USER MANUAL

A4400 VA4 Pro

A4404 SAB with Virtual Unit

Version 2.73 – June 26, 2020

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Before you begin read this manual

The VA4 Pro device is continuously developed and new functions and features are added quite often. Such additions also require changes in manual and that changes can be very time expensive. That is why we do not change all pictures in the manual so that are related to the latest version. Some pictures (which are usually only backgrounds) remain in the manual although they were changed already. Certainly it is acceptable only on places, where such background has no consequences.

A4400 VA4 Pro vs. A4404 SAB

Both of these units are described in this user manual. This chapter should clear up the difference between A4400 VA4 Pro vibration analyzer and A4404 SAB vibration analyzer.

A4400 VA4 Pro

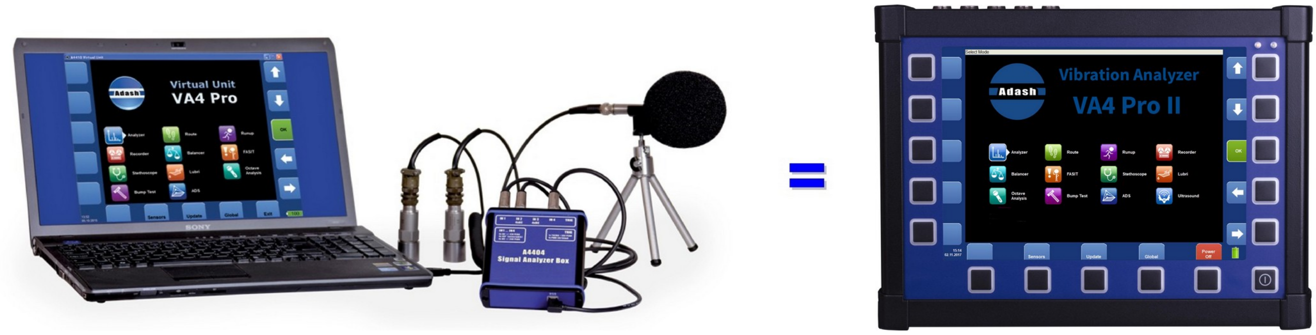
A4400 VA4 Pro is a portable vibration analyzer which is based on unique Digital Signal Processing board (DSP) developed by Adash.

Adash
Vibration Analyzer
VA4 Pro II

A4400 VA4 Pro analyzer

A4404 SAB (Signal Analyzer Box)

A4404 SAB is a pocket size vibration analyzer which contains input connectors for sensors. It does not contain keyboard and screen. It must be used with computer. It uses the same DSP board as VA4 Pro analyzer. You need to install the A4410 Virtual Unit software on your computer and then you can use all functions which are available in VA4 Pro analyzer. The software is free. It enables you to test all VA4 features before you will buy it. See the website for details.



Graph control by mouse

A4410 Virtual Unit runs on PC. Therefore you control graphs by mouse.

Graph selection
Left button click

Cursor Move
Left button click on signal. Both X and Y coordinates are used, it means you should click to signal line.

Maximalization / Minimalization
Left button double click

Zoom
Mouse wheel
When the mouse cursor takes place bellow (or slightly above) the x axe, only the x axe is zoomed.
When the mouse cursor takes place to the left from the y axe, only the y axe is zoomed.
When the mouse cursor takes place in the inner area of the graph, both the x and the y axes are zoomed.

Signal Move

Move mouse with the left button pressed

Before Switching On

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

Never connect higher then 30 V to the Analyzer !

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 ± 18 V (peak) can damage the instrument.

DC channels - voltage higher then ± 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.

PC USB connection warning

Switch off the A4400 instrument when you connect/disconnect it to/from computer by USB cable.

Battery charging

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

The unit 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 unit 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 unit is switched to the SLEEP mode by the Power Off button (instead of switching off the unit).
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 eventually.

To avoid deep discharge of the unit, charge the unit 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 UNIT/ WHEN THE UNIT CANNOT BE CHARGED NORMALLY:

- **Discharged battery** – battery needs to be charged (charging for approximately 3 hours), the unit can be switched on normally with the charger connected

- **Deeply discharged battery**, when the unit wasn't charged for longer period of time – the unit 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 unit even with the charger connected.

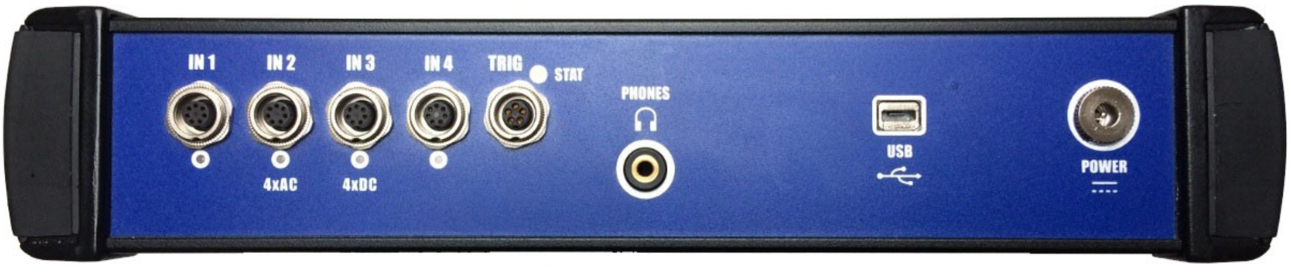
- **Damaged charger** – when the charger is connected, the indicator should start to light (green or orange color), only with deep discharge the indicator does not light immediately.

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

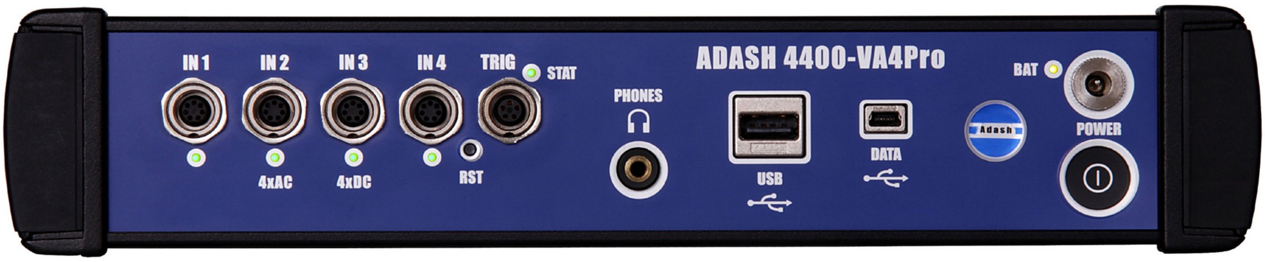
General information

The upper panel

Version A4400 VA4 Pro II (from January 2018)

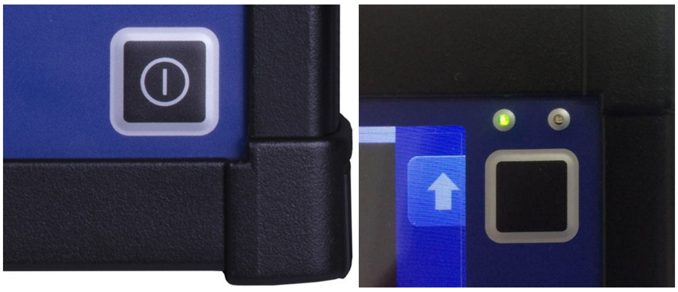

IN 1
IN 2
IN 3
IN 4
TRIG
STAT
PHONES
USB
POWER
4xAC
4xDC

Older version A4400 VA4 Pro


IN 1
IN 2
IN 3
IN 4
TRIG
STAT
ADASH 4400-VA4Pro
BAT
PHONES
POWER
DATA
USB
Adash
4xAC
4xDC
RST

The switching-on

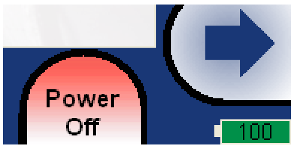
The power button is in bottom right corner of the front panel. Two LEDs are in the upper right corner. The left indicates switch on, the right indicates charging. Press the button for a few seconds until the left LED begins to light. Firstly it blinks red for a while, then it lights green.



The older version has power bottom on upper panel. The green LED is in the upper right corner of the front panel. Press the button and the LED lights on.

The switch off

The switching off can be done by:
- **Power Off** button on the main screen,
- in the **Global** menu is the **Power Off** item available.



Warning! The general power button (intended for the switching on) doesn't turn the unit off. It switches the unit into a sleep mode!

The Sleep mode

Use the power button (described in "The switching 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 the unit again.

Auto switch off

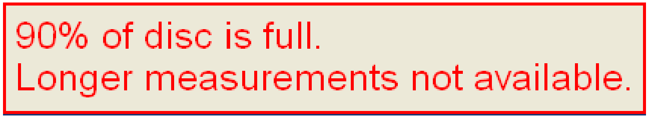
If no button is pushed in 5 minutes from switching on, the unit will be switched off.

The 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 5 seconds. Instrument will switch off.

Disc free capacity warning

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



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

Connection to the computer

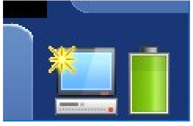
VA4_DISC

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 a flash memory (**VA4_DISC**), which is accessible from external computer. The **VA4_DISC** is an interface for user's data. For example, you save a route project from DDS to the **VA4_DISC**, the instrument stores it automatically to its hard disk, then you work with the route (make some measurements, look at data) and eventually export the modified route back to the **VA4_DISC**, from where you can access it from external computer. You don't need to export all data from internal hard disk. Export only the data which you want to access from computer. A detailed description how to export will be stated later in chapters about project's control for each module.

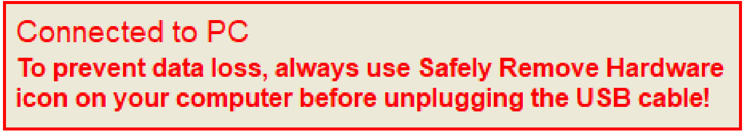
Connection

To make a connection between computer and instrument (more precisely **VA4_DISC**) use the USB cable which is the standard accessory of VA4 set. Connect the small plug to the USB socket (see the image above). Connect second plug to the computer.

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 VA4_DISC remains to be connected to the instrument processor and you cannot see it on your PC. The real connection with PC is announced by the message box.



Connected to PC

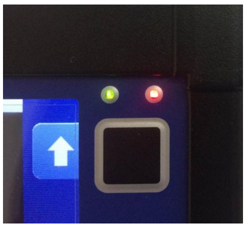
To prevent data loss, always use Safely Remove Hardware icon on your computer before unplugging the USB cable!

VAx_DISC (for VA4 II only)

Sometimes you may need higher capacity interface disk than the VA4_DISC (16GB for VA4 II). 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 rather than **VA4_DISC**.
Note: The OTG cable is not a standard accessory of VA4 set.

The charging

The **POWER** socket for external charger is on the top panel. Indicating LED diode is in upper right corner of front panel. The LED lights red during charging and lights green when fully charged.
Note. Two LEDs are in upper right corner. The left one for switching on and the right one for charging.



The older version has the socket for external charger on the upper panel above the POWER button. The **BAT** LED on the upper panel lights orange during charging. When the battery is fully charged, it lights green.

The DSP board - monitoring and reset

The DSP board is the most important part of the instrument. The special chip provides all necessary operations, which are required for achieving of 4 channel synchronous data.
The STAT LED is on the top panel and enables to monitor the DSP board. Several states can appear:
- Green with 0.25sec time interval (4Hz, four times per sec) - the measurement is running.
- Green with 1 sec time interval - STANDBY, the measurement is not running.
- Red - the DSP board does not work properly. Turn the instrument off and on.

The older version enables different procedure. When the red STAT occurs, do the reset of DSP board. Do not switch-off the instrument. Use the slim not sharp thing (e.g. paper clip) and push the button, which is hidden in the **RST** hole.

Next LED is near each input connector:
- green – OK
- no light – no measurement is taken in this input
- red – error (usually ICP error).

Note: During the measurement are functional only LEDs for inputs used for measurement (e.g. red LED ends the lighting during the measurement and starts again after it).

Virtual Analyzers Data Processing

When older Analyzers would take more measurements, they took them step by step. If the user wanted e.g. acceleration overall, velocity overall, velocity time signal and velocity spectrum from one sensor, then the Analyzers took first overall, then second overall with integration, then time signal and finally spectrum. The time which was required for all 4 measurements was the sum of 4 individual times.
The instrument includes high speed chips and it uses the much more advanced concept. For every individual measurement is created one virtual Analyzer in the instrument memory. All virtual Analyzers read data from input DSP board and perform required data acquisition.
What does it mean? It means, that the total required time is not equal the sum of all individual times, but it is equal the time required for the longest measurement.

Run the instrument on your computer

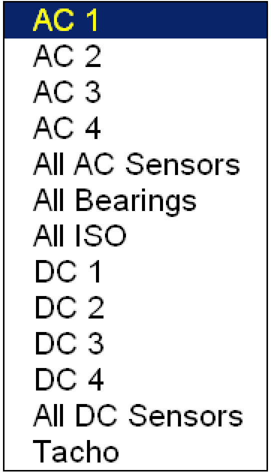
The A4410 Virtual Unit you can download from the producer’s website. Install it on your PC. Now you can easy try to work with all functions in your computer. Do not forget define the record as signal source. You can also download the next records from that website. See the A4410 Virtual Unit chapter for more details.

How to work with Menu

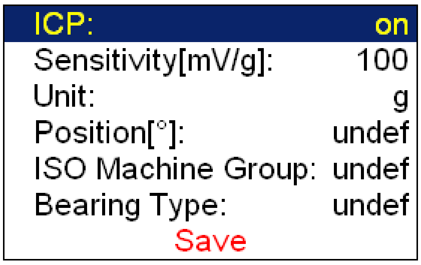
For the taking of measurements you have to define many parameters. All those definitions are providing by menu items. The procedure for operation with all menu items is the same. We describe it on example - the sensor properties definition.

Item selection

The sensor properties first menu appears after you push the **Sensors** button.

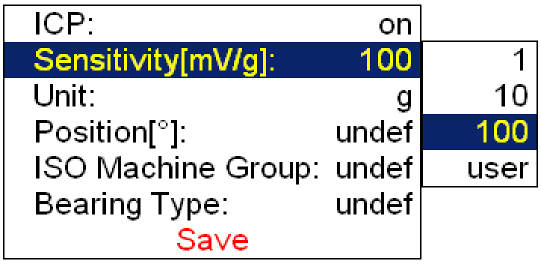


Use the arrow buttons for one item selection, e.g. **AC2**. Then push **OK** button. The second menu appears.



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

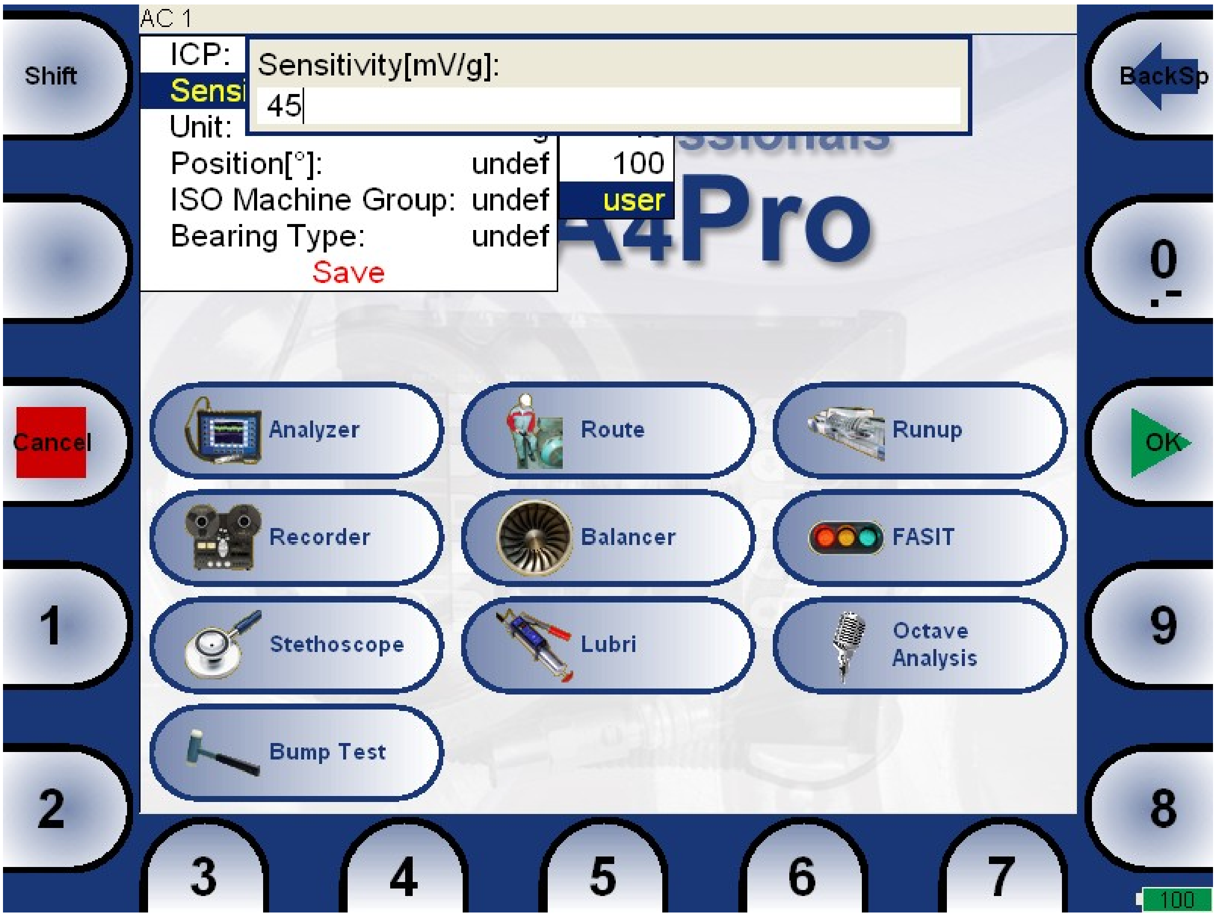
Again use the arrow button for one item selection. Then push the right arrow button to display possible parameters of selected item. E.g. for Sensitivity you see this picture:



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

User defined values

Again use the arrow button for one sensitivity selection (**1**,**10**,**100**). In most of cases you want to enter the **user** sensitivity according to the real sensor sensitivity of your sensor (e.g. 96,8 mV/g). Select the **user** and push **OK**. The next window appears and the buttons get the numerical values entry functions.



AC 1

ICP:

Sensitivity[mV/g]:

45

Position[°]: undef 100

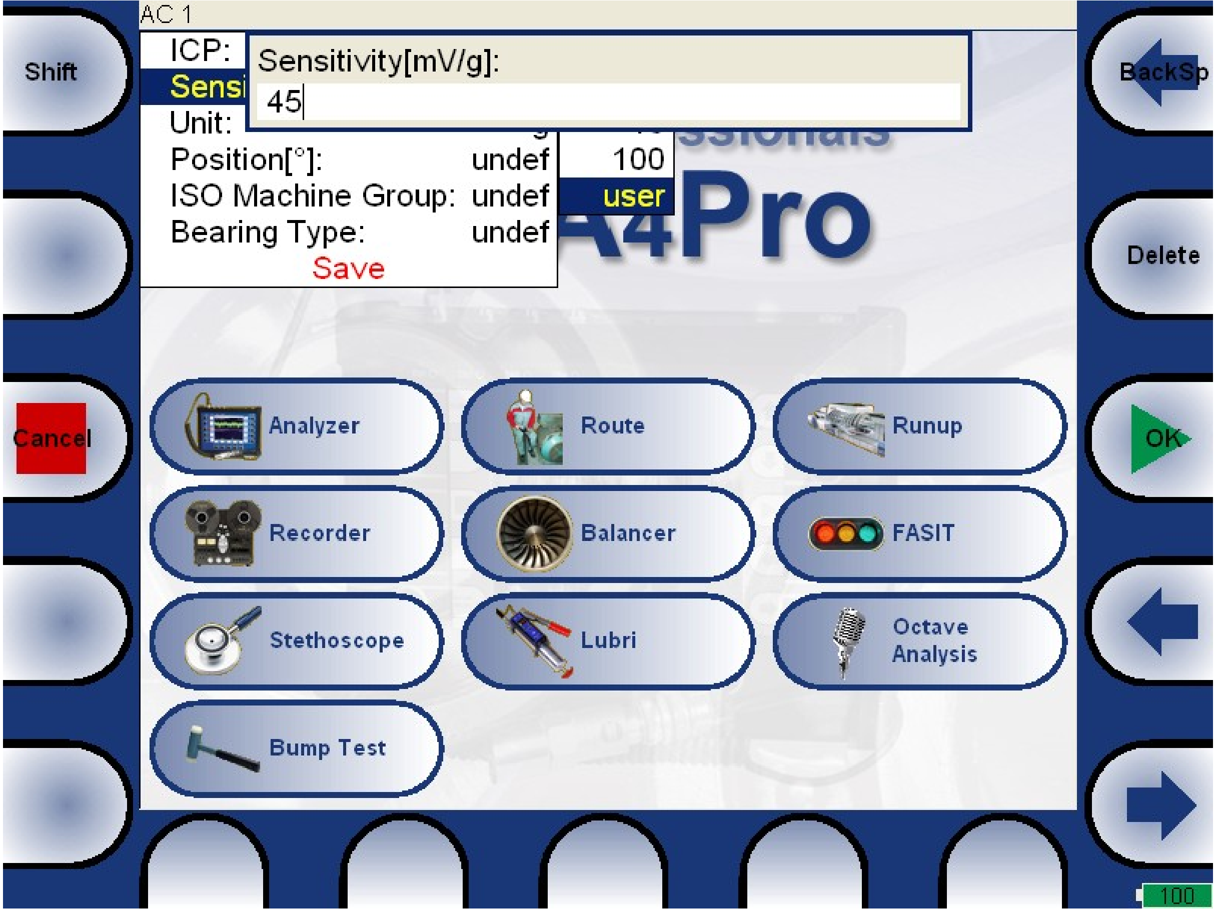
ISO Machine Group: undef user

Bearing Type: undef

Save

Shift
BackSp
0
Cancel
OK
1
9
2
8
3
4
5
6
7
Analyzer
Route
Runup
Recorder
Balancer
FASIT
Stethoscope
Lubri
Octave Analysis
Bump Test
100

Use the buttons and enter required value (e.g.45). If you need to edit the value, push the **Shift** button. The buttons change the functions of buttons.



AC 1

ICP:

Sensitivity[mV/g]:

45

Position[°]: undef 100

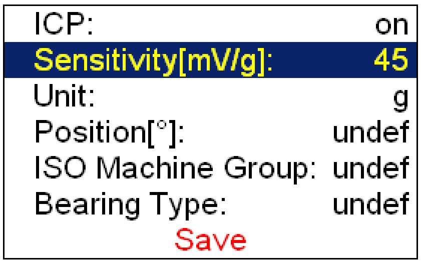
ISO Machine Group: undef user

Bearing Type: undef

Save

Shift
BackSp
Delete
Cancel
OK
Analyzer
Route
Runup
Recorder
Balancer
FASIT
Stethoscope
Lubri
Octave Analysis
Bump Test
100

Now you can move the cursor, to use the **Delete** function. Press the **Shift** again and the buttons functions change back. When the value is correct, push **OK**. The menu with new value appears.



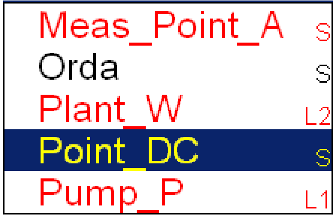
ICP: on
Sensitivity[mV/g]: 45
Unit: g
Position[°]: undef
ISO Machine Group: undef
Bearing Type: undef
Save

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.

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.

Multi-selection of items

Sometimes you could need to work with more then one item together. The usual example is the deleting of more items in one step.
The left bottom button **Multi on** enables to select more items at once. Press the **Multi on** button. When you move in the list by arrows, the items remain selected (red color) or unselected (black color). Press the same button (now the **Multi off**) again for ending of multi-selection.



Meas_Point_A S
Orda S
Plant_W L2
Point_DC S
Pump_P L1

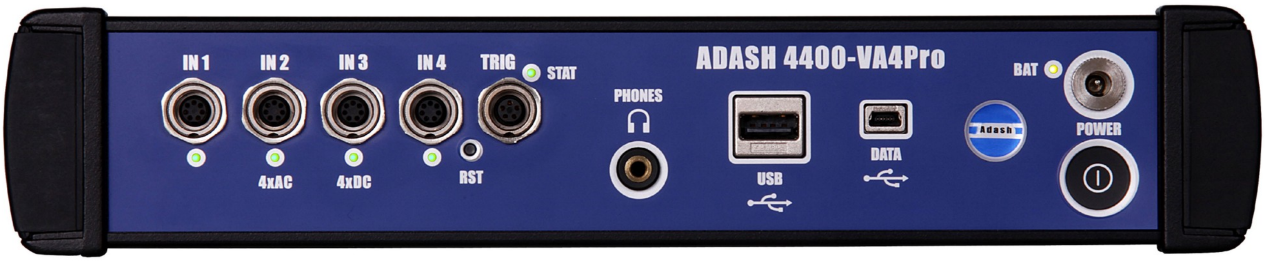
Example of multi-selected items. It needs a short time to play with and to find the right understanding of this feature. The item with the cursor (the full blue field) can be selected or unselected too. The standard yellow color means unselecting and the red color means selecting.

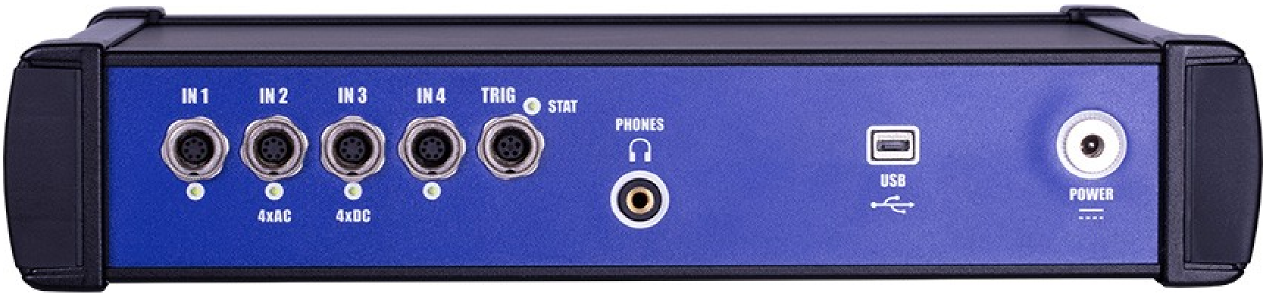
Searching of item

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.

Input channels

All input sockets are in the top panel. The versions older then 0200 had only 3 sockets in the panel.

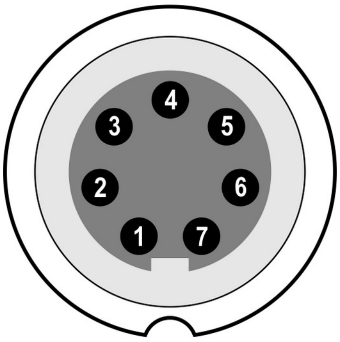

IN 1
IN 2
IN 3
IN 4
TRIG
STAT
ADASH 4400-VA4Pro
BAT
PHONES
4xAC
4xDC
RST
USB
DATA
Adash
POWER


IN 1
IN 2
IN 3
IN 4
TRIG
STAT
PHONES
4xAC
4xDC
USB
POWER

Top panel of A4400 Va4 Pro II (from 2018).

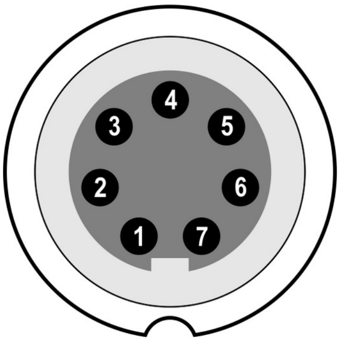
The input sockets labeled IN1, IN2, IN3, IN4 are used for AC or DC signals. The input socket labeled TRIG is used for trigger signals, usually tacho. All sockets have several pins. It enables to connect more signals to one socket (see wire diagrams).
The AC inputs enable to measure max voltage peak +/-12V. The DC channels enable to measure max +/-24V.

IN1 socket



1 – CH1 AC INPUT
2 – GROUND
3 – +20V DC OUTPUT (max 10mA) for eventual sensor powering
4 – SHIELDING
5 – NOT USED
6 – CH1 DC INPUT
7 – +5 V DC OUTPUT (max 50 mA) for ultrasound sensor powering
Warning! Pin 7 of IN1 socket (ultrasound sensor powering) is internally connected with pin 4 of TRIG socket (tacho sensor powering).

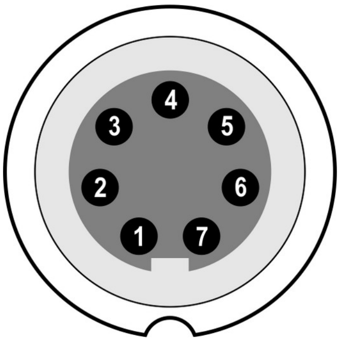
IN2 socket



1 – CH2 AC INPUT
2 – GROUND
3 – CH1 AC INPUT
4 – SHIELDING
5 – CH3 AC INPUT
6 – CH2 DC INPUT
7 – CH4 AC INPUT

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

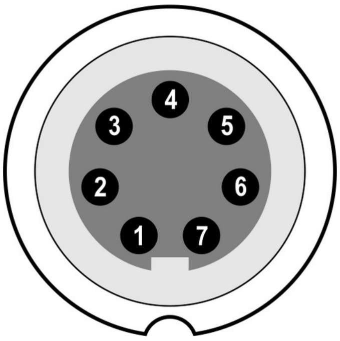
IN3 socket



1 – CH3 AC INPUT
2 – GROUND
3 – CH1 DC INPUT
4 – SHIELDING
5 – CH4 DC INPUT
6 – CH3 DC INPUT
7 – CH2 DC INPUT

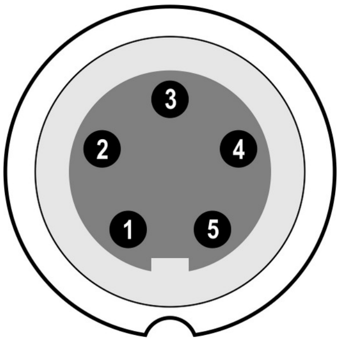
Pay attention to possibility of connecting all four DC channels to **IN3**.

IN4 socket



1 – CH4 AC INPUT
2 – GROUND
3 – +20V DC OUTPUT (max 10mA)
4 – SHIELDING
5 – NOT USED
6 – CH4 DC INPUT
7 – NOT USED

TRIG socket



1 – GROUND
2 – NOT USED
3 – NOT USED
4 – +5 V OUTPUT/ 50 mA for tacho power supplying
Warning! Pin 7 of IN1 socket (ultrasound sensor powering) is internally connected with pin 4 of TRIG socket (tacho sensor powering).
5 – TRIG INPUT - for tacho signal

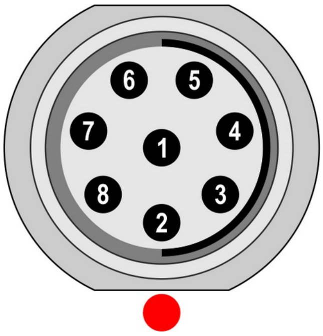
Standard cable wiring

The standard cable, which are the part of the unit, have the sensor signal connected to the pin number 1. The second sensor wire is connected to the ground (pin 2).
When you use this cable:
In IN1 socket, the signal will be measured on CH1.
In IN2 socket, the signal will be measured on CH2.
In IN3 socket, the signal will be measured on CH3.
In IN4 socket, the signal will be measured on CH4 (ver. 2.0 and higher).

If you want to use the 3-direction sensor, then you should use the IN2 socket (pins 3,1,5) + ground (pin 2). You need the special cable for this purpose.

Input channels (ODU variation)

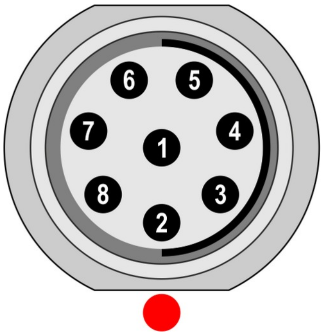
IN1 Socket



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).

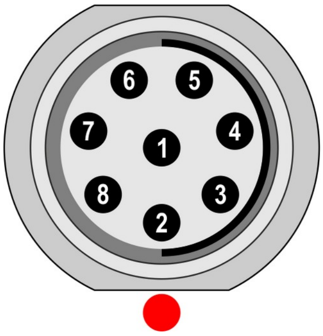
IN2 Socket



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**.

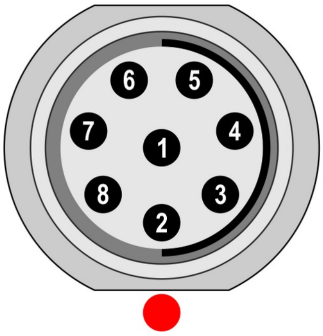
IN3 Socket



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

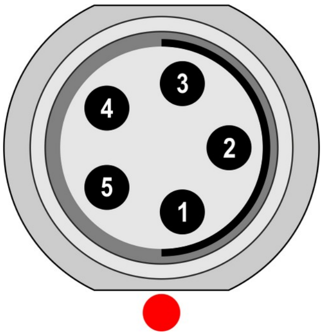
Pay attention to possibility of connecting all four DC channels to **IN3**.

IN4 Socket



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

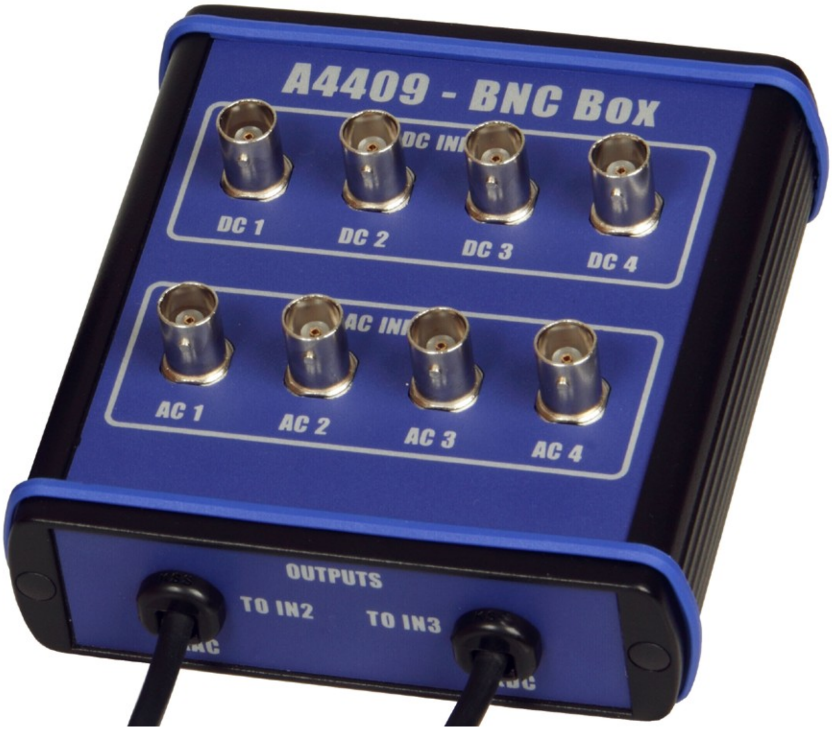
TRIG Socket



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).

A4409 - BNC Box


A4409 - BNC Box
DC IN
DC 1
DC 2
DC 3
DC 4
AC IN
AC 1
AC 2
AC 3
AC 4
OUTPUTS
TO IN2
TO IN3

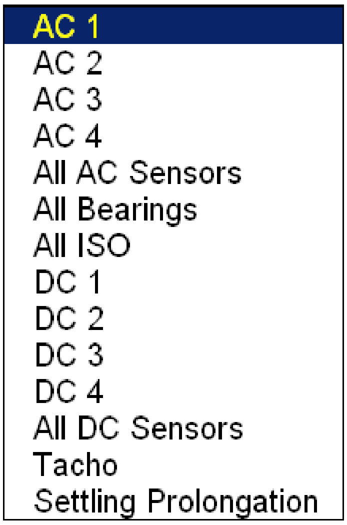
This box can simplify the connection of more cables to VA4Pro inputs. The BNC input connectors are used on the top panel for connection of 4 AC channels and 4 DC channels. On the side panel are two Binder connectors, which enable to connect all 4 AC channels to IN2 input and all 4 DC channels to IN3 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.

Sensors properties

When you connect the sensors to the instrument, you have to tell what kind of sensors you use. The **Sensors** button is on most screens in the bottom. You can define the bearing and ISO 10816 group for every AC channel individually.

Sensors
Update
Global

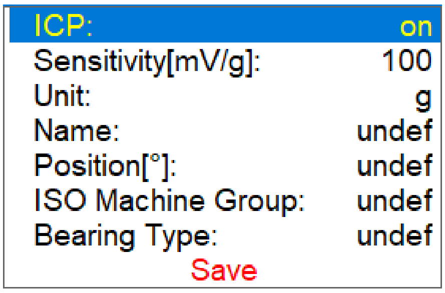
Push the **Sensors** button. In the next menu select channel sensor you want define.



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
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, e.g. vibrations.



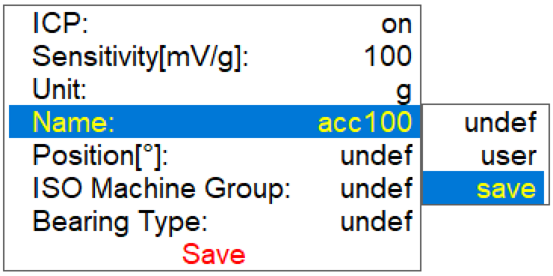
ICP:	on
Sensitivity[mV/g]:	100
Unit:	g
Name:	undef
Position[°]:	undef
ISO Machine Group:	undef
Bearing Type:	undef

ICP	**on, off** (selection of required setting accordingly the sensor type)
Sensitivity[mV/unit]	usually **1**,**10**,**100**, **user**
Unit	unit selected from the list or user unit

Name **undef, user**
You can optionally enter a name of the sensor by choosing **user** item. Use **undef** item to reset the sensor name.

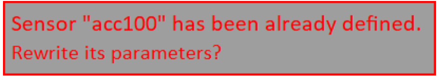
Saving sensor

Parameters of named sensor can be saved. After you enter the name open the **Name** menu again. New item **save** is available now. When you choose then this item the sensor will be saved.



ICP: on
Sensitivity[mV/g]: 100
Unit: g
Name: acc100
Position[°]: undef
ISO Machine Group: undef
Bearing Type: undef

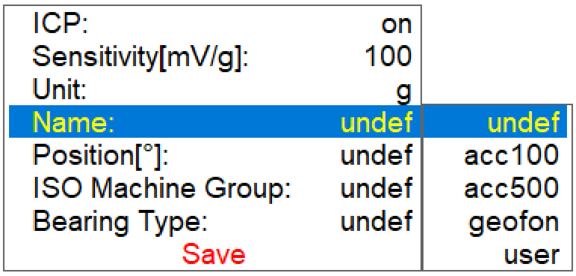
Note! If you want to save a sensor with a name which has been already defined you'll be asked to rewrite its parameters.



Sensor "acc100" has been already defined.
Rewrite its parameters?

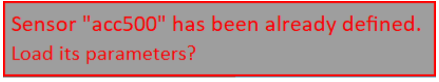
Loading sensors

Saved sensors are displayed on when you open the **Name** menu item. Select a name of a saved sensor and press OK. Then its parameters are loaded.



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

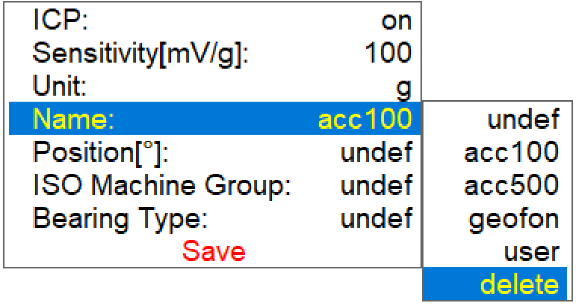
Note! If you choose "**user"** option and then enter a name which has been already saved (e.g. "acc500") you'll be asked to load its parameters.



Sensor "acc500" has been already defined.
Load its parameters?

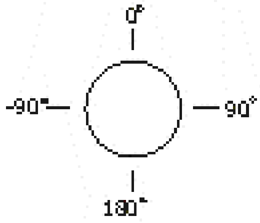
Deleting sensor

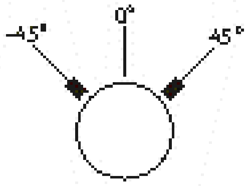
Select a sensor which you want to delete. Open the **Name** menu again. Now new item **delete** appears. Select this item and press OK. The sensor will be removed from the list.

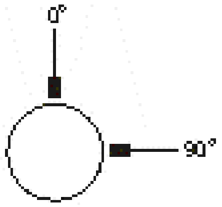


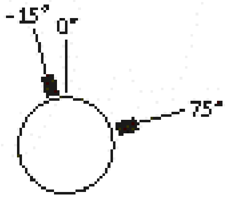
ICP: on
Sensitivity[mV/g]: 100
Unit: g
Name: acc100
Position[°]: undef
ISO Machine Group: undef
Bearing Type: undef

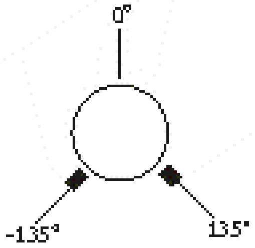
Position the angle of sensor (see picture bellow). Usually used for proximity sensors.

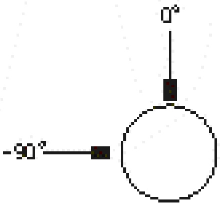








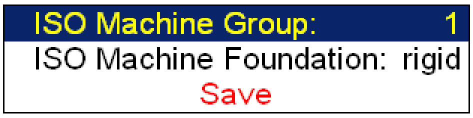




DC gap channel In case of displacement sensor (eddy current) also DC channel could be entered, which is used for gap measurement (eddy current sensor should be concurrently connected to AC and DC input). The gap value is stored in time signal and orbit measurements and the value is added to a signal.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

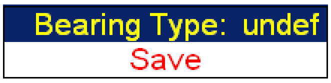


ISO Machine Group: 1
ISO Machine Foundation: rigid
Save

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

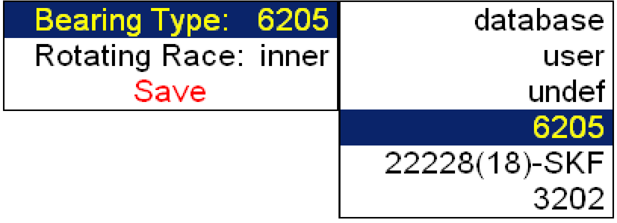
Bearing Settings

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



Bearing Type: undef
Save

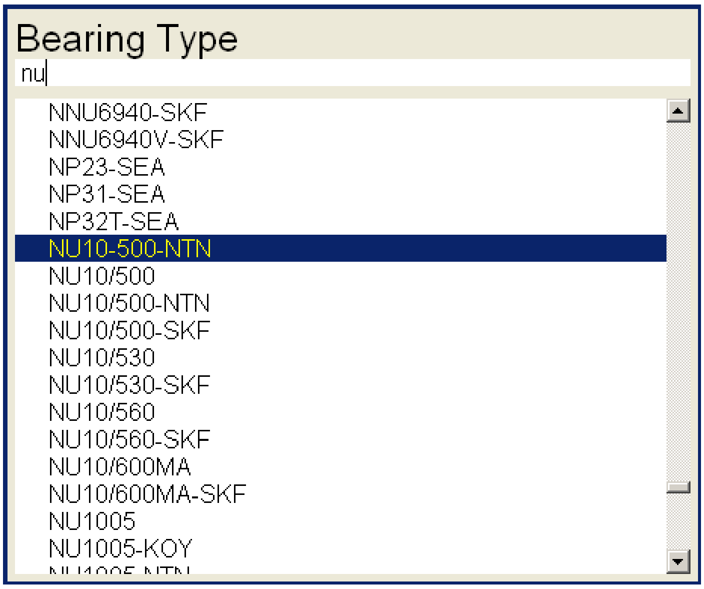
Select **Bearing Type** item and press **OK** button or right arrow button. From next list select required item and press **OK** button. Also recently used bearings are displayed.



Bearing Type: 6205
Rotating Race: inner
Save

database
user
undef
6205
22228(18)-SKF
3202

Bearing type
database selection from database



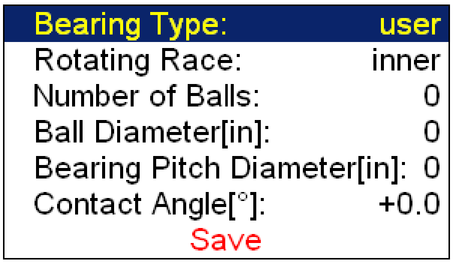
Bearing Type

nu

NNU6940-SKF
NNU6940V-SKF
NP23-SEA
NP31-SEA
NP32T-SEA
NU10-500-NTN
NU10/500
NU10/500-NTN
NU10/500-SKF
NU10/530
NU10/530-SKF
NU10/560
NU10/560-SKF
NU10/600MA
NU10/600MA-SKF
NU1005
NU1005-KOY

Enter the name (or part of the name) and use the up/down arrows (use **Shift** button to change buttons function) bearing selection. Confirm by **OK**.

user



Bearing Type: user
Rotating Race: inner
Number of Balls: 0
Ball Diameter[in]: 0
Bearing Pitch Diameter[in]: 0
Contact Angle[°]: +0.0
Save

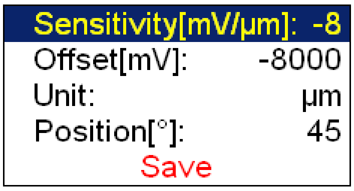
If the required bearing is not contained in the database, then you can define the parameters manually.

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

Rotating Race for correct calculation of fault frequencies the selection of rotating race is required.

DC sensors

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



Sensitivity[mV/µm]: -8
Offset[mV]: -8000
Unit: µm
Position[°]: 45
Save

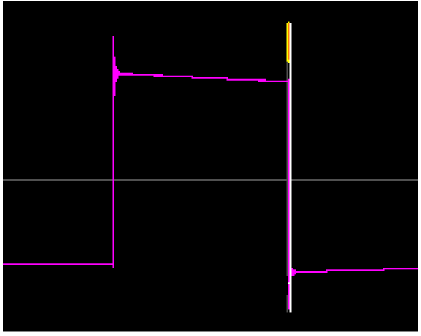
Sensitivity[mV/unit]	**sensitivity value**
Offset[mV]	**offset value**
Unit	unit selected from the list or user unit
Name	the name of sensor (see AC sensors for more details)
Position	the angle of sensor (see picture above). Usually used for proximity sensors and **GAP** measurement.

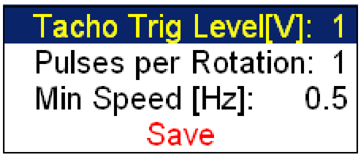
The used formula: **output value in Unit = (input value in mV - Offset) / Sensitivity**.

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 VA4 uses the falling edge of tacho signal for triggering (it means the end of the tacho mark).





Tacho Trig Level[V]: 1
Pulses per Rotation: 1
Min Speed [Hz]: 0.5
Save

Tacho Trig Level The correct reference value has to be set for speed measurement. E.g. 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.

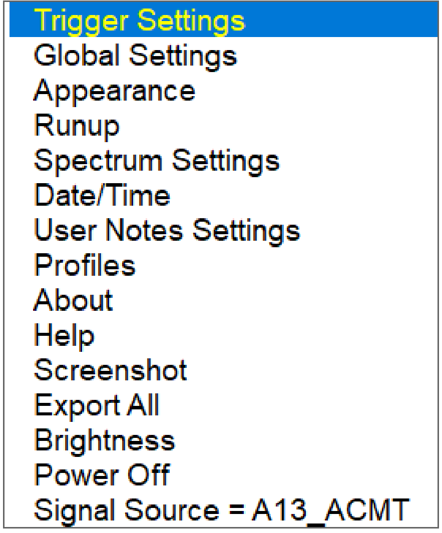
Sensor Properties of recorded signal

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.

Global properties

The parameters which have effect to all or many functions are understood as Global parameters. The definition is made by **Global** button.



Trigger Settings
Global Settings
Appearance
Runup
Spectrum Settings
Date/Time
User Notes Settings
Profiles
About
Help
Screenshot
Export All
Brightness
Power Off
Signal Source = A13_ACMT

Power Off

Additional way for switching off.

Brightness

Screen brightness settings (for instruments made after November 2013).

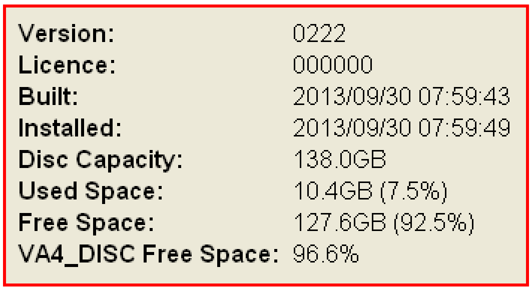
Screenshot

The screenshot in png format will be saved to the **images** folder on VA5_DISC.

Export All

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

The About ...

