USER MANUAL

VA5 Pro
A4404 SAB
Virtual Unit

Version 2.69 – July 01, 2019

Content:

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VA5 Pro vs. A4404 SAB

The **VA5 Pro** instrument, the **A4404 SAB** Signal Analyzer Box and the **Virtual Unit** application will be described in this user manual. This chapter should clear up the difference between them.

VA5 Pro

VA5 Pro is a portable vibration analyzer which is based on unique Digital Signal Processing board (DSP) developed by Adash.

A4404 SAB (Signal Analyzer Box)

A4404 SAB is a pocket size vibration analyzer which contains input connectors for sensors. It uses the same DSP board as **VA5 Pro** but it doesn't contain keyboard and screen. It must be connected with computer via USB. You need to install **Virtual Unit** application which is the same software used in **VA5 Pro**. Almost all functions described in this manual work both in the instrument and in the **Virtual Unit**. You will be notified when some difference occurs. **Virtual Unit** and **A4404 SAB** peculiarities will be described in a standalone chapter in the end of the manual.
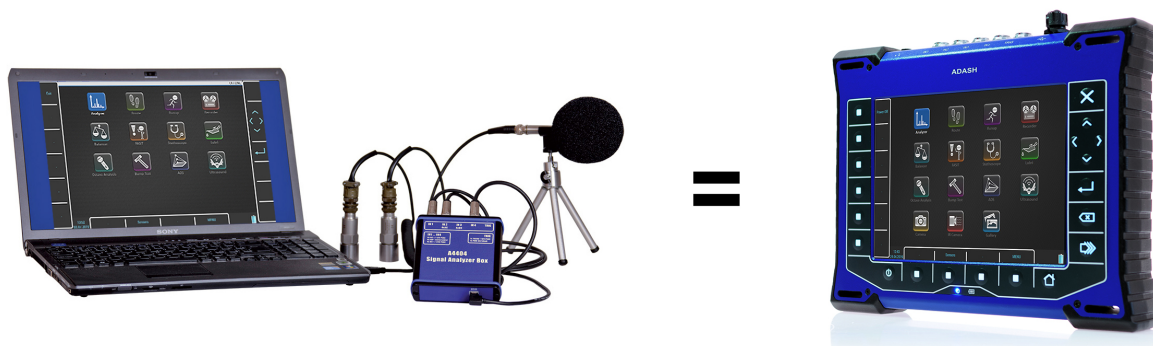
<u>*Before Switching On*</u>

**Ignoring any recommendations mentioned below may cause failure of the device.
Operating with a power higher then 24 V can cause an accident.**

General Warnings

Only suitable ICP powered sensors can be connected to the AC signal inputs.

If the measurement without ICP power is required, ICP power must be switched off. You can damage the external signal source, which is not protected against ICP powering.

AC channels - voltage higher then $\pm$ 18 V (peak) can damage the instrument.

DC channels - voltage higher then $\pm$ 30 V (peak) can damage the instrument.

Always use only original cables designed for connection with sensor.

Long push and hold of POWER button evokes incorrect instrument switching off. Data could be lost.

If you are unsure, contact your distributor or the manufacturer.

General Information

Front View

Top View

Rear View

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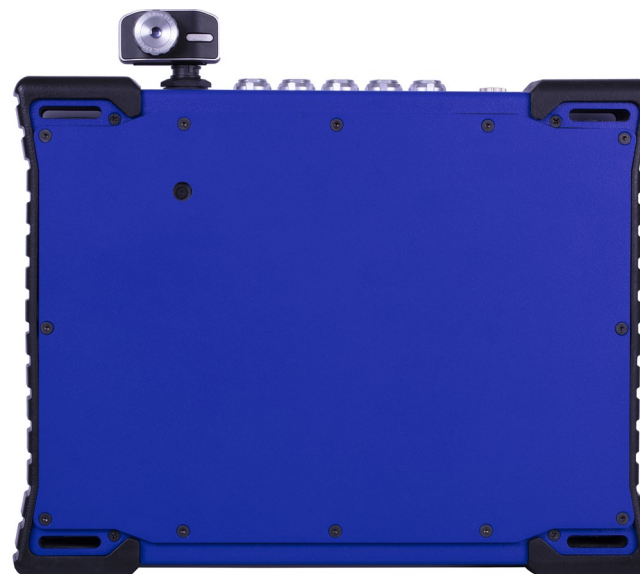
Battery Charging

Charge the battery only at 0 - 40°C (30 - 100 °F)!

The POWER socket for external charger is on the top panel. The battery LED diode lights orange during charging and lights green when fully charged.

The VA5 instrument uses Li-ION (LiON) batteries. This type of battery should not be discharged completely. If the battery is discharged below certain Voltage, we call it deep discharging. The deep discharging shortens battery life. The charging of deeply discharged battery takes much longer.

If the instrument is not charged for longer period of time, then the deep discharge can occur. It is caused by self-discharging of the battery. Another cause of deep discharge can be a situation when the instrument is switched to the SLEEP mode by the Power Off button (instead of switching off the instrument). When the battery is deeply discharged, it takes much longer to charge it again. Sometimes the indicator on the charger does not light when the battery is deeply discharged – it does not mean it is not charging. Please keep the battery charging even if the indicator does not light, the indicator will start light later.

To avoid deep discharge of the instrument, charge it regularly, even when you don't use it. We recommend you to check if it is charged every 3 months.

WHAT TO DO WHEN YOU CANNOT SWITCH ON THE INSTRUMENT/ WHEN THE INSTRUMENT CANNOT BE CHARGED NORMALLY:

- **Discharged battery** – battery needs to be charged (charging for approximately 5 hours), the instrument can be switched on normally with the charger connected

- **Deeply discharged battery**, when the instrument wasn't charged for longer period of time – the instrument needs to be charged completely until the indicator on the charger starts light green. It can take more than 12 hours. The indicator on the charged does not light from the beginning of charging process. Sometimes it is not possible to switch on the instrument even with the charger connected.

- **Damaged charger** – when the charger is connected, the indicator should start to light (green or orange color), only with deep discharge the indicator does not light immediately.

- **Sudden decrease of battery life** – the instrument needs to be charged and discharged completely few times (usually 2-5 times). The battery lifetime should increase this way.

Switching on
The POWER button is in bottom left corner of the front panel. Press the button for a few seconds until a power LED begins to light. Firstly it blinks orange for a while, then it lights blue. A keyboard backlight blinks for a while.
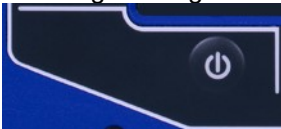
Switching off
Use a **Power Off** in main MENU and confirm.

Warning! The POWER button (intended for the switching on) doesn't turn the instrument off. It switches it into a sleep mode!

Sleep Mode

Use the POWER button (described in the "**Switch on**" chapter) to switch the instrument into a sleep mode. The screen is off and power consumption is lower in the sleep mode. Use the same POWER button to wake up again.

Note! You can use any button to wake the instrument up. However notice the button press isn't ignored by the system even in the sleep mode and the press can cause some unexpected event in the application. The reaction to the button press is same like not being in the sleep mode.

Auto Switch off

If no button is pushed in 5 minutes from switching on, the instrument will be switched off.

Emergency Switch off

This is not correct method to switch off the instrument. Using it can cause data corruption. Use this method only in case of emergency (eg. when the system freezes).

Push and hold the POWER button for about 10 seconds. Instrument will switch off.

Capacity Warning

If this warning message appears, you need to get free disc space by removing the measurements, routes or records, which are not needed.

90% of disc is full.
Longer measurements not available.

Connection to the computer

VA5_DISC

All data like projects, measurements, readings, setups and so on are stored to a high capacity hard disk which is intended for internal purposes only. Furthermore the instrument contains the VA5_DISC, it is flash memory, which is accessible from external computer. The VA5_DISC is an interface for data. For example, you save a route from DDS to the VA5_DISC, the instrument copies it automatically to hard disk. Then you measure the route and then you export the route back to the VA5_DISC. Here you can read it from computer. You don't need to export all data from internal hard disk. Export only the data which you want to read from computer. A detailed description how to export will be stated later in chapters about project's control for each module.

Connection

To make a connection between computer and instrument (more precisely VA5_DISC) use the USB cable which is the standard accessory of VA5 set.

The connection to PC is indicated by icon located on the bottom right corner next to battery icon. For data download you must be in the main screen.
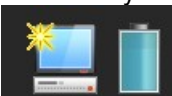
Until you are not on main screen, the VA5_DISC remains to be connected to the instrument processor and you cannot see it on your PC. The correct connection with PC is announced by the message box.

Connected to PC
To prevent data loss, always use Safely Remove Hardware icon on your computer before unplugging the USB cable!

VAx_DISC

Sometimes you may need higher capacity interface disk than the VA5_DISC (16GB). You can connect any external disk via USB. In order that the instrument is able to recognize your disk, you must name it as VAx_DISC. Use a standard USB OTG cable (see bellow) to allow the instrument to act as a host. Connect the small plug to the USB socket then connect the VAx_DISC to the OTG's socket. When VAx_DISC is connected the instrument prefers it against VA5_DISC.

Note: The OTG cable is not a standard accessory of VA5 set.

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Input Channels

All input sockets are in the top panel.

The input sockets IN1, IN2, IN3, IN4 are used for AC and DC signals. The TRIG input socket is used for trigger signals, usually tacho. All sockets have several pins. It enables to connect more signals to one socket (see wire diagrams).

The AC inputs enable to measure max voltage peak +/-12V. The DC channels enable to measure max +/-24V.

IN1 Socket
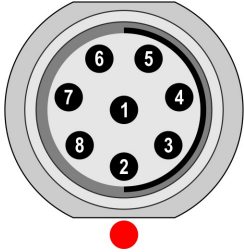
1 – GND
2 – +5V/0.1A
3 – **DC1**
4 – NC
5 – SHLD
6 – +20V/5mA
7 – **GND**
8 – **AC1**

Warning! Pin 2 of IN1 socket (ultrasound sensor powering) is internally connected with pin 2 of TRIG socket (tacho sensor powering).

IN2 Socket
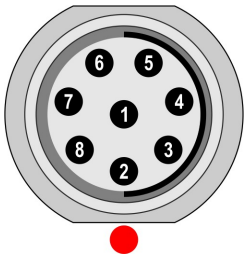
1 – GND
2 – AC4
3 – **DC2**
4 – AC3
5 – SHLD
6 – AC1
7 – **GND**
8 – **AC2**

Pay attention to possibility of connecting all four AC channels to **IN2**.

IN3 Socket
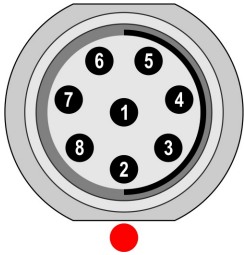
1 – GND
2 – DC2
3 – **DC3**
4 – DC4
5 – SHLD
6 – DC1
7 – **GND**
8 – **AC3**

Pay attention to possibility of connecting all four DC channels to **IN3**.

IN4 Socket
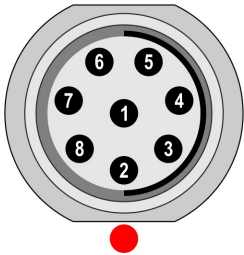
1 – GND
2 – NC
3 – **DC4**
4 – NC
5 – SHLD
6 – +20V/5mA
7 – **GND**
8 – **AC4**

TRIG Socket
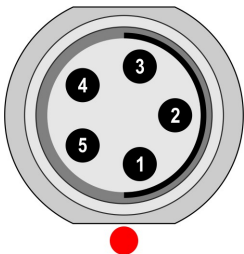
1 – TRIG
2 – +5V/0.1A
3 – SHLD
4 – GND
5 – GND

Warning! Pin 2 of IN1 socket (ultrasound sensor powering) is internally connected with pin 2 of TRIG socket (tacho sensor powering).

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Standard Cable Wiring

The standard cable, which are the part of the VA5 set, have the sensor signal connected to the pin number 8. The second sensor wire is connected to the ground (pin 7).

If you want to use the tri-axial sensor, then you have to use the IN2 socket (pins 6,8,4) + ground (pin 7). You need the special cable for this purpose.

A4409 - BNC Box

This box can simplify the connection of more cables to VA5 inputs. The BNC input connectors are used on the top panel for connection of 4 AC channels and 4 DC channels. On the side panel are two connectors, which enable to connect all 4 AC channels to IN2 input and all 4 DC channels to IN3 input.
See the wiring diagram of IN2 and IN3 in previous chapter. You see, that all 4 AC channels can be connected to one input IN2. In the same way all 4 DC channels can be connected to one input IN3.

Instrument Control

You can control the instrument by buttons around the display or by touch-screen.

Buttons on right side have these meanings.

✕   Escape / Cancel / Stop / No

∧   Up Arrow

‹   Left Arrow

›   Right Arrow

∨   Down Arrow

↵   Enter / Ok / Start / Yes

⌫   Backspace, Escape

⇨»   Tab / Shift

⌂   Home

The function of next buttons is always written on the screen near the button. Such approach enables to use one button for many functions depending of the actual needs. You can press the button or tap the touch-screen to call the function.

How to work with menu

You have to define many parameters for using the instrument. All those definitions are providing by menu items and windows. The procedure for operation with all is the same. We describe it on one example - the sensor properties definition.

Item Selection

After you push the **Sensors** button the sensor properties menu appears.

AC 1
AC 2
AC 3
AC 4
All AC Sensors
All Bearings
All ISO
DC 1
DC 2
DC 3
DC 4
All DC Sensors
Tacho
Settling Prolongation

Use the arrow buttons or touch-screen for one item selection, for example **AC2**. Then push **OK** button. The second menu appears.

ICP	on
Sensitivity[mV/g]	100
Unit	g
Position[°]	undef
ISO Machine Group	undef
Bearing Type	undef
Save	

Value Selection

Select one item. Then push the right arrow or OK button to display available values. For example for Sensitivity you see this picture:

ICP	on	1
Sensitivity[mV/g]	100	10
Unit	g	100
Position[°]	undef	user
ISO Machine Group	undef	
Bearing Type	undef	
Save		

User Defined Values

You can select predefined sensitivity or you can enter the **user** sensitivity (for example 96,8 mV/g). Select the **user** and push **OK**. Enter the value in next window.

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You can also enter a decimal point or minus symbol by several pushes of zero button. Use **Backspace** button to delete entered characters. Use **Ok** button to confirm the value or **Escape** button to leave without any change.

ICP	on
Sensitivity[mV/g]	45
Unit	g
Position[°]	undef
ISO Machine Group	undef
Bearing Type	undef
	Save

As we mentioned the value entry, also the text has to be entered in some menu items. The screen looks similar to the numerical screen. The only difference is the characters selection on buttons. It works like mobile phones keypad, for second character selection you must press the button two times.

Item Value Saving

Use the arrows and select the **Save** item. Press the **OK** button and the working with sensors menu will close. Also you can use the **Save** button with the same function. When the **Cancel** button is used, then nothing is saved.

Multi-selection of Items

Sometimes you can need to work with more then one item together. The usual example is the deleting of more items in one step.
The left button **Multi on / Multi off** enables to select more items at once. The text of the button indicates which mode is just active. Press the button to change the mode. When you move in the list by arrows and the Multi is on, you can select (or unselect) more items. The **Escape** button cancels all selections.

	Project List
Meas_Point_A	S
Plant_W	S
Point_DC	S
Pump_P	S

Find

Multi
on

Searching an Item

If the list is to long or you know the name, then use the **Find** button. Enter the name or part of name and confirm.

Main Screen

After the switching on the main screen appears.
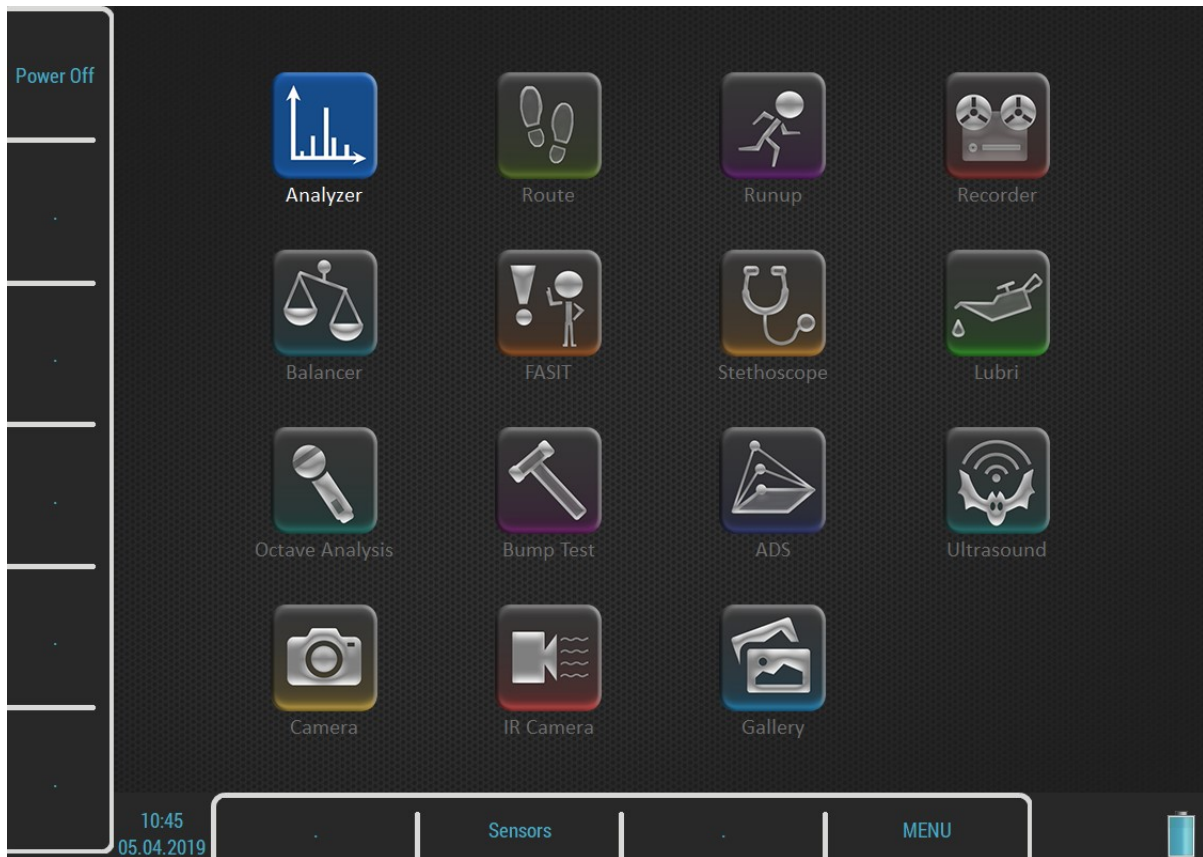
Modules

The VA5 instrument contains many modules. Each module has an icon on the main screen. Use arrows or double tap the icon to open the module. Each module will be described in separated chapter.

MENU button

The MENU button opens a main MENU of the instrument. This button is available on most screens.

Shortcuts

Left side and bottom buttons have no meaning on the main screen. They can be used for user defined shortcuts. You can define the meaning for each free button in the **MENU / Shortcuts**. The free button is marked with the "**.**" (dot) symbol. You can call the **Shortcuts** dialog also by pressing the free key. In this case the dialog setups only the pressed key.

Two shortcuts are set by default, the **Power Off** on button 1 and The **Sensors** on button 8. You can change these shortcuts as well.

The button 8 is something special for shortcuts. A shortcut defined on this button is available also in other screens, not only on the main screen.

Battery Lifetime

The information about % of battery lifetime is displayed in the right bottom corner of the display.

Battery lifetime 75 – 100 %

Battery lifetime 50 – 75 %

Battery lifetime 20 – 50 %

Battery lifetime 8 – 20 %

Battery lifetime 7 %

Battery lifetime under 7 %. Instrument is switched off under 3%.

PC Connection Indication

It is shown next to the battery icon when instrument is connected to PC

MENU

Press the MENU button. Two parts **SETTINGS** and **RUN** appears.

MENU		
SETTINGS		**RUN**
Global Settings	Signal Source	Camera
Touchscreen	Trigger Settings	IR Camera
Keyboard	Runup	Gallery
Language	Spectrum Settings	Update
Brightness	MCA Settings	Help
Appearance	Sensors	Screenshot
Profiles		Export All
User Notes Settings		About
Date/Time		Power Off
Shortcuts		

All MENU items will be explained. The underlined values are the default values (factory settings).

MENU / SETTINGS

Global Settings

Display Route Values

on, **off**
When you want to go faster during the route and you do not want to look at measurement results after each point, then set it **off**.

Route Autosave

on,**off**
When set to **on**, the data are saved after taking measurement at each point by itself. When set to **off**, then the user has to save it manually.

Route Auto Forward

off, **on**
The list of measurement points is automatically displayed after data saving and next measurement point is selected. The necessary condition is, that all measurements from last point are taken and correctly saved.

Check Route Sensors

yes, **no**
Each point in the route contains the sensor setting, which is defined in DDS. The instrument contains also the sensors setting (**Sensors** button). Both settings are compared for each point during the route readings. When the sensor setting in point is not equal the sensor setting in instrument, then the **Used sensor** window appears. It is the warning to the user.

Used Sensor
on AC1: 100 mV / g, ICP on

The user should connect the correct sensor to the unit with the parameters displayed in window. Confirm by pressing **Ok**. The setting in **Sensors** will be rewritten by point setting in route. You can made changes in setting now using the **Sensors** button.

The sensor can have a name in DDS (for example ACC100) defined. It should help the user in field to use correct sensor. These names are checked in instrument. When the names are not the same, then the **Used Sensor** window appears. No checking of other parameters is done.

Used Sensor
ACC100 on AC1: 100 mV / g, ICP on

Display Small Values

on, **off**
When you are interested to see values under the 0,001, then set it to **on** and the values will be displayed in exponential form (for example 5,26E-6). Otherwise the 0 (zero) will be displayed for small values.

Stop if ICP Error

on   the measurement is stopped, when ICP error occurs
off   the measurement continues, ICP error is only information

Units

metric, **imperial**, **both**

Units available in measurement setup.

Frequency unit

Hz, **RPM**, **CPS**, **CPM**

Speed unit

Hz, **RPM**, **CPS**, **CPM**

Power/Line Frequency

It is used for Elect value in Synch table, which is displayed for spectra

Phase range

(-180, 180) , **(0, 360)**
Range of phase values

Displayed Spectra in Cascade

32, **128, 256, 512, 1024**
Number of displayed spectra in waterfall (cascade) graph. It is not the number of measured spectra!

Align Graphs

on, **off**
If more graphs of the same type are displayed, then the Zoom and Cursor function of all graphs can be aligned.

Graph Grid

on, **off**

Cursor Type

linear, **maxs**
This item must be deeply explained. The graph width (for example spectrum frequency axe) is displayed on the approx. 600 screen pixels. But the spectrum could have 25600 lines and then 42 lines is displayed in one pixel line (42=25600/600). This number of lines in one graph pixel is different for other total line number and used zoom. In the older instruments we used the cursor movement procedure by lines. It means that the cursor moves inside one pixel without any real move on the screen. The users complained about it. Now we have used another procedure. The cursor moves by pixels, not by lines. In each pixel is hidden more lines and the cursor must display one specific line. What line should we use? When the Cursor type is set to linear, then the step of cursor movement is the number of lines in one pixel. When the maxs is set, then the cursor always moves to the maximum line, which is contained in one pixel.

Record analysis speed

fast, **real time**
A record could be analyzed in two ways. Let's suppose the record length is 300 sec, it could be for example run up record. You want to measure the 1x amp+phase (ampl+phase+speed) during the record. If you want to watch the continuous results, then select the **real time** mode and the processing of record will take 300 sec (the analyzing time is the same time as the recording time was). If you want to save results to the memory and not to watch them on the screen, then select **fast** mode. The analyzing time will be much faster then 300 sec. You can also imagine, that it is like tape recorder. You can push the button play (real time) or rewind (much faster). The instrument enables to analyze record also in fast (rewind) mode. It enables to analyze for example 1 hour length in several seconds.

Record Analysis Start

continue, **begin**, **again**, **ask**

These options are used when the record is selected for analysis.

It would be better to use example for explanation. For example we use record which length is 60 sec. We define time signal measurement which length is 8 sec. It means when we push Start button, the reading takes 8 sec and position of cursor moves of 8 sec in record.

continue   the next reading will start on the end of last reading
begin   the next reading will start on the beginning of record
again   the next reading will start on the beginning of last reading
ask   the user select any option before the reading

When you moved the cursor manually, the next reading will always start from that position.

Touchscreen

Enable Touchscreen

yes, <u>no</u>

Keyboard

Keyboard Backlight

on, <u>off</u>
The keyboard backlight is always off after instrument's startup. This setup is not saved.

Language

Language

Select your language.

Brightness
Not for Virtual Unit!
Screen brightness settings

Appearance

Interface Style

For Virtual Unit only!
old (VA4 I), old (VA4 II), <u>new (VA5)</u>
You can choose which user interface Virtual Unit uses, VA4 or VA5. The change of the interface takes effect after the application restarts.

Background Color

<u>black</u>, white
Background color of graphs

Profiles
All instrument parameters can be saved to the **Profile**. It is useful for example for saving of sensor sensitivities.

Save settings to "*just opened profile name*"

Save the parameters to the currently opened profile (updates the profile). **Note!** You have to create and open a profile otherwise this item is not visible.

Save settings as new profile

Save the parameters to the new profile (after name entry).

Factory

Open the factory default profile.

List of saved profiles

Select an existing profile. The **Delete** button removes selected profile.

User Notes Settings

You can attach the short text notes to route points. There are three ways how to handle with notes.
1. Enter the note manually.
2. Select predefined note from **Factory notes** set.
3. Select predefined note from **User notes**.

The user notes set is created and edited by user here under the **User Notes Settings**.
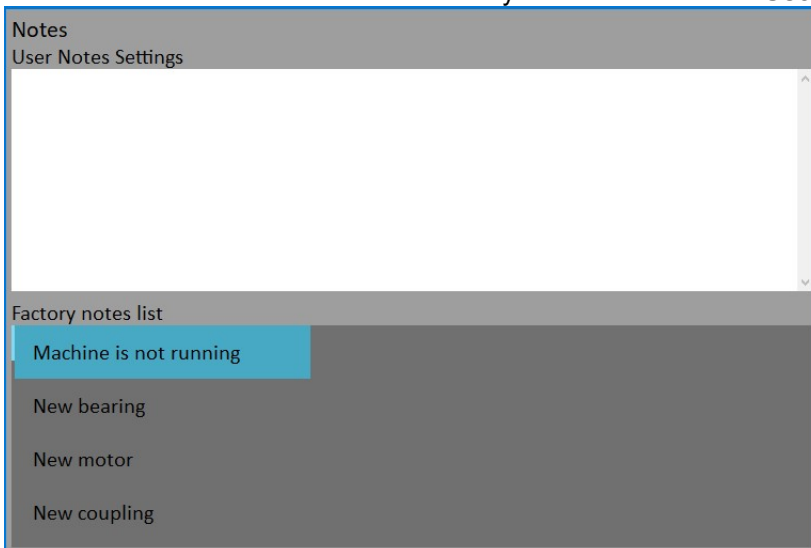
In upper half is the list of existed user notes (now empty). The predefined **Factory notes** are displayed in lower half.
Because usually the user wants to use only the **User notes**, you can copy any factory note to the user notes.
Select it by arrows and press **Select** or **Enter** button.
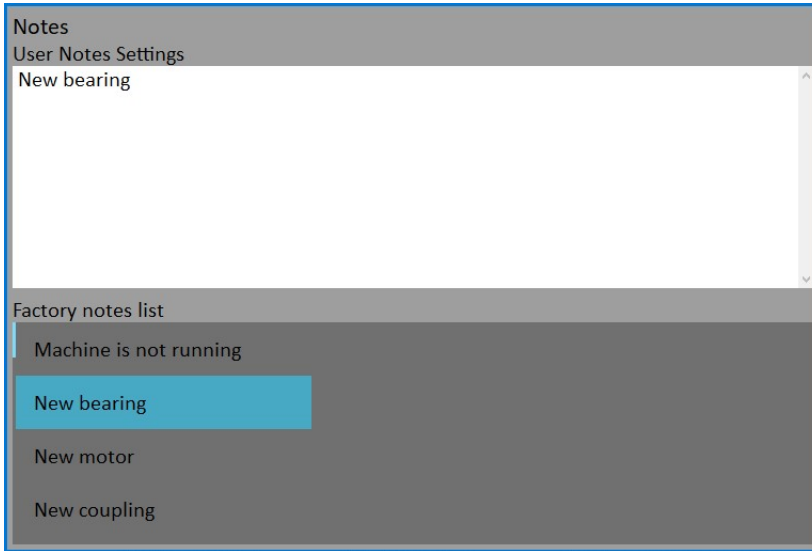
If you want to create your own note, then push **Edit text** button. Enter your note manually. Each line in text is one note. Press **Enter** button to add new line.
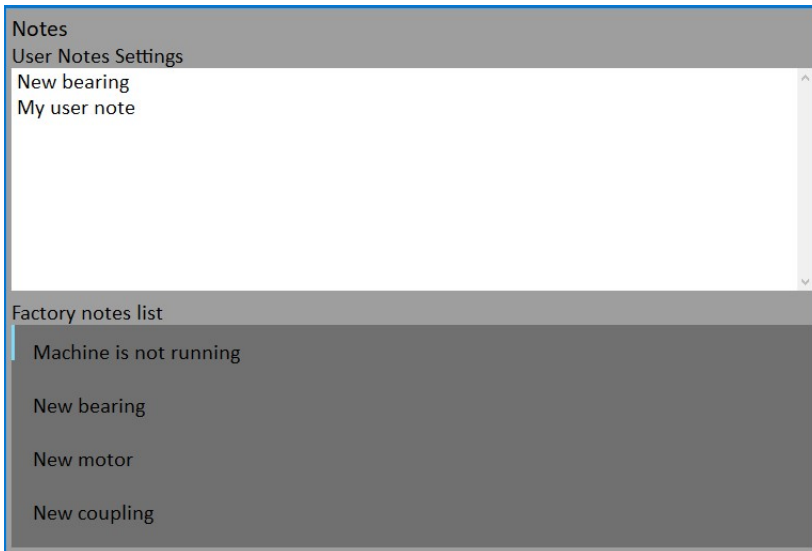
Press Escape button to skip back to the **Factory notes** list.

Press **Escape** button when **Factory notes** list is active to close the dialog. The Save changes question will appear. Confirm if you want.

Date/Time

Date format

yyyy/mm/dd
dd.mm.yy
mm/dd/yyyy   the a.m./p.m. is used

Year, Month, Day, Hour, Minute, Second

Set the actual date and time

Shortcuts
Set the shortcuts for buttons.

Signal Source

The measurement can be taken from **LIVE** channels (AC 1-4 or DC 1-4) or from RECORD (see **Recorder** chapter for understanding). All records saved in the memory are displayed for selection. Select required item and press **OK** button.

Trigger Settings

Trigger Mode

This setting is used in Analyzer and Octave Analysis modules.

single   Only one measurement is taken and displayed

<u>**retrig**</u>   When you use the analogue oscilloscope, you see always the actual new signal on the screen. This means the similar thing. The measurement is repeated until you push the **Stop** button.

Select the **single** option when you want only one measurement.

Runup Mode

This setting is used in **Runup** module. It has to be defined, how often the data will be taken.

<u>**asap**</u>   The next measurement is taken immediately after previous measurement without any delay.

manual   The user starts next measurement manually (by pressing the **Start** button). For averaging is only one pushing of **Start** needed.

speed   The next measurement is taken when the speed is significantly different from the previous measurement speed. The user defines in **Speed change** item, what it is significant change.

time   All measurement are taken with the same time interval between them. The time interval length is define in **Time Change** item.

time or speed This option is the combination of speed and time. The next measurement is taken when one of them is changed more then the value of **Speed change** or **Time Change**.

Note! When the process waits for retrig event (defined as **Runup Mode**), the **Waiting for retrig** window appears. The text informs, which event is expected.

Waiting for manual retrig	Waiting for time or speed retrig
Press enter for retrig	10 s or 1.00 Hz

Speed change

See **Runup Mode** item.

Time change

See **Runup Mode** item.

Trigger Source

Every measurement must be triggered (it means started). When you press the **Start** button for taking the measurement, you run only the initialization. When everything is ready to take the data, then the **Trigger Source** item is applied.

In Runup mode is the frequency of measurements controlled by **Runup Mode** at first. Then is applied the **Trigger Source**.

freerun   The taking of measured data begin immediately after initialization without waiting for anything.

external   The taking of measured data begins, when the external signal (voltage level higher then defined in External Trig Level) appears on the trigger input. Such signal may be generated for example when the machine starts to work. This type of signal is usually created in the control system.

manual   The taking of measured data begin after pressing the **Start** button. Remember that you should push the **Start** button twice. First pushing is for initialization, second for triggering.

manual sequential   Similar to manual, but every measurement for averaging must be start separately. For example when AVG=10, then the **START** button must be used 10 times.

amplitude   The taking of measured data begins when the signal level exceed the **Ampl Trig Level**, which is set by user also in this menu. Both - positive (rising edge) and negative (falling edge) levels are accepted. The signal amplitude is taken directly from sensor input, no additional filtering is applied.
Examples:
   the level is set to 100mV - triggered when the raising signal goes from for example 99mV to 101mV
   the level is set to -100mV - triggered when the falling signal goes from for example -99mV to -101mV

tacho   The **tacho** is special case of **external** trigger. When we talk the tacho, we mean the signal (usually like TTL) which contains one pulse during one rotation of the shaft. It can be also understood like series of single external pulses. The taking of measured data begins, when the external signal (voltage level higher then defined **Tacho Trig Level** in tacho sensor) appears on the trigger input (the same like **external** item).

Note! If no trigger event occurs, the **Waiting for trigger** window appears. The text informs, which event is expected.

Waiting for external trigger	Waiting for amplitude trigger 3 g / AC 1	Waiting for manual trigger Press enter for trigger

Use Ampl Tacho

yes, <u>no</u>
When **yes** is set, then the tacho pulses will be created by amplitude trigger level, not from tacho sensor. Set the channel and level by the same way as for amplitude trigger. Set the **Ampl Tacho Hysteresis** to 30-50% of level to avoid creation of more pulses in near times. It could happen when signal is noisy. Sometimes you need to try more percentage values to find the correct one. See pictures for understanding.
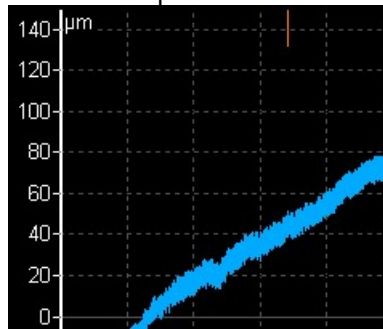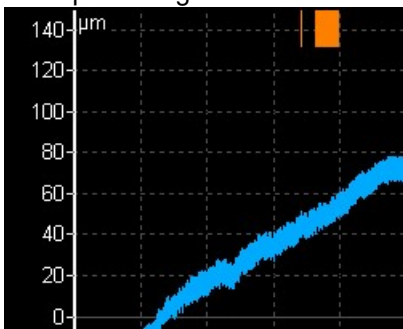
Ampl Trig Channel

It is a number of channel, which will be used for **amplitude** triggering.

Ampl Trig Level

See the description of **amplitude** mode (**Trigger Source** section). The unit is the unit of sensor on selected channel.

Ampl Tacho Hysteresis

See **Use Ampl Tacho**

External Trig Edge

<u>rising</u>, falling   edge for triggering

External Trig Level[V]

See the description in **Trigger Source/ external**

Pretrig (%)

value in (-100, 100)

Usually the taking of measurement (for example time signal) begins exactly from the trigger moment. But in some applications you are interested also to know the signal before trigger. The required time should be define in seconds, but in signal Analyzers is usually defined as percent part of the total signal length. When 1 second time signal is measured and pretrigger=25, then 0,25s will be taken before trigger and 0,75s after trigger. Also the negative pretrigger could be used. It means that the time signal will be taken later then trigger pulse.

Runup

The **Runup** menu contains parameters for **Runup** module.

Max Memory Size [MB]

It enables partial savings of runup measurement. If the size of measured data exceeds the value, then data are saved and new runup is opened.

Time Unit

days, hours, minutes
The unit of **Length** parameter (see next line)

Length

undef, value
If defined, then measured data are saved to individual files, where each file contains defined length.

Trend Time Axe

relative   the time axe begins from zero
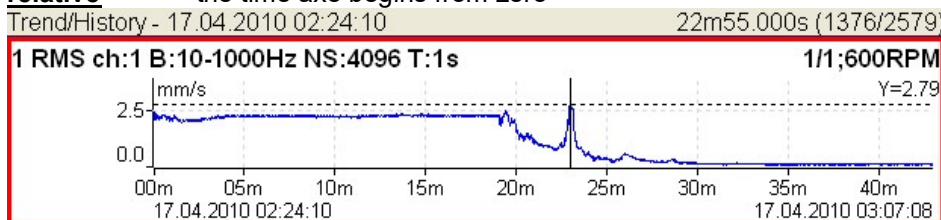
real time   the time of measurement is displayed on time axe
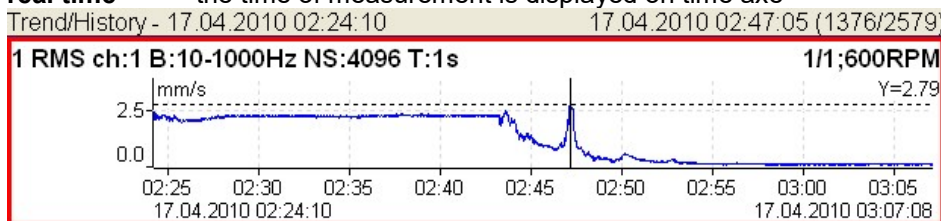
Trend Length

auto, value
The length of the trend graph (the range of X axe). It is used for Runup measurement and for the Graph Properties / View Trend. When the auto is used, then all data in the trend are displayed.

Spectrum Settings

Some spectrum **Graph Properties** parameters can be predefined here. Every new created spectrum graph has these parameters set to values form this menu. More detailed description of each parameter will be stated in chapter about **Graph Properties** for spectrum.

Detect Type

RMS, 0-P, P-P

Axe X

lin, **log**

Axe Y

lin, **log**, **dB**

Peaks list

on, **off**

Graph Lines

continuous, **discrete**

Sensors

When you connect the sensors to the instrument, you have to tell what kind of sensors you use. Select the Sensors item. In the next menu select channel you want to define.

Sensor Properties for Records

When you use the record (recorded signal from memory) for analysis, then the sensor properties are defined in the record, because you had to define them before the recording. You can change them for next analysis, but this change is not written to the record. The original values are kept in the record.

The new values will be used only for analysing.
Nothing is rewritten in record.

AC 1
AC 2
AC 3
AC 4
All AC Sensors
All Bearings
All ISO
DC 1
DC 2
DC 3
DC 4
All DC Sensors
Tacho
Settling Prolongation

AC1 – AC4   setting of each AC channel properties (sensor, ISO 10816 group, bearing)
All AC Sensors   setting of all AC channels together
All Bearings   setting of one bearing to all AC channels
All ISO   setting of one ISO 10816 group to all AC channels
DC1 – DC4   setting of each DC channel properties
All DC sensors   setting of all DC channels

For further technical and contact information visit www.adash.com or email: info@adash.com

Tacho   setting of tacho channel properties
Settling Prolongation if you need longer time for sensor settling, use this item

AC Sensors
AC (alternate current) sensors are used for signals, for example vibrations.

ICP

on, off
Select of required setting accordingly the sensor type

Sensitivity[mV/unit]

usually **1**,**10**,**100**, **user**

Unit

unit selected from the list or user unit

Position

The angle of sensor (see picture bellow). Usually used for proximity sensors.
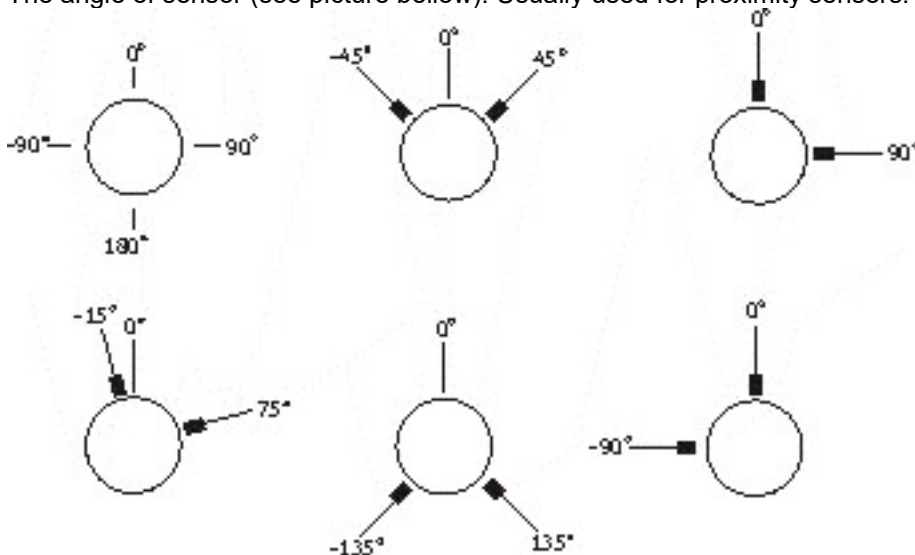
DC gap channel

In case of displacement sensor (eddy current) also DC channel could be entered, which is used for gap measurement (eddy current sensor must be connected to both AC and DC input). The gap value is stored in time signal and orbit measurements and the value is added to a signal.

ISO Machine Group

See next chapter ISO 10816 Machine Groups

Bearing Type

See Bearing Settings chapter

ISO 10816 Machine Groups

You can set the appropriate machine group according the ISO 10816 for each channel separately or for all channels together.

ISO 10816 Classification of machinery. These parameters are used for limit values according to machine type, nominal power or shaft height.

Bearing Settings

The fault bearing frequencies can be displayed in spectra. The bearing type definition is required for that.

Bearing type

Select **Bearing Type** item and press **OK** button or right arrow button. From next list select required item and press **OK** button. Also recently used bearings are displayed.

database   selection from database

Bearing Type
nu
NP32T-SEA
NU10-500-NTN
NU10/500
NU10/500-NTN
NU10/500-SKF

Enter the name (or part of the name) and use the up/down arrows. Confirm by **OK**.

user
If the required bearing is not contained in the database, then you can define the parameters manually.

undef
none bearing defined, the fault frequencies will not be displayed

Rotating Race

The selection of rotating race is required for correct calculation of fault frequencies.

DC Sensors

DC sensors are used for discrete current signals, for example temperature, pressure, ...
After selection of **DC1** - **DC4** or **All DC Channels** item the sensor properties menu appears.

Sensitivity [mV/unit]

Sensitivity value

Offset [mV]

Offset value
The used formula: **output value in Unit = (input value in mV - Offset) / Sensitivity**.

Unit

Unit selected from the list or user unit

Position

The angle of sensor. Usually used for proximity sensors and **GAP** measurement.

Tacho

The speed is measured from tacho channel. The signal contains one or more pulses per one rotation. The pulses can also trigger the measurement.
The VA5 instrument uses the falling edge of tacho signal for triggering (it means the end of the tacho mark).
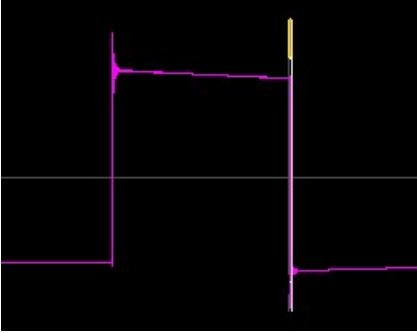
Tacho Trig Level

The correct reference value has to be set for speed measurement. For example when the standard tacho level is 0.5V and the pulses rich the 1.5V, then the value 1V should be correct. The negative pulses are not allowed, you need to use Adash converter for them.

Pulses per rotation

This value has to be set for correct speed evaluation, when more pulses are generated during one rotation. The Trigger Source=tacho is not available for more then one pulse.

Min Speed

The lowest speed, which the user is interested to measure with tacho. We suppose that there is one puls per one revolution. In other words, it means how long the instrument will wait for two tacho pulses (the speed is calculated from the time between two pulses). When the pulses are missing, then the NO SPEED error is displayed. When you choose 1Hz, then the waiting interval is 1 second. When you enter 0.1Hz, then you will wait 10 seconds. You should be aware of time prolongation of each measurement.
If the machine's speed is lower than **Min Speed**, then tacho trigger will not be used.

Settling Prolongation

Sometimes you can need longer time for sensor settling. Set the required additional time in seconds.

MENU / RUN

Camera
Runs the **Camera** module. This is next option how to run it. The basic option is to run it from main screen.

IR Camera
Runs the **IR Camera** module.

Gallery
Opens the **Gallery** module. This is next option how to open it. The basic option is to open it from main screen.

