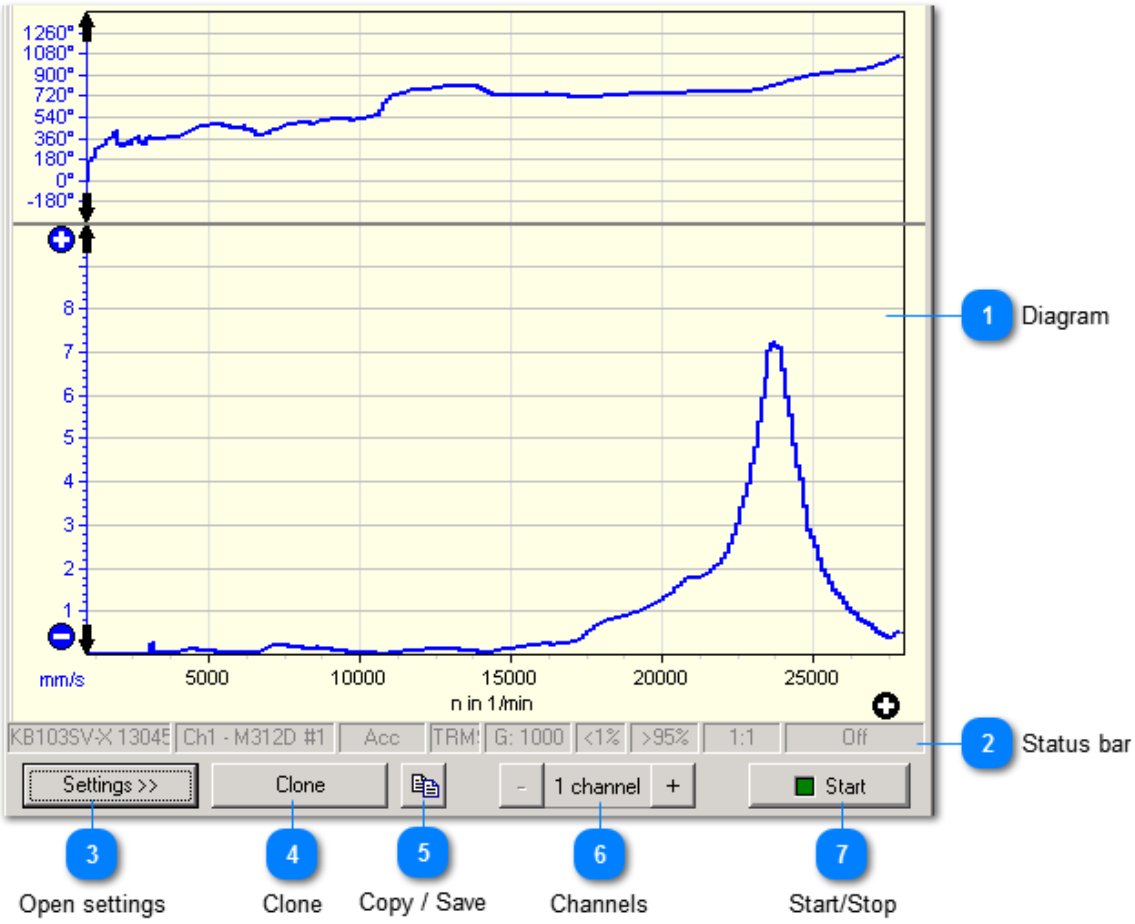
The typical application of the InnoAnalyzer Speed is finding resonances and the rotation speeds when they occur. For this purpose rotation is started up to the nominal rotation speed. During this startup process the InnoAnalyzer Speed measures magnitude and phase of the vibration signal at the rotation frequency or its multiples. The same measurement can also be performed during coast-down. From the measured diagram you can quickly determine resonances.



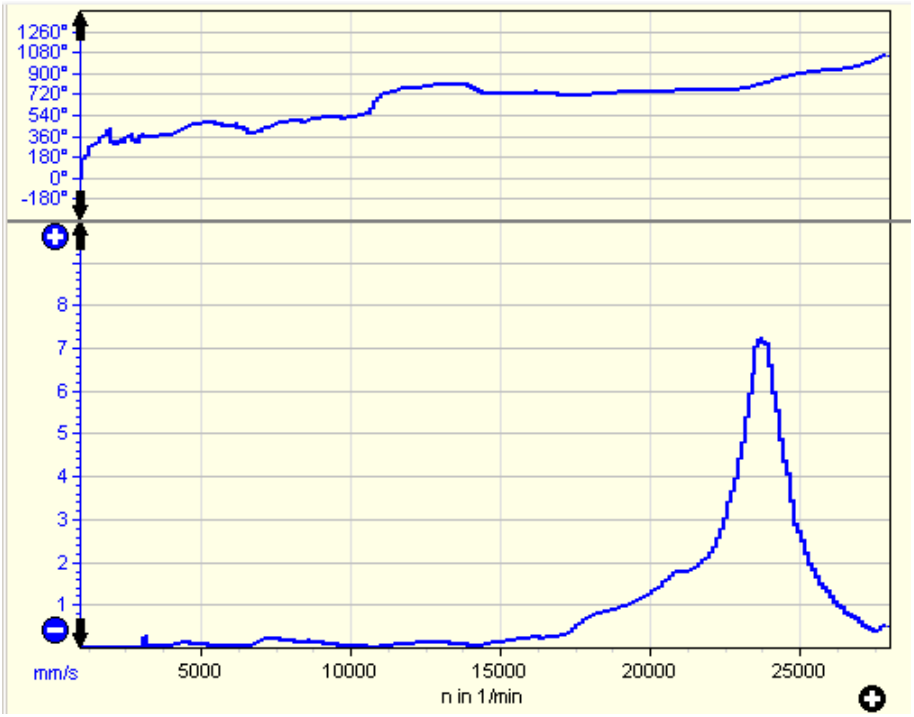
A special feature of the InnoAnalyzer Speed is filtering at fractional parts of rotation frequency like, for example 12 : 27. This enables the analysis of gears by entering the teeth ratios.

In addition to measurements at multiples or fractions of the rotation frequency, the InnoAnalyzer Speed also allows measurements within a frequency band. This can be useful, for example, to measure vibration severity from 10 to 1000 Hz to ISO 10816 against rotation speed.

Display area



1 Diagram

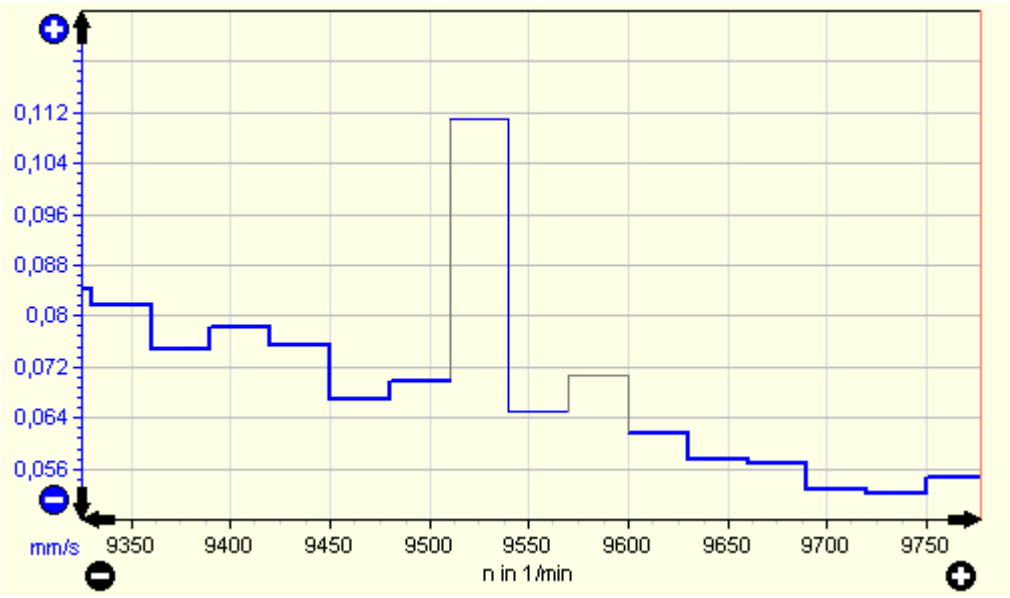


The curves show magnitude and phase of the vibration signal versus rotation speed or multiples of rotation speed. Each curve has its own y-axis which can be scaled and scrolled independently.
Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows. The display control panel contains more settings for the measurement chart.
By means of the mouse, the measurement chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

Traces

Different types of traces inform you about the reliability of the measured values. Each trace is divided into several rotation speed sections. Revolutions belonging toe the same rotation speed are averaged.

- Grey line — 0 ..1 revolution measured in this section, less reliable
- Thin line in channel color — 2..9 revolutions measured in this section, acceptable reliability
- Bold line in channel color — 10 or more revolutions measured in this section, good reliability



2 Status bar

Shows the most important settings of the channel:

- Sensor
- Measuring channel
- Measurand
- Characteristic
- Gain
- Underload
- Overload
- Current rotation speed

3 Open settings

Opens and closes the setup menu.

4 Clone

Opens a new window with the same settings which can be modified.

5 Copy / Save

Copies the diagram data into the clipboard or saves it on hard disk. Different file formats can be chosen.

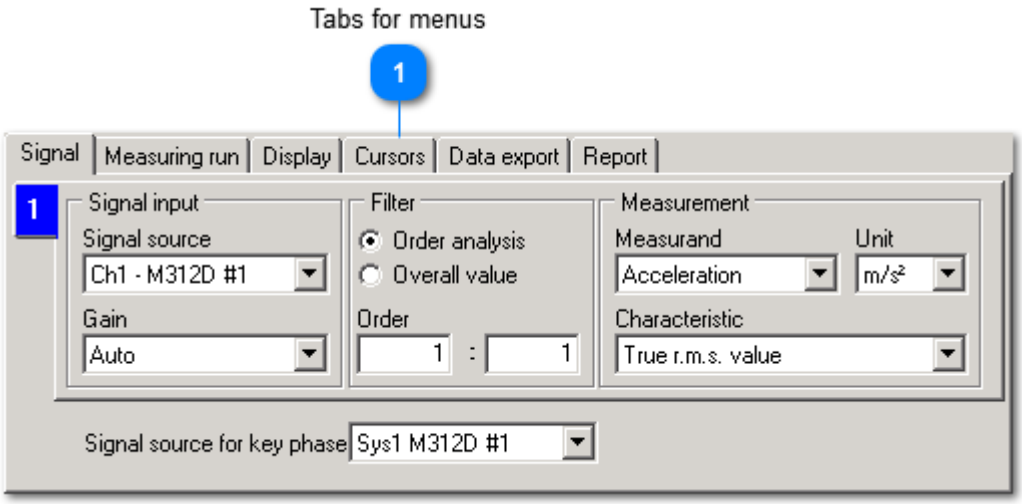
6 Channels

Increase or decrease the number of measuring channels (and curves). One to four channels are possible.

7 Start/Stop

Starts and stops measurement.

Setup area

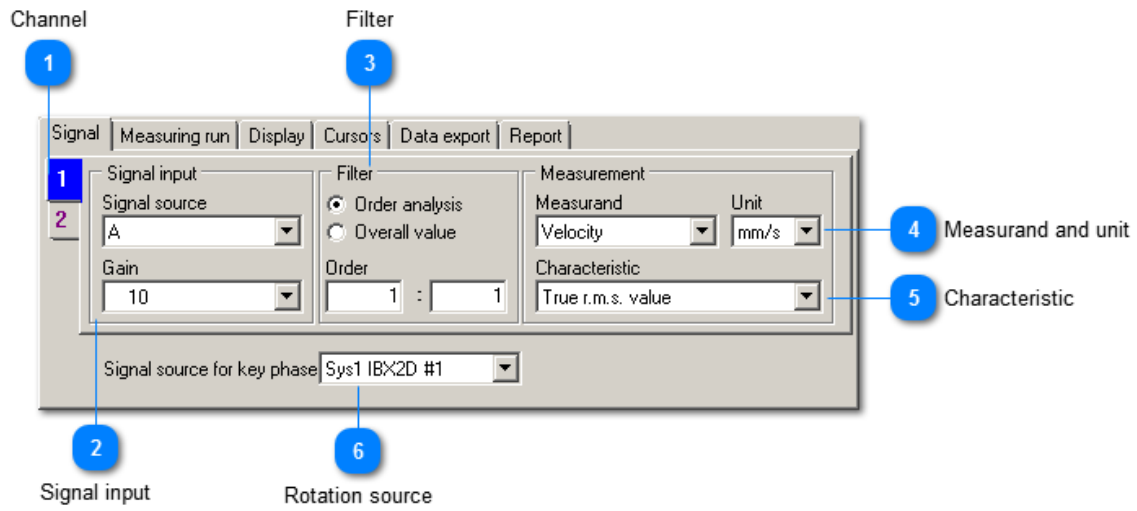


1 Tabs for menus

The submenus are:

Signal:	Signal processing settings to condition the signal
Measuring run:	Speed up / coast down settings
Display:	Settings for the display of measurement curves
Cursors:	Activation/deactivation of cursors, display of measurement data at the cursor position
Data export:	Settings for destination, time and formats of data to be saved
Report:	Settings for report printing

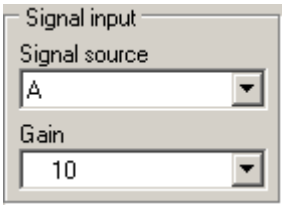
Signal



1 Channel

All settings can be entered independently for each channel. For example, you may use different filters. The number of tabs depends on the number of active channels.

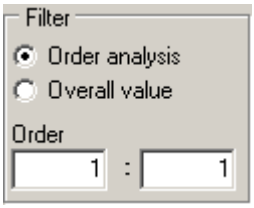
2 Signal input



Selects the physical input and the gain of the USB device InnoBeamer.

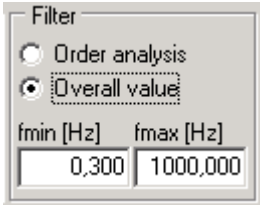
3 Filter

The filter determines which frequencies are observed. It can be an order, i.e. a multiple of the current rotation speed or a frequency range.



In *Order analysis* mode the InnoAnalyzer Speed selectively measures at the rotation frequency or a multiple. Other frequencies are suppressed.

Examples:	rotation frequency	1 : 1
	double rotation frequency	2 : 1
	half rotation frequency	1 : 2
	13/5 rotation frequency	13 : 5



In *Overall value* mode the InnoAnalyzer Speed measures RMS or peak values within the entered filter range, independent of rotation speed. There is no phase measurement in this mode.

4 Measurand and unit

The connected sensor determines the available options. Velocity and displacement are calculated from acceleration by integration (InnoAnalyzer Speed Pro only).
The unit should be selected in a way that the measuring value does not drop below 0.001 permanently.

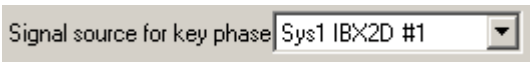
5 Characteristic

In *Order analysis* mode the following choices are possible:

Peak value	The order value represents the magnitude of the filtered sine-wave signal.
True RMS value	The order value represents the root mean square value of the filtered sine-wave signal.
Peak-to-peak value	The order value represents the double magnitude of the filtered sine-wave signal.

In *Overall values* mode you can choose between positive, negative and absolute peak value, peak-to-peak value, RMS value and instantaneous value

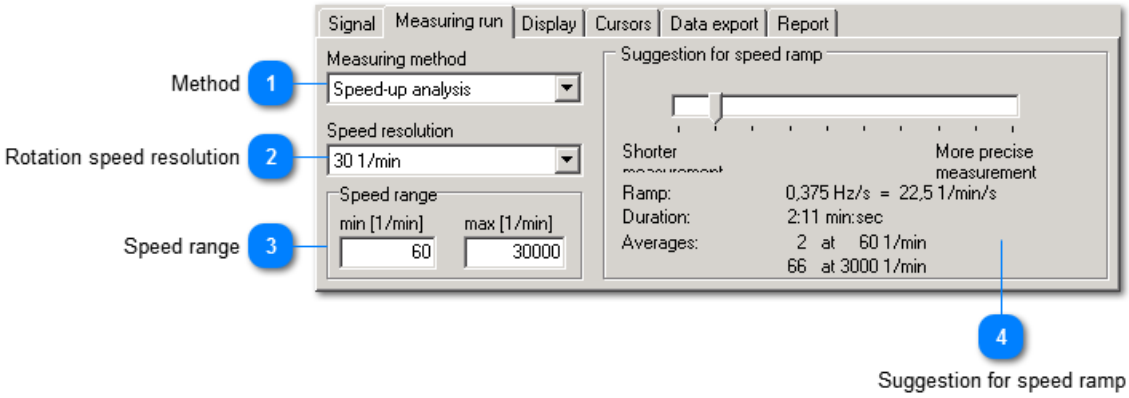
6 Rotation source



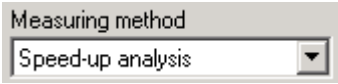
Selects the signal source for rotation speed measurements at all channels.

Measuring run

This panel controls the measuring procedure. The suggested ramp parameters can be used to control drives. They also provide useful information about the suitability of the settings.



1 Method

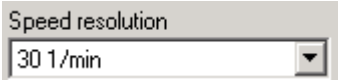


The InnoAnalyzer Speed measures at increasing or at decreasing rotation speeds. If both conditions occur you may select which sections are to be displayed.

- free analysis Measurement at rising and falling speeds
- Speed up analysis Measurement at rising speeds
- Coast down analysis Measurement at falling speeds

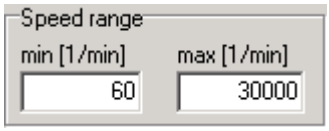
The mode can also be changed during measurement.

2 Rotation speed resolution



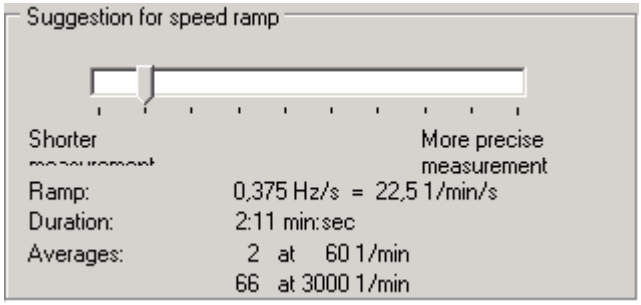
The rotation speed range is divided into discrete sections. This entry selecets the width of these sections. The smaller the value the slower should be the change of rotation speed. Otherwise it may happen that there are invalid sections with less than one revolution measured.
The InnoAnalyzer Speed shows different line types depending on the measured number of revolutions.

3 Speed range



You can enter the expected minimum and maximum rotation speed here. These frequencies determine the limits of the displayed frequency axis.

4 Suggestion for speed ramp

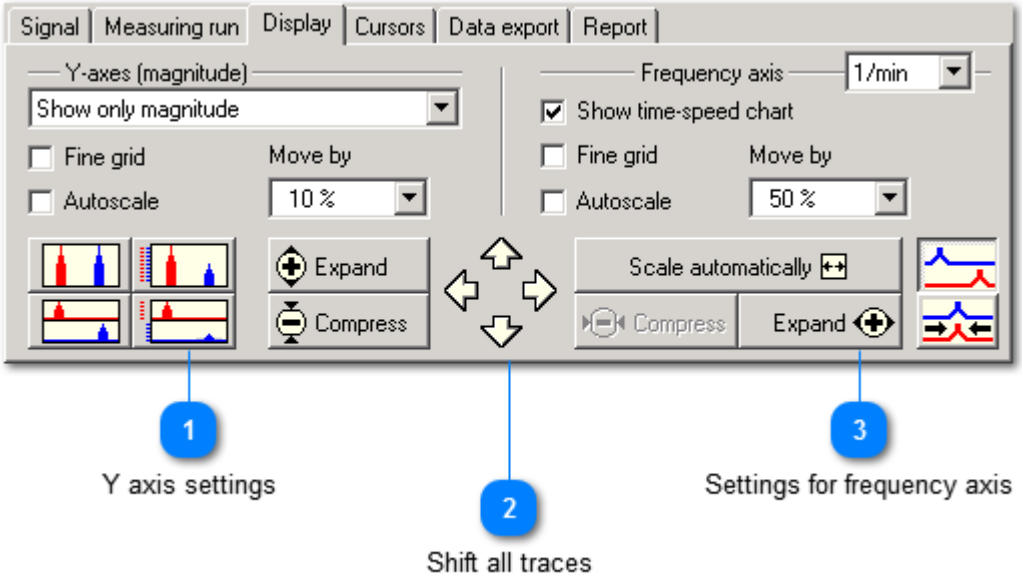


If you are able to control the machine's change of rotation speed you will find here some information about the needed duration of measurement. The slider can be moved between shortest measurement and highest precision.

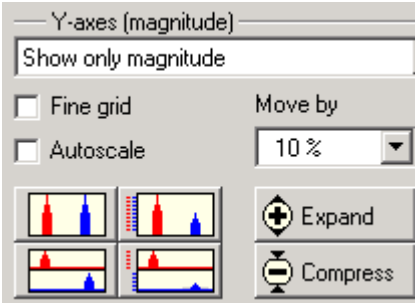
- Shortes measurement assumes at the lowest speed only one revolution for measurement. There will be more revolutions considered at higher speeds.
- Highest precision guarantees even at low speed that at least 10 revolutions are measured.

The data shown here is only a suggestion for your information. It does not influence measurement.

Display of traces

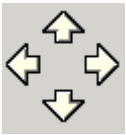


1 Y axis settings



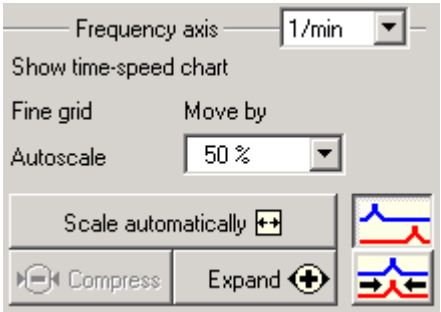
These settings change vertical scaling and arrangement of traces in the diagram.

2 Shift all traces



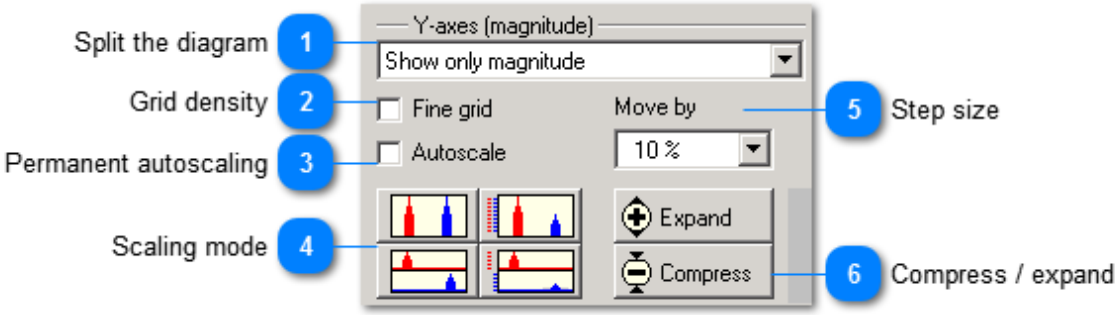
Shifts all traces together into the desired direction.

3 Settings for frequency axis

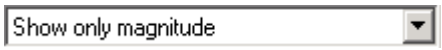


In this area, you can adjust all settings which influence the measurement curves in horizontal direction, i.e. in direction of the frequency axis.

Y axis settings

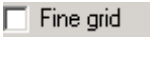


1 Split the diagram



The InnoAnalyzer Speed provides magnitude and phase. Both can be displayed in the measurement chart. You can select whether one of them is to be shown mainly (using more space) or only.

2 Grid density

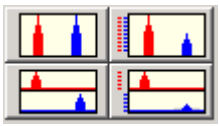


If you activate this checkbox, the InnoAnalyzer Speed will show grid lines at all graduation marks of the Y-axis.

3 Permanent autoscaling

If you activate this checkbox, the InnoAnalyzer Speed will rescale the Y-axes each time the measurement chart is refreshed, using the last scaling mode.

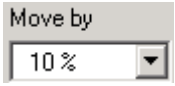
4 Scaling mode



There are four scale modes:

- All curves are maximized.
- Same scale for all curves.
- All curves are maximized and stacked with their own area.
- All curves use the same scale, they are stacked with their own area.

5 Step size

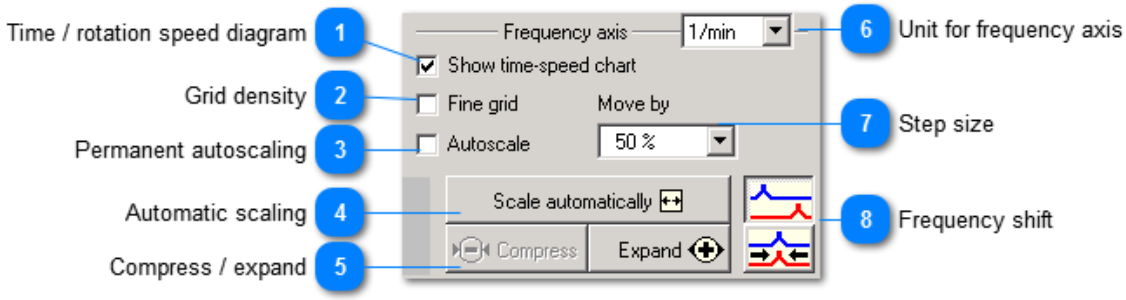


The step size (shown in scale lengths), by which measurement curves and scale are shifted during a movement. For instance, 10% means that the measurement curves are moved by 1/10 of the Y-axis.

6 Compress / expand

These buttons expand or compress all measurement curves in Y direction.

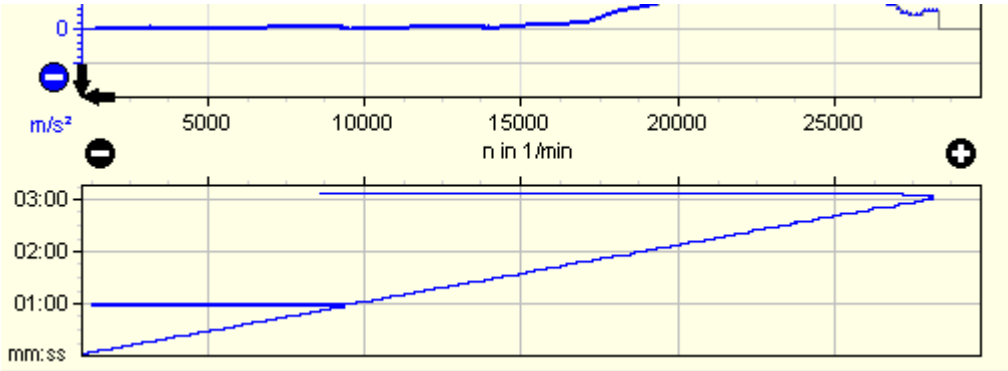
Frequency axis settings



1 Time / rotation speed diagram

Show time-speed chart

Switches on the display of a time / speed diagram. Switching it off allows a bigger area for the magnitude / phase diagram.



Example: The speed diagram shows a speed up measurement with a short drive interruption at 9600 1/min after 1 hour.

2 Grid density

Fine grid If you activate this checkbox, the InnoAnalyzer Speed will show grid lines at all graduation marks of the frequency axis.

3 Permanent autoscaling

Autoscale The frequency axis is permanently adapted so that all lines with more than 5 % of the highest magnitude are visible.

4 Automatic scaling

Scale automatically Automatically scales the frequency axis.

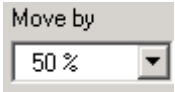
5 Compress / expand

These buttons compress or expand the measurement curve.

6 Unit for frequency axis

Switch between Hz and 1/min.

7 Step size



The step size (shown in scale lengths) by which measurement curves and scale are shifted during a movement. For instance, 10% means that the measurement curves are moved by 1/10 of the frequency axis.

8 Frequency shift

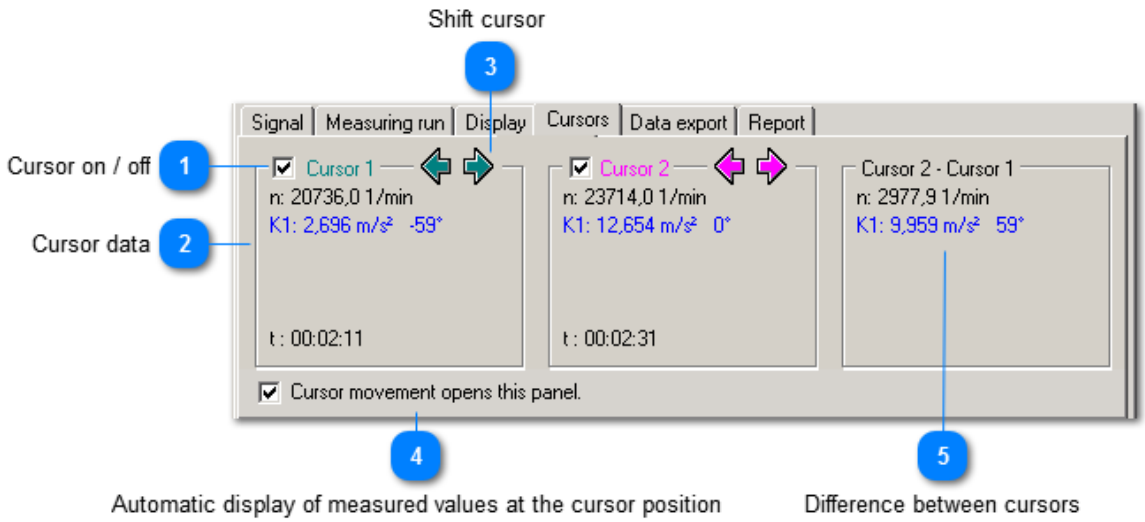
If in order analysis mode different orders are examined you can choose here how the frequency axis as scaled:

Measurements are displayed at their actual frequencies. This will help you to detect resonance frequencies.

Measurements are scaled to order 1, i.e. rotation frequency. The diagram will show you the reaction of the test object in different orders at the same speed.

Cursors

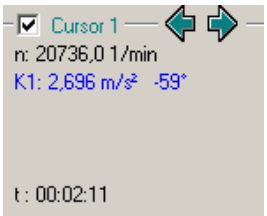
You can activate 2 cursors and move them on the frequency axis. The measured values at the marked frequency are displayed.



1 Cursor on / off

Activates the cursor function

2 Cursor data



Frequency and magnitude at the cursor position.

3 Shift cursor

Shift the cursor in the direction of the time axis. Shifting is also possible by dragging the cursor line directly.

4 Automatic display of measured values at the cursor position

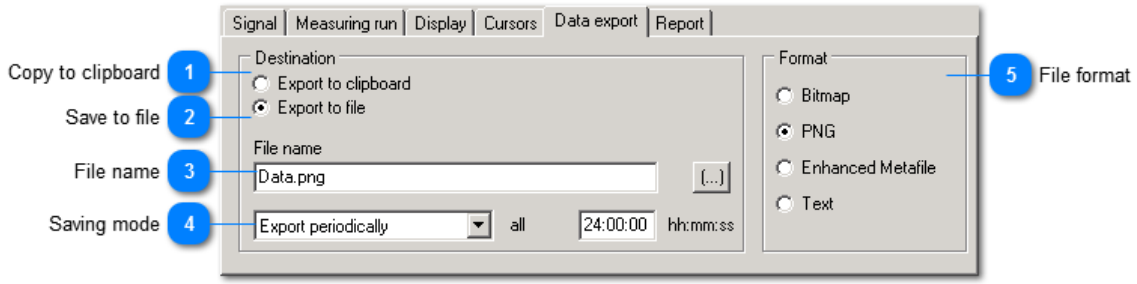
If you activate the automatic opening of the cursor control panel, the measured values at the cursor position are displayed immediately in case of cursor movement.

5 Difference between cursors

Shows the difference of magnitude and frequency between the two cursors.

Data export

The measurement data from the InnoAnalyzer Speed can be exported easily. The export is started by pushing the export button.



1 Copy to clipboard

Selects the Copy function.

2 Save to file

Selects the Save function.

3 File name

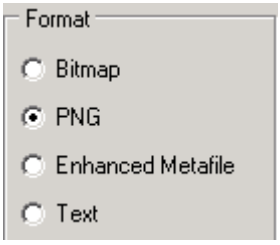
You can directly enter a file name for the data to be saved. The button (...) opens a dialog which also allows to enter a file name. Additionally, you can include placeholders in the filename which are filled when the data is saved.

4 Saving mode

Two modes are available:

- Manually — Data is saved when clicking the save button.
- Periodically — Data is saved in time intervals.

5 File format

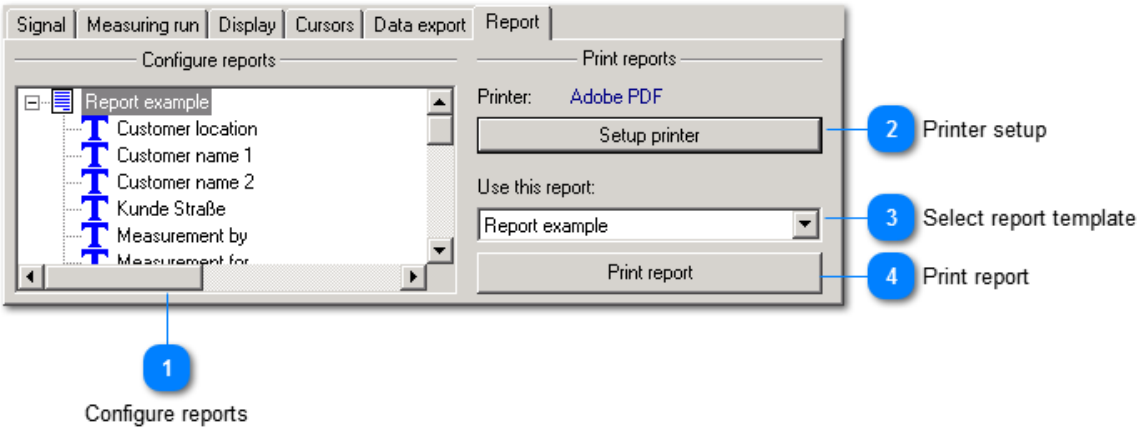


The following file formats are available:

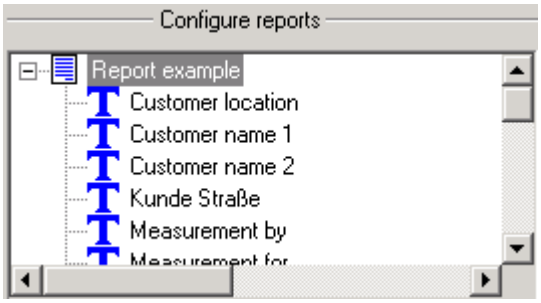
- Bitmap — raster graphics file format
- PNG — raster graphics file format, less than 10 % of bitmap file size without loss of quality
- Enhanced Metafile — Windows enhanced metafile format, allow later changes of characters
- Text — data is saved in a text table format including header which allows later processing by table calculation software

Report

Here the settings are made for printing reports including text information, diagrams, logos etc. After designing the report layout you may save these settings.



1 Configure reports



In this tree view you find the available report templates. Some sample reports are provided. You may adapt them to your needs.

2 Printer setup

Opens the printer configuration menu.

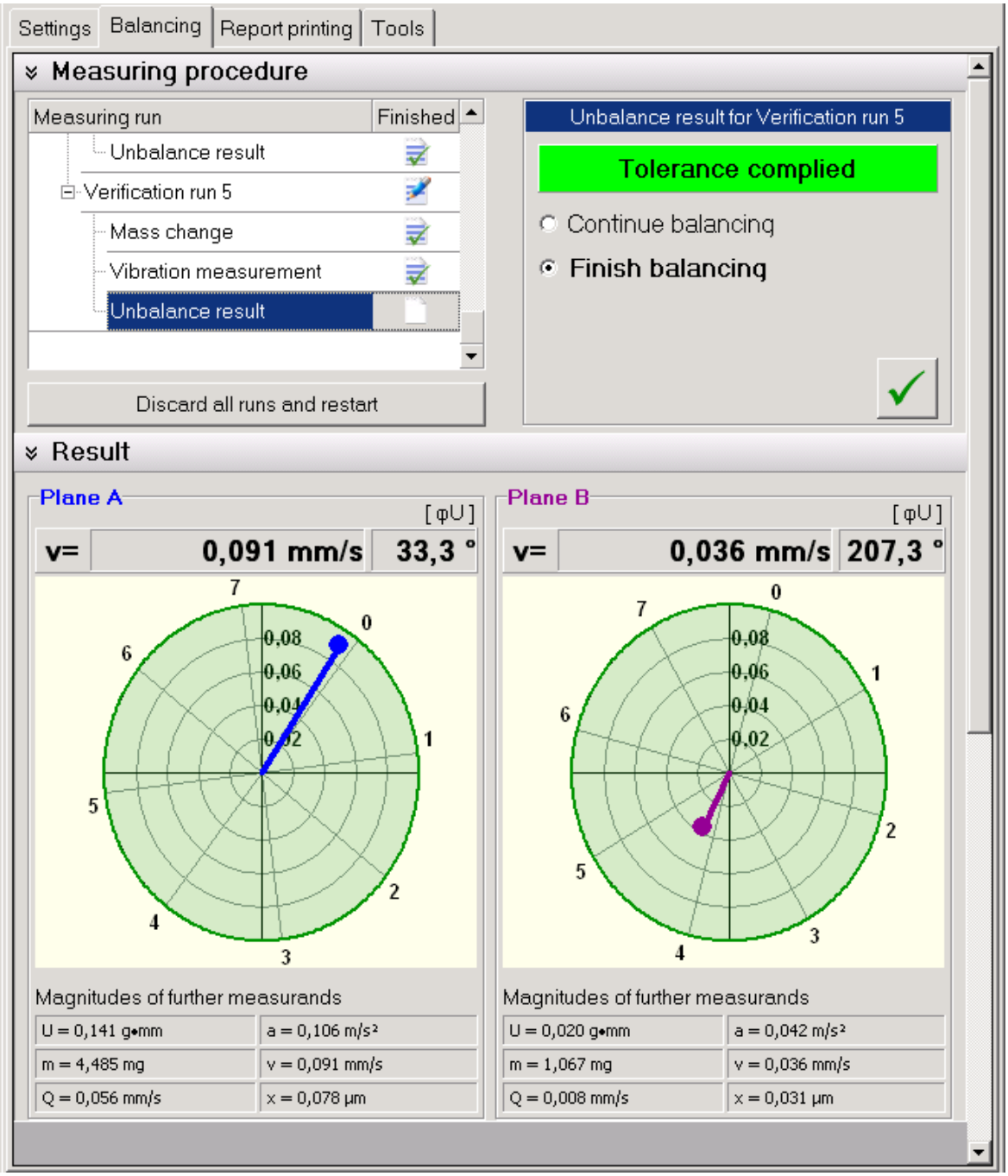
3 Select report template

You can select one of the report templates for printing.

4 Print report

InnoBalancer® (Pro)

The InnoBalancer is intended for field balancing in one or two planes. Ideally, the rotor is balanced directly in its regular operating condition.

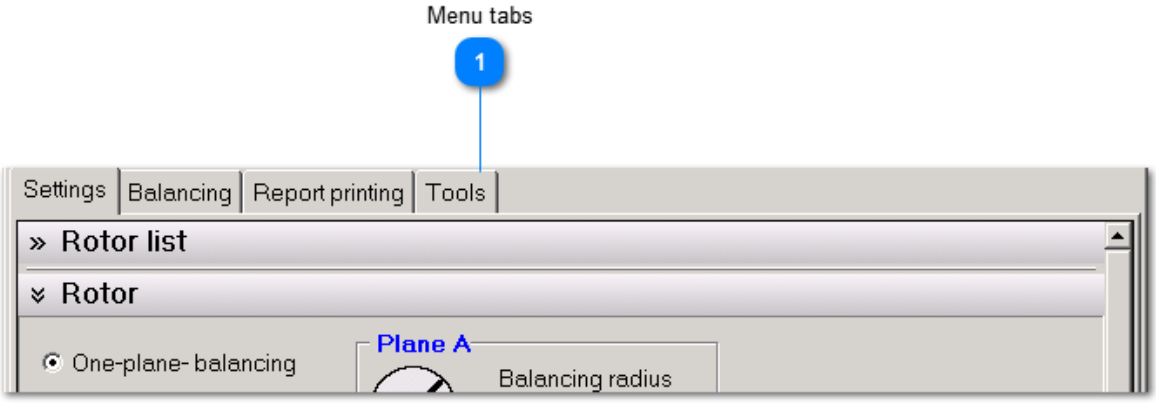


The InnoBalancer safely guides the user through all steps of setup and operation. Operations and results are clearly displayed as graphics.

Special features for high balancing efficiency are:

- To avoid erroneous balancing at rotation speeds near the rotor resonance the InnoBalancer provides instructions for finding an optimum rotation speed after a first test run.
- The InnoBalancer calculates the optimum test mass.
- The test mass can be left at the rotor during balancing. The InnoBalancer will consider it in its calculations, if desired.
- Drilling, milling, adding or removing mass, sliding blocks, set screws, etc. - the InnoBalancer offers 8 corrections methods.
- Incomplete balancing sessions can be saved and reloaded to be continued later.
- Only a few mouse clicks are needed to produce a balancing report.

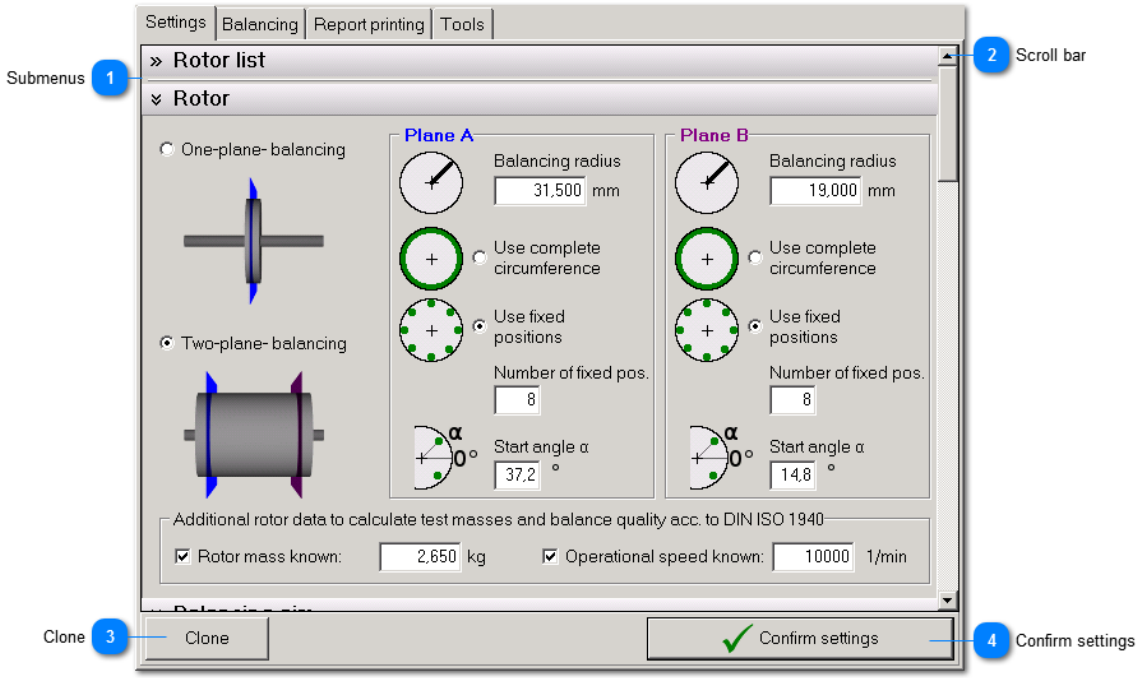
Operation panels



1 Menu tabs

Settings	Settings to be made before starting the balancing process
Balancing	The actual balancing process consisting of vibration measurement and mass shifting
Report	Printing balancing reports
Tools	Useful functions supporting the balancing process

Settings



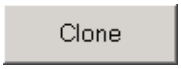
1 Submenus

Before balancing, it is recommended to check all settings of these submenus from the top to the bottom.

2 Scroll bar

Scroll up and down to open the submenus.

3 Clone



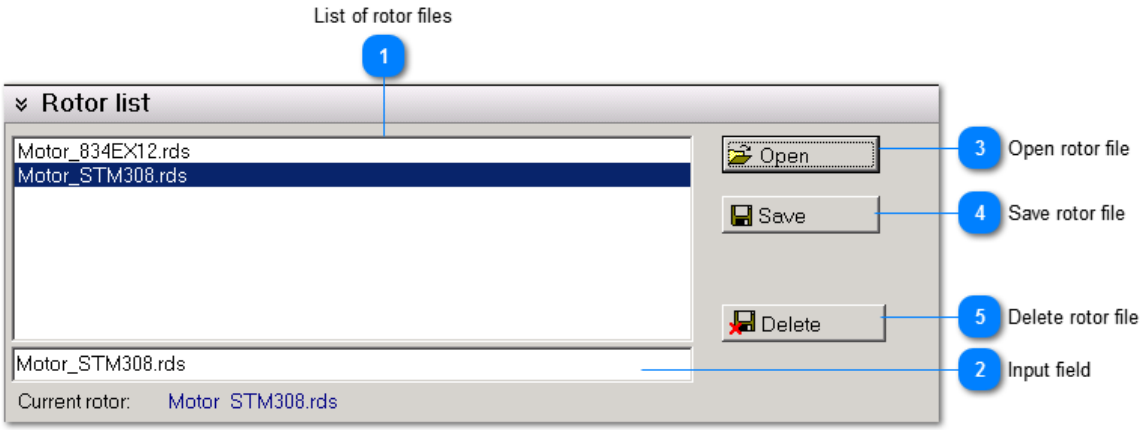
Opens a new window with the same settings which can be modified in a different way.

4 Confirm settings

Click this button when you have finished all settings. This is a precondition for balancing. After pressing this button all settings will be crossed out and blocked until you press the *Edit settings* button.

Rotor list

All settings concerning the rotor may be saved in file. This will save time when the same machine or a similar one are balanced again.



1 List of rotor files

The list shows all rotor files that have been saved. Click at a file name to put it into the input field.

2 Input field

Select either an existing file name from the list (see above) or type in a new file name.

3 Open rotor file

Opens the rotor file entered in the input field and loads all data and settings.

4 Save rotor file

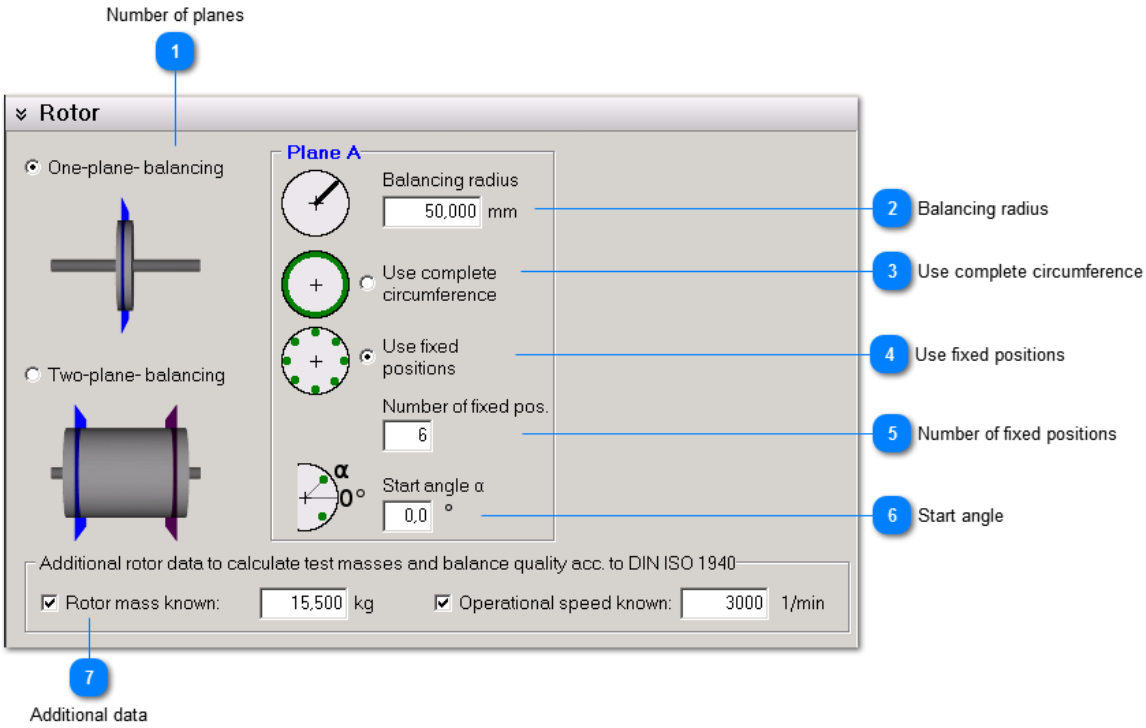
Saves a rotor file under the name entered in the input field .

5 Delete rotor file

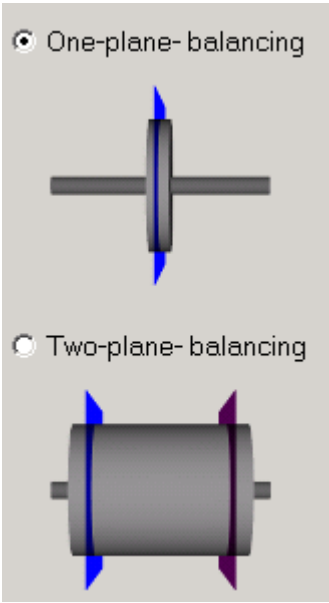
Deletes the file in the input field.

Rotor data

These settings are important for specifying the rotor properties.



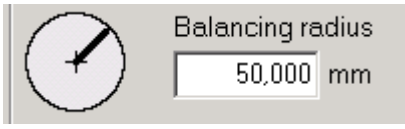
1 Number of planes



Factors for the decision between one or two plane balancing:

- One-plane balancing saves time compared with two-plane balancing.
- Two-plane balancing requires at least one additional balancing run and mass shifting in both planes.
- One-plane balancing only compensates static unbalance.
- Two-plane balancing compensates static and couple unbalances.
- Disk shaped rotors can be usually balanced in one plane.
- For longish rotors two-plane balancing is required in many cases.

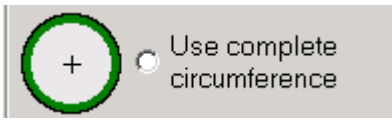
2 Balancing radius



This is the radius at the rotor where mass shifting will be done. It is not necessarily the outer rotor radius.

Simple balancing with the aim of reducing the unbalance mass with the methods of adding or removing mass will also succeed without entering a balancing radius. For many other calculations, however, the balancing radius is needed. Therefore entering a radius is recommended.

3 Use complete circumference

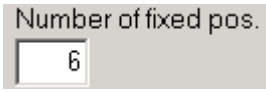


This selection allows balancing at any angle position of the rotor circumference.

4 Use fixed positions

If the rotor only allows changes at a limited number of positions, e.g. when balancing propellers or crankshafts, choose this option.

5 Number of fixed positions

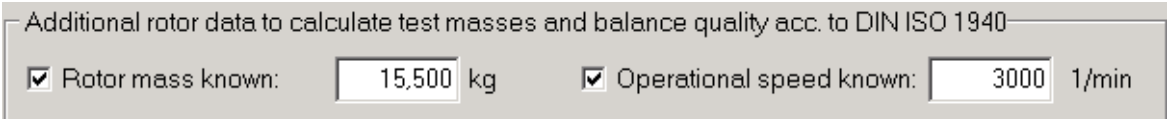


You can enter here between 3 and 360 positions. The InnoBalancer assumes that the fixed positions are evenly distributed in the same angles at the rotor circumference.

6 Start angle

For efficient balancing the zero angle should correspond to the angle of the rotation speed mark at the rotor. This will not always be the case when balancing at fixed positions, e.g. in two-plane balancing when there is an offset between the fixed positions of both planes. You may enter here an angle offset.

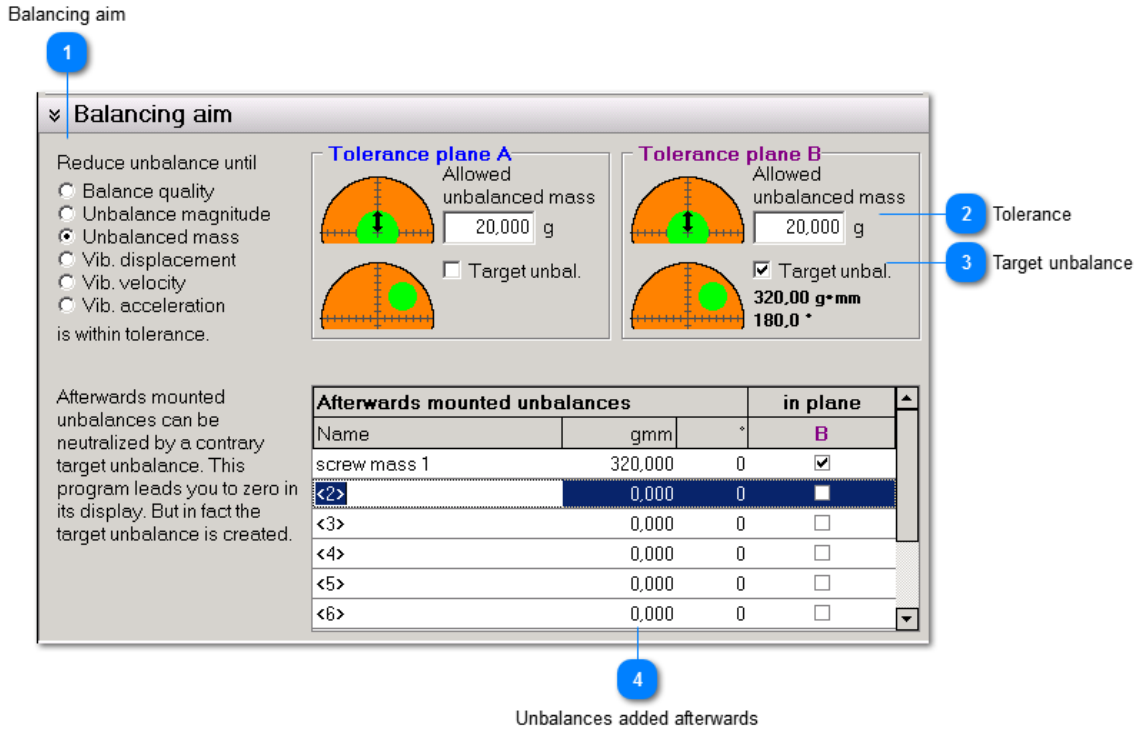
7 Additional data



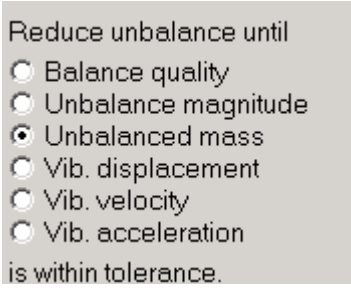
If rotor mass and rotation speed are known, it is recommended to enter them here. This data is not mandatory for balancing but it helps to determine the right test mass and to calculate balancing quality to ISO 1940.
Disable the checkboxes if the data is unknown.

Balancing aim

Balancing can be performed with different aims. The purpose will always be to bring the unbalance under a certain tolerance limit. It may also be necessary to create a determined unbalance.



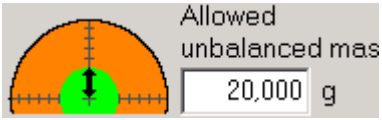
1 Balancing aim



Balancing can be performed for different reasons, like reaching a certain balancing quality or reducing vibration levels. Select the desired aim here so that the InnoBalancer can present the results in the appropriate way and compare them with suitable tolerance limits.

Once balancing has been started the balancing aim cannot be changed anymore.

2 Tolerance



After selecting the balancing aim you enter here the acceptable limit. The InnoBalancer will ask you to finish balancing when the entered value is reached.

3 Target unbalance

A special feature of the InnoBalancer is the possibility of creating a certain unbalance. This can be advantageous in situations where the rotor is not completely assembled in the moment of balancing. The InnoBalancer will take into account that parts added later will be compensated.

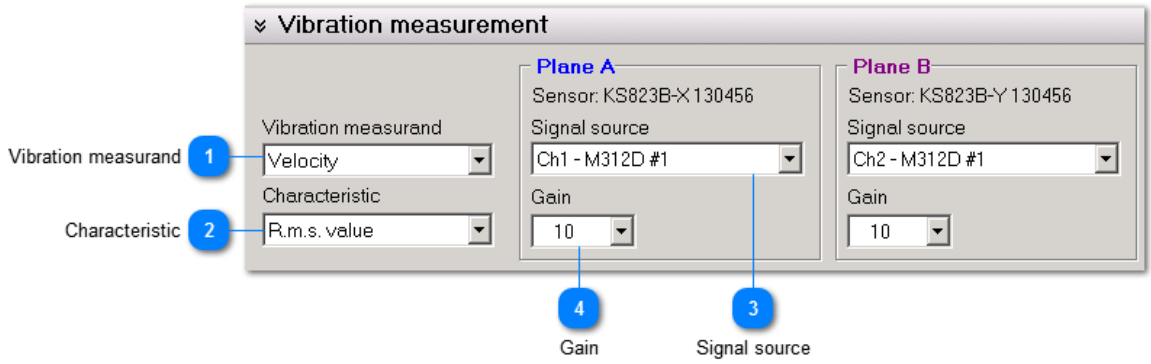
4 Unbalances added afterwards

Afterwards mounted unbalances			in plane
Name	gmm	°	B
screw mass 1	320,000	0	☑
<2>	0,000	0	☐
<3>	0,000	0	☐
<4>	0,000	0	☐
<5>	0,000	0	☐
<6>	0,000	0	☐

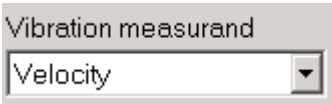
Enter the unbalances to be mounted later for the calculation of target unbalance. Up to 9 unbalances can be entered with name, amount and angle. They will be considered if the respective checkbox is enabled.

Vibration measurement

Initial unbalance is measured indirectly. A rotating unbalance generates a centrifugal force acting at the bearings. This results in vibration which is measured. For each plane an accelerometer is mounted in radial direction and connected to the inputs of the InnoBeamer device.

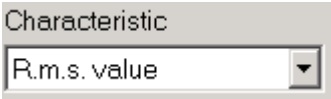


1 Vibration measurand



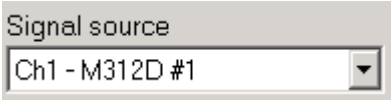
Vibration can be displayed as acceleration, velocity or displacement. Most common in the machine building industry is vibration velocity which is also used in machine condition monitoring to ISO 10816.

2 Characteristic



RMS or peak values can be measured to characterize vibration.

3 Signal source



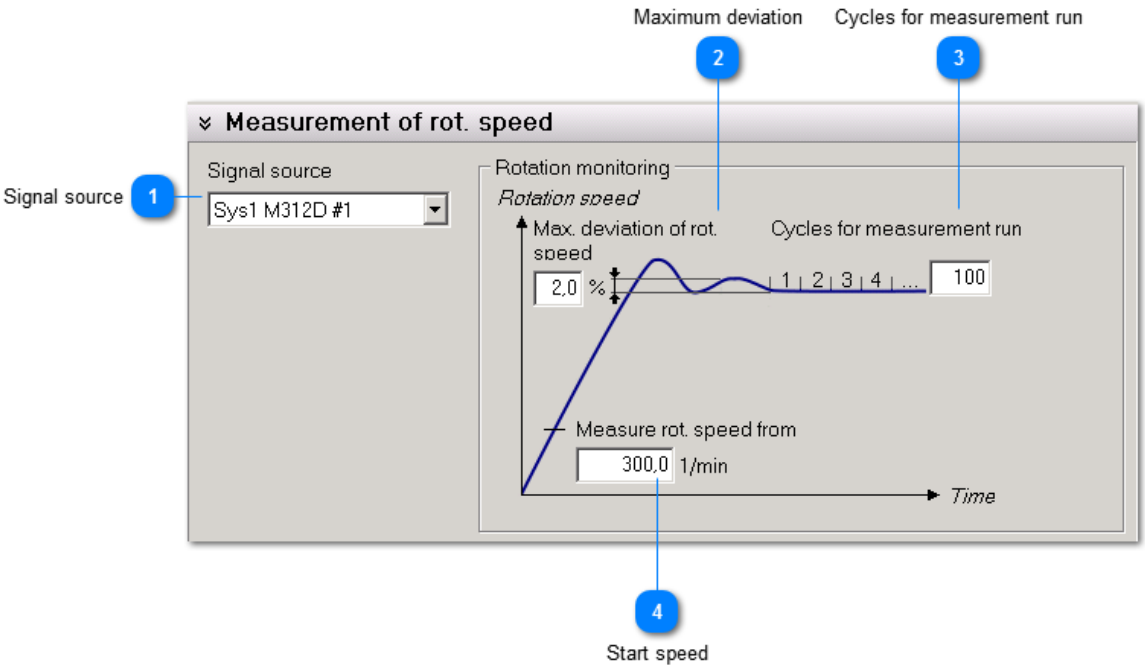
Selects the physical signal input for vibration of the USB device InnoBeamer.

4 Gain

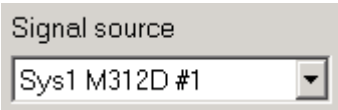
Selects the physical gain of the USB device InnoBeamer for vibration. Auto ranging must not be used for balancing.

Rotation speed

Balancing is performed at constant rotation speed. The InnoBalancer uses the rotation speed signal from the photoelectric reflex switch VM-PS which is connected to the digital input of the InnoBeamer. Alternatively signals from rotor-specific sensors can be measured like, for example, the z signal of a rotary encoder.

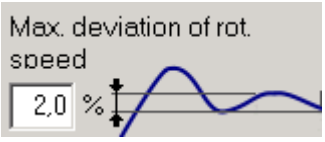


1 Signal source



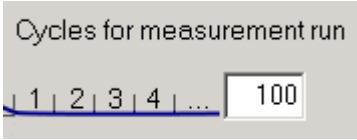
Default setting is the digital input of the InnoBeamer device.

2 Maximum deviation



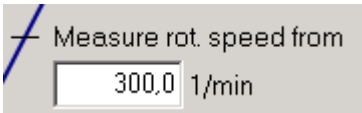
Constant speed is crucial for successful balancing. The InnoBalancer monitors the stability of rotation speed to ensure that balancing is performed within specified limits.
The allowable deviation will depend on the type of drive and load variance. For a controlled drive with low load the preset of 2 % can be higher than the actual variations. The situation may be different for a combustion engine controlled by a foot throttle.

3 Cycles for measurement run



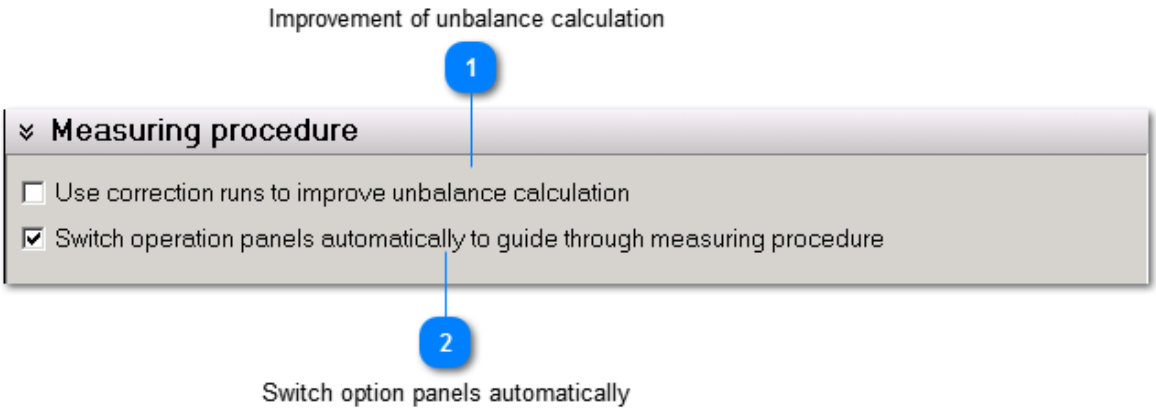
Here you enter the number of revolutions used for vibration measurement. The higher the number of revolutions the better the InnoBalancer can distinguish unbalance from vibration of other sources.

4 Start speed



The InnoBalancer covers a very wide range of rotation frequencies from 6 to 100,000 rpm and higher.
For monitoring the stability at low speeds the InnoBalancer needs to measure over a longer period which may take some time. Operation can be sped up by entering a minimum rotation speed. The entered value should be at least the nominal speed less the expected tolerances.

Measuring procedure



1 Improvement of unbalance calculation

☐ Use correction runs to improve unbalance calculation

After unbalance measurement the InnoBalancer will make suggestions for balancing and ask you whether you have implemented these suggestions. Your answers will give the InnoBalancer the necessary information about the current state of the rotor. By this means the InnoBalancer can use test runs as well as correction runs to evaluate the remaining unbalance. This can be particularly useful when a large portion of the unbalance has been compensated already and when the current vibration information is very different from the initial test runs.
You can choose for each test run whether you want to use its data for calculation. This menu option sets the default choice for balancing.

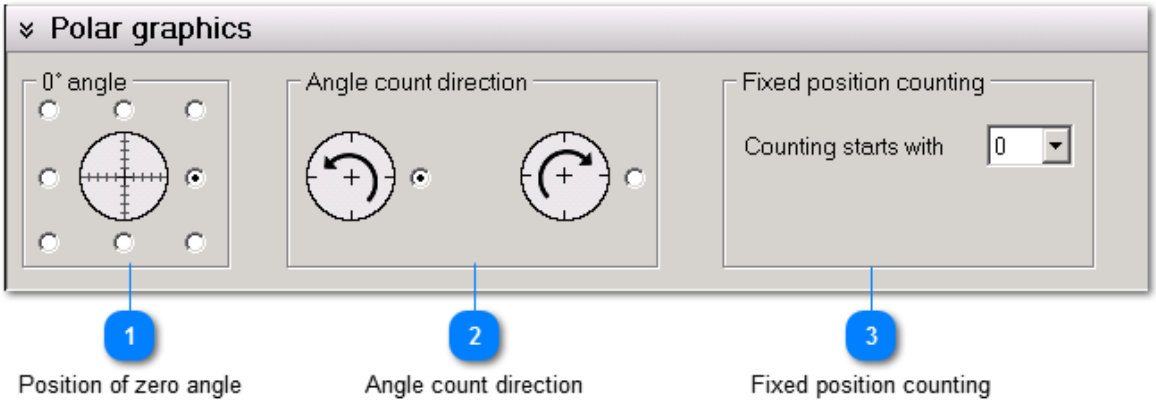
2 Switch option panels automatically

☑ Switch operation panels automatically to guide through measuring procedure

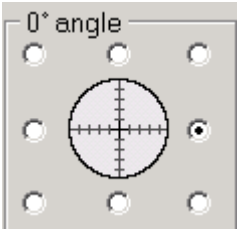
Balancing is performed in a given order of actions and measurements. If the check box is enabled the InnoBalancer will automatically switch to the panel for the next step. You can always reset the results of the last step manually. Alternatively you may deselect this option and switch manually to the next step.

Polar graphics

Vibration and unbalance are displayed for both planes as polar graphics. The length of the pointer indicates the amount and the angle the position. There are some options concerning the polar graphics display.

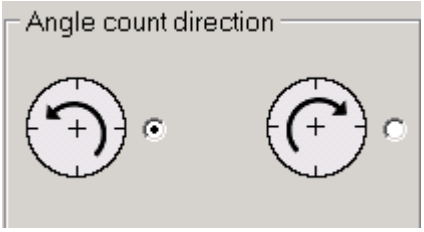


1 Position of zero angle



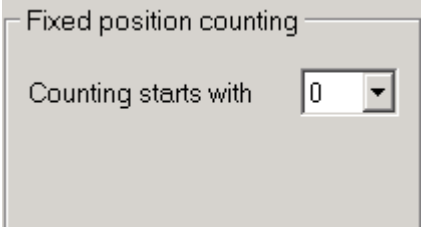
By mathematical definition zero position is on the right side of the circle. You may change the zero position if desired.

2 Angle count direction



By definition angles are measured counterclockwise. This can be changed to clockwise.
The setting only affects the diagram. The angles at the rotor are always counted against the direction of rotation.

3 Fixed position counting

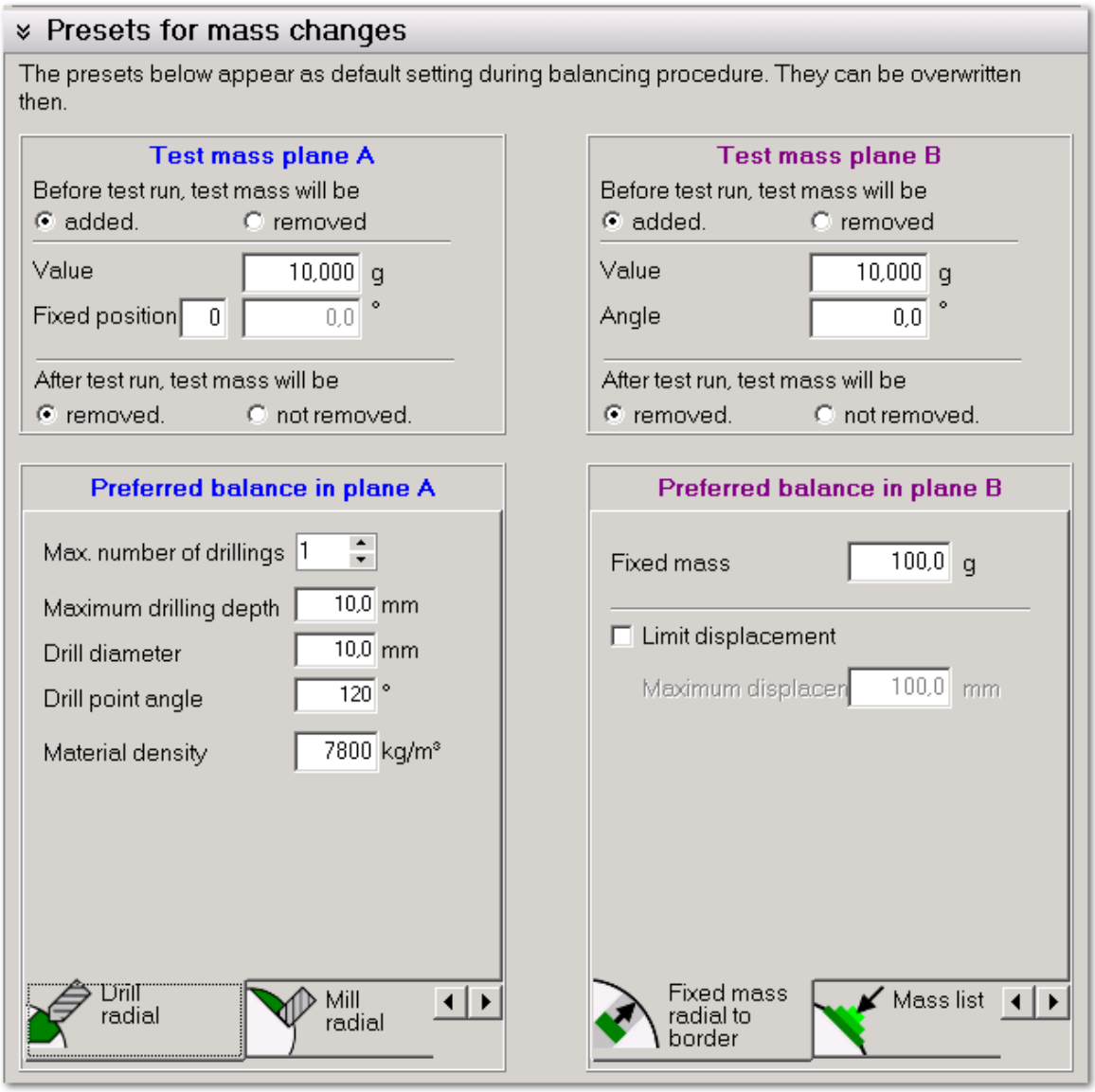


- Fixed positions (if selected in rotor settings) can be counted starting at number zero or one.

Presets for mass changes

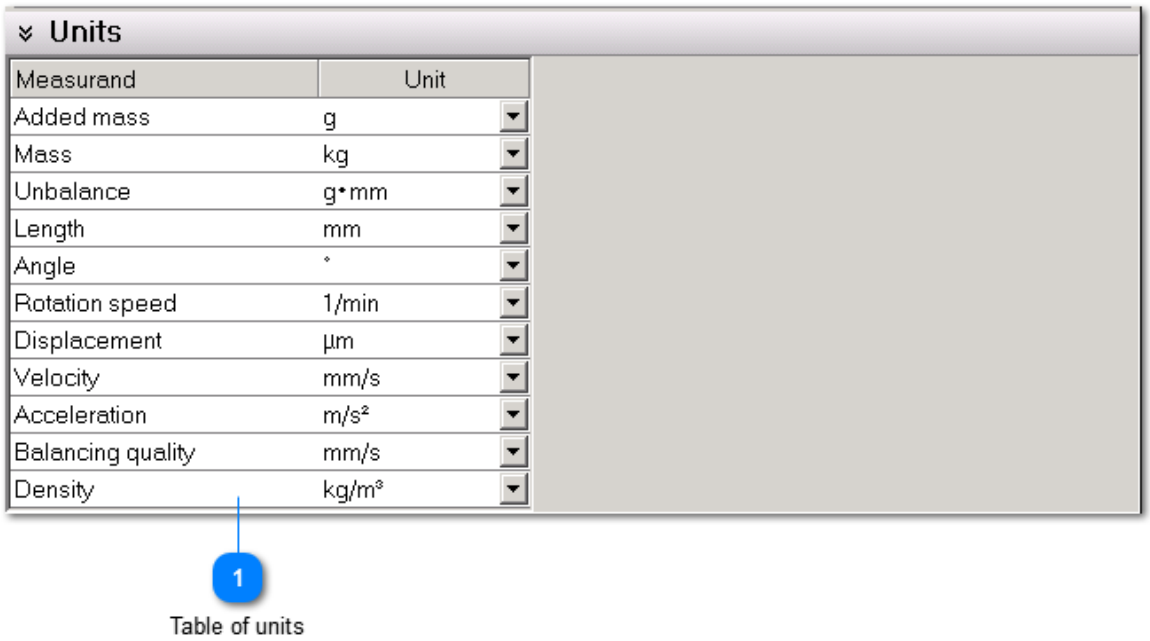
If balancing is always performed in the same way you can enter here some presets. In conjunction with the rotor list typical settings for the test mass and for mass changes can be entered here for each type of rotor. These presets may be modified later during the actual balancing process.
Detailed descriptions are found in the sections

- Test mass
- Correction mass



Units

The InnoBalancer is capable of balancing tiny rotors with only 1 mg remaining unbalance but also rotors weighing some tons.
The physical units can be adapted to the balancing application here.



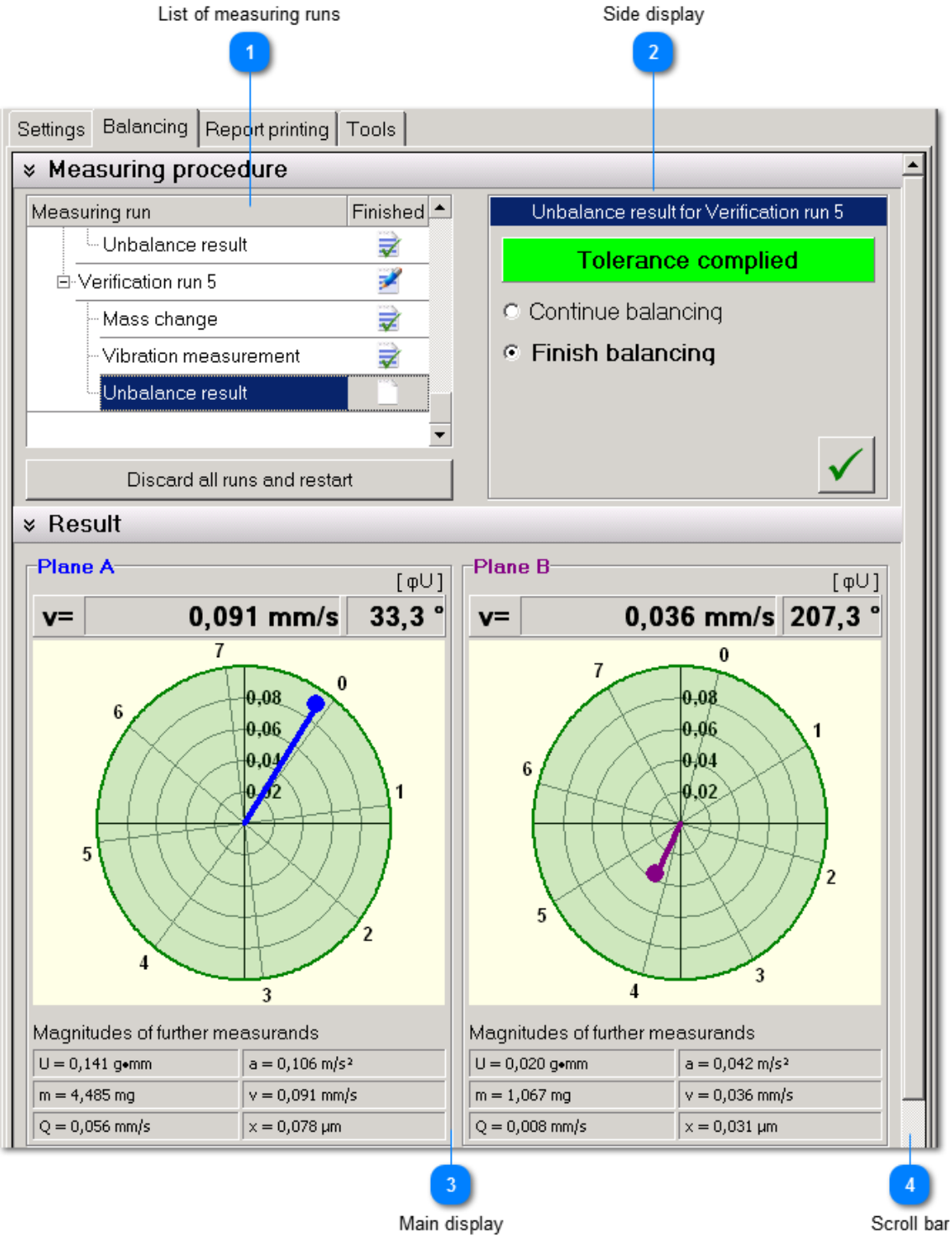
1 Table of units

Measurand	Unit
Added mass	g
Mass	kg
Unbalance	g•mm
Length	mm
Angle	°
Rotation speed	1/min
Displacement	µm
Velocity	mm/s
Acceleration	m/s²
Balancing quality	mm/s
Density	kg/m³

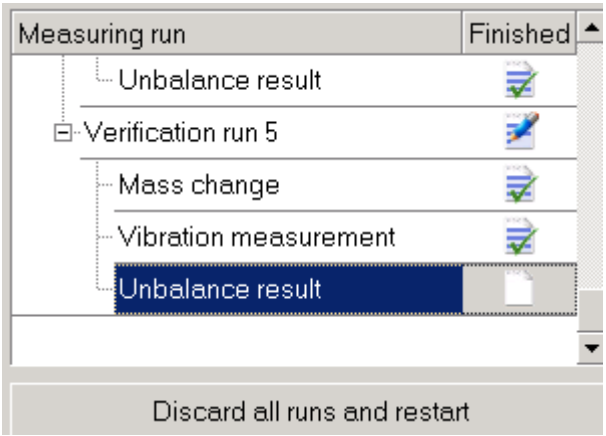
Units of the same type can occur several times if they occur with different magnitudes. For example, the quantity "mass" is listed as mass (of the rotor) and added mass.

Balancing

After finishing the settings you may start balancing. The panel below lists each step with the relevant information.



1 List of measuring runs



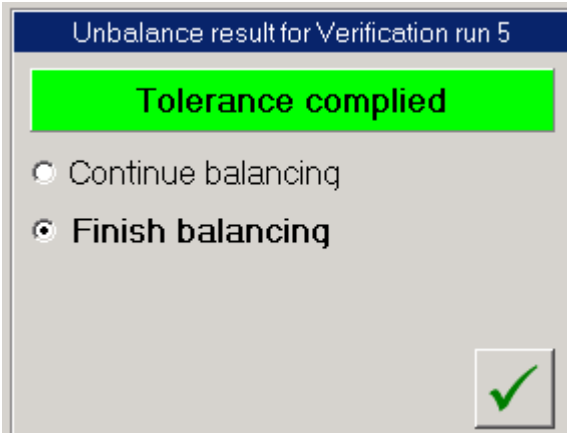
The table lists all balancing runs belonging to the balancing session. Some entries are divided into steps. Click the respective run or step to see the belonging settings.

The button *Discard all runs and restart* opens a new balancing session.

There are the following types of balancing runs:

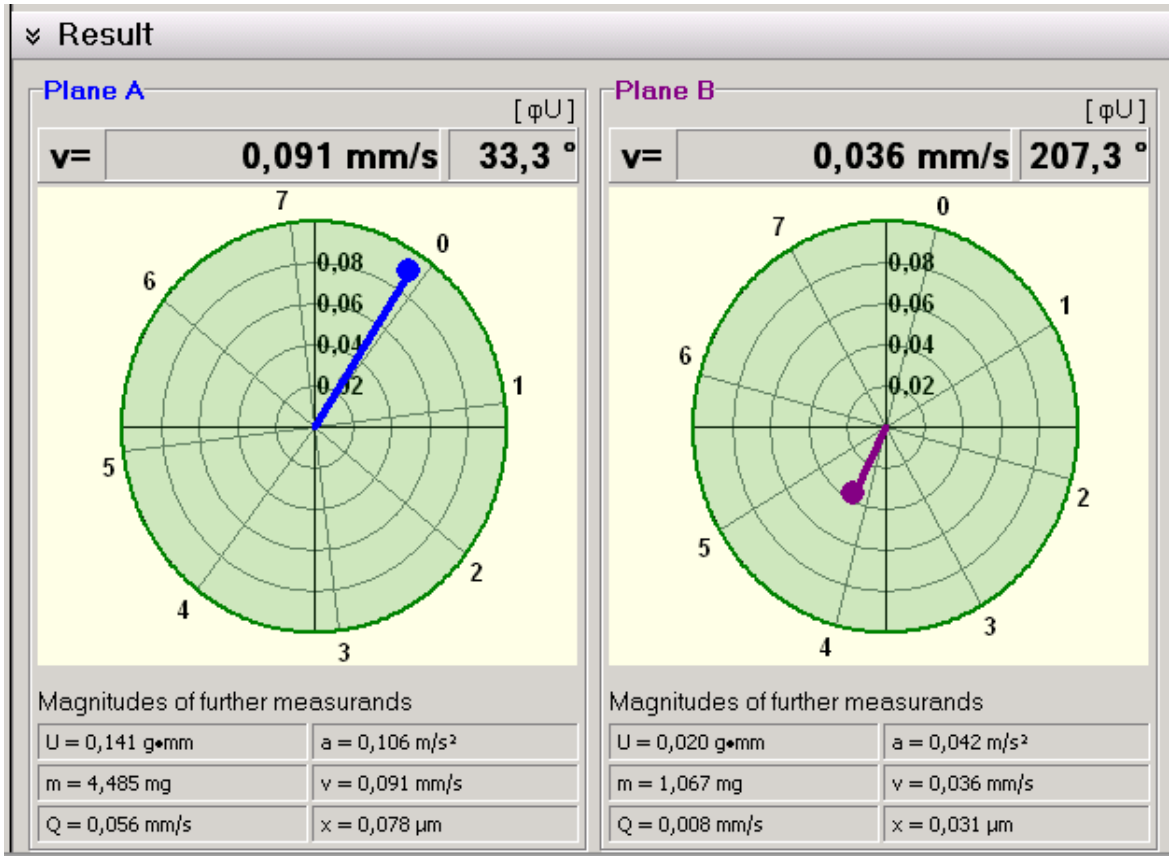
- Pilot survey detects the optimum rotation speed for the rotor.
- Test runs determine the dynamical properties of the rotor.
- Verification runs suggest correction measures and show whether their application was successful.

2 Side display



Shows compiled information about the current run.

3 Main display



Shows further detailed information.

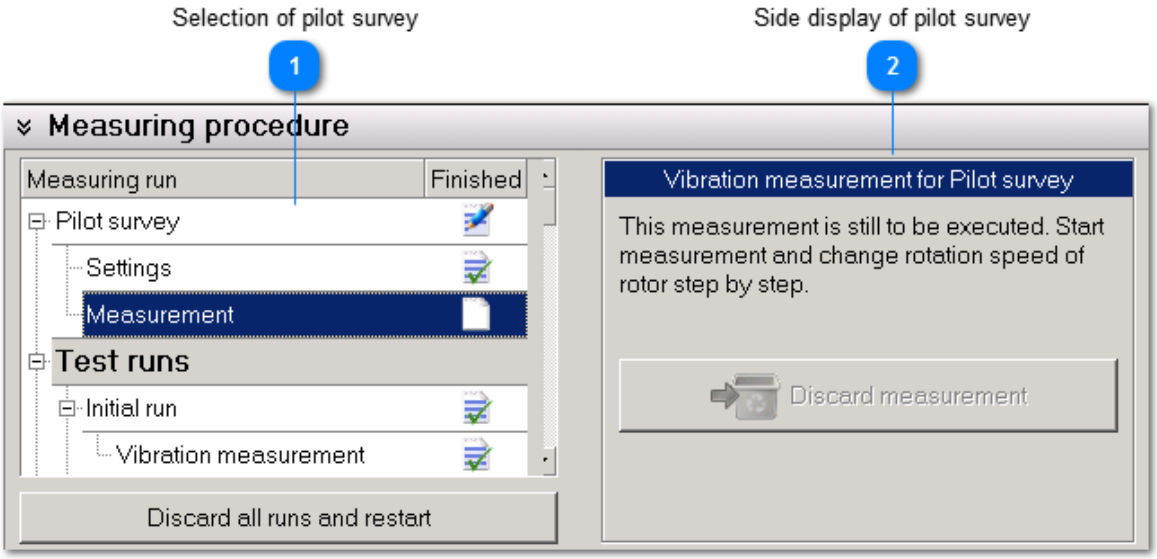
4 Scroll bar

Scroll up and down if not all areas are visible.

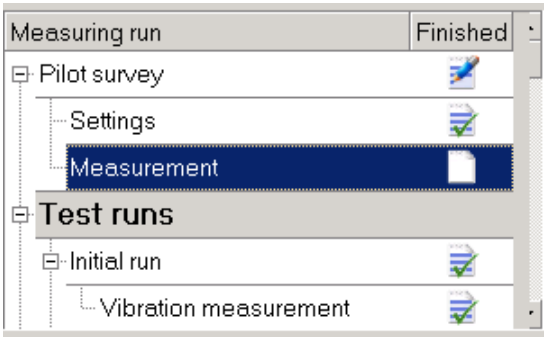
Pilot survey

Balancing should be performed at rotation speeds where there are no resonances. This condition is checked by the pilot run. To perform this test the rotor has to run through the relevant range of rotation speed. If there is no way to control rotation speed you may also coast down rotation.

- For rotors running at constant speed the pilot survey issues warnings in case of expected problems.
- For rotors with variable speed the pilot run recommends optimum rotation speeds for balancing.



1 Selection of pilot survey

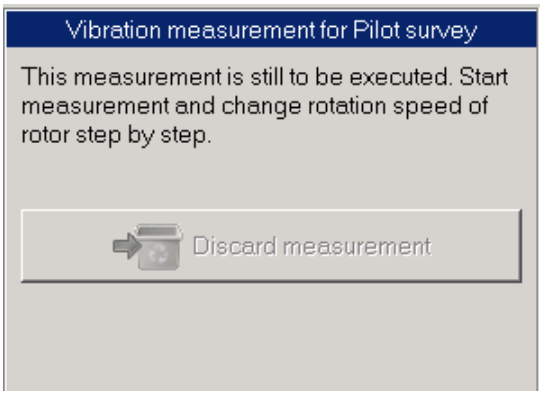


The pilot survey has two steps:

- Settings
- Measurement

Measurement can only be started after finishing the settings.

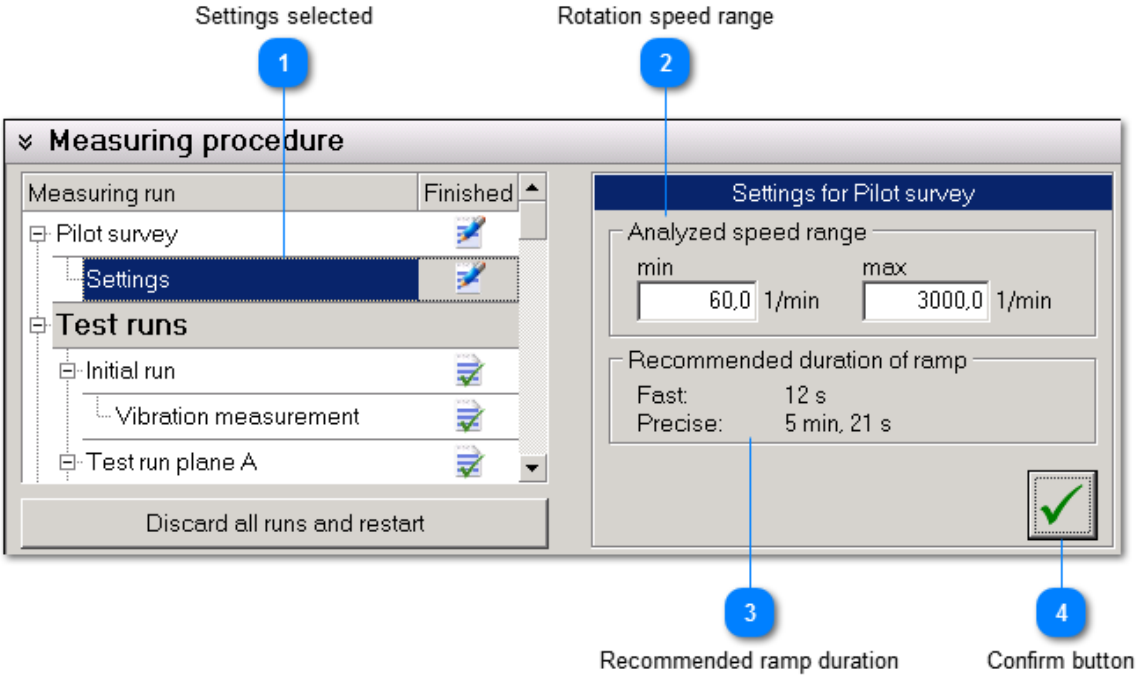
2 Side display of pilot survey



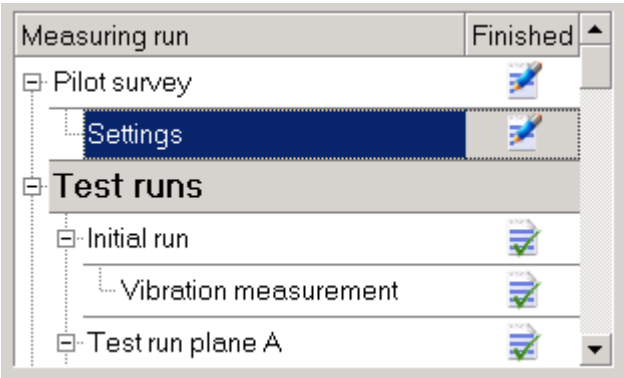
This area informs you about the next step to do.

Settings

The only setting needed for the pilot survey is the rotation speed range used.

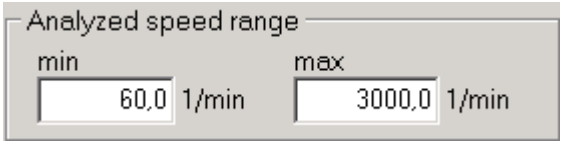


1 Settings selected



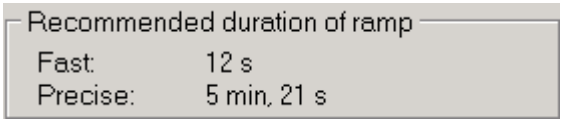
Click this entry to open the settings.

2 Rotation speed range



Enter the rotation speed range here in which you intend to balance the rotor.

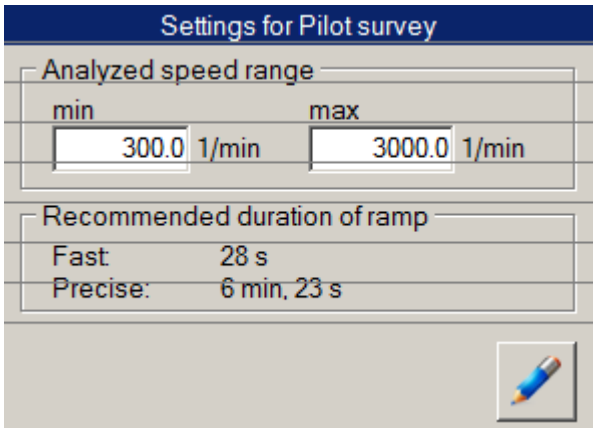
3 Recommended ramp duration



The InnoBalancer calculates the minimum time needed for acceleration. The smaller the entered rotation speed range and the minimum value the faster rotation speed can be increased.

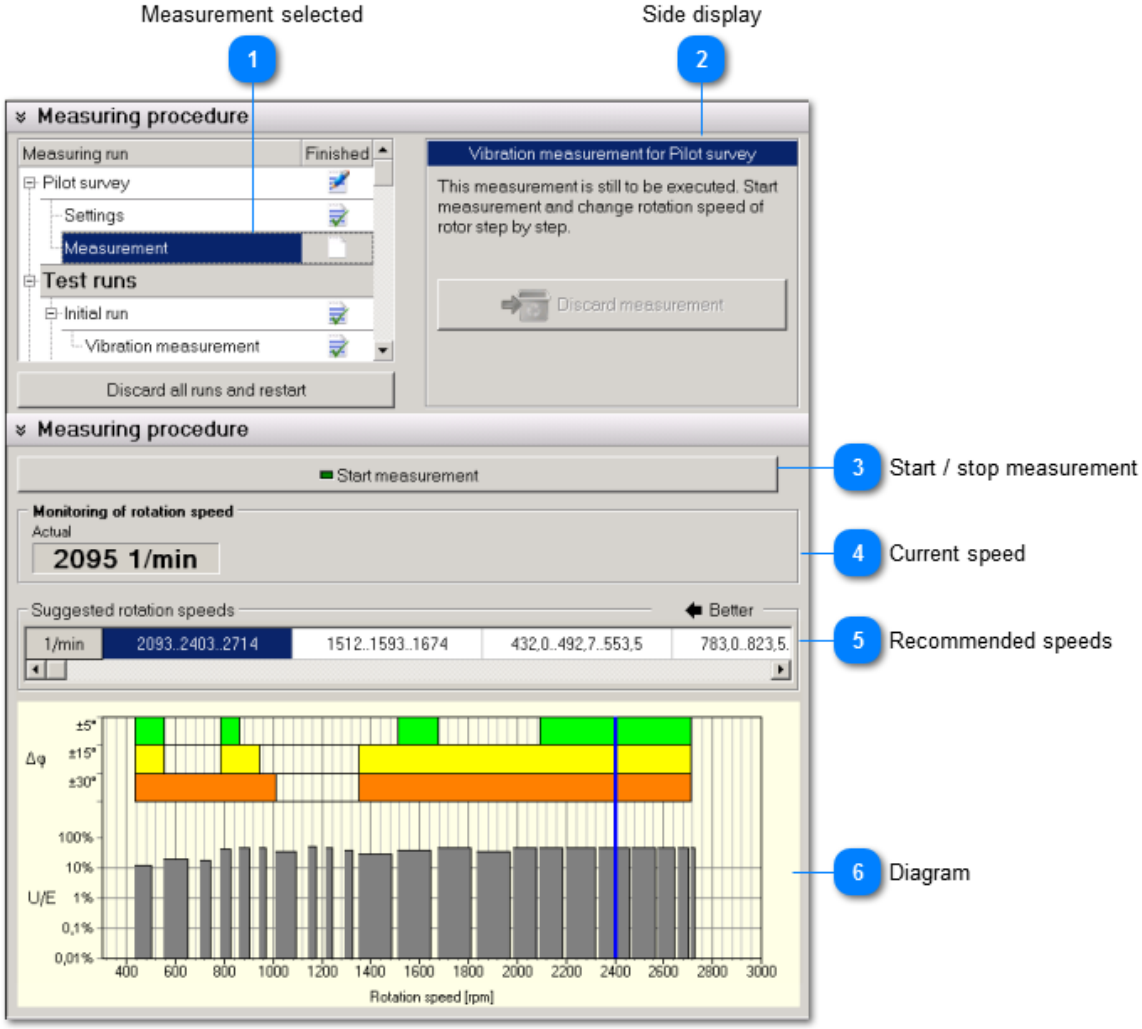
4 Confirm button

Click this button to confirm the settings you have made. The settings will be locked by horizontal lines and measurement is enabled.