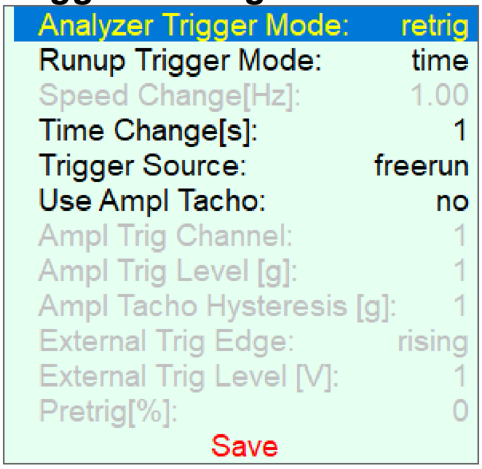


Version: 0222
Licence: 000000
Built: 2013/09/30 07:59:43
Installed: 2013/09/30 07:59:49
Disc Capacity: 138.0GB
Used Space: 10.4GB (7.5%)
Free Space: 127.6GB (92.5%)
VA4_DISC Free Space: 96.6%

Help

Displays html version of manual

Trigger Settings



Analyzer Trigger Mode: retrig
Runup Trigger Mode: time
Speed Change[Hz]: 1.00
Time Change[s]: 1
Trigger Source: freerun
Use Ampl Tacho: no
Ampl Trig Channel: 1
Ampl Trig Level [g]: 1
Ampl Tacho Hysteresis [g]: 1
External Trig Edge: rising
External Trig Level [V]: 1
Pretrig[%]: 0

Analyzer Trigger Mode This setting is used in Analyzer and Octave Analysis modes.

single Only one measurement is taken and displayed

retrig 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 Trigger Mode This setting is used in RunUp module. It has to be defined, how often the data will be taken.

asap 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(Hz)** item, what it is significant change.

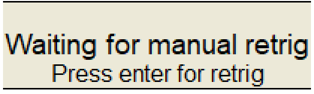
time All measurement are taken with the same time interval between them. The time interval length is define in **Time Change(s)**.

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 **Speed change(Hz)** or **Time Change(s)**.

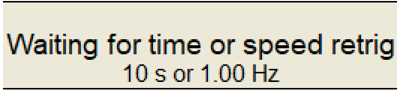
Speed change(Hz) **1, 10, user** see the **Runup Trigger Mode** item.

Time change(s) see the **Runup Trigger Mode** item.

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



Waiting for manual retrig
Press enter for retrig



Waiting for time or speed retrig
10 s or 1.00 Hz

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

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

freerun The taking of measured data begin immediately after preparation 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 e.g. 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 preparation, second for triggering.

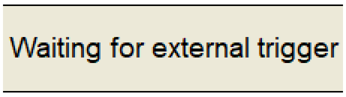
manual sequential Similar to manual, but every measurement for averaging must be start separately. E.g. when AVG=10, then the **START** button must be used 10 times.

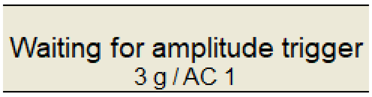
amplitude The taking of measured data begin when the signal level exceed the **Ampl Trig Level**, which is set by user also in this menu. Both - positive (rising edge) and negative (falling edge) levels are accepted. The signal amplitude is taken directly from sensor input, no additional filtering is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

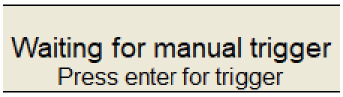
the level is set to 100mV - triggered when the raising signal goes from e.g.99mV to 101mV
the level is set to -100mV - triggered when the falling signal goes from e.g.-99mV to -101mV

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).

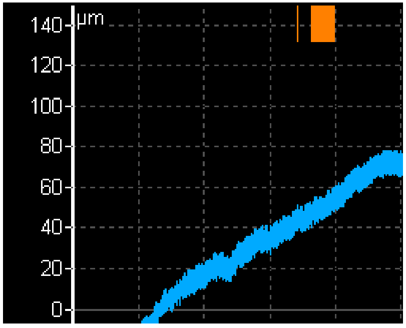
Note! If no trigger event occurs, the **Waiting for trigger** window appears. The text informs, which event is expected.

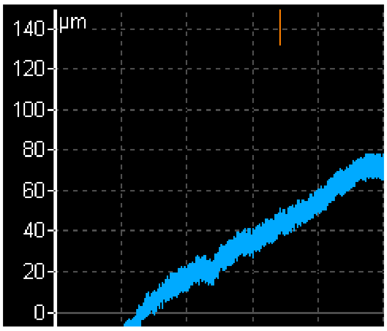

Waiting for external trigger


Waiting for amplitude trigger
3 g / AC 1


Waiting for manual trigger
Press enter for trigger

Use Ampl Tacho **yes, no**
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.





Ampl Trig Channel **(1,2,3,4)** The number of channel, which will be used for **amplitude** triggering.

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

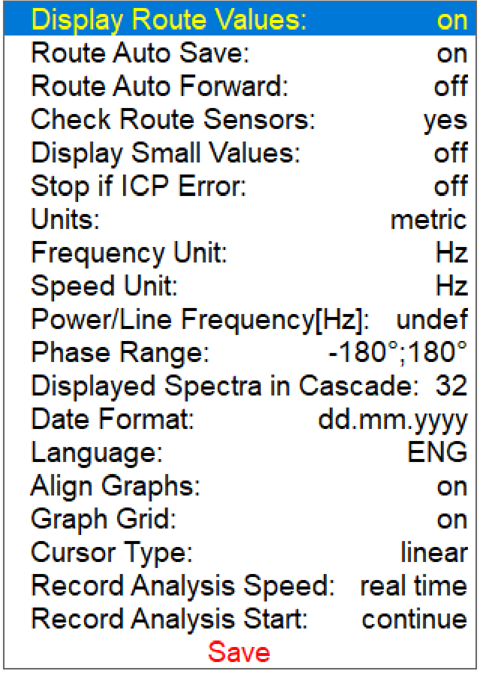
Ampl Tacho Hysteresis see **Use Ampl Tacho**

External Trig Edge **rising, falling** edge for triggering

External Trig Level[V] See the description in **Trigger Source/ external**

Pretrig (%) **value in (100,-100) or user** Usually the taking of measurement (e.g. 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.

Global Settings



Display Route Values: on
Route Auto Save: on
Route Auto Forward: off
Check Route Sensors: yes
Display Small Values: off
Stop if ICP Error: off
Units: metric
Frequency Unit: Hz
Speed Unit: Hz
Power/Line Frequency[Hz]: undef
Phase Range: -180°;180°
Displayed Spectra in Cascade: 32
Date Format: dd.mm.yyyy
Language: ENG
Align Graphs: on
Graph Grid: on
Cursor Type: linear
Record Analysis Speed: real time
Record Analysis Start: continue

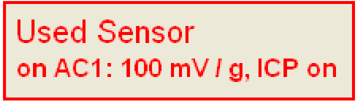
The underlined values are the default values (factory settings).

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 after results confirmation has to save it manually (by **Save** button)

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.

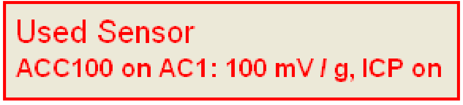
Check Route Sensors **yes**, **no**
Each point in the route contains the sensor setting, which is defined in DDS. The instrument contains also the sensors setting (**Sensors** button). Both settings are compared for each point during the route readings. When the sensor setting in point is not equal the 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 defined the name in DDS (e.g.ACC100). 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 (e.g. 5,26E-6). Otherwise the 0 (zero) will be displayed.

ICP Initialisation Delay[s] **default**, **user** the time delay after the ICP is switched on

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** (all units appears in the menu)

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)** the range of phase values

Displayed Spectra in Cascade **32, 128, 256, 512, 1024** the number of displayed spectra in cascade graph. It is not the number of measured spectra !

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

Language **ENG**, **CZE**, ... select your language

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 (e.g.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 VA4 version 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. In the version 2 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 is always move to the maximum line, which is contained in one pixel.

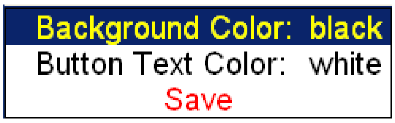
Record analysis speed **fast, real tíme** the record could be analyzed in two ways. Let's suppose the record length is 300 sec, it could be e.g. run up record. You want to measure the 1x amp+phase (ampl+phase+speed) during the record. If you want to watch the continuous results, then select the **real 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.

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. E.g. 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

IMPORTANT : when you moved the cursor manually, the the next reading will always start from that position.

Appearance


Background Color: black
Button Text Color: white

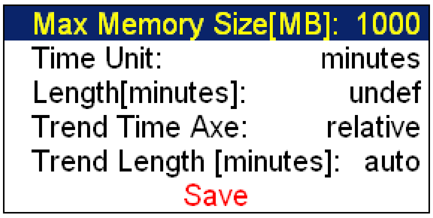
Background Color **black**, **white** setting of background and other colors.
You can create your own colors profile. Use the **create** item below the black and white. The **col.cpy** will be creted on VA4_DISC. You can change the RGB value of all colors and then save it with new name. When the

instrument is switched on, then all cpy profiles are moved to the instrument and then used. You will find your new name in the list of Background Colors. Use the **Delete** button for removing of user defined colors.

Button Text Color **black, white**

Runup

Contains runup global parameters.



Max Memory Size[MB]: 1000
Time Unit: minutes
Length[minutes]: undef
Trend Time Axe: relative
Trend Length [minutes]: auto

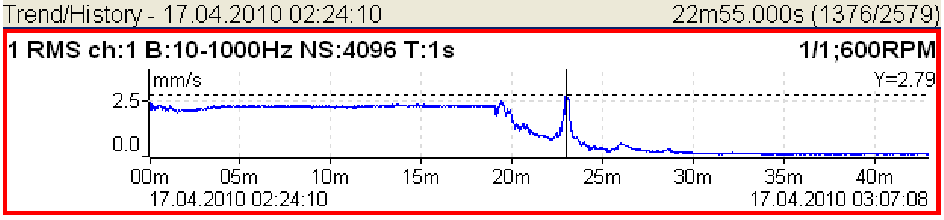
Max Memory Size[MB] **value** It enables partial savings of runup measurement. If the size of measured data exceeds the value, then data are saved and new runup is opened.

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

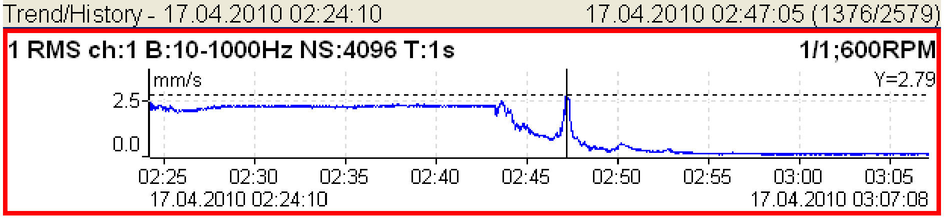
Length **undef, value** If defined, then measured data are saved to individual files, where each file contains defined length.

Trend Time Axe

relative the time axe begins from zero



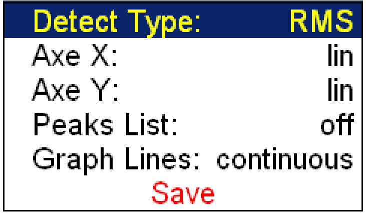
real time the time of measurement is displayed on time axe



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

These settings are the default settings, which are used for graphs.



Detect Type: RMS
Axe X: lin
Axe Y: lin
Peaks List: off
Graph Lines: continuous

Detect Type **RMS, 0-P, P-P** the spectrum values on amplitude axe

Default detect type for spectral amplitude values. E.g. spectral graph in analyzer module uses this type of amplitude but you can enter another value for particular graph in its **Graph Properties** menu.

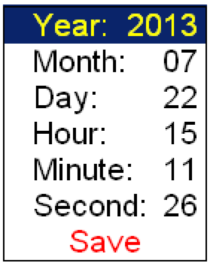
Axe X **lin, log** this parameter you can set in **Graph Properties** functions, which are accessible in every graph.

Axe Y **lin, log** this parameter you can set in **Graph Properties** functions, which are accessible in every graph.

Peaks list **on, off** the list of peaks can be displayed in each spectrum graph

Graph Lines **continuous, discrete** the spectrum can be drawn as line through the tops of line or as discrete vertical line for each frequency

Date/ Time



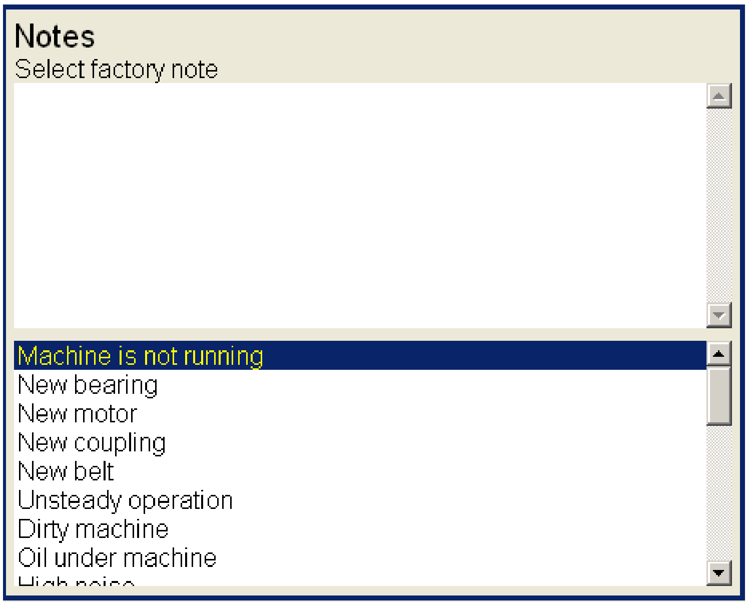
Year: 2013
Month: 07
Day: 22
Hour: 15
Minute: 11
Second: 26

Set the actual date and time.

User Notes Settings

You can attach the short text notes to route points. There are three ways how 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.



Notes
Select factory note

Machine is not running
New bearing
New motor
New coupling
New belt
Unsteady operation
Dirty machine
Oil under machine

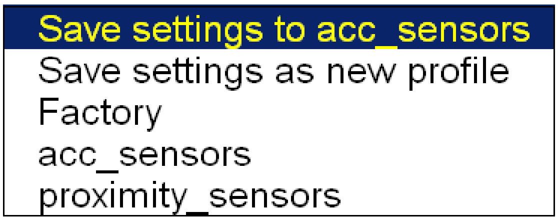
Now we describe how to create the **User notes** list. Press the **Global** button and select **User Notes Settings**. The new window appears. In upper half is the list of existed user notes (now empty). The predefined **Factory notes** are displayed in lower half.

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** button.

If you want to create your own note, then push **Edit text** button. Enter your note manually. Press the **Save** button and all notes are saved to memory.

Profiles

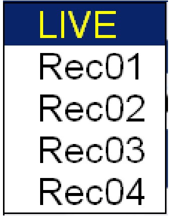
All instrument parameters can be saved to the **Profile**. It is useful e.g. for saving of sensor sensitivities.


Save settings to acc_sensors
Save settings as new profile
Factory
acc_sensors
proximity_sensors

Save settings to *name*	saves the parameters to the Profile, which was opened.
Save settings as new profile	save the parameters to the new Profile (after name entry).
Factory	opens the factory default Profile
list of saved profiles (acc_sensors, proximity_sensors)	selection of existed profile

The **Delete** button removes selected profile.

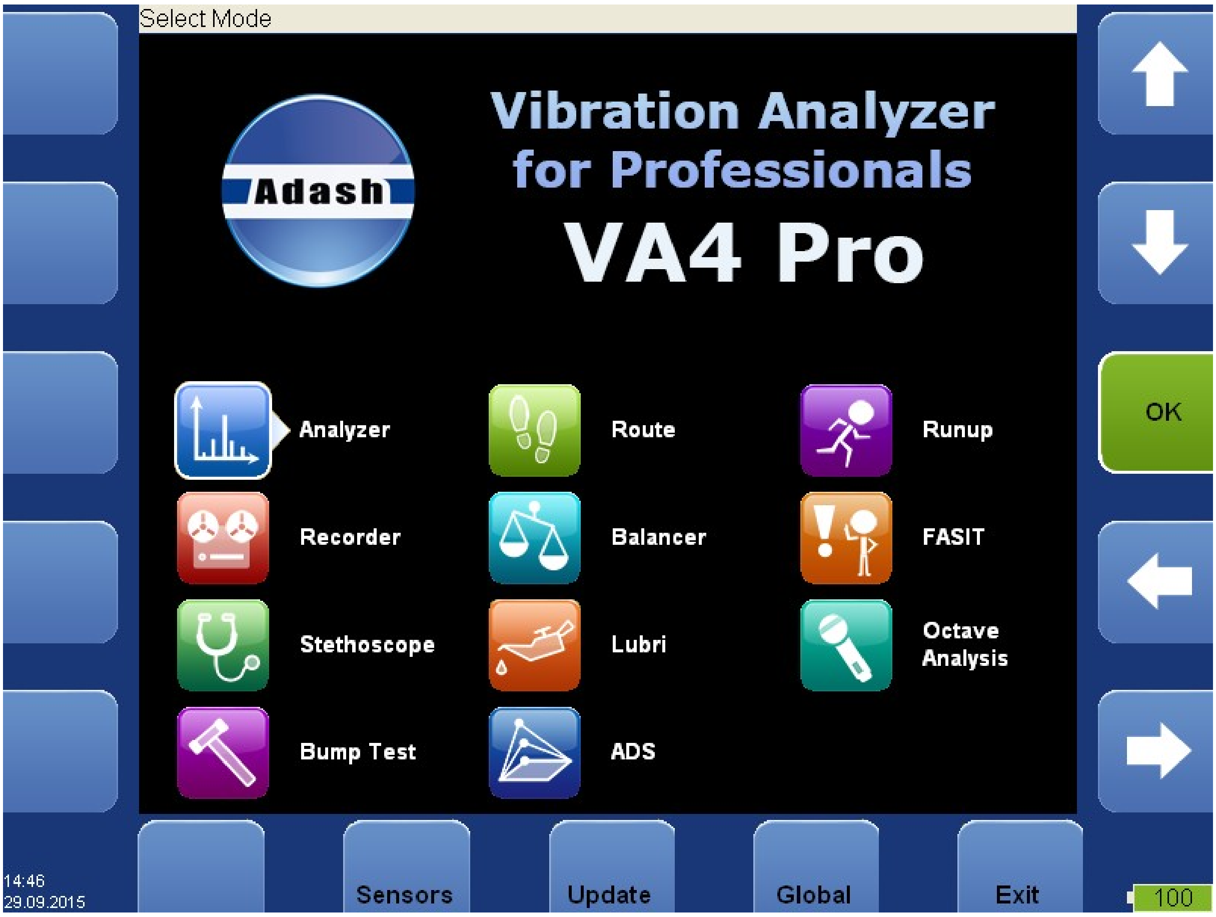
Signal Source


LIVE
Rec01
Rec02
Rec03
Rec04

Every 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. The selected signal source is also displayed in the Global window.
If you work with Virtual unit on your computer, use the Default Rec for testing.

The Main screen

After switch-on the Main screen appears. You can select the required mode of the unit.


Select Mode
Adash
Vibration Analyzer
for Professionals
VA4 Pro
Analyzer
Route
Runup
Recorder
Balancer
FASIT
Stethoscope
Lubri
Octave Analysis
Bump Test
ADS
OK
14:46
29.09.2015
Sensors
Update
Global
Exit
100

Update of the unit firmware

You can download the updated firmware from producer website www.adash.cz. Follow the procedure:
- Download the file for update (e.g. A4400_ver0202.up2) from website (www.adash.cz) and save it to your computer.
- Connect the instrument to the computer. Remember, it has to be switched off.
- Run the Explorer or other software, which you use for copy of files.
- Copy the update file from the computer to the **VA4_DISC**.
- Use **Safely remove hardware** function and disconnect instrument from the computer.
- Switch-on the instrument to the main screen.
- Push the **Update** button.
- 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 main screen appears again.

Update of bearing database

The bearing database you can download from website Adash/ Downloads/ Software Adash. The Bearing Database item is in A4400 - VA4Pro section. The name of the file is **bdx01.va4**.
- Connect the instrument to the computer. Remember, it has to be switched off.
- Run the Explorer or other software, which you use for copy of files.
- Copy the update file from the computer to the **VA4_DISC**.
- Use **Safely remove hardware** function and disconnect instrument from the computer.
- Switch-on the instrument to the main screen. Bearing database is ready to use.

Battery capacity

The information about % of battery lifetime is displayed in the right bottom corner of the display. When the capacity is more then 30%, the green symbol appears. When the capacity is 10-30%, the yellow symbol is used. Under the 10% the red symbol appears. If less then 6%, the lifetime image begins to blink. At that time the running measurements are stopped. The next measurement is not enabled.
When the 3% is achieved, the unit will switch off.

Instrument buttons

Fifteen buttons are around the screen allows to control the unit. The function of every button is described on the screen near the button. Such dynamic approach enables to use one button for many functions depending of the actual needs.

Control and Menu buttons

Control buttons with the description are on the left and right screen side. The Menu items with the description are displayed in the bottom of the screen.

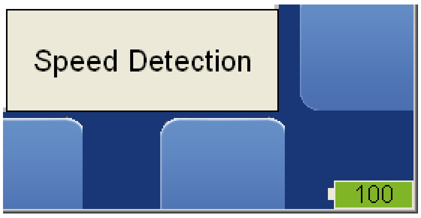
The Shift button

The Shift button changes the purposes of buttons. It is used for numerical and text inputs. Also it is used for changing of arrows properties.

Speed detection

You need to know the speed of the measured machine in some cases. We will describe here how the speed detection works. In the following text, this chapter can be mentioned.

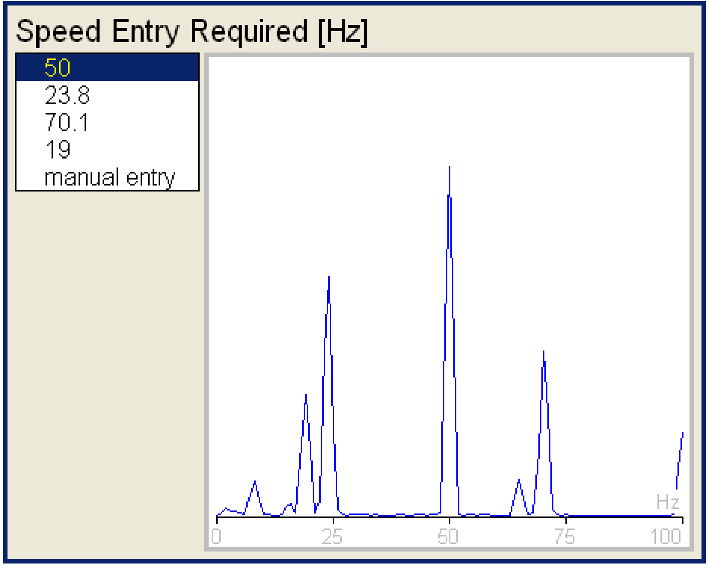
Detection is done just before the measurement itself after pressing the Start button. During the detection there is information window displayed in bottom right corner.



Speed Detection

If the tacho probe is detected, no other speed detection will happen. The speed is measured by tacho probe.

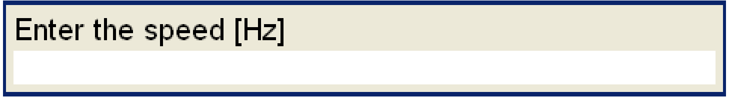
The highest peaks are found and displayed in the list. The highest amplitude speed in on the top of list. The spectrum is displayed also. Select the correct value and press **OK**.



Speed Entry Required [Hz]

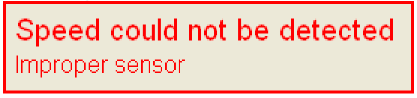
50
23.8
70.1
19
manual entry

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.



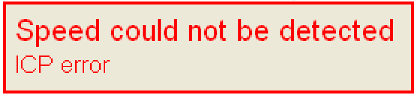
Enter the speed [Hz]

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.



Speed could not be detected
Improper sensor

If the measurement for speed detection fails, then error message appears. E.g. ICP error.



Speed could not be detected
ICP error

If the speed value is detected, it is automatically saved to the data header for following measurement in the same way as the speed value measured by tacho probe. If the speed is measured by tacho probe simultaneously, the value from the tacho probe has priority when saving.

The Analyzer mode

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

The Meas

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

The Graph

The graphical form of that **Meas** values displayed on the screen we will call the **Graph** (overall value, time signal, spectrum, orbit, order analysis. One Graph works with data from one measurement item. You should keep in mind that also one overall value is the Graph.

The Set

The **Set** is the most important term in the Analyzer mode. The **Set** is the set (or group) of one or more measurements **Meas**, which the user wants to take and display together. E.g. 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 measurements **Meas**. 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 simultaneously. See also **Virtual Analyzers** section for better understanding.

The Project

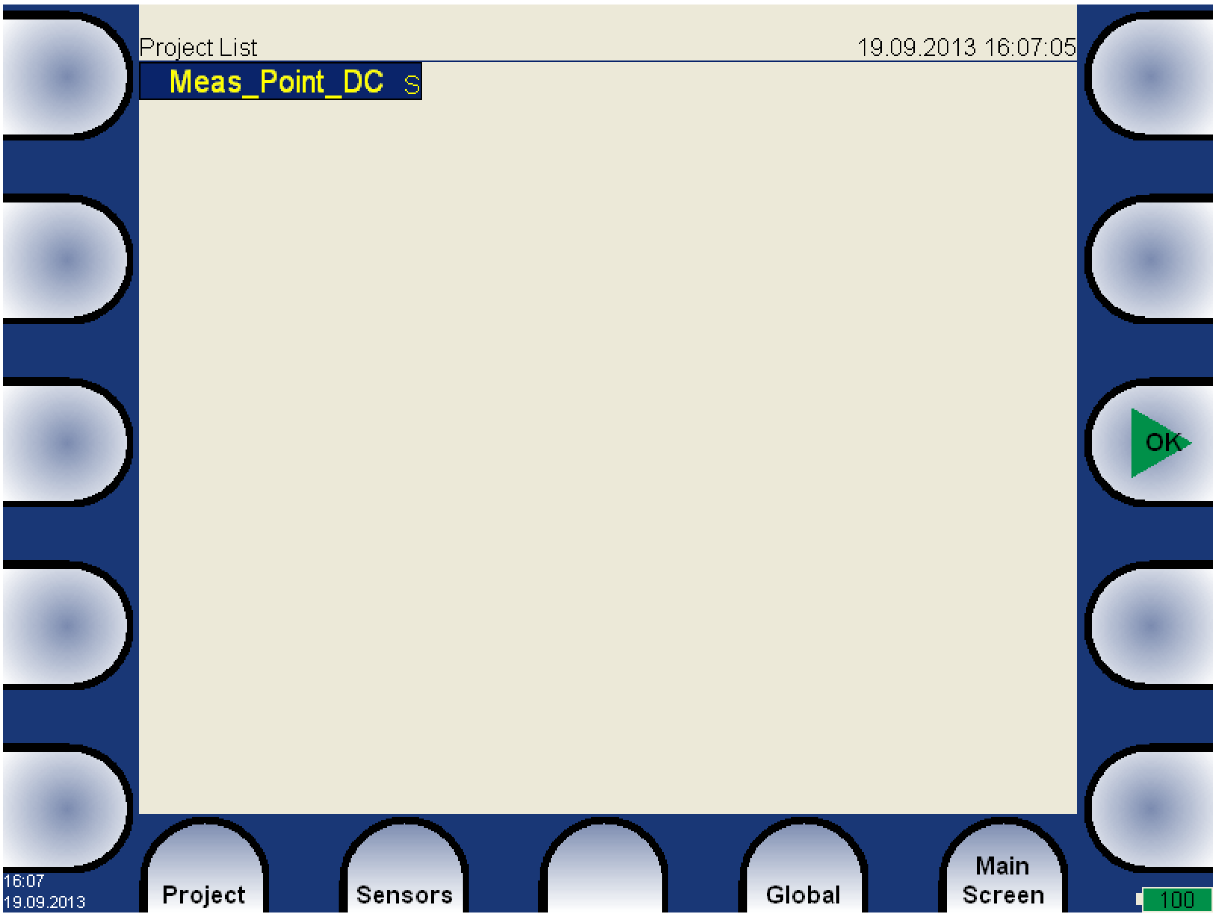
You can use only various **Sets** for analyzing. But sometimes you can need the more structured items then simple **Set**. Such items we call **Projects**.
Examples:
Meas_Point_A
    This is only simple **Set**, which contain several measurements in one point.
Pump_P/ Point_1, Pump_P/Point_2, Pump_P/Point_3
    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 VA4_DISC (flash disc)

The computer can read any data from VA4 flash disc only. This flash disc has the name VA4_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 VA4 hard disc only (or SSD). When the set is closed, then the VA4 asks the user "Export to VA4_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 **Set/ Export** you can select the set and export it manually.

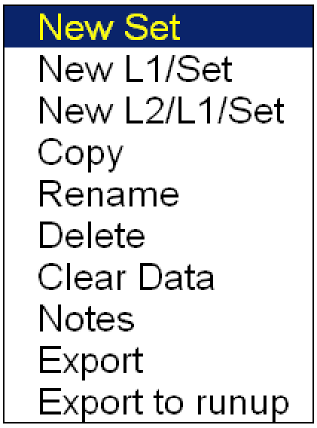
First Analyzer screen

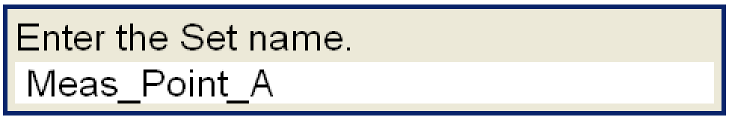
The first Analyzer screen contains the list of Projects saved in the memory or the empty list, when no Projects were saved. The time and date of last saving of selected project is displayed in top right corner.


Project List
19.09.2013 16:07:05
Meas_Point_DC S
OK
16:07
19.09.2013
Project
Sensors
Global
Main Screen
100

New Project - Set creation

Push the **Project** button. Them menu appears, select **New Set** item.

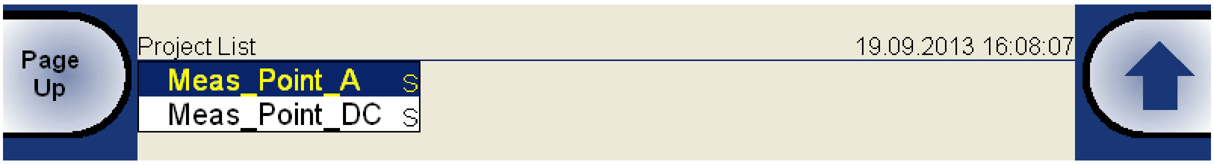

New Set
New L1/Set
New L2/L1/Set
Copy
Rename
Delete
Clear Data
Notes
Export
Export to runup



Enter the Set name.

Meas_Point_A

Enter the name of new set. Use the **Shift** button for next buttons displaying. Then press **OK**. Your new item appears in the displayed Project list (alphabetical order).



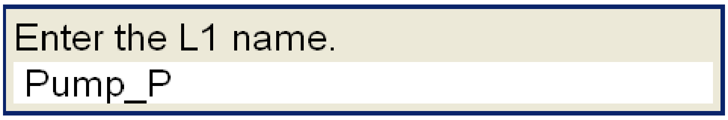
Project List 19.09.2013 16:08:07

Meas_Point_A S
Meas_Point_DC S

The **S** letter after the name is the **Set** type indication.

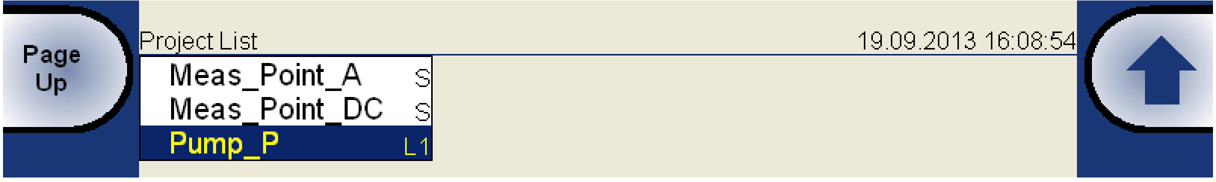
New Project - L1/Set creation

The L1/Set structure usually enables to create the machine item with several points. Push the **Project** button and select **New L1/Set** item.



Enter the L1 name.
Pump_P

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

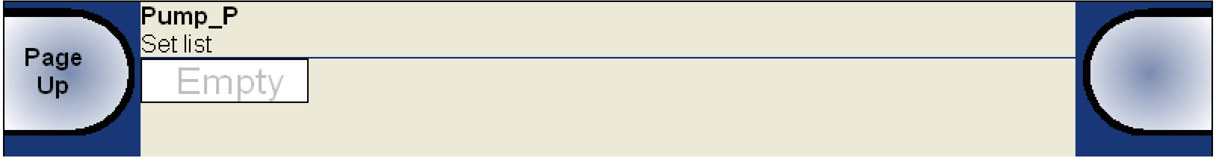


Project List 19.09.2013 16:08:54

Meas_Point_A S
Meas_Point_DC S
Pump_P L1

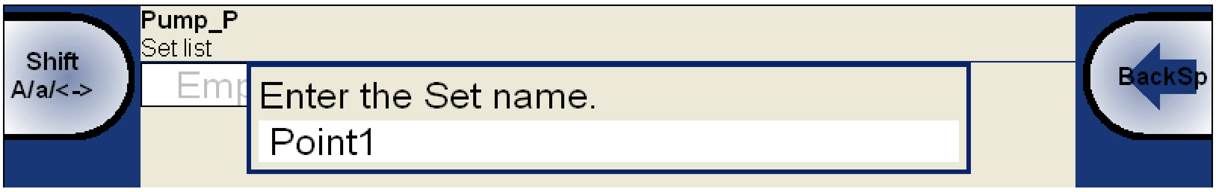
The **L1** letter after the name is the **Level 1** type indication.

L1 item is selected. Push **OK**. The item will be opened and the list of included **Sets** appears (now it is empty).



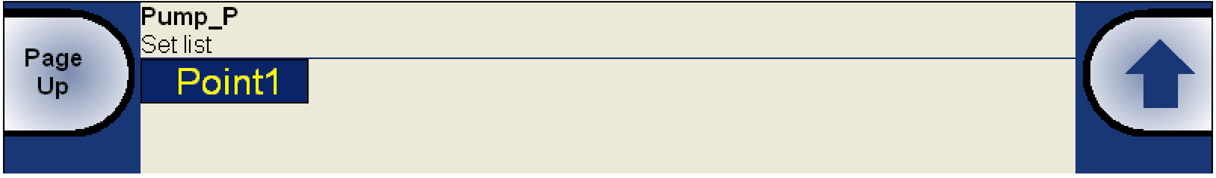
Pump_P
Set list
Empty

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



Pump_P
Set list
Emp
Enter the Set name.
Point1

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

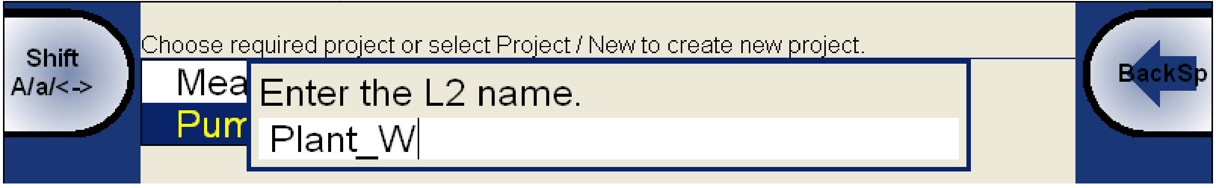


Pump_P
Set list
Point1

Use the **Close Project** button to return back to the project list.

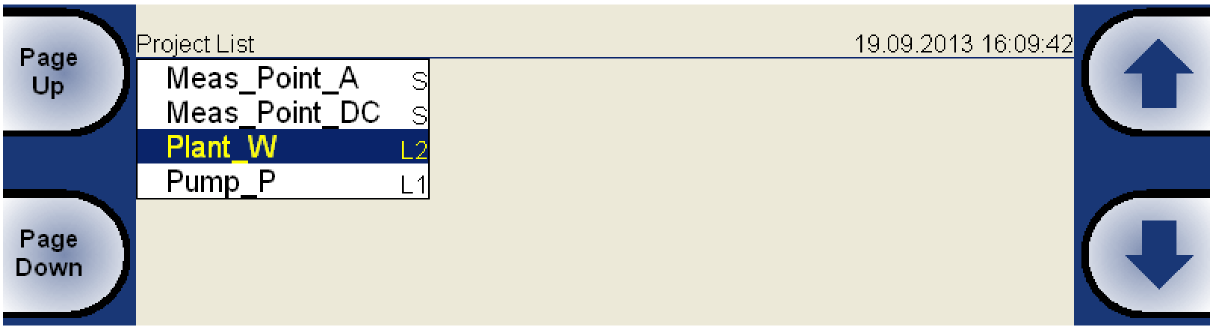
New Project - L2/L1/Set creation

The L2/L1/Set structure usually enables to create the plant with several machines. Every machine can contain several points. Push the **Project** button and select **New L2/L1/Set** item.

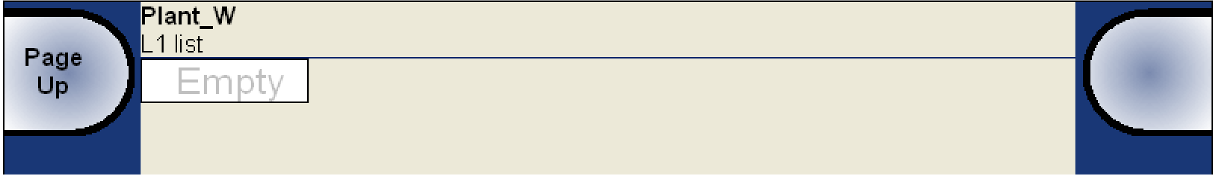


Choose required project or select Project / New to create new project.
Mea
Pum
Enter the L2 name.
Plant_W

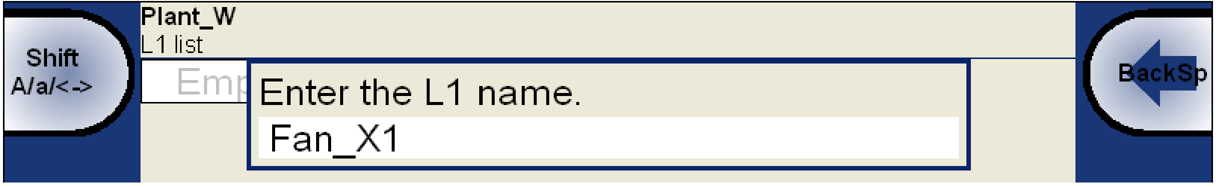
Enter the name, push **OK**. The project list appears (alphabetical order).


Page Up
Page Down
Project List
19.09.2013 16:09:42
Meas_Point_A S
Meas_Point_DC S
Plant_W L2
Pump_P L1

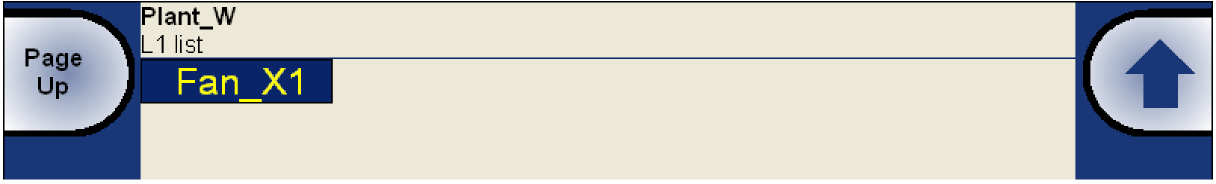
The **L2** letter after the name is the **Level 2** type indication.
Open the Project by **OK**.


Page Up
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.


Shift A/a/<->
Plant_W
L1 list
Emp
Enter the L1 name.
Fan_X1
BackSp

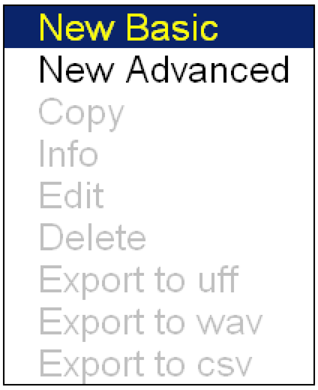
The L1 list appears.


Page Up
Plant_W
L1 list
Fan_X1

Open the L1 item and create the Set in the same way as it the previous section.
Use the **Back** and **Close Project** buttons to return to the Project list.

New Meas creation

Select the set from Set list of selected Project and press **OK**. Press the **Meas** button and select **New Basic** or **New Advanced**.


New Basic
New Advanced
Copy
Info
Edit
Delete
Export to uff
Export to wav
Export to csv

New Basic

You can create the new **Meas** by two ways. When you want define some basic measurement use the **New Basic**. Select required measurement from the list. This way is very fast.

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

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

Channel **1**, .., **4** The input signal source channel for evaluation.

Unit **name** 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** 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 (Hz)value 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 (approx. 0,6 Hz).

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

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

Input channel **1**, .., **4** Required only for response functions.

Output channel **1**, .., **4** Required only for response functions.

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

Zoom spectrum **no** standard spectrum will be made (range fro 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 be applied for evaluation.

ACMT FS(Hz) **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 (e.g.revolutions)

Number of triggers **value** Required number of revolutions (Speed control = on)

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

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

Avg **value** 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 (constant phase)
amplitude	every signal for averaging is triggered (constant phase)
manual	first signal for averaging is triggered manually, next signals are taken freerun

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.

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.

Order
Usually user needs the measurement of amplitude and phase on speed frequency. In Order parameter you can define any multiplication of speed and to measure amplitude and phase on that frequency.

measured frequency = Order * speed

Caution! You may enter any number as an order, but the phase can only be evaluated for integer orders.

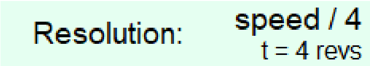
Orders **(1/2,1-5), (1-5), (1/2,1-10), (1-10)**
It defines which orders in order analysis will be measured.

Resolution **speed / 4 – speed / 1024**
This number defines the bandwidth of the spectrum line. When two near frequency exist and they are contained in one spectrum line, then this line shows the sum of both. When we want to get correct amplitude and phase value for example on speed frequency, then we must ensure that the spectrum speed line bandwidth contains just the speed frequency. If other frequency exists in the speed line, then it makes disturbing and we get wrong value. The next important feature of the ***speed / N*** resolution is that the number N is number of revolutions in required time signal, from which the spectrum is made.

Example! The speed is 25 Hz. The entered resolution is ***speed / 4*** (it means that time signal contains 4 revolutions), i.e. 6.25 Hz. The line bandwidth in FFT will be 6.25 Hz. 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, for example ***speed / 8***.

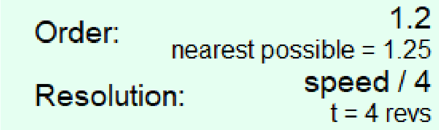
Attention! When you select higher resolution (for example speed / 64 or even speed / 1024) then more revolutions must be taken and you will wait for results longer time. The higher resolution means longer time signal for evaluation. We do not recommend using always the maximal value, because you will wait for results longer (much longer). Use the high resolution only in cases, when your signal contains two close frequencies and you need to separate them.

Resolution in orders. The resolution value in order analysis is connected with the number of revolutions similarly as resolution in frequency spectrum is connected with the number of seconds. Resolution in frequency domain can be expressed as $\Delta f = 1 / T$, where T is the number of seconds per FFT record. Similarly resolution in order analysis can be expressed as $\Delta ord = 1 / rev$, where rev is number of revolutions per FFT record. This resolution is defined in orders. If you want to express the order analysis resolution in frequency unit you need to multiply the resolution in orders by the speed frequency. Therefore the value of resolution is entered as the fraction of speed frequency and the required number of revolutions is displayed in the note below the resolution value.



Resolution: speed / 4
t = 4 revs

Attention! For measurements with adjustable order value, take care to correctly setup suitable resolution according to demanded order. The order value must be an integer multiple of the resolution in orders, i.e. an integer multiply of the 1 / rev. The menu itself helps you meet this condition. Any time you enter the order, the lowest appropriate resolution is automatically set. Then, you may increase the resolution value according to your needs. The resolution submenu always contains suitable values for actual order. However, you may still enter any user value. The nearest possible order, which will be truly used in calculation, is shown as a note if the actual order is not possible for the entered resolution.
For example, when the resolution in Hz = speed/4, then resolution in orders = 1/4 = 0.25. The available orders are for example 1.25, 1.5, 1,75 etc.



Order: 1.2
nearest possible = 1.25
Resolution: speed / 4
t = 4 revs

Attention! The order value should be at least four times higher than Resolution in orders. Instrument ensures this condition regardless the setup by increasing the number of revolutions.

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. Otherwise the positive/negative parts would be transposed.

Next Meas functions

Copy copy of selected measurement to the new one

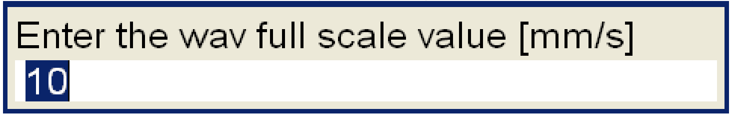
Info displays measurement properties

Edit enables changes in measurement properties

Delete deletes selected measurement

Export to uff exports data of selected measurement to the uff file format (not for all measurement types), the file is saved to uff folder on VA4_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 exports data of selected measurement to the wav file format (time signal and orbit), the file is saved to wav folder on VA4_DISC.
Time signal is exported as one file with two channels (1ch signal, 2ch trigger).
Orbit is exported as two files (A and B channels).
before exporting you need to enter the required range of signal in wave file. It enables to obtain better resolution in file. If the true peak of signal is e.g.8mm/s, then enter e.g. 10mm/s.



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

Export to csv exports data of selected measurement to the csv file format (see next chapter), the file is saved to csv folder on VA4_DISC.

Export to csv (all) Export to csv for all measurements which are in the set (to a directory)

Export to Records (only when the **Record** measurement is selected

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.

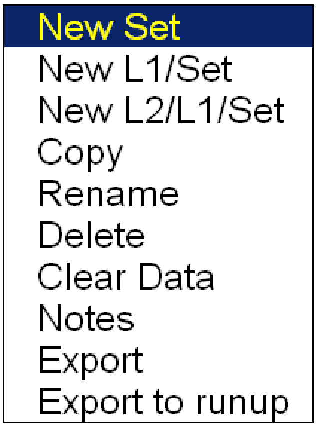
Export to VA4_DISC (only when the **Record** measurement is selected)
Very similar to previous item. Exports selected records to VA4_DISC/ VA4recorder folder.

CSV file description

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

Next functions available for list of projects



Copy	copy of selected item to the new one
Rename	renames selected item
Delete	erases selected item
Clear Data	erases measured data in selected item
Notes	see the Route chapter for details
Export	copy of selected item to the VA4_DISC, where is accessible for computer.
Export to runup	export of selected item to the Runup module. Also you can export projects from Runup to the Analyzer module.

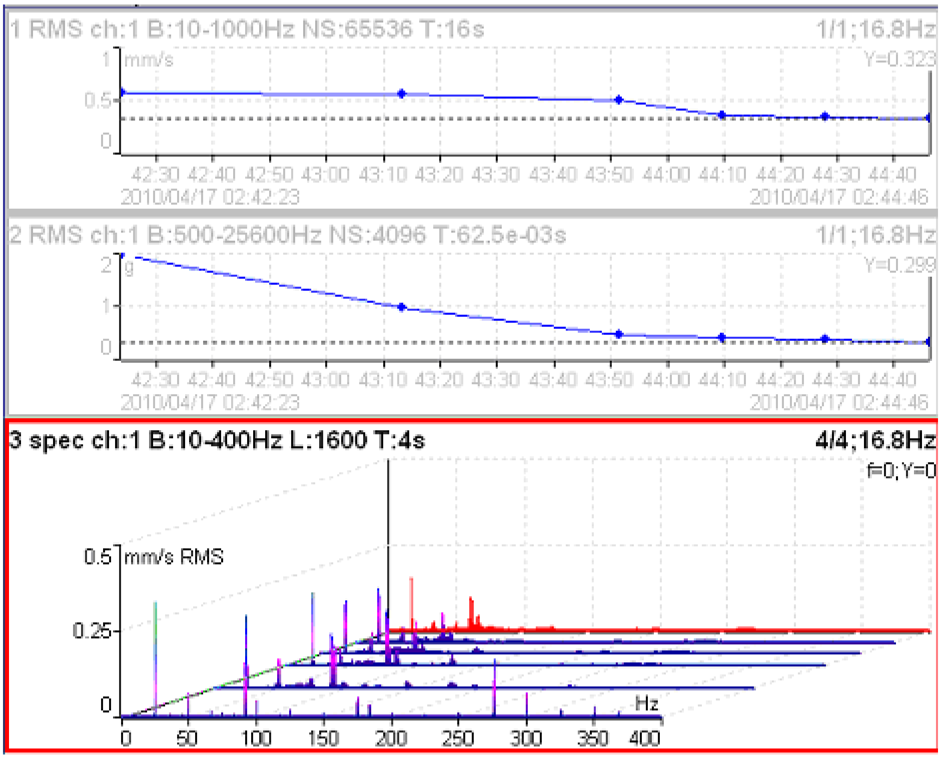
Functions for Set

Next function are available, when the Set is opened (it means the graphs are displayed).

Notes see next chapter

Save data saves last measured data. When you close the Set without saving, the measured data will be lost.

View Trend/ View Actual
The switch button for displaying of last measured data (Actual) and data saved in memory (Trend).



The View Trend example. The trends of overall values is in two top graphs. The cascade graph contains several spectra.

Clear Last Data if the trend is displayed, then it deletes last measured data in measurement point or set (according of displayed data).