Update
Update of the instrument firmware. The Update item is available only when the MENU item was selected in the main screen. If any module is running, then the Update item is not displayed. You can download the updated firmware from producer website. Follow the procedure:
- Download the file for update (for example VA5_ver0268.up3) and save it to your computer.
- Connect the instrument to the computer.
- Run the Explorer or other software, which you use for copy of files.
- Copy the update file from the computer to the VA5_DISC.
- Use **Safely remove hardware** function and disconnect instrument from the computer.
- Select the **Update** item
- Select the required update file from the list (more version files can be saved in the instrument). Press **OK**.
- The main screen window is closed now. The procedure of update is described in the new command window.
- After the update the instrument is reset

Help
Displays html version of manual

Screenshot
The screenshot will be saved to the **images** folder on VA5_DISC.

Export All
Export all still unexported projects from Analyzer, Route and Runup modules.

About

Version:	0222
Licence:	000000
Built:	2013/09/30 07:59:43
Installed:	2013/09/30 07:59:49
Disc Capacity:	138.0GB
Used Space:	10.4GB (7.5%)
Free Space:	127.6GB (92.5%)
VA4_DISC Free Space:	96.6%

Power Off

Switch off the instrument.

Speed detection

You need to know the speed of the measured machine in some cases. Usually the route readings has set the Detected speed from DDS. We will describe here how the speed detection works.

Detection is done just before the measurement itself after pressing the Start button. During the detection there is information window displayed in bottom right corner.

If the tacho probe is used, then the speed is measured by that.

If the tacho is not used, then the spectrum is displayed. The highest peaks are found and displayed in the list. The highest amplitude speed in on the top of list. You can select the correct value and press **OK**.
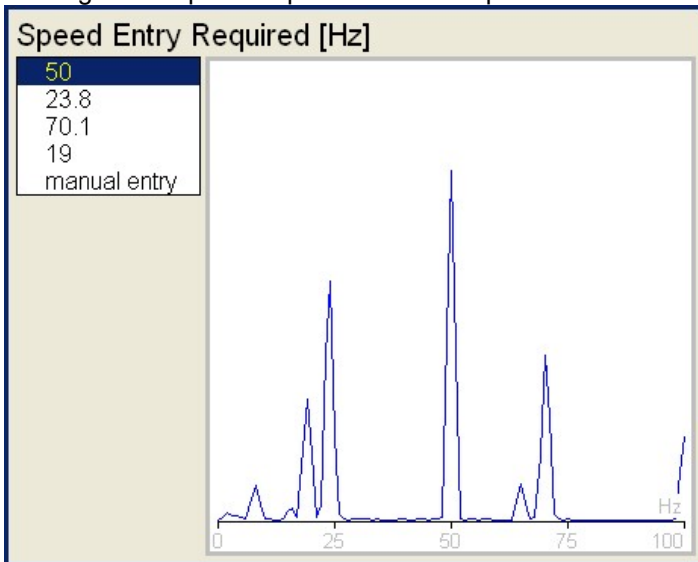
If no value in the list is correct, then select **manual entry** and enter the speed manually. If no value of speed is defined in this window, then the readings will be taken without it.

The speed detection is available only when vibration sensor is used for point reading. In other cases the warning appears. Then the manual entry of speed is required.

If the measurement for speed detection fails, then error message appears. For example ICP error.

If the speed value is detected, it is automatically saved to the data head for following measurement in the same way as the speed value measured by tacho probe. This speed value has the priority for using in DDS. The Default speed defined in DDS properties is not used.

Analyzer

The **Analyzer** module is the basic module for signal analysis. If you have not prepared the **Route** measurement, then you use the **Analyzer** for analysis. All required parameters must be set by hand or you can use the saved measurement parameters from memory.

Meas

The **Meas** means one measurement as it is usually understood, for example overall value or time signal or spectrum or other.

Graph

The graphical form of that **Meas** values displayed on the screen we will call the **Graph**. One Graph works with data from one **Meas** item. You should keep in mind that also one overall value is the **Graph**.

Set

The **Set** is the most important term in the Analyzer mode. The **Set** is the set (or group) of one or more **Meas** items, which the user wants to collect and display together. For example you want to take 4 **Meas** together - acceleration overall, velocity overall, velocity time signal and velocity spectrum. You prepare the **Set**, which includes these 4 required **Meas** items. The definition of Set is saved in the Analyzer memory. You can save many various Sets, which can contain your often used sets of measurement. Then you select one Set and run it. The taking off all measurements included in the set is made **<u>simultaneously</u>**.

Reading

The Reading means all **Meas** items (signals and values) from one set measured together at the same time.

Project

You can use only various **Sets** for analyzing. But sometimes you can need the more structured items then simple **Set**. Such items we call **Projects**.
Examples:
Meas_Point_A
      This is only simple **Set**, which contain several measurements in one point.
Pump_P/ Point_1, Pump_P/Point_2, Pump_P/Point_3
      The structured **Project** of 3 **Sets** (3 points) on one machine (Pump_P). This type of Project we call
      L1/Set. It means Level1_Name/ Set_Names.)
Plant_X/ Pump_P/ Points
      The structured **Project** with name of Plant (Level2) , names of machines (Level1) and names of Sets.
      This Project type we call **L2/L1/Set**.

Export of the Project to the VA5_DISC (flash disc)

The computer can read any data from the flash disc only. This flash disc has the name VA5_DISC. The set with measured data has to be exported to the flash before the transfer to the PC. During the set measurement are data saved to the VA5 hard disc only (SSD). When the set is closed, then the VA5 asks the user "Export to VA5_DISC?" and user selects one option. The export to flash is not done automatically because the writing procedure to flash is slow. That is why the user can determine, when the right moment to export the set is.
In the menu item **Project / Export** you can select a project and export it manually.

Project List

The first Analyzer screen contains the list of Projects saved in the memory or the empty list, when no Projects were saved. The time and date of last saving of selected project is displayed in top right corner. Each item in project list has a note on right side, S (means Set), L1 or L2.

	Project List		26.03.2019 09:25:00
Point_DC		S	

Page Up

Page Down

| 09:25 26.03.2019 | Project | Sensors | | MENU | |
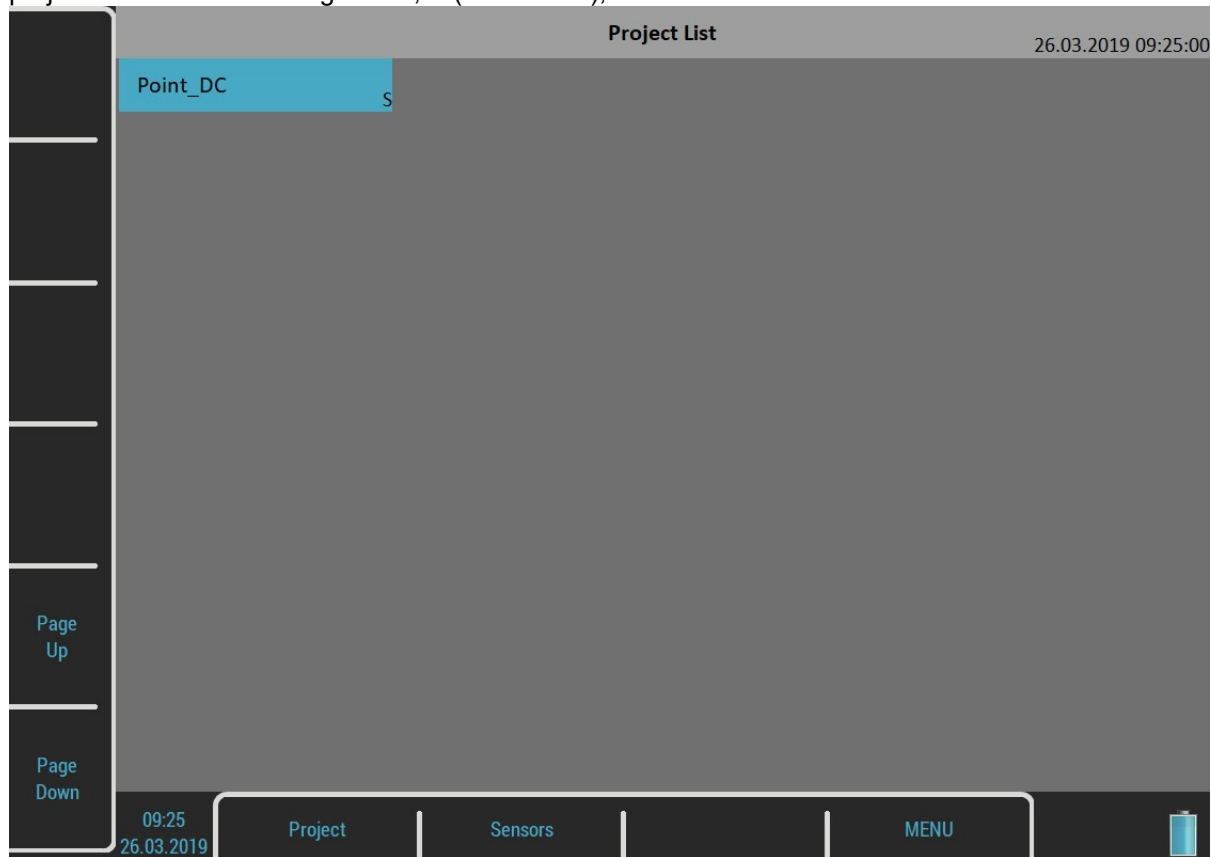
Project Menu

Push the **Project** button. The **Project** menu appears.

Project
New Set
New L1/Set
New L2/L1/Set
Copy
Rename
Delete
Clear Data
Notes
Export
Export to runup
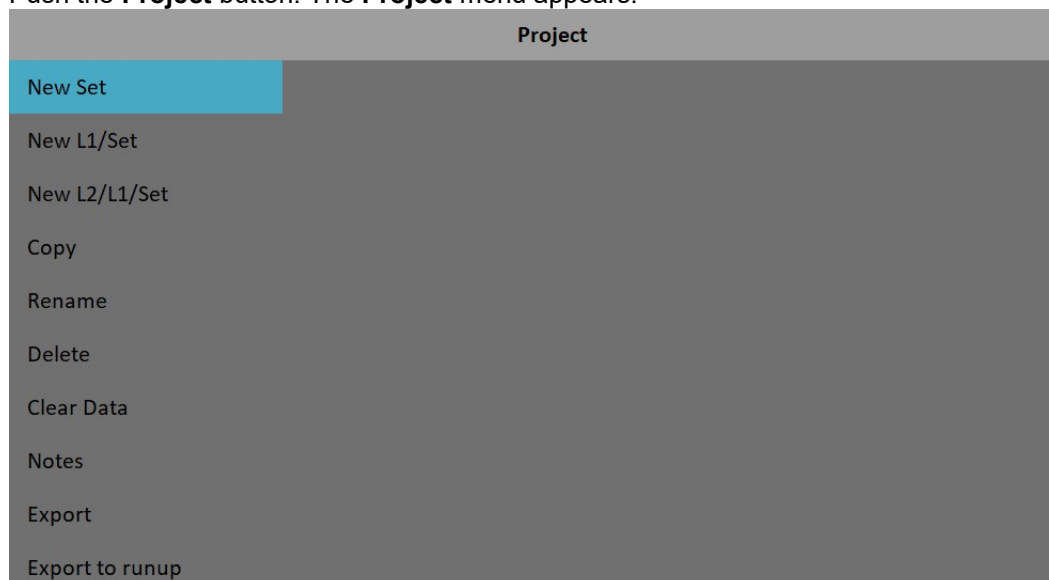
New Project - Set creation

Select the **New Set** item from the **Project** menu. The **Enter the set name** dialog appears.

Enter the set name.
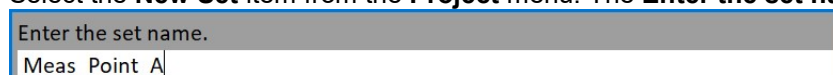
Meas_Point_A

Enter the name of new set. Then press **OK**. Your new item appears in the displayed Project list (alphabetical order).

Project List	26.03.2019 09:26:42
Meas_Point_A S	
Point_DC S	

The **S** letter after the name is the **Set** type indication. Date and time of project last modification (here creation) is displayed in status bar right corner.

New Project - L1/Set creation

The **L1/Set** structure usually enables to create the machine item with several points. Select the **New L1/Set** item in the **Project** menu.

Enter the L1 name.
Pump_P

Enter the name on Level 1 (for example machine name) and press **OK**. The Project list appears (alphabetical order).

Project List	26.03.2019 09:29:56
Meas_Point_A S	
Point_DC S	
Pump_P L1	

The **L1** letter after the name is the **Level 1** type indication.
New item is selected. Push **OK**. The project will be opened and the list of included **Sets** appears (now it is empty).

Pump_P
Set List
Empty

Push the **Set** button and select **New** item.

Enter the set name.
Point1

Enter name and push **OK**. The list of sets appears.

Pump_P
Set List
Point1

Use the **Escape** button to return back to the project list.

New Project - L2/L1/Set creation

The **L2/L1/Set** structure usually enables to create the plant with several machines. Every machine can contain several points. Select the **New L2/L1/Set** item in the project menu.

Enter the L2 name.
Plant_W

Enter the name, push **OK**. The project list appears (alphabetical order).

Project List	26.03.2019 10:33:22
Meas_Point_A S	
Plant_W L2	
Point_DC S	
Pump_P L1	

The **L2** letter after the name is the **Level 2** type indication.
Open the Project by **OK**.

Plant_W
L1 List

Empty

The empty list of L1 items appears. Press **L1** button and select **New**. Enter the name of new Level 1 item.

Enter the L1 name.

Fan_X1

The L1 list appears.

Plant_W
L1 List

Fan_X1

Open the L1 item and create the Set in the same way as in the previous section.

Copy

Copy of selected item to the new one

Rename

Rename selected item

Delete

Erases selected item. You can also erase more items at once by using **multi on** function.

Clear Data

Erases measured data in selected item(s).

Notes

See the **Route** chapter for details.

Export

Export of selected item to the VA5_DISC, where is accessible for computer.

Export to runup

Export selected item to a **Runup** module. Also you can export projects from **Runup** module to the **Analyzer** module (**Export to analyzer** item is available in the **Runup** module).

Main Set Screen

Select a Set project (noted by S) from the project list or a Set from the set list of a structured project and press **Ok** or double tap the screen.

Meas_Point_A	No Measurements
Actual	

10:56 26.03.2019	Set	Sensors	Meas	MENU	
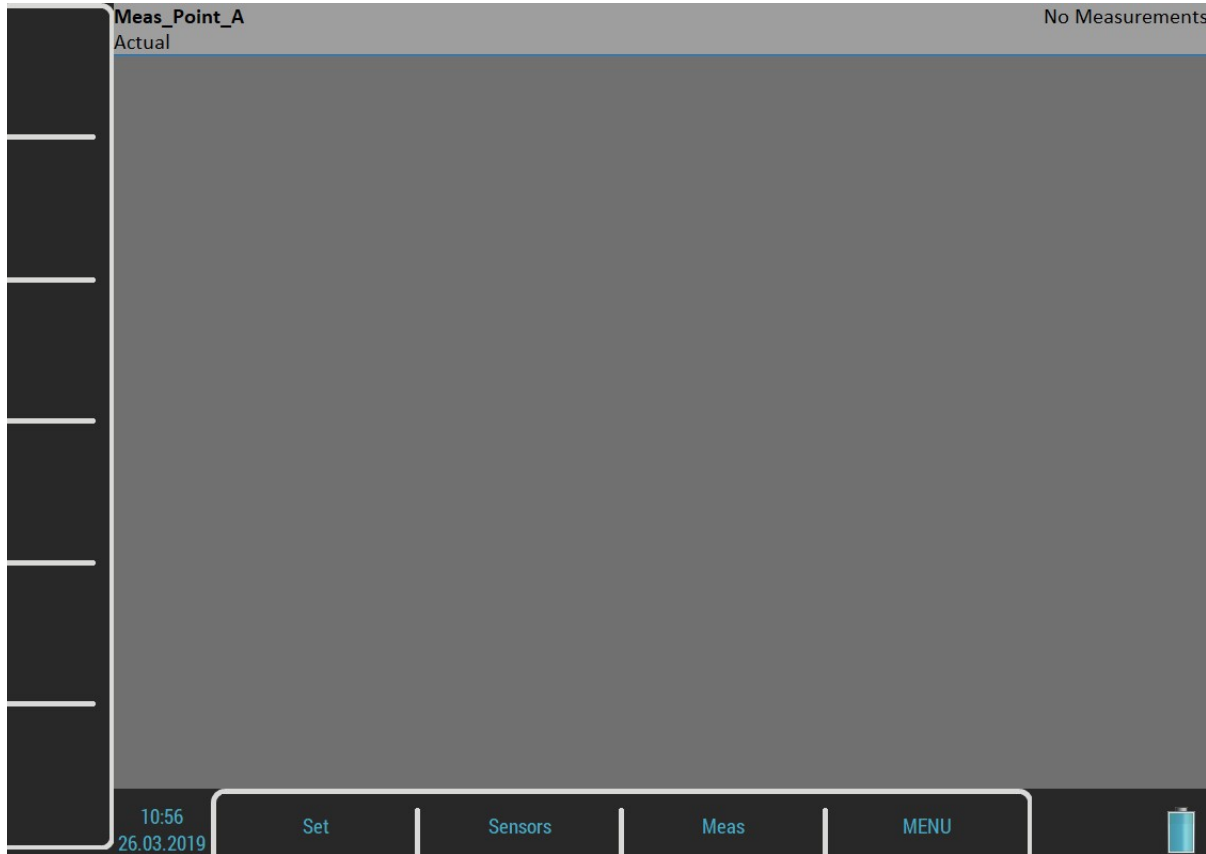
The Set screen contains graphs of set's measurements (now empty).

The status bar contains several texts. The set's name (**Meas_Point_A**) takes place in the top left corner. The **Actual** indicator informs you are working with actual data. The **Trend/History** alternates the **Actual** if you are watching saved data. The **No Measurement** indicates there are no measurements yet. The selected graph index and the total number of graphs is written in this place if some graphs are on screen (**Graph 2 of 5**).

Two menus are available for the Set screen, the **Set** menu and the **Meas** menu.

Measurement Definition in the Set

As has been described already the Set contains definitions of measurements (**Meas**), which we want to take together.

To show the example is the best way how to learn the process of measurement.

The example of requirements for the Set:

Meas 1: RMS overall value in mm/s, frequency band 10-1000Hz, from channel 1
Meas 2: RMS overall value in g, frequency band 500-25600Hz, from channel 1
Meas 3: time signal in mm/s, frequency band 10-1000Hz, from channel 1
Meas 4: Spectrum in mm/s, range 400Hz, 1600 lines, from channel 1, number of average 4
Meas 5 Spectrum in g, range 3200Hz, 3200 lines, from channel 1, number of average 8

First you need to define your measurements. Press the Meas button. The Meas menu will appear.

Meas
New Basic
New Advanced

Select the **New Advanced** item. An **Edit Measurement** dialog will appear.

Edit Measurement	
Type	overall freerun,retrig
All Channels	no
Channel	1
Unit	mm/s
Detect Type	RMS
Band fmin[Hz]	10
Band fmax[Hz]	1000 fs=4096Hz
Trigger Control	off
Samples	4096 t=1s
Averaging	linear
Avg	off total t=1s
	Save

The **Type** parameter displays current trigger settings as a note under the value.
If you need to create same measurement on all channels set the **All channels** to **yes**.
The **Band fmax** parameter determines measurement's required sampling frequency. Therefore the **fs** note is displayed under the **Band fmax** value.
The measurement's length depends on the number of samples and number of averages. The time required for taking one average is under the **Samples** value. The total time for all averages is displayed under the **Avg** value.

You can edit the type and parameters of the measurement here. There are factory predefined parameters for ISO RMS which is exactly what we need as our first measurement. Just press the **Save** button and a new graph will be created on the Set screen.

Meas_Point_A	Graph 1 / 1
Actual	

1 RMS ch:1 B:10-1000Hz NS:4096 T:1s
U:mm/s

No Data

| 10:19
27.03.2019 | Set | Sensors | Meas | MENU | |
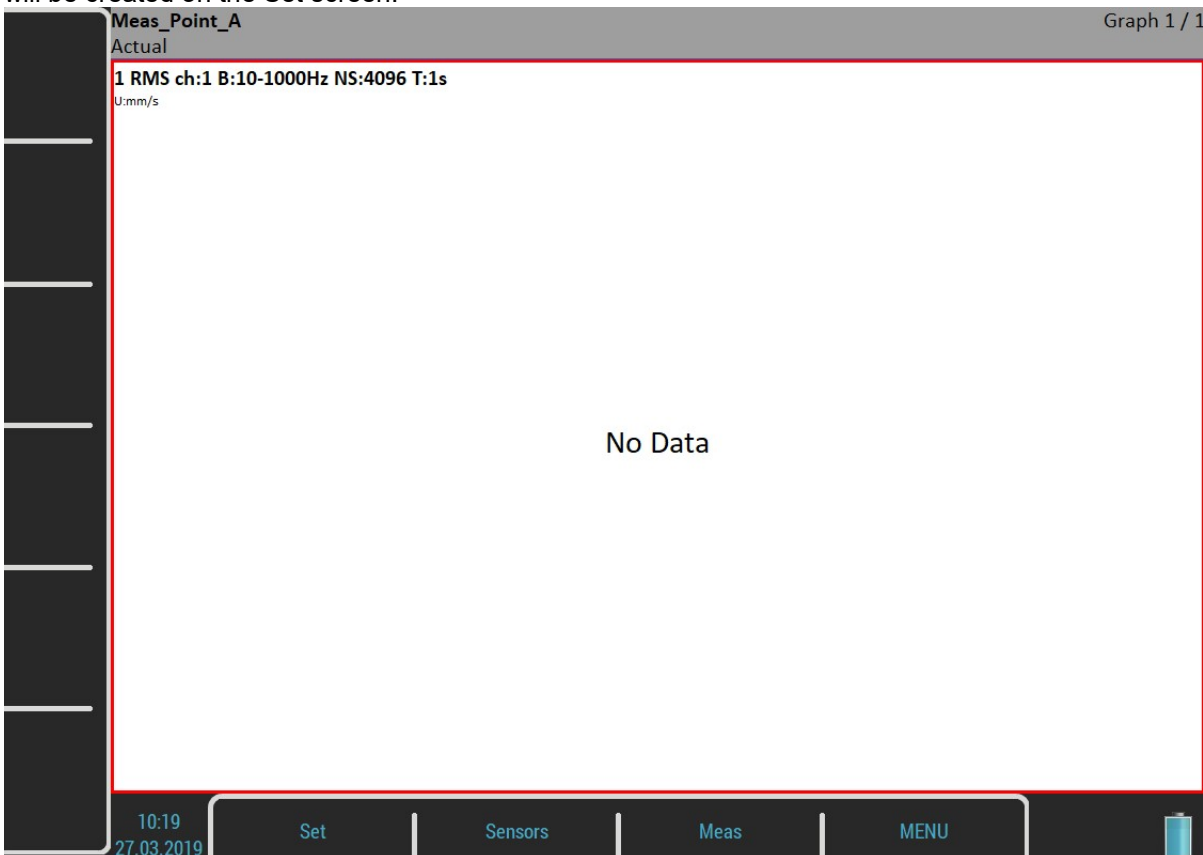
Create the second measurement. Use the **Meas / New Advanced** item again. Change the **Unit** to g, the **Band fmin** to 500 Hz , the **Band fmax** to 25600 Hz and the **Samples** to 65536. Confirm the dialog and the second graph will be ready.

The graph number three is a time signal. In the **Edit Measurement** set the **Type** parameter to **time**.

Type	time freerun,single
All Channels	no
Channel	1
Unit	mm/s
Band fmin[Hz]	10
Band fmax[Hz]	1000 fs=4096Hz
Trigger Control	off
Samples	4096 t=1s
Avg	off total t=1s
	Save

You need to change the **Type** parameter to **spectrum** to define the next two measurements. The **Edit Measurement** dialog for spectrum looks like this.

Type	spectrum freerun,retrig
All Channels	no
Channel	1
Window	hanning
Unit	mm/s
Zoom Spectrum	no
Band fmin[Hz]	10
Range[Hz]	1600 fs=4096Hz
Lines	1600 t=1s,df=1Hz
Averaging	linear
Avg	off total t=1s
Overlap	0%
Full Spectrum	no
	Save

The **Band fmax** has changed to **Range** and the **fs** note is under the **Range** value. Change the Range parameter to 400 Hz and the **Avg** to 4 and confirm. The graph number three will be created.
To finish the set definition create another spectrum measurement with the unit of g, range of 3200 Hz, 3200 lines and 8 averages.

The Set screen contains five graphs of just defined measurements. The graphs don't contain data yet.
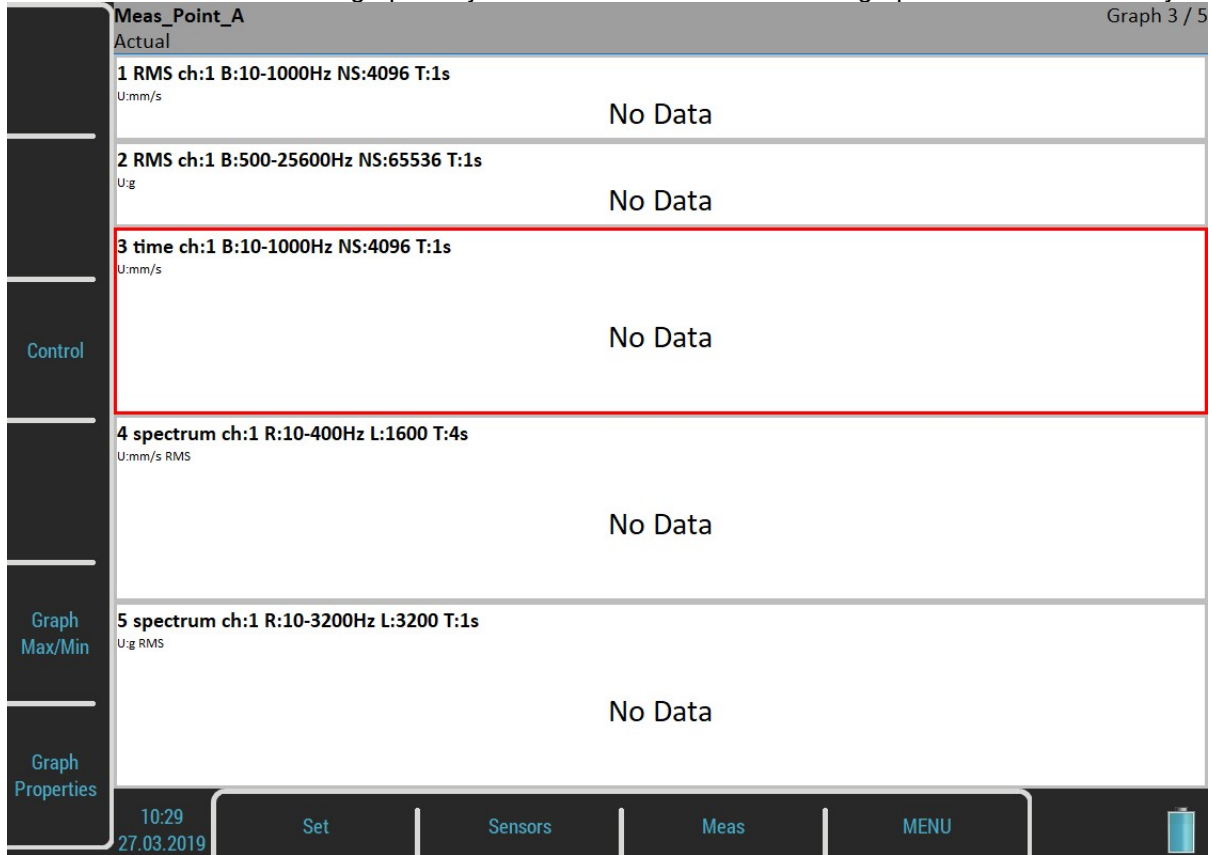
The **Graph 3 / 5** text in the status bar top right corner says that the third graph is selected (you see the red frame) and there are five graphs on the screen. Operations like edit, copy, delete are made on selected graph. Use up and down arrow button to change the selected graph.

The description of each graph is in the top. The complete list of symbols is stated in an appendix.

The description example:
1 RMS ch:1 B:10-1000Hz NS:4096 T:1s
The translation: Meas No.1, RMS value, Channel 1, Applied band filter 10 -1000Hz, Number of Samples of the signal 4096, Time length of signal 1s. The Signal means the time signal, from which the evaluation was made.

New buttons are available now, **Control**, **Grah Max/Min** and **Graph Properties** buttons. Their meaning will be explained later.

When the measurements definition is made everything is ready to make the real measurement. Push the **Start** button.
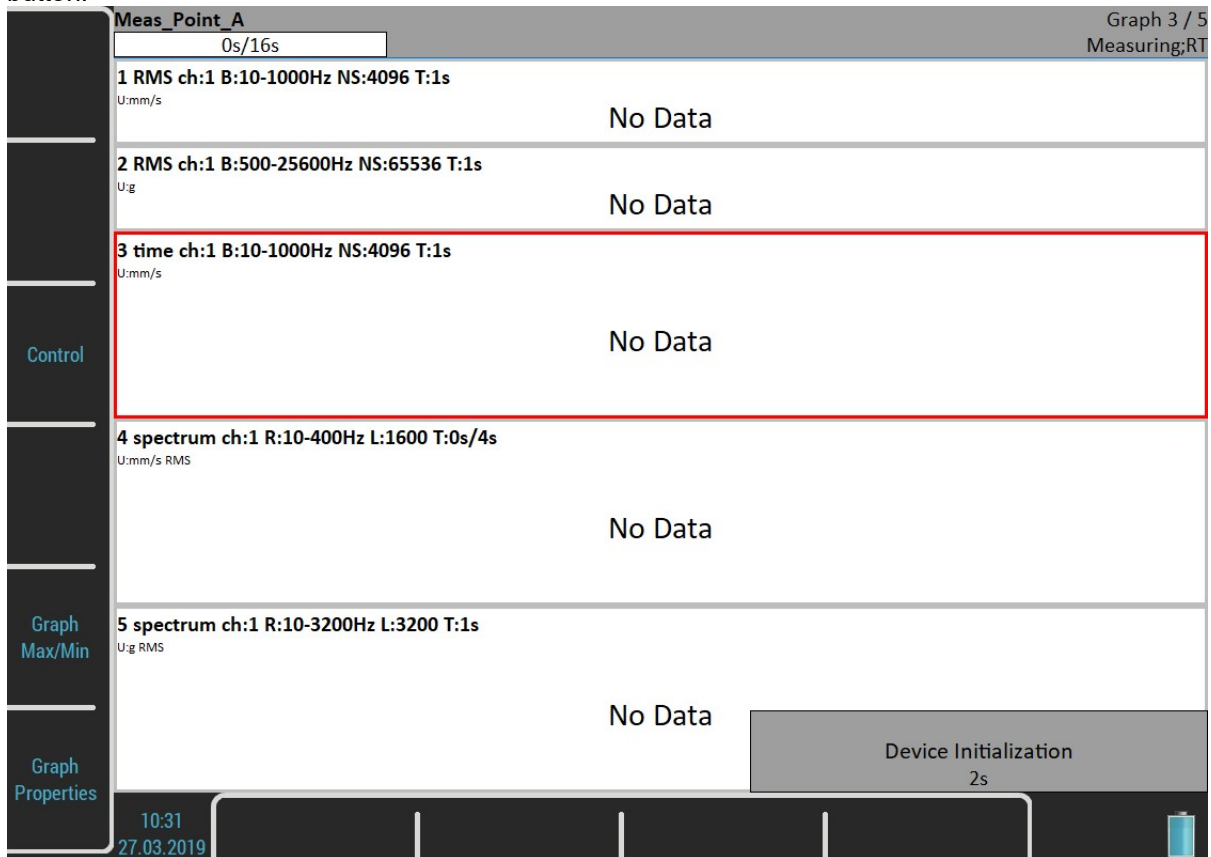
The **Device Initialization** count down appears in the bottom right corner before the measurement begins. The **Measuring** indication is in the bottom right corner of the status bar. The **RT** note means Real Time (see the Input Buffering chapter). The measurement count down indicator appears in the top left corner of the status bar if the total time of the longest measurement takes at least four seconds.

If the **Trigger Mode** is set to single, then only one measurement is taken. If the **Trigger Source** is set to manual, use the **Start** button to trigger the measurement. For stopping the measurement use **Stop** button.

A "**Measurement is not completed**" dialog appears when you push the **Stop** button and the measurement is not completed yet in the single mode. Press the **Stop Meas** button to stop it anyway or the **Continue** button otherwise.
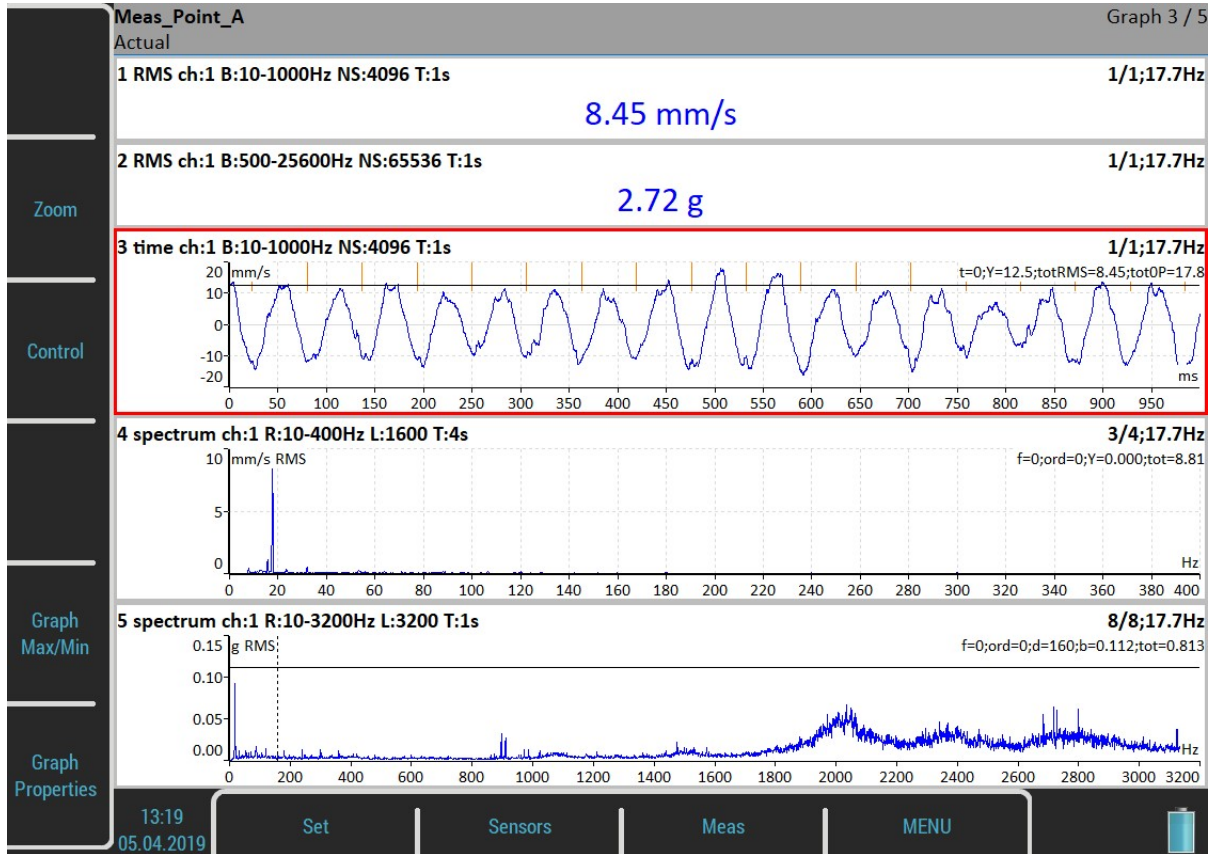
When graph contains data the averages and speed notification appear in the graph's top right corner. See the graph 4. The **3/4** means the 3 of 4 averages has been taken and **17.7Hz** is the speed on the beginning of the reading. The light orange lines in the time signal are tacho marks.

Input Buffering

Measured signal is collected into the input memory. The analyze procedures read the signal data from the memory and compute all required results, which are displayed on the screen. In the case, when too many results are required, the computation is slow and displayed graphs are not in time - they are delayed. We are talking about **Real Time (RT)** graphs (you see the actual results) or about **Non Real Time (non RT)** graphs (delayed results).
This information is displayed in the right upper corner – **Measuring; RT** or **Measuring; non RT**.

After the measurement is stopped, the computation continues until the input memory is empty. The bellow window appears.
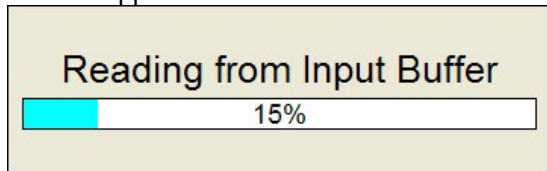
You can wait for all data acquisition or if you are not interested of measurement from input memory press the **Stop** button to stop data processing.

Graph Max/Min

It maximizes the selected graph to the whole screen or returns back to the initial screen with more graphs.

Graphs Control

Use up and down arrow button to change the selected graph. Use the left and right button to change the cursor position. You can do it also by tapping the touch screen. If you tap the non selected graph, it becomes selected.

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If you tap the selected graph, the cursor moves to the place you tapped (more precisely it will move to the nearest place on signal).

Another control functions are available under the side buttons. Press the **Zoom** button. The buttons mode will change. You will be able to zoom and move in selected graph. You can zoom and move also with standard gestures on touch screen.
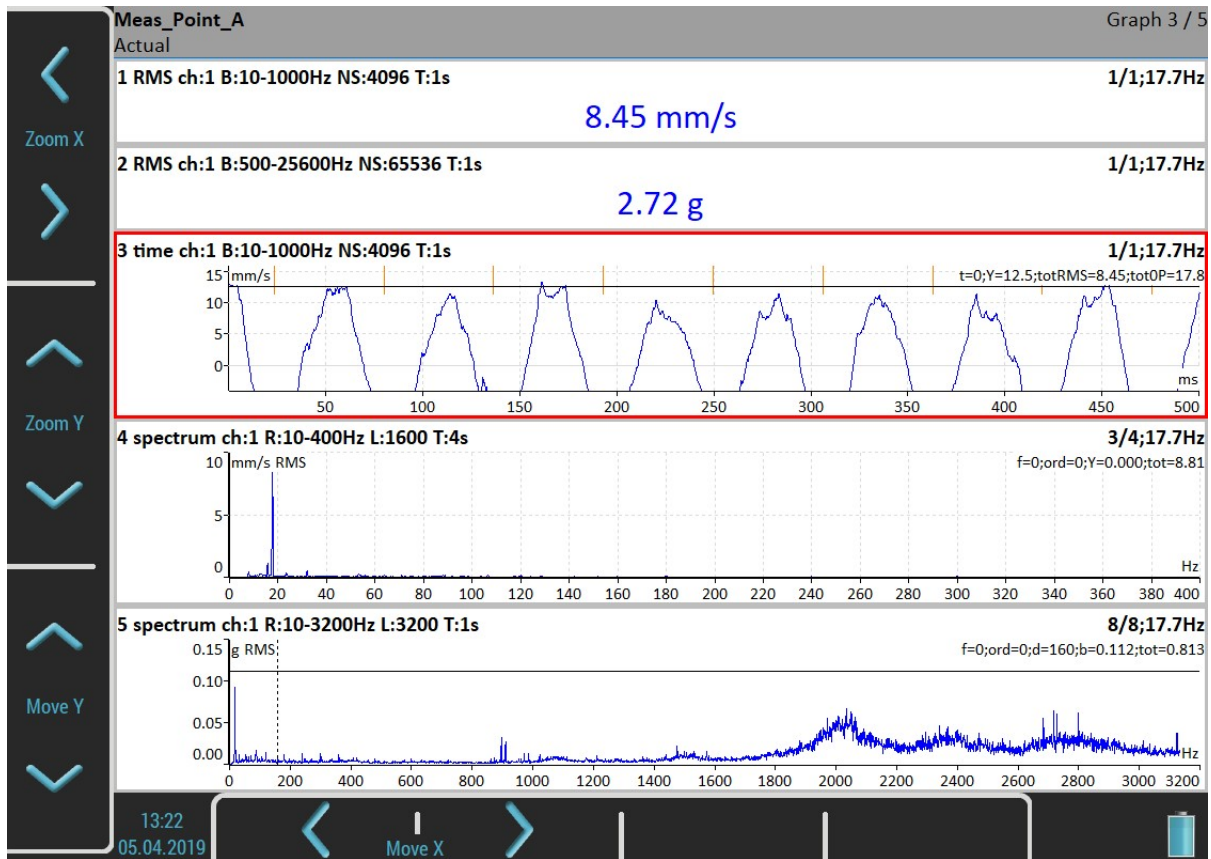
Use the **Backspace** button to restore the side buttons meaning. Then press the **Control** button. You will be able to change selected graph's position.
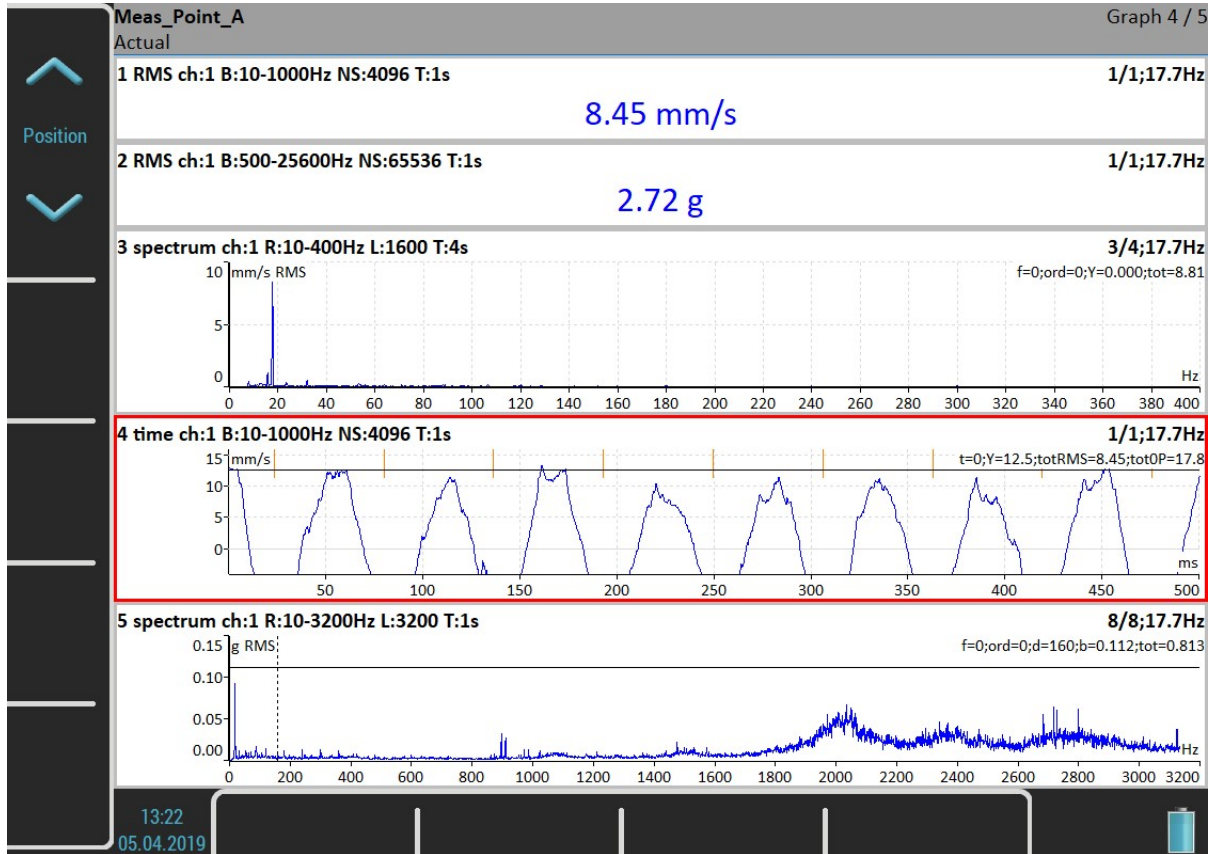
Next available functions of the Control mode are **Trend**, **Delta X**, **Zoom Z** and **Move Z**. These functions are hidden now and will be shown in certain situations.

The **Backspace** button restores side buttons again.

Another possibility how to switch side buttons mode is the **Tab** button. Press the **Tab** button once and the buttons change to the **Zoom** mode. Press it again and the **Control** mode will be active. Next press will restore the initial state. This way you can rotate the buttons modes. In some situations there may also be more than two modes. You can use anytime the **Backspace** button to restore the initial state.

Set Menu
Push the **Set** button. The **Set** menu appears.

Save data

Save last measured data. When you close the set without saving, the measured data will be lost. A "**Save data?**" question appears when you are leaving the set or restarting the measurement without saving.

Save data?

Notes

Open the **Notes** dialog for currently opened set. See the **Route** chapter for more details.

Clear Data

Clear all saved data from the set.

Enter speed / Cancel speed

Open the "**Enter Speed**" dialog or cancel currently entered speed. See the **Route** chapter for more details.

