



VIBER X3™



Manual Ver. 3.1

English



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VMI:s handheld vibration instruments





1 Important information

Security actions

Vibration measurements and balancing result in measurement on rotating machine parts. Keep a safe distance and secure the accelerometer, including cable from rotating parts. Always follow internal, local and national safety precautions. When working with rotors always secure the starter button with a locking and also use the emergency stop button for double safety. This is especially important when using remote control.

VMI accepts no liability for personal injury or damage to machinery.

VMI and our dealers takes no responsibility for machinery or premises caused by negligence or negligence when using the **VIBER X3™** vibrometer.

VMI aims to improve and develop our products, which means that future upgrade versions of this manual will be necessary.



2 Introduction

VIBER X3™ is designed for repair and maintenance personnel. It is an excellent tool for condition monitoring, easy to use and reliable to permit analysis. **VIBER X3™** has the following features:

- Measurement in four frequency ranges, which provides high reliability.
- Measurement of total vibration level and bearing condition (BC), measured and displayed in real time.
- Headphones with volume control and high pass filter for listening to noise in bearings. Used with Bearing Conditioning measurement it can save time compared with trending measurements. Used with advantage if there are many small layers as in, for example. Printing machines or conveyor or similar machines.
- Possible to listen to bearing noise and compare with displayed BC value.
- Quick and an easy analysis by looking at the five highest peak-amplitudes and frequency.
- Measurement quantities and units of measure can be selected by the user from the following list:
 - * g-value = Acceleration (RMS, Peak or Peak to Peak).
 - * a = Acceleration (m/s^2) (RMS, Peak or Peak to Peak).
 - * V = Velocity (mm/s) (RMS, Peak or Peak to Peak).
 - * D = Displacement (mils) (RMS, Peak or Peak to Peak).
 - * D = Displacement (μm) (RMS, Peak or Peak to Peak).
- Bearing condition is measured within the frequency range of 500Hz to 16000Hz.
- Built-in infrared temperature sensors, selectable units are °C or °F.
- Bar indicator shows when the measurement is stable.



- High vibration and temperature alarms are indicated by red and yellow LED.
- Display with backlight.
- Fast battery charging with external charger.
- Adjustable “auto shut-off” for energy saving.
- Dust and waterproof, class IP65.

3 Components at delivery

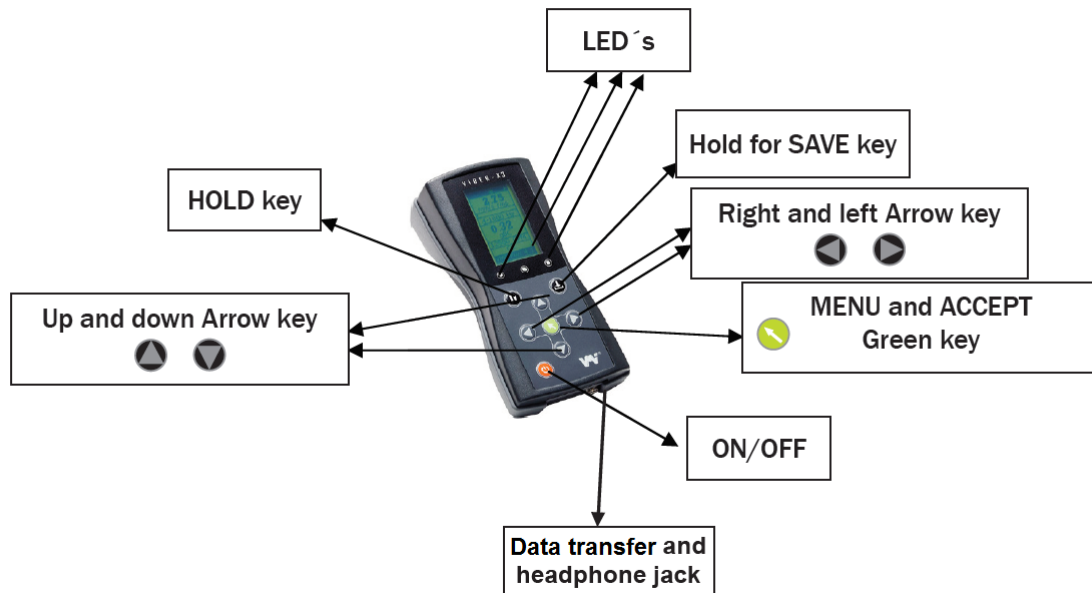


A complete delivery contains the following:

- **VIBER X3™** Measuring device
- Accelerometer of high quality and with 1m integrated cable
- 1 Measuring tip, 1 holding magnet
- Battery charger
- Headphones
- The software “VMI Trend View” and manual is delivered in a USB-memory stick
- Cable for data transfer

All these components are packed in a sturdy and shock resistant bag, airtight, resistant to chemicals and waterproof to class IP68.


4 Instrument keypad and LED's



The **VIBER X3™** keypad

1 ON/OFF Orange key

1 MENU and ACCEPT Green key 

1 Hold for SAVE key for Route and Balancing measurements 

1 Hold key 

4 Arrow white keys 

1 Green LED lights, when any key is pressed.

1 Yellow LED lights, when the measurement is above the warning set level.

1 Red LED lights, when the measurement is above the danger set level.

NOTE: As default, when the instrument starts, the transducer power is **ENABLED**



The following item settings are available:

Item	Value	Notes
Backlight	ENABLED or DISABLED	
Auto-shutoff	ENABLED or DISABLED	Shutoff after 60 seconds
Setting	20 sec, 30 sec, 40 sec, 1 min, 2 min and 3 min	Set the Auto-shutoff
Quantities and units	g (RMS, Peak or P-P) m/s ² (RMS, Peak or P-P) mm/s (RMS, Peak or P-P) µm (RMS, Peak or P-P) inch/sec (RMS, Peak or P-P) mils (RMS, Peak or P-P)	0 - 50 g or 490 m/s ² with standard accelerometer other quantities are frequency dependent
Frequency range	2 - 400 Hz 6 - 1600 Hz 11 - 3200 Hz 10 - 1000 Hz	Peak detection max 2000 Hz
Alarm *	ENABLED or DISABLED	Only for Velocity = mm/s and in/s
Warning	Default value 6.00 mm/s	Keep key pressed to auto-repeat
Danger	Default value 11.0 mm/s	Keep key pressed to auto-repeat
Language **		(Depending of firmware version)
Sensitivity (mV/g)	During calibration the transducer sensitivity can be adjusted between 0,1 to 999 mV/g	Do not change after instrument calibration. Set sensitivity in accordance with the transducers
Transducer power	ENABLED or DISABLED	4 mA for accelerometer
Frequency	RPM or Hz	



5 Menu and functions

To activate menus, press the green key. Navigate using the arrow keys.

Functions
Vibration
Temperature
Audio
Balancing
Settings
Upload
Delete

fig1.

Settings
Instrument
Transducer
Vibration
Temp.
Audio
Display
ACCEPT

fig 2.

The first menu you get is "Functions". Here you can choose from 7 different functions, see fig1. When selecting "Settings" you get 6 new options, etc. See fig2. Scroll with the arrow keys up or down to make a selection, confirm by pressing the green key. To return to the function menu, select "ACCEPT" and confirm with the green key.

Functions
Vibration
Temperature
Audio
Balancing
Settings
Upload
Delete

fig 3.

To delete a measurement from the **VIBER X3:s** memory table, select "Delete" from the function menu, see fig3 and confirm with the green key. A new menu appears, see Fig 4.

Delete
Clear mem.
ALL vib.
ALL temp.
ALL bal.
Vibration
Temperatur
Balancing
BACK

fig 4.

Choose what you want to delete, for example, a vibration measurement, scroll with the arrow keys to "Vibration" confirm with the green key and the following menu appears, see fig5.

Vibration	
1	15,71 0,12
2	17,19 0,10
3	2,09 0,08
4	
5	

fig 5.

Select the memory cell that you want to delete, for example memory cell 3, confirm with the green key. The "Delete" function can also be used to see which data is stored in the different memory tables. To exit this type of menu, press the "save key".





5.1 The menu for vibration

The vibration analysis menu looks like as shown in Figure 7

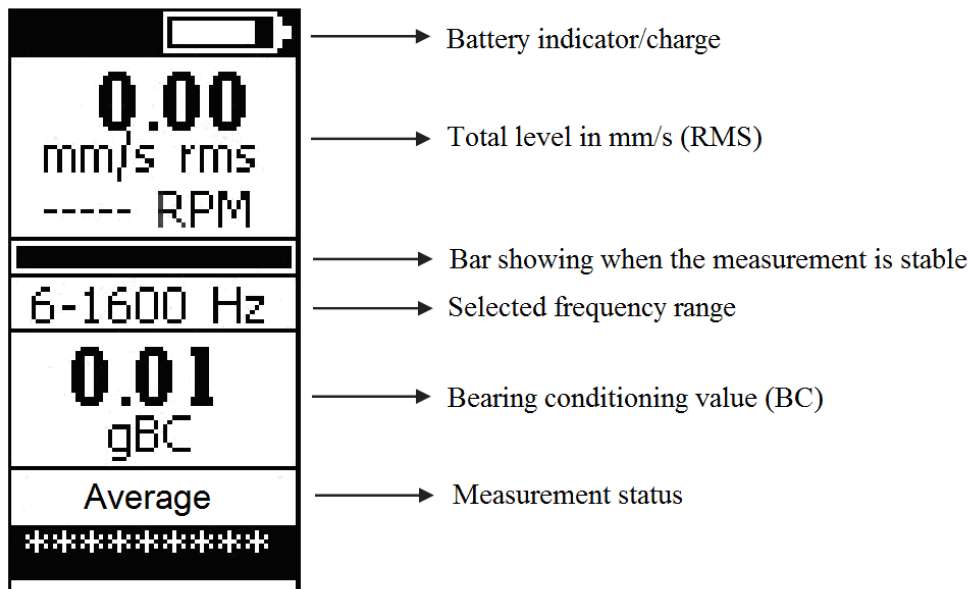


fig 7

To view the peak values, as shown in Figure 8, press the right or left arrow key.