Enter speed

This function are 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

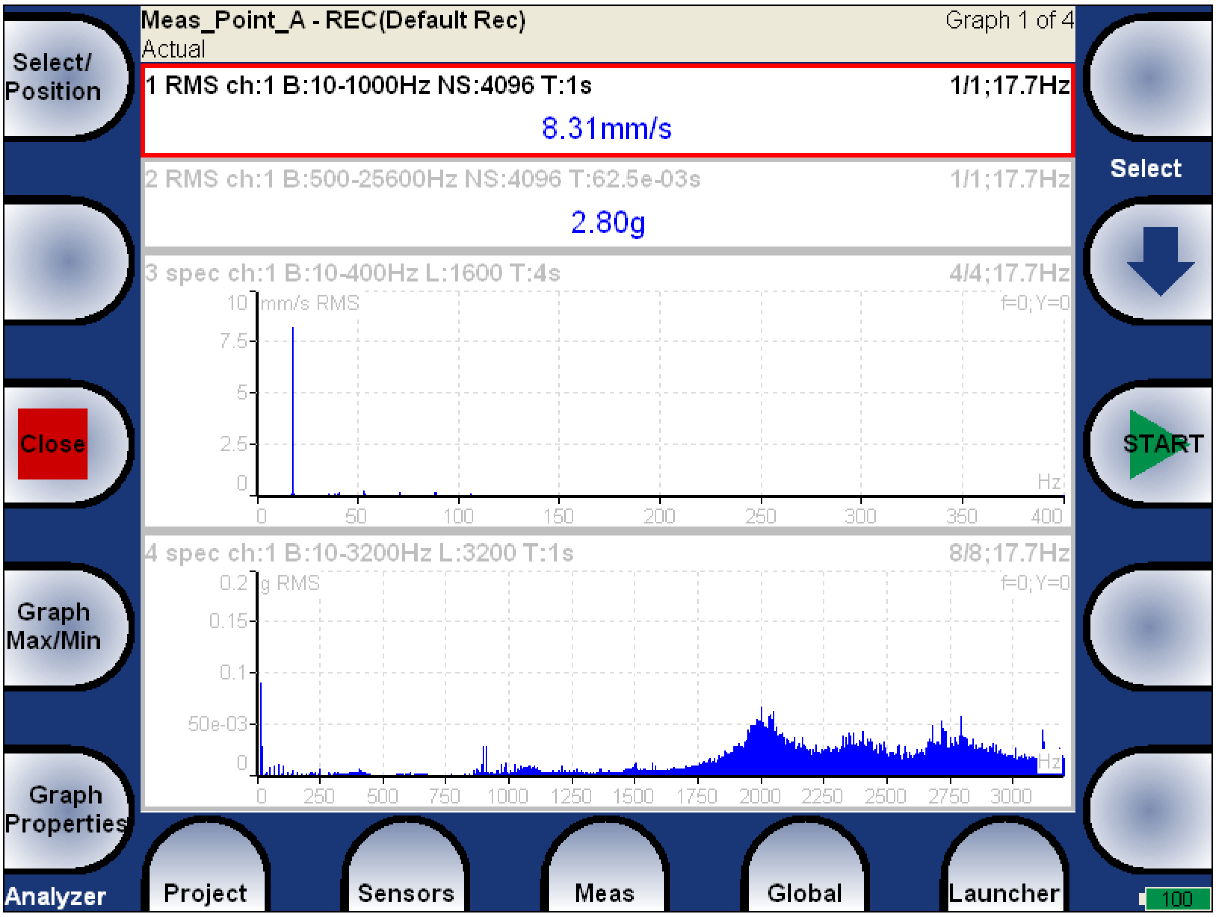
It cancels (removes) manually entered speed value.
The Cancel speed function is also available in Route.

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: Spectrum in mm/s, range 400Hz, 1600 lines, from channel 1, number of average 4
Meas 4 Spectrum in g, range 3200Hz, 3200 lines, from channel 1, number of average 8

When the measurements definition is made (see the **New Meas creation** section) everything is ready to make the real measurement. Push the **Start** button (green triangle button). For stopping the measurement use **Stop** button (the red square button). If the **Analyzer Trigger Mode** is set to single, then only one measurement is taken.



Meas_Point_A - REC(Default Rec) Graph 1 of 4
Actual

1 RMS ch:1 B:10-1000Hz NS:4096 T:1s 1/1;17.7Hz
8.31mm/s

2 RMS ch:1 B:500-25600Hz NS:4096 T:62.5e-03s 1/1;17.7Hz
2.80g

3 spec ch:1 B:10-400Hz L:1600 T:4s 4/4;17.7Hz

4 spec ch:1 B:10-3200Hz L:3200 T:1s 8/8;17.7Hz

Select/ Position
Close
Graph Max/Min
Graph Properties
Analyzer
Project
Sensors
Meas
Global
Launcher
Select
START
100
mm/s RMS
f=0;Y=0
10
7.5
5
2.5
0
Hz
0
50
100
150
200
250
300
350
400
g RMS
f=0;Y=0
0.2
0.15
0.1
50e-03
0
Hz
0
250
500
750
1000
1250
1500
1750
2000
2250
2500
2750
3000

Every graph on the screen contains one measurement. More screens with graphs can be developed.

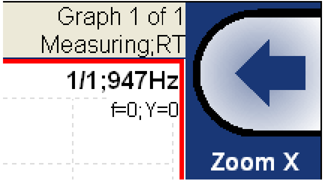
The description of each graph is in the top.
Example:
1 RMS ch:1 B:10-1000Hz NS:4096 T:1s
The translation: Meas No.1, RMS value, Channel 1, Applied band filter 10-1000Hz, Number of Samples of the signal 4096, Time length of signal 1s. The Signal means the time signal, from which the evaluation was made.

3 spec ch:1 B:10-400Hz L:1600 T:4s **4/4;17.7Hz**
The translation: Meas No.3, Spectrum from Channel 1, Range 400Hz, Lines 1600 Time length of signal 4s, 4 signals for 4 AVG used, speed 17.7Hz

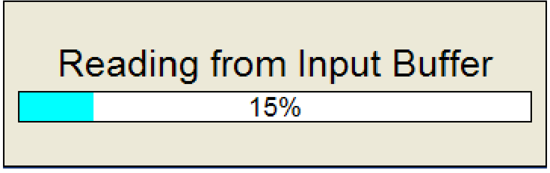
Input Buffering

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 (e.g. by **Stop** button), the computation continues until the input memory is empty. The bellow window appears.



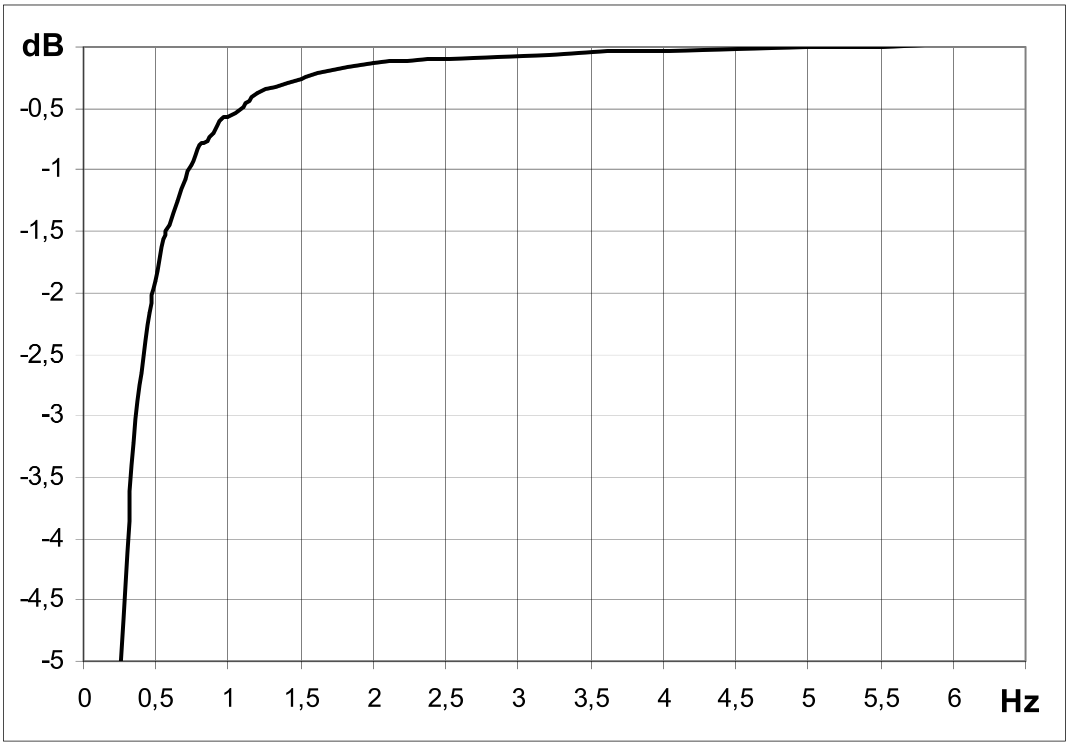
Reading from Input Buffer

15%

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.

Band fmin[Hz] - HP filtering

Almost in all measurements you should define the HP filtering of input signal. You set it in **Band fmin[Hz]** parameter. You can select the **none**, **1, 2, 10** and **user** filter. 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.



The Analyzer buttons description

The Arrow Mode button

The **Arrow Mode** button switch functions of arrow buttons.

Try to push the **Arrow Mode** button and notice that the left top button changes between **Select/Position**, **Zoom X/Zoom Y and Move X/Move Y**.
When the delta or sideband cursor is displayed, then the additional **DeltaX** item appears.
When the measurement from disc are displayed, (**View Trend** function), then the additional **Trend** item appears.
According selected function two right top buttons change their meaning.

Functions for up and down arrows (top right buttons):
Select - moves the selection of active graph
Position - you can change the order of graphs
Zoom - makes zoom-in or zoom-out on vertical Y axe
Move - when the zoom-in is applied, then button move with the signal in defined zoom view vertically

Functions for left and right arrows:
Zoom - makes zoom-in or zoom-out functions on X or Y axe
Move - when the zoom-in is applied, then buttons move with the signal in defined zoom
Delta X - defines the delta X resolution for sideband or delta cursor
Trend - moves on the displayed measurement from disc (history).

The Start, OK button

This right middle button has more purposes and it can :
START the measurement,
OK confirm the selections or entries.

The Stop, Cancel, Back and Close button

This left middle button has more purposes and it can :
STOP the measurement,
Cancel the definition or selection in menu items,
Back moves back in structure of project
Close closes the measurement screen and returns you to the project list

Graph Max/Min

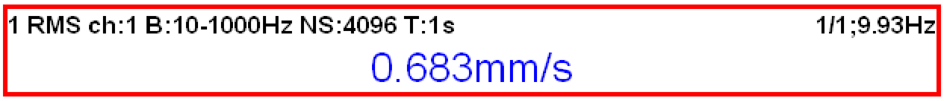
Maximizes or minimizes the selected graph to the whole screen or returns back to the initial screen with more graphs.

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.
E.g. the Axe Z (third) axe is only visible in 3D graphs (e.g.cascade, spectrograph).

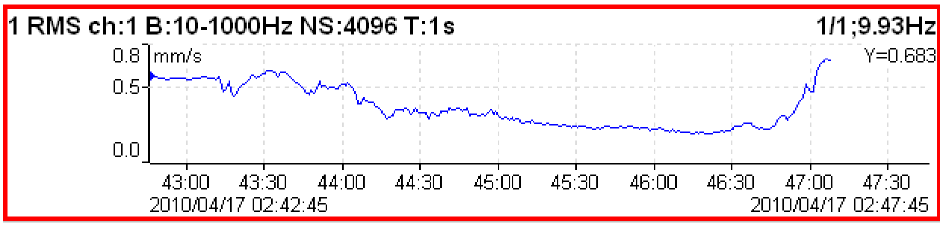
Display value, **trend**



1 RMS ch:1 B:10-1000Hz NS:4096 T:1s 1/1;9.93Hz

0.683mm/s

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



1 RMS ch:1 B:10-1000Hz NS:4096 T:1s 1/1;9.93Hz

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

Graph Unit for specra
Sets a physical unit which is used to display a signal in the graph. The unit may differ from the unit in which the signal was measured and stored (*Edit Measurement / Unit*). You can choose any unit from a menu. By default, a **same as meas** value is used, i.e. no recalculation is applied and the signal is displayed in the same unit as it was measured.

Note! Integration and derivation of the signal is available in spectra.

Cursor for time signals -

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

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

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**

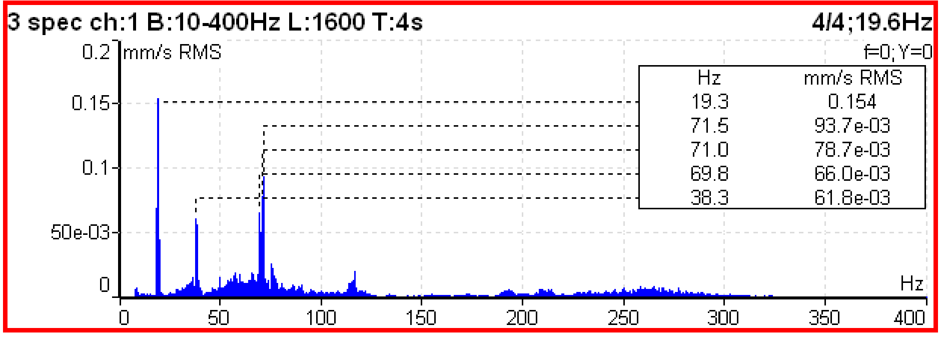
Axe Y - **lin, log**

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

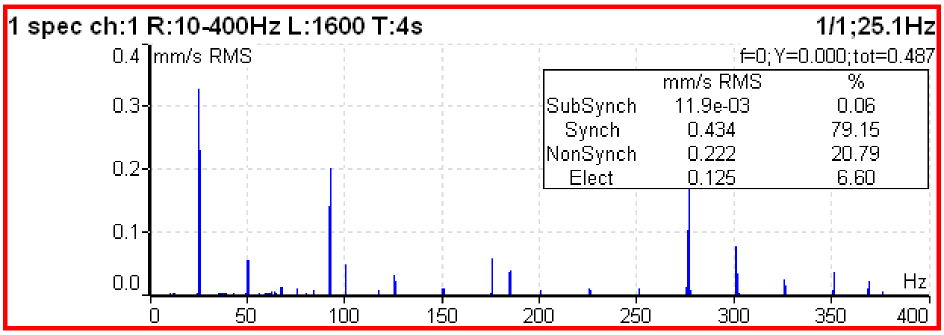
Detect Type - **RMS, 0-P, P-P** Y axe type
When the spectrum is displayed first time, then the global **Spectrum Settings / Detect Type** is used**.** You can change it to other type here.

Peaks List - **on**, **off** the 5 highest spectrum lines table



Hz	mm/s RMS
19.3	0.154
71.5	93.7e-03
71.0	78.7e-03
69.8	66.0e-03
38.3	61.8e-03

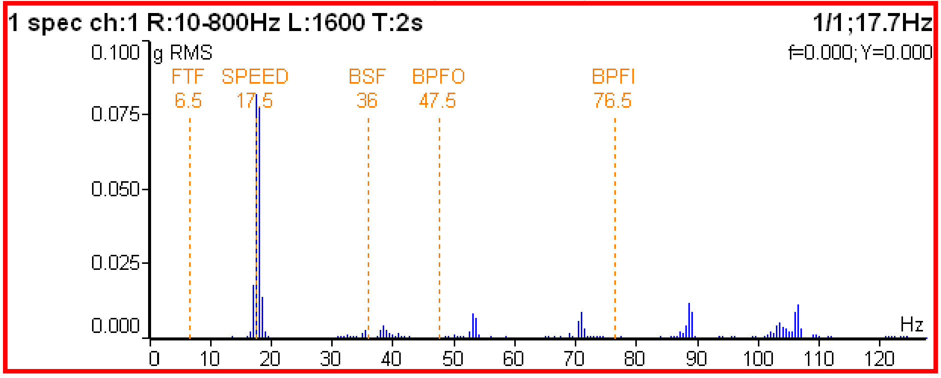
Synch Table **on, off** table of values synchronized with speed and line frequency
SubSynch - value under speed frequency
Synch - value on speed frequency and harmonics
NonSynch - total value decreased of SubSynch and Synch
Elect - value on line frequency and harmonics (setting in Global Settings / Power/Line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



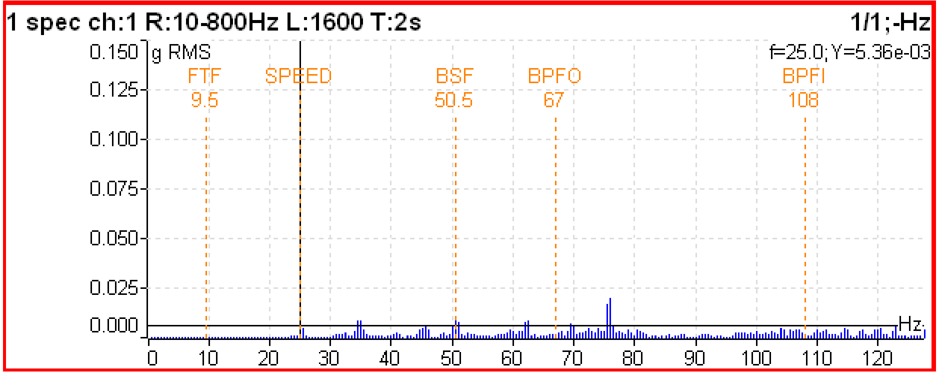
	mm/s RMS	%
SubSynch	11.9e-03	0.06
Synch	0.434	79.15
NonSynch	0.222	20.79
Elect	0.125	6.60

Bearing Faults - if the bearing type (or parameters) is defined and the tacho was used for speed measurement, then the fault frequencies are displayed in spectrum.

- **FTF**
  Fundamental Train Frequency
- **BPFI**
  Ball Pass Frequency of Inner ring
- **BPFO**
  Ball Pass Frequency of Outer ring
- **BSF2**
  Ball Spin Frequency * 2 = Ball defect frequency
  BSF2 is the bearing failure frequency which you can see exactly in the spectrum, because spinning defective ball hits the bearing twice during one ball revolution: once hits outer ring and once inner ring.



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

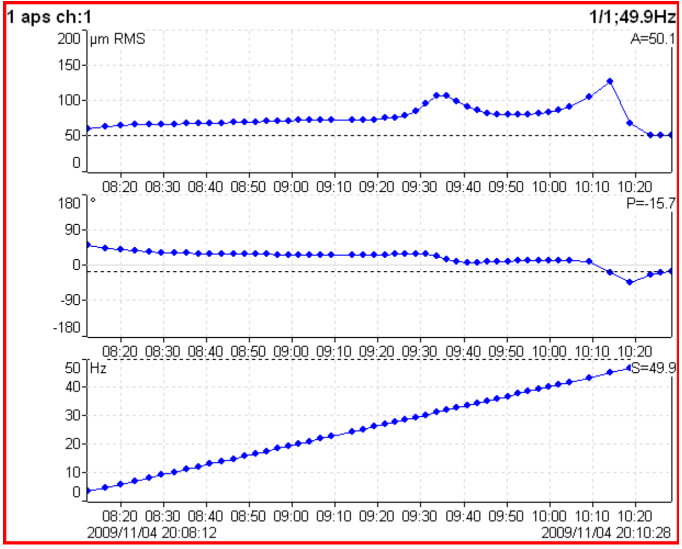
amplitude, phase, coherence for frequency response (Frf)
X, Y for orbit

View (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

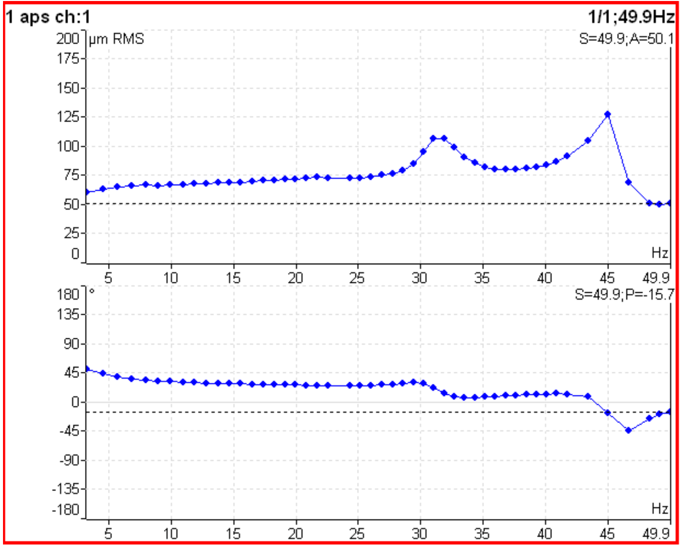
View (frf)
ampl, phase
real, imag
nyquist
amplitude
phase
coherence
time
amplitudes

View (1x amp+phase) available only for trend

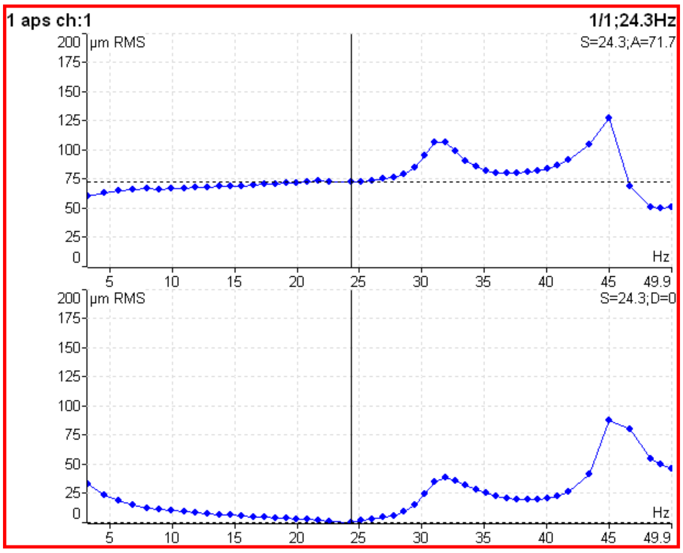
aps_t the trends of amplitude, phase and speed related to time of measurement



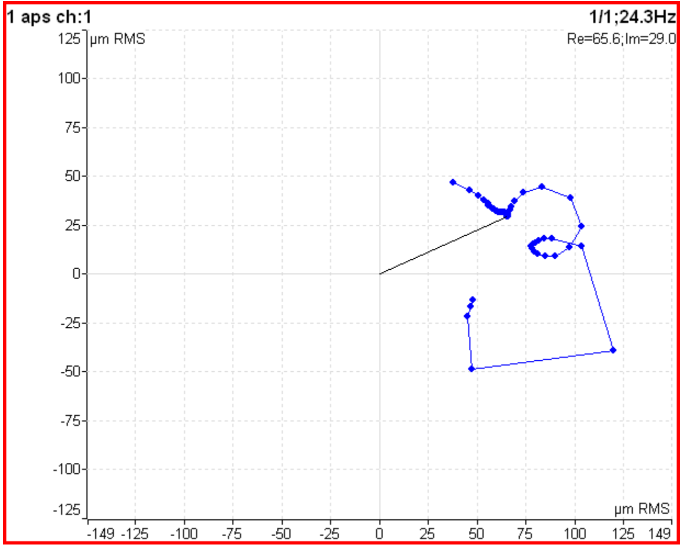
ap_s the trends of amplitude and phase related to speed



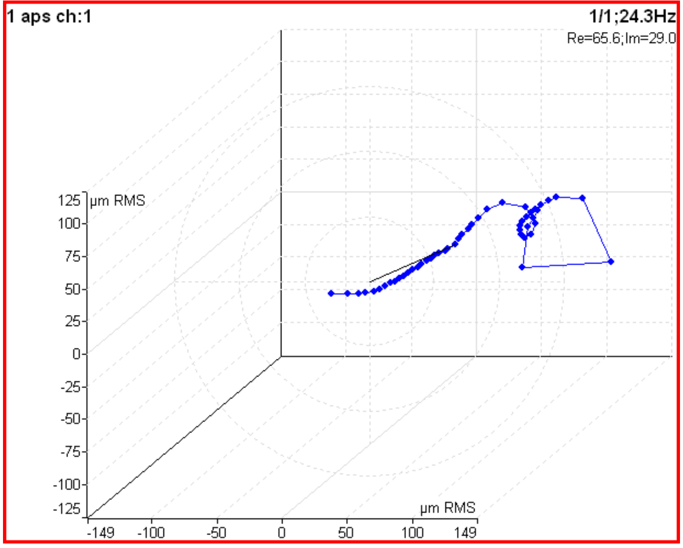
ad_s the trends of amplitude (upper graph) and difference amplitude (lower graph) related to speed, the difference is related to the trend cursor position (in that point is always zero).



polar 2D complex view



trend3D_t the 3D "tube" view, it is the nyquist graph expanded to Z axe (time scale)



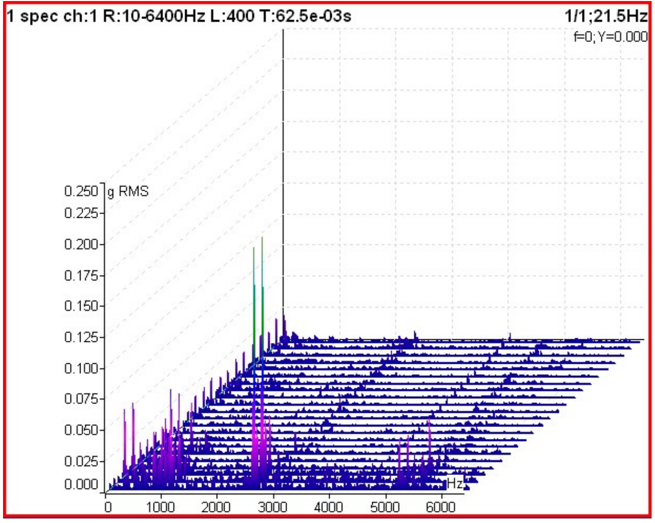
View (phase shift) available only for trend

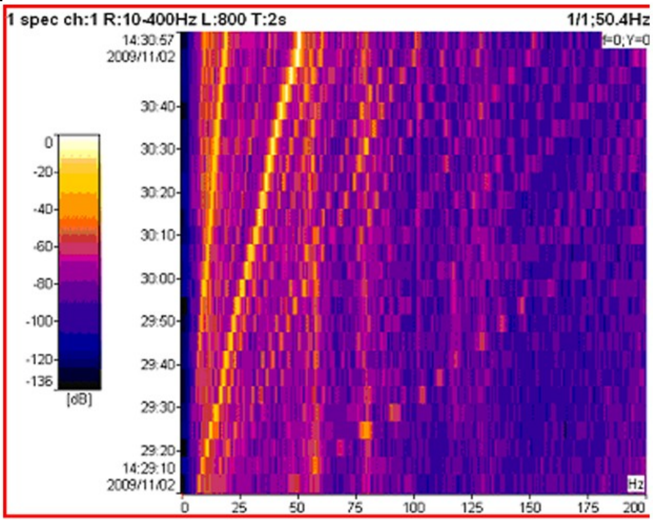
linear graph of phase shift, amplitude ratio and coherence related to the time scale

polar	polar plot of phase shift and amplitude ratio

View (spectrum)- available for trend

amplitude	one spectrum amplitude graph
cascade	waterfall graph
spectrograph	2D view of amplitudes vs. time
phase	one spectrum phase graph





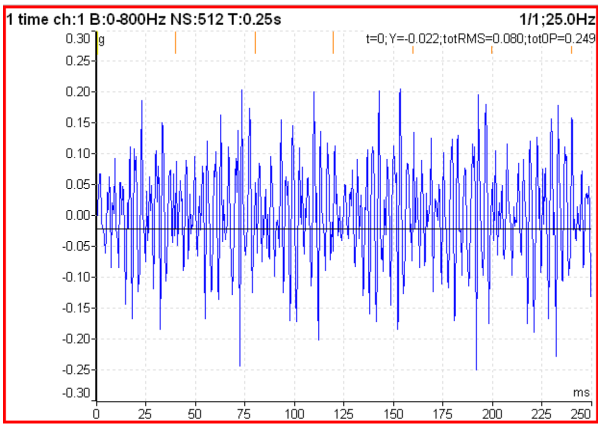
View (spectrum)– available for actual

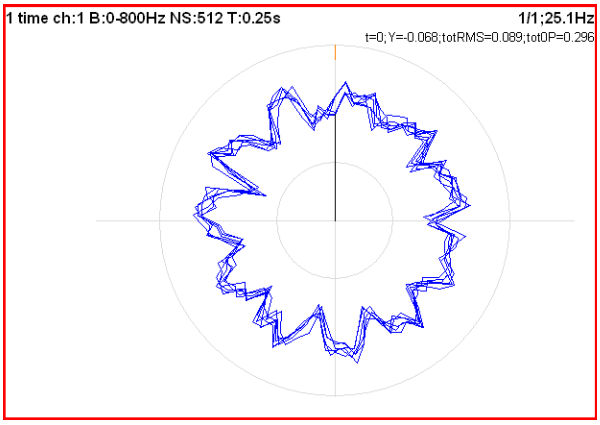
amplitude	one spectrum amplitude graph
time	displays the time signal from which the FFT was developed
phase	one spectrum phase graph

View (time waveform)

linear	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.



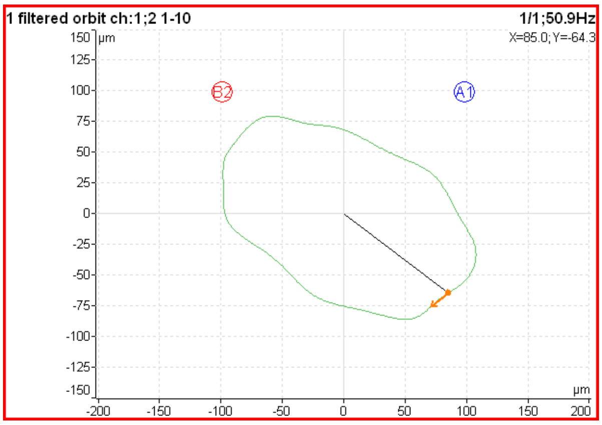


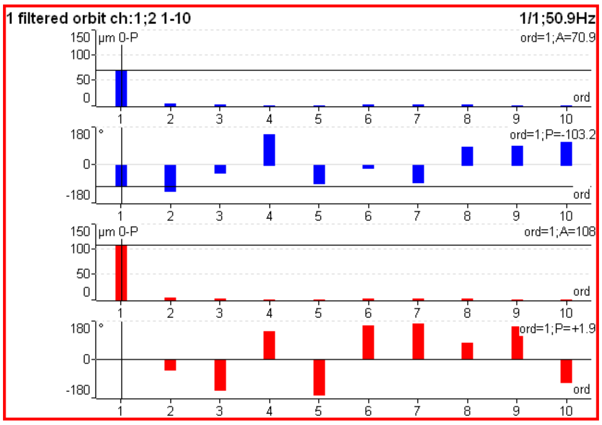
View (orbit)

orbit	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 (filtered orbit)

orbit
orders





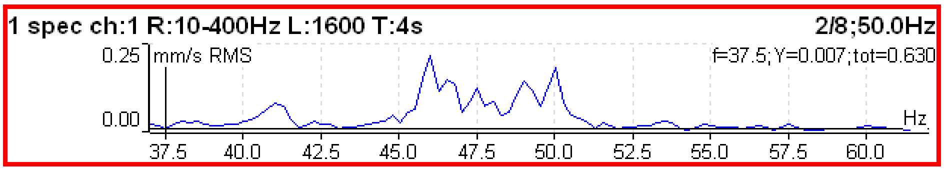
FFT Output (spectrum)

- **amplitude spectrum**
- **power spectrum**
- **amplitude spectral density**
- **power spectral density (PSD)**
- **energy spectral density (ESD)**

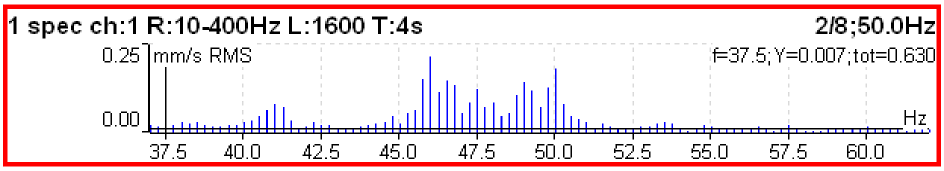
Speed Period	**on, off**	the speed time period is displayed
FTF Period	**on, off**	the FTF time period is displayed
BSF Period	**on, off**	the BSF time period is displayed
BPFO Period	**on, off**	the BPFO time period is displayed
BPFI Period	**on, off**	the BPFI time period is displayed

Graph Lines **continuous, discrete** the spectrum can be drawn as line through the tops of line or as discrete vertical line for each frequency

continuous

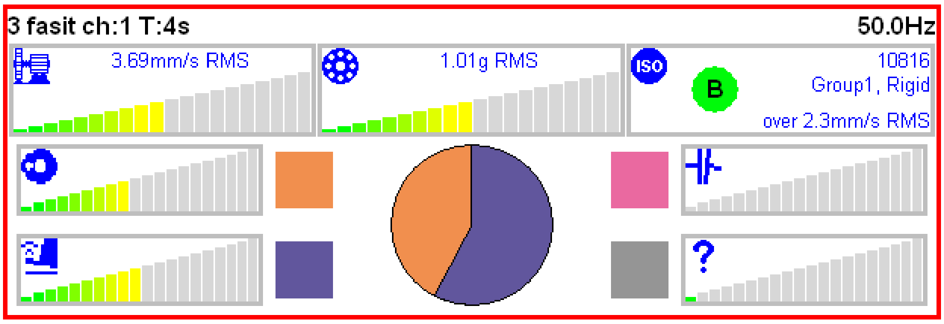


discrete



FASIT measurement

There is detailed description in the FASIT mode chapter.
If the FASIT is measured, the speed detection is done before the measurement itself (see the Speed detection chapter).



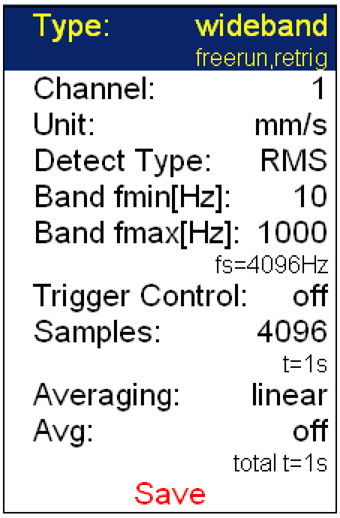
3 fasit ch:1 T:4s 50.0Hz

3.69mm/s RMS

1.01g RMS

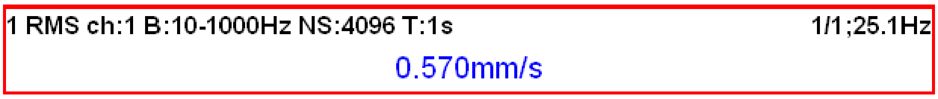
10816
Group1 , Rigid
over 2.3mm/s RMS

Overall measurement



Type: wideband
freerun,retrig
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

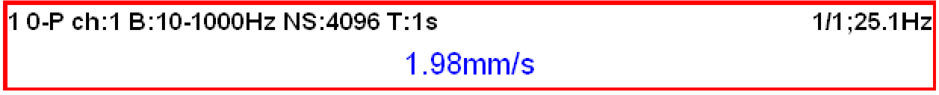
This is typical example of overall measurement. The RMS value of vibration velocity in frequency range 10-1000 Hz is measured.



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.

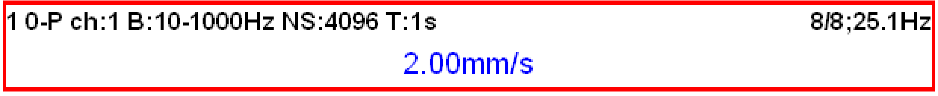
Change the Detect Type to 0-P.



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

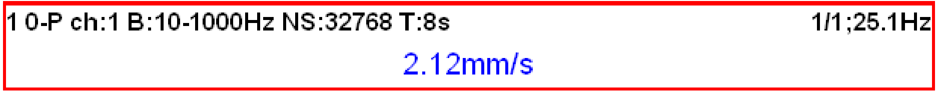
Note, that the 1.98 is not 1.414 times bigger then 0.570. Some of users mistakenly think, that the formula 0-P=1.414*RMS is valid for every signal. It is not true. That formula is valid only for pure sine wave ! The true RMS and true peak measurement are generally independent. The only rule is that the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

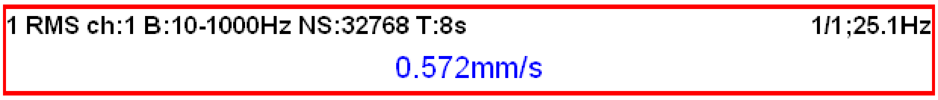
Let's change the Avg back to off and change the samples number to 32768. The measurement will be 8 sec long.



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

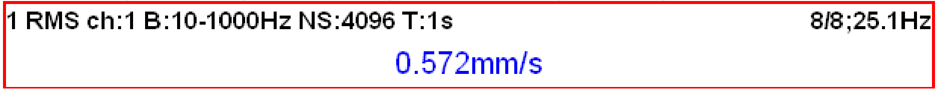
You see that the result is different from the previous value. It is clear, the max 0-P value in 8 sec signal is not equal the average of 8 0-P values (which takes 1 sec each).

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

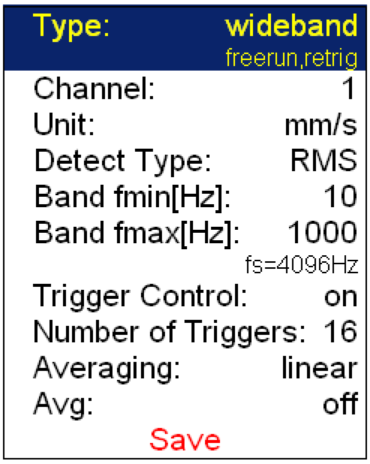
Now change the length to 1 sec (4096 samples) and Avg=8.

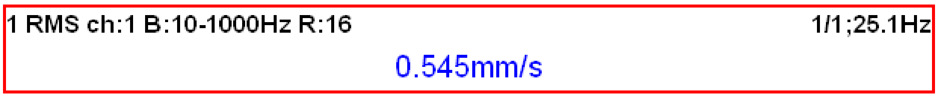

1 RMS ch:1 B:10-1000Hz NS:4096 T:1s 8/8;25.1Hz

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 revolutions, not only in samples (=time). The tacho signal must be available in that case.

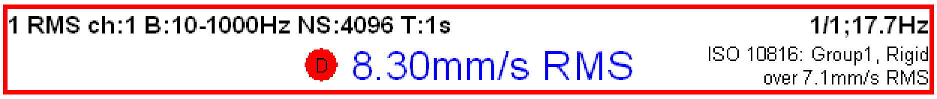

Type: wideband
freerun,retrig
Channel: 1
Unit: mm/s
Detect Type: RMS
Band fmin[Hz]: 10
Band fmax[Hz]: 1000
fs=4096Hz
Trigger Control: on
Number of Triggers: 16
Averaging: linear
Avg: off


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 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 (see Global/ ISO Machine Settings).

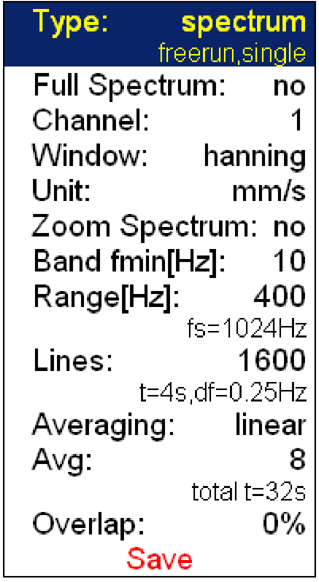

1 RMS ch:1 B:10-1000Hz NS:4096 T:1s 1/1;17.7Hz

D 8.30mm/s RMS

ISO 10816: Group1, Rigid
over 7.1mm/s RMS

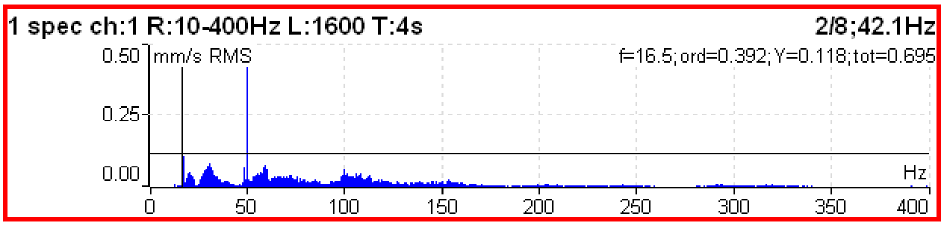
The color of circle is related to the machine condition class A,B,C,D (the green for A or B, the orange for C and the red for D). Also the information about machine group and foundation are displayed. The limit which is exceeding is also displayed at the bottom.

Spectrum measurement



Type: spectrum
freerun,single
Full Spectrum: 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%
Save

The triggering type is displayed bellow the spec word. The **fs** below the Range means sampling frequency. The **t** below the Lines is the time signal length, which is used for one spectrum. The **df** is the frequency resolution between lines.



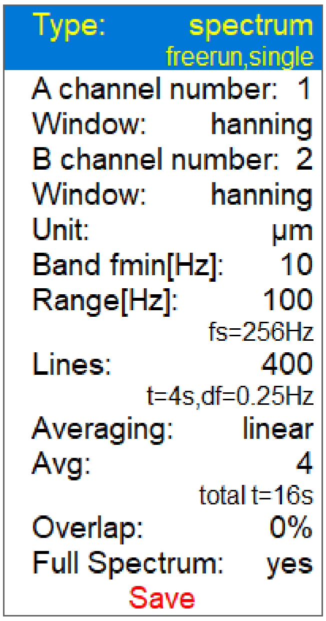
1 spec ch:1 R:10-400Hz L:1600 T:4s 2/8;42.1Hz
f=16.5;ord=0.392;Y=0.118;tot=0.695

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).

The **Band fmin** defines the frequency of HP filtering, which is used for DC part removing. If you do not expect any important lines bellow 10Hz, use the 10 instead 1. The initialization time of 1Hz filter is much longer then 10Hz.

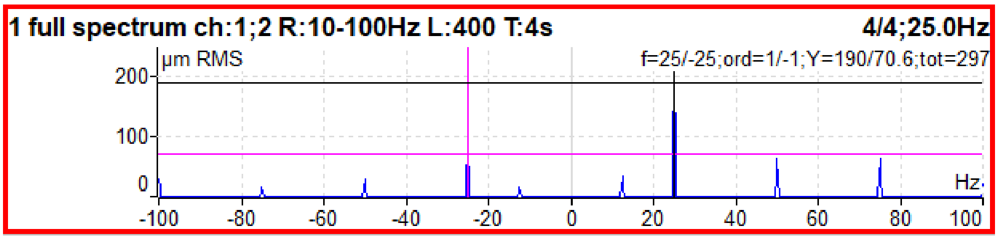
The Overlap enables to you to make the averaging faster. E.g. 75% overlap means, that ending 75% of actual time signal + 25% of new signal is used for next average.

Full spectrum



Type: spectrum
freerun,single
A channel number: 1
Window: hanning
B channel number: 2
Window: hanning
Unit: µm
Band fmin[Hz]: 10
Range[Hz]: 100
fs=256Hz
Lines: 400
t=4s,df=0.25Hz
Averaging: linear
Avg: 4
total t=16s
Overlap: 0%
Full Spectrum: yes
Save

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.

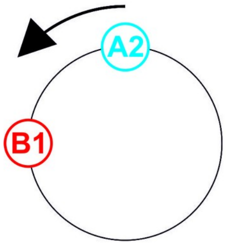


1 full spectrum ch:1;2 R:10-100Hz L:400 T:4s 4/4;25.0Hz

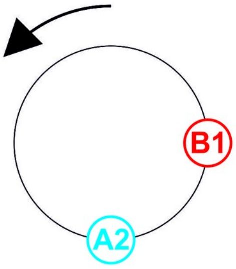
f=25/-25;ord=1/-1;Y=190/70.6;tot=297

Note: Cursor is displayed on both sides. Different colors are used. Both cursor values are displayed.

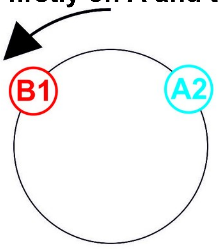
Attention!
The correct setting of channel A and B is critical for correct result. If this setting is wrong then the negative and positive side are interchanged. Firstly we find the angle between A and B, which is less then 180° (usually it is 90°). The rotation mark must be firstly on A and then in B.



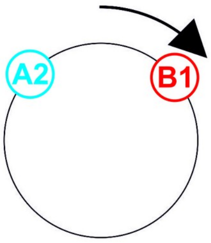
CORRECT



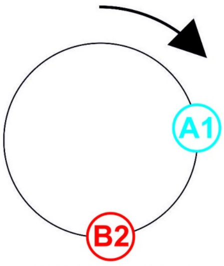
CORRECT



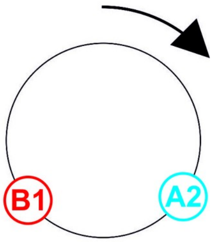
CORRECT



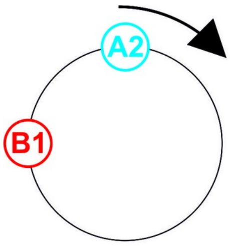
CORRECT



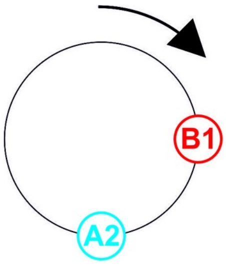
CORRECT



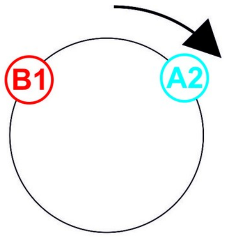
CORRECT



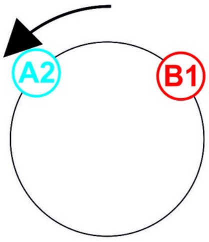
WRONG



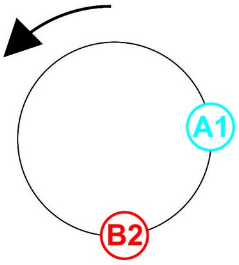
WRONG



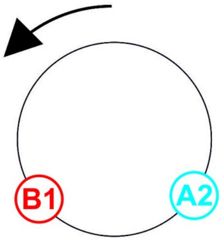
WRONG



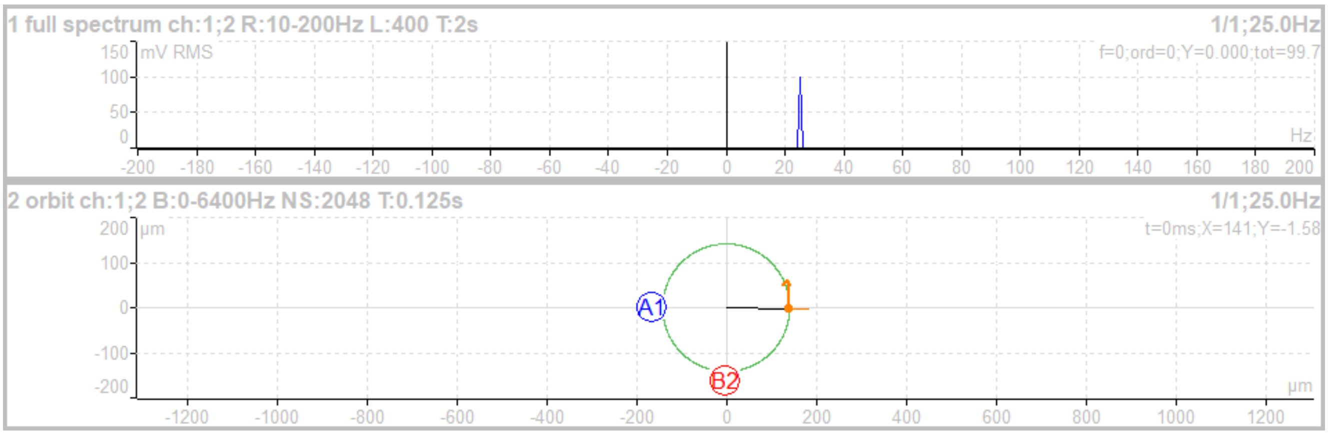
WRONG



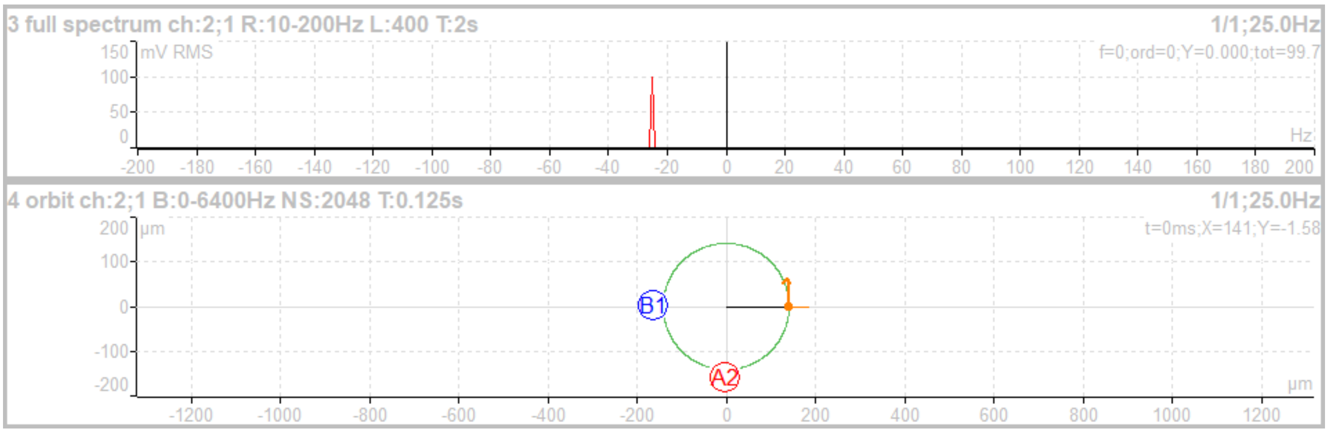
WRONG



WRONG

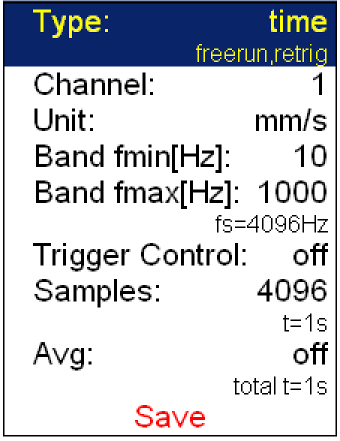

1 full spectrum ch:1;2 R:10-200Hz L:400 T:2s
1/1;25.0Hz
mV RMS
f=0;ord=0;Y=0.000;tot=99.7
Hz
2 orbit ch:1;2 B:0-6400Hz NS:2048 T:0.125s
1/1;25.0Hz
μm
t=0ms;X=141;Y=-1.58
A1
B2
μm

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

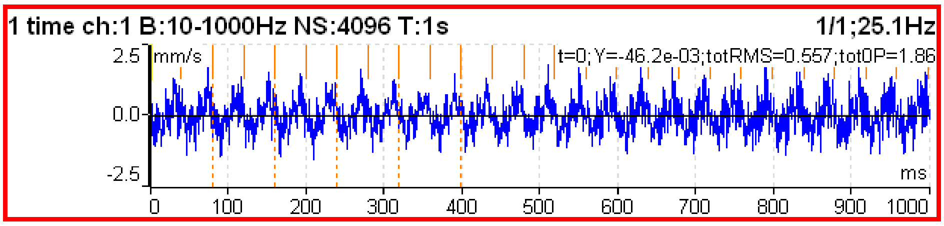

3 full spectrum ch:2;1 R:10-200Hz L:400 T:2s
1/1;25.0Hz
mV RMS
f=0;ord=0;Y=0.000;tot=99.7
Hz
4 orbit ch:2;1 B:0-6400Hz NS:2048 T:0.125s
1/1;25.0Hz
μm
t=0ms;X=141;Y=-1.58
B1
A2
μm

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

Time signal measurement



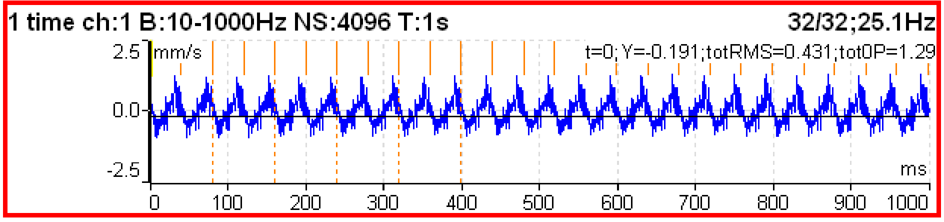
Type: time
freerun,retrig
Channel: 1
Unit: mm/s
Band fmin[Hz]: 10
Band fmax[Hz]: 1000
fs=4096Hz
Trigger Control: off
Samples: 4096
t=1s
Avg: off
total t=1s
Save



Similar parameter like for overall is used. The red short vertical lines at the top of graph indicates the tacho inputs.