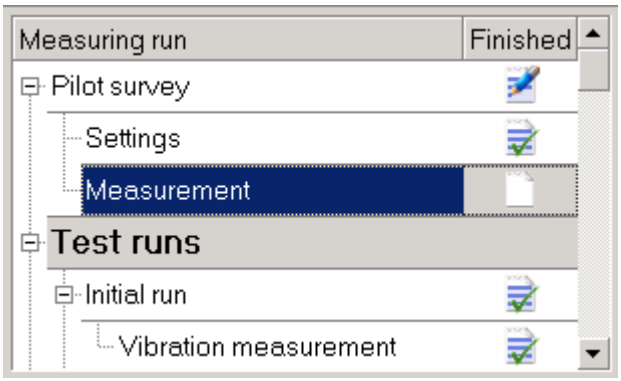


Measurement

The results of pilot survey are displayed in a diagram versus the specified speed range.
Recommended speeds are indicated in a list.



1 Measurement selected

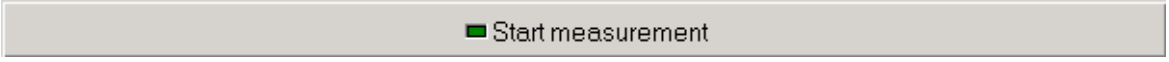


Select measurement as the next step after settings.

2 Side display

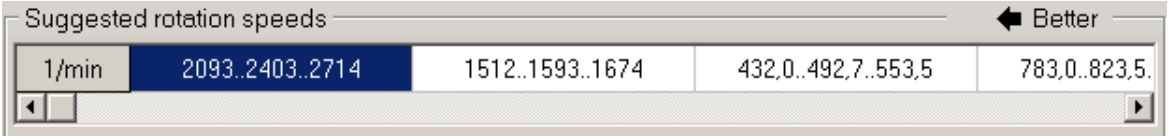
This area is similar in all steps of measurement. A description can be found here.

3 Start / stop measurement



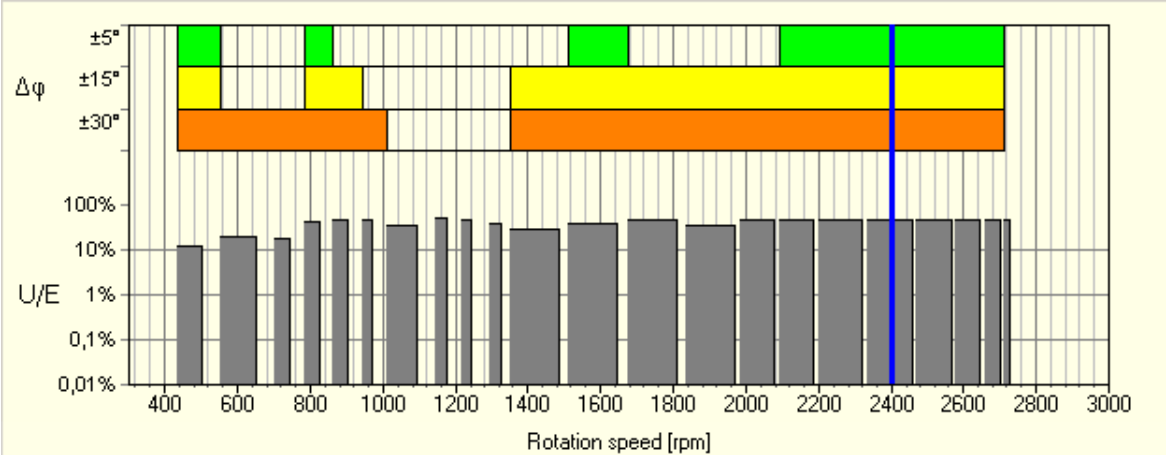
4 Current speed

5 Recommended speeds



This field shows recommended rotation speeds. The best values are found on the left side. Each entry has the form Min..Nominal..Max
The nominal value is in the middle between minimum and maximum. It should be used preferably.

6 Diagram



The horizontal axis shows the entered rotation speed range. The blue line marks the recommended speed. You can see from the diagram why this speed has been chosen:

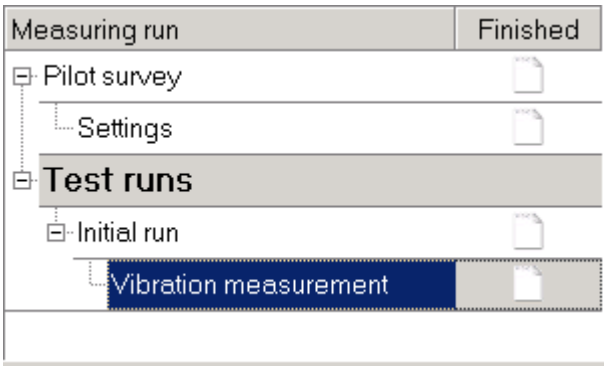
1. Angle stability: Resonances result in changeable phase angles. There are three colored bars for angle stability. The green bar indicates best values below +/- 5 %.
2. Dominant unbalance signal: Unbalance vibration is only one component in a mix of other frequencies. The higher the difference between unbalance vibration and other vibration the better the chance of good balancing results. A value of 100 % in the U/E diagram would mean that there is no other signal than unbalance vibration.

Test runs

Unbalance is measured indirectly by the vibration which the rotator is generating by centrifugal force. The magnitude of vibration does not only depend on the unbalance. It is also influenced by the stiffness of machine parts and the foundation. A machine with flexible foundation will vibrate stronger than the same machine with stiff foundation.

The InnoBalancer conducts test runs to evaluate the behavior of an unknown rotor. For one-plane balancing two test runs are needed, for two-plane balancing there are three test runs.

- Test runs typically start with the "initial run". The rotor remains in unchanged condition and its vibration is measured at constant speed.
- After this, the mass in plane A is changed and test run A is started.
- For two-plane balancing this procedure needs to be repeated for plane B.



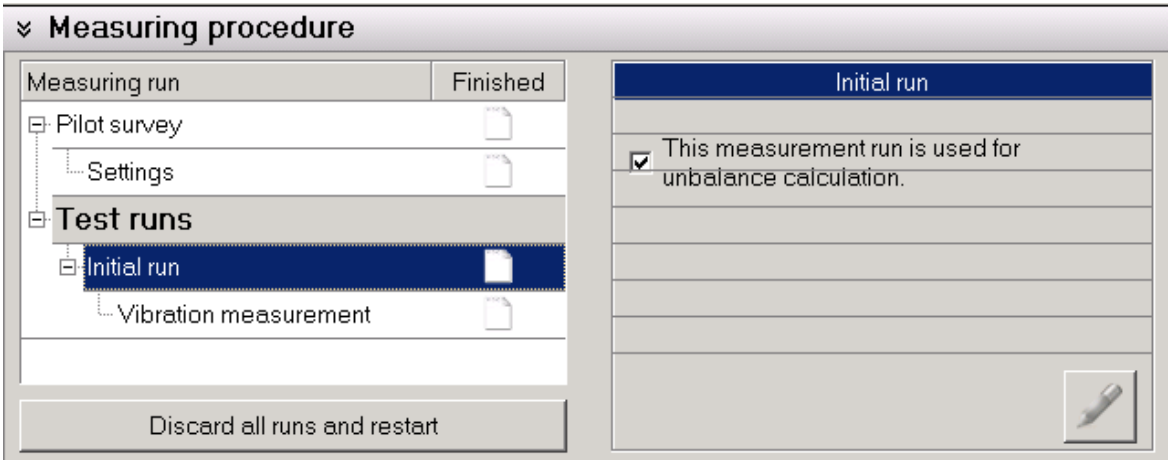
The test runs are selected in the list of measuring runs. In the beginning there is only one entry of the initial run. If the initial run was finished the next test run will be shown. You are guided through the process step by step.

Initial run

Test runs start with the initial run. The rotor is left in its initial condition. Vibration is measured at constant speed.
Generally, a balancing run will always include the following steps:

1. Changing the mass
2. Measuring vibration
3. Decision based on the results

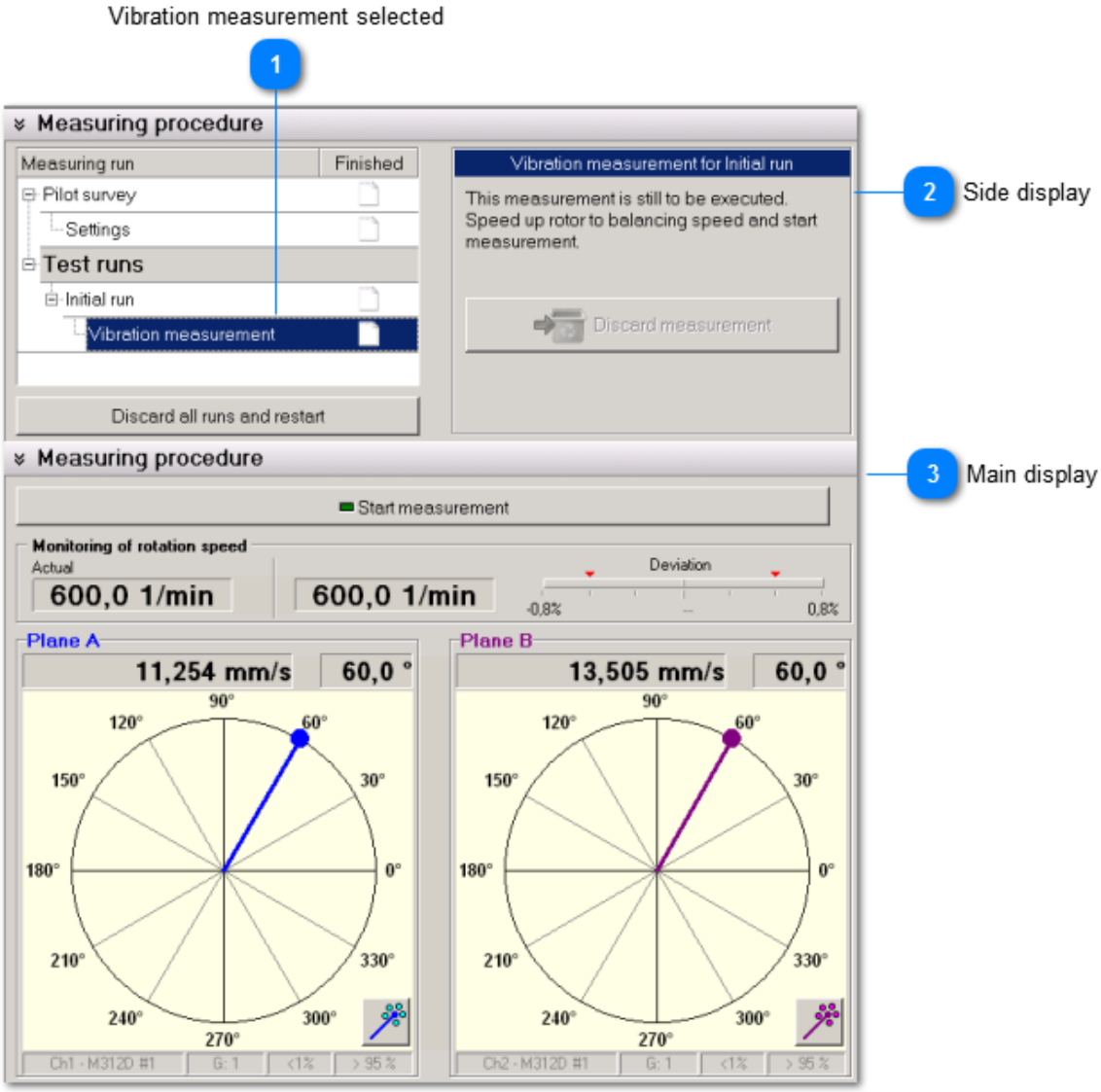
Since there is no mass change needed for initial runs, step 1 can be skipped and the procedure starts at step 2, vibration measurement. There will be no information about unbalance yet after the initial run.



There is an information on the right side of the list which is explained here.

Vibration measurement

Vibration measurement in the initial run determines the magnitude of vibration caused by the unknown unbalance.
The rotor has to run at constant speed.



Vibration measurement is followed by a test run for plane A starting with mass change.

1 Vibration measurement selected
Select *Vibration measurement* under *Initial run* in the list of measuring runs.

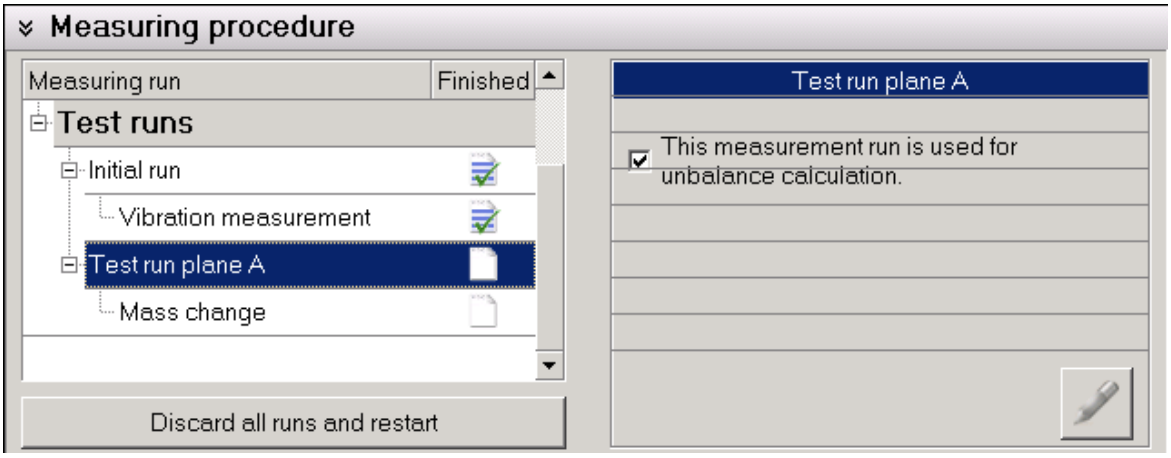
2 Side display
This section is explained here.

3 Main display
This section is explained here.

Test run plane A

The initial run is followed by the test run for the first plane.

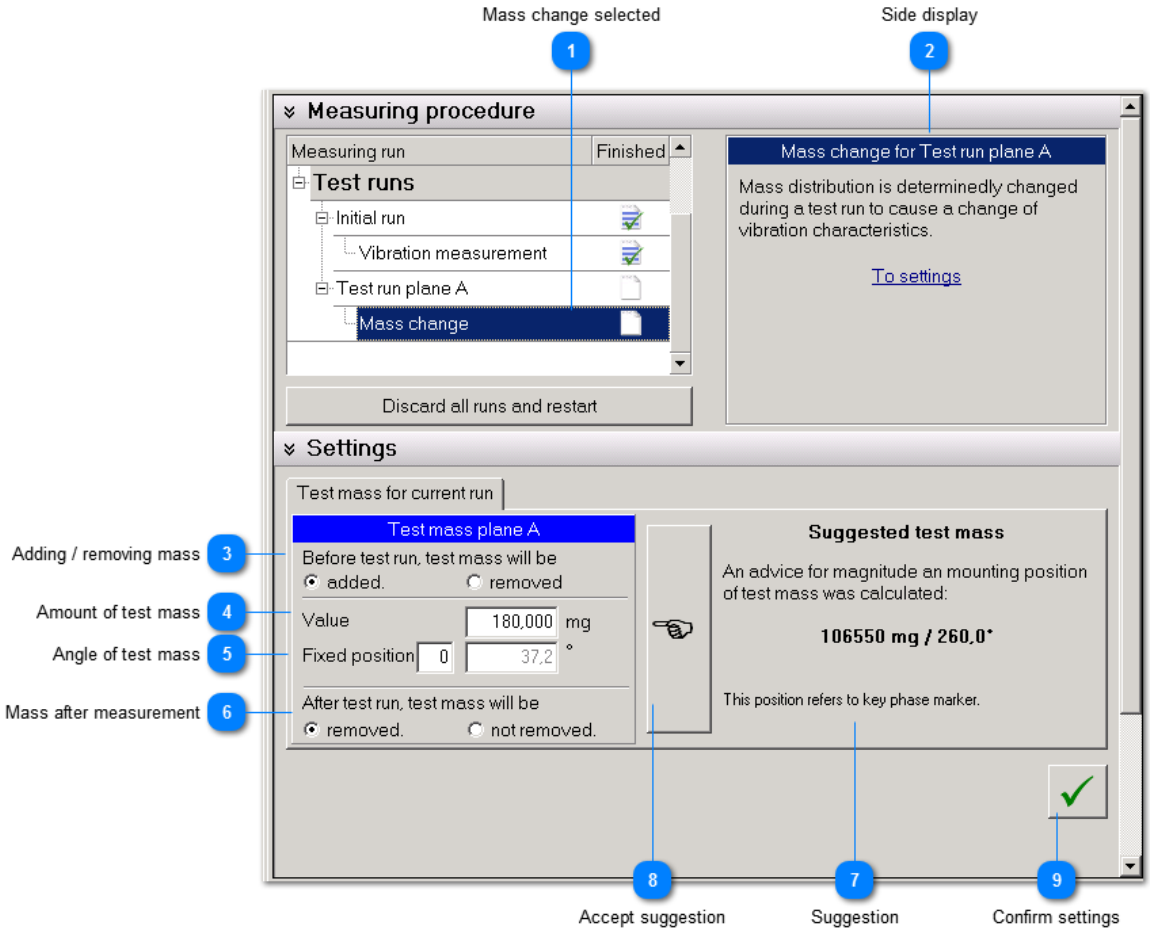
- A change of mass is carried out and entered into the InnoBalancer.
- Rotation is started again and vibration measured at constant speed.
- Depending on the number of planes
    - the result will be available for one-plane balancing
    - test run B follows in case of two-plane balancing.



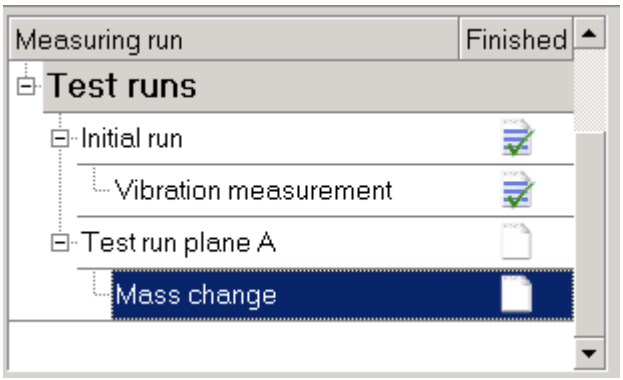
There is an information on the right side of the list which is explained here.

Mass change

Mass change is carried out before vibration measurement.
The changes made need to be entered into the InnoBalancer. The software can also make suggestions for the test mass.

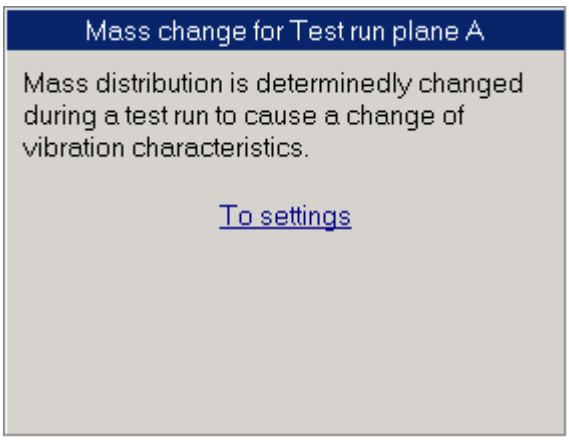


1 Mass change selected



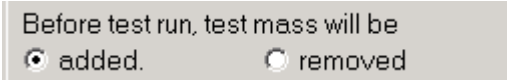
After finishing the initial run the first test run is started with a mass change.

2 Side display



This section gives information about the next step and quick access to the relevant settings.

3 Adding / removing mass



Select the intended way of changing mass.

4 Amount of test mass

Enter the mass you have removed or added.

5 Angle of test mass

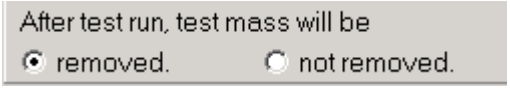
Enter the angle position where you have added or removed mass. Angle steps will be offered for balancing at fixed positions.

All subsequently displayed angles will refer to this position. Preferably the test mass should be at the same position as the zero angle of the reflex mark because

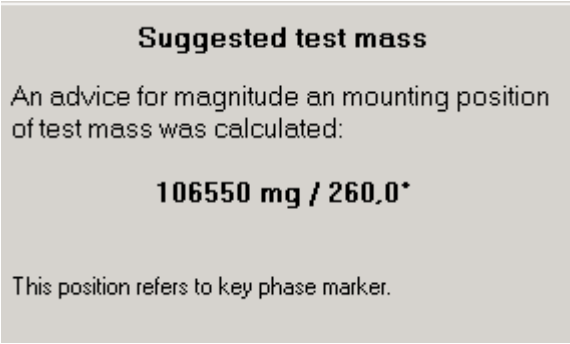
1. There is a visible mark at this angle position.
2. The angles of vibration measurement, unbalance display and mass changes refer to the same coordinate system.

6 Mass after measurement

Normally the test mass will be removed after the test run. In some situations it may be desired to leave the test mass at the rotor.



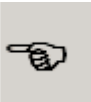
7 Suggestion



The test mass is often chosen arbitrarily, sometimes based on experience. The purpose of adding or removing some mass is changing the dynamical behavior of the rotor to a certain degree. Extreme vibration needs to be avoided, too.
The InnoBalancer can make a suggestion for the test mass under the following preconditions:

- Balancing radius and rotor mass have been entered.
- The sensors for vibration and zero angle are in one line.
- The recommended angle uses the reflex mark as reference.
- The suggestion is only applicable for adding mass.

8 Accept suggestion



Click this button to transfer the suggested mass and angle into the input fields.

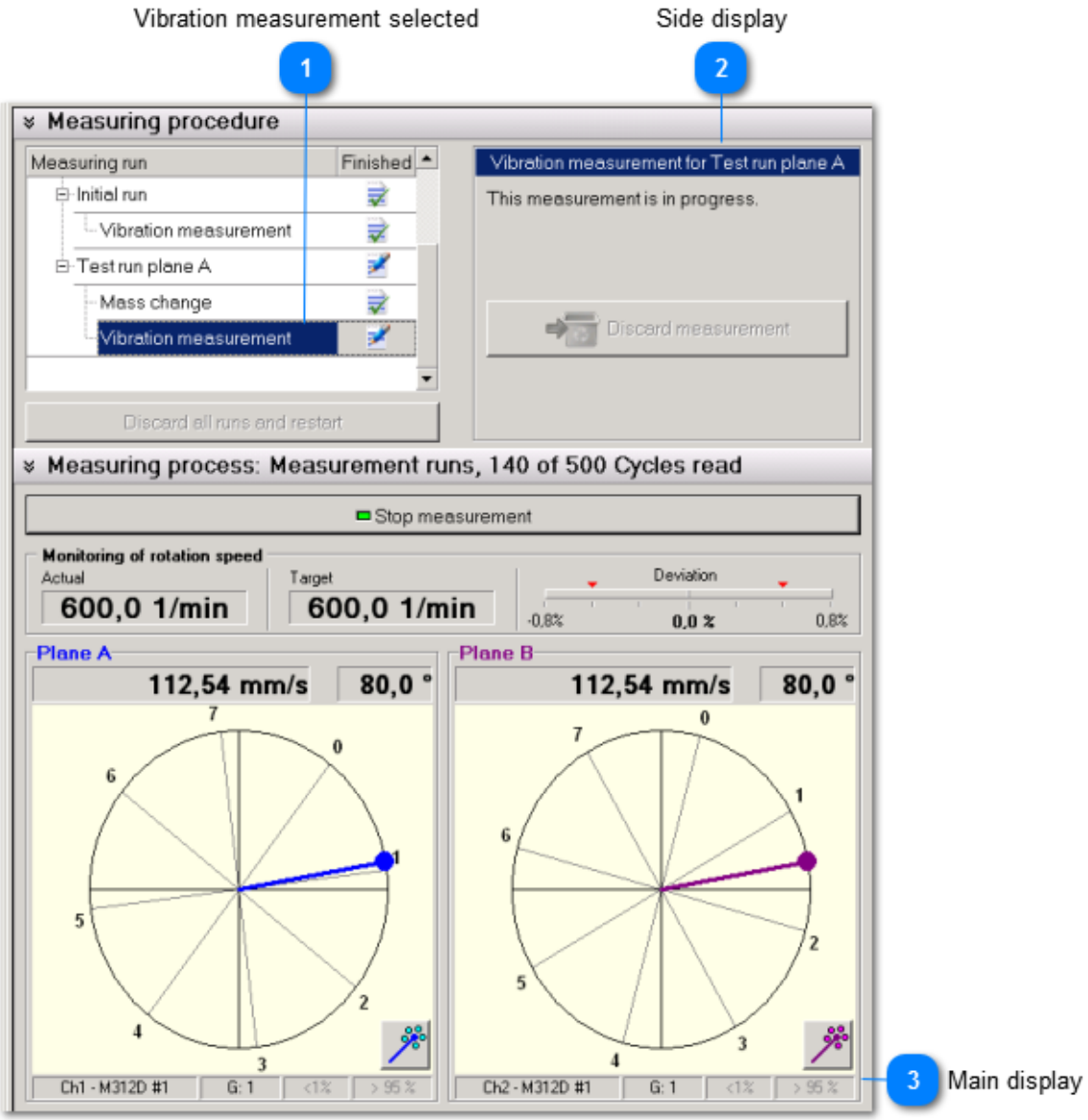
9 Confirm settings

Click this button to confirm your changes and proceed to vibration measurement.

The confirm button turns into an edit button. You can return to the mass edit menu as long as vibration measurement has not been started yet.

Vibration measurement

Vibration measurement for plane A evaluates the effects of mass change. The rotor has to run at the same constant speed as in the initial run.



1 **Vibration measurement selected**
Select under *Test run plane A* the step *Vibration measurement*.

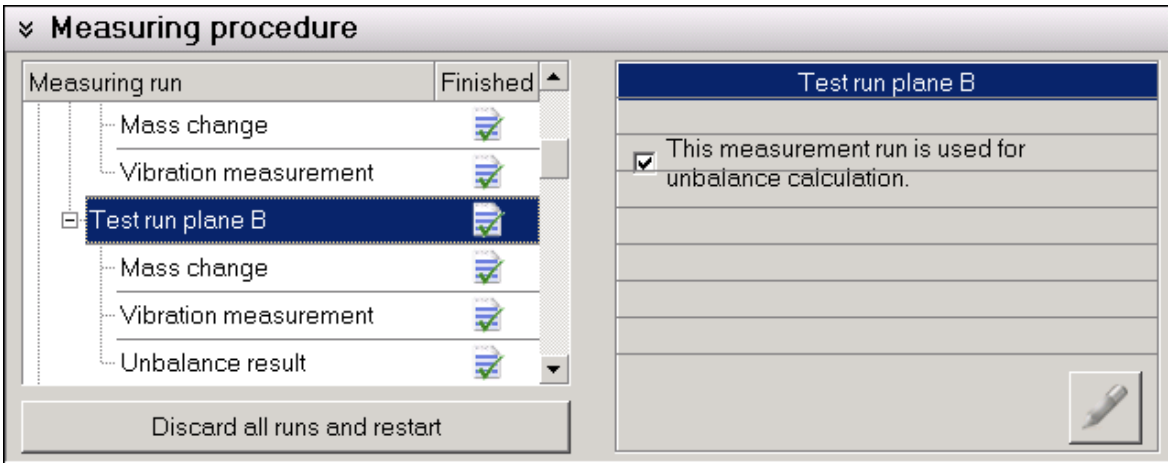
2 **Side display**
This section is explained here.

3 **Main display**
This section is explained here.

Test run plane B

The Test run of plane A is followed by the test run for the second plane.

- Firstly, mass changes at plane A are cancelled if this was chosen in test run A.
- A change of mass is carried out at plane B and the change is entered into the InnoBalancer.
- Rotation is started again and vibration measured at constant speed.
- The InnoBalancer will now show the unbalance result.

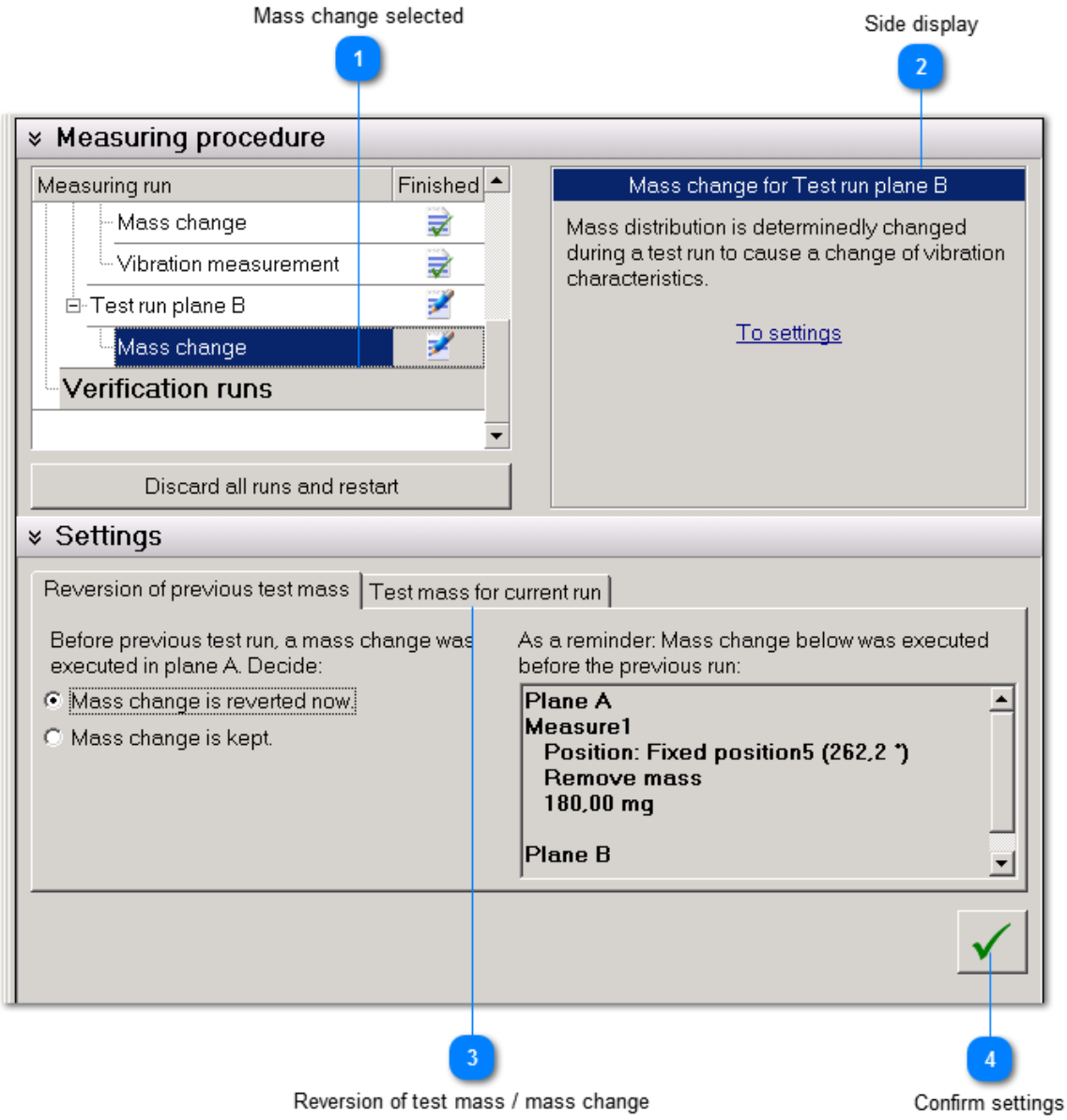


There is an information on the right side of the list which is explained here.

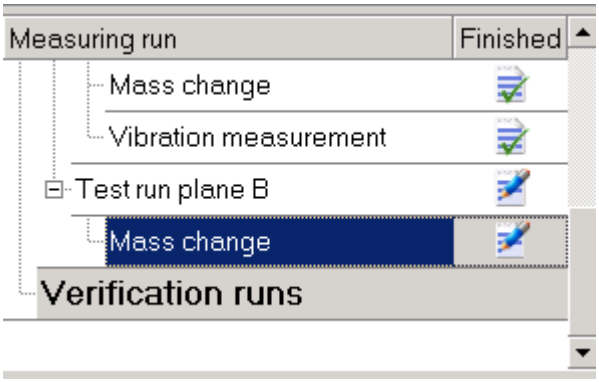
Mass change

Mass change in the second plane may include:

1. Returning the mass change of plane A.
2. Performing the mass change for plane B.

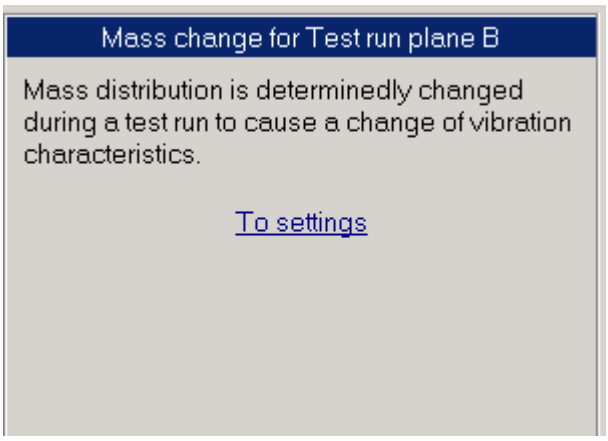


1 Mass change selected



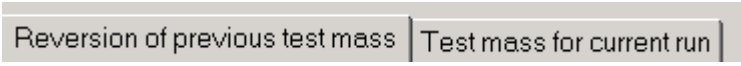
If the test run for plane A has been completed plane B test run will be displayed in case of two-plane balancing. The first step is a mass change.

2 Side display



This section shows information about the next step and allows quick access to the relevant settings.

3 Reversion of test mass / mass change



The mass change during test run B may include

1. the reversion of the mass change in plane A
2. changing the mass in plane B

4 Confirm settings

Click this button to confirm your changes and proceed to vibration measurement.

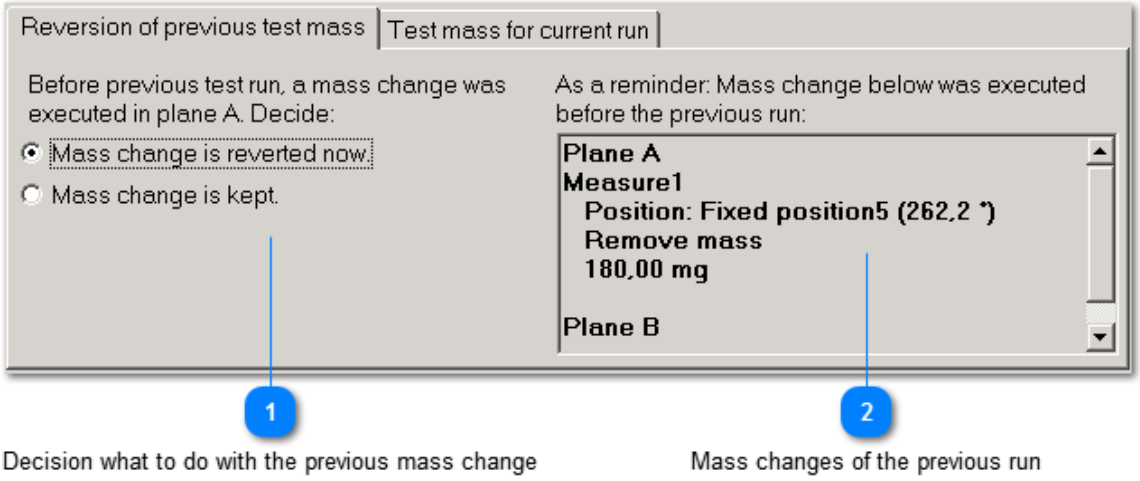
The confirm button turns into an edit button. You can return to the mass edit menu as long as vibration measurement has not been started yet.

Reversion of mass changes from test run A

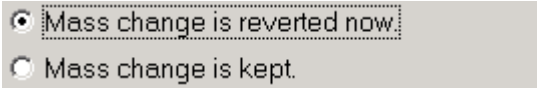
You can decide yourself whether you want to keep mass changes of test run A or not.

Example: A mass was added for plane A. The initial intention was to remove this mass again. However, vibration measurement after test run A indicates that vibration has been reduced by adding the test mass. Therefore you might wish to keep the test mass.

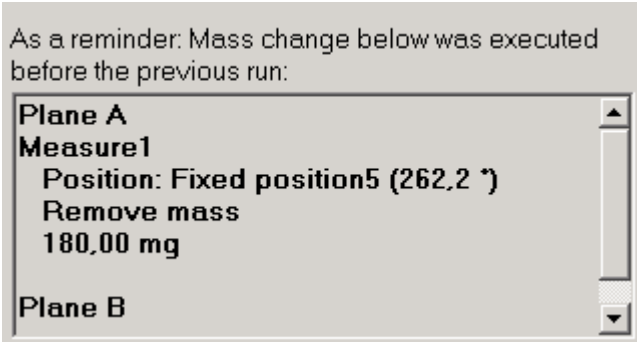
The information on the right side of this panel shows you what has been done in test run A including the location of the added mass.



1 Decision what to do with the previous mass change

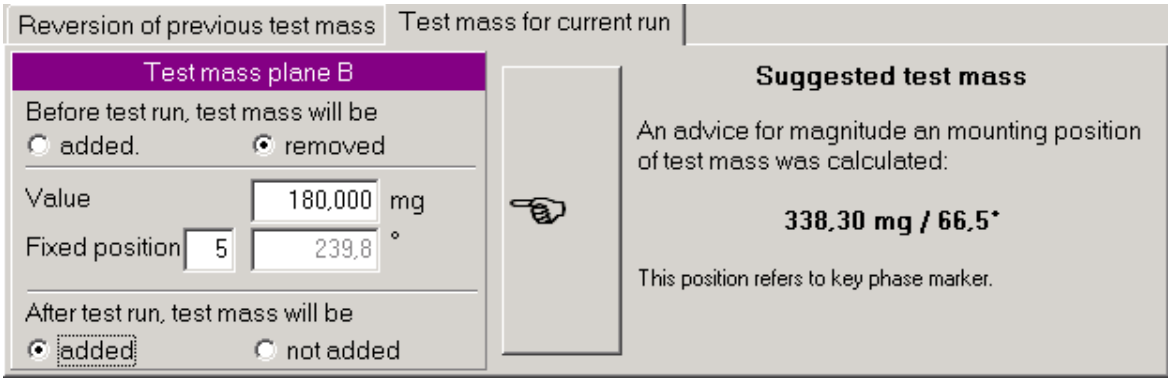


2 Mass changes of the previous run



The mass changes of test run A are listed up again.

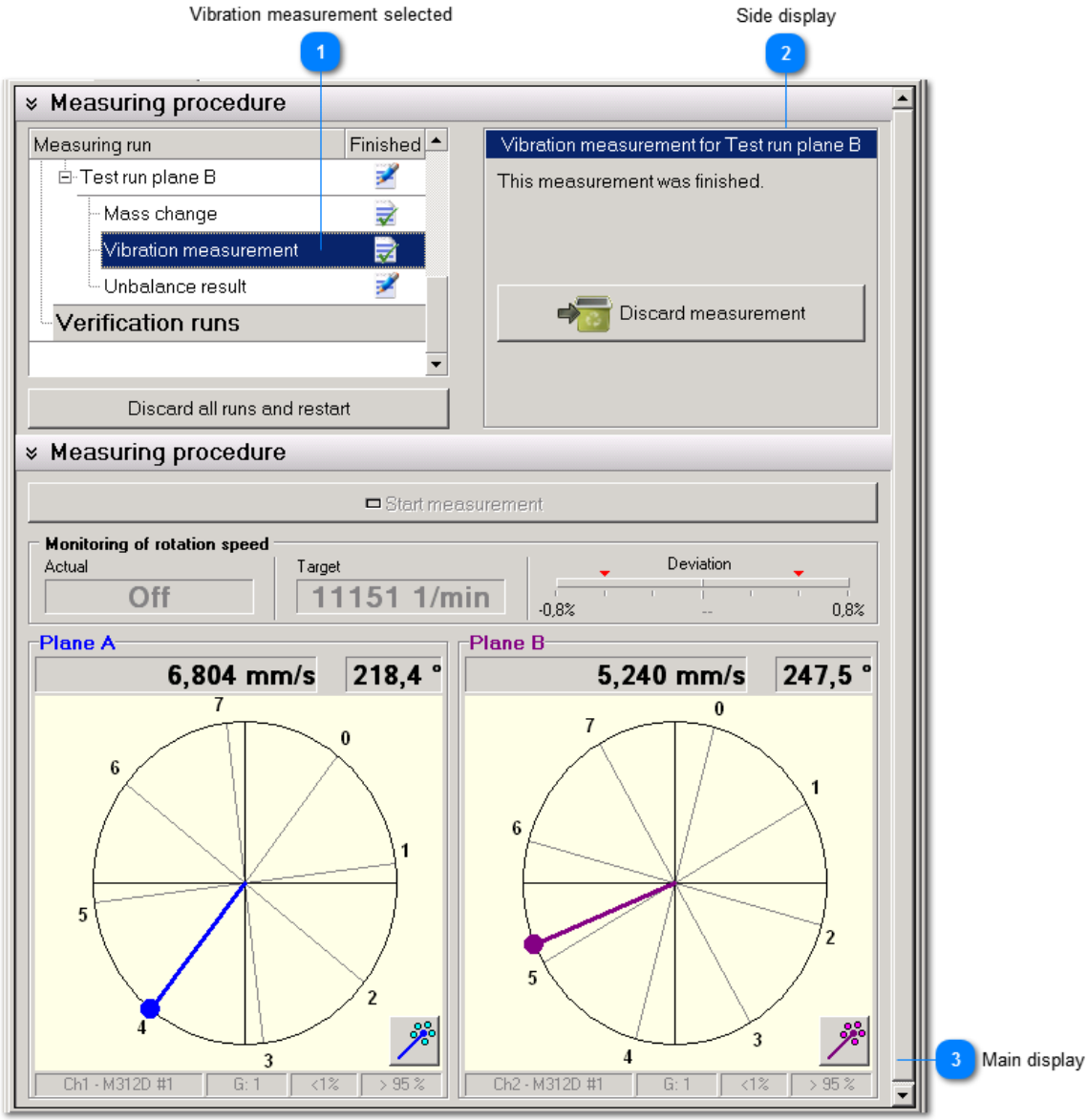
Test mass for the current run



The settings are the same as in test run of plane A.

Vibration measurement

Vibration measurement for plane B evaluates the effects of mass change. The rotor has to run at the same constant speed as in the initial run.



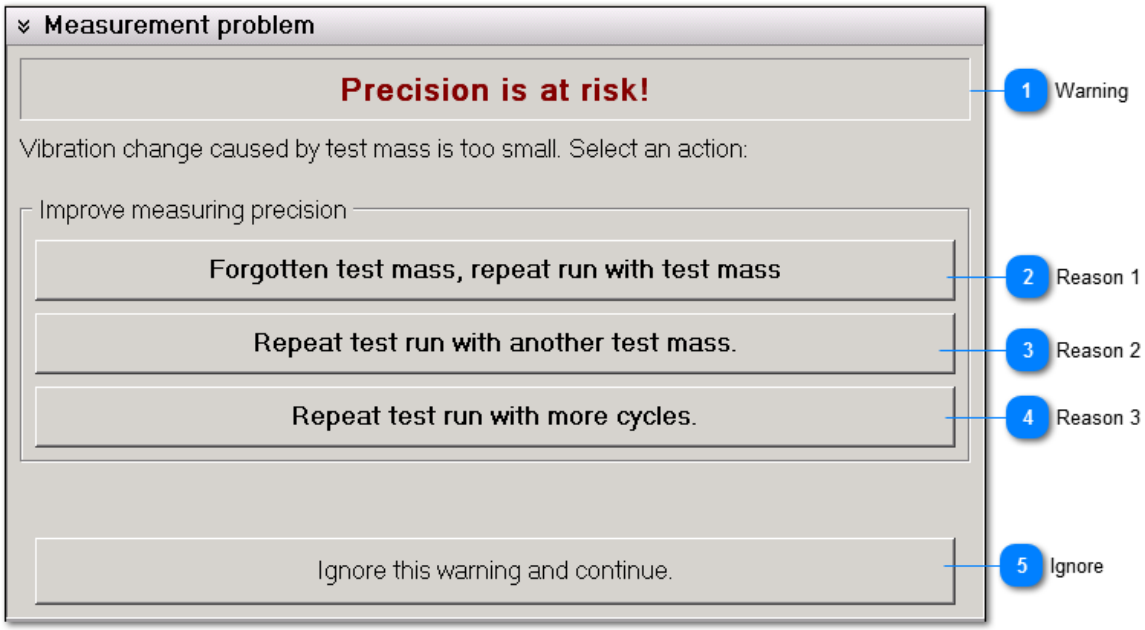
1 **Vibration measurement selected**
Select Vibration measurement under Test run plane B in the list of measuring runs.

2 **Side display**
This section is described here.

3 **Main display**
This section is described here.

Monitoring of measuring results

Mass changes during the test runs need to cause significant changes of rotor vibrations. The InnoBalancer will indicate problems by insufficient changes as shown below:



1 Warning

Reliable unbalance calculation cannot be performed if the results of the test runs are too similar.

2 Reason 1

A possible reason is that you might have forgotten to do the calculated mass changes of plane A or plane B at the actual rotor. Click this button to discard the measuring run and to start a new one after you have done the mass changes.

3 Reason 2

The test mass might have been too small. Use a test mass with higher weight.

4 **Reason 3**

Repeat test run with more cycles.

Vibrations of other sources with similar frequencies may interfere with the balancing process. You may repeat the measurement with a higher number of revolutions.

5 **Ignore**

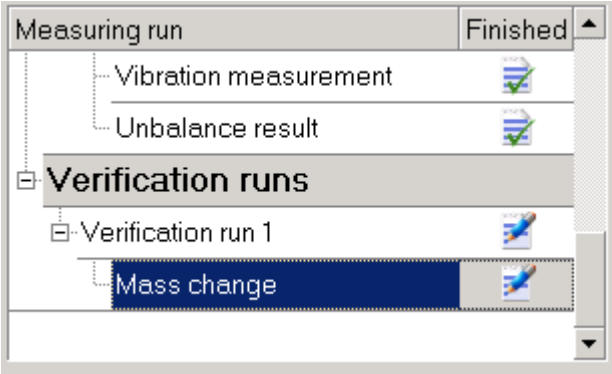
Ignore this warning and continue.

If none of the above reasons applies or no changes are possible you may skip this warning. Please keep it in mind, however, for the evaluation of the balancing results.

Verification runs

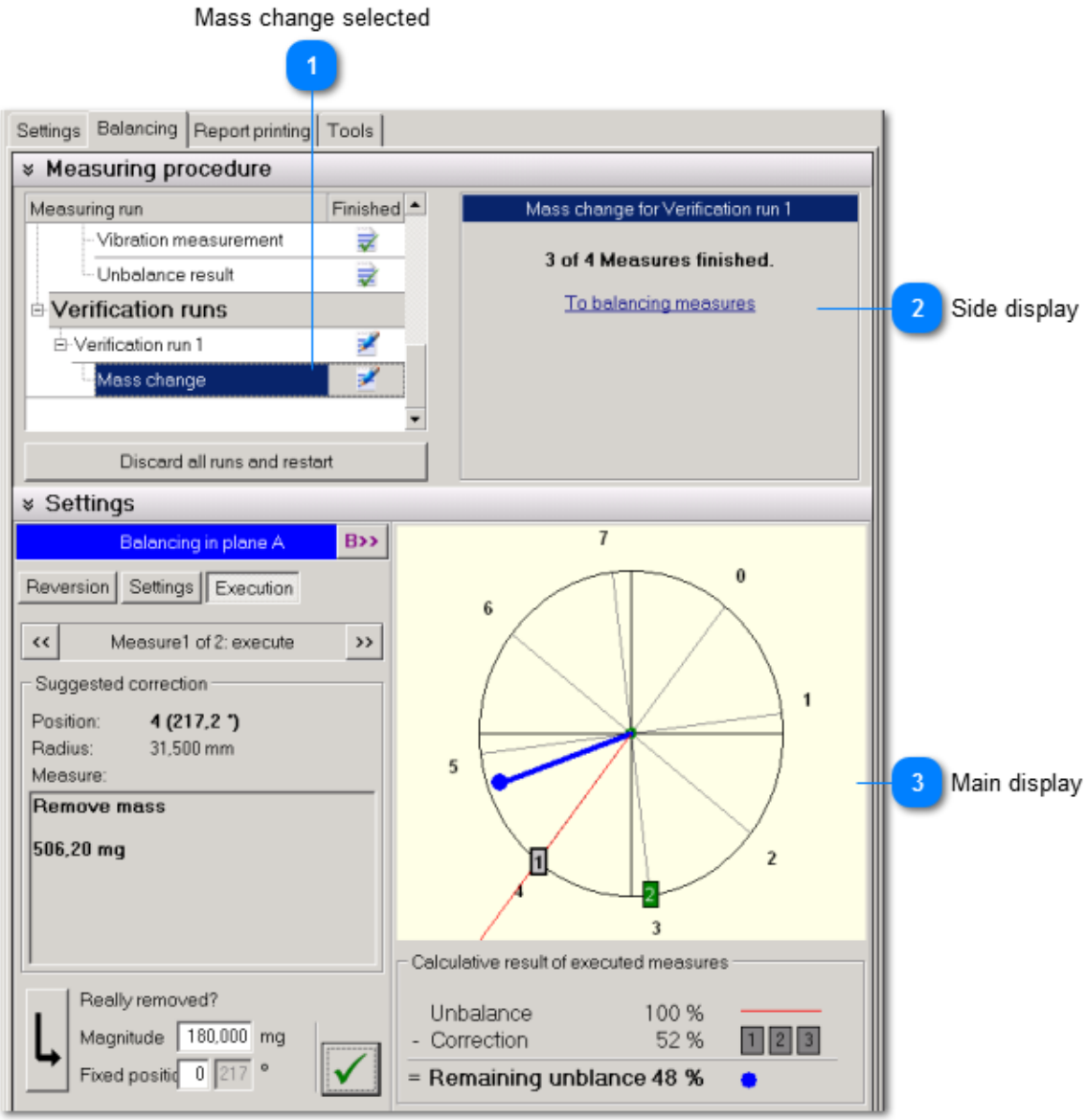
After you have got the unbalance result and decided to continue balancing, the InnoBalancer will start the verification runs. They consist of the following steps:

1. Compensating the unbalance by a mass change.
2. Vibration measurement to determine the remaining unbalance
3. Decision about continuing balancing

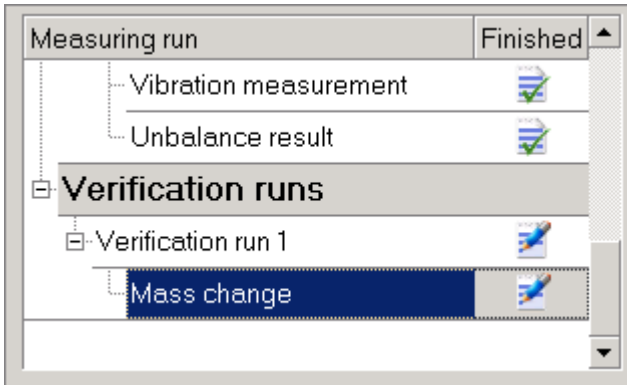


Mass change

The mass of the rotor is changed with the purpose of reducing its unbalance. The InnoBalancer offers suggestions for suitable measures.

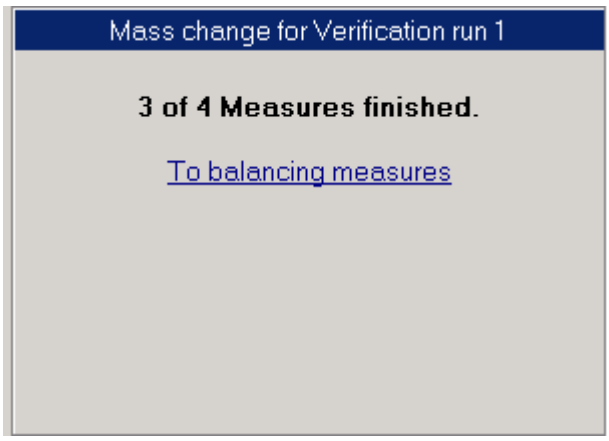


1 Mass change selected



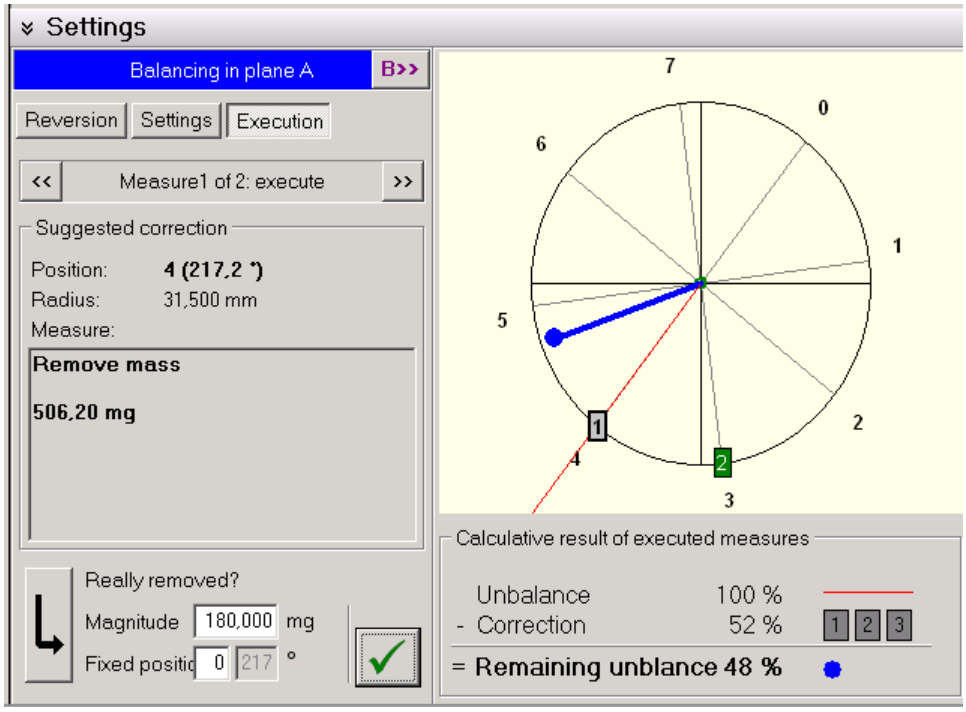
After continuing balancing a verification run is opened. The first step is a mass change.

2 Side display



Here you find information about the steps of mass change to be done.

3 Main display



This panel allows

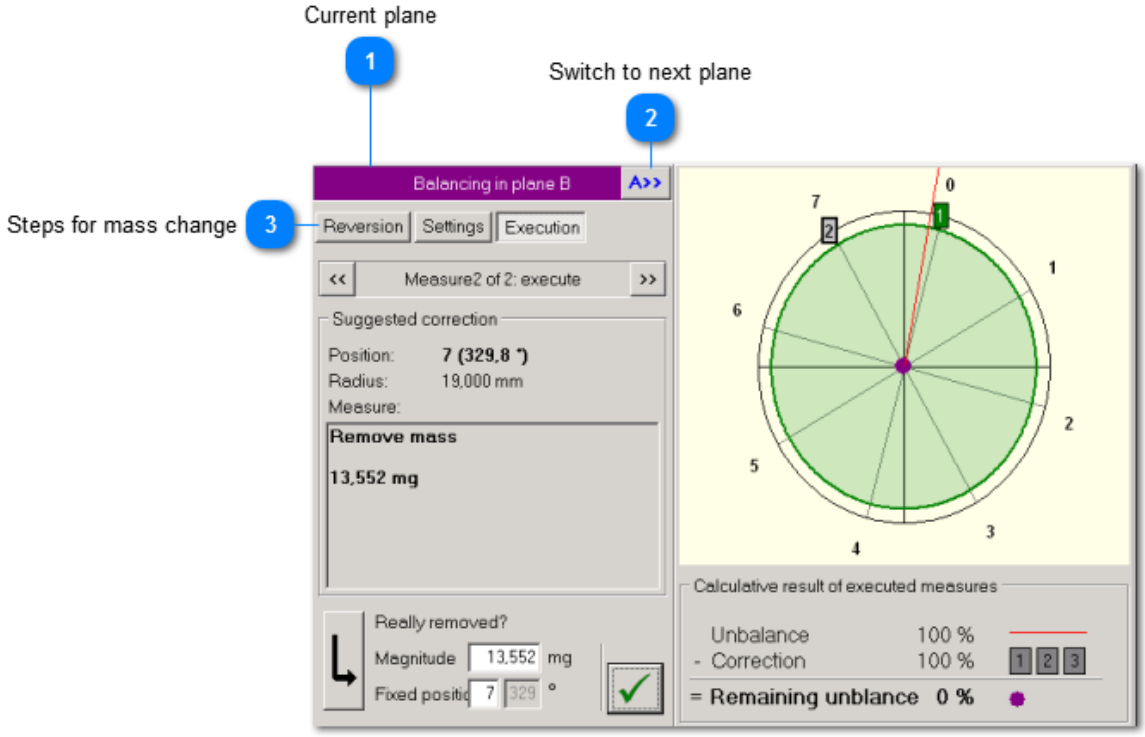
- the reversion of mass changes and
- the selection of balancing methods.

It also shows

- balancing suggestions and
- done corrections.

Main display

This panel shows the corrections for one plane each. Suggestions are offered. You can enter your intended correction measures and check their expected impacts.



1 Current plane

2 Switch to next plane

Only relevant for two-plane balancing

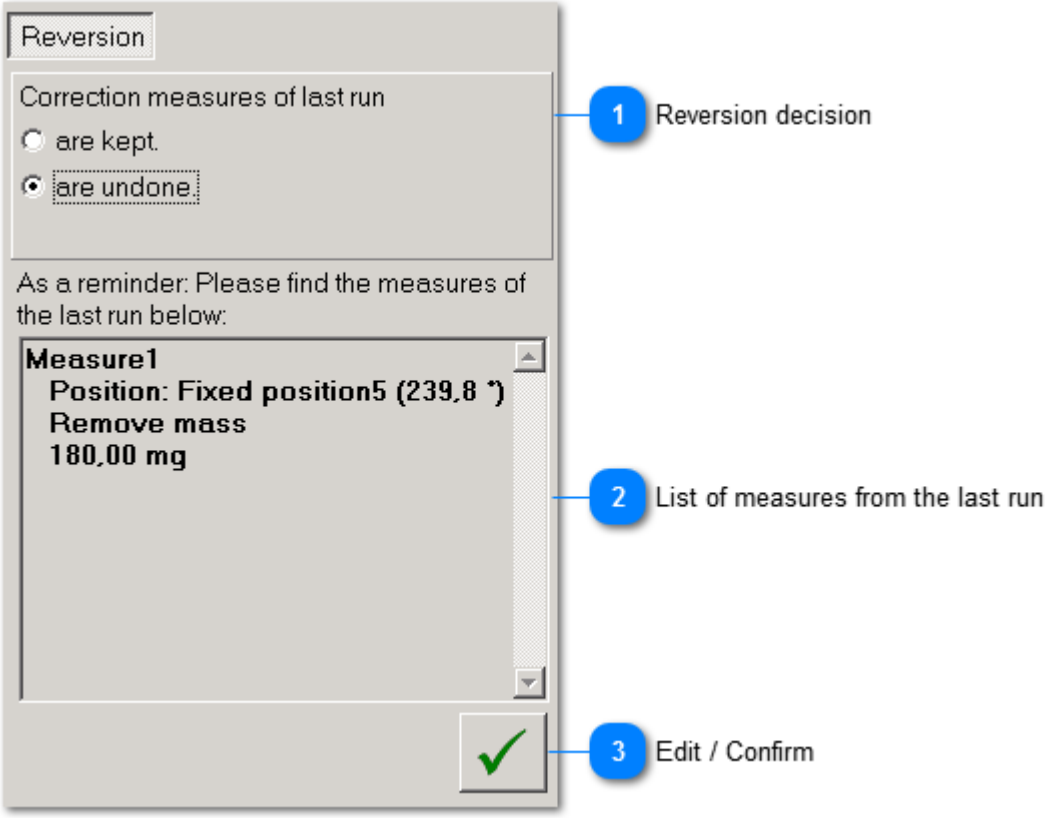
3 Steps for mass change

A mass change may include the following steps:

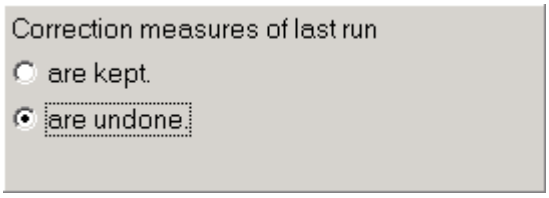
1. Reversion of mass changes from a previous balancing run
2. Selecting a correction method
3. Performing the correction

Reversion of mass changes from a previous run

This panel will open in locked condition. Click the edit button to unlock it.
A change of the reversion setting will also change the current unbalance result.

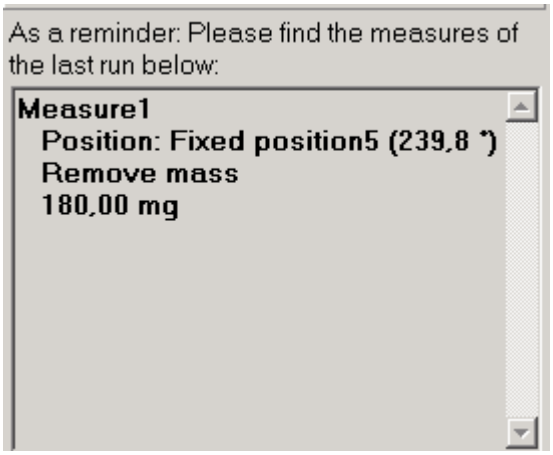


1 Reversion decision



Select whether you want to keep or undo mass changes of the last balancing run.

2 List of measures from the last run



All measures of the last run are listed up again.

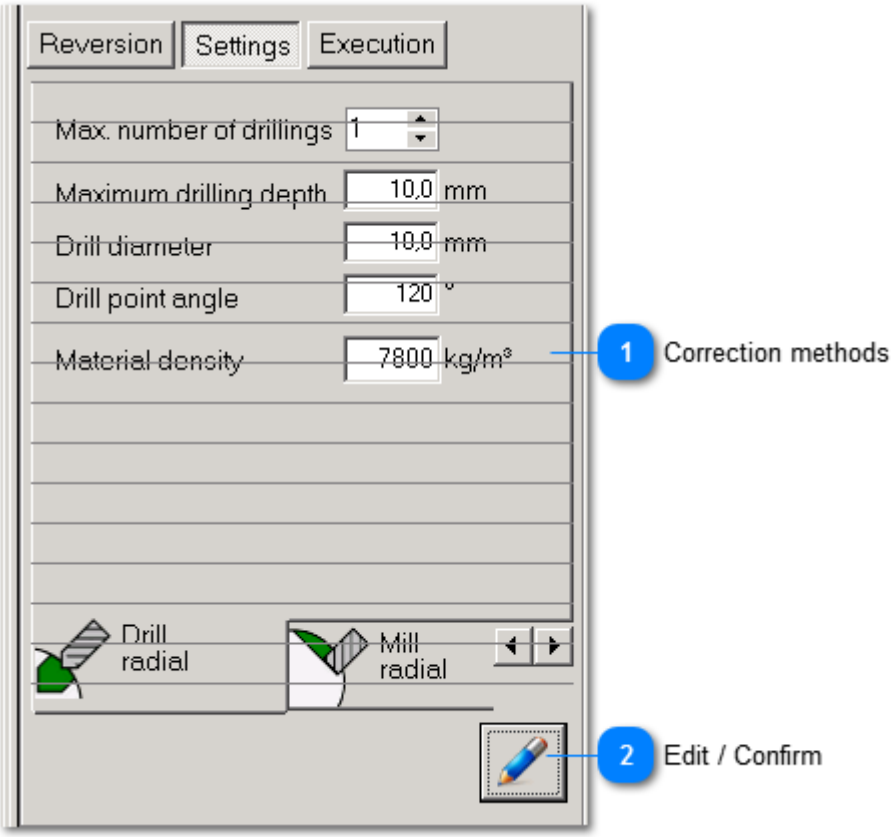
3 Edit / Confirm

The edit button enables the decision about the reversion of mass changes.

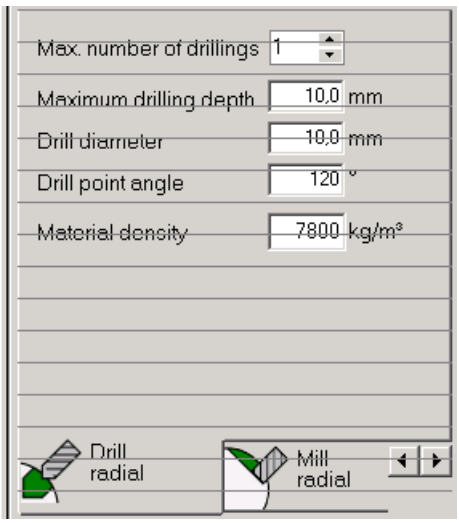
The confirm button turns into an edit button. You can return to the mass edit menu as long as vibration measurement has not been started yet.The confirm button turns into an edit button. You can return to the mass edit menu as long as vibration measurement has not been started yet.

Selecting correction methods

The InnoBalancer offers up to 8 correction methods. To unlock these settings click the edit button.



1 Correction methods



Click the edit button to unlock these settings. 8 correction methods are available:

1. Adding mass
2. Removing mass
3. Radial drilling
4. Radial milling
5. Shifting fixed masses concentrically (sliding block, swivel)
6. Shifting fixed masses radially towards the center
7. Shifting fixed masses radially away from the center
8. Mass list

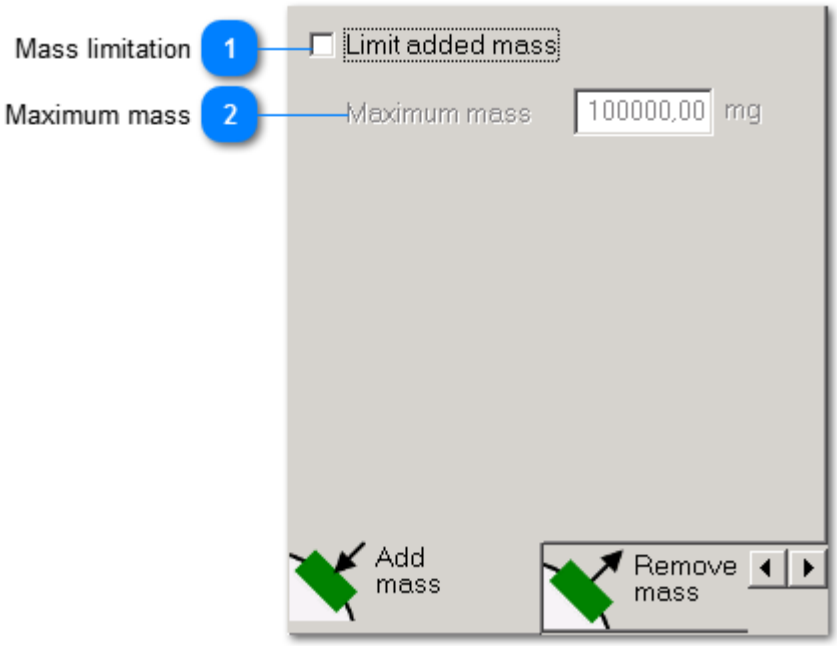
2 Edit / Confirm

Click to enable the selection and setup of correction methods.

Click to confirm your settings and to lock the panel again.

Adding mass

The most common way of unbalance compensation is adding a piece of mass opposite to the unbalance. The InnoBalancer will calculate the amount of mass to be added and its angle position.



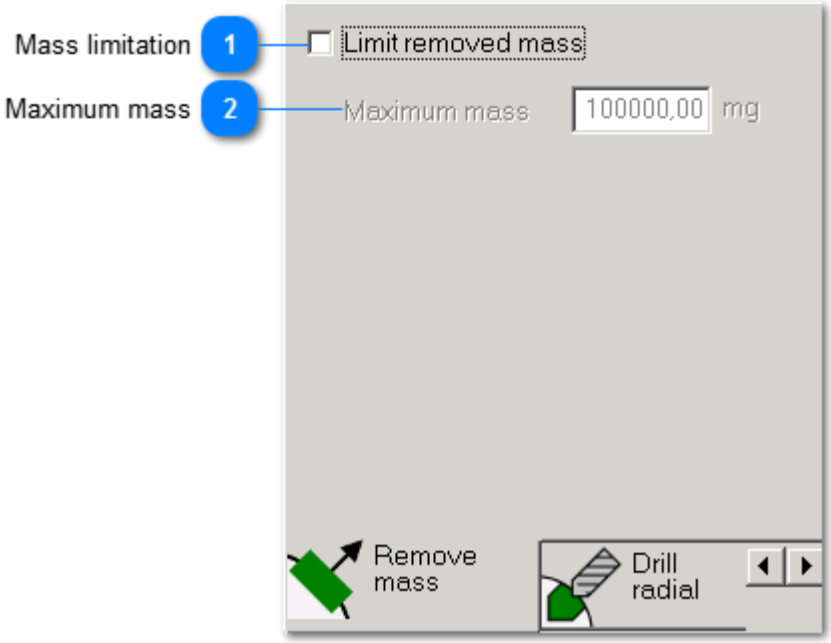
1 Mass limitation

Click this checkbox and enter a maximum possible correction mass if necessary. The InnoBalancer will consider this in its calculations.

2 Maximum mass

Removing mass

This method is used to remove material at the rotor side with the unbalance. The removed mass corresponds to the measured unbalance. The InnoBalancer calculates the amount of mass and the angle position.



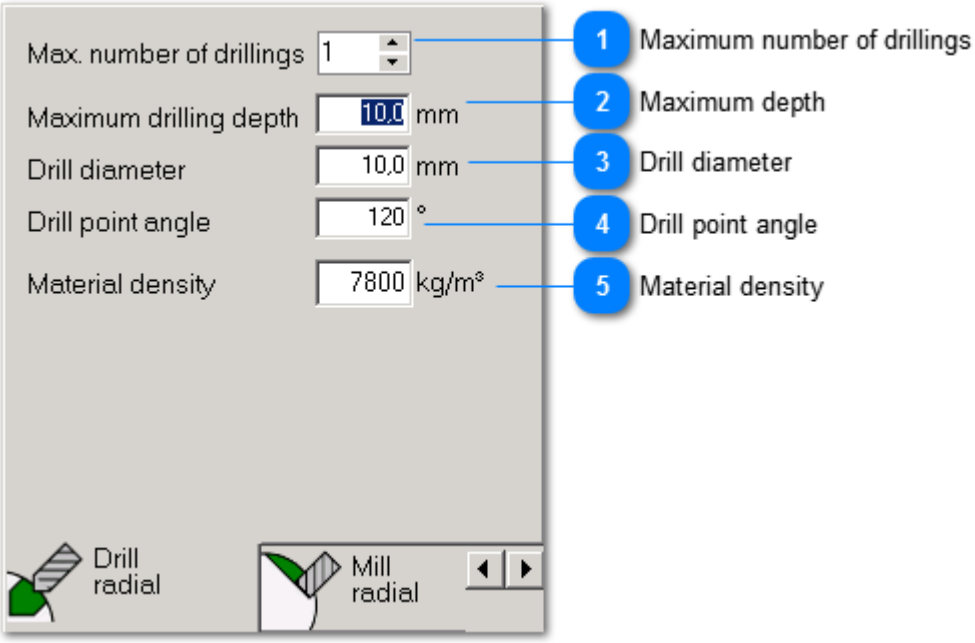
1 Mass limitation

Click this checkbox and enter a maximum value for the mass that can be removed if necessary. The InnoBalancer will consider this in its calculations.

2 Maximum mass

Drilling radially

Drilling is a method to remove mass on the side of the unbalance. The InnoBalancer calculates angle positions, depth and number of drillings.



1 Maximum number of drillings

Up to 3 equal drillings are allowed to increase the amount of removed material

2 Maximum depth

3 Drill diameter

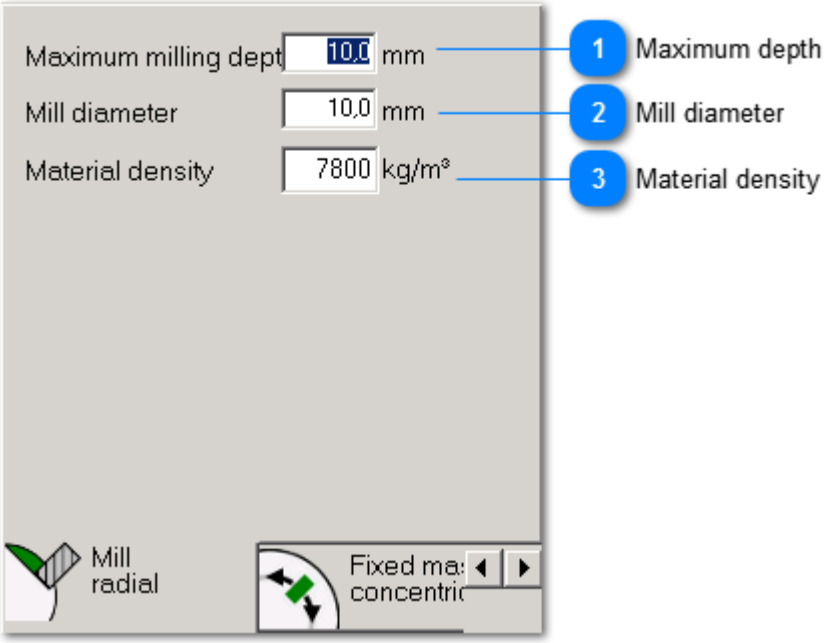
4 Drill point angle

5 Material density

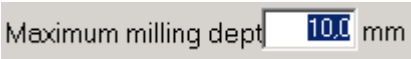
The density of the removed rotor material is needed to calculate the removed mass.

Milling radially

Mass can be removed on the side of the unbalance by milling. The InnoBalancer calculates angle position and milling depth.
The density of the removed rotor material is needed to calculate the removed mass.



1 Maximum depth



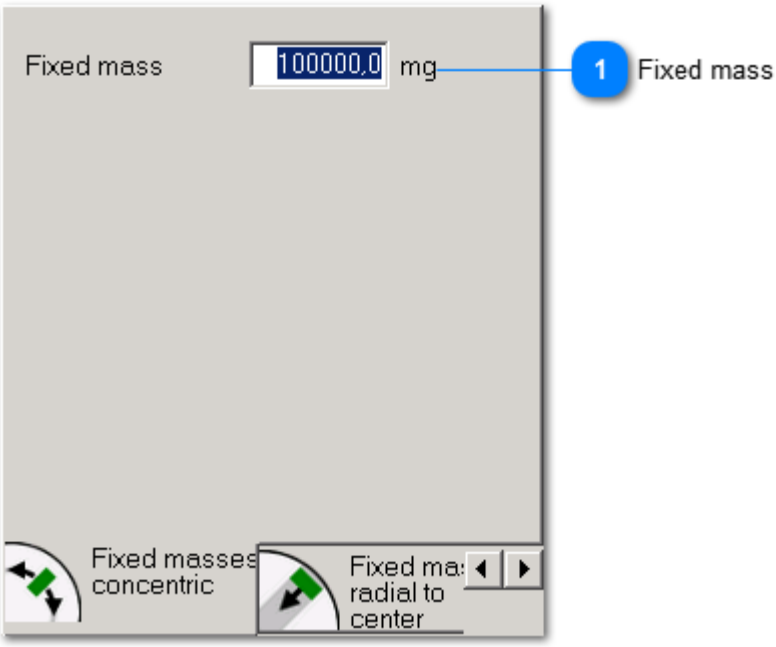
2 Mill diameter

3 Material density

Shifting fixed masses concentrically

This method adds mass to the opposite of the unbalance. Two identical mass pieces are used which can be slid concentrically around the rotation axis. In practice these can be sliding blocks or adjusting rings.

At the time of vibration measurement these masses are either removed or in neutral position (exactly opposite each other) .
The InnoBalancer calculates the angles to be adjusted for both masses.

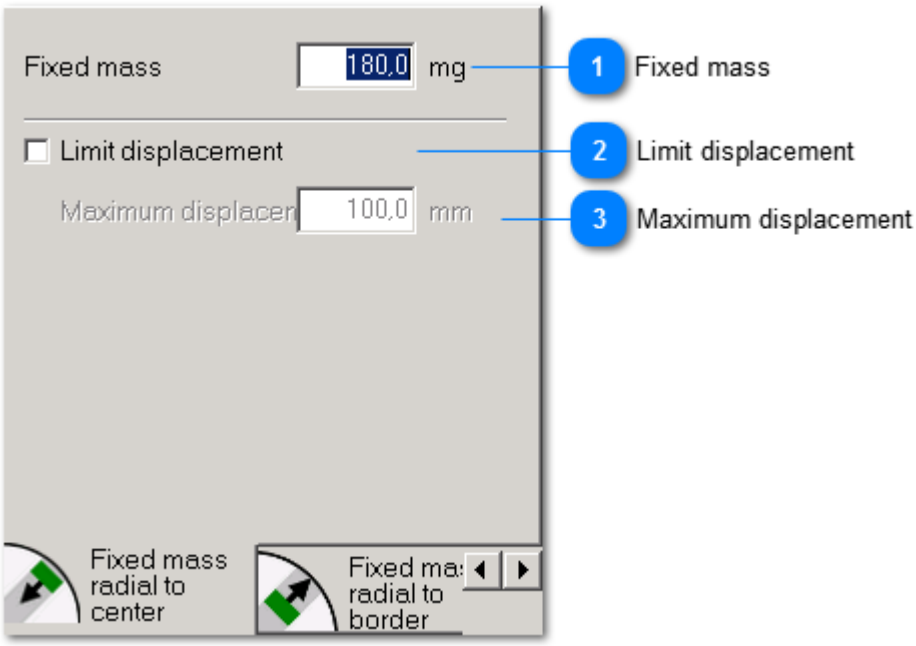


1 Fixed mass

Enter the value of the fixed mass.

Shifting fixed masses radially towards the center

This correction method is applied on the side of the unbalance. In practice set screws are used in radially drilled tapped holes. This method is normally combined with fixed positions.



1 Fixed mass

Mass of the set screw.

2 Limit displacement

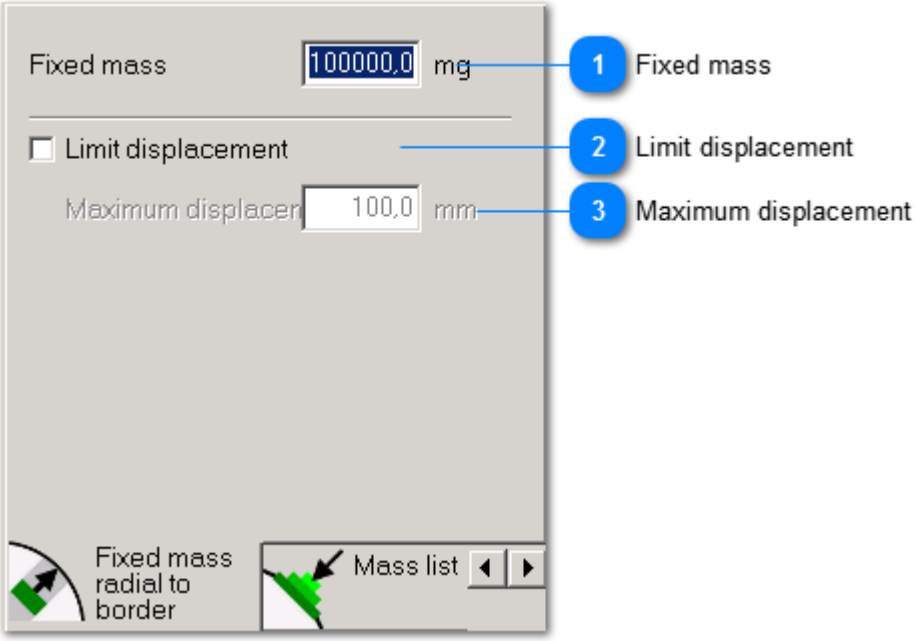
Limits the maximum distance for moving mass.

3 Maximum displacement

If you activated Limit displacement, you can enter the maximum displacement here.

Shifting fixed masses radially away from the center

This correction method is applied on the opposite of the unbalance. In practice set screws in radially drilled tapped holes are used. This method is normally combined with fixed positions.



1 Fixed mass

Mass of the set screw.

2 Limit displacement

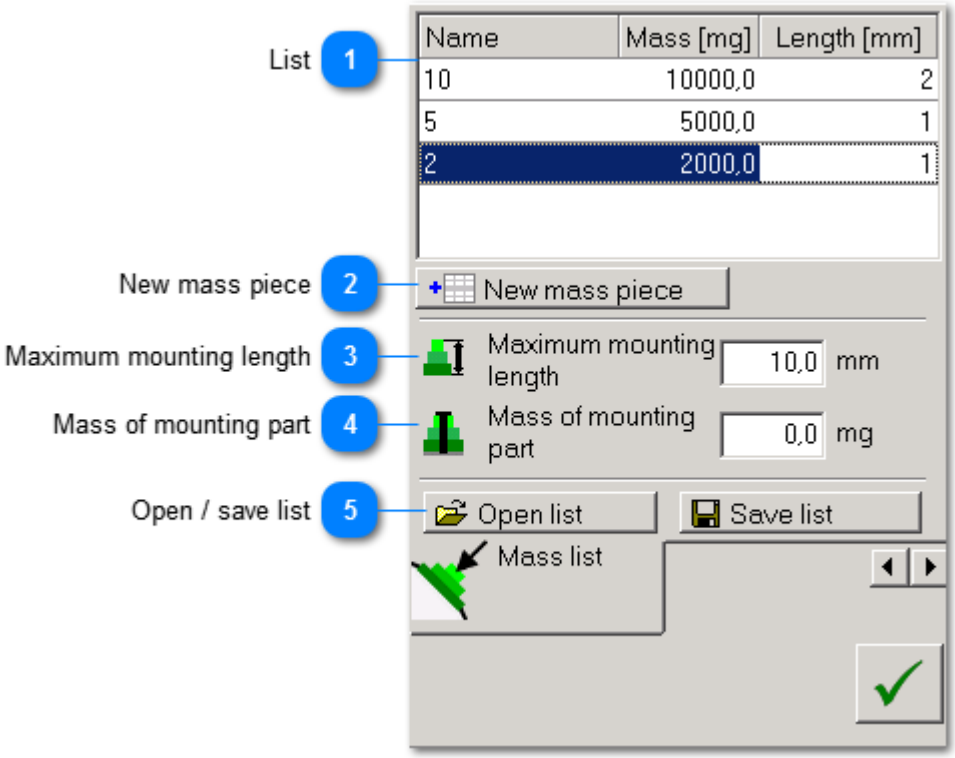
Limits the maximum distance for moving mass.

3 Maximum displacement

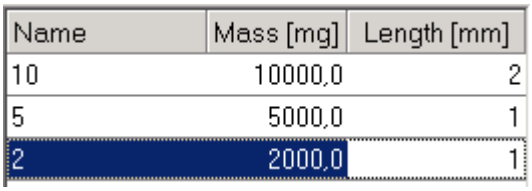
If you activated Limit displacement, you can enter the maximum displacement here.

Mass list

A mass list is belongs to a correction method of adding mass pieces opposite to the unbalance. In practice it will be often time-consuming to make an exact mass according to the balancing calculations. It may be advantageous to use prefabricated mass pieces instead. These can be prepared in practical weight steps, for example 1, 2 and 5.
The InnoBalancer can calculate the optimum combination of these masses using as few pieces as possible.
The mass list method can be particularly useful for fixed positions. Many rotors have on their face side screws or threads in certain angles which can serve as fixed locations. Washers can be put under the screw heads for balancing. These washers could be entered as a mass list. The InnoBalancer will ensure that only a limited number of washers can be mounted and it can also consider the weight of the screws.



1 List

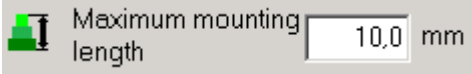


The list shows the entered mass pieces. All entries can be directly edited. An entry can be deleted by right mouse click.

2 New mass piece

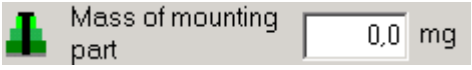
Click to add a new mass piece.

3 Maximum mounting length



The number of mass pieces that can be attached at one position will be usually limited, for example by the length of the used screw. This entry is the total length of all all stacked mass pieces. The individual lengths of the mass pieces is found in the mass list.

4 Mass of mounting part



The part used for attaching the mass pieces, for example a screw, will also contribute a mass. Enter zero if this part was already attached to the rotor at the time of vibration measurement. If the mounting part is attached only in combination with a mass piece, enter here its weight.

5 Open / save list

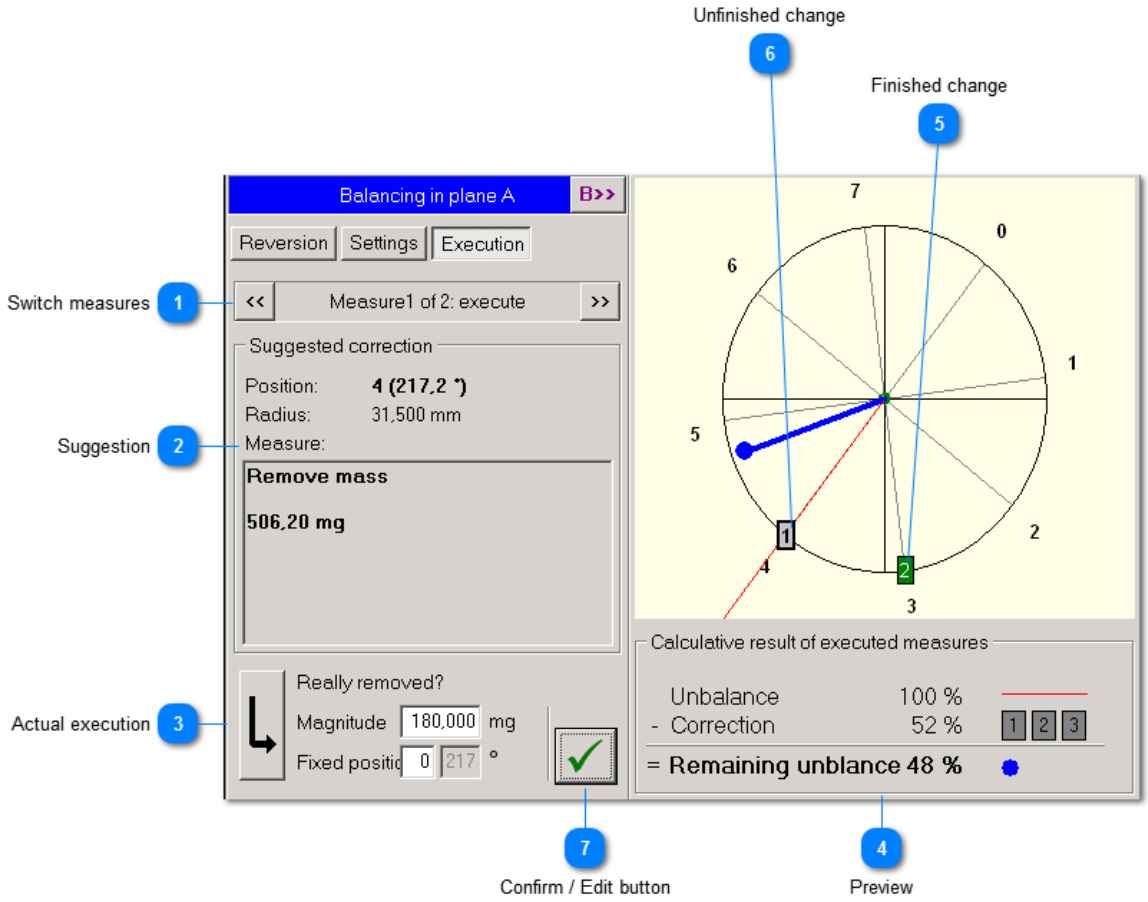
A mass list can be saved and loaded.

Performing the correction

Correction is done interactively.

- The InnoBalancer offers a correction suggestion based on the measured unbalance result and the selected correction method.
- You may modify these suggestions if desired.
- Enter your own corrections and you will see the effects immediately in the right section of the panel.
- Confirm if the correction was done actually at the rotor.

If all steps are finished in both planes you can proceed to the next step, a vibration measurement run.

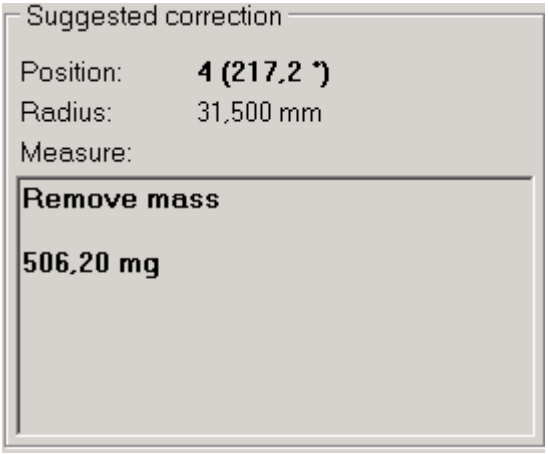


1 Switch measures

Especially for balancing at fixed positions several suggestions can be issued.

Use the buttons << and >> to switch between them. The location of the currently selected correction is indicated in the preview diagram by a bold framed number, for example 2 for correction 2.

2 Suggestion



The InnoBalancer issues a suggestion for unbalance correction based on the unbalance result and the selected correction method.

3 Actual execution

Reasons for user inputs can be

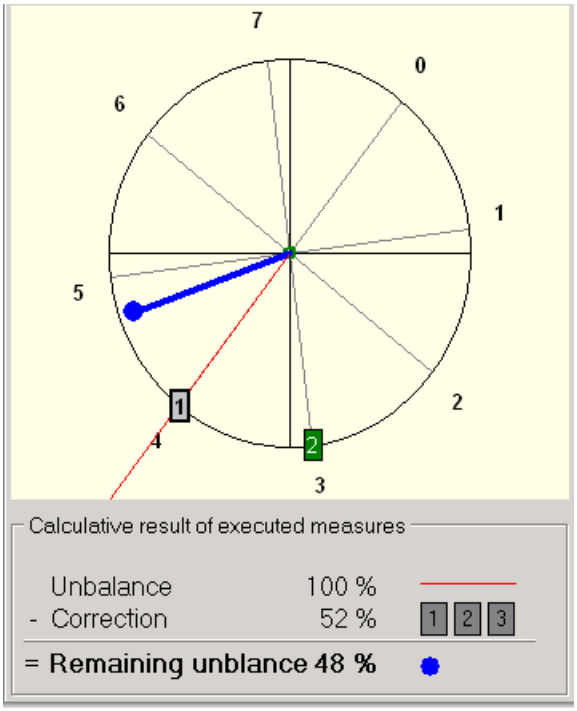
- No correction can be made at the calculated angle
- The calculated correction mass is not at hand

etc.

The effects of the entered changes can be observed in the preview section.

This button resets the data entered by the user back to the system suggestions.

4 Preview



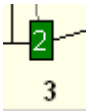
This section shows all correction measures at their location. Completed steps are indicated green, unfinished steps are grey.

The preview also shows the estimated unbalance pointer after all correction steps will be finished. A zero length pointer would indicate complete correction of the unbalance. Under the diagram you see a calculation of the remaining unbalance.

The length of the pointer will not become zero in case of practical balancing restrictions, like mass limitations) or differences between calculated suggestions and practical measures. A tolerance circle indicates whether the deviation is acceptable or another way of correction needs to be found.

The preview function can be practical to test different correction methods. Please note that the show unbalance is an estimation only. It cannot replace the subsequent verification run.

5 Finished change



A finished correction is shown as a green box.

6 Unfinished change

An unfinished correction is shown as a grey box.

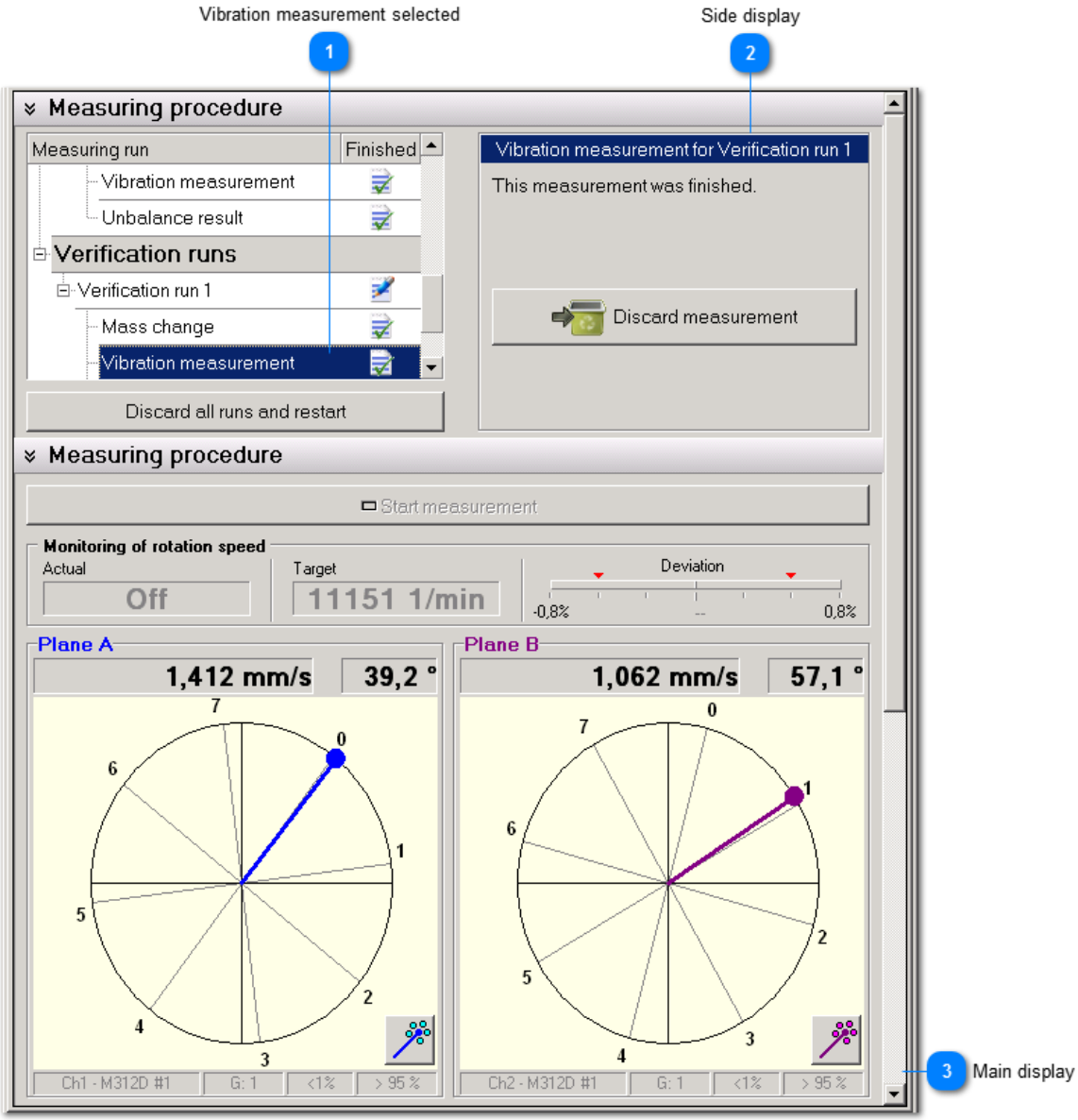
7 Confirm / Edit button

Click this button to confirm your entries.