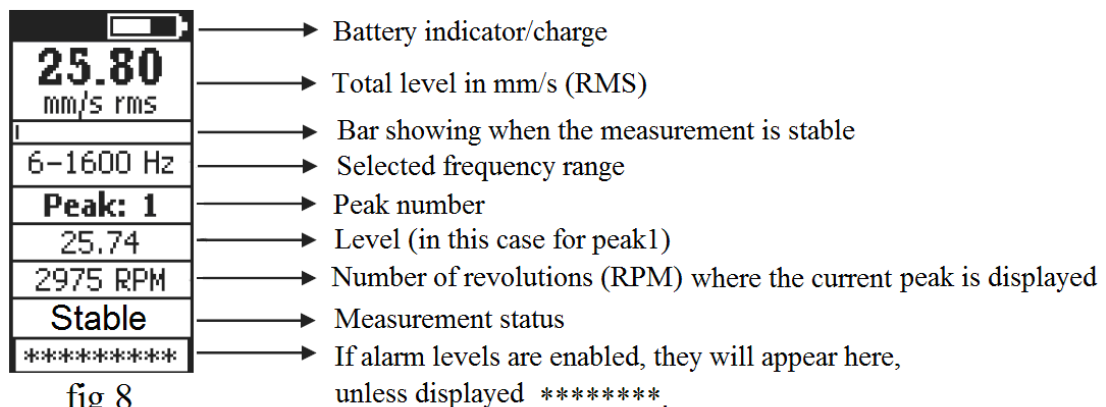
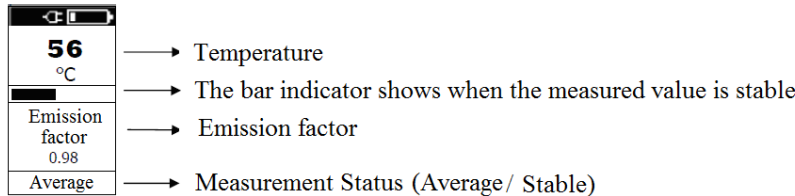


fig 8



5.2 The menu for temperature

The temperature menu shows the temperature of the measurement object



The temperature measurement status can be as follows:

Average (Average value in progress)

Stable (now measurement is reliable)

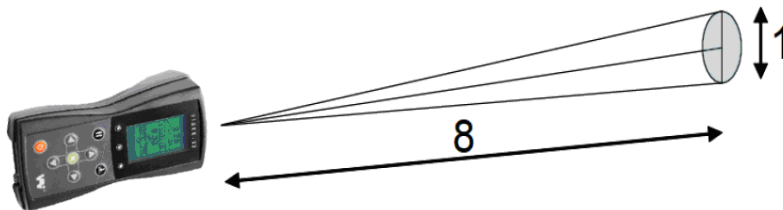
Overridden (signal is too high).

When the instrument is overridden, the value is shown in the form of three stars ***


The following temperature units can be selected: Celsius (°C) and Fahrenheit (°F).

When measuring, aim the IR- sensor using the red laser beam towards the surface to be measured. Keep a distance of approximately **200 - 500 mm** between the instrument and the object. Reduce the distance between instruments and objects depending on the size of the surface.

Note. When you get a temperature value that differs from the environment, you have probably found the right direction to the object.



Measurement surface size is related to the distance of about 8:1

When the green  (MENU key) is pressed, the "Function Menu" appears.

Select temperature.



Emissivity:


Set the coefficient for surface reflection factor (Emissivity factor) using the table below or check with a known contact thermometer

Material	Emissivity factor
Heat, sink, black anodized	0.98
Paper	0.97
Black paint, matt	0.97
Ice, smooth	0.97
Wood	0.94
Glass	0.94
Rubber, hard	0.94
Transformer paint	0.94
Concrete	0.93
Brick, mortar, plaster	0.93
Porselain	0.92
Steel, oxidized	0.79
Copper, oxidized	0.76
Steel, heat treated surface	0.52
Copper	0.04
Aluminium, bright	0.04

Warning!
Incorrect setting of the emissivity factor can lead to considerable errors of measured temperature.

Don't use

Temp
°C
Emissivity
0,98
Alarm
DISABLED
Warning
60,0 °C
Danger
80,0 °C
ACCEPT

To change the **Emission factor**, go to the "**Function menu**" select "**Settings**" select "**Temp**". Select "**Emissitivity**" Use first right arrow key for digit position and change the number value using the up or down keys. Finish with the green key press. 



5.3 Audio menu

Listening to machine sounds enables analysis of gears and low speed bearings (<300 RPM) as an alternative way and can contribute to a faster analysis with higher quality. **VIBER X3™** makes it possible for the user to listen to the machine while at the same time reading the vibration level on the instrument display.

When "Audio On" is activated, you return to the vibration menu by selecting "Display". From the "Function Menu" select vibration.

Warning!

To protect your hearing, you should always remove the headphones from your ears when you move the sensor or re-connect the cable.

Always connect the headphones to **VIBER X3™** before turning on "Audio On" volume can be controlled on both the instrument and the headphone cable depending on the model.

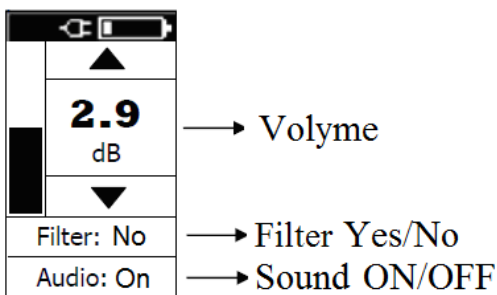


fig 9.

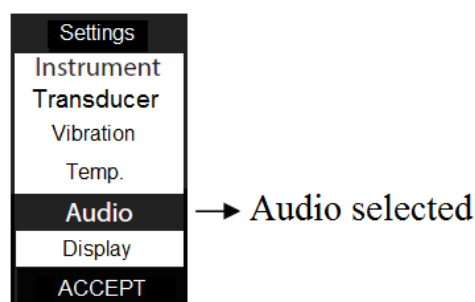


fig 10.

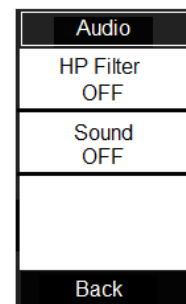


fig 11.

When the menu key is selected, select "Audio" from "Function Menu" and the menu in Figure 9 is displayed.

Audio:

When audio is enabled, use LEFT or RIGHT arrow keys to adjust the volume. Hold resp. Key pressed to the desired volume.

**Filter:**

When the filter is ON, a high-pass filter activates, allowing listening to only the higher audio frequencies of the machine. You can also activate filters and sounds from the setup menu and select Audio, see Figure 10 and Figure 11.

Note. With a headphone connected, at full volym, the current consumption increases by 150 mA. To save batteries, turn off the audio when not in use. At low battery voltage with connected headphone, the sound automatically turns off and you can measure an additional few minutes without charging the batteries.



6 Warning messages

The following message may appear in normal operation:

**Calibration
lost!**

This message may appear if the calibration data is lost from the permanent FRAM memory or if the calibration data are corrupted. In such cases, the instrument must be re-calibrated; otherwise it will measure incorrectly. The message appears only once, and then default calibration data is used.

**Battery
too low**

When this message appears, the battery voltage is too low to ensure a correct running condition. The measurements may be invalid! The instrument battery pack must be charged immediately, using the external charger. In order to temporarily decrease the power consumption, the backlight will be switched OFF. The instrument can still work, but only for a short while. If even in this condition the voltage remains low, the instrument will shut off in 20 sec. Battery charge should not be terminated before the green LED light has gone out.

**Shut-off
in 5 sec**

This message appears only if the Auto-shut off setting is enabled. The user may cancel the shut-off condition, pressing any key except ON/OFF. If no key is pressed the instrument will shut off in 5 seconds.

**Missing
transducer**

This message appears if you have forgot to connect the transducer or if the transducer is broken.

When the Transducer power setting is disabled, the user has the possibility to use another external source for the vibration input (a signal generator or a buffered output from another device).

When the instrument starts, the Transducer power setting is always ENAB-LED. When this message appears, it will remain on the screen, even if the transducer is plugged-in. To continue the normal running mode in such a condition, switch the screen temporarily to another menu.

When you go back, the message disappears.



7 How to interpret vibration levels

A user with no previous experience, should use the ISO 10816-3 standard.