Time signal averaging

For averaging you need to set the Global/ Trigger Settings/ Trigger Source = tacho. 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.

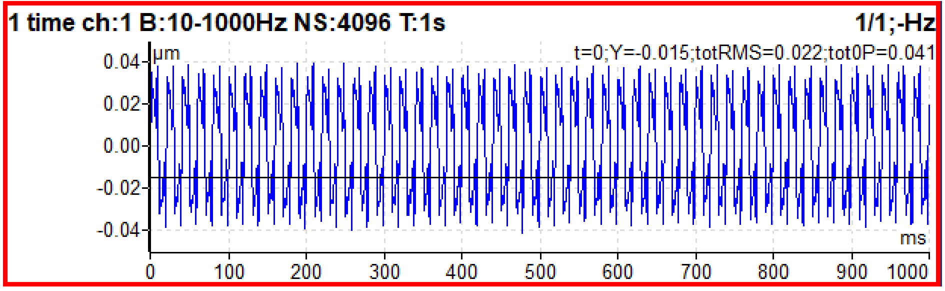
How to setup a sensor

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).

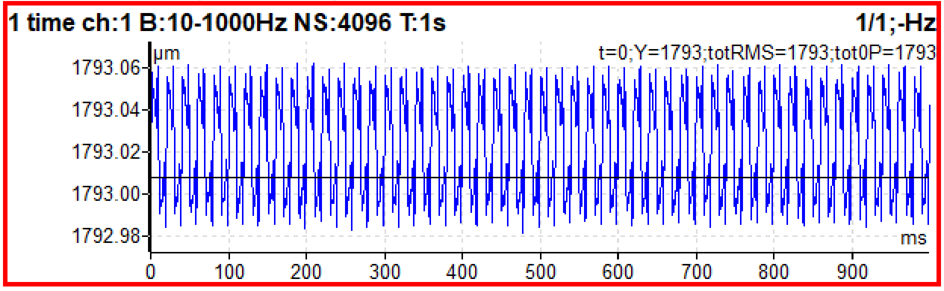
Measurement

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

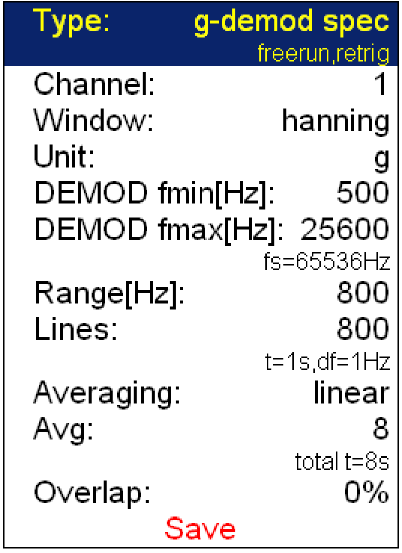
First picture shows the signal without gap



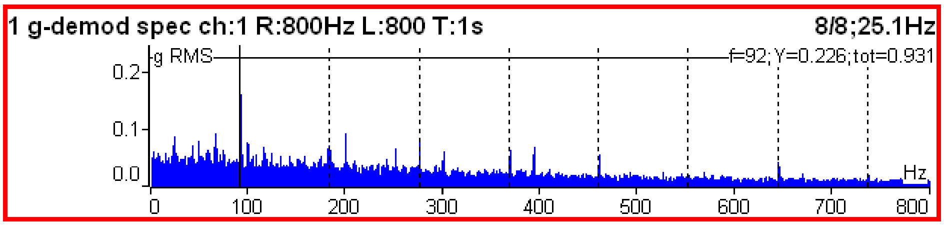
And the same signal with a gap



G-demod spectrum measurement

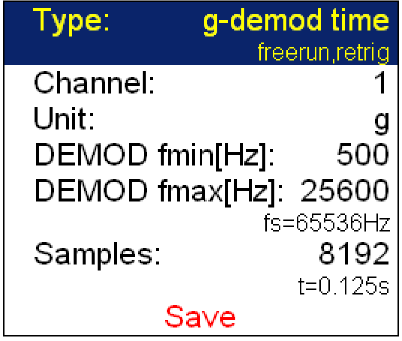


Type: g-demod spec
freerun,retrig
Channel: 1
Window: hanning
Unit: g
DEMOD fmin[Hz]: 500
DEMOD fmax[Hz]: 25600
fs=65536Hz
Range[Hz]: 800
Lines: 800
t=1s,df=1Hz
Averaging: linear
Avg: 8
total t=8s
Overlap: 0%



Example: the demodulated frequency 92Hz with harmonics.
The Unit cannot be changed, only the acceleration g unit can be used. No integration of signal is enabled.

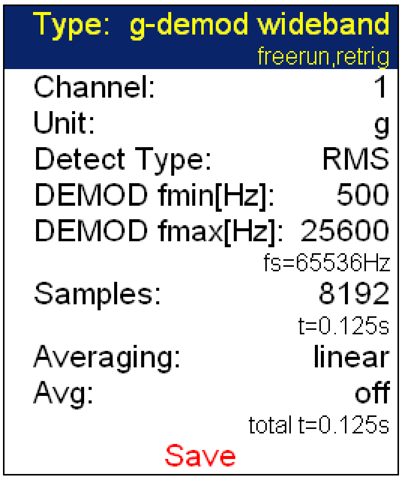
G-demod time signal measurement



Type: g-demod time
freerun,retrig
Channel: 1
Unit: g
DEMOD fmin[Hz]: 500
DEMOD fmax[Hz]: 25600
fs=65536Hz
Samples: 8192
t=0.125s
Save

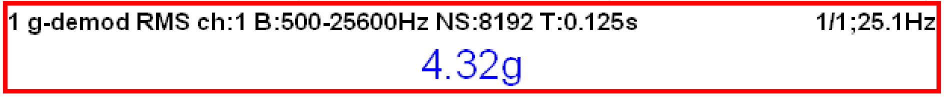
This function enables to see the signal, when the standard envelope demodulation is used.
The Unit cannot be changed, only the acceleration g unit can be used. No integration of signal is enabled.

G-demod overall measurement



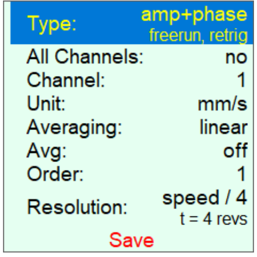
Type: g-demod wideband
freerun,retrig
Channel: 1
Unit: g
Detect Type: RMS
DEMOD fmin[Hz]: 500
DEMOD fmax[Hz]: 25600
fs=65536Hz
Samples: 8192
t=0.125s
Averaging: linear
Avg: off
total t=0.125s
Save

It is very similar to standard overall measurement. The signal is filtered in (DEMOD fmin, DEMOD fmax) range and demodulated then.
The Unit cannot be changed, only the acceleration g unit can be used. No integration of signal is enabled.

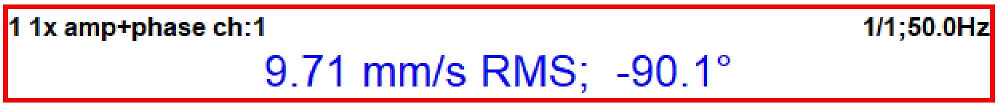


1 g-demod RMS ch:1 B:500-25600Hz NS:8192 T:0.125s 1/1;25.1Hz
4.32g

amp+phase measurement



Type: amp+phase
freerun, retrig
All Channels: no
Channel: 1
Unit: mm/s
Averaging: linear
Avg: off
Order: 1
Resolution: speed / 4
t = 4 revs
Save

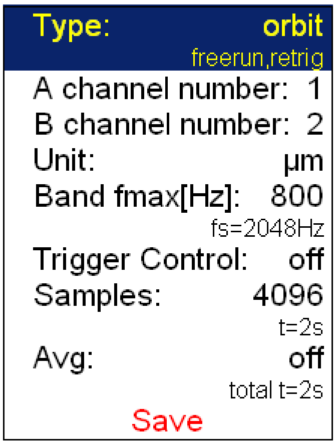


1 1x amp+phase ch:1 1/1;50.0Hz
9.71 mm/s RMS; -90.1°

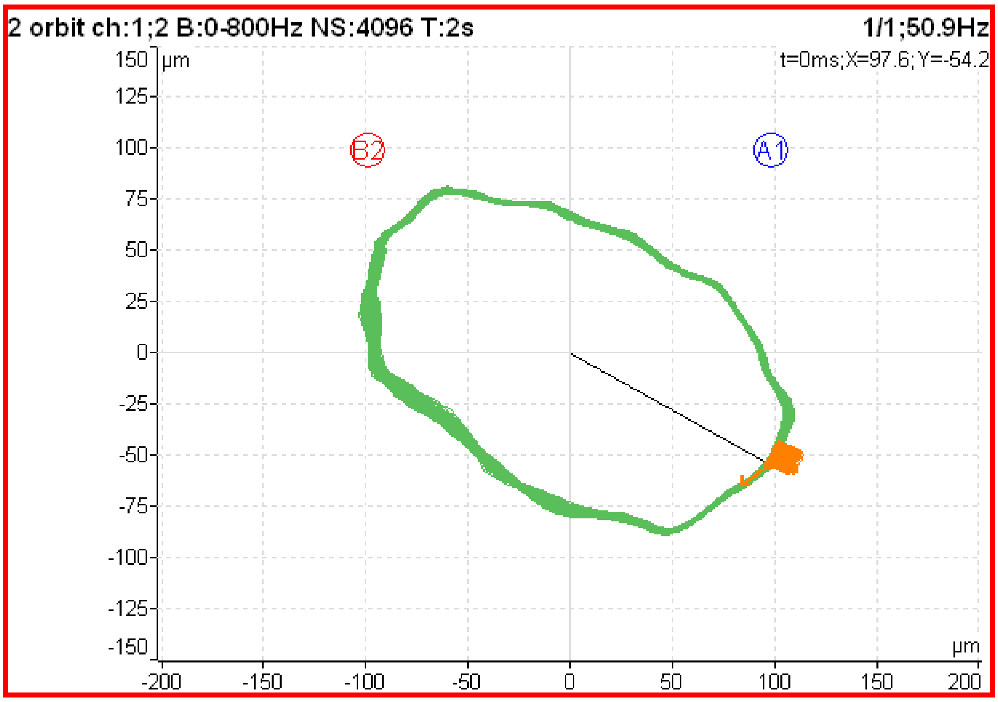
By default, the amp+phase is measured on speed frequency (Order = 1). However, you may define any value as the order for the measurement. For example, if you want to measure amplitude and phase on 1/3x speed frequency, then you enter the order as 0.333333. The order value is announced in the graph's information line, the "*1x*" on the picture above means the order value is 1. Thus, the speed frequency is used for measurement.

Note! Remember to set appropriate resolution according to used order. See **Resolution** for more details.

Orbit measurement



Type: orbit
freerun,retrig
A channel number: 1
B channel number: 2
Unit: µm
Band fmax[Hz]: 800
fs=2048Hz
Trigger Control: off
Samples: 4096
t=2s
Avg: off
total t=2s

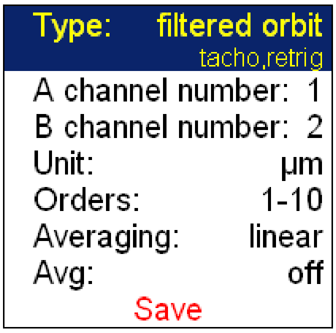


The A1 means, that the channel 1 is used for A orbit channel.
B2 - channel 2 is used as B.
The position of A1 and B2 matches the sensor angles used for measurement (see Sensors definition). The knowledge of those angles enables to draw the correct shape of orbit.

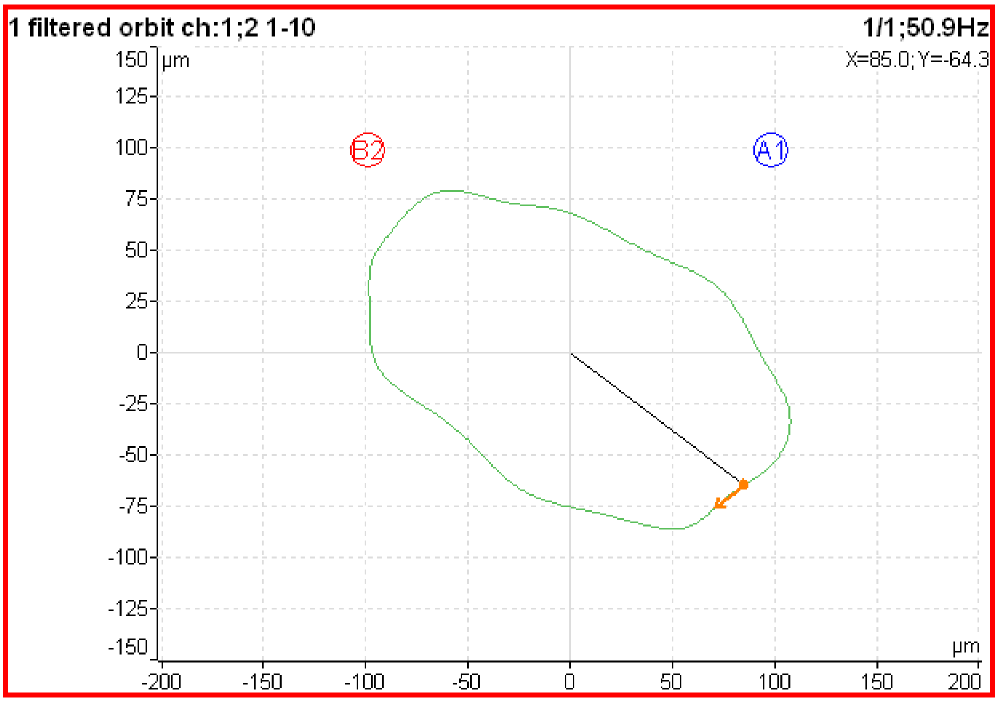
Orbit measurement with DC offset (gap)

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 measurement



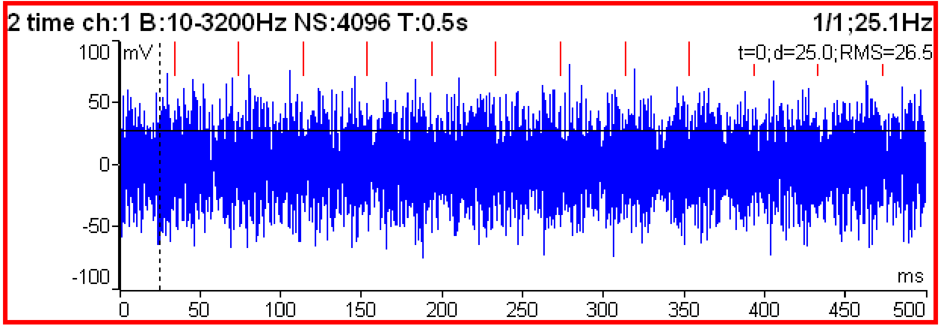
Type: filtered orbit
tacho,retrig
A channel number: 1
B channel number: 2
Unit: µm
Orders: 1-10
Averaging: linear
Avg: off
Save

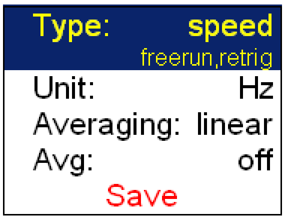


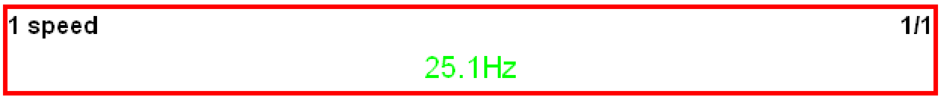
Filtered orbit is built up from two order analysis readings. Correct sensors positions (angles) must be set for correct calculations as for standard orbit graph (see Sensors definition). You can switch displayed orders on or off in **Graph Properties** menu.

Speed measurement

The machine speed (revolutions) is measured.
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 red lines.




Type: speed
freerun,retrig
Unit: Hz
Averaging: linear
Avg: off
Save

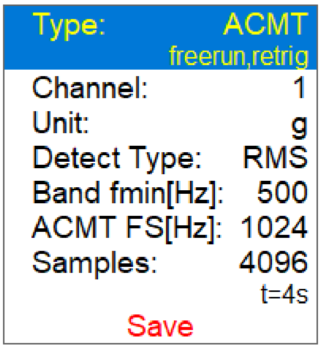

1 speed 1/1
25.1Hz

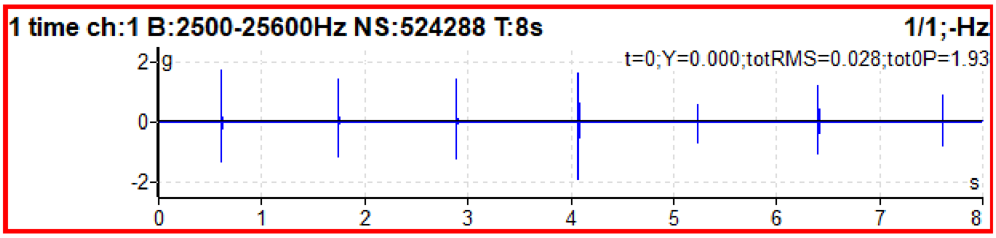
The speed measurement is taken 8 times in every second. The value is evaluated from 3 tacho events in time signal. When the averaging is required, then more values is used. But keep in mind that only 8 values is taken in one second.

ACMT measurement

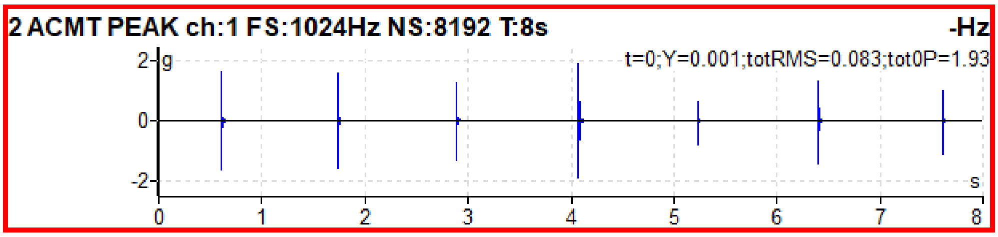
It enables to measure long time signals and compress them. It is used when you need high frequency range, for example 25.6kHz. The highpass filtering is used (Band fmin). The basic property of ACMT is resampling initial high frequency sampling (64kHz) to low ACMT FS frequency sampling (usually 1kHz).

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.


Type: ACMT
freerun,retrig
Channel: 1
Unit: g
Detect Type: RMS
Band fmin[Hz]: 500
ACMT FS[Hz]: 1024
Samples: 4096
t=4s
Save


1 time ch:1 B:2500-25600Hz NS:524288 T:8s 1/1;-Hz
t=0;Y=0.000;totRMS=0.028;tot0P=1.93

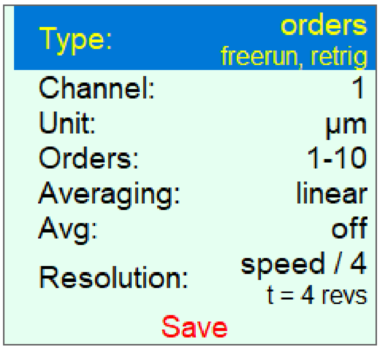
The original time signal 8 sec long, which contains shocks. Signal contains 524288 samples.


2 ACMT PEAK ch:1 FS:1024Hz NS:8192 T:8s -Hz
t=0;Y=0.001;totRMS=0.083;tot0P=1.93

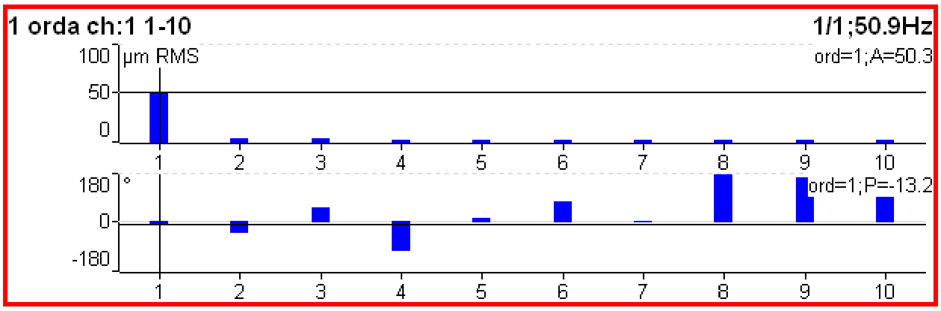
The ACMT time signal. You can see the same shocks, but signal contains only 8192 samples.

Orders measurement

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

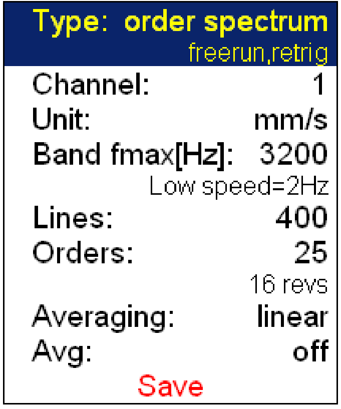


Type: orders
freerun, retrig
Channel: 1
Unit: µm
Orders: 1-10
Averaging: linear
Avg: off
Resolution: speed / 4
t = 4 revs
Save



1 orda ch:1 1-10 1/1;50.9Hz
ord=1;A=50.3
ord=1;P=-13.2

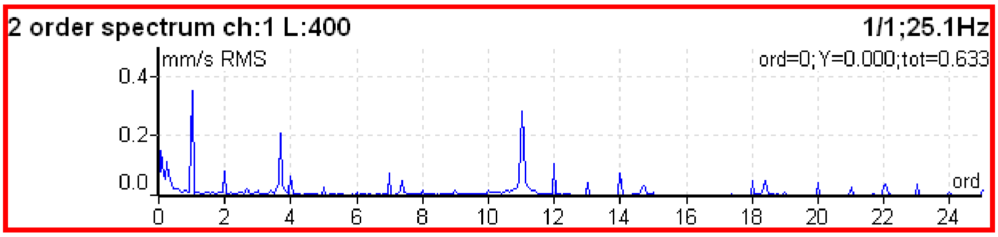
Order spectrum measurement (order tracking analysis)



Type: order spectrum
freerun,retrig
Channel: 1
Unit: mm/s
Band fmax[Hz]: 3200
Low speed=2Hz
Lines: 400
Orders: 25
16 revs
Averaging: linear
Avg: off
Save

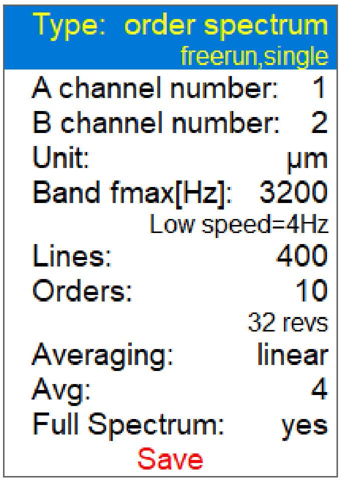
The **Band fmax** defines the range of spectrum. All frequencies over this range will be equal zero. To define this range is necessary, when you need high number of orders. The required range is equal number of orders multiplied by speed frequency. Be careful, higher **Band fmax** increases the minimum 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.



2 order spectrum ch:1 L:400 1/1;25.1Hz
ord=0;Y=0.000;tot=0.633

Order full spectrum

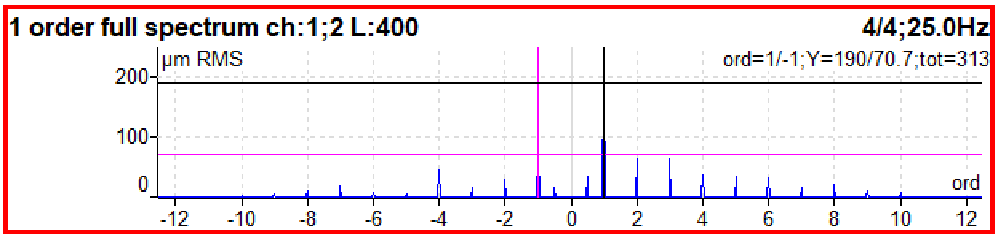


Type: order spectrum
freerun,single
A channel number: 1
B channel number: 2
Unit: µm
Band fmax[Hz]: 3200
Low speed=4Hz
Lines: 400
Orders: 10
32 revs
Averaging: linear
Avg: 4
Full Spectrum: yes

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 channelCH1 first and then to B channel. Otherwise the positive/negative parts would be transposed.

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.

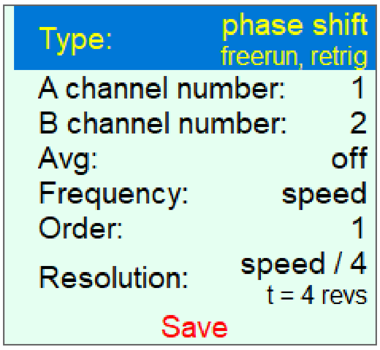
Note: Cursor is displayed on both sides. Different colors are used. Both cursor values are displayed.



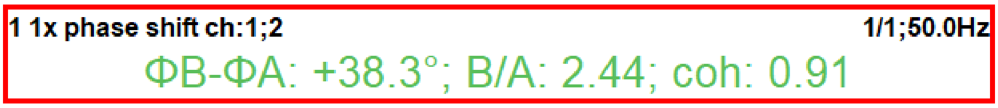
Attention!
The correct setting of channel A and B is critical for correct result. If this setting is wrong then the negative and positive side are interchanged. See Full spectrum for details.

Phase shift measurement

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
A channel number: 1
B channel number: 2
Avg: off
Frequency: speed
Order: 1
Resolution: speed / 4
t = 4 revs



1 1x phase shift ch:1;2 **1/1;50.0Hz**

ΦB-ΦA: +38.3°; B/A: 2.44; coh: 0.91

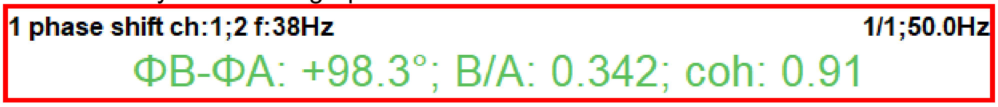
The result contains:

- 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.

By default, the phase shift is measured on speed frequency (Order = 1). However, you may define any value as the Order for the measurement. For example, if you want to measure amplitude and phase on 1/3x speed frequency, then you enter the order as 1/3. The order value is announced in the graph's information line, the "*1x*" on the picture above means the order value is 1. Thus, the speed frequency is used for measurement.

Furthermore, you may enter any frequency using the Frequency parameter. In this case the Order parameter is not available, the Resolution parameter is entered as a fraction of the frequency and the entered frequency is announced by "*f:*" label in graph's information line.

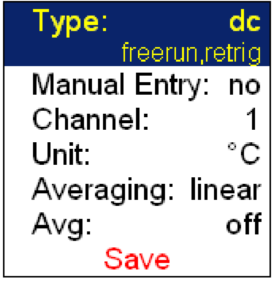


1 phase shift ch:1;2 f:38Hz **1/1;50.0Hz**

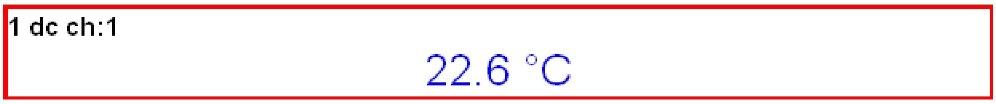
ΦB-ΦA: +98.3°; B/A: 0.342; coh: 0.91

DC measurement

The direct DC signal can be measured by this function.



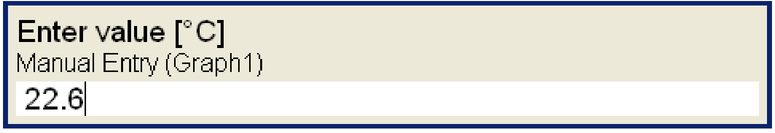
Type: dc
freerun,retrig
Manual Entry: no
Channel: 1
Unit: °C
Averaging: linear
Avg: off
Save



1 dc ch:1

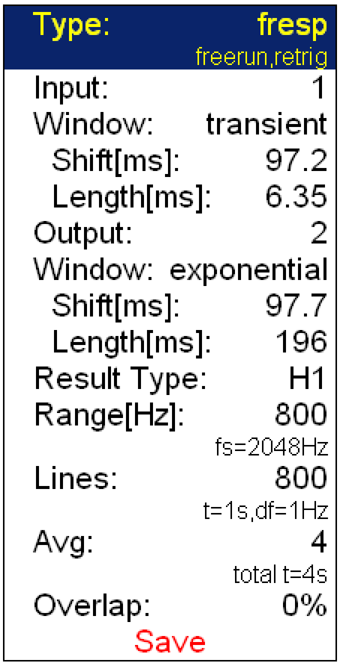
22.6 °C

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

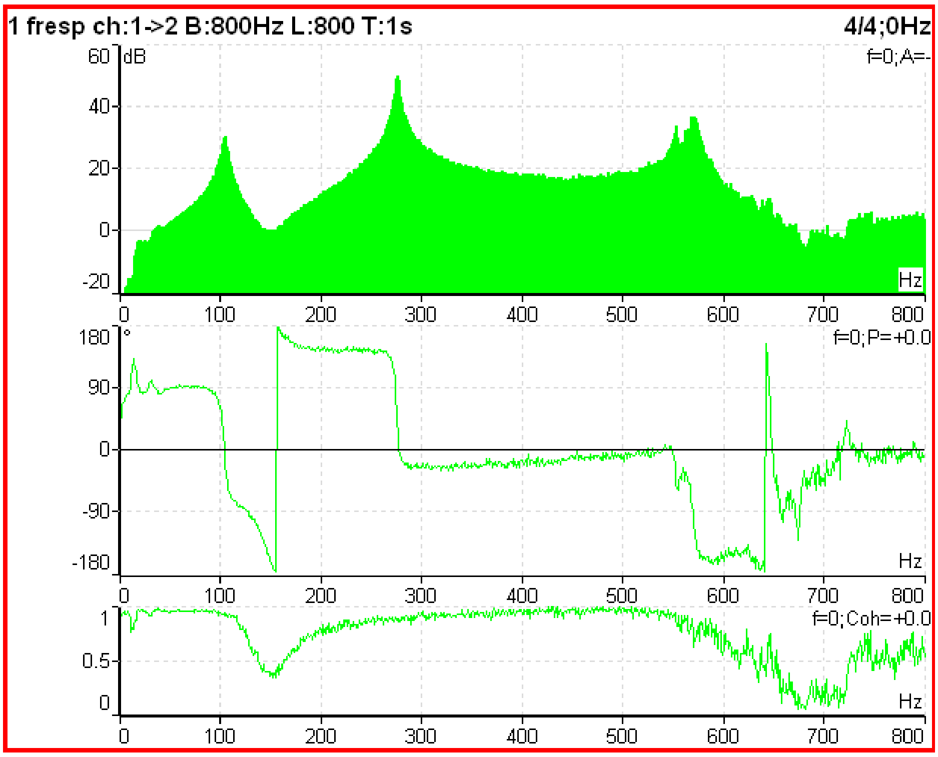


Enter value [°C]
Manual Entry (Graph1)
22.6

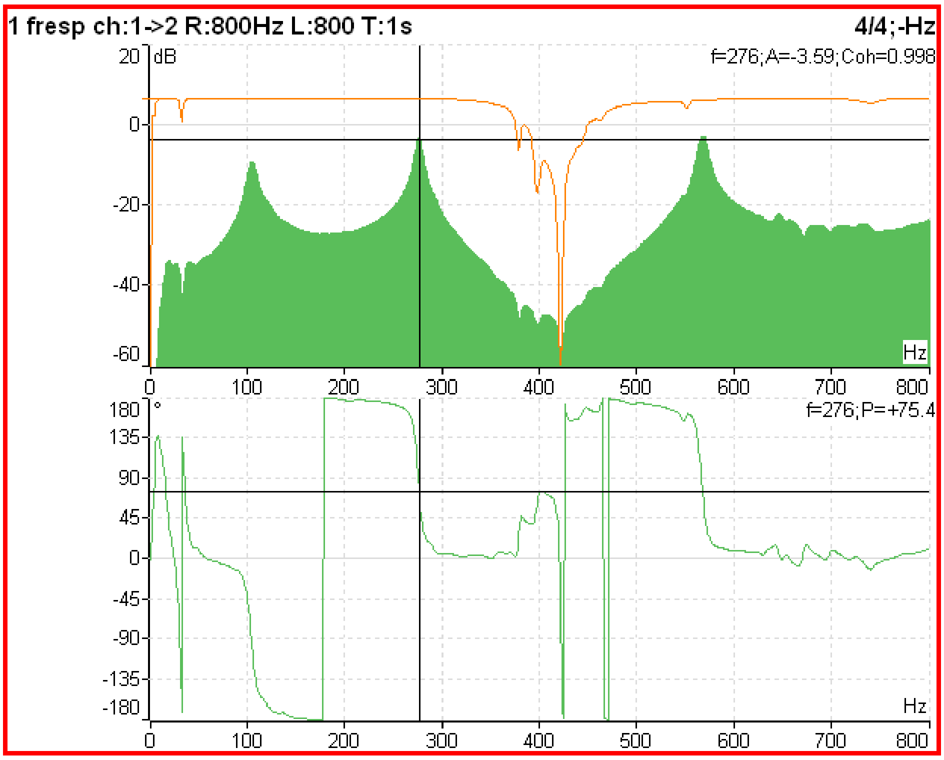
Frf measurement - frequency response function



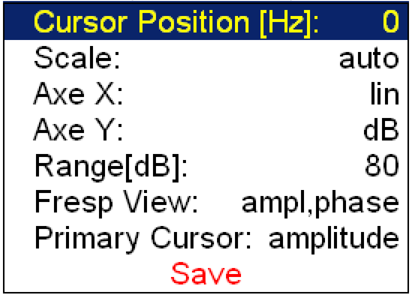
Type: fresp
freerun,retrig
Input: 1
Window: transient
Shift[ms]: 97.2
Length[ms]: 6.35
Output: 2
Window: exponential
Shift[ms]: 97.7
Length[ms]: 196
Result Type: H1
Range[Hz]: 800
fs=2048Hz
Lines: 800
t=1s,df=1Hz
Avg: 4
total t=4s
Overlap: 0%
Save



From ver.2.32 is the coherence displayed in the amplitude graph. The short horizontal line on Y axe is on position of value=1 for coherence.

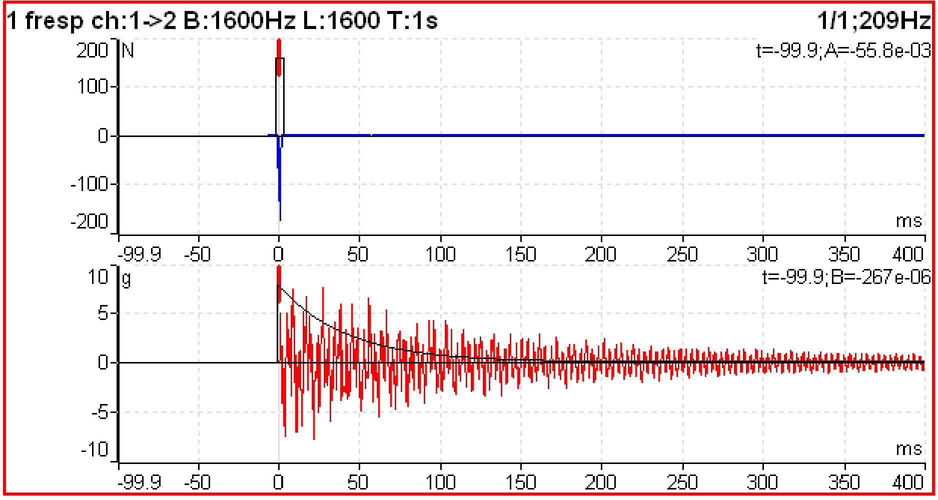


This display is created by this Graph Properties.



Cursor Position [Hz]: 0
Scale: auto
Axe X: lin
Axe Y: dB
Range[dB]: 80
Fresp View: ampl,phase
Primary Cursor: amplitude

When you set the Frf view to **time**, you see the time signals from both channels. When you use the hammer, the remember to set the **Trigger Settings/ Trigger Source** to **amplitude**, the **Pretrig** to e.g. 25%, select **Ampl Trig Channel** number and the **Ampl Trig Level** value.



Use the **Arrow mode** button and set **Shift** or **Length** top right buttons. Now you can simply shift with FFT windows or change the length. When you use the **Shift1** button, you change the **Shift1** to **Shift2** or to **Shift12** (shift both windows together) by using the top left button **Shift1/Shift2/Shift12**.

The frf function do not use the any HP filter. If you want to compare the time signal from frf with standard time signal, you must set the **Band fmin** to none.

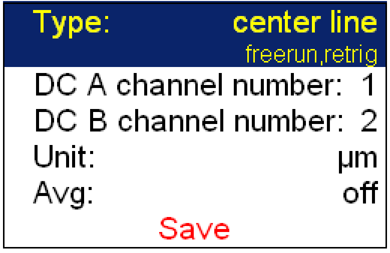
Octave spectrum, sound level and equivalent sound level measurement

All parameters are described in Octave Analysis chapter. The exponential averaging is not available in Analyzer mode.

Center line measurement

This measurement is often used for turbines. The **Center line** values define the static position of shaft in bearing.

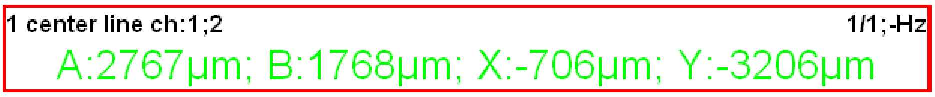
The signals from proximity sensors must be connected to DC channels. We need to remove the AC part and to hold the DC part. The DC inputs work in that way.



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

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).

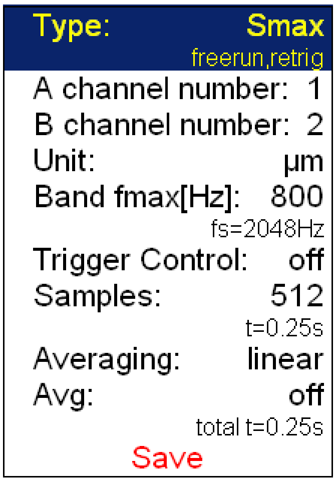
While in orbit we see the shape around the (0,0) position, in the center line we see the position of shaft center without shape of orbit.



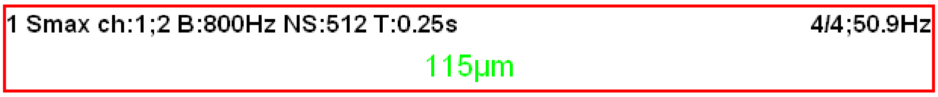
1 center line ch:1;2 1/1;-Hz
A:2767µm; B:1768µm; X:-706µm; Y:-3206µm

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 measurement



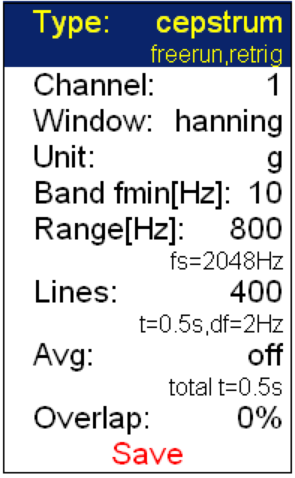
Type: Smax
freerun,retrig
A channel number: 1
B channel number: 2
Unit: µm
Band fmax[Hz]: 800
fs=2048Hz
Trigger Control: off
Samples: 512
t=0.25s
Averaging: linear
Avg: off
total t=0.25s
Save



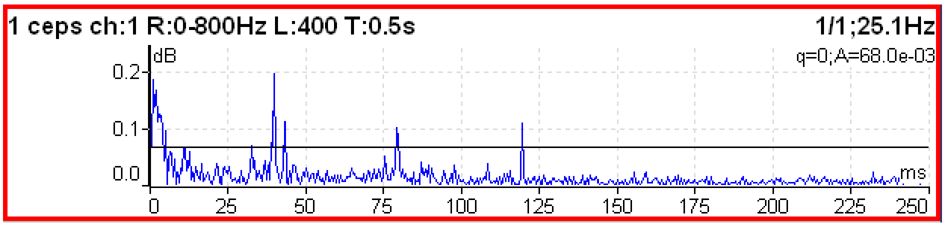
1 Smax ch:1;2 B:800Hz NS:512 T:0.25s 4/4;50.9Hz
115µm

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).

Cepstrum measurement



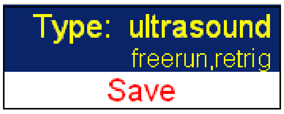
Type: cepstrum
freerun,retrig
Channel: 1
Window: hanning
Unit: g
Band fmin[Hz]: 10
Range[Hz]: 800
fs=2048Hz
Lines: 400
t=0.5s,df=2Hz
Avg: off
total t=0.5s
Overlap: 0%
Save



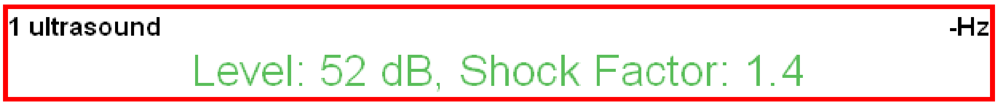
Used algorithm is cepstrum(x) = inv (fft(log10(abs(fft(x)))))

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

Ultrasound measurement



Type: ultrasound
freerun,retrig
Save



1 ultrasound -Hz

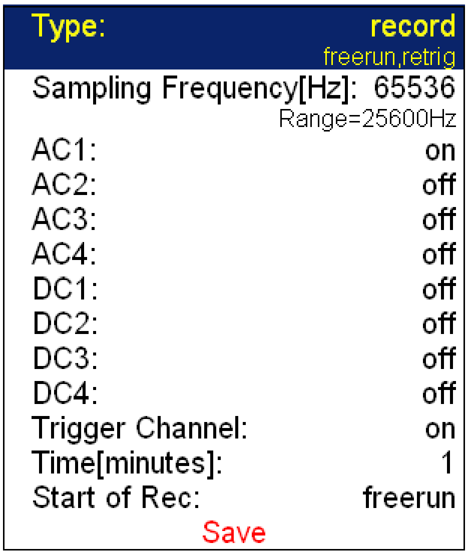
Level: 52 dB, Shock Factor: 1.4

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 means that transient shock events are in the sound signal.

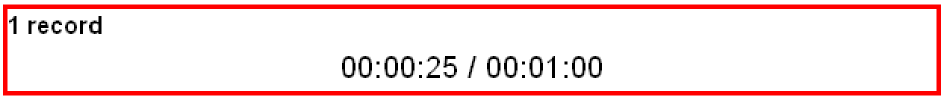
Note: The ultrasound sensor (microphone) required.

There is detailed description in the Ultrasound mode chapter.

Record



Type: record
freerun,retrig
Sampling Frequency[Hz]: 65536
Range=25600Hz
AC1: on
AC2: off
AC3: off
AC4: off
DC1: off
DC2: off
DC3: off
DC4: off
Trigger Channel: on
Time[minutes]: 1
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 VA4_Virtual Unit (see the **A4410 Virtual Unit** chapter).

There is detailed description in the Recorder mode chapter.

The Balancer

Introduction

The balancing process is based on standard measurements of amplitude, phase on the speed frequency. The VA4Pro 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.

The 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 re-written.
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.

The Project Screen

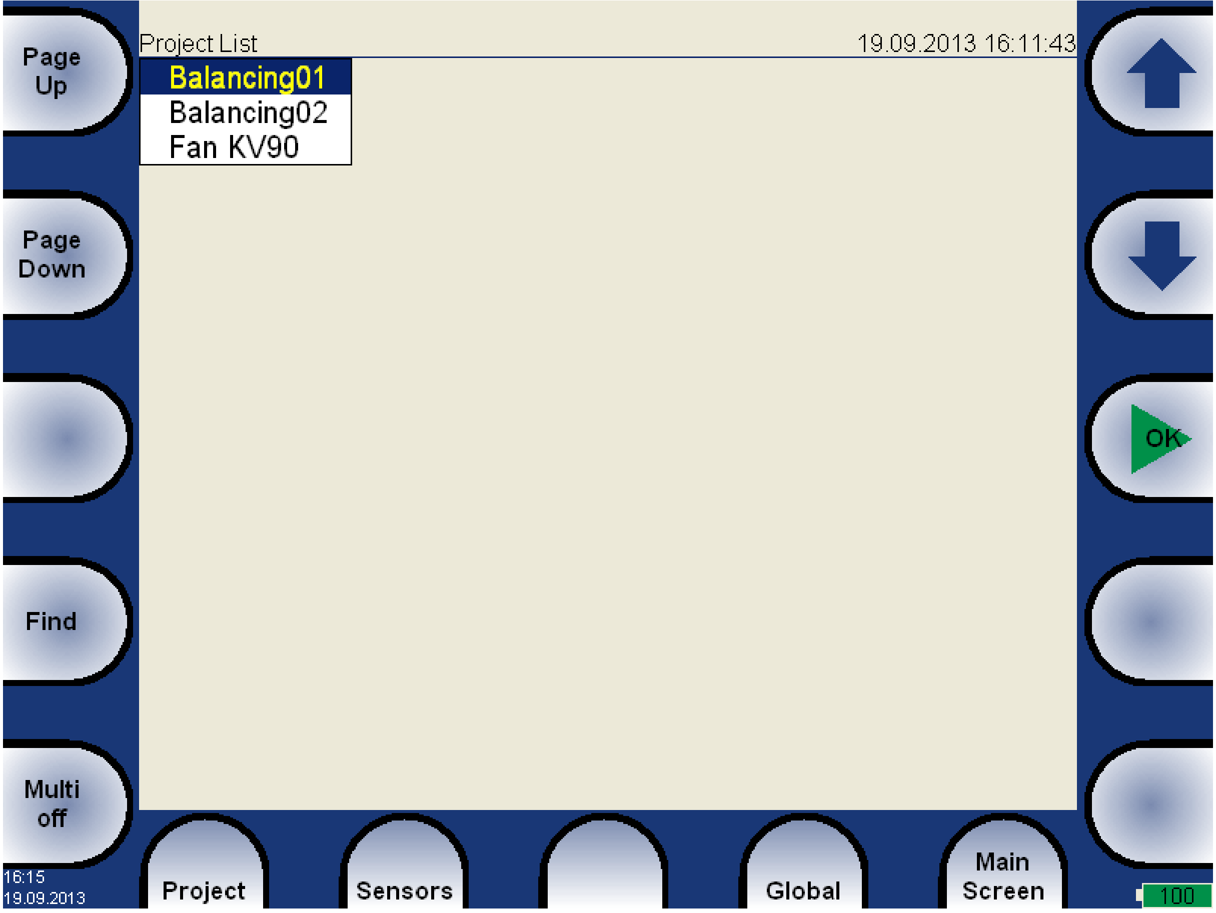
Every step is displayed in one screen.

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

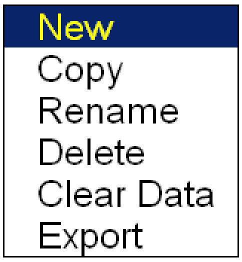
The usual Enter button is not used, it could confuse the user. The movement enables to return back anytime. The important property must be clearly told. When you return back in the job screens and you take again repeated measurement or value enter, then the measured data will be erased in all screens 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.

The first screen

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.