The confirm button turns into an edit button. As long as the next balancing step is not completed you may return to the edit mode.

Vibration measurement

Vibration measurement as part of the verification run determines the amount of vibration after mass changes.
The rotor needs to run at constant speed.
After vibration measurement the remaining unbalance will be shown.



1 Vibration measurement selected
Select Vibration measurement under Verification run X in the list of measuring runs.

2 Side display
This section is described here.

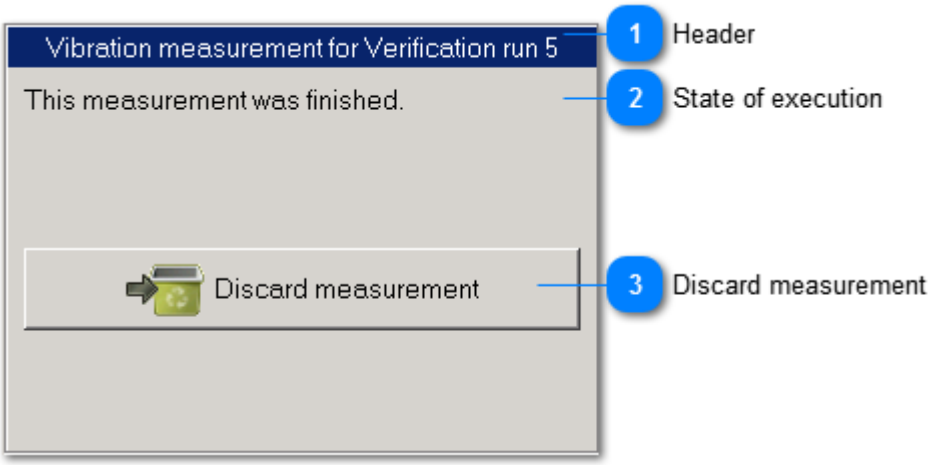
3 Main display
This section is described here.

General functions

This section explains functions used in different steps of the balancing process.

Side display for vibration measurement

This panel appears each time vibration is measured.



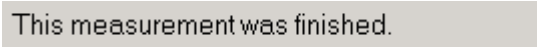
1 Header

This field displays the name of the measuring run.

Depending on the measuring run, this name can be:

- Vibration measurement for Pilot survey
- Vibration measurement for Initial run
- Vibration measurement for Test run plane A
- ...

2 State of execution



This field informs about the execution state.

The status can be:

- This measurement is still to be executed.
- This measurement is in progress.
- This measurement was finished.
- This measurement was discarded.

3 Discard measurement

Click this button to discard the measurement.

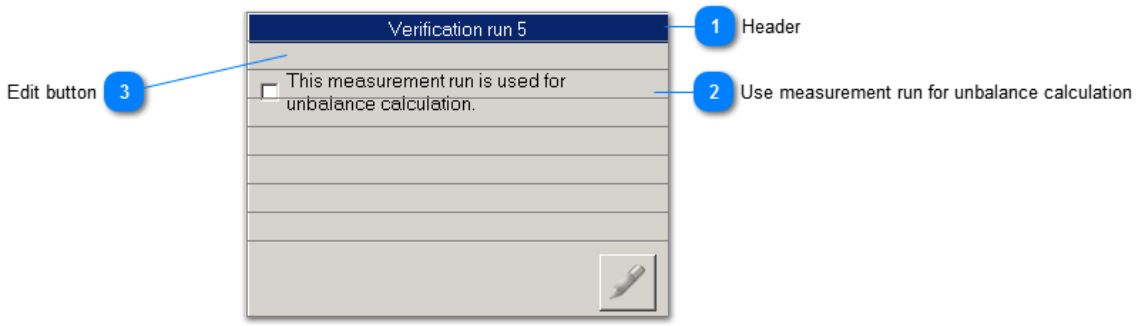
After finishing vibration measurement the InnoBalancer will lock the start button so that no further measurement can be started. Before repeating the measurement you need to discard the previous measurement.

After discarding the measurement the button changes its design:

Click again to restore the discarded measurement if you have pressed the above button by mistake.

Side display for balancing runs

This panel is displayed in all balancing runs



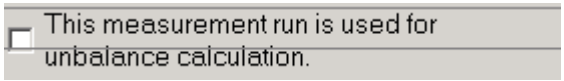
1 Header

This field displays the name of the measuring run.

Depending on the measuring run, the name can be:

- Initial run
- Test run plane A
- Test run plane B
- Verification run 1
- ...

2 Use measurement run for unbalance calculation



Two inputs are needed for unbalance calculation:

1. How was the rotor mass changed?
2. What was the resulting vibration?

For the first unbalance calculation the InnoBalancer uses the data from the test runs. However, the InnoBalancer can also use verification runs in its calculations. This can be advantageous in the last balancing stage when a large portion of the initial unbalance has been compensated already. In such cases balancing would be based on vibration data measured under very different conditions. Instead of performing new test runs the InnoBalancer may simply include verification run results in its calculation. This option can be selected in the settings. Even if you have enabled the inclusion of verification runs you can still disable this option individually for each run.

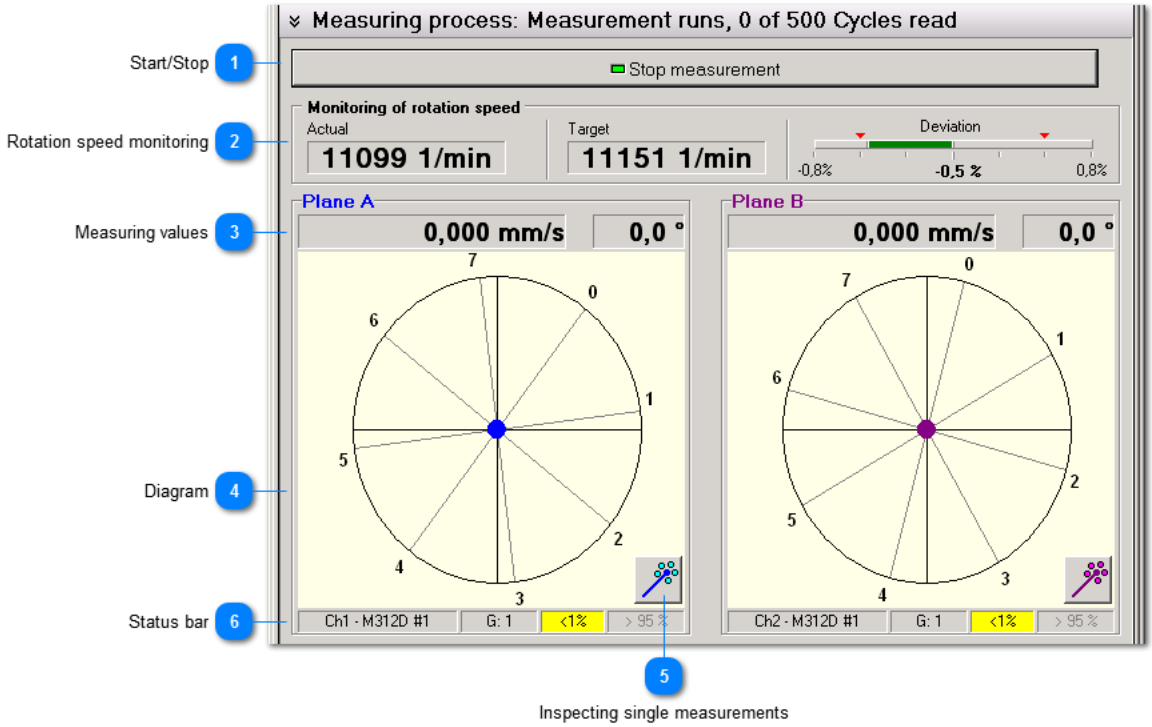
3 Edit button

Changing the calculation is not possible in most situations of the balancing procedure, i.e. the edit button is deactivated.

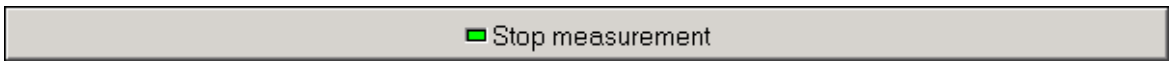
Main vibration display for balancing run

Vibration measurement is performed in initial runs, test runs and verification runs. The measured vibration values are intermediate results for the calculation of the final unbalance.
In the vibration diplay you find the button for starting a measurement. If rotation speed reaches the specified range, vibration is measured and indicated. After measuring the specified number of revolutions the InnoBalancer stops vibration measurement.

Depending on the selected mode the InnoBalancer will switch to the next step or wait for user control. You may always return to the vibration display by selecting *Vibration measurement* in list of measuring runs.

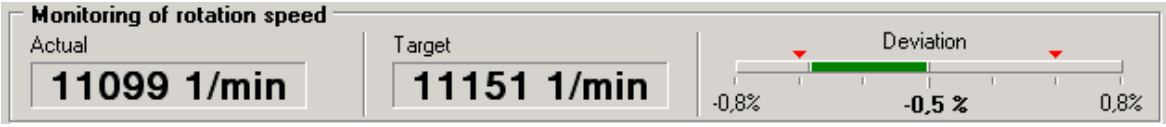


1 Start/Stop



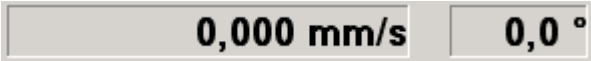
Starts and stops vibration measurement. The InnoBalancer will stop measurement automatically after raching the entered number of revolutions. Hence a manual stop is usually not necessary.

2 Rotation speed monitoring



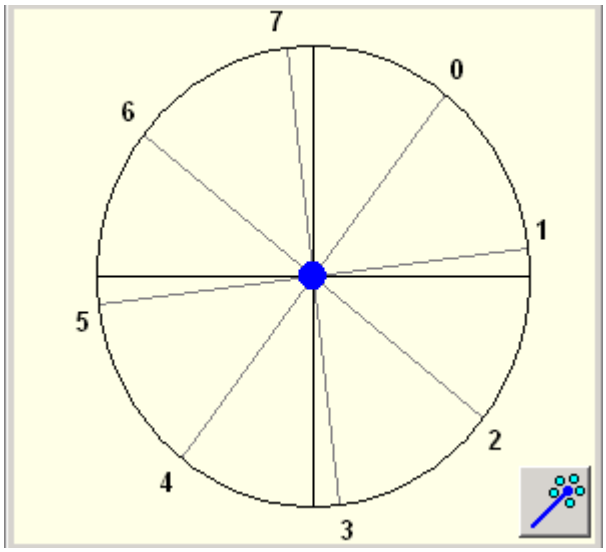
Rotation speed is monitored before and during vibration measurement.
In the first measuring run there is no nominal speed. In this case the InnoBalancer only checks whether rotation speed is within the limits for a sufficiently long period. By this means the InnoBalancer can find a nominal speed and starts vibration measurement. If the actual rotation speed differs from the nominal value the InnoBalancer will discard the measured vibration values, find a new nominal speed and restart the measurement.
In further measuring runs the nominal speed is fixed and vibration measurement is performed only at rotation speeds within the specified limits.

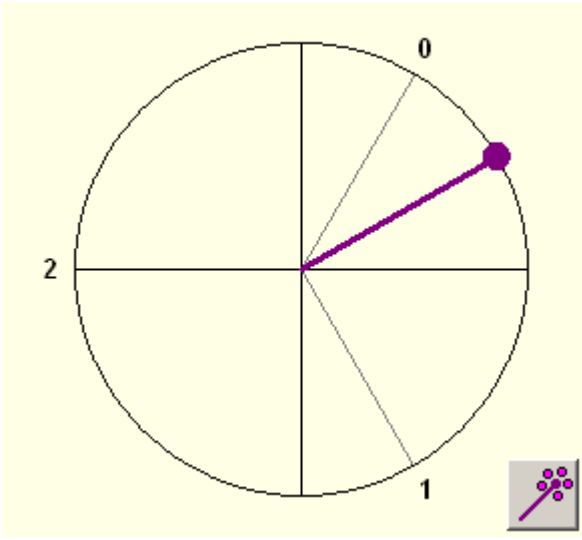
3 Measuring values



For both planes amount and phase angle are indicated with the selected unit.

4 Diagram

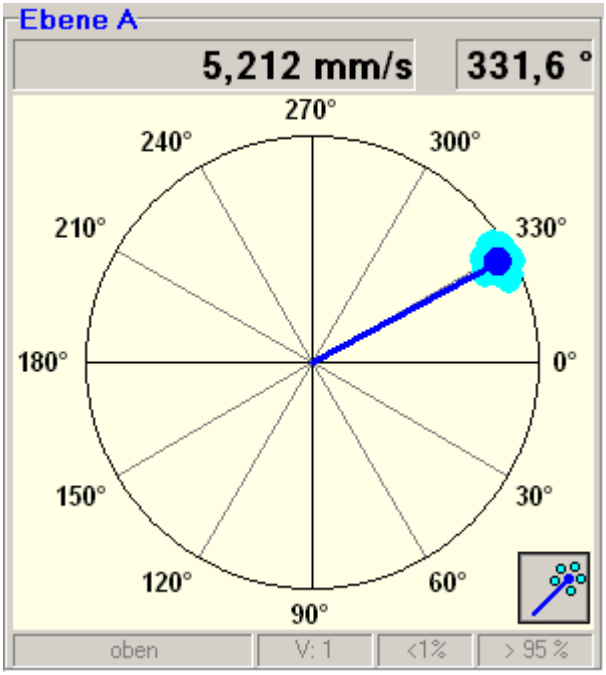




The vibration value is shown as a pointer. The angle is marked according to the settings.
Fixed positions are indicated in the diagram.

5 Inspecting single measurements

This feature informs about deviation of the averaged single measurement.



High deviations can reduce the reliability of the result. This can happen when the unbalance becomes so low that there is almost no remaining vibration. On the other hand there can be fundamental problems, for example strong interference by external sources. The image shows a measurement of good quality.

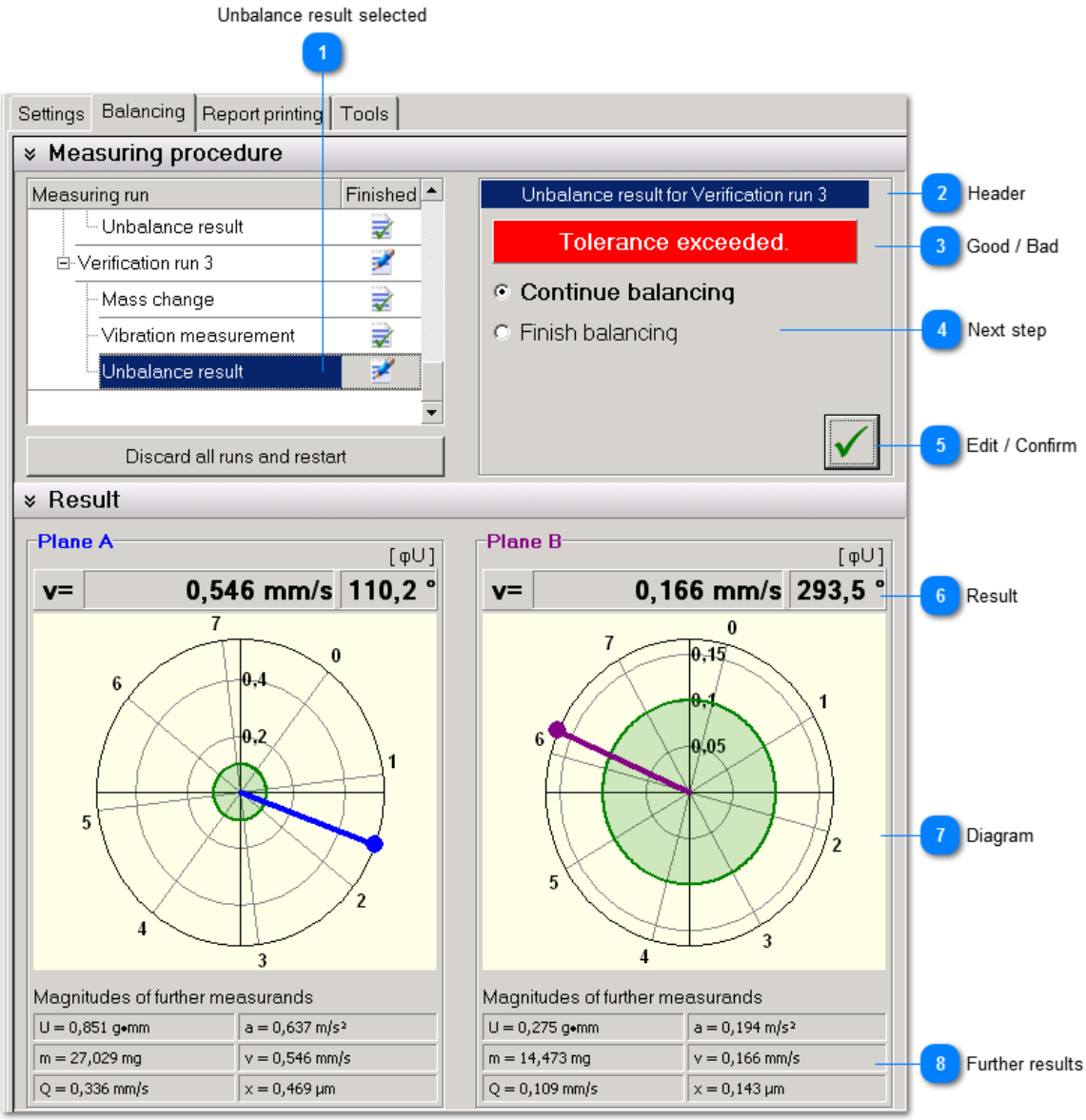
6 Status bar

The following properties of the measuring channel are shown:

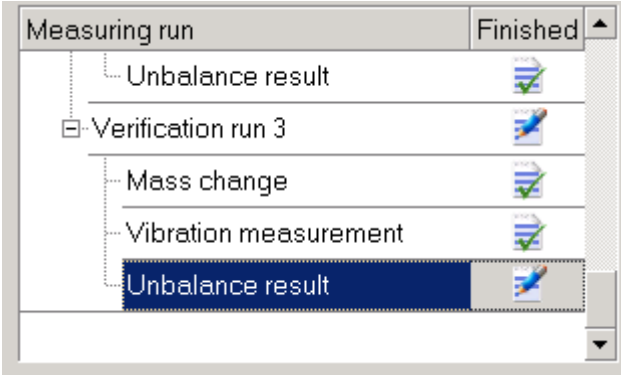
- Channel name
- Gain
- Underload
- Overload

Unbalance result

After finishing the test runs you will get the first unbalance result. Further unbalance results are shown after the verification runs.



1 Unbalance result selected



2 Header

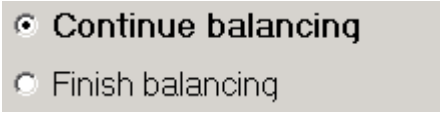
Measuring run, for example

- Unbalance result for Test run Plane A(in case of Single-Plane-Balancing)
- Unbalance result for Test run Plane B (in case of Two-Plane-Balancing)
- Unbalance result for Verification run 1
- ...

3 Good / Bad

Good / bad indication based on the tolerance limits.

4 Next step



You may decide what to do next. If the tolerance limit was exceeded the InnoBalancer will suggest to continue balancing. However, you can always finish the procedure.

5 Edit / Confirm

Click this button to confirm your entries and proceed to the next run.

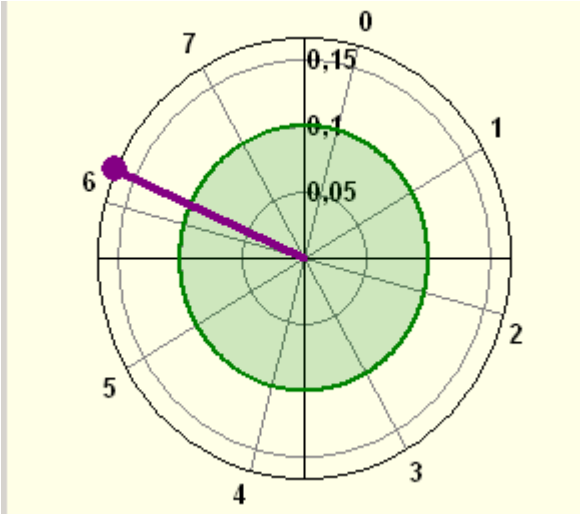
The confirm button turns into an edit button. You can return to the mass edit menu as long as the next mass change has not been finished yet.

6 Result

v=	0,166 mm/s	293,5 °

The result is shown as magnitude and angle according to the balancing aim.
The angle corresponds to the measured unbalance. If the balancing aim was a reduction of vibrations the angle may differ from the angle measured vibration display because of dynamic rotor properties. To maintain concurrence with the angles used during unbalance correction the unbalance angle is here also used for vibration indication.

7 Diagram



The diagram shows magnitude and position of the unbalance with regard to the tolerance limit indicated as a green circle.

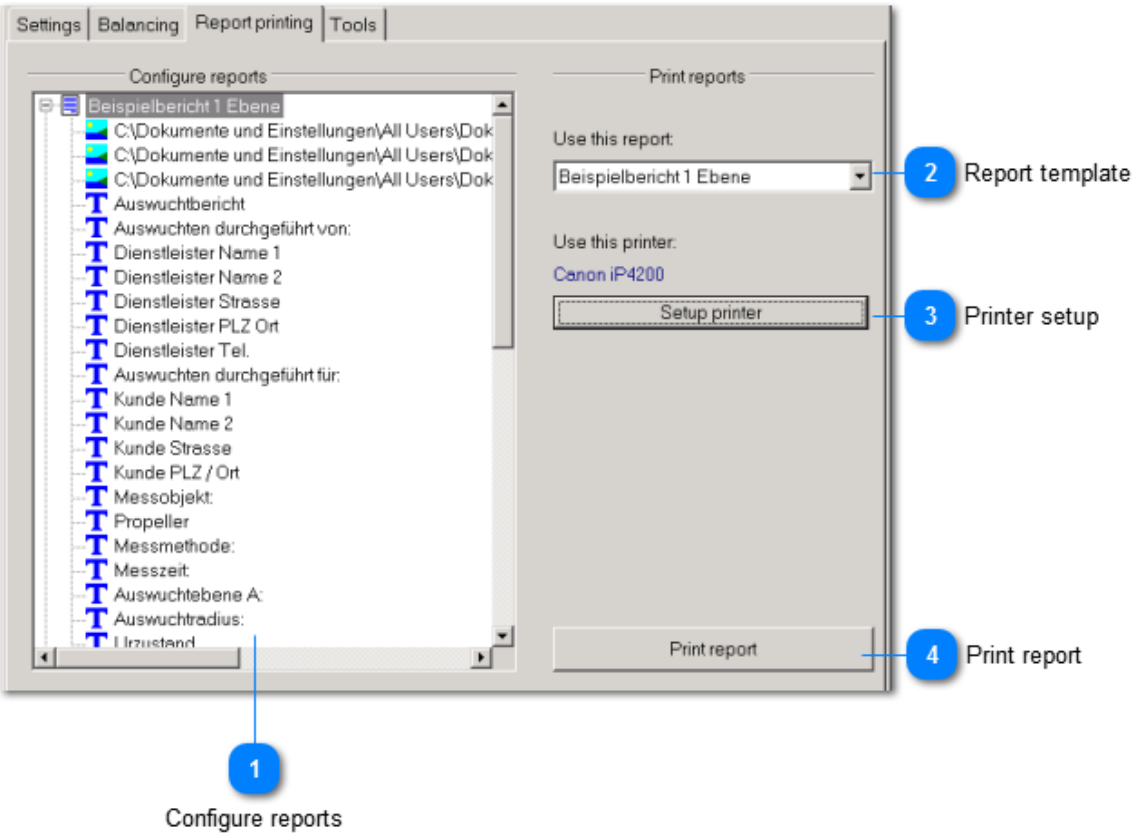
8 Further results

Magnitudes of further measurands	
U = 0,275 g•mm	a = 0,194 m/s²
m = 14,473 mg	v = 0,166 mm/s
Q = 0,109 mm/s	x = 0,143 µm

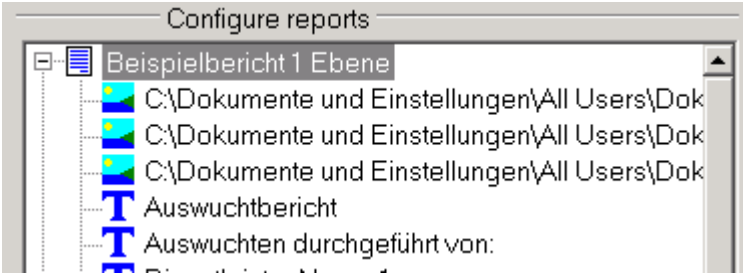
In addition the results according to the balancing aim the InnoBalancer shows other measurands providing information about the balancing condition of the rotor.

Report printing

This panel includes functions for printing a balancing report. Elements like texts, logos and variables can be combined to report templates.

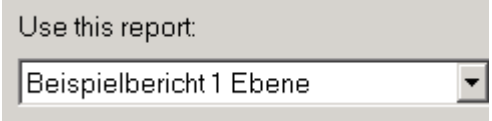


1 Configure reports



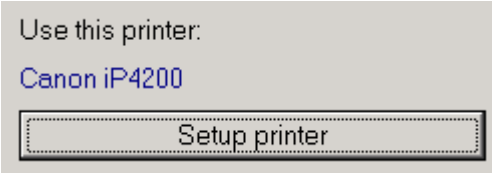
The report templates can be found in this tree structure. One report example is pre-configured. User templates can be configured or loaded.

2 Report template



Select one of the saved report templates.

3 Printer setup



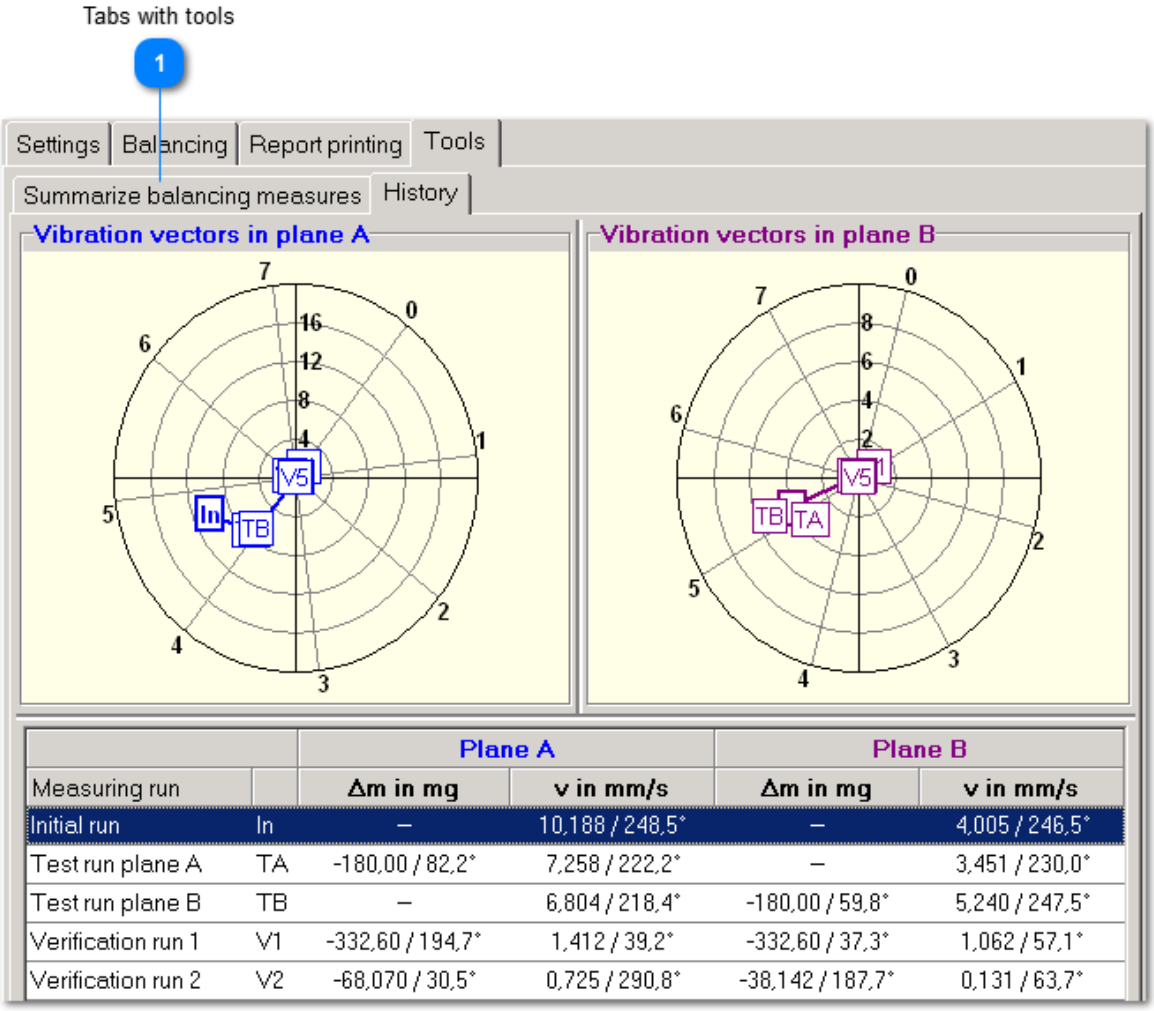
This button opens a dialog for printer selection and configuration.

4 Print report

Prints the report.

Tools

The following tools are not necessary for balancing, but they facilitate the balancing process:



1 Tabs with tools

2 tools are available:

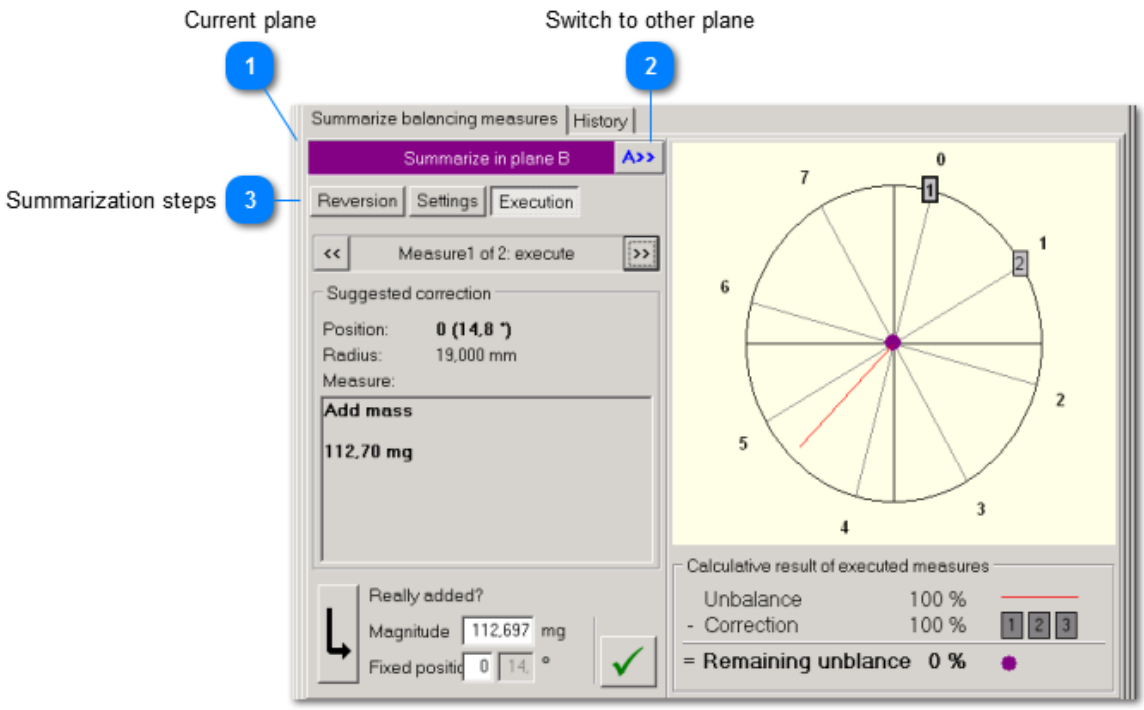
- Summarize balancing measures
- Balancing history

Summarizing is only possible before and after balancing. Balancing history is always available.

Summarizing balancing measures

In practical unbalancing it may occur that over a longer period several correction masses accumulate at the rotor.
If, for example, a mass is added each time, there will be a number of masses around the rotor after some balancing periods.
One could attempt to remove the old masses completely before balancing. However, this could lead to unexpected unbalance with the risk of high vibrations.
This tool of the InnoBalancer allows the reduction of several old masses to one or two pieces by calculation. This will provide space for further balancing.

Summarizing masses can only be done before or after balancing. For summarizing masses before balancing the input rotor data is needed.



1 Current plane

Summarize in plane B

2 Switch to other plane

A>> Only for two-plane balancing

3 Summarization steps

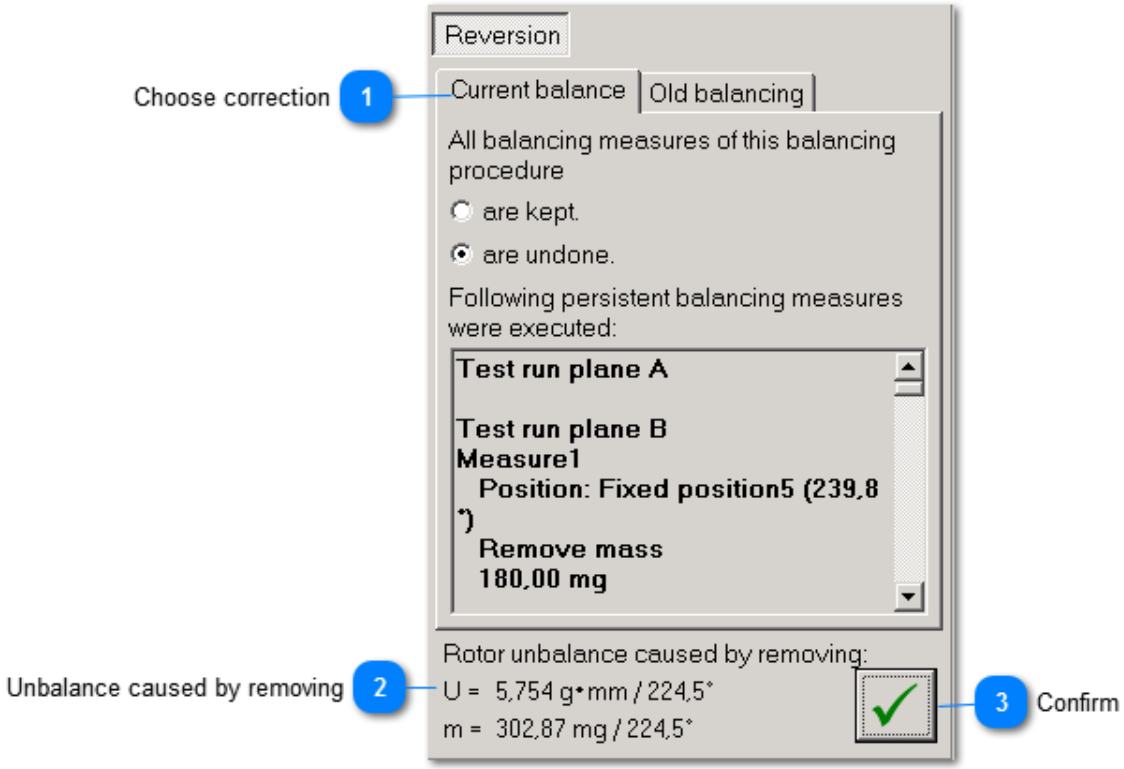
Reversion | Settings | Execution

- Summarization starts with the reversal of earlier corrections.
- Then you choose the method for the summarized correction.
- The last step is the new correction

Reversion of earlier corrections

A number of corrections can be reversed in order to summarize them into one or a few new corrections.
You can reverse

- the existing corrections of earlier balancing sessions
- the corrections of a balancing session that was just finished

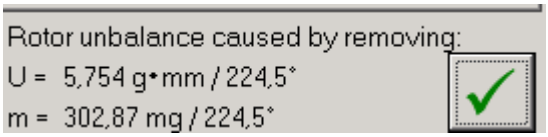


1 Choose correction

Available options are

- *Current balance*: Reverses the corrections of a balancing session that was just finished . This option is only available if a balancing session was just finished and is still in the buffer.
- *Old balancing*: Reverses the existing corrections of earlier balancing sessions

2 Unbalance caused by removing



Here you see the resulting new unbalance if a correction will be removed.

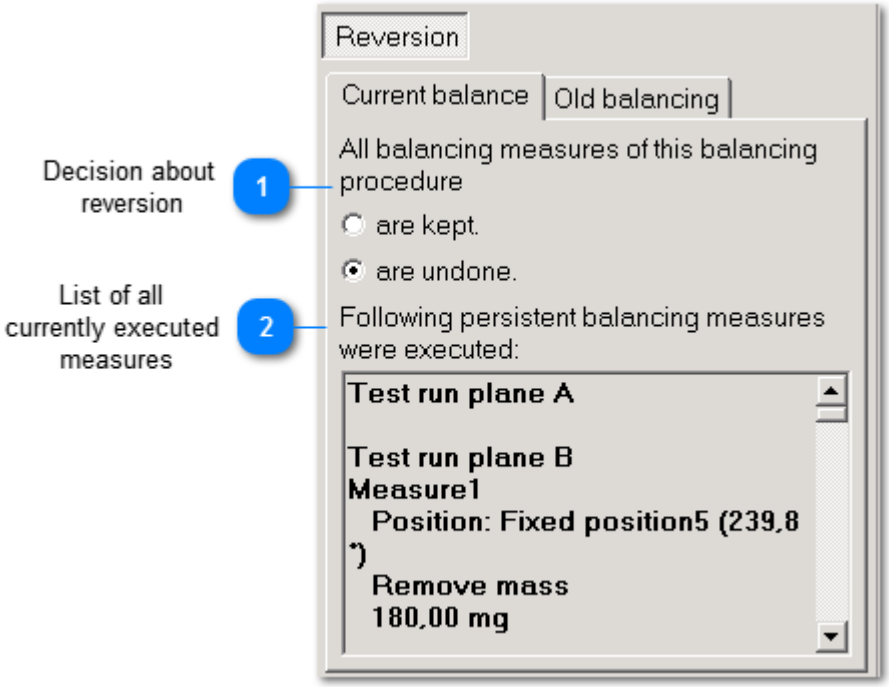
3 Confirm

Click to confirm your entries and to start summarization.

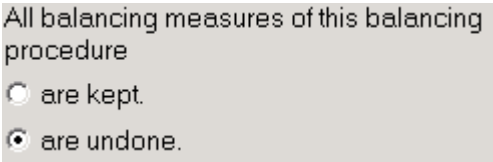
Reverse current balancing measures

By means of the summerization after a balancing procedure all executed measures can be summarized to few measures. The InnoBalancer registered all mass changes during a balancing procedure and lists them up again.

If there are balancing measures of old balancing procedures on the rotor, they can be included in the summarization.

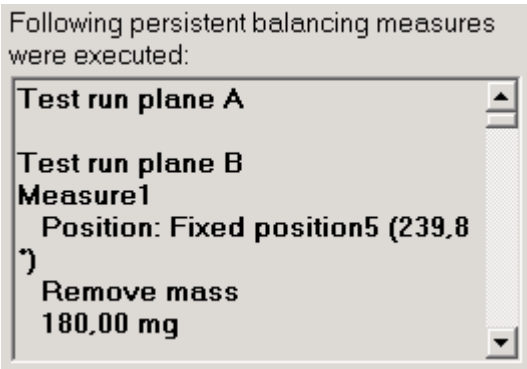


1 Decision about reversion



If the measures from the current balancing procedure are to taken over into the summerization, you must select are undone.

2 List of all currently executed measures

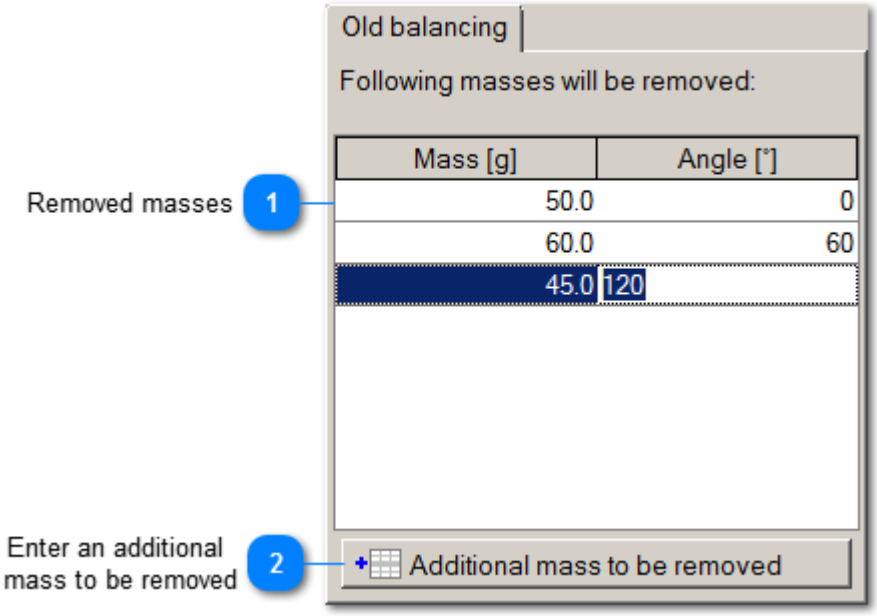


If you decided to reverse all measures from the current balancing procedure, all executed measures are listed up to that you can reverse them on the rotor.

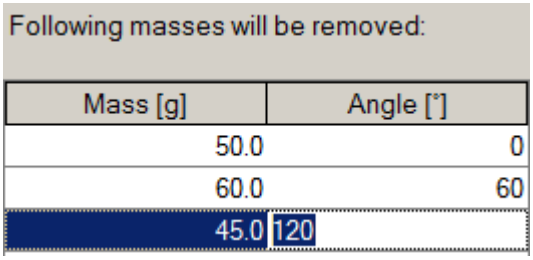
Reverse old balancing measures

Reversion of balancing measures means removing added masses from old balancing procedures. When you remove a mass, you have to enter its data into the list of removed masses.

Masses have to be removed on a balancing radius which is consistent with the radius you entered in the settings.



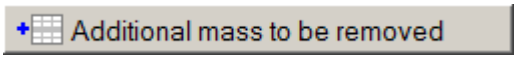
1 Removed masses



This list contains all removed masses. Data can be changed directly in the list. The value of the mass is determined by means of scales. The angle position is measured opposite to the zero reference mark. But it has to fit together with entered angle settings if measures from a current balancing procedure are included in the summarization as well.

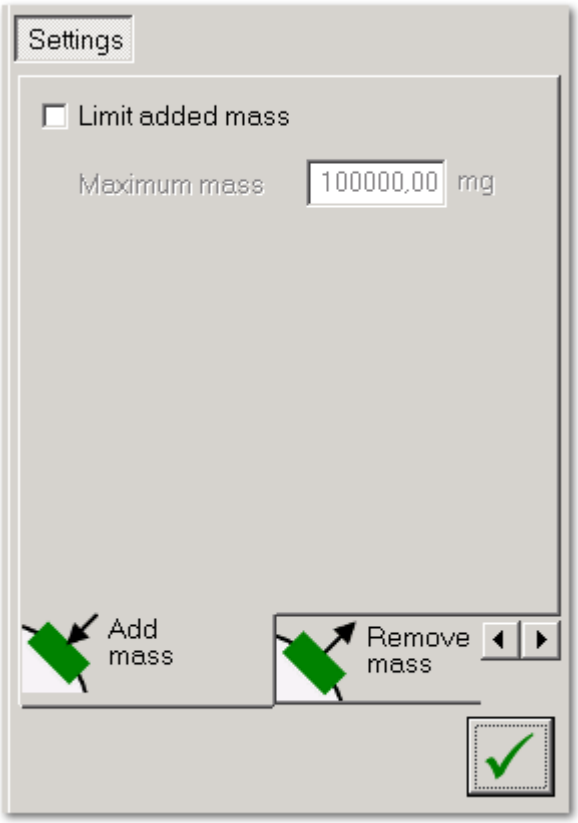
Deleting a row or the whole table is initiated by clicking with the right mouse button.

2 Enter an additional mass to be removed



This button adds a new row to the list.

Settings for summarization

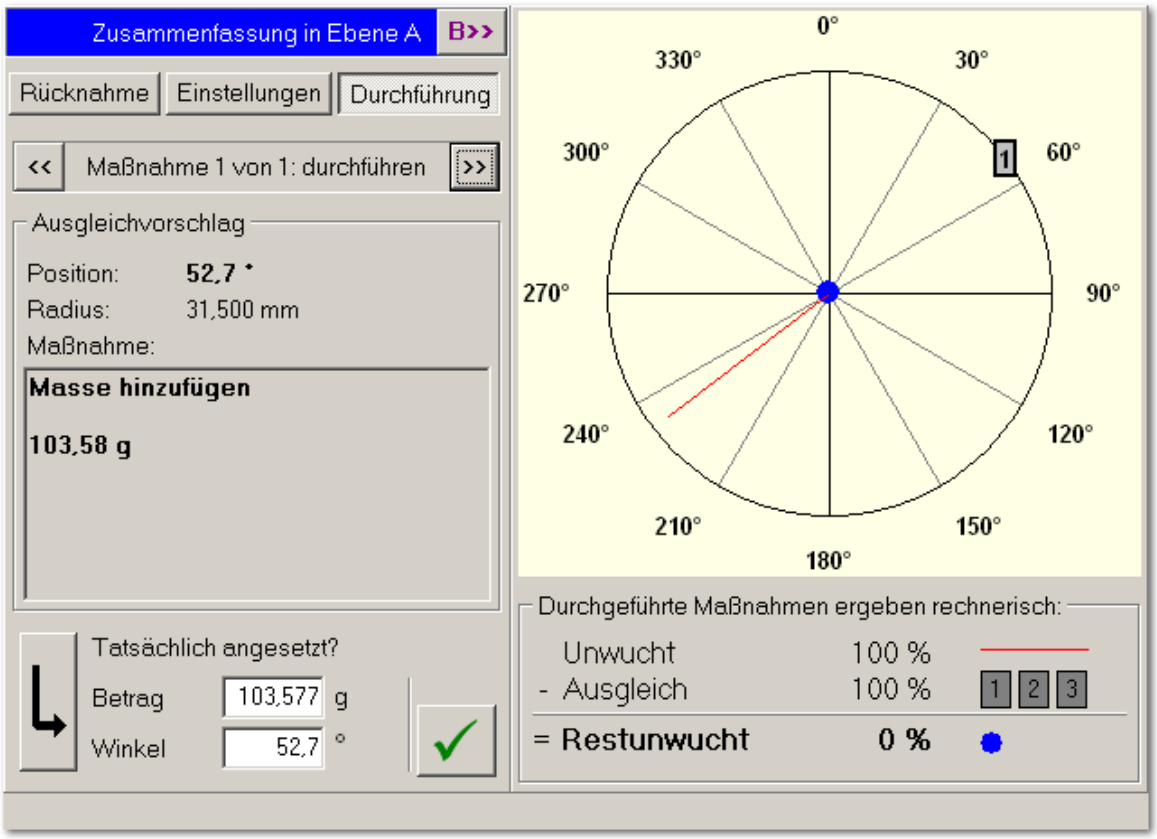


For the summarized correction you can choose again between the 8 correction methods offered by the InnoBalancer. The settings to be entered are the same as in the balancing process. Details are found here.

Reversion of an existing correction and summarization are blocked until the settings have been made.

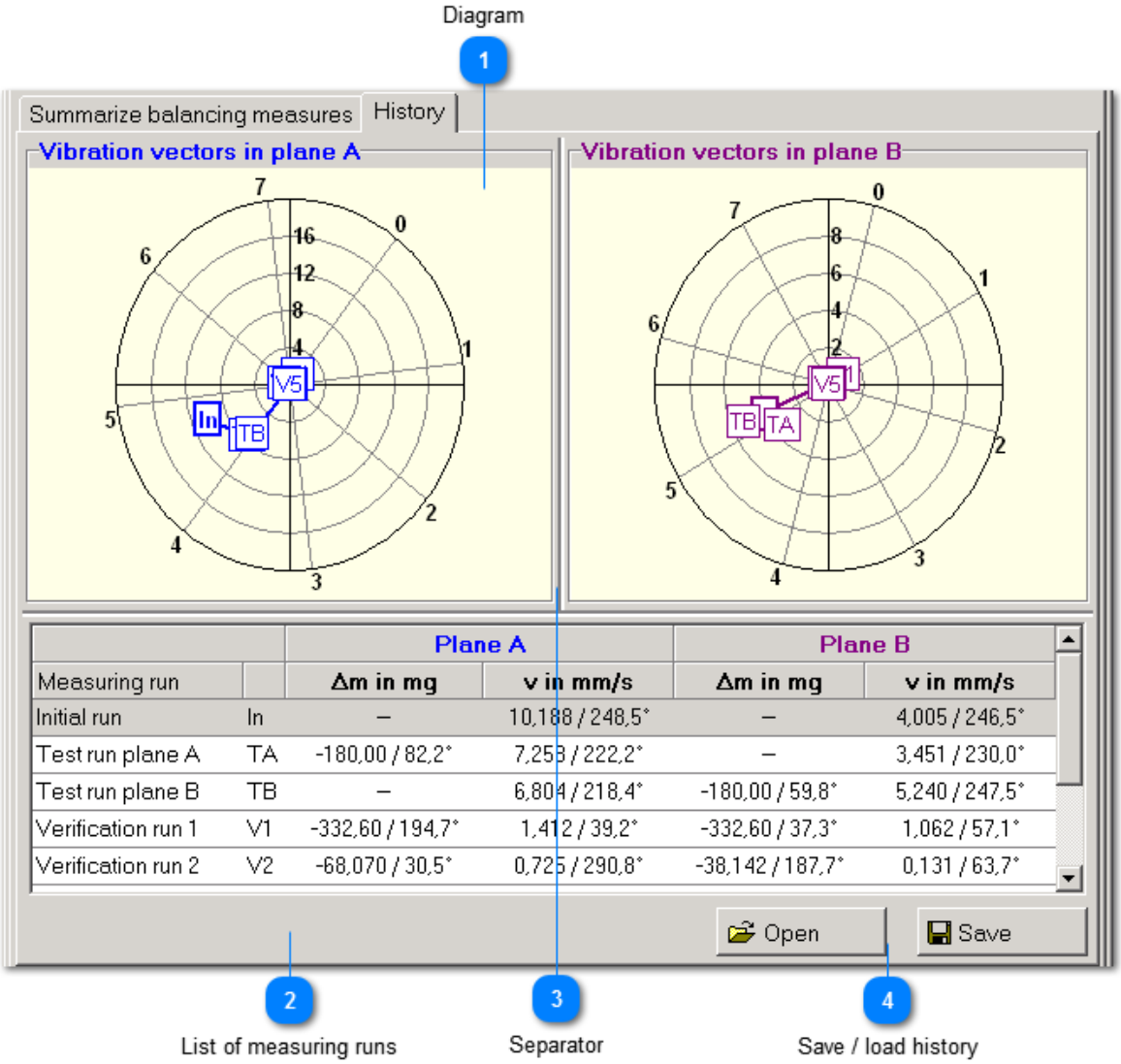
Summarization

The calculation of the summarized correction is done in the same way as in a balancing session. Details can be found here.



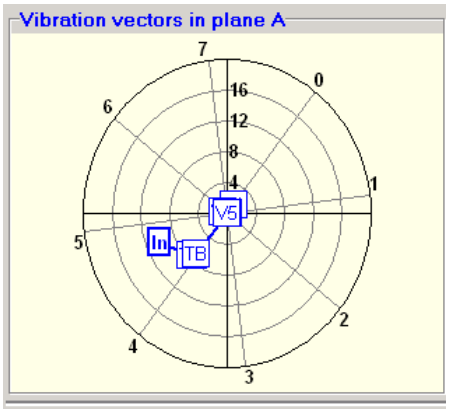
Balancing history

This tool shows in a clear way the resulting unbalance vibrations after mass changes for each balancing run. The vibration behavior is also shown a graphics.



		Plane A		Plane B	
Measuring run		Δm in mg	v in mm/s	Δm in mg	v in mm/s
Initial run	In	–	10,188 / 248,5°	–	4,005 / 246,5°
Test run plane A	TA	-180,00 / 82,2°	7,253 / 222,2°	–	3,451 / 230,0°
Test run plane B	TB	–	6,804 / 218,4°	-180,00 / 59,8°	5,240 / 247,5°
Verification run 1	V1	-332,60 / 194,7°	1,412 / 39,2°	-332,60 / 37,3°	1,062 / 57,1°
Verification run 2	V2	-68,070 / 30,5°	0,725 / 290,8°	-38,142 / 187,7°	0,131 / 63,7°

1 Diagram



The graphics shows magnitude and angle of the measured vibration for each balancing run. The abbreviations are explained in the table below.

2 List of measuring runs

Measuring run		Δm in mg	v in mm/s	Δm in mg	v in mm/s
Initial run	In	–	10,188 / 248,5°	–	4,005 / 246,5°
Test run plane A	TA	-180,00 / 82,2°	7,258 / 222,2°	–	3,451 / 230,0°
Test run plane B	TB	–	6,804 / 218,4°	-180,00 / 59,8°	5,240 / 247,5°
Verification run 1	V1	-332,60 / 194,7°	1,412 / 39,2°	-332,60 / 37,3°	1,062 / 57,1°
Verification run 2	V2	-68,070 / 30,5°	0,725 / 290,8°	-38,142 / 187,7°	0,131 / 63,7°

Open Save

The table lists the balancing runs and shows for each one the mass changes and the resulting vibration. Mass changes can be listed twice: as reversal of a previous correction (first entry) and as change from the current run (second entry).

A mouse click into a row highlights the run in the diagram.

3 Separator

Use the mouse pointer to adapt the space for the diagrams.

4 Save / load history

The InnoBalancer can save balancing sessions including measuring data and settings.

- This feature can be used to interrupt a balancing session and to continue it later at the same point.
- It is also useful to archive balancing sessions and to reuse the information for later balancing sessions.
- The rotor dynamics data obtained in the test runs can be saved. A future balancing session can load this data and skip the test runs.
- Saved history files can be sent by e-mail in order to consult specialists in complicated situations. These files can be opened and inspected in the InnoMaster RT Trainer.

InnoMeter® HVM 2631 (Pro)

Occupational medicine

The InnoMeter HVM 2631 is applied for measuring human whole-body vibrations. Whole-body vibrations are caused by vibrations or shocks which are transmitted by machines and vehicles in the workplace via seat or feet. If a person is exposed to strong whole-body vibrations, safety and health are endangered and it is proven that backache can be provoked or aggravated.

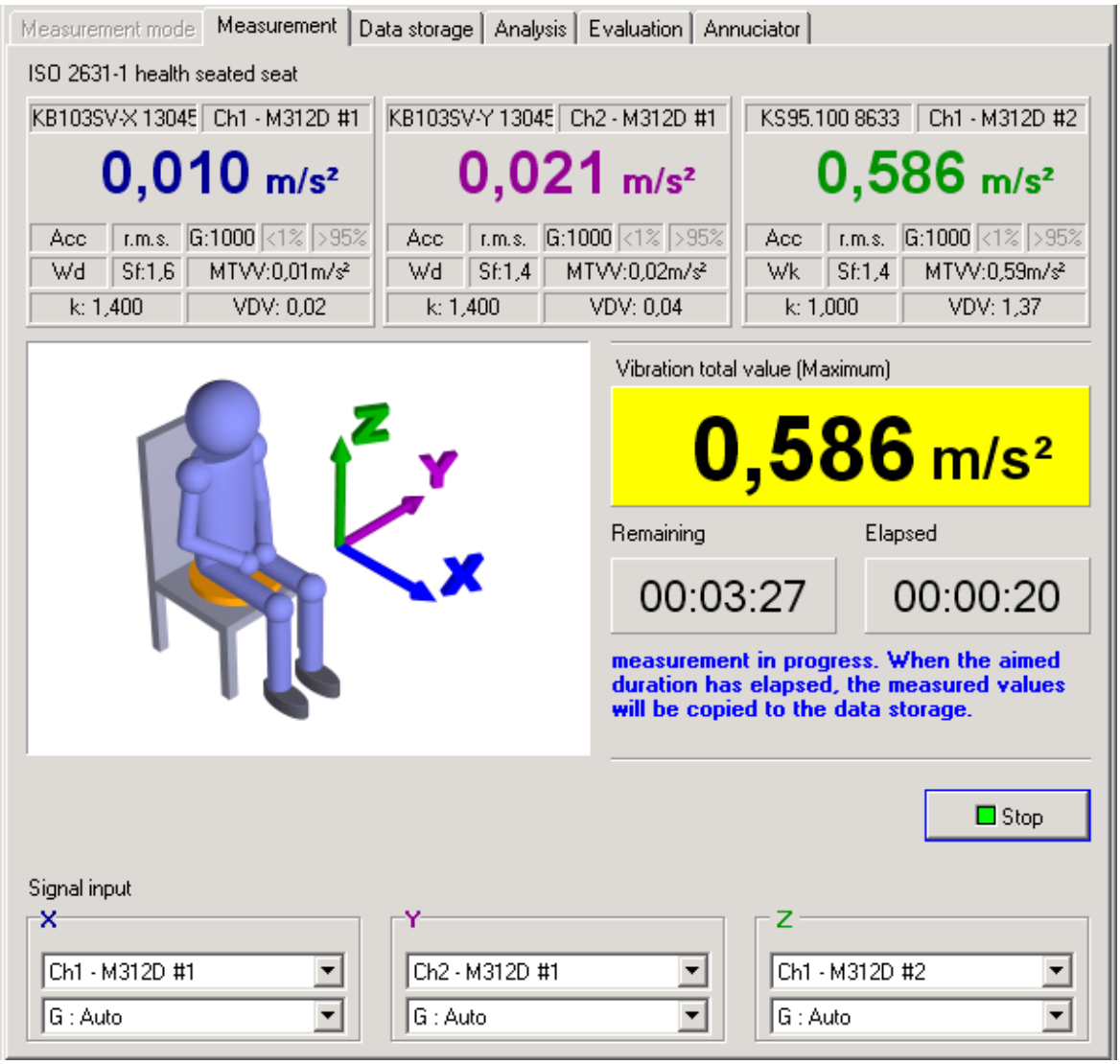
The "vibration directive” (directive 2002/44/EC) defines minimum requirements for the protection against risks arising from whole-body vibrations.

Comfort

The measurement modes are based on the international standard ISO 2631. This standard not only covers whole-body vibrations from a medical view, but also comfort assessments, e.g. for passengers in rail vehicles (trains, underground railway, etc.). Thus, the comfort of a person during the transport can be assessed objectively and according to an internationally accepted method.

Identify causes

As an extra measurement mode, the identification of transmission characteristics of seats (SEAT value) is available in the InnoMeter HVM 2631 Pro. For each measurement, the Pro version additionally offers an analysis in frequency domain - for both, the unweighted signal and also with weighting filters. This way, causes (e.g. structural ones) which contribute to the total vibration value most are detected quickly.

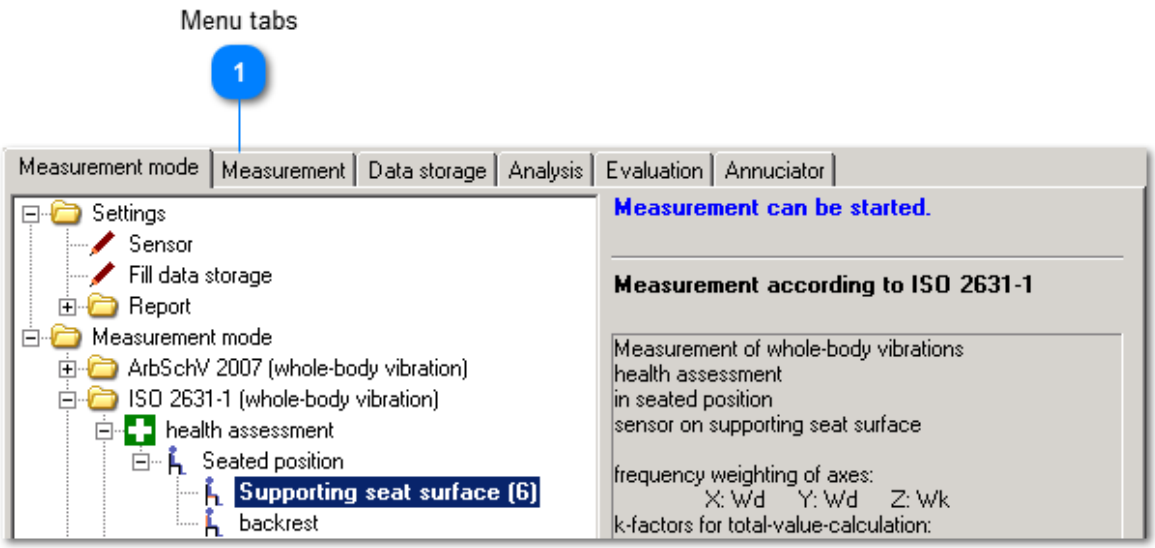


Supported standards

The InnoMeter HVM 2631 offers **21** different measurement modes, based on

- 2002/44/EC
- ISO 2631-1:1997 (whole-body vibration) health assessment
- ISO 2631-1:1997 (whole-body vibration) comfort assessment
- ISO 2631-2:2003 (vibration in buildings) comfort assessment
- ISO 2631-4:2001 (rail vehicles) comfort assessment

Operation panels

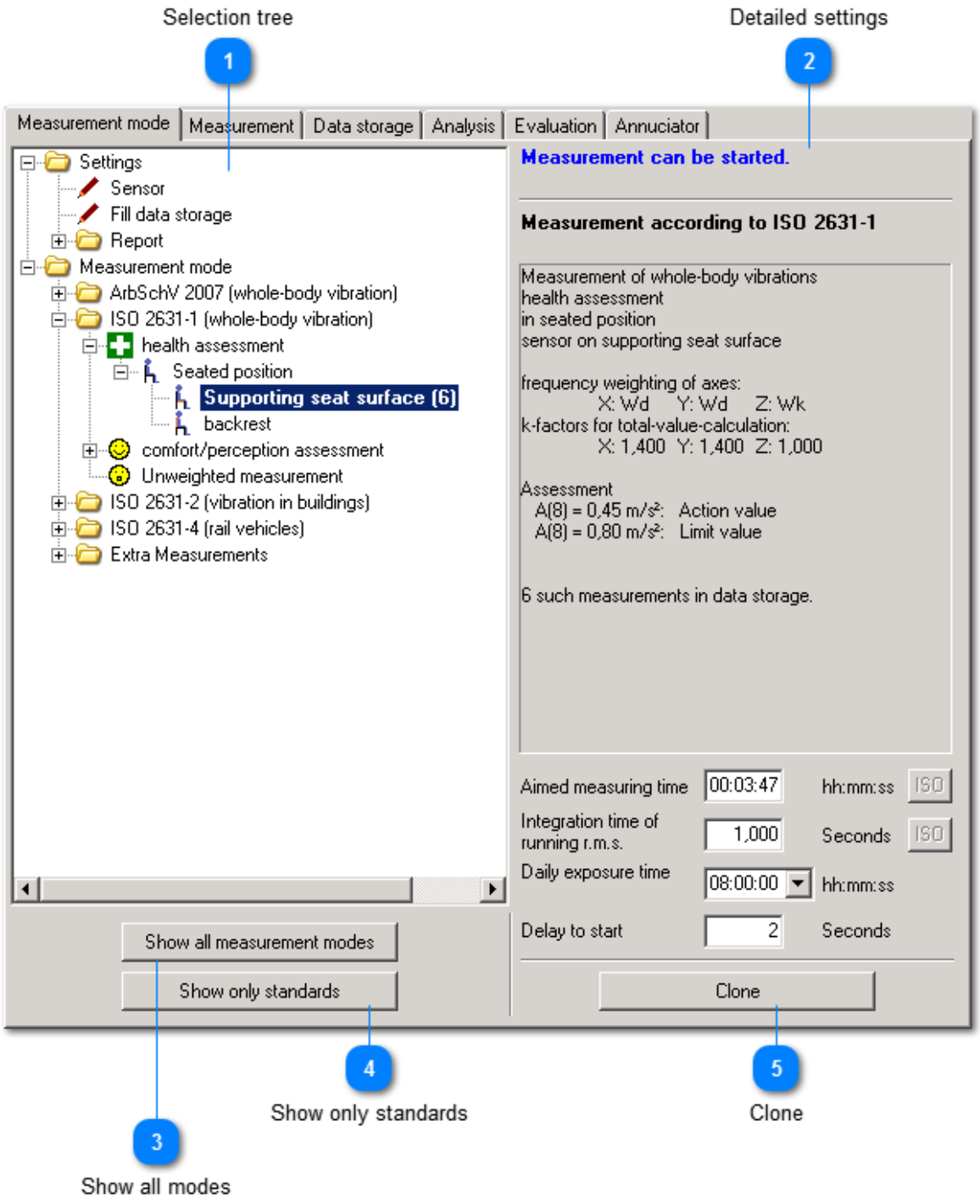


1 Menu tabs

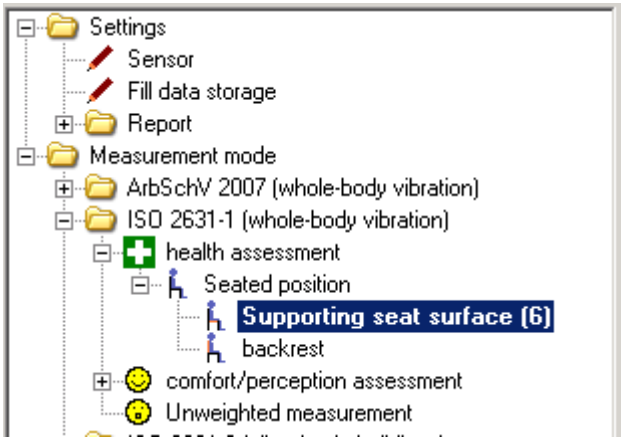
There are the following menus:

Measurement mode	Settings for the measurement
Measurement	Execution of the measurement with indication of the measured values and colored evaluation
Data storage	Storage for the completed measurements, detailed evaluation, printing a report
Analysis	Frequency analysis for the detection of vibration causes
Evaluation	Automatic calculation sheet for the calculation of the daily vibration exposure A(8) from several exposure segments
Annunciator	Signaling measured values and states for automated tests

Measuring mode



1 Selection tree

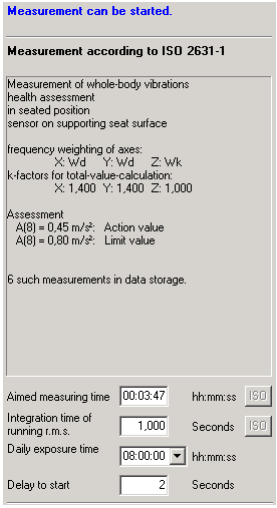


In the selection tree, you find the setting options and measurement modes in a clearly arranged way.
A measurement mode has to be selected before starting a measurement.

Depending on the selected measurement mode or setting option, the detail and configuration area on the right side changes.

By means of the buttons Show all measurement modes and Show only standards the selection tree can be closed or opened completely.

2 Detailed settings



The detail and configuration area changes depending on the selection in the selection tree. Here you can configure:

- Sensor
- Data storage
- Reports
- Measurement mode

3 Show all modes

This button opens all measurement modes in the selection tree.

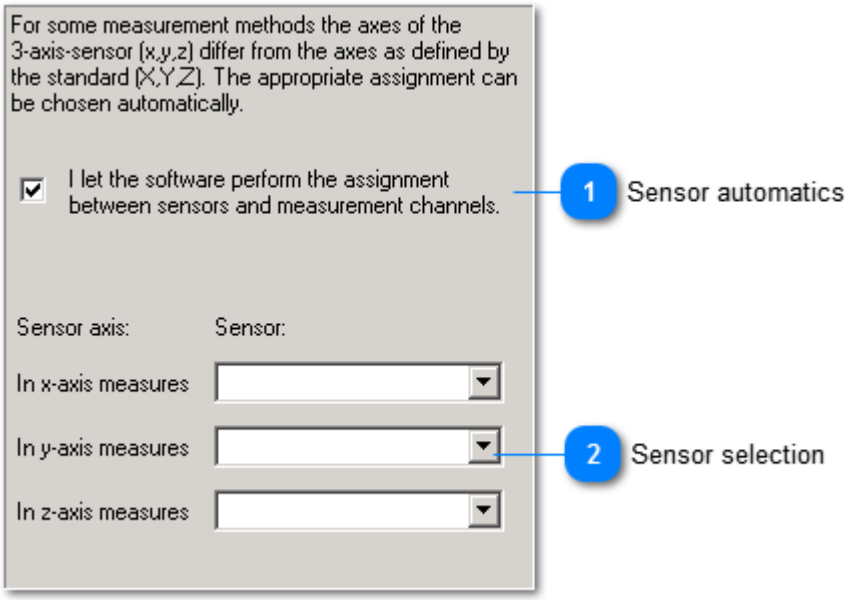
4 Show only standards

This button only shows the top level of measurement modes in the selection tree.

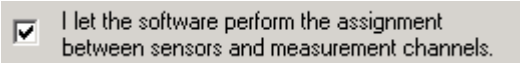
5 Clone

Opens a new window with the same settings which can be modified.

Sensor settings



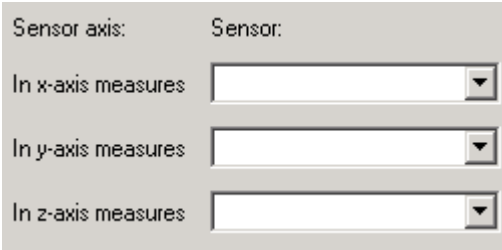
1 Sensor automatics



The measurements for whole-body vibrations are carried out in three axes. The allocation of the axes plays an important role because they are weighted differently in some measurement modes. The coordinate system refers to humans and is constant. The triaxial sensor has its own coordinate system, which - depending on the sensor positioning - does not always correspond to the body's coordinate system.

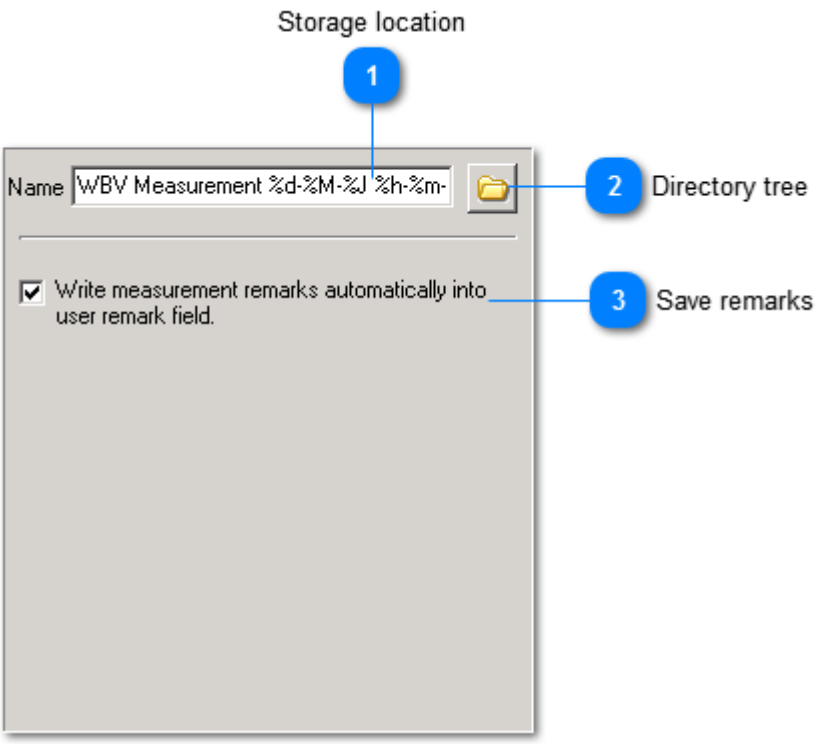
If you activate the automatic assignment of axes, the InnoMeter HVM 2631 correctly assigns the sensor axes to the body's coordinate system. It also shows the correct sensor positioning in graphical drawings. If you follow these graphical instructions you avoid positioning errors.

2 Sensor selection



To work correctly, the sensor automatic requires assigned sensors. In the drop-down list, you can choose among all sensors from the sensor management.

Data storage settings



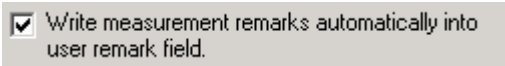
1 Storage location

The data storage can be named here. It is saved as a directory. Additional to fixed components, the name of the directory can also contain variable components, the placeholders.

2 Directory tree

This button opens a directory tree.
Data storage is carried out in a directory which contains several files. The target directory can be newly generated in the displayed directory tree.

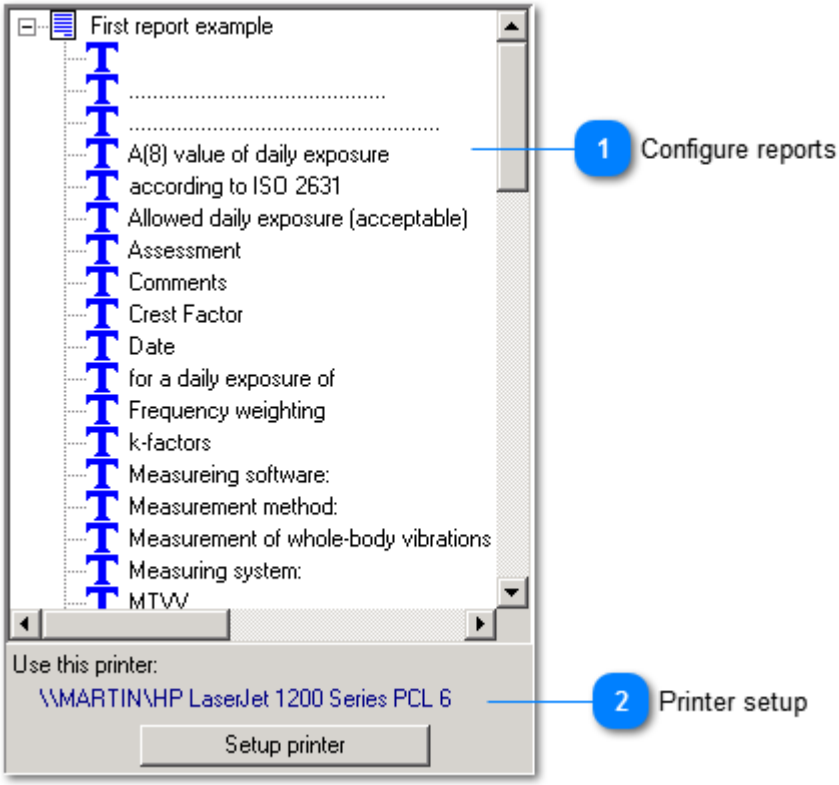
3 Save remarks



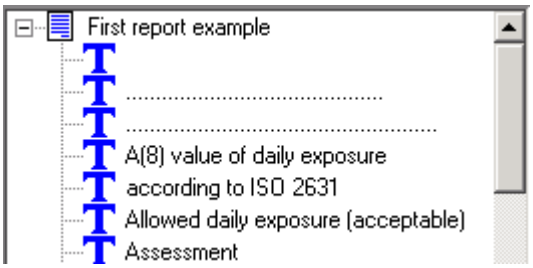
The measurement is monitored by the InnoMeter HVM 2631.
For instance, it recognizes overload and underload. Such measurement remarks can be automatically taken over into the remark field, which is available for every measurement. The remarks are also taken over when a report is printed. Deselect this option if you do not wish to take over the remarks.

Report templates

Reports can be printed directly from the InnoMeter HVM 2631. Texts, graphical elements (e.g. company logo) and variable components can be combined to one or more report templates, which are saved. For printing, you simply select the configured report template and print it with one mouse click.



1 Configure reports

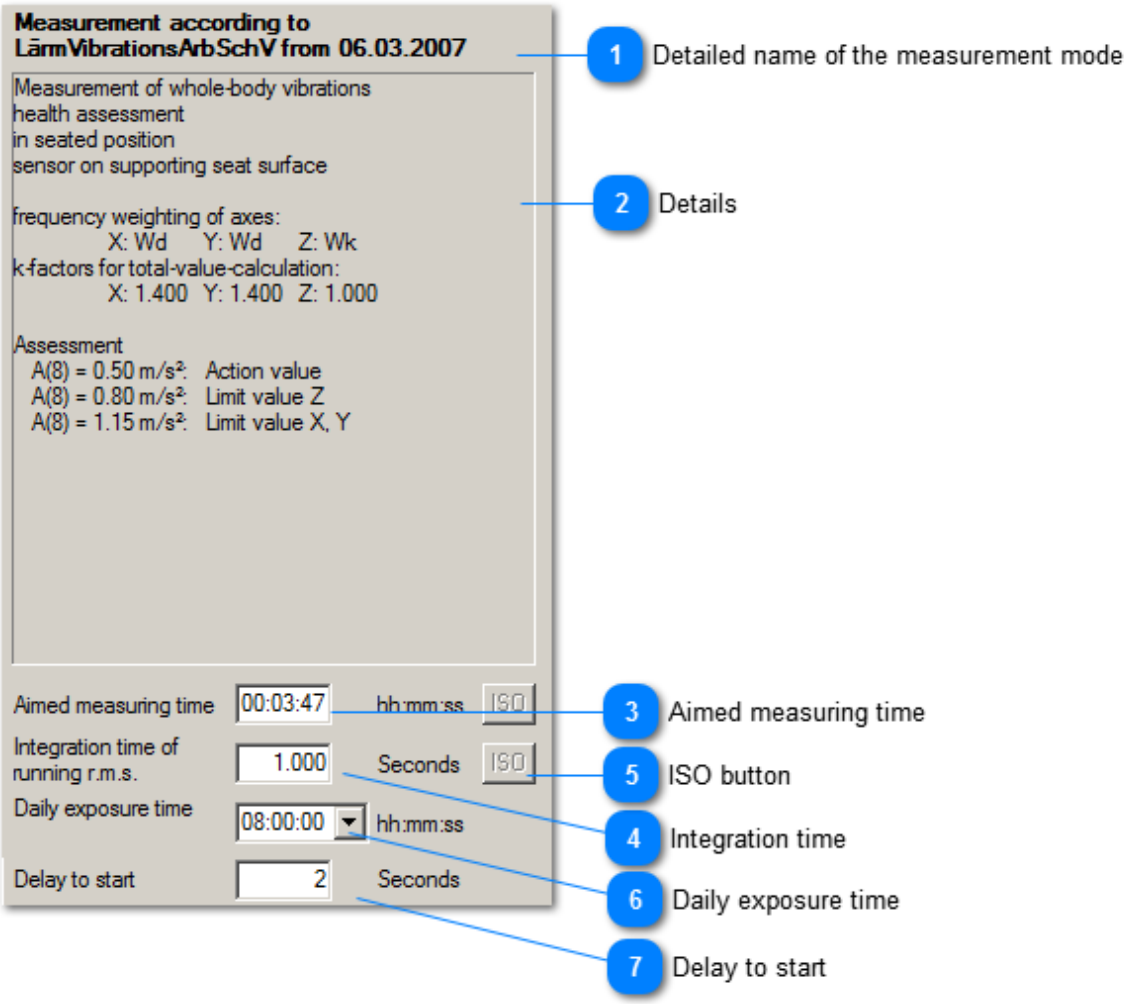


The report templates can be found in this tree structure. One report example is pre-configured. More templates can be configured or loaded.

2 Printer setup

This button opens a dialog for printer selection and configuration.

Configuration options for the measurement mode



1 Detailed name of the measurement mode

Measurement according to
LärmVibrationsArbSchV from 06.03.2007

2 Details

Measurement of whole-body vibrations
health assessment
in seated position
sensor on supporting seat surface

frequency weighting of axes:
X: Wd Y: Wd Z: Wk
k-factors for total-value-calculation:
X: 1.400 Y: 1.400 Z: 1.000

Assessment
A(8) = 0.50 m/s²: Action value
A(8) = 0.80 m/s²: Limit value Z
A(8) = 1.15 m/s²: Limit value X, Y

For greater certainty concerning the selected measurement mode, the following details are displayed:

- assessment type
- position
- measurement location
- weighting filters for the different axes
- k factors
- assessment information

3 Aimed measuring time

The measurement is usually carried out for a limited time. This duration can be entered here. However, it must not be below a certain minimum duration. By means of the ISO button, the minimum duration conforming to the standard is entered .

4 Integration time

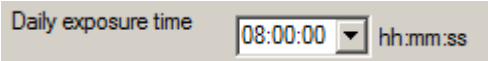
The validity ot the measurement is monitored by means of a running RMS value.
You can enter the time frame (integration time) for forming this RMS value. By means of the ISO button, the time is set conforming to the standard.

5 ISO button

By means of the ISO button you can set the following parameters conforming to the standard:

- the minimum duration of a measurement
- the integration time of the running RMS value

6 Daily exposure time



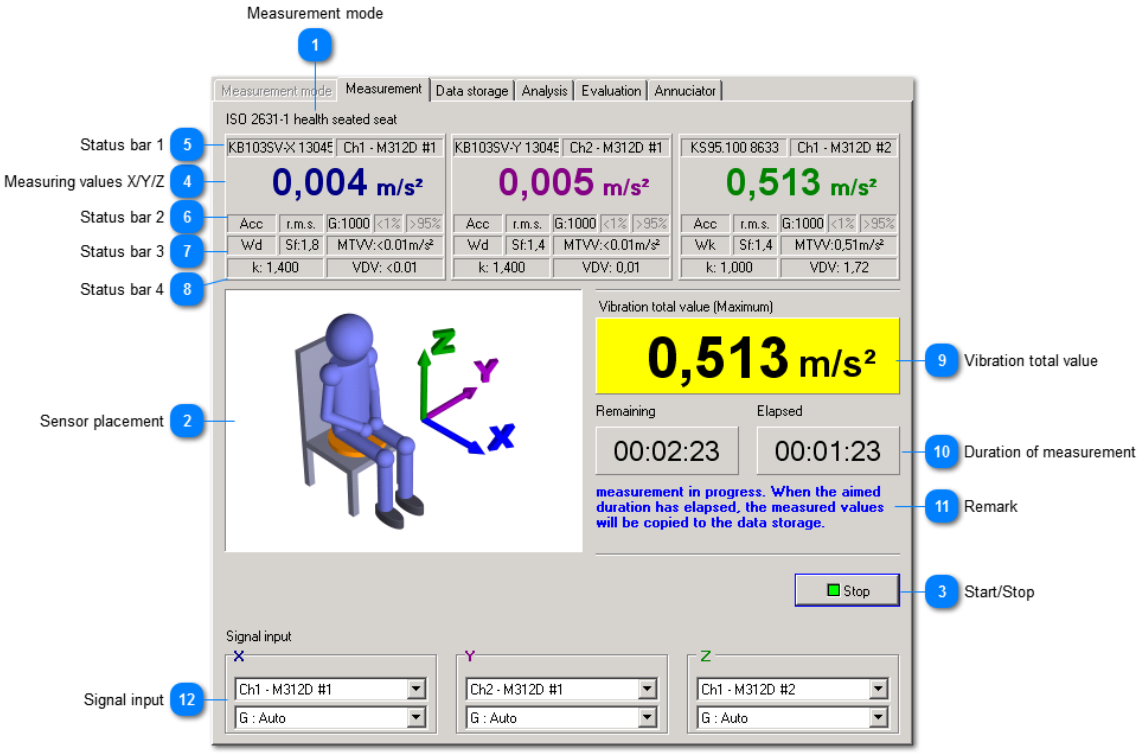
To be able to show a colored evaluation already during the measurement, VM_BODY requires a daily exposure time to which the measured values can be referred. The measurements are usually not carried out for the actual exposure time, but for a representative duration and then the measured values are extrapolated to the daily exposure time.

7 Delay to start

If you do not want the measurement to start right after pushing the start button, you can enter a delay here.

Measurement

While measuring, the InnoMeter HVM 2631 displays the vibration total value and a colored assessment.

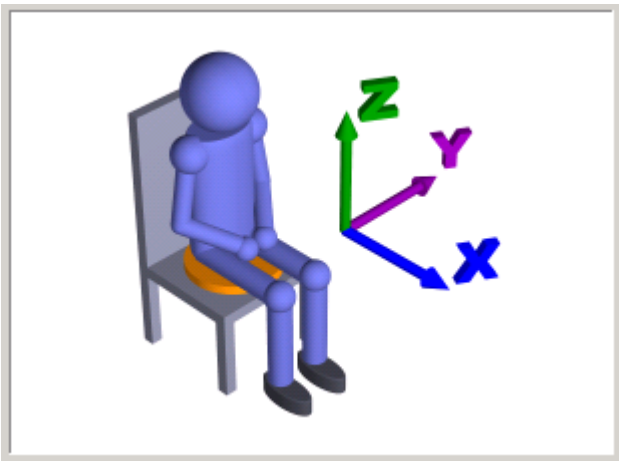


1 Measurement mode

ISO 2631-1 health seated seat

Shows the selected mode.

2 Sensor placement



The image shows the body's coordinate system and the position of the sensor with regard to the person.

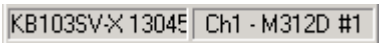
3 Start/Stop

Starts and stops measurement. Starting is only possible when all settings in Measurement mode menu have been completed.

4 Measuring values X/Y/Z

This field displays the vibration value (weighted RMS value) for the measurement axes.

5 Status bar 1



This status bar displays sensor and measuring channel.

6 Status bar 2

This status bar indicates:

- Measurand
- Characteristic
- Gain
- Underload
- Overload

7 Status bar 3

This status bar displays weighting filters, crest factor and MTVV.
Crest factor and MTVV are two additional characteristics which always have to measured when measuring human whole-body vibration conforming to the standard. For instance, they indicate whether the measurement contained shocks. If they exceed a certain value, this information has to occur in the measurement report. The InnoMeter HVM 2631 automatically monitors these characteristics in the background. In case of exceedance, the respective characteristic field is displayed yellow. The InnoMeter HVM 2631 is also able to take over limit exceedance to the measurement report automatically.

8 Status bar 4

This status bar displays k factor and VDV.
The Vibration Dose Value (VDV) is common especially in Great Britain and is classified as vibration characteristic for whole-body vibrations there. It is formed automatically in the InnoMeter HVM 2631.

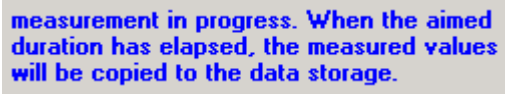
9 Vibration total value

This can be, depending on the measuring mode, the vector sum or the maximum value of the 3 axis values.

10 Duration of measurement

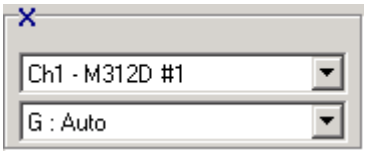
Remaining and elapsed measurement duration are displayed. The elapsed measurement duration counts with minus sign from start delay to 00:00:00. Afterwards, the elapsed measurement duration counts up to the aimed measuring time. The measurement is stopped when it reaches the aimed measuring time.

11 Remark



This remarks inform about the current state.

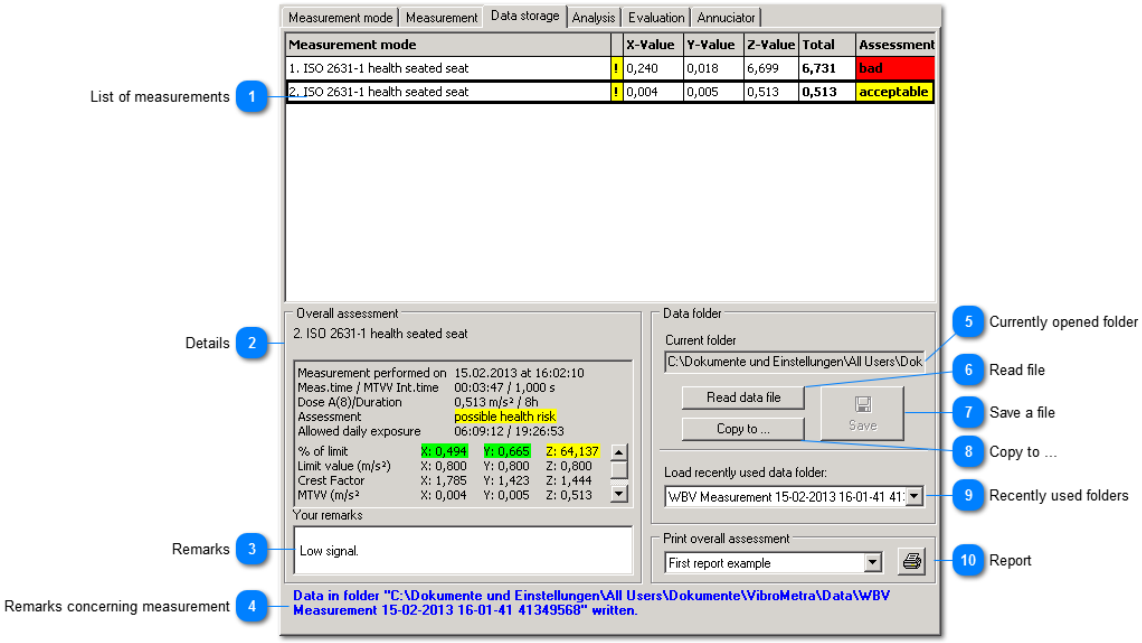
12 Signal input



At the signal input, you select the measuring channel and configure the measuring range. If you activated the sensor automatic, the InnoMeter HVM 2631 selects the measuring channel automatically.

Data storage

The results of all completed measurements are transferred to the data storage. All measurements are listed up here incl. individual details. Data storages can be saved on a data medium and be read into the InnoMeter HVM 2631 again. You can load several data storages to combine the contained measurements to one big data storage.

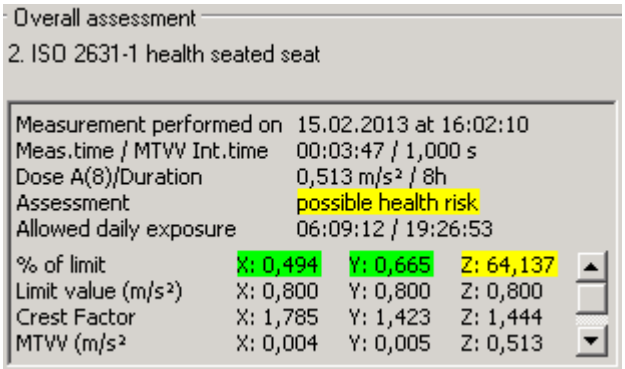


1 List of measurements

Measurement mode		X-Value	Y-Value	Z-Value	Total	Assessment
1. ISO 2631-1 health seated seat	!	0,240	0,018	6,699	**6,731**	bad
2. ISO 2631-1 health seated seat	!	0,004	0,005	0,513	**0,513**	acceptable

The results of all measurements are listed up here including the values of the single axes as well as the vibration total value and its assessment. If irregularities were detected during the measurement, the measurement is marked with an exclamation mark.

2 Details



Here you can find more details for each measurement, including measured values, additional characteristics and measurement settings.

3 Remarks

You may add your own remarks for each measurement.

4 Remarks concerning measurement

For a whole-body vibration measurement conforming to the standard, some additional characteristics and measurement conditions have to be monitored during the measurement. The InnoMeter HVM 2631 monitors these characteristics and conditions simultaneously to the measurement and informs you about irregularities. Optionally, the remarks concerning the measurement can automatically be taken over into "Your remarks" as well.

5 Currently opened folder

This field shows which data folder is currently open.

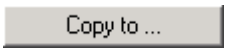
6 Read file

This button opens a directory tree from which you can select the measurement folder. The read data is added to the data in data storage. This way, you can for instance combine measurements from different days.

7 Save a file

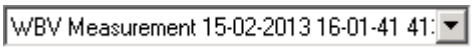
This button saves the current data storage on a data medium.

8 Copy to ...



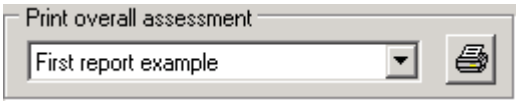
This button saves the current data storage on a data medium. You can enter a new name for the measurement folder.

9 Recently used folders



This drop-down list shows the currently used data folders. By clicking on an entry, the respective data folder is opened.

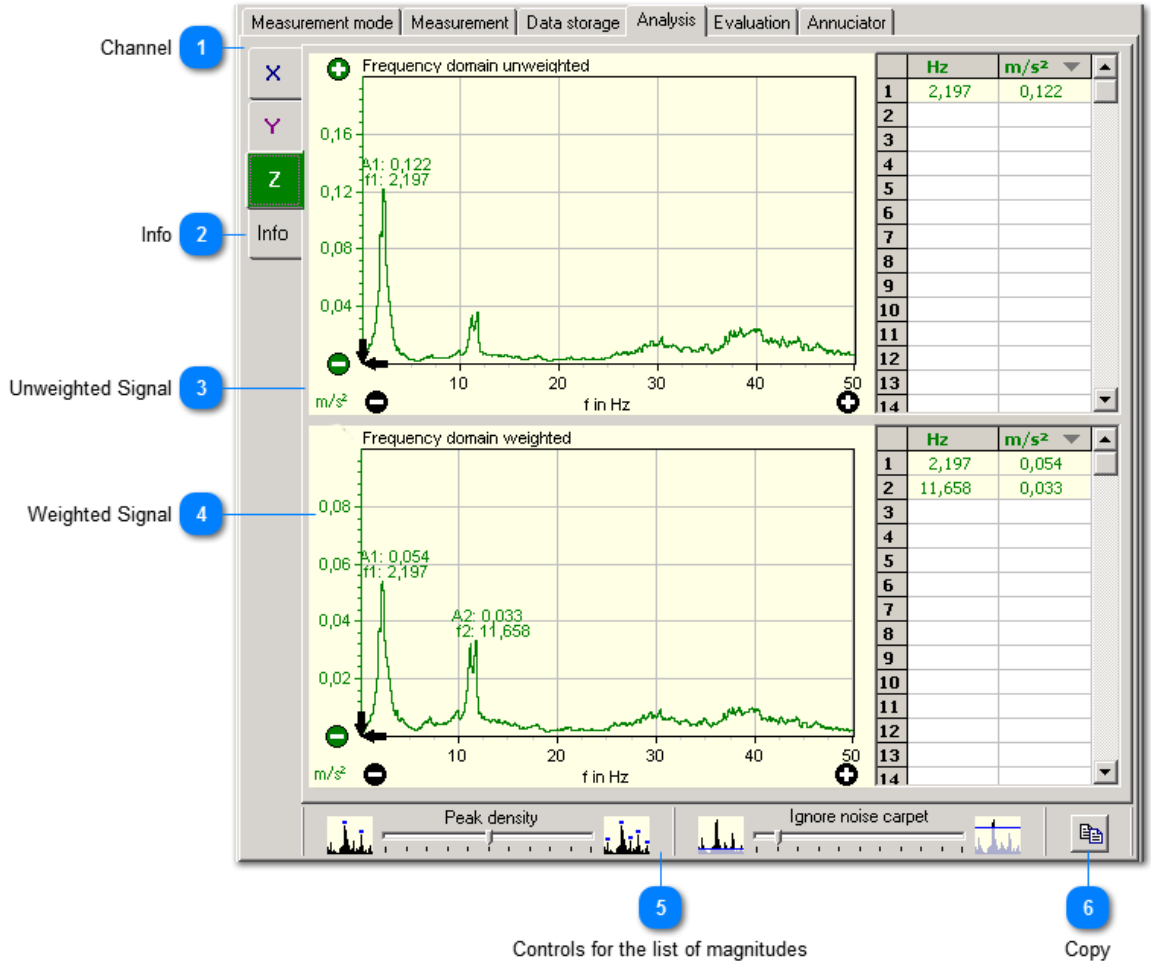
10 Report



Allows the selection of a report template and the printing of the selected measurement.