The standard normally calls for a velocity measurement in mm/s RMS. To better understand what this measurement means, think of it as how fast the machine is moving back and forth. This measure gives a good understanding of the amount of “break down energy”, causing mainly wear and fatigue in the machine or the structure.

The instrument measures the total RMS vibration value in the frequency range. This RMS value is the square average sum of all the measured vibrations.

Example:

If the simultaneous vibration caused by unbalance is (4mm/s), by misalignment (2 mm/s) and by the gear mesh (5 mm/s) then the total vibration measured with **VIBER X3™** is 6.7 mm/s.

$$\text{Total vibration(RMS)} = \sqrt{(4*4) + (2*2) + (5*5)} = 6,7 \text{ mm/s}$$

Notice that a reduction of the unbalance from 4 mm/s to 1 mm/s will reduce the total value from 6, 7 mm/s to 5, 5 mm/s.



7.1 Excerpt from ISO standard

ISO Standard 10816-3 classifies machines differently depending on whether they are flexible or rigid (fixed) mounted. This reflects the location of the machine's "rigid resonances" related to the machine's operating speed.

Examples of vibration levels ISO standards

Vibration mm/s	Class 1	Class 2	Class 3	Class 4
0.28	A	A	A	A
0.45				
0.71				
1.12	B	B	B	
1.8				
2.8	C	C	C	
4.5				
7.1	D	D	C	B
11.2				
18		D	D	C
28				
45	D			

Class 1: Small machines, Electric motors below 15 kW

Class 2: Medium-sized machines, Electric motors 15 - 75 kW

Class 3: Large machines, rigid foundation

Class 4: Large machines, weak foundations

A = Good

B = Satisfactory

C = Unsatisfactory

D = Unacceptable



8 Vibration analysis

Recommended vibration levels in mm/s and common findings

The list and table on previous page can be used, as a first consideration, when you approach a machine newly commissioned or after some time in operation. Investigate the reason for any machine that vibrates above 3 mm/s RMS. Do not leave levels above 7 mm/s without analyzing consequences.

0 – 3 mm/s | 0 – 0,12 in/s

Small vibrations - None or very small bearing wear. Rather low noise level.

3 – 7 mm/s | 0,12 – 0,28 in/s

Noticeable vibration levels often concentrated to some specific part as well as direction of the machine. Noticeable bearing wear. Seal problems occur in pumps etc. Increased noise level; try to investigate the reason. Plan an action during next regular stop. Keep the machine under observation and measure at shorter time intervals than before to detect a deterioration trend if any. Compare vibrations to other operating variables.

7 – 11 mm/s | 0,28 – 0,43 in/s

Large vibrations. Bearings running hot. Bearing wear-out cause frequent replacements. Seals wear out, leakage of all kinds evident. Cracks in welding and concrete foundations. Screws and bolts are loosening. High noise level. Plan action soonest. Do your best to reveal the reason. You are wearing down investments quickly.

11 – mm/s | 0,43 – in/s

Very large vibrations and high noise levels. This is detrimental to the safe operation of the machine. Stop operation if technically or economically possible considering the plant stop cost. No known machine will withstand this level without internal or external damage. Reduce any further running time to an absolute minimum.



8.1 Resonance

A resonance can easily be found when a flexible machine is running up or down its speed. The resonance frequencies are located at the RPM's where the vibration has a local maximum level.

To understand a resonance you can compare with the string of a guitar. The string has its natural basic tune that will ring as soon as the string is struck. The actual frequency of the tune depends on the stiffness and the distributed mass of the string.

All machines have similar built in "tunes" with corresponding properties consisting of stiffness and a mass in the form of mechanical string such as shafts, beams, floors and in all mechanical parts. If any natural excitation (alternating force) in the machine has the same or nearly the same frequency as a resonance frequency the vibration will be amplified in this machine part, and a much higher vibration level will occur.

To identify, measure the vibration levels in three perpendicular directions at the bearings. If you find a measurement with at least three times higher level than in the other directions, consider resonance as a likely possibility. The resonance is amplifying the mechanical force and thus gives a high vibration in that direction. The resonance makes the machine unnecessarily sensitive to mechanical forces.

Actions to handle a resonance are different depending on its location, operating conditions etc. It will normally require experience to alter the situation. One reason is that the modification can affect the basic mechanical design of the machine and normally require the competence of a machine designer.

We recommend however to consider such modifications since the change of the resonance frequency normally is cheap compared to the high maintenance cost that will follow any attempt to run a machine under the influence of a resonance.

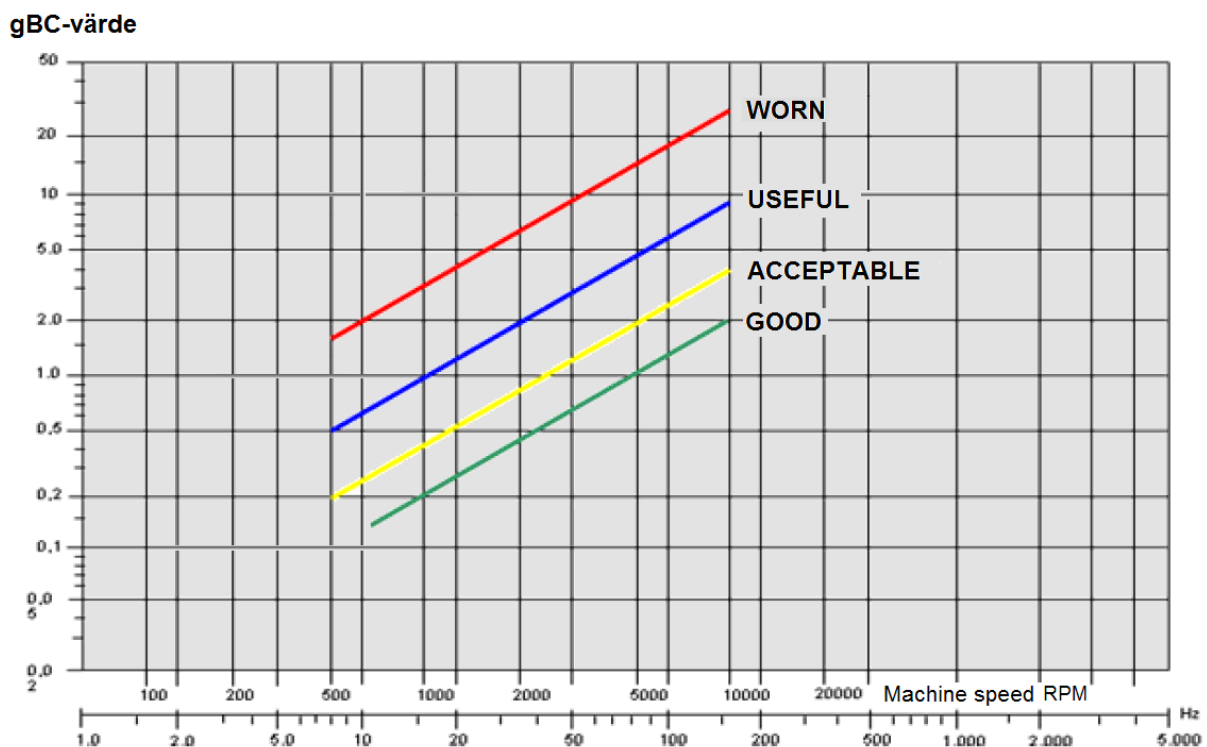
Sometimes it's possible to change the speed of machines, which often is a simple solution.



8.2 Recommended bearing condition levels

The bearing condition value is the total RMS value of the acceleration of all high frequency vibrations within the range from 500 Hz up to 16000 Hz, given as a “gBC-value”.

Based on the machines measured “gBC-value”, follow the line corresponding to the measured “gBC-value” on the left-hand axis, towards the line in the centre of the chart that corresponds to the machines speed. Depending on which of the four lines in the centre of the chart, which corresponds to the other two values, (gBC and RPM), you can get the following information about the bearing: GOOD, ACCEPTABLE, USEFUL and WORN.



The diagram above is a help to translate bearing condition values. About, for example the measured gBC value is 2.0g. It shows that if a machine has a speed of approximately: 10000 RPM, the bearing may still be good, while a machine with a speed of about 550 RPM with the same gBC value can be considered as consumed.



If vibrations of other causes occur (eg flow, pressure shock, gears) and within the frequency range, it may also give high "gBC values" without damage to the bearings. A high "gBC value" can also be expected if the bearing is poorly lubricated or overloaded (eg in case of poor alignment or hard tension drive belt).

Compare this value with the bearing temperature. If both the "gBC value" and the temperature are high or increase in a trend measurement, then there is probably a bearing problem.

8.3 Listen to the bearing noise

Listening to bearing noise is an old method. Sound analysis of low-speed bearings and gearboxes can sometimes be faster and more realistic than a "bearing condition value" (gBC). With **VIBER X3™** you can listen and view the bearing condition value at the same time.

Also test to grease the bearing and after that, listen again.



9 Balancing with VIBER X3™

This chapter describes how you can perform balancing with your instrument.

The **VMI 3-Point Balancing method** does not need any additional hardware except for the **VIBER X3™** instrument and the accelerometer. Mount the accelerometer on the bearing and in the direction where you have the highest vibration caused by unbalance. Use this measuring point for all following measurements. If you need to leave the place during the balancing procedure, disconnect the accelerometer BNC-connector from the instrument and leave the accelerometer at the point from where the measurements are taken. If this is not possible, mark the position with a pen or paint. It is important that it is only the trial weights that will influence the vibrations and not the change in vibration due to a different position of the transducer.