Page Up
Project List
19.09.2013 16:11:43
Balancing01
Balancing02
Fan KV90
Page Down
OK
Find
Multi off
16:15
19.09.2013
Project
Sensors
Global
Main Screen
100

Also next functions for projects managing are enabled.


New
Copy
Rename
Delete
Clear Data
Export

New when you select the New item, then you will entry the name of new project. The screen for manual entry was in details described in **Menu - how to work with ...** section.

Copy creates the new project as the copy of selected project (like Save As function in MS Word). Only the header data are saved (machine name, balancing type,...). No measured data are saved.

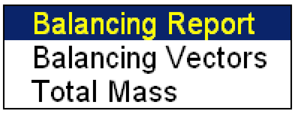
Rename renames the selected project. The project with old name does not exist anymore.

Delete deletes selected project.

Clear Data erases all measured data, only the project header remains in unit.

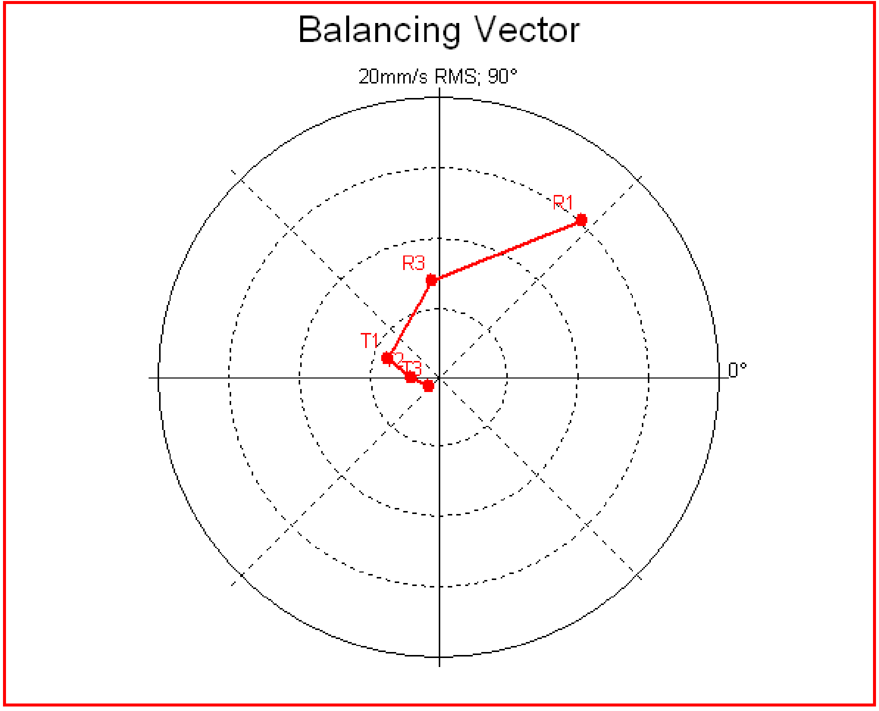
Export exports selected project to VA4_DISC.

Next functions are available for opened project.


Balancing Report
Balancing Vectors
Total Mass

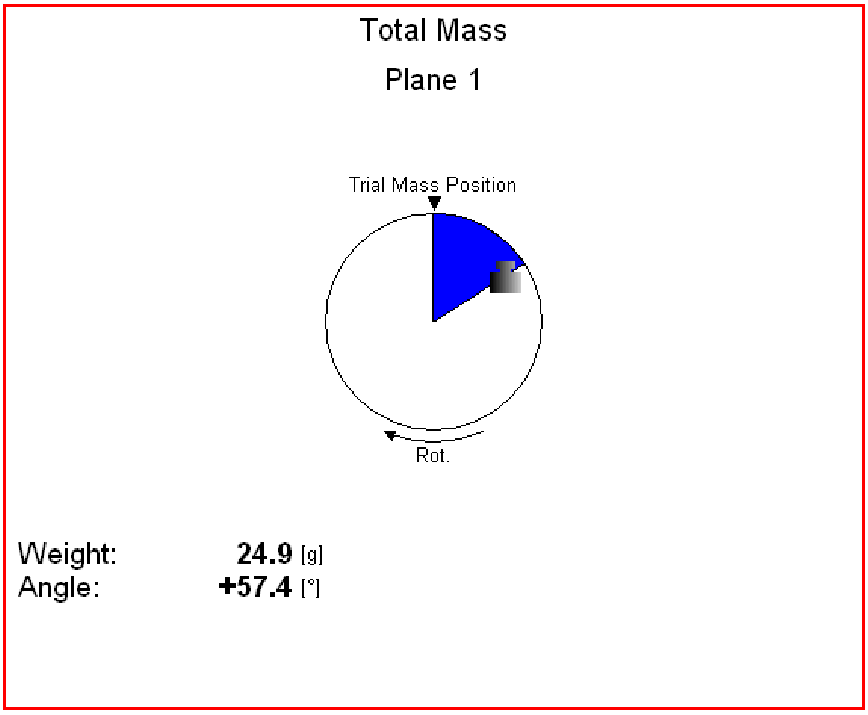
Balancing Report creates balancing report in rtf format (MS Word) and save it to VA4_DISC for PC downloading.

Balancing Vectors the drawing of ampitude/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 displays the total balancing mass. It is the vector sum of all masses mounted to the rotor (basic+all trims).


Total Mass
Plane 1
Trial Mass Position
Rot.

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

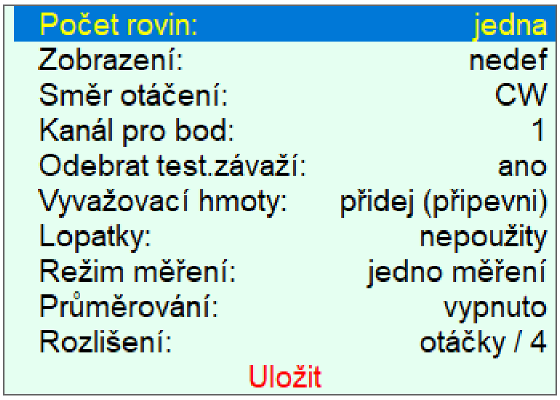
New project

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 (active in dark color). Press **OK**, it will be opened. The list of basic properties appears. 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



Počet rovin: jedna
Zobrazení: nedef
Směr otáčení: CW
Kanál pro bod: 1
Odebrat test.závaží: ano
Vyvažovací hmoty: přidej (připevni)
Lopatky: nepoužity
Režim měření: jedno měření
Průměrování: vypnuto
Rozlišení: otáčky / 4

Planes	**single, 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	**1-4**	the number of AC input, which will be used for sensor mounted on the bearing (only for single plane balancing)
Channel A	**1-4**	the number of AC input, which will be used for sensor mounted on the bearing A (only for dual planes balancing)
Channel B	**1-4**	the number of AC input, which will be used for sensor mounted on the bearing B (only 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.

Remove Trial **yes**, **no**
The trial mass can be left on the rotor or can be removed from the rotor after trial run.

Remove Trial (Plane 1), Remove Trial (Plane 2) **yes**, **no**
For dual plane balancing, you may remove or keep trial on each plane individually.

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

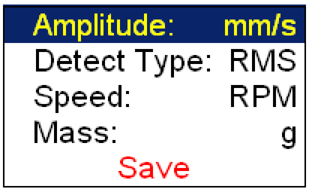
Blades the number of blades (for rotors with blades). This parameter is used in job figuring to split the mass to blades.

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 Meas functions/ New Advanced section.

Units Settings



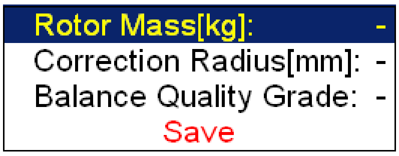
Amplitude: mm/s
Detect Type: RMS
Speed: RPM
Mass: g

Amplitude	selection from available units for used sensor
Detect Type	**RMS, 0-P, P-P**

Initially the global **Spectrum Settings / Detect Type** is used**.** You can change it to other type here.

Speed	selection from available units for speed
Mass	selection of unit for mass

Rotor Settings



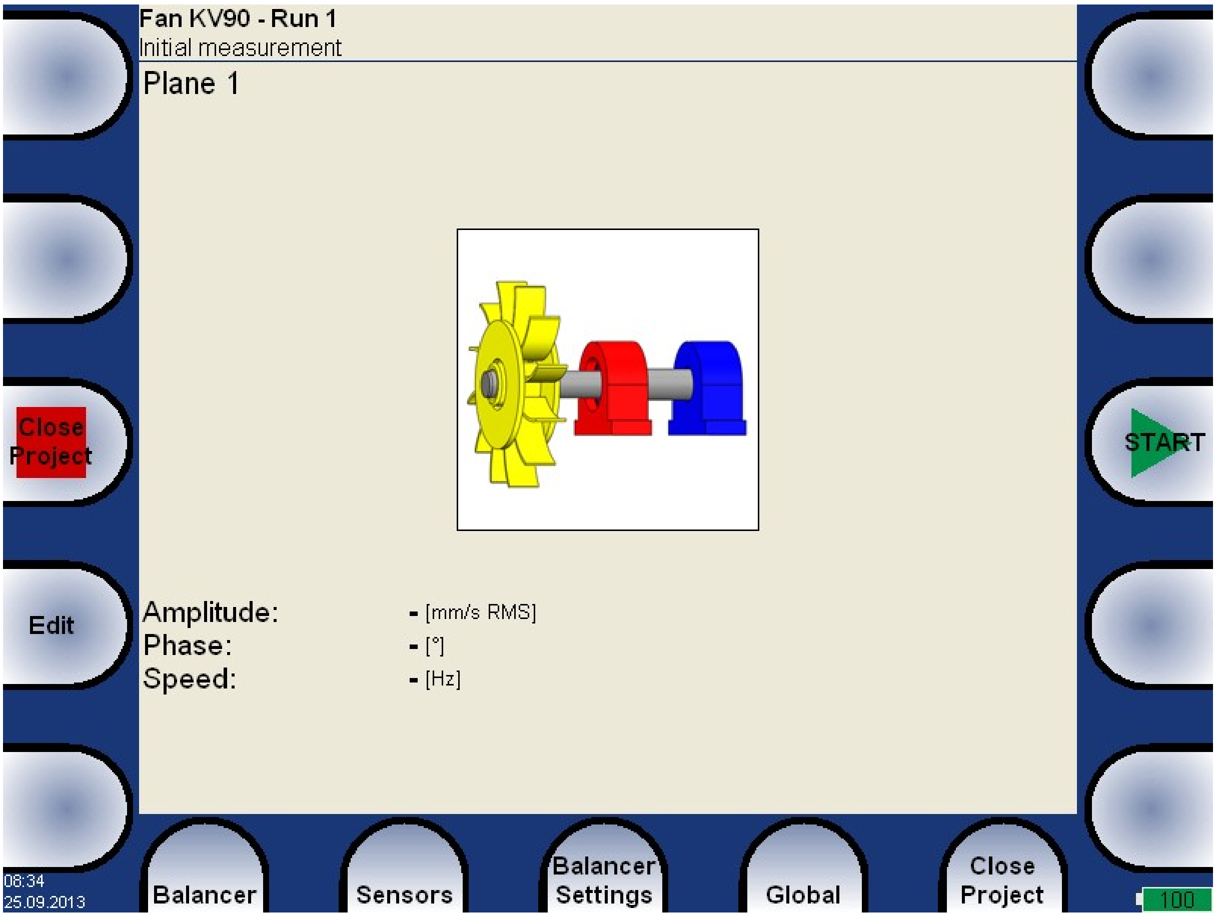
Rotor Mass[kg]: -
Correction Radius[mm]: -
Balance Quality Grade: -

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.

Single plane balancing

RUN 1 screen



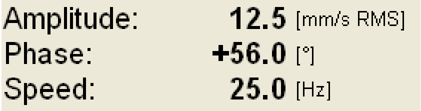
Fan KV90 - Run 1
Initial measurement

Plane 1

Amplitude: - [mm/s RMS]
Phase: - [°]
Speed: - [Hz]

Close Project
Edit
START
Balancer
Sensors
Balancer Settings
Global
Close Project
08:34
25.09.2013
100

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 manually enter all values (balancing calculator function). Use the **Tab** for shift between values.

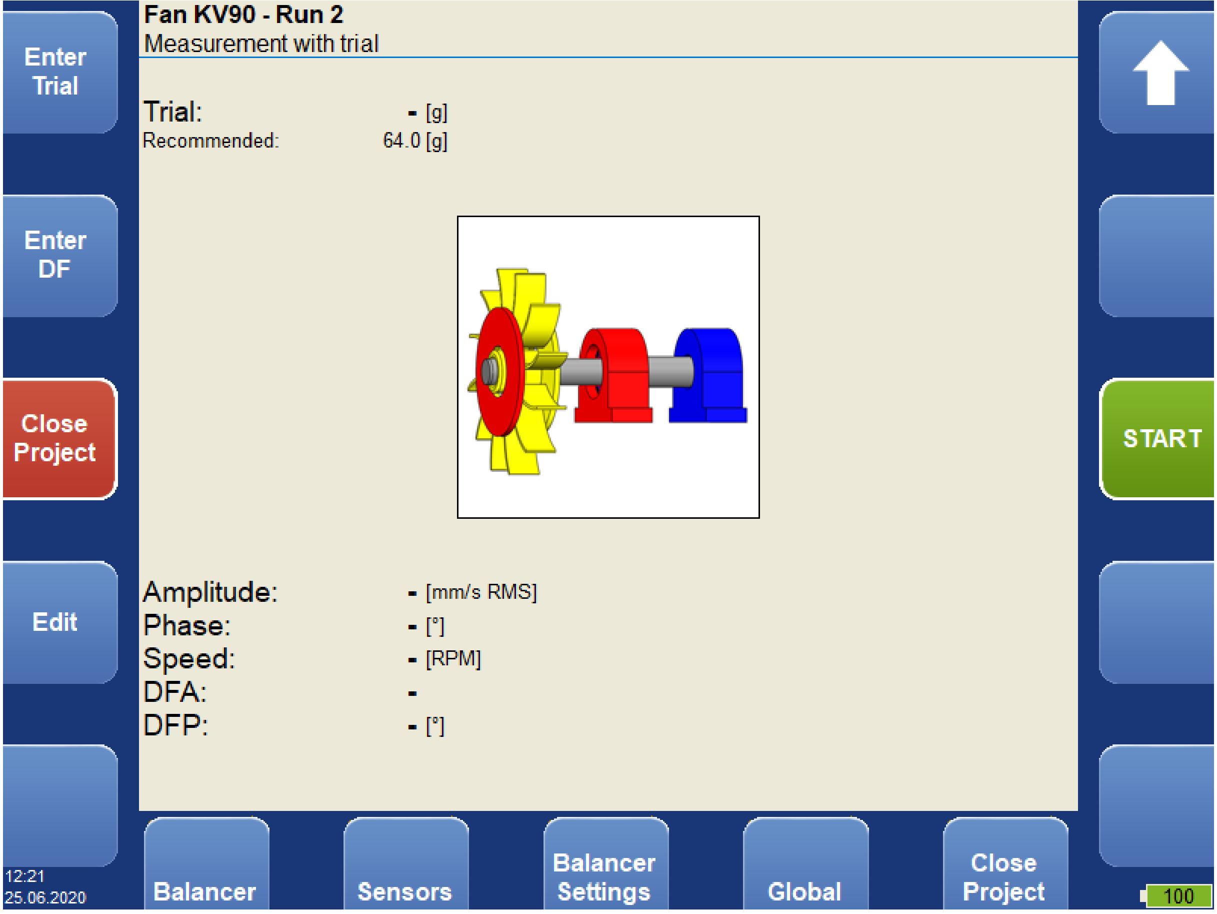


Amplitude: **12.5** [mm/s RMS]
Phase: **+56.0** [°]
Speed: **25.0** [Hz]

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

RUN 2 - the 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

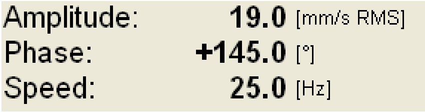
Trial: - [g]
Recommended: 64.0 [g]

Amplitude: - [mm/s RMS]
Phase: - [°]
Speed: - [RPM]
DFA: -
DFP: - [°]

12:21
25.06.2020

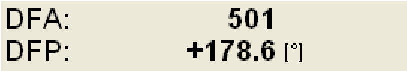
Push the **Enter Trial** button and enter the weight of trial. Confirm by **OK**. The weight can be negative, it represents removing of mass (for example dismounting of old balancing mass).
The recommended weight is displayed only if the **Rotor settings** parameters are entered.

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



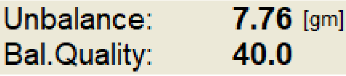
Amplitude: 19.0 [mm/s RMS]
Phase: +145.0 [°]
Speed: 25.0 [Hz]

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.



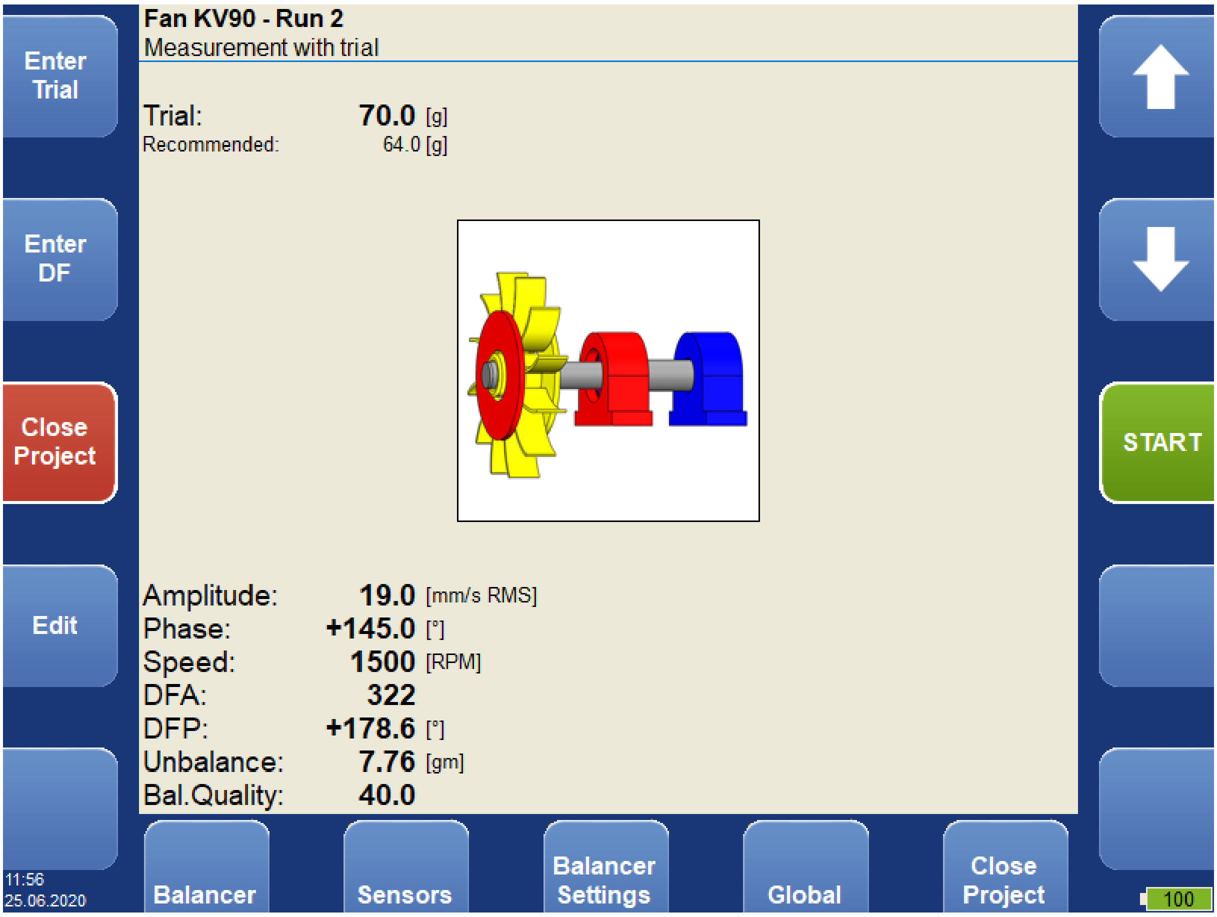
DFA: 501
DFP: +178.6 [°]

Moreover, if you have entered Correction Radius and Rotor Mass values in the Rotor Settings menu, the ***Unbalance*** and ***Bal.Quality*** values according to *ISO 1940* are displayed. In case the values are satisfactory, you don't need to continue with the balancing job.



Unbalance: 7.76 [gm]
Bal.Quality: 40.0

Note! If the trial mass is kept, it is included in the unbalance calculation.


Enter Trial
Enter DF
Close Project
Edit
START
11:56
25.06.2020
Balancer
Sensors
Balancer Settings
Global
Close Project
100

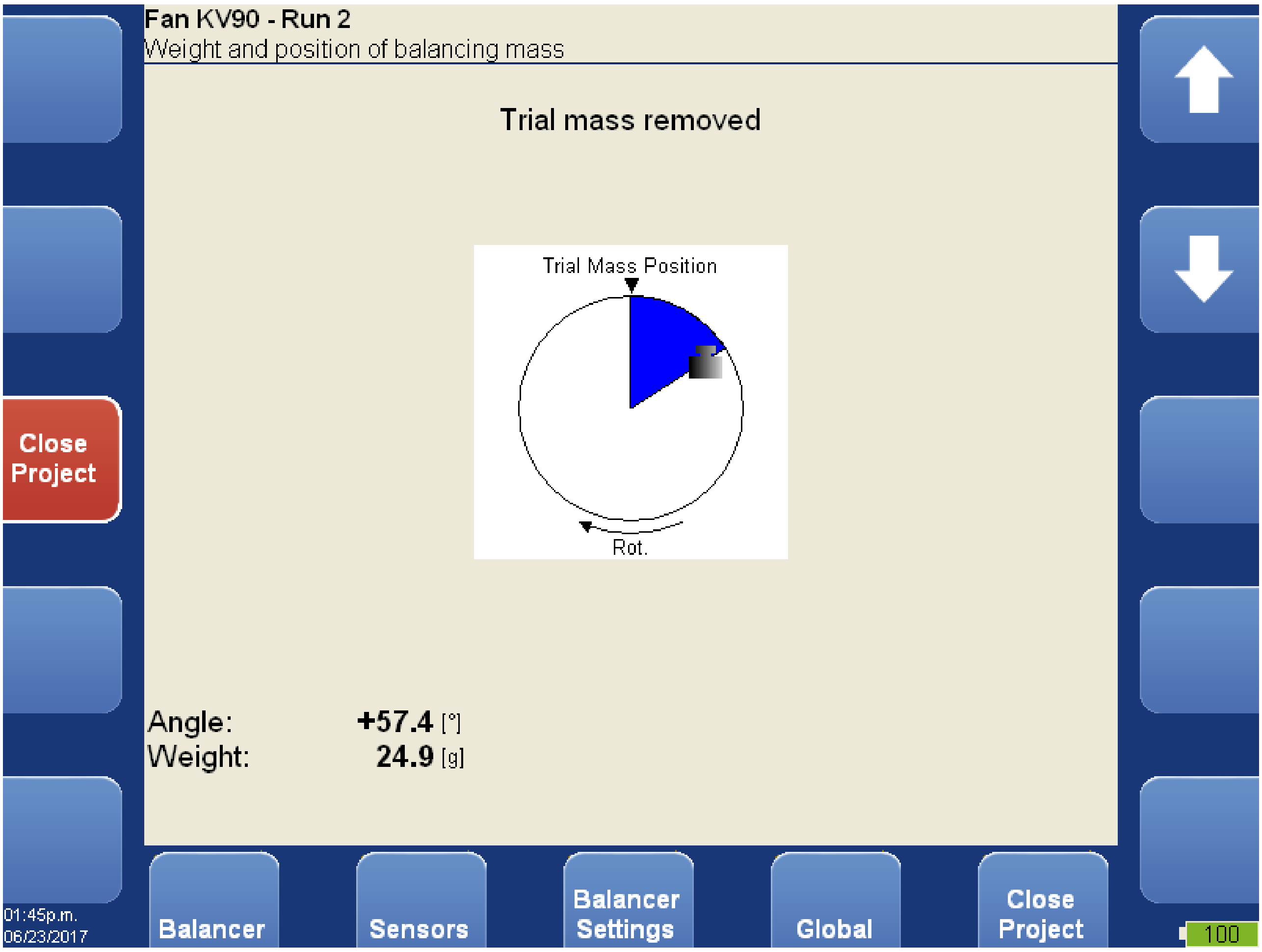
Fan KV90 - Run 2
Measurement with trial

Trial:	70.0	[g]
Recommended:	64.0	[g]
Amplitude:	19.0	[mm/s RMS]
Phase:	+145.0	[°]
Speed:	1500	[RPM]
DFA:	322	
DFP:	+178.6	[°]
Unbalance:	7.76	[gm]
Bal.Quality:	40.0	

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

RUN 2 - the 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. E.g. +57 degrees means from the trial mass position in the direction of rotation. Minus degrees means against the direction of rotation.


Close Project
Trial Mass Position
Rot.
01:45p.m.
06/23/2017
Balancer
Sensors
Balancer Settings
Global
Close Project
100

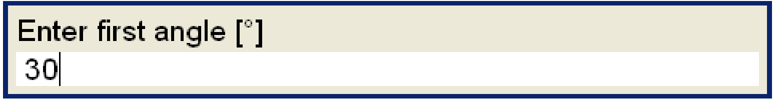
Fan KV90 - Run 2
Weight and position of balancing mass

Trial mass removed

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

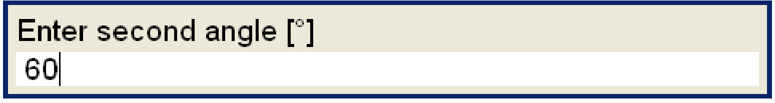
You can split correction mass to two arbitrary angles (in case if it is not possible to place the correction mass into calculated position). Go to menu **Balancer / Split Balancing mass**

Enter the value of the first angle.



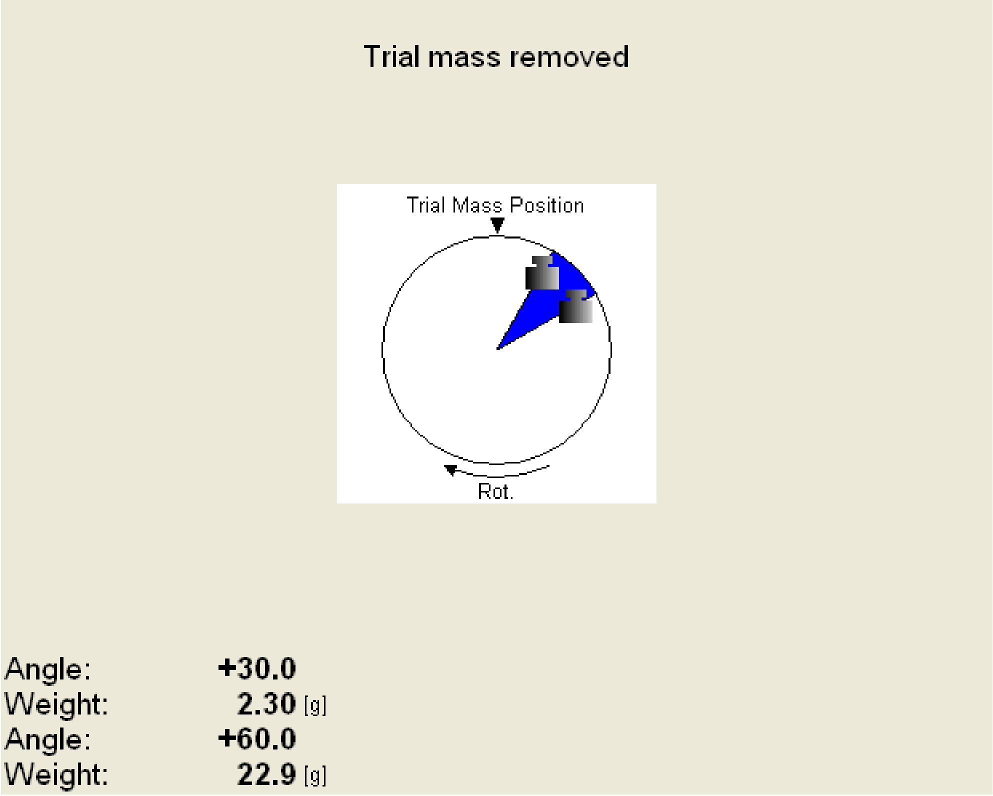
Enter first angle [°]
30

Then enter the value of the second angle.



Enter second angle [°]
60

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

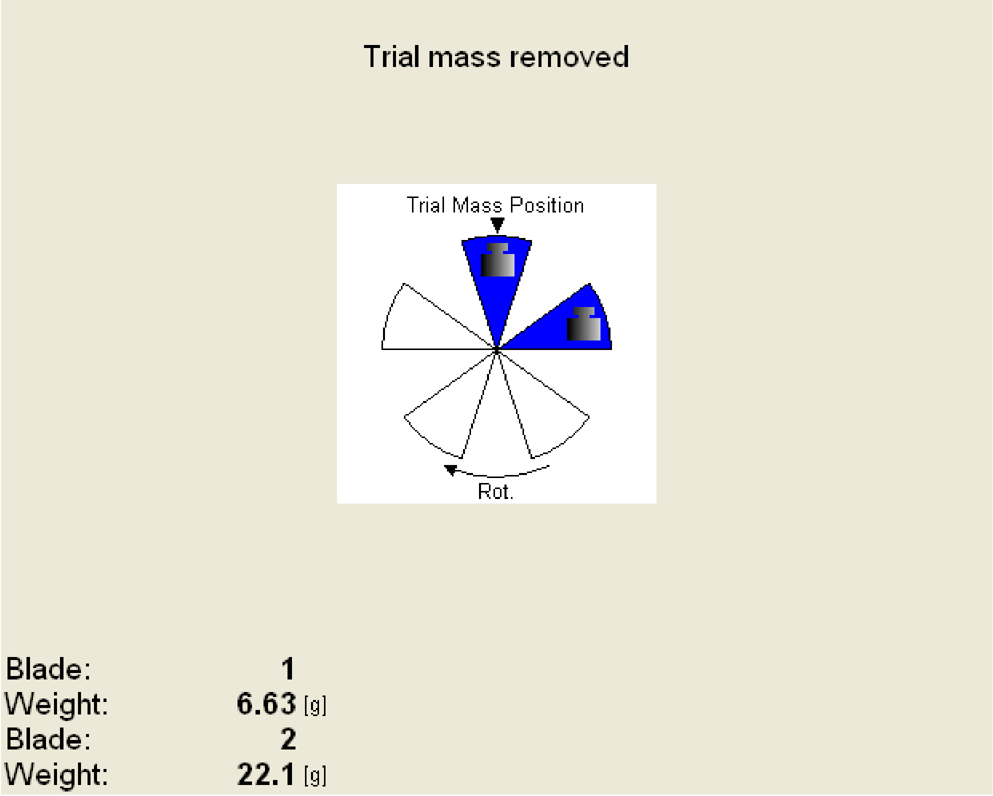


Trial mass removed

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.

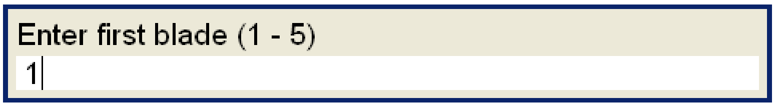


Trial mass removed

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.

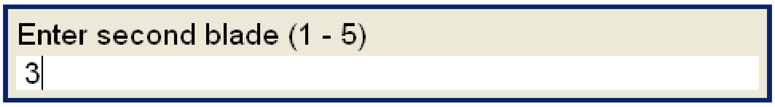
Enter the number of the first blade.



Enter first blade (1 - 5)

1

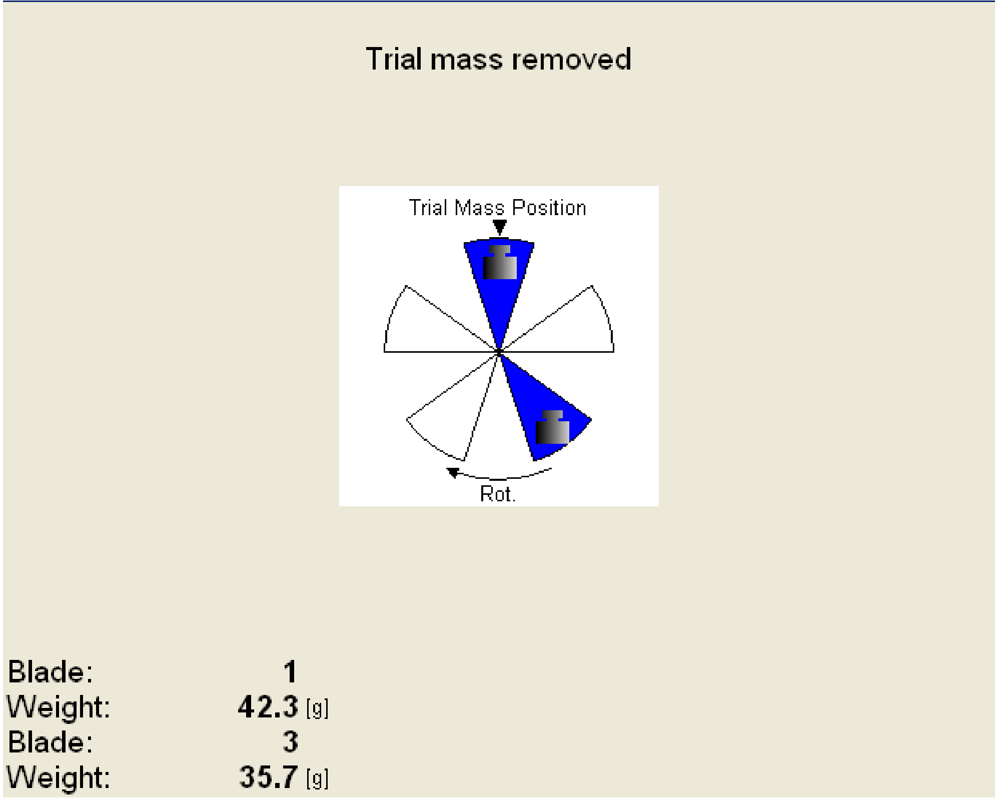
Then enter the number of the second blade.



Enter second blade (1 - 5)

3

New balancing masses will be displayed.



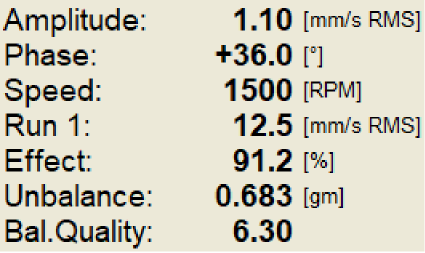
Trial mass removed

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.

The 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.

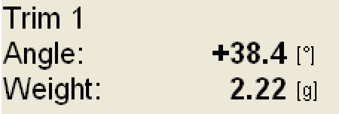


Amplitude:	1.10	[mm/s RMS]
Phase:	+36.0	[°]
Speed:	1500	[RPM]
Run 1:	12.5	[mm/s RMS]
Effect:	91.2	[%]
Unbalance:	0.683	[gm]
Bal.Quality:	6.30	

RUN1	amplitude of RUN1
Effect	is the reduction of balancing in % (the 1.1mm/s is the 9.2% of 12.5 mm/s according to rounding)
Unbalance	the residual unbalance after the correction mass was applied
Quality	balancing quality factor according ISO 1940 (mass of rotor and radius of balancing required)

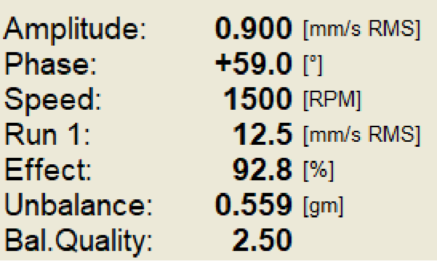
Trim Screens

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: +38.4 [°]
Weight: 2.22 [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 [%]
Unbalance: 0.559 [gm]
Bal.Quality: 2.50

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.

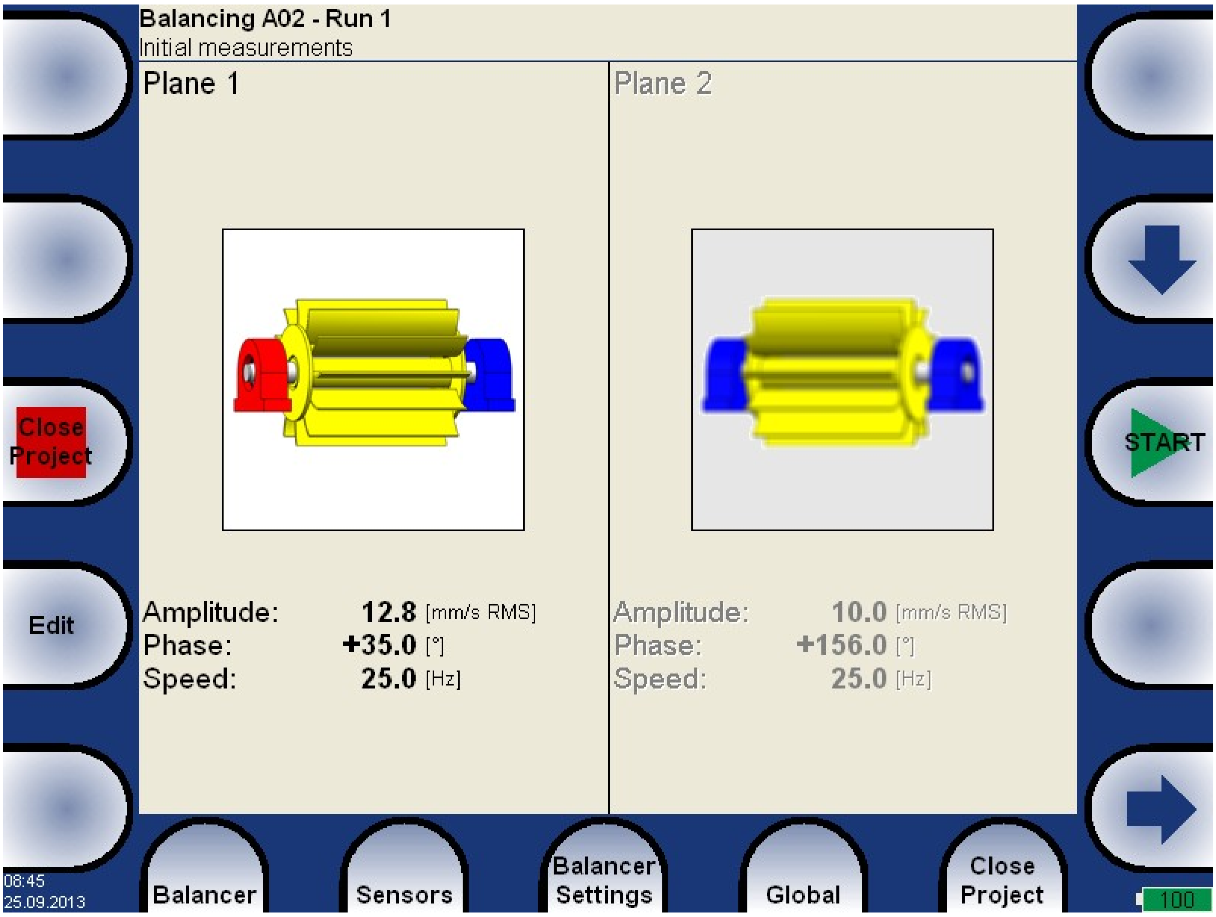
Dual plane balancing

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, 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.
With two sensors you make both plane measurements together at once.

You can also use the **Edit** button, when you want to enter the values manually. Use the **Tab** for shift between values.

Then the screen should look like next picture.



Balancing A02 - Run 1

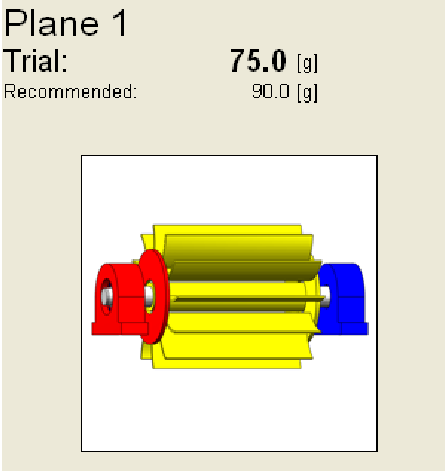
Initial measurements

Plane 1		Plane 2	
Amplitude:	12.8 [mm/s RMS]	Amplitude:	10.0 [mm/s RMS]
Phase:	+35.0 [°]	Phase:	+156.0 [°]
Speed:	25.0 [Hz]	Speed:	25.0 [Hz]

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.



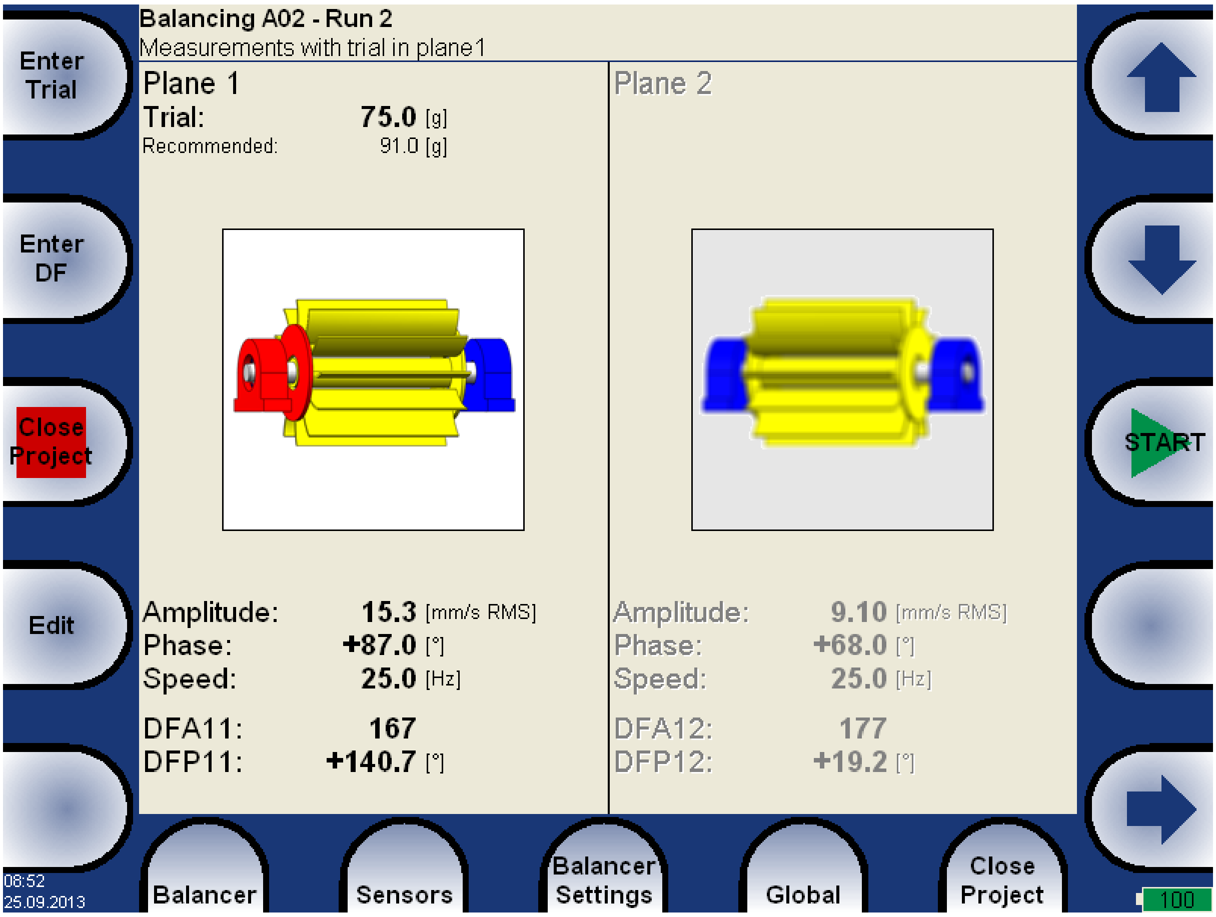
Plane 1

Trial: 75.0 [g]

Recommended: 90.0 [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.



Balancing A02 - Run 2

Measurements with trial in plane1

Plane 1

Trial: 75.0 [g]

Recommended: 91.0 [g]

Amplitude: 15.3 [mm/s RMS]

Phase: +87.0 [°]

Speed: 25.0 [Hz]

DFA11: 167

DFP11: +140.7 [°]

Plane 2

Amplitude: 9.10 [mm/s RMS]

Phase: +68.0 [°]

Speed: 25.0 [Hz]

DFA12: 177

DFP12: +19.2 [°]

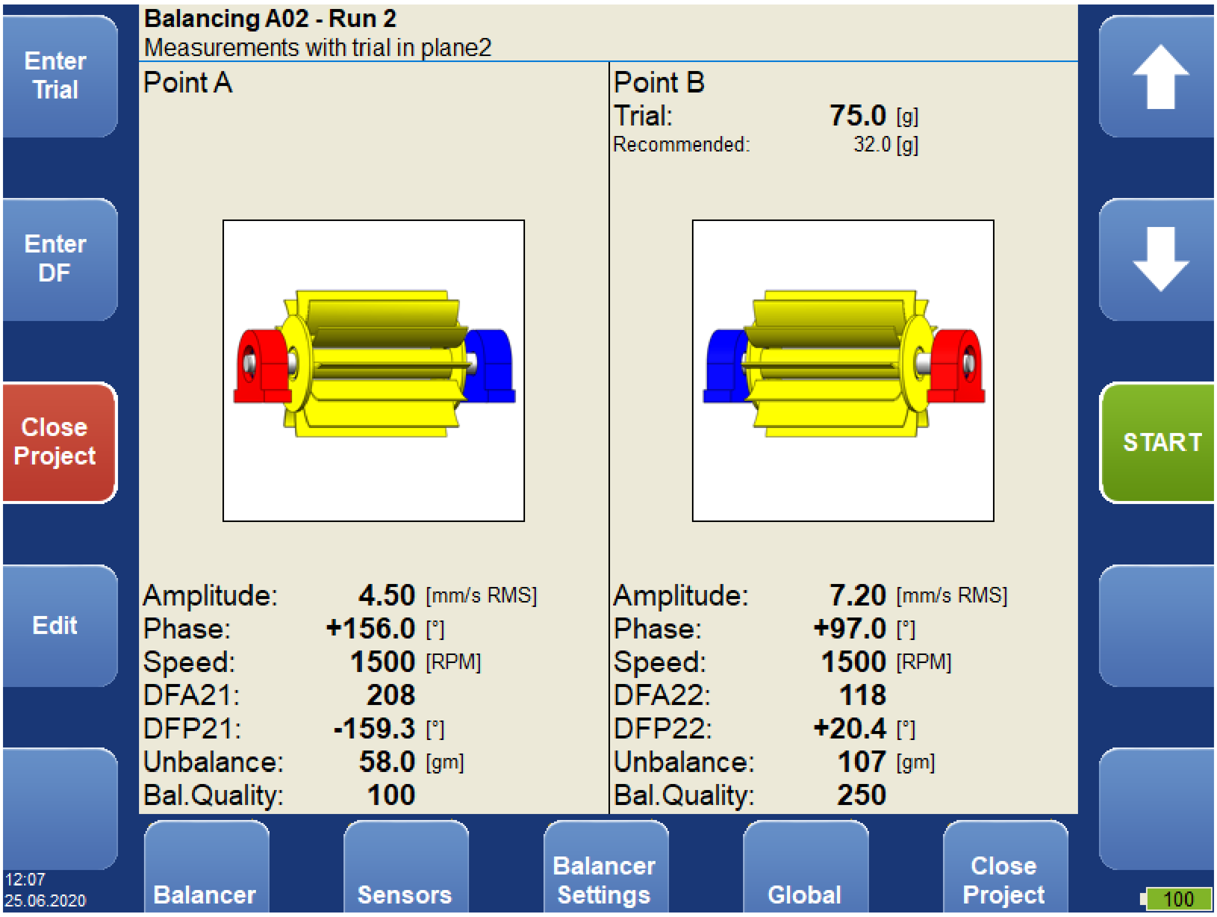
Enter Trial
Enter DF
Close Project
Edit
START
08:52
25.09.2013
Balancer
Sensors
Balancer Settings
Global
Close Project
100

Press **down arrow**.

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.