View Trend / View Actual

Loads saved data of the set. The screen looks like this while looking the saved data. Notice the overall values are displayed as trends. The status bar contains **Trend/History** notification with the data and time of the beginning of the history. The date and time of currently displayed value takes place in the bottom right corner of the status bar. The 4/8 note means that 4th trend's item of 8 is displayed. You can move the trend cursor by left and right arrows or by tapping the trend. This is possible only for trends of static values. Graphs like time signals or spectra use the arrows for standard axe x cursor.

The **Control** mode of the side buttons contains a **Trend** function for moving the trend cursor. The trend cursor is common for all graphs. Values from same time are displayed on all graphs.

Use the **Set / View Actual** item or the **Escape** button to view the actual values again.
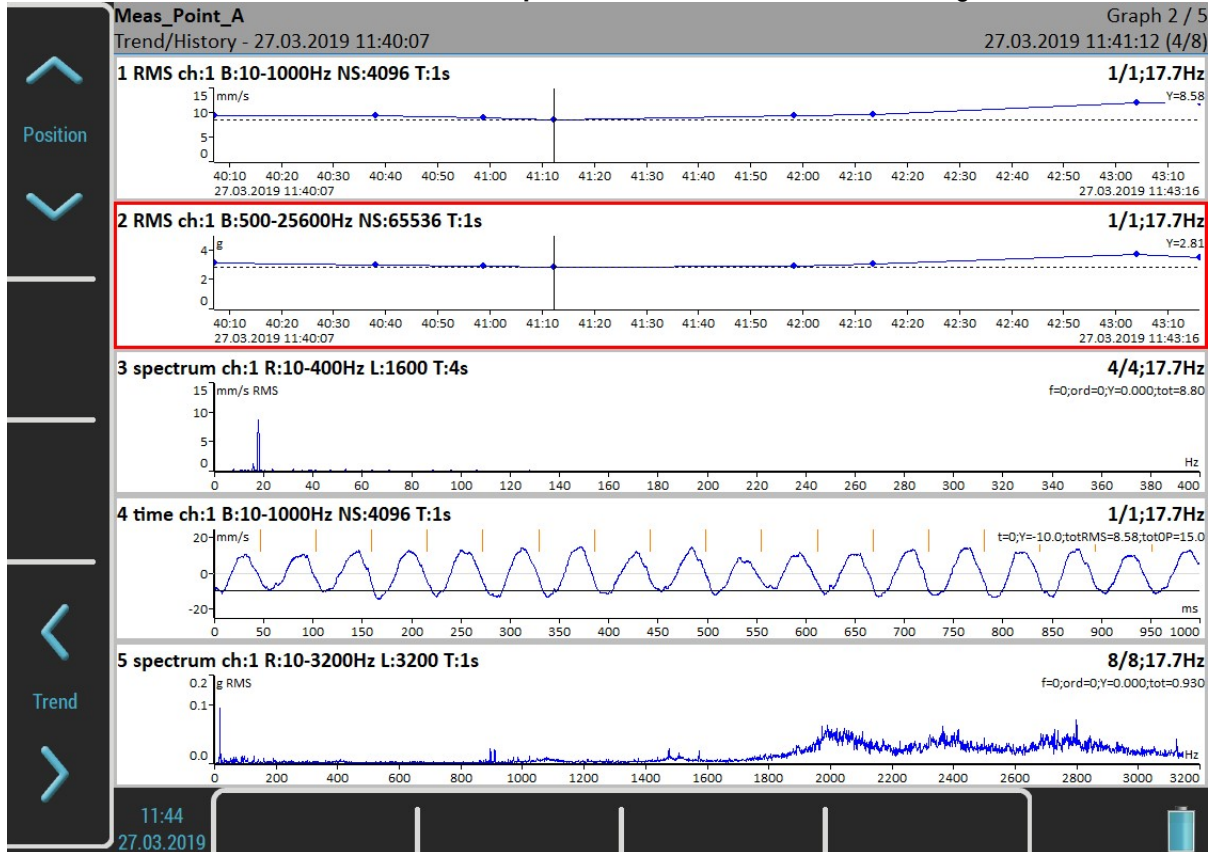
Clear Last Data

This item is available only when trend is displayed. It deletes last saved data from the set.

Meas Menu

Push the **Meas** button. The **Meas** menu appears.

New Basic

Creates measurement from the predefined list.

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Name	Type	Unit	Frequency Band/Range	Length	Samples	Lines	Average
RPM	speed	RPM					
ISO RMS	wideband RMS	vel	10-1000 Hz	1 sec			
BEARING RMS	wideband RMS	acc	5000-25600 Hz	1 sec			
LBEARING RMS	wideband RMS	acc	500-25600 Hz	1 sec			
OVERALL RMS	wideband RMS	acc	1-25600 Hz	1 sec			
ISO 0-P	wideband 0-P	vel	10-1000 Hz	1 sec			
BEARING 0-P	wideband 0-P	acc	5000-25600 Hz	1 sec			
LBEARING 0-P	wideband 0-P	acc	500-25600 Hz	1 sec			
OVERALL 0-P	wideband 0-P	acc	1-25600 Hz	1 sec			
ISO TIME	time signal	vel	10-1000 Hz	1 sec	4096		
BEARING TIME	time signal	acc	5000-25600 Hz	0,5 sec	32768		
LBEARING TIME	time signal	acc	500-25600 Hz	0,5 sec	32768		
OVERALL TIME	time signal	acc	1-25600 Hz	1 sec	65536		
ISO SPEC	spectrum	vel	1600 Hz	4 sec		1600	4
OVERALL SPEC	spectrum	acc	25600 Hz	1 sec		1600	16

New Advanced

Creates new advanced measurement, where all parameters are available. You can edit type and parameters of the measurement as you need. Then press the **Ok** button and new measurement's graph will appear on the Set screen.

Copy

Creates new measurement with properties of selected measurement.

Info

Displays measurement properties.

Edit

Enables change the measurement properties.

Delete

Deletes selected measurement.

Export to uff

Export data of selected measurement to the uff file format (not for all measurement types). The file is saved to uff folder on VA5_DISC.
If the **Actual** measurement is displayed then only this data will be exported.
If the saved data are displayed (View Trend) then you can export just one displayed data or all data saved in memory. The unit asks you **Export (All/One)?** and then you select the button.

Export to wav

Export data of selected measurement to the wav file format (time signal and orbit). The file is saved to wav folder on VA5_DISC.
Time signal is exported as one file with two channels (1st channel for signal, 2nd channel for trigger).
Orbit is exported as two files (A and B channel).
Before exporting you need to enter the required range of signal in wav file. It enables to obtain better resolution in file. If the true peak of signal is for example 8mm/s, then enter for example 10mm/s.

```
Enter the wav full scale value [mm/s]
10
```

Export to csv

Exports data of selected measurement to the csv file format. The file is saved to csv folder on the VA5_DISC. The measurement data are saved in individual lines. Each line contains values depending of type of measurement.

Time	time; amplitude; trigger
g-env Time	time; amplitude; trigger
Orbit	time, amplitude A, amplitude B, amplitude X, amplitude Y, trigger
Spectrum	frequency, amplitude
g-env Spectrum	frequency, amplitude
Cepstrum	quefrency, amplitude
ACMT	time, amplitude min, amplitude max, trigger
Orders	order, amplitude, phase
Frf	frequency, amplitude, phase, coherence
Octave spectrum	frequency, amplitude

Export to csv (all)

Exports to csv for all measurements which are in the set (to a folder).

Export to Records

Only when the **Record** measurement is selected in analyzer!
The list of all records in the selected Record measurement appears. Select one or more records from the list. If you select only one record then enter the new name. The default name of the new record begins of the set name followed by the date and time of recording (yyyy_mm_dd_hh_mm_ss_msec). Selected records will be exported/copied to the Recorder module (folder). Now you can work with them in Recorder module.

Export to VA5_DISC

Only when the **Record** measurement is selected!
This item is very similar to the previous one. Export selected records to VA5_DISC/ VA4recorder folder.

Edit Measurement

This is the base dialog for definition of measurements. The content of the dialog is implication of the measurement **Type** selection (first row).

Type

The type of measurement

Channel

The input signal source channel for evaluation

Unit

The required unit for results and graph.
This information is used for decision whether and how many integrations should be used.

Detect Type

RMS, **Scaled 0-P, Scaled P-P, True 0-P, True P-P, AVG, Crest, Kurtosis**
The detected value property (P means Peak)

Scaled 0-P	it is equal 1.414 * RMS
True 0-P	it is true 0-peak value in the waveform (the highest value captured in time signal).
Scaled P-P	it is equal 2.828 * RMS
True P-P	it is true peak-peak value in the waveform (the difference between highest positive and highest negative value in signal)

AVG   it is average value of all samples (total sum of absolute values divided by number of samples)
Crest   it is equal True 0-P/ RMS
Kurtosis   standard statistical formula for Kurtosis

Result Type

H1, **H2**, **H3**, **PAS**
Standard frequency response functions measured between source channel and response channel
H1- input noise,
H2 - output noise,
H3 - the average of H1 and H2.
PAS – Phase Assigned Spectrum – the amplitude spectrum of response channel and phase are displayed

Band fmin

The low cut-off frequency of band pass filter, which is applied to the signal before evaluation. The **none** value means, that only input DSP filter is applied.

Note! If you do not expect any important signal bellow 10Hz, use the 10 instead 1. The initialization time of 1Hz filter is much longer then 10Hz.

The "**none**" value is available only for direct measurement without integration. The "**none**" value does not mean the DC part measurement. The HP filter on A/D converter is always used. But no additional filter is used. The frequency range with **none** filtering begins on 0.35 Hz (-3dB point). See the response graph.
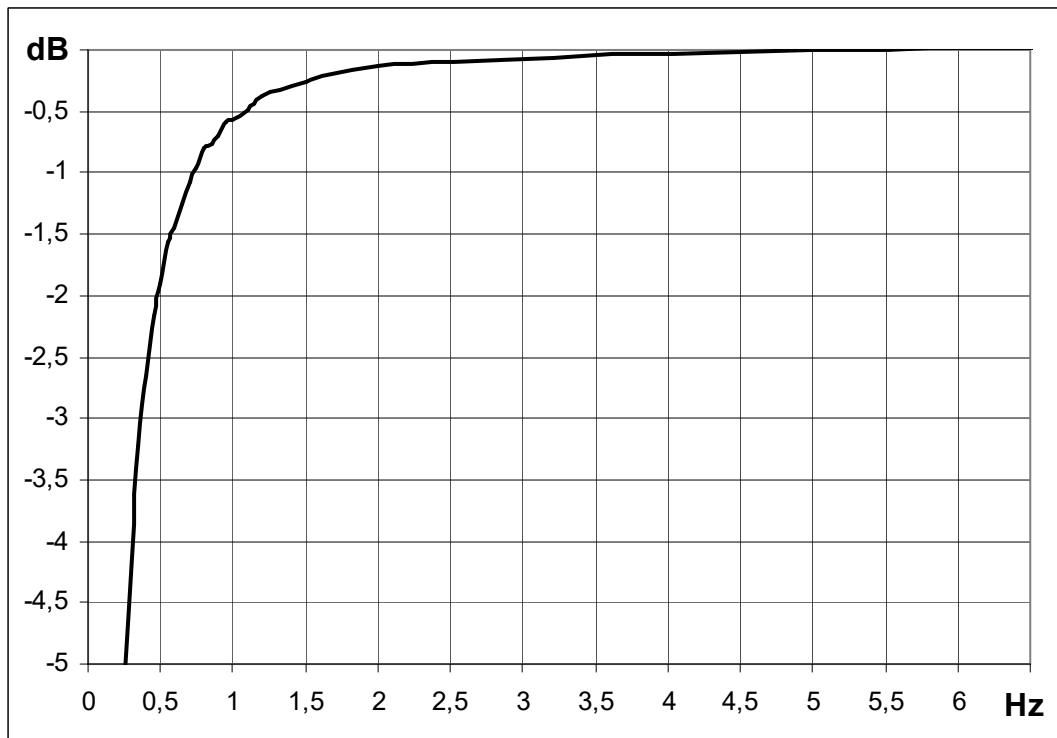
Band fmax

The high cut-off frequency of band pass filter, which is applied to the signal before evaluation. Under this item is also displayed the information about sampling frequency (fs=), which be applied for evaluation.

DEMOD fmin

The low cut-off frequency of band pass filter, which is applied to the signal (removing low frequencies).

DEMOD fmax(Hz)

The high cut-off frequency of band pass filter, which is applied to the signal (removing high frequencies).

Input channel

Required only for response functions

Output channel

Required only for response functions

FFT Window

Rectangular, **Hanning**, **Transient**, **Exponential**
The standard offer of FFT windows functions.

When you select the Transient or the Exponential window you need to define it's **Shift** and **Length**, both in miliseconds. You can enter these values directly in the dialog. But this can be impossible in most cases. Rather use the approach from the next example (used to setup an exponential window for a bump test).

Set the **exponential** window. Keep the default values of the Shift and Length parameters. Confirm the dialog. Use **Graph Properties** / **View** / **time** so as to show the measured time signal instead of spectrum. Take first reading.
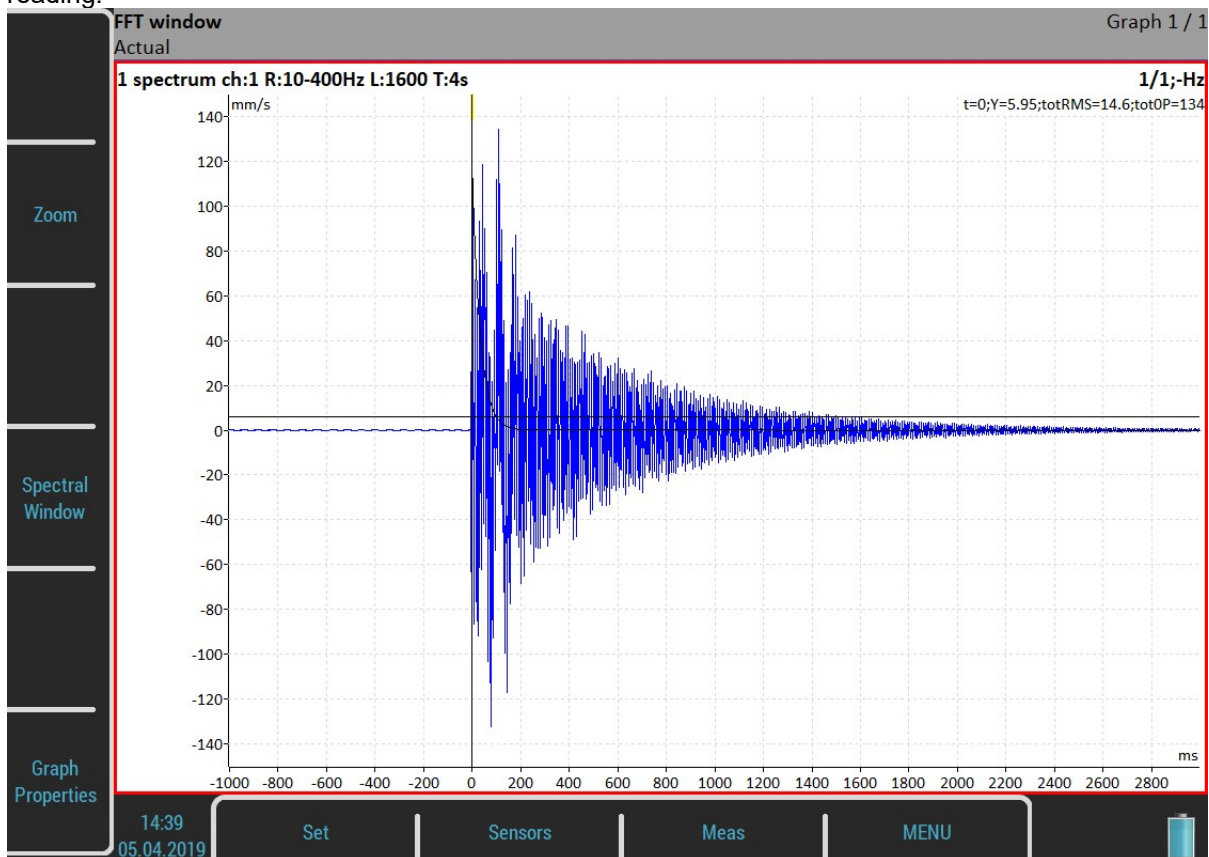
A **Spectral Window** option is available as a buttons mode now. Push the button and you will be able to setup the parameters according to the measured signal using **Shift1** and **Length1** functions.
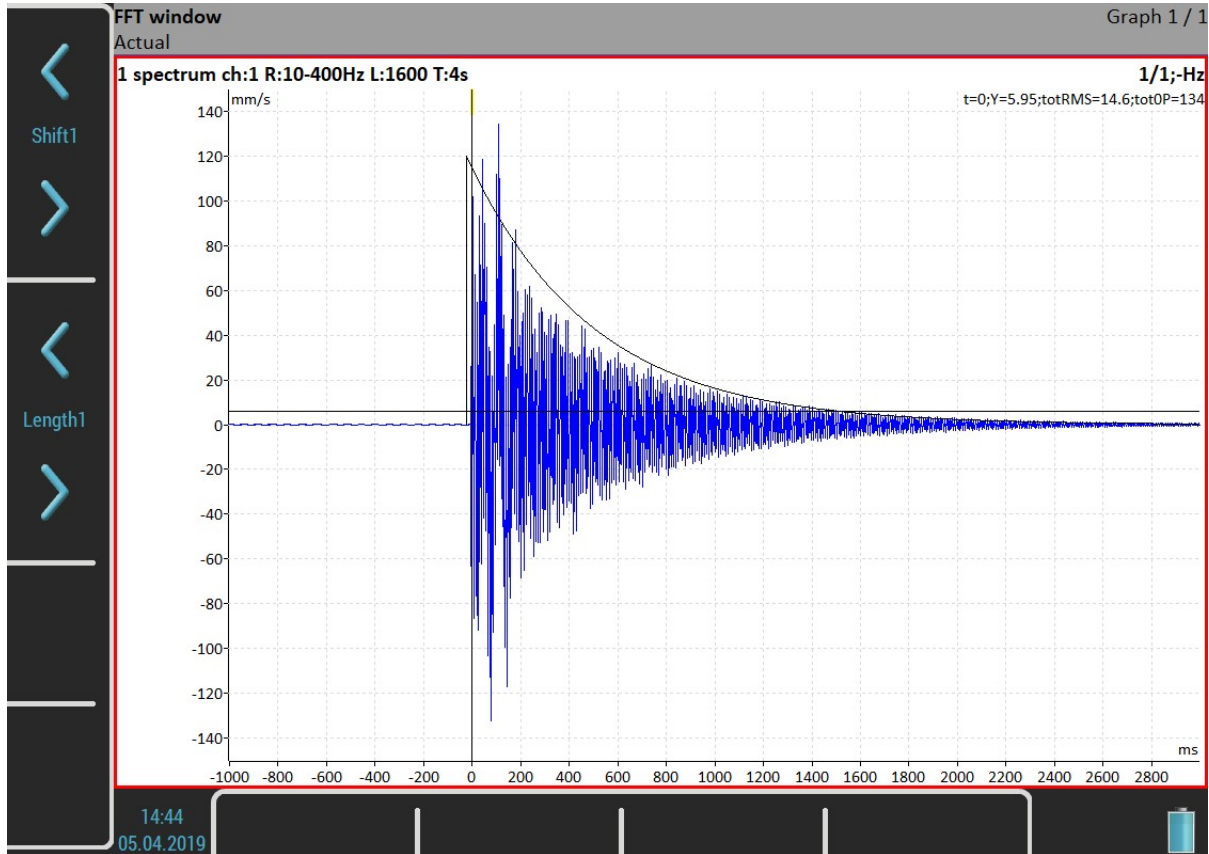
Now when the window is well set change the view back to the spectrum and take your final reading.

In case of the frequency response function you setup two FFT windows for input and output signal. Then a **Shift2**, **Length2** and **Shift12** functions are available moreover.

Zoom spectrum

no   standard spectrum will be made (range from zero)
yes   zoom spectrum will be made (range around the center frequency)

Center freq

value   center frequency for zoom spectrum

Range

value   Frequency range of the graph. Under this item is also displayed the information about sampling frequency (fs=), which will be applied for evaluation.

ACMT FS

value   The sampling frequency for ACMT compression.

Trigger control

off   Time signal will contain defined number of samples
on   Time signal will contain defined number of triggers (for example revolutions).

Number of triggers

value   Required number of triggers (Trigger control = on).

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Samples

value   Number of samples (Speed control = off). The signal time length is displayed under this item.

Lines

value   Number of lines. The signal time length is displayed under this item.

Orders

(1/2,1-5), (1-5), (1/2,1-10), (1-10)

Avg

Averaging number
How the averaging is used depends of type of trigger:
freerun   when the measurement is started, all signals needed for averaging is taken continuously
external   when the external trigger comes, all signals needed for averaging is taken continuously without waiting for next trigger
tacho   every signal for averaging is triggered by tacho (constant phase)
amplitude   every signal for averaging is triggered by amplitude
manual   first signal for averaging is triggered manually, next signals are taken freerun
manual sequential   every signal for averaging is triggered manually

Averaging

linear, **peak hold, time synchro** (for spectrum)
linear, **maximum, minimum, median** (for static values)
Time synchro averaging works in this way: the time signals are averaged (must be controlled by tacho in most cases) and from averaged time waveform is calculated the final spectrum. It can be set for non-enveloped and non-zoomed spectra.

Overlap

% value   overlapping of signals in averaging

Resolution

speed / 4 – speed / 1024
When you use the tacho for 1x amp+phase measurement, the choice of resolution is available. The number of FFT lines must be chosen in the computational procedure. The FFT with fewer lines is faster and displays results more often. When you select higher resolution (for example speed / 64 or even speed / 1024), then more lines must be used and you will wait for results longer time. If you have some considerable spectrum amplitude near the speed frequency, then you need to select the higher resolution. It eliminates the disturbing influence of the non speed frequency near the speed.
Example: the speed is 25Hz. The resolution is speed/4, i.e. 6.25Hz. The speed line bandwidth in FFT will be 6.25Hz. It means, that speed line contains all frequencies in the interval (21.875 , 28.125). If any disturbing frequency is in that interval, then higher resolution must be used.

Frequency

speed, value   the frequency value for phase shift measurement can be entered manually (value) or can be used the speed frequency from tacho sensor.

Full spectrum

yes, no   the spectrum will have two sides, positive and negative (see literature about turbine analysis for more details).
It is important to define correct sequence of channels. It must match the rotation direction. It means, the tacho mark must come to A channel first and then to B channel. The angle must be less then 180 degrees. Otherwise the positive/negative parts would be transposed.

Graph Properties

The list of properties is displayed for properties selection. The scale ranges and types (lin, log,...) definitions are the typical use.

!!! Important notice: All available values will be described for every item. But these all values are not visible always. During your work are always displayed only values/choices, which give sense at that moment.
For example the Axe Z (third) axe is only visible in 3D graphs (for example cascade, spectrograph).

Display

value, trend
Available for overall values in the **Runup** module

When **value** is used, then last measurement value is displayed (default setting).

When **trend** is used, the measured values are displayed in the trend.

Scale

max   Y autoscale for every new graph, but the range is increased when higher value comes
auto Y autoscale according data values of every new measurement
user user defines Y range for all graphs independently of data values

Cursor (for time signals)

single   standard simple cursor
periodic   multiplied cursor with several additions of delta time
delta   band cursor with delta time length

When you use periodic or delta cursor you need to setup a delta value. A **Delta X** function is available under the **Control** mode of side buttons.

Cursor (for spectra)

single   standard cursor
harmonic   cursor with several additions of delta
sideband   cursor with one addition delta
delta   cursor with one addition delta

When you use sideband or delta cursor you need to setup a delta value. A **Delta X** function is available under the **Control** mode of side buttons.

Cursor Position

The time or frequency position of cursor in the selected graph, manual entry available

Delta X

The time or frequency interval used for delta cursor computation, manual entry available

Axe X

lin, log

Axe Y

lin, log, dB

Axe Z

time   scale according time of measurements
speed   scale according the speed of machine (tacho must be used)
regular   regular scale

Order Z

first in front, **last in front**   the order of measurements on Y axe

Detect Type

RMS, 0-P, P-P Y axe type

Peaks List

on, off   the 5 highest spectrum lines table
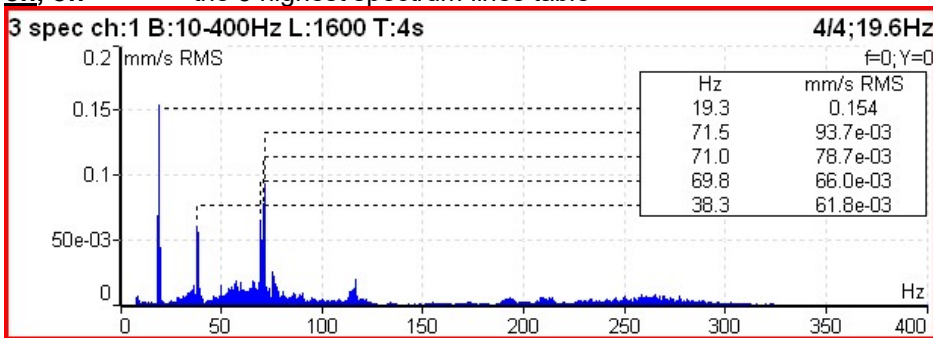
Synch Table

on, off   table of values synchronized with speed and line frequency
        SubSynch - value under speed frequency
        Synch - value on speed frequency and harmonics
        NonSynch - total value decreased of SubSynch and Synch
        Elect - value on line frequency and harmonics (setting in **Global Settings / Power/Line Frequency**)
All values are in displayed spectrum unit and in % of total value.
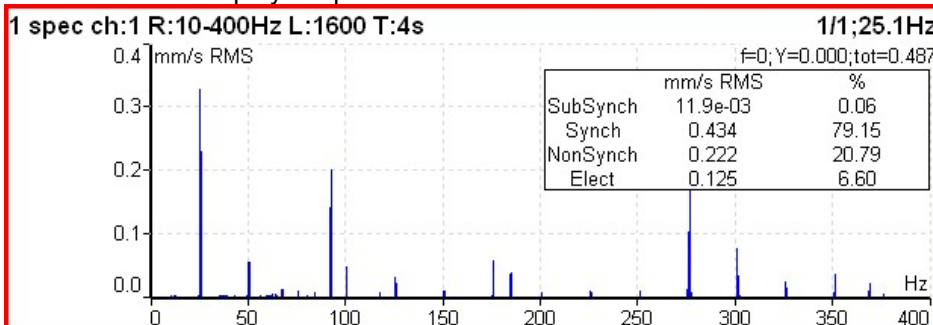
Bearing Faults

- if the bearing type (or parameters) is defined and the tacho was used for speed measurement, then the fault frequencies is displayed.
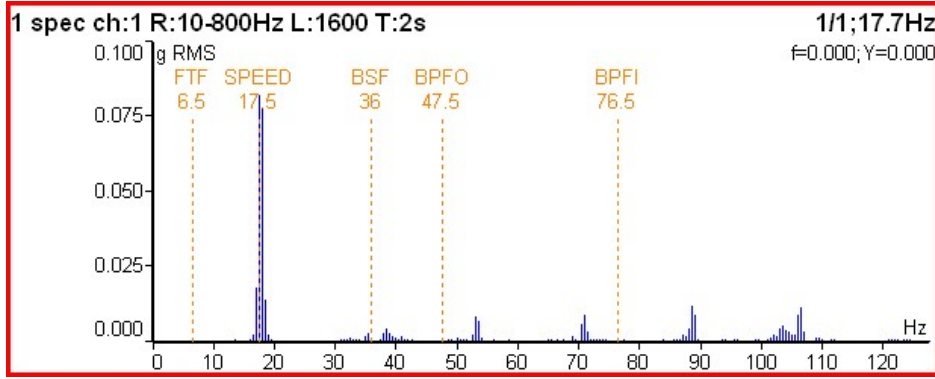
If the tacho was not used (the measurement does not contain the speed information), then move the cursor to the speed position. The bearing fault frequencies will be displayed according the cursor position.
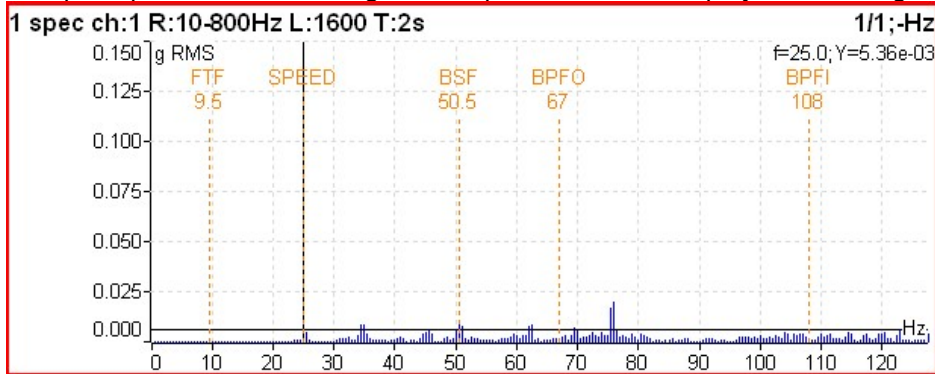
Orders Table

on, **off**   the order values table

Statistics Table

the basic statistic values of trend are displayed:

n	number of measurements in trend
EX	mean value (arithmetic average)
σ (sigma)	deviation average
Xmax	maximum value
Xmin	minimum value
Xmax-Xmin	the interval of measured values

Primary Cursor

when the Global/Cursor Type is set to **max**, then is required to select the quantity (graph), to which will be this **max** searching function applied

amplitude, phase, coherence   for frequency response (Frf)
X, Y   for orbit

View (for center line)

center line   standard 2D center line view, available only for **View Trend**
AB   two DC values for **View Actual** or two trends for **View Trend**
XY   data transferred to X and Y axes

View (for frf)

ampl, phase
real, imag
nyquist
amplitude
phase
coherence

View (for 1x amp+phase)

available only for trend

aps_t   the trends of amplitude, phase and speed related to time of measurement
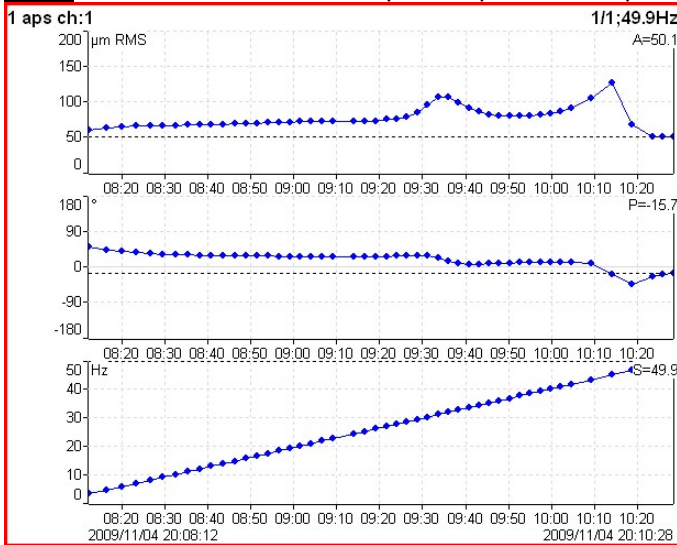
ap_s   the trends of amplitude and phase related to speed
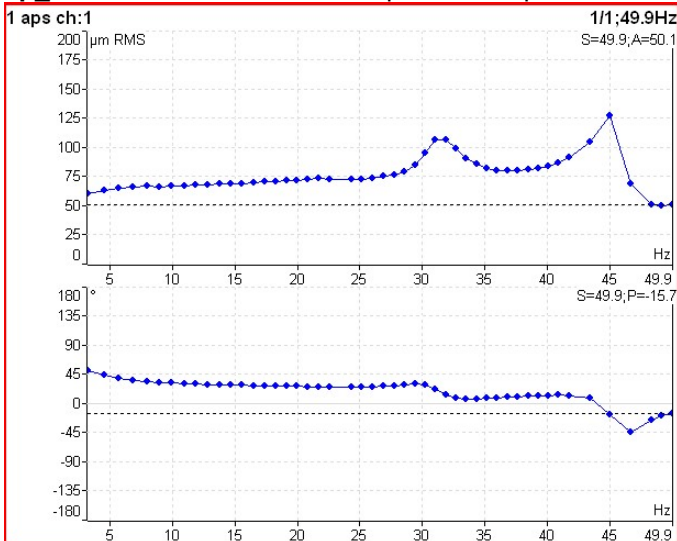
ad_s   the trends of amplitude (upper graph) and difference amplitude (lower graph) related to speed, the difference is related to the trend cursor position (in that point is always zero).
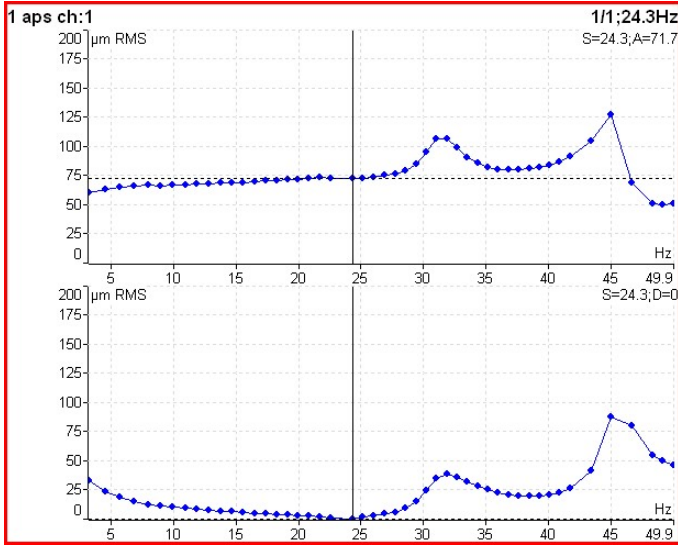
polar   2D complex view
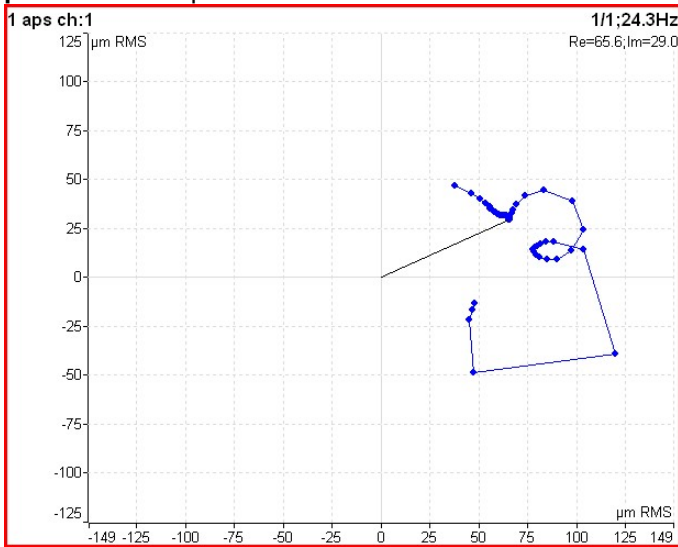
trend3D_t   the 3D "tube" view, it is the nyquist graph expanded to Z axe (time scale)
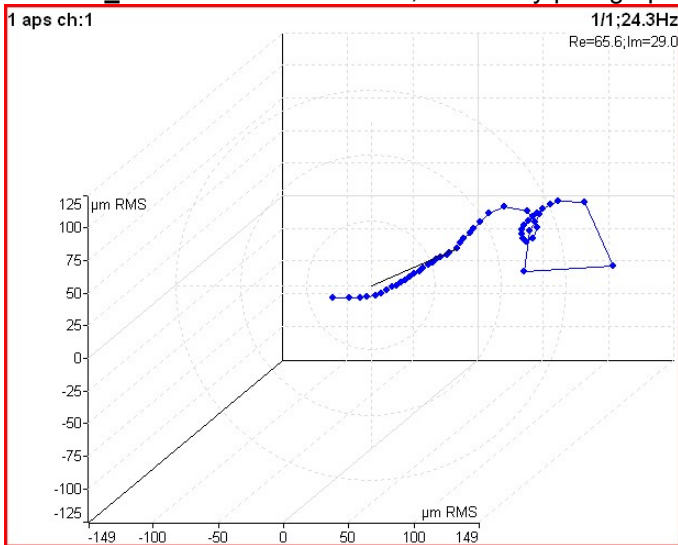
View (for phase shift)

available only for trend

       linear   graph of phase shift, amplitude ratio and coherence related to the time scale
       polar   polar plot of phase shift and amplitude ratio

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View (for spectrum)

available for trend

<u>amplitude</u>	one spectrum amplitude graph
cascade	waterfall graph
spectrograph	2D view of amplitudes vs. time
phase	one spectrum phase graph
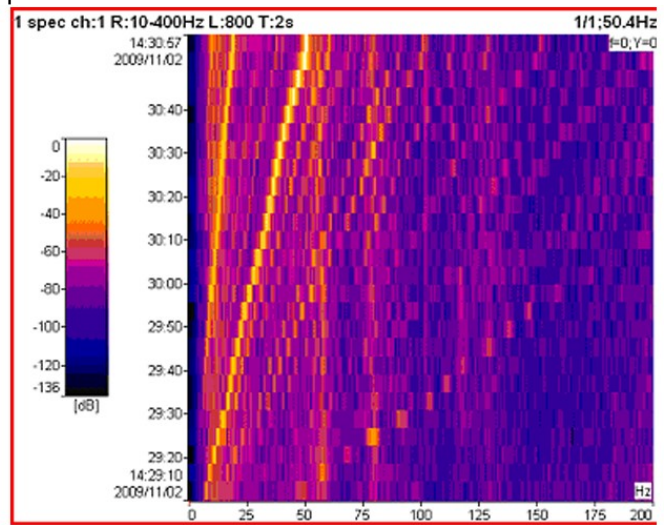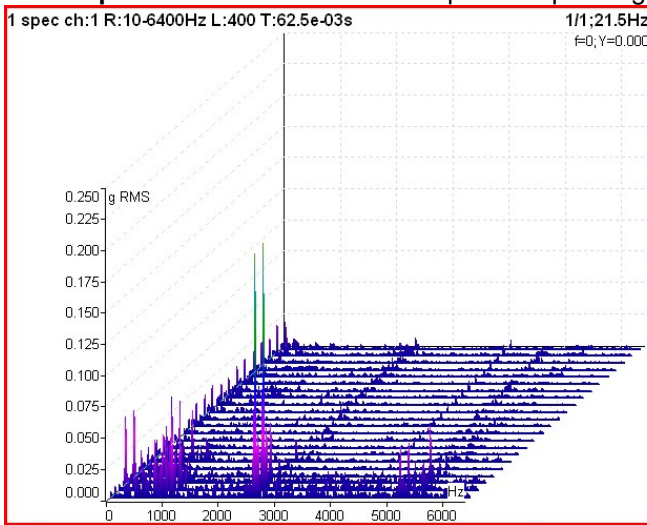
View (for spectrum)

available for actual

<u>amplitude</u>	one spectrum amplitude graph
time	displays the time signal from which the FFT was developed
phase	one spectrum phase graph

View (for time waveform)

<u>linear</u>	standard drawing in Cartesian coordinates
circular	circular drawing

Note! When signal contains tacho pulses, then one rotation length is 360° (one circle). If not, then complete signal is drawn only in one circle.
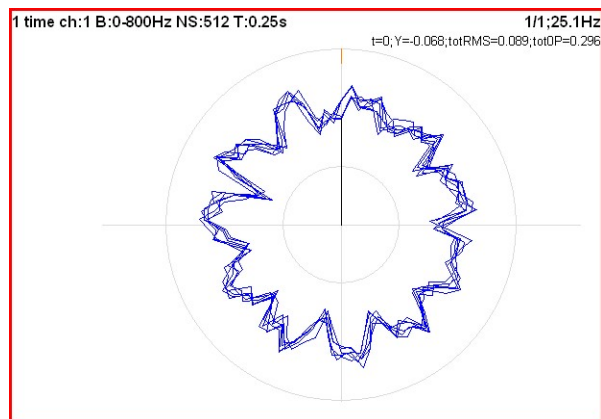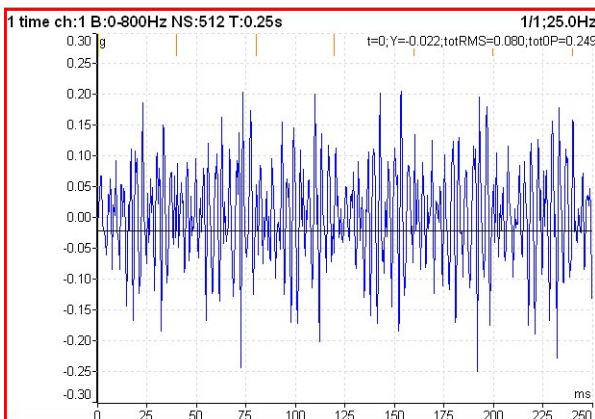
View (for orbit)

<u>orbit</u>	standard 2D orbit view
AB	two input time signals from channels A and B
XY	two time signals transferred to X and Y axes

View (for filtered orbit)

<u>orbit</u>

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orders
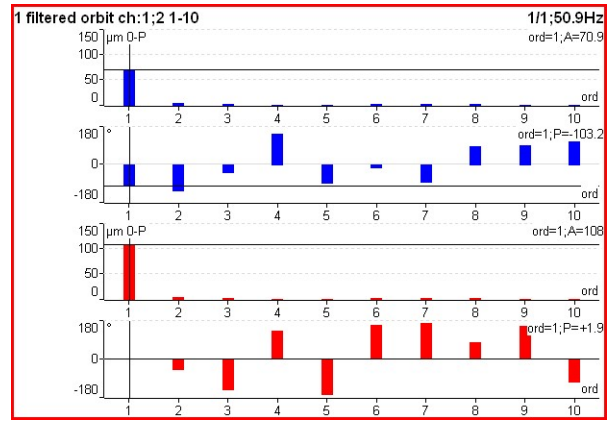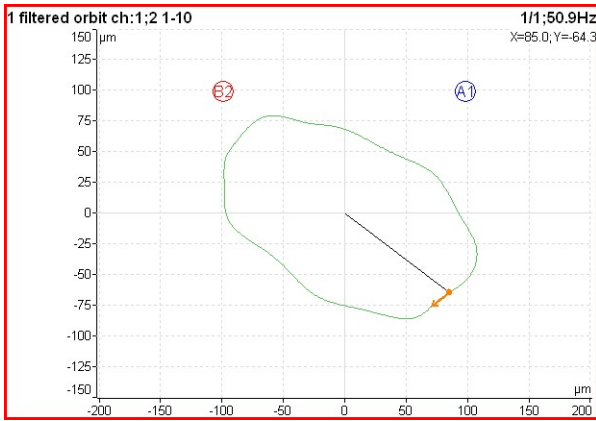
FFT Output (for spectrum)

<u>**amplitude spectrum**</u>
power spectrum
amplitude spectral density
power spectral density (PSD)
energy spectral density (ESD)

Speed Period

on, <u>off</u>   the speed time period is displayed

FTF Period

on, <u>off</u>   the FTF time period is displayed

BSF Period

on, <u>off</u>   the BSF time period is displayed

BPFO Period

on, <u>off</u>   the BPFO time period is displayed

BPFI Period

on, <u>off</u>   the BPFI time period is displayed

Graph Lines

<u>**continuous**</u>**, discrete**   the spectrum can be drawn as line through the tops of line or as discrete vertical line for each frequency

continuous

discrete

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```
1 spec ch:1 R:10-400Hz L:1600 T:4s                          2/8;50.0Hz
   0.25 mm/s RMS                                    f=37.5;Y=0.007;tot=0.630

   0.00                                                              Hz
       37.5    40.0    42.5    45.0    47.5    50.0    52.5    55.0    57.5    60.0
```
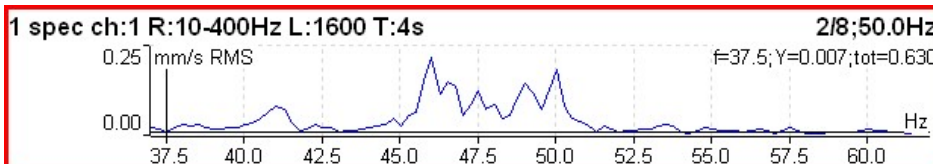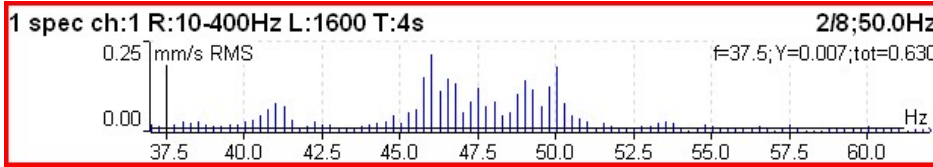
FASIT

There is detailed description in the **FASIT** module chapter.

If the FASIT is measured, the speed detection is done before the measurement itself (see the **Speed detection** chapter).