To know if the vibration is caused by imbalance, study the five highest peaks in the spectrum by pressing the right arrow key when the vibration menu is displayed. The level of the peak at the machine speed or the frequency, indicates whether balancing is necessary, if the peak level is 2 mm/s or lower, balancing is usually not necessary. See the calculation of the RMS g-value on page 19.



During the balancing procedure remember that:

- It is only possible to balancing machines, if there is an unbalance.
- Do not change the position of the vibration transducer after the start of the balancing procedure.
- Balancing using this method requires three consecutive trial runs to change by adding weights.
- Only measurement of the vibration level is needed.
- Balancing can only reduce the vibration caused by unbalance.
- **VIBER X3™** can display the frequency of the five highest peaks. If none of the peaks in spectrum matches the machine speed, the cause of vibration is probably something else.
- A balancing round will often be a good approach and a first attempt to find the reason for increased vibration. If the balancing attempt is not successful, the cause can be loose rotor parts or other faults.
- If the machine speed is variable, be sure to choose the same speed during every trial run. Do not search the speed that gives the highest vibration. Such speeds mostly show non-linear results.
- Start balancing with measuring the bearings in the directions (horizontal, vertical and axial). Select the direction in which the highest vibration is read. The unbalance vibration should be at the same speed/frequency as the machine speed/frequency.
- You must use the same radius for the trial weights and the balancing weights.
- Accuracy in balancing ensure a good result.



9.1 3-point method for balancing

VMI's 3-point method has been further developed and adapted to **VIBER X3™**. This method gives a result fully comparable to more advanced instruments. This is possible due to bandpass filtering of the measurement signal, where vibration is measured at the machine-speed. This can not be done with older instruments that measure with a larger bandwidth (total level). **VIBER X3™** calculates balance-weight and where it should be placed. The balancing procedure requires 5 runs/test.

Balancing Classes are available in standard ISO 1940-, there are recommendations for various applications. We can, with 3-point method and a **VIBER X3™** at normal rotor weights and speeds often balance to class G (2.5).

This method calculates the balancing weight and where to place it. The balancing requires 5 starts/test runs.

Test drives 1 – 5

1. Test drive 1, measures the unbalance before action
2. Test drive 2 with trial weight
3. Test drive 3 with trial weight
4. Test drive 4 with trial weight
5. Test and verify result



9.2 Important at all types of balancing are:

- The machine must have the same rotational speed at all tests
- The rotational radius must be the same for both trial weights and balancing weights.
- Placement of the sensor must be the same during balancing.
- Accuracy at measuring and mounting of trial weight is important and critical for the result.
- The behaviour of some machines can be non-linear, and can therefore not be balanced without constructional changes as rigidity, mass or boundary conditions.

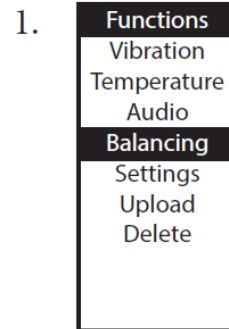
The manual is divided into two sections, one with preparation and one section with balancing runs.



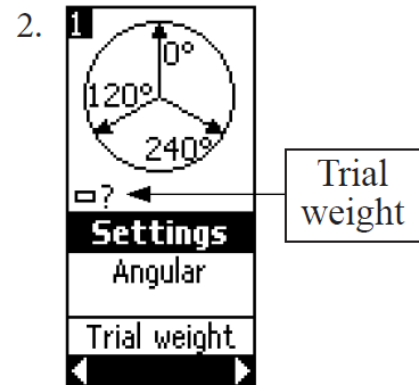
9.3 Preparations before balancing act

Start **VIBER X3™** and press the green button, select with arrows:

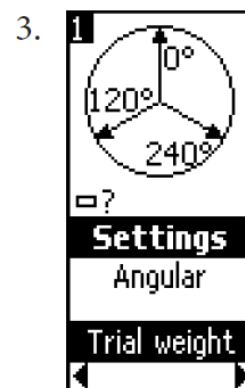
”Balancing” from the main menu, confirm with the green button.



Setting the balancing parameters, the upper half shows the rotor and trial weight symbol. Rotor symbol has indicator for the trial weights placement. The symbol for the sample weight has question marks before the weight is selected.



Move the marker to **”Trial weight”** and confirm with the green button





9.4 Estimation/Calculation of mass of trial weight.

T = Trial weight, unit mass (grams)

W = Mass of rotor, unit mass (kg)

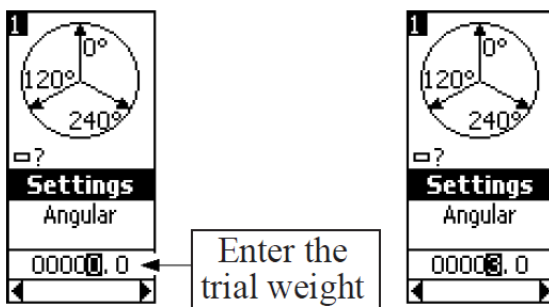
R = Center distance to the test weight location, (radius length) unit (mm)

S = Speed, (RPM)

Constant = 180 000

Example: W = 3,22 kg, R = 65 mm, S = 2972 RPM, which gives T = 3,0 gram.

Enter the trial weight with the arrow keys and confirm with the green button

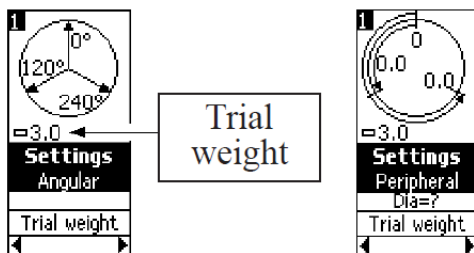


$$T_{grams} = \frac{W_{kg} \times 180000}{R_{mm} \times S_{rpm}}$$

9.5 Calculation of trial weight and position.

The instrument can calculate the position in two ways;

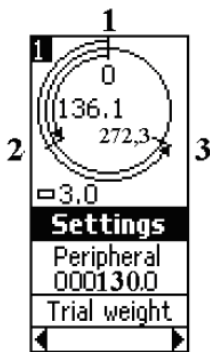
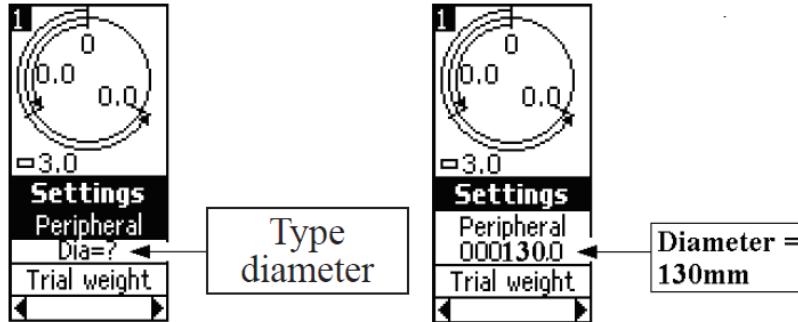
Angle calculation or length of the perimeter where the weight is placed. This is specified as angle or peripheral (length). The length is calculated in the instrument after the diameter is specified.



Move the highlight in the line that says "Angle" or "peripheral". Select whether you enter the revolving portion of a diameter or angle by switching with the green button. **VIBER X3™** shows when trial weight placement as an angular measurement or the length of a circular arc. The diameter shall be given to the part of the rotor where the weights should be applied.

9.6 Calculating length of the arc

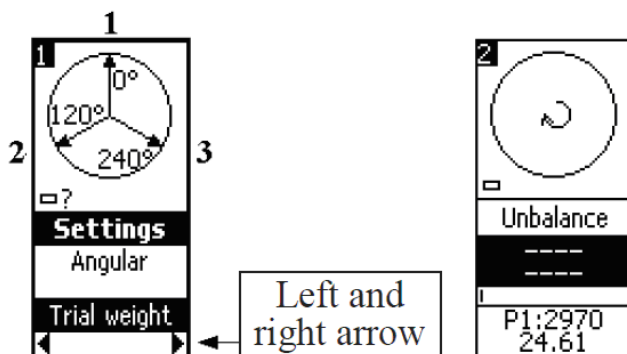
Measure diameter of the rotational object and scroll down to "Dia =?" (diameter) and press the green button. Enter the "Diameter Value" (in our example 130mm) on the line by highlighting the digit positions and step-up or down with the arrow keys, see the right-hand picture. Confirm with the green key press.



VIBER X3™ now calculates the distance to the periphery of the three test points. Mark these three points on the machine part with a pencil or marking tape. Mark the positions in the direction of zero (0) as (position 1) and others (Item 2) and (Item 3) in the direction towards the rotation.