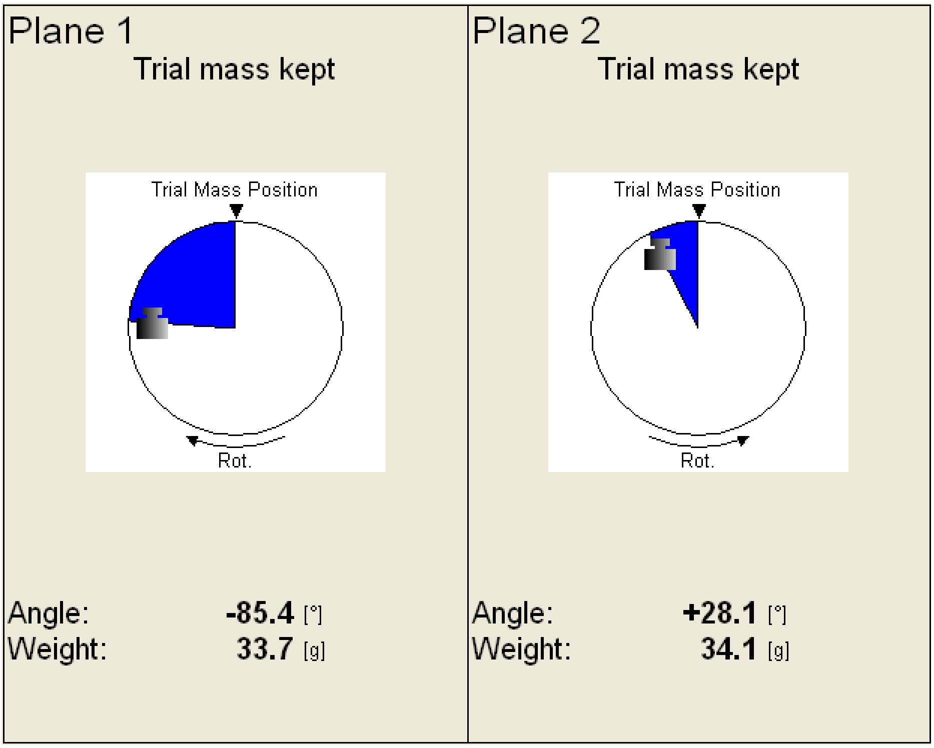

Enter Trial
Enter DF
Close Project
Edit
12:07
25.06.2020
Balancer
Sensors
Balancer Settings
Global
Close Project
START
100

Balancing A02 - Run 2
Measurements with trial in plane2

Point A		Point B	
		Trial:	**75.0** [g]
		Recommended:	32.0 [g]
Amplitude:	**4.50** [mm/s RMS]	Amplitude:	**7.20** [mm/s RMS]
Phase:	**+156.0** [°]	Phase:	**+97.0** [°]
Speed:	**1500** [RPM]	Speed:	**1500** [RPM]
DFA21:	**208**	DFA22:	**118**
DFP21:	**-159.3** [°]	DFP22:	**+20.4** [°]
Unbalance:	**58.0** [gm]	Unbalance:	**107** [gm]
Bal.Quality:	**100**	Bal.Quality:	**250**

Press **down arrow**.

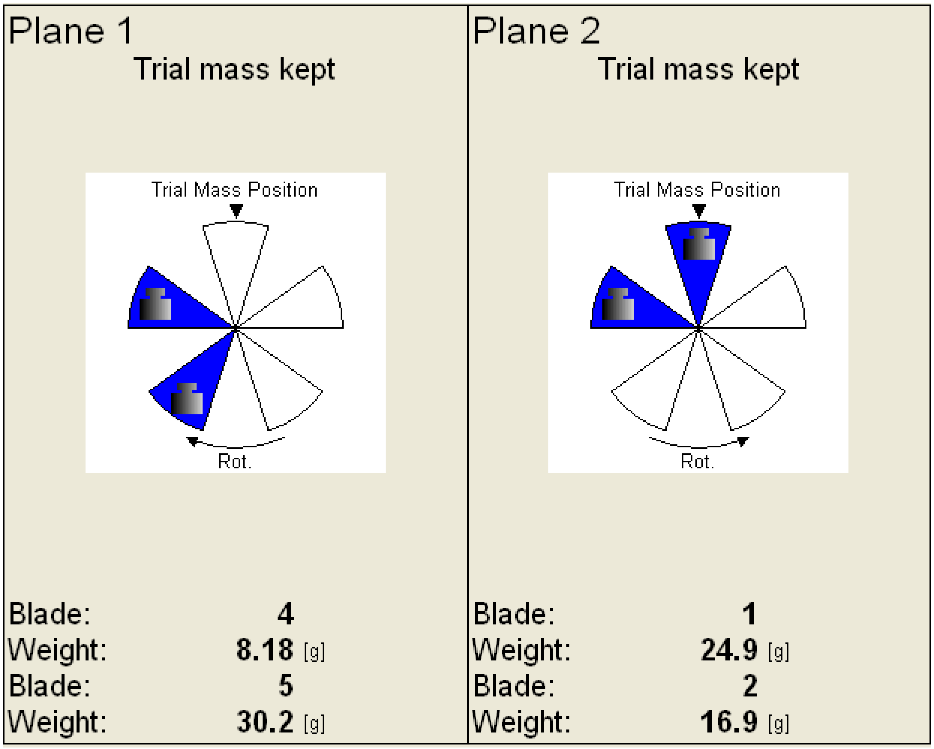
RUN 2 - Result screen


Trial Mass Position
Rot.
Trial Mass Position
Rot.

Plane 1		Plane 2	
Trial mass kept		Trial mass kept	
Angle:	**-85.4** [°]	Angle:	**+28.1** [°]
Weight:	**33.7** [g]	Weight:	**34.1** [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) as in one plane balancing.

In case you have used blades, the result screen looks like that.

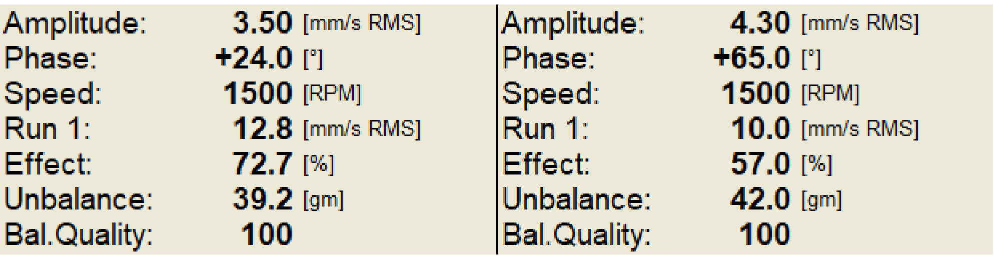


Plane 1		Plane 2	
Trial mass kept		Trial mass kept	
Blade:	4	Blade:	1
Weight:	8.18 [g]	Weight:	24.9 [g]
Blade:	5	Blade:	2
Weight:	30.2 [g]	Weight:	16.9 [g]

Blades can be changed the same way as in one plane balancing mode.

The 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 [%]
Unbalance:	39.2 [gm]	Unbalance:	42.0 [gm]
Bal.Quality:	100	Bal.Quality:	100

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 %
Unbalance	the residual unbalance after the correction mass was applied
Quality	balancing quality factor according ISO 1940 (mass of rotor and radius of balancing required)

Trim Screens

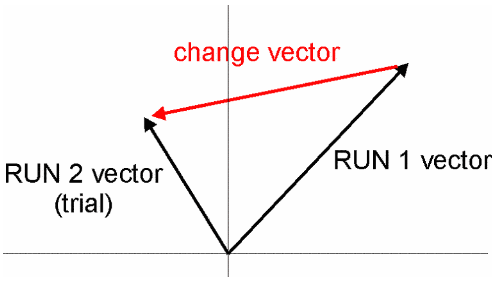
After RUN3 measurement you can continue with the job when you are not satisfied with the results. These next steps do not required trial mass measurements already. After each measurement the next masses are recommended. The trim screens are very similar to screens in single plane balancing.

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).

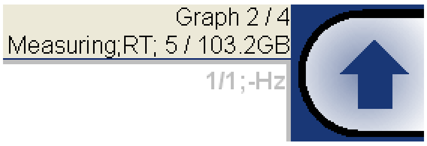
A warning is displayed when the change is less than 20% but bigger than 1%. You can continue with balancing after this warning and use these values.

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.

The 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 the 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 Trigger 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 (e.g.10 RPM).
Also the **time** can be used to control that procedure. Then you can take the measurement in defined time interval (e.g. 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.
The information about used and free memory is displayed during the measurement (e.g. 5 / 103.2GB).



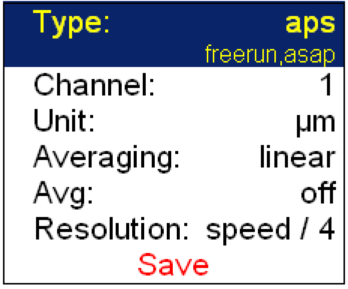
Graph 2 / 4
Measuring;RT; 5 / 103.2GB
1/1;-Hz

The Set and other items

The meaning of the **Set** and also meaning of other items in the RunUp menu are the same as in the Analyzer mode.

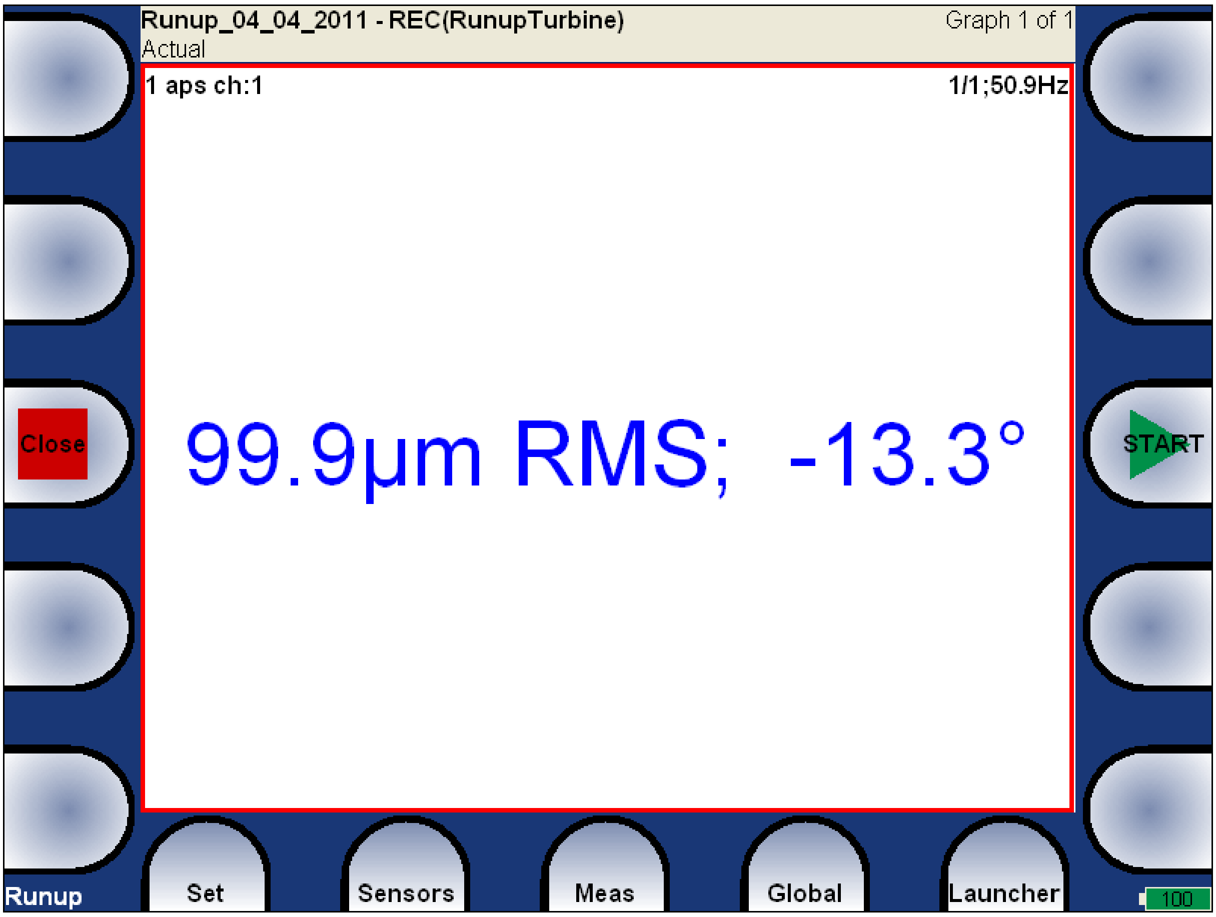
Run up measurement

For example we define only one measurement in set. The proximity sensor on channel 1 is used.



Type: aps
freerun,asap
Channel: 1
Unit: µm
Averaging: linear
Avg: off
Resolution: speed / 4
Save

The **Runup Trigger Mode** is set to **speed** and the value is 1Hz.
Start measurement - push **Start** button. After the full speed is achieved press **STOP**.



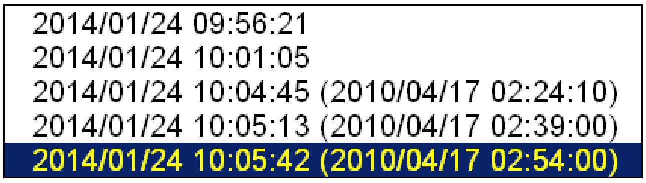
Runup_04_04_2011 - REC(RunupTurbine)
Actual

1 aps ch:1 1/1;50.9Hz

99.9µm RMS; -13.3°

The last measured value is on the screen.
Press **Set/ View Trend** and in the left upper screen corner the list of measured run ups appear. Every new measurement creates new item in this list. The date and time of measurement is displayed. Select one trend from the list and press **OK**.

If the analyze 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 (e.g. runup is very long). See the Global/Runup chapter.

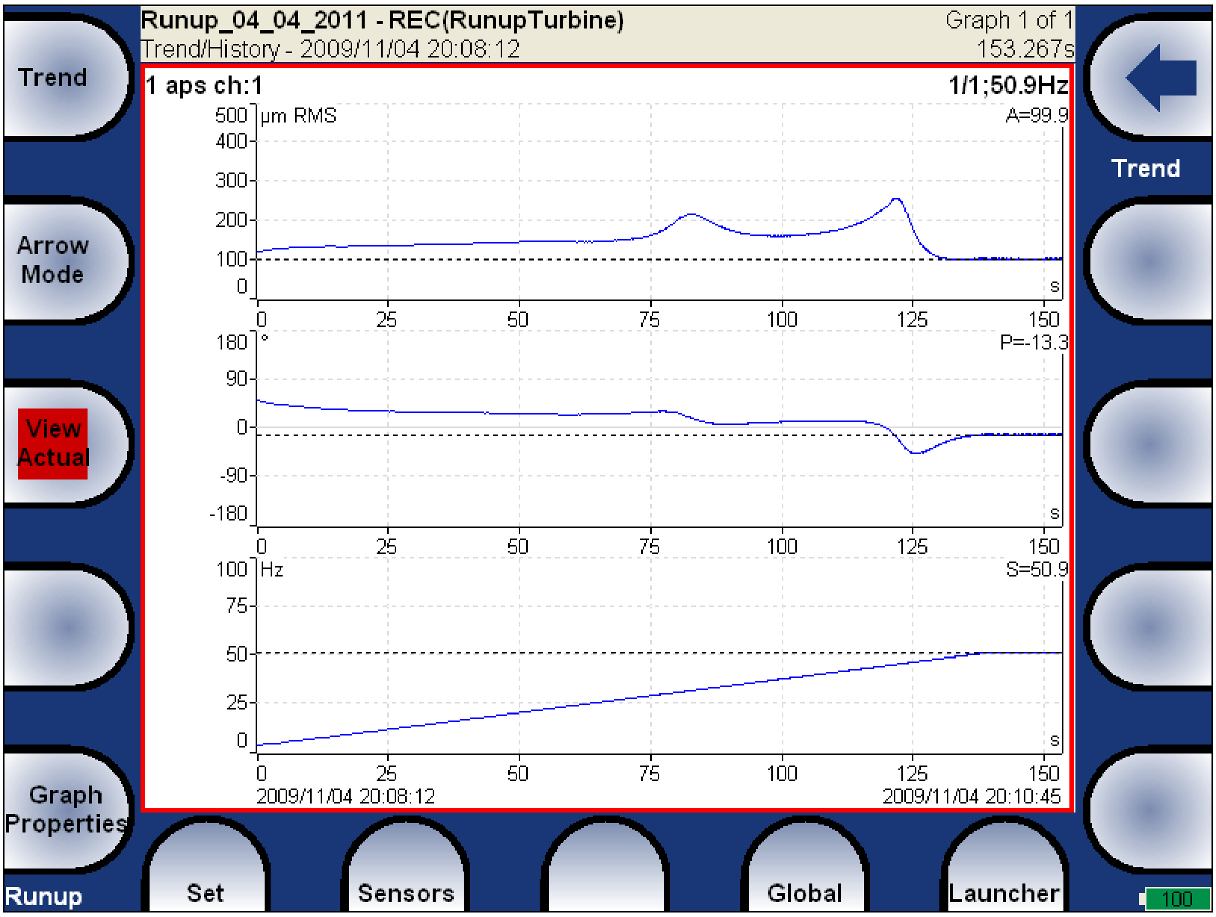


2014/01/24 09:56:21
2014/01/24 10:01:05
2014/01/24 10:04:45 (2010/04/17 02:24:10)
2014/01/24 10:05:13 (2010/04/17 02:39:00)
2014/01/24 10:05:42 (2010/04/17 02:54:00)

Menu Trend

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

Delete deletes selected trends
Export exports selected trends


Runup_04_04_2011 - REC(RunupTurbine)
Graph 1 of 1
Trend/History - 2009/11/04 20:08:12
153.267s
1 aps ch:1
1/1;50.9Hz
µm RMS
A=99.9
500
400
300
200
100
0
s
0
25
50
75
100
125
150
°
P=-13.3
180
90
0
-90
-180
Hz
S=50.9
100
75
50
25
2009/11/04 20:08:12
2009/11/04 20:10:45
Trend
Arrow Mode
View Actual
Graph Properties
Runup
Set
Sensors
Global
Launcher
Trend
100

The aps - amplitude+phase+speed graphs appear. Several types of graphs is available under the **View** item. All items are in details described in chapter
The Analyzer Mode/The Analyzer buttons description/Graph Properties.

Use **Arrow Mode** button for functions selection.

The Route

Loading of the route to the instrument

The co-operation with DDS2014 software is required for the route measurement. See also the DDS user manual for more details. We do not describe all details about DDS2014 function in this guide.
Open the database in DDS2014, from which you want create the route. Use menu Route / A4400-VA4Pro.
Connect the unit with the computer. See **Connection to the computer** chapter.
Press the **Connect** button and DDS2014 will automatically connect and receive projects (Off-route, Runup, Route…) from VA4Pro.
There are two options - move required points directly from DDS2014 tree to the projects list or from predefined list of routes (use mouse Drag'n'Drop).

You can see that the structure of tree is changed. This is because in VA4Pro 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 to use shortcuts in a tree items (in this case "Turbo Generator" should be "TG").

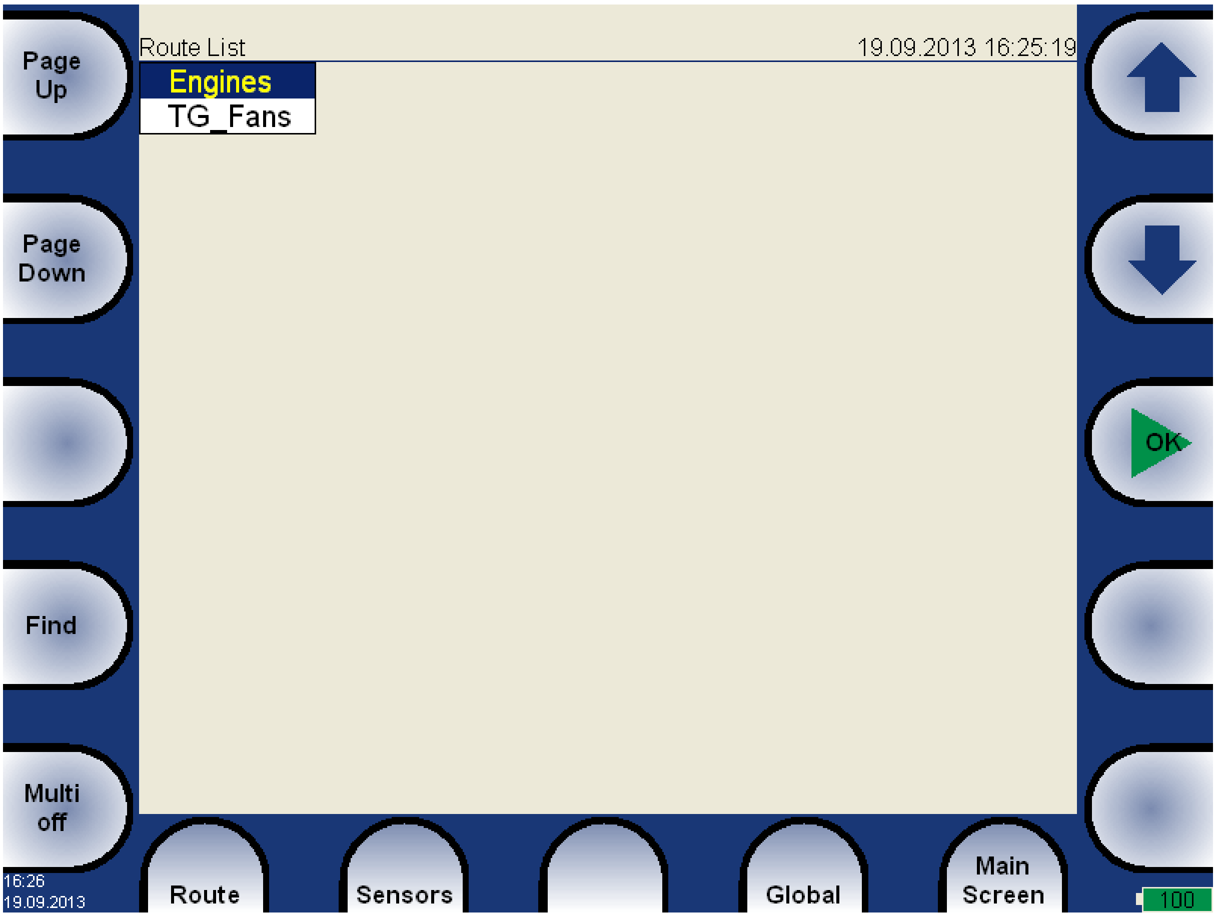
Select route(s) in projects windows and press "Send" button in instrument window.

Creation of the route tree

The route tree can be created also in the VA4 directly. The new database must be created in DDS for it. See DDS guide for details.

Route measurement

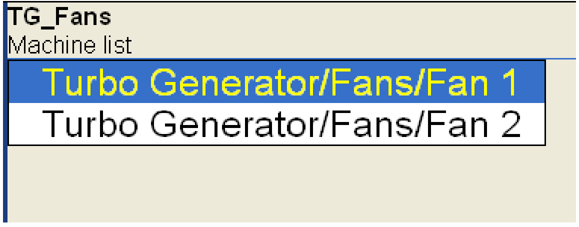
In VA4Pro select the **Route** mode in main screen. The list of routes in the memory is displayed. The time and date of last saving of selected project is displayed in top right corner.



Route List 19.09.2013 16:25:19

Engines
TG_Fans

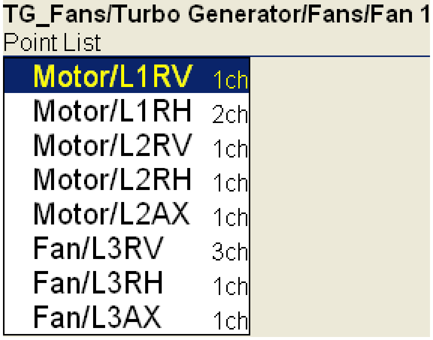
Select one route and press OK. The list of machines appears.



TG_Fans
Machine list

Turbo Generator/Fans/Fan 1
Turbo Generator/Fans/Fan 2

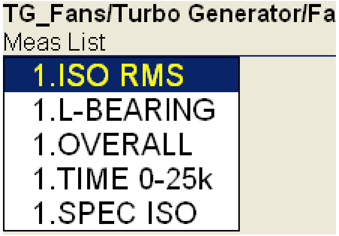
Select the machine and press right arrow to develop the list of measurement points.
The number of AC channels for each point is displayed behind the point name.



TG_Fans/Turbo Generator/Fans/Fan 1
Point List

Motor/L1RV	1ch
Motor/L1RH	2ch
Motor/L2RV	1ch
Motor/L2RH	1ch
Motor/L2AX	1ch
Fan/L3RV	3ch
Fan/L3RH	1ch
Fan/L3AX	1ch

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.



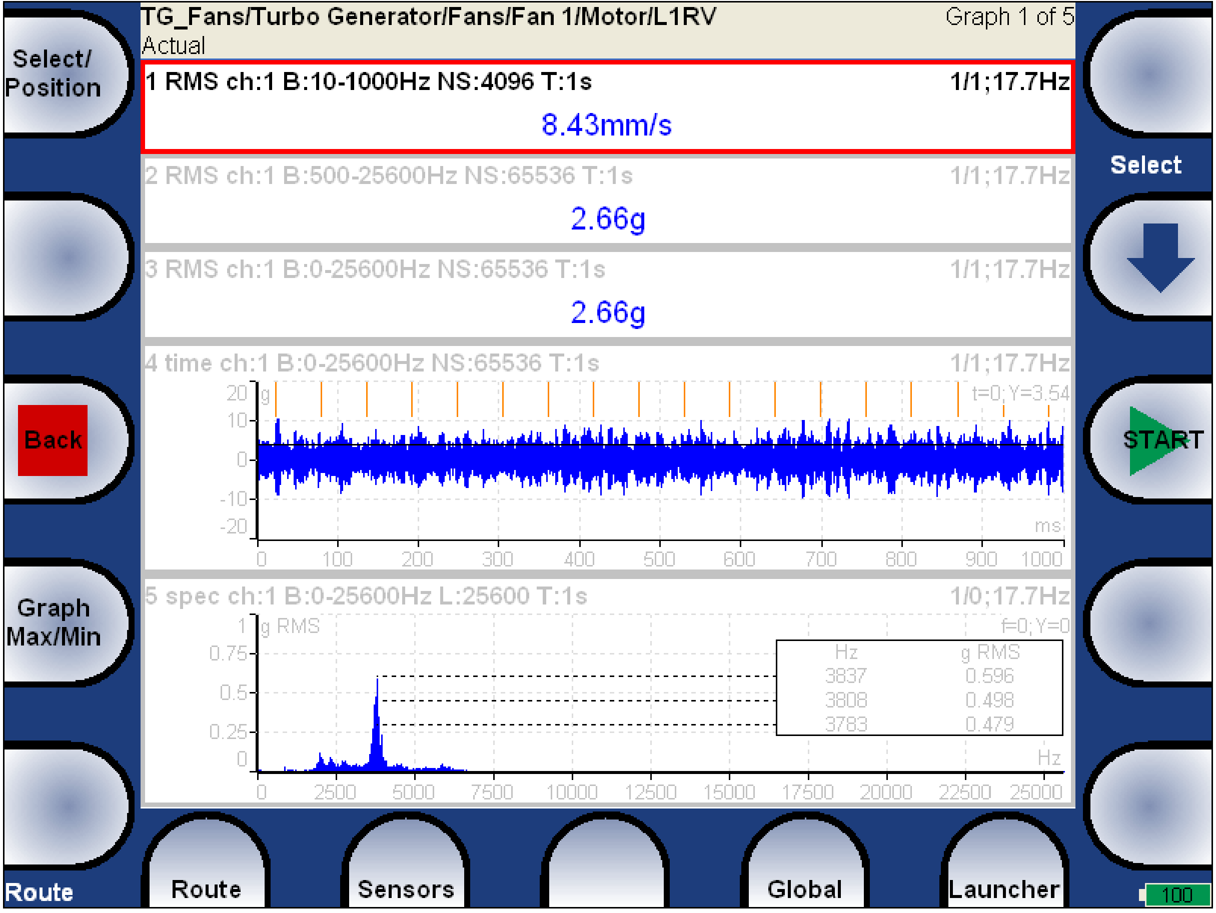
TG_Fans/Turbo Generator/Fa
Meas List

1.ISO RMS
1.L-BEARING
1.OVERALL
1.TIME 0-25k
1.SPEC ISO

When you press the **Start** button in the points list, the measurement graphs are drawn with the **No_Data** message. If the required sensor (defined in the route) is not compatible with the sensor connected to channel input (Sensors properties) instrument warns us about this. In this case change the sensor or use the different sensitivity and press **Continue**.

Press the **START** to begin the point measurement. All defined measurement will be taken together.

The complete point measurement should be taken now. The measured data are or are not displayed on the screen regarding the **Display Route Values** parameter in **Global Settings**.



TG_Fans/Turbo Generator/Fans/Fan 1/Motor/L1RV Graph 1 of 5
Actual

1 RMS ch:1 B:10-1000Hz NS:4096 T:1s 1/1;17.7Hz
8.43mm/s

2 RMS ch:1 B:500-25600Hz NS:65536 T:1s 1/1;17.7Hz
2.66g

3 RMS ch:1 B:0-25600Hz NS:65536 T:1s 1/1;17.7Hz
2.66g

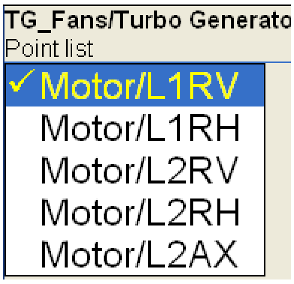
4 time ch:1 B:0-25600Hz NS:65536 T:1s 1/1;17.7Hz

5 spec ch:1 B:0-25600Hz L:25600 T:1s 1/0;17.7Hz

Hz	g RMS
3837	0.596
3808	0.498
3783	0.479

Select/
Position
Back
Graph
Max/Min
Route
Select
START
Route
Sensors
Global
Launcher
100
20
10
0
-10
-20
g
t=0; Y=3.54
ms
0
100
200
300
400
500
600
700
800
900
1000
1
0.75
0.5
0.25
0
g RMS
f=0; Y=0
Hz
0
2500
5000
7500
10000
12500
15000
17500
20000
22500
25000

Use the Back to return back to points list. The measured point is labeled by the symbol √ (all defined measurement were taken) or by the cross (some measurements were not taken due to error).

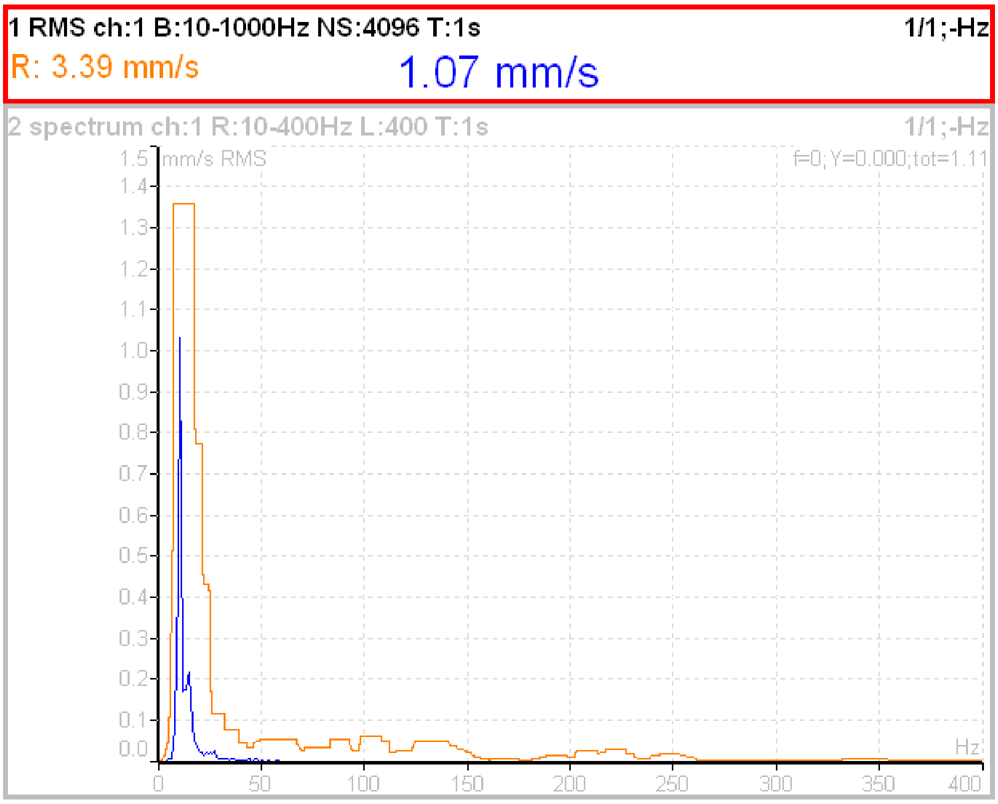


TG_Fans/Turbo Generato
Point list

✓ Motor/L1RV
Motor/L1RH
Motor/L2RV
Motor/L2RH
Motor/L2AX

Reference values

You can download reference values from DDS to VA4Pro unit for spectrum and overall measurements. 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.



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

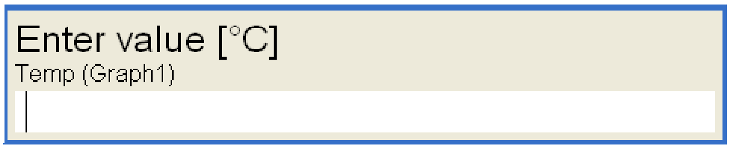
R: 3.39 mm/s 1.07 mm/s

2 spectrum ch:1 R:10-400Hz L:400 T:1s 1/1;-Hz

f=0;Y=0.000;tot=1.11

Manual entry

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



Enter value [°C]

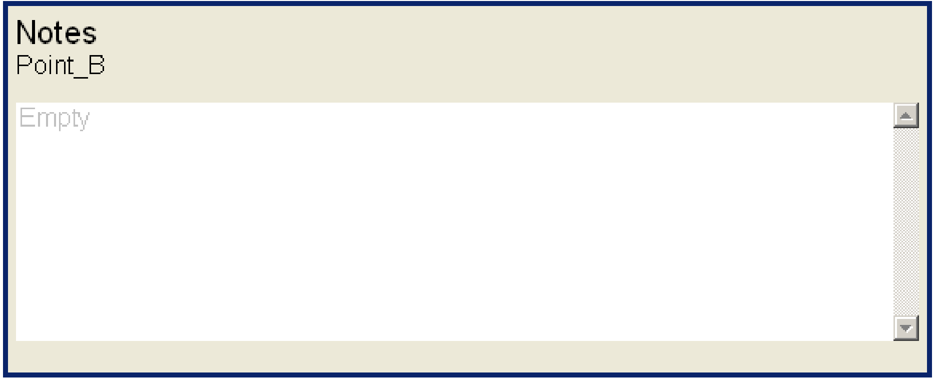
Temp (Graph1)

Notes

You can attach the short text notes to route points.
There are three ways how 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 point appears. It is empty when no note was created yet.



Notes

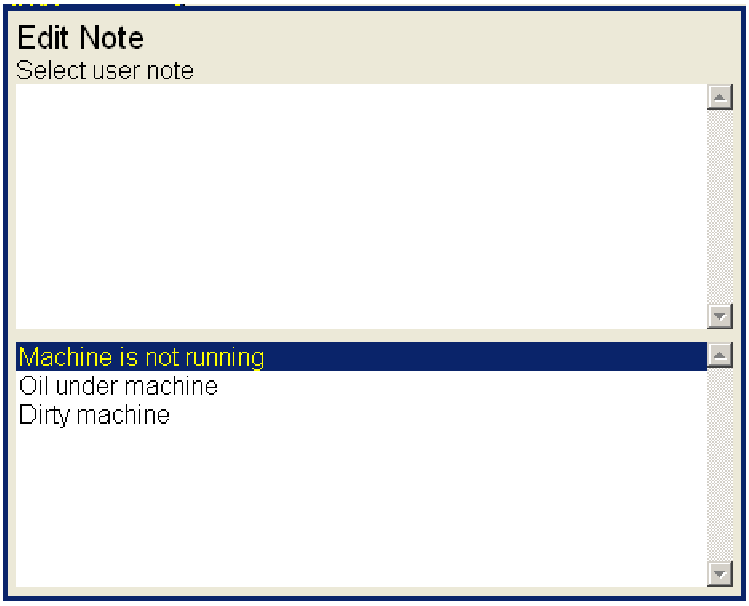
Point_B

Empty

New note

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 select the note and press **Select**.

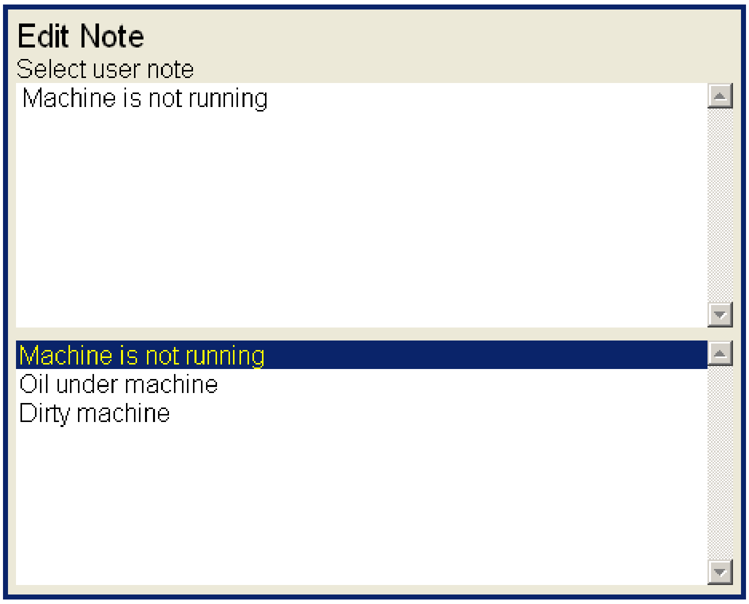

Edit Note

Select user note

Machine is not running

Oil under machine

Dirty machine


Edit Note

Select user note

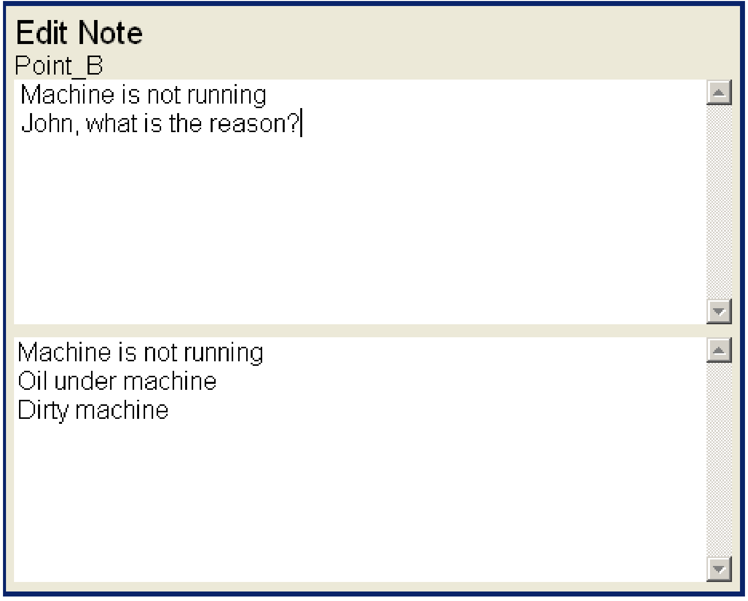
Machine is not running

Machine is not running

Oil under machine

Dirty machine

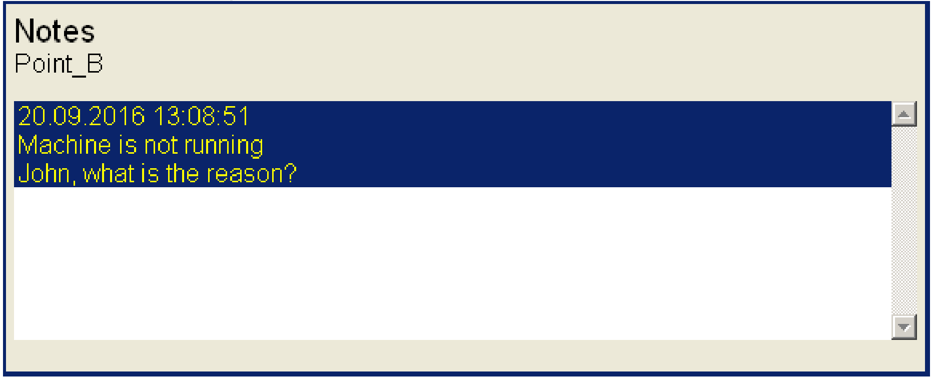
- If you want to enter your own text, then press **Edit Text** button. The cursor appears in upper area and you can enter the required note. Press **Notes List** (the same button position as **Edit Text**) to return back to the selection of User/Factory note.



Edit Note
Point_B
Machine is not running
John, what is the reason?

Machine is not running
Oil under machine
Dirty machine

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



Notes
Point_B
20.09.2016 13:08:51
Machine is not running
John, what is the reason?

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

Note edit

Select the note from the list and press **Edit** button. Then use the same procedures as for new note for editing.

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

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

Export to VA4_DISC

The computer can read any data from VA4_DISC only. The route with measured data has to be exported to this memory before the transfer. During the route measurement are data saved to the VA4 hard disc only. When the route is closed the VA4 asks the user "Export to VA4_DISC?" and user selects one option. The export to VA4_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.

Download of the route to the computer

The process is the same as the load of route to the instrument. In **VA4Pro instrument window** use the **Receive** button and select the required route from the list (all routes saved in the VA4_DISC). The list of all points appears in instrument window. The grey items were not measured. Press **Store to database** to save data.

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 VA4

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

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

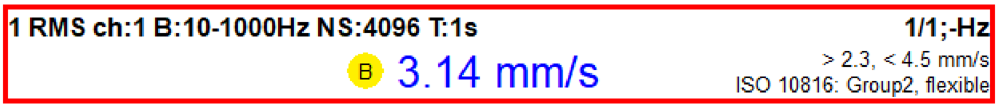
If the speed is measured by tacho probe, it is saved always with data regardless the fact if there were already defined by one of the previous ways (speed entered in device or DDS).

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

Speed: 50.8 Hz

Limits

In DDS, you can define limit values and alarm colors (see the DDS manual to find out how to do it). For static data cells, these limits are transferred into the instrument together with the route. Exceeding the limit values is signaled during the measurement and also in trends.

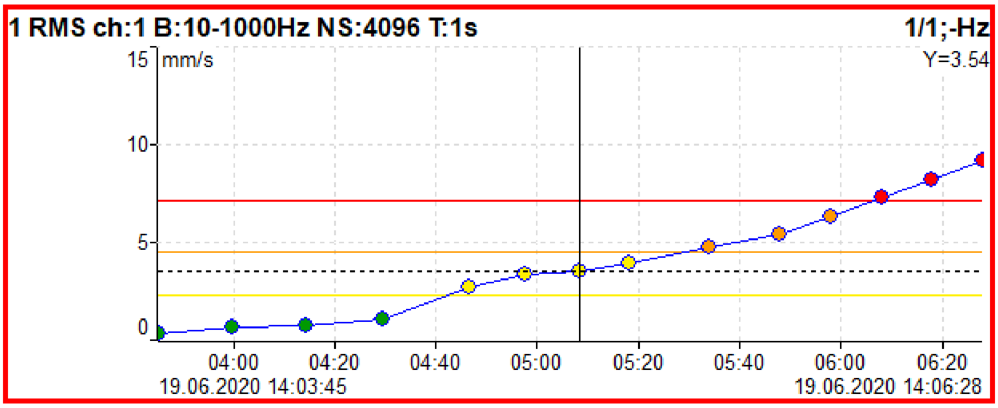


1 RMS ch:1 B:10-1000Hz NS:4096 T:1s 1/1;-Hz

B 3.14 mm/s

> 2.3, < 4.5 mm/s

ISO 10816: Group2, flexible

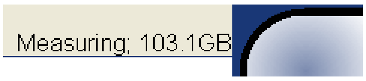


1 RMS ch:1 B:10-1000Hz NS:4096 T:1s 1/1;-Hz

The Recorder

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 e.g. 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.

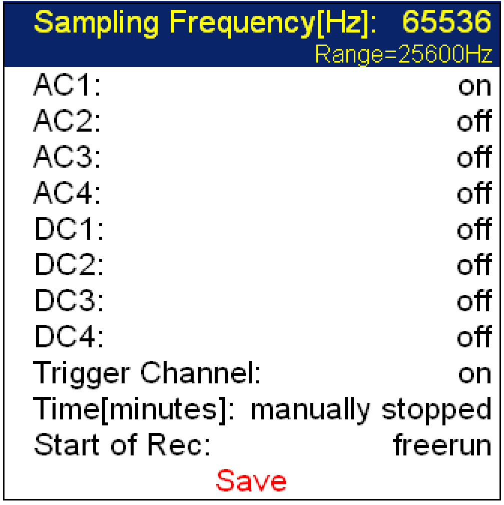
The same solution offers the VA4 Recorder. It enables to record simultaneously all 4 AC channels, tacho channel and 4 DC process values channels into the unit memory. The sampling frequency is from 64Hz to 196kHz. The maximum record length depends of free memory size, which is displayed in right upper corner.



Measuring; 103.1GB

New Record

Run the Recorder. The list of records which are saved already in the memory appears on the screen. Push the **Project/ New** button and entry the name. The new item appears in the list. Select it and push **OK**.



Sampling Frequency[Hz]: 65536
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

Select the **Sampling Frequency**. Switch to **on** all channels you want to record. Define the length of record (or how it will be stopped). Select the **Start of Rec** way.

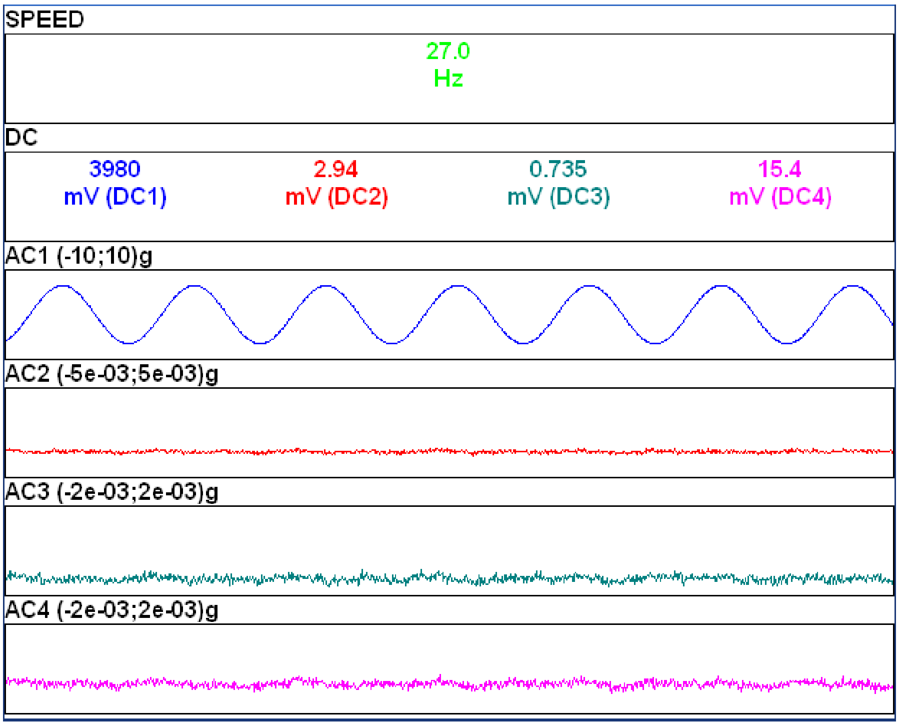
Start of Rec

freerun After the measurement preparation is the recording started immediately.

external The **external** signal (voltage level higher then defined threshold level in the **Global** menu) starts the recording. Such signal may be generated e.g. 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 **Treshold level**, which is set by user in **Global** menu. Both - positive and negative levels are accepted.

When the **Record** parameters are set, use the **Start** button for start of the recording. During the recording all recorded input signals are displayed on the screen.

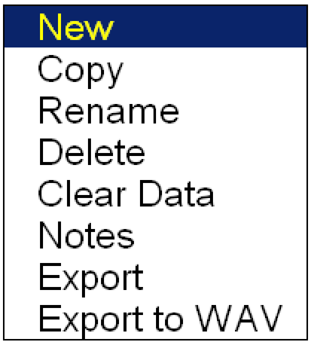

SPEED
27.0
Hz
DC
3980
mV (DC1)
2.94
mV (DC2)
0.735
mV (DC3)
15.4
mV (DC4)
AC1 (-10;10)g
AC2 (-5e-03;5e-03)g
AC3 (-2e-03;2e-03)g
AC4 (-2e-03;2e-03)g

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

Editing of Record

Run the Recorder. The list of records which are saved already in the memory appears on the screen. The time and date of last saving of selected record is displayed in top right corner. Select one of them (arrows and OK). The preview of recorded signals appears.

Project button


New
Copy
Rename
Delete
Clear Data
Notes
Export
Export to WAV

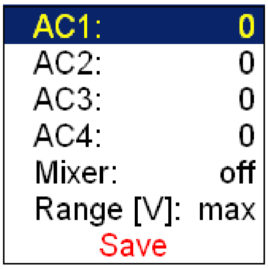
New	the new project for recording
Copy	copies all record parameters to new project without the recorded data
Rename	renames the project
Delete	deletes project from memory
Clear Data	deletes recorded data, all record parameters is kept
Notes	adds the notice to the record, see **Global Properties/ User Notes** chapter
Export	exports the record to **VA4_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. Large record you need to split to several smaller records. Use the **Recorder** module, open the record and by using of **Cursor** and **Length** buttons select part of record. Press **Save selection as** and define new name. Do not forget to delete record from VA4_DISC after

downloading to PC.

Export to wav exports the record to wav data format (all channels are saved to one multichannel wav file, for example the Audacity software can read it))
Export to wav Settings setting of next export parameters (see next chapter)

Export to wav Settings

Contains setting of advanced parameters.



AC1: 0
AC2: 0
AC3: 0
AC4: 0
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 VA4 Pro 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.

Sensors button

You can change the sensor parameters for next recording.

Record button

The record parameters are displayed. You can change them, but it will influence the next record.