Analysis

The InnoMeter 2631 Pro allows a frequency analysis for both, the unweighted and weighted vibration signal. This way you can detect causes of too high vibration values.



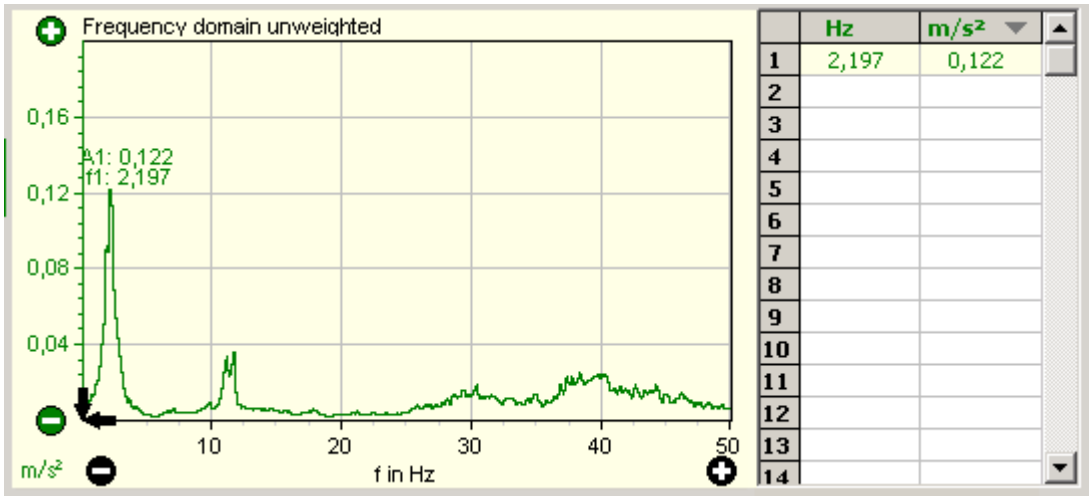
1 Channel

Graphical analysis is provided for each measuring channel.

2 Info

Information concerning the storage location of the measured data for analysis etc.

3 Unweighted Signal



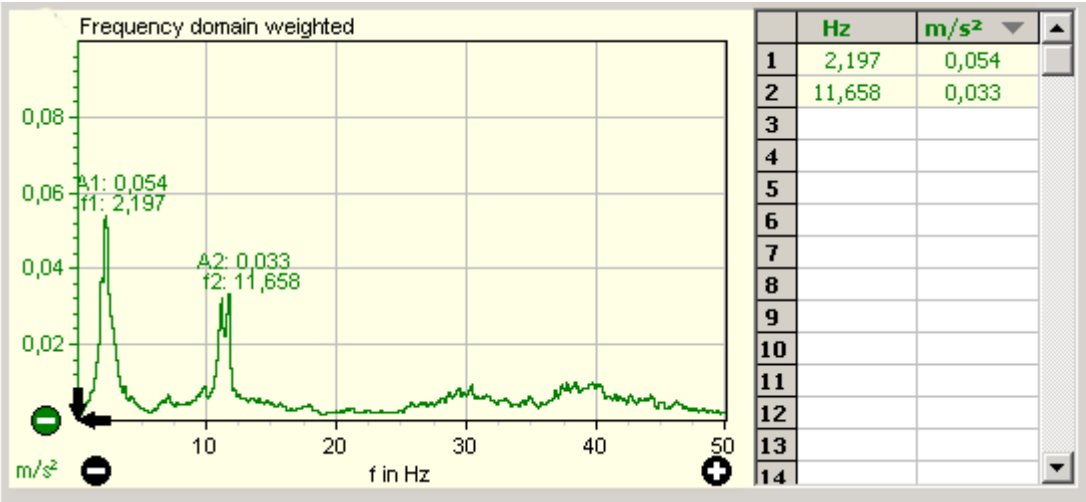
The unweighted signal only contains the bandpass filter before it is transmitted to the frequency analysis. The displayed vibration frequencies do not have a special weighting with regard to health, comfort or perception of humans.

Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows.

Scaling with the mouse
By means of the mouse, the chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

List of magnitudes
The highest magnitudes are detected automatically and they are presented with frequency and value. Frequency and value are indicated directly in the chart as well as in the list next to the chart. The detection algorithm can be configured.

4 Weighted Signal



The weighted signal contains the bandpass filter and weighting filter for human vibration before it is transmitted to the frequency analysis. Thus, the displayed vibration frequencies are weighted with regard to health, comfort or perception of humans.

Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows.

Scaling with the mouse
By means of the mouse, the chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

List of magnitudes
The highest magnitudes are detected automatically and they are presented with frequency and value. Frequency and value are indicated directly in the chart as well as in the list next to it to graphic. The detection algorithm can be configured.

5 Controls for the list of magnitudes

These controls work like the ones in the InnoAnalyzer.

6 Copy

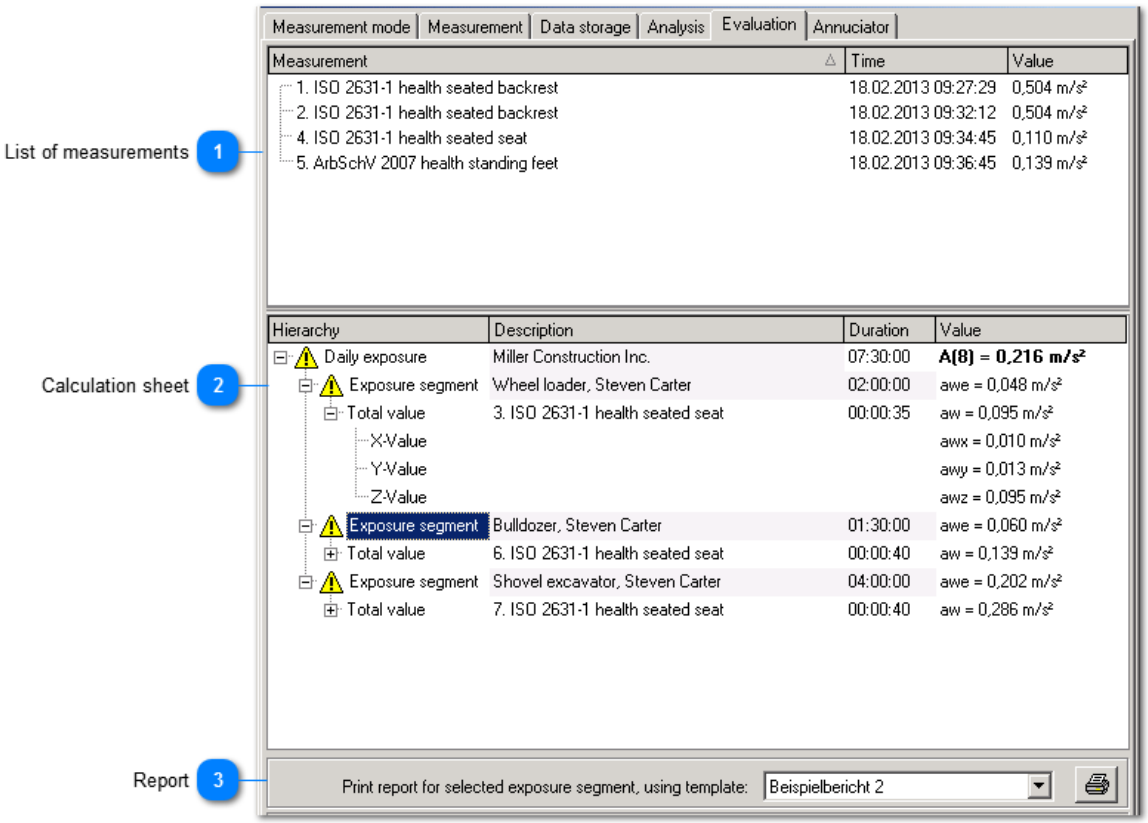
By means of this button the graphical presentation of both signals is copied to the clipboard. Afterwards, the chart can be entered into a word processing or other programs.

Automatic A(8) calculation sheet

If only one activity is carried out the whole day, the vibration total value corresponds to the daily vibration exposure. But persons usually carry out many different activities during one working day. All these activities have to be considered when calculating the daily vibration exposure. The InnoMeter HVM 2631 makes it absolutely easy to calculate a complex daily vibration exposure:

1. The vibration total value is measured for each activity. It is not necessary to carry out the measurement for the entire exposure duration per day. It is sufficient to measure for a minimum duration. You can repeat the measurement for one activity several times to obtain a higher statistical certainty.
2. All measurements can be found in the data storage. And exactly these measurements are available in the list of all measurements as well.
3. Now you simply drag the measurements into the calculation sheet by mouse, name the activities (exposure segments) and enter the actual exposure duration.

Now you have finished the complex calculation of the daily vibration exposure with the A(8) value as result.



1 List of measurements

Measurement	Time	Value
1. ISO 2631-1 health seated backrest	18.02.2013 09:27:29	0,504 m/s²
2. ISO 2631-1 health seated backrest	18.02.2013 09:32:12	0,504 m/s²
4. ISO 2631-1 health seated seat	18.02.2013 09:34:45	0,110 m/s²
5. ArbSchV 2007 health standing feet	18.02.2013 09:36:45	0,139 m/s²

All measurements from the data storage are listed up here. If the single measurements have been carried out on different days, they are read into the data storage successively and create a big data storage for all measurements.

2 Calculation sheet

Hierarchy	Description	Duration	Value
Daily exposure	Miller Construction Inc.	07:30:00	**A(8) = 0,216 m/s²**
Exposure segment	Wheel loader, Steven Carter	02:00:00	awe = 0,048 m/s²
Total value	3. ISO 2631-1 health seated seat	00:00:35	aw = 0,095 m/s²
X-Value			awx = 0,010 m/s²
Y-Value			awy = 0,013 m/s²
Z-Value			awz = 0,095 m/s²
Exposure segment	Bulldozer, Steven Carter	01:30:00	awe = 0,060 m/s²
Total value	6. ISO 2631-1 health seated seat	00:00:40	aw = 0,139 m/s²
Exposure segment	Shovel excavator, Steven Carter	04:00:00	awe = 0,202 m/s²
Total value	7. ISO 2631-1 health seated seat	00:00:40	aw = 0,286 m/s²

The single measurements are taken over to the calculation sheet by drag & drop.

- When the measurement is dropped to "daily exposure", a new exposure segment is created which contains the dropped measurement. Now simply enter a name for the new exposure segment.
- If the measurement is dropped to an exposure segment, an average value is indicated. This procedure is intended to increase the statistical certainty when several measurements were carried out for one activity.

For every exposure segment, the actual exposure duration has to be entered in the column Duration. The measurement is not usually carried out for the entire exposure duration, but for a shorter duration which must not be below a certain minimum duration.

As a result, there is a daily vibration exposure A(8) calculated conforming to standards, which can be printed in a detailed report at the push of button.

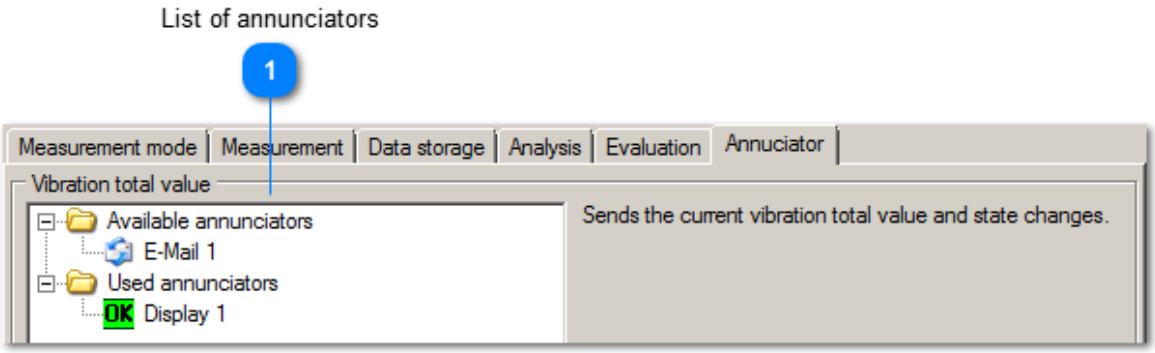
3 Report

Print report for selected exposure segment, using template: Beispielbericht 2

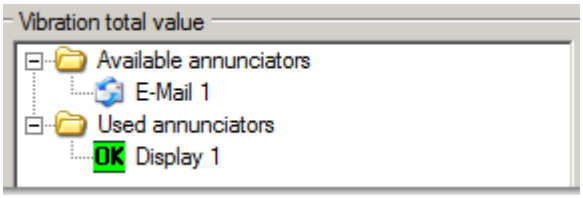
The calculated daily vibration exposure can be printed in a report. You can choose the report template.

Annunciators

VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.



1 List of annunciators



Shows a list of available and used annunciators.

InnoMeter® HVM 5349 (Pro)

Occupational medicine

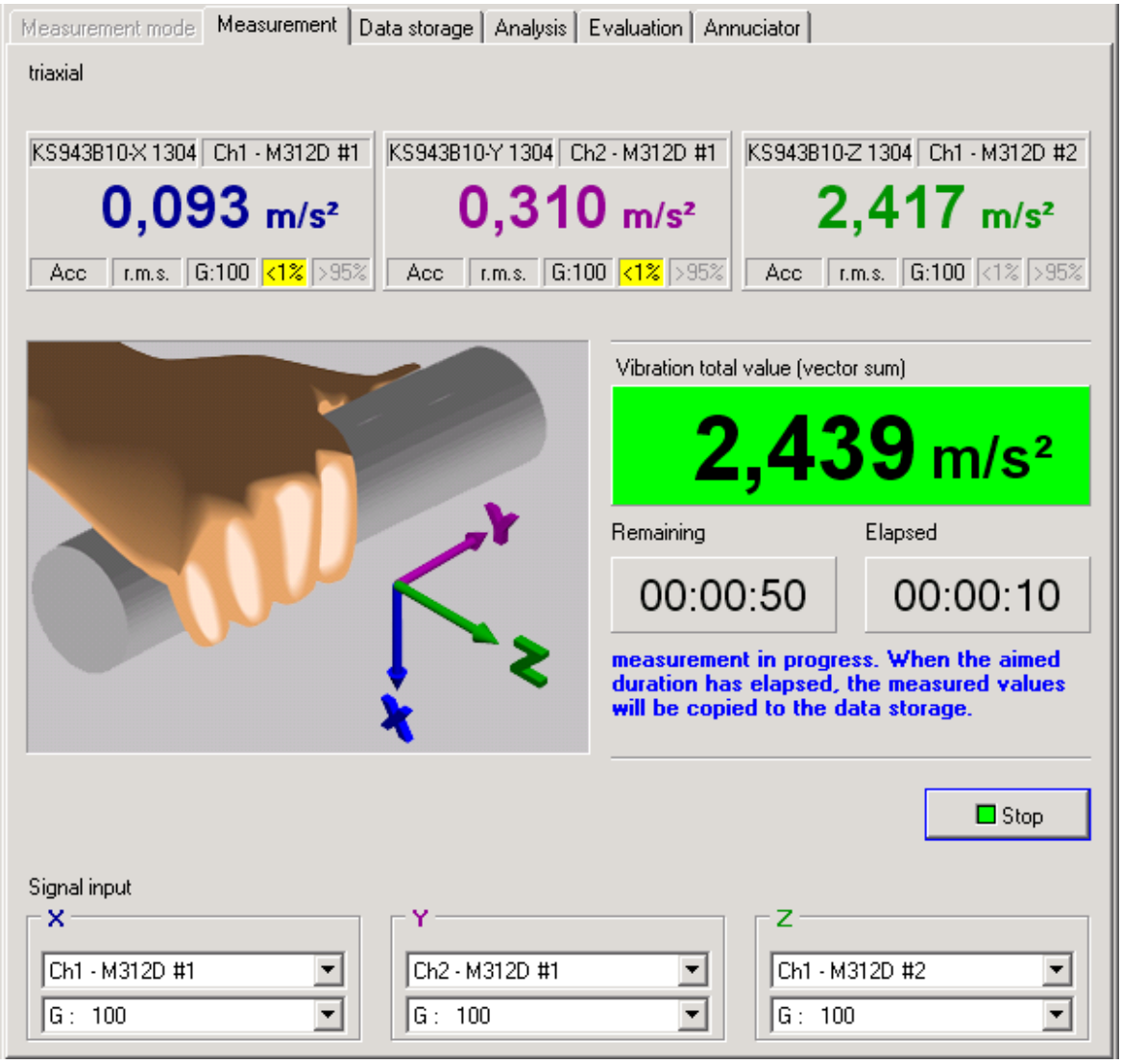
The InnoMeter HVM 5349 is applied for measuring human hand-arm vibrations. Hand-arm vibrations are caused by vibrations or shocks which are transmitted by tools, machines and vehicles in the workplace via inner hand and fingers. If a person is exposed to strong hand-arm vibrations, safety and health are endangered and there is an increasing risk of bone, joint and muscle diseases.

The "vibration directive" (directive 2002/44/EC) defines minimum requirements for the protection against risks arising from hand-arm vibrations.

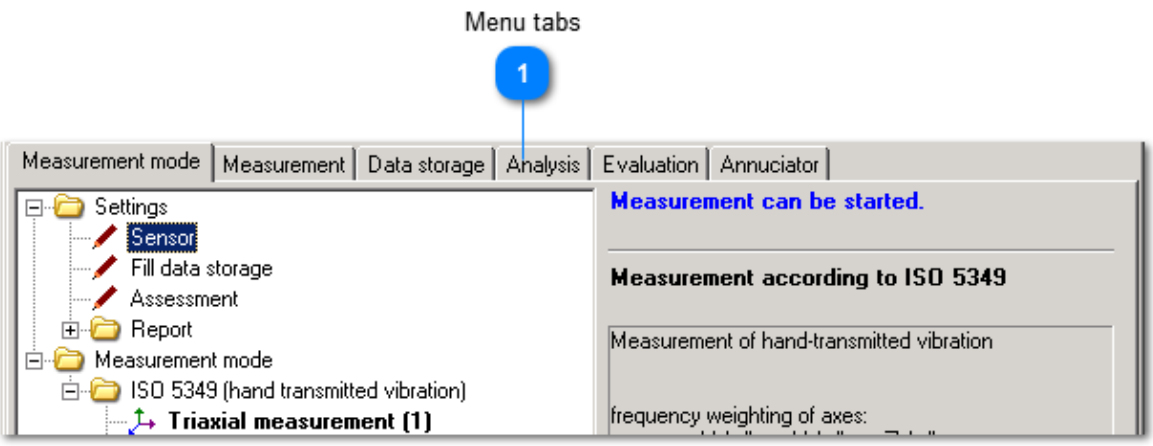
The measurements are based on the international standards ISO 5349 and ISO 8041.

Identify causes

The InnoMeter HVM 5349 Pro offers as additional feature a frequency analysis of the weighted and unweighted vibration signal. This can help to find the source of vibration and to change the design of the tested equipment accordingly.



Operation panels

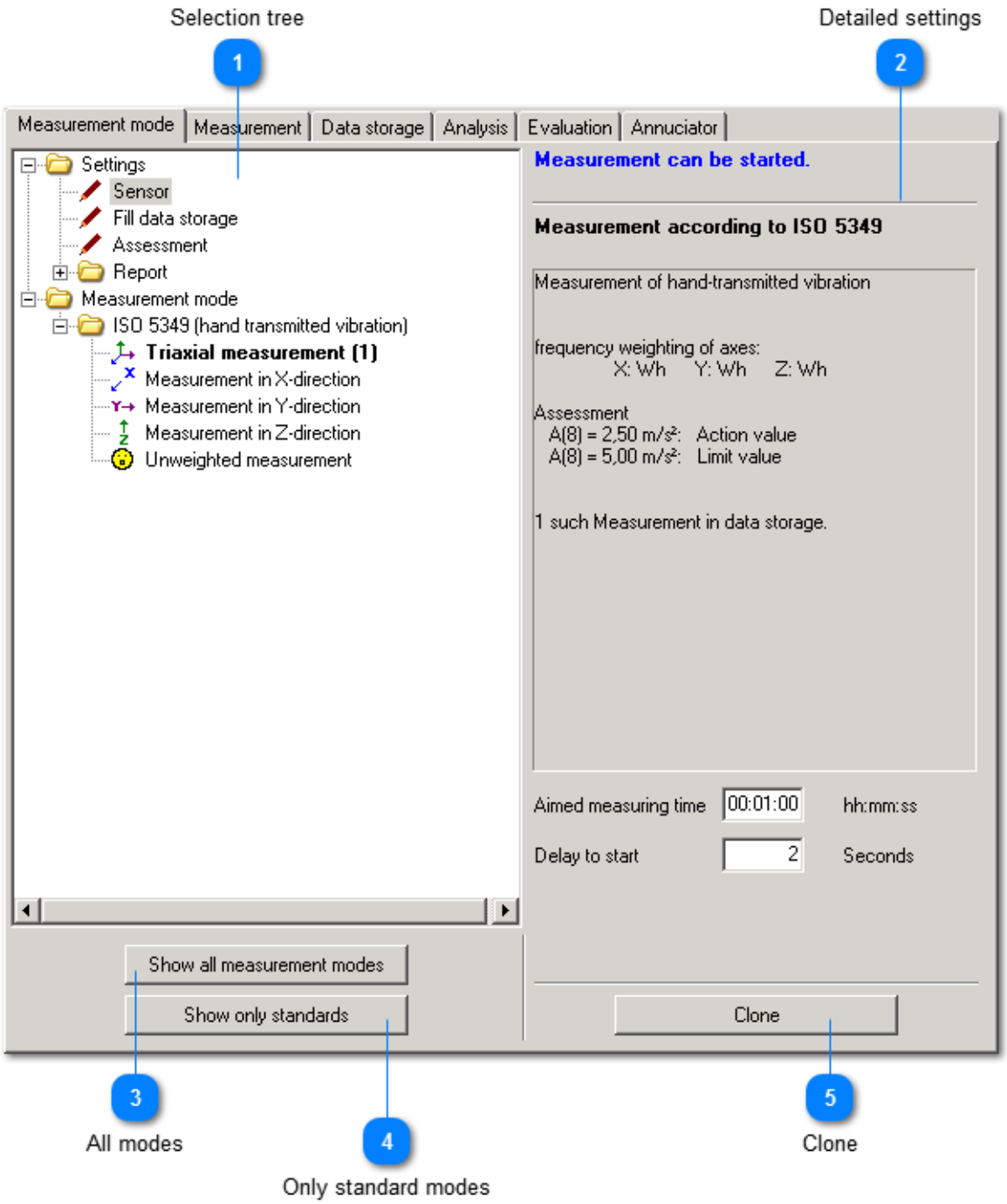


1 Menu tabs

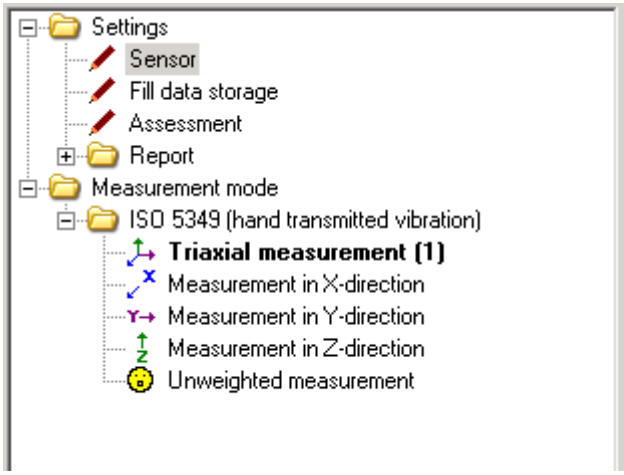
Here you can enter the following submenus:

Measurement mode	Settings for measurement
Measurement	Execution of the measurement with indication of the measured values and colored evaluation
Data storage	Memory for measuring values, evaluation and report generation
Analysis	Frequency analysis for the detection of vibration sources
Evaluation	Calculation of the calculation of vibration exposure A(8) with different activities
Annunciator	Signaling measured values and states for automated tests

Measuring mode



1 Selection tree

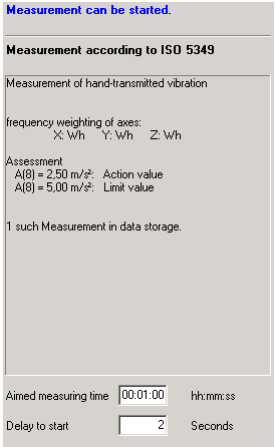


In the selection tree, you find the setting options and measurement modes in a clearly arranged way.
A measurement mode has to be selected before starting a measurement.

Depending on the selected measurement mode or setting option, the detail and configuration area on the right side changes.

By means of the buttons Show all measurement modes and Show only standards the selection tree can be closed or opened completely.

2 Detailed settings



The detail and configuration area changes depending on the selection in the selection tree. Here you can configure:

- Sensor
- Data storage
- Evaluation
- Reports
- Measuring modes

3 All modes

Opens the complete selection tree.

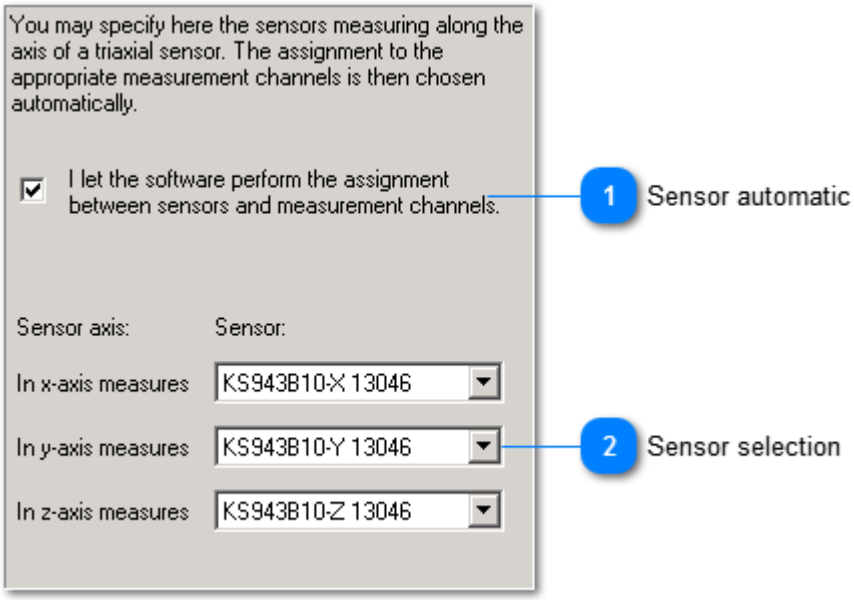
4 Only standard modes

Only shows ISO 5349 settings.

5 Clone

Opens a new window with the same settings which can be modified.

Sensor settings

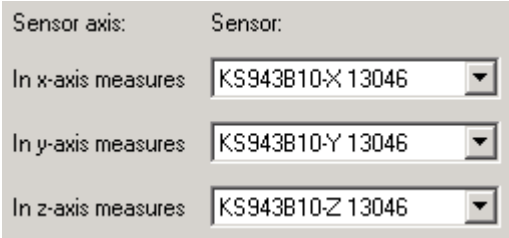


1 Sensor automatic

The measurements for hand-arm vibrations are carried out in three axes. The direction of the axes plays an important role. The coordinate system refers to humans and is constant. The triaxial sensor has its own coordinate system, which - depending on the sensor positioning - does not always correspond to the hand's coordinate system.

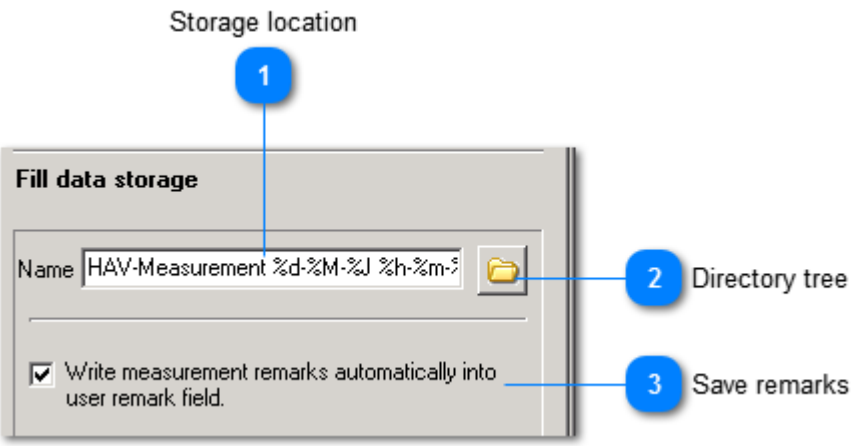
If you activate the automatic assignment of axes, the InnoMeter HVM 5349 correctly assigns the sensor axes to the body's coordinate system. It also shows the correct sensor positioning in graphical drawings. If you follow these graphical instructions you avoid positioning errors.

2 Sensor selection



To work correctly, the sensor automatic requires assigned sensors. In the drop-down list, you can choose among all sensors from the sensor management.

Data storage settings



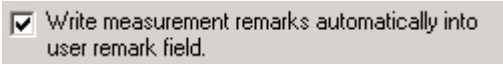
1 Storage location

The data storage can be named here. It is saved as a directory. Additional to fixed components, the name of the directory can also contain variable components, the placeholders.

2 Directory tree

This button opens a directory tree.
Data storage is carried out in a directory which contains several files. The target directory can be newly generated in the displayed directory tree.

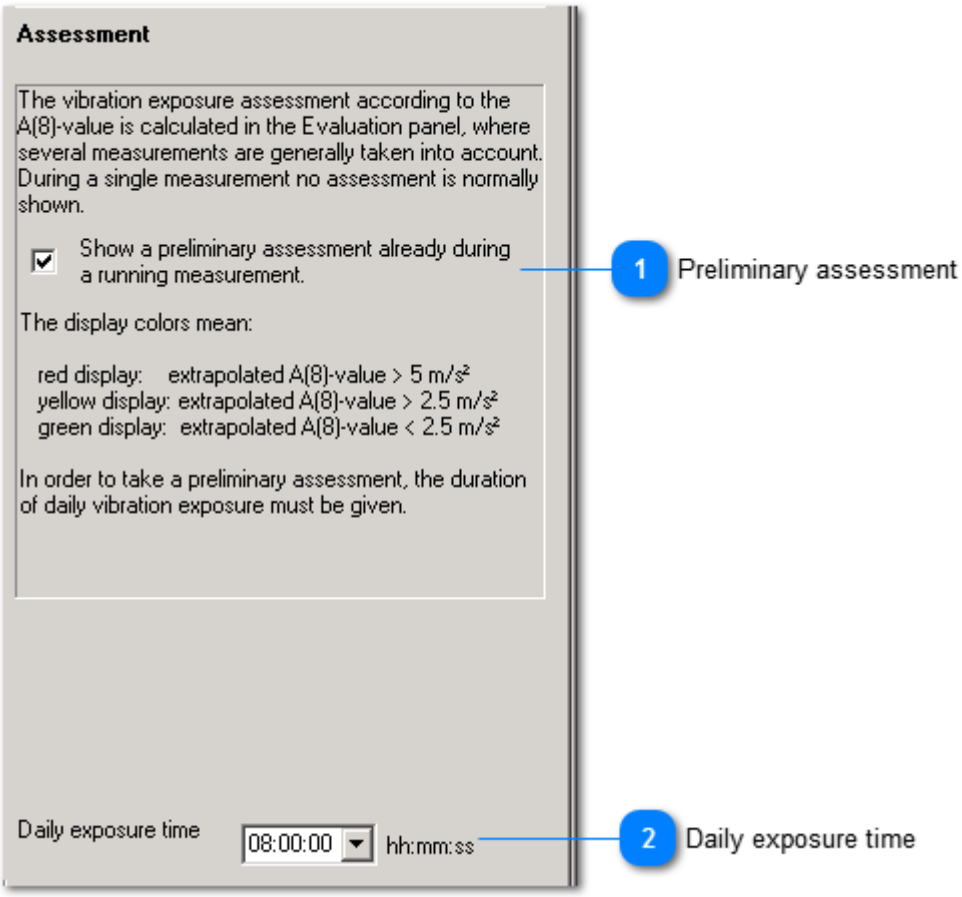
3 Save remarks



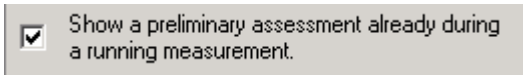
The measurement is monitored by the InnoMeter HVM 5349.
For instance, it recognizes overload and underload. Such measurement remarks can be automatically taken over into the remark field, which is available for every measurement. The remarks are also taken over when a report is printed. Deselect this option if you do not wish to take over the remarks.

Evaluation settings

Hand-arm vibration is usually not measured for a whole work shift but for representative intervals and works steps. To improve accuracy measurements can be repeated several times for averaging. However, the InnoMeter HVM 5349 can already display an estimated daily exposure value during measurement. The daily exposure time can be entered.



1 Preliminary assessment



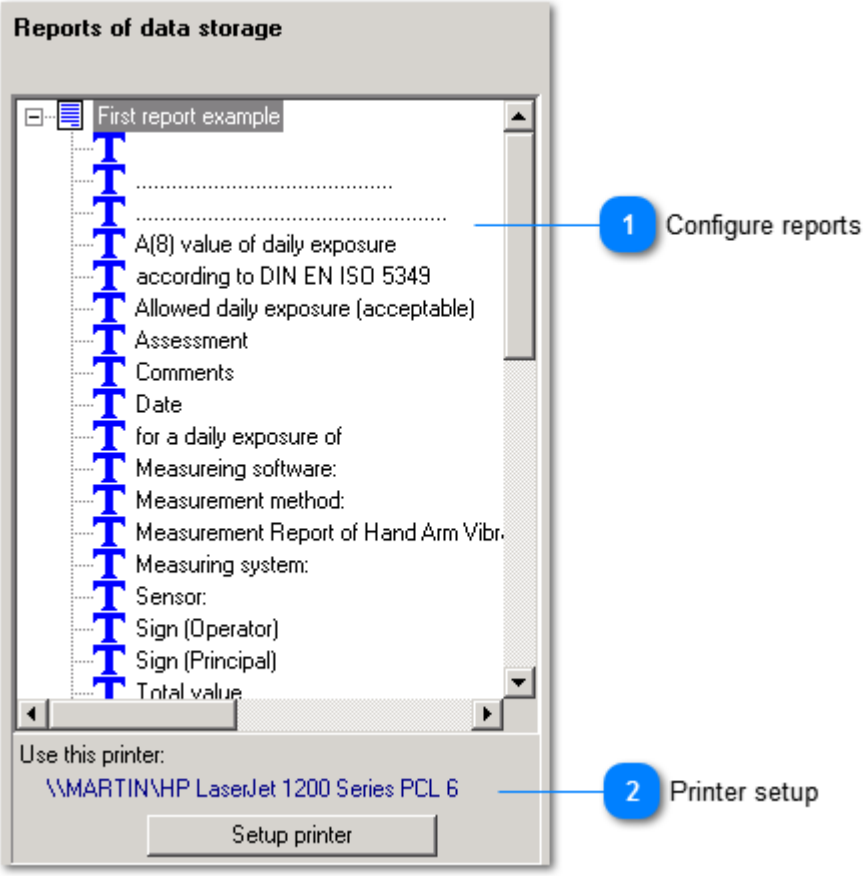
Allows evaluation and color change of the measuring result already during the measurement. This feature is only available for triaxial measurements.

2 Daily exposure time

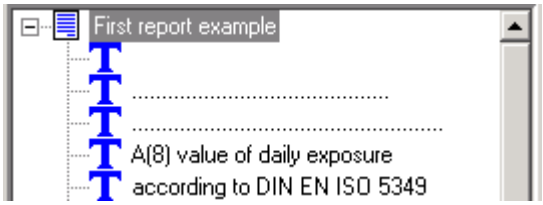
This is the exposure time per day by the currently measured activity needed for preliminary A(8) calculation.

Report templates

Reports can be printed directly from the InnoMeter HVM 5349. Texts, graphical elements (e.g. company logo) and variable components can be combined to one or more report templates, which are saved. For printing, you simply select the configured report template and print it with one mouse click.



1 Configure reports

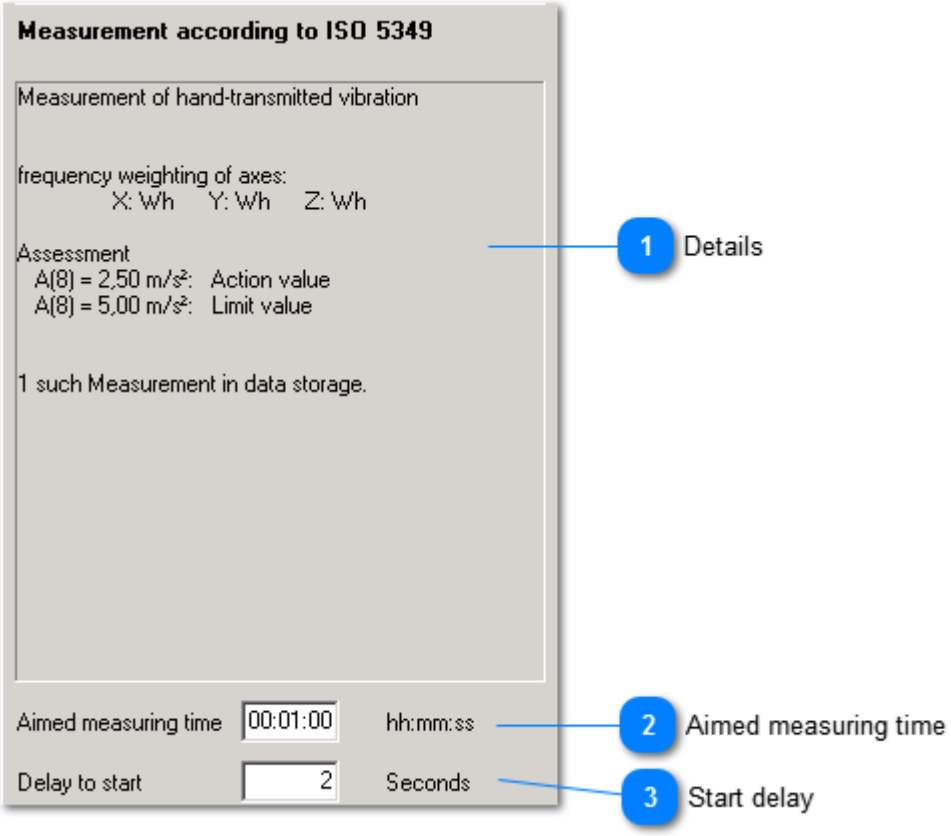


The report templates can be found in this tree structure. One report example is pre-configured. More templates can be configured or loaded.

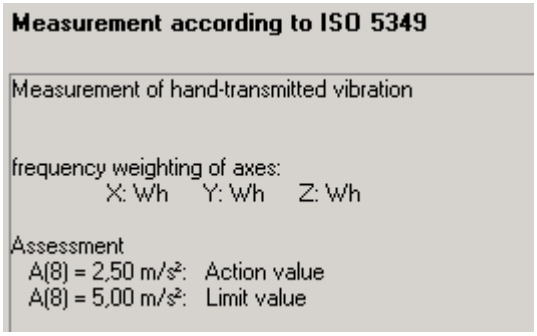
2 Printer setup

This button opens a dialog for printer selection and configuration.

Configuration options for the measuring mode



1 Details



For greater certainty concerning the selected measurement mode, the following details are displayed:

- evaluation type
- weighting filters for the different axes
- evaluation zones

2 Aimed measuring time

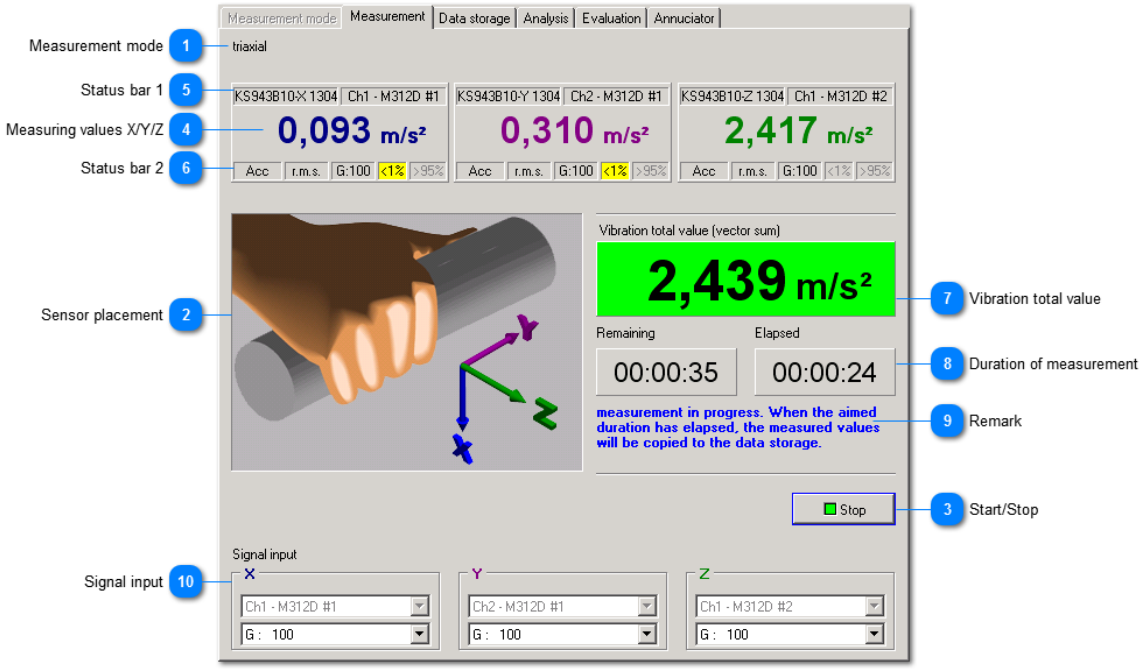
The measurement is usually carried out for a limited time. This duration can be entered here. A minimum of 1 minute is recommended.

3 Start delay

If you do not want the measurement to start right after pushing the start button, you can enter a delay here.

Measurement

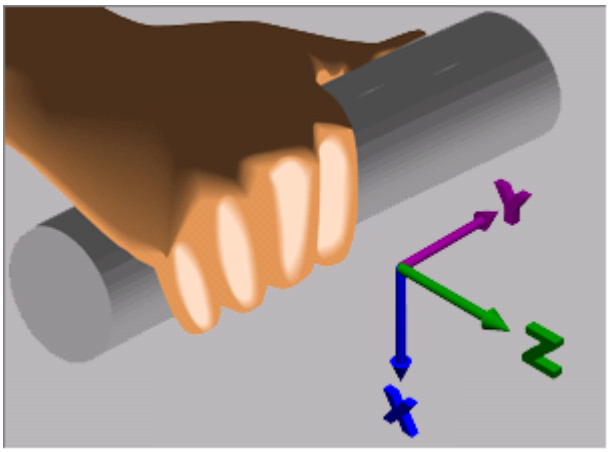
While measuring, the InnoMeter HVM 5349 displays the vibration total value and a colored assessment.



1 Measurement mode

triaxial Shows the selected mode

2 Sensor placement



The image shows the hand's coordinate system and the position of the sensor with regard to the hand. The assignment of sensor axes can be changed.

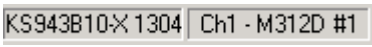
3 Start/Stop

Stop Starts and stops measurement. Starting is only possible when all settings in Measurement mode menu have been completed.

4 Measuring values X/Y/Z

0,093 m/s² This field displays the vibration value (weighted RMS value) for the measurement axes.

5 **Status bar 1**



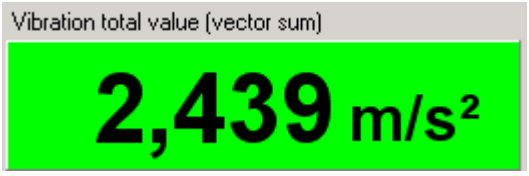
Shows sensor and channel settings.

6 **Status bar 2**

This status bar indicates:

- Measurand
- Characteristic
- Gain
- Underload
- Overload

7 **Vibration total value**

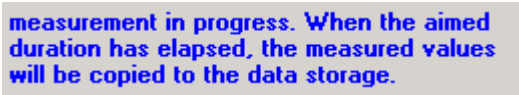


This is the vector sum of the 3 axis values.

8 **Duration of measurement**

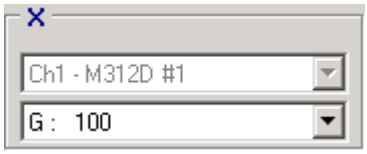
Remaining and elapsed measurement time are displayed. The elapsed measurement duration counts with minus sign from start delay to 00:00:00. Afterwards, the elapsed measurement duration counts up to the aimed measuring time. The measurement is stopped when it reaches the aimed measuring time.

9 **Remark**



This remarks inform about the current state.

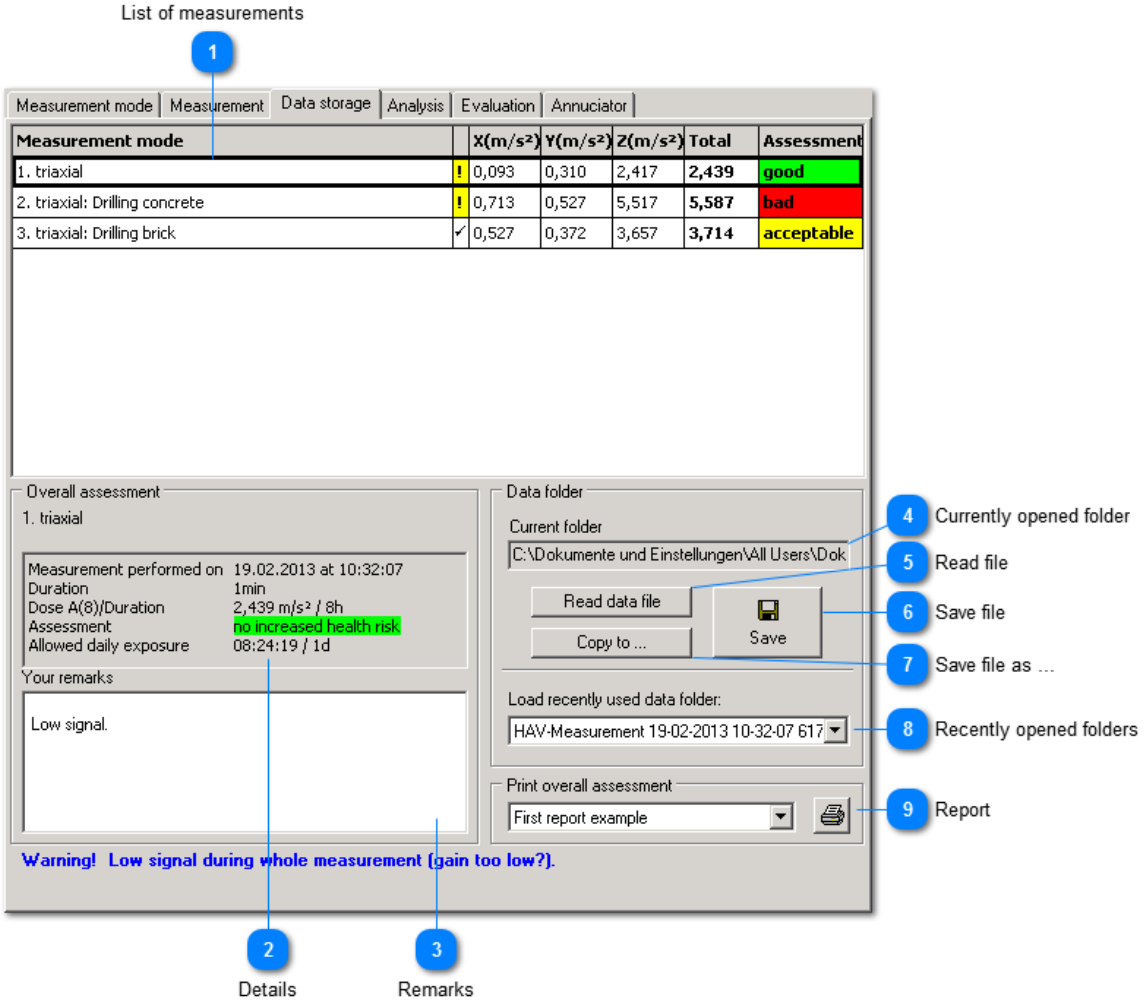
10 **Signal input**



At the signal input, you select the measuring channel and configure the measuring range. If you activated the sensor automatics the InnoMeter HVM 5349 selects the measuring channel automatically.

Data storage

The results of all completed measurements are transferred to the data storage. All measurements are listed up here incl. individual details. Data storages can be saved on a data medium and be read into the InnoMeter HVM 5349 again. You can load several data storages to combine the contained measurements to one big data storage.



1 List of measurements

Measurement mode		X(m/s²)	Y(m/s²)	Z(m/s²)	Total	Assessment
1. triaxial	!	0,093	0,310	2,417	**2,439**	good
2. triaxial: Drilling concrete	!	0,713	0,527	5,517	**5,587**	bad
3. triaxial: Drilling brick	✓	0,527	0,372	3,657	**3,714**	acceptable

The results of all measurements are listed up here including the values of the single axes as well as the vibration total value and its assessment. If irregularities were detected during the measurement, the measurement is marked with an exclamation mark.

2 **Details**

1. triaxial

Measurement performed on	19.02.2013 at 10:32:07
Duration	1min
Dose A(8)/Duration	2,439 m/s² / 8h
Assessment	no increased health risk
Allowed daily exposure	08:24:19 / 1d

Here you can find more details for each measurement, including measured values, additional characteristics and measurement settings.

3 **Remarks**

Your remarks

Low signal.

You may add your own remarks for each measurement.

4 **Currently opened folder**

Current folder

C:\Dokumente und Einstellungen\All Users\Dok

This field shows which data folder is currently open.

5 **Read file**

Read data file

This button opens a directory tree from which you can select the measurement folder. The read data is added to the data in data storage. This way, you can for instance combine measurements from different days.

6 **Save file**

Save

This button saves the current data storage on a data medium.

7 **Save file as ...**

Copy to ...

This button saves the current data storage on a data medium. You can enter a new name for the measurement folder

8 **Recently opened folders**

HAV-Measurement 19-02-2013 10-32-07 617

This drop-down list shows the currently used data folders. By clicking on an entry, the respective data folder is opened.

9 **Report**

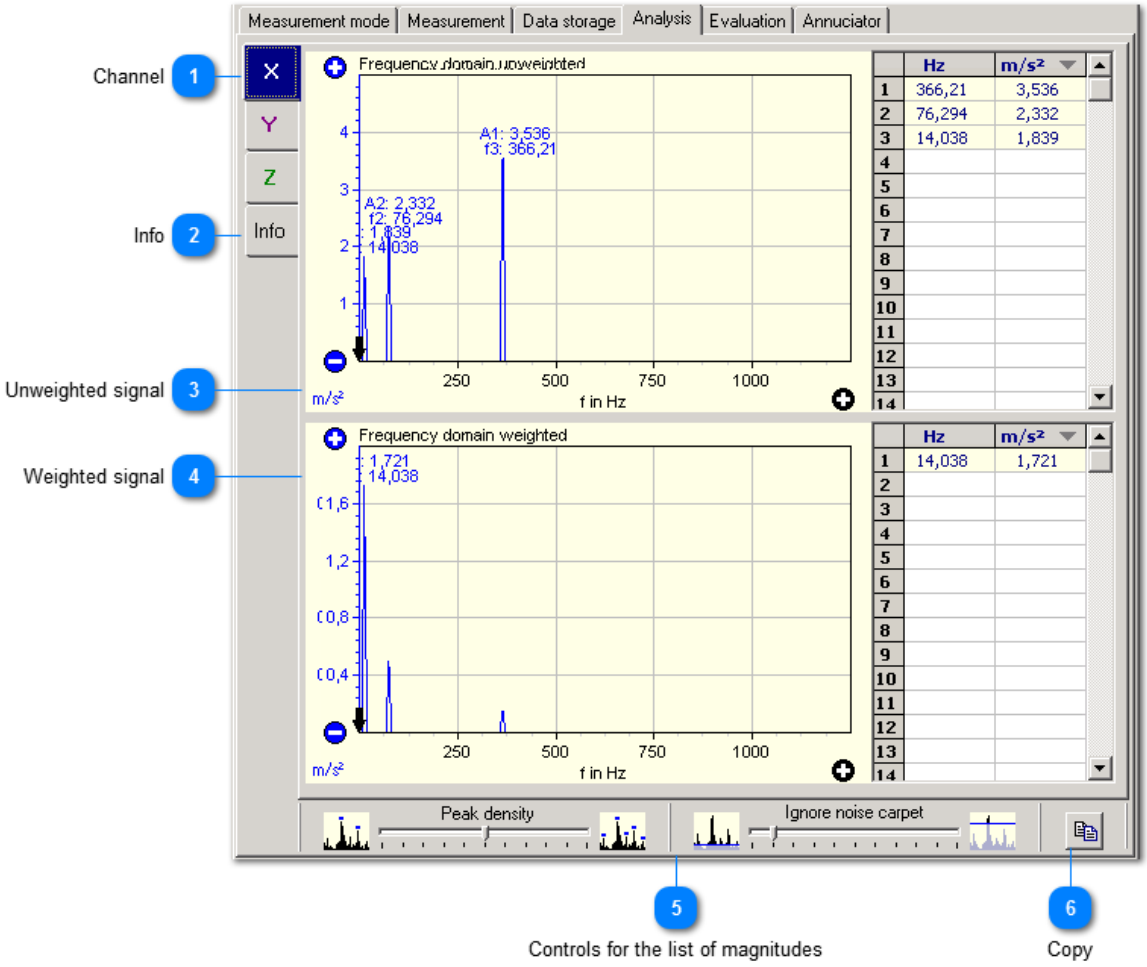
Print overall assessment

First report example

Allows the selection of a report template and the printing of the selected measurement.

Analysis

The InnoMeter HVM 5349 Pro allows a frequency analysis for both, the unweighted and weighted vibration signal. This way you can detect causes of too high vibration values.



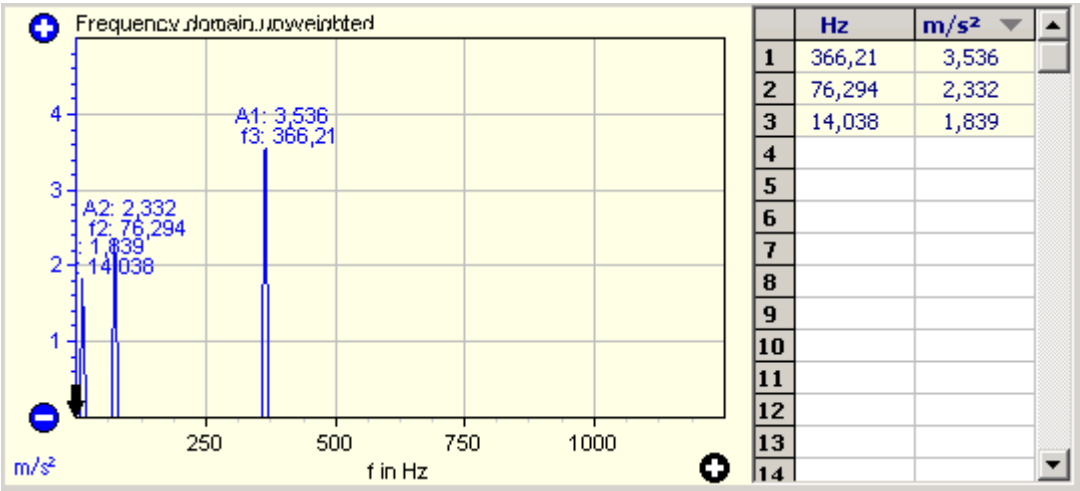
1 Channel

Graphical analysis is provided for each measuring channel.

2 Info

Information concerning the storage location of the measured data for analysis etc.

3 Unweighted signal



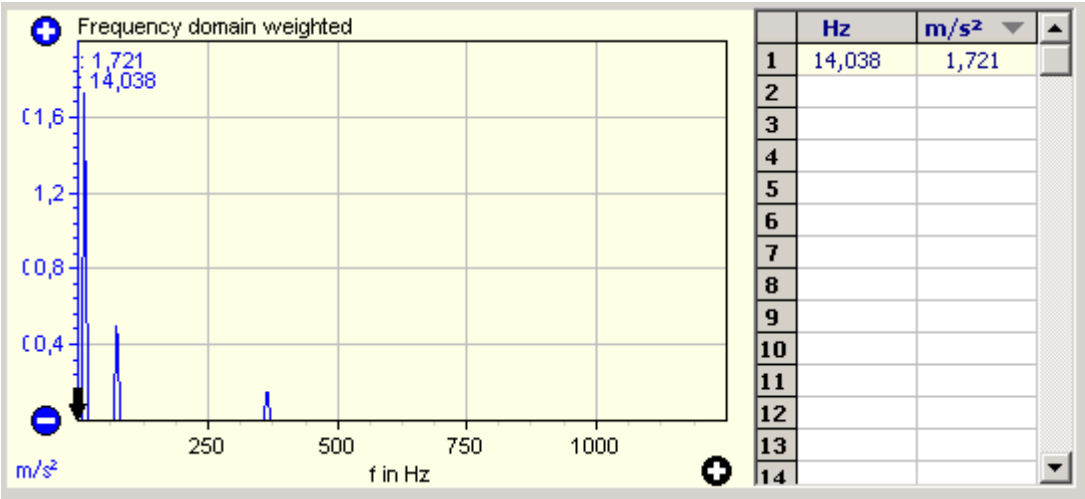
The unweighted signal only contains the bandpass filter before it is transmitted to the frequency analysis. The displayed vibration frequencies do not have a special weighting with regard to health, comfort or perception of humans.

Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows.

Scaling with the mouse
By means of the mouse, the chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

List of magnitudes
The highest magnitudes are detected automatically and they are presented with frequency and value. Frequency and value are indicated directly in the chart as well as in the list next to the chart. The detection algorithm can be configured.

4 Weighted signal



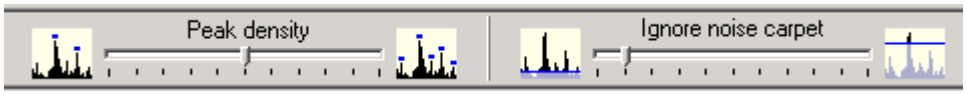
The weighted signal contains the bandpass filter and weighting filter for human vibration before it is transmitted to the frequency analysis. Thus, the displayed vibration frequencies are weighted with regard to health, comfort or perception of humans.

Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows.

Scaling with the mouse
By means of the mouse, the chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

List of magnitudes
The highest magnitudes are detected automatically and they are presented with frequency and value. Frequency and value are indicated directly in the chart as well as in the list next to it to graphic. The detection algorithm can be configured.

5 Controls for the list of magnitudes



These controls work like the ones in the InnoAnalyzer.

6 Copy

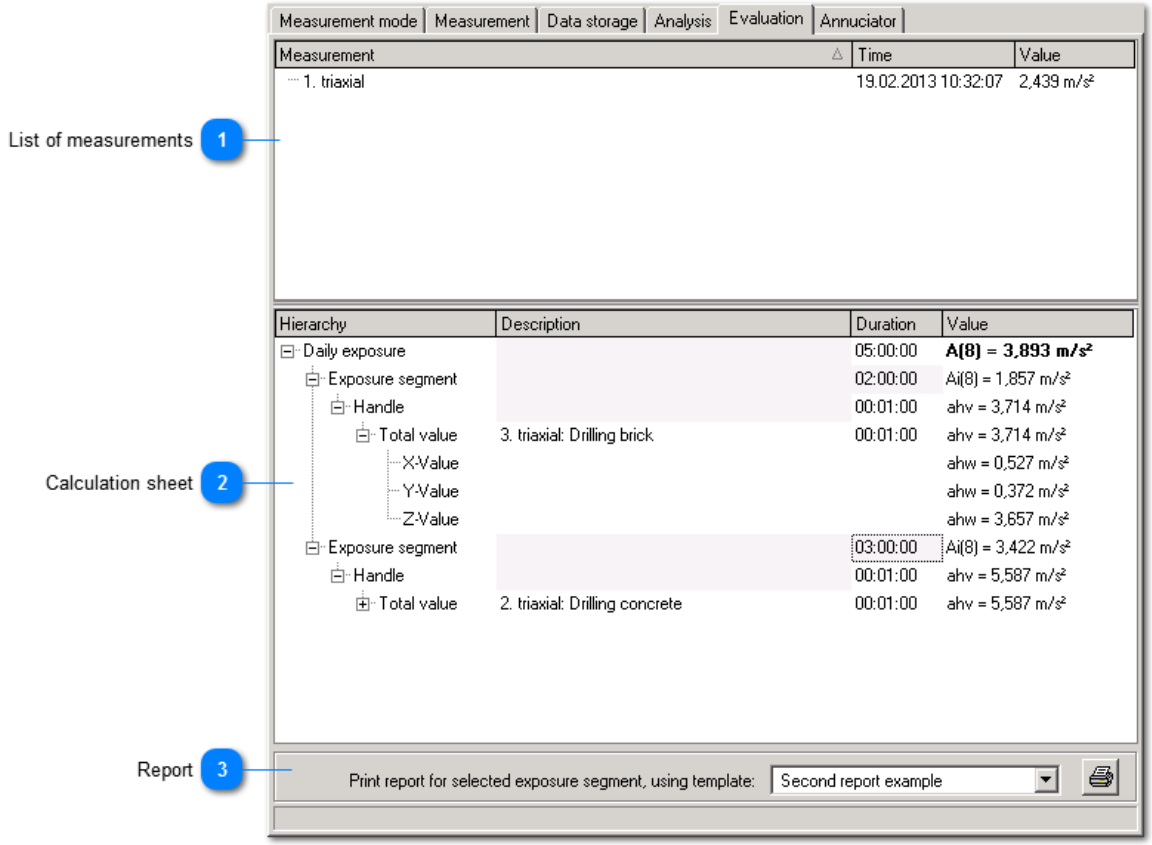
By means of this button the graphical presentation of both signals is copied to the clipboard. Afterwards, the chart can be entered into a word processing or other programs.

Automatic A(8) calculation sheet

If only one activity is carried out the whole day, the vibration total value corresponds to the daily vibration exposure. But persons usually carry out many different activities during one working day. All these activities have to be considered when calculating the daily vibration exposure. The InnoMeter HVM 5349 makes it absolutely easy to calculate a complex daily vibration exposure:

1. The vibration total value is measured for each activity. It is not necessary to carry out the measurement for the entire exposure duration per day. It is sufficient to measure for a minimum duration. You can repeat the measurement for one activity several times to obtain a higher statistical certainty.
2. All measurements can be found in the data storage. And exactly these measurement are available in the list of measurements as well.
3. Now you simply drag the measurements into the calculation sheet by mouse, name the activities (exposure segments) and enter the actual exposure duration.

Now you have finished the complex calculation of the daily vibration exposure with the A(8) value as result.



1 List of measurements

Measurement	Time	Value
1. triaxial	19.02.2013 10:32:07	2,439 m/s²

All measurements from the data storage are listed up here. If the single measurements have been carried out on different days, they are read into the data storage successively and create a big data storage for all measurements.

2 Calculation sheet

Hierarchy	Description	Duration	Value
Daily exposure		05:00:00	**A(8) = 3,893 m/s²**
Exposure segment		02:00:00	Ai(8) = 1,857 m/s²
Handle		00:01:00	ahv = 3,714 m/s²
Total value	3. triaxial: Drilling brick	00:01:00	ahv = 3,714 m/s²
X-Value			ahw = 0,527 m/s²
Y-Value			ahw = 0,372 m/s²
Z-Value			ahw = 3,657 m/s²

The single measurements are taken over to the calculation sheet by drag & drop.

- When the measurement is dropped to "daily exposure", a new exposure segment is created which contains the dropped measurement. Now simply enter a name for the new exposure segment.
- If the measurement is dropped to an exposure segment, an average value is indicated. This procedure is intended to increase the statistical certainty when several measurements were carried out for one activity.

For every exposure segment, the actual exposure duration has to be entered in the column Duration. The measurement is not usually carried out for the entire exposure duration, but for a shorter duration which must not be below a certain minimum duration.

As a result, there is a daily vibration exposure A(8) calculated conforming to standards, which can be printed in a detailed report at the push of button.

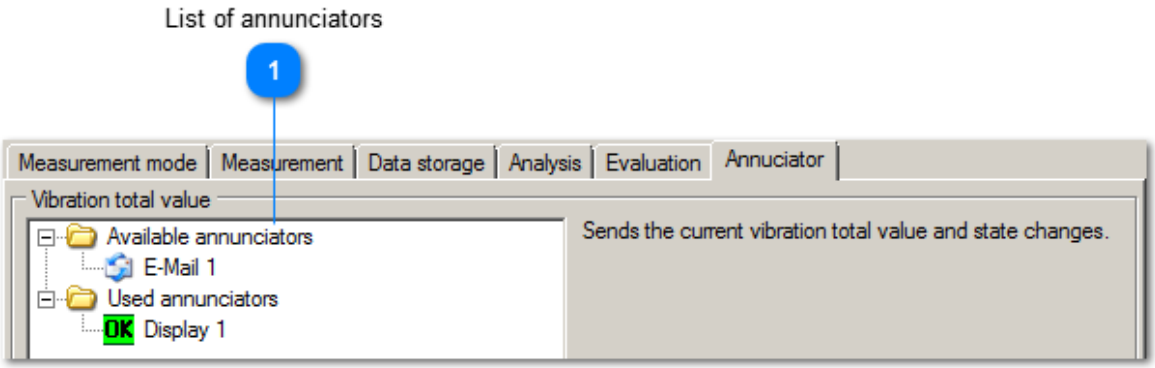
3 Report

Print report for selected exposure segment, using template: Second report example

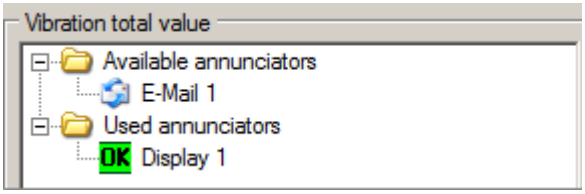
The calculated daily vibration exposure can be printed in a report. You can choose the report template.

Annunciators

VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.



1 List of annunciators



Shows a list of available and used annunciators.

InnoMeter® HVM 6954 (Pro)

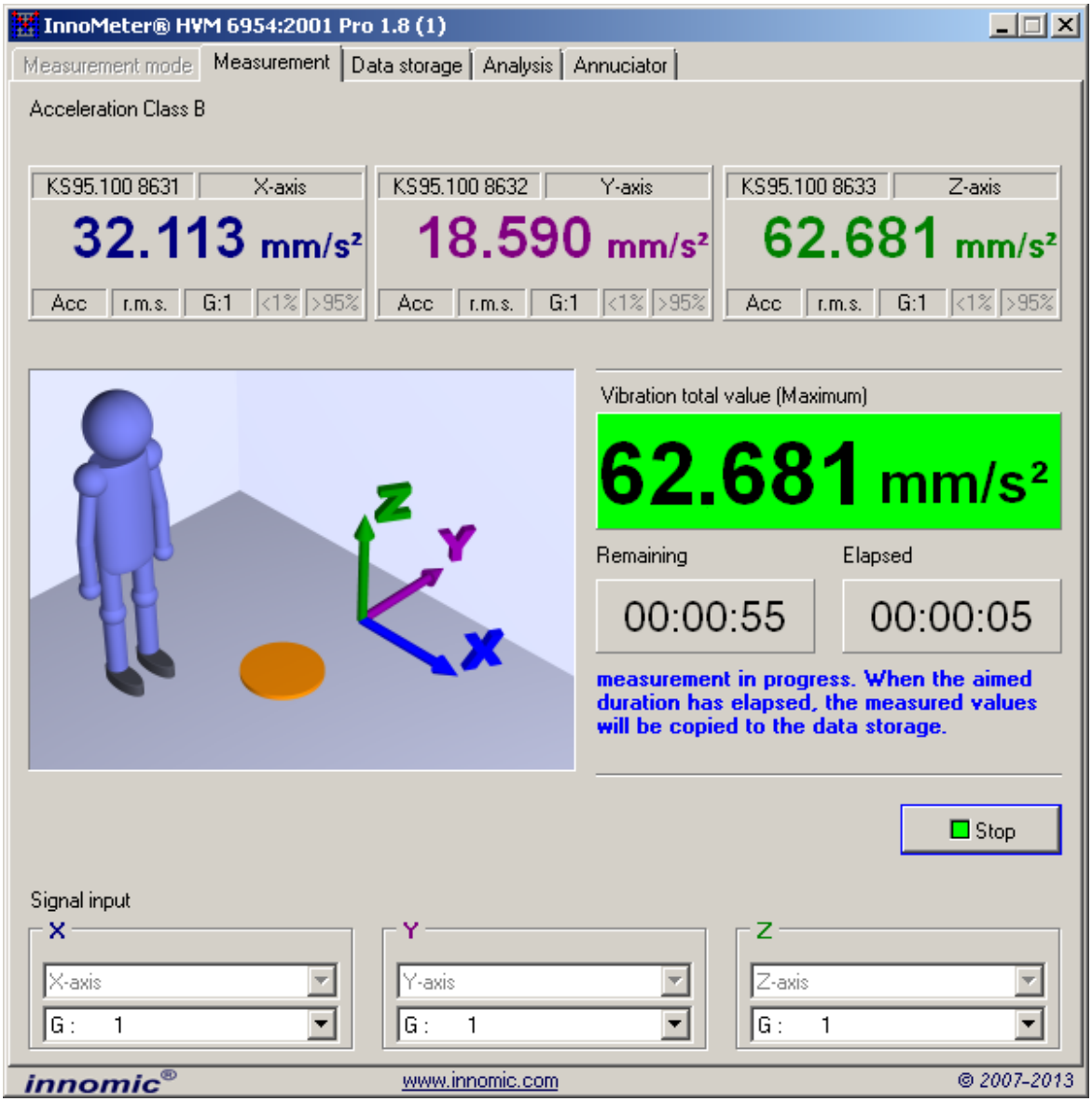
Comfort and health assessment

The InnoMeter HVM 6954 is used to measure human whole-body vibrations on ships. Whole-body vibrations are caused by vibrations which are transmitted from drives and machines to a person that is standing, sitting or lying down. If the crew is exposed to strong whole-body vibrations, safety and health are endangered. Too strong vibrations also diminish the comfort of the passengers in their cabins.

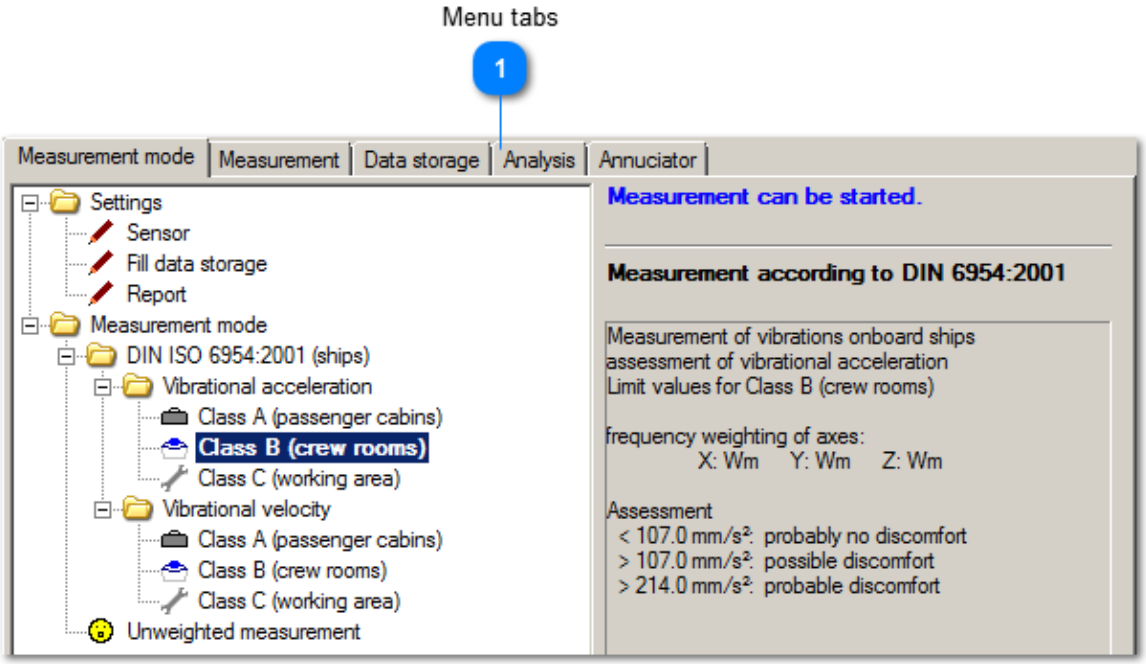
The international standard ISO 6954 provides guide values for different classes of rooms. Exceeding these guide values may cause complaints. For acceptance inspections, parties can use these guide values or agree on their own values.

Identify causes

The InnoMeter HVM 6954 Pro additionally offers a frequency analysis of the weighted and unweighted vibration signal. This can help to find the source of vibration.



Operation panels

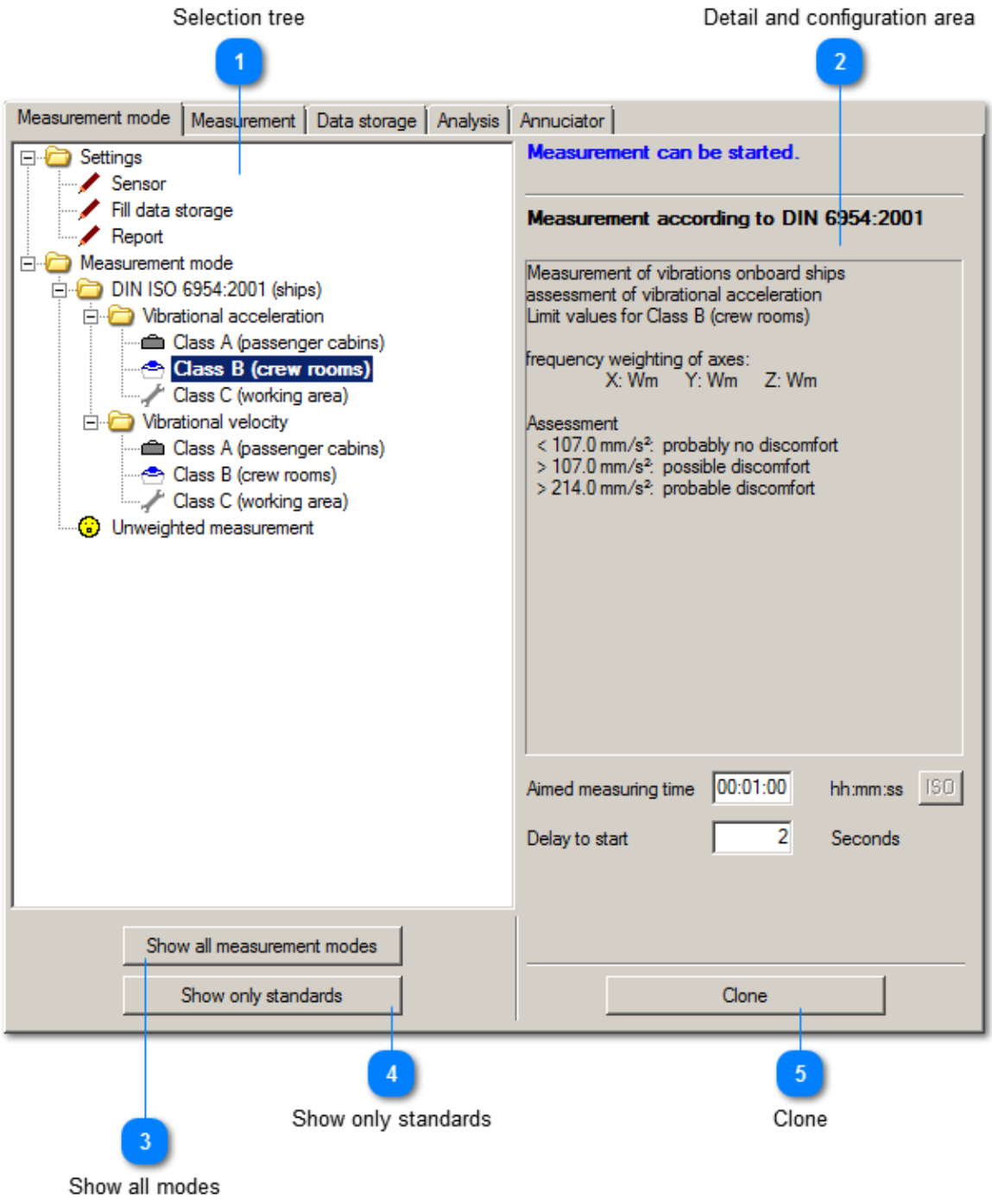


1 Menu tabs

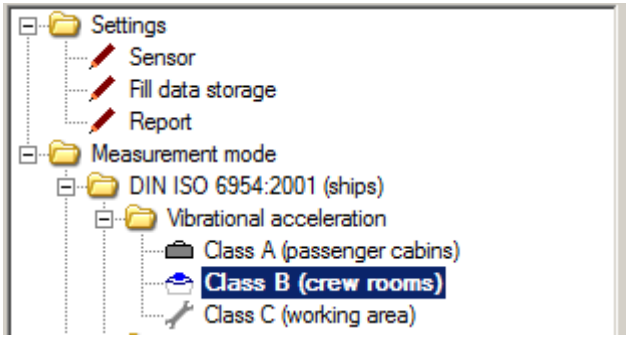
Here you can switch between the different submenus of the InnoMeter HVM 6954:

Measurement mode	Measurement settings
Measurement	Execution of the measurement with indication of the measured values and colored evaluation
Data storage	Memory for measured values, detailed evaluation and report generation
Analysis	Frequency analysis for the detection of vibration sources
Annunciators	Signaling measured values and states for automated tests

Measurement mode



1 Selection tree

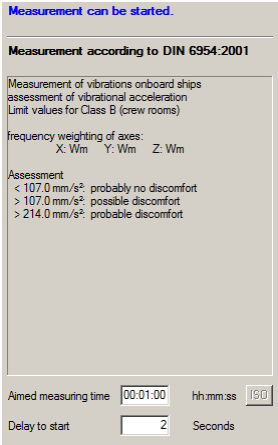


The selection tree shows setting options and measurement modes in a clearly arranged way.
A measurement mode has to be selected before starting a measurement.

Depending on the selected measurement mode or setting option, the detail and configuration area on the right side changes.

By means of the buttons Show all measurement modes and Show only standards the selection tree can be closed or opened completely.

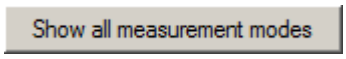
2 Detail and configuration area



The detail and configuration area changes depending on the selection in the selection tree. Here you can configure:

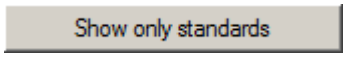
- Sensor
- Data storage
- Report templates
- Measurement modes

3 Show all modes



This button opens all measurement modes in the selection tree.

4 Show only standards

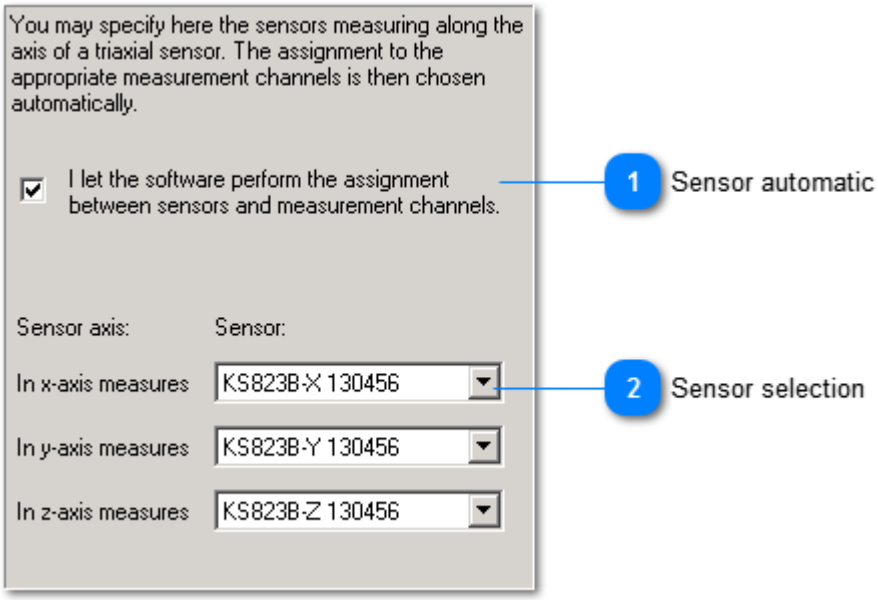


This button only shows the top level of measurement modes in the selection tree.

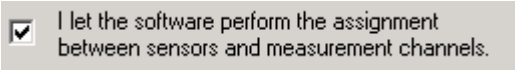
5 Clone

Clone	This button generates an additional InnoMeter HVM 6954 with the same settings. The newly generated instrument can be configured freely.

Sensor settings



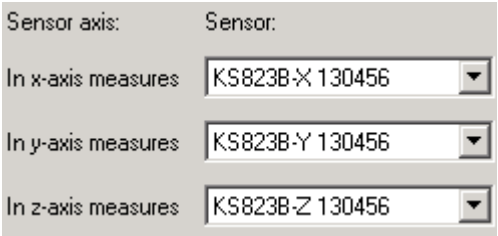
1 Sensor automatic



The measurements for whole-body vibrations are carried out in three axes. The allocation of the axes plays an important role because they are weighted differently in some measurement modes. The coordinate system refers to humans and is constant. The triaxial sensor has its own coordinate system, which - depending on the sensor positioning - does not always correspond to the body's coordinate system.

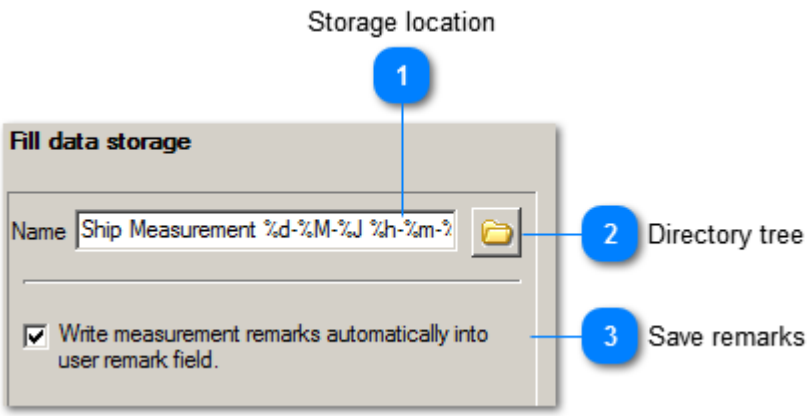
If you activate the automatic assignment of axes, the InnoMeter HVM 6954 correctly assigns the sensor axes to the body's coordinate system. It also shows the correct sensor positioning in graphical drawings. If you follow these graphical instructions you avoid positioning errors.

2 Sensor selection

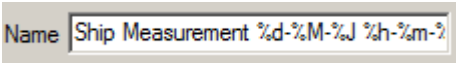


To work correctly, the sensor automatic requires assigned sensors. In the drop-down list, you can choose among all sensors from the sensor management.

Data storage settings



1 Storage location

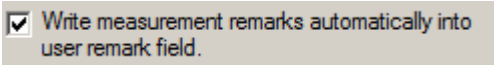


The data storage can be named here. It is saved as a directory. Additional to fixed components, the name of the directory can also contain variable components, the placeholders.

2 Directory tree

This button opens a directory tree.
Data storage is carried out in a directory which contains several files. The target directory can be newly generated in the displayed directory tree.

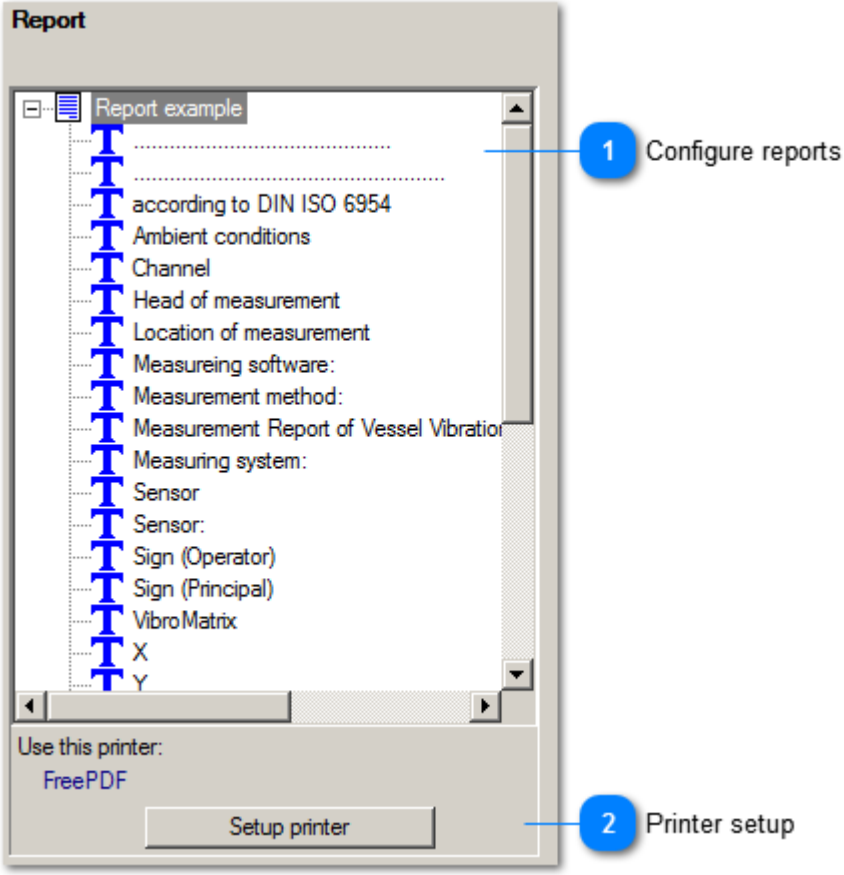
3 Save remarks



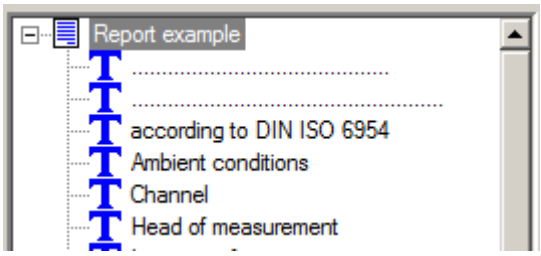
The measurement is monitored by the InnoMeter HVM 6954.
For instance, it recognizes overload and underload. Such measurement remarks can be automatically taken over into the remark field, which is available for every measurement. The remarks are also taken over when a report is printed. Deselect this option if you do not wish to take over the remarks.

Report templates

Reports can be printed directly in the InnoMeter HVM 6954. Texts, graphical elements (e.g. company logo) and variable components can be combined to one or more report templates, which are saved. For printing, you simply select the configured report template and print it with one mouse click.

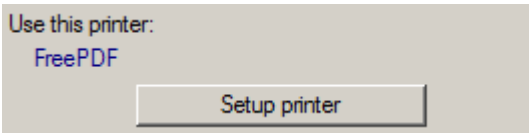


1 Configure reports



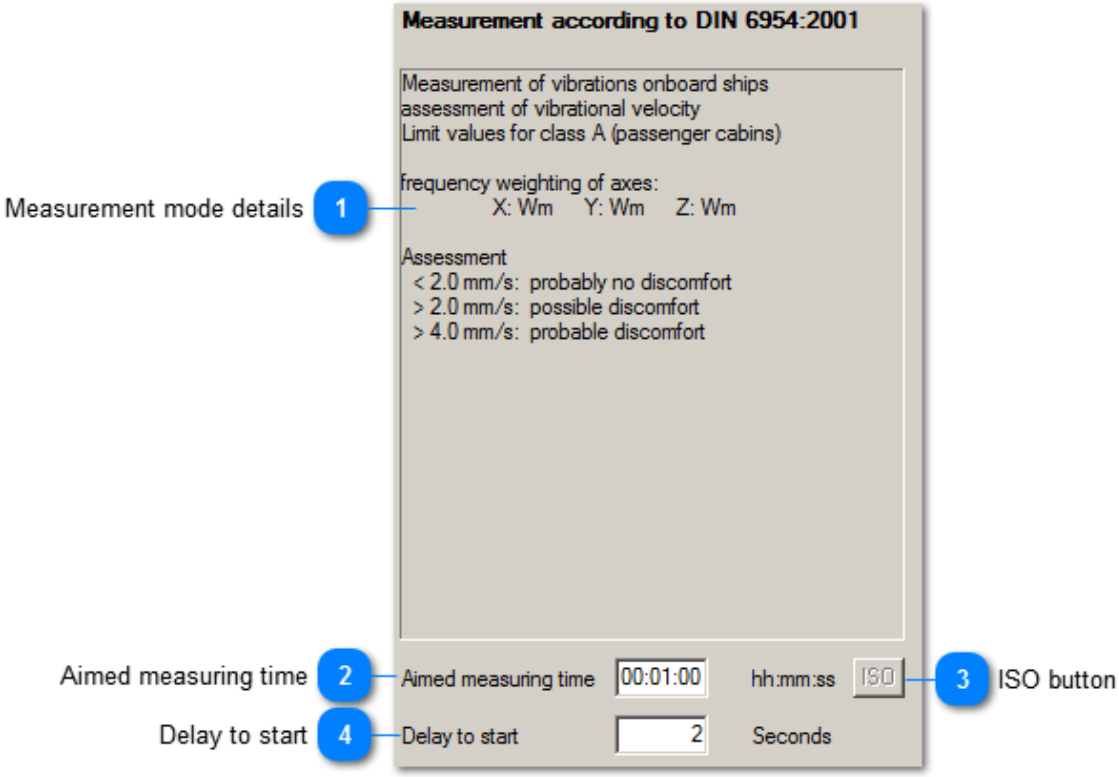
The report templates can be found in this tree structure. One report example is pre-configured. More templates can be configured or loaded.

2 Printer setup

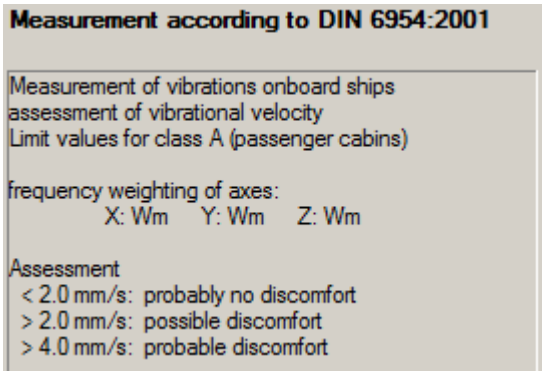


This button opens a dialog for printer selection and configuration.

Configuration options for the measurement mode



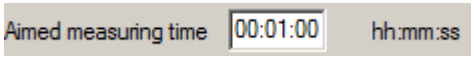
1 Measurement mode details



For greater certainty concerning the selected measurement mode, the following details are displayed:

- evaluation type
- weighting filters for the different axes
- evaluation zones

2 Aimed measuring time



The measurement is usually carried out for a limited time.
This duration can be entered here. However, it must not be below a certain minimum duration. By means of the ISO button, the minimum duration conforming to the standard is entered.

3 ISO button

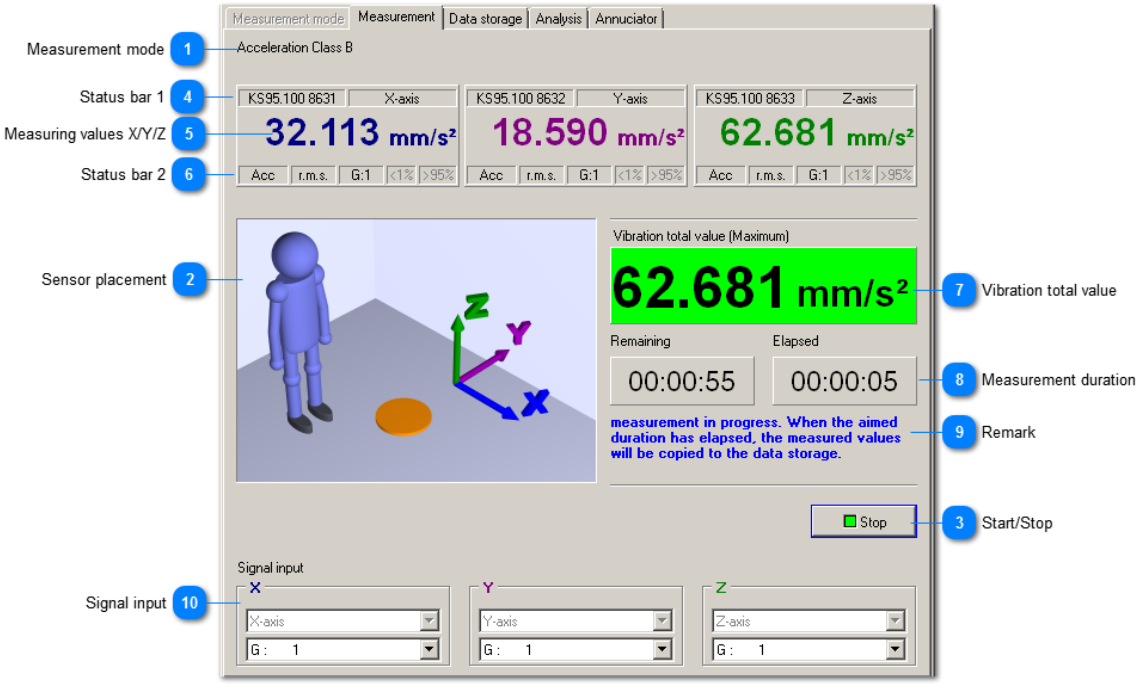
By clicking the ISO button, the minimum measurement duration conforming to the standard is entered as aimed measuring time.

4 Delay to start

If you do not want the measurement to start right after pushing the start button, you can enter a delay here.

Measurement

While measuring, the InnoMeter HVM 6954 displays the vibration total value and a colored assessment.

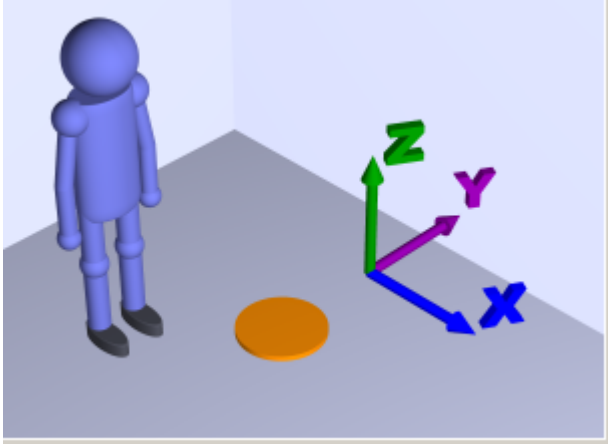


1 Measurement mode

Acceleration Class B

The selected measurement mode is shown once again.

2 Sensor placement



The image shows the body's coordinate system. The sensor has to be mounted in a way that its axes are aligned accordingly resp. you have to select the axis accordingly in the sensor automatic.

3 Start/Stop

Stop

This button starts resp. stops the measurement.

4 Status bar 1

KS95.100 8631 | X-axis

This status bar shows sensor and measuring channel.

5 **Measuring values X/Y/Z**

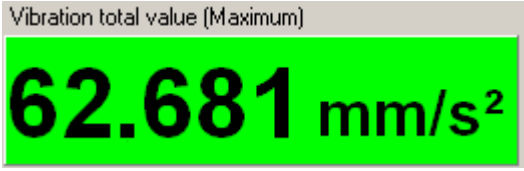
The vibration value (weighted interval RMS value) for the axis is displayed here.