9.7 Calculating the angle

The instrument calculates the angle of the balancing weight. The runs to 0°, 120°, 240°, indicated that the test weight should be placed at these angles



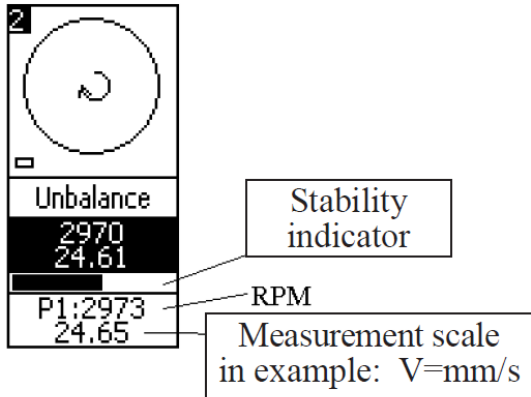
Preparations of first test drive

Move the cursor to the field at the bottom that has a left and right arrow symbol, press the right arrow key * to display the screen for measurement.

**The left and right arrow key, provides a means to jump back and forward between the steps in the balancing procedure.*



9.8 Balancing procedure



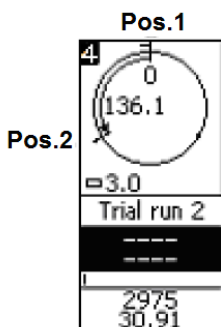
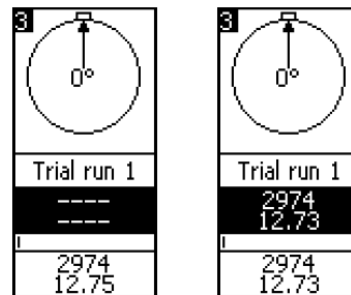
Moment 1) Start the machine, (Initial run without test weight)

VIBER-X3™ measures and calculates the five largest amplitudes in the spectra. To reduce noise and disturbance the signal is filtered. Wait until the stability indicator has gone down to zero.

Check that the machine's base speed is shown on the "RPM" If not scroll using the up / down arrows until the speed of the machine is displayed. Wait, if possible, until the stabilization indicator has gone down to zero, or else try to save as stable value as possible, press the green button to save. Turn off the machine. Prepare the next measurement by stepping forward with the right arrow key.

Moment 2) Test run No:1

Install the selected sample weight (in our example. 3.0 grams) in the selected position (Pos.1). Start the machine, wait until it is stable measurement, preferably with the stability indicator is 0. Check that the speed is the same as last time, save with the green button. Turn off the machine. Prepare the next measurement by stepping forward with the right arrow key.



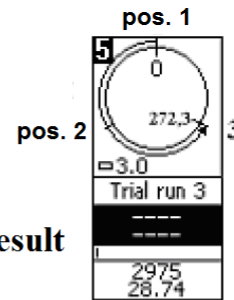
Moment 3) Test run No: 2

Moving the test weight from (position 1) to the calculated distance (in our example. 136.1 mm) towards the direction of rotation (Item 2), or if the angle calculation made to 120 °. Then do the same as test run No: 1.

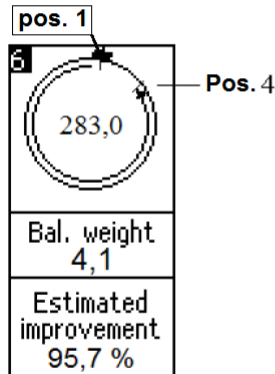


Moment 4 Test run No: 3

Move the test weight from (Item 2) to the calculated distance (in our example. 272.3 mm), calculated from (Item 1) towards the direction of (Item 3) or 240 ° of angle calculation used. Then do the same as when measured 1 and 2.



Moment 5) Testing and evaluation of the measurement result



If the result is an error message, for example: **"Irrational vibration level"** that means that the trial weight has to low weight.

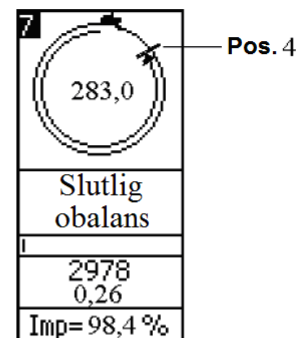
Remove the sample weight from (pos.3) or 240 ° and mount the calculated balance weight as in our ex became 4.1 grams, in the calculated position, towards the direction of rotation, from "zero" (pos.1) to (in our example 283, 0 mm), (pos.4).

Balancing the machine

After three test runs, the instrument automatically calculates balance weight and where it should be placed, the expected improvement is also calculated, in our example it became 95.7%.

Checking the result

Scroll with the right arrow key to the menu: **Final unbalance**. Start the machine, check that the speed is the same as the previous runs, wait for stable readings. Confirm with the green button. The end result in this example was better (98.4%) than the estimated value. Balancing is now complete turn off the machine, and mount the test weight permanently.



Balansering		Initial vibration (mm/s)
1	24,65	Vibraton after balancing
	0,26	
	4,1	Estimated Balance Weight (gram)
	350°	
2	98,4	Estimated angle
		Improvement in%

Save the result

If the result of balancing is to be saved, use the "SAVE" key

select a number in the memory cell where the result will be stored. To view the saved result, press the green key and select "Delete" from the function menu and select "Balance" from the "Delete menu", step in the memory table using the arrow keys.



Functions
Vibration
Temperature
Audio
Balancing
Settings
Upload
Delete

If you want to further improve the balancing performance, a completely new balancing process must be carried out and with test weights with lower weight.

9.9 Example of balancing report

Balancing report

Balancing results

Weight	0.0 g
Angle	0.0 °
Improvement	0.0 %
Acceleration	0.000000 g[rms]
Speed	0.000000 mm/s[rms]
Displacement	0.000000 um[rms]

Balancing setup

Test frequency	0.0 Hz
Trial weight	0.0 g
Shaft diameter	0.0 mm

Trial 1	
Acceleration	0.000000 g[rms]
Speed	0.000000 mm/s[rms]
Displacement	0.000000 um[rms]
Trial 2	
Acceleration	0.000000 g[rms]
Speed	0.000000 mm/s[rms]
Displacement	0.000000 um[rms]
Trial 3	
Acceleration	0.000000 g[rms]
Speed	0.000000 mm/s[rms]
Displacement	0.000000 um[rms]



10 Trend View software use for trends and route

This software is designed to trend measurement and this enables the users to monitor the condition in machines.

Trends are one method to perform condition monitoring (CM). **TREND VIEW™** is designed for use only with **VIBER X2 Pro™** and **VIBER X3™**.

For every plant or building, you can create a database and a route with up to 100 measurements. If there are need for several measurement points, you can create several projects with 100 new storage locations. Each measurement store vibration amplitude and bearing condition. This covers normally 5 – 20 machines / project, depending on how many directions are measured on every bearing* and the number of bearings. That amount is equivalent to number of measuring points in a route.

For **VIBER X3™** you can also store temperature, there is an additional space for 100 temperature measurements.

If only one direction is measured at each measuring point, choose the direction with the highest vibration. After the measurement, the data can be uploaded to the computer. In the computer you can store almost an unlimited number of machines. You can choose what unit you want to display in **TREND VIEW™**.

Analyzing this information, periodically, you can act proactively and avoid failures.

Regarding installation of the software, see the installation guide.

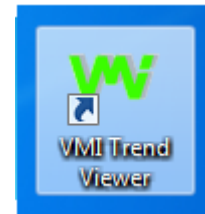
* Bearing condition is stored in horizontal direction on each bearing. If you not measures this direction you must choose one of the direction you measure. Change direction in properties.



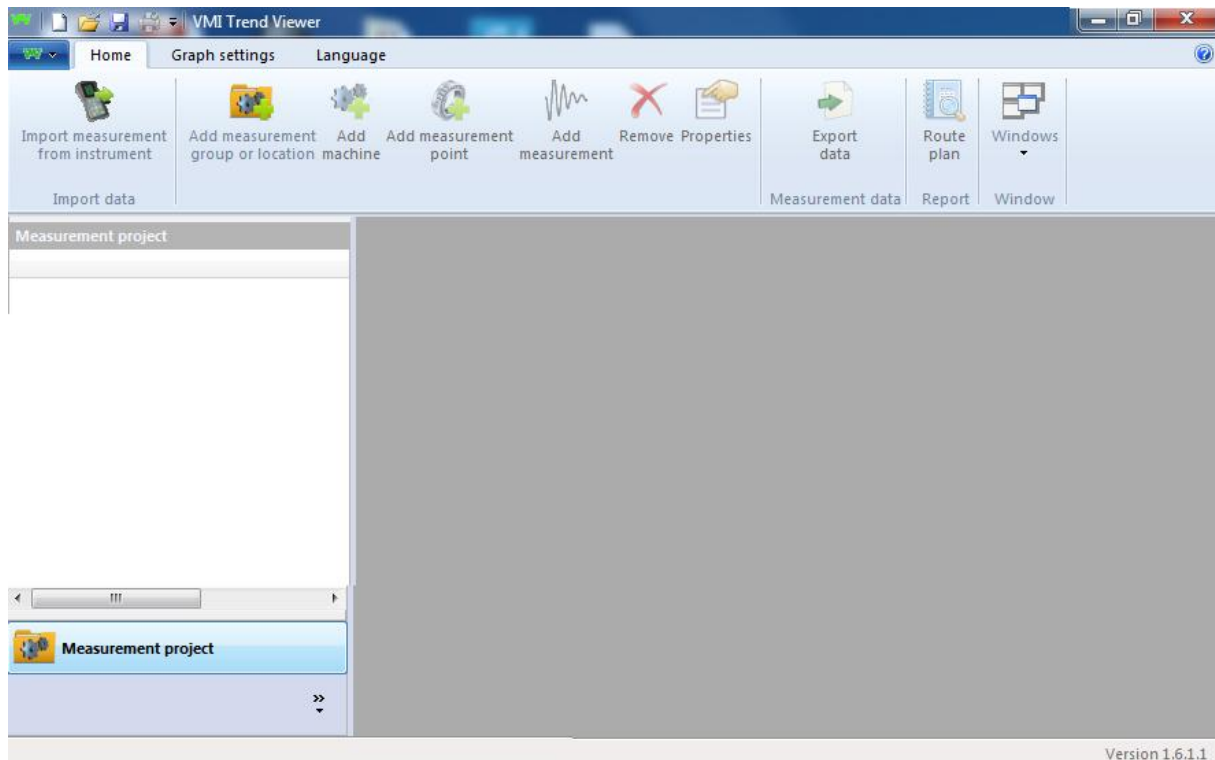
10.1 Create a measurement project

You start by creating a "measurement project" to store measurement values.