START button

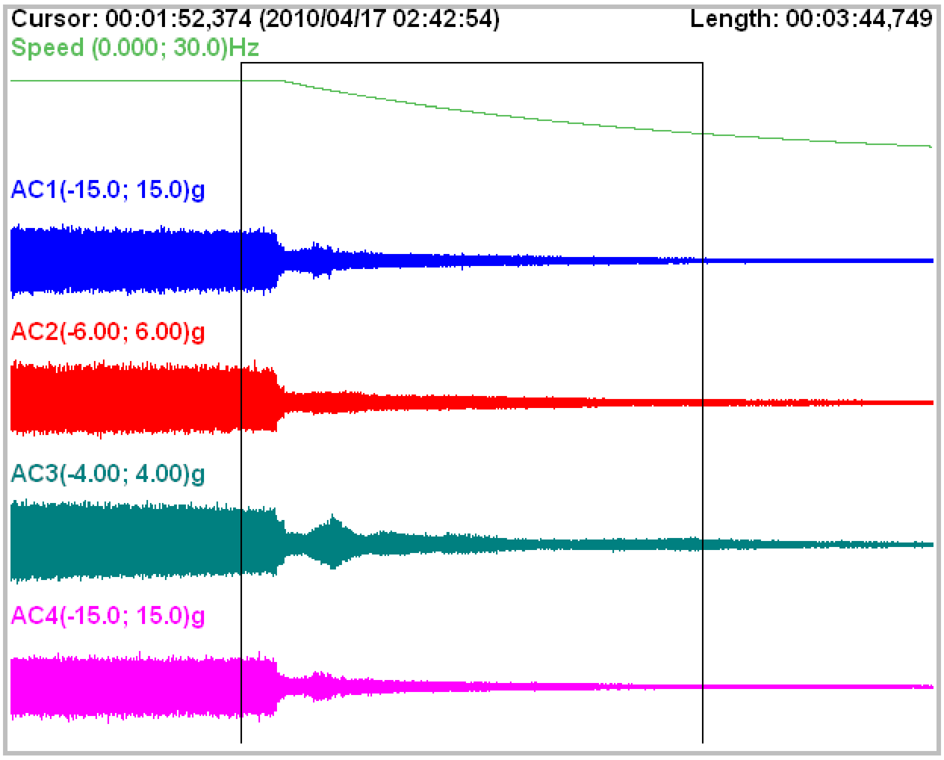
It starts new recording. The old recorded data will be rewritten.

Properties button

It displays all record properties.

Cursor and Length arrow buttons

When the record contains longer data then you need to analyzing you can select any part of record and save it as new record.
The **Cursor** arrow defines the beginning of new record. The **Length** defines the length of new record. when you defined the borders of new record, use the **Save Selection As** button.


Cursor: 00:01:52,374 (2010/04/17 02:42:54)
Length: 00:03:44,749
Speed (0.000; 30.0)Hz
AC1(-15.0; 15.0)g
AC2(-6.00; 6.00)g
AC3(-4.00; 4.00)g
AC4(-15.0; 15.0)g

Arrow mode

It changes the arrows from **Cursor+Length** to **ZoomX+Y**.

Zoom X button

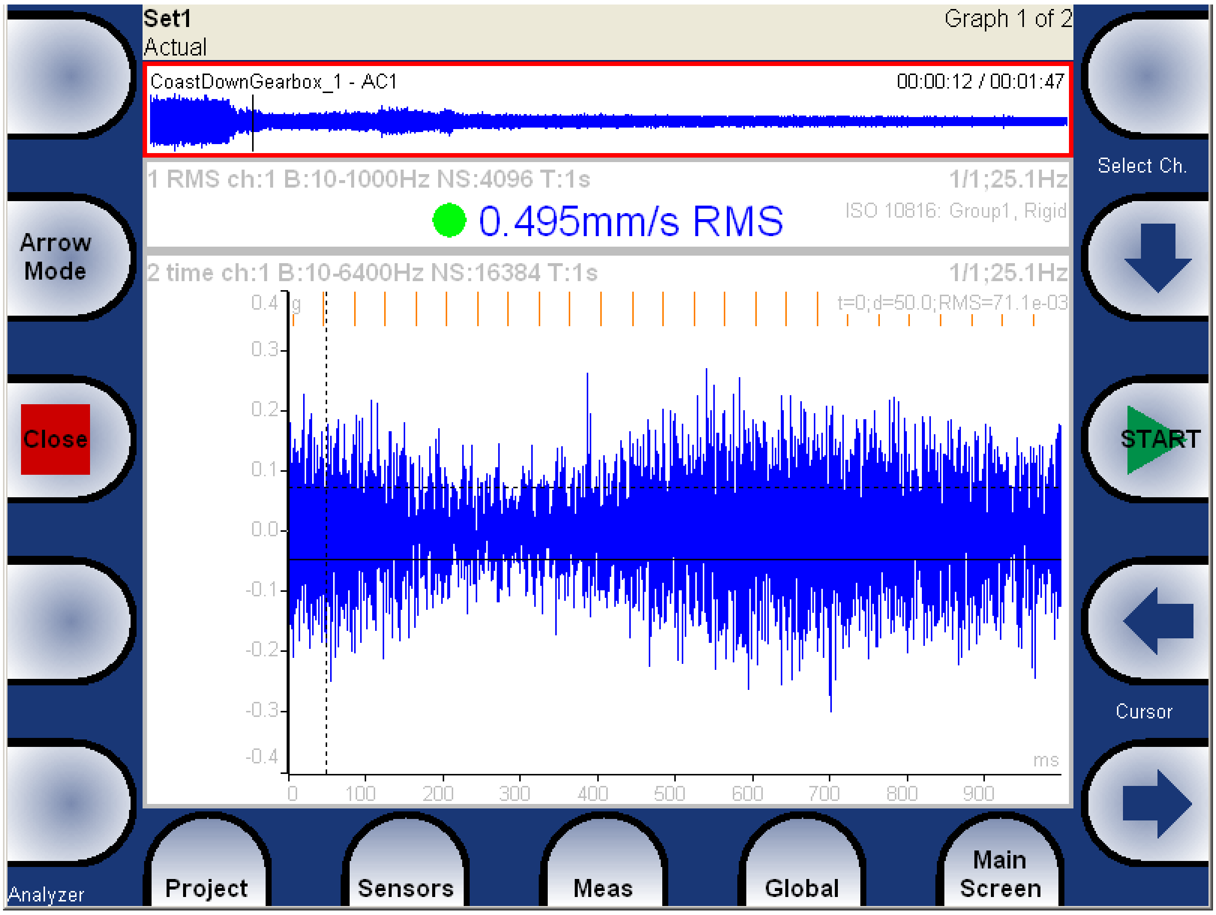
It switches the display between complete record and the zoom selection made by **Cursor+Length**.

Zoom Y button

It is standard Y zooming.

Using of record for analyzing

When you select the record for analyzing in any VA4 module, then the preview appears on the top of display.


Set1
Actual
Graph 1 of 2
CoastDownGearbox_1 - AC1
00:00:12 / 00:01:47
1 RMS ch:1 B:10-1000Hz NS:4096 T:1s
1/1;25.1Hz
0.495mm/s RMS
ISO 10816: Group1, Rigid
2 time ch:1 B:10-6400Hz NS:16384 T:1s
1/1;25.1Hz
t=0;d=50.0;RMS=71.1e-03
g
ms
Arrow Mode
Close
Analyzer
Select Ch.
START
Cursor
Project
Sensors
Meas
Global
Main Screen

During the analyzing of record the cursor is displayed in the record preview. The moving of cursor is available and it enables to select the required position for analyses.
When you need to move the cursor then you have to select the record area (to move the red border to the record). There are two ways how to do it:
Analyzer, Route and RunUp modules - use the **Arrow Mode** button repetitively until the red border is on the record.
The rest of the modules - use the **Record** button to select and de-select the record.

Also the selection of record channel is available for preview (the record can contain more channels then one). Also the DC channels or speed channel can be used for navigation. When the record is selected, use the **Select Ch.** arrows in the right top of display. Sound of selected channel is also on audio output.

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. It will be deleted once you will close the Virtual Unit. See more instructions in DDS manual.

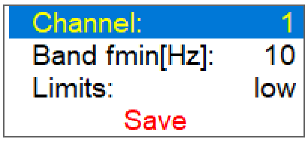
The FASIT

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

Attention!
The FASIT correctly analyses only machines with speed over 10Hz (600 RPM). The velocity measurements is in the 10-1000Hz range.

Setup

Select the FASIT mode. The menu appears.



Channel: 1
Band fmin[Hz]: 10
Limits: low

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.

Limits:
low, medium, high
You can adjust limit values according to which warnings are displayed. The **low** value means basic setup which will be described bellow in **Vibration Limits** part. This setup can be too strict for some machines. By choosing the **medium** or **high** value you can increase the limits √2 times or two times. **Note!** This works only for machines limits and has no effect for bearing limits.

The menu can be repeatedly opened by pressing **FASIT Settings** button.

Sensor Settings

In the **Sensors** item set up 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.

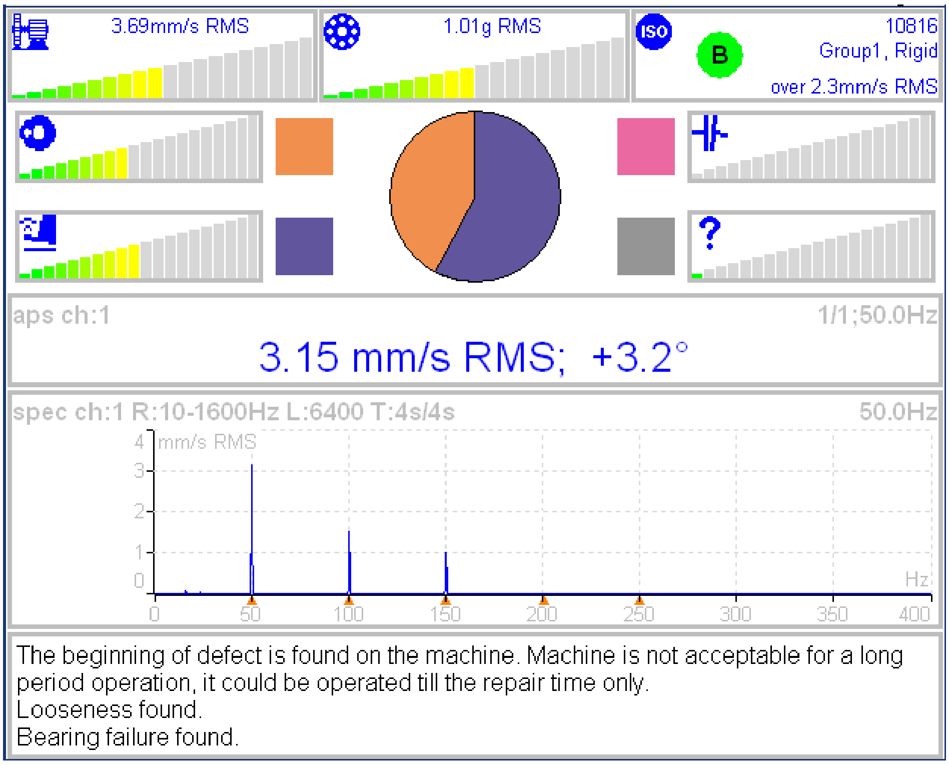
Units

The displayed units can be set up under the **Global/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 of this measurement. The speed detection is described in the **Speed Detection** chapter.

FASIT screen



The beginning of defect is found on the machine. Machine is not acceptable for a long period operation, it could be operated till the repair time only.
Looseness found.
Bearing failure found.

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 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 colours in pie chart correspond to the colours 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.

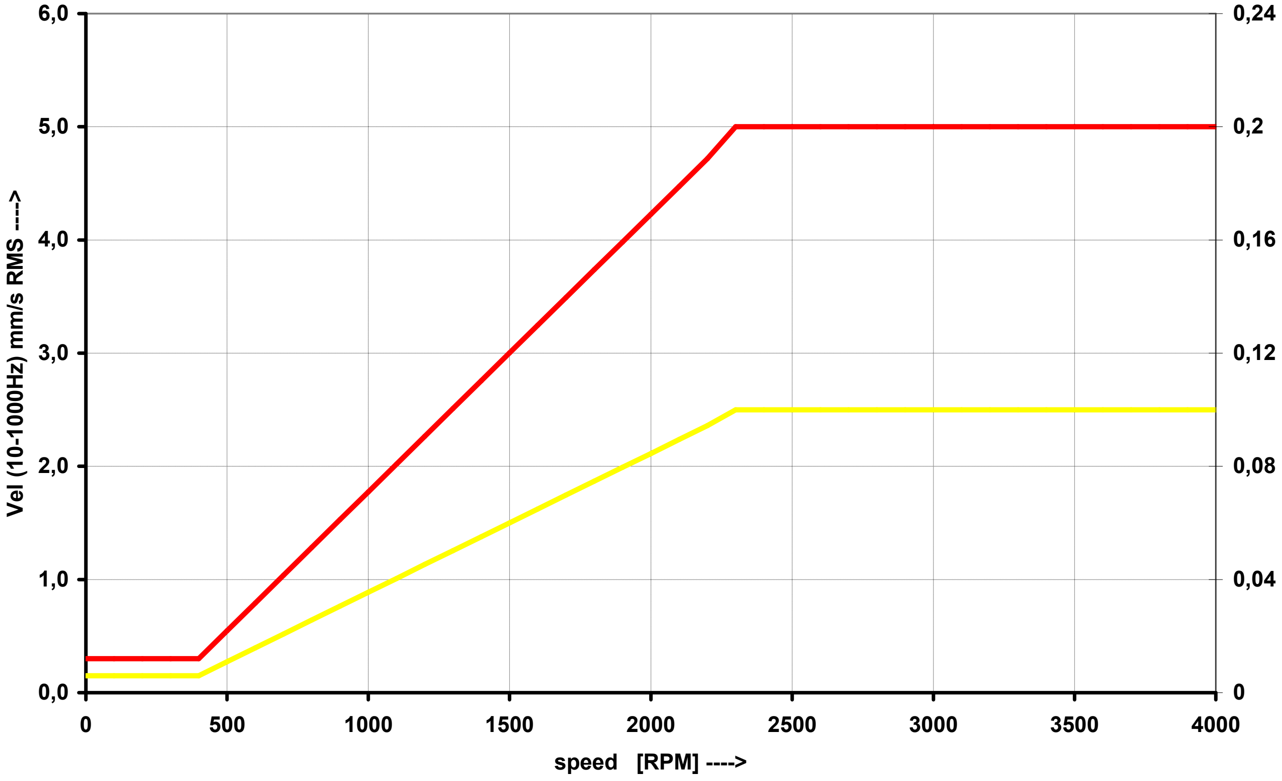
In the graphs area you found three particular areas. The GOOD condition is the space up to the yellow line that means operation without restriction. The space above yellow but under red line is an ALERT condition. Possible to operate the machine but have to be more checked. It's necessary to determine the source of worse condition and plan repair (for instance change the bearing) or maintenance (balancing, alignment). The space above red line is an 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.

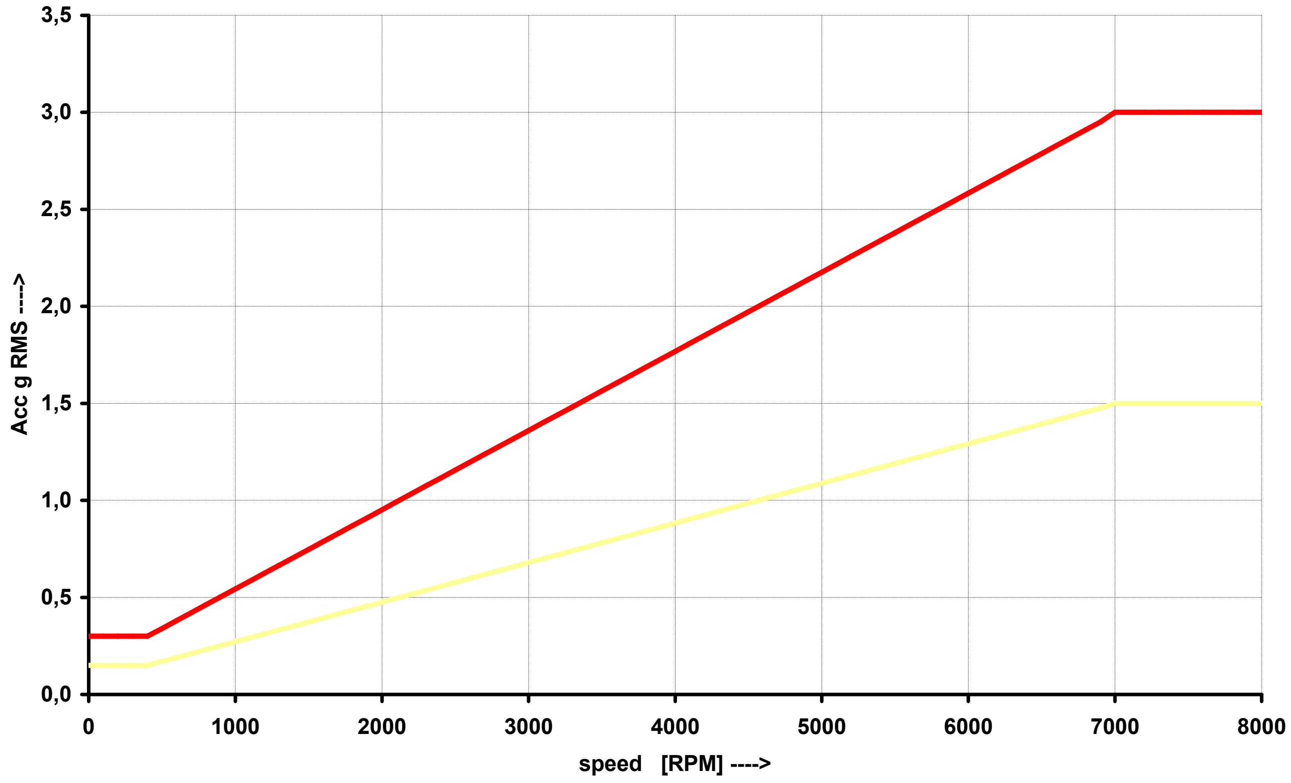
Machine limits

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



Bearing Limits

The roller bearing limits are used for acceleration RMS value in 500-25600Hz frequency range.



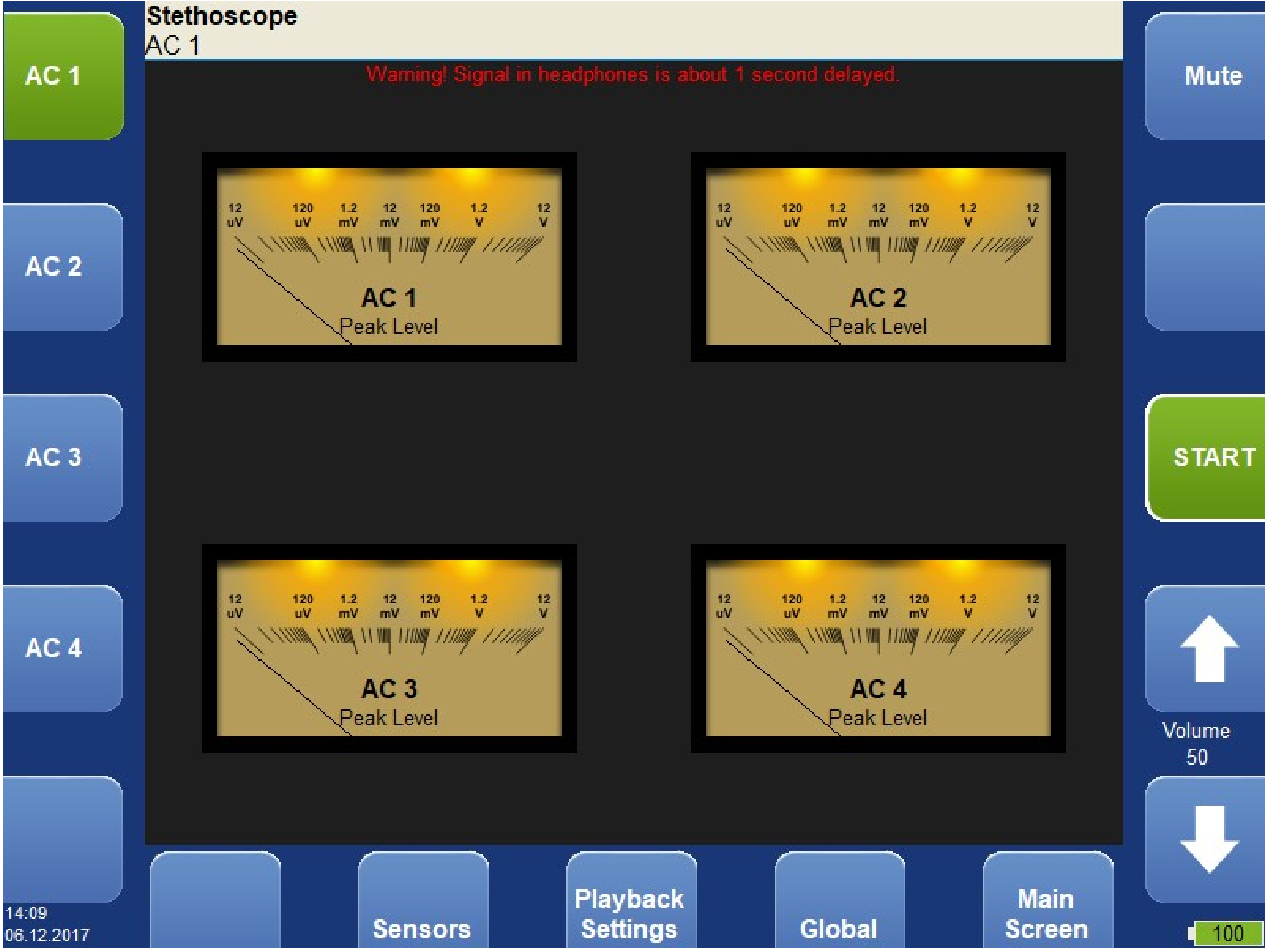
Unbalance, Misalignment and Looseness

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

The Stethoscope

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

Select the Stethoscope mode and push **OK**. The 4 displays appear. Push **START**. Each input signal level will be displayed.



Stethoscope
AC 1

Warning! Signal in headphones is about 1 second delayed.

AC 1
AC 2
AC 3
AC 4
Mute
START
Volume
50
12 uV
120 uV
1.2 mV
12 mV
120 mV
1.2 V
12 V
AC 1
Peak Level
AC 2
Peak Level
AC 3
Peak Level
AC 4
Peak Level
14:09
06.12.2017
Sensors
Playback Settings
Global
Main Screen
100

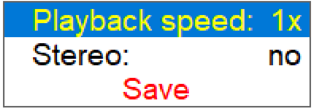
The TRUE PEAK level is displayed. By buttons on the left side you choose the channel for listening. The volumes buttons are on right side.

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 listen this knock after the delay time.

Playback Settings

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



Playback speed: 1x
Stereo: no
Save

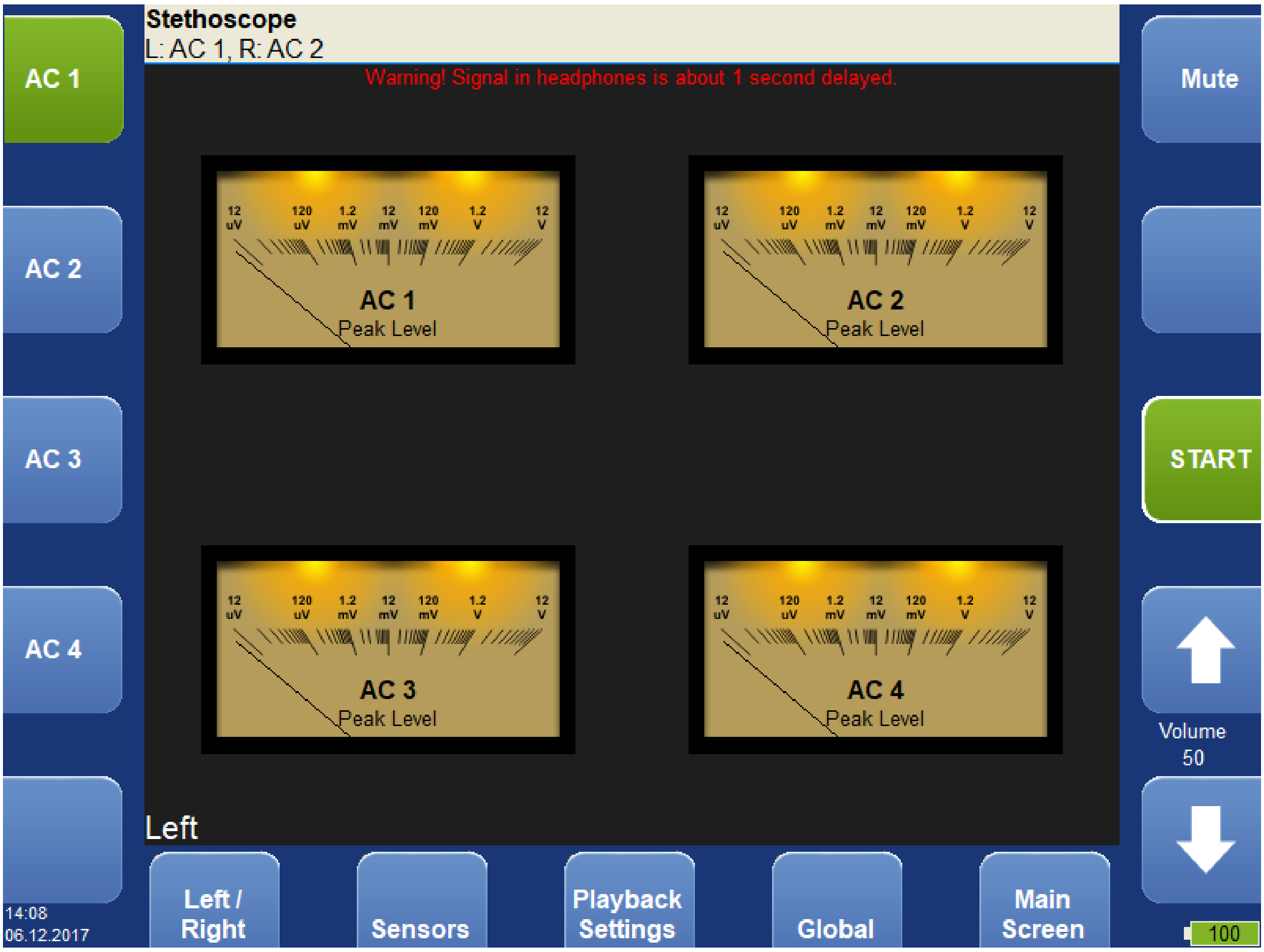
Playback speed

This function speed up (bigger then 1) or slow down (lesser then 1) the playback speed.

Stereo **yes, no**

It enables to define two channels for playback. One channel for right headphone and second for left.

Stereo channels setup



Stethoscope
L: AC 1, R: AC 2

Warning! Signal in headphones is about 1 second delayed.

AC 1
AC 2
AC 3
AC 4
Mute
START
Volume
50
100
12 uV
120 uV
1.2 mV
12 mV
120 mV
1.2 V
12 V
AC 1
Peak Level
AC 2
Peak Level
AC 3
Peak Level
AC 4
Peak Level
Left
14:08
06.12.2017
Left / Right
Sensors
Playback Settings
Global
Main Screen

The current setting of left/right output is displayed on status line on the left top (**L: AC 1, R: AC 2**). Use the **Left/ Right** button for output side selection and the **AC 1** – **AC 4** buttons for channel selection.

The 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 mode 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.

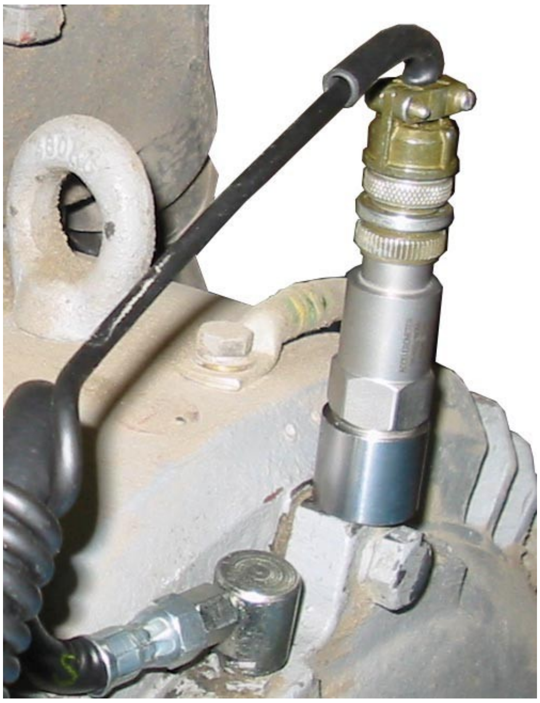
As a result, your machines will be maintained in their best lubrication condition. The Lubri mode enables you to make the whole lubricating process simpler and it normally reduces the consumption of very expensive lubricants.

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.



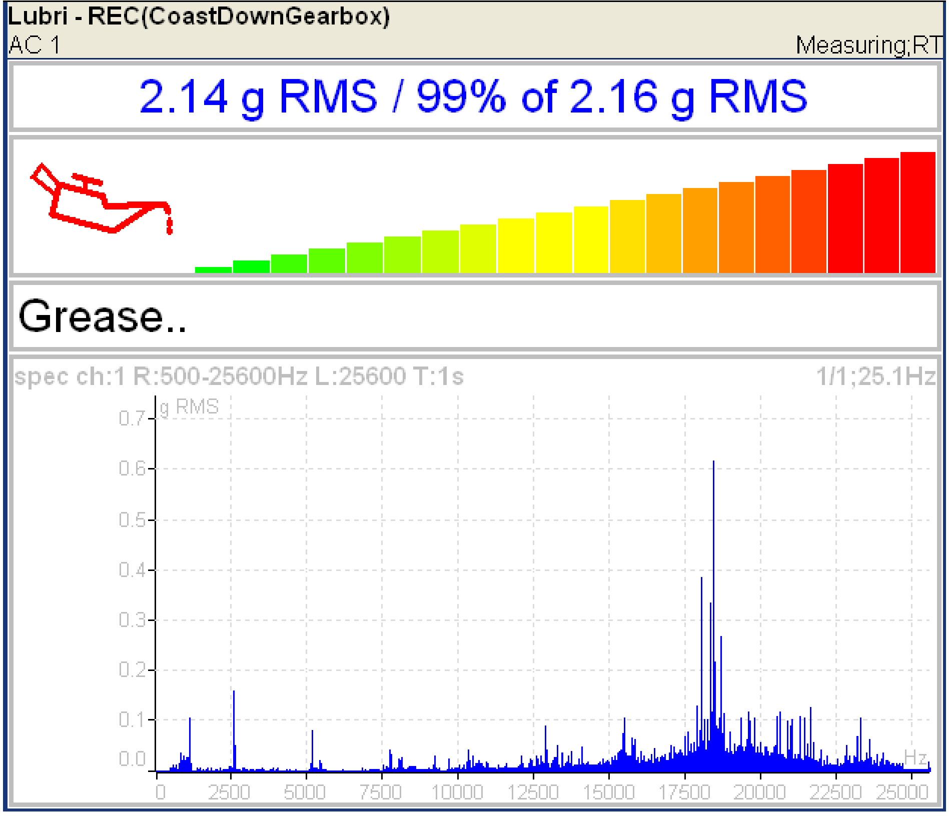
Sensor mounted near to lubrication point

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.

The procedure

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

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



Lubri - REC(CoastDownGearbox)
AC 1
Measuring;RT

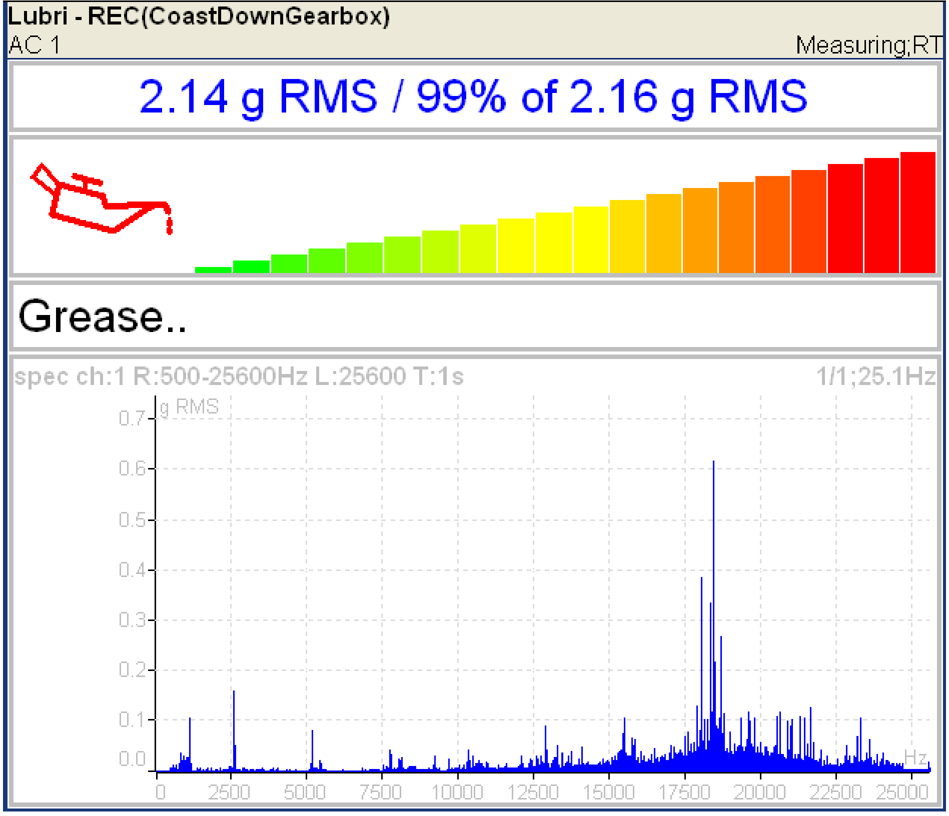
2.14 g RMS / 99% of 2.16 g RMS

Grease..

spec ch:1 R:500-25600Hz L:25600 T:1s
1/1;25.1Hz

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.



Lubri - REC(CoastDownGearbox)

AC 1

Measuring;RT

2.14 g RMS / 99% of 2.16 g RMS

Grease..

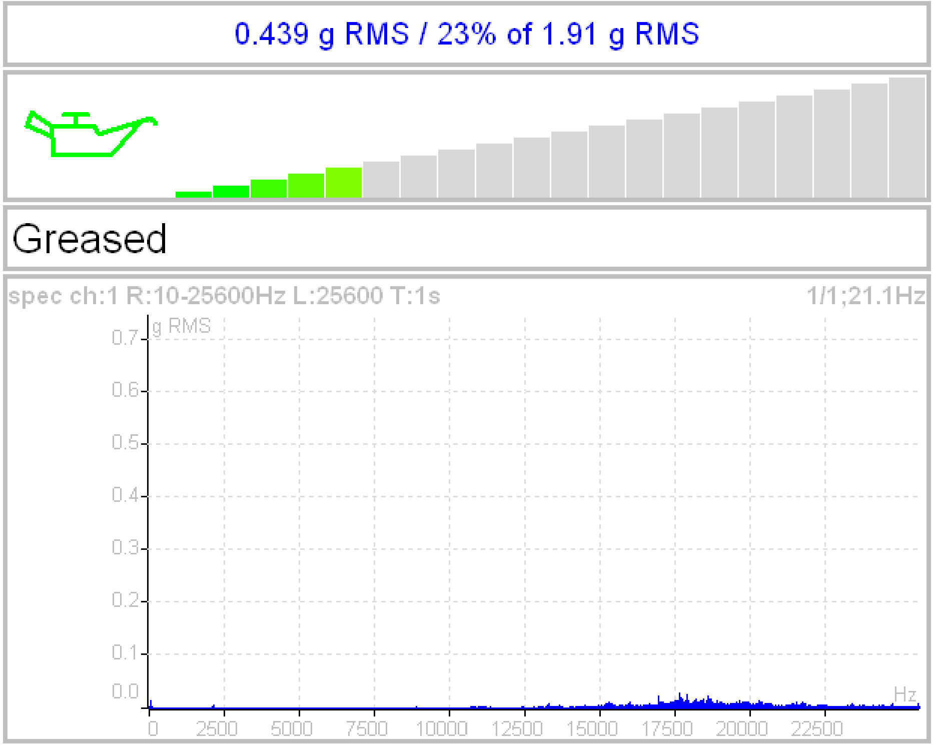
spec ch:1 R:500-25600Hz L:25600 T:1s

1/1;25.1Hz

g RMS
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Hz
0
2500
5000
7500
10000
12500
15000
17500
20000
22500
25000

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.



0.439 g RMS / 23% of 1.91 g RMS

Greased

spec ch:1 R:10-25600Hz L:25600 T:1s

1/1;21.1Hz

g RMS
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Hz
0
2500
5000
7500
10000
12500
15000
17500
20000
22500

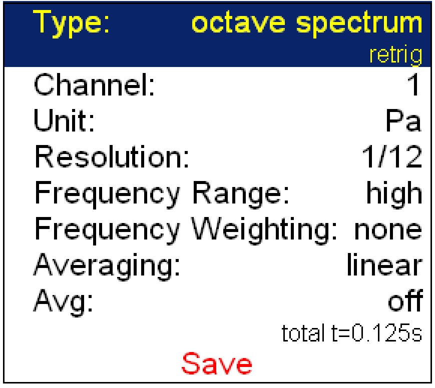
The recommendations are also displayed below the bar.

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

Using of this mode is similar to Analyzer mode. You need to create Set and Measurements like in Analyzer.

Measurement parameters are:



Type: octave spectrum
retrig
Channel: 1
Unit: Pa
Resolution: 1/12
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

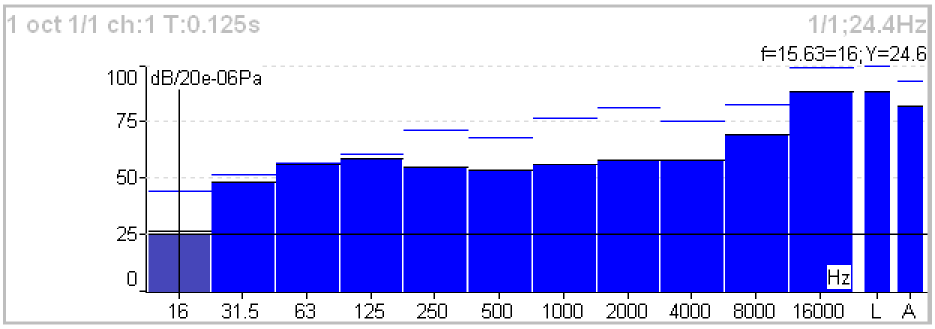
The human ear has the subjective characteristics known as the loudness. It is the function of sound intensity and frequency. For example the 20Hz pure tone with sound level 20dB would be clearly audible. The 100Hz with the same level would not be heard, it lies below the threshold of hearing. The unit 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.

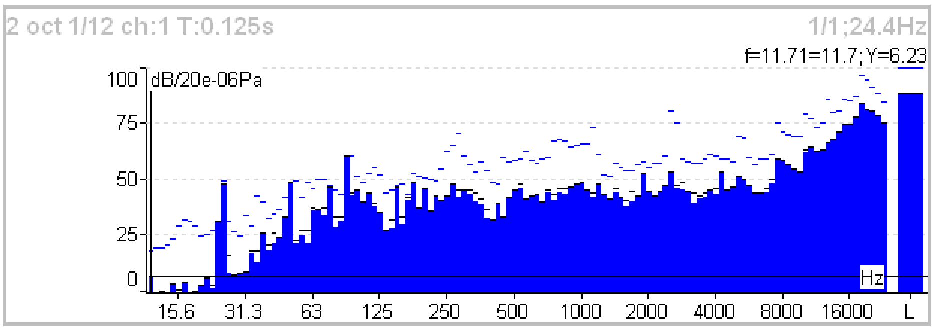
However today is A-weighting frequently specified for measurements irrespective of level.

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



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.

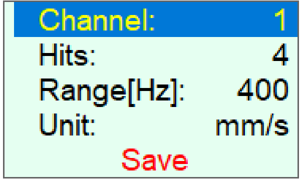
Octave Analysis Algorithm

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.

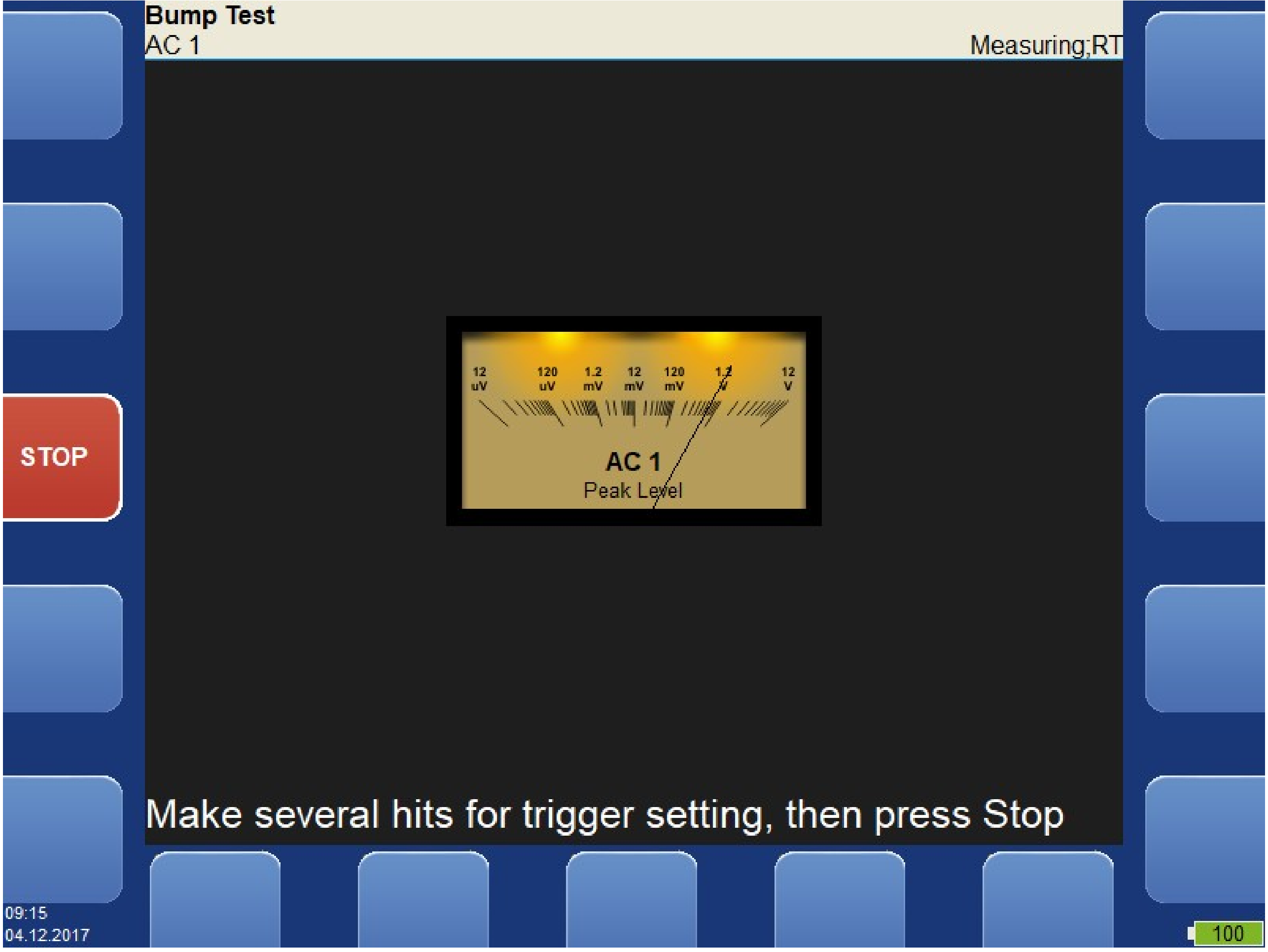
Settings



Channel: 1
Hits: 4
Range[Hz]: 400
Unit: mm/s

Channel	channel with the accelerometer
Hits	number of hits
Range	Frequency range (maximal frequency of the analysis)
Unit	Measurement unit. Integration of signal is also available.

Amplitude trigger setting



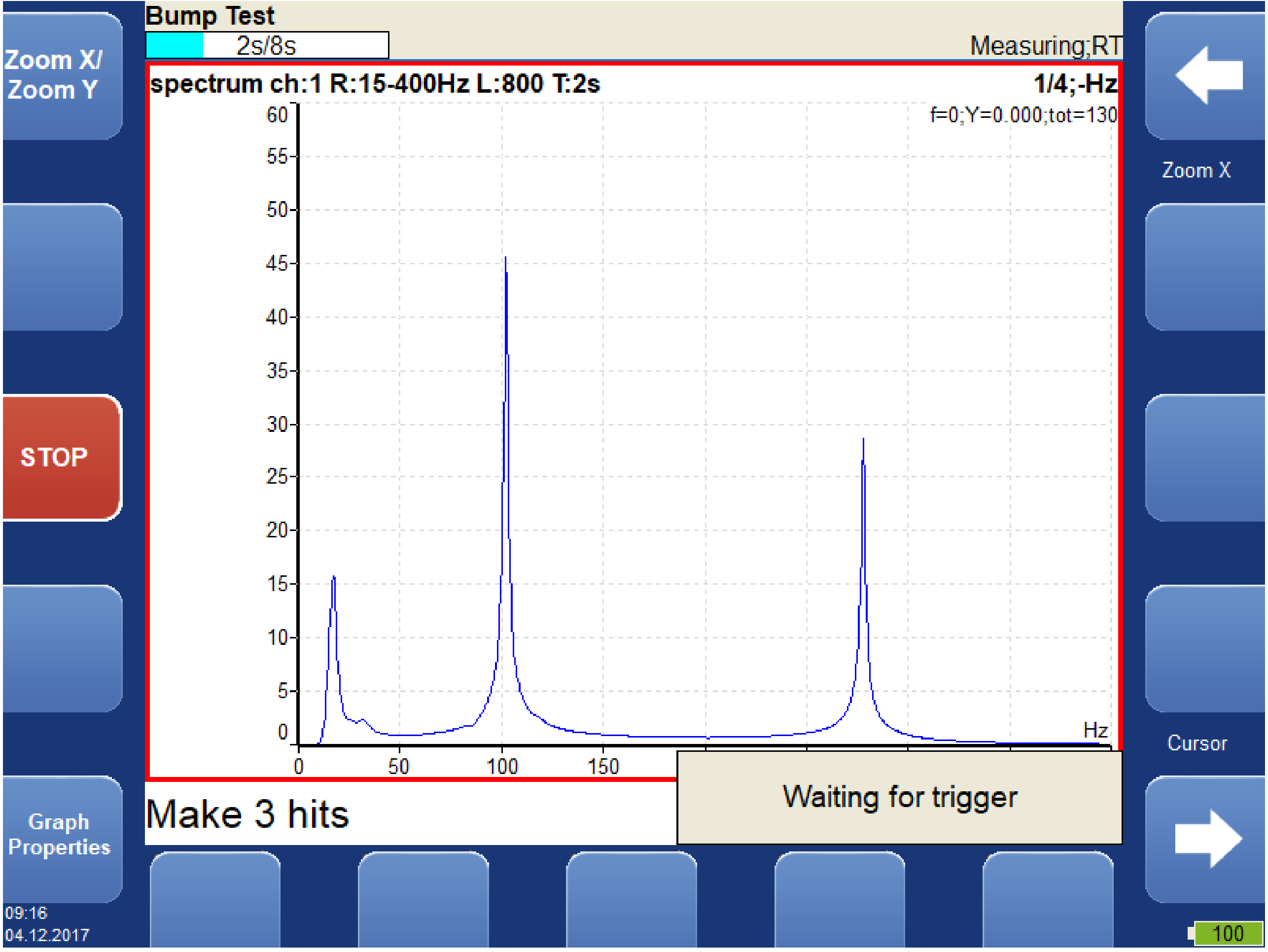
Bump Test
AC 1
Measuring;RT

Make several hits for trigger setting, then press Stop

09:15
04.12.2017

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.

Response spectrum



Bump Test

2s/8s

Measuring;RT

spectrum ch:1 R:15-400Hz L:800 T:2s

1/4;-Hz

f=0;Y=0.000;tot=130

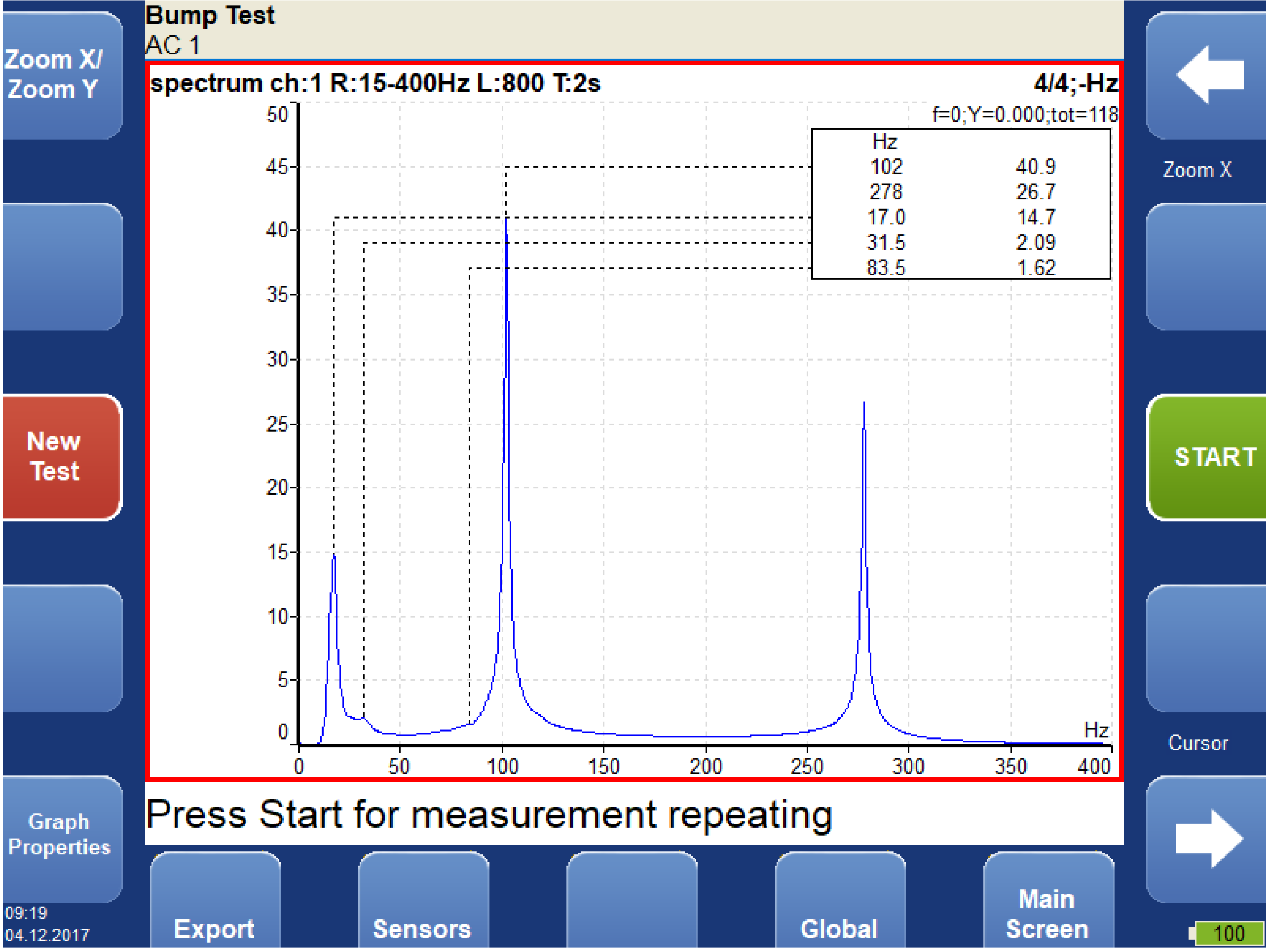
Make 3 hits

Waiting for trigger

Zoom X/ Zoom Y
STOP
Graph Properties
09:16
04.12.2017
Zoom X
Cursor
100
60
55
50
45
40
35
30
25
20
15
10
5
0
0
50
100
150
Hz

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.