6 **Status bar 2**

The second status bar shows:

- Measurand
- Characteristic
- Gain
- Underload
- Overload

7 **Vibration total value**

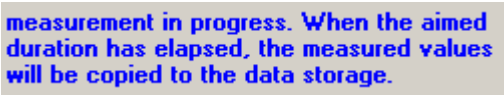


The maximum of the values from the single axes is displayed as vibration total value.

8 **Measurement duration**

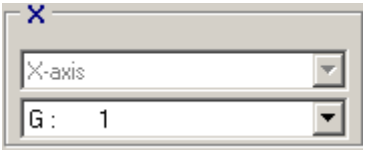
The InnoMeter HVM 6954 displays elapsed and remaining measurement duration. The elapsed measurement duration counts with minus sign from start delay to 00:00:00. Afterwards, the elapsed measurement duration counts up to the aimed measuring time. The measurement is stopped when it reaches the aimed measuring time.

9 **Remark**



This remark informs about the current state.

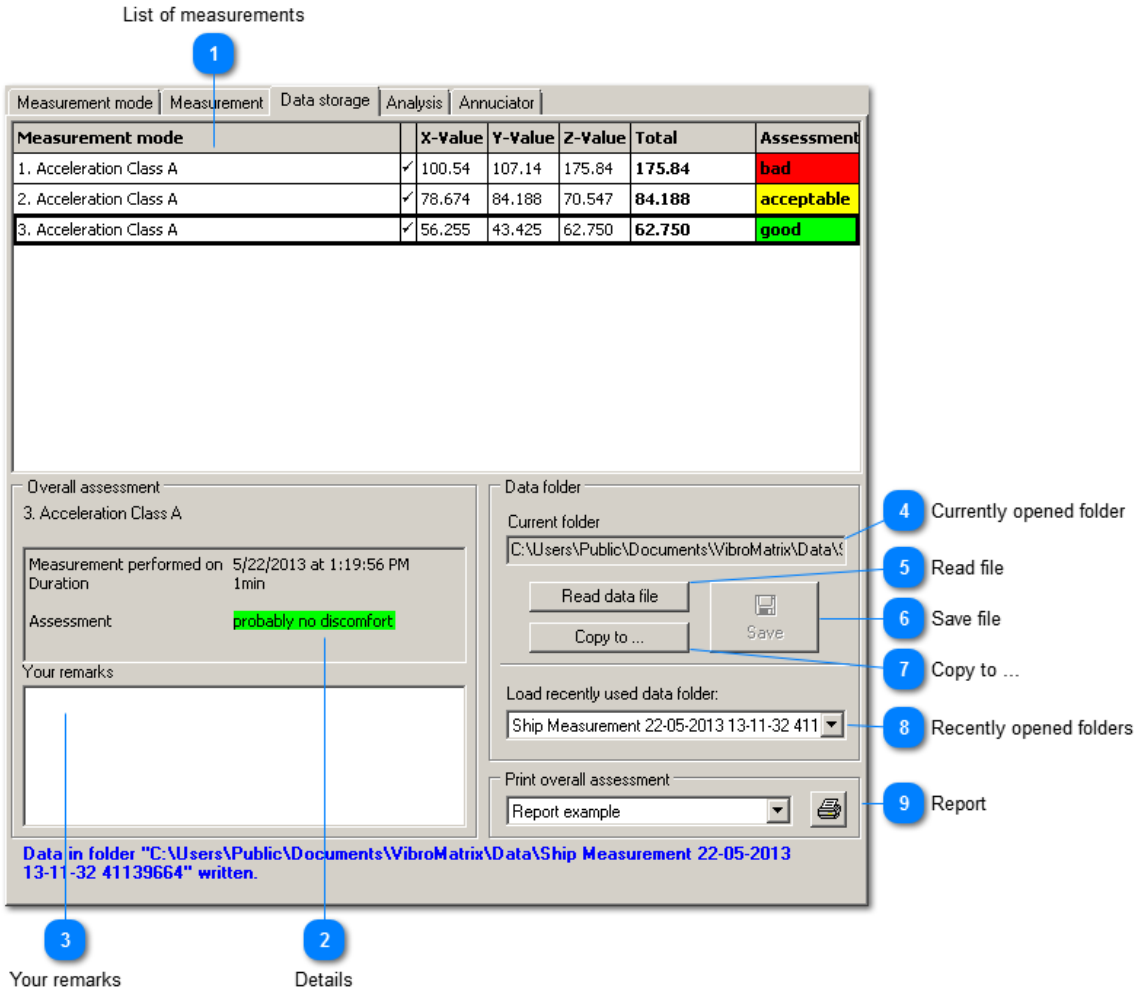
10 **Signal input**



At the signal input, you select the measuring channel and configure the measuring range. If you activated the sensor automatic the InnoMeter HVM 6954 selects the measuring channel automatically.

Data storage

The results of all completed measurements are transferred to the data storage. All measurements are listed up here incl. individual details. Data storages can be saved on a data medium and be read into the InnoMeter HVM 6954 again. You can load serveral data storages to combine the contained measurements to one big data storage.

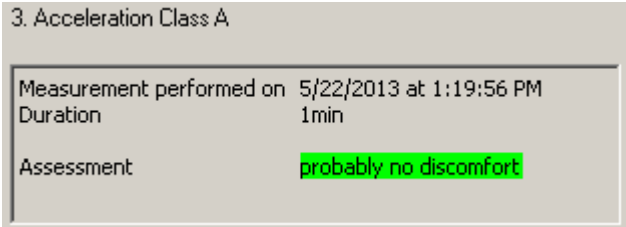


1 List of measurements

Measurement mode		X-Value	Y-Value	Z-Value	Total	Assessment
1. Acceleration Class A	✓	100.54	107.14	175.84	**175.84**	bad
2. Acceleration Class A	✓	78.674	84.188	70.547	**84.188**	acceptable
3. Acceleration Class A	✓	56.255	43.425	62.750	**62.750**	good

The results of all measurements are listed up here including the values of the single axes as well as the vibration total value and its assessment. If irregularities were detected during the measurement, the measurement is marked with an exclamation mark.

2 **Details**

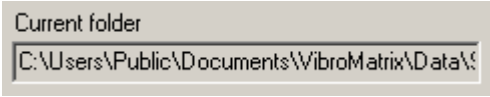


This field shows time and assessment of the measurement.

3 **Your remarks**

You may add your own remarks for each measurement.

4 **Currently opened folder**



This field shows which data folder is currently open.

5 **Read file**

This button opens a directory tree from which you can select the measurement folder. The read data is added to the data in data storage. This way, you can for instance combine measurements from different days.

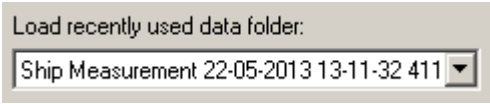
6 **Save file**

This button saves the current data storage on a data medium.

7 **Copy to ...**

This button saves the current data storage on a data medium. You can enter a new name for the measurement folder.

8 **Recently opened folders**



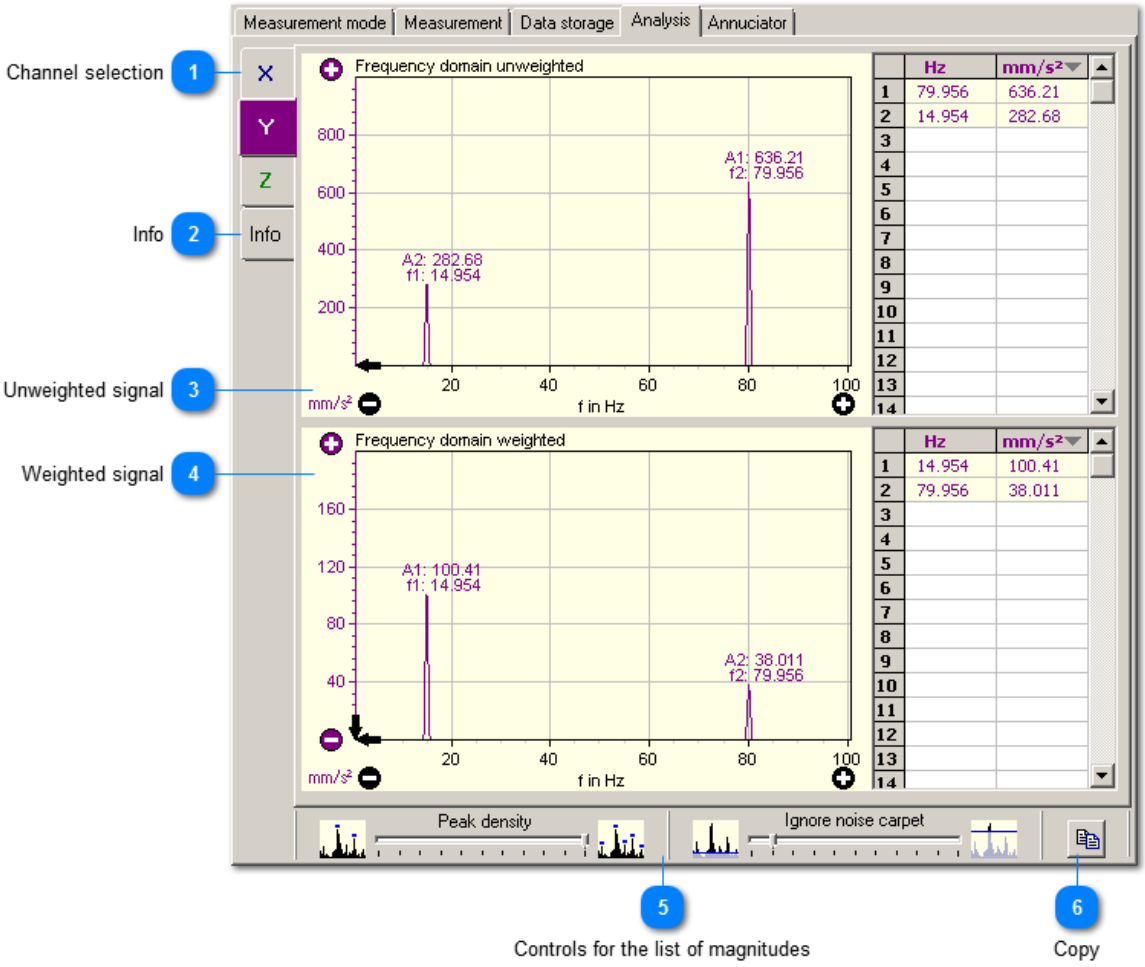
This drop-down list shows the recently used data folders. By clicking on an entry, the respective data folder is opened.

9 **Report**

Allows the selection of a report template and the printing of the selected measurement.

Analysis

The InnoMeter HVM 6954 Pro allows a frequency analysis for both, the unweighted and weighted vibration signal. This way you can detect causes of too high vibration values.



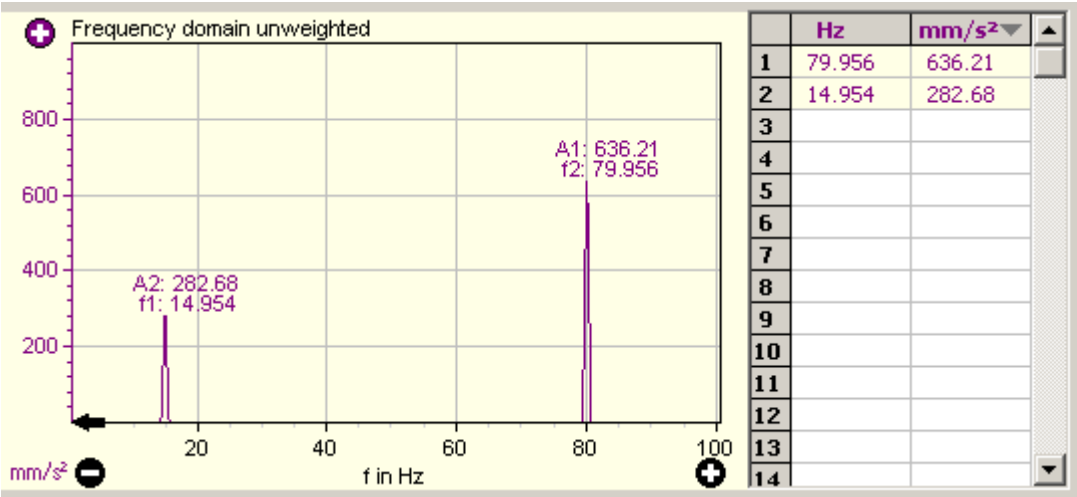
1 Channel selection

Graphical analysis is provided for each measuring channel.

2 Info

Information concerning the storage location of the measured data for analysis etc.

3 Unweighted signal



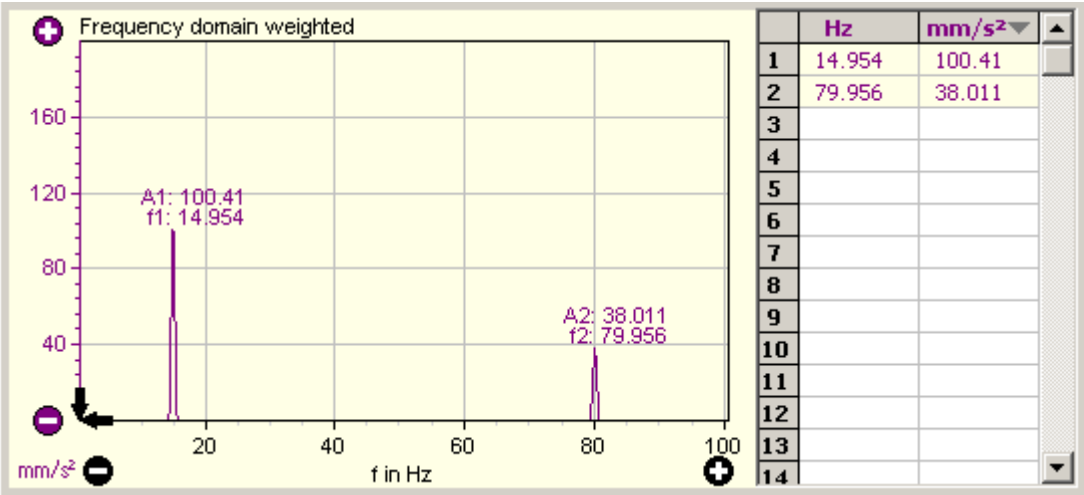
The unweighted signal only contains the bandpass filter before it is transmitted to the frequency analysis. The displayed vibration frequencies do not have a special weighting with regard to health, comfort or perception of humans.

Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows.

Scaling with the mouse
By means of the mouse, the chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

List of magnitudes
The highest magnitudes are detected automatically and they are presented with frequency and value. Frequency and value are indicated directly in the chart as well as in the list next to the chart. The detection algorithm can be configured.

4 Weighted signal



The weighted signal contains the bandpass filter and weighting filter for human vibration before it is transmitted to the frequency analysis. Thus, the displayed vibration frequencies are weighted with regard to comfort/health of humans.

Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows.

Scaling with the mouse
By means of the mouse, the chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

List of magnitudes
The highest magnitudes are detected automatically and they are presented with frequency and value. Frequency and value are indicated directly in the chart as well as in the list next to it to graphic. The detection algorithm can be configured.

5 Controls for the list of magnitudes

These controls work like the ones in the InnoAnalyzer.

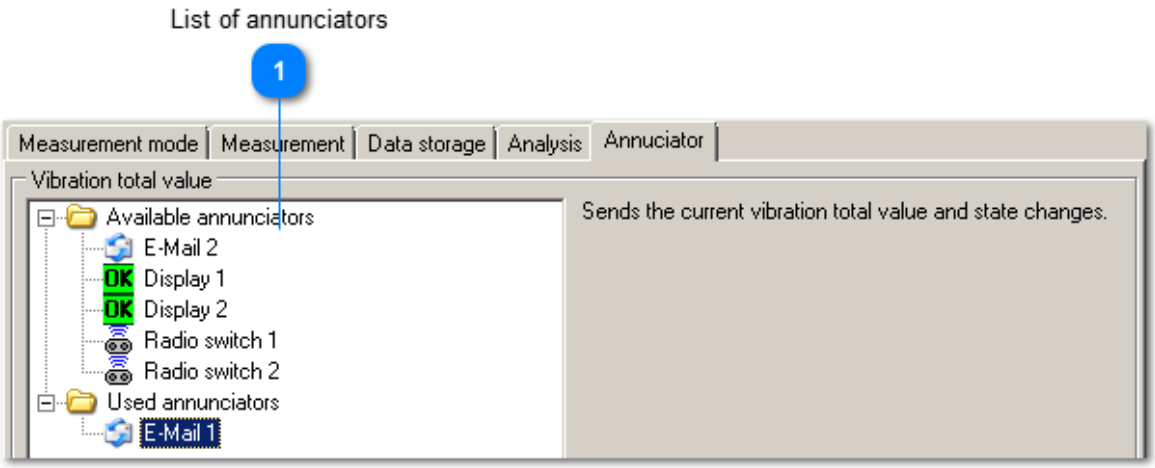
6 Copy

 By means of this button the graphical presentation of both signals is copied to the clipboard.
Afterwards, the chart can be entered into a word processing or other programs.

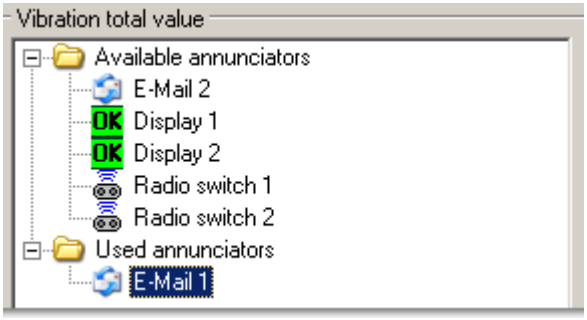
Annunciators

VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.

These annunciators are suitable e.g. for unattended permanent measurements. If a limit value was exceeded, you are for instance informed by e-mail.



1 List of annunciators



This list shows all available and used annunciators.

InnoMeter® 4150-2 (Pro)

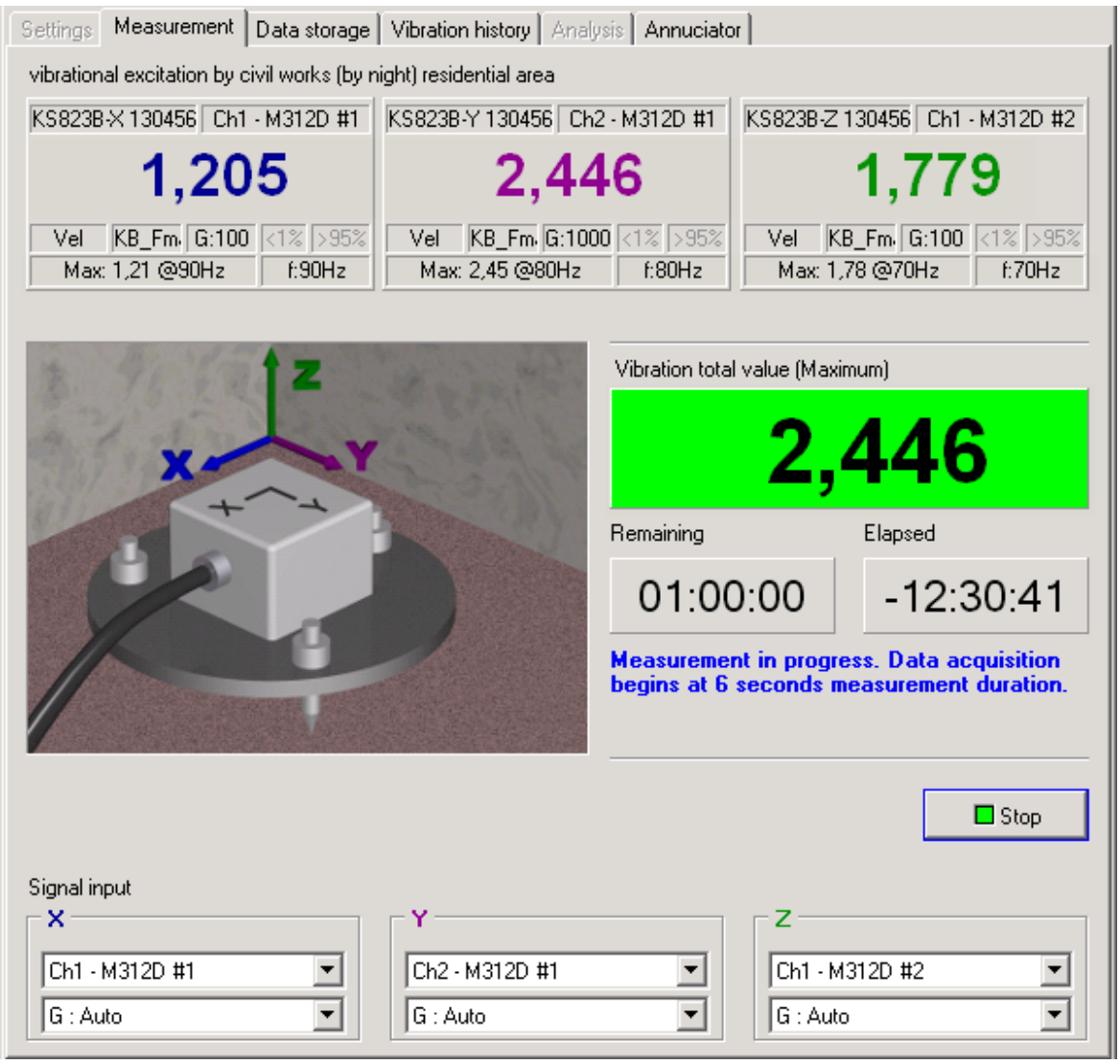
Vibrations in buildings - Effects on persons in buildings

Vibrations in buildings can be caused by

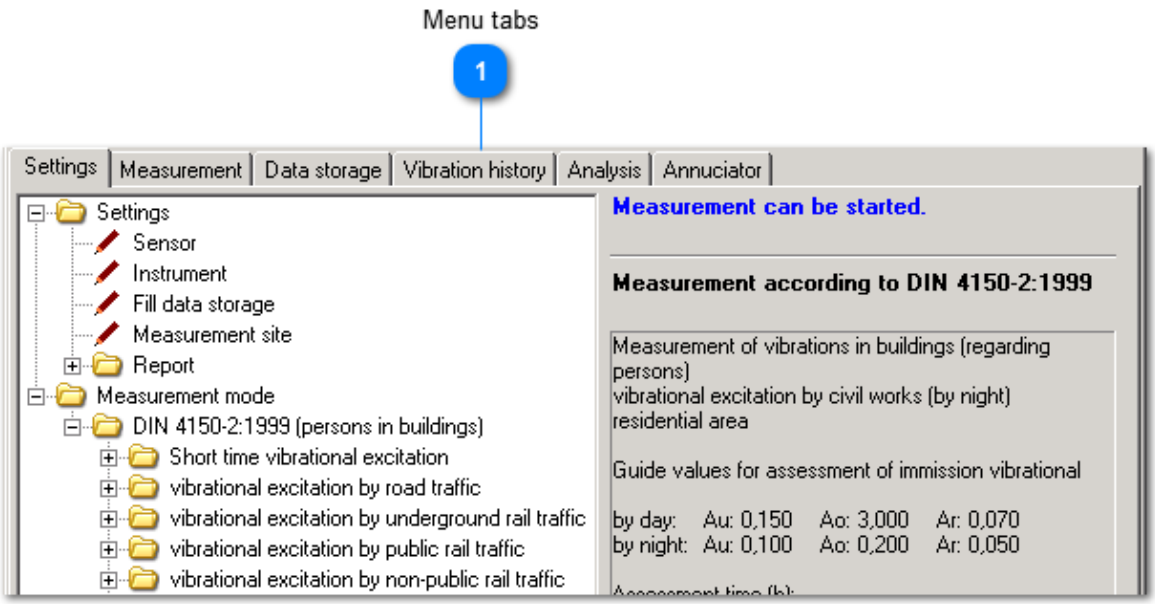
- Construction activities, like impact driving, falling material (e.g. demolition), explosions, pile driving by vibration, compaction and tunnel drilling
- Rail and road traffic, uneven railway tracks and wheels, track switches, uneven pavements etc.
- Operation of machinery, like die cutters, forging presses, forging hammers, reciprocating saws

The InnoMeter 4150-2 covers all fields of application to DIN 4150-2:

- short-time vibration
- vibration by road traffic
- vibration by underground rail traffic
- vibration by public and non-public rail traffic
- vibration by civil works (day and night)
- other vibration sources



Operation panels

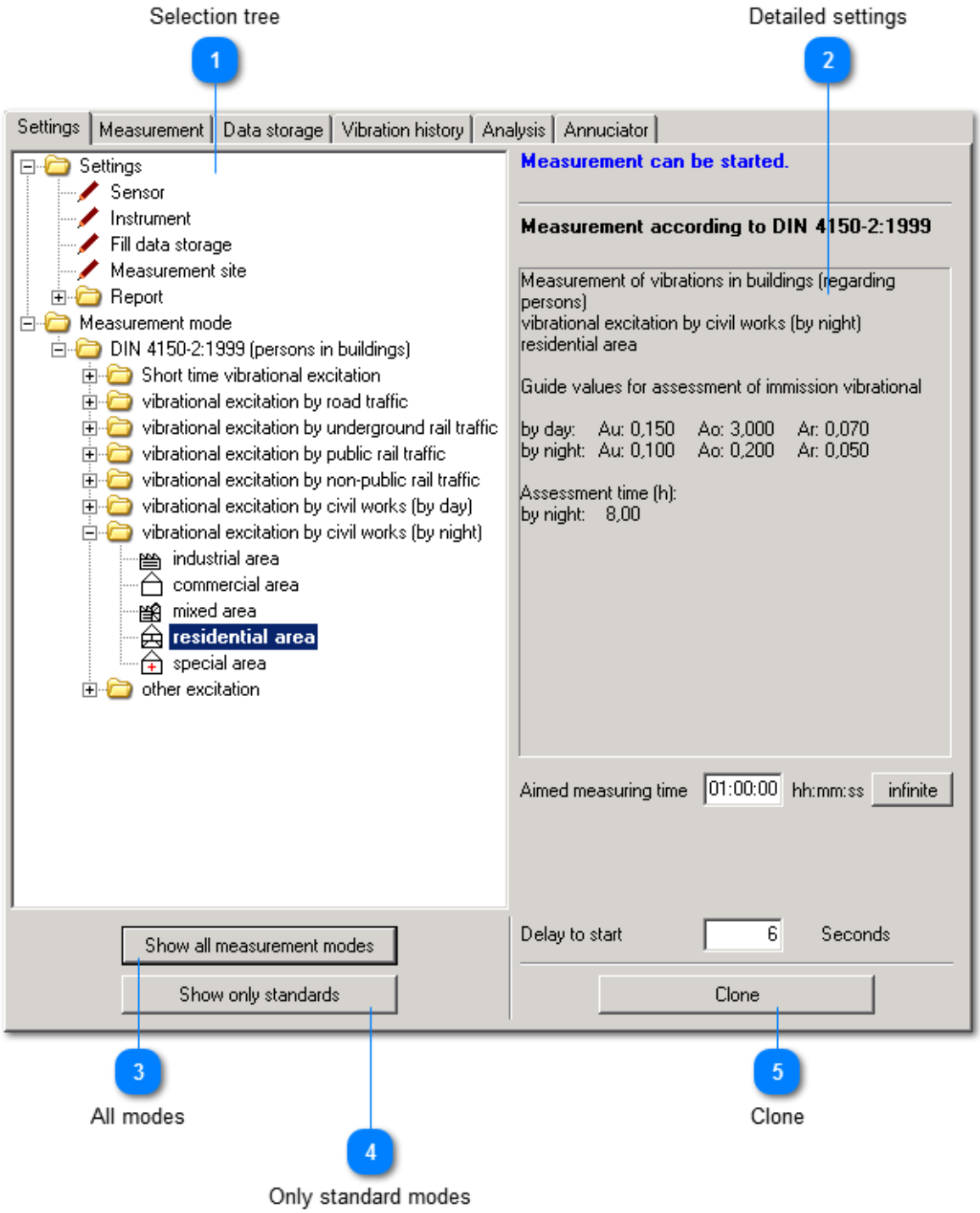


1 Menu tabs

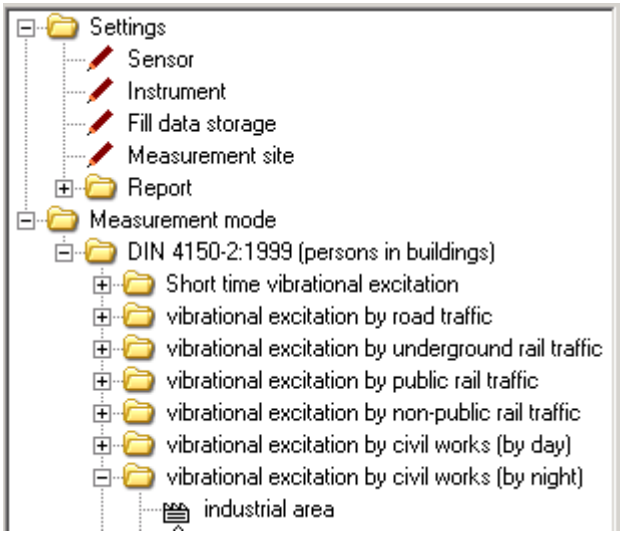
In the InnoMeter 4150-2 you find the following menus:

Settings	Settings for measurement
Measurement	Execution of the measurement with indication of the measured values and colored evaluation
Data storage	Memory for measuring values, evaluation and report generation
Vibration history	Graphical display of the vibration trend
Analysis	Automated analysis of vibration maximum and main frequency
Annunciator	Signaling measured values and states for automated tests

Settings


Selection tree
Detailed settings
1
2
Settings
Measurement
Data storage
Vibration history
Analysis
Annuciator
Settings
Sensor
Instrument
Fill data storage
Measurement site
Report
Measurement mode
DIN 4150-2:1999 (persons in buildings)
Short time vibrational excitation
vibrational excitation by road traffic
vibrational excitation by underground rail traffic
vibrational excitation by public rail traffic
vibrational excitation by non-public rail traffic
vibrational excitation by civil works (by day)
vibrational excitation by civil works (by night)
industrial area
commercial area
mixed area
residential area
special area
other excitation
Measurement can be started.
Measurement according to DIN 4150-2:1999
Measurement of vibrations in buildings (regarding persons)
vibrational excitation by civil works (by night)
residential area
Guide values for assessment of immission vibrational
by day: Au: 0,150 Ao: 3,000 Ar: 0,070
by night: Au: 0,100 Ao: 0,200 Ar: 0,050
Assessment time (h):
by night: 8,00
Aimed measuring time
01:00:00
hh:mm:ss
infinite
Delay to start
6
Seconds
Show all measurement modes
Show only standards
Clone
3
All modes
4
Only standard modes
5
Clone

1 Selection tree

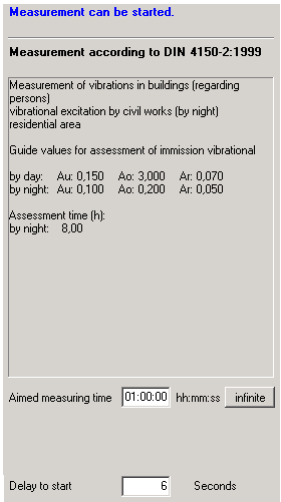


In the selection tree, you find the setting options and measurement modes in a clearly arranged way.
A measurement mode has to be selected before starting a measurement.

Depending on the selected measurement mode or setting option, the detail and configuration area on the right side changes.

By means of the buttons Show all measurement modes and show only standards the selection tree can be closed or opened completely.

2 Detailed settings



The detail and configuration area changes depending on the selection in the selection tree. Here you can configure:

- Sensor
- Data storage
- Measuring location
- Report
- Measuring method

3 All modes

Opens the complete selection tree.

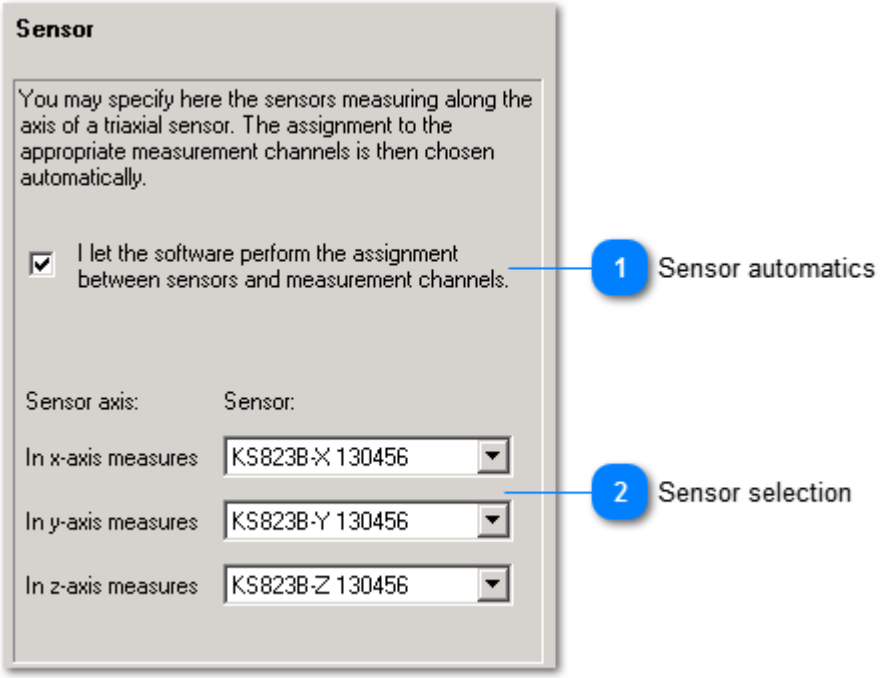
4 Only standard modes

Only shows DIN 4150-2 settings.

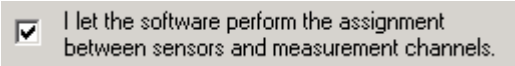
5 Clone

Opens a new window with the same settings which can be modified.

Sensor settings

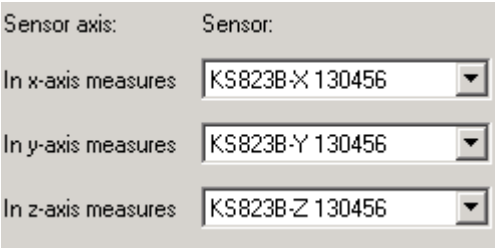


1 Sensor automatics



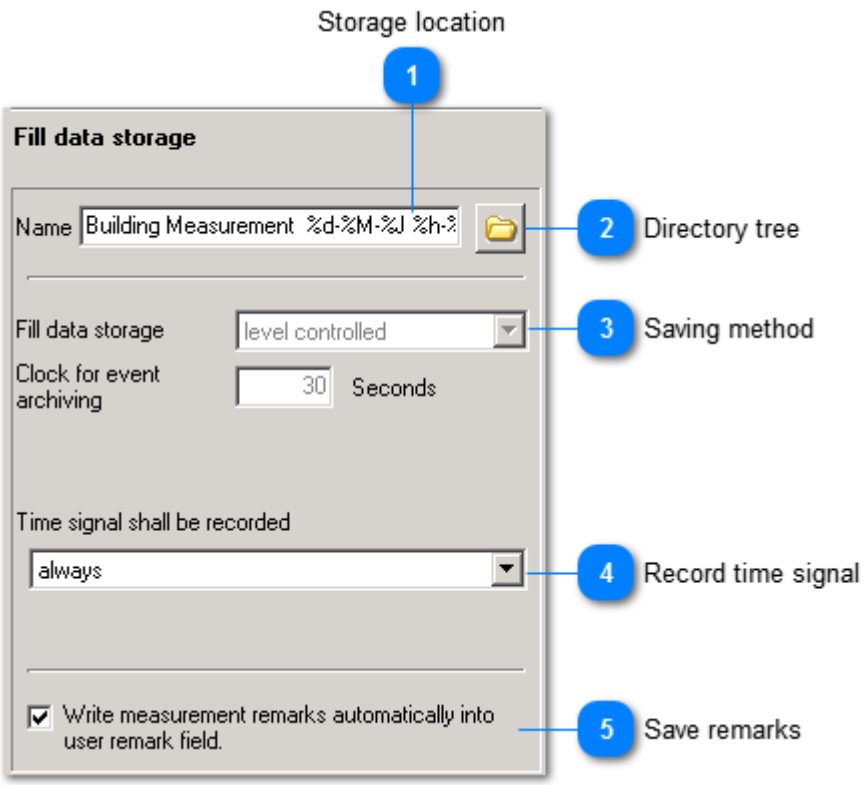
The measurements are carried out in three axes. The direction of the axes plays an important role. If you activate the automatic assignment of axes, the InnoMeter 4150-2 correctly assigns the sensor axes. It also shows the correct sensor positioning in graphical drawings. If you follow these graphical instructions you avoid positioning errors.

2 Sensor selection



To work correctly, the sensor automatic requires assigned sensors. In the drop-down list, you can choose among all sensors from the sensor management.

Data storage settings



1 Storage location

The data storage can be named here. It is saved as a directory. Additional to fixed components, the name of the directory can also contain variable components, the placeholders.

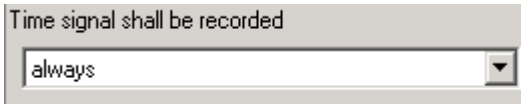
2 Directory tree

This button opens a directory tree.
Data storage is carried out in a directory which contains several files. The target directory can be newly generated in the displayed directory tree.

3 Saving method

DIN 4150-2 demands measurements in intervals of 30 seconds. The menu is locked therefore.

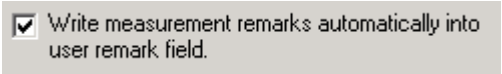
4 Record time signal



For a deeper analysis or for conservation of evidence the InnoMeter 4150-2 can save the signal in time domain.
The following options are available for saving time signals

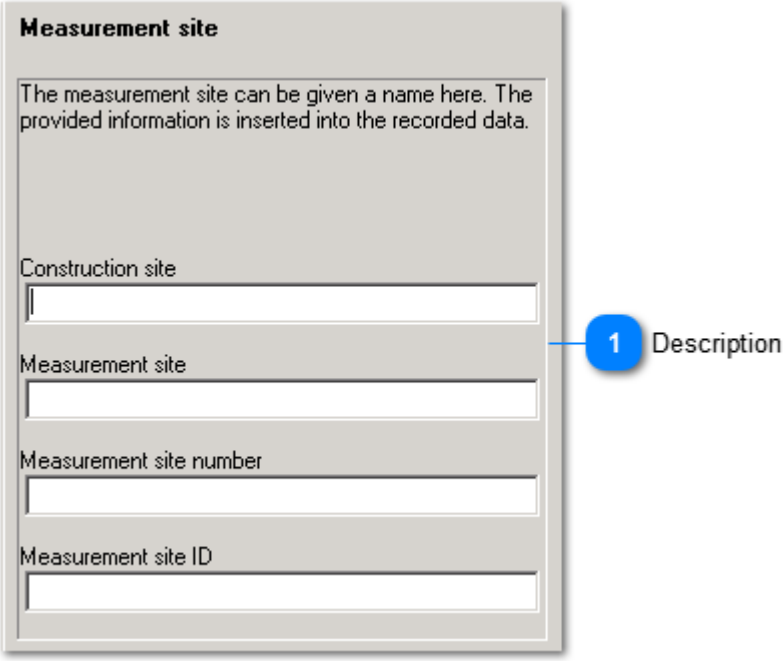
- never
- always

5 Save remarks



The measurement is monitored by the InnoMeter 4150-2.
For instance, it recognizes overload and underload. Such measurement remarks can be automatically taken over into the remark field, which is available for every measurement. The remarks are also taken over when a report is printed. Deselect this option if you do not wish to take over the remarks.

Measurement site

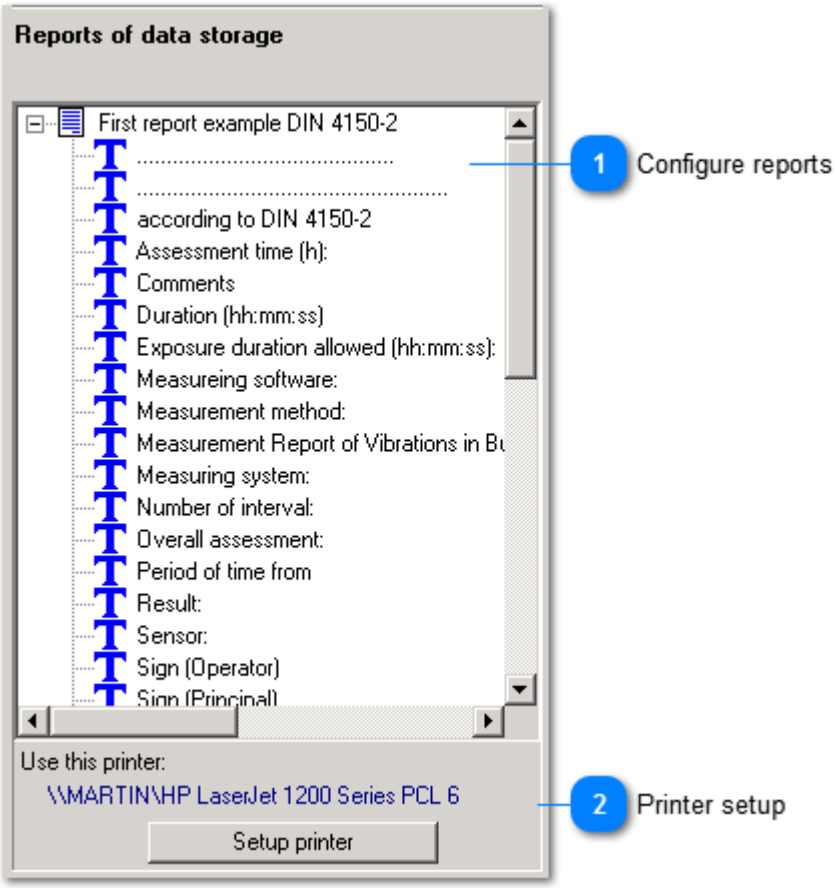


1 Description

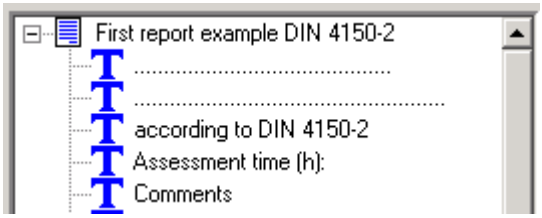
You can enter here a short description of the measuring site. This is not needed for measurement but the data is used in reports.

Report templates

Reports can be printed directly from the InnoMeter 4150-2. Texts, graphical elements (e.g. company logo) and variable components can be combined to one or more report templates, which are saved. For printing, you simply select the configured report template and print it with one mouse click.



1 Configure reports



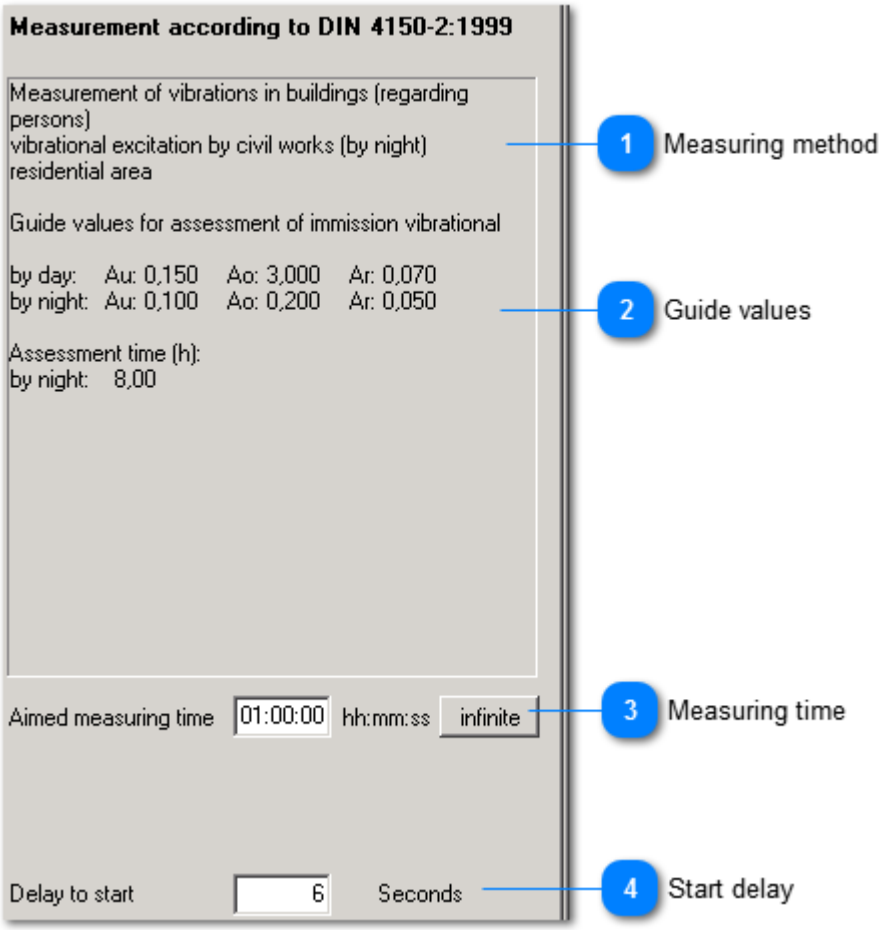
The report templates can be found in this tree structure. One report example is pre-configured. More templates can be configured or loaded.

2 Printer setup

This button opens a dialog for printer selection and configuration.

Measurement mode

On the left side of this window you find a selection tree with the different measuring modes. The right section shows some detailed settings.



1 Measuring method

Measurement of vibrations in buildings (regarding persons)
vibrational excitation by civil works (by night)
residential area

Shows the selected mode.

2 Guide values

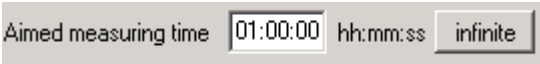
Guide values for assessment of immission vibrational

by day: Au: 0,150 Ao: 3,000 Ar: 0,070
by night: Au: 0,100 Ao: 0,200 Ar: 0,050

Assessment time (h):
by night: 8,00

These are the limit values to DIN 4150-2 for the selected mode.

3 Measuring time



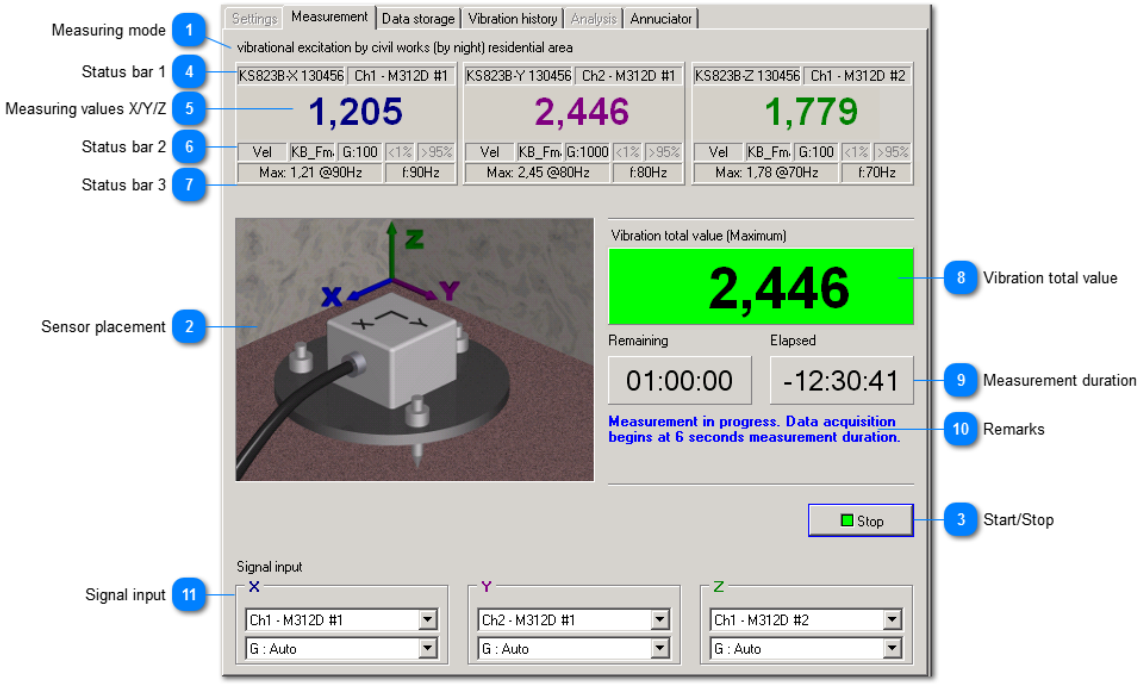
The measuring time can be limited to switch off the instrument automatically after measurement.

4 Start delay

The time delay between pressing Start and the beginning of the actual measurement can be used to suppress signal settling effects.

Measurement

While measuring, the InnoMeter 4150-2 displays the vibration total value and a colored assessment.

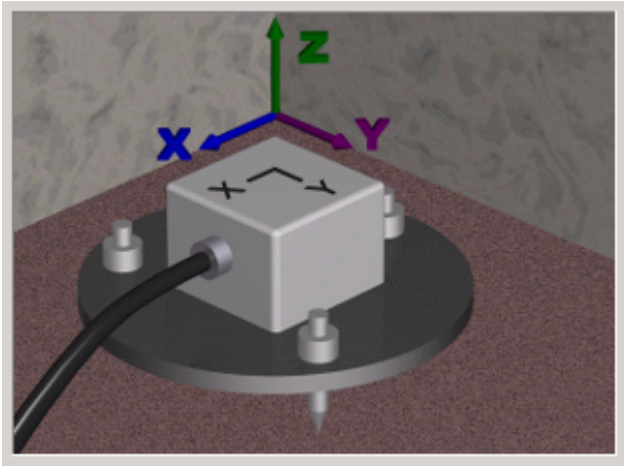


1 Measuring mode

vibrational excitation by civil works (by night) residential area

The selected mode is shown here.

2 Sensor placement



The X and Y axes should be oriented along the walls of the building. Adjust the Z axis vertically using the level and the adjustable feet.

3 Start/Stop

Stop

Starts and stops measurement. Starting is only possible when all settings in Measurement mode menu have been completed.

4 Status bar 1

Shows sensor and measuring channel.

5 Measuring values X/Y/Z

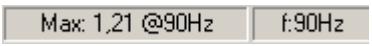
Shows the vibration value KB_Fmax for each axis.

6 Status bar 2

Shows for each direction:

- Measurand
- Characteristic
- Gain
- Low level
- Overload

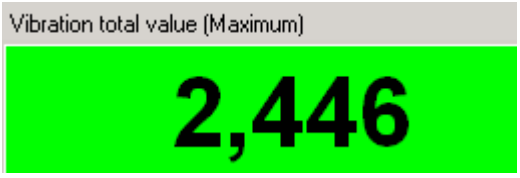
7 Status bar 3



Shows for each direction:

- the most critical value at the frequency with the highest magnitude
- the frequency with the highest magnitude

8 Vibration total value

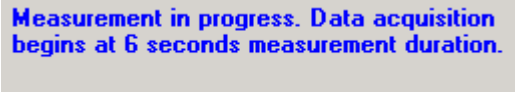


This is the maximum value of the three axes.

9 Measurement duration

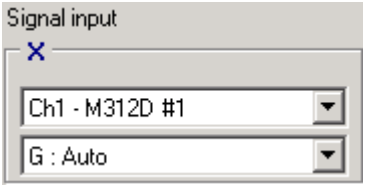
Remaining and elapsed measurement time are displayed. The elapsed measurement duration counts with minus sign from start delay to 00:00:00. Afterwards, the elapsed measurement duration counts up to the aimed measuring time. The measurement is stopped when it reaches the aimed measuring time.
For infinite measurement there is no display of remaining time.

10 Remarks



Shows the current status of measurement.

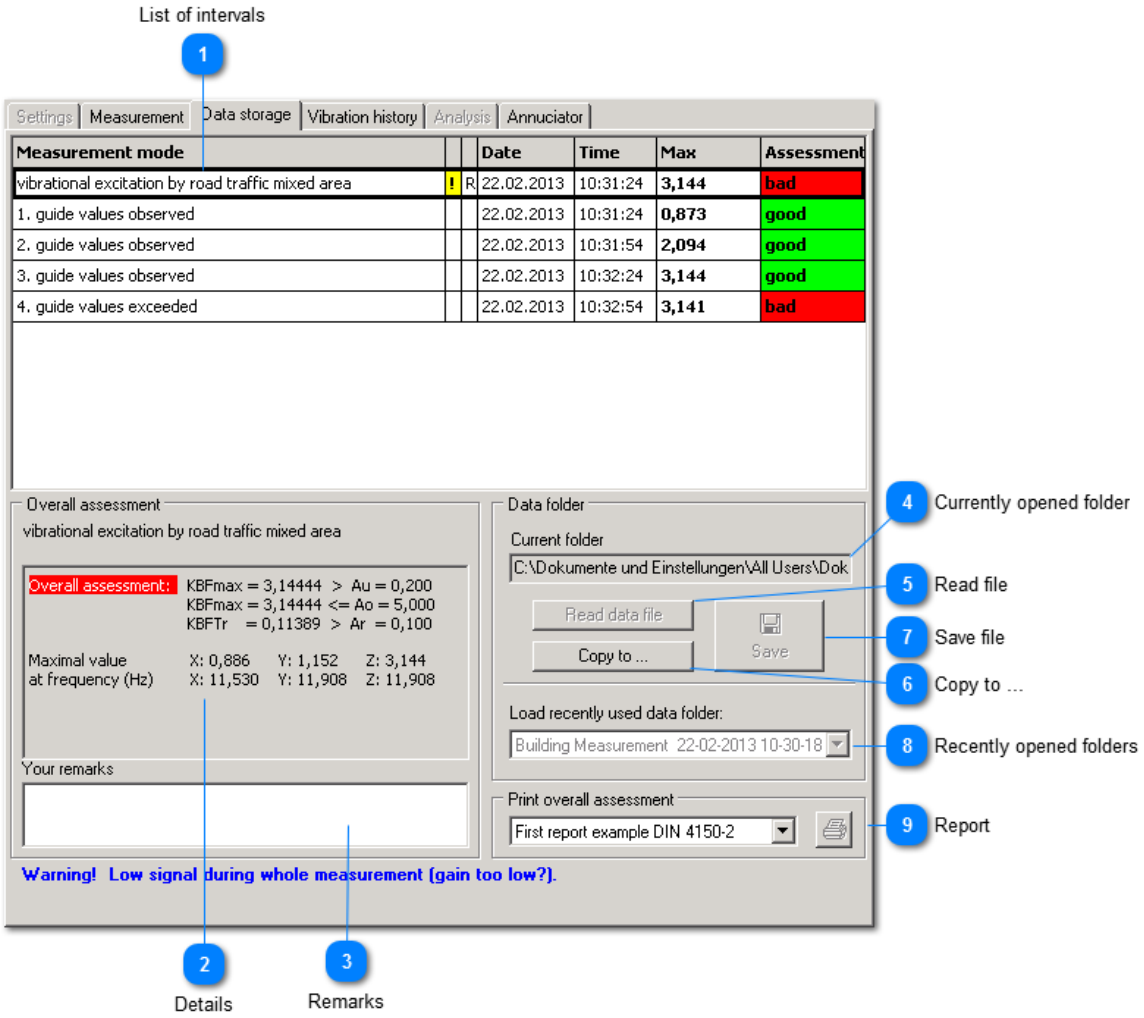
11 Signal input



At the signal input, you select the measuring channel and configure the measuring range. If you activated the sensor automatics the InnoMeter 4150-2 selects the measuring channel automatically.

Data storage

Data is stored in the memory in time intervals.

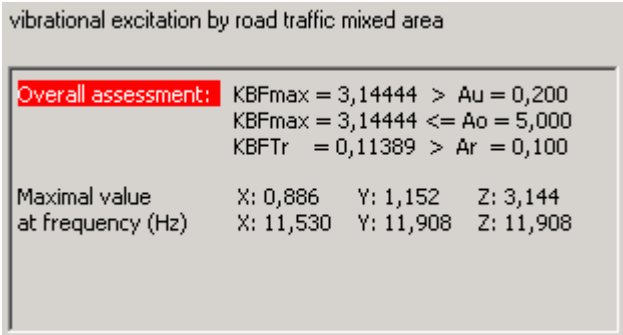


1 List of intervals

Measurement mode			Date	Time	Max	Assessment
vibrational excitation by road traffic mixed area	!	R	22.02.2013	10:31:24	**3,144**	**bad**
1. guide values observed			22.02.2013	10:31:24	**0,873**	**good**
2. guide values observed			22.02.2013	10:31:54	**2,094**	**good**
3. guide values observed			22.02.2013	10:32:24	**3,144**	**good**
4. guide values exceeded			22.02.2013	10:32:54	**3,141**	**bad**

This section shows the record intervals including time, date and maximum value. An exclamation mark indicates possible conflicts.
The first line gives an evaluation summary including the highest measuring value.

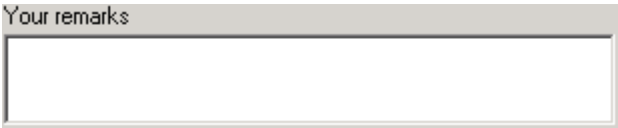
2 **Details**



Here you see for the marked event:

- Guide value for each axis
- Measuring value for each axis
- Main frequency for each axis

3 **Remarks**



You can enter comments here for each event.

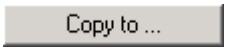
4 **Currently opened folder**

This field shows which data folder is currently open.

5 **Read file**

This button opens a directory tree from which you can select the measurement folder.

6 **Copy to ...**

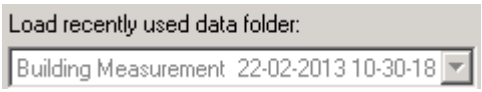


This button saves the current data storage on a data medium. You can enter a new name for the measurement folder.

7 **Save file**

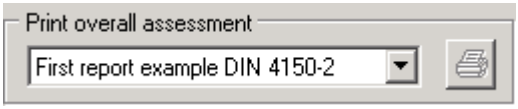
This button saves the current data storage on a data medium.

8 **Recently opened folders**



This drop-down list shows the currently used data folders. By clicking on an entry, the respective data folder is opened.

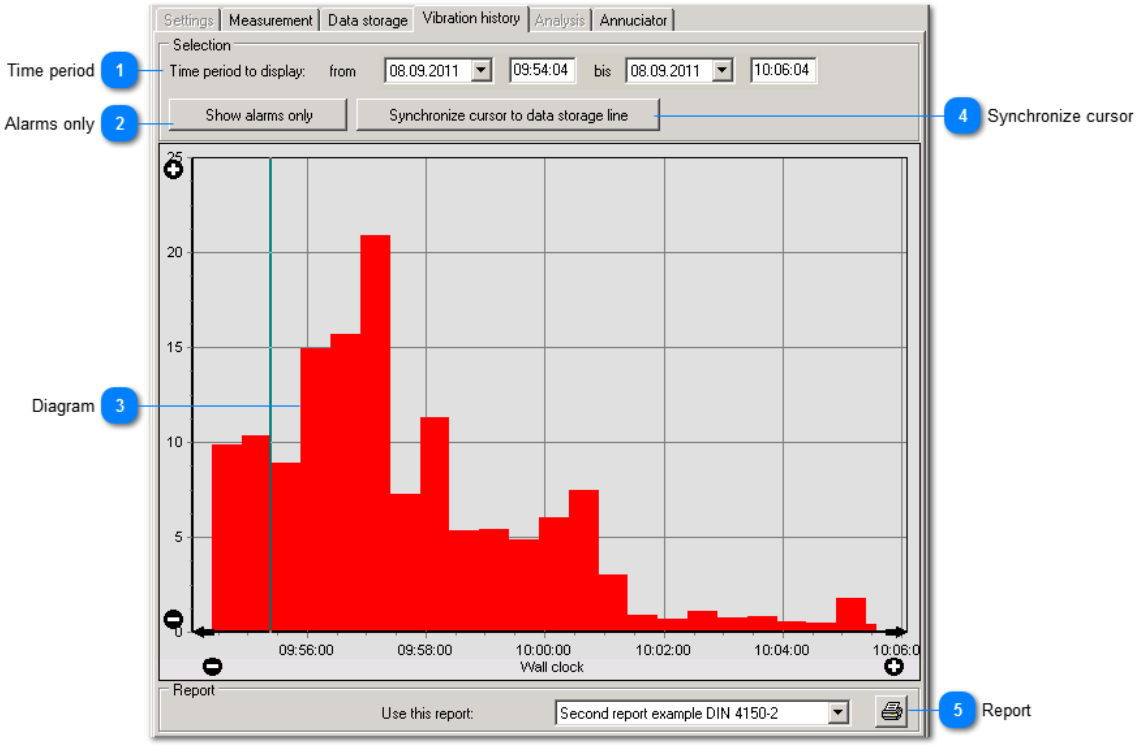
9 **Report**



Allows the selection of a report template and the printing of the selected measurement.

Vibration history

This diagram shows the maximum values over the measuring time. There are zooming and report printing functions.

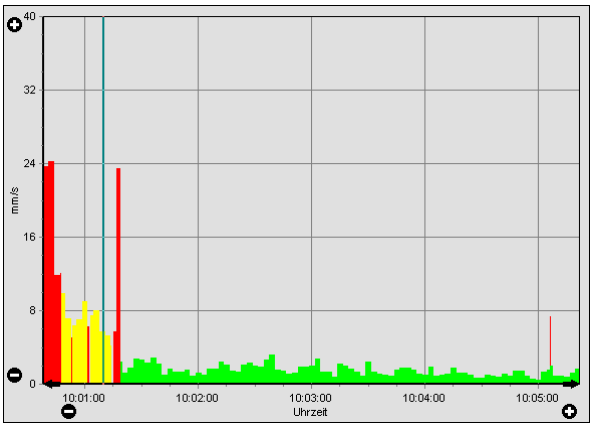


1 Time period

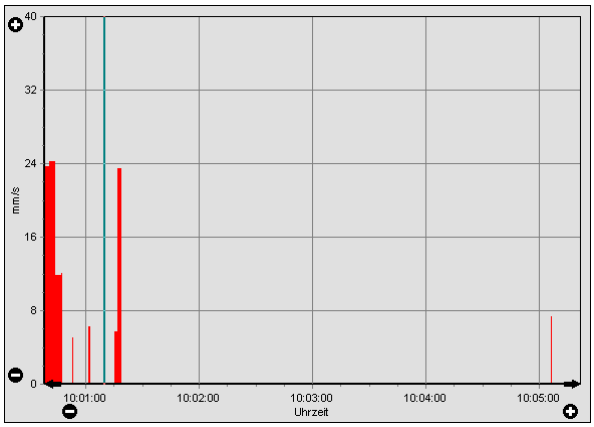
Choose the time period to be displayed.

2 Alarms only

Only events exceeding guide values (alarms) are displayed.

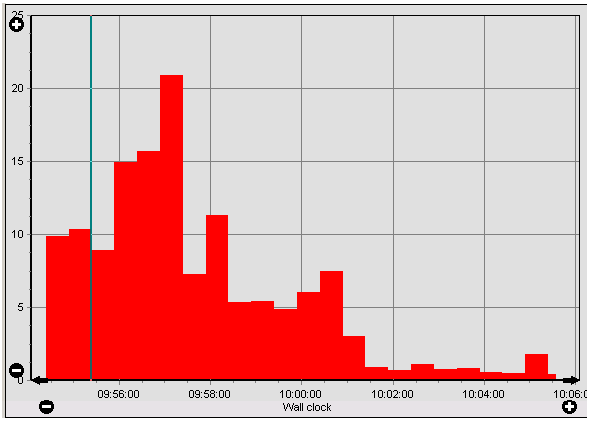


All events



Only alarm events

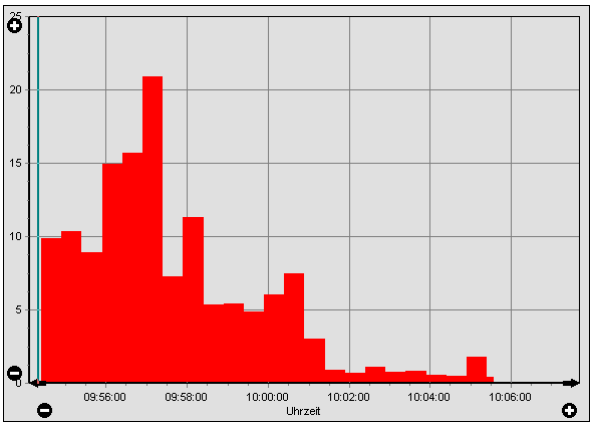
3 Diagram



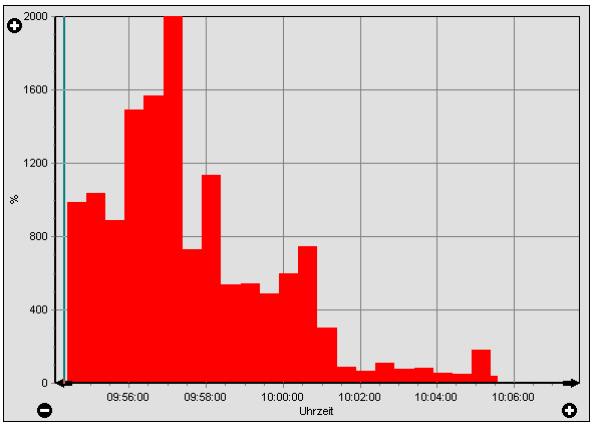
The diagram shows the maximum vibration magnitudes versus time with their color depending on the alarm / warning limits.

Scaling the vertical axis

You may compress and expand the vertical axis by clicking the symbols ⊕ and ⊖. Double left click at the vertical axis scales it automatically so that the maximum value can be displayed.
Right click at the vertical axis switches the unit between mm/s and percent of the guide value.



Display in mm/s



Display in %

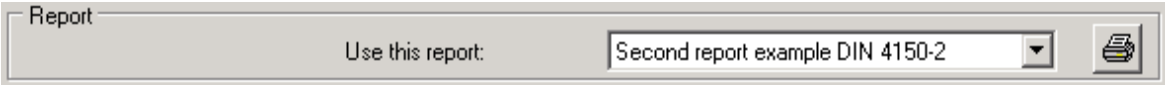
Scaling the time axis

You may shift and zoom the graphics in time direction by the mouse with pressed left or right button. The time axis can be compressed and expanded by clicking the symbols ⊕ and ⊖.

4 Synchronize cursor

This enables a cursor which synchronizes the time in the diagram with the belonging entry in the data storage. In the same way you may mark an event in the data storage and the cursor will move to the respective position.

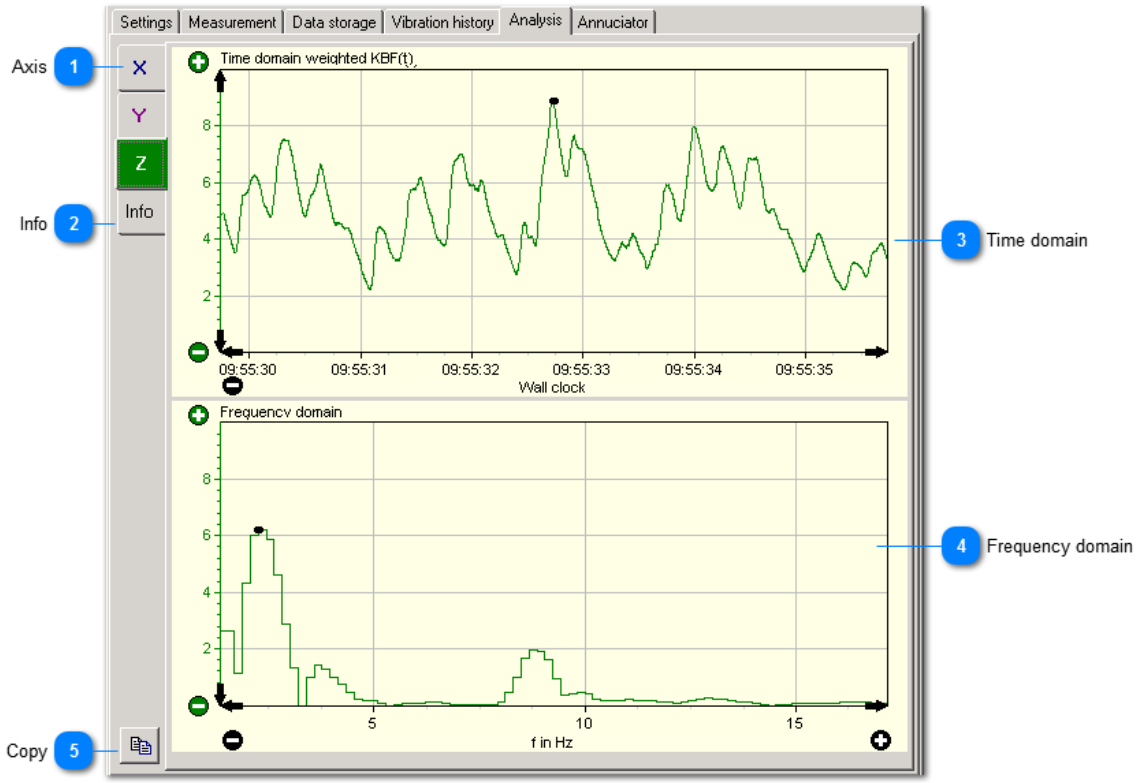
5 Report



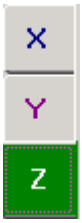
Allows the selection of a report template and the printing of the selected measurement.

Analysis

If you select an event in the data storage the InnoMeter 4150-2 Pro can perform an analysis provided that time signal recording was enabled.



1 Axis

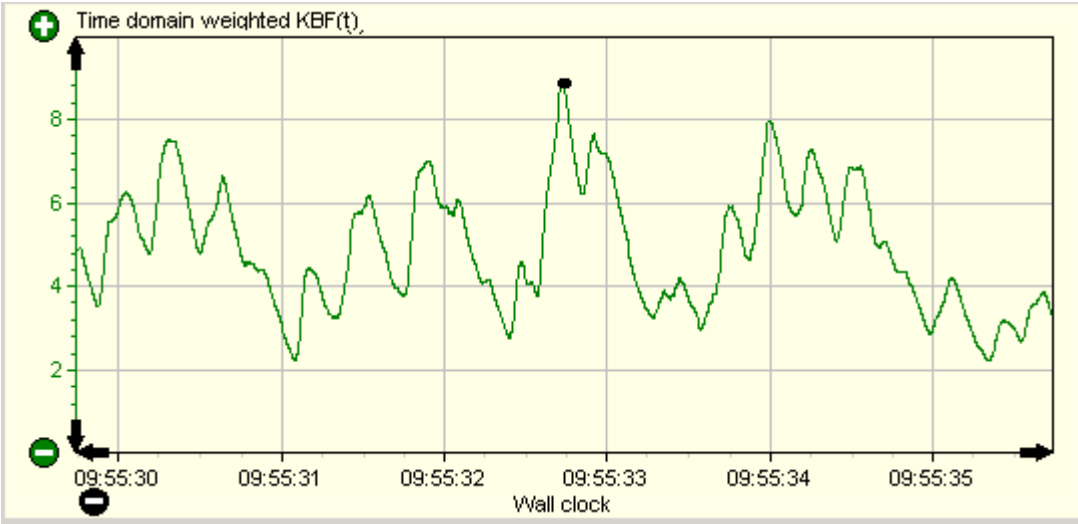


There is an analysis for each axis direction. The first shown analysis always belongs to the direction with the most critical magnitude.

2 Info

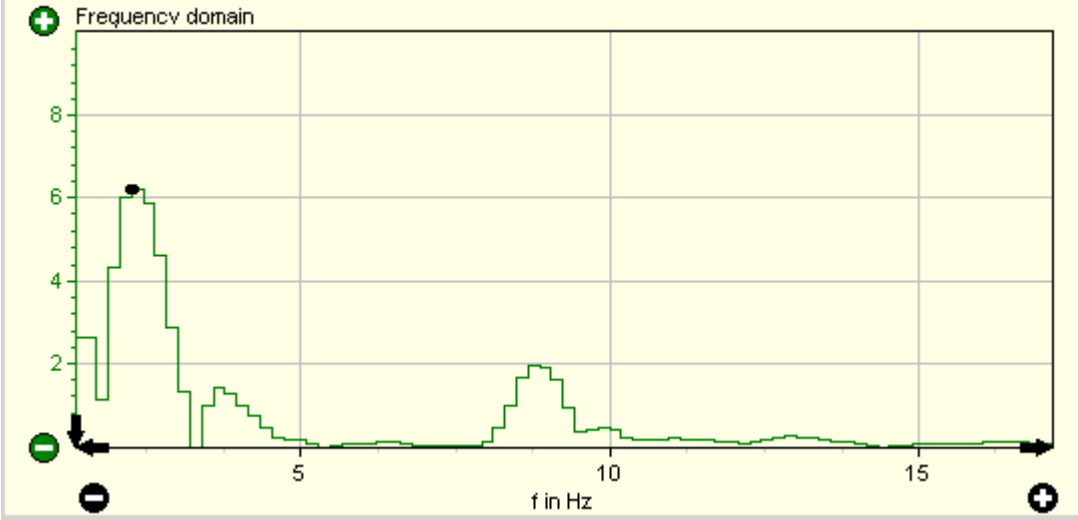
Information concerning the file location.

3 Time domain



Band filtered weighted vibration velocity KBF(t) in time domain. The peak magnitude is marked.

4 Frequency domain



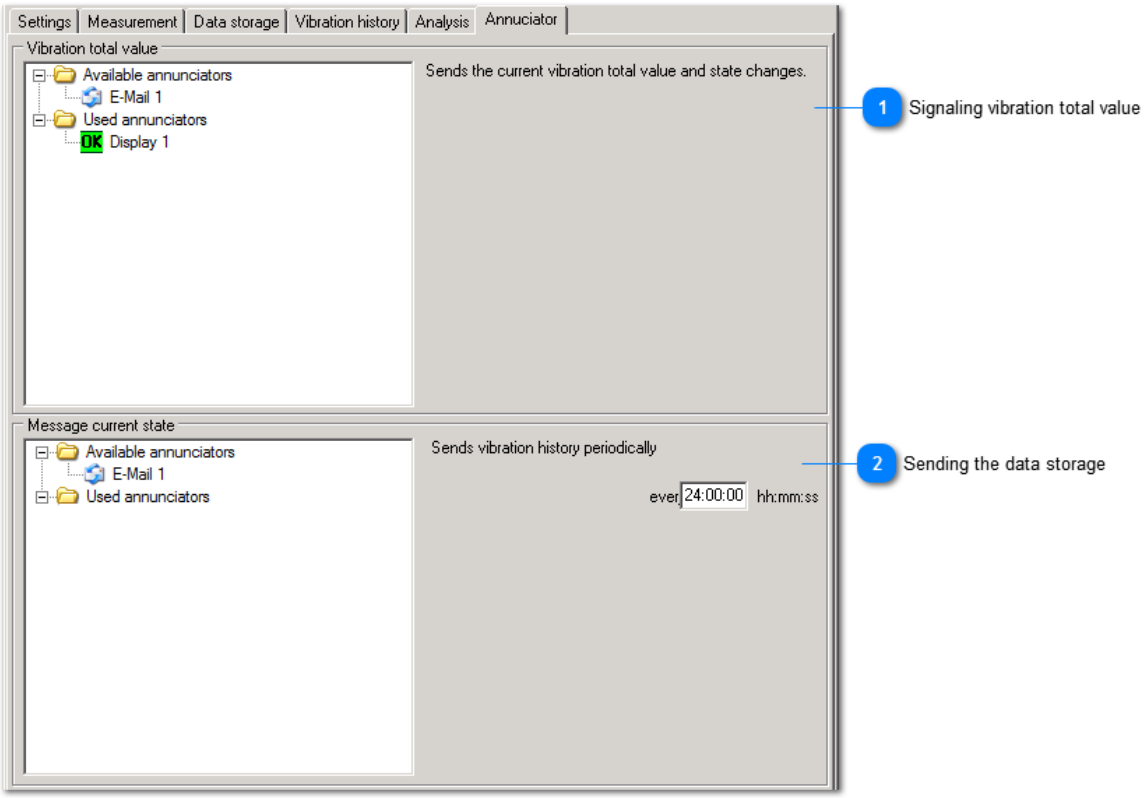
Band filtered weighted vibration velocity KBF(t) in frequency domain. The peak magnitude is marked.

5 Copy

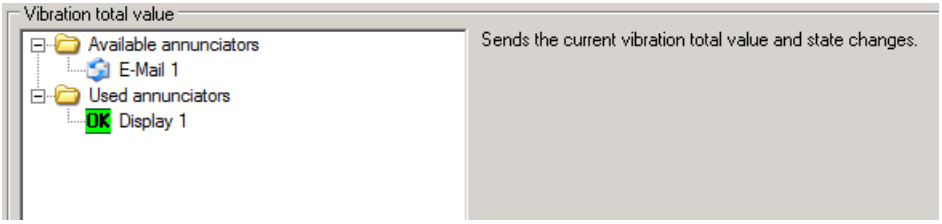
Copies the analysis data to the clipboard for use in reports.

Annunciators for events and data transmission in regular intervals

VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred. Annunciators can be useful for unattended long term measurements. The InnoMeter 4150-2 can send you an e-mail, for example, if a guide value was exceeded.

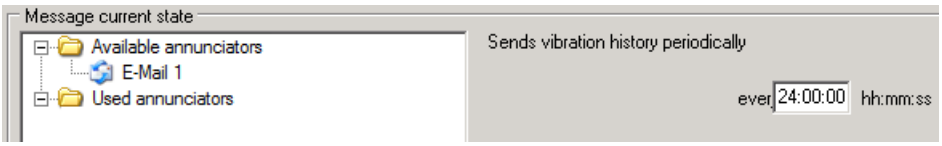


1 Signaling vibration total value



The vibration total value can be signaled by all types of annunciators. For example, the radio-controlled outlet can switch an alarm light on if a guide value was exceeded. This may inform construction workers about the potential risk of their activities.
You may also configure the e-mail annunciator to send you a message each time an alarm was tripped.

2 Sending the data storage



To observe the measured data from a remote location the InnoMeter 4150-2 can also send the contents of its data storage periodically by e-mail.

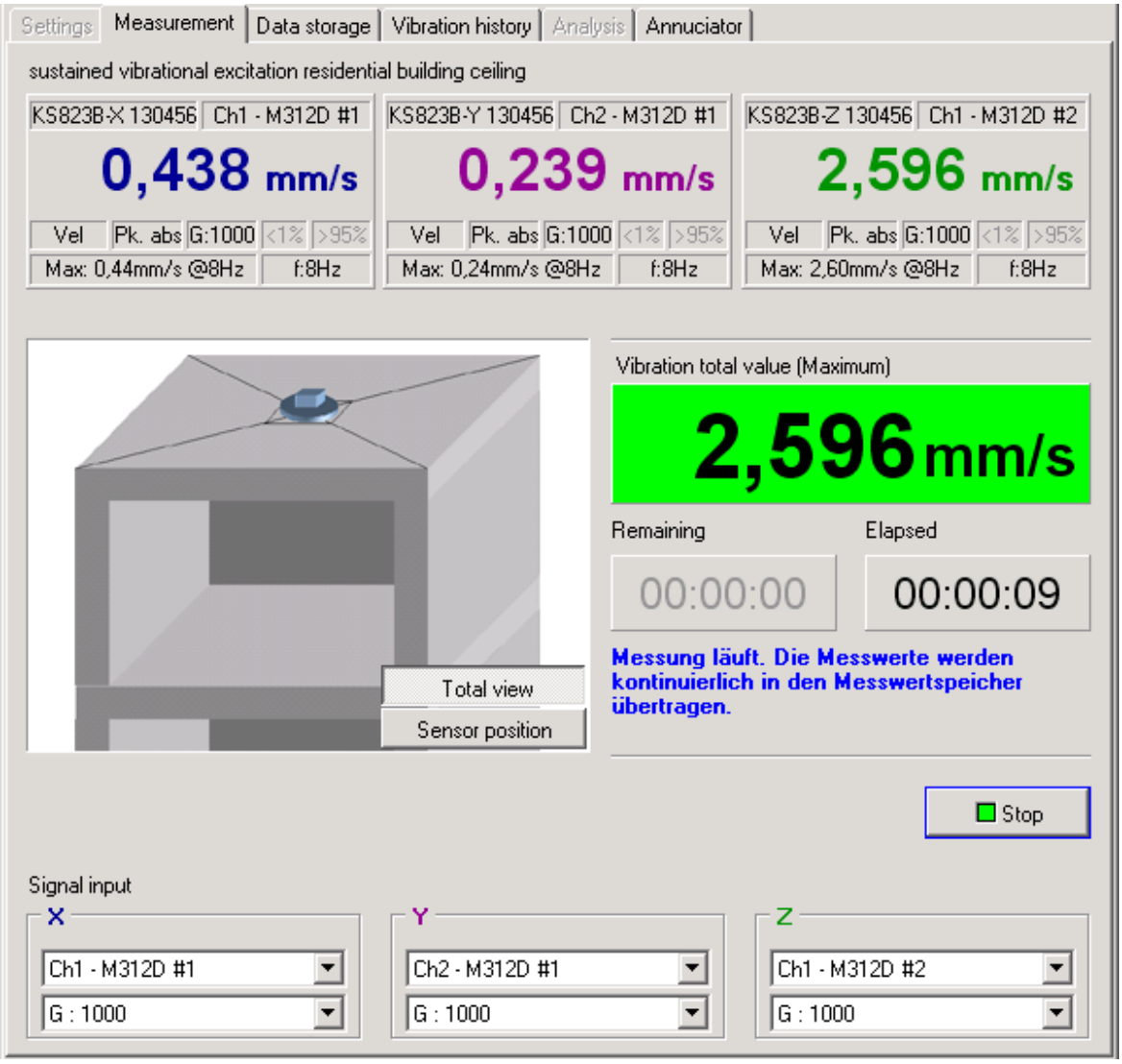
InnoMeter® 4150-3 (Pro)

Structural Vibration

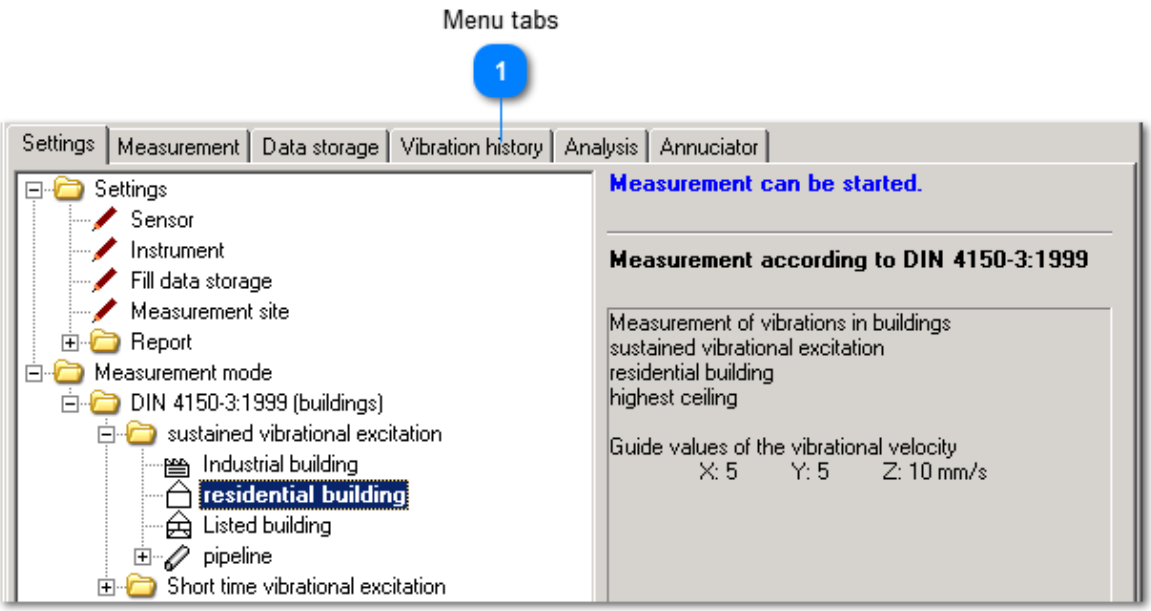
Vibrations in buildings can be caused by

- Construction activities, like impact driving, falling material (e.g. demolition), explosions, pile driving by vibration, compaction and tunnel drilling
- Rail and road traffic, uneven railway tracks and wheels, track switches, uneven pavements etc.
- Operation of machinery, like die cutters, forging presses, forging hammers, reciprocating saws

The InnoMeter 4150-3 measures to DIN 4150-3. This standard considers both sustained and short-time vibration.



Operation panels

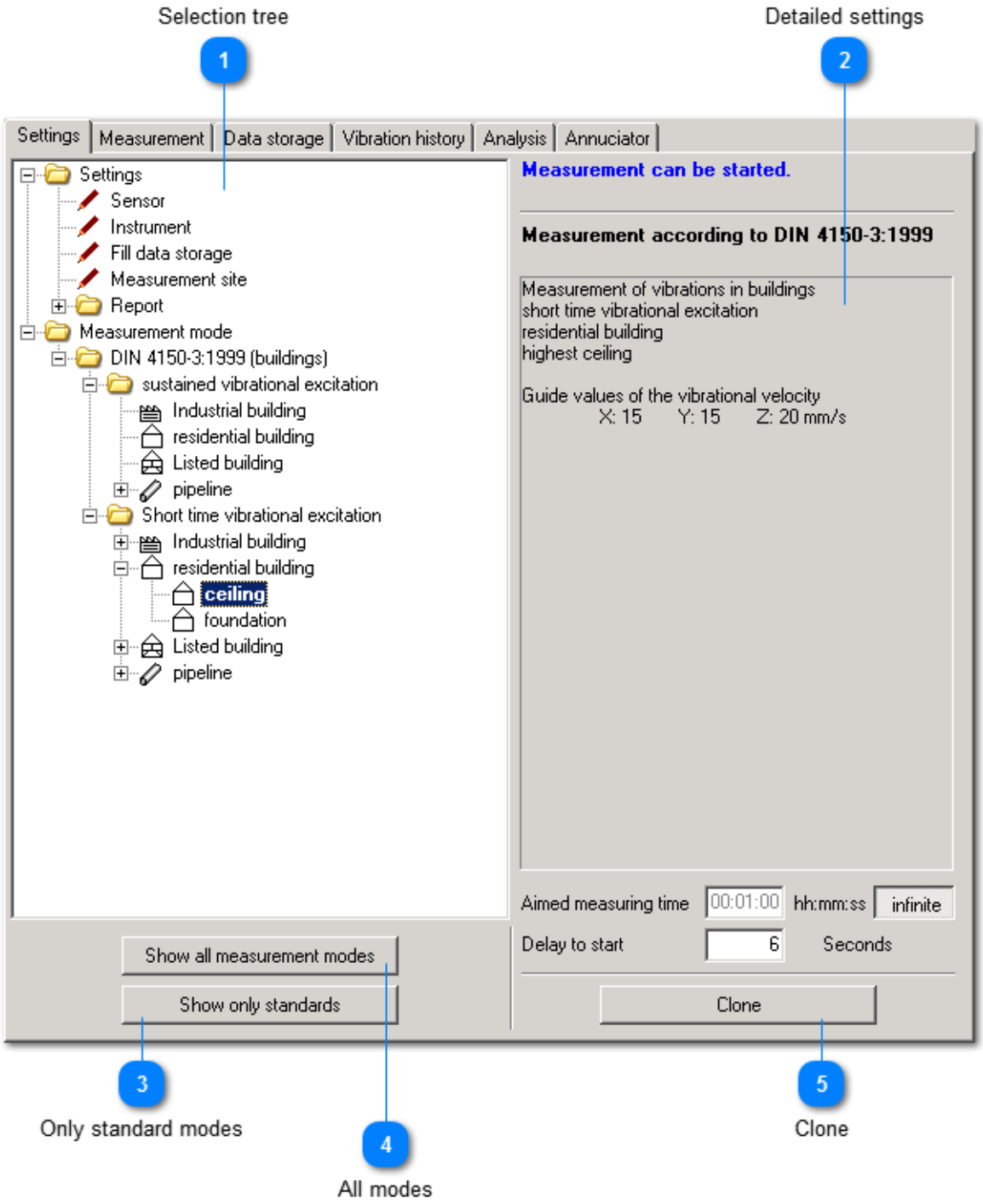


1 Menu tabs

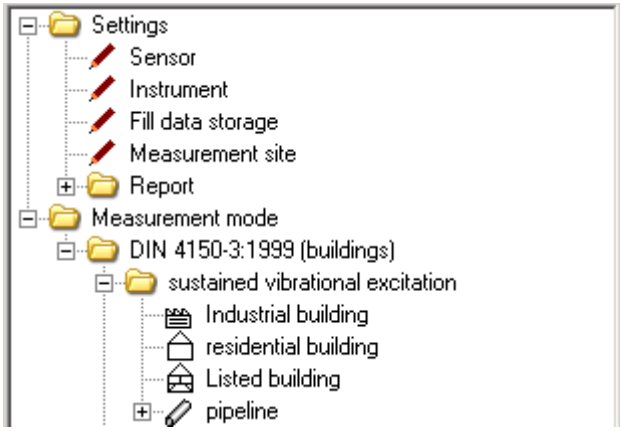
In the InnoMeter 4150-3 you find the following menus:

Settings	Settings for measurement
Measurement	Execution of the measurement with indication of the measured values and colored evaluation
Data storage	Memory for measuring values, evaluation and report generation
Vibration history	Graphical display of the vibration trend
Analysis	Automated analysis of vibration maximum and main frequency
Annunciator	Signaling measured values and states for automated tests

Settings


Selection tree
Detailed settings
1
2
Settings
Measurement
Data storage
Vibration history
Analysis
Annuciator
Settings
Sensor
Instrument
Fill data storage
Measurement site
Report
Measurement mode
DIN 4150-3:1999 (buildings)
sustained vibrational excitation
Industrial building
residential building
Listed building
pipeline
Short time vibrational excitation
Industrial building
residential building
ceiling
foundation
Listed building
pipeline
Measurement can be started.
Measurement according to DIN 4150-3:1999
Measurement of vibrations in buildings
short time vibrational excitation
residential building
highest ceiling
Guide values of the vibrational velocity
X: 15 Y: 15 Z: 20 mm/s
Aimed measuring time
00:01:00
hh:mm:ss
infinite
Delay to start
6
Seconds
Show all measurement modes
Show only standards
Clone
3
Only standard modes
4
All modes
5
Clone

1 Selection tree

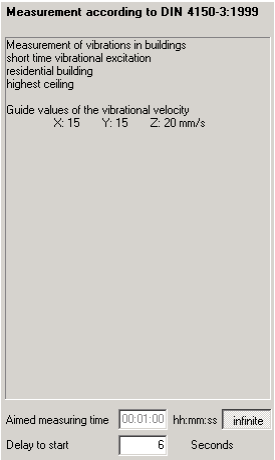


In the selection tree, you find the setting options and measurement modes in a clearly arranged way.
A measurement mode has to be selected before starting a measurement.

Depending on the selected measurement mode or setting option, the detail and configuration area on the right side changes.

By means of the buttons Show all measurement modes and Show only standards the selection tree can be closed or opened completely.

2 Detailed settings



The detail and configuration area changes depending on the selection in the selection tree. Here you can configure:

- Sensor
- Instrument type
- Data storage
- Measuring location
- Reports
- Measuring method

3 Only standard modes

Only shows DIN 4150-3 settings.

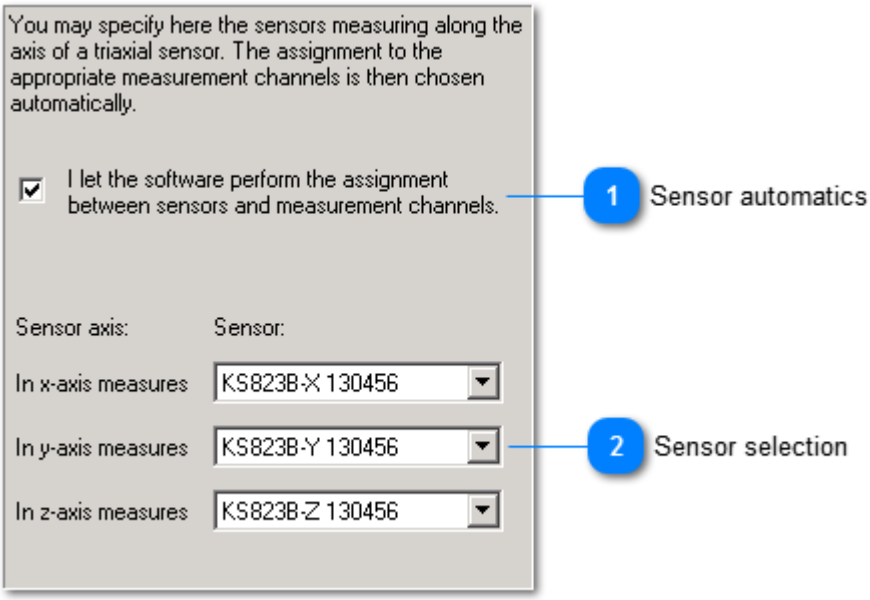
4 All modes

Opens the complete selection tree.

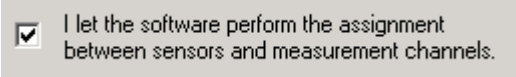
5 Clone

Opens a new window with the same settings which can be modified.

Sensor settings

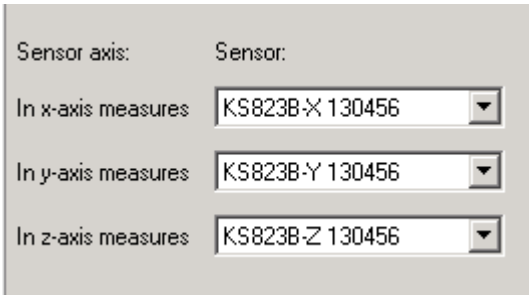


1 Sensor automatics



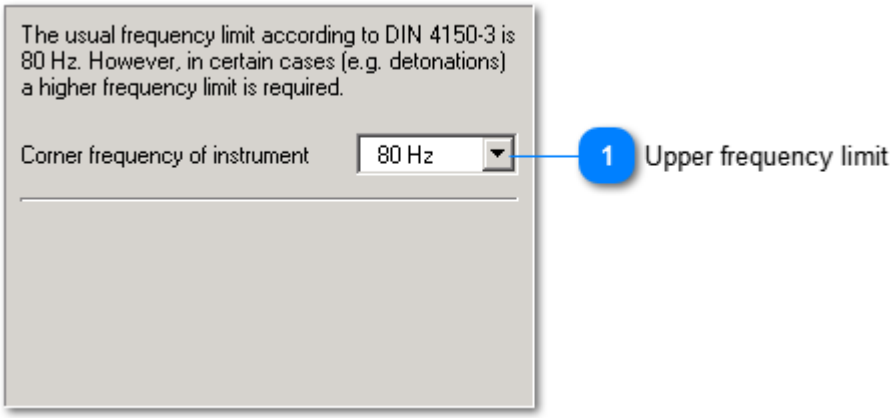
The measurements are carried out in three axes. The direction of the axes plays an important role. If you activate the automatic assignment of axes, the InnoMeter 4150-3 correctly assigns the sensor axes. It also shows the correct sensor positioning in graphical drawings. If you follow these graphical instructions you avoid positioning errors.

2 Sensor selection



To work correctly, the sensor automatic requires assigned sensors. In the drop-down list, you can choose among all sensors from the sensor management.