In this manual, we show an example of how to build a "measurement project" or "database" with two grinding machines. Grinding machine 1 and Grinding machine 2. For both machines we measure : Vibration, Bearing condition (BC) and Temperature. The machines belong to the "Grinding department".

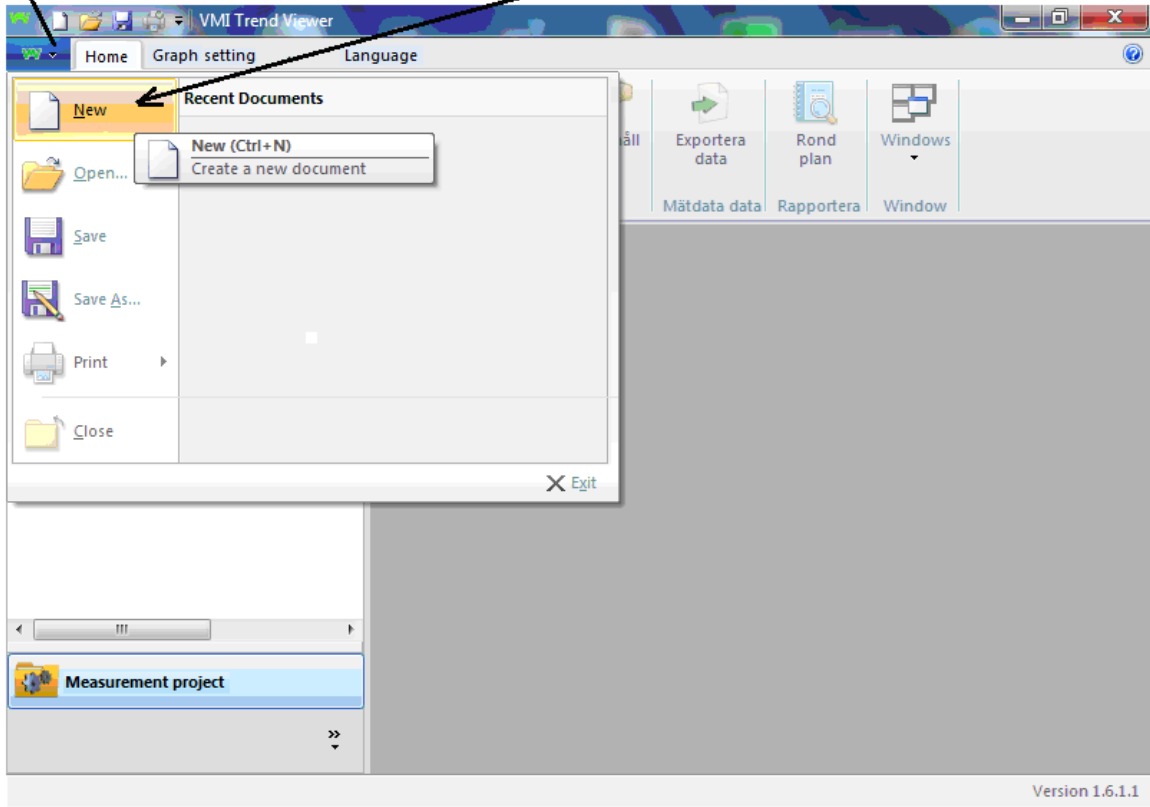


Start the "Trend View" program by clicking on the icon:
on the desk.

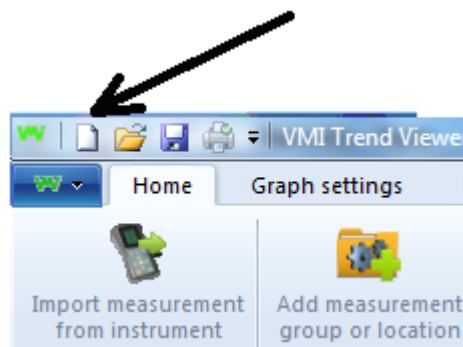




Click the green "W" and choose "New" from the dialogbox

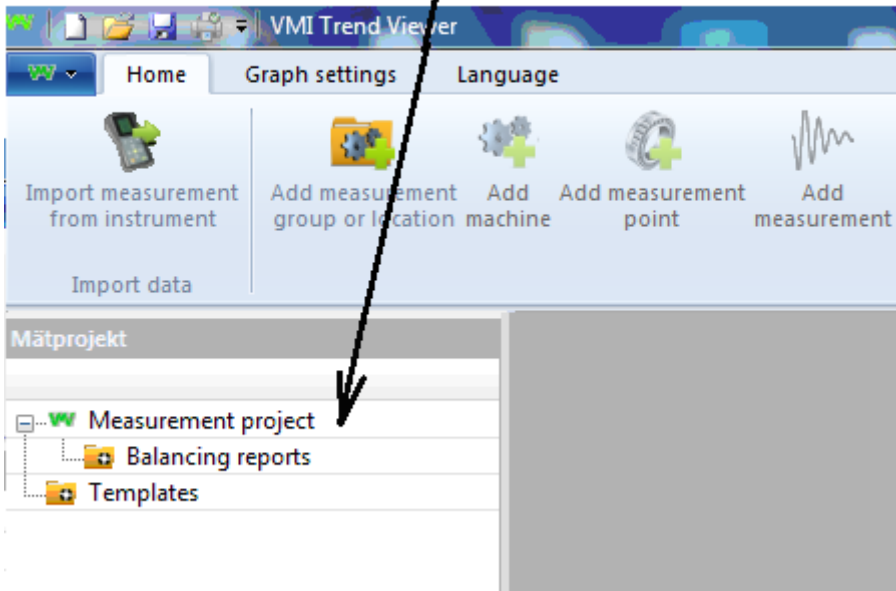


You can also click on the symbol that shows a "white sheet of paper" to create a new project.

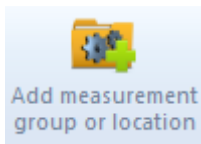




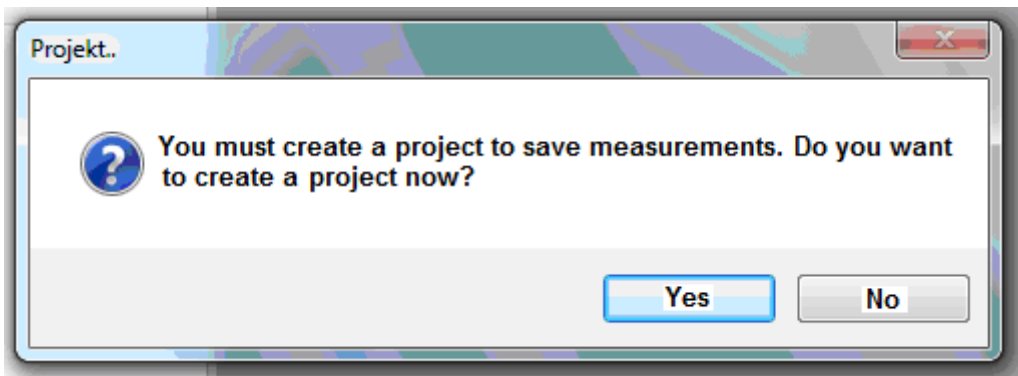
Here is the new project.