Bump Test
AC 1

spectrum ch:1 R:15-400Hz L:800 T:2s **4/4;-Hz**

f=0;Y=0.000;tot=118

Hz	
102	40.9
278	26.7
17.0	14.7
31.5	2.09
83.5	1.62

Press Start for measurement repeating

Zoom X/ Zoom Y
New Test
Graph Properties
09:19
04.12.2017
Export
Sensors
Global
Main Screen
Zoom X
START
Cursor
100
50
45
40
35
30
25
20
15
10
5
0
0
50
100
150
200
250
300
350
400
Hz

Using of the **Peaks list** helps to detect required frequencies.

Start	repeats part 2 (the same trigger level)
New test	new test
Export	spectrum export to VA4_DISC

ADS

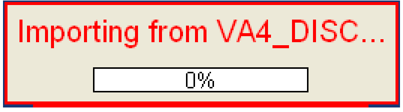
The Adash Deflection Shapes mode enables to measure operating deflection shapes of the machine.

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).

Import of project from computer to VA4

Copy the project file (ads extension) to VA4_DISC (to the root or VA4ads folder). The project will be moved to the VA4 memory after entering the ADS module. The file in VA4_DISC will be deleted.

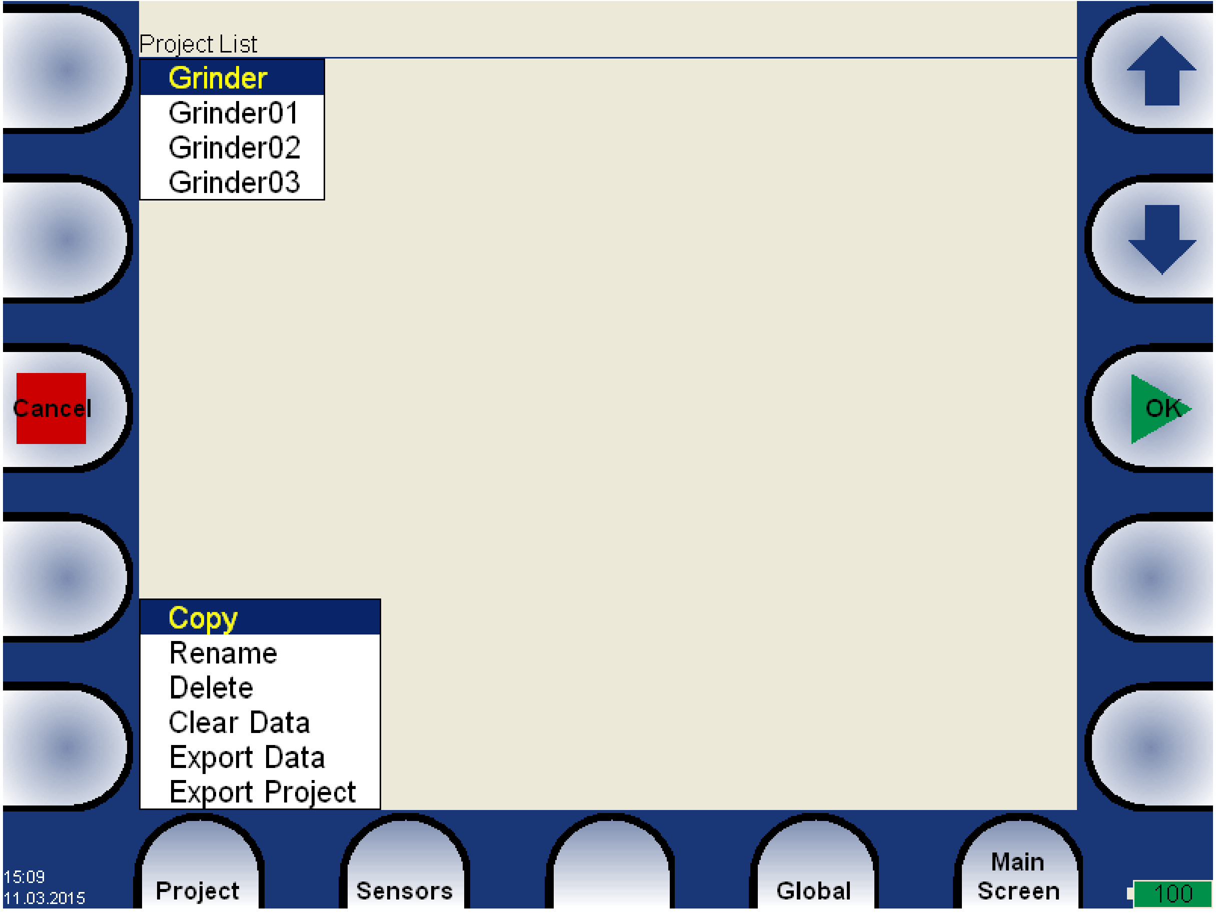


Importing from VA4_DISC...

Rewriting of geometry

Usually the user creates the simple geometry firstly and takes the measurements. After that first test he changes the geometry (adds the 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 menu



Project List
Grinder
Grinder01
Grinder02
Grinder03
Cancel
OK
Copy
Rename
Delete
Clear Data
Export Data
Export Project
15:09
11.03.2015
Project
Sensors
Global
Main Screen
100

Copy

Copy of selected project to new project.

Rename

Renames project.

Delete

Deletes project.

Clear Data

All readings (measurements) will be deleted.

Export Data

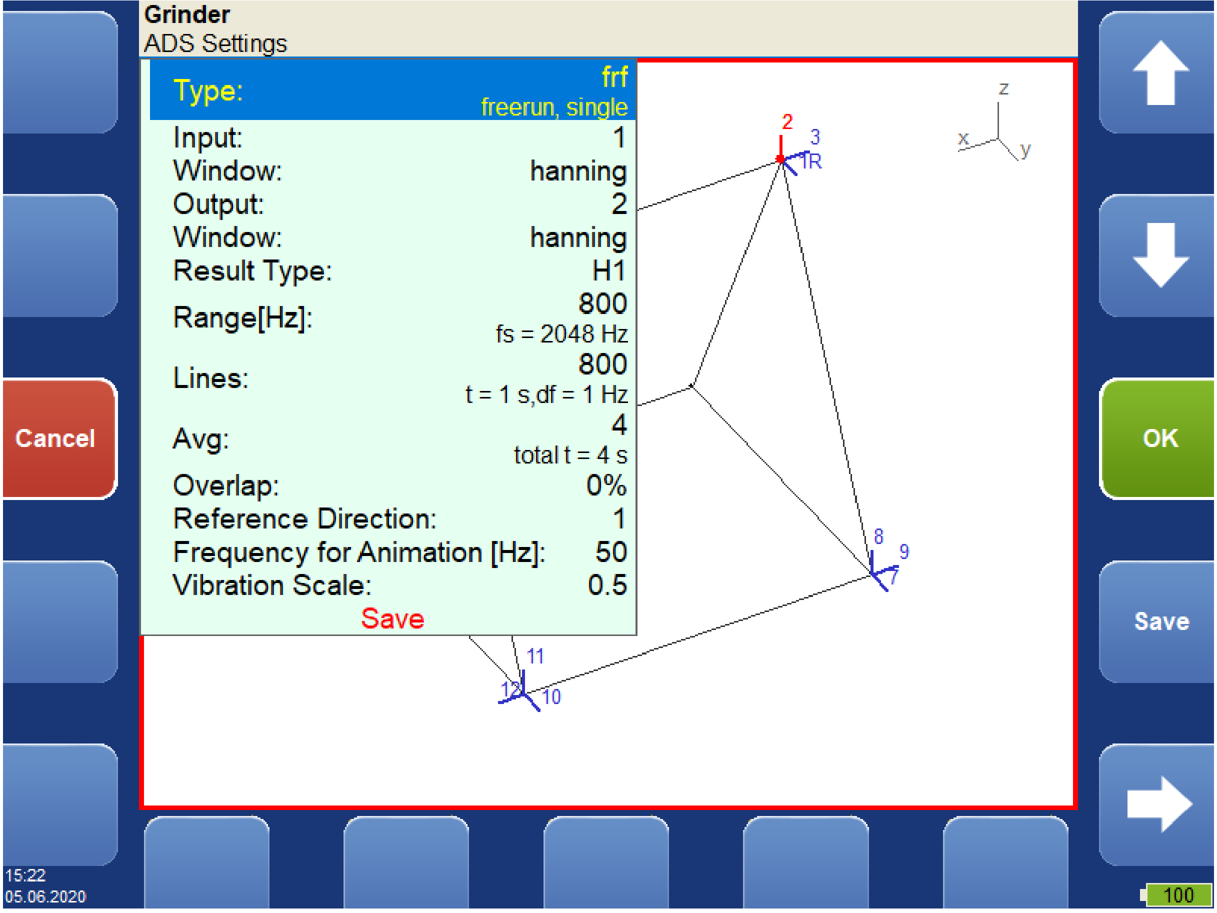
Export of readings (measurements) to VA4_DISC. File with dsd extension will be saved to VA4ads folder. Here is prepared for download to the computer.

Export Project

Exports both of data (readings and geometry) to VA4_DISC. It could be useful when user wants to use A4410 Virtual Unit software for next readings.

ADS Settings

The settings of parameters are required when the project is opened first time.



Grinder
ADS Settings

Type: frf, freerun, single
Input: 1
Window: hanning
Output: 2
Window: hanning
Result Type: H1
Range[Hz]: 800, fs = 2048 Hz
Lines: 800, t = 1 s,df = 1 Hz
Avg: 4, total t = 4 s
Overlap: 0%
Reference Direction: 1
Frequency for Animation [Hz]: 50
Vibration Scale: 0.5
Save

Measurement definition

The 1x amp+phase, orders and frf are available measurement for ADS. All parameters are the same as in Analyser mode.
The settings you can change any time later, use the ADS Settings button.
The change of measurement parameters requires to delete 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 sensors is moved sequentially to all other directions.
The change of Reference Direction number requires to delete all saved readings, because they are not compatible with new reference direction number.

Frequency for Animation

This frequency will be used for animation on VA4 screen. It works only for frf measurement. In case of 1x amp+phase or orders will be the speed frequency used (1X).

Vibration Scale

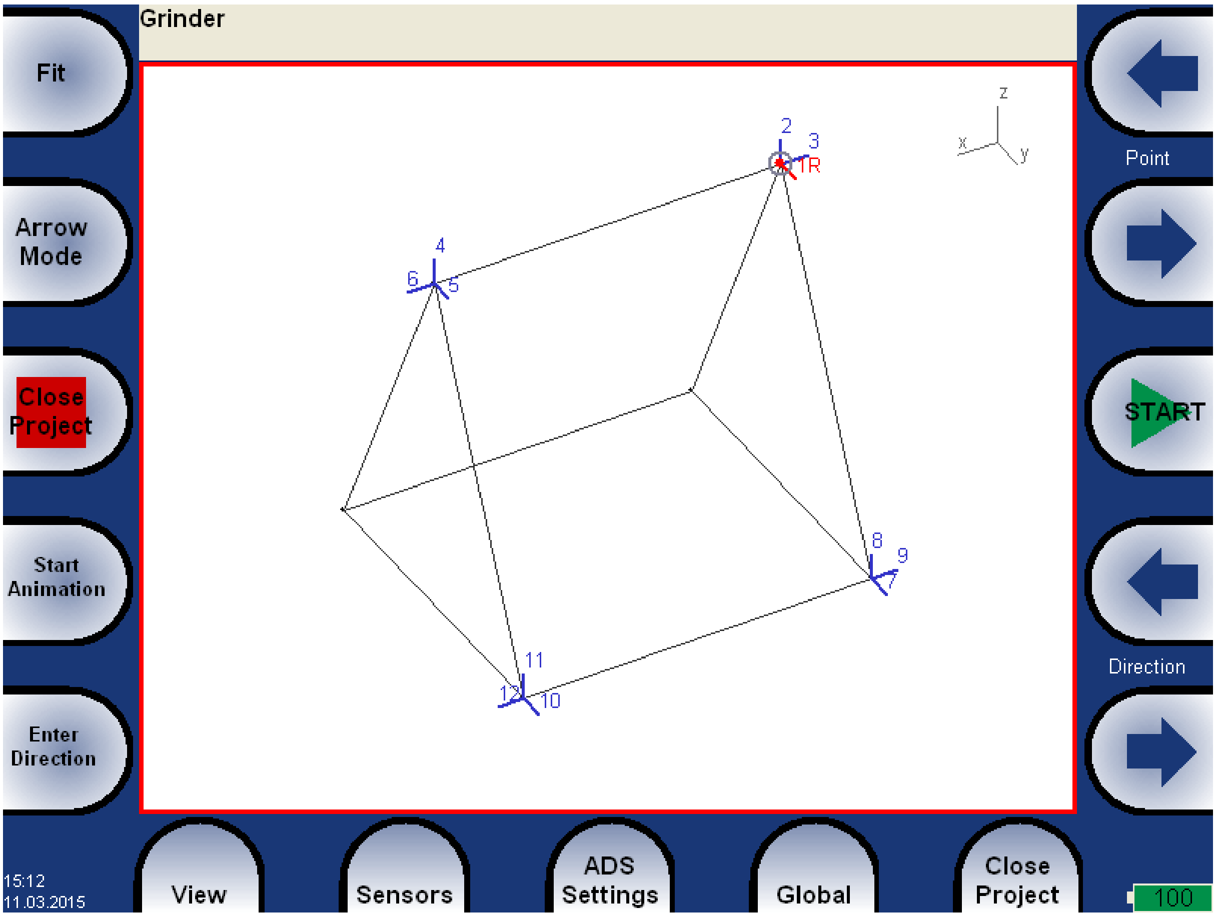
<0, 1>
Scales amplitudes of vibrations in animation.

Views

Three types of screen view are available.

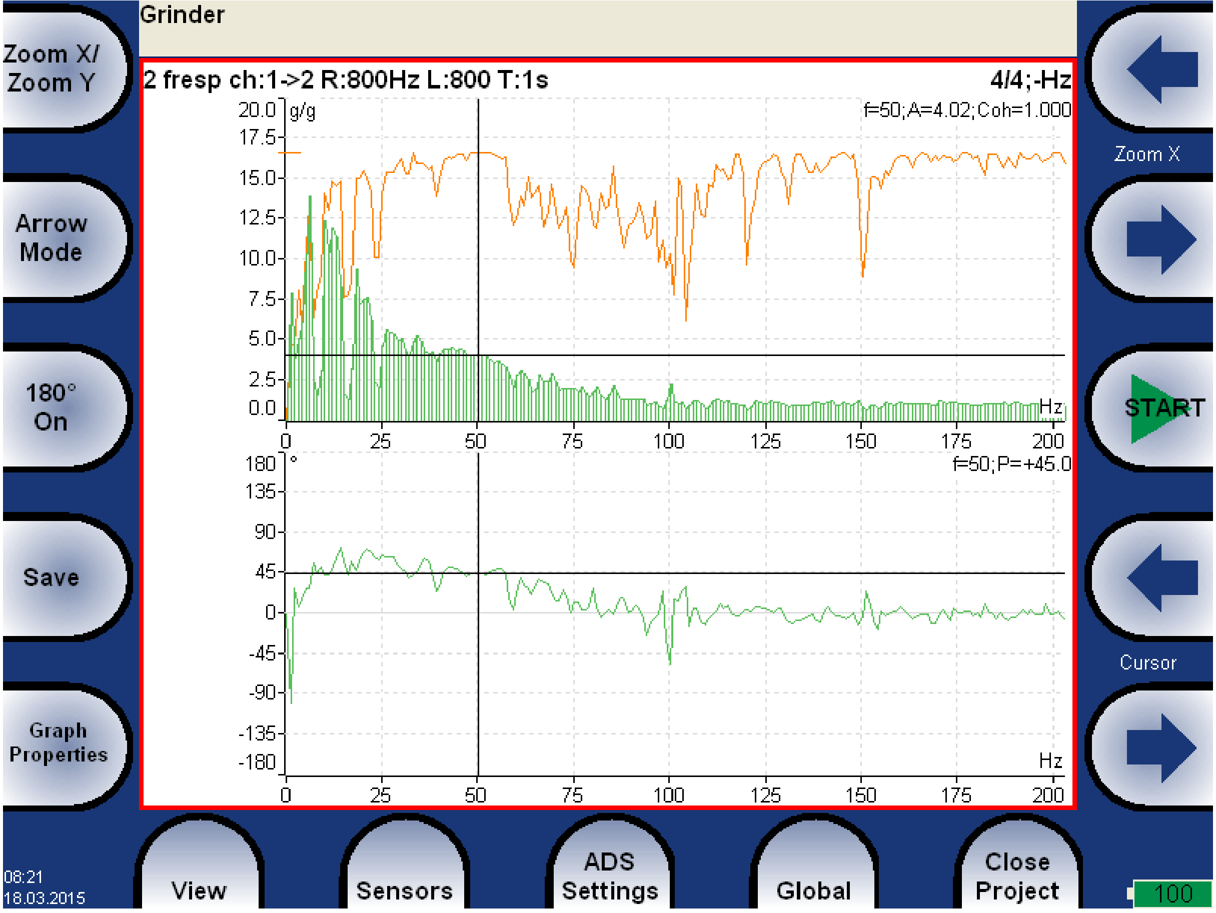
Machine View

The geometry is displayed. The directions contains the numbers. The reference direction is marked as R. Just selected point contains the small circle. Just selected direction is drawn by different color.


Grinder
Fit
Arrow Mode
Close Project
Start Animation
Enter Direction
15:12
11.03.2015
Point
START
Direction
z
x
y
2
3
R
4
5
6
8
9
7
11
12
10
View
Sensors
ADS Settings
Global
Close Project
100

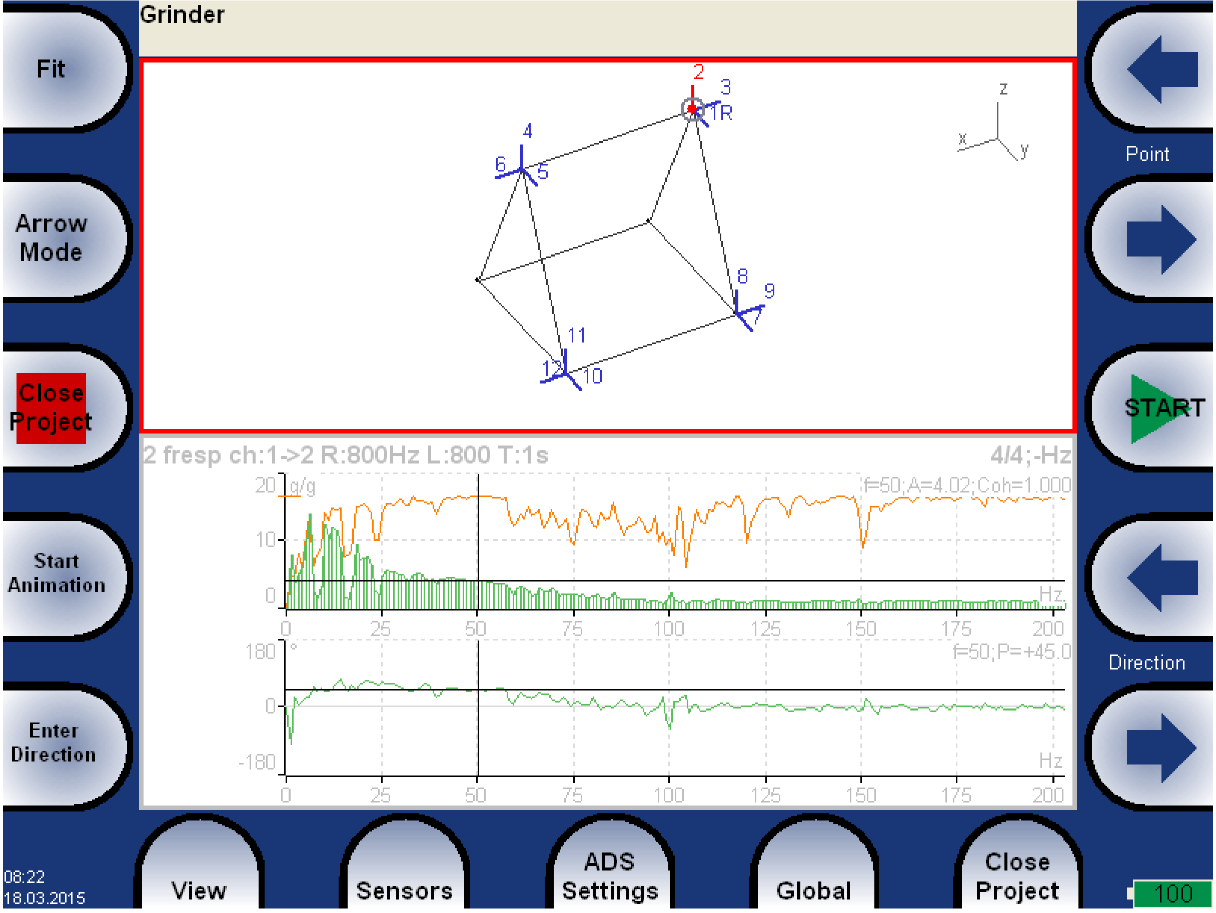
Measurement View

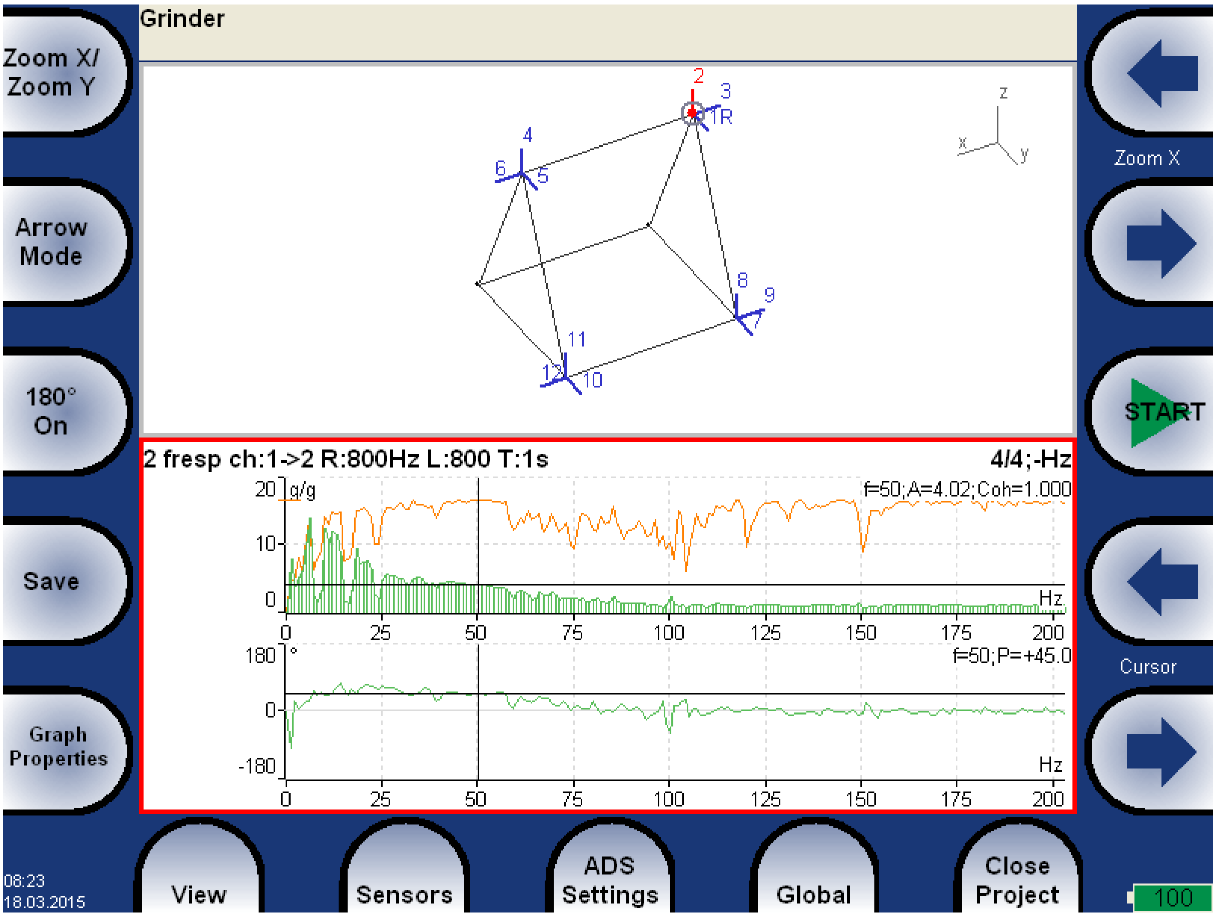
Standard graph display. The number of selected direction is displayed in front of measurement type (**2** frf ….)


Grinder
Zoom X/ Zoom Y
Arrow Mode
180° On
Save
Graph Properties
08:21
18.03.2015
2 fresp ch:1->2 R:800Hz L:800 T:1s
4/4;-Hz
g/g
f=50;A=4.02;Coh=1.000
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Hz
0
25
50
75
100
125
150
175
200
°
f=50;P=+45.0
180
135
90
45
0
-45
-90
-135
-180
Hz
0
25
50
75
100
125
150
175
200
Zoom X
START
Cursor
View
Sensors
ADS Settings
Global
Close Project
100

Machine+Measurement View

Both previous screens in one together. The user can select one of them (the red border) and to work with it. The different set of buttons are displayed for every selected area of screen.


Grinder
Fit
Arrow Mode
Close Project
Start Animation
Enter Direction
Point
START
Direction
2 fresp ch:1->2 R:800Hz L:800 T:1s
4/4;-Hz
f=50;A=4.02;Coh=1.000
f=50;P=+45.0
08:22
18.03.2015
View
Sensors
ADS Settings
Global
Close Project
100


Grinder
Zoom X/
Zoom Y
Arrow
Mode
180°
On
Save
Graph
Properties
08:23
18.03.2015
Zoom X
START
Cursor
100
View
Sensors
ADS
Settings
Global
Close
Project
2 fresp ch:1->2 R:800Hz L:800 T:1s
4/4;-Hz
f=50;A=4.02;Coh=1.000
g/g
f=50;P=+45.0
Hz
20
10
0
180
-180
0
25
50
75
100
125
150
175
200
z
x
y
1
2
3
4
5
6
7
8
9
10
11
12
TR

Automatic change of view

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

Buttons in Machine View

Fit

Auto-zoom of machine in window.

Arrow Mode

Changes the arrows functions.

Point

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

Direction

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

Zoom/Move/Rotation

Zoom/Move/Rotation of machine.
Zoom and move functions are also available by touch screen.

Blink on/Blink off

The directions which are not measured yet can be blinking.

Hide on/Hide off

The directions which are measured yet can be hide.

Start/Stop Animation

Run or stop animation.

Enter Direction

Manual entry for direction number.

Start

Starts new measurement.

Buttons in Measurement View

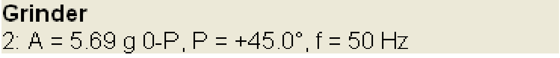
The most of buttons have the same function as in Analyzer mode.

180° on/180°off

Sometimes it is possible to mount the sensor to direction which is defined in geometry. Usually in such case is possible to mount the sensor in opposite direction. The use this button and change the phase of 180 degrees.

Save

Saves the measurement (reading). In the first row are displayed:
direction number, amplitude, phase on selected speed.



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 20kHz is best detected with an ultrasonic sensor. Most useful information is found between 30 and 50kHz. 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:

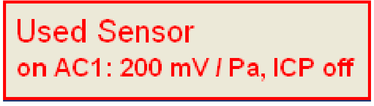
- Air leaks
- Vacuum leaks
- Electrical Arcing
- Electrical Corona
- Tightness testing where a signal generator is located within a sealed unit, then by scanning the sealed areas from the outside leaks can be detected.

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 AC CH1. You need the ultrasound microphone for that. When you run the module, then the sensor is changed automatically to Pascal sensor.

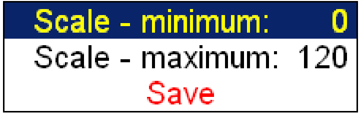


Used Sensor
on AC1: 200 mV / Pa, ICP off

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.

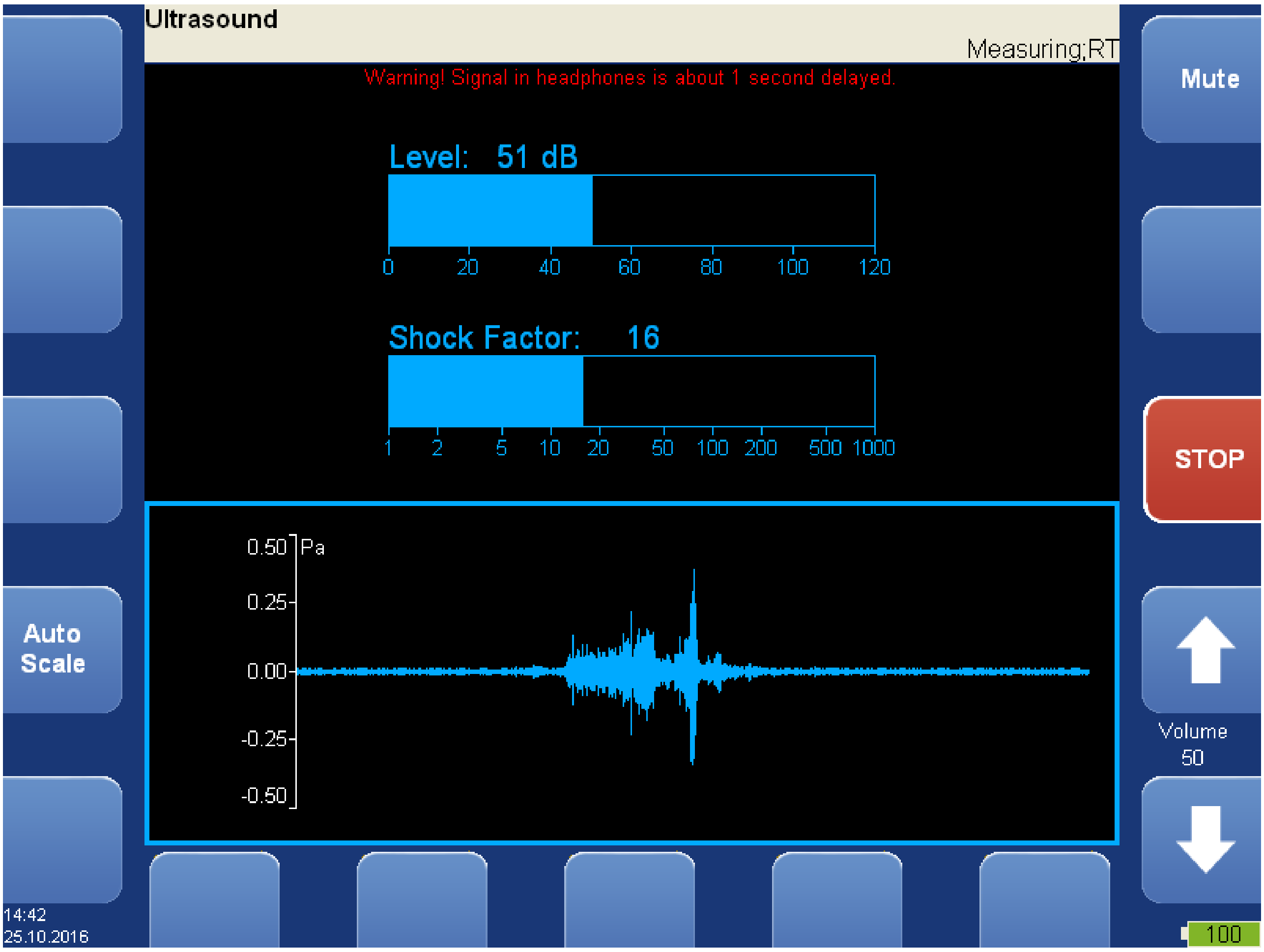
Settings

You can set the range of measurement. Use **Menu / Ultrasound Settings.** Enter required range.



Scale - minimum: 0
Scale - maximum: 120
Save

Measurement


Ultrasound
Measuring;RT
Mute
Level: 51 dB
0
20
40
60
80
100
120
Shock Factor: 16
1
2
5
10
20
50
100
200
500
1000
STOP
Auto Scale
0.50
Pa
0.25
0.00
-0.25
-0.50
Volume
50
14:42
25.10.2016
100

Warning! Signal in headphones is about 1 second delayed.

Press **Start** button. Two values are displayed. The **Level** of sound in dB 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 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 delayed 1 sec. It is because of digital processing, which takes this time.

A4410 Virtual Unit

A4410 Virtual unit is the computer application. It emulates the A4400 VA4 Pro analyzer on your computer screen.

The A4410 Virtual unit is designed for measurement with the **A4404 - SAB** (it is a 4 channel signal analyzer with USB connection to the computer).

IN 1
IN 2
4xAC
IN 3
4xDC
IN 4
TRIG
IN1 ... IN4
4x AC +/-12V PEAK
4x ICP® (selectable)
4x DC +/-24V PEAK
TRIG
1x TACHO +10V PEAK
1x PWR 5V/50mA
A4404
Signal Analyzer Box

IN 1
IN 2
4xAC
IN 3
4xDC
IN 4
TRIG

Installation

Download the A4410 Virtual Unit from website or run it from installation drive.

A4404 – SAB drivers installation

The A4404 SAB needs special drivers. Follow next instructions:
1) Download FTDI drivers file from www.adash.com / Download / Third parties software / A4404 SAB driver / CDM20828_WHQL_Certified.zip
2) Uncompress the file into any selected directory (e.g. C:\CDM20828_WHQL_Certified).
3) Connect the A4404 - SAB to your PC via USB cable.
4) **Add hardware Wizard** window will 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 (do not accept any automatic downloads).
6) Check **Include this location in the search**.
7) Click the **Browse** button and select the driver folder, where you uncompressed the file (e.g. C:\CDM20828_WHQL_Certified).
8) Click the **Next** button and wait for installation completing.
9) Delete the driver folder (not required).

Software Installation

Run the A4410 Virtual Unit installation.
During the installation you will be asked to enter the directory path where data will be stored.

License file

Each A4404 SAB device is supplied with a unique license file which is paired with the A4410 Virtual Unit software.
The A4410 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 directory path you have defined during installation, C:\ProgramData\A4410 Virtual Unit by default).
The ver.0226 and older use the file name **adash.a44**.

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

The A4410 Virtual unit contains the same functions as the A4400 VA4 Pro vibration analyzer. The only difference is in controlling of the Virtual unit, which is controlled by mouse and keyboard. Live signal is measured only with the A4404 - SAB. Without this device it's possible to post process records. A4410 Virtual Unit contains one record (**Default Rec**) for demonstration. Next records you need to measure directly or import them from A4400 VA4Pro device (see A4410 - Virtual unit and A4400 VA4 Pro connection chapter below).

VA4_DISC

VA4_DISC folder is created in the data folder after the first run of the application. A4410 Virtual unit use VA4_DISC folder the same way as the real instrument.

VA4_DISC Folders Structure

VA4analyser - analyzer projects are exported here
VA4balancer - balancing projects are exported here
VA4balancer_protocol - balancing reports are exported here
VA4route - route projects are exported here
VA4runup - runup projects are exported here
VA4recorder - records are exported here
va4ver file - unit version information (for DDS)

These folders are created when the unit needs them, not actually in the first run.

A4410 Virtual unit and A4400 VA4Pro connection

How to share projects between the real and virtual unit will be described in this chapter.
Connect the real Va4Pro instrument to the computer with installed Virtual unit (via USB cable). The VA4Pro unit will be found as **VA4_DISC** (removable disc) on your system. It's possible to copy the data to and from the Virtual **VA4_DISC** folder.

Copying projects to the VA4Pro instrument

Copy the **workdir\Data\VA4analyser\ProjectName** project folder (workdir is the directory path you have defined during installation, C:\ProgramData\A4410 Virtual Unit by default, ProjectName is your folder name which you want to copy) into the VA4Pro **VA4_DISC\VA4analyser** folder (**VA4_DISC** is the real removable storage device here, NOT the virtual unit folder !!!). You have to create empty file with the name ***script.dds*** in VA4Pro **VA4_DISC\VA4analyser** after project copy (it has the label sense only). RunUp and Route projects (*VA4runup* and *VA4route* folders) are copied the same way. Next mode projects are not available to copy.

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) **VA4_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 folder into the VA4Pro **VA4_DISC**.
4) Create the empty file **script.dds** in VA4Pro **VA4_DISC\VA4analyser\Power Station** folder.

Projects and records copy from the VA4Pro instrument

!!! Attention: Projects has to be exported to the VA4Pro **VA4_DISC** first (the same as export to the DDS).

Copy the VA4Pro **VA4_DISC\VA4analyser\ProjectName** (the real removable storage device here, NOT the virtual unit folder!!!) into the **workdir\Data\VA4analyser** folder (workdir is the directory path you have defined during installation, C:\ProgramData\A4410 Virtual Unit by default). In this case there is no need of script.dds file. RunUp, Route, Records and Balancer projects (*VA4runup, VA4route, VA4recorder* and *VA4Balancer* directories) are able to copy.

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) **VA4_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 VA4_DISC into the **workdir\Data\Va4analyser** folder.

The Virtual Unit vs. the real instrument differences

- The Virtual unit use VA4_DISC directory for export and import instead of VA4_DISC flash drive.
- Update button does not work in the Virtual unit (see instructions above for Virtual unit upgrade).
- The Virtual unit application runs in window.
- It is not possible to measure live signal without the A4404 - Signal Analyzer Box.

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 (e.g. to blades positions): yes
Manual entry: yes
Intuitive graphic user interface: yes
Trial mass: get out or leave in

General VA4 Pro II (from 2018):

Processor: Atom 1.9 GHz
RAM: 2 GB
Display: LCD colour 191 x 134 mm (9.1” diagonal), 1140x800 resolution
Memory (Internal SSD): 64 GB
Memory (VA4_DISC) 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

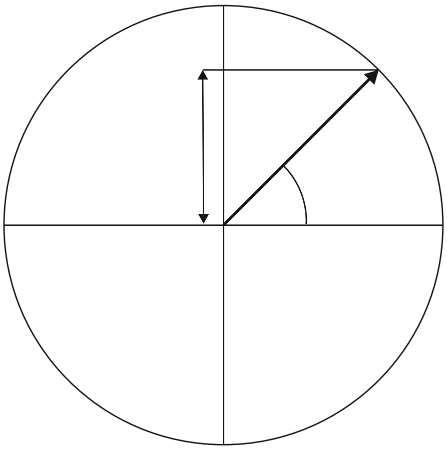
General VA4 Pro (up to 2018):

Processor:	Atom 1.6 GHz
RAM:	1 GB
Display:	LCD colour 174 x 127 mm (8.5” diagonal), 800x600 resolution
Memory (Internal SSD):	128 GB
Memory (VA4_DISC)	8 GB
Interface:	USB
Powering:	Li-Ion long life battery pack (more then 5 hours of measurement)
Operating temperature:	-10 °C - +50 °C, 15°F-120°F
EMC:	CE tested
Dimensions:	280 x 205 x 55 mm
Weight:	2.5 kg

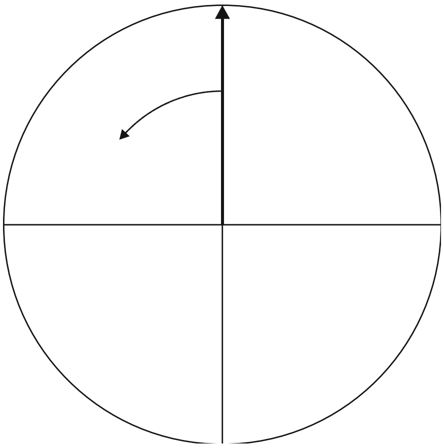
Appendix B : Phase measurement conventions

Single channel measurement with tacho

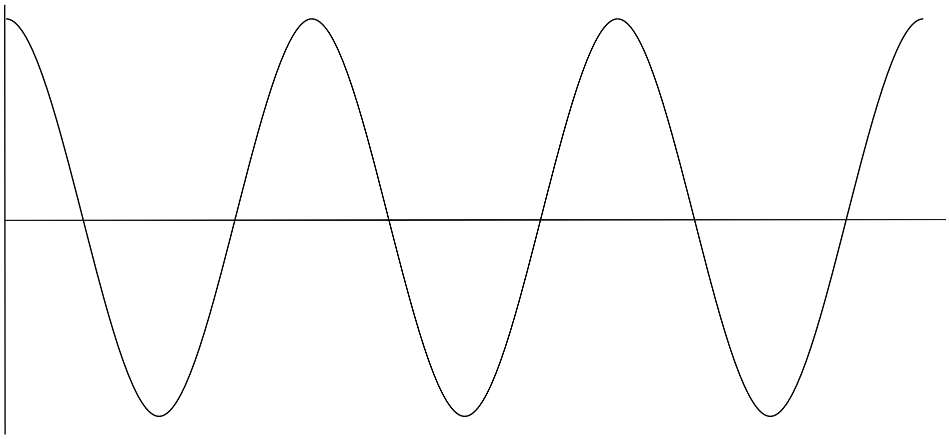
Let’s assume the time signal defined as y=cos(ωt). We use the cosine function because FFT uses it too. It simplifies the calculations and understanding.



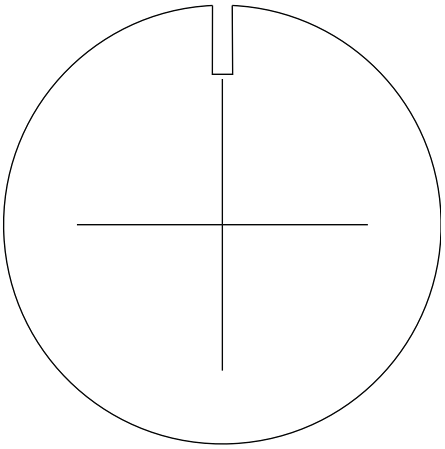
Our starting position of rotating vector V will be 90°, we will mark it as T0.



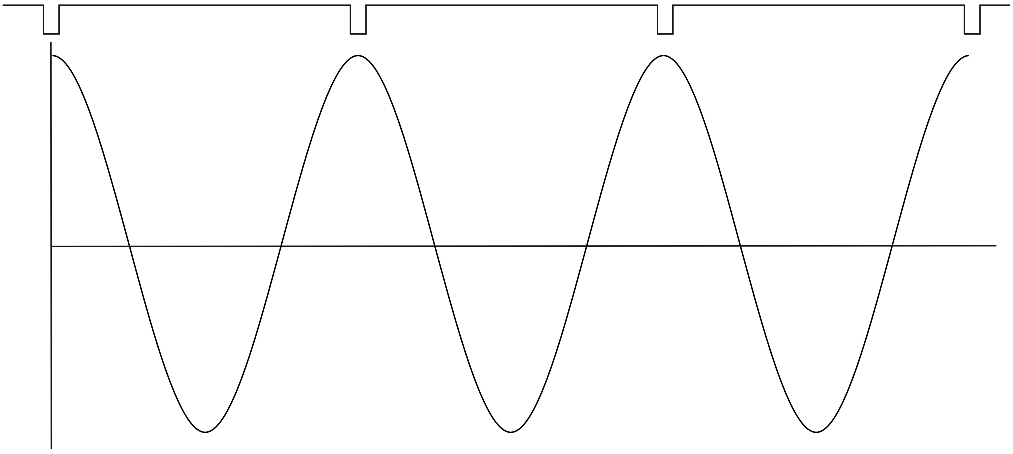
When the vector V rotates for example 3 times, then we get the time signal as follows.



Now we assume the tacho signal. The tacho pulse we put to the T0 position.

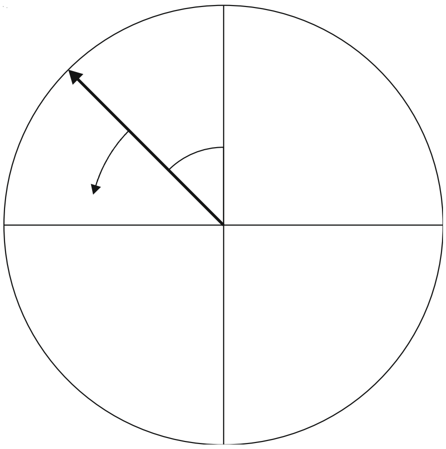


Corresponding time signal with tacho pulses is on the following picture.

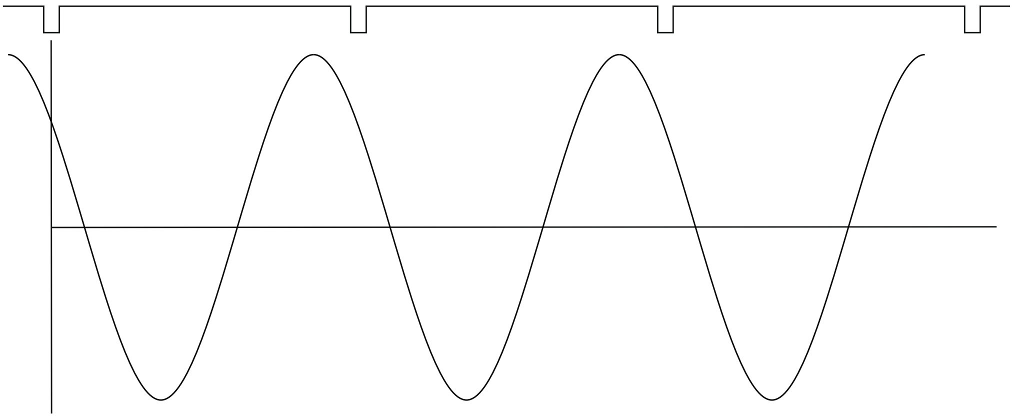


Now we begin to assume the phase shift (marked as φ) of time signal vs. tacho signal. The signal formula changes to y=cos(ωt + φ). The previous picture corresponds with φ=0°. And this value is displayed on the instrument screen. When the tacho pulses are in the maximum time signal positions, then phase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

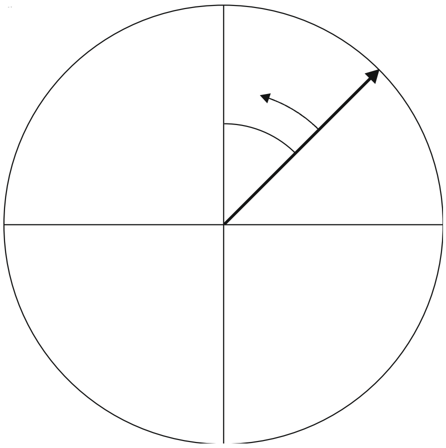


On the next picture is the corresponding time signal with tacho pulses.

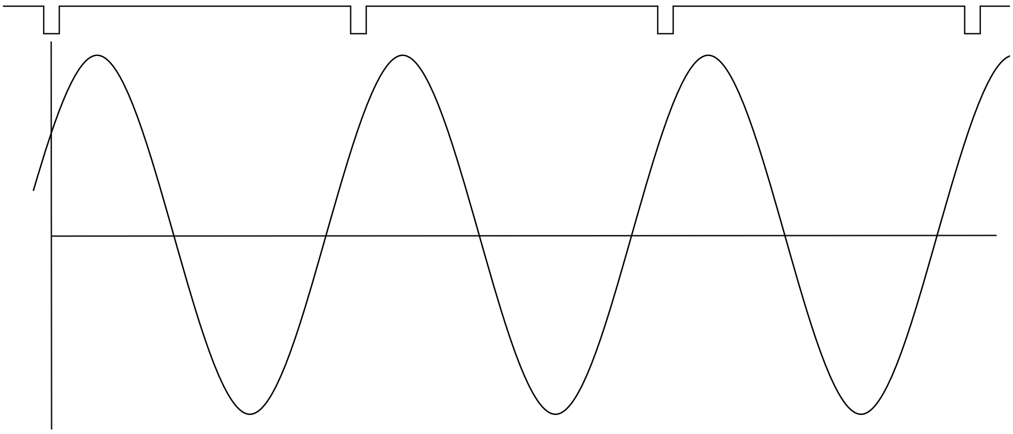


The time signal foreruns (gets ahead of) the tacho signal of the 45°. The 45° appears on instrument screen in this case.

Now we assume the φ=-45°.



On the next picture is the corresponding time signal.



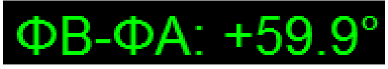
The time signal is delayed. The -45° appears on instrument screen in this case.

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.