```
3 fasit ch:1 T:4s                                                 50.0Hz
         3.69mm/s RMS              1.01g RMS               10816
                                                    ISO      B    Group1, Rigid
                                                            over 2.3mm/s RMS
```
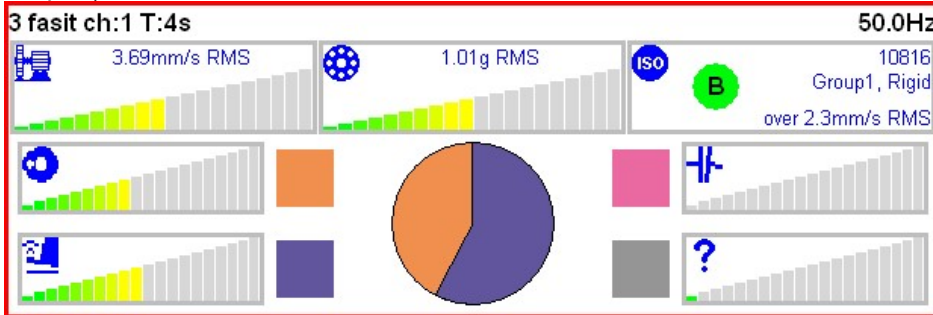
Overall

Type	overall freerun,retrig
All Channels	no
Channel	1
Unit	mm/s
Detect Type	RMS
Band fmin[Hz]	10
Band fmax[Hz]	1000 fs=4096Hz
Trigger Control	off
Samples	4096 t=1s
Averaging	linear
Avg	off total t=1s

This is typical example of overall measurement. The RMS value of vibration velocity in frequency range 10-1000 Hz is measured.

```
1 RMS ch:1 B:10-1000Hz NS:4096 T:1s                          1/1;25.1Hz
                         0.570mm/s
```

The first row contains used parameters. The 25.1Hz on the right is the speed, because the tacho sensor was used.

Change the Detect Type to 0-P.

```
1 0-P ch:1 B:10-1000Hz NS:4096 T:1s                          1/1;25.1Hz
                         1.98mm/s
```

Note, that the 1.98 is not 1.414 times bigger then 0.570. Some of users mistakenly think, that the formula 0-P=1.414*RMS is valid for every signal. It is not true. That formula is valid only for pure sine wave ! The true

RMS and true peak measurement are generally independent. The only rule is that the peak value is always bigger then RMS value.

Let's change the Avg to 8. The eight individual values (1 sec length) will be taken and the result will be the linear average of them (RV = (V1+V2+...+V8)/8). The indication 8/8 is on the right top.

1 0-P ch:1 B:10-1000Hz NS:4096 T:1s	8/8;25.1Hz
2.00mm/s	

Let's change the Avg back to off and change the samples number to 32768. The measurement will be 8 sec long.

1 0-P ch:1 B:10-1000Hz NS:32768 T:8s	1/1;25.1Hz
2.12mm/s	

You see that the result is different from the previous value. It is clear, the max 0-P value in 8 sec signal is not equal the average of 8 0-P values (which takes 1 sec each).

Let's change the type back to RMS.

1 RMS ch:1 B:10-1000Hz NS:32768 T:8s	1/1;25.1Hz
0.572mm/s	

Now change the length to 1 sec (4096 samples) and Avg=8.

1 RMS ch:1 B:10-1000Hz NS:4096 T:1s	8/8;25.1Hz
0.572mm/s	

You see the same result. Both values are equal. The meaning of RMS differs from peak values. The RMS value depends only of total time of measurement. It does not care if one long signal was taken or several shorter signals were averaged.

You can define the signal length also in **Number of Triggers**, not only in samples (=time). Set the **Trigger Control** parameter to **on** for that.

Type	overall freerun,retrig
All Channels	no
Channel	1
Unit	mm/s
Detect Type	RMS
Band fmin[Hz]	10
Band fmax[Hz]	1000 fs=4096Hz
Trigger Control	on
Number of Triggers	16
Averaging	linear
Avg	off

The **T** note changes to **R**, which means Revolutions, because the number of revolutions and tacho triggering is the most common usage.

1 RMS ch:1 B:10-1000Hz R:16	1/1;25.1Hz
0.545mm/s	

ISO 10816 overall measurement

The ISO 10816 limit values are also available for overall measurements. The green/ amber-orange/ red point is displayed in front of measured value according to the ISO limit.

If you want to use this function you need to define the correct measurement parameters (RMS velocity measurement in 10-1000Hz range) and the group for machine. The **ISO Machine Group** is defined in the sensor dialog for the measured AC channel.

1 RMS ch:1 B:10-1000Hz NS:4096 T:1s	1/1;17.7Hz
🔴 8.30mm/s RMS	ISO 10816: Group1 , Rigid over 7.1mm/s RMS

The color of circle is related to the machine condition class A,B,C,D (the green for A or B, the orange for C and the red for D). Also the information about machine group and foundation are displayed. The limit which is exceeding is also displayed at the bottom.

Spectrum

Type	spectrum freerun,retrig
All Channels	no
Channel	1
Window	hanning
Unit	mm/s
Zoom Spectrum	no
Band fmin[Hz]	10
Range[Hz]	400 fs=1024Hz
Lines	1600 t=4s,df=0.25Hz
Averaging	linear
Avg	8 total t=32s
Overlap	0%
Full Spectrum	no

The **Overlap** enables you to make the averaging faster. For example 75% overlap means, that ending 75% of actual time signal + 25% of new signal is used for next average.
Note! The **Overlap** isn't possible for **time synchro** averaging.
Note! The **Overlap** is possible only for the trigger sources which don't require waiting for trigger between averages. That means only **freerun**, **external** and **manual** triggering enable the **Overlap**.

1 spec ch:1 R:10-400Hz L:1600 T:4s	2/8;42.1Hz
0.50 mm/s RMS	f=16.5;ord=0.392;Y=0.118;tot=0.695
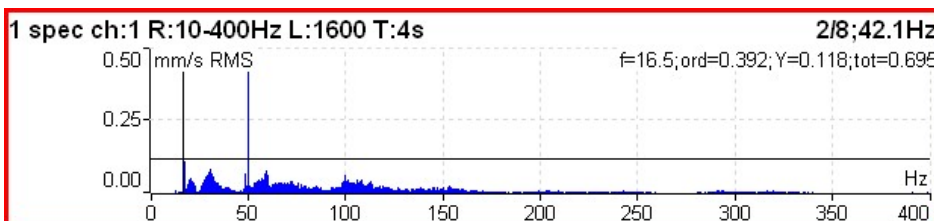
The information in top right contains averaging (2/8), speed (42.1Hz) and bellow them cursor position (16.5Hz), order (f / speed = 0.392), value (0.132mm/s) and total RMS of spectrum (0.619mm/s).

Full spectrum

Set **Full Spectrum** to **yes**. Remember to set correct angles of both sensors. It influences the calculation. The FFT is applied to complex signal, first channel is real part and second channel is imaginary part.