You can build a hierarchical tree, from a plant or department down to a single measuring point, or just set up a single machine. In this example, we select "Department" (Grinding Department). We also add two machines, (Grinding machine 1) and (Grinding machine 2). Next step is to click on the icon:

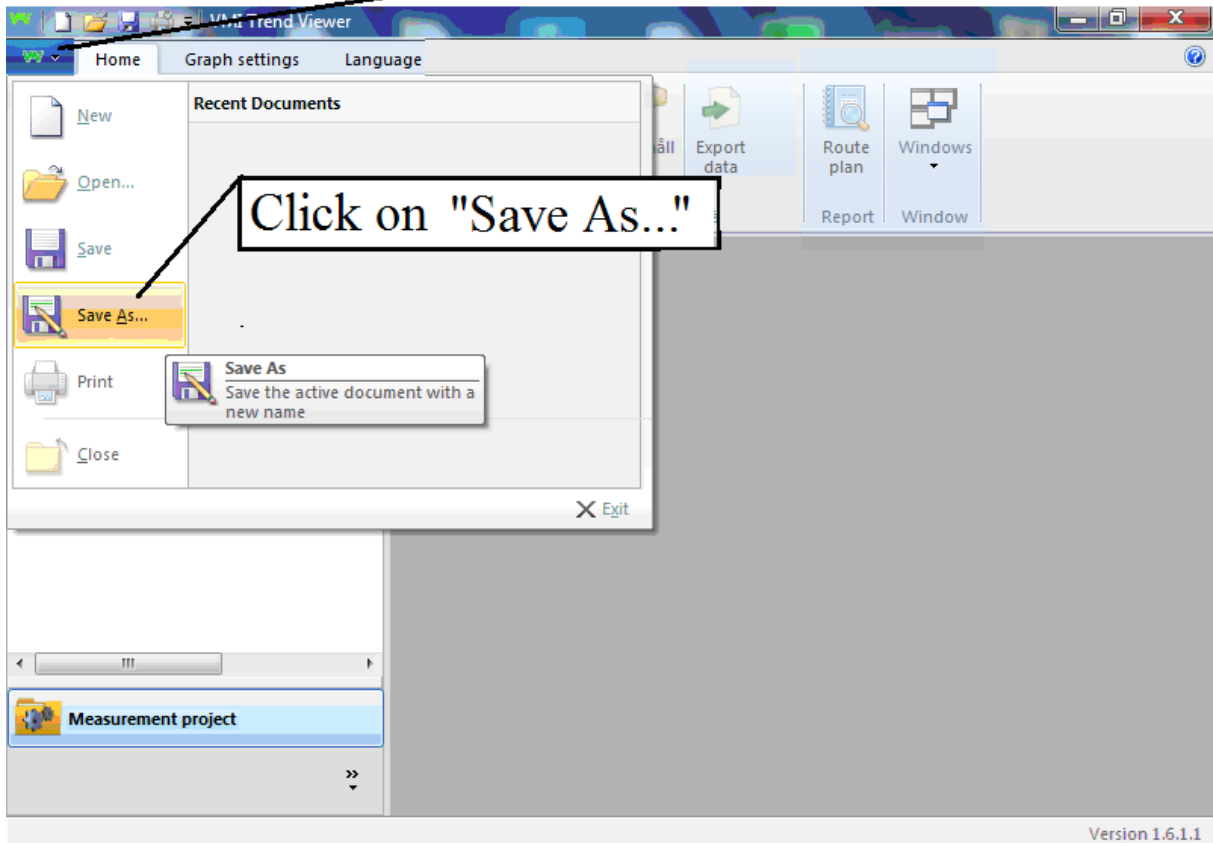


If you click on the icon "Add Group or Location" before you create a project, you will receive the following prompt:



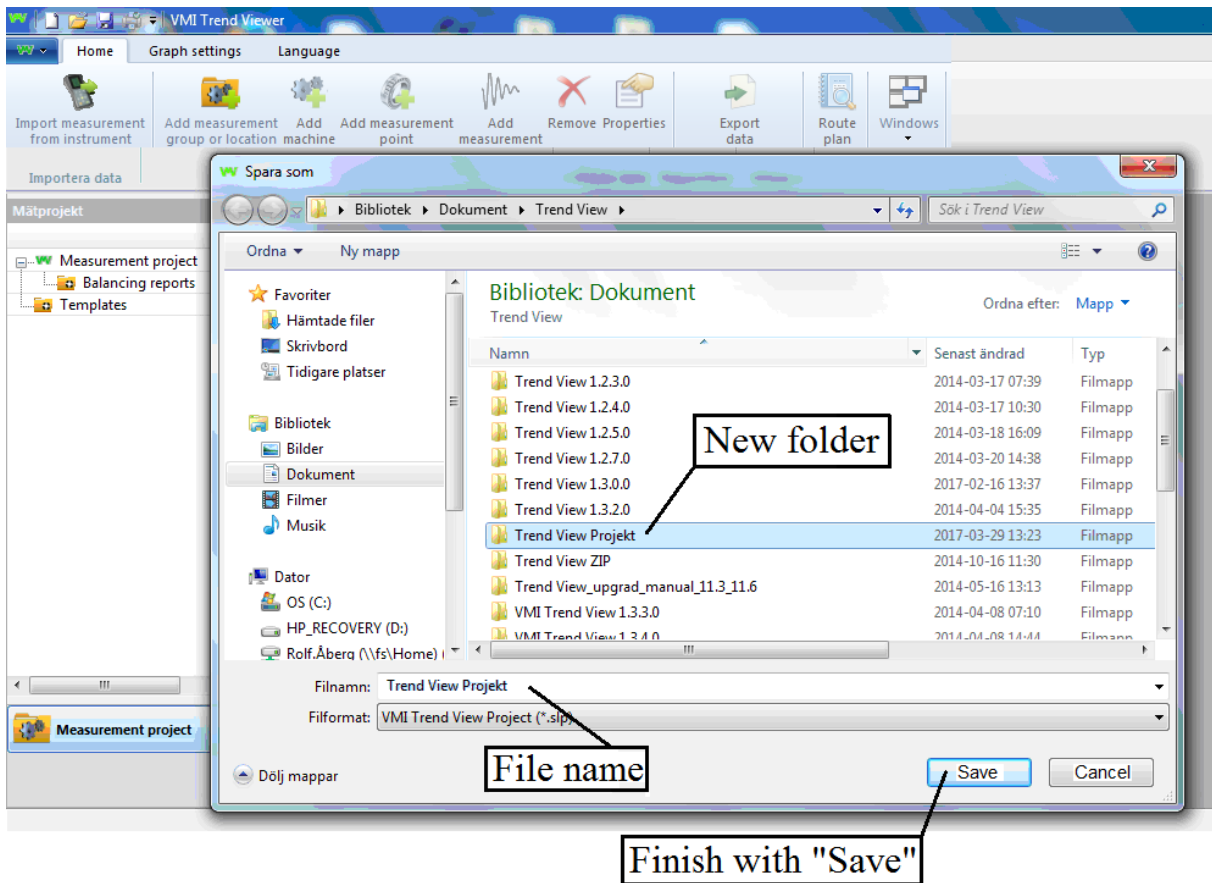


Assign the project a name by clicking on the green "W"

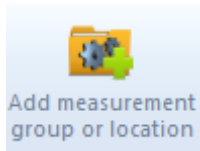




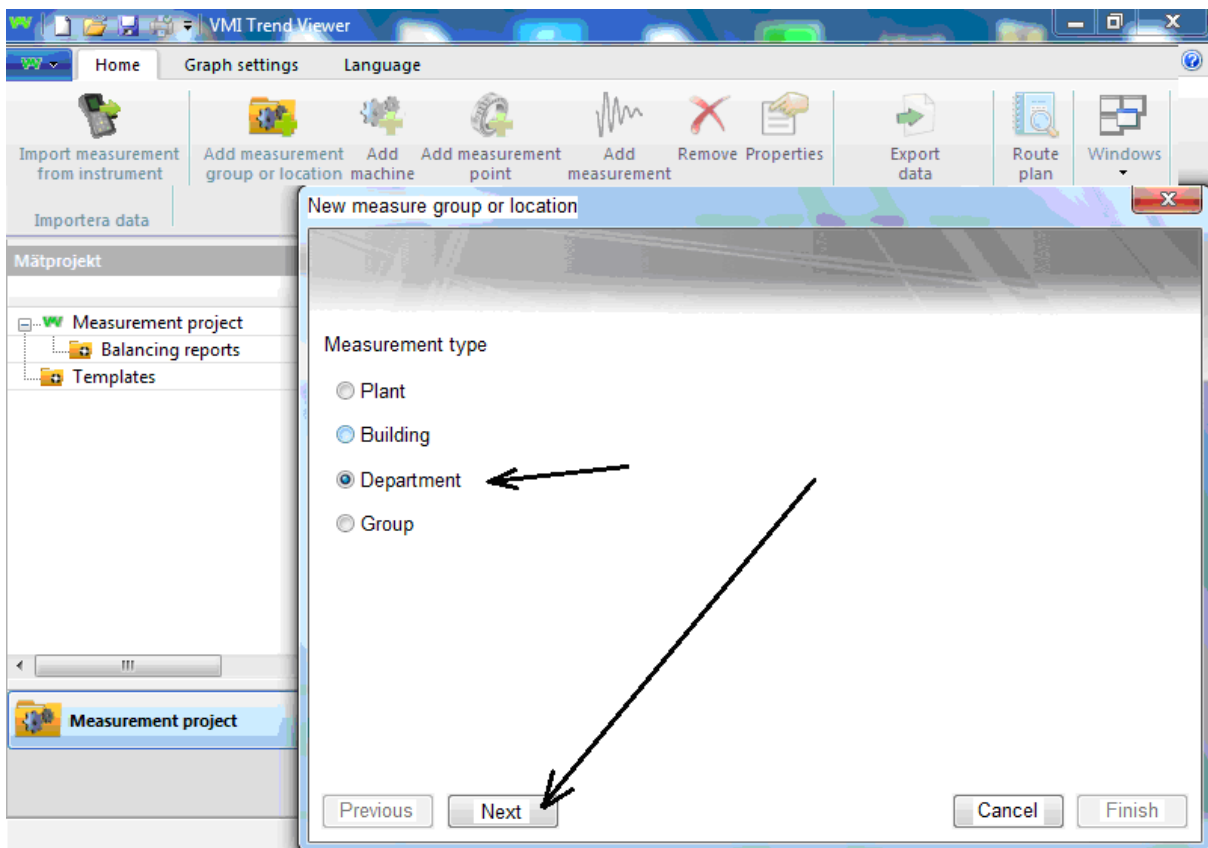
Assign a project name to the project and decide where you want to save your projects. Create a "Folder" and give it a name, for example: "Trend View Project".