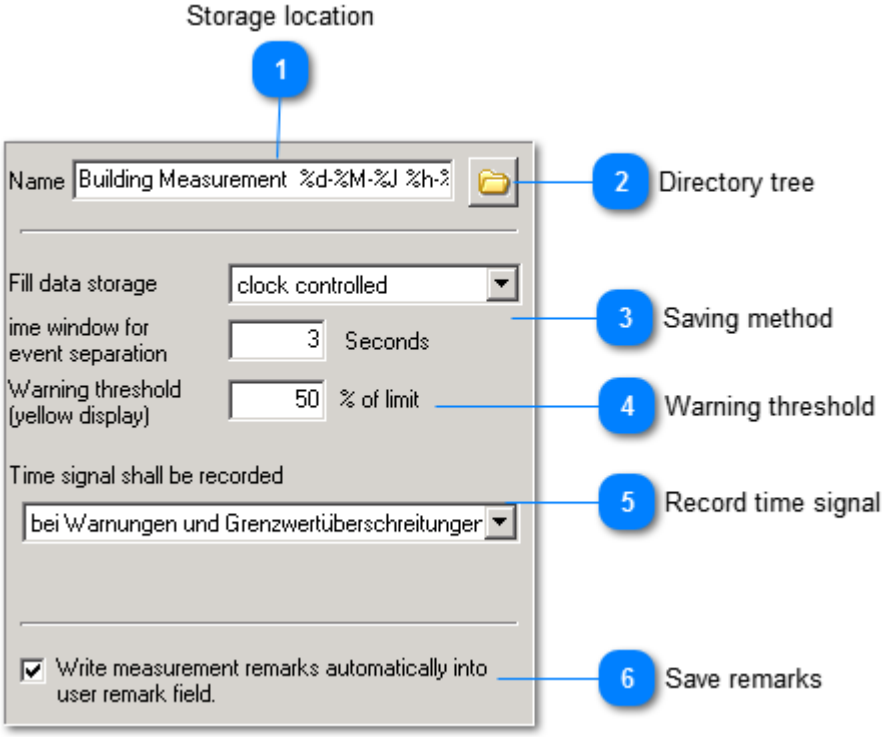
Instrument type



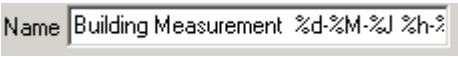
1 Upper frequency limit

DIN 4150-3 normally observes frequencies up to 80 Hz. In special cases, like for explosions, an extended frequency range up to 315 Hz may be necessary.

Data storage settings



1 Storage location



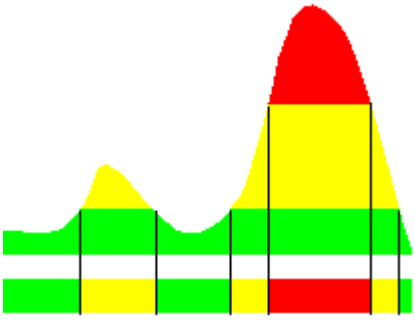
The data storage can be named here. It is saved as a directory. Additional to fixed components, the name of the directory can also contain variable components, the placeholders.

2 Directory tree

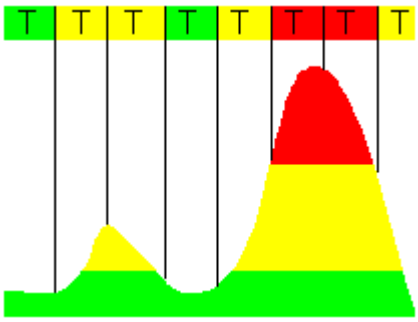
This button opens a directory tree.
Data storage is carried out in a directory which contains several files. The target directory can be newly generated in the displayed directory tree.

3 Saving method

The InnoMeter 4150-3 will typically be used for long term monitoring. It will store a list of measuring intervals. Each of these interval is evaluated for warning or alarm events.



Level-controlled data storage will save records with variable length. A new record will only be saved if the evaluation result has changed. This method is practical and memory saving because it saves quick changes in short intervals whereas just one record is saved for long intervals when there is no change. The duration of each event is also recorded.
The time window for event separation defines how long a certain alarm event must persist to become a separate record.



Clock-controlled data storage saves records of constant length.
Each record is evaluated. The time resolution only depends on the entered clock rate. Long intervals without change will produce large amounts of data without additional information.

Example for two periods of time:

1. Alarm level exceeded for 5 seconds
2. No alarm event for 1 hour

- Level-controlled recording with 3 seconds event separation will save two records:
  1. Alarm condition for 5 seconds
  2. No alarm condition for 1 hour
- Clock-controlled recording with 60 seconds clock will save 61 records:
  1. 1 record of 60 seconds with alarm event
  2. 60 records of 60 seconds each without event

4 Warning threshold

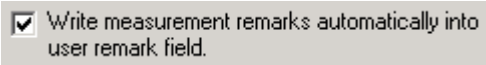
DIN 4150-3 only defines two conditions: alarm or good. The InnoMeter 4150-3 features an additional threshold for warnings at a certain percentage of the alarm level.

5 Record time signal

For a deeper analysis or for conservation of evidence the InnoMeter 4150-3 can save the signal in time domain.
The following options are available for saving time signals

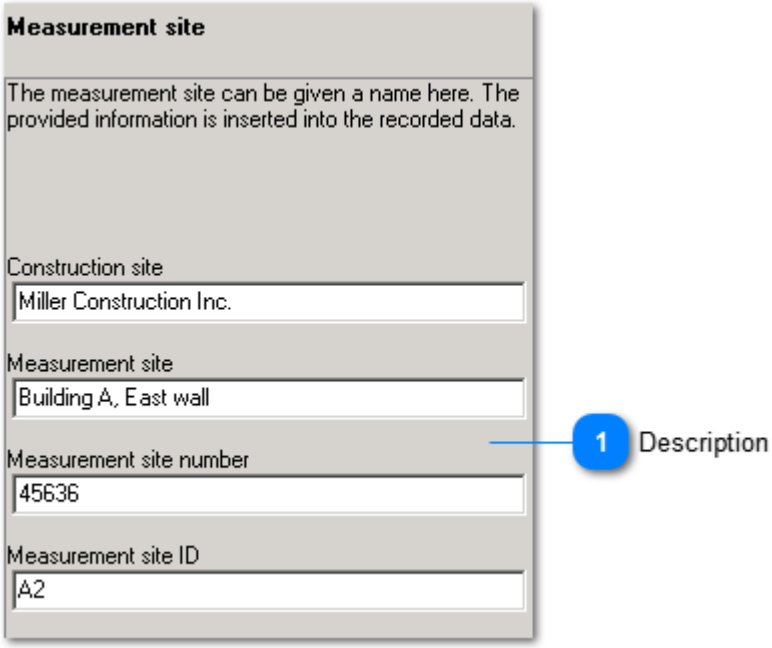
- never
- only at alarm events
- at alarm and warning events

6 Save remarks



The measurement is monitored by the InnoMeter 4150-3.
For instance, it recognizes overload and underload. Such measurement remarks can be automatically taken over into the remark field, which is available for every measurement. The remarks are also taken over when a report is printed. Deselect this option if you do not wish to take over the remarks.

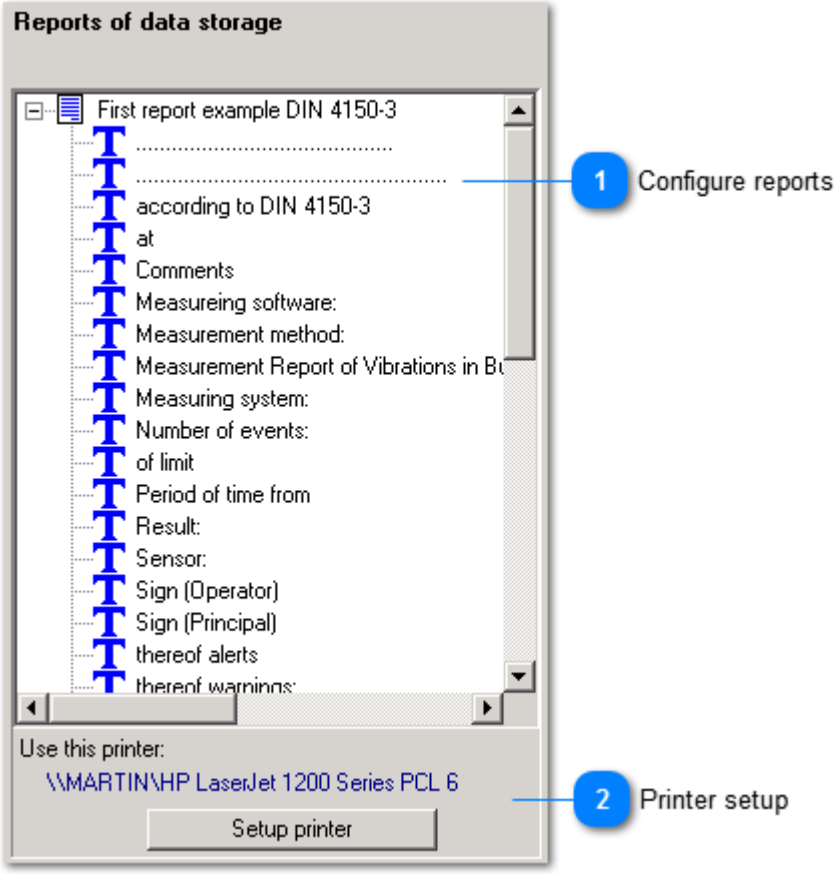
Measurement site



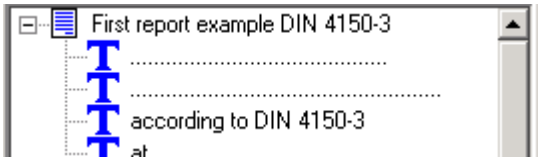
1 **Description**
You can enter here a short description of the measuring site. This is not needed for measurement but the data is used in reports.

Report templates

Reports can be printed directly from the InnoMeter 4150-3. Texts, graphical elements (e.g. company logo) and variable components can be combined to one or more report templates, which are saved. For printing, you simply select the configured report template and print it with one mouse click.



1 Configure reports



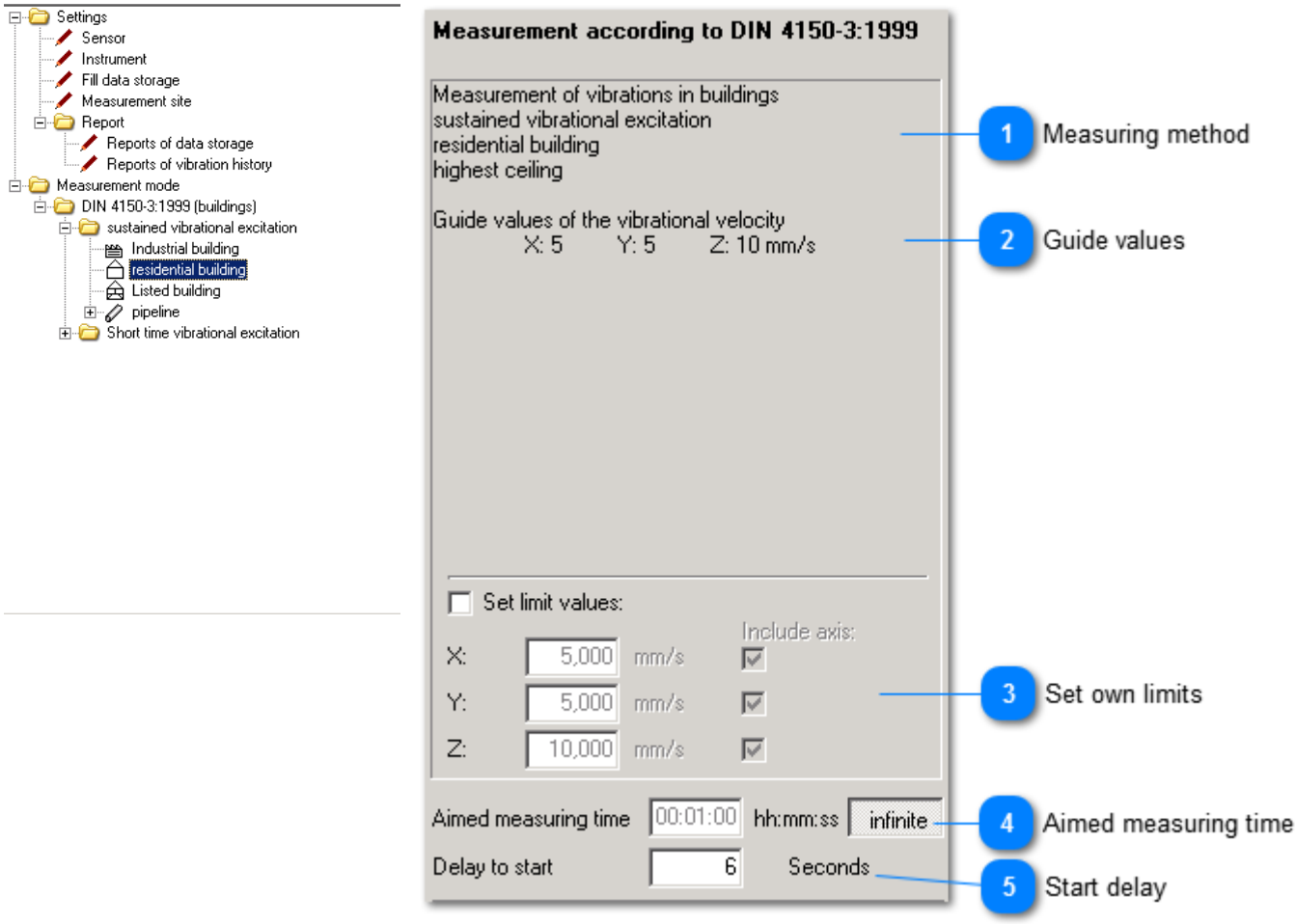
The report templates can be found in this tree structure. One report example is pre-configured. More templates can be configured or loaded.

2 Printer setup

This button opens a dialog for printer selection and configuration.

Measurement mode

On the left side of this window you find a selection tree with the different measuring modes. The right section shows some detailed settings.



1 Measuring method

Measurement of vibrations in buildings
sustained vibrational excitation
residential building
highest ceiling

Shows the selected mode.

2 Guide values

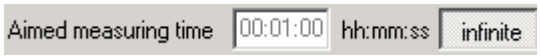
Guide values of the vibrational velocity
X: 5 Y: 5 Z: 10 mm/s

These are the limit values to DIN 4150-3 for the selected mode.

3 Set own limits

Here you may enter non-standard limits if desired.

4 Aimed measuring time



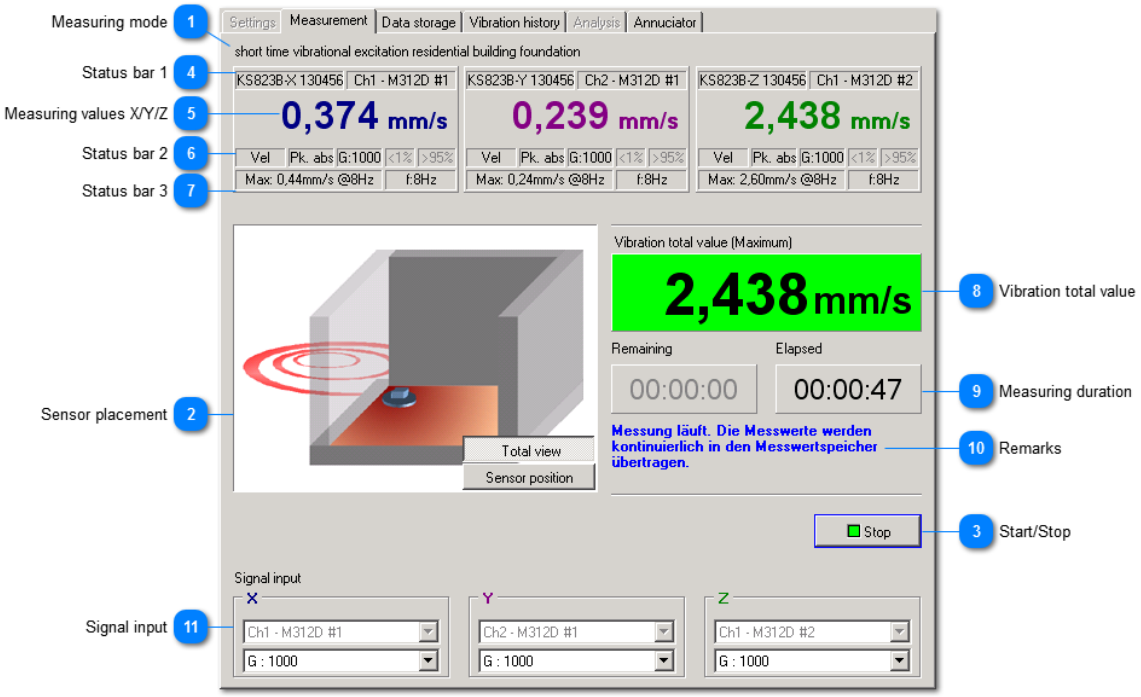
The measuring time can be limited to switch off the instrument automatically after measurement.

5 Start delay

The time delay between pressing Start and the beginning of the actual measurement can be used to suppress signal settling effects.

Measurement

While measuring, the InnoMeter 4150-3 displays the vibration total value and a colored assessment.



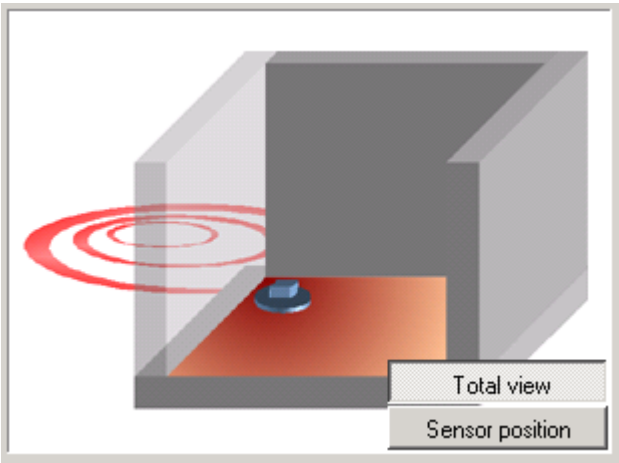
1 Measuring mode

short time vibrational excitation residential building foundation

Shows the used settings

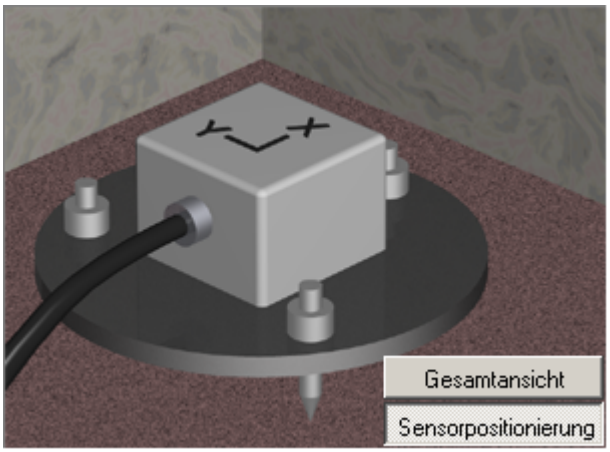
2 Sensor placement

Shows sensor placement with regard to the building and in detail.



Total view

Place the sensor at a location in the building where highest vibration is expected.



Sensor position
The X and Y axes should be oriented along the walls of the building. Adjust the Z axis vertically using the level and the adjustable feet.

3 Start/Stop

Starts and stops measurement. Starting is only possible when all settings in Measurement mode menu have been completed.

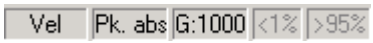
4 Status bar 1

Shows sensor and channel data.

5 Measuring values X/Y/Z

Shows the peak value of vibration velocity for each direction.

6 Status bar 2



Shows for each direction:

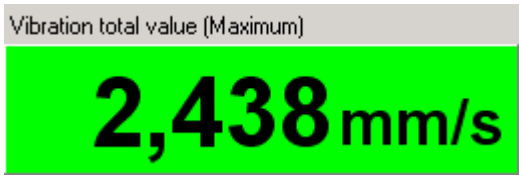
- Measurand
- Characteristic
- Gain
- Low level
- Overload

7 Status bar 3

Shows

- the most critical peak value at the frequency with the highest magnitude
- the frequency with the highest magnitude

8 Vibration total value



The maximum value of the three axes.

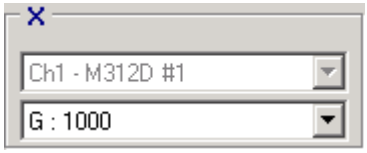
9 Measuring duration

Remaining and elapsed measurement time are displayed. The elapsed measurement duration counts with minus sign from start delay to 00:00:00. Afterwards, the elapsed measurement duration counts up to the aimed measuring time. The measurement is stopped when it reaches the aimed measuring time.
For infinite measurement there is no display of remaining time.

10 Remarks

Shows the current status of measurement.

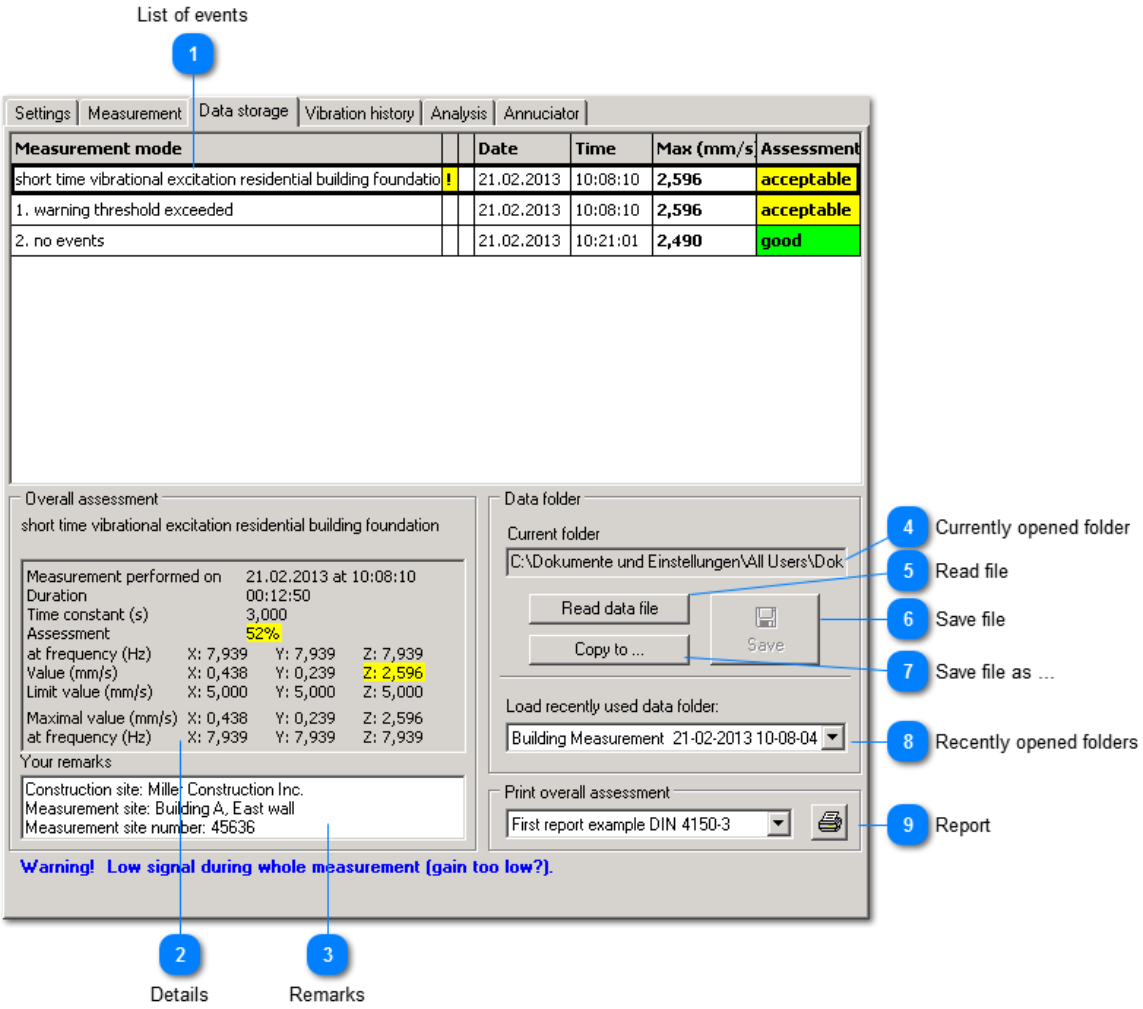
11 Signal input



At the signal input, you select the measuring channel and configure the measuring range. If you activated the sensor automatics the InnoMeter 4150-3 selects the measuring channel automatically.

Data storage

Data is stored in the memory in time intervals or when levels are reached.



1 List of events

Measurement mode			Date	Time	Max (mm/s)	Assessment
short time vibrational excitation residential building foundatio	!		21.02.2013	10:08:10	2,596	acceptable
1. warning threshold exceeded			21.02.2013	10:08:10	2,596	acceptable
2. no events			21.02.2013	10:21:01	2,490	good

This section shows all alarm or warning events including time, date and maximum value. An exclamation mark indicates possible conflicts.
The first line gives an evaluation summary including the highest measuring value.

2 Details

Overall assessment

short time vibrational excitation residential building foundation

Measurement performed on	21.02.2013 at 10:08:10		
Duration	00:12:50		
Time constant (s)	3,000		
Assessment	52%		
at frequency (Hz)	X: 7,939	Y: 7,939	Z: 7,939
Value (mm/s)	X: 0,438	Y: 0,239	Z: 2,596
Limit value (mm/s)	X: 5,000	Y: 5,000	Z: 5,000
Maximal value (mm/s)	X: 0,438	Y: 0,239	Z: 2,596
at frequency (Hz)	X: 7,939	Y: 7,939	Z: 7,939

Here you see for the marked event:

- Time of occurrence
- Duration of the event
- Guide value for each axis
- Measuring value for each axis
- Main frequency for each axis

3 Remarks

Your remarks

Construction site: Miller Construction Inc.
Measurement site: Building A, East wall
Measurement site number: 45636

You can enter comments here for each event.

4 Currently opened folder

Current folder

C:\Dokumente und Einstellungen\All Users\Dok

This field shows which data folder is currently open.

5 Read file

Read data file

This button opens a directory tree from which you can select the measurement folder. The read data is added to the data in data storage. This way, you can, for instance, combine measurements from different days.

6 Save file

Save

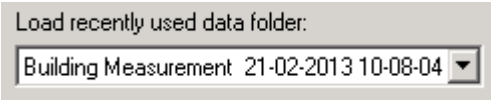
This button saves the current data storage on a data medium.

7 Save file as ...

Copy to ...

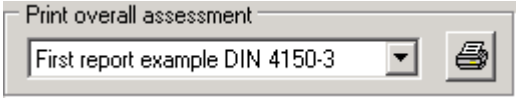
This button saves the current data storage on a data medium.
You can enter a new name for the measurement folder.

8 Recently opened folders



This drop-down list shows the currently used data folders.
By clicking on an entry, the respective data folder is opened.

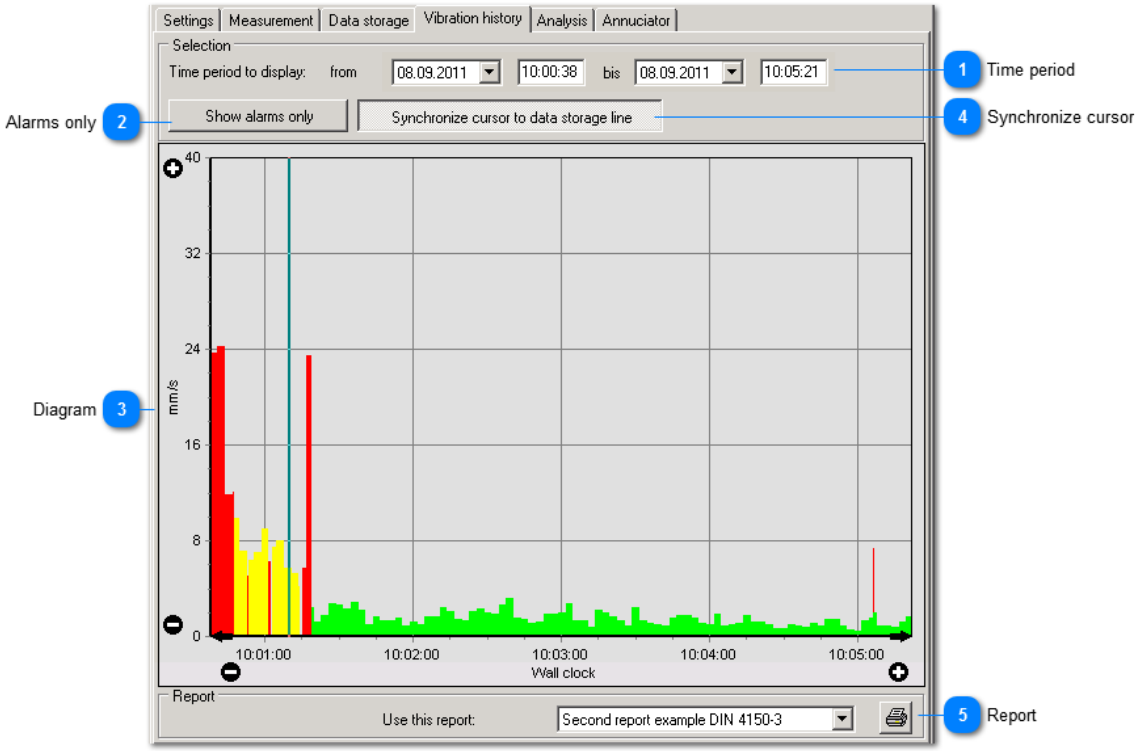
9 Report



Allows the selection of a report template and the printing of the selected measurement.

Vibration history

This diagram shows the maximum values over the measuring time. There are zooming and report printing functions.

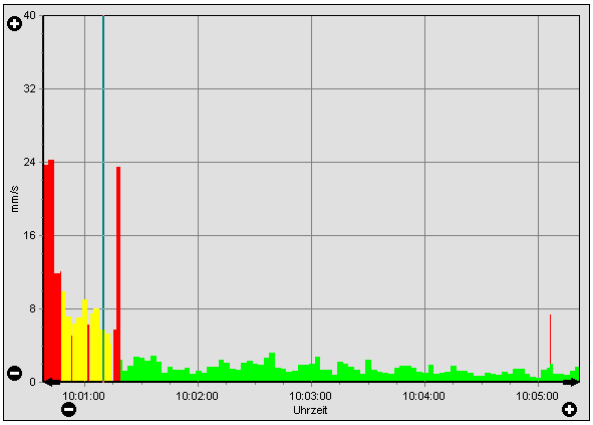


1 Time period

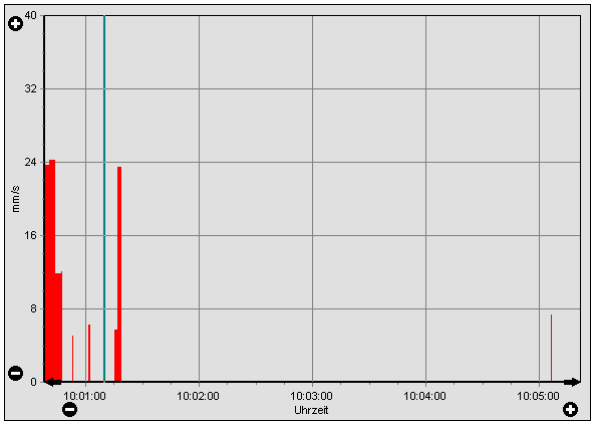
Choose the time period to be displayed.

2 Alarms only

Only events exceeding guide values (alarms) are displayed.

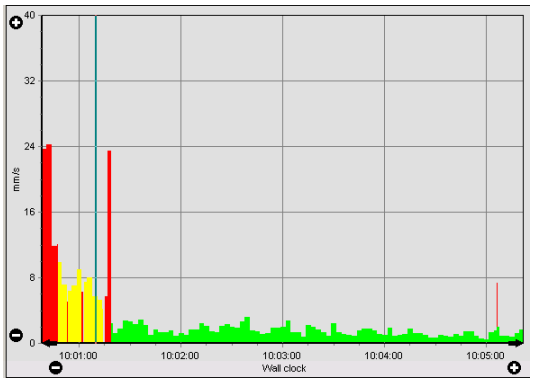


All events



Only alarm events

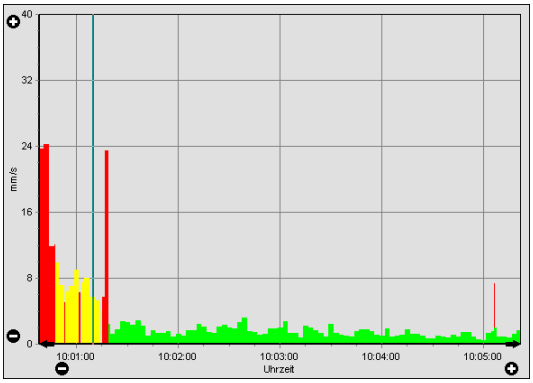
3 Diagram



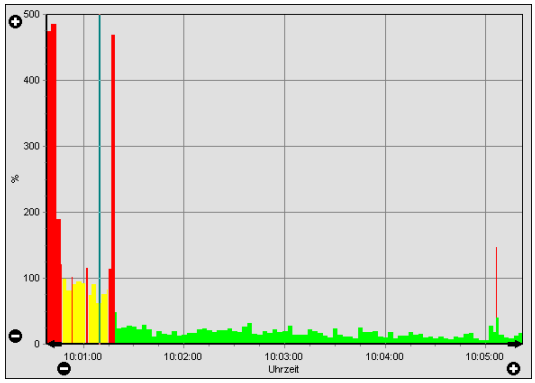
The diagram shows the maximum vibration velocity magnitudes versus time with their color depending on the alarm / warning limits.

Scaling the vertical axis

You may compress and expand the vertical axis by clicking the symbols ⊕ and ⊖. Double left click at the vertical axis scales it automatically so that the maximum value can be displayed.
Right click at the vertical axis switches the unit between mm/s and percent of the guide value.



Display in mm/s

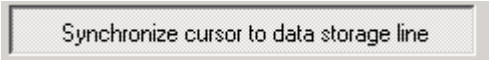


Display in %

Scaling the time axis

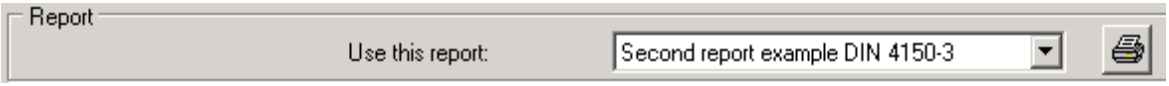
You may shift and zoom the graphics in time direction by the mouse with pressed left or right button. The time axis can be compressed and expanded by clicking the symbols ⊕ and ⊖.

4 Synchronize cursor



This enables a cursor which synchronizes the time in the diagram with the belonging entry in the data storage. In the same way you may mark an event in the data storage and the cursor will move to the respective position.

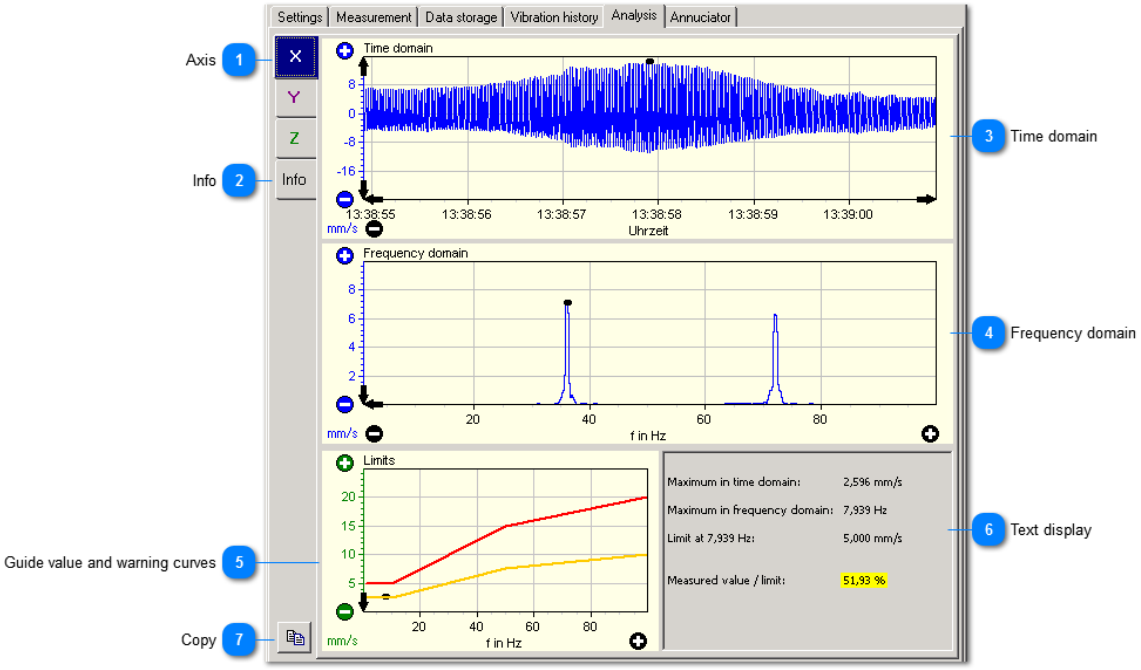
5 Report



Allows the selection of a report template and the printing of the selected measurement.

Analysis

If you select an event in the data storage the InnoMeter 4150-3 Pro can perform an analysis provided that time signal recording was enabled.



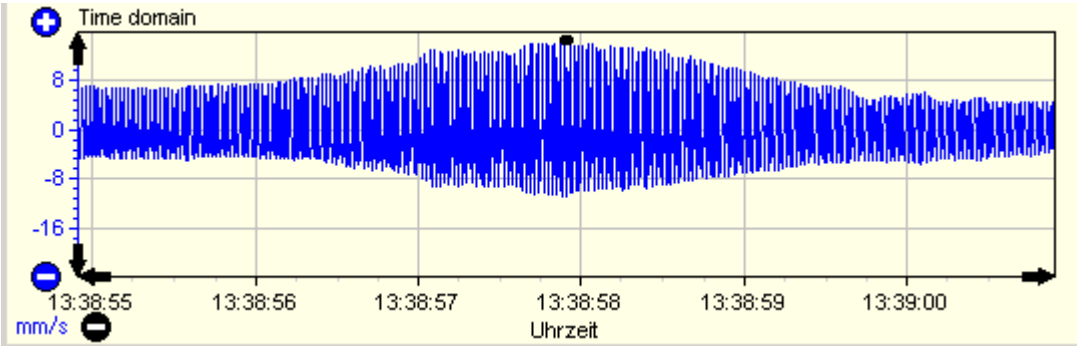
1 Axis

There is an analysis for each axis direction. The first shown analysis always belongs to the direction with the most critical magnitude.

2 Info

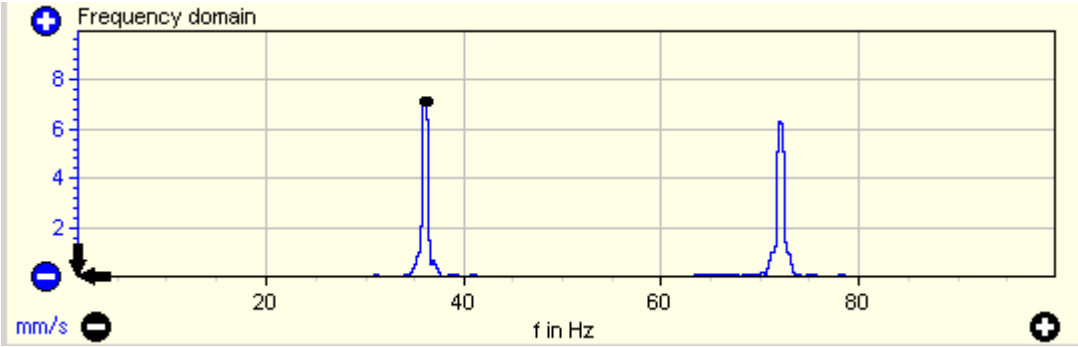
Information concerning the file location.

3 Time domain



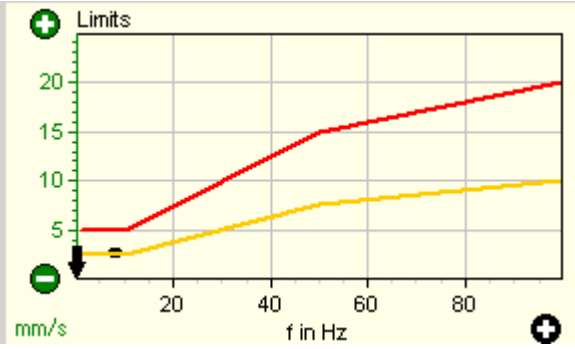
Band filtered vibration velocity in time domain. The peak magnitude is marked.

4 Frequency domain



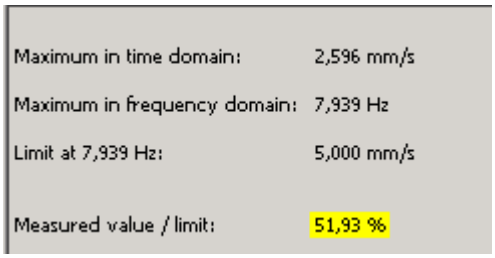
Band filtered vibration velocity in frequency domain. The peak magnitude is marked.

5 Guide value and warning curves



This diagram shows the signal (as a black mark) in comparison with the guide value and the warning limits.
The guide values are frequency dependent for short-time vibration.

6 Text display



Maximum in time domain:	2,596 mm/s
Maximum in frequency domain:	7,939 Hz
Limit at 7,939 Hz:	5,000 mm/s
Measured value / limit:	51,93 %

Here you find the most important characteristics calculated from the analysis.

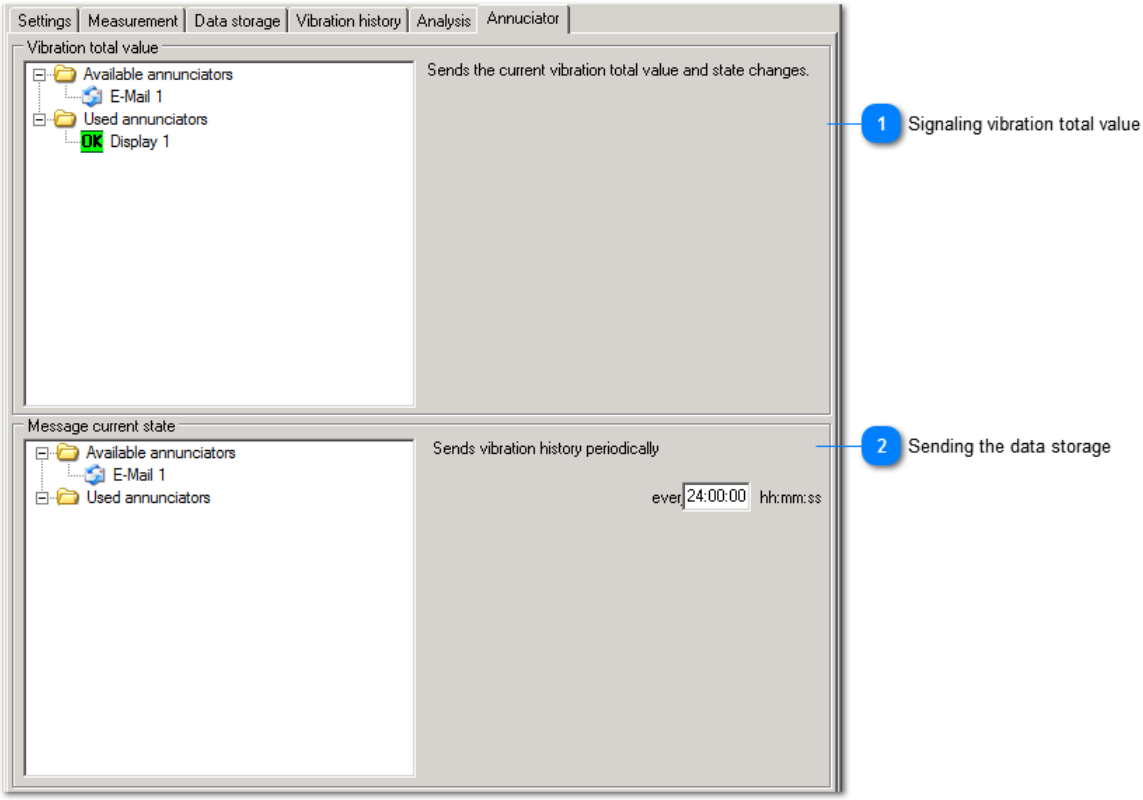
7 Copy

Copies the analysis data to the clipboard for use in reports.

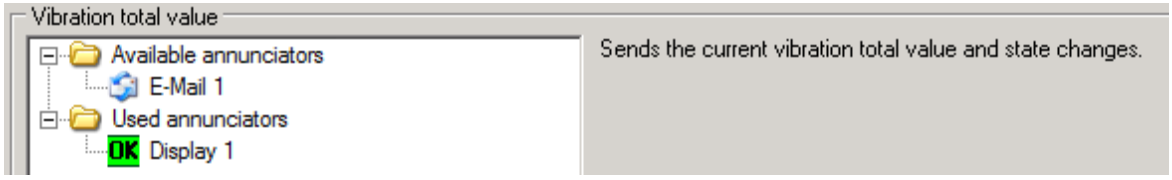
Annunciators for events and data transmission in regular intervals

VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.

Annunciators can be useful for unattended long term measurements. The InnoMeter 4150-3 can send you an e-mail, for example, if a guide value was exceeded.



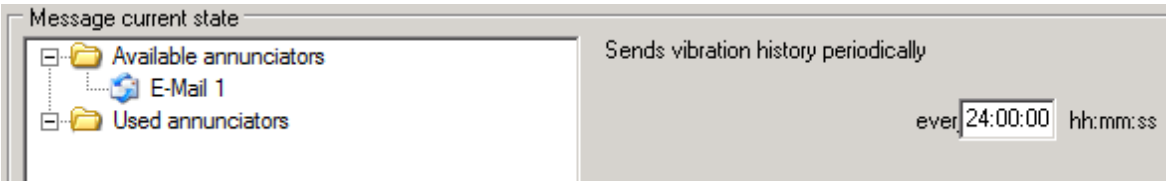
1 Signaling vibration total value



The vibration total value can be signaled by all types of annunciators. For example, the radio-controlled outlet can switch an alarm light on if a guide value was exceeded. This may inform construction workers about the potential risk of their activities.

You may also configure the e-mail annunciator to send you a message each time an alarm was tripped.

2 Sending the data storage



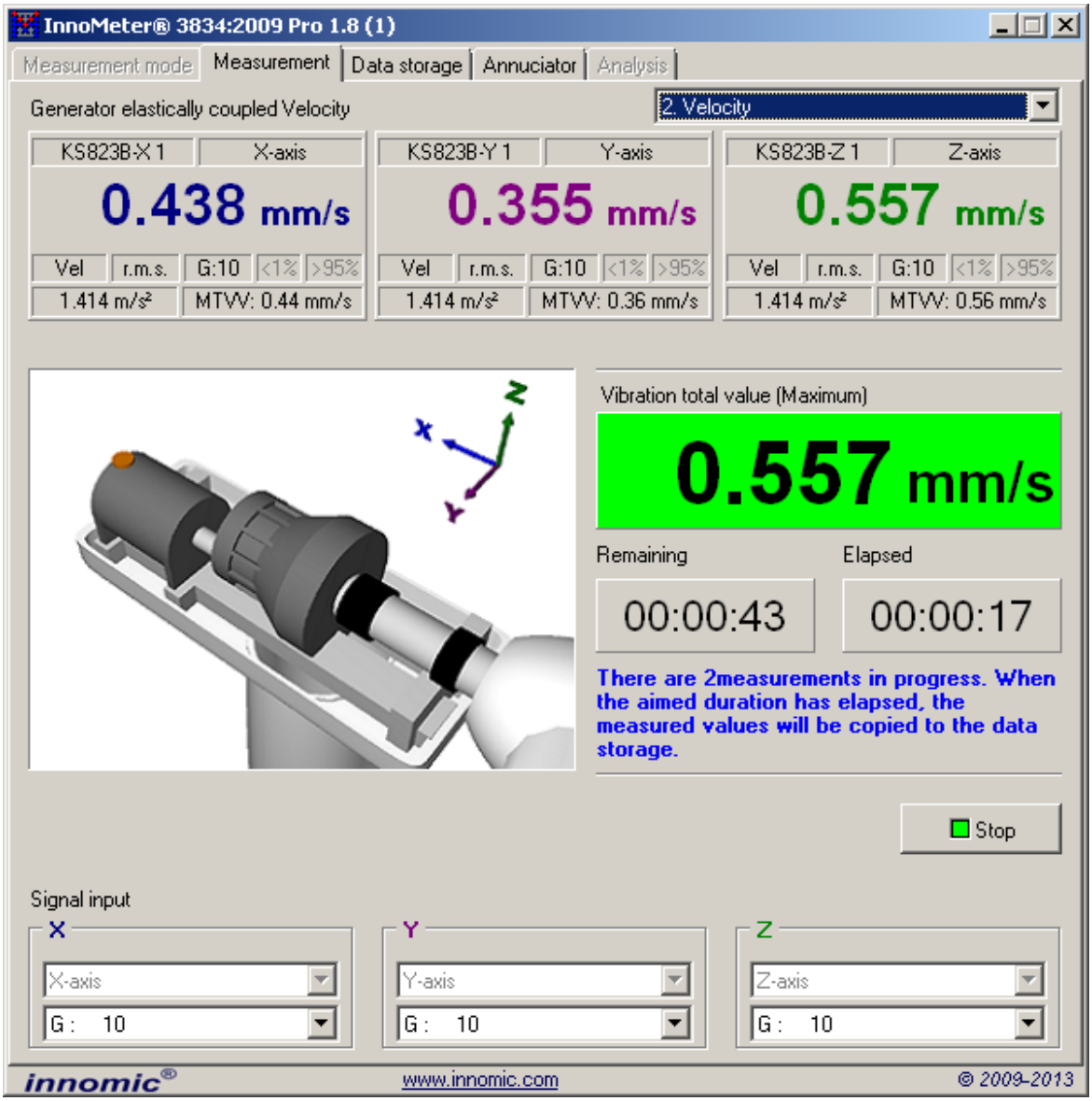
To observe the measured data from a remote location the InnoMeter 4150-3 can also send the contents of its data storage periodically by e-mail.

InnoMeter® 3834 (Pro)

Measurement and evaluation of vibration in wind energy turbines

There is a neutral technical guideline for evaluating vibrations in wind energy turbines – VDI 3834. Manufacturers, operators and insurers brought in their knowledge about vibrations on wind energy turbines.

There is a simple basic principle: Turbines with lower vibrations are better turbines. Too high vibrations stress the components of wind energy turbines, particularly the drive train, in a way that these components often do not reach the intended lifetime of 20 years.
The VDI guideline 3834 also offers guide values for evaluating vibrations on wind energy turbines. The software InnoMeter 3834 features automatic evaluation: The result is indicated in traffic light colors and numerically. A report is printed at the push of a button.



Identify causes

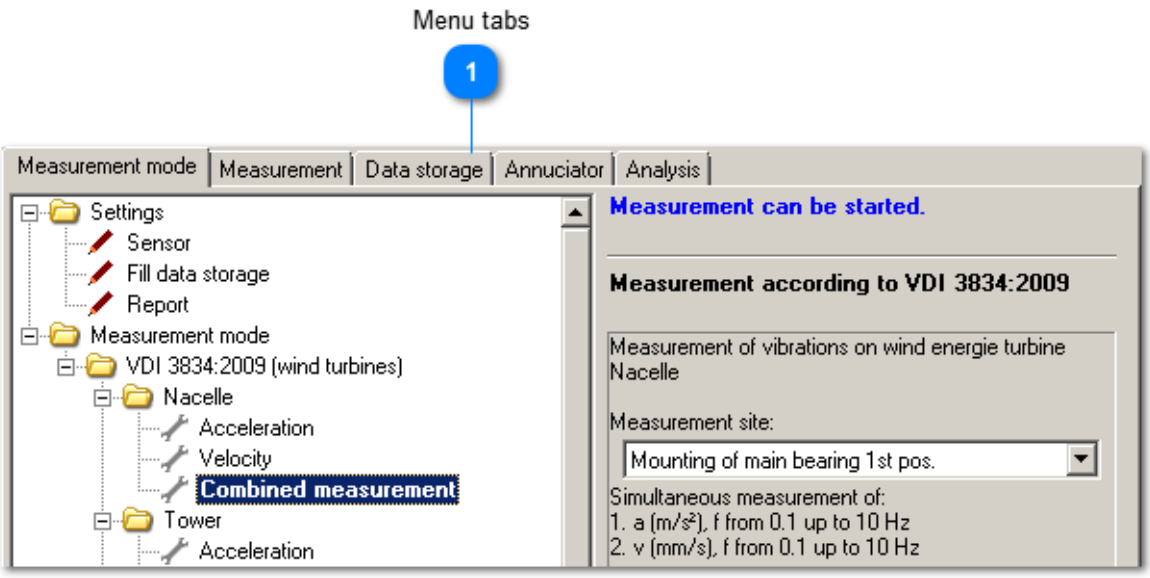
The Pro version of the InnoMeter 3834 additionally displays the vibration signals in time and frequency domain and thus allows to identify causes of elevated values. However, it is an additional function and not required by the guideline VDI 3834.

For deeper analysis, further specialized software modules, e.g.

- InnoScope
- InnoAnalyzer
- InnoAnalyzer Speed
- InnoPlotter

are available. If vibrations are caused by an unbalance, use the InnoBalancer to balance the rotating component.

Operation panels

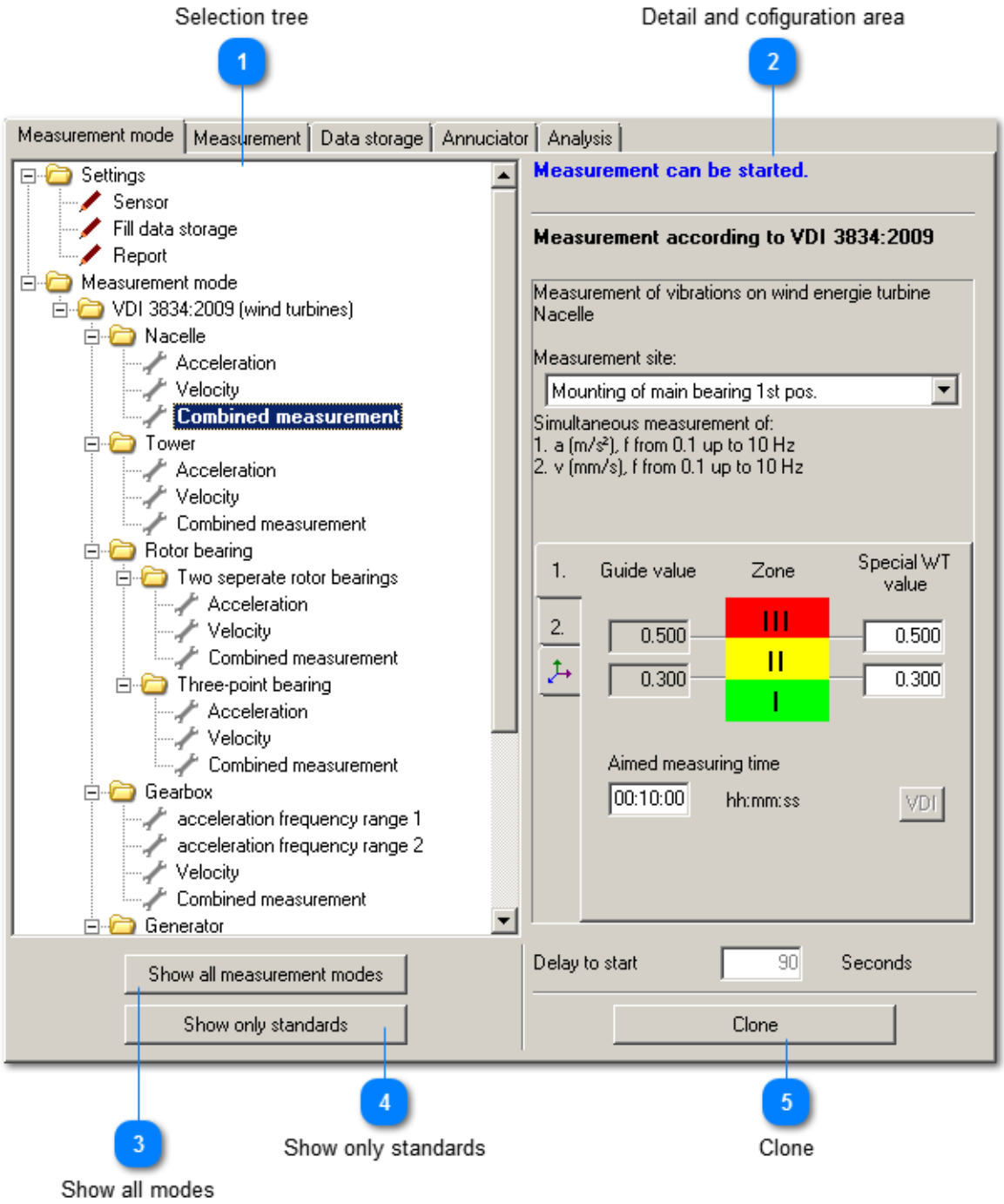


1 Menu tabs

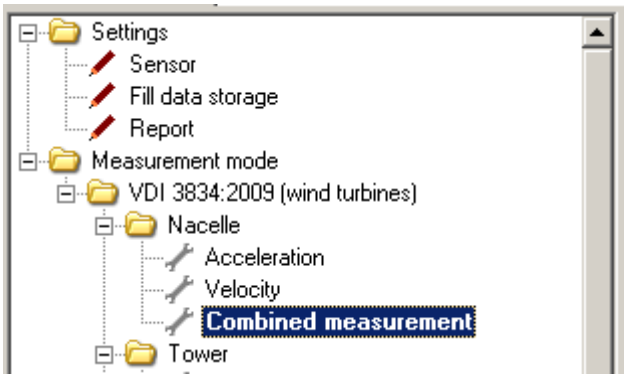
Here you can switch between the different submenus:

Measurement mode	Measurement settings
Measurement	Execution of the measurement with indication of the measured values and colored evaluation
Data storage	Memory for measured values, detailed evaluation and report generation
Analysis	Frequency analysis for the detection of vibration sources
Annunciators	Signaling measured values and states for automated tests

Measurement mode



1 Selection tree



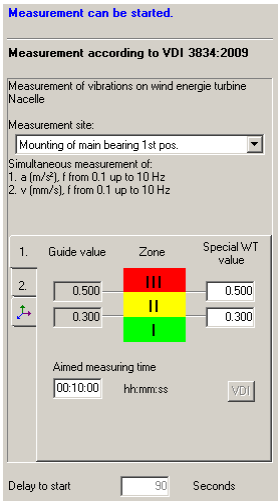
The selection tree shows setting options and measurement modes in a clearly arranged way.
A measurement mode has to be selected before starting a measurement.

Depending on the selected measurement mode or setting option, the detail and configuration area on the right side changes.

When selecting combined measurement, different measurement modes which have to carried out on the same measuring point are carried out simultaneously.

By means of the buttons Show all measurement modes and Show only standards the selection tree can be closed or opened completely.

2 Detail and cofiguration area



The detail and configuration area changes depending on the selection in the selection tree. Here you can configure:

- Sensor
- Data storage
- Report templates
- Measurement modes

3 Show all modes

This button opens all measurement modes in the selection tree.

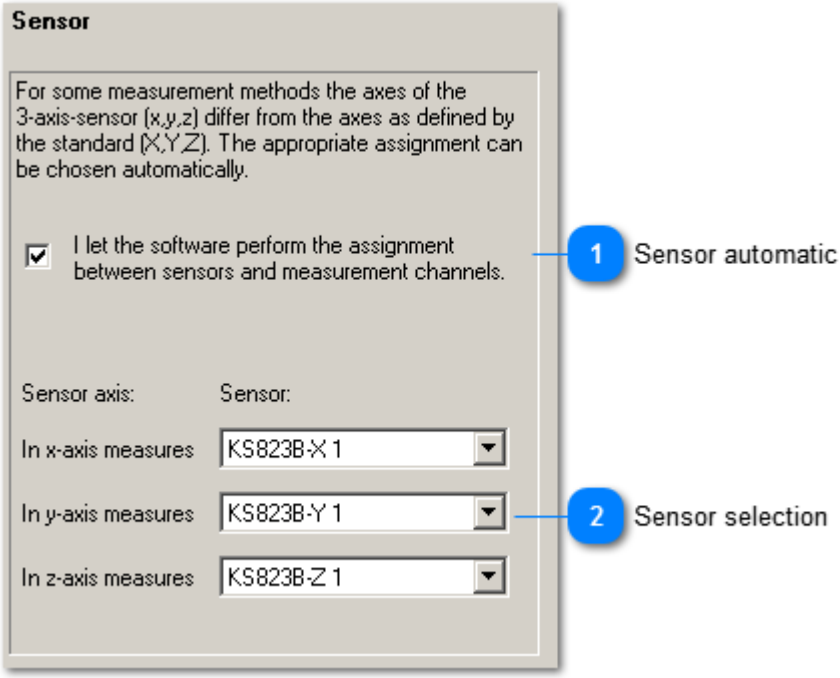
4 Show only standards

This button only shows the top level of measurement modes in the selection tree.

5 Clone

This button generates an additional InnoMeter 3834 with the same settings. The newly generated instrument can be configured freely.

Sensor settings

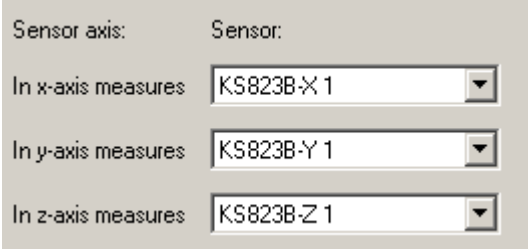


1 Sensor automatic

The measurements for vibrations in wind energy turbines are carried out in three axes. The direction of the axes plays an important role. The coordinate system refers to the turbine and is constant. The triaxial sensor has its own coordinate system, which - depending on the sensor positioning - does not always correspond to the turbine's coordinate system.

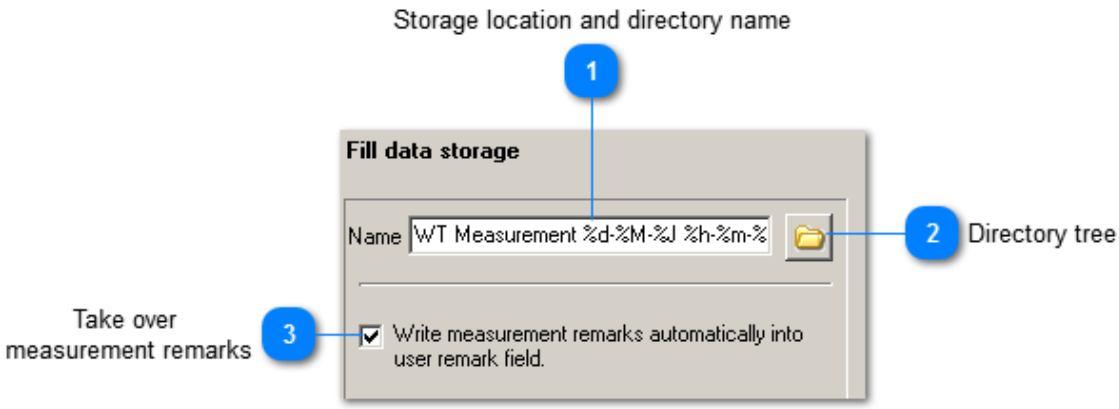
If you activate the automatic assignment of axes, the InnoMeter 3834 correctly assigns the sensor axes to the turbine's coordinate system. It also shows the correct sensor positioning in graphical drawings. If you follow these graphical instructions you avoid positioning errors.

2 Sensor selection

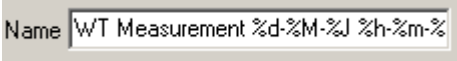


To work correctly, the sensor automatic requires assigned sensors. In the drop-down list, you can choose among all sensors from the sensor management.

Data storage settings



1 Storage location and directory name

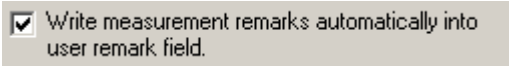


The data storage can be named here. It is saved as a directory. Additional to fixed components, the name of the directory can also contain variable components, the placeholders.

2 Directory tree


This button opens a directory tree.
Data storage is carried out in a directory which contains several files. The target directory can be newly generated in the displayed directory tree.

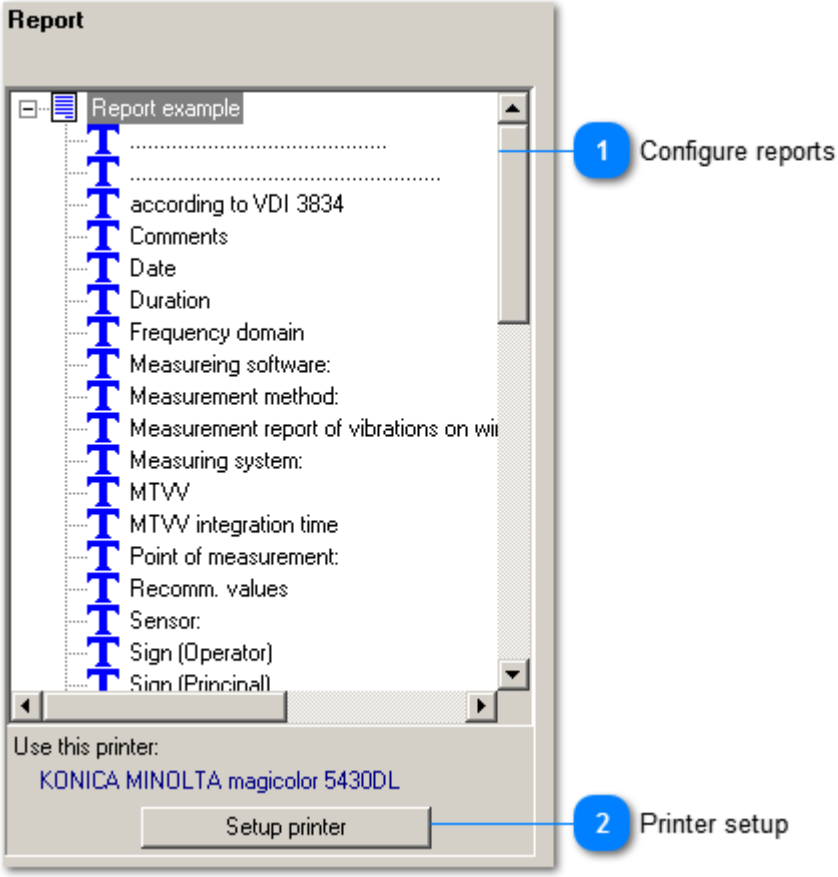
3 Take over measurement remarks



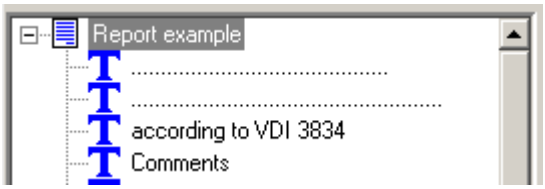
The measurement is monitored by the InnoMeter 3834.
For instance, it assesses whether the measurement has been over- or underloaded. Such measurement remarks can be automatically taken over into the remark field, which is available for every measurement. The remarks are also taken over when a report is printed. Deselect this option if you do not wish to take over the remarks.

Report templates

Reports can be printed directly in the InnoMeter 3834. Texts, graphical elements (e.g. company logo) and variable components can be combined to one or more report templates, which are saved. For printing, you simply select the configured report template and print it with one mouse click.

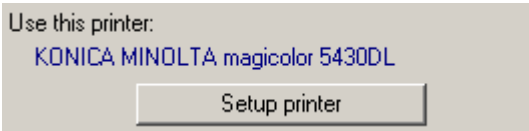


1 Configure reports



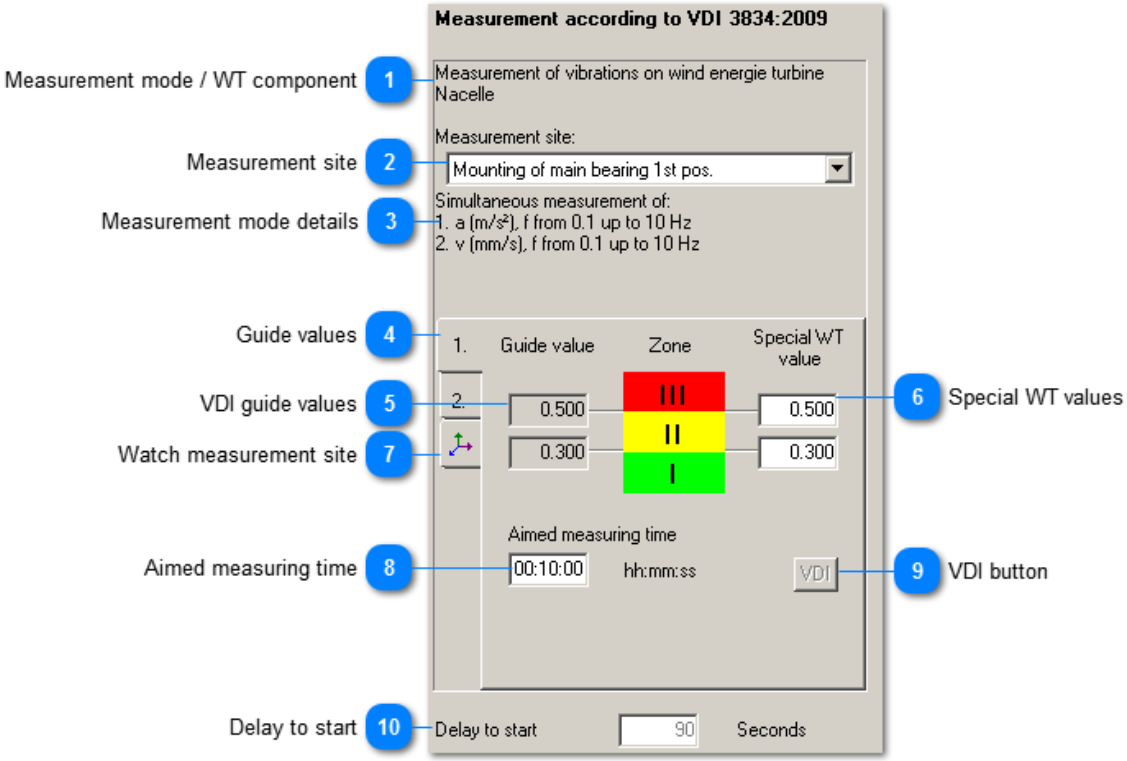
The report templates can be found in this tree structure. One report example is pre-configured. More templates can be configured or loaded.

2 Printer setup

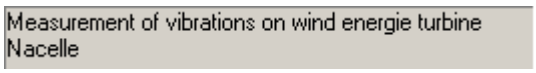


This button opens a dialog for printer selection and configuration.

Configuration options for the measurement mode



1 Measurement mode / WT component

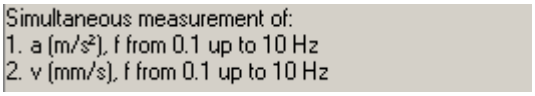


This field shows the selected measurement mode on the selected WT component.

2 Measurement site

This drop-down menu lists up all measurement sites for the respective WT component. Some components are measured on several site, e.g. the generator.

3 Measurement mode details



For greater certainty concerning the selected measurement mode, the following details are displayed:

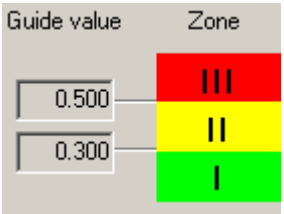
- weighted measurand
- unit
- frequency range

When selecting combined measurement, several measurement modes which have to carried out on the same measuring point are carried out simultaneously. The measurement modes are numbered consecutively.

4 Guide values

In case of combined measurements, several measurands are recorded simultaneously. They have different guide values. By means of the tabs you can see the different guide values. The numbers stand for the measurement modes described in the measurement mode details.

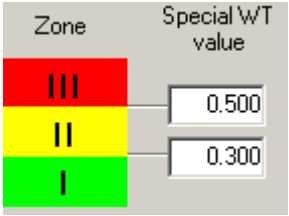
5 VDI guide values



Show the VDI 3834 guide values for the limits of the evaluation zones. These zones have the following meaning:

III	Vibrations within this zone are generally regarded as so dangerous that damage to the WT and its components could occur.
II	The WT and its measured components are not normally regarded as being suitable for running in continuous operation. Investigation is recommended to detect the causes of the vibration excitations and decide whether design and operating conditions of the equipment in question permit continuous operation.
I	The WT and its measured components are regarded as suitable for running in continuous operation with these vibratory stresses.

6 Special WT values



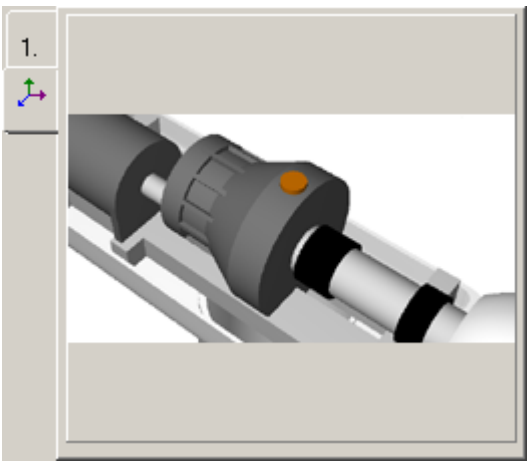
The contracting parties can agree to use other (higher or lower) values for the zone limits of certain WTs. It is necessary that the manufacturer gives reasons for this decision and - in case of higher limit values - confirms that the WT or the component can be operated with higher vibration values.

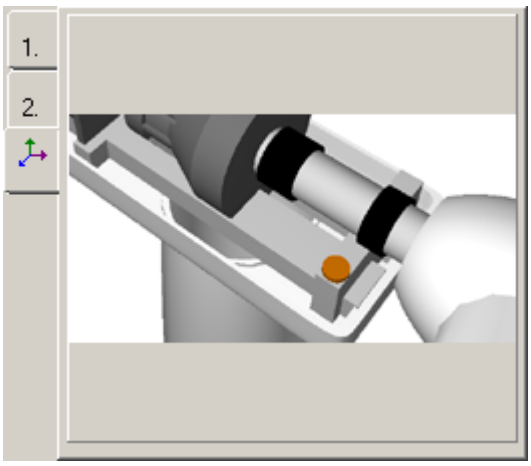
You can enter the changed values for the zone limits in the respective fields. However, the VDI guide values remain visible to make it possible to return to them.

7 Watch measurement site

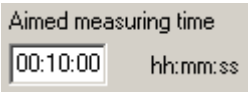

By clicking on this tab, the measurement site for the selected measurement mode is shown graphically.

Beispiele:





8 Aimed measuring time



To obtain correct result, a certain minimum measurement duration must be adhered. But the measurement duration can also be longer than this minimum duration. If you changed the aimed measuring time, you can enter the minimum measurement duration acc. to guideline by clicking the VDI button.

9 VDI button

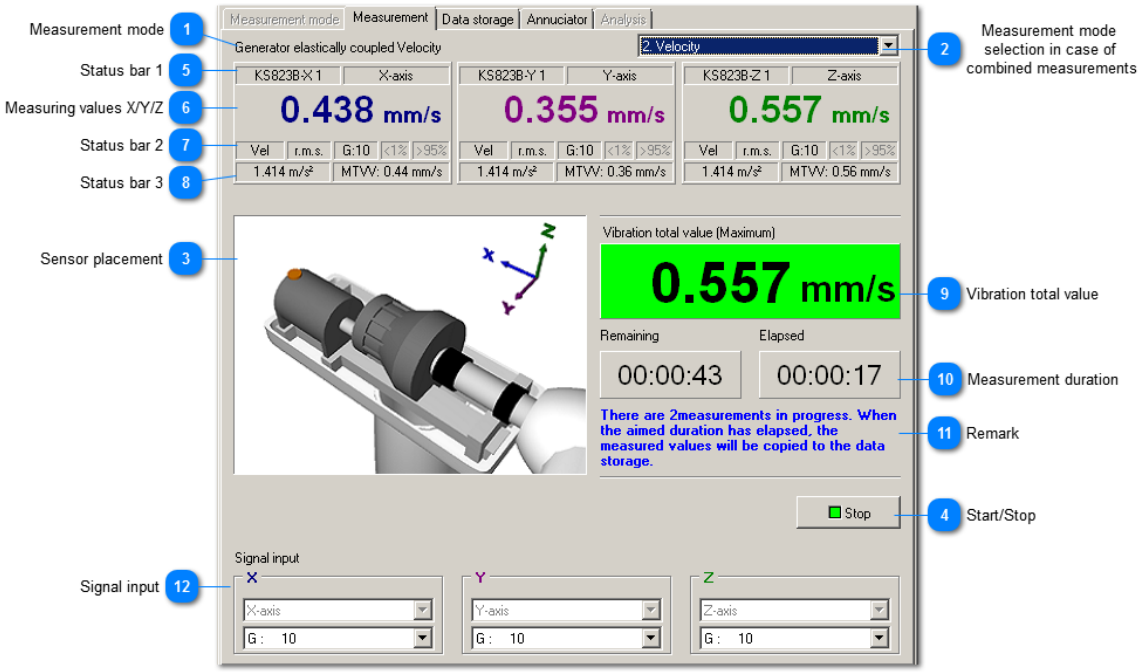
By clicking this button, you enter the minimum measurement duration acc. to the guideline in the aimed measuring time.

10 Delay to start

Right after having been switched on, vibration measurement equipment usually shows transient effects. During this time, the measurement signal is not yet displayed correctly. The start delay makes it possible to react. The lower the lower limit frequency of the filter, the longer these transient effects will last (90 s for measurements with a lower limit frequency of 0.1 Hz).

Measurement

While measuring, the InnoMeter 3834 displays the vibration total value and a colored assignment to the evaluation zones.



1 Measurement mode

Generator elastically coupled Velocity

The selected measurement mode is shown once again.

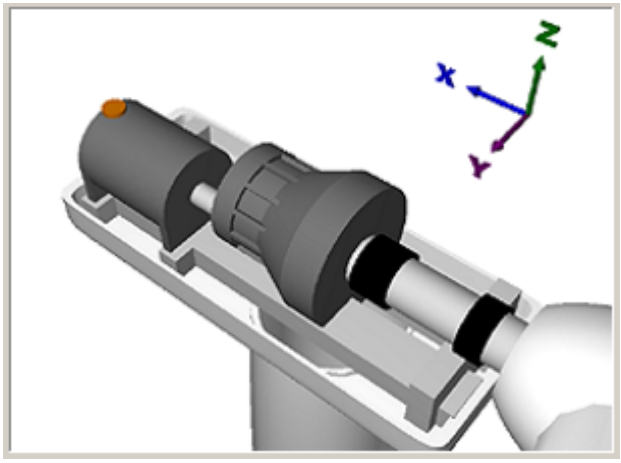
2 Measurement mode selection in case of combined measurements

2. Velocity

When selecting combined measurement in the selection tree, different measurement modes which have to carried out on the same measuring point are carried out simultaneously. They are numbered consecutively.

During the the measurement, you can select which measurand with its values is to be displayed. The other measurement modes are carried out in the background. You can watch their results in status bar 3.

3 Sensor placement



The image shows the coordinate system for the wind energy turbine. The sensor has to be mounted in a way that its axes are aligned accordingly resp. you have to select the axis accordingly in the sensor automatic.

A correct alignment is especially advantageous for analyzing the causes, e.g. for elevated vibration values.

4 Start/Stop

This button starts resp. stops the measurement.

5 Status bar 1

This status bar shows sensor and measuring channel.

6 Measuring values X/Y/Z

The vibration value (interval RMS value) for the axis is displayed here.

7 Status bar 2

The second status bar shows:

- Measurand
- Characteristic
- Gain
- Underload
- Overload

8 Status bar 3

This status bar shows additional values. If you carry out combined measurements, the measuring value of the other measurand (which is measured in the background) is shown here.

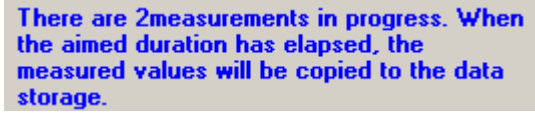
9 Vibration total value

The maximum of the values from the single axes is displayed as vibration total value.

10 Measurement duration

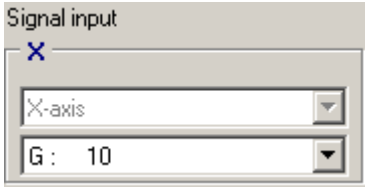
The InnoMeter 3834 displays elapsed and remaining measurement duration. The elapsed measurement duration counts with minus sign from start delay to 00:00:00. Afterwards, the elapsed measurement duration counts up to the aimed measuring time. The measurement is stopped when it reaches the aimed measuring time.

11 Remark



This remark informs about the current state.

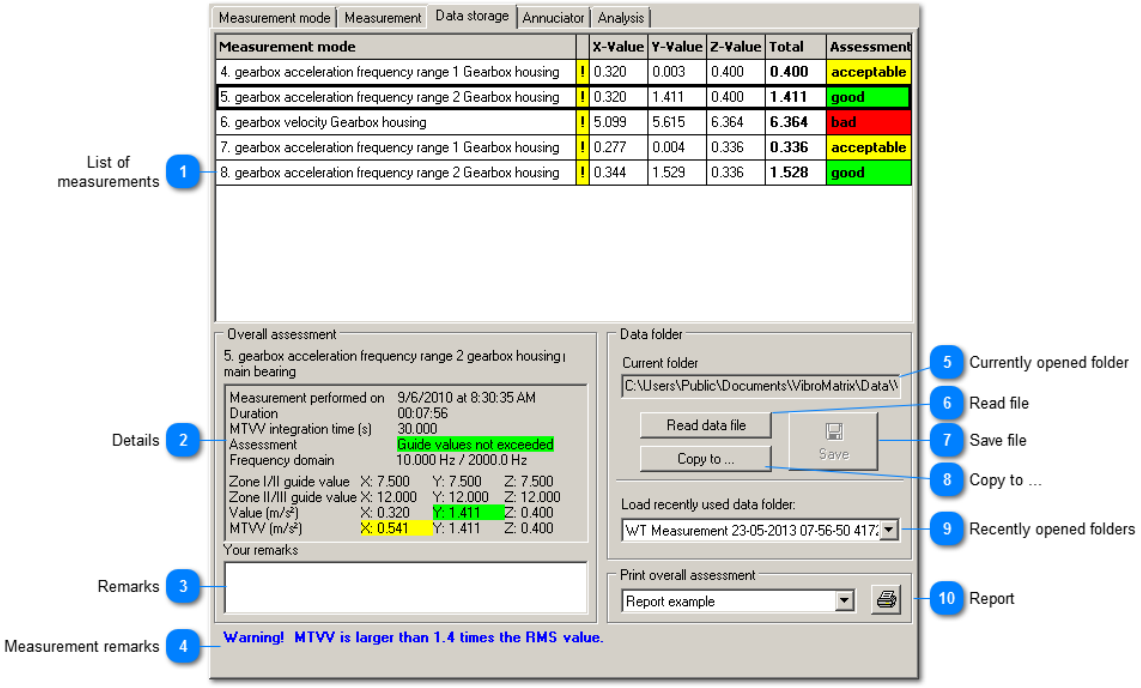
12 Signal input



At the signal input, you select the measuring channel and configure the measuring range. If you activated the sensor automatic the InnoMeter 3834 selects the measuring channel automatically.

Data storage

The results of all completed measurements are transferred to the data storage. All measurements are listed up here incl. individual details. Data storages can be saved on a data medium and be read into the InnoMeter 3834 again. You can load serveral data storages to combine the contained measurements to one big data storage.



1 List of measurements

Measurement mode		X-Value	Y-Value	Z-Value	Total	Assessment
4. gearbox acceleration frequency range 1 Gearbox housing	!	0.320	0.003	0.400	**0.400**	acceptable
5. gearbox acceleration frequency range 2 Gearbox housing	!	0.320	1.411	0.400	**1.411**	good
6. gearbox velocity Gearbox housing	!	5.099	5.615	6.364	**6.364**	bad
7. gearbox acceleration frequency range 1 Gearbox housing	!	0.277	0.004	0.336	**0.336**	acceptable
8. gearbox acceleration frequency range 2 Gearbox housing	!	0.344	1.529	0.336	**1.528**	good

The results of all measurements are listed up here including the values of the single axes as well as the vibration total value and its assessment. If irregularities were detected during the measurement, the measurement is marked with an exclamation mark.

2 Details

5. gearbox acceleration frequency range 2 gearbox housing | main bearing

Measurement performed on	9/6/2010 at 8:30:35 AM		
Duration	00:07:56		
MTVV integration time (s)	30.000		
Assessment	Guide values not exceeded		
Frequency domain	10.000 Hz / 2000.0 Hz		
Zone I/II guide value	X: 7.500	Y: 7.500	Z: 7.500
Zone II/III guide value	X: 12.000	Y: 12.000	Z: 12.000
Value (m/s²)	X: 0.320	Y: 1.411	Z: 0.400
MTVV (m/s²)	X: 0.541	Y: 1.411	Z: 0.400

Here you can find more details for each measurement:

- time
- verbal assessment
- limit values for all axes
- measured values of all axes

3 Remarks

Your remarks

You may add your own remarks for each measurement. If you activated the respective option, measurement remarks are automatically written into this field as well.

4 Measurement remarks

Warning! MTVV is larger than 1.4 times the RMS value.

While measuring, the InnoMeter 3834 simultaneously monitors additional characteristics and measurement conditions to ensure a correct measurement and informs you about irregularities. Optionally, the remarks concerning the measurement can automatically be taken over into the "Your remarks"-field as well.

5 Currently opened folder

Current folder

C:\Users\Public\Documents\VibroMatrix\Data\\

This field shows which data folder is currently open.

6 Read file

Read data file

This button opens a directory tree from which you can select the measurement folder. The read data is added to the data in data storage. This way, you can for instance combine measurements from different days.

7 Save file

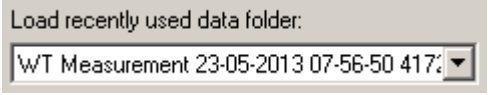
Save

This button saves the current data storage on a data medium.

8 Copy to ...

This button saves the current data storage on a data medium.
You can enter a new name for the measurement folder.

9 Recently opened folders



This drop-down list shows the recently used data folders.
By clicking on an entry, the respective data folder is opened.

10 Report

Allows the selection of a report template and the printing of the selected measurement.

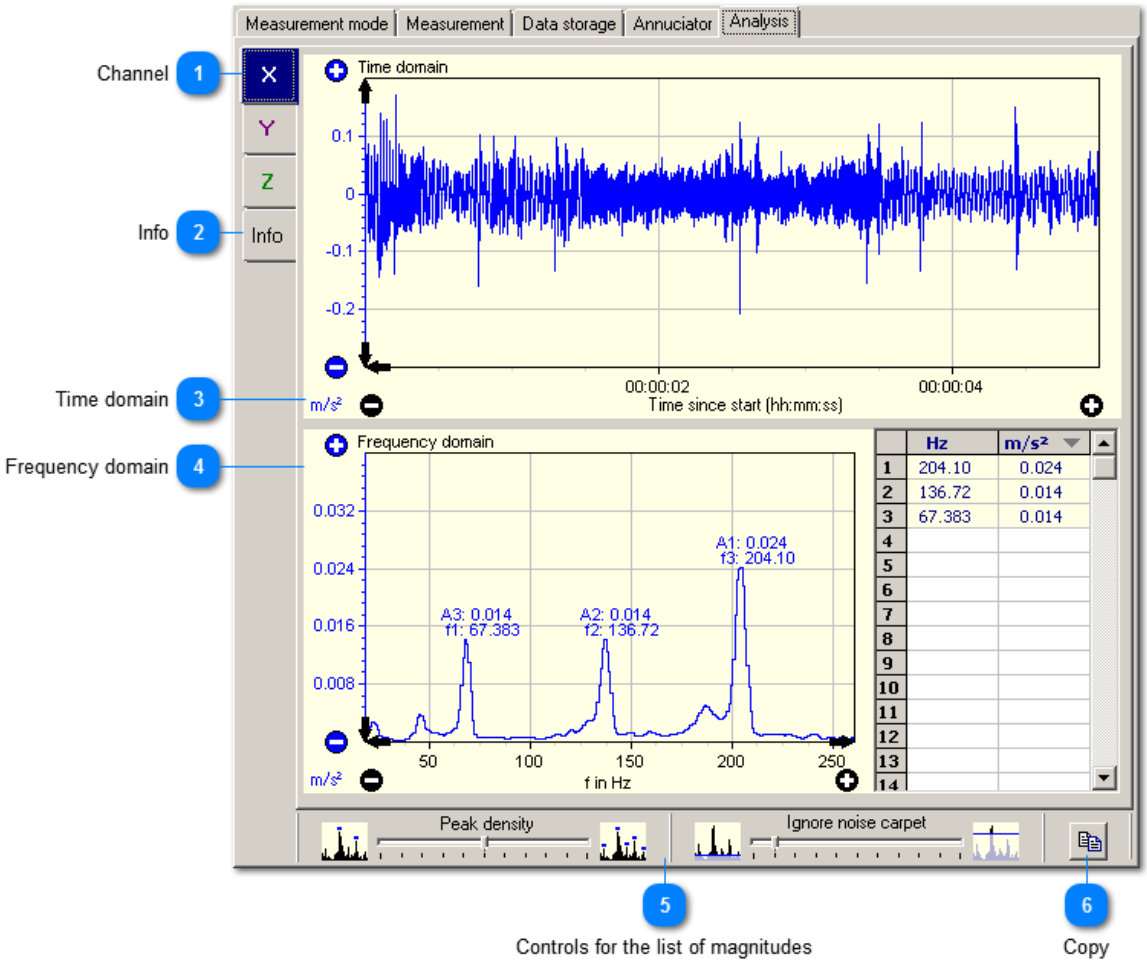
Analysis

The Pro version of the InnoMeter 3834 offers an analysis of vibration signals in time and frequency domain: Beyond the measurements required by VDI 3834 you identify first causes for elevated vibration total values.

For deeper analysis, further specialized software modules are available, e.g.

- InnoScope
- InnoAnalyzer
- InnoAnalyzer Speed
- InnoPlotter.

If vibrations are caused by an unbalance, use the InnoBalancer to balance the rotating component.



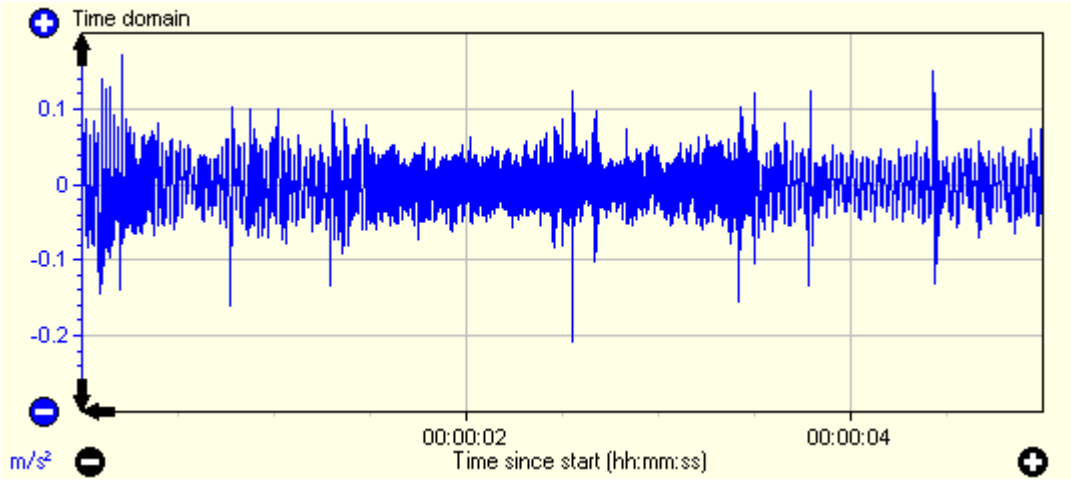
1 Channel

Graphical analysis is provided for each measuring channel.

2 Info

Information concerning the storage location of the measured data for analysis etc.

3 Time domain

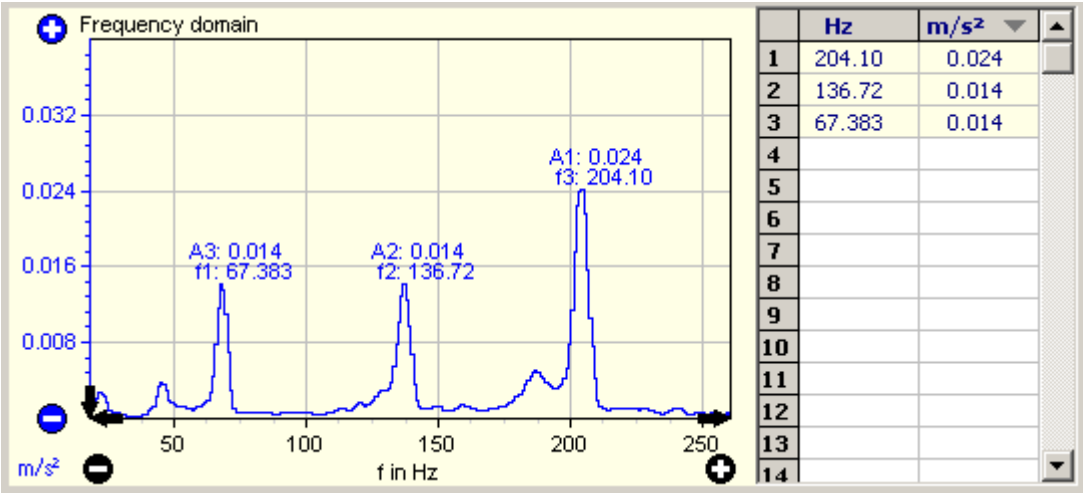


The analysis in time domain shows e.g. whether the values vary a lot during the measurement or whether the signal contains shocks.

Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows.

Scaling with the mouse
By means of the mouse, the chart can be zoomed or scrolled on the time axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

4 Frequency domain



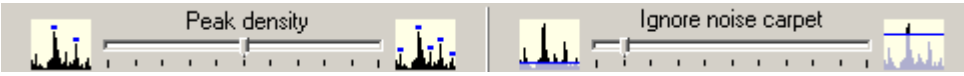
Rotor frequency, generator frequency, natural frequency... By means of the frequency analysis you can identify the components which are mainly responsible for the vibration total value.

Scaling (spreading and compressing the measurement curve) is carried out by means of the buttons ⊕ and ⊖. Scrolling is carried out by clicking on the scroll arrows.

Scaling with the mouse
By means of the mouse, the chart can be zoomed or scrolled on the frequency axis. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

List of magnitudes
The highest magnitudes are detected automatically and they are presented with frequency and value. Frequency and value are indicated directly in the chart as well as in the list next to it to graphic. The detection algorithm can be configured.

5 Controls for the list of magnitudes



These controls work like the ones in the InnoAnalyzer.

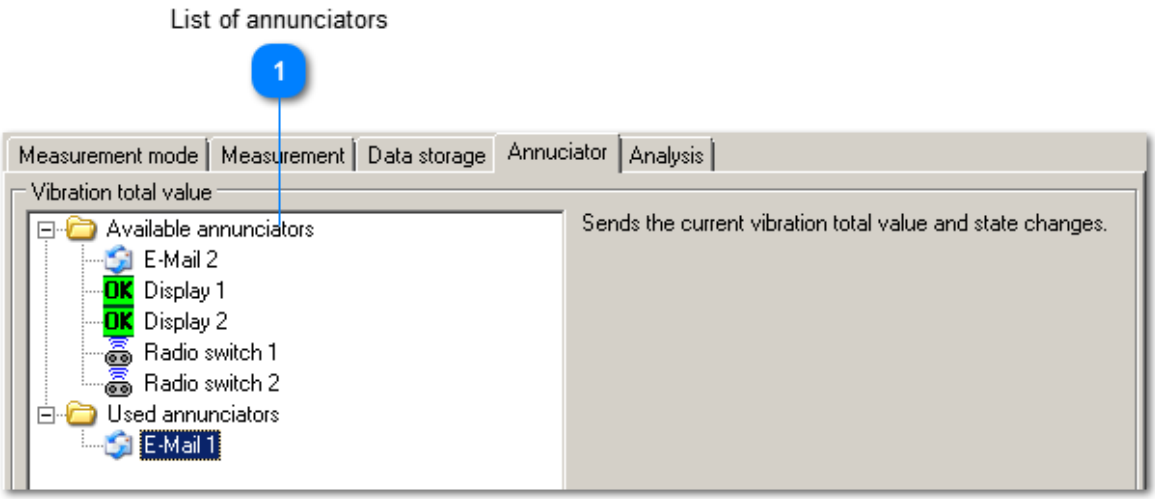
6 Copy

 By means of this button the graphical presentation of both signals is copied to the clipboard.
Afterwards, the chart can be entered into a word processing or other programs.