```
1 full spectrum ch:1;2 R:10-100Hz L:400 T:4s                    4/4;25.0Hz
```
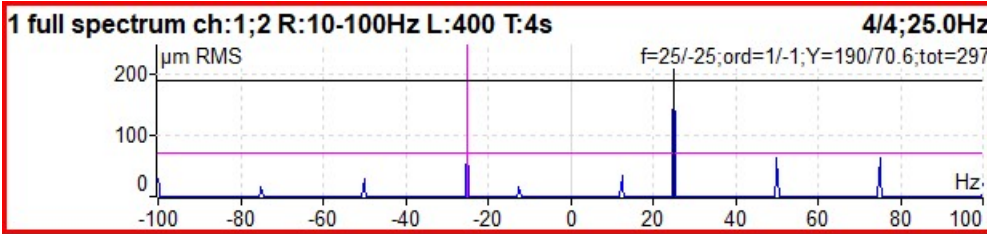
Note! Cursor is displayed on both sides. Different colors are used. Both cursor values are displayed.

Attention!
The correct setting of channel A and B is critical for correct result. If this setting is wrong then the negative and positive side are interchanged. Firstly we find the angle between A and B, which is less then 180° (usually it is 90°). The rotation mark must be firstly on A and then in B.

For further technical and contact information visit www.adash.com or email: info@adash.com

1 full spectrum ch:1;2 R:10-200Hz L:400 T:2s   1/1;25.0Hz
f=0;ord=0;Y=0.000;tot=99.7

2 orbit ch:1;2 B:0-6400Hz NS:2048 T:0.125s   1/1;25.0Hz
t=0ms;X=141;Y=-1.58
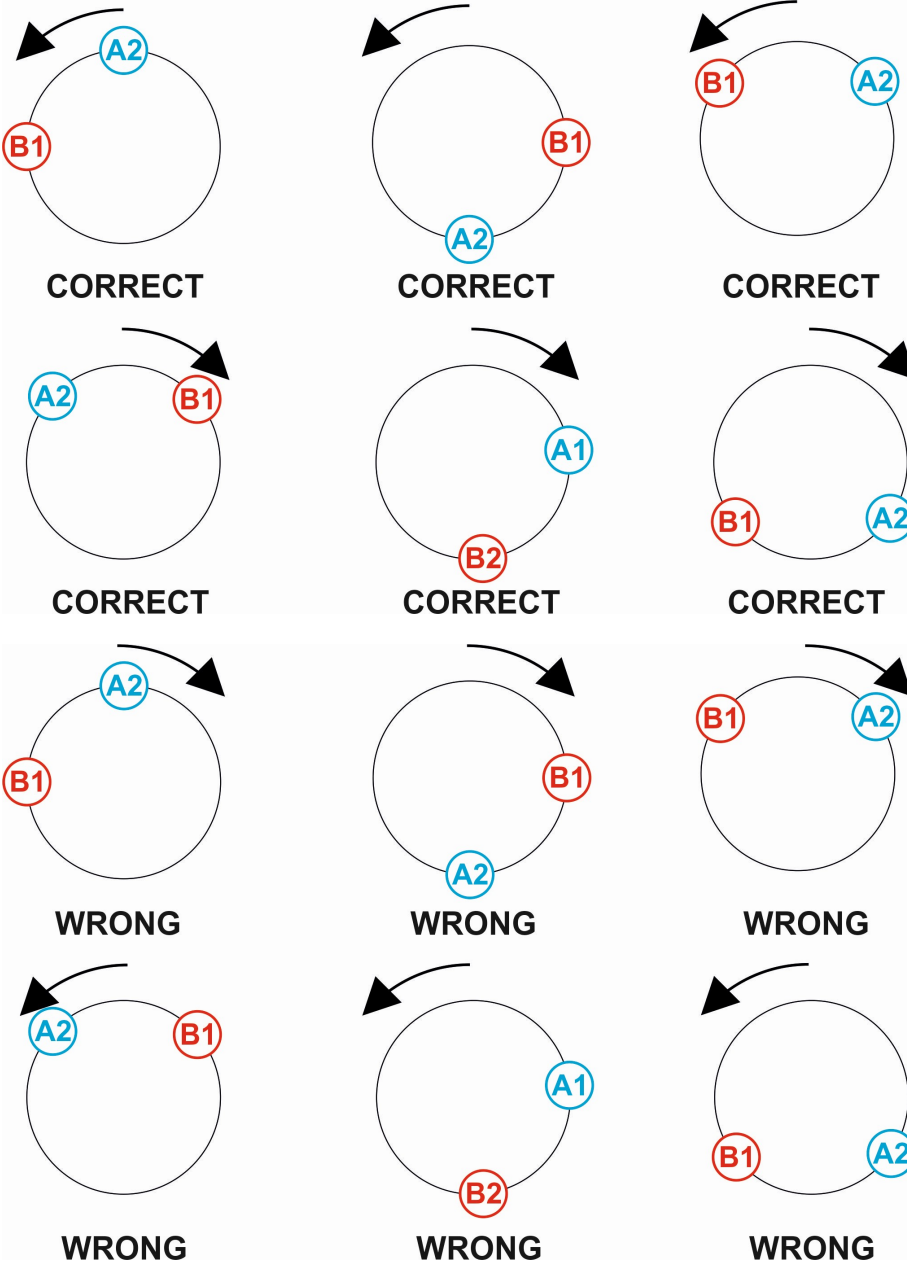
The vibration (orbit arrow) has the same direction as rotation.

3 full spectrum ch:2;1 R:10-200Hz L:400 T:2s   1/1;25.0Hz
f=0;ord=0;Y=0.000;tot=99.7

4 orbit ch:2;1 B:0-6400Hz NS:2048 T:0.125s   1/1;25.0Hz
t=0ms;X=141;Y=-1.58

The vibration (orbit arrow) has the opposite direction as rotation.

Time

Type	time freerun,retrig
All Channels	no
Channel	1
Unit	mm/s
Band fmin[Hz]	10
Band fmax[Hz]	1000 fs=4096Hz
Trigger Control	off
Samples	4096 t=1s
Avg	off total t=1s

1 time ch:1 B:10-1000Hz NS:4096 T:1s   1/1;25.1Hz
t=0;Y=-46.2e-03;totRMS=0.557;totOP=1.86
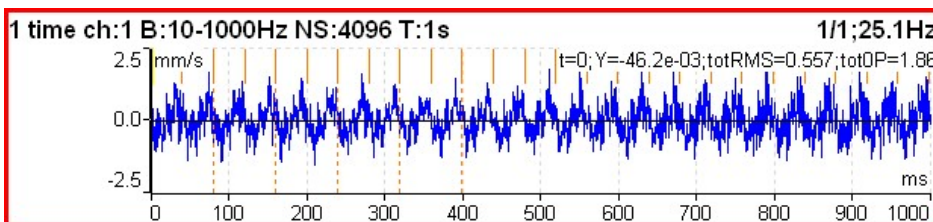
Similar parameter like for overall is used. The orange short vertical lines at the top of graph indicates the tacho inputs.

Time signal averaging

For averaging you need to set some trigger source in the **Trigger Setting** dialog, because only triggered time signals can be triggered. Then define the number of averages.
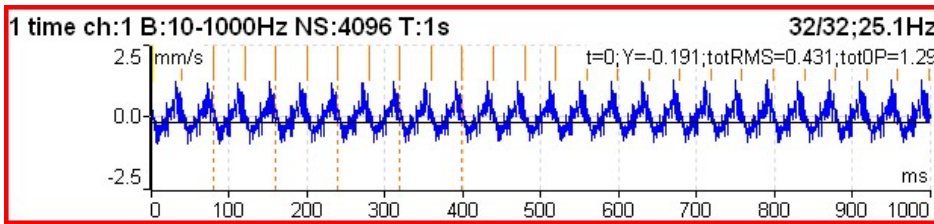
You see the effect of averaging in decreasing of signal noise. The speed frequency is better seen. With the cursor values are displayed also totRMS and tot0P values.

Time signal with DC offset (gap)

You can measure a gap value from DC channel simultaneously with a **displacement** time signal. This gap value is added to the time signal.

How to connect a sensor
A displacement sensor must be connected to an AC and to a DC channel at the same time. You can find where all channels pins take place in an **Input channels** chapter. You can order a cable with right connection from your instrument vendor.

How to setup a sensor
Open **Sensors** menu and select used AC channel (the channel where the sensor is connected). Setup sensitivity and other values like for every sensor. There is one more item for a displacement sensor, **DC gap channel**. Its value is not defined by default. You need to enter the value of your DC channel here (this number is usually same as the AC channel). Then setup an associated DC sensor (sensitivity, unit and position must be same as in AC sensor).

Measurement
Setup and measure a time signal as usually. Time signal is modulated to a DC gap value measured from the associated DC channel.

First picture shows the signal without gap
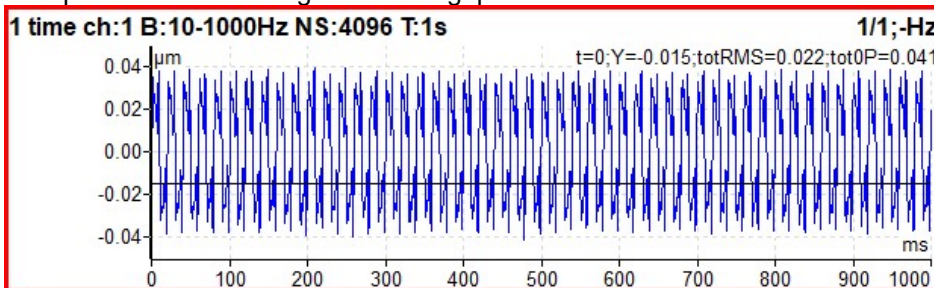
And the same signal with a gap
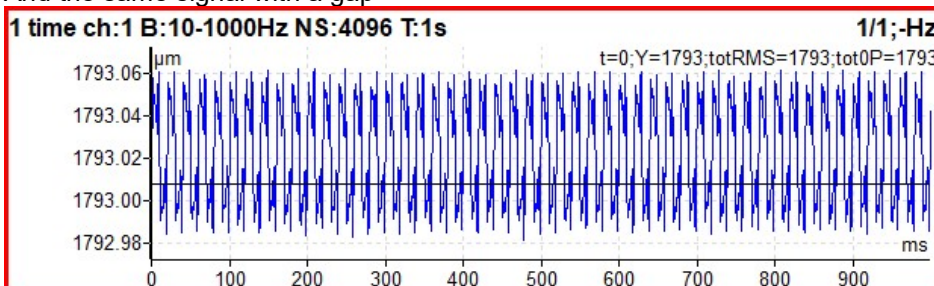
G-demod Spectrum

Type	time freerun,retrig
All Channels	no
Channel	1
Unit	mm/s
Band fmin[Hz]	10
Band fmax[Hz]	1000 fs=4096Hz
Trigger Control	off
Samples	4096 t=1s
Avg	off total t=1s

The signal is filtered in (DEMOD fmin, DEMOD fmax) range and demodulated then. Only the acceleration or voltage unit can be used. No integration of signal is enabled.
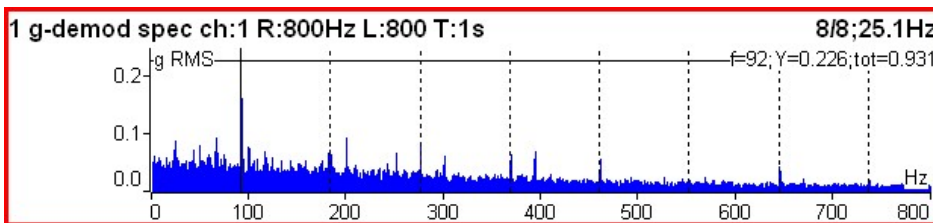
Example: the demodulated frequency 92Hz with harmonics.

G-demod Time

Type	g-demod time freerun,retrig
Channel	1
Unit	g
DEMOD fmin[Hz]	500
DEMOD fmax[Hz]	25600 fs=65536Hz
Samples	512 t=0.00781s

This function enables to see the signal, when the standard envelope demodulation is used. The signal is filtered in (DEMOD fmin, DEMOD fmax) range and demodulated then. Only the acceleration or voltage unit can be used. No integration of signal is enabled.

G-demod Overall

Type	g-demod overall freerun,retrig
All Channels	no
Channel	1
Unit	g
Detect Type	RMS
DEMOD fmin[Hz]	500
DEMOD fmax[Hz]	25600 fs=65536Hz
Samples	8192 t=0.125s
Averaging	linear
Avg	off total t=0.125s

The signal is filtered in (DEMOD fmin, DEMOD fmax) range and demodulated then. Only the acceleration or voltage unit can be used. No integration of signal is enabled.

1 g-demod RMS ch:1 B:500-25600Hz NS:8192 T:0.125s   1/1;25.1Hz

4.32g

1x amp+phase

The amplitude and phase on speed frequency.

Type	1x amp+phase freerun,retrig
All Channels	no
Channel	1
Unit	µm
Averaging	linear
Avg	off
Resolution	speed / 4

1 aps ch:1   1/1;49.3Hz

50.0µm RMS; -18.5°

The smaller resolution means longer time signal for evaluation. We do not recommend using always the minimum value, because you will wait for results longer (much longer). Use the small resolution only in cases, when your signal contains two close frequencies and you need to separate them. For 50Hz speed the speed/4 means the band (43.75Hz, 56.25Hz) and the speed/64 means (49.61Hz, 50.39Hz).

Orbit

Type	orbit freerun,retrig
All Channels	no
A channel number	1
B channel number	2
Unit	μm
Band fmin[Hz]	10
Band fmax[Hz]	800 fs=2048Hz
Trigger Control	off
Samples	4096 t=2s
Avg	off total t=2s

2 orbit ch:1;2 B:0-800Hz NS:4096 T:2s   1/1;50.9Hz

t=0ms;X=97.6;Y=-54.2
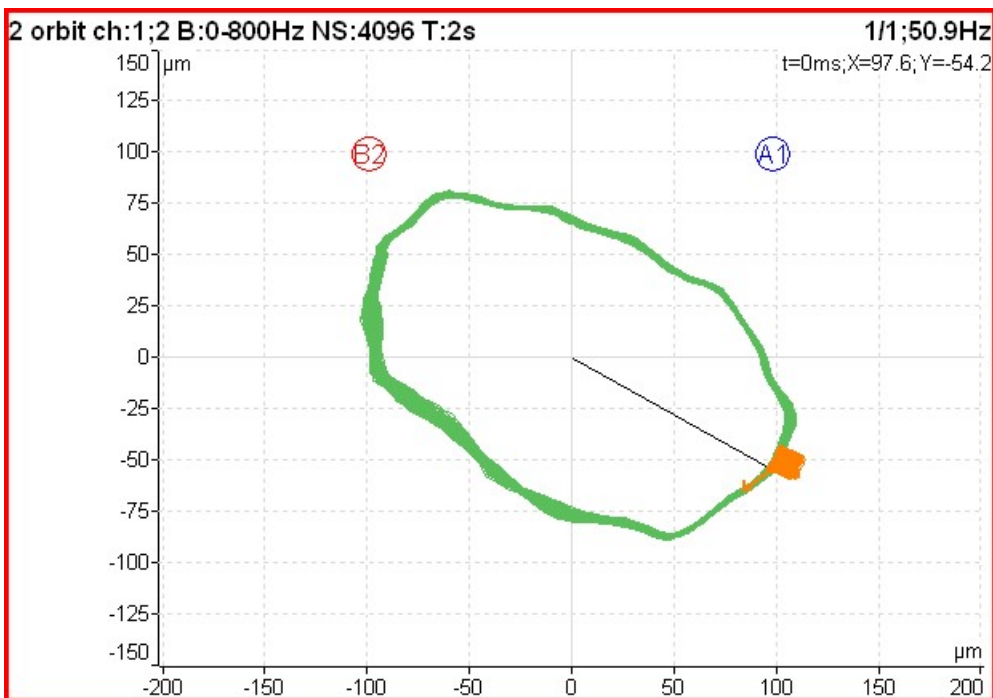
The A1 means, that the channel 1 is used for A orbit channel, similarly B2 means channel 2 is used as B. The position of A1 and B2 matches the sensor angles used for measurement (see Sensors definition). The knowledge of those angles enables to draw the correct shape of the orbit.

Orbit measurement with DC offset (gap)

An orbit contains two time signals. Each time signal could be modulated to a gap value as referred in **Time signal with DC offset (gap)** chapter. If you setup gap channels for orbit's time signals the resulting orbit will be displayed with an offset.

Filtered Orbit

Type	filtered orbit freerun,retrig
All Channels	no
A channel number	1
B channel number	2
Unit	μm
Orders	1-10
Averaging	linear
Avg	off
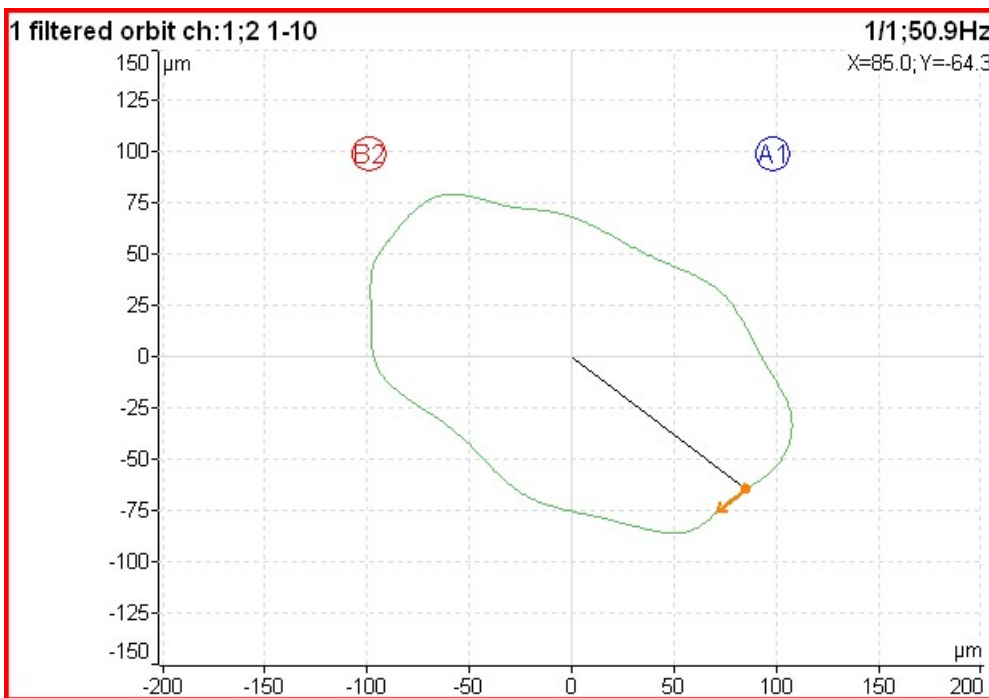
Filtered orbit is built up from two order analysis readings. Correct sensors positions (angles) must be set for correct calculations as for standard orbit graph (see Sensors definition). You can switch displayed orders on or off in **Graph Properties** menu.

Speed

The machine speed (revolutions) is measured.

Type	speed freerun,retrig
Unit	Hz
Averaging	linear
Avg	off

When the tacho sensor is used (connected to the tacho input), then the impulses is added to all AC inputs. In the time signal graph are marked by short lines.
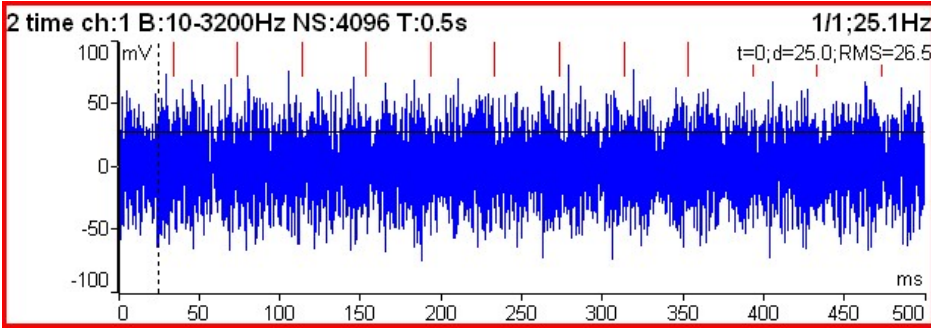
The speed measurement is taken 8 times in every second. The value is evaluated from 3 tacho events in time signal. When the averaging is required, then more values is used. But keep in mind that only 8 values is taken in one second.

ACMT

Type	ACMT freerun,retrig
All Channels	no
Channel	1
Unit	g
Detect Type	RMS
Band fmin[Hz]	500
ACMT FS[Hz]	1024
Samples	4096 t=4s

It enables to measure long time signals and compress them. It is used when you need high frequency range, for example 25.6kHz. The highpass filtering is used (Band fmin). The basic property of ACMT is resampling initial high frequency sampling (64kHz) to low ACMT FS frequency sampling (usually 1kHz).

The compressed ACMT time signal can keep the RMS or TRUE PEAK of original signal. Use the **Detect Type** parameter for selection. RMS value enables better trending.
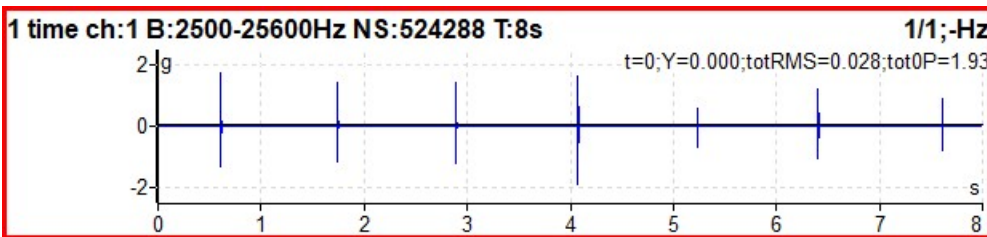
The original time signal 8 sec long, which contains shocks. Signal contains 524288 samples.
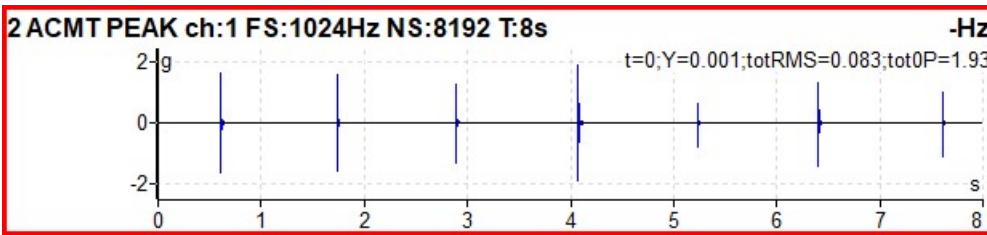
The ACMT time signal. You can see the same shocks, but signal contains only 8192 samples.

Orders

The amplitude and phase on speed frequency, harmonic frequencies and possibly subharmonic frequency.

Type	orders freerun,retrig
All Channels	no
Channel	1
Unit	µm
Orders	1-10
Averaging	linear
Avg	off
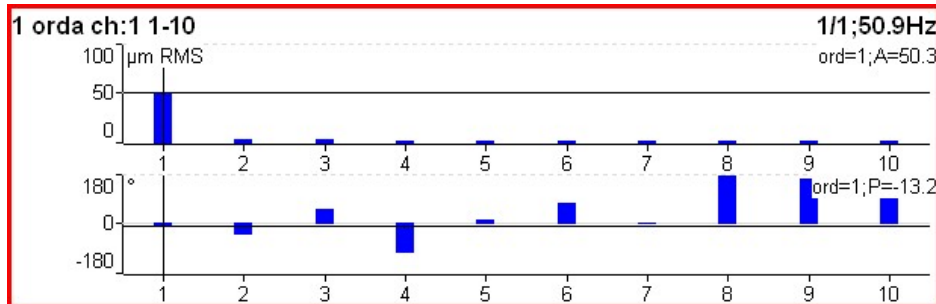
Order Spectrum (Order Tracking Analysis)

Type	order spectrum freerun,retrig
All Channels	no
Channel	1
Window	hanning
Unit	mm/s
Band fmax[Hz]	3200 Low speed=0.5Hz
Lines	400
Orders	25 16 revs
Averaging	linear
Avg	off
Full Spectrum	no

The **Band fmax** defines the range of spectrum. All frequencies over this range will be equal zero. To define this range is necessary, when you need high number of orders. The required range is equal number of orders multiplied by speed frequency. Be careful, higher **Band fmax** increases the minimum speed, which can be used. This minimum you can see below (**Low speed**). When the speed is lower then this value, then error appears and the measurement is stopped.

The number of revolutions is displayed below the number of orders (16 revs in image). Such number of revolutions is needed for one spectrum calculation. We cannot display it in time, like for spectrum. One revolution is the time quantity for order spectrum.
The 4 revolutions is the minimum number. It means that lines number must be 4 times greater then orders number as the minimum.
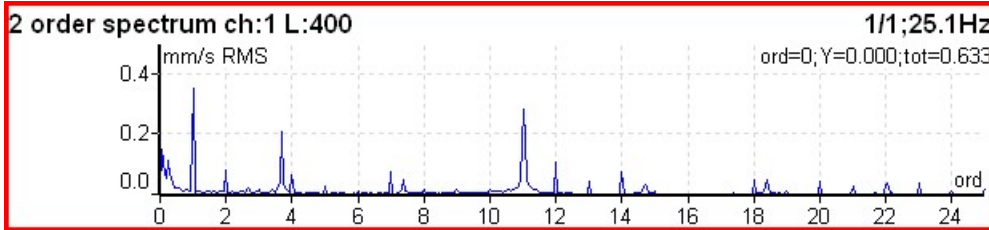
Order full spectrum

Set **Full Spectrum** to **yes**. Remember to set correct angles of both sensors. It influences the calculation. The FFT is applied to complex signal, first channel is real part and second channel is imaginary part.

Note: Cursor is displayed on both sides. Different colors are used. Both cursor values are displayed.
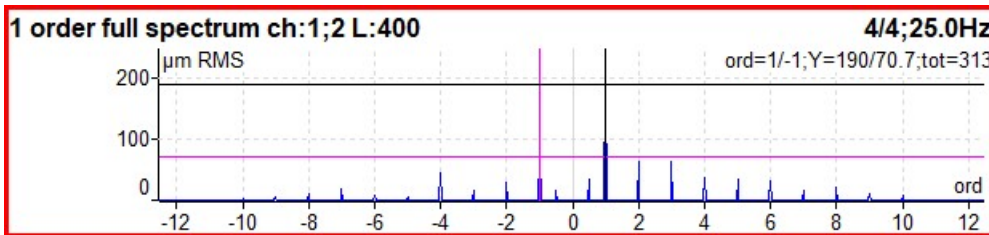
Attention!
The correct setting of channel A and B is critical for correct result. If this setting is wrong then the negative and positive side are interchanged. See Full spectrum for details.

Phase Shift
The measurement of phase shift (between two channel A and B), amplitude ratio and coherence on speed frequency (with tacho) or manually entered frequency.

Type	phase shift freerun,retrig
All Channels	no
A channel number	1
B channel number	2
Avg	8
Frequency	speed
Resolution	speed / 4

The result contains:
- phase shift value in degrees,
- amplitude ratio (ampl B/ ampl A),
- coherence

If the phase shift is reliable, then the coherence must be bigger then 0.8.

DC
The direct DC signal can be measured by this function.

Type	dc freerun,retrig
Manual Entry	no
All Channels	no
Channel	1
Unit	°C
Averaging	linear
Avg	off

1 dc ch:1

22.6 °C

If you want to enter the value manually, then select **Manual Entry** to **yes**. All manual inputs are required before the measurement. The new window for each one appears.

Enter value [°C]
Manual Entry (Graph1)
22.6

Frf - Frequency Response Function

Type	frf freerun,retrig
Input	1
Window	transient
Shift[ms]	97.2
Length[ms]	6.35
Output	2
Window	exponential
Shift[ms]	97.7
Length[ms]	196
Result Type	H1
Range[Hz]	800 fs=2048Hz
Lines	800 t=1s,df=1Hz
Avg	4 total t=4s
Overlap	0%

The coherence displayed in the amplitude graph. The short horizontal line on Y axe is on position of value = 1 for coherence.
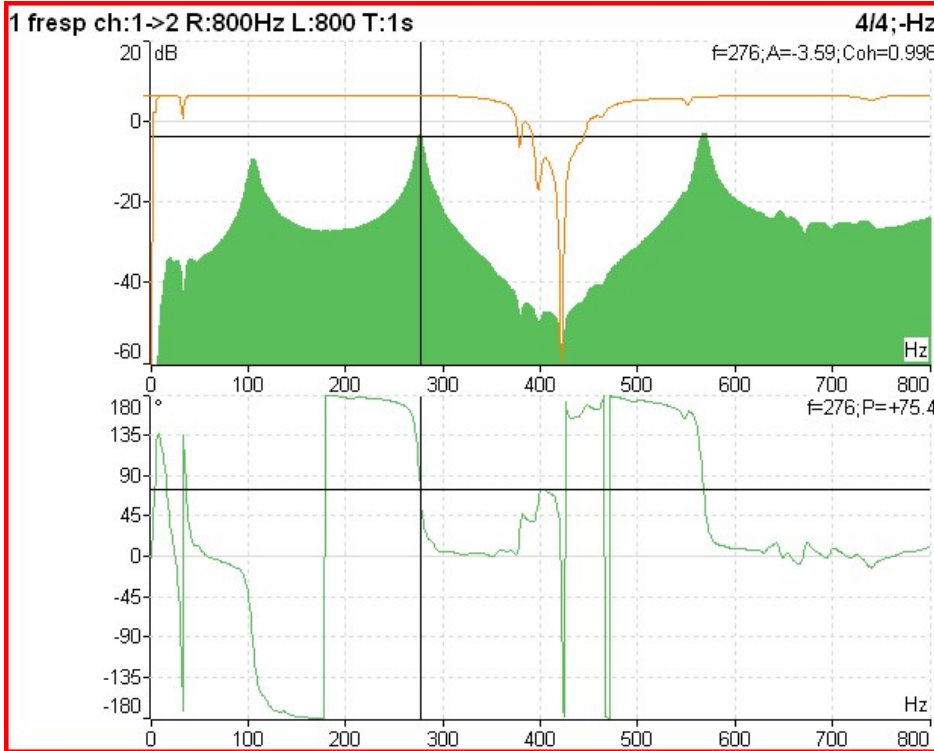
When you set the Frf view to **time**, you see the time signals from both channels. When you use the hammer, then remember to set the **Trigger Settings / Trigger Source** to **amplitude**, the **Pretrig** to for example 25%, select **Ampl Trig Channel** number and the **Ampl Trig Level** value.
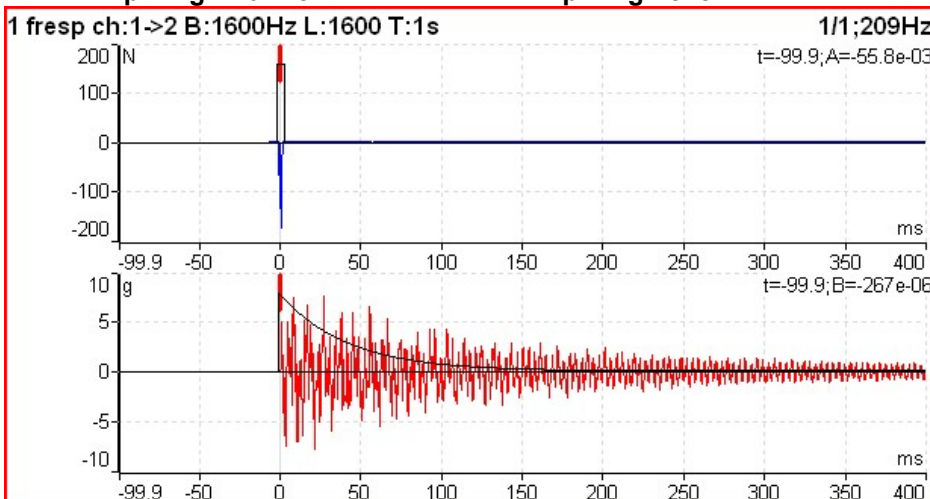
Set the **Buttons mode** to "**Spectral widnow**". Now you can simply shift with FFT windows or change the length. See the **Window** parameter in the **Edit Measurement** chapter for more details. The frf function doesn't use any HP filtering. If you want to compare the time signal from frf with standard time signal, you must set the **Band fmin** to none in the standard time signal dialog.

Octave Spectrum, Sound Level and Equivalent Sound Level
All parameters are described in the **Octave Analysis** chapter. The exponential averaging is not available in the **Analyzer** module.

Center Line
This measurement is often used for turbines. The **Center line** values define the static position of shaft in bearing.
The signals from proximity sensors must be connected to DC channels. We need to remove the AC part and to hold the DC part. The DC inputs work in that way.

Type	center line freerun,retrig
DC A channel number	1
DC B channel number	2
Unit	µm
Avg	off

The Center line is related to the orbit measurement. We also need two sensors with known angles of mounting. Correct dc sensors positions (angles) must be set for correct calculations (see Sensors definition).
While in orbit we see the shape around the (0,0) position, in the center line we see the position of shaft center without shape of orbit.

1 center line ch:1;2	1/1;-Hz
A:2767µm; B:1768µm; X:-706µm; Y:-3206µm	

Two couples of values are displayed - A+B and X+Y. The A, B values represent distances of sensors from the reference position defined by offset value. The X, Y values represent that positions according the Cartesian X, Y coordinates (The position (0,0) correspond the position, where A,B are equal their offsets). The polar graph is displayed for trend.

S-max

It is standard S-max measurement as the maximum vector amplitude of displacement. Correct sensors positions (angles) must be set for correct calculations as for standard orbit graph (see Sensors definition).

Type	Smax freerun,retrig
A channel number	1
B channel number	2
Unit	µm
Band fmin[Hz]	10
Band fmax[Hz]	800 fs=2048Hz
Trigger Control	off
Samples	512 t=0.25s
Averaging	linear
Avg	4 total t=1s

1 Smax ch:1;2 B:800Hz NS:512 T:0.25s	4/4;50.9Hz
115µm	

Cepstrum

Type	cepstrum freerun,retrig
Channel	1
Window	hanning
Unit	g
Band fmin[Hz]	10
Range[Hz]	800 fs=2048Hz
Lines	400 t=0.5s,df=2Hz
Avg	off total t=0.5s
Overlap	0%
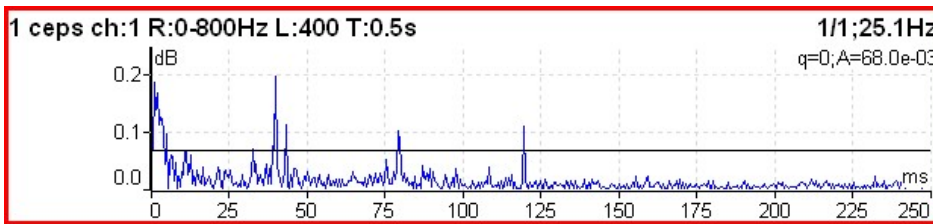
Used algorithm is cepstrum(x) = inv (fft(log10(abs(fft(x)))))

x   signal
fft   fourier transform
abs   absolute value
log10   common logarithm
inv   inverse function

Ultrasound

Type	ultrasound freerun,retrig
	Save

Two values are displayed. The **Level** of sound in dB (30-50kHz range) and **Shock Factor**. The Shock factor is defined as Peak value divide by RMS value. It means value 1.4 for pure sine. Higher values mean that transient shock events are in the sound signal.

Note: The ultrasound sensor (microphone) required.

There is detailed description in the Ultrasound mode chapter.

Record

Type	record freerun,retrig
Sampling Frequency[Hz]	65536 Frequency Range=25600Hz
AC1	on
AC2	off
AC3	off
AC4	off
DC1	off
DC2	off
DC3	off
DC4	off
Trigger Channel	off
Time[minutes]	manually stopped
Start of Rec	freerun

1 record

00:00:25 / 00:01:00

Creates and saves the record. After the download to PC it is ready for using with VA5 Virtual Unit (see the **VA5 Virtual Unit** chapter).

There is detailed description in the **Recorder** chapter.

Route

Loading of the route to the instrument

The cooperation with DDS software is required for the route measurement. See also the DDS user manual for more details. We do not describe all details about DDS function in this guide.

You can see that the structure of tree is changed when you create a route from a part of tree in DDS. This is because the VA5 instrument strictly requires the tree with the following structure Tree Name - Machine - Measuring Point - Data Cell. If there are more items in DDS tree in a path between this items, the names of such items are combined together (like in this example "Turbo Generator/Fans/Fan 1" or "Motor/L1RV" etc.). If the item name in a route tree is longer then 45 characters DDS is trying to truncate such names. To avoid this we recommend using shortcuts in a tree items (in this case "Turbo Generator" should be "TG").

Creation of the route tree

The route tree can be created also in the VA5 directly. The new database must be created in DDS for it. See DDS user manual for details.

Route Measurement

Select the **Route** mode in main screen. The list of routes in the memory is displayed. The time and date of last saving of selected project is displayed in top right corner.

Route List	
	28.03.2019 14:10:08
Engines	
TG Fans	

Select one route and press OK. The list of machines appears.

TG Fans
Machine List

TG/Fans/Fan 1
TG/Fans/Fan 2

Select the machine and press OK or right arrow to develop the list of measurement points.
The number of AC channels for each point is displayed behind the point name.

TG Fans/TG/Fans/Fan 1
Point List

Motor/L1RV	1ch
Motor/L1RH	1ch
Motor/L2RV	1ch
Motor/L2RH	1ch
Triax	3ch

For further technical and contact information visit www.adash.com or email: info@adash.com

In this moment you can start the measurement or by right arrow display the list of measurements, which are defined for this point. The channel number is displayed in front of name of measurement. By left arrow button you will close the displayed list and you return back to the previous level.

TG Fans/TG/Fans/Fan 1/Motor/L1RV
Meas List

| 1.ISO RMS |
| 1.LBEARING RMS |
| 1.LBEARING TIME |
| 1.OVERALL SPECTRUM |

When you press the **Start** button over the **Point List** or over the **Meas List**, the Set screen with graphs of all measurements will appear. If the required sensor (defined in the route) is not compatible with the sensor connected to channel input (defined in sensor's properties) instrument warns us about this. In this case change the sensor or use the different sensitivity and press **Continue**.

Press the **Start** button to begin the measurement. All defined measurements will be taken together. The measured data are or are not displayed on the screen regarding the **Display Route Values** parameter in **Global Settings**.

TG Fans/TG/Fans/Fan 1/Motor/L1RV   Graph 4 / 4
Actual

1 RMS ch:1 B:10-1000Hz NS:4096 T:1s   1/1;17.7Hz

8.78 mm/s

2 RMS ch:1 B:500-25600Hz NS:65536 T:1s   1/1;17.7Hz

2.84 g

3 time ch:1 B:500-25600Hz NS:32768 T:0.5s   1/1;17.7Hz

t=0;Y=4.96;totRMS=2.82;tot0P=12.5

4 spectrum ch:1 R:0-25600Hz L:1600 T:0.063s   16/16;17.7Hz

f=3792;ord=214.376;Y=1.03;tot=2.98
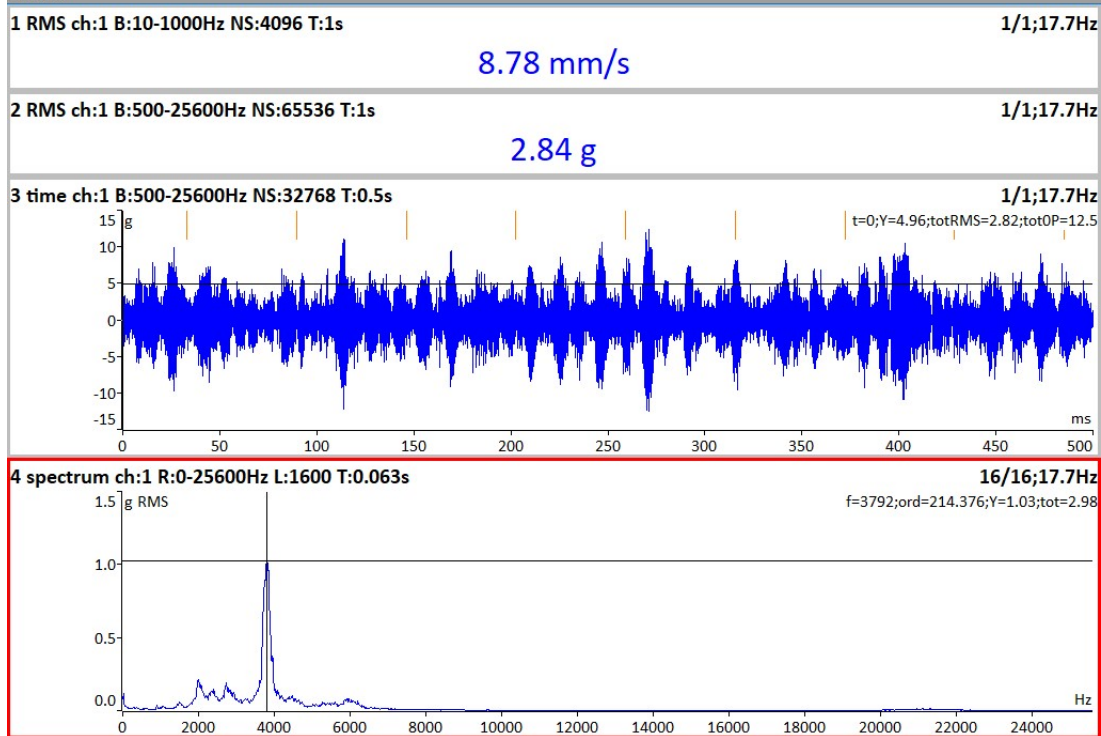
All values are automatically saved unless you defined the **Route Auto Save** parameter in the **Global Settings** as **off**.

If the **Route Auto Forward** parameter in the **Global Settings** is defined as **on** then the Set screen will be automatically closed, otherwise use the **Escape** to return back to the **Point List**. The measured point is labeled by the symbol √ (all defined measurement were taken) or by the cross (some measurements were not taken). The next point in the list will be selected if all measurements are taken.

Reference Values

You can download reference values for spectrum and overall measurements from DDS to the instrument. These values are displayed together with measured values.

Reference spectrum is displayed together with measured spectrum in the same graph.

Overall reference value is displayed in left side of graph and it is signed by "R:" or like a line in trend view.
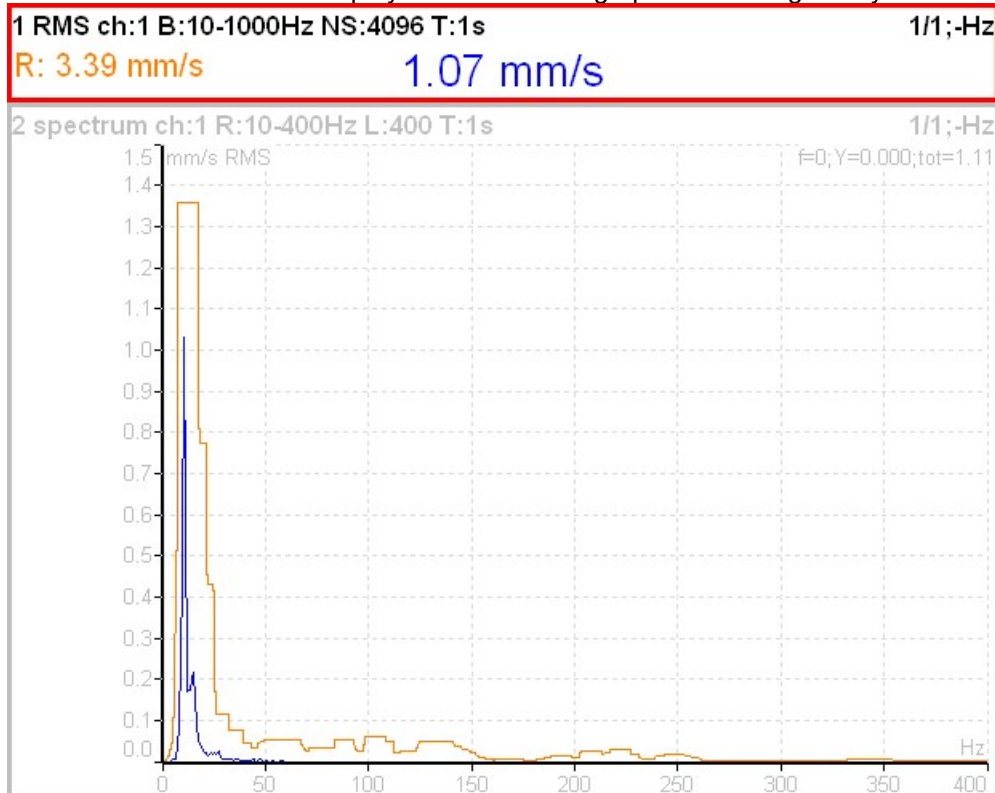
Manual Entry

The route may contain the measurements, which have to be entered manually (for example temperatures read from analogue display). The measurement with subtype **MANUAL** in DDS is defined. Before beginning of measurements from sensors (after you press **Start**) the window for manual input appears (one for each manual input).

Enter Speed

This function is available by pushing the bottom left button. This button can have various names depending of mode (Analyzer, Route) and displayed screen (Project, Machine, Set, Point, Meas).

The manual entered speed value will be saved to all next readings. It is saved to the same position in the head of data as the speed measured by tacho. If the speed is manually entered and also measured by tacho, then the tacho has priority and it is saved.
The manually entered speed is displayed on the right side at the top of the screen with the word "Speed:"

Speed: 50 Hz

You should notice, that the speed value is saved to the head of data. That is why you have to use the Tacho factor (Machine or Point Properties) in DDS for recalculation of speed to other ratios.
The Gear Ratio (in Properties) is used with Default Speed value not with the speed value in data head. The Default speed is defined by user in Properties. It is used with machines, which have constant speed (always the same value).

Cancel Speed

It cancels (removes) manually entered speed value.
The Cancel speed function is also available in Route.

Notes

You can attach the short text notes to tree item in the route. There are three ways how to handle with notes.
1. Enter the note manually.
2. Select predefined note from **Factory notes** set.
3. Select predefined note from **User notes**. This set is created and edited by user.

Press the button on the left bottom (it can have more names as **Route**, **Machine** or **Point**). Select **Notes** item.
The list of existed notes for selected item appears. It is empty when no note was created yet.

Notes
TG Fans/TG/Fans/Fan 1/Motor/L1RV

Empty
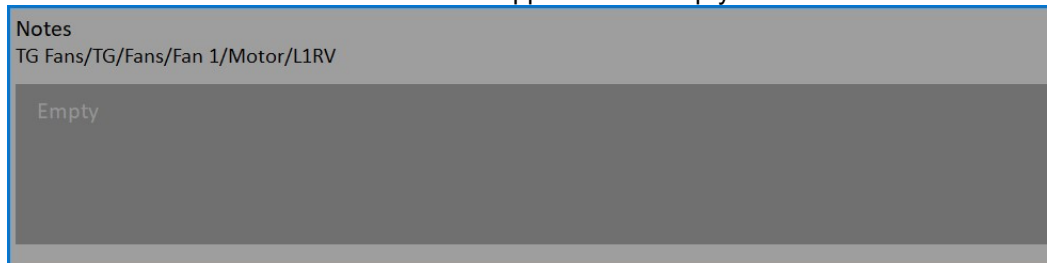
Press **Add** button to create new note. New window appears. In the upper half area you can directly type the note. The User notes list is displayed in the bottom. The several ways how to create new note exist.
- Select one note from User notes list and press **Select**. Selected note is copied to the upper area.
- Press **User/Factory** button to change the User notes to Factory notes or back. Then choose the note from the list and press **Select**.

Edit Note
TG Fans/TG/Fans/Fan 1/Motor/L1RV

Oil under machine

User notes list

Machine is not running

Oil under machine

Dirty machine
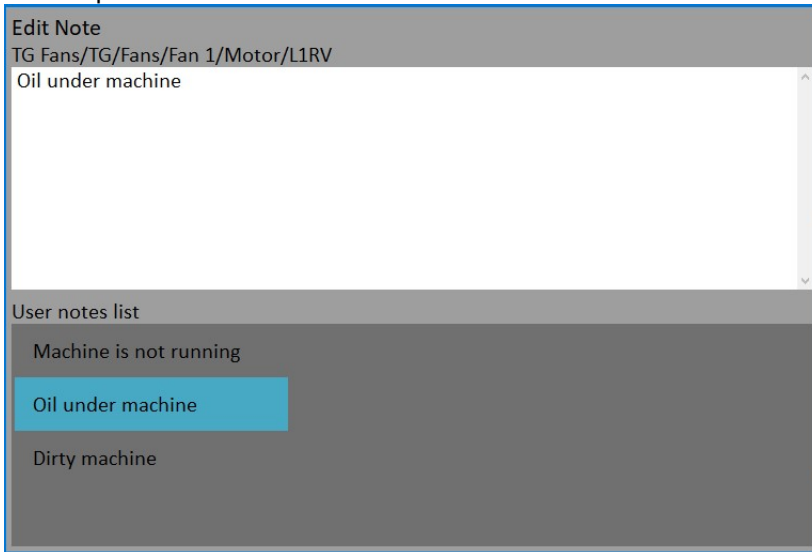
- If you want to enter your own text, then press **Edit Text** button. The cursor appears in upper area and you can enter the required note. Press **Escape** to return back to the selection of User/Factory note.

Edit Note
TG Fans/TG/Fans/Fan 1/Motor/L1RV

Oil under machine
John, what is the reason?

User notes list

Machine is not running

Oil under machine

Dirty machine
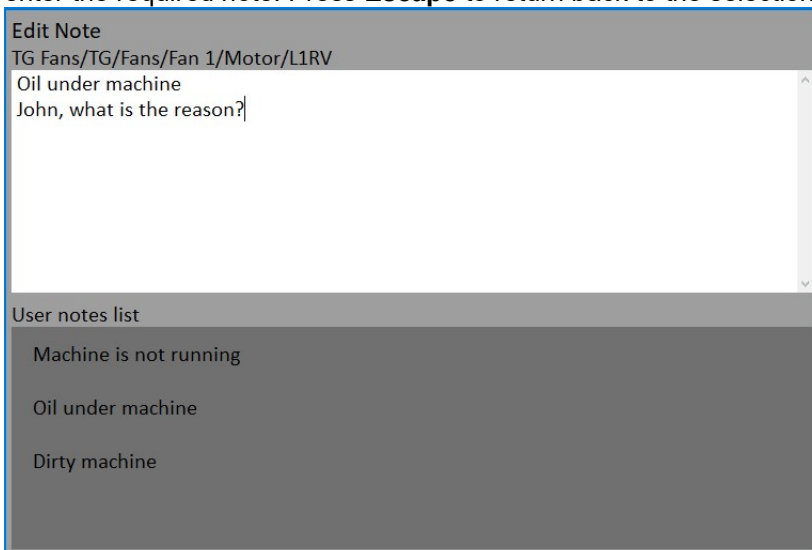
If the note is done, press the **Escape** button. You return back to the list of all notes for selected point.

Notes
TG Fans/TG/Fans/Fan 1/Motor/L1RV

28.03.2019 15:21:04
Oil under machine
John, what is the reason?
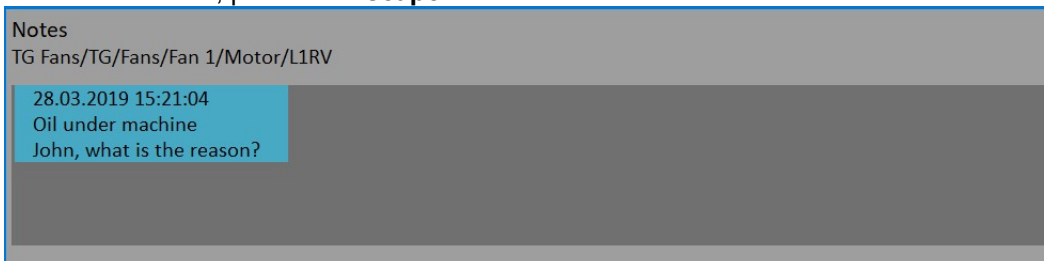
You can also edit any defined note. Pres the **Ok** or **Edit** button when the Notes list is opened. The selected note opens for editing.

To delete the selected note press the **Delete** button.

Press **Escape** to leave the list of notes. The **N** letter appears behind the point name in the list.

Speed in the Route

There are various ways how to get the speed and transfer it to DDS. The ways are described here in the order from the lowest priority to the highest priority.

Speed entered in the instrument

The speed can be entered manually with the function Enter Speed (described before in the Analyzer module).

Speed entered in DDS

The **Default Speed** can be set in DDS as a machine parameter (**Tree Item Properties / Speed** tab). This value is sent to the instrument and it is used in place of tacho sensor value. The three options of **Default Speed** are available for the machine item.

Entered value - the value entered in Default speed is sent to the instrument. The value is used only for FASIT measurement. If the value is entered, then no speed detection is used.

Detected option runs speed detection before measurement (see the **Speed Detection** chapter).

Manually Entered option opens **Enter the speed** dialog, where you enter the value.

Detected or manually entered speed is valid for whole machine. Unless you close the machine item, the same speed value is used.