Continue by clicking on the "Add measurement group or location" icon.

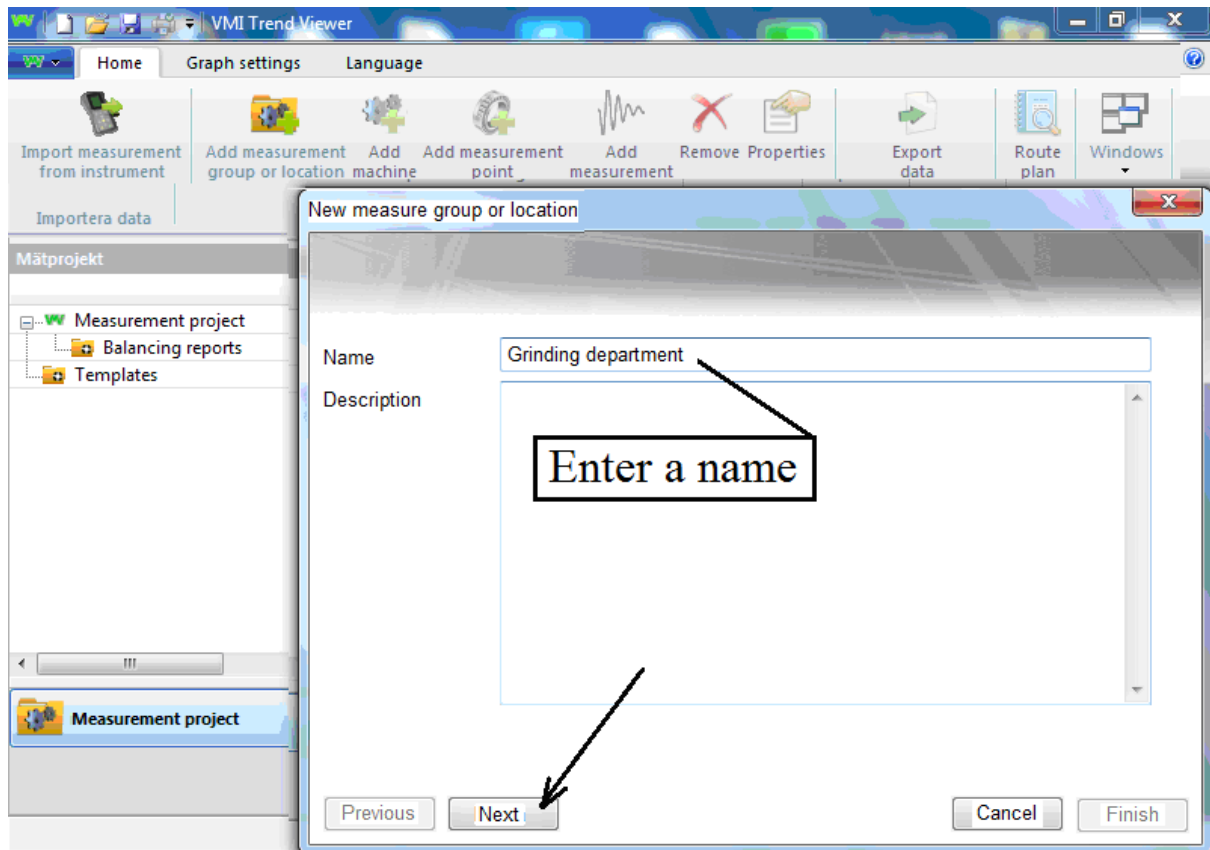


Select "Department" for our example. In other cases, choose the option that suits. The top level of the project (Database) is usually a building or department, which must be added to the project. Then click on the next.



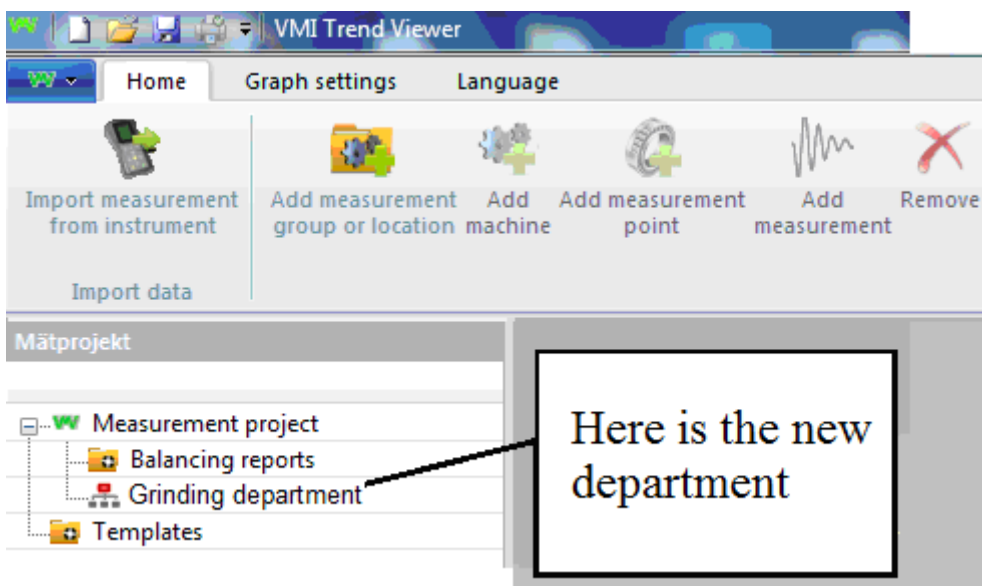
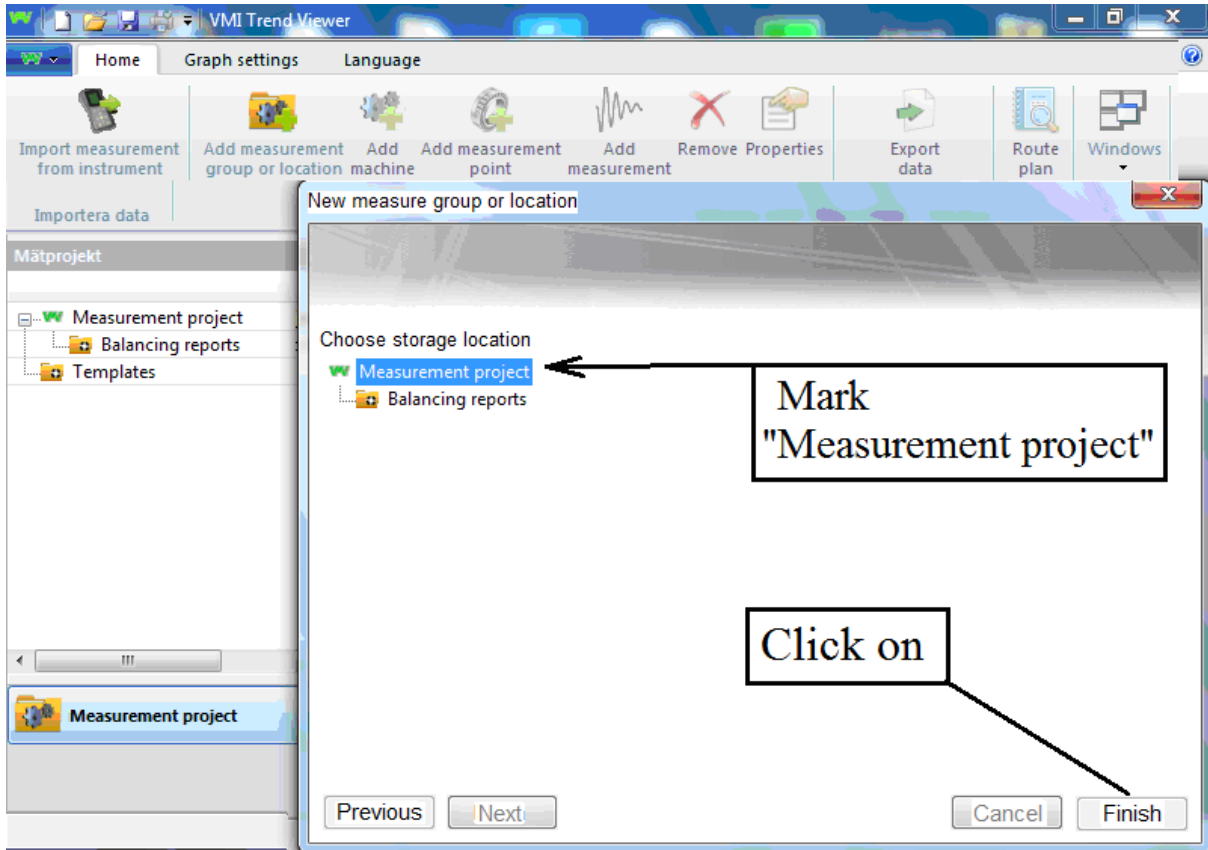


Enter a name for the department, proceed with a click on "Next".