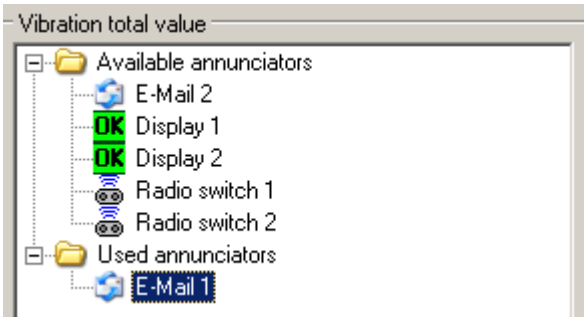
Annunciators

VibroMatrix provides annunciators for sending messages to remote recipients or to other equipment. Depending on the used annunciator measuring data and other information can be transferred.

These annunciators are suitable e.g. for unattended permanent measurements. If a limit value was exceeded, you are for instance informed by e-mail.



1 List of annunciators



This list shows all available and used annunciators.

Unified control elements

All VibroMatrix have a similar design and handling for basic functions to ensure a quick orientation.

Start/Stop button

All instruments feature a Start/Stop button, which changes its look depending on the state.

- If an instrument was started, measured values are updated continuously. The indicator in the button is lit and the label shows the function of the next click: Stop measurement.

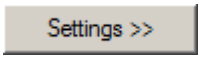
- If an instrument was stopped, the last measured values are displayed but do not change. The indicator in the button is no longer lit and the label shows the function of the next click: Start measurement.

The InnoMaster allows to start/stop all instruments centrally.

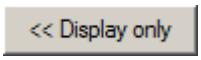
Collapse/expand control panel

For a space-saving presentation, you can collapse the control panel of many instruments. Switching is possible by means a button which changes its look depending on the status

- In the compact presentation, the control panel is collapsed and the instrument uses less space on the screen. The label of the button shows the function of the next click: Expanding the control panel so that the settings of the instruments can be adjusted.

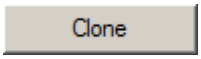


- In the extended presentation, the control panel is expanded and the settings of the instruments can be adjusted. The label of the button shows the function of the next click: Reducing the presentation to the display of measured values.

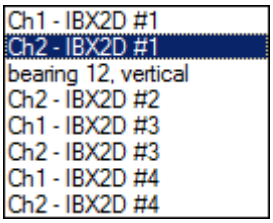


Clone funtion

The clone function allows you to multiply an instrument which you have purchased once. The instrument is copied with all settings. Nevertheless each instrument setting may be changed separately afterwards.



Select measuring channel



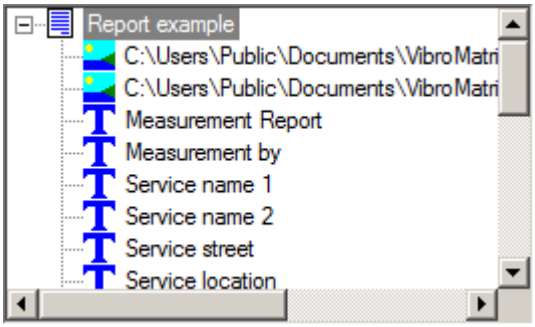
The measuring channels as the instruments' signal source can be switched. The list shows all measuring channels which are available for the instrument, i.e. which the instrument is registered on.

Each measuring channel represents an input of the InnoBeamer. If you entered a name for the measuring channel, this name is listed up here. If you did not name the channel, a standard name is used consisting of the InnoBeamer's device and channel number.

Gain on a measuring channel

The gain of each measuring channel can be changed in an instrument, i.e. the gain in the measurement electronics of a channel is changed. A gain change in one instrument will automatically change the gain in all other instruments connected to the same channel.
Besides fixed gain ranges, VibroMatrix features an autoranging function. It automatically switches to a higher/lower range when the input signal is too high/low for more than 1s.

Report printing



Many instruments are able to print the measurement results in reports. No additional software is required for simple report printing. Report templates are configured once. For report printing, you simply select a template and start printing.

Detailed explanations about simple report printing.

Report printing

Simple reports can be directly printed from the VibroMatrix modules. Each module with report function includes a sample report. It can be used as a basis for your customized report templates.

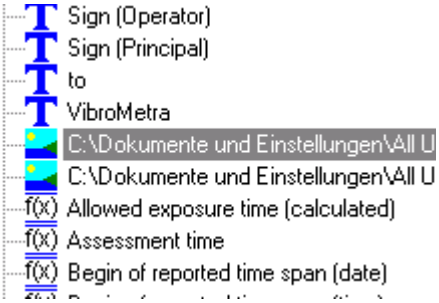
Printing without printer

If no printer is at hand you can use PDF printers to save your reports.

Using templates

Report templates are shown in a tree structure of printable elements. Each of these elements has properties like its position on the page. Three types of report elements are selectable:

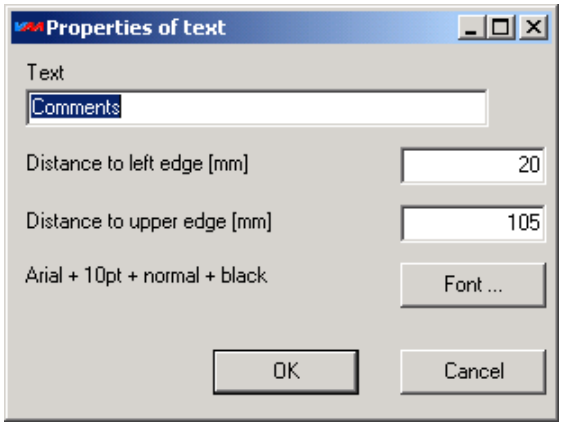
- fixed text
- fixed images
- variable text or images generated by the software



Functions related to report templates are shown in a context menu. There are also import and export functions to exchange report templates between different Workspaces and computers.

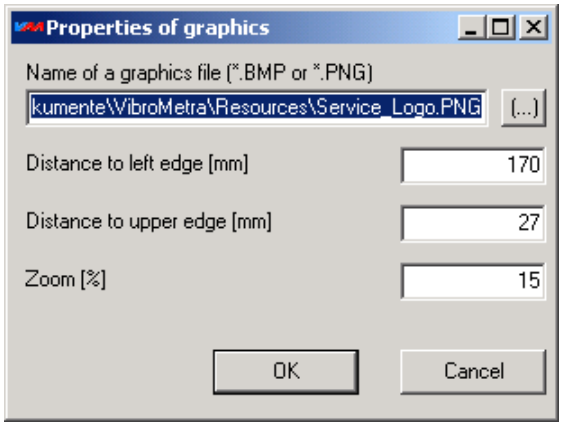
Changing report elements

Double click an element in the tree menu to change its properties.



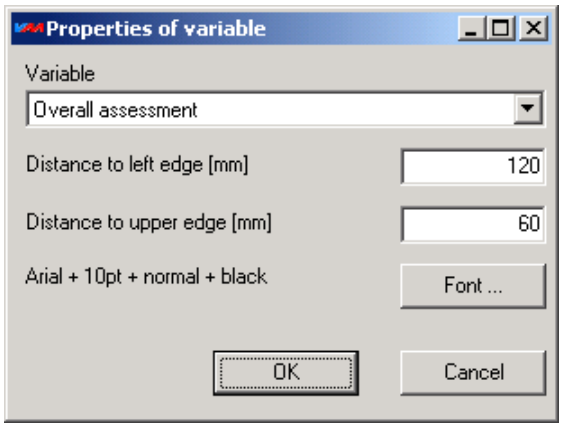
For **fixed text** enter

- the text to be printed
- the text position on the page
- character size and color



For **fixed images** enter

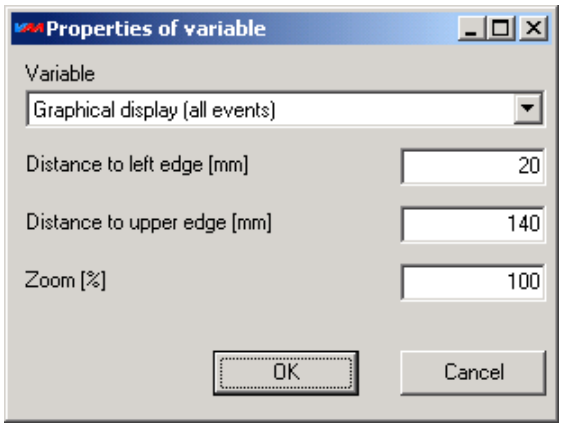
- the file name of the image to be printed
- the position on the page
- the zoom ratio



Variables are filled by the VibroMatrix modules, for example, with measuring values or settings.

For **variable text** enter

- the variable to be printed
- the text position on the page
- character size and color



For **variable images** enter

- the variable of the image to be printed
- the position on the page
- the zoom ratio

Clone, export or import report templates

There are several ways of reusing or modifying existing report templates:

New text New graphics New variable Properties Clone report template Export report template Delete	Right click an existing report template. Click *Clone...* to create a new template based on the existing one.
New text New graphics New variable Properties Clone report template Export report template Delete	Right click an existing report template. Click *Export...* to save the report template.
New report Import report template	Right click in an empty space of the tree structure to import an existing template file.

Unified indicators

All VibroMatrix modules have status bars showing the following indicators:

Sensor

This field shows the sensor type connected with the channel. A red indicator warns if the instrument was started without assigning a sensor to the channel. In this case the measuring signal will be a voltage.

Channel

This is the name of the measuring channel or a standard text if no name was entered.

Gain

The gain range that was selected on this channel.

Overload

This indicator becomes red if the peak amplitude of the signal is > 95 % of the magnitude which the InnoBeamer devices can handle without clipping.
To lower the magnitude you may switch to a lower gain.

Underload

If the unfiltered and unweighted measuring signal drops for at least 3 second s below 1 % of the full scale value this indicator becomes yellow. This is a warning that the accuracy may decrease. To increase the magnitude you may switch to a higher gain.
Underload is not a problem in periods when there is no relevant signal.

Control center InnoMaster

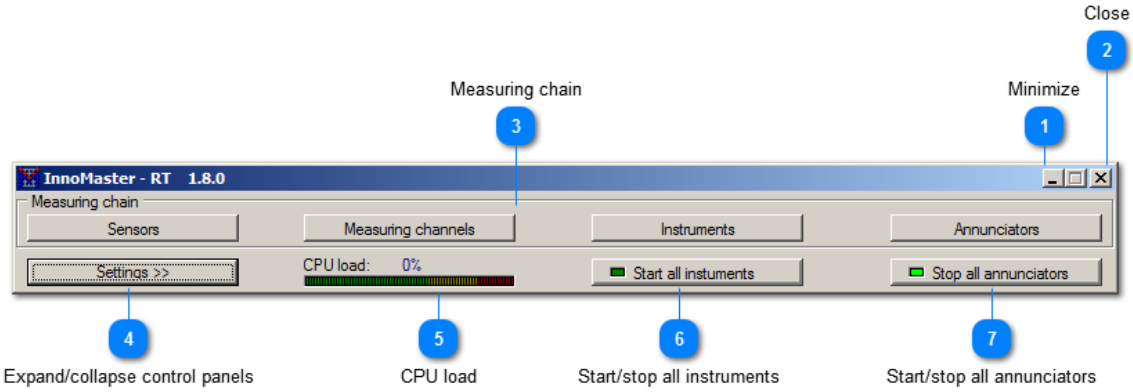
VibroMatrix is modular. Sensors, measuring channels, instruments and - if required - annunciators are combined to solve vibration measurement tasks. The InnoMaster offers comfort and overview. This control center positions ifself at the lower edge of your screen after having started VibroMatrix.

The control center is available in 3 variants:

	InnoMaster RT	Measurement in real-time and additional recording of raw data
	InnoMaster Replay	Offline measurement with recorded raw data
	InnoMaster RT Trainer	For testing all instruments without measurement hardware (free of charge)

InnoMaster RT®

For real-time measurement and additional recording of raw data, you start the InnoMaster RT.



1 Minimize

 This button minimizes the window into the tray of Windows. 

2 Close

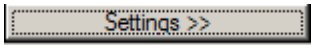
 This button closes the InnoMaster and all instruments.

3 Measuring chain

All elements of the measuring chain are administrated in the upper area. They are sorted in order of the natural signal flow, which starts with the sensors and ends with the instruments or the optional annunciators.

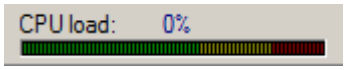
- Sensors
- Measuring channels
- Instruments
- Annunciators

4 Expand/collapse control panels



This button switches the view of the control panels.

5 CPU load

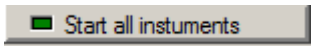


VibroMatrix works in the so-called streaming mode. That means, from the moment you start the instruments until you stop them, sensor signals are acquired without interuption and with high sample rate. They are displayed in the instruments immediately. Not a single value gets lost.

The CPU load shows how fast VibroMatrix can solve this tasks with regard to the computing time assigned by the computer. Values below 100% mean that VibroMatrix can carry out all tasks. Values above 100% signal an overload: The computer cannot carry out real-time measurement. In this case, the following measures can put things right:

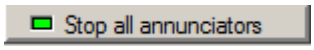
- Closing instruments
- Reducing the number of channels in the instruments (example)
- Reducing the refresh rate

6 Start/stop all instruments



Instruments can be started and stopped separately or centrally in the InnoMaster.

7 Start/stop all annunciators



This button starts/stops all annunciators centrally.

InnoMaster® RT Trainer

Using the InnoMaster Trainer is free of charge. You can operate all instruments without purchasing licenses. The InnoMaster Trainer works like the InnoMaster RT, but there is one important difference:

Instead of using measurement data from the connected measuring equipment, you generate the signal artificially in the InnoMaster Trainer. You can adjust magnitude and frequency of three sine generators for each measuring channel.

You can use the InnoMaster RT Trainer for different purposes:

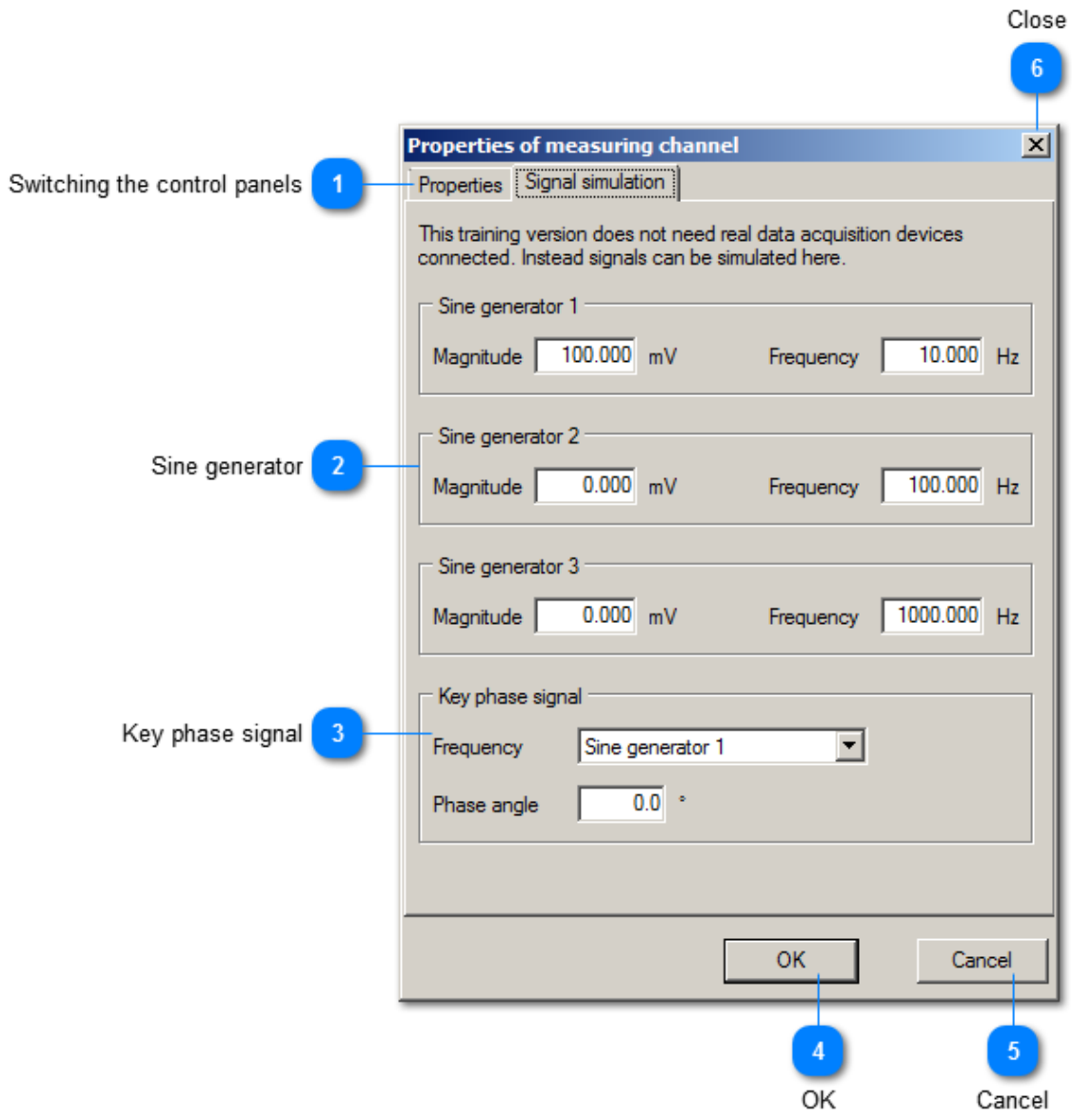
- **Trying the handling:** All instruments are available for operation. By means of the artificial measurement signals, measuring is possible as well. This way, you can practice the handling of VibroMatrix without connecting measuring hardware.
- **Evaluation without measuring hardware:** Several instruments can read back their saved data (InnoMeter HVM 2631/5349/6954, InnoMeter 4150-2, 4150-3, 3834). With this data, you can carry out further evaluations and print reports.
- **Analysis of special effects:** You can purposefully analyse effects from digital signal processing, for instance the leakage effect during Fourier transformation of finite signals in time domain. You set the artificial signals exactly, they are free of disturbances (e.g. secondary frequencies) of real measurement objects.

Differences in comparison with the InnoMaster RT are:

- No raw data recording
- Extended settings for the measuring channel to adjust the signal generators.

Properties of the measuring channel - signal generators

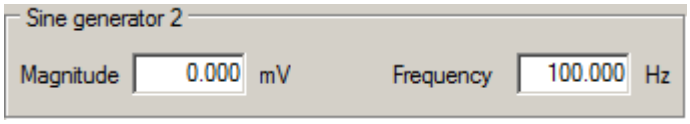
In the InnoMaster RT Trainer, you generate the measurement signals artificially. This way, no connected measuring devices are required.



1 Switching the control panels

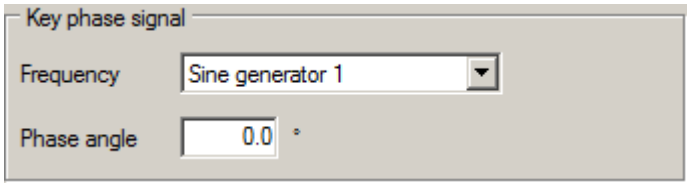
The control panel Properties contains the same settings like in the InnoMasterRT. The elements of the control panel Signal simulation are presented here.

2 Sine generator



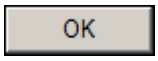
Three sine generators are available to generate a signal mix. The generated signal simulates the input of a measuring device, to which measurement signals (in this case: the artificially generated ones) are applied. You can adjust magnitude and frequency for each generator. A magnitude of 0 mV deactivates the respective signal generator.

3 Key phase signal



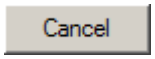
In addition to the sinusoidal signals you can generate a digital pulse. It occurs at a frequency of one of the selectable sine generators and you can enter a phase angle. To deactivate the digital pulse, select "Off" in the Frequency list.

4 OK



This button closes the window, saves the data and adjusts the signals.

5 Cancel



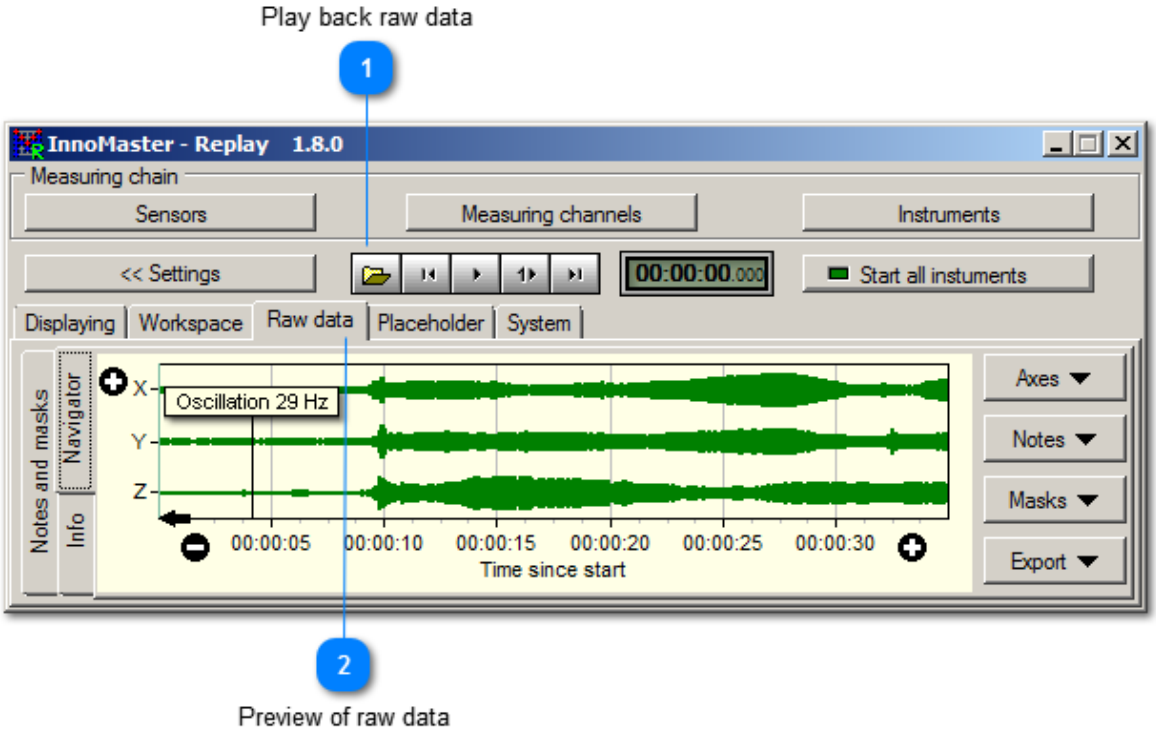
This button closes the window without saving changes.

6 Close

This button closes the window without saving changes.

InnoMaster® Replay

The raw data recorded in the InnoMaster RT can be played back in the InnoMaster Replay. To display the data, you open the instruments and adjust them acc. to the measurement task. The raw data contains the full information content of the sensor signals. So when playing back the data, the settings in the instruments can be diffferent from those during the original measurement.
Thus, you can carry out analyses which remained undone during the measurement. This way, repeated measurements are often unnecessary so that you save time and costs.



1 Play back raw data

The following elements are available for playing back the raw data:

This button opens a file of raw data.

This buttons replays the data with normal speed. After you pushed this button, it changes its appearance and becomes the pause button

This button pauses the replay of raw data.

Single-step button. By means of this button, a short time segment of raw data can be played back. This way, you can reconstruct fast processes that are visible for a short time only in slow-motion. The single-step button is only visible in the pause mode. It changes to Fast-forward button during play-back.

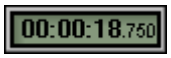
This button replays the data with maximum speed. Its only available during play-back and changes to single-step button in pause mode .

Jump back to important points in time:

- to a note
- to the time a measuring channel starts measuring
- to the start of the raw data file

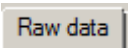
Jump forward to important points in time:

- to a note
- to the time a measuring channel stops measuring
- to the end of the raw data file



The time display shows the play-back position, which is also marked by a cursor.

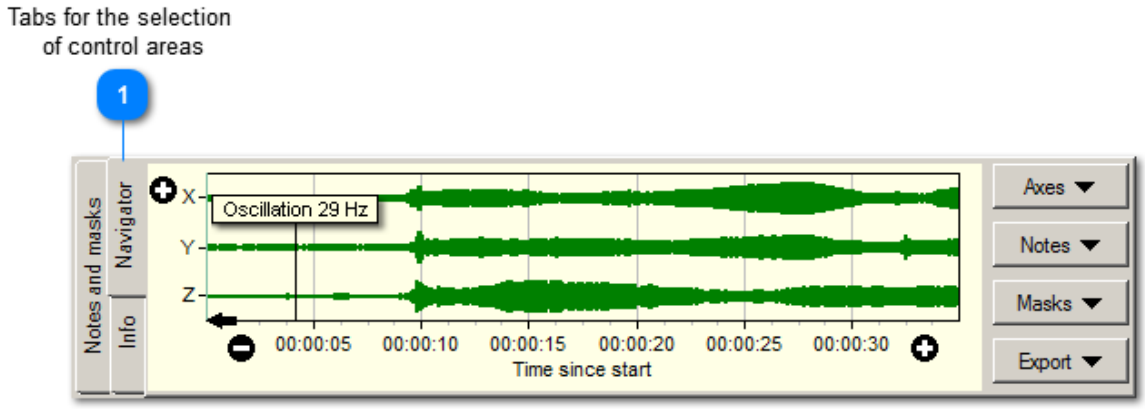
2 Preview of raw data



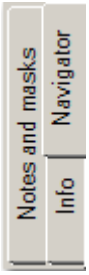
The raw data control panel provides, amongst others, a preview of the recorded raw data.

Working with raw data

Additional to the operating controls for playing back raw data, the raw data control panel of the InnoMaster RT Replay provides further options.



1 Tabs for the selection of control areas

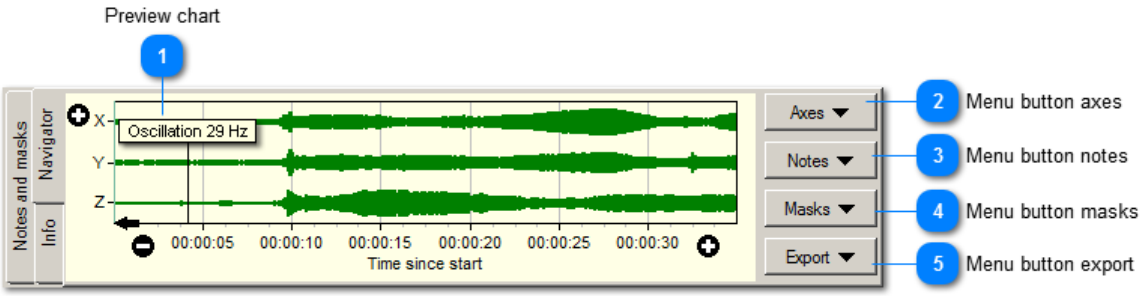


The raw data control panel is devided into three control areas:

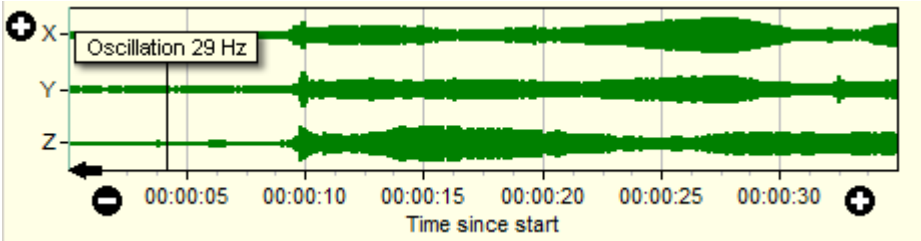
Navigator	Preview of raw data, display options, data export.
Notes and masks	Table of all notes entered during the measurement or later.
Info	Information about the opened raw data file or about the export progress.

Navigator

The Navigator provides a preview of the saved raw data and notes. Furthermore, diverse display and export functions are available.



1 Preview chart



The recorded raw data is visible in the preview chart. It is displayed as level of the measuring channel for the whole measurement range and also includes the gain ranges of the different parts of the measurement range.

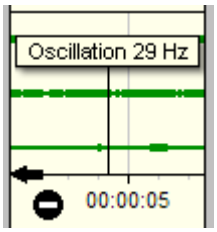
Time axis
By clicking right on the time axis you can switch between

- the relative time since starting the measurement and
- absolute time of day (of the measurement PC) during measurement.

By means of the button you expand the raw data, by means of the button you compress it. By means of the the scroll arrows you shift the raw data in the respective direction.

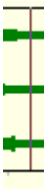
Scaling with the mouse
By means of the mouse, the measurement chart can be zoomed or scrolled. The chart is scrolled with the left mouse button held down. By holding down the right mouse button, you choose an area to be zoomed.

Notes



Notes are shown with a line that connects them to their exact time of recording on the time axis. Setting options for notes can be found in the Notes menu.

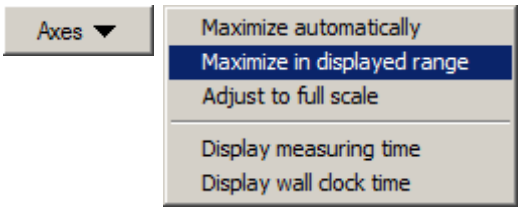
Cursor



The cursor is shown as vertical line at the position of play-back. You can move it by mouse after you paused play-back. As moving the cursor interrupts the time consistence of the raw data signal, the instruments are resetted after cursor movement.

2 Menu button axes

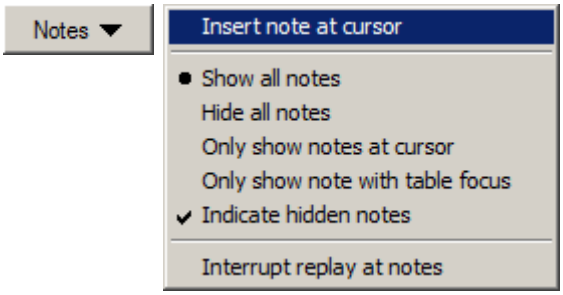
Pushing this button opens a menu. The axes menu provides functions for the channel axis and for the time axis.



Maximize automatically	If this entry is active, the maximum level in the displayed time range is drawn with maximum height. The other level values are scaled accordingly. At the same time, the entries for manual adjustments are deactivated. They are available again after deactivating "Maximize automatically".
Maximize in displayed range	Activating this entry causes the same behavior as automatic maximizing. But if you change the displayed time range, scaling is kept and not changed. If there are higher levels in the new time range, they are cut off in their height.
Adjust to full scale	The levels are scaled to the full dynamic range of the measuring equipment (InnoBeamer).
Display measuring time	The relative time since starting the measurement file is displayed on the time axis when activating this entry.
Display wall clock time	The wall clock time valid during the original measurement is displayed on the time axis when activating this entry. If the time range is longer than 24 hours, the date is displayed as well.

3 Menu button notes

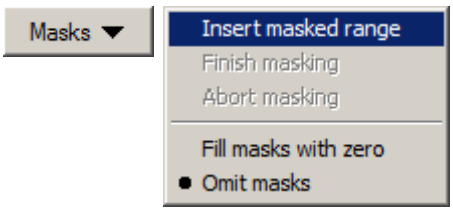
Pushing this button opens a menu. This menu controls the display of notes saved in the data stream.



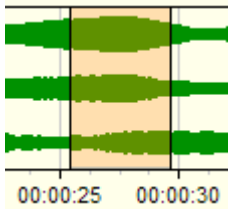
Insert note at cursor	In addition to notes that were entered during the measurement, you can also add notes during offline-analysis by means of this function. It is only available if the cursor is not positioned at the beginning of the time axis, i.e. time display does not show 00:00:00 000. Activating this function causes a switch to the control panel Notes and masks and adds a new row to the table at the correct time position. The time marker is filled automatically and a default text for the note is given. You can change this text.
Show all notes	If you select this option, the Navigator displays all notes in maximum presentable length. This function is useful if there are only few notes in the displayed time range.
Hide all notes	No notes are displayed if you select this option. Thus you have a clear view on other elements of the preview chart.
Only show notes at cursor	The note closest to the cursor is displayed in full length.
Only show note with table focus	The Navigator displays the note you selected in the control panel Notes and masks.
Indicate hidden notes	Notes are displayed as running numbers, not as text. If Only show notes at cursor is active at the same time, only the note closest to the cursor is displayed in full length and all other notes are displayed with running numbers.
Interrupt replay at notes	If the cursor reaches a note during play-back, the Navigator automatically switches to pause mode and play-back is interrupted.

4 Menu button masks

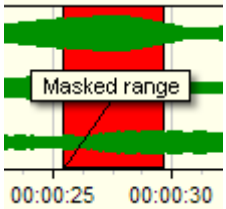
The masking technology of the InnoMaster Replay allows to suppress measurement data (section by section) while it is transmitted to the instruments. This function may be helpful if there are short sections of measurement data which are not representative for the complete measurement course.
For instance there may be measurements which are to form characteristics for a longer time. If there are abnormal short-time events now, for example overload of a measurement channel because of accidentally vibrations on the sensor, the whole measurement would have to be dismissed. By masking the abnormal time period, the measurement is still valid. This procedure saves time and costs since the measurement does not need to be dismissed and carried out again. Another advantage of using masks is the preservation of the original measurement data. When the mask is deleted, the complete measurement data is visible again.



Insert masked range
This function enters a mask visible in the Navigator graphic. This provisional mask is displayed in pale red first and can be adjusted now. Therefore, the mouse pointer is positioned on one of the mask's side borders. By clicking left and dragging, the border can be adjusted anew.



If the mask is situated and sized correctly, the procedure is finished by the menu entry Finish masking. This entry is only active while a mask is inserted. After finishing, the mask is displayed in red. Additionally, an entry is created in the control panel Notes and masks. Here you can describe for which reason the mask was entered so that this information is available later.



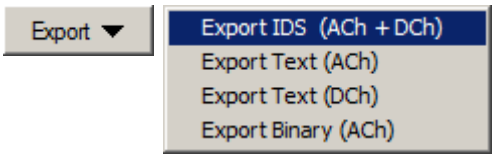
If inserting a mask is to be aborted, the entry Abort masking has to be selected. The pale red mask disappears then. The entry is only active while a mask is inserted, too.

Fill masks with zero
This option causes the measuring time to run normally during the masked time period, but as signal, zeros are transmitted instead of the original measurement signal.

Omit masks
This option means that masked time periods are simply skipped. So regular measurement data is transmitted to the instruments until the masks starts and afterwards the measurement data following the mask is transmitted immediately.

5 Menu button export

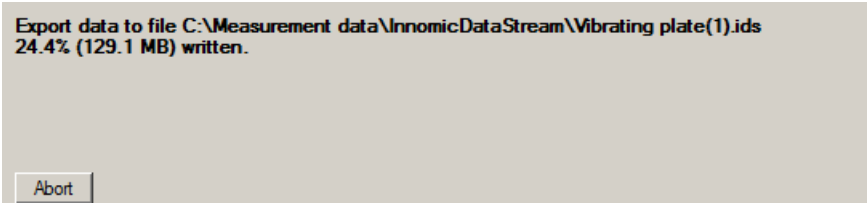
The export functions allow to save measurement data from the currently displayed time period in a new file. This way, interesting sequences in the measurement data can be extracted and saved in smaller files. These files can be send by e-mail.
Different output formats are available. Text and binary export are only possible if you purchased licenses for these options.



IDS (ACh + DCh)	This option exports data in IDS format. This format is the VibroMatrix format so that all additional pieces of information like wall clock time, notes, masks, etc. are saved as well. VibroMatrix exports the signals of the measuring channels (ACh) as well as the rotation speed signal (DCh).
Text (ACh)	This option exports the signals of the measuring channels (ACh) into a text file. The data from all channels for the same time period is shown in one row separated by tabulators. The first column shows the time axis is seconds.
Text (DCh)	This option exports the rotation speed signal (DCh) into a text file.
Binary (ACh)	This option exports the signals of the measuring channels (ACh) into a file in binary format. At first, a header in text format is written with two rows for the name of the measuring channels and the unit. Its followed by time and measurement data for each time period: For each time period, the time of the measurement in seconds is written in double format (floating point number, 8 Byte), followed by the measured values of all channels in float format (floating point number, 4 Byte). In this order, the data of the time range shown in the preview chart follows time period per time period.

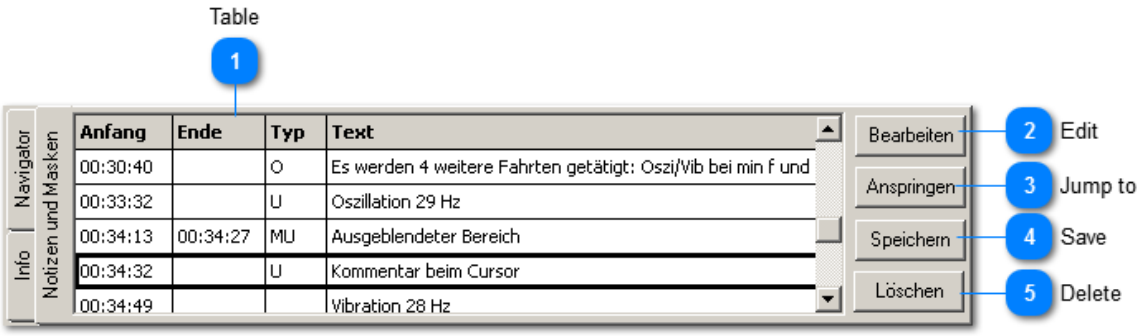
After having selected the format, you decide which channels are to be exported. You can deselect unimportant channels to reduce the amount of data.

Click on Start export to initiate exporting. The generated file has the same name as the currently opened one, but with a new index.

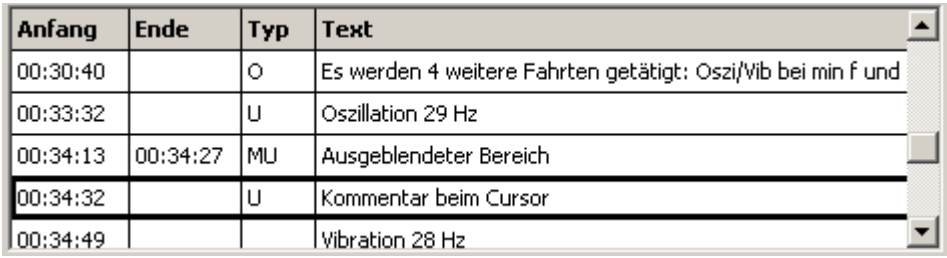


Notes and masks

This control area shows all notes and masks in a table assorted by time.



1 Table



Anfang	Ende	Typ	Text
00:30:40		O	Es werden 4 weitere Fahrten getätigt: Oszi/Vib bei min f und
00:33:32		U	Oszillation 29 Hz
00:34:13	00:34:27	MU	Ausgeblendeter Bereich
00:34:32		U	Kommentar beim Cursor
00:34:49			Vibration 28 Hz

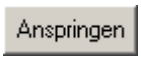
Additional to the time stamp of a note resp. the time range of a mask the table also shows the type of entry.

O Original notes saved during measurement.
U Unsaved notes or masks.
M Mask
(Empty) Saved note that has been changed or entered during offline analysis.

2 Edit

Click this button to edit the text of the selected note/mask.

3 Jump to



Click this button to position the cursor at the position of the selected note/mask in the preview chart.

4 Save

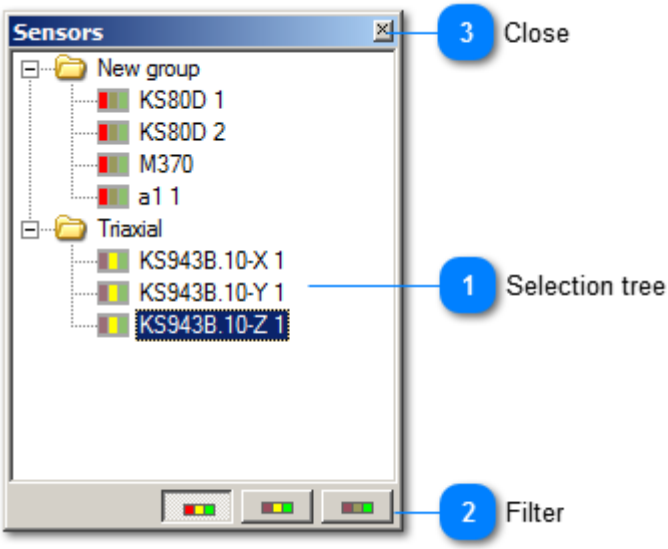
This button saves changes or new notes/masks.

5 Delete

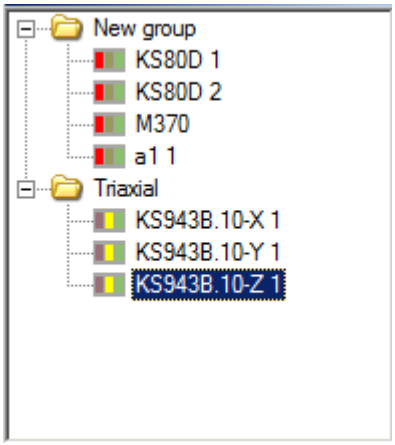
This button deletes the selected note/mask.

Sensor management

VibroMatrix supports the use of different sensors by means of a sensor data base.



1 Selection tree



The selection trees shows all saved sensors. They are divided into groups. The traffic light on the left side of the sensor name is an activity indicator:

- red: The sensor is not in use at the moment.
- yellow: The sensor is assigned to a measuring channel but this channel is inactive.
- green: The sensor is assigned to a measuring channel and this channel is measuring at the moment.

Mouse operation

- A double click on a sensor entry opens the properties window of the respective sensor.
- A double click on a sensor group opens the properties window of the respective group.
- A right click on a sensor opens its context menu.
- A right click on a sensor group opens its context menu.
- A right click in an empty space of the selection tree opens its context menu.

2 Filter

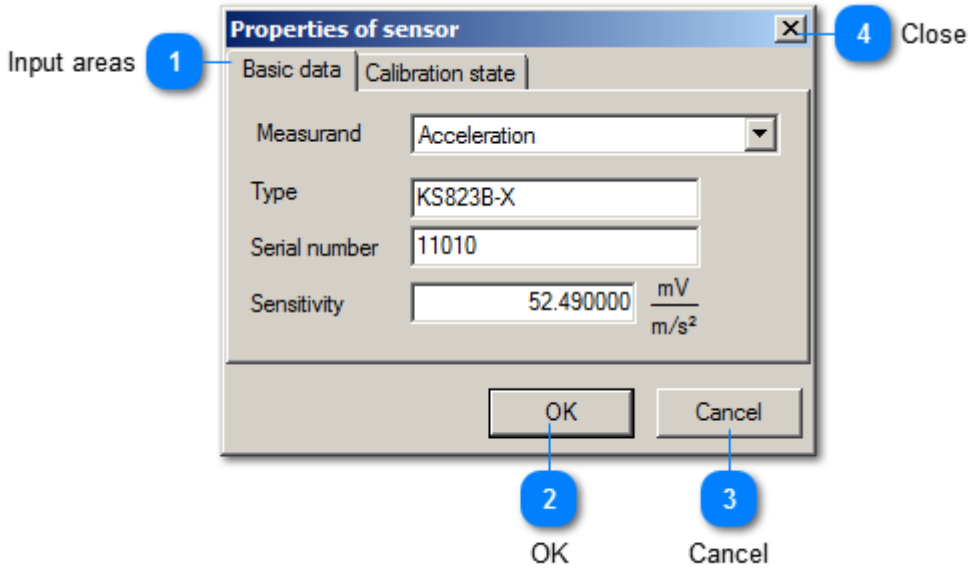
You can restrict the sensor list, e.g. to sensors which are currently measuring (green activity indicator).

3 Close

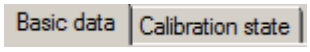
This button closes the sensor management.

Properties of sensor

You can save the properties of each sensor in use. Several common alternating measurands are already listed with suitable units. But you can also enter sensors for other measurands. The basic data contains a clear identification with type and serial number as well as the sensor sensitivity.
If the sensor is equipped with TEDS technology, basic data and calibration state are read directly from the sensor and entered automatically.



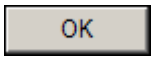
1 Input areas



By means of these tabs, you switch the input areas:

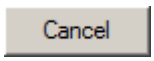
- Basic data: Measurand, clear identification and sensitivity
- Calibration state: Time information concerning calibration
- If you selected the measurand User measurand, a third input area is available to characterize this measurand.

2 OK



This button saves the sensor properties and closes the window.

3 Cancel



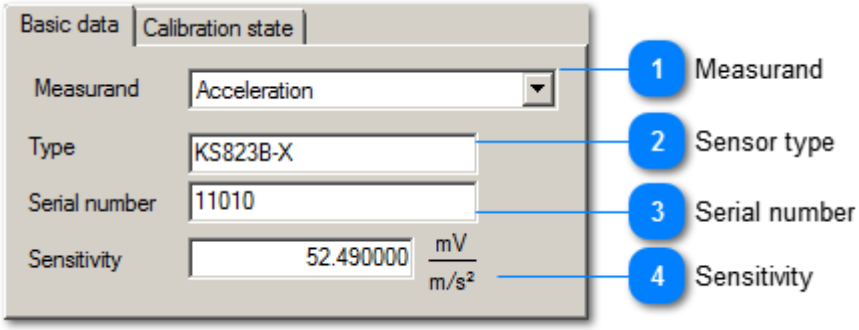
This button closes the window without saving changes.

4 Close

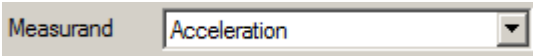
This button closes the window without saving changes.

Basic data

Basic data of the sensor includes measurand, clear identification and sensitivity.

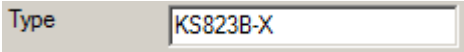


1 Measurand



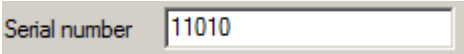
Different common alternating measurands are listed with suitable units. You can select the required measurand from the drop-down list. By selecting the entry User measurand you can enter another non-predefined measurand.

2 Sensor type



You can enter the sensor type here. The combination of type and serial number is usually unique and it is used to distinguish the sensors. When using triaxial sensors, you usually add the name of the axis (e.g. X, Y or Z) to type or serial number.

3 Serial number



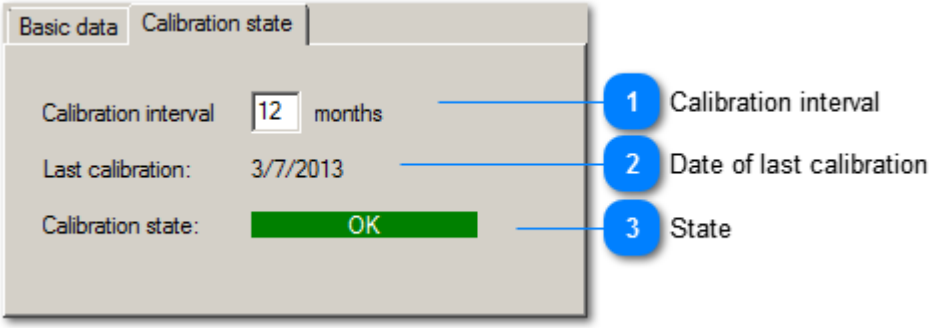
You can enter the serial number of the sensor here. The combination of type and serial number is usually unique and it is used to distinguish the sensors. When using triaxial sensors, you usually add the name of the axis (e.g. X, Y or Z) to type or serial number.

4 Sensitivity

The sensitivity characterizes the transmission behavior of the sensor. Der Sensor bildet eine physikalische Messgröße auf einer elektrischen Spannung ab, welche gemessen wird. You can use sensors with a transmission behavior which can be described with one factor. Die Angaben finden sich im Kennblatt des Sensors oder werden bei einer Folgekalibrierung durch die Kalibrierstelle mitgeteilt.

Calibration state

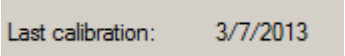
The calibration state panel shows time information concerning the calibration and the calibration state.



1 Calibration interval

You can adjust the calibration interval of a sensor. Manufacturers usually recommend a calibration interval of 12 months for piezoelectric sensors which are frequently used and 24 months for rarely used piezoelectric accelerometers.

2 Date of last calibration



Shows the date of the last calibration. The date is set by

- entering a sensitivity,
- saving in the instrument Calibrator
- in case of using TEDS sensors by writing data into the internal storage of the sensor.

3 State

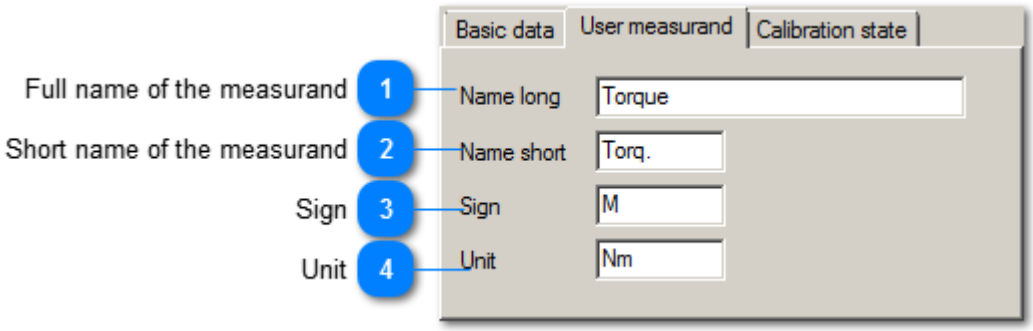
The status gives a quick overview about the elapsed time since the last calibration.

- If less than 90% of the calibration interval have elapsed, the status is OK.
- From 90% .. 100% the label shows: Calibrate soon
- If more than 100% of the calibration interval have elapsed, the status is: Calibrate!!!

However, you can use the sensor independently from the calibration state. The status information is only there to remind you of the calibration and you can still use a sensor with an expired calibration interval together with VibroMatrix.

User measurand

If you use a sensor for a measurand which is not available in the prepared list, you can characterize this measurand as user measurand.



1 Full name of the measurand

This name is used for instance in drop-down lists for selecting the measurand.

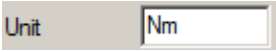
2 Short name of the measurand

This name is used for instance in status bars.

3 Sign

The sign for the measurand is used for instance as axis label in charts.

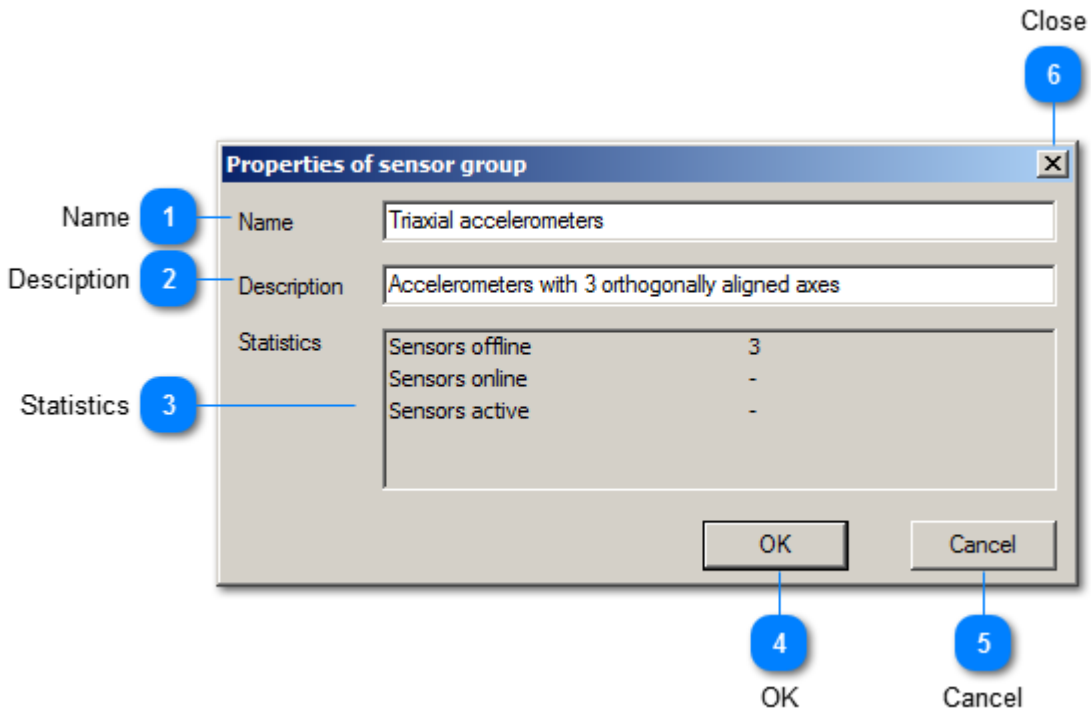
4 Unit



The unit of the measurand is used for all numerical displays of the measurand or also as axis label.

Properties of sensor group

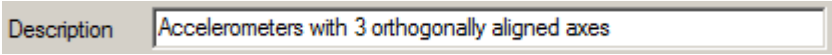
Sensor groups are used for a clear sorting in case of measuring with many different sensors.



1 Name

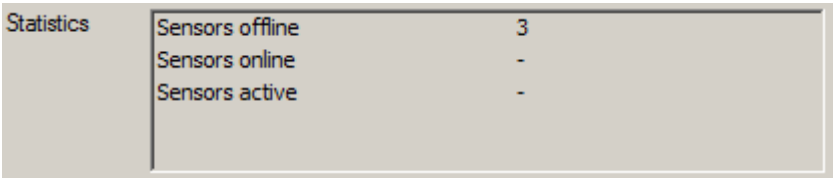
Name of the sensor group in the selection tree. It has to be unique, i.e. it is not possible to have two sensor groups with the same name in a selection tree.

2 Desciption



An optional description of the sensor group.

3 Statistics

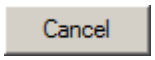


Statistics for the number of sensors in the group and their states.

4 **OK**

This button saves changes and closes the window.

5 **Cancel**



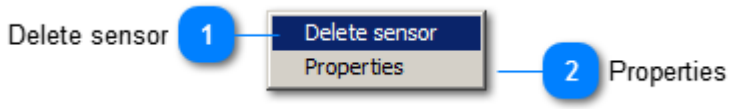
This button closes the window without saving changes.

6 **Close**

This button closes the window without saving changes.

Context menu sensor

A context menu opens when clicking right on a sensor in the selection tree.



1 Delete sensor

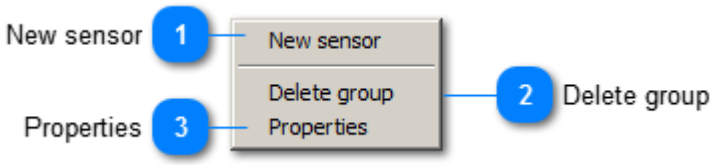
Delete sensor A click on this entry deletes the sensor from the selection tree after confirmation prompt.

2 Properties

Properties A click on this entry opens the properties window of the sensor.

Context menu sensor group

A context menu opens when clicking right on a sensor group in the selection tree.



1 New sensor

New sensor A click on this entry creates a new sensor in the group and opens its properties window.

2 Delete group

Delete group A click on this entry deletes the sensor group after confirmation prompt.

3 Properties

Properties A click on this entry opens the properties window of the sensor group.

Context menu selection tree

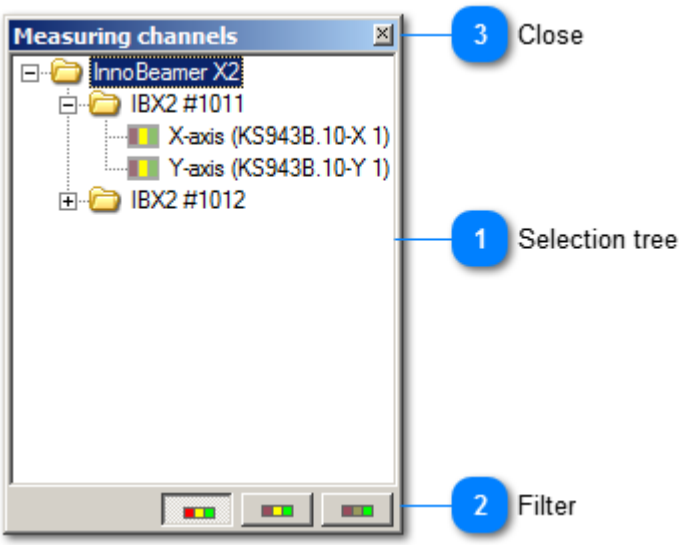
A context menu opens when clicking right in an empty space of the selection tree.

1 New group

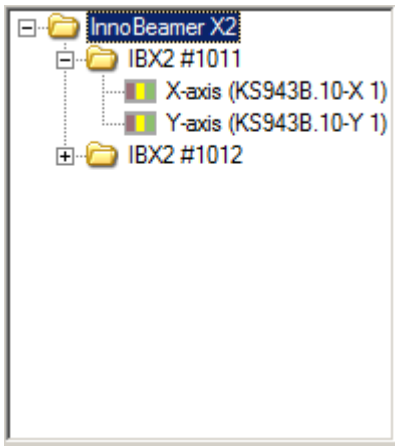
A click on this entry creates a new sensor group and opens its properties window.

Measuring channel management

VibroMatrix can be operated with one single measuring channel, but also with 32 channels. The management of measuring channels provides an overview.



1 Selection tree



The selection tree shows all devices incl. their measuring channels. The devices are sorted acc. to their type.
The left picture shows the device type *InnoBeamer X2*. There are 2 devices of that type, their serial numbers are *1011* and *1012*. Each device provides two measuring channels. Device 1011 displays its channels. These measuring channels have been named individually (*X-axis* and *Y-axis*). On the left of the channel name, there is a status indicator in traffic light colors:

red:	This measuring channel belongs to a device which is not connected at the moment.
yellow:	This measuring channel belongs to a connecteed device and it is ready for measuring. However, the channel is not measuring yet.
green:	This measuring channel is currently measuring.

Mouse operation

- A double click on a device type opens the properties window of the respective device type.
- A double click on a device opens the properties window of the respective device.
- A double click on a measuring channel opens the properties window of the respective channel.
- A right click on a measuring channel opens its context menu.

2 **Filter**

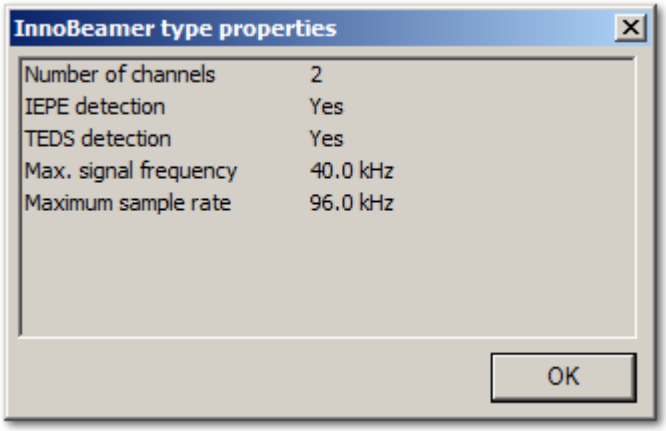
You can restrict the list of measuring channels, e.g. to channels which are currently measuring (green activity indicator).

3 **Close**

This button closes the window.

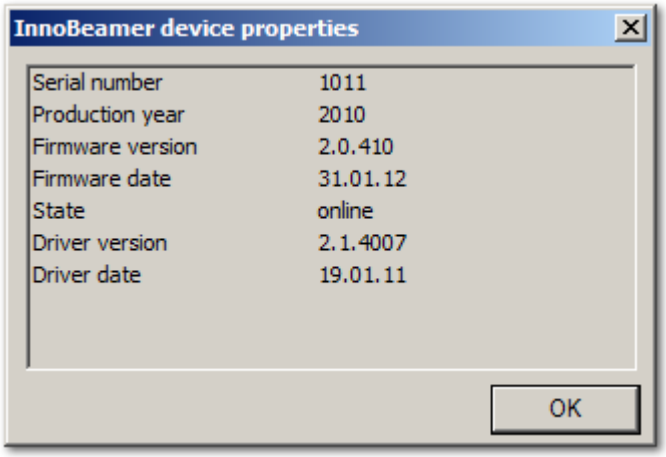
Device type properties

The window shows some properties which are characteristic of that device type.



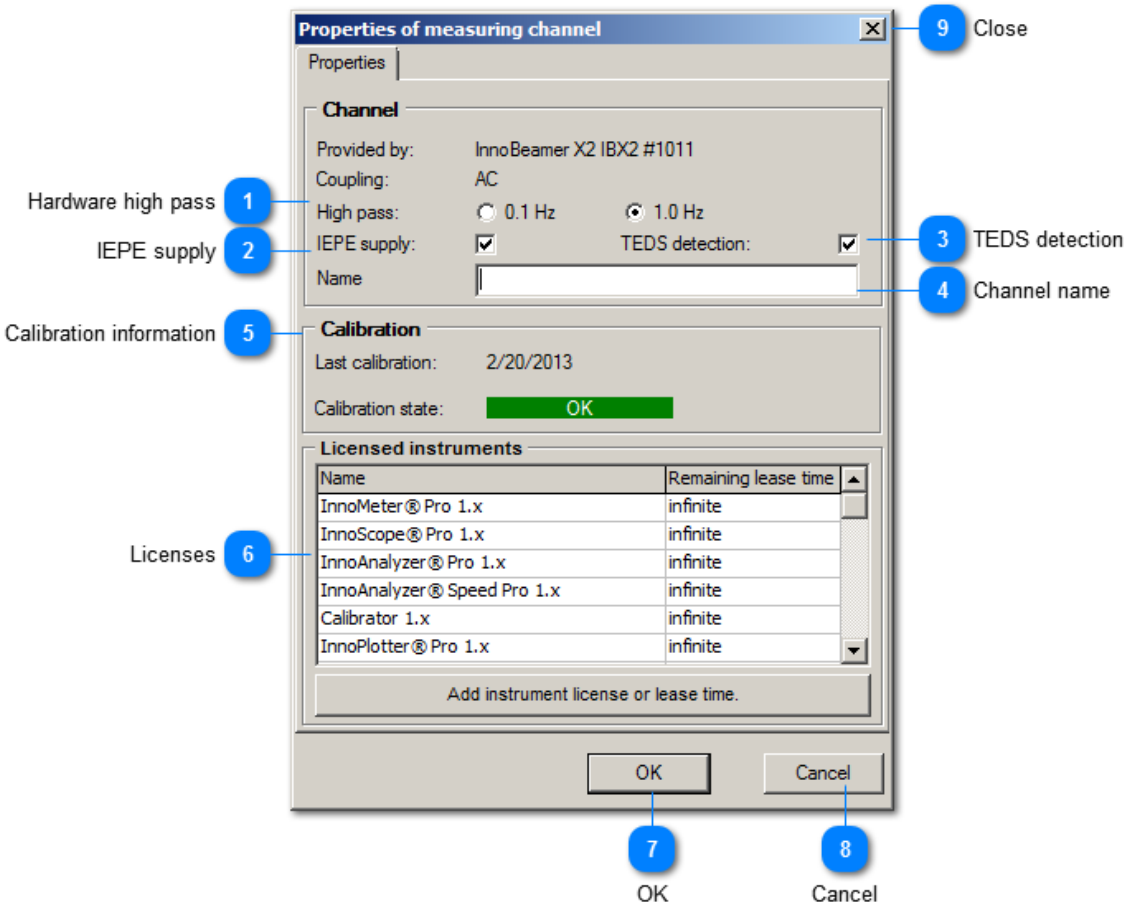
Device properties

The window shows some characteristics of the device.



Measuring channel properties

You can adjust measuring input settings separately for each measuring channel. Additionally, you can enter an individual name which is used in the whole program.



1 Hardware high pass

High pass: 0.1 Hz 1.0 Hz

The high pass frequency of VibroMatrix instruments is freely adjustable. However, this freedom is limited by the hardware high pass of the measuring channel. Two high passes are available:

- 0.1 Hz for low-frequency processes.
- 1.0 Hz for all other processes.

In principle, you can also measure all other processes for which the 1.0 Hz high pass is suitable if you selected 0.1 Hz. But a high-pass filter always features a settling time after switching on or sensor connection: the lower the limit frequency, the longer the settling time. When measuring low-frequency processes, one accepts a longer settling time (e.g. 30 s). However, such a long settling time is perturbing when measuring faster processes. It can be reduced to 1/10 when selecting the 1.0 high pass.

2 IEPE supply

IEPE supply: ☑

The measuring input supports piezoelectric sensors or microphones with so-called IEPE interface. A constant current supplies the sensor's integrated amplifier. Thanks to this integrated amplifier, it is possible to transfer the sensor signal over long distances (e.g. 100 m).
If you connect other sensors, we recommend to switch off the IEPE supply. This way, the measuring input is a high-quality measuring input for AC voltges from +/- 10 V.

3 TEDS detection

TEDS detection: ☑

TEDS is an abbreviation for Transducer Electronic Data Sheet. The sensor not only contains an amplifier as described at IEPE supply, but also a chip with important data. For instance, this data contains type, serial number, transmission behavior, date of last calibration. To work with TEDS information, you have to activate the IEPE supply.
There are few IEPE sensor types which react to TEDS detection in a way which does not comform to the standard. The result is that the IEPE supply is switched on and off. In this case you have to deactivate TEDS detection.

4 Channel name

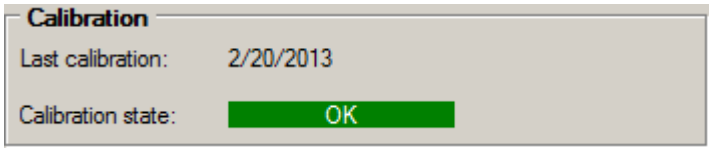
Name

For each measuring channel, you can enter an individual name which is suitable for the measurement task. In VibroMatrix, this name is used e.g.

- when selecting the measuring channel
- in status bars

If you do not enter a name, a standard name is used for the measuring channel. It consists of device type, serial number and channel number, for instance
K1 - IBX2 #1010 (channel 1 of the InnoBeamer X2 with serial number 1010)

5 Calibration information

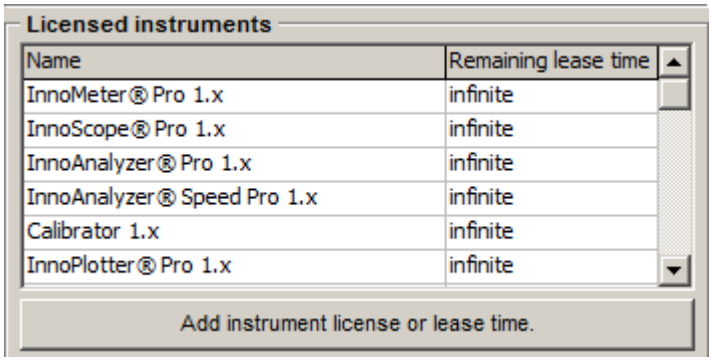


This field displays the date of the last calibration. Internally, 5 years are used as calibration interval. The status information means:

- If less than 90% of the calibration interval have elapsed, the status is OK.
- From 90% .. 100% the label shows: Calibrate soon
- If more than 100% of the calibration interval have elapsed, the status is: Calibrate!!!

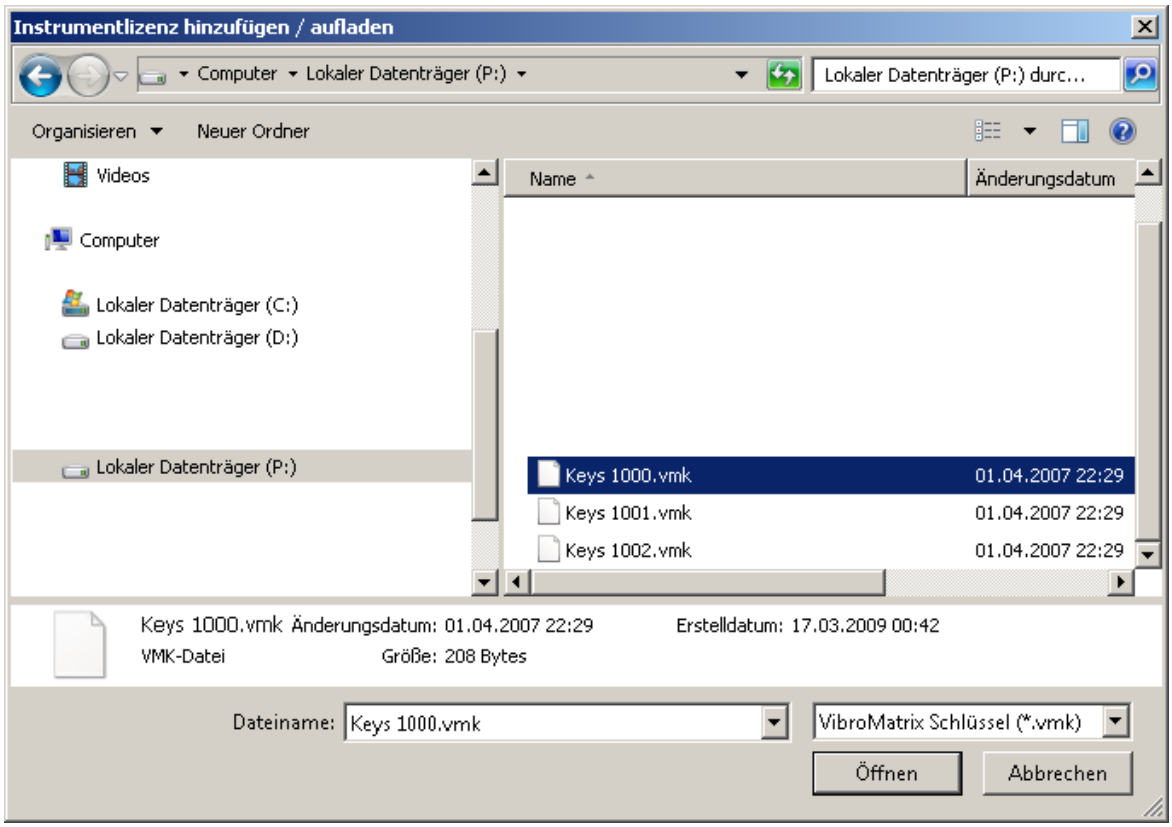
However, you can use the measuring channel independently from the calibration state. The status information is only there to remind you of the calibration and you can still use a measuring channel with an expired calibration interval in VibroMatrix.

6 Licenses



The licenses for the instruments of are saved in the InnoBeamer. This field shows the licenses for the respective measuring channel.

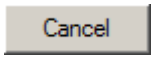
A file window opens when adding a license. Select the key file and confirm with Open. The license wiill be loaded into the InnoBeamer now.



7 **OK**

This button saves the changes and closes the window.

8 **Cancel**



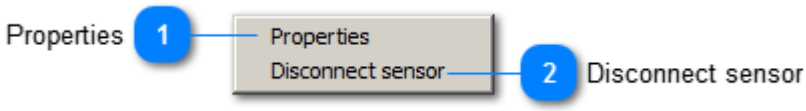
This button closes the properties window without saving changes.

9 **Close**

This button closes the properties window without saving changes.

Context menu measuring channel

A context menu opens when clicking right on a measuring channel in the selection tree.



1 Properties

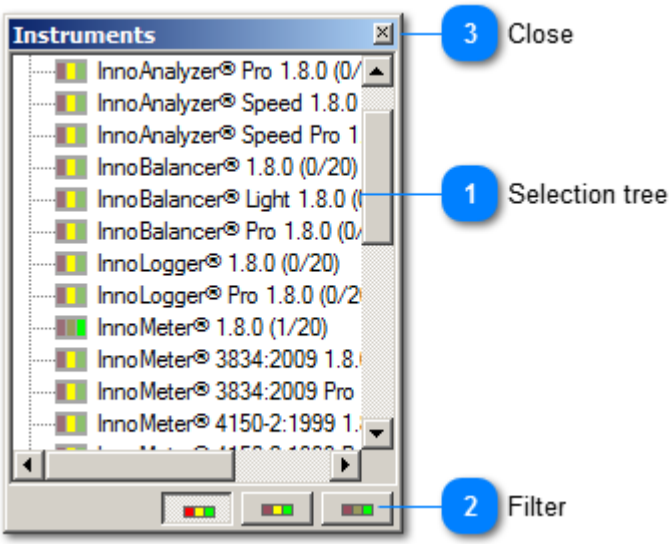
Properties A click on this entry opens the properties window of the respective measuring channel.

2 Disconnect sensor

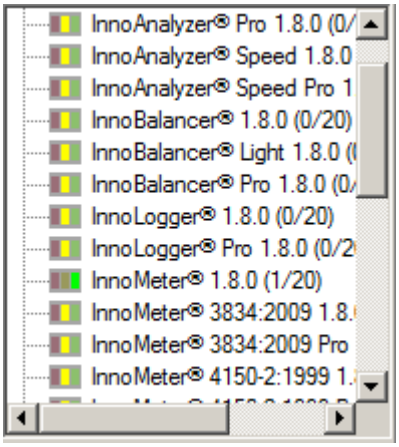
Disconnect sensor A click on this enty disconnects the sensor from the measuring channel.

Instrument management

VibroMatrix offers a variety of instruments, each for a certain purpose. Several instruments can be operated together.



1 Selection tree



The selection tree lists up all available instruments. The traffic light on the left side of the instrument's name is an activity indicator:

• red:	This instrument has been installed, but there is no license for using it.
• yellow:	This instrument is ready for measuring, but it has not yet been started.
• green:	This instrument hast been started.

Mouse operation

- A double click on an instruments opens a new instrument window.
- A right click on an instrument opens its context menu.
- A right click in an empty space of the selection tree opens its context menu.

The number following the instrument indicates how much instrument windows are opened. One license allows the five-fold use of an instrument. With a single license, you can for instance open 5 InnoMeter windows to display 5 different values simultaneously, e.g. vibration displacement, velocity, acceleration, rotation speed and main frequency.

2 **Filter**

You can restrict the list of instruments, e.g. to instruments which can be opened (yellow or green activity indicator).

3 **Close**

 This button closes the window.

Context menu instrument

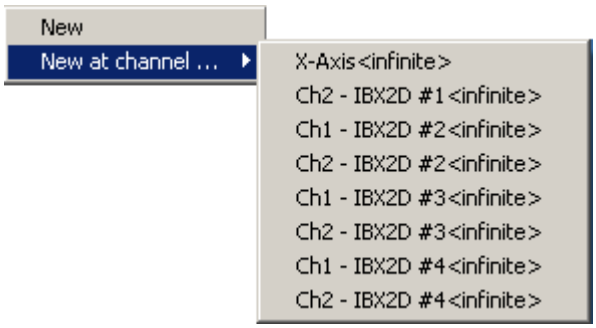
A context menu opens when clicking right on an instrument in the selection tree.

1 New

A click on this entry opens a new window for the respective instrument.

2 New at channel ...

A click on this entry opens a new window for the respective instrument and uses the selected channel as first measuring channel.



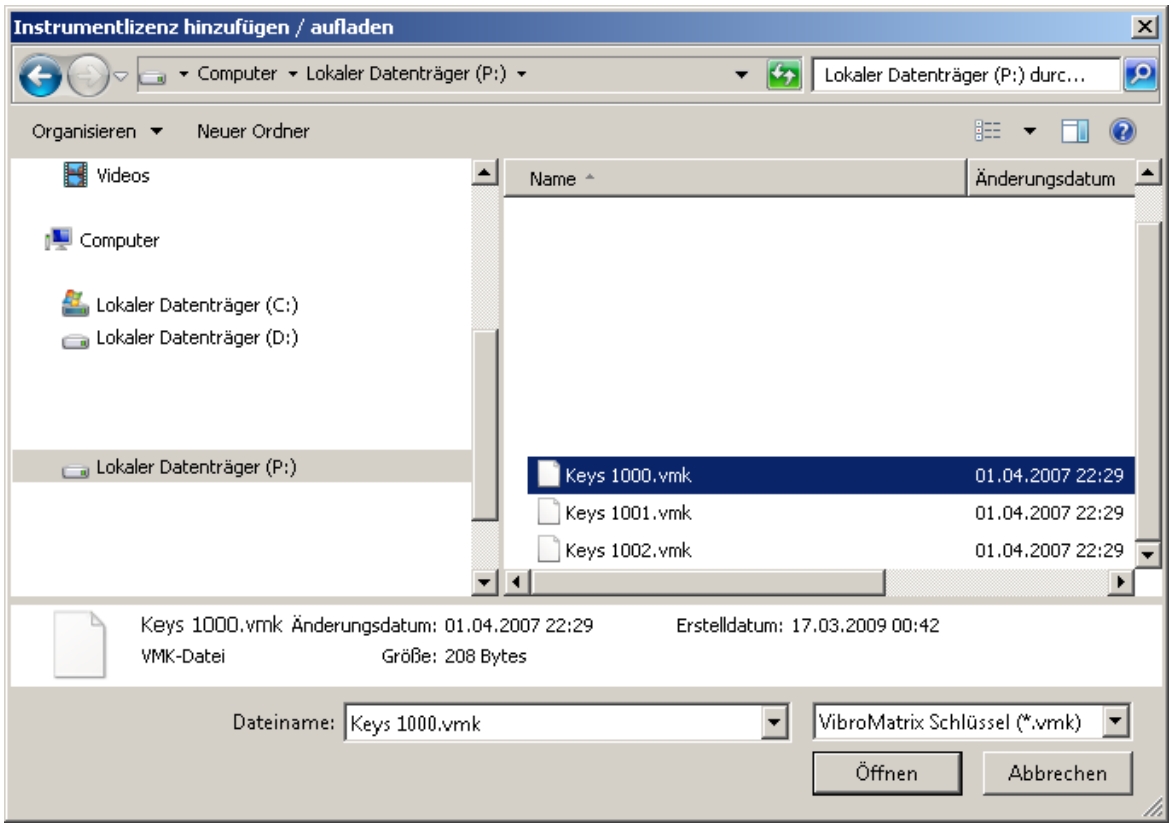
Context menu selection tree

A context menu opens when clicking right in an empty space of the selection tree.

1 Add

Add A click on this entry adds an instrument license.

The instrument license is key file. Usually this file will be sent to you from your seller, e.g. by e-mail. This license is transferred to the USB box InnoBeamer. That is why you must connect the InnoBeamer. When clicking on Add, a file window opens in which you select the respective key file.

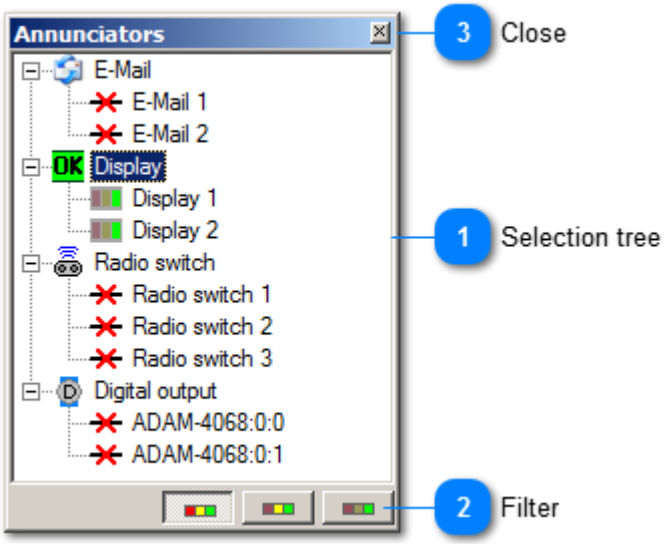


Confirm the selection by clicking on Open to transfer the file to the InnoBeamer.

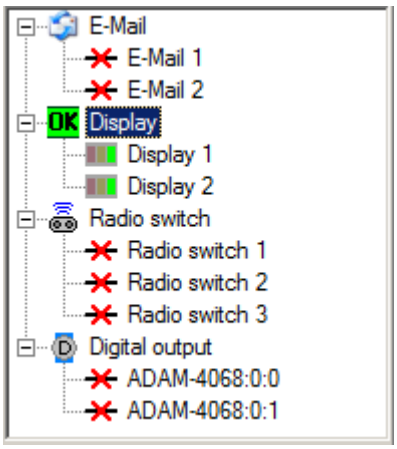
Annunciator management

Many instruments of VibroMatrix can signal information outward optionally by means of annunciators. Here, in the annunciator management, you create the annunciators. Afterwards, they are available in the instruments. Annunciators are additional ways to communicate information:

1. Transfer by e-mail
2. Signaling in a display
3. Using radio switches
4. Controlling digital outputs



1 Selection tree



The selection tree shows all available types of annunciators and the created annunciators for each type. The traffic light on the left side of the annunciator's name is an activity indicator:

- red: This annunciator is not connected to an instrument.
- yellow: This annunciator is connected to an instrument, but the respective instrument has not yet been started.
- green: This annunciator is connected to an instrument and the respective instrument has been started.

If there are missing general pre-conditions for operating an annunciator type (e.g. a disconnected radio control unit for operation of radio switches), the respective annunciators are marked as follows:

Mouse operation

- A double click on an annunciator type opens the properties window of this type: E-Mail, radio switch, digital output.
- A double click on an annunciator opens its properties window: E-Mail, display, radio switch, digital output.
- A right click on an annunciator type opens the context menu of this type.
- A right click on an annunciator opens its context menu.

2 Filter

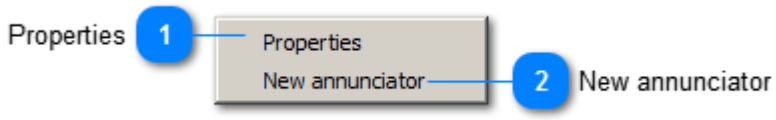
You can restrict the list of annunciators, e.g. to annunciators which are currently connected (yellow or green activity indicator).

3 Close

This button closes the window.

Context menu annunciator type

A context menu opens when clicking right on an annunciator type in the selection tree.



1 Properties

Properties

The annunciator types E-Mail, digital output and radio switch feature a properties window. It is opened by clicking on Properties.

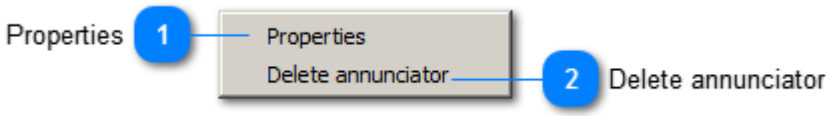
2 New annunciator

New annunciator

Clicking on this entry creates a new annunciator of the respective type.

Context menu annunciator

A context menu opens when clicking right on an annunciator in the selection tree.



1 Properties

Properties By clicking on Properties, you open the properties window of the annunciator (display, E-Mail, digital output, radio switch).

2 Delete annunciator

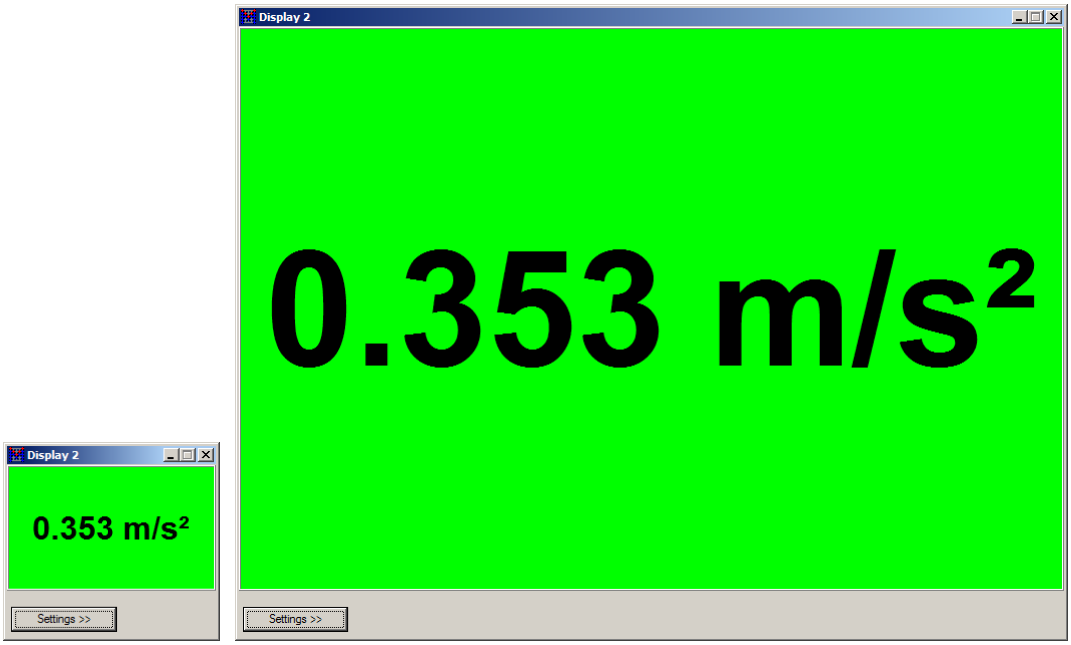
Delete annunciator By clicking on this entry, you delete the annunciator. But it is only possible if the annunciator is used in no instrument.

Annunciator type Display

If VibroMatrix is to be applied for monitoring or inspection tasks (for instance in quality control), work is often divided:

1. Measurement experts define measurement modes as well as limit values and configure the VibroMatrix instruments acc. to these specifications.
2. Measurement staff carries out the measurements afterwards. A clear but also simplified view on the measurement result is required.

This simplified view is fulfilled by the display annunciator. The display is a window adjustable in size, which fills out the complete screen if required. It indicates a measured value or status and colors the text color and the background acc. to the configured specifications.

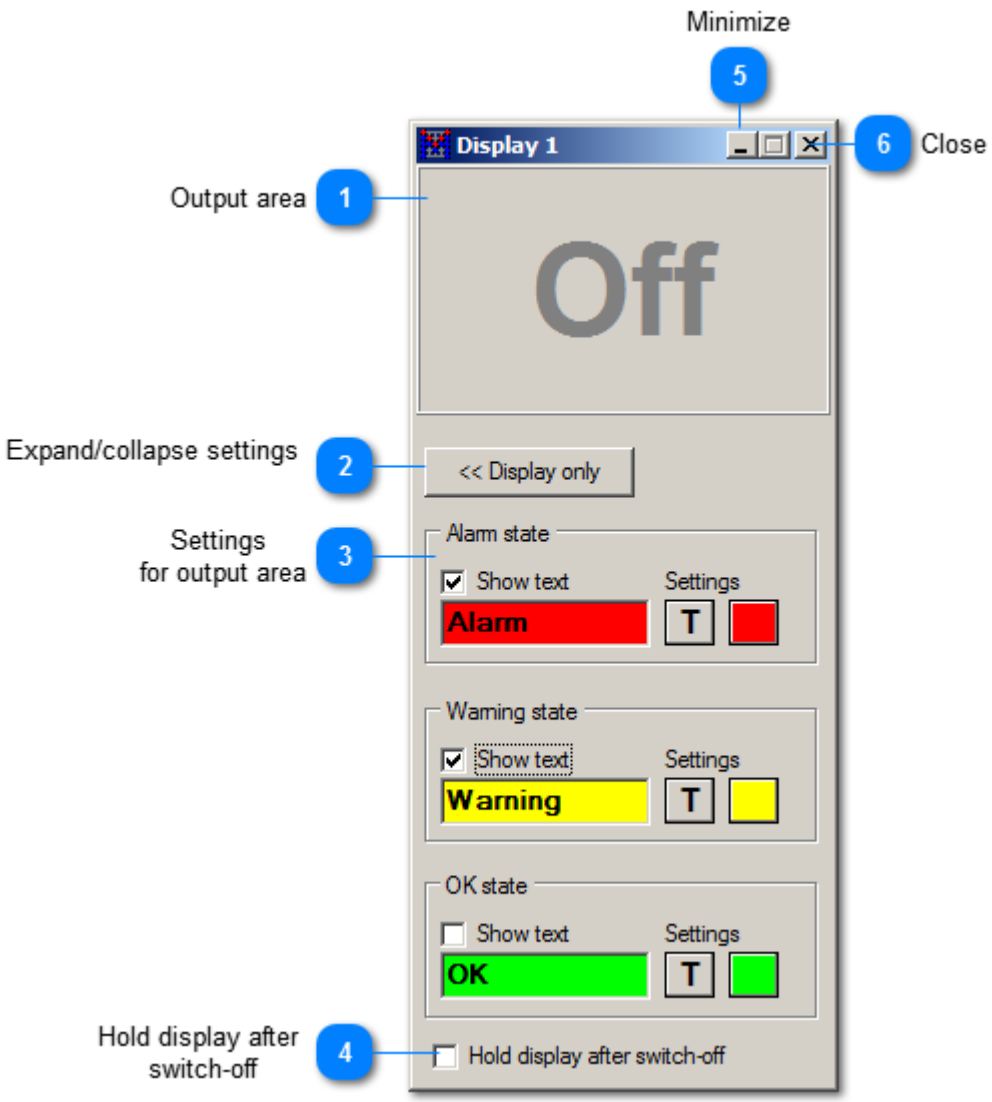


Configuration

The configuration is carried out in the properties window of the display.

Configuration of a display annunciator

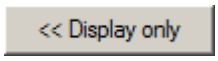
The display is suitable for a big but reduced view on the measurement results. Connected to an instrument, it can collapse its detailed settings and only displays the result of the measurement in a big and clear way.



1 Output area

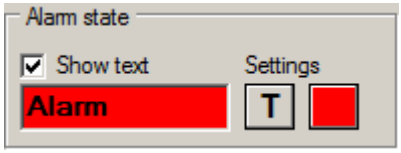
Depending on the configuration, the output area displays measured values or texts.

2 Expand/collapse settings

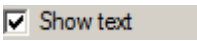


After you have completed the configuration of the display, you can collapse the settings area. You can expand it again for configuration.

3 Settings for output area



You can configure the output area indiviually for three states.



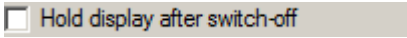
- If you activate this option, the entered text will be displayed in the output area.
- If you do not activate this option, the measured value will be displayed in the output area.

Enter the text for the respective state here.

This button opens a dialog box for selecting font type and also font size.

This button opens a dialog box for selecting the background color.

4 Hold display after switch-off



- If you activate this option, the last output is held after you switched off the connected instrument.
- If the option is deactivated, the display shows "Off" in grey color after you switched off the connected instrument.

5 Minimize

This button minimizes the display.

6 Close

This button closes the display.
But it can be opened again, for instance by a double click in the selection tree. Only deleting the annunciator will erase the display permanently.

Annunciator type E-Mail

Long-term measurements with quite few events are often to run unattended. Still, interesting events are to reach the measurement staff.
A suitable way of transmitting data in general is by e-mail. Depending on the instrument, the following VibroMatrix data is transmitted:

- Single values
- Status annunciations
- Measurement charts
- Greater amounts of measurement data

Configuration

A VibroMatrix instrument notes an interesting value – how does it reach the recipient at the other end of the world?

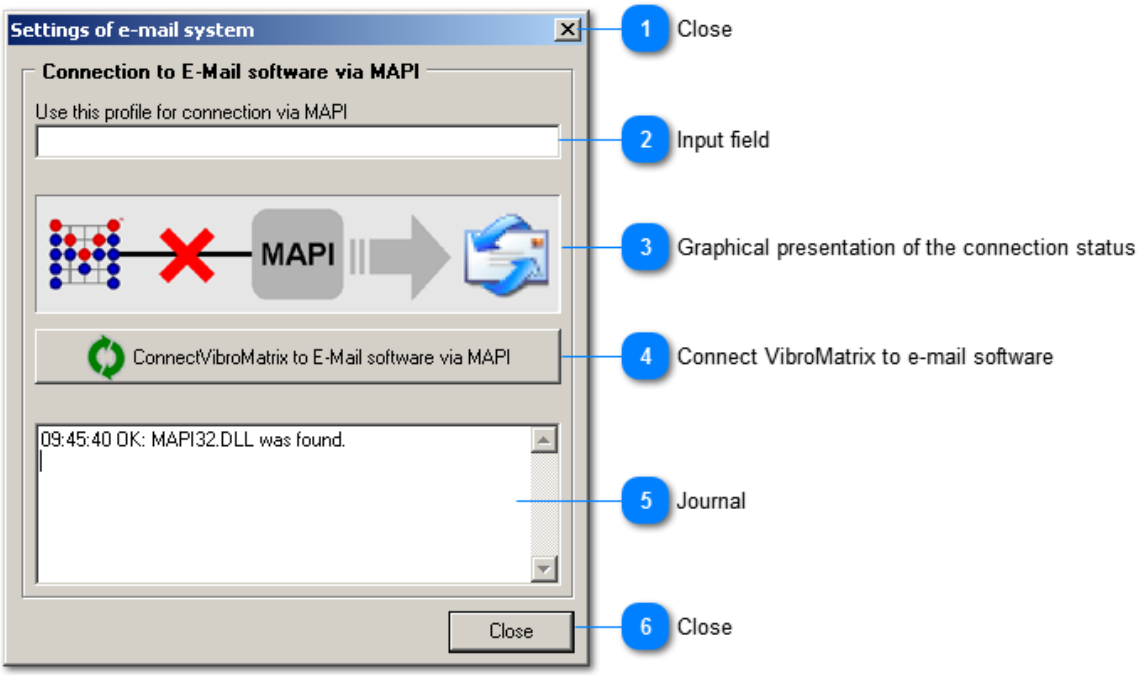
1. Firstly, you configure for each messenger with which text it is to be sent and to which recipient the measured values are to be sent.
2. From these data, an e-mail is created and transmitted to the e-mail program installed on the PC. Therefore, you have to configure the connection to the e-mail program before. Configuring the e-mail program is not a part of VibroMatrix.
3. Your e-mail program sends the mail to the recipients configured in the e-mail annunciator via Internet. Configuring the Internet access is carried out as usual under Windows and is not explained here.

Settings for the annunciator type E-Mail

VibroMatrix does not create its own connection to an e-mail server to send event annunciations by e-mail. It uses the installed e-mail software instead. This way, there are two advantages:

1. You only enter your e-mail data once and not a second time for VibroMatrix.
2. You work in your usual environment, e.g. you can watch all e-mails send from the annunciator in the e-mail software you are used to.

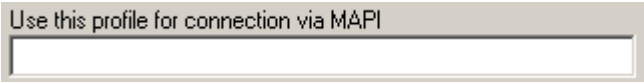
In order to enable the E-Mail annunciators to work, you have to create a connection to an installed e-mail software. This bridge is called MAPI. Many e-mail programs feature a MAPI interface, e.g. Outlook, Outook Express, Windows Mail, Thunderbird, The Bat!.



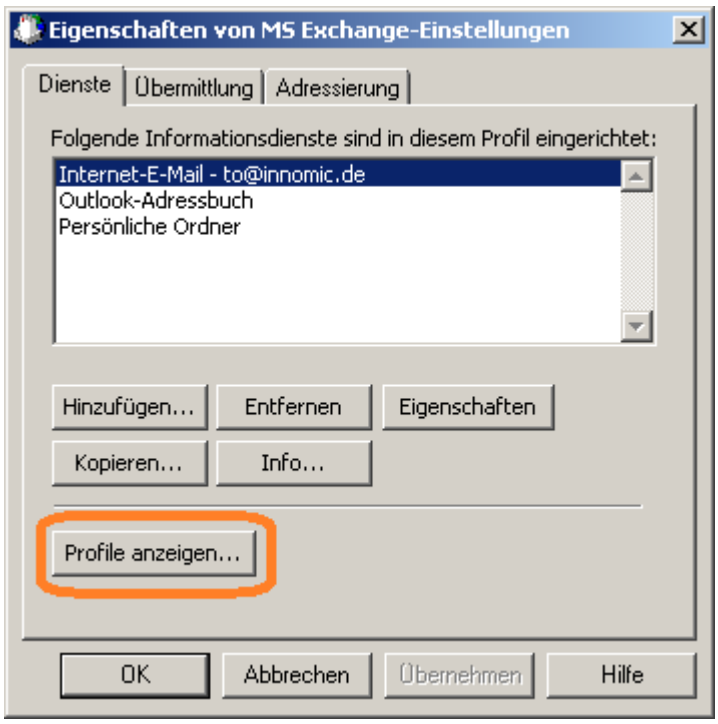
1 Close

This button closes the window.
But it can be opened again, e.g. by a double click in the selection tree.