The **Default Speed** can be also set in other items, not only in the machine. In this case only numerical value is available. If you enter default speed value and in the same time you have set machine's default speed as **Detected** or **Manually Entered**, then the machine's setup has priority.

Measured Speed

If the speed is measured by tacho probe, it is saved always with data regardless the fact there were already defined by one of the previous ways (speed entered in device or DDS).

Current entered or detected speed value (if defined) is displayed in information panel at the right (if the measurement is not in progress).

Speed: 50 Hz

Export to VA5_DISC

The computer can read any data from VA5_DISC only. The route with measured data has to be exported to this memory before the transfer. During the route measurement all data are saved to the VA5 hard disk only. When the route is closed the VA5 asks the user "**Export to VA5_DISC?**" and user selects one option. The export to VA5_DISC is not done automatically because the writing procedure to flash is slow. The large route export can take several minutes. That is why the user can determine, when the right moment to export the route is.

In the menu item **Route/ Export** you can select the route and export it manually.

Runup

Measurement Control

When you need to measure Run Up or Coast Down of the machines, then you should use the **Runup** module. It enables the same measurements as in Analyzer mode, but controlled by speed, time or uncontrolled.

What does it mean "controlled"? In Analyzer mode you can measure the Set and then you have to save measurements manually.

The **Runup** is different. The measurements are saved automatically and additionally the measurements are regularly repeated under the control. The trigger function is used for that control. The menu item **Global/ Trigger Settings/ RunUp mode** is used for setting.

Usually the **speed** is used for that control and new measurement is made, when the speed changes from previous measurement of defined value (for example10 RPM).

Also the **time** can be used to control that procedure. Then you can take the measurement in defined time interval (for example each 60 sec).

The **asap** is the next choice. It means no delay between measurements - **A**s **S**oon **A**s **P**ossible. Be careful for such mode. You can use all memory quickly.

The last choice is the **Manual** mode. You can press the **Start** button at any suitable moment to make a new measurement.

The ending of run up is usually made manually by pushing **Stop** button.

Runup Measurement

The meaning of the **Set** and also meaning of other items in the **Runup** are the same as in the **Analyzer** module.

For example we define only one measurement in the set.

Edit Measurement	
Type	1x amp+phase freerun,time
All Channels	no
Channel	1
Unit	µm
Averaging	linear
Avg	off
Resolution	speed / 4
	Save

The proximity sensor on channel 1 is used. The **Runup Mode** is set to **speed** and the value is 1Hz.

Push the **Start** button to start the measurement.
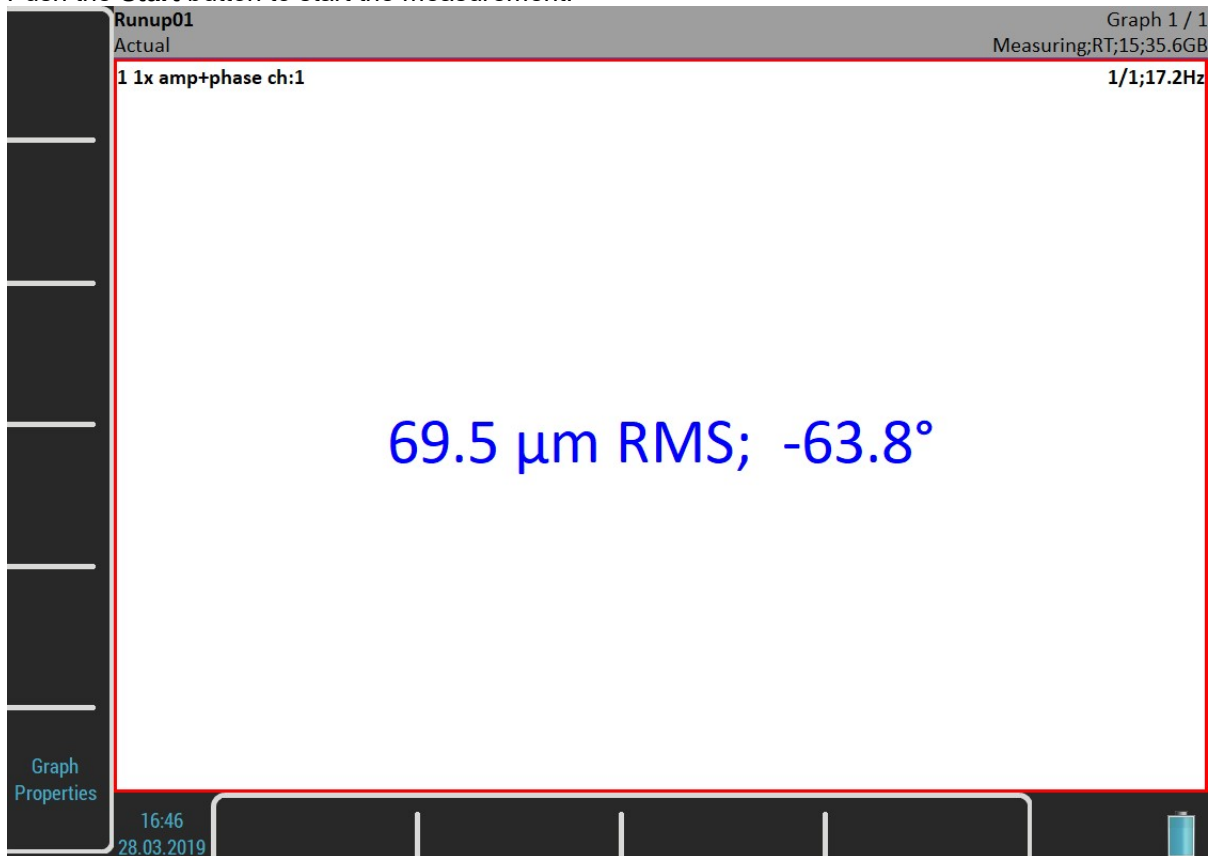
The **Measuring** indicator contains additional information during the **Runup** measurement, the number of saved values (15) and the free memory size (35.6GB).

The Set screen looks same as in the **Analyzer** module. But there is one difference. The values are saved during the measurement.

After the full speed is achieved press **Stop**.

Trends

Unlike the **Analyzer** module, one trend is saved during each measurement in the **Runup**. Press the **Set** button and select the **View Trend** item to open a **Trend List**. The date and time of measurement is displayed. If the analysis is made from record, then two time stamps are displayed. The analyze time is the first and the measurement time is the second.

One **Runup** measurement can be divided into more files (for example the measurement is very long). See **The MENU / Runup** chapter.
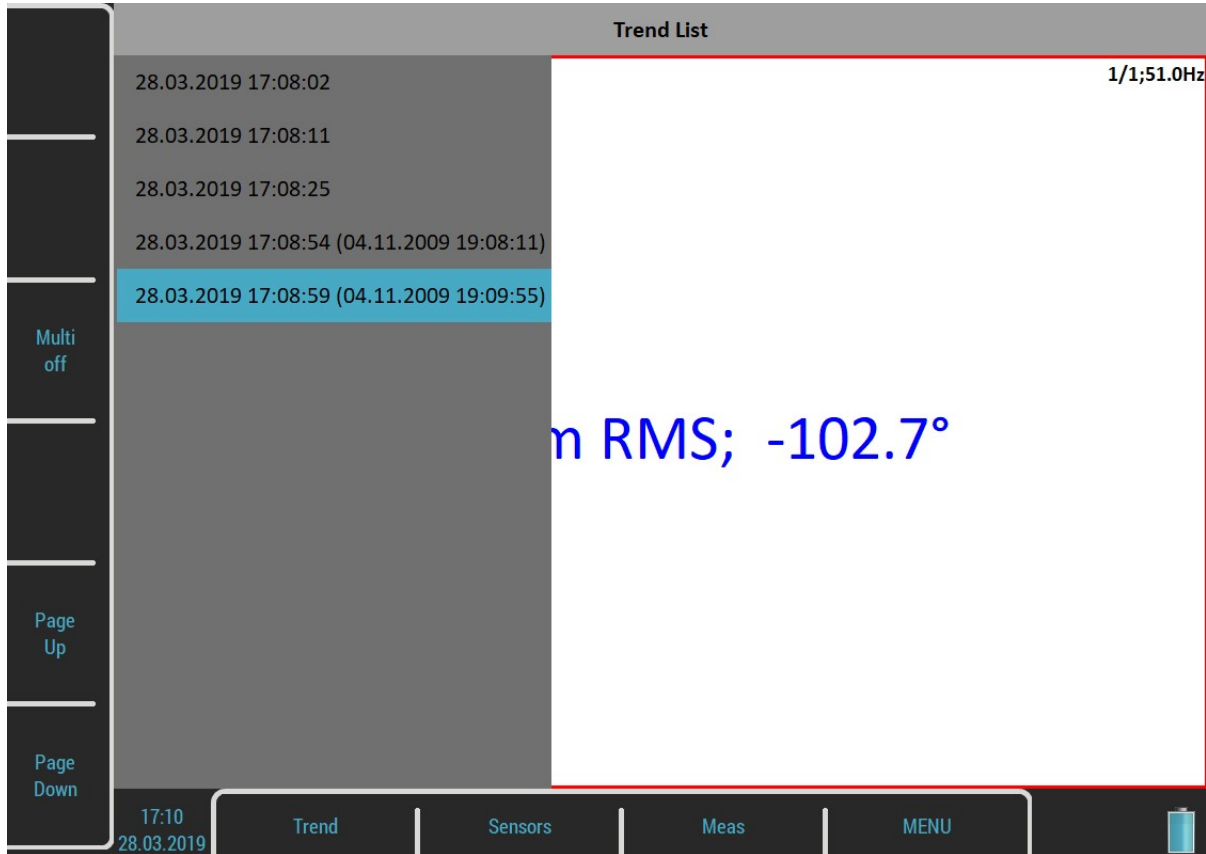
Select one item in the list and open it by pressing the **Ok** button. The selected trend will be loaded.
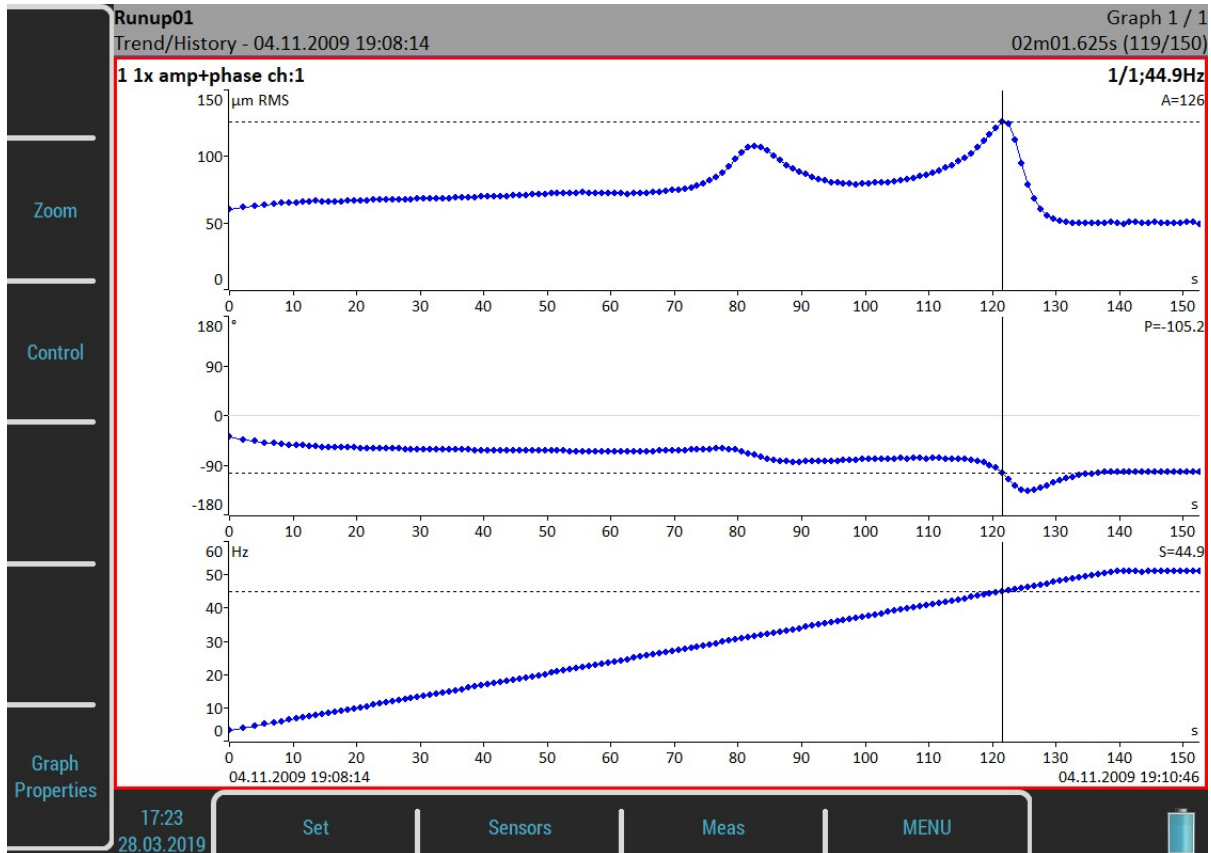
The date and time after the **Trend/History** indicator means the beginning of the measurement. The time stamp in the bottom right corner of the status bar means the actual trend cursor position and the 119/150 means the index and the total number of values in the trend. The trend axe is marked relatively from the beginning. This is

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the default setup for the **Runup** module. If you want absolute date and time change the **Trend Time Axe** parameter in the **MENU / Runup** to a **real time** value.

Trend Menu

When the list of trends is displayed, then the **Trend** button is available. It contains next functions:

Delete

Delete selected trends.

Export

It is not necessary to export the whole set with all trends but you can export only the trends you need. You find them in the folder named as the current **Runup** project (set) in the VA4runup folder on the VA5_DISC. Thus you are able to work with them same way like you would export the whole project (for example import to DDS or copy to virtual unit).

<u>Recorder</u>

Many of older engineers remember the past time, when the signal was recorded to the tape-recorder and consequently analyzed in Analyzer. Such approach had one important benefit. You can analyze the signal again and again. When you need to make all required analysis in real-time, you are under time pressure. If additionally the for example runup can be run only once, the pressure is extreme. The tape-recorder was the solution. It was simple unit with simple operation, no danger to loose the data.

The same solution offers the VA5 **Recorder**. It enables to record simultaneously all 4 AC channels, tacho channel and 4 DC process values channels into the memory. The sampling frequency is from 64Hz to 196kHz. The maximum record length depends of free memory size.

Project List

The list of saved records opens when you enter the **Recorder** module. The list is empty if you have no saved records yet. The recording date and time is displayed in the status bar in the bottom right corner.
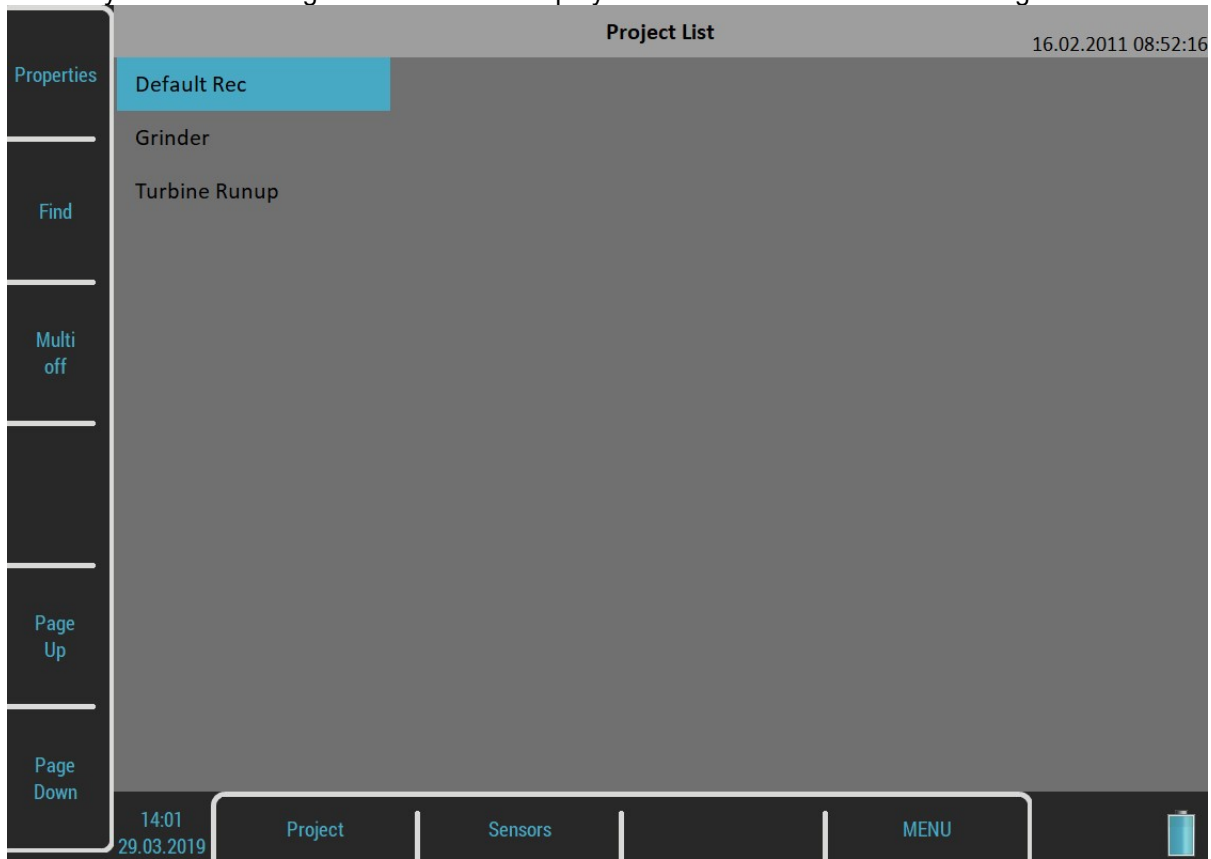
Project Menu

Use the **Project** button to manage the records in the list.

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Project
New
Copy
Rename
Delete
Clear Data
Notes
Export
Export to wav
Export to wav Settings
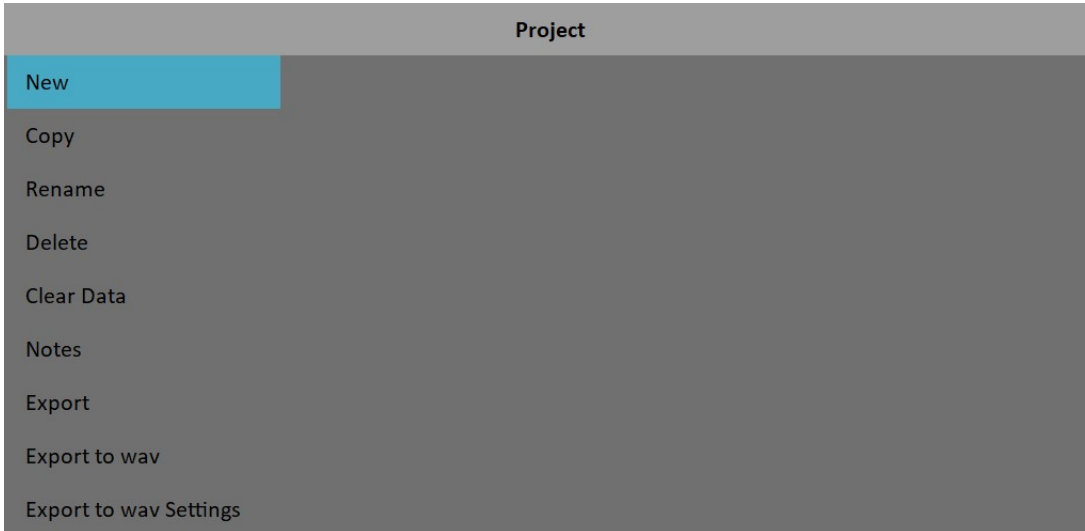
New

Create a new record and add it to a **Project List**.

Copy

The Copy functions copies only the parameters of the selected record, no recorded signals will be copied.

Rename

Rename the record.

Delete

Delete record from memory.

Clear Data

Delete recorded data, all record parameters are kept.

Notes

Add a note to the record. The **Notes** dialog has been already in the **Route** module.

Export

Export the record to VA5_DISC.
Note! The max size of exported record is 4 GB. The total size of flash drive is 8GB. The 4 GB represents 80 minutes of 4 channel recording with 65kHz sampling frequency. One second takes 800kB. When you want to export bigger record, then the error **Not enough space** appears. You need to split a large record to several smaller records. See the **Record preview** chapter.

Export to wav

Export the record to wav data format (will be described later).

Export to wav Settings

Open an **Export to wav Settings** dialog.

Record Settings

The Records Settings dialog opens automatically when you open a record without data. You can also open the dialog by pressing the **Recorder** button when any record is opened. You don't lose any measured data by editing the settings.

Edit Record Settings	
Sampling Frequency[Hz]	65536 Frequency Range=25600Hz
AC1	on
AC2	off
AC3	off
AC4	off
DC1	off
DC2	off
DC3	off
DC4	off
Trigger Channel	on
Time[minutes]	manually stopped
Start of Rec	freerun
	Save

Sampling Frequency

The sampling frequency used by recording. The available frequency range of the recorded signal is in the note under the value.

AC1 – AC4, DC1 – DC4, Trigger Channel

Switch to **on** all channels you want to record.

Time

Define the length of record.

Start of Rec

freerun
The recording is started immediately after the measurement's preparation.

external
The **external** signal (voltage level higher then defined threshold level in the **Trigger Settings**) starts the recording. Such signal may be generated for example when the machine starts to work. This type of signal is usually created in the control system.

amplitude
The recording is started when the signal level exceed the **Ampl Trig Level** on **Ampl Trig Channel**. The **Ampl Trig** parameters are available only if the **amplitude** is chosen.

Start of Rec	amplitude
Ampl Trig Channel	1
Ampl Trig Level [µm]	1
Pretrig[minutes]	0

Pretrig

When the **Start of Rec** event occurs the recording is started. But you are able to save a signal before the event be defining the **Pretrig** length.

Recording

Remember to setup all sensors properties before recording. Use the **Sensors** menu. When the **Sensors** and **Record** parameters are set, use the **Start** button to start the recording.

If the record already contains data you will be warned and you can cancel the measurement.

Record contains data.
Data will be rewritten.

During the recording all recorded input signals are displayed on the screen.
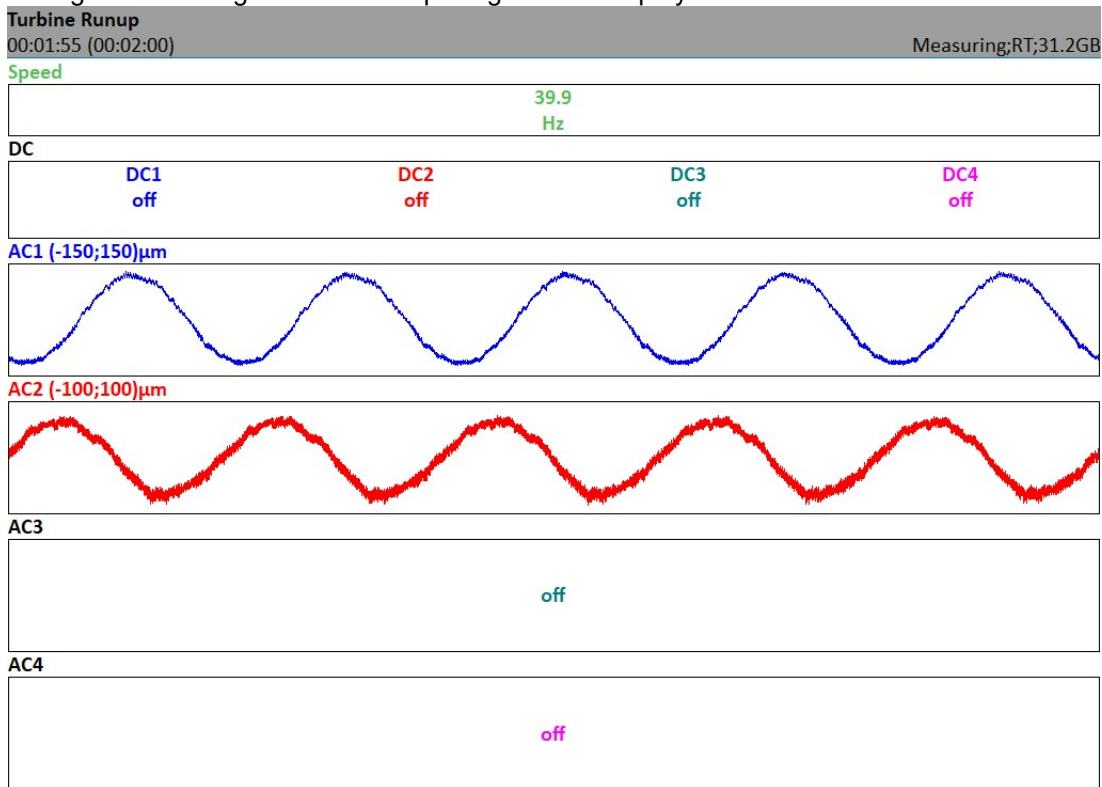
Elapsed and demanded time is displayed in the status bar bottom left corner. The available memory is in the bottom right corner.

The recording is finished when
- the time is over,
- manually by **Stop** button,
- the memory is full.

Record Preview

After the record is taken the preview of recorded signals is displayed.
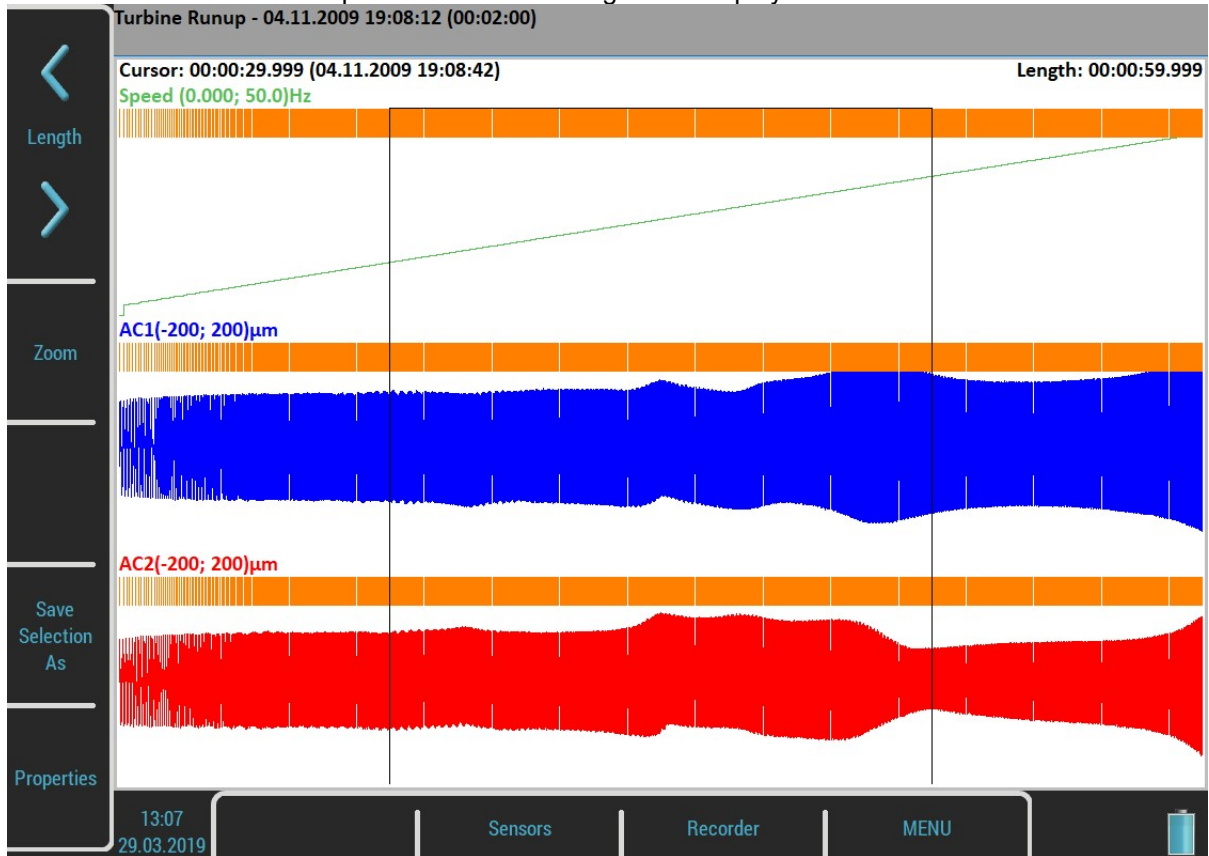
The record date, time and length are displayed behind the record's name in the status bar.

The selection cursor is displayed over the signals. The **Cursor** label shows the beginning of the selection, relatively according to the beginning of the record and also absolutely. You can move the cursor with **Left** and **Right** buttons. The **Length** of the selection can be changed with the **Length** arrows. You can also use touch screen gestures.

You can zoom the record using the **Zoom** button. The Zoom X is done to the selection area.

The **Tab** button switches the side buttons meaning between the **Zoom** and initial mode. The **Backspace** button returns the initial mode.

When the record contains longer data then you need for analyzing you can select any part and save it as new record. The **Save Selection As** does it. The **Cursor** arrow defines the beginning of new record. The **Length** defines the length of new record.

The Properties button opens the Properties window.

The **Start** button starts a new recording if you want to rewrite the signals. You will be warned before the data erasing.

The **Escape** button closes the preview and skips back to the **Project List**.

Export to wav

When the Project List is opened you can export selected records as wav files. All channels are saved to one multichannel wav file, for example the Audacity software can read it. The export is made by the **Export to wav** item of the **Project** menu. You can setup the wav settings using the **Export to wav Settings**.

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Export to wav Settings		
AC1	1	
AC2	1	
AC3	1	
AC4	1	
Mixer	off	
Range [V]	max	
	Save	

AC1 – AC4

All channels can be mixed to one channel into wav file (like in music studio). The gain factor can be defined for each channel. When the zero is used, then this channel will not be used for mixing.

Mixer

on, off
Select **on** when you want mix all channels to one channel wav file. If the **off** is used, then multichannel wav file will be created. The gain factors are used in both options.

Range [V]

1.5, max, auto, user
The full AC range of VA5 is +/- 12V. This range is also used for wav export. But it is usually too much, because the real voltage level is much lower. For example the range hundreds of millivolts measured from accelerometer 100mV/g. The wav file is then very quiet. The **Range** option enables to apply better wav range and better hearing from headphones.
1.5   this range should be generally acceptable in most of cases
max   the 12V is used as range
auto   the reached maximum value in signal is used as range
user   any value from (0.1 - 12) interval
If you need to compare two signals in headphones (for example the noise of old and new bearing) then the same range must be used.
When the range value is lower then the range of signal, then the warning **Wav overload** appears.

Temporary records

Records can be stored in the DDS database. For record analysis, the DDS copies the record into the list of records in Virtual Unit and run the Virtual Unit. We call this record as temporary. It will be deleted once you will close the Virtual Unit.

Balancer

Introduction

The balancing process is based on standard measurements of amplitude and phase on the speed frequency. The VA5 balancer includes many special internal functions, which remove the influence of noise, speed changes etc. If you are not familiar with field balancing method, please see any special literature.

Project

The Project is the base structure in balancer. It corresponds of one balancing job. You can use the same Project for repeated jobs on the same machine. The measured data will be rewritten.
The Project contains all measured or entered data, which were be used during the job. The typical scheme looks like next list of steps:
- Project name enter.
- Mode (machine type and number of planes) enter.
- RUN 1 - Initial measurement of vibration amplitude and phase in required number of planes.
- Trial mass put on the rotor. Step by step to all planes.
- RUN 2 - Trial mass response measurement. Step by step to all planes.
- Final masses put on all planes.
- RUN 3 - Check of effect (success) measurement.
- Trim measurements for additional masses and better results.

Project Screen

Every step is displayed in one screen.

The movement between screens is provided by up/down arrows.

The usual Enter button is not used, it could confuse the user. The movement enables to return back anytime. The important property must be clearly told. When you return back in the job screens and you take again repeated measurement or value enter, then the measured data will be erased in all screens after actual screen. The reason is simple. The implications are derived from every screen to the next screens. When you repeat the measurement, you change the parameters for those implications. That is why all next screen implications must be removed and you have to make all necessary measurements again.

Project List

The list of saved projects or the Empty label is displayed on the first screen. The time and date of last saving of selected project is displayed in top right corner.
Select one project or use the **Project** button for **New** project creation.

Project List	27.03.2019 15:04:35

Balancer01

Balancer02

Fan KV90

Find

Multi off

Page Up

Page Down

15:17
27.03.2019   Project   Sensors   MENU
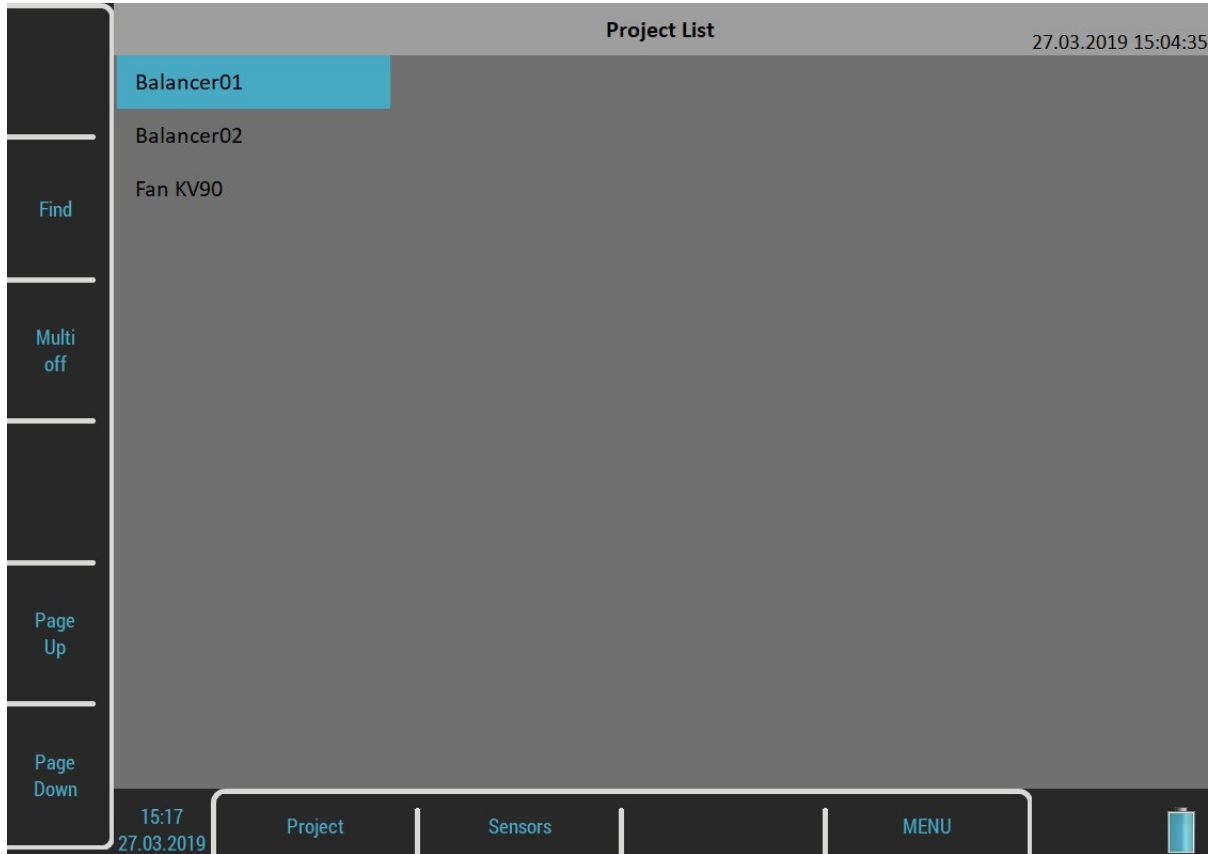
Also next functions for projects managing are enabled. Open the **Project** menu by pushing the **Project** button.

Project

New

Copy

Rename

Delete

Clear Data

Export
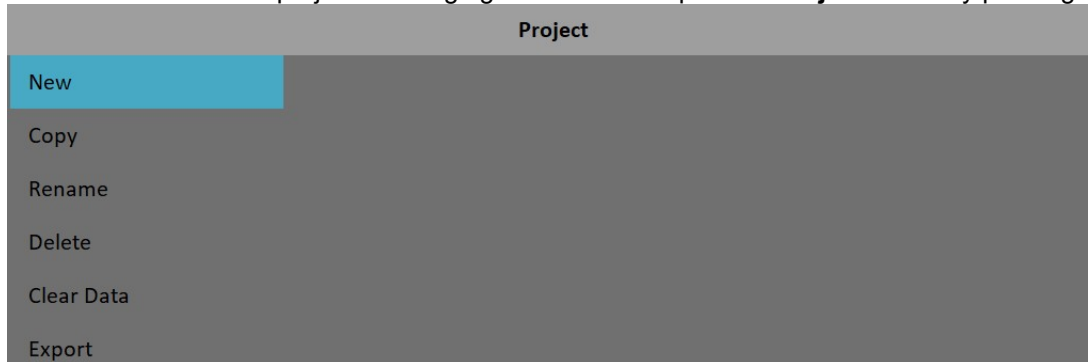
New

Create a new project with default properties.

Copy

Create a new project as the copy of selected project. Only the header data are saved. No measured data are saved.

Rename

Rename the selected project. The project with old name does not exist anymore.

Delete

Deletes selected project.

Clear Data

Erase all measured data, only the project header remains.

Export

Export selected project to VA5_DISC.

New project

Push the **Project** button and select the **New** item. Enter the name of project. The new project is added to the list of projects and it is selected. Press **Ok**, it will be opened. The list of basic properties appears when you open a project without data. Define your values and press **Ok**.
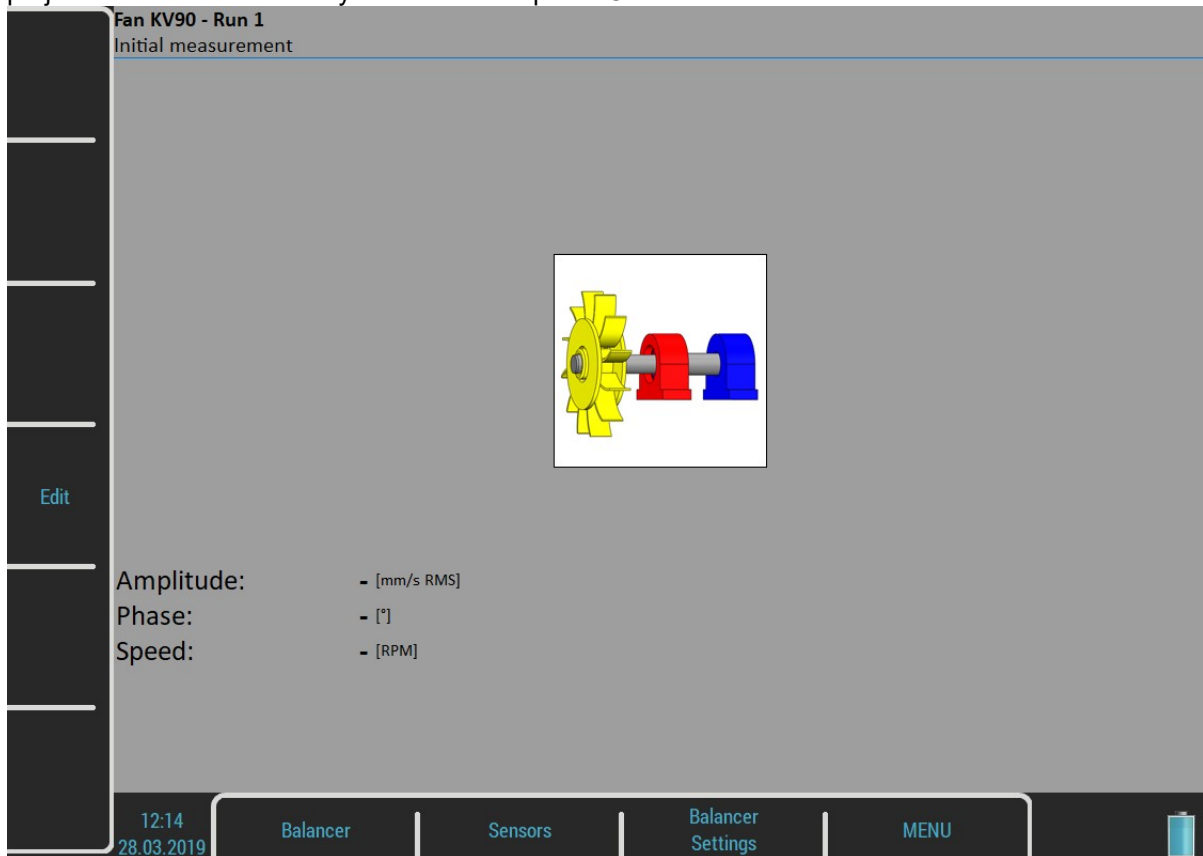
Balancer Settings

All project properties are defined under this button. When you push it, the menu with several items appears.
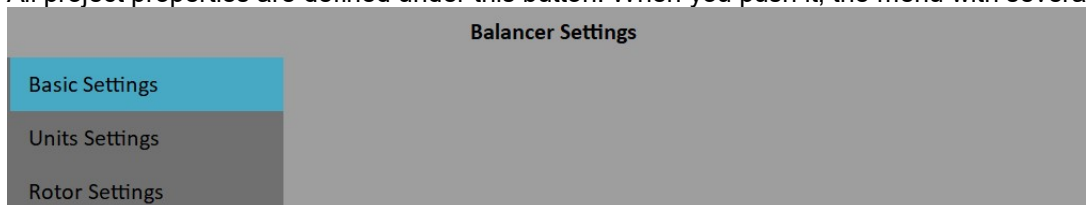
Basic Settings

Planes

<u>single</u>**, dual**   plane(s) balancing

Image

Selection of machine image, different images are available for single and dual plane balancing

Look

left, **right**   view direction (only for single plane balancing)

Rotation

CW, **CCW**
clockwise or counterclockwise

Inputs

single, **dual**   one or two AC inputs (sensors) can be used (only for dual planes balancing)

Channel

The number of AC input, which will be used for sensor mounted on the bearing, for single plane balancing

Channel A, Channel B

Numbers of AC inputs, which will be used for sensors mounted on the bearings, for dual planes balancing

Note: The bearing marking A and B has only the symbolic sense. It has no relation to the balancing planes 1,2 and to the balancing computational procedure. You can mark any bearing as A and the second as B.

Balancing Masses

add (mount) / **remove (drill)**

Blades

the number of blades (for rotors with blades). This parameter is used in job figuring to split the mass to blades.

Meas Mode

single, **online meter**
when you push the **Start** button, then only one measurement value can be taken (single) or the continual measurement values displayed (online meter). In online meter mode you can look at more values and to evaluate the changing of them in time. You need to **STOP** the measurement, when is displayed the value, which you want to use.

Avg

The averaging of more then one measured values is available

Resolution

Read the explanation in the **Edit Measurement** caption for the Analyzer module.

Units Settings

Amplitude

Selection from available units for used sensor

Detect Type

<u>**RMS**</u>**, 0-P, P-P**

Speed

Selection from available units for speed

Mass

Selection of unit for mass

Rotor Settings

All parameters are optional. It enables to calculate balancing quality factor according ISO1940.

Rotor Mass

Rotor mass in kg

Correction Radius

Radius to which the balancing mass will be mounted (could be different for each plane)

Balance Quality Grade

Demanded quality grade according to ISO 1940, if entered, the recommended trial can be computed

RUN 1 Screen
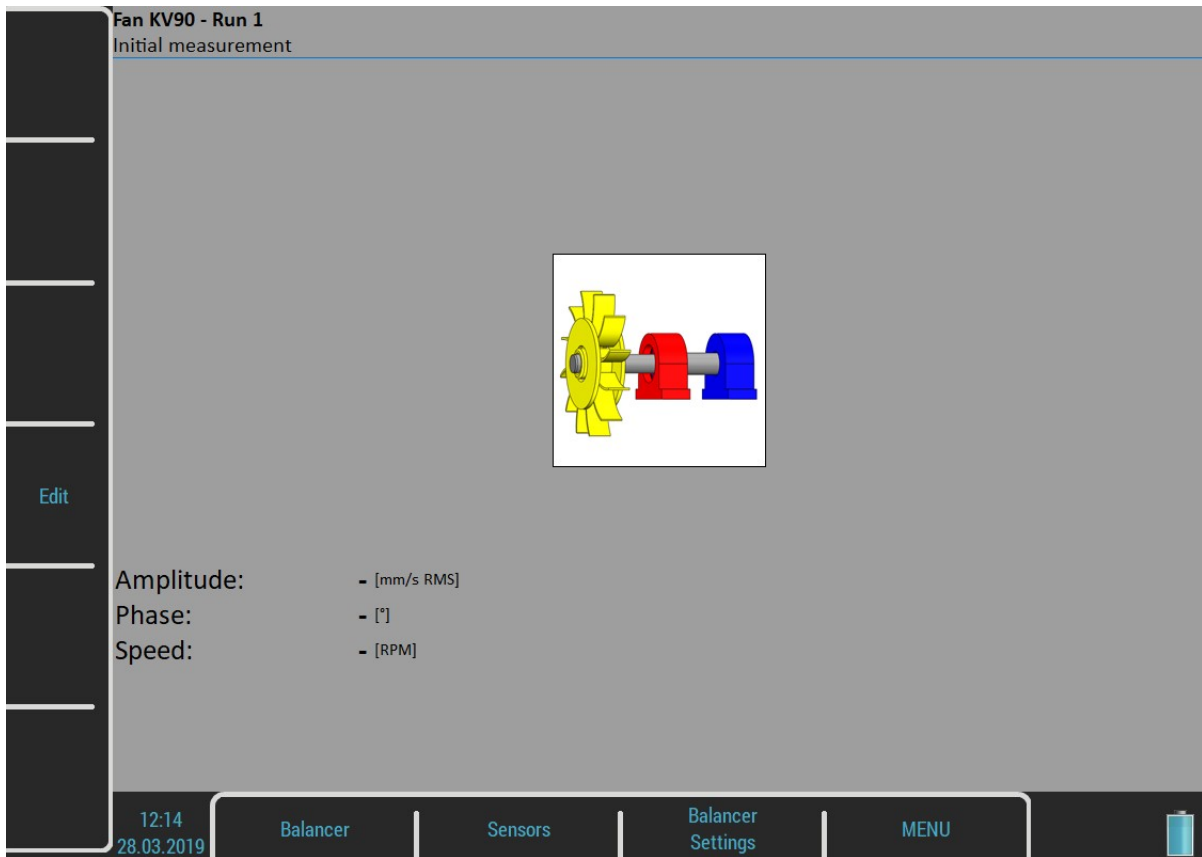
The red bearing house is the recommended point for sensor mounting. But you can use any other place, which is suitable for measurements.
Press **Start** button and measurement will be taken.
If you press the **Edit** button, then you can enter all values manually (balancing calculator function). Use the **Tab** for shift between values.

Amplitude:	**12.5**	[mm/s RMS]
Phase:	**+56.0**	[°]
Speed:	**1500**	[RPM]

Use the **down arrow** to move to the next screen.

RUN 2 - TRIAL MASS Screen

The trial mass mounting and response measurement is required to take on RUN 2 screen.

Fan KV90 - Run 2
Measurement with trial

Enter Trial	Trial:	**-** [g]	
	Recommended:	39.0 [g]	

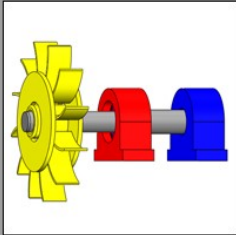|	Amplitude:	**-** [mm/s RMS]
Enter DF	Phase:	**-** [°]
	Speed:	**-** [RPM]
Edit	DFA:	**-**
	DFP:	**-** [°]

12:16 28.03.2019	Balancer	Sensors	Balancer Settings	MENU

Push the **Enter Trial** button and enter the weight of trial. Confirm by **Ok**. The weight can be negative, it represents removing of mass (for example dismounting of old balancing mass).
The recommended weight is displayed only if the **Rotor Settings** parameters are entered.

Push **Start** button for measurement.
Push **Edit** and all values can be manually entered (19balancing calculator function). Use **Tab** (in left) for cursor movement.

Amplitude:	**19.0** [mm/s RMS]	
Phase:	**+145.0** [°]	
Speed:	**1500** [RPM]	

After the RUN2 measurement the dynamic factor is displayed. The **DFA** and **DFP** (amplitude and phase) values are the response values of standardized trial mass (mm/s$_{RMS}$ / 1kg regardless the selected unit for balancing). If you will balance the same machine again after some time, then you do not need to measure the RUN2. Instead of that you only will enter the DFA,DFP values in this screen. Use **Enter DF** button for that.

DFA:	**501**
DFP:	**+178.6** [°]

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Use the **down arrow** to move to the next screen.

The trial mass can be left on the rotor or can be removed from the rotor after trial run. Before the RESULT screen you will be asked for that.

Remove trial mass?

Select the answer.

RUN 2 - RESULT Screen

The weight and phase (position) of the final balancing mass are displayed. Mount the final mass. The angle is applied from the trial mass position, which represents the 0 (zero) degrees. The direction of the angle is the same as the direction of rotation. For example +57 degrees means from the trial mass position in the direction of rotation. Minus degrees value means the position against the direction of rotation.

Fan KV90 - Run 2
Weight and position of balancing mass

Trial mass removed

Trial Mass Position

Rot.
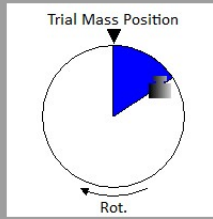
Angle: **+57.4** [°]
Weight: **24.9** [g]

You can split correction mass to two arbitrary angles (in case if it is not possible to place the correction mass into calculated position). Go to menu **Balancer / Split Balancing mass**

Enter the value of the first angle.

Enter first angle [°]
30

Then enter the value of the second angle.

Enter second angle [°]
60

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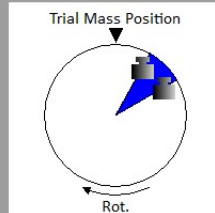
The balancing mass will be recalculated (split) into two required angles.

Fan KV90 - Run 2
Weight and position of balancing mass

Trial mass removed

Trial Mass Position

Rot.

Angle:	**+30.0**
Weight:	**2.30** [g]
Angle:	**+60.0**
Weight:	**22.9** [g]

Select **Balancer / Set Default Angle** to return back to the original calculation.

If the number of blades was defined, the final mass is divided between the two nearest blades. The blade number is always counted from the position of the trial mass. It means the trial mass is mounted to blade number one.

Fan KV90 - Run 2
Weight and position of balancing mass

Trial mass removed

Trial Mass Position

Rot.
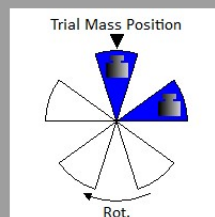
Blade:	**1**
Weight:	**6.63** [g]
Blade:	**2**
Weight:	**22.1** [g]

You can select other blades in case when you cannot mount weight to the nearest blade (blades). Select **Balancer / Change Blades** menu item.

Enter the number of the first blade.

Enter first blade (1 - 5)
1

Then enter the number of the second blade.

Enter second blade (1 - 5)
3

New balancing masses will be displayed.

Fan KV90 - Run 2
Weight and position of balancing mass

Trial mass removed

Blade:	**1**
Weight:	**42.3** [g]
Blade:	**3**
Weight:	**35.7** [g]

Select **Balancer / Set Default Blades** menu item to return to the original masses.

RUN 3 Screen

When the mass or masses are mounted you want to check the job. The screen is very similar to RUN 1 screen. Make the measurement or manually enter the values.

Amplitude:	**1.10** [mm/s RMS]
Phase:	**+36.0** [°]
Speed:	**1500** [RPM]
Run 1:	**12.5** [mm/s RMS]
Effect:	**91.2** [%]
Bal.Quality:	**172**

RUN1   amplitude of RUN1

Effect   is the reduction of balancing in % (the 1.1mm/s is the 8.8% of 12.5 mm/s according to rounding)

Quality   balancing quality factor according ISO 1940 (mass of rotor and radius of balancing required)

Trim Screens

After RUN3 measurement you can continue (press down arrow) with the job when you are not satisfied with the results. These next steps do not required trial mass measurements already. After each measurement the next mass (masses) is recommended. The trim screens are very similar to screens described beyond.

Trim 1	
Angle:	**+37.4** [°]
Weight:	**2.19** [g]

The recommended trim mass is displayed. After the mounting press the down arrow.
The TRIM 1 screen appears. It is the same screen as RUN 3 screen. Run the measurement or enter the values.
Then the new results, effect and quality value are displayed.

| Amplitude:	**0.900** [mm/s RMS]
Phase:	**+59.0** [°]
Speed:	**1500** [RPM]
Run 1:	**12.5** [mm/s RMS]
Effect:	**92.8** [%]
Bal.Quality:	**141**

Press the down arrow and continue with TRIM 2 in same way as with TRIM 1. You can use how many trims you want. But when after trim the result is not better (or even is worse) the next trims has not sense.


Dual Plane Balancing

RUN 1 Screen

The screen is divided to two parts. The left part corresponds to plane 1 and right to plane 2.
If you use only one sensor (the **Inputs** parameter of the **Basic Settings** dialog is set as **single**), then only one part is active. The non-active part is grey and contains un-sharpened image. Mount the sensor to the active plane point and start the measurement. Corresponding bearing house is red colored. The results appear in the bottom. Use the right/left arrow button to move the active focus. Make the same for the second plane.
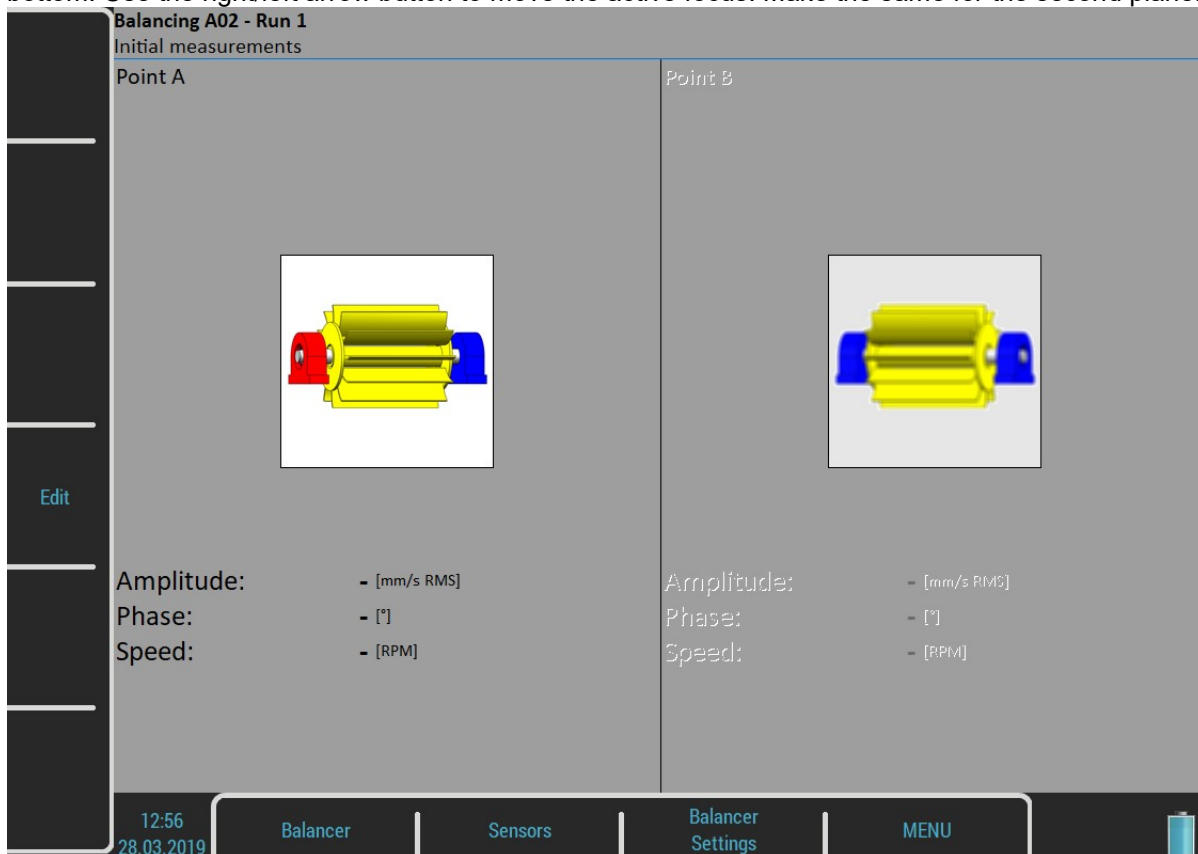
You make both plane measurements together at once with two sensors (the **Inputs** parameter of the **Basic Settings** dialog is set as **dual**). Then the screen should look like next picture.
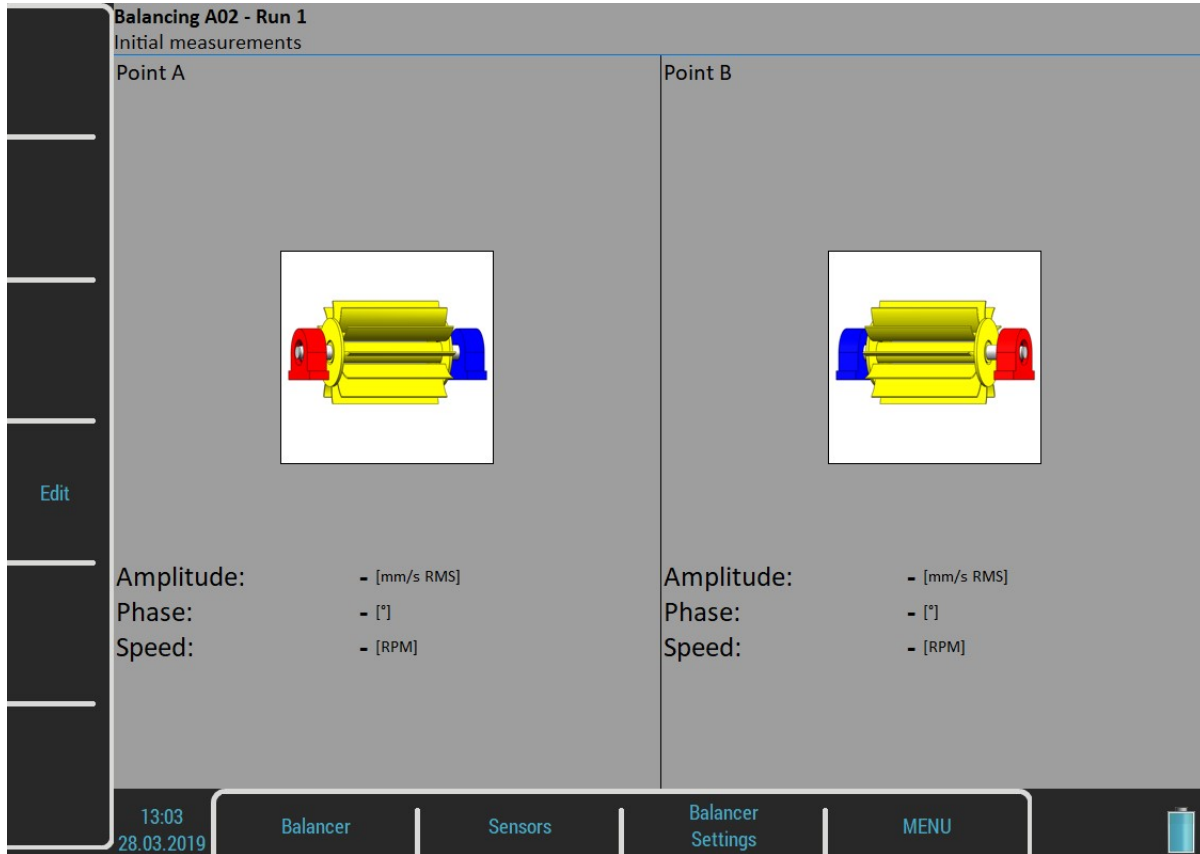
Press **START** button and measurement will be taken.
If you press the **Edit** button, then you can manually enter all values (balancing calculator function). Use the **Tab** for shift between values.

Amplitude:	**12.8** [mm/s RMS]	Amplitude:	**10.0** [mm/s RMS]
Phase:	**+35.0** [°]	Phase:	**+156.0** [°]
Speed:	**1500** [RPM]	Speed:	**1500** [RPM]

Use the **down arrow** to move to the next screen.

RUN 2 with trial mass in plane 1

It is similar like single plane balancing, only two trial masses must be subsequently mount to two planes.
If you know the dynamic factor, then you can enter all 4 values manually and you do not need measure the RUN2.

The red disc on the screen is displayed on the plane, to which should be just mount the trial mass.
If you defined the properties in **Rotor Settings**, then the recommended trial mass is displayed.

Point A
Trial: **75.0** [g]
Recommended: 64.0 [g]
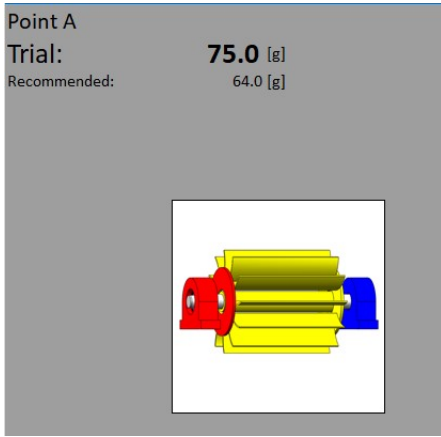
Use the **Enter Trial** button for re-entering of the trial mass, if it is required.

The corresponding plane for trial mass mounting is demonstrated by the red disc. After the measurement of plane 1 take the measurement on plane 2 (or take them at once, when you use 2 channels). The trial mass remain in the plane 1.
After measurements of both planes with trial mass on the plane 1 remove the trial mass from plane 1.
The RUN 2 with trial in plane 1 completed screen is in the next picture.

Press **down arrow**.

The trial mass can be left on the rotor or can be removed from the rotor after trial run. Before the RESULT screen you will be asked for that.
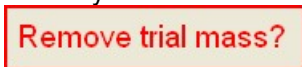
Select the answer.

RUN 2 with trial mass in plane 2

The same two measurements we have to take with trial mass on plane 2. The screen for those measurement looks similarly like previous screen. Only the red disc is in the plane 2. Press down arrow button after both measurements.
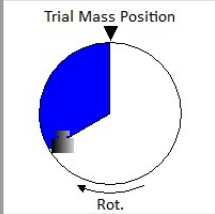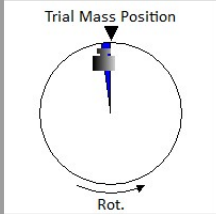
The RUN 2 completed screen is in the next picture.

Press **down arrow**.
You will be asked again about trial mass removal.

RUN 2 - Result Screen

Balancing A02 - Run 2
Weight and position of balancing mass

Plane 1	Plane 2
Trial mass removed	Trial mass removed

Angle:	**-120.1** [°]	Angle:	**+8.1** [°]
Weight:	**58.0** [g]	Weight:	**107** [g]

Mount the final masses to both planes. The angle is counted from trial mass position, which represents the 0 (zero) degrees. Each balancing mass can be split into two angles (blades) or into two blades as in one plane balancing.

RUN 3 Screen

When the masses are mounted then you want to check the job. The measurements on both planes are required.

Amplitude:	**3.50** [mm/s RMS]	Amplitude:	**4.30** [mm/s RMS]
Phase:	**+24.0** [°]	Phase:	**+65.0** [°]
Speed:	**1500** [RPM]	Speed:	**1500** [RPM]
Run 1:	**12.8** [mm/s RMS]	Run 1:	**10.0** [mm/s RMS]
Effect:	**72.7** [%]	Effect:	**57.0** [%]
Bal.Quality:	**30.8**	Bal.Quality:	**33.0**

The screen is in fact the same as screen for RUN 1 with additional information.

RUN1   original amplitude of RUN1

Effect   is the reduction of vibrations in %

Quality   balancing quality factor according ISO 1940 (mass of rotor and radius of balancing required)

Trim Screens

After RUN3 measurement you can continue with the job when you are not satisfied with the results. These next steps do not required trial mass measurements already. After each measurement the next masses are recommended. The trim screens are very similar to screens in single plane balancing.

Balancing Errors

Balancing errors and warnings can occur during the job.

The effect of trial weight is low

This message informs you that the effect of the trial mass is low.
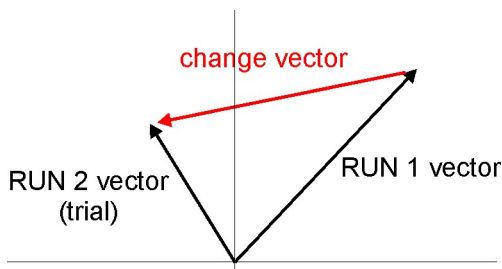
The percentual value is derived from ratio (amplitude of change vector/ amplitude of RUN1 vector).

The percentage value is derived from the ratio (amplitude of vector change/ amplitude of RUN 1 vector).

A warning is displayed when the change is less than 20% but bigger than 1%. You can continue with balancing after this warning and use these values.

An error is displayed when the change is less than 1%. You cannot continue with balancing after this error, because such a small change is not acceptable. You could get incorrect results.

Balancer Menu

Next functions are available for opened project. Press the **Balancer** button and the menu with additional functions appears.

Balancing Report

Create balancing report in rtf format (MS Word) and save it to VA5_DISC to a VA4balancer_protocol folder for PC downloading.

Balancing Vectors

Create a drawing of amplitude / phase vector development during the balancing process. The drawing is also included to the balancing report.
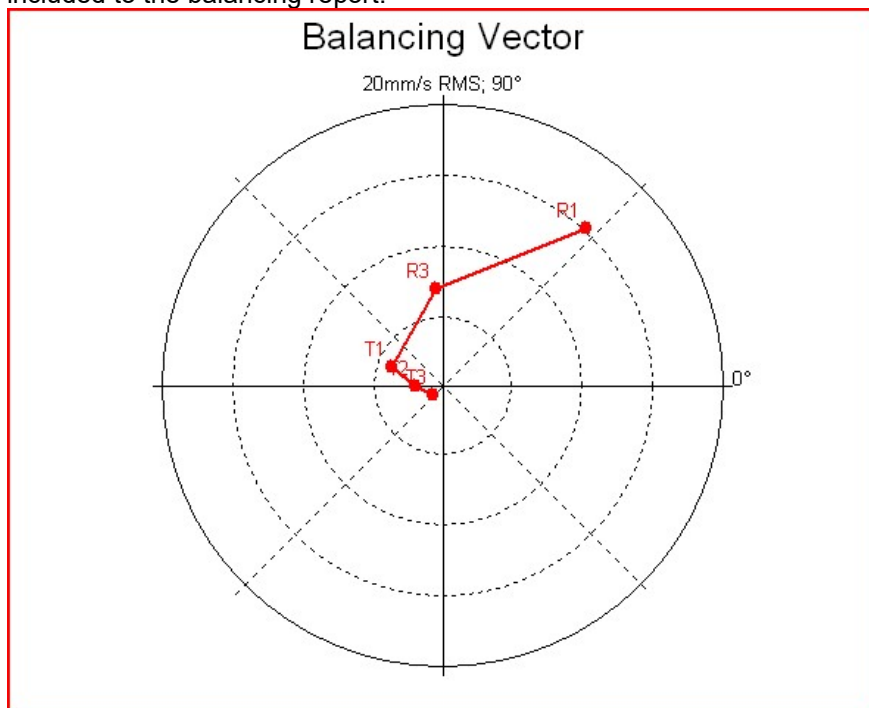
Description: R1-RUN1, R3-RUN3, T1-T3 -trims 1-3.

Total Mass

Display the total balancing mass. It is a vector sum of all masses mounted to the rotor (basic + all trims).

FASIT

The FASIT means the **FA**ult **S**ource **I**dentification **T**ool. This mode should help beginners to determine the machine condition.

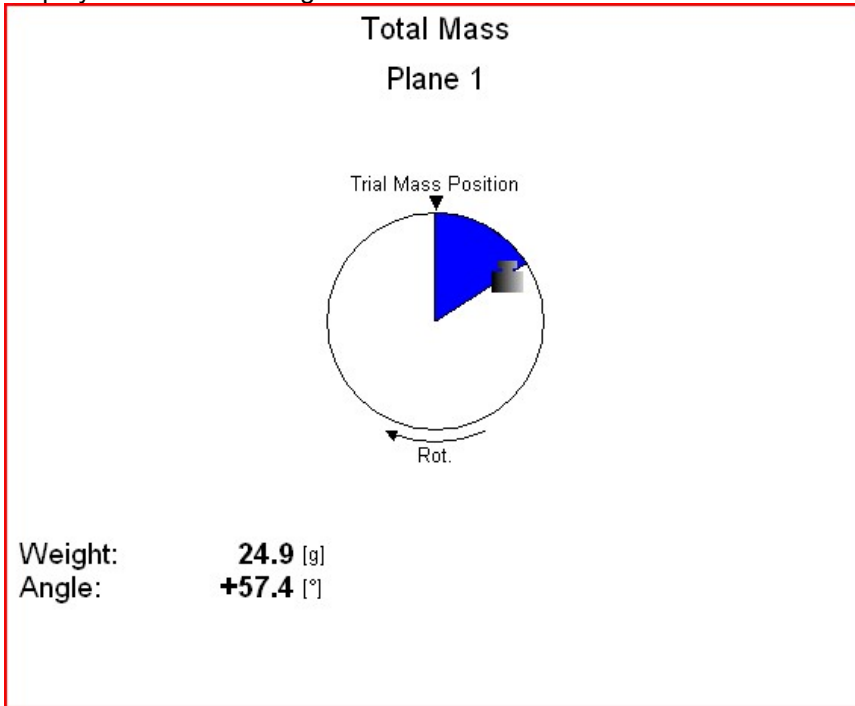## Setup

Select the FASIT module. The menu appears. The menu can be repeatedly opened by pressing **FASIT Settings** button.

FASIT Settings		
Channel	1	
Band fmin[Hz]	10	
	Save	

Channel

The number of the input channel

Band fmin [Hz]

The velocity measurement is taken in 10 – 1000 Hz range to detect the overall machine condition. This range is not convenient for low speed machines (bellow 10 Hz = 600 RPM). Therefore you can setup lower value of fmin.

Sensor Settings

In the **Sensors** menu setup the parameters of the chosen sensor. FASIT uses the measurement of acceleration or velocity from one channel. If you will use a velocity sensor, the bearing condition is not detected. For bearing condition detection the acceleration measurement is necessary.

Units

The displayed units can be set up under the **Global Settings**. Set up the unit of speed (Hz, RPM, CPS, CPM) in the **Speed Unit** item. The vibration values are displayed according to the setting of **Units** (**metric**, **imperial**). The units are set up as follows:
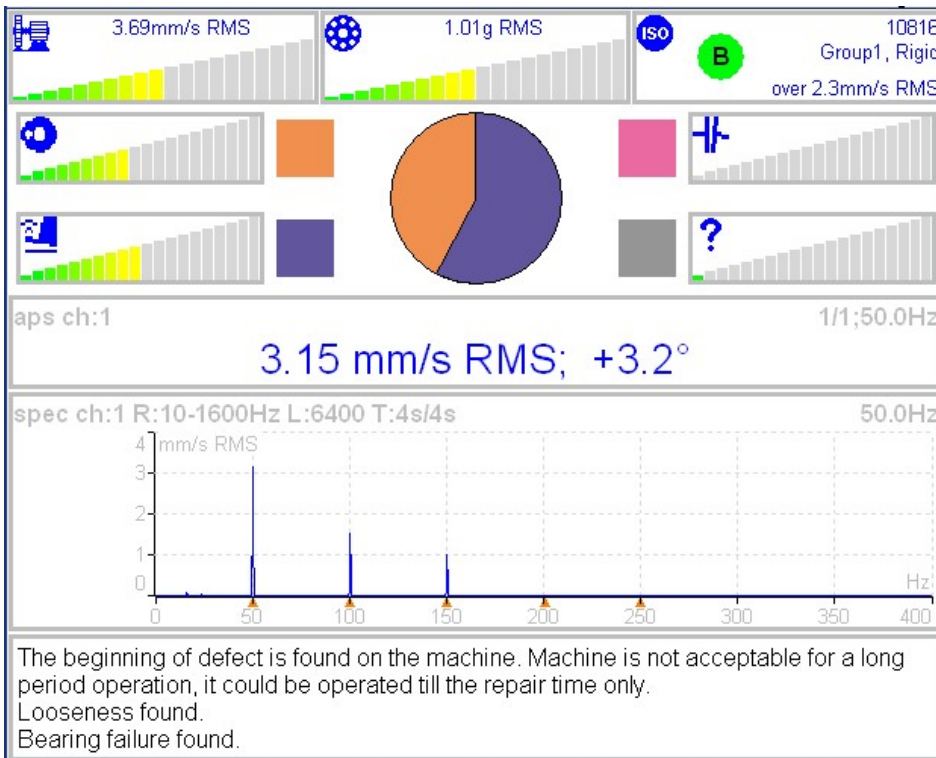
metric

acceleration - g
velocity - mm/s

imperial:

acceleration - g,
velocity – in/s

Measurement

Press the **Start** button to start the measurement. The speed needs to be known for the processing. The speed detection is described in the **Speed Detection** chapter.

FASIT screen

Each horizontal bar displays the severity of individual item. It starts from green color on the left to the red on the right.

The machine condition bar, see the Machine limits description below.

The bearing condition bar, see the Bearings limits description below.

The Unbalance severity level.

The Looseness severity level.

The Misalignment severity level,

The severity level of a different type of a fault.

ISO 10816 limits (see the ISO overall measurements), the color of circle is related to the machine condition class A,B,C,D (the green for A or B, the orange for C and the red for D). Also the information about machine group and foundation are displayed. The limit which is exceeding is also displayed at the bottom.

The pie chart displays the percentages of severity of individual faults. The colors in pie chart correspond to the colors of the rectangle next to the individual graphs.

The 1x amp+phase value and velocity spectrum with speed and harmonics (marked by red triangles) are displayed in the middle of screen.
Note: the 1x amp+phase value is displayed only when the speed is measured by a tacho probe.

The condition report and advises are in the bottom.

Vibration Limits

Because there are a lot of different types of machines it is impossible to determine the critical limits of vibrations for wide range of machines. Its reliability would be low then. It could happen, you will repair machine, which do not require it. The standards should be rather determined for a narrow range of machines.
The instrument uses the Adash limit values. These limits are not rewritten from any existing standard. It's a result of 20 years of Adash engineering team experiences. It's difficult to invent critical value definition which would be simple (that means not many parameters such as speed, power, bearing type, machine type and so on) and reliable.

On the figures below is clear how we derived limit values. Three levels of machine condition are defined: GOOD, ALERT (Machines lays in this range are not acceptable for a long period operation, they could be operated till time when could be repaired) and DANGER (Vibration values in this range are considered as very dangerous and they can cause a damage of the machine). The corresponding colors are taken from traffic semaphore - green, amber and red.

All limit values are related to the speed value. The low speed machine should generate lower vibration then higher speed machine.

In the graphs area you found three particular areas. The GOOD condition is the space up to the yellow line that means operation without restriction. The space above yellow but under red line is an ALERT condition. Possible to operate the machine but have to be more checked. It's necessary to determine the source of worse condition and plan repair (for instance change the bearing) or maintenance (balancing, alignment). The space above red line is a DANGER condition and the machine should not be operated.

First figure contains the values for overall machine condition and you search unbalance, misalignment, and mechanical looseness above all. They are called "overall" because we can measure them on most of the measuring points. Second figure contains the limit values of a roller bearing condition. This condition is local and can be measured only on appropriate bearing house.

Work with figures is simple. It's necessary to know the speed. Instrument determines it automatically or user can enter it manually. On the bottom horizontal axis you should find the point which corresponds with speed. Above this point you will find an intersection with orange and red graph. Projections to the vertical axis will determine limit values for amber or red state. If the measured value is lower than amber the condition is GOOD – green. If the value is above amber but under red then the condition is ALERT – amber. If the value is higher then red graph then the condition is DANGER – red.

Machine Limits

The machine limits are used for velocity RMS value in 10-1000Hz frequency range. This value helps to define the complete health of machine.

For further technical and contact information visit www.adash.com or email: info@adash.com
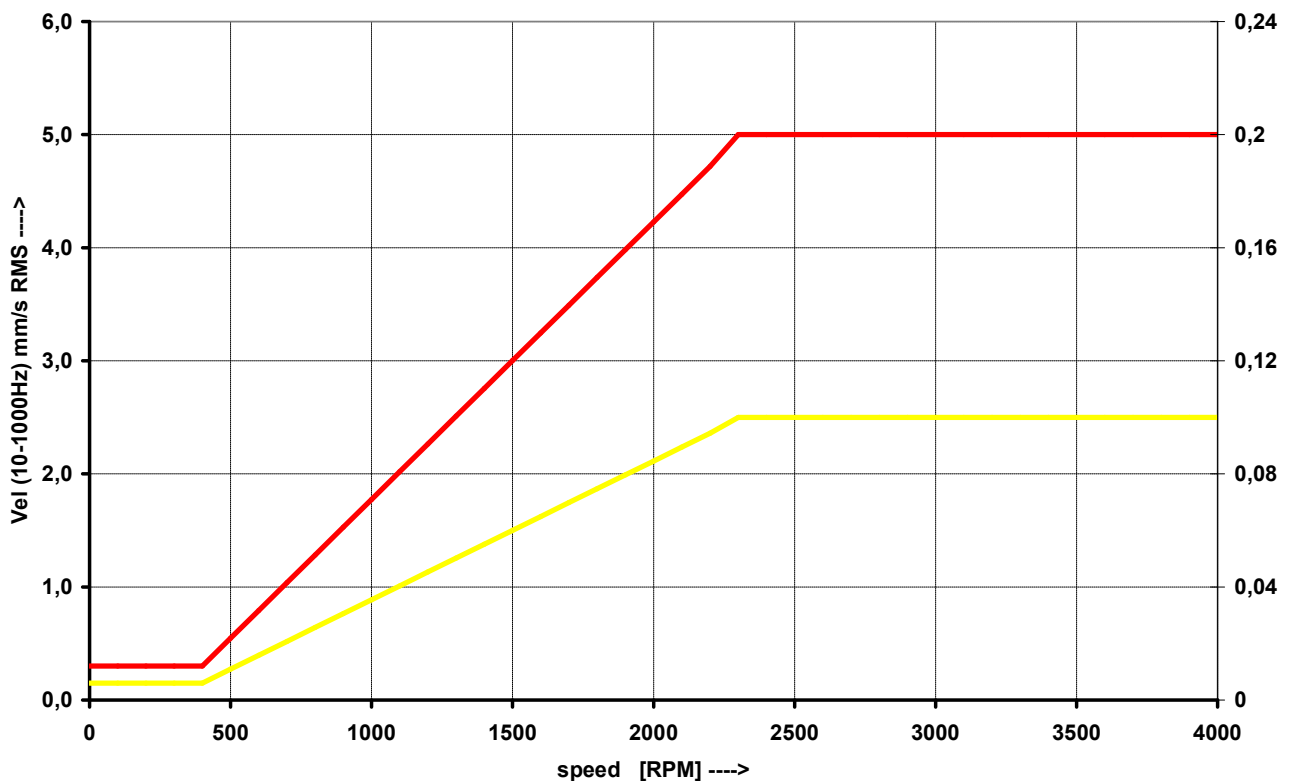
Bearing Limits

The roller bearing limits are used for acceleration RMS value in 500-25600Hz frequency range.
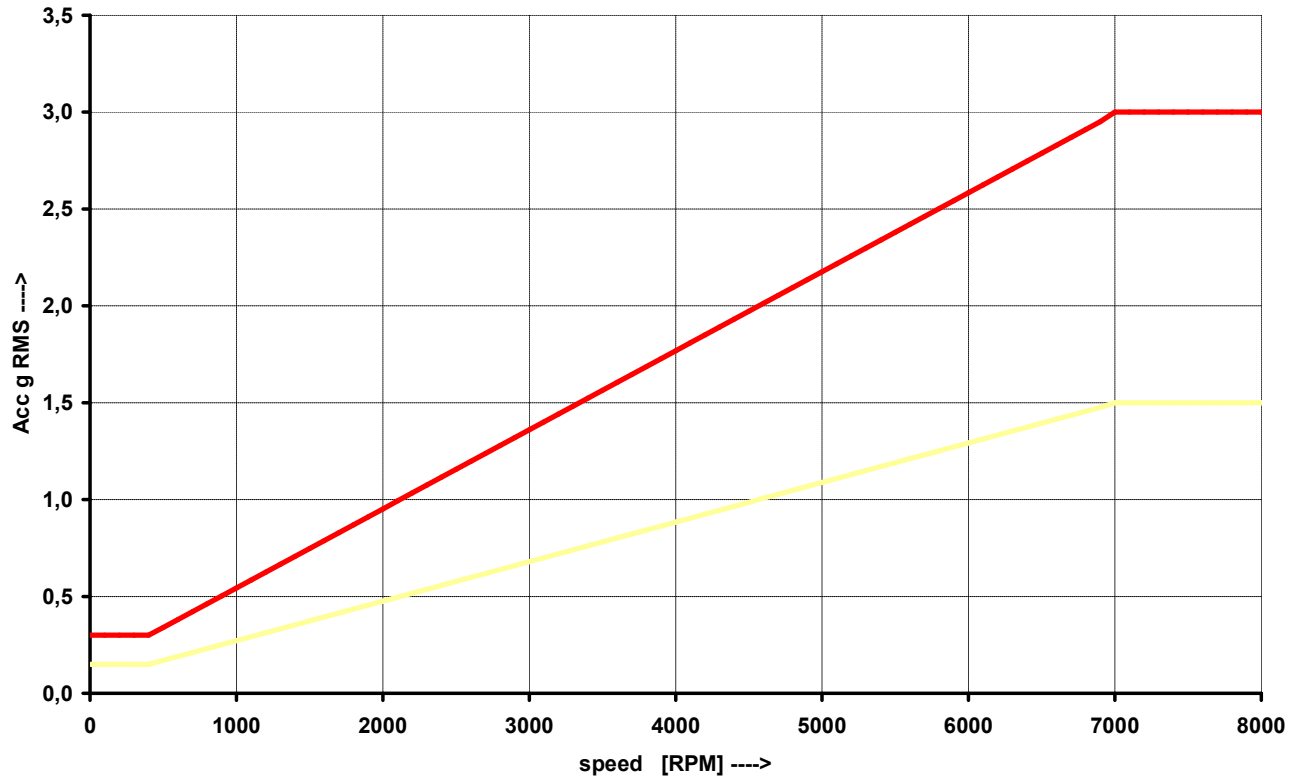
Unbalance, Misalignment and Looseness

The FASIT module also advises you, what the most probable source of vibration is. The three individual bars are displayed.

Stethoscope

This module enables listening of vibrations. Use the standard headphones and connect them to the audio output on top panel.

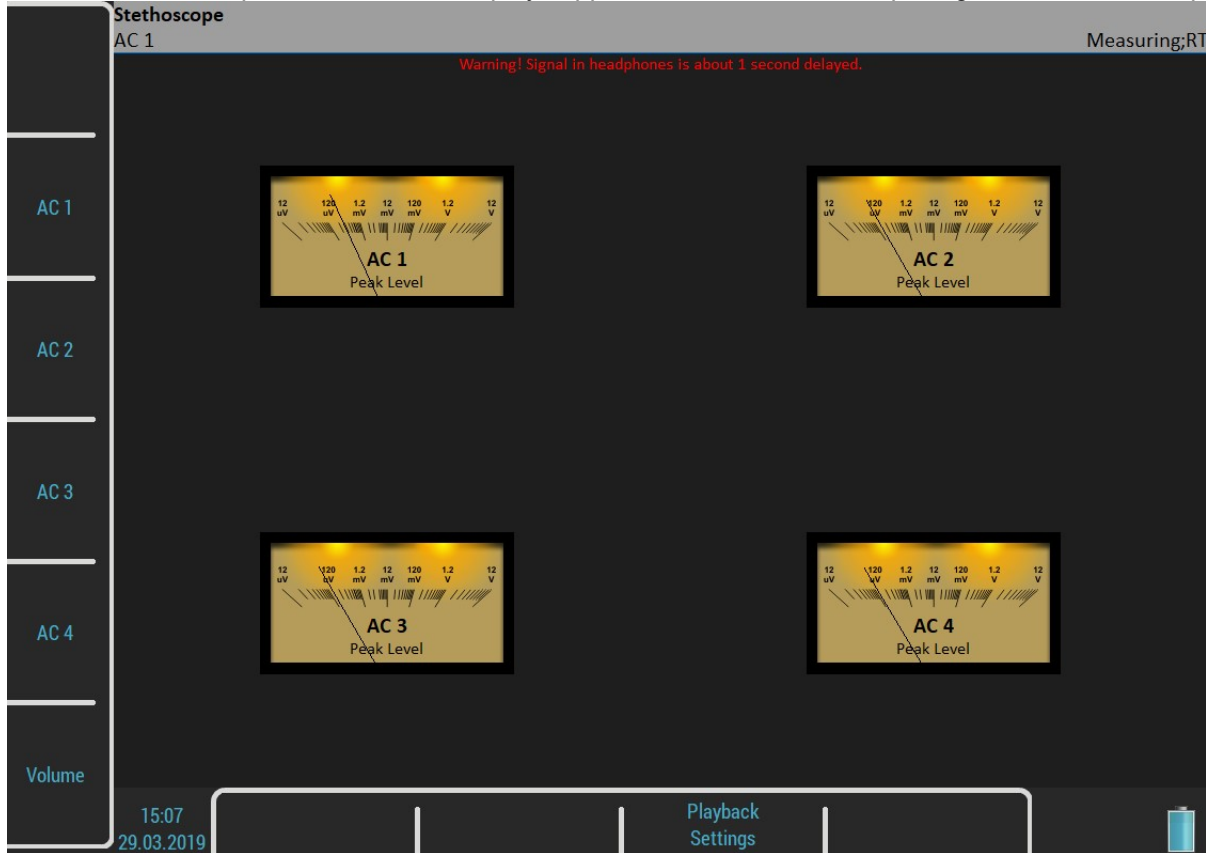Enter the Stethoscope module. The 4 displays appear. Push **Start**. Each input signal level will be displayed.

The TRUE PEAK level is displayed. By buttons on the left side you choose the channel for listening. The selected channel is written in the status bar.

The **Volume** button changes the buttons mode to volume regulation.

The delay of audio output

Because all signal conditioning is digitally arranged, the delay of signal appears. Typically the delay is 1 sec. You can clearly test to knock to the sensor and you will hear this knock after the delay time.

Playback Settings

For playback settings push **Playback Settings** button.
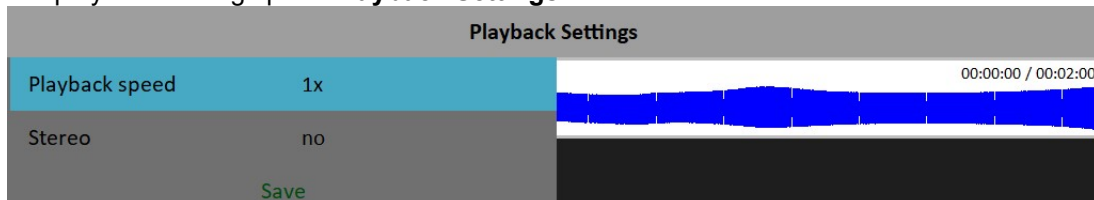
Playback speed

This function is available only when a record is listened. It speeds up (bigger then 1) or slows down (lesser then 1) the playback speed.

For further technical and contact information visit www.adash.com or email: info@adash.com

Stereo

yes, <u>no</u>

It enables to define two channels for playback, one channel for the right headphone and second for the left one. The current setting of left/right output is displayed on status line on the left top (**L: AC 1, R: AC 2**). The **Left** note in the bottom left corner says that you setup the left channel in this moment. Press the **AC1** – **AC4** to change the number of the left channel. Press the **Left/Right** button and the **Left** note changes to **Right**. Then the **AC1** – **AC4** buttons enable to setup the number of the right channel.

For further technical and contact information visit www.adash.com or email: info@adash.com

Lubri - the greasing control

There is an increasing demand for an instrument which is able to simply check lubrication of rolling bearings and also the condition of these bearings.

Every machine does have in its specifications how much lubricant every one of its bearings uses in a specific amount of operational hours. A task of each technician or engineer is to regularly check all the lubricated points and maintain lubricant at sufficient levels. Either state, lack or excess of lubricant are harmful for a rolling element bearing. The result is always excessive stress on the bearing and consequently excessive wear. Every lubricating point has a lubrication time interval (in hours of service) and also an amount of lubricant that needs to be replenished. This manner of lubrication control has a significant disadvantage.

The amount of lubricant that any bearing actually needs for proper operation changes during its lifetime. Longer lubricating intervals in the case of a new machine are usually not sufficient for a machine after several years of operation.

It is clear that it would be useful to be able to determine a state of a bearing somehow and replenish only as much lubricant as is actually needed. Controlled lubrication increases bearing service life and lowers costs for lubrication and repairs.

The main use of this Lubri module is in the lubrication replenishment process. During this process the mode measures the actual lubrication condition of a bearing and tells the operator when the amount of lubricant is ideal. This way it is ensured that we do not under or over lubricate.

This mode exactly determines the ideal amount of lubricant needed.

As a result, your machines will be maintained in their best lubrication condition. The Lubri mode enables you to make the whole lubricating process simpler and it normally reduces the consumption of very expensive lubricants.

## Two Possible Ways How to Measure

A standard accelerometer (sensitivity 100mV/g and ICP power) mounted on a bearing housing is used to measure lubrication.

You have two possibilities how to do this:

1 The sensor is mounted on a lubrication head.
This option enables a quick service since the lubrication head is transferred together with the sensor. The disadvantage is a partial loss of sensitivity, since the lubrication head attenuates the measured signal.
2 The sensor is mounted next to lubrication point on a bearing housing (measurement pad recommended).
This option enables a perfect measurement. The disadvantage is a longer preparation, since the lubrication head and sensor must be mounted separately.
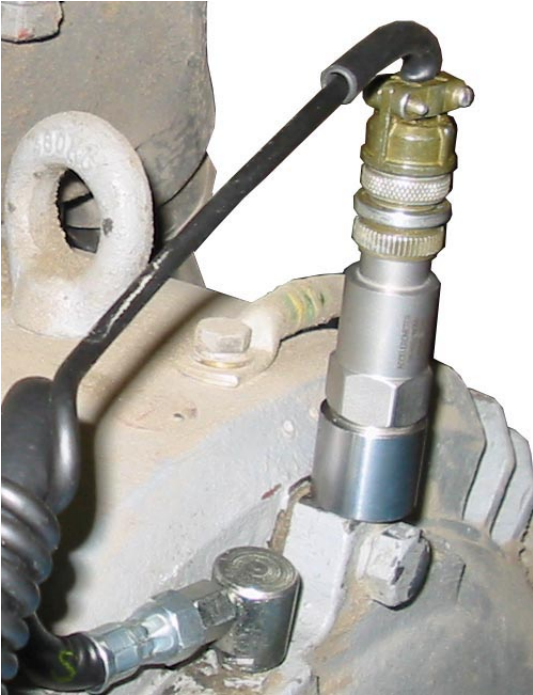
Sensor mounted near to lubrication point

If vibration diagnostic measurements are performed on a machine, then a measurement pad is already mounted. This pad can be used also for lubrication measurements.

Procedure

1. Mount the sensor near to the bearing. Prepare the greasing gun for use.

2. Select the **Lubri** module and the input channel, which will be used for measurement. Push the **Start** button. Then the instrument will automatically measure an actual lubrication state.
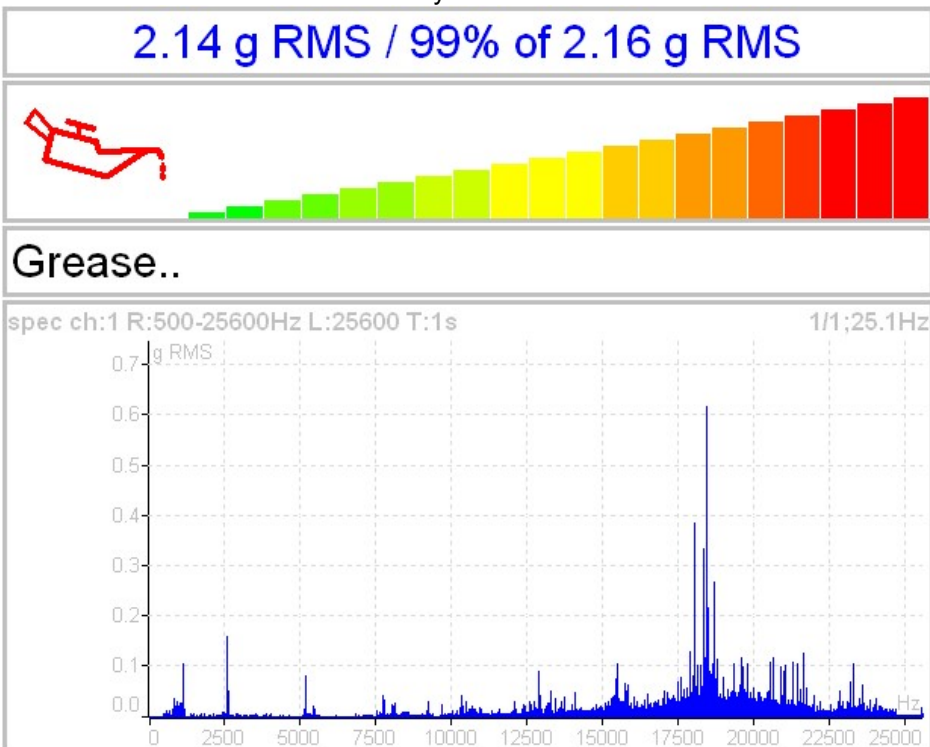

In the beginning, the instrument takes the initial g RMS value in the frequency band 500 - 25600 Hz.
The first line contains the actual g RMS value (re-triggered) and the proportion to initial value in %. Below first line is horizontal bar, which always reaches a maximum level after procedure start.

You need to slowly start adding lubricant, while monitoring the height of the column on the display. Usually there is not much going on in the beginning, which means that the lubricant is pushed toward the bearing, however it is not there yet. At the moment when the lubricant reaches the bearing, the column decreases (usually its red part disappears and only the green part remains). You need to add a little more lubricant, and if there is no further decrease, you end the lubrication process.

If, at the beginning of measurement, value of vibrations and oilcan are green, then the signal from a bearing is very low. We have either new or a very well greased bearing.
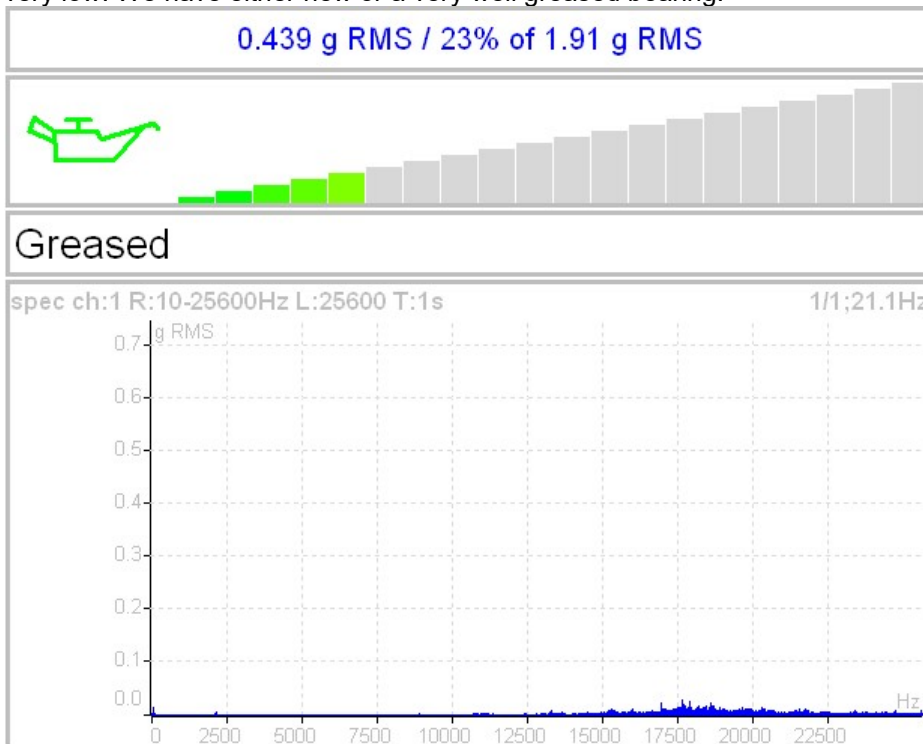
The recommendations are also displayed below the bar.

The acceleration spectrum is displayed in the bottom. You can look at the spectrum changes during the procedure. You can find more detailed information about lubrication in the A4910-Lubri manual.

Octave Analysis

The **Octave Analysis** module is a subset of the **Analyzer** module. It enables only sound measurements. Unlike the Analyzer, the Octave analysis enables the exponential averaging.

Measurement settings

Edit Measurement	
Type	octave spectrum single
All Channels	no
Channel	1
Unit	mm/s
Resolution	1/1
Frequency Range	high
Frequency Weighting	none
Averaging	linear
Avg	off total t=0.125s
Save	

Type

octave spectrum

sound level
The sound pressure level in dB is defined as $20\log_{10}(p_{RMS}/p_0)$, p_0=0,00002 Pa (p is sound pressure)

equivalent sound level
When during time interval the sound level changes, then the equivalent sound level is the average sound level of the whole interval.

Channel

1 - 4

Unit

The unit of measurement (has to be compatible with sensor settings)

Resolution

1/1, 1/3, 1/12, 1/24

Frequency Range

high   16 - 16000 Hz for noise measurements (central octave frequencies)
low   1 - 1000 Hz for vibrations

Frequency Weighting

none, A, B, C, D
The human ear has the subjective characteristics known as the loudness. It is the function of sound intensity and frequency. For example the 20Hz pure tone with sound level 20dB would be clearly audible. The 100Hz

with the same level would not be heard, it lies below the threshold of hearing. The unit of loudness is **phon**. The loudness level in phons of any sound is defined as being numerically equal to the intensity level in dB of a 1000Hz tone. The purpose of weighting is to make the readings correspond as closely as possible to the loudness level. Historically four weighting were defined:

        A   used for loudness levels below 55 phons.
        B   used for loudness levels between 55 and 85 phons.
        C   used for loudness levels over 85 phons.
        D   used especially for aircraft noise.

However today is A-weighting frequently specified for measurements irrespective of level.

Averaging

linear
The standard arithmetic mean for every line

peak hold
The maximum value during the measurement for every line
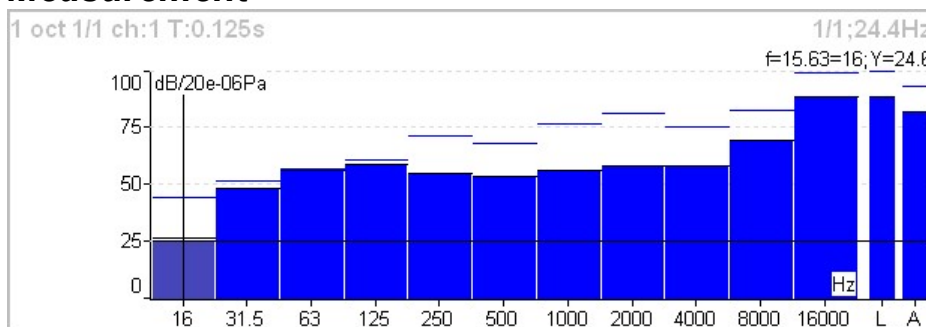
exponential
The continuous measurement where the older spectra have less weighting then the newer
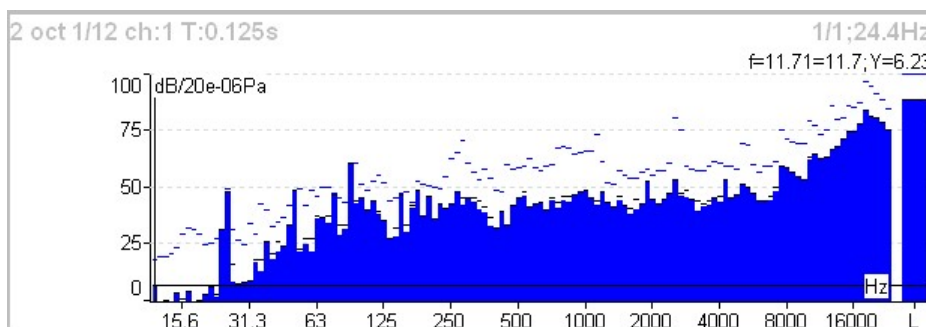
Avg

Number of averages

Measurement

Each spectrum is combined with two bars at the right side. The total sound level **L** and the used weighting level **A-D** are displayed. The line over each line is the maximum peak reached during the measurement.

For each line is used also the short time peak memory. It looks like snowing.

Octave Analysis Algorithm

Octave analysis uses set of digital filters. Each filter has designated a center frequency and bandwidth. Filters are designed according to ANSI S1.11:2004 and IEC1260:1995.

Bump Test

It enables to find the resonance frequency of machine body. Set the used channel and the number of hits for averaging.

Test contains two parts. The level of amplitude trigger is found in the first part. The response spectrum is developed in the second part.

Settings

Settings		
Channel	1	
Hits	4	
	Save	

Channel

Channel with the accelerometer

Hits

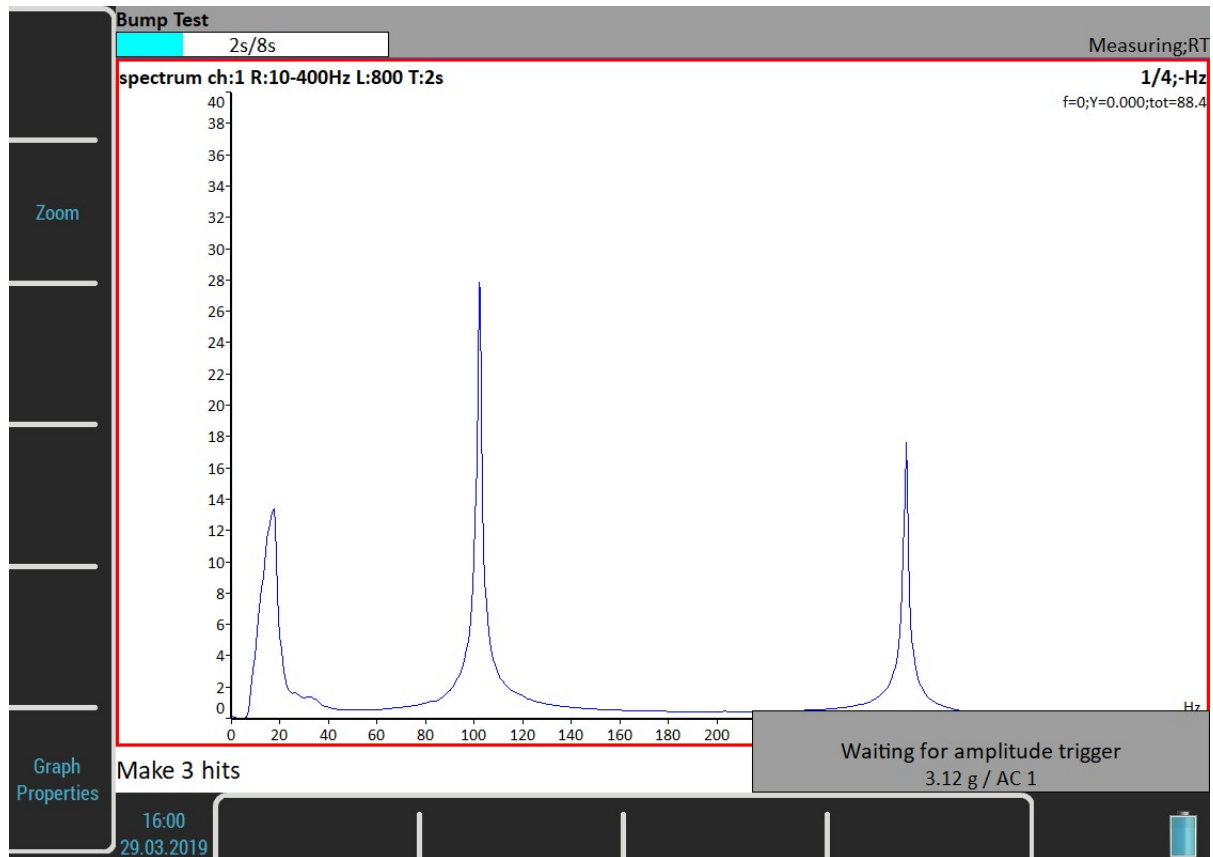Number of hits

Amplitude Trigger

In the first part of test we need to detect the correct value for triggering. The system set it automatically. Make the hit and look the moving of the hand on display. Make all hits with the same force. More then one hit is recommended (3-4). Push **Stop** to finish it.

For further technical and contact information visit www.adash.com or email: info@adash.com
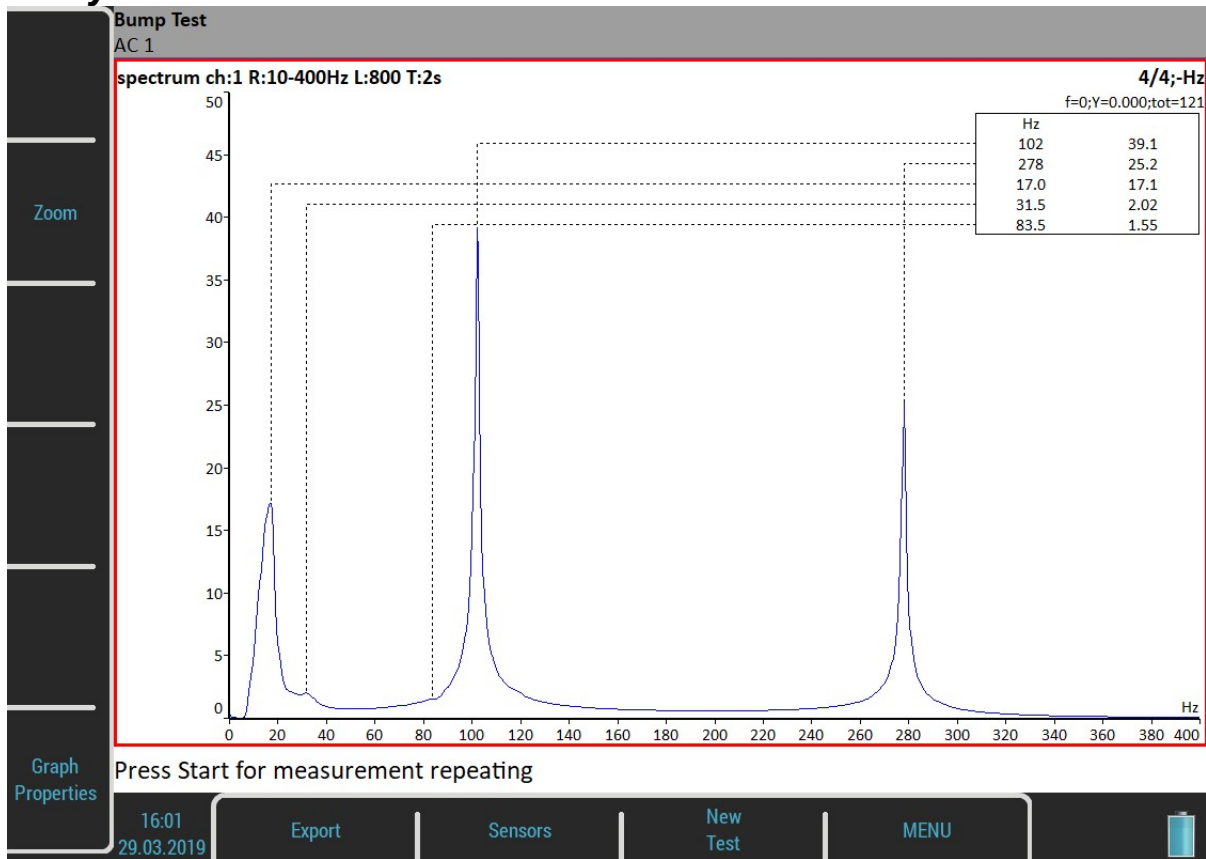
Response Spectrum

In part 2 continue with hits. The spectrum is displayed after first hit and the the average is used for next hits. Look at the top right corner and make the hit only when the message **Waiting for trigger** is displayed. You can stop the test anytime by **Stop** button. Spectrum graph has the same properties like in Analyser mode.

Note! A 10Hz high pass filter is used during signal processing. Frequencies bellow this value are removed.

For further technical and contact information visit www.adash.com or email: info@adash.com

Using of the **Graph Properties / Peaks list** helps you to detect required frequencies.

Buttons

Start

Repeat part 2 (the same trigger level)

New test

Start new test including the trigger level initialization.

Export

Export spectrum to **VA5_DISC** an analyzer project. You will be asked for entering its name. This project can be imported in DDS as a usual analyzer project.

ADS

The Adash Deflection Shapes modul enables to measure operating deflection shapes of the machine.

ADS project

The project must be created on the computer. The ADS software enables to create the geometry of the machine (points, lines and directions).

Project Import to VA5

Copy the project file (ads extension) to VA5_DISC (to the root or VA4ads folder). The project will be moved to the VA5 memory after entering the **ADS** module. The file on the VA5_DISC will be deleted.

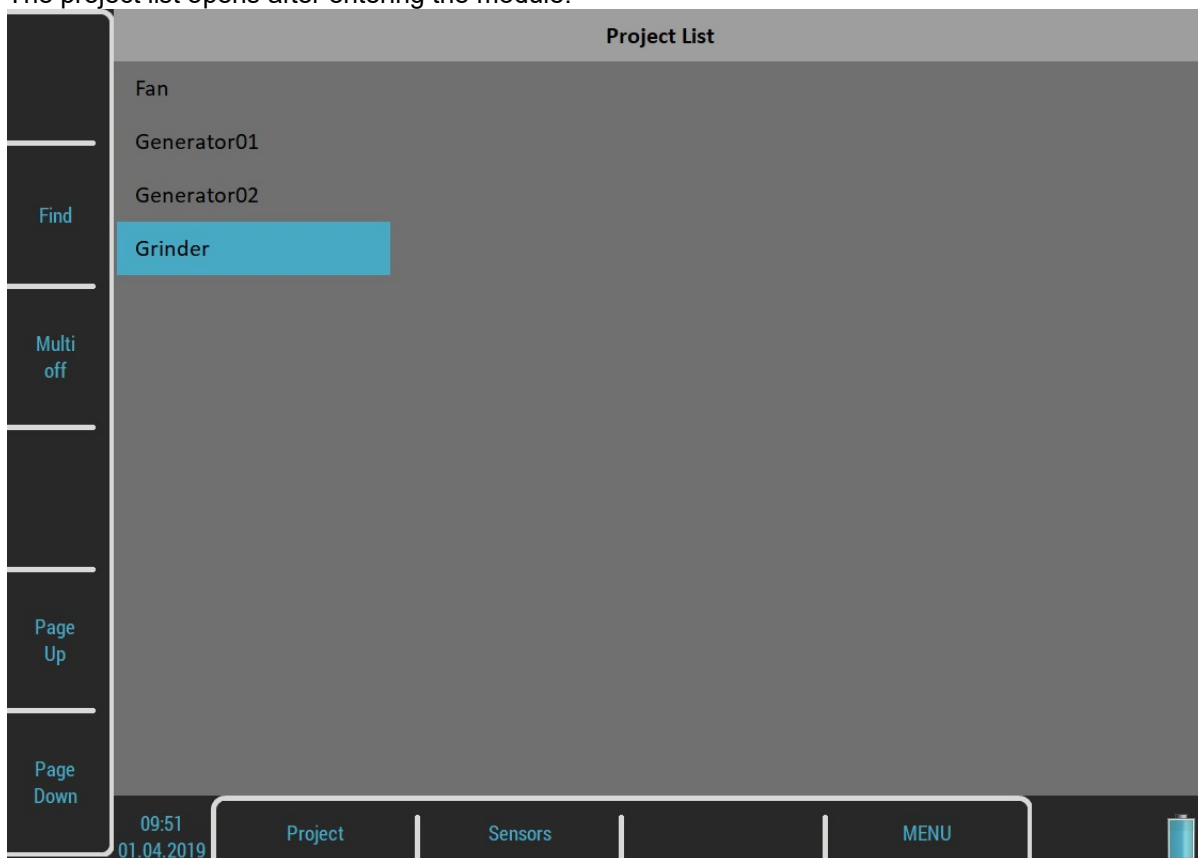Importing from VA5_DISC...