2 Input field



Some e-mail softwares, e.g. Outlook, expect a profile name it you want establish a connection to them. Therefore you can watch the profile in the system control under Mail:



3 Graphical presentation of the connection status

The connection status between VibroMatrix and the installed e-mail software is shown in a connection chart.

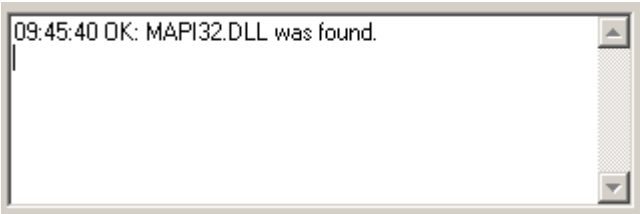
VibroMatrix is not connected to the e-mail software.

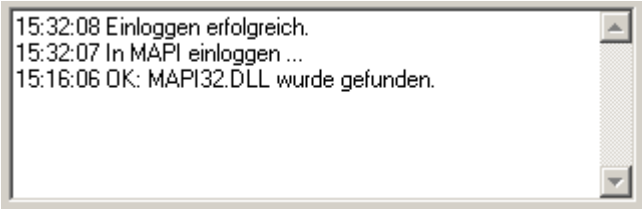
VibroMatrix is connected to the e-mail software.

4 Connect VibroMatrix to e-mail software

By clicking this button you connect VibroMatrix to the installed e-mail software. You can see whether a connection has been established or not in the connection chart and in the journal.

5 Journal





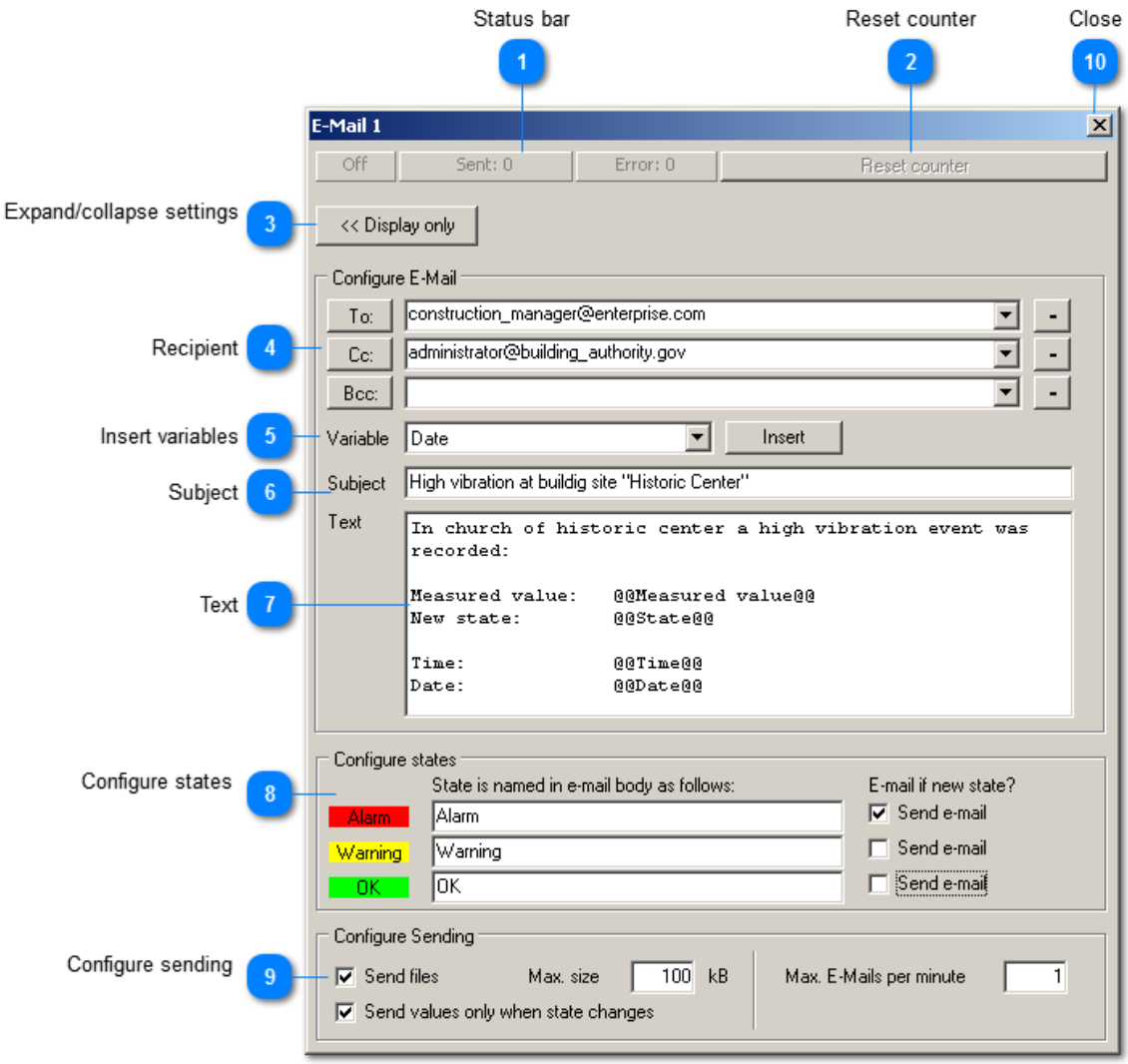
The connection attempts to the e-mail software and the result are listed up here as well as entries for sent e-mails.

6 Close

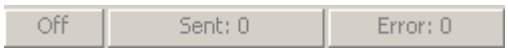
This button closes the window.
But it can be opened again, e.g. by a double click in the selection tree.

Configuration of an E-Mail annunciator

You can create up to 100 E-Mail annunciators in VibroMatrix and enter recipients and texts individually for each annunciator.



1 Status bar



The status bar indicates

- whether the annunciator is switched on or not,
- how many e-mails have been sent by the annunciator,
- how many errors occurred.

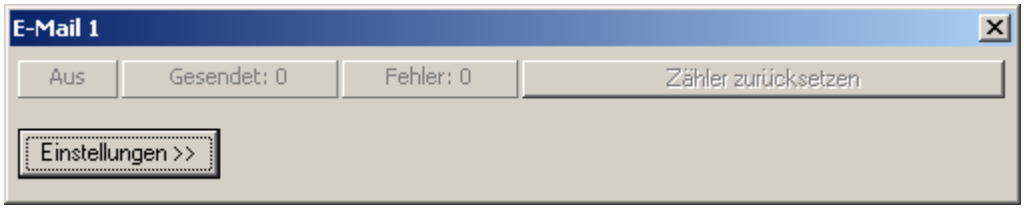
2 Reset counter

This button zeros the counters for the sent e-mails and the errors in the status bar.

3 Expand/collapse settings

After having finished the configuration of the e-mail annunciator, you can collapse the setting area to save space on the screen. For configuration, you can expand the setting area again.

Collapsed state:



4 Recipient

In this area, you can enter the recipients for the e-mails.

- In line To: you enter the main recipients.
- In line Cc: you enter recipients who are to receice a copy of the e-mail and whose e-mail address is to visible for all recipients.
- In line Bcc: you enter recipients who are to receive a copy of the e-mail and whose e-mail address is to be invisible for all recipients.

- You can enter several addresses in each line. Therefore, you confirm the address by pressing the Enter button and enter the next address. By means of the button you can expand the list and enter addresses.
- If you want to delete an address, expand the list by means of the button and select the address you want to delete. Confirm by clicking on -.
- The buttons An: Cc: Bcc: open the address book of the e-mail software. But only few e-mail programs support this function (e.g. Outlook 2000), so that clicking on these buttons mostly does not have any effect.

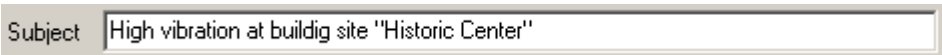
5 Insert variables

In subject line and text of the e-mail, you can insert variables which are filled with current values at time when the e-mail is sent. 4 variables are available:

- Measured value: The currently measured value is inserted.
- State: The current state is inserted.
- Date: The current date is inserted.
- Time: The current time is inserted.

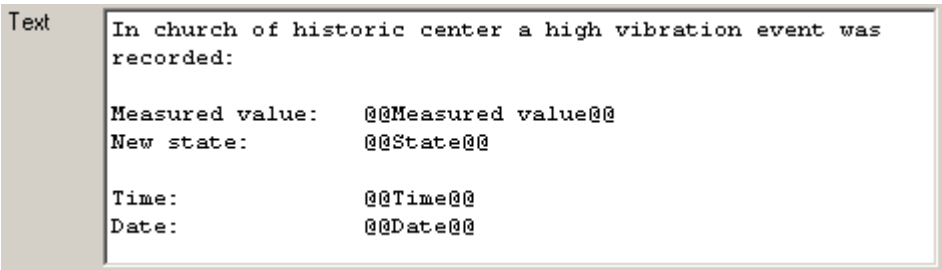
By clicking on Insert, you insert the variable in the subject or text of e-mail at the place of the cursor. The placeholder for the variable is simple text which is specially marked (with @@)

6 Subject



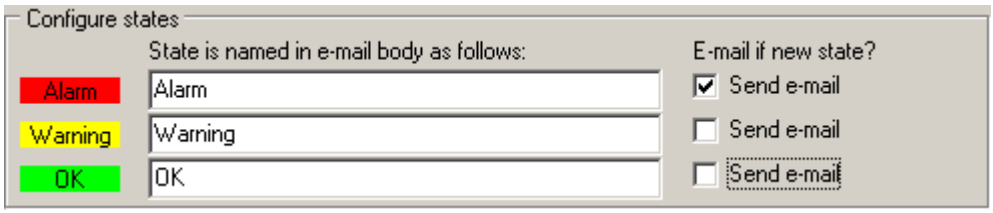
You can configure the subject line of the e-mail in this field. This subject can contain simple text but also variables.

7 Text



You can configure the text of the e-mail in this field. You can enter simple text but also variables.

8 Configure states



You can change the state names here. For instance, a limit exceedance could be named "exceedance of guide values" instead of "alarm". Furthermore, you can select for which states e-mails are to be sent.

9 Configure sending

You can set different limits for e-mail sending so the recipient will not receice too many e-mails.

- For instance you can decide that attached files will only be sent if they do not exceed a certain size.
- Up to 16 measured values can be ready for sending per second. It is advisable to send measured values only in case of state changes.
- Finally, you can restrict e-mail sending globally by a maximum number of e-mails per minute. If the connected instrument generates more e-mails per minute. these e-mails are blocked until the minute is over. E-mail which have not beent sent are counted as errors in the status bar.

10 Close

This button closes the window.
But it can be opened again, for instance by a double click in the selection tree. Only deleting the annunciator will erase it permanently.

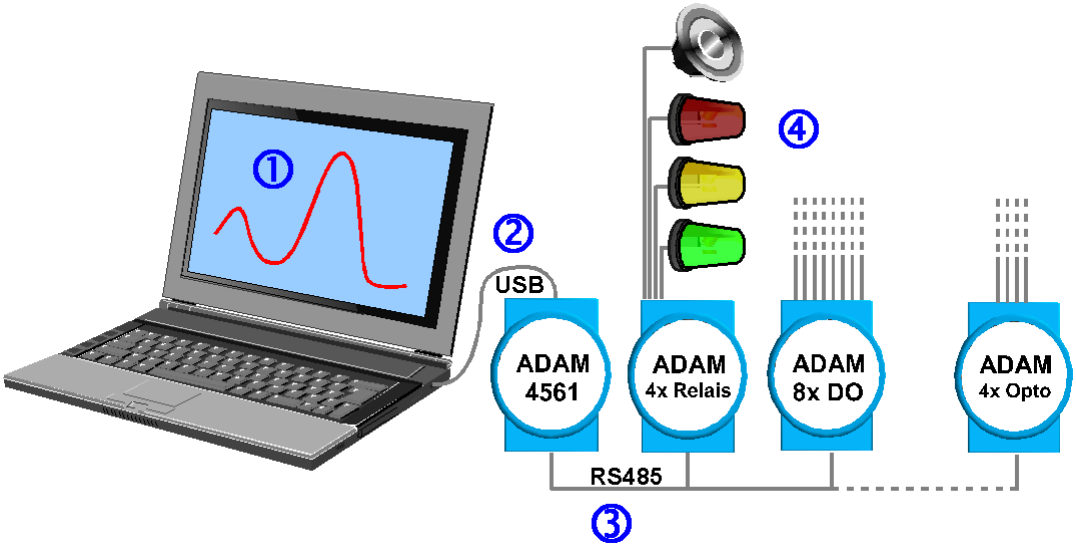
Annunciator type Digital Output

By means of this type of annunciator alarm states can be signaled via industrially common electrical switching outputs, e.g. relays as well as simple or insulated digital outputs. You can connect electrical annunciators to this switching outputs, e.g. alarm lamps, horns or flashlights.
That is why these annunciators are particularly suitable for stationary installations, e.g. in process or quality control. The variety of electrical outputs is represented by different output modules of the ADAM* system. The system concept allows to extend the annunciators modularly. Thus, VibroMatrix can control hundreds of electrical switching outputs.

* The ADAM system is a product of Advantech, represented in Germany by the Advantech Europe GmbH.

Set-up

The measuring PC **(1)** is connected to a single converter type ADAM-4561 **(2)** via USB interface. It converts commands for the output modules of the ADAM network **(3)**. Each ouput module contains several electrical switching outputs. Number and type of switching ouputs differ depending on the type of output module. The switching outputs control annunciators or signal their state to other devices, e.g. controls or a PLC **(4)**.



Modules in the ADAM network

All modules of an ADAM network can be connected to each other by a twisted pair wire. Without further measures you can connect 32 modules in series. The allowable distance between two modules is up to 1200 m. You can use repeaters for more modules or longer distances.
The RS485 standard is used for communication beween the modules. Two terminals are required, the following colors are recommended for the wires:

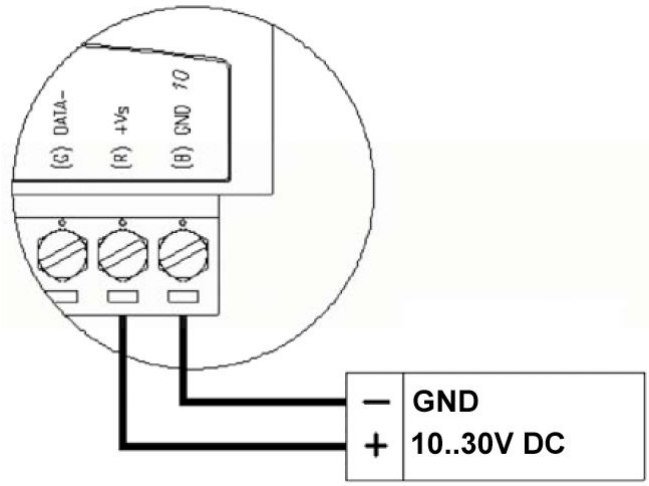
- DATA+ Yellow (on module: Y)
- DATA– Green (on module: G)

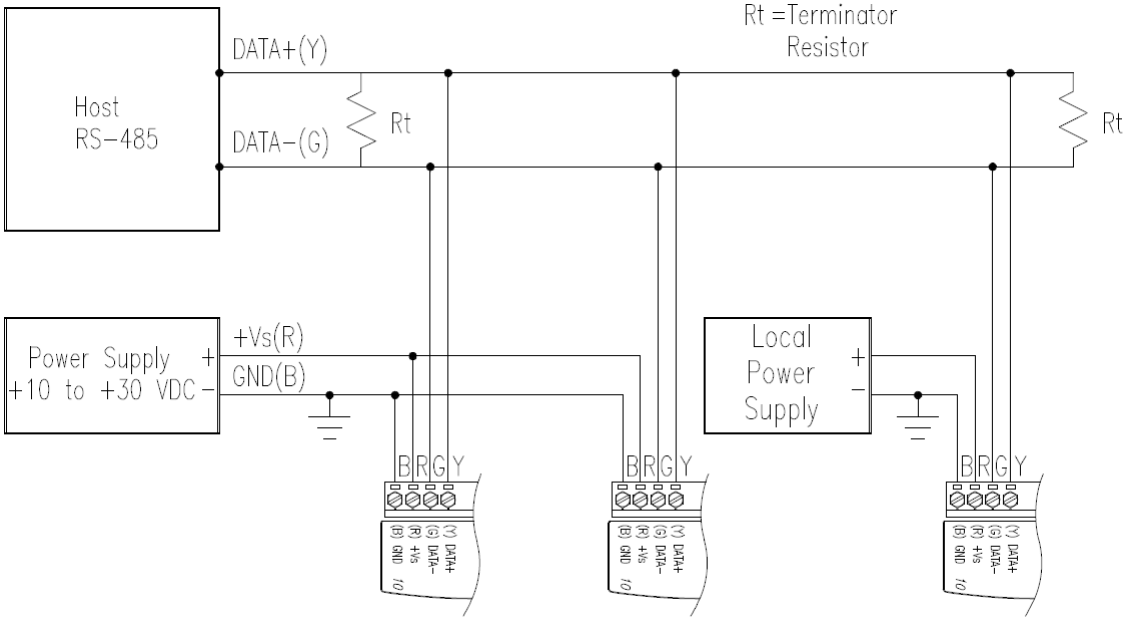
Supply

The converter ADAM-4561, which connects the ADAM network to the PC, is supplied by the USB interface. The output modules feature two terminal blocks, to which you can apply a supply voltage of 10..30 V DC. The following colors are recommended for the wires:

- +Vs Red (on module: R)
- GND Black (on module: B)

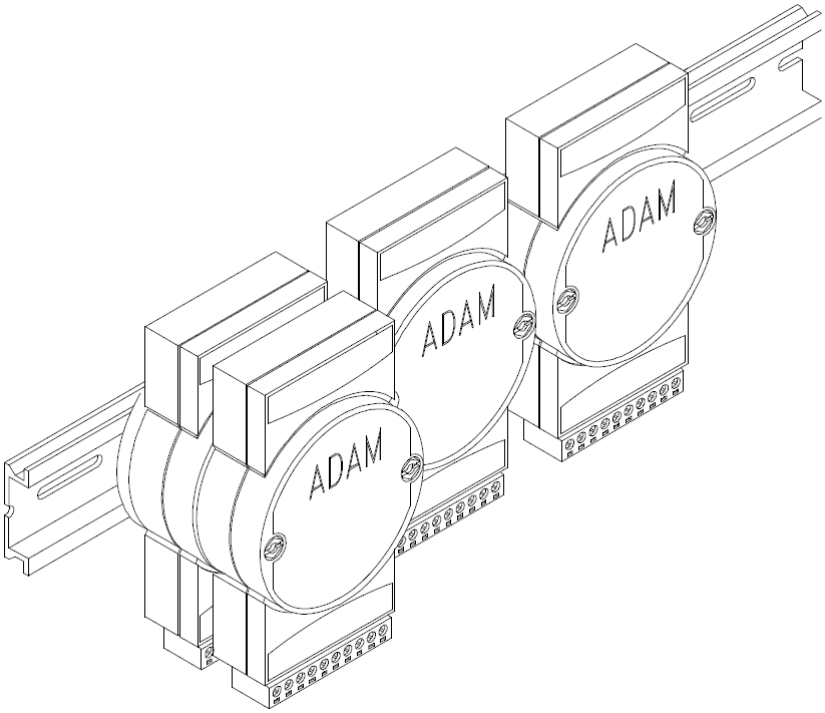
It is not necessary to connect the supply lines of all modules. It is also possible to supply separate modules locally.





Mounting

For all ADAM modules, adapters for wall-mounting but also for DIN rail are included in delivery. Additionally, the modules can be screwed to each other.



Configuration

The configuration is carried out in three steps:

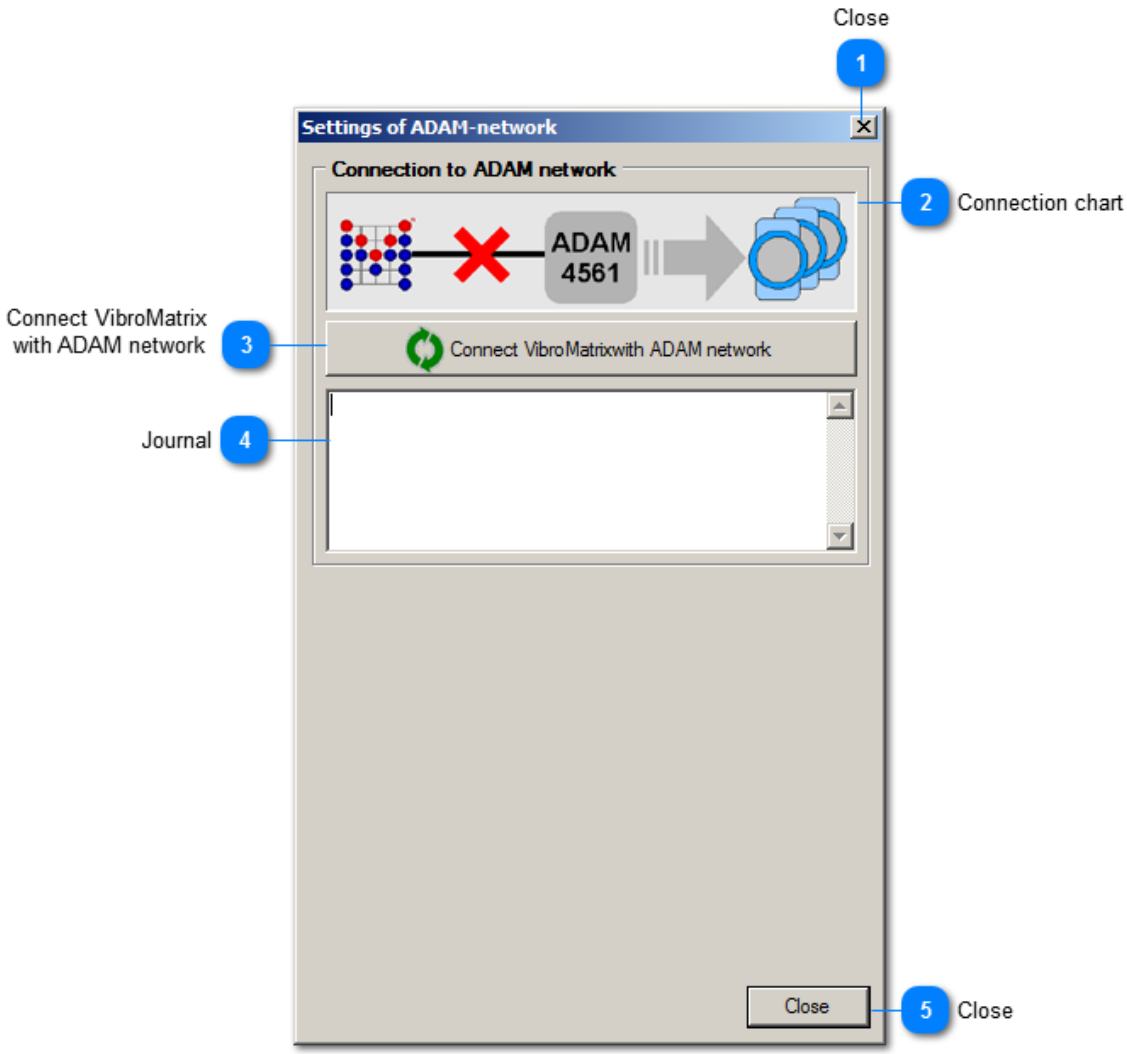
1. Establish the connection to the converter ADAM-4561.
2. Detect connected modules and change addresses if necessary.
3. Configure the annunciator.

Establish connection with ADAM network

VibroMatrix always tries to establish connection with the ADAM network automatically. By double-clicking on the annunciator type Digital output in the selection tree, you open the settings for the ADAM network to check the connection.

As a condition for a successful connection you have to install the driver for the converter ADAM-4561 and connect the converter ADAM-4561 with the PC. If you want VibroMatrix to detect an ADAM output module, you have to supply it and wire it with the converter ADAM-4561 (see design).

As long as there is no connection, the settings are displayed as follows:



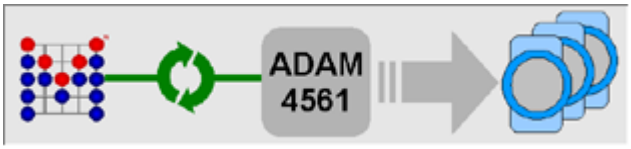
1 Close

This button closes the window.
But it can be opened again, e.g. by a double click in the selection tree.

2 Connection chart

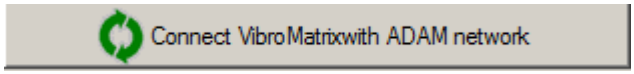
The connection status between VibroMatrix and the ADAM network is shown in a connection chart.

Unconnected status



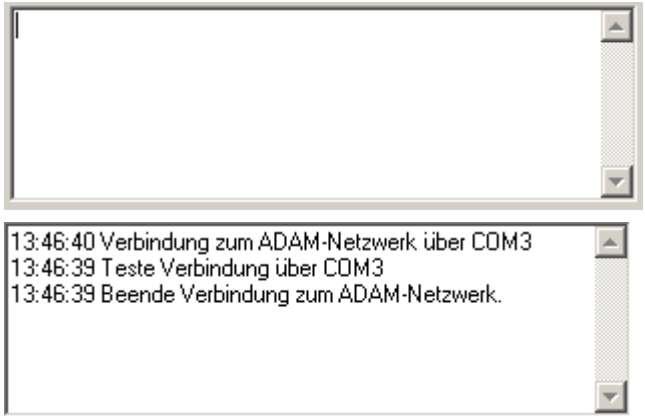
Connected status

3 Connect VibroMatrix with ADAM network



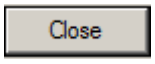
By clicking this button you connect VibroMatrix to the ADAM network. You can see whether a connection has been established or not in the connection chart and in the journal.

4 Journal



The connection attempts to the ADAM network and the result are listed up here as well as entries for switching processes.

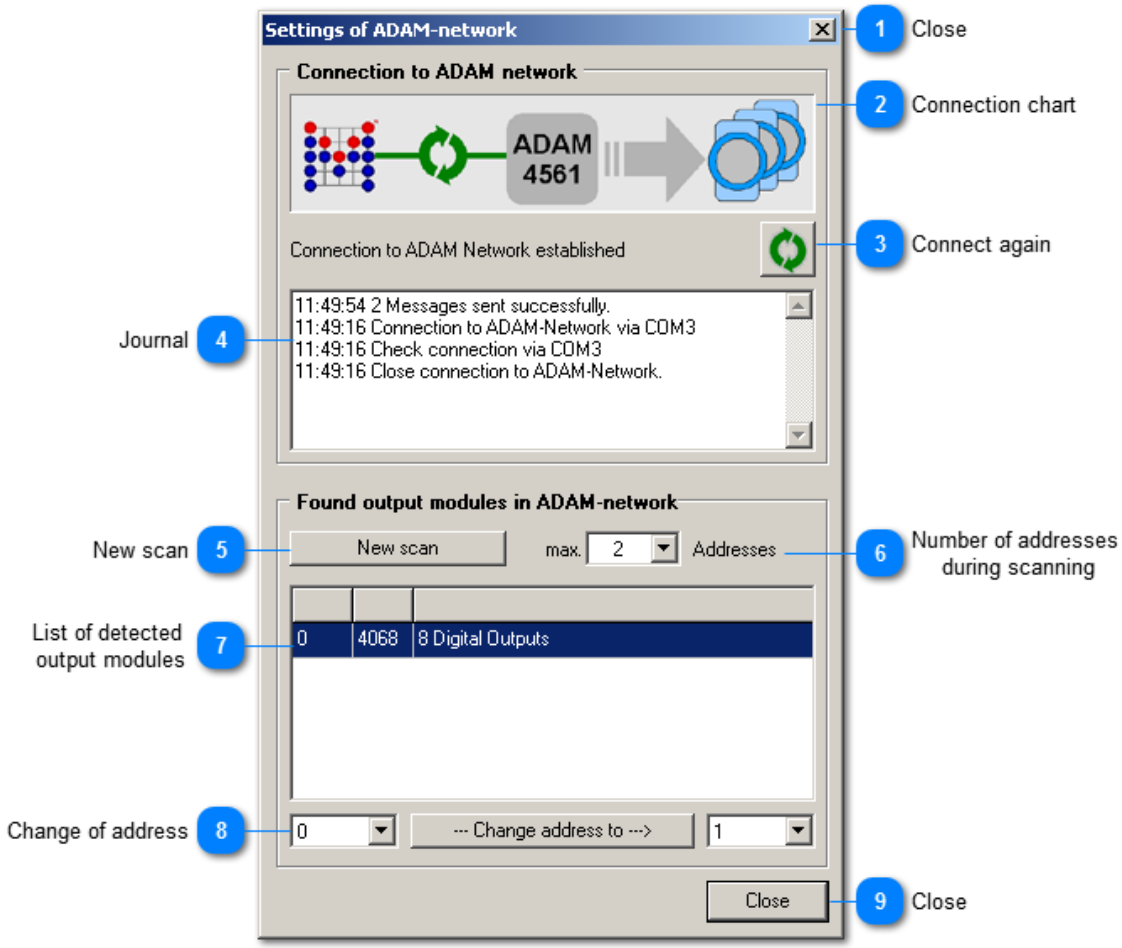
5 Close



This button closes the window.
But it can be opened again, e.g. by a double click in the selection tree.

Detect connected modules and change addresses if necessary

If VibroMatrix is connected with the ADAM network, it can detect the connected output modules and you can change their addresses if necessary.

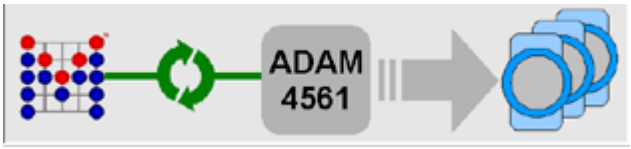


1 Close

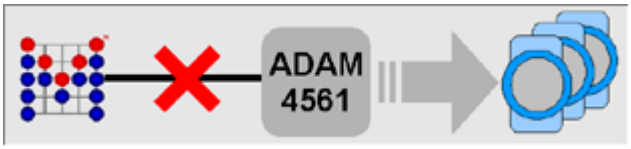
This button closes the window.

2 Connection chart

The connection status between VibroMatrix and the ADAM network is shown in a connection chart.



Connected status

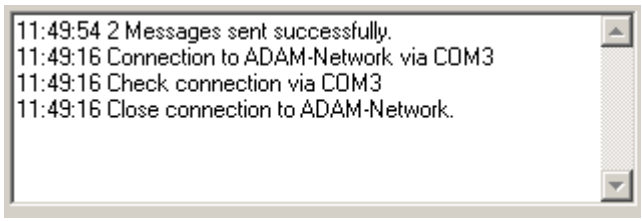


Unconnected status

3 Connect again

If the connection with the converter ADAM-4561 has been interrupted (for instance because the USB cable has been removed), you can establish the connection again by clicking this button.

4 Journal



The connection attempts to the ADAM network and the result are listed up here as well as entries for switching processes.

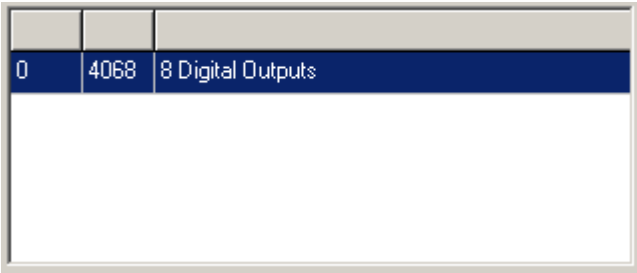
5 New scan

By clicking this button you start a search for output modules connected to the ADAM network.
They are taken over to a list. To ensure that the scanning process will not take too long, you can limit the number of addresses to be scanned.

6 Number of addresses during scanning

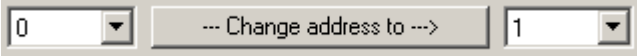
This entry limits the number of scanned addresses.

7 List of detected output modules



This field lists up the detected output modules with address, module type number and functionality.

8 Change of address



Every ADAM output module has its own address so that you can address it clearly. When delivered, this address is often set to 0. So make sure that all output modules have different addresses if you want to use them together.

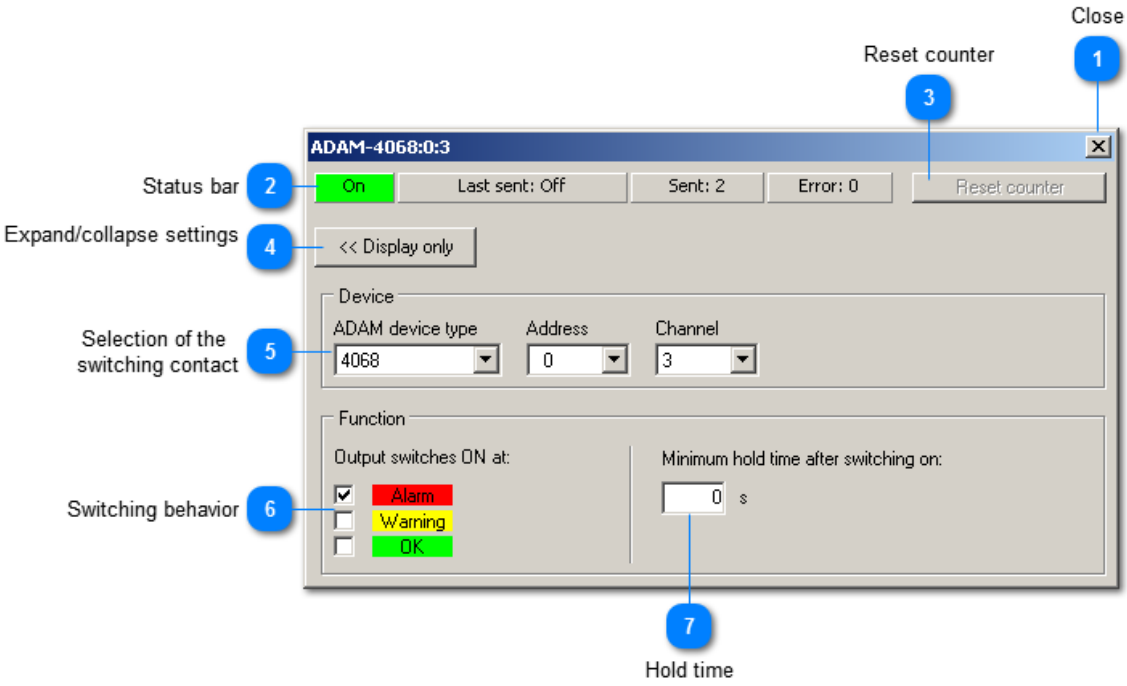
You can change the address comfortably in this window. The left list contains the addresses of all detected modules. The right list offers free addresses. You change the address by clicking on the button --- Change address to --->.

9 Close

This button closes the window.

Configuration of a digital output

Each digital output can be configured individually.



1 Close

This button closes the window.
But it can be opened again, for instance by a double click in the selection tree. Only deleting the annunciator will erase it permanently.

2 Status bar

On | Last sent: Off | Sent: 2 | Error: 0

The status bar indicates

- operating mode
- last command
- number of sent commands
- number of errors occured when sending commands

3 Reset counter

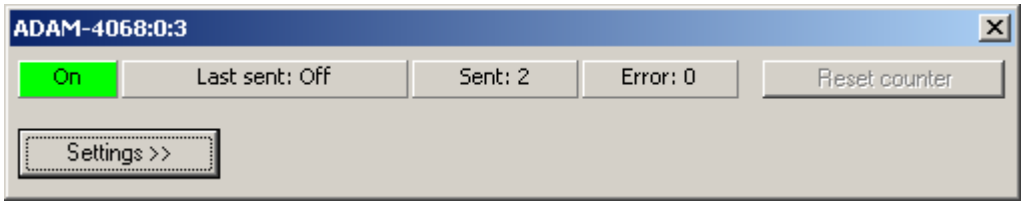
Reset counter

This button zeros the counter for the errors.

4 Expand/collapse settings

This button expands/collapses the setting area.

The annunciator uses less space on the screen in collapsed state.



5 Selection of the switching contact

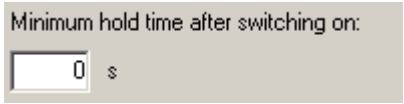
In this area, you select the concrete switching contact.

- All detected device types are listed up.
- All devices of the selected type are listed up. They are represented by their addresses since there might be several devices of the same type.
- Finally you can select the switching channel of the selected device (most devices feature several digital outputs).

6 Switching behavior

In this area, you decide at which state the digital output is to switch on. The output switches off if the connected instrument shows a different state.

7 Hold time



You can enter a minimum hold time after switching on to make sure that slower successive devices are able to recognize the switching state.

Annunciator type Radio Switch

By means of this type of annunciator, alarm states can be signaled by electric devices. Therefore, the annunciator controls a 230V radio switch which switches the power supply of connected loads. These loads can be alarm lamps, horns, flashlights or other devices as well.

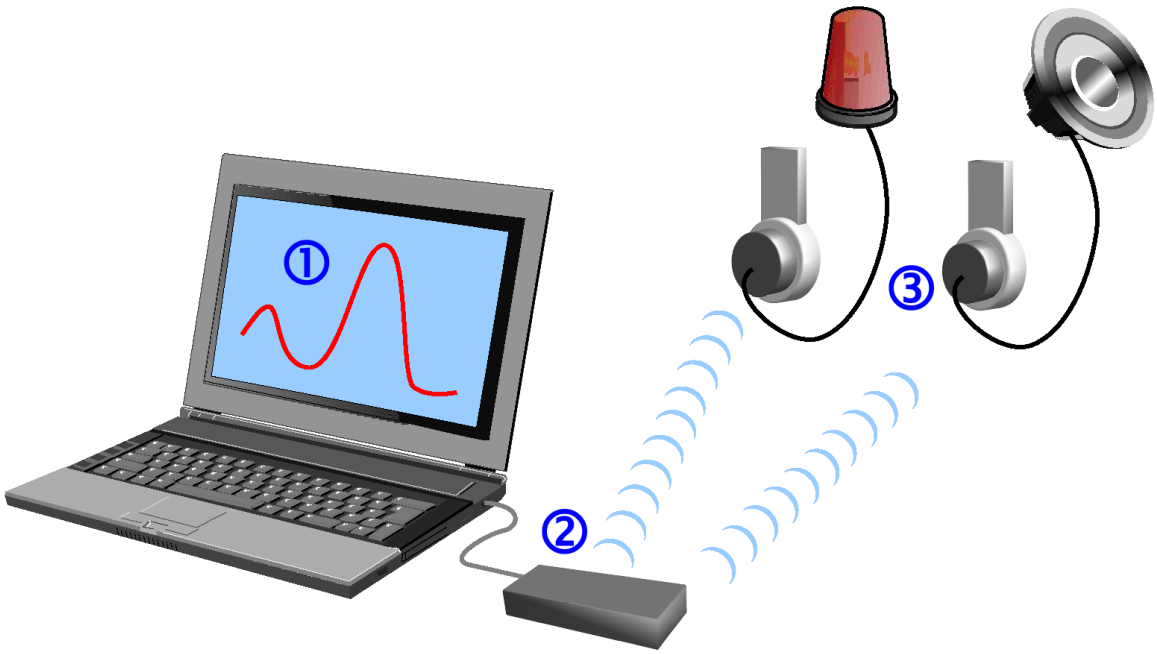
These annunciators are suitable for temporary monitoring tasks at a certain location. Thanks to radio transmission, no wiring is required. This way, you can build up your equipment quickly.

The radio switch is a product of the FS20 radio system, which is offered by different suppliers independently from the VibroMatrix system. It is quite common in the field of home automation. In free field, the radio range is up to 100 m.

Unfortunately, the FS20 radio system does not possess a feedback channel. There is no feedback for VibroMatrix whether the switch was actually switched after the switching command. Apart from that, the system has proved its worth thousandfold and is a very versatile and simple option for alarms.

Set-up

The measurement PC **(1)** is equipped with a single USB radio control unit type FHZ 1000 PC **(2)**. It transfers the switching commands to all associated radio switches **(3)** by radio commnunication. 16 different channels are available so that 16 different states can be signaled.



Even if there is another FS-20 system working in the closer environment, there usually is no interference. The reason is the so-called home code. This code is set especially for the FS20 system controlled by VibroMatrix. Your VibroMatrix distributor already does that for you as factory setting. The possibility of having the same home code in a neighboring system is less than guessing the four-digit-code of a cash card correctly. Thus, no “foreign” radio switches are switched and in return, the radio switches of VibroMatrix are not controlled by other radio control centers.

Driver installation

If the radio control unit FHZ 1000 PC is connected to the PC for the first time, Windows will ask for a driver for this device. You find this driver on your VibroMatrix CD.

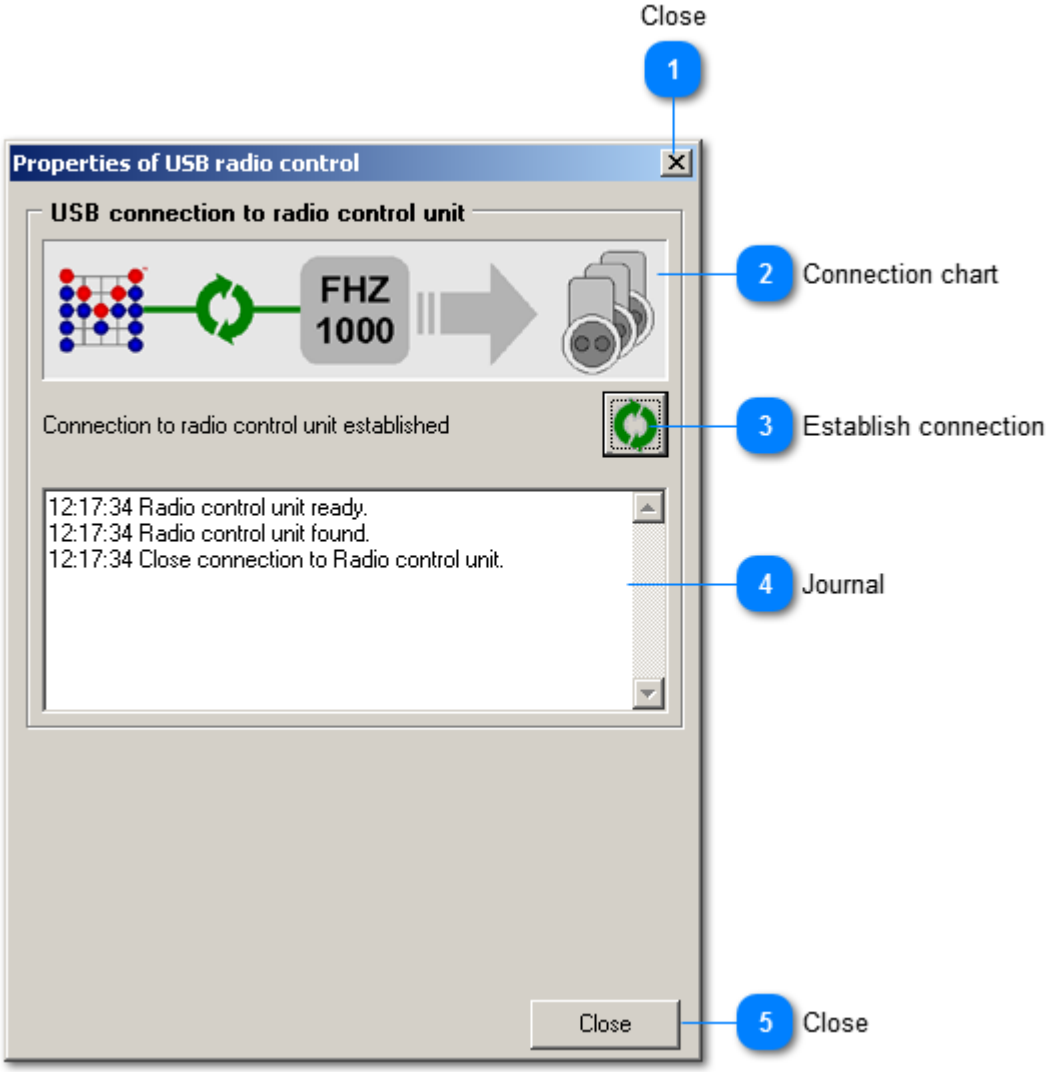
Configuration

The configuration is carried out in three steps::

1. Establish connection with the radio control unit.
2. Teach radio switches.
3. Configure the annunciator.

Establish connection with the radio control unit

As soon as you generated an annunciator type radio switch, VibroMatrix tries to establish connection with the radio control unit automatically. To check the connection, double-click on the superordinated entry radio switch. A control window for the connection with the radio control unit opens.
As a condition for a successful connection you have to install the driver for the radio control unit FHZ 1000 PC and connect the radio control unit to the PC.



1 **Close**

This button closes the window.
But it can be opened again, e.g. by a double click in the selection tree.

2 Connection chart

The connection status between VibroMatrix and the radio control center is shown in a connection chart.

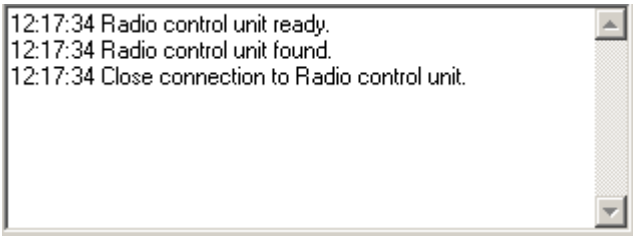
Unconnected status

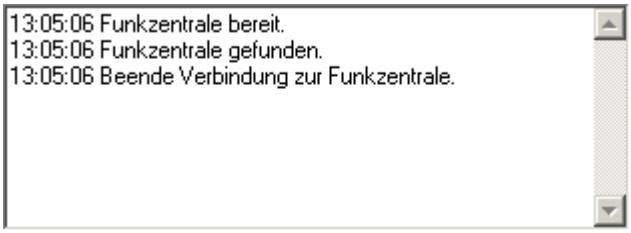
Connected status

3 Establish connection

By clicking this button you connect VibroMatrix to the radio control center. You can see whether a connection has been established or not in the connection chart and in the journal.

4 Journal





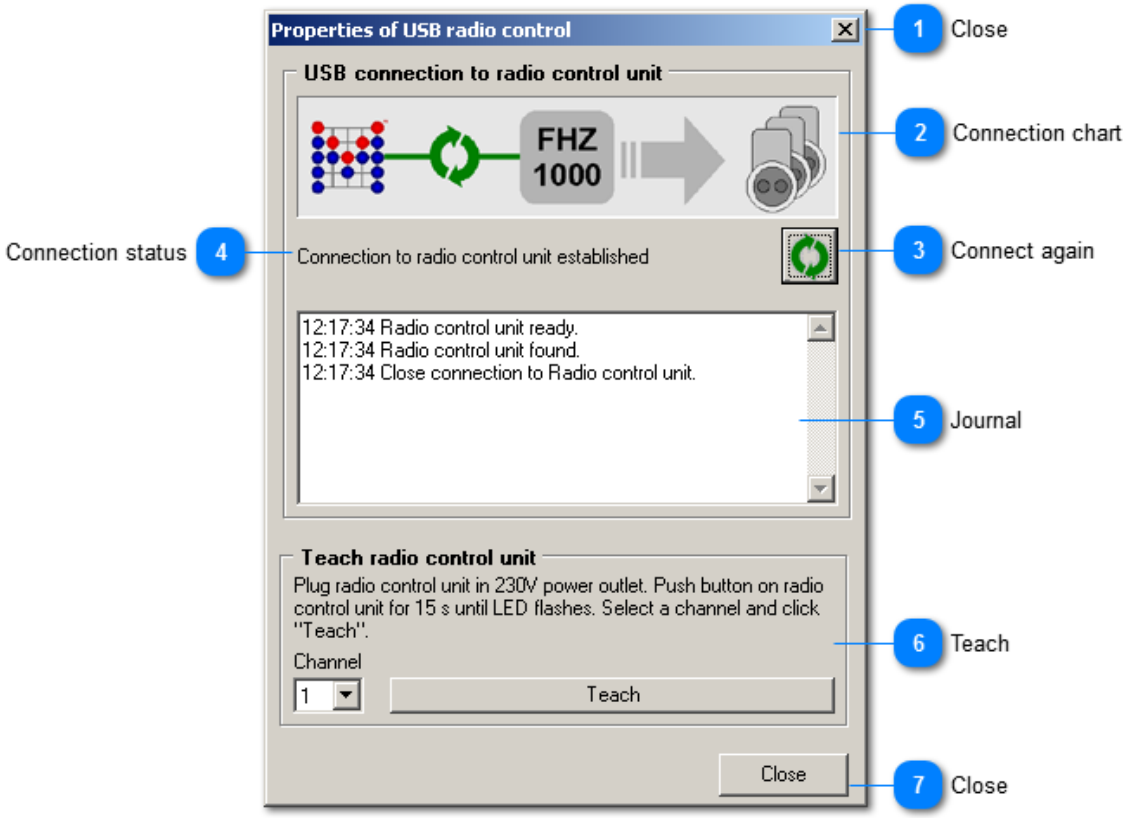
The connection attempts to the radio control center and the result are listed up here as well as entries for switching processes.

5 Close

This button closes the window.
But it can be opened again, e.g. by a double click in the selection tree.

Teach radio switches

If a radio switch is to work on one of the 16 available channels, it has to be taught on the respective channel. That is why the properties window for the annunciator type radio switch offers a teaching function. The teaching function is only visible if the connection between instruments and annunciators has been interrupted by means of the central master switch.



1 Close

This button closes the window.
But it can be opened again, e.g. by a double click in the selection tree.

2 Connection chart

The connection status between VibroMatrix and the radio control unit is shown in a connection chart.

Unconnected status

Connected status

The connection to the radio control unit has to be established to teach radio switches.

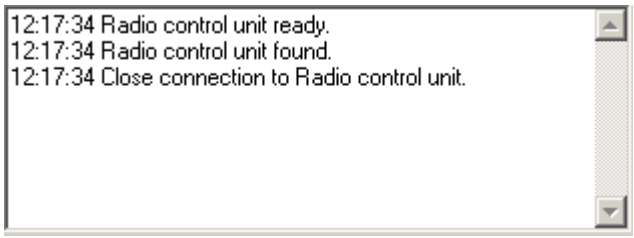
3 Connect again


If the connection has been interrupted (e.g. because the USB cable has been removed), you can establish the connection again by clicking this button.

4 Connection status

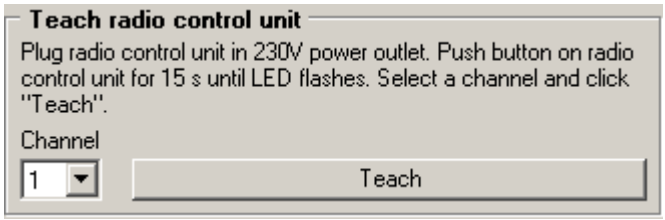
Connection to radio control unit established This entry shows the successful connection.

5 Journal



The connection attempts to the radio control unit and the result are listed up here as well as entries for switching processes.

6 Teach



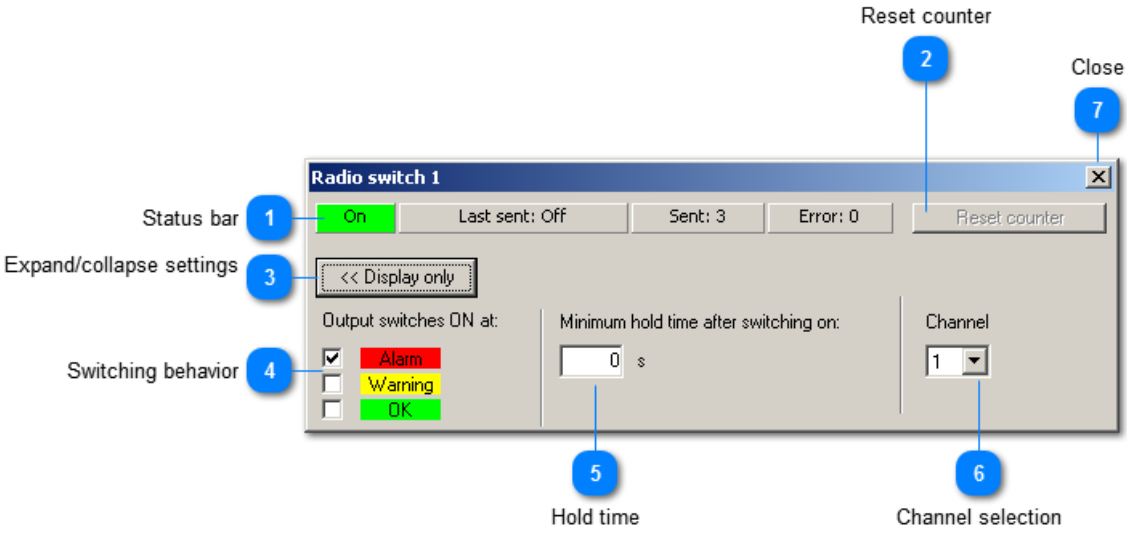
- Select the channel on which the radio switch is to work.
- Plug radio switch in a 230V power outlet.
- Push the on-off switch of the radio switch for 15 seconds.
- A flashing LED on the on-off switch of the radio switch signals the teaching mode.
- In the teaching function, you now select the channel on which the radio switch is to work.
- Click on "Teach".
- The flashing on the on-off switch of the radio switch stops now. The radio switch has been taught successfully.

7 Close

Close This button closes the window.
But it can be opened again, e.g. by a double click in the selection tree.

Configuration of a radio switch

Each radio switch can be configured individually.



1 Status bar

The status bar indicates

- operating mode
- last command
- number of sent commands
- number of errors occured when sending commands

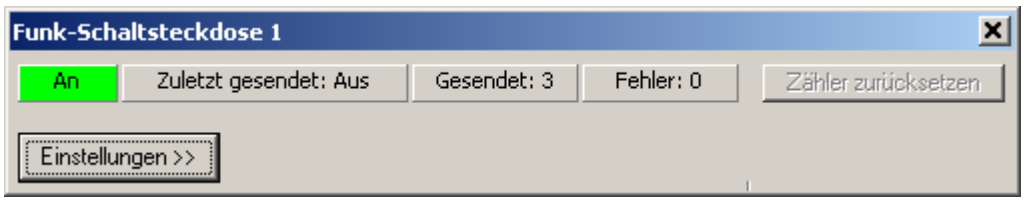
2 Reset counter

This button zeros the counter for the errors.

3 Expand/collapse settings

This button expands/collapses the setting area.

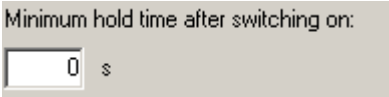
The annunciator uses less space on the screen in collapsed state.



4 Switching behavior

In this area, you decide at which state the output is to switch on. The output switches off if the connected instrument shows a different state.

5 Hold time



You can enter a minimum hold time after switching on to make sure that slower successive devices are able to recognize the switching state.

6 Channel selection

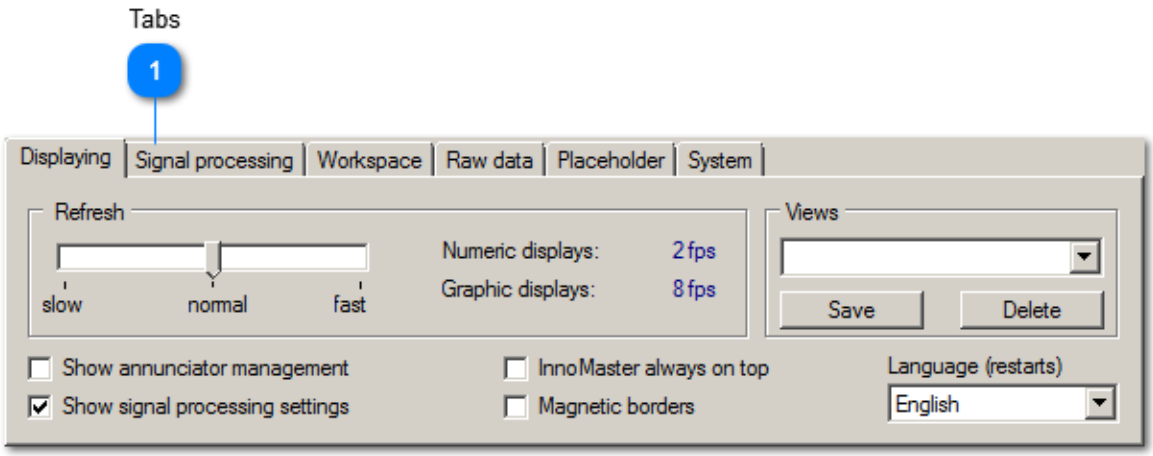
Selection of the transmission channel. The settings are valid for all radio switches on this channel.

7 Close

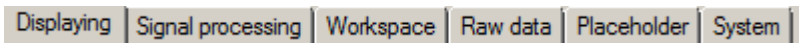
This button closes the window.
But it can be opened again, for instance by a double click in the selection tree. Only deleting the annunciator will erase it permanently.

Control panels

Global settings for VibroMatrix are adjusted in the control panels of the InnoMaster.



1 Tabs

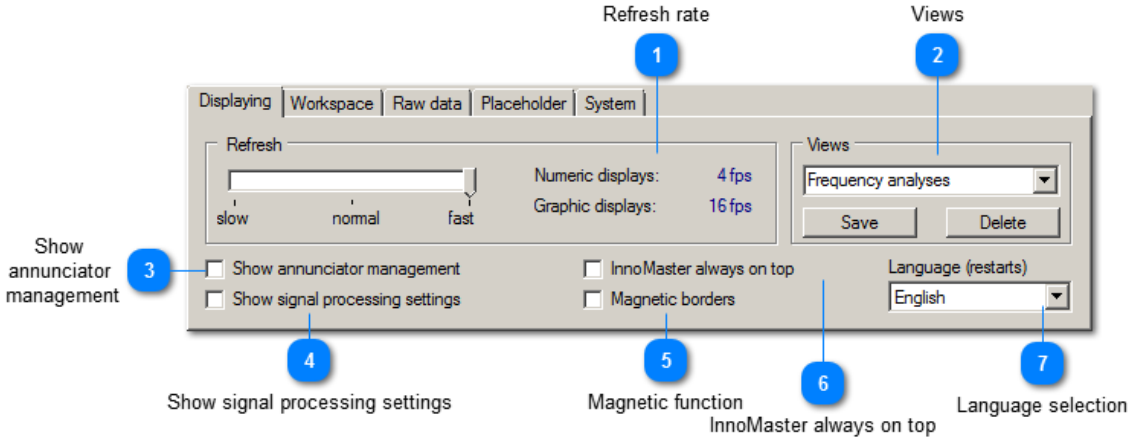


By means of the tabs you switch among the control panels:

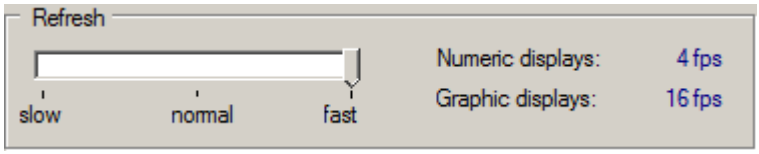
Displaying	Settings for refresh, arrangement of windows and language.
Signal processing	Settings for filter slope and dB references.
Workspace	Saving arrangements and configurations of instrument windows.
Raw data	Recording of sensor signals with full information content.
Placeholder	Placeholders as variable components in file names.
System	Information about the VibroMatrix system.

Displaying

In this control panel, you adjust global displaying settings.



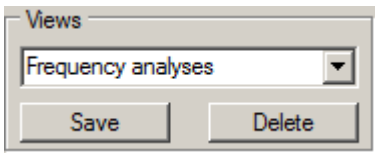
1 Refresh rate



VibroMatrix works with a streaming technique. From the time an instrument is started to the time it is stopped, there is a continuous data stream of measured values. There are no interruptions when processing the measured values: Every single sample is transmitted to the instruments to be processed.

The refresh rate determines how many times per second the measurement data is transmitted to the instruments so that they can refresh their displays. VibroMatrix distinguishes between numeric displays (characteristics) and graphic displays (raw data). Graphic displays require a high quality and thus a faster refresh than numeric displays which are analysed quantitatively.

2 Views



VibroMatrix allows to start and operate many instruments at the same time. If the number of instruments is too large to be displayed on your screen(s), they can be grouped in so-called views.

- Therefore, you minimize all instruments which are not to be visible in a view.
- Arrange the other instruments on the screen in a suitable way.
- Enter a name for the view in the drop-down list.
- Save the view by pushing the 'Save' button.

Proceed in a similar way for other groups of instruments.

If you select a view from the list, the instruments will be shown on the screen or will be minimized like they were at the time when the view was saved. By simply selecting a view you can switch quickly from one group of instruments to another group. The minimized instruments keep on working in the background, which means that they show their data as soon as they are called up.

To ensure a smooth working we recommend to deactivate effects and animations for minimizing and maximizing windows. You find these settings in the system control of Windows.

3 Show annunciator management

☐ Show annunciator management Activate this checkbox to show the annunciator management. Only a part of users works with annunciators. That is why they are not shown by default.

4 Show signal processing settings

☐ Show signal processing settings

Activate this checkbox to show the signal processing settings. These settings require an advanced knowledge in the field of signal processing so that this control panel is not shown by default.

5 Magnetic function

☐ Magnetic borders VibroMatrix allows to start and operate many instruments at the same time. The magnetic function supports you when arranging instrument windows on the screen. The edges of the windows are magnetically pulled to other edges when approaching them. Magnetic areas are the edges of the screen and the edges of other instruments, but not the InnoMaster. By means of the magnetic function you can arrange instruments quickly without using the mouse for fine-positioning.

6 InnoMaster always on top

☐ InnoMaster always on top Activate this checkbox to display the InnoMaster and its administration windows on top of the instruments.

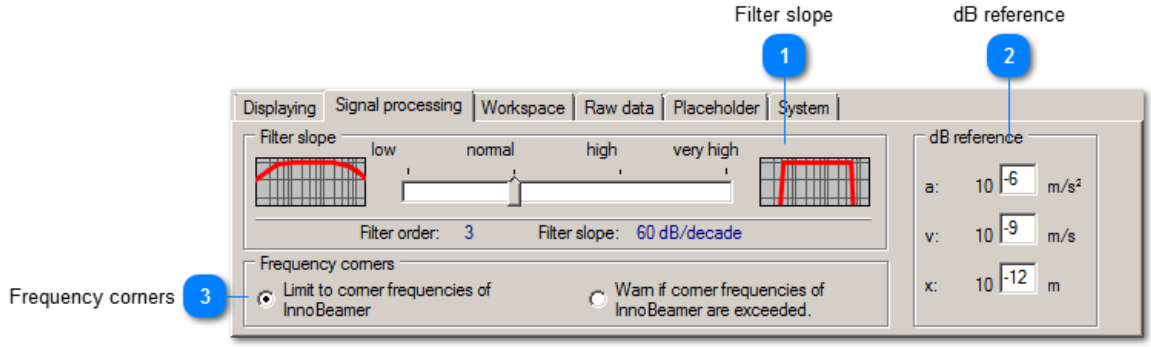
7 Language selection

Language (restarts)
English By means of this list you select the language for VibroMatrix. System, Deutsch, English are available. The default setting is System. It means that VibroMatrix automatically detects the Windows language setting when starting the InnoMaster and uses this language. If the detected language is not available, VibroMatrix automatically uses German.

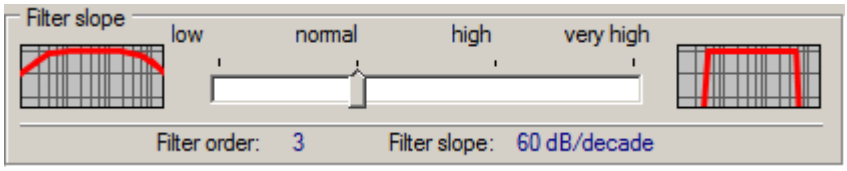
When switching the language, all instruments are automatically closed and re-opened. Consequently, switching the language during the measurement causes a loss of data in the instruments. So do not switch the language during the measurement if you want to keep the data.

Signal processing

The signal processing settings are only visible after you activated them in the displaying settings.



1 Filter slope



The filter slope determines how much VibroMatrix attenuates the magnitudes of instruments with freely adjustable filters out of the passband. The passband is limited by means of the fmin and fmax settings in the instruments (example). The higher the filter slope, the stronger the separation between passband and cutoff region.

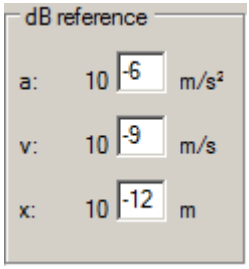
The filter slope is set to 60 dB/decade by default. It means that vibrations at a frequency 10x higher than fmax or 1/10 of fmin are reduced to one thousandth of their original magnitude. A filter slope of 60 dB/decade corresponds to specifications in standards, e.g. DIN ISO 2954 which standardizes measurement equipment for vibration measurement on rotating machinery acc. to ISO 10816.

The filter slope can be set up to 1280 dB/decade. The necessary filter order 64 could not be reached with coventional electronic components. However, by implementing the filter by means of digital signal processing and thanks to the high internal precision, VibroMatrix allows such slopes. A high filter slope can be useful when extracting single frequencies from a mix of periodical signals. In contrast, a high filter slope can be disadvantageous with transient signals, e.g. shocks, because the filter reacts with longer duration transients depending on the selected lower limit frequency fmin..

The type of bandpass filter used in VibroMatrix is Butterworth. This type of filter does show no ripples in the passband of the amplitude frequency response. It is also stipulated in standards for vibration measurement equipment (DIN 45662, DIN ISO 2954).

The filter slope does not influence instruments which are directly measuring acc. to a certain standard. For instance, the filter slope of measuring equipment for building vibration is set to 40 dB/decade according to DIN 4150-3. So this slope is integrated in the instrument InnoMeter 4150-3 and it is not influenced by the global filter slope setting.

2 dB reference



The measurands vibration acceleration, velocity or displacement can be displayed in absolute units, but also as reference measurand. In case of displaying as reference measurand, the measured value is displayed as percentage of a fixed reference value. These reference values can be entered for:

- a: vibration acceleration
- v: vibration velocity
- x. vibration displacement

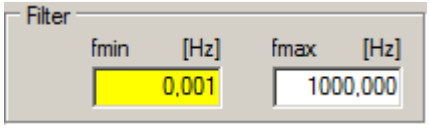
The default values are based on standard specifications. But they can be adjusted.

VibroMatrix uses the logarithmic dB as unit for the reference measurand.

3 Frequency corners

Limit to corner frequencies of InnoBeamer
The limit frequencies for bandpass filter can be adjusted freely in the VibroMatrix instruments. However, this freedom is limited by the limit frequencies of the measurement hardware (InnoBeamer). In case of using an InnoBeamer X2, these limits are 0.1 ... 40 000 Hz. The restriction to the corner frequencies (resp. cutoff frequencies*) is the default setting.

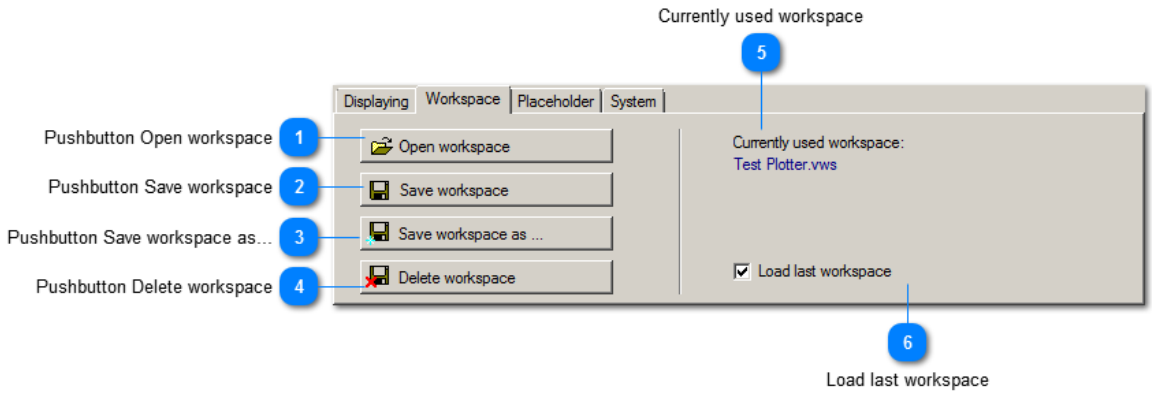
Warn if corner frequencies of InnoBeamer are exceeded
For special analysis, it can be useful to set the the limit frequencies in the bandpass filter beyond the corner frequencies of the measurement hardware. In this case, VibroMatrix will allow the bandpass filters for fmin to be below the lower limit frequency of the measurement hardware. In this case, the input field will be colored yellow as a warning.



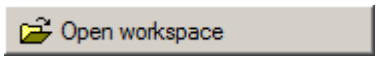
* Cutoff frequency = special limit frequency with an amplitude attenuation of -3 dB.

Workspaces and templates

VibroMatrix allows to operate single instruments or combinations of different instruments. These instruments can be configured and placed on the screen individually. This way, you can adapt VibroMatrix to every measurement task optimally.
To be able to use a configuration again for the same or similar measurement tasks, you can save it as workspace. A workspace contains information about all opened instruments, their configuration and the configuration of the InnoMaster.
Templates are working in a similar way. But they contain a more general description of a workspace and thus can be used in a more flexible way.
For instance, the serial numbers of the InnoBeamers in use are saved in a workspace. So if you open a workspace again, exactly the same measuring channels will be used even if you are working with more devices now. In contrast, templates only contain general information about the used devices.
By means of templates, you can exchange configurations with measurement teams that use other PCs and InnoBeamers with different serial numbers. It is also possible to start an InnoMaster Trainer without using measurement hardware, configure a template there and use it in the InnoMaster RT with real measurement hardware.

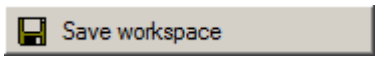


1 Pushbutton Open workspace



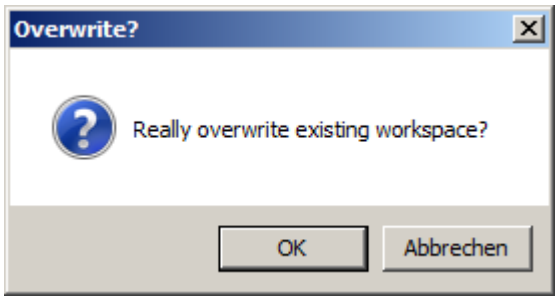
By clicking on this button, you open a window for selecting a workspace or a template to be loaded.

2 Pushbutton Save workspace

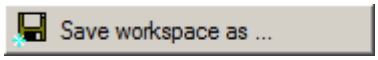


By clicking on this button, you save your current configuration with the name of the currently used workspace.

However, a confirmation request will open to avoid accidental overwriting.

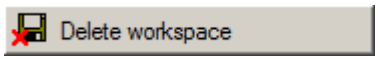


3 Pushbutton Save workspace as...



By clicking on this button, you open a window for saving workspaces and templates.
You can enter a new file name.

4 Pushbutton Delete workspace

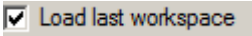


By clicking on this button, you open a window for selecting a workspace or template to be deleted.

5 Currently used workspace

This field shows the currently used workspace.

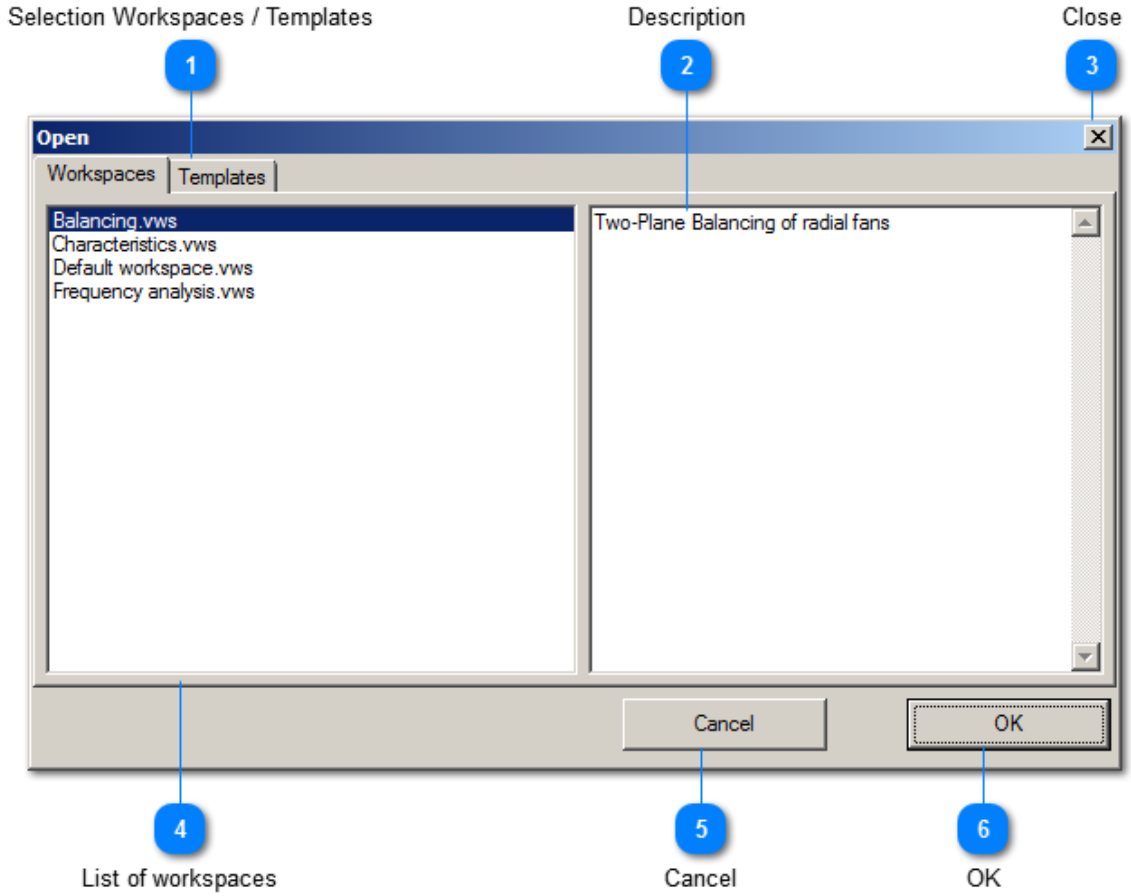
6 Load last workspace



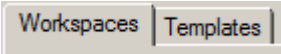
If you activate this option, VibroMatrix will open the workspace that was in use the last time the InnoMaster was closed when starting the InnoMaster again.

Open workspace or template

All available workspaces are listed up so that you can select the one to be opened. If you click on a workspace in the list, a respective description is shown on the right.

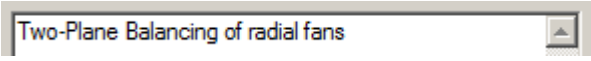


1 Selection Workspaces / Templates



You can open a workspace or a template. If you open a template, VibroMatrix generates a workspace from it. Since a template contains only general information about measuring channels and accelerometers, you should check whether the generated workspace corresponds to your requirements.
The layout of the control panels for workspaces and templates is identical.

2 Description

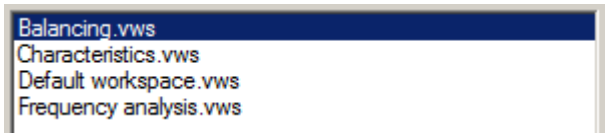


You can enter a description of a workspace or template when saving it. This description is shown here.

3 Close

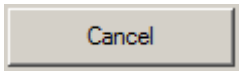
This button closes the window.

4 List of workspaces



This list contains all saved workspaces.

5 Cancel



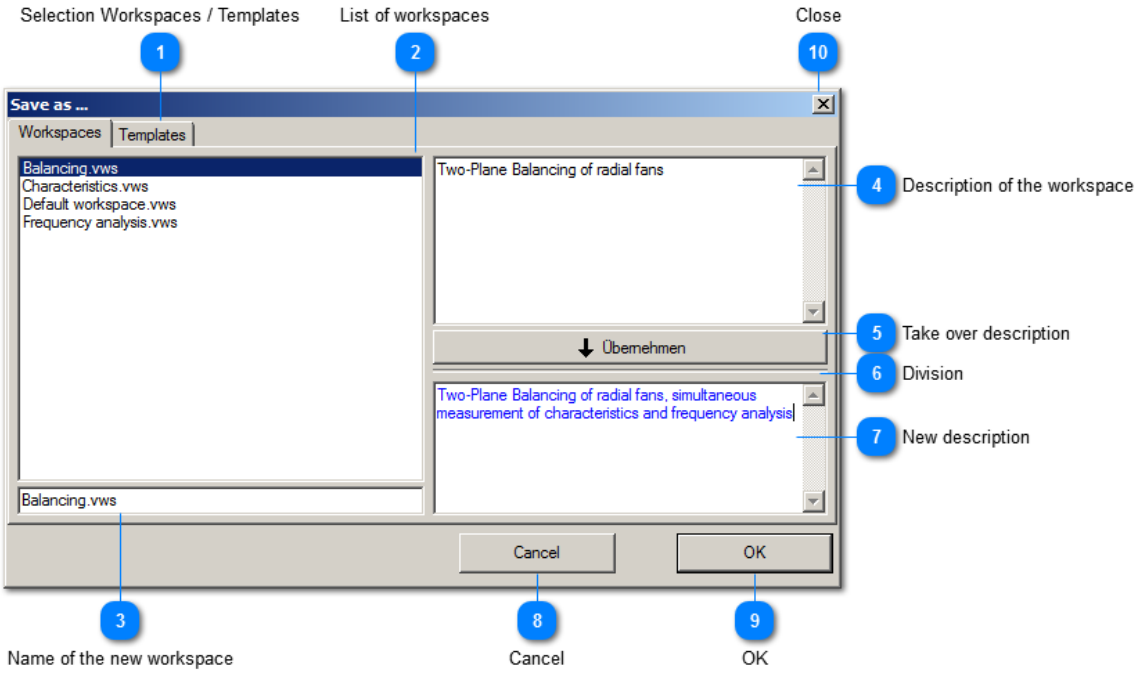
This button closes the window.

6 OK

This button closes the window and opens the selected workspace or template.

Save workspace or template with new name

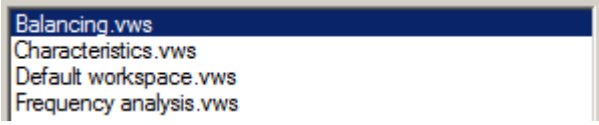
To use a configuration repeatedly, save it with a new name. You can enter a description as well.



1 Selection Workspaces / Templates

You can save a workspace or a template. The layout of the control panels for workspaces and templates is identical.

2 List of workspaces

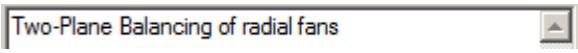


The list contains all saved workspaces.

3 Name of the new workspace

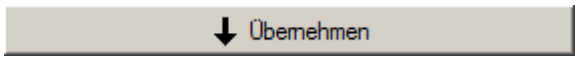
You can enter a new name for the workspace to be saved.

4 Description of the workspace



This field shows the description of the workspace or template.

5 Take over description

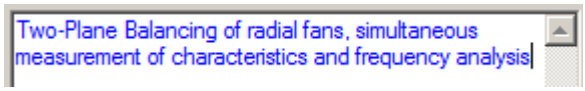


Transfers the existing desciption into the field for the new description. The text is positioned after the new description (if already existing). So VibroMatrix does not overwrite existing texts.

6 Division

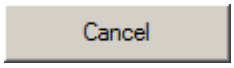
Devides the space between the input fields for existing and new description.

7 New description



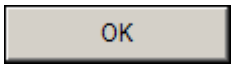
In this field, you can enter a new description to be saved with the workspace or template.

8 Cancel



This button closes the window without saving changes.

9 OK



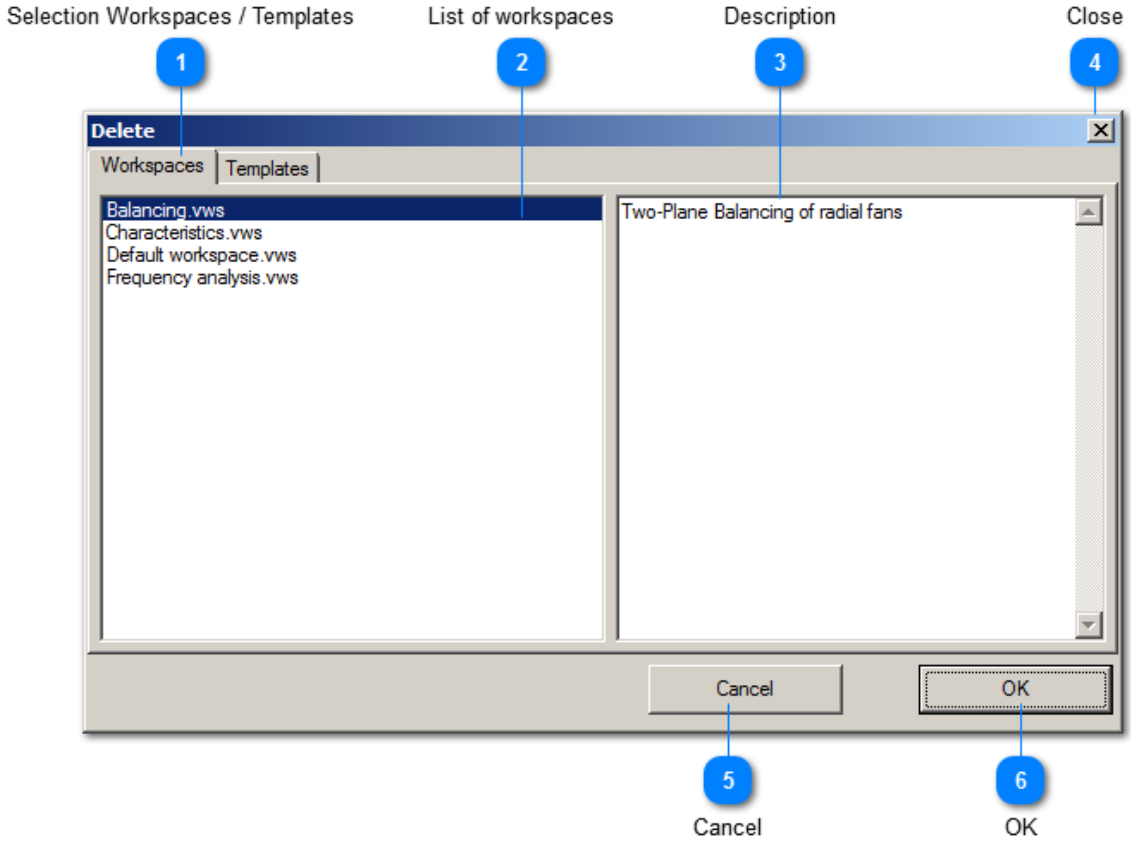
This button closes the window and saves the workspace or template.

10 Close

This button closes the window without saving changes.

Delete workspace or template

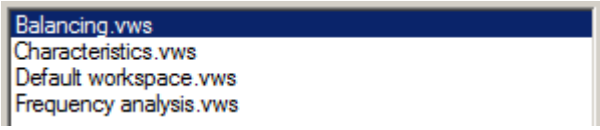
All available workspaces are listed up so that you can select the one to be deleted. If you click on a workspace in the list, a respective description is shown on the right. Click on OK to delete the selected workspace.



1 Selection Workspaces / Templates

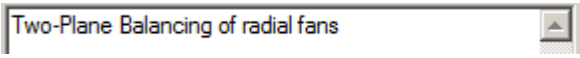
You can delete a workspace or a template. The layout of the control panels for workspaces and templates is identical.

2 List of workspaces



The list contains all saved workspaces.

3 Description

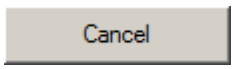


This field shows the description of the workspace or template.

4 Close

This button closes the window without deleting.

5 Cancel



This button closes the window without deleting.

6 OK

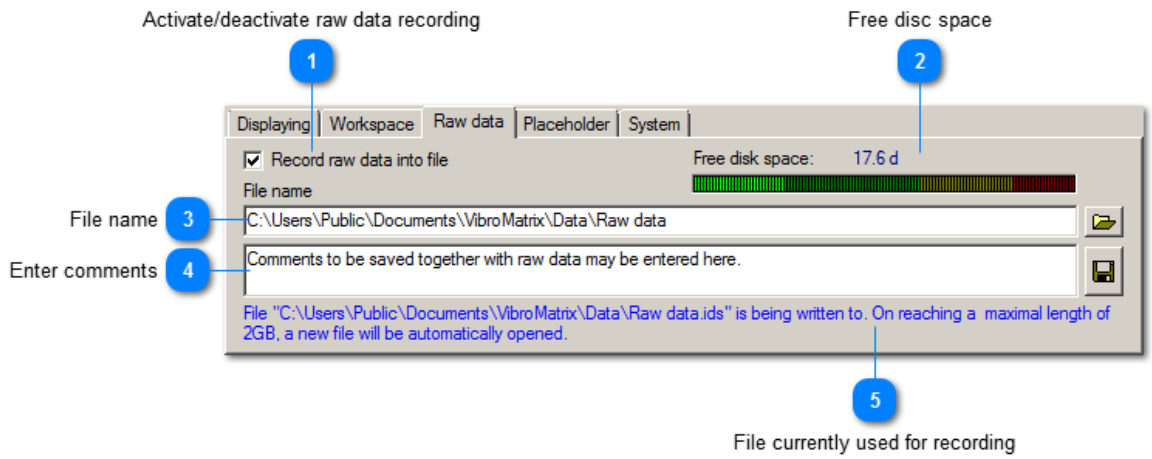
This button closes the window and deletes the selected workspace.

Record raw data

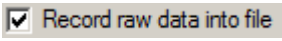
VibroMatrix masters the recording of raw measurement data. The unprocessed data stream from the InnoBeamers is recorded into a file with full information content before it is transmitted to the instruments. You can replay this data later with the InnoMaster Replay and analyze it offline. In the InnoMaster RT you determine if raw data is to be recorded or not and where the files are to be saved. VibroMatrix generates files with a maximum file size of 2 GB. After a file reached the maximum size, a new file is opened automatically. The name for the new file is the file name used so far followed by an index.

Raw data recording not only includes the measured data, but also additional informationen:

- Gain of each measuring channel
- Connected sensor of each measuring channel
- Wall clock time
- Comments

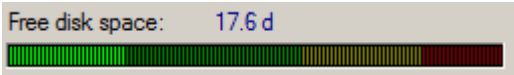


1 Activate/deactivate raw data recording



By clicking on this checkbox, you activate raw data recording. But VibroMatrix only starts recording when instruments are working on the measuring channels and only saves raw data of channels that are currently measuring.
If all instruments are stopped, VibroMatrix keeps on writing into the raw data file. However, no raw data is recorded any longer, but additional information like wall clock time.

2 Free disc space



Indicates free disc space.

- If raw data recording is deactivated, the free disc space is stated in units like MB, GB etc.
- If raw data recording is activated, free disc space in stated in time units. This value is refreshed continuously.

3 File name

C:\Users\Public\Documents\VibroMatrix\Data\Raw data

You can enter a file name for the raw data in this field, optionally optionally preceded by a directory. If you enter no directory, the raw data will be saved in the VibroMatrix directory, subdirectory Data. Furthermore, you can also use placeholders.

You can also select the storage location in the file system by means of file dialog:

4 Enter comments

Comments to be saved together with raw data may be entered here.

According to experience, a measurement task often requires comments, e.g. about the measurement conditions. In the InnoMaster RT, such comments can be entered directly into an input field and they are recorded with the measurement data stream. All comments are time-stamped automatically and displayed again with their time stamp when replaying measurement data in the InnoMaster.

- Activate raw data recording (checkbox Record raw data info file) to save comments.
- Enter a text into the input field for comments.
- Save the text in the data stream by pushing the Enter key or by clicking on the button .
- Afterwards, the text turns grey to signal that it has been already saved. But it can still be edited and as soon as you change a single character, the text turns black again.

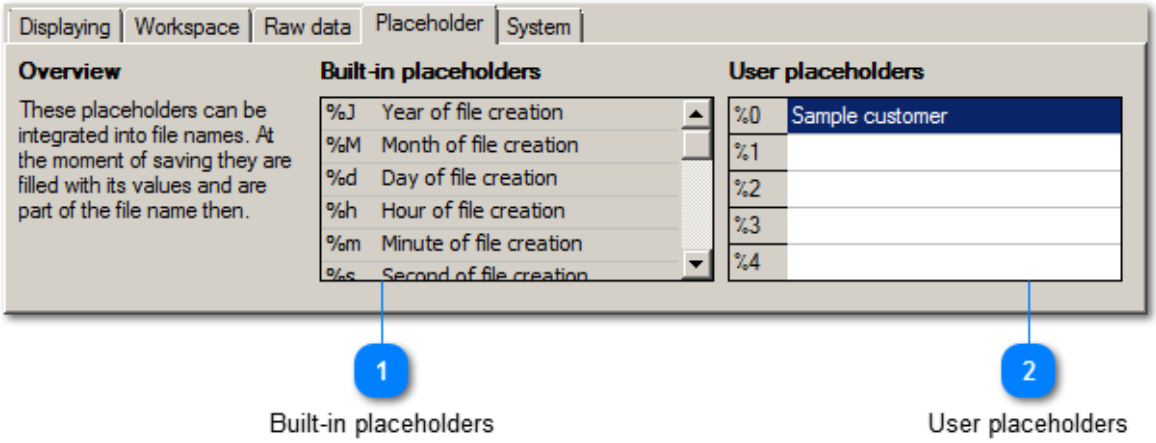
5 File currently used for recording

File "C:\Users\Public\Documents\VibroMatrix\Data\Raw data.ids" is being written to. On reaching a maximal length of 2GB, a new file will be automatically opened.

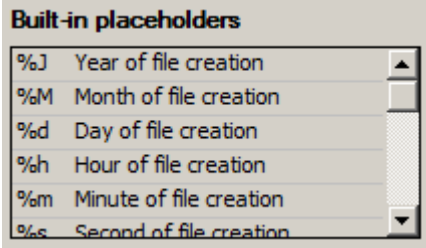
This field indicates the storage location incl. directory name and entered placeholders.

Placeholders

Placeholders can be integrated into file names, which are used in different instruments of the VibroMatrix system (example). Additional to fixed built-in placeholders you can also enter 5 individual ones. At the moment the file is saved the placeholders are filled with their current values and are part of the file name then.

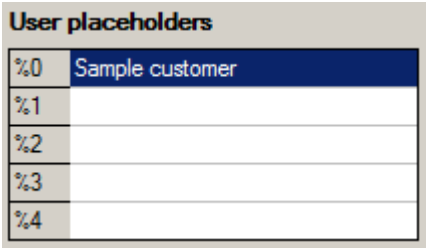


1 Built-in placeholders



These placeholders are already intergrated in VibroMatrix. They are listed up again for explanation.

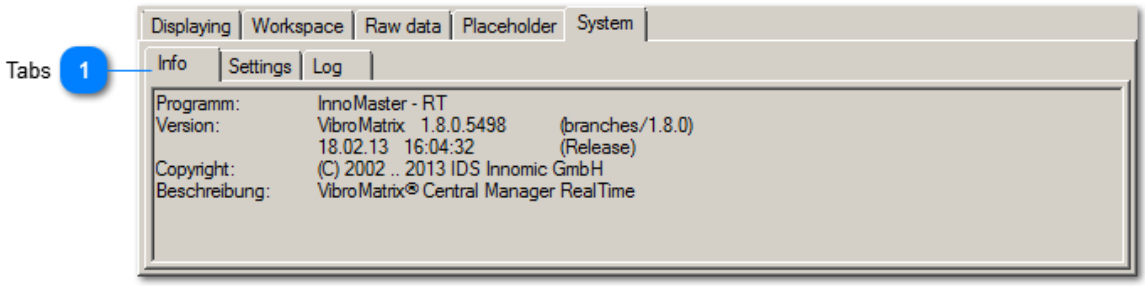
2 User placeholders



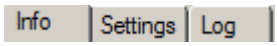
You can enter individual values for the placeholders %0 .. %4.

System information

Global system information and settings for the VibroMatrix system.



1 Tabs

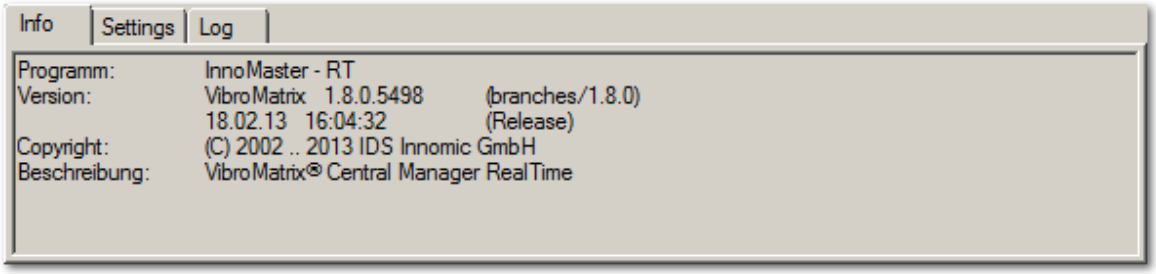


System information and settings are distributed to three control panels:

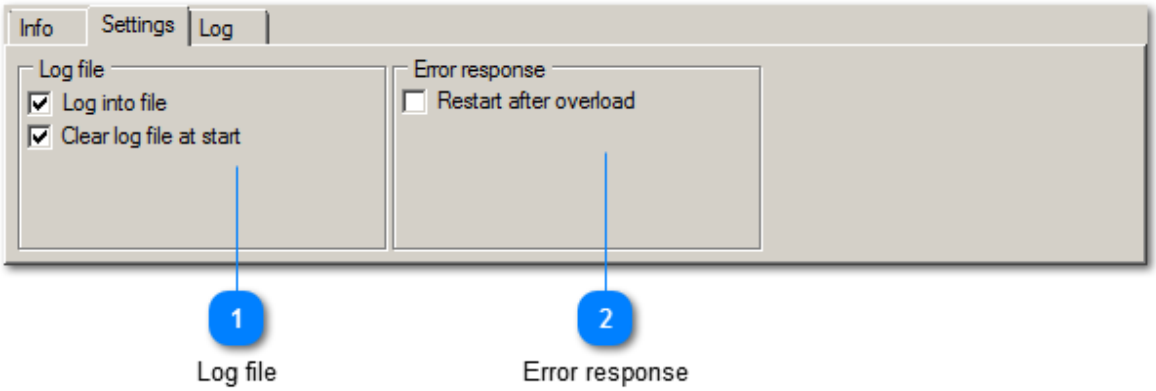
Info	Information about the version of the program.
Settings	Settings e.g. concerning the log file.
Log	Special states of the VibroMatrix system (for instance, start/stop are listed here)

System information

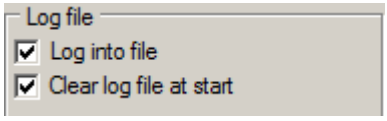
This panel provides information about the version of the VibroMatrix system.



System settings

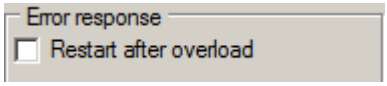


1 Log file



You can activate the logging of internal states and events into a file to analyze the behavior of VibroMatrix in special situations.

2 Error response



VibroMatrix works with a continuous data stream. From start to stop, every single sample is transmitted to the instruments for analysis. But if the PC is not able to cope with the data stream (CPU load permanently exceeds 100%) , there will be interruptions which are not in accordance with VibroMatrix' way of working.
In this case, VibroMatrix usually simply stops measuring to signal the problem. Just click on Stop/Start to continue the measurement.
For unattended measurements, you can instruct VibroMatrix to restart the measurement automatically after overload.

Event log

This panel lists up internal states and events in the VibroMatrix system.