```
0%
```
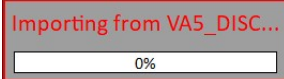
Rewriting of geometry

Usually the user creates the simple geometry firstly and takes the measurements. After that first test he changes the geometry (adds next points, lines and directions). When the project is imported to the instrument again then only the geometry file will be rewritten. The already taken data will not be deleted.

Project List

The project list opens after entering the module.

	Project List
Fan	
Generator01	
Generator02	
Grinder	

Find

Multi off

Page Up

Page Down

09:51 01.04.2019   Project   Sensors   MENU

Project Menu

Press the **Project** button to open a menu. A **Create** item misses here. You can create an **ADS** project only by importing geometry from computer (see above).

Copy

Copy selected project to new project.

Rename

Rename selected project.

Delete

Delete selected project.

Clear Data

All readings (measurements) will be deleted.

Export Data

Export of readings (measurements) to VA5_DISC. File with **dsd** extension will be saved to VA4ads folder. It is prepared for download to the computer now.

Export Project

Export both of data (readings and geometry) to VA5_DISC. It could be useful when user wants to use Virtual Unit software for next readings.

ADS Settings

Select required project in the project list and open it by pressing the **Ok** button or by tapping the touch screen. The settings of parameters are required when the project is opened first time.

For further technical and contact information visit www.adash.com or email: info@adash.com

Measurement Definition

The 1x amp+phase, orders and frf are available measurement for ADS. All parameters are the same as in the **Analyser** mode.

You can change the settings any time later, use the **ADS Settings** button.

The change of measurement parameters requires deleting all saved readings, because they are not compatible with old definition.

Reference Direction

This parameter is available only for frf measurement with two accelerometers. One reference sensor is mounted to one point (one direction) on the machine and is on that place all the time. The second sensor is moved sequentially to all other directions.

The change of Reference Direction number requires deleting all saved readings, because they are not compatible with new reference direction number.

Frequency for Animation

This frequency will be used for animation on VA5 screen. It works only for frf measurement. In case of 1x amp+phase or orders the speed frequency (1X) will be used.

Views

Three types of screen view are available. Use the **View** button to switch it.
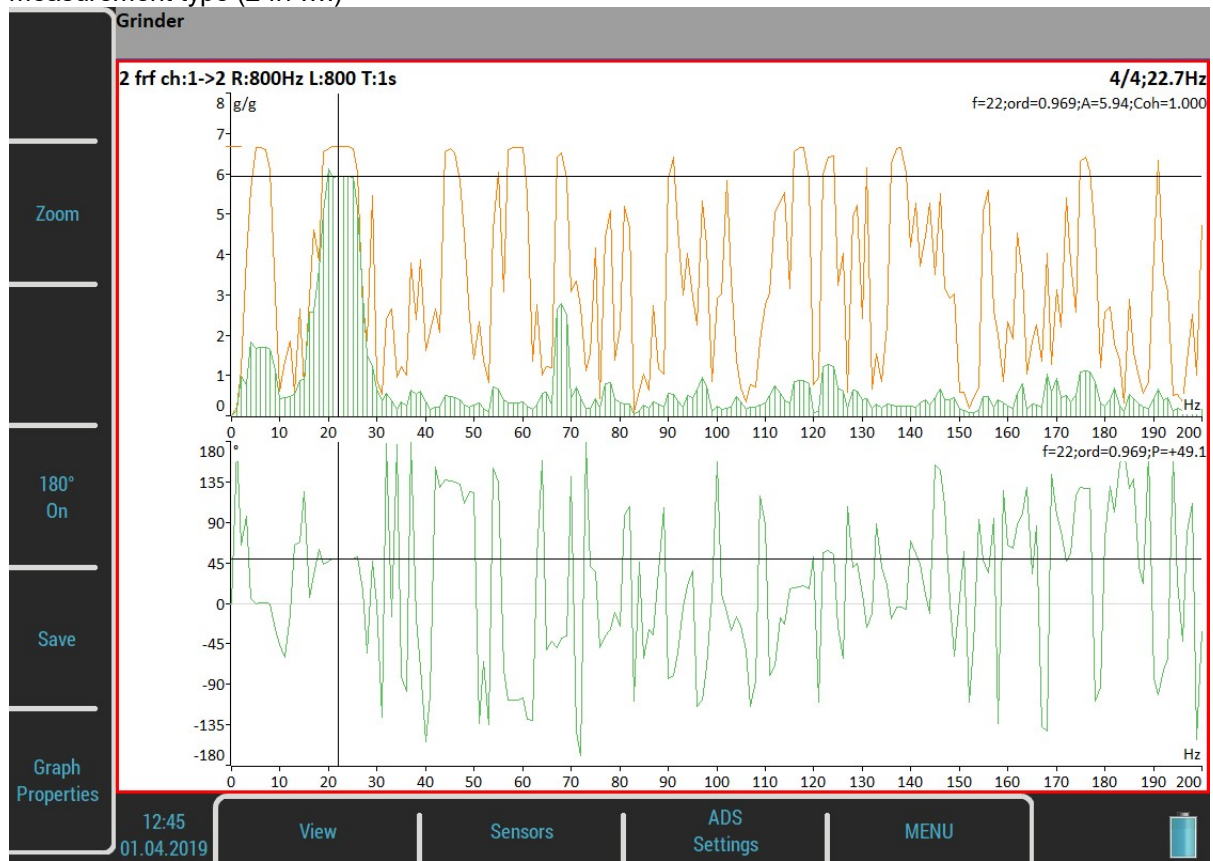
Machine View

The geometry is displayed. Directions contain numbers. The reference direction is marked as **R**.
Just selected point contains a small circle. Just selected direction is drawn by different color.

*For further technical and contact information visit www.adash.com or email: info@adash.com*
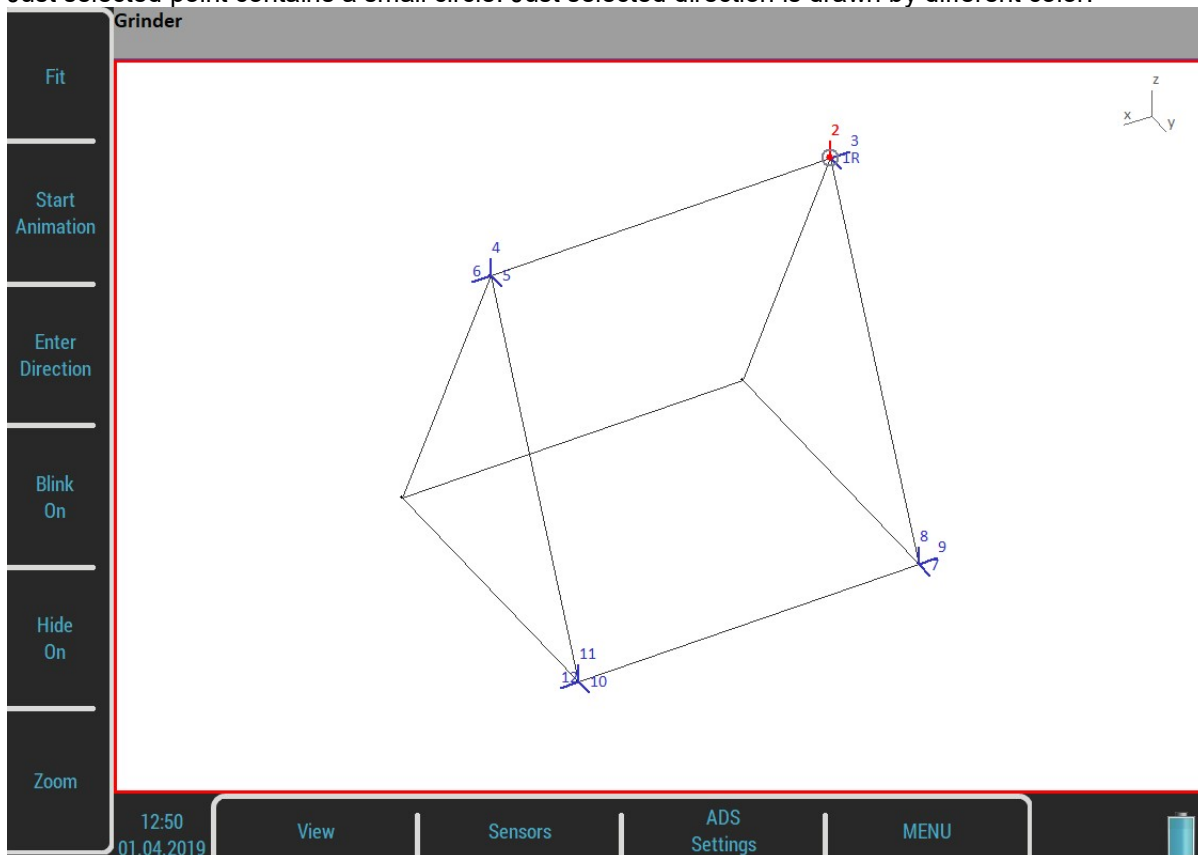
Measurement View

A standard graph with measurement is displayed. The number of selected direction is displayed in front of measurement type (**2** frf ….)

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Machine+Measurement View

Both previous screens are displayed together. The user can select one of them (the red border) with the **View** button and to work with it. Different buttons are displayed for each view.
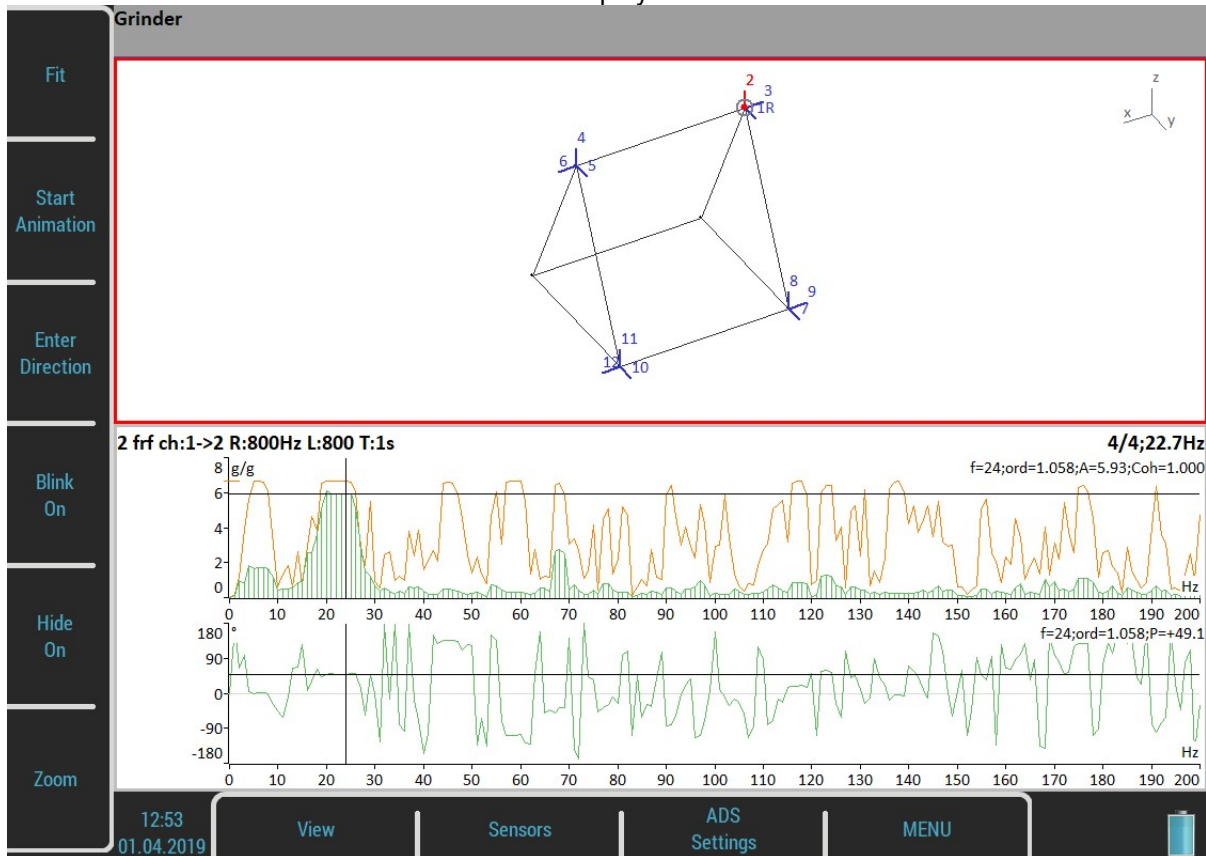
Automatic change of view

When the measurement starts, the machine view is replaced by measurement view.

Buttons for Machine View

Fit

Auto-zoom of machine in window

Start/Stop Animation

Run or stop the animation.

Enter Direction

Manually enter the direction number.

Blink on/Blink off

The directions which are not measured yet can blink.

Hide on/Hide off

The directions which are measured yet can be hidden.

Zoom

Switch buttons to the **Zoom** mode. Press the **Tab** or **Backspace** button to return the initial mode.

Left / Right Arrow - Direction

Change the direction number (on the selected point). The new direction for measurement can be manually entered by the **Enter Direction** button.

Up / Down Arrow - Point

Move the point selection (blinking circle). When the new selection is confirmed by OK, then the selected direction is also moved to that point.

Start

Start new measurement.

Buttons for Measurement View

Zoom

Switch buttons to the **Zoom** mode. Press the **Tab** or **Backspace** button to return the initial mode.

Graph Properties

Open the **Graph Properties** dialog which is described in the **Analyzer** module.

180° on/180°off

Sometimes it is not possible to mount the sensor to direction which is defined in geometry. Usually in such case it is possible to mount the sensor in opposite direction. Then use this button and change the phase about 180 degrees.

Save

Save the measurement (reading).
Direction number, amplitude, phase on selected speed are displayed in the status bar.

Grinder
2: A = 5.69 g 0-P, P = +45.0°, f = 50 Hz

Ultrasound

Introduction
We would like to explain a few terms in the beginning of this chapter.
Higher frequency energy above 20 kHz is best detected with an ultrasonic sensor. Most useful information is found between 30 and 50 kHz. The Adash ultrasonic module enables monitoring ultrasonic energy.

Ultrasound utilizes a solid, liquid or gas to transmit (will not exist in a vacuum), and is a very directional and short waveform. It has several things in common with the vibration, for instance the ability to detect the ultrasound energy requires the sensor to be focused in the direction of the waveforms.

Field applications for airborne ultrasound detection:
- Consider the wave energy is easily reflected and attenuated.
- When looking to detect airborne ultrasound energy a rule of half distance twice amplitude is a good thing to consider, this is called the "inverse rule".
- Remember airborne ultrasound is easily reflected, when detecting a leak, you should turn in the other direction to determine if the sound is coming from behind you.
- Use shields such as cardboard or to isolate the potential defect from other sources.

For airborne ultrasound the instrument microphone attachment will detect:
- Air leaks
- Vacuum leaks
- Electrical Arcing
- Electrical Corona
- Tightness testing where a signal generator is located within a sealed unit, then by scanning the sealed areas from the outside leaks can be detected.

The probe attachment that enables direct transmission ultrasound will detect:
- Early signs of poor lubrication in anti-friction roller bearings
- Impacting noise from defects in roller bearings including bearings with shaft speeds under 100 rpm.
- Steam trap leakage and failures
- Gearbox defects
- Valve leakage
- Actuator malfunctions

Sensor Setting
The ultrasound measurement is available only on AC1. You need the ultrasound microphone for that. When you run the module, then the sensor is changed automatically to Pascal sensor.

Used Sensor
on AC1: 200 mV / Pa, ICP off

Use the **Sensors / AC1** to change the sensitivity if needed. The new setting is saved and used in next run. The original sensor is set, when you leave the module.

Settings
You can set the scale of the displayed bar graph. Use **Menu / Ultrasound Settings.** Enter required scale.

Ultrasound Settings	
Scale - minimum	0
Scale - maximum	120
Save	

Measurement
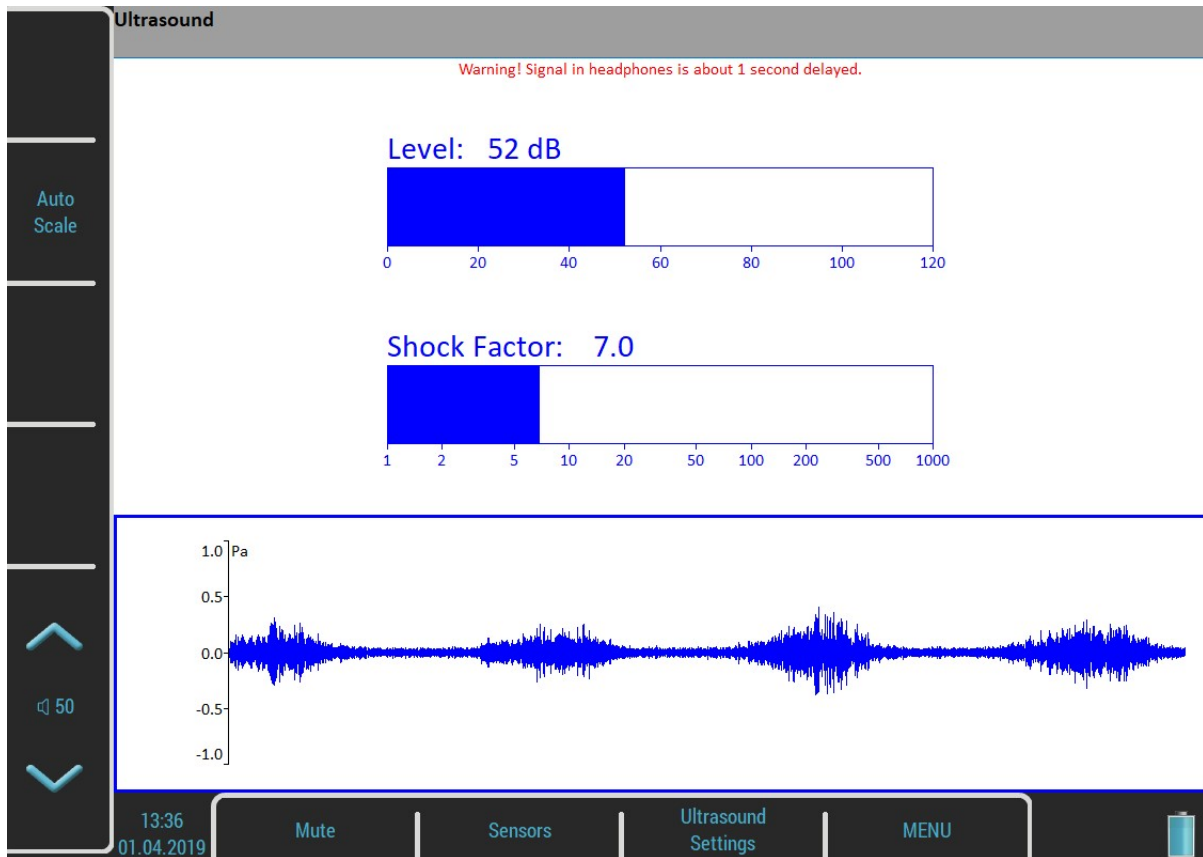
Press **Start** button. Two values are displayed, the **Level** of sound in dB and **Shock Factor**. The Shock factor is defined as Peak value divided by RMS value. It means value 1.4 for pure sine. Higher value means that transient shock events are in the sound signal.

The time waveform is displayed at the bottom of the screen. Use **Auto Scale** button to fit the scale of the graph.

Press **Stop** to stop the reading.

Listening

The ultrasound is demodulated to the frequencies around 1kHz and you can hear it in headphones. Use the volume buttons to set the correct level.

Important note! The signal in headphones is about 1 second delayed. It is because of digital processing, which takes this time.

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Camera

The VA5 instrument is equipped with the optical camera. The picture from the camera is automatically on the screen a few seconds after opening the module.

Buttons

Pause / Run

Freeze a picture from the camera and then run it again.

Capture

Take a picture. All images are saved to the **images** folder on the VA5_DISC.

Gallery

Open a **Gallery** so as you can watch taken pictures.

IR Camera

The IR camera can be connected to the micro USB slot on the instrument's top panel. The IR camera is not a part of the standard VA5 instrument set. You can order it at your vendor.
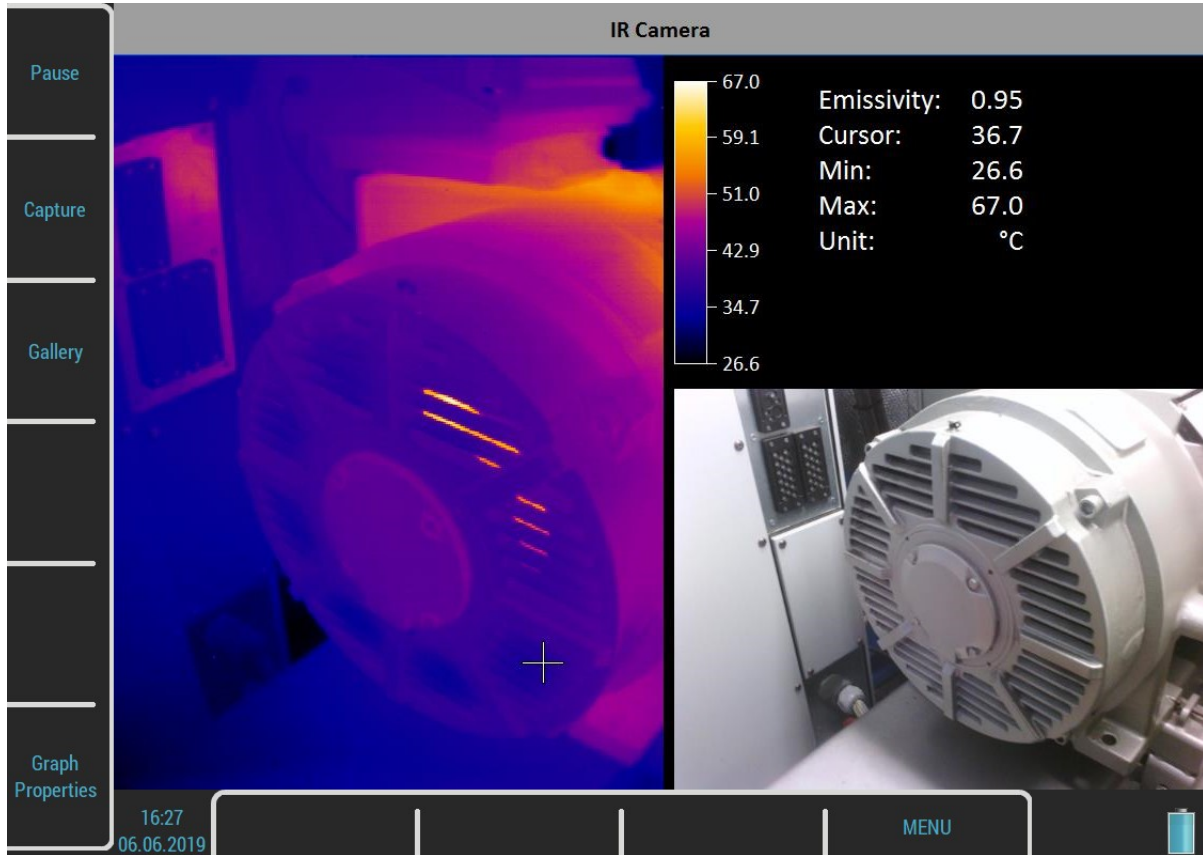
The image from IR camera takes place in the left half of the screen. The image of nearly same scene from the optical camera is in the bottom right corner. The information panel is in the top right corner. You can see the minimal and maximal temperature and the temperature of the point under the cursor. Use arrows or tap the touch screen to change the cursor position.

Cursor

Use arrow buttons or tap the IR image to move the cursor cross. The temperature of the point under the cursor is written in the table.

Buttons

Pause / Run

Pause and then run again the scene.

Capture

Take the image of the scene. Two files will be stored in the **images** folder. One file stores the raw temperatures from the IR camera in the special thm format. You can work with this file in the DDS software. Second file is the jpg picture of the screen. You can watch the picture but you are not able to make further analysis.

Gallery

Open a **Gallery** so as you can watch taken pictures.

Graph Properties

Unit

Choose the temperature unit.

Emissivity

The emissivity value of the observed place is needed to calculate the right temperature.

Color spectrum

Choose the colors of the images, **colored** or **black and white**.

Scale

Choose an **auto** or **user** scale. The auto scale ensures highest possible contrast of the picture. With the user scale you have fixed color for each temperature.

Gallery

The images from the camera, IR camera and also all screenshots (**MENU / Screenshot**) can be watched in the **Gallery**. You can watch the images as icons or one image on screen. Use the **Enter** button or double tap an image to maximize it. Then use an **Escape** button to restore the icons mode.
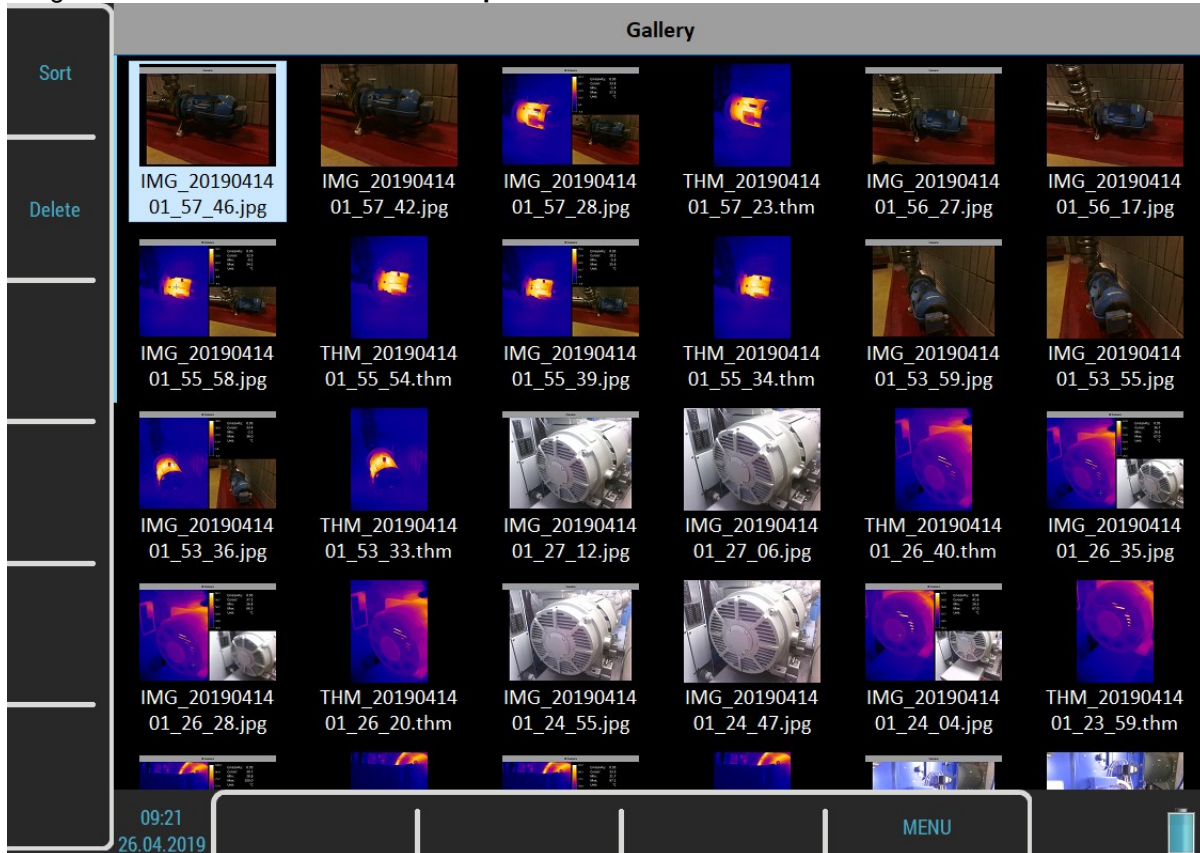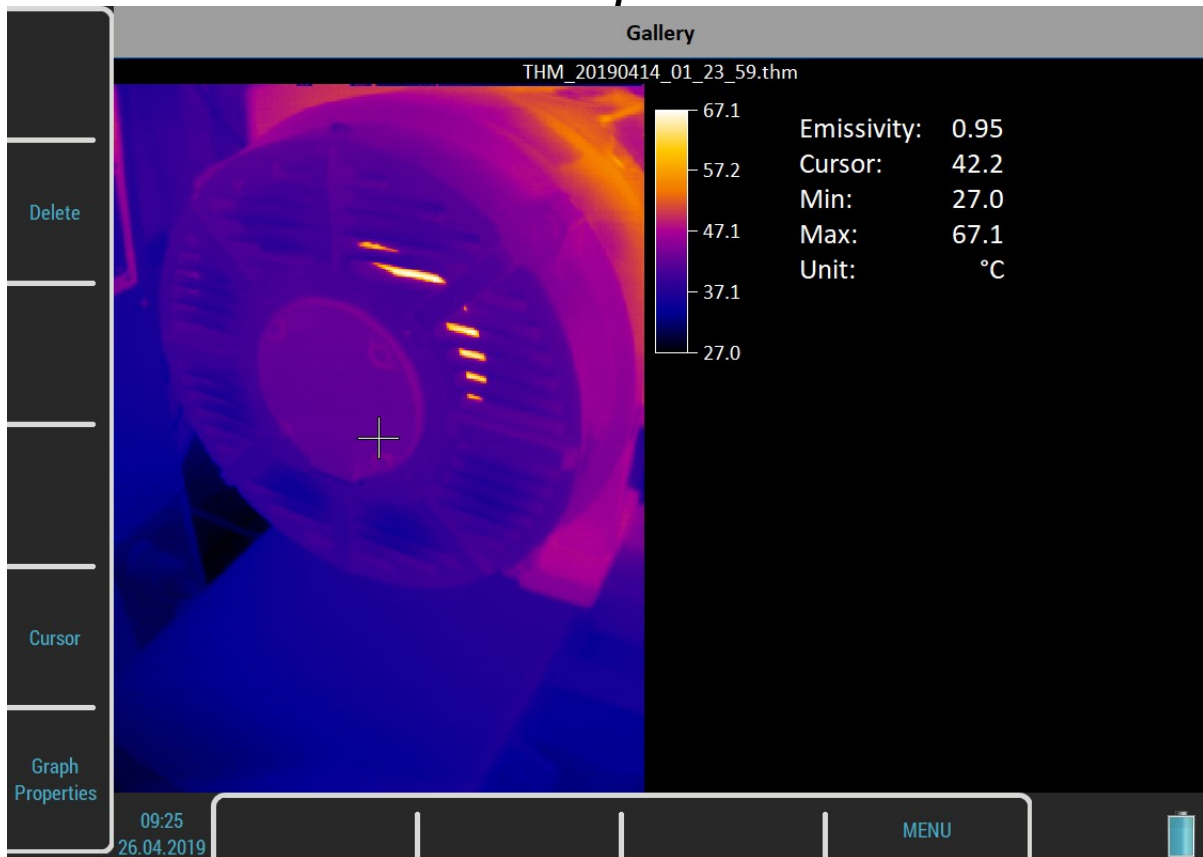

Buttons

Sort

You can sort the images by name or by time, in ascending or descending order.
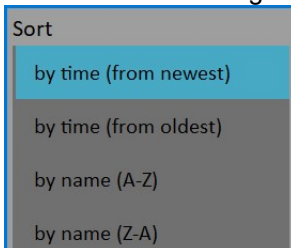
Delete

Delete the selected image.

Buttons for maximized IR Camera picture

Note! The **thm** file doesn´t contain an image from optical camera.

Cursor

When a picture from IR camera is maximized you can also move the cursor. Press the **Cursor** button to switch arrows into a cursor mode. Then press the same button, now named as **Gallery**, to return. You can also switch the mode by tapping the screen. Tap to the IR camera picture to switch into a cursor mode or tap outside the picture to switch into a gallery mode.

Graph Properties

Open a **Graph Properties** dialog like in the **IR Camera** module.

For further technical and contact information visit www.adash.com or email: info@adash.com

A4404 SAB and Virtual Unit

Virtual Unit is the same software used in **VA5 Pro** vibration analyzer. You can use the **Virtual Unit** in **Demo mode** and see the **VA5 Pro** vibration analyzer working environment. In other words, you can download and install the **Virtual Unit** free of charge and see all the measurement capabilities of the instrument.

You can also use the Virtual Unit to post process your records from real instrument.

Furthermore the **Virtual Unit** is designed for measurement with the **A4404 – SAB.**

Installation

A4404 SAB Drivers Installation

The drivers should be automatically installed from the internet after the SAB is connected.

In case you have no internet connection or some problem occurs, follow these instructions:
1. Download a driver file from https://adash.com/downloads/third-parties-software or from the supplied SAB installation flash drive
2. Uncompress the file anywhere on your computer (for example C:\driver).
3. Connect the A4404 - SAB to your PC via USB cable.
4. The **Add hardware Wizard** window should open when drivers are not found on your PC. Follow the wizard instructions.
5. Select **Install from a list or specific location** and click the **Next** button.
6. Check **Include this location in the search**.
7. Click the **Browse** button and select the driver folder, where you uncompressed the file
8. Click the **Next** button and wait for installation completing.
9. Delete the driver folder (not required).

Virtual Unit Installation

Download the A4410 Virtual Unit from Adash website:
http://www.adash.com/downloads/adash-software

Run the A4410 Virtual Unit file and follow the installation wizard process.

Eventually you can run the installation file from the supplied **A4404 SAB** installation drive.

License file

Each **A4404 SAB** device is supplied with a unique license file. The **Virtual Unit** needs the license file **adashx*123456*.a44** in order to control the A4404 – SAB (the 123456 is the serial number of A4404). Copy this file from supplied flash drive into the **workdir\data\VA4licence** folder (workdir is the folder path you have defined during **Virtual Unit** installation, C:\ProgramData\VA5 Virtual Unit by default).

Update
To update the software just run the installation file with the newer version. The old version will be replaced. The application data will not be lost.

Operation
If you want to use the **A4404 SAB,** plug it before you launch the **Virtual Unit** application. Computer with the connected **SAB** and running **Virtual Unit** then behaves as **VA5 Pro** instrument.
Live signal is measured only with the **A4404 - SAB**. Without this device it's possible to post process records.
Virtual Unit installation contains one record (**Default Rec**) for demonstration. You can download more Records

from our website: http://www.adash.com/downloads/adash-software. You can also post process your own records from the instrument.

VA5_DISC

VA5_DISC folder is created in the data folder after the first run of the application. VA5 Virtual unit uses this folder the same way as the real instrument.

VA5 Virtual unit and VA5 Pro connection

How to share projects between the instrument and the **Virtual Unit** will be described in this chapter.
Connect the instrument to the computer via USB cable. The instrument will be found as VA5_DISC (removable disc) on your system. It's possible to copy the data to and from the virtual unit's data and VA5_DISC folder.

Copying projects to the instrument

Copy the **workdir\Data\VA4analyser\ProjectName** project folder (workdir is the folder path you have defined during installation, C:\ProgramData\A4410 Virtual Unit by default, ProjectName is the folder with the project you want to copy) into the **VA5_DISC\VA4analyser** (VA5_DISC is the real removable storage device here, NOT the virtual unit's folder!). You have to create empty file with the name *script.dds* in the project folder on the instrument VA5_DISC. The project will be imported to the instrument's hard disk after you enter the **Analyzer** module.
Runup and Route projects (*VA4runup* and *VA4route* folders) are copied the same way.

Example:
We've got the analyzer project called Power Station in the virtual unit and we want to add it to the real instrument.
1) Connect the instrument with the computer.
2) VA5_DISC removable storage device appears. Open **VA4analyser** folder on this device.
3) Open **workdir\Data\Va4analyser** folder. Find **Power Station** folder in this folder. Copy it into the VA5 Pro VA5_DISC.
4) Create the empty file **script.dds** in VA5 Pro **VA5_DISC\VA4analyser\Power Station** folder.
5) Enter the **Analyzer** module. The project will be imported and shown in the project list.

Projects and records copy from the instrument

Attention! Projects have to be exported to the VA5_DISC first (the same as export to the DDS).

Copy the **VA5_DISC\VA4analyser\ProjectName** into the **workdir\Data\VA4analyser** folder. In this case there is no need of script.dds file. Runup, Route, Records and Balancer projects (*VA4runup, VA4route, VA4recorder* and *VA4Balancer* directories) are copied same way.

Example:
We've got the analyzer project called Power Station in the real instrument and we want to add it to the virtual unit.
1) Connect the instrument with the computer.
2) VA5_DISC removable storage device appears. Open **VA4analyser** folder on this device. Find **Power Station** folder in this folder.
3) Open **workdir\Data\Va4analyser** folder.
4) Copy the **Power Station** folder from the VA5_DISC into the **workdir\Data\Va4analyser** folder.

Appendix A: Technical Specification

Inputs

Dynamic Channels (AC)

Number of synchronous parallel channels (AC):	4 AC
Frequency range (-3dB):	0.35 - max 90000 Hz
	(196 kHz sampling frequency)
Input range:	+/- 12V (only one range, no gains)
Measurement timing:	fully synchronous
A/D Resolution:	24 bit input, 64 bit double floating point internal precision
	(no gain procedures used !)
Dynamic range:	120 dB
Channel configuration:	voltage or ICP (individually for every channel)
Input protection:	up to 30 V
Input impedance:	100 kOhm
Input type:	acceleration, velocity, displacement, any non-vibration AC voltage
Integration:	single, double fully digital integration
2D Processing:	axis rotation according sensor mounting
Accuracy:	< 0.5 %
ICP drive:	18 V, 3.8 mA
User HP filtering:	0.35Hz - 12800 Hz
User LP filtering:	25Hz - 90000 Hz
Connector:	Binder 712 series

Tacho Channel

Number:	1 independent tacho input
Speed range:	0.01Hz - 1000 Hz
Input impedance:	80 kOhm
Input type:	voltage
Input range:	+ 10V (only one range, no gains)
	or +/-30V (tacho signal + DC) with optional tacho signal converter
Accuracy:	<0.5 %
Trigger level:	0.1 -9.9 V, user defined
Input protection:	up to 48 V
Connector:	Binder 712 series

Static Channels (DC or 4-20mA)

Number:	4 DC or 4-20mA (has to be specified in order)
Input range:	+/- 24 V or 4-20mA
Input impedance:	100kOhm (V-DC), 250 Ohm (4-20mA-DC)
A/D Resolution:	12 bit input
Accuracy:	0.1% fsd
Input protection:	up to 30 V

Measurement Functions

Data Analysis Speed:	0.1 sec for 25600 lines FFT spectrum
Amplitude Units:	Metric, Imperial (English) or user programmable
Frequency Units:	Hz, CPS, RPM, CPM, Orders
Amplitude scale:	Acceleration, Velocity, Displacement, User defined
Scaling:	Linear or Log, both X and Y axes
Cursor:	Single, Harmonics, Sidebands
Triggering:	free run

tacho
amplitude (positive or negative)
external (voltage)

Signal Range: full, No Auto ranging
Data acquisition: TRUE RMS, TRUE PEAK, TRUE PEAK-PEAK overall or band values
user defined high, low and band pass filters for band measurement
time waveforms (8 388 608 samples max)
real-time FFT
3D graphs (waterfall, cascade)
order analysis
Amplitude + phase values on speed frequency
speed measurement
process static DC or 4-20mA values
Envelope demodulation
ACMT procedure for low speed machines bearings

Time waveform samples: 256 – 8 388 608
Waveform (ACMT) length: max 131 072 sec (36 hours)
Spectrum ranges: 25 – 90 000 Hz
Spectrum lines: 100 – 3 276 800
Spectrum Peaks listing: yes
Spectrum units: RMS, 0-P and P-P
Windows: Rectangular, Hanning, Exponential, Transient
Order analysis parameters: 1/2 - 10th order
Averaging: 1-255
Overlap: yes
Smax, Gap and Centerline displays for proximity sensors: yes

Recording:

Sampling frequency: user defined in range 64Hz - 196 kHz
Record length example: 3 GB for 1 hour record with 64kHz sampling (4ch AC+4ch DC+1ch tacho signal)
(100GB memory enables over 30 hours of full 64kHz recording,
lower sampling frequency enables much longer record))

Balancing:

Planes: 1 or 2
Speed range: 0,5 Hz - 1000 Hz
Balancing Advisor for automatic fault detection: yes
Balancing Quality factor according ISO1940: yes
Balancing vector graph for balancing process reporting: yes
Balancing Report: yes
Trim function: yes
Vector split (for example to blades positions): yes
Manual entry: yes
Intuitive graphic user interface: yes
Trial mass: get out or leave in

General:

Processor: Atom 1.9 GHz
RAM: 2 GB
Display: LCD color 191 x 134 mm (9.1" diagonal), 1140x800 resolution
Memory (Internal SSD): 64 GB
Memory (VA5_DISC flash): 16 GB
Interface: USB
Powering: Li-Ion long life battery pack (more then 8 hours of measurement)
Operating temperature: -10 °C - +50 °C, 15°F-120°F
EMC: CE tested
Dimensions: 280 x 205 x 55 mm
Weight: 2.2 kg

For further technical and contact information visit www.adash.com or email: info@adash.com

# *Appendix B : Phase measurement conventions*

Single channel measurement with tacho
Let's assume the time signal defined as y=cos(ωt). We use the cosine function because FFT uses it too. It simplifies the calculations and understanding.
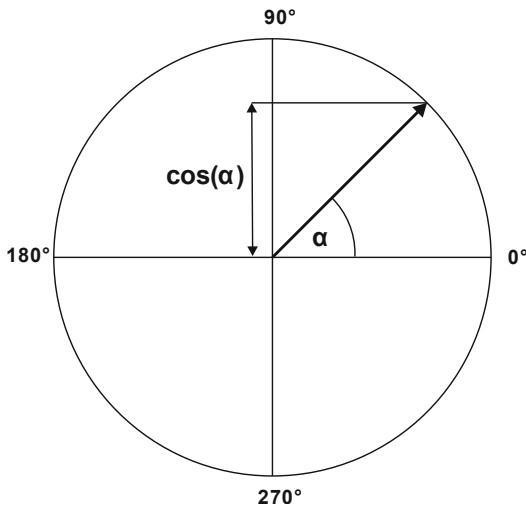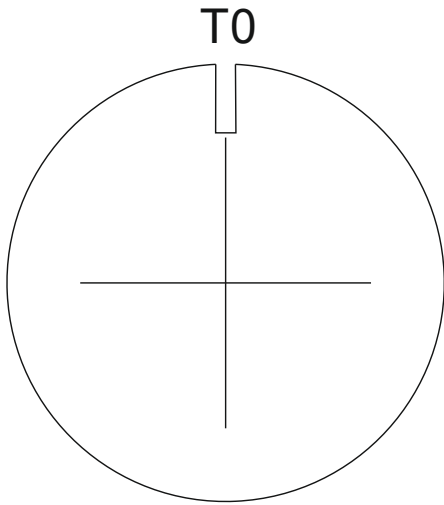

Our starting position of rotating vector V will be 90°, we will mark it as T0.
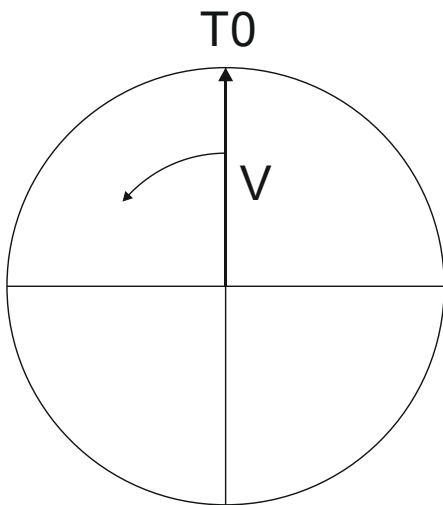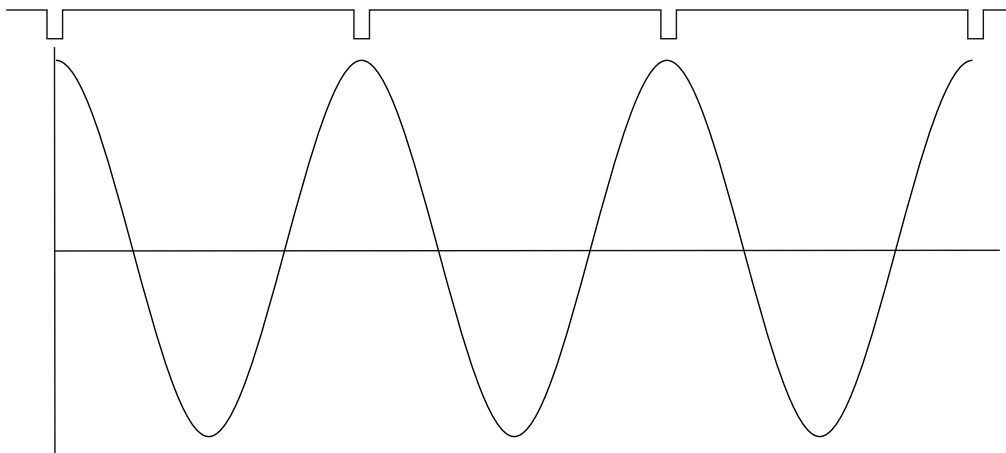

When the vector V rotates for example 3 times, then we get the time signal as follows.
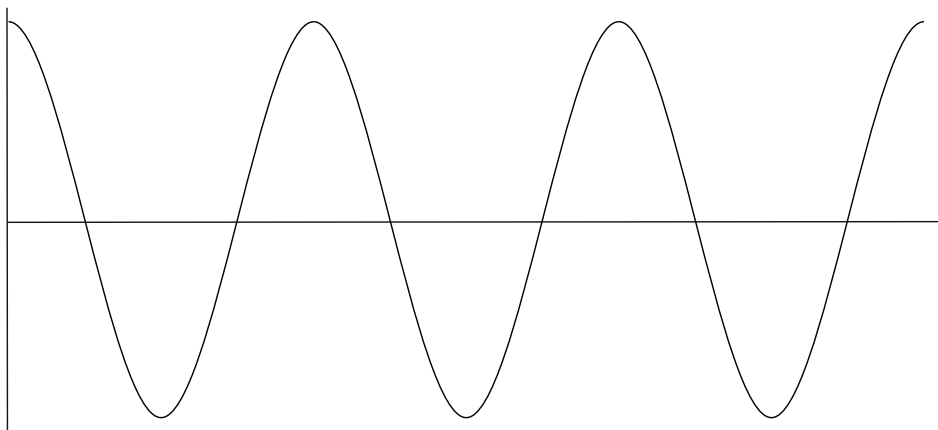
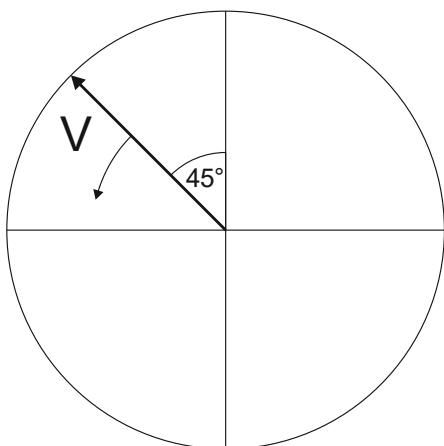Now we assume the tacho signal. The tacho pulse we put to the T0 position.

Corresponding time signal with tacho pulses is on the following picture.

Now we begin to assume the phase shift (marked as φ) of time signal vs. tacho signal. The signal formula changes to y=cos(ωt + φ). The previous picture corresponds with φ=0°. And this value is displayed on the instrument screen. When the tacho pulses are in the maximum time signal positions, then phase value is equal to zero.

Now assume the φ=45°. We use the degrees unit to make it simple for all readers. The radians have to be used in exact math formula.
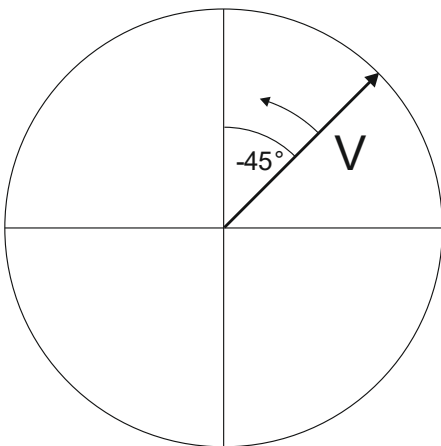
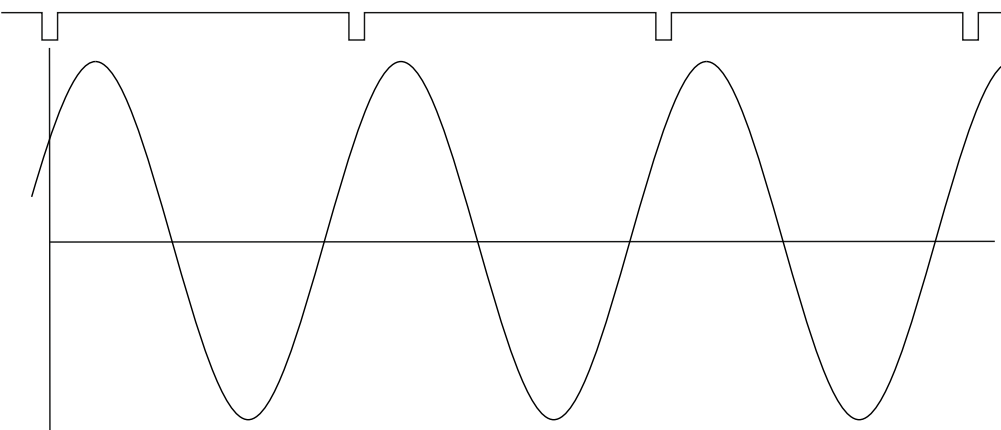On the next picture is the corresponding time signal with tacho pulses.
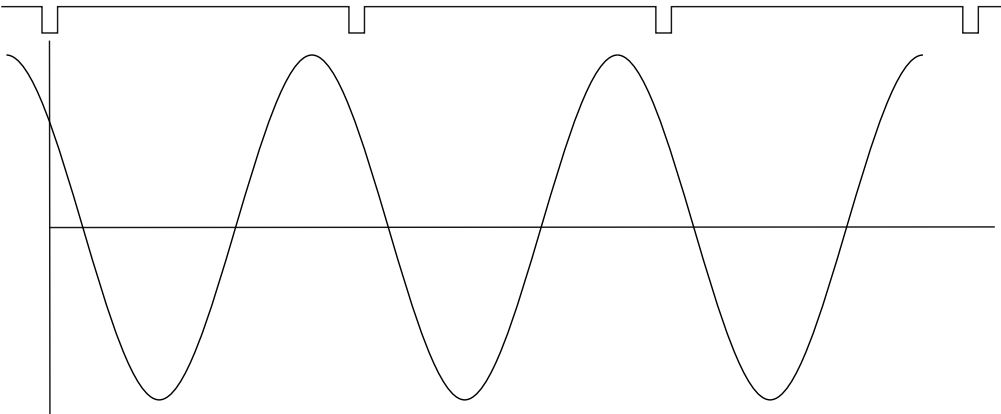
The time signal foreruns (gets ahead of) the tacho signal of the 45°. The 45° appears on instrument screen in this case.

Now we assume the φ=-45°.
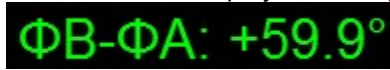

On the next picture is the corresponding time signal.

The time signal is delayed. The -45° appears on instrument screen in this case.

This approach is used for single channel measurement as 1xamp+phase and orders.

Dual channel measurement

We must always define the channels of A and B. For example we use channel 1 as A and channel 2 as B. You have to always assign the channel numbers of A and B. The A represents the input channel and B the output channel. You can imagine it as black box and you need to measure the phase response of that.

You see on the display for example this:

ΦB-ΦA: +59.9°

The logic is the same as for single channel measurement. The A has the same function as tacho signal. This 60° means that B is ahead (foreruns) the A of 60°.

This approach is used for double channel measurements as phase shift and frf.

Last reminder

We talk about time signals and their positions in time in this chapter. We have used a words such as "signal is ahead", "foreruns" and on the other side that signal is delayed.

You should always keep in mind:

To be ahead of for example 60° is the same as to be delayed of 300°. Don't forget that we are working with periodic pure cosine time waveform.

Appendix C: Symbols and Abbreviations

Abbreviations in Graphs

ch	channel, input
NS	number of samples
R	number of revolutions
L	number of lines
B	frequency band
R	frequency range
FS, fs	sampling frequency
Y	y value on cursor's position
t	cursor position on time axe
f	cursor position on frequency axe
df	frequency resolution (delta)
A	A value on cursor's position (orbit, center line)
B	B value on cursor's position (orbit, center line)
A	amplitude value on cursor's position (spectrum, frf)
P	phase value on cursor's position
Coh	coherence value on cursor's position
Re	real value on cursor's position
Im	imag value on cursor's position
X	value calculated from signals A and B to axe X (orbit, center line)
Y	value calculated from signals A and B to axe Y (orbit, center line)
S	speed value
D	difference value
d	delta cursor length
b	value of the band bounded by delta cursor in spectrum
tot	value of the whole band in spectrum
RMS, 0P	rms and 0P value in the time signal bounded by delta cursor
totRMS, tot0P	rms and 0P value in the whole time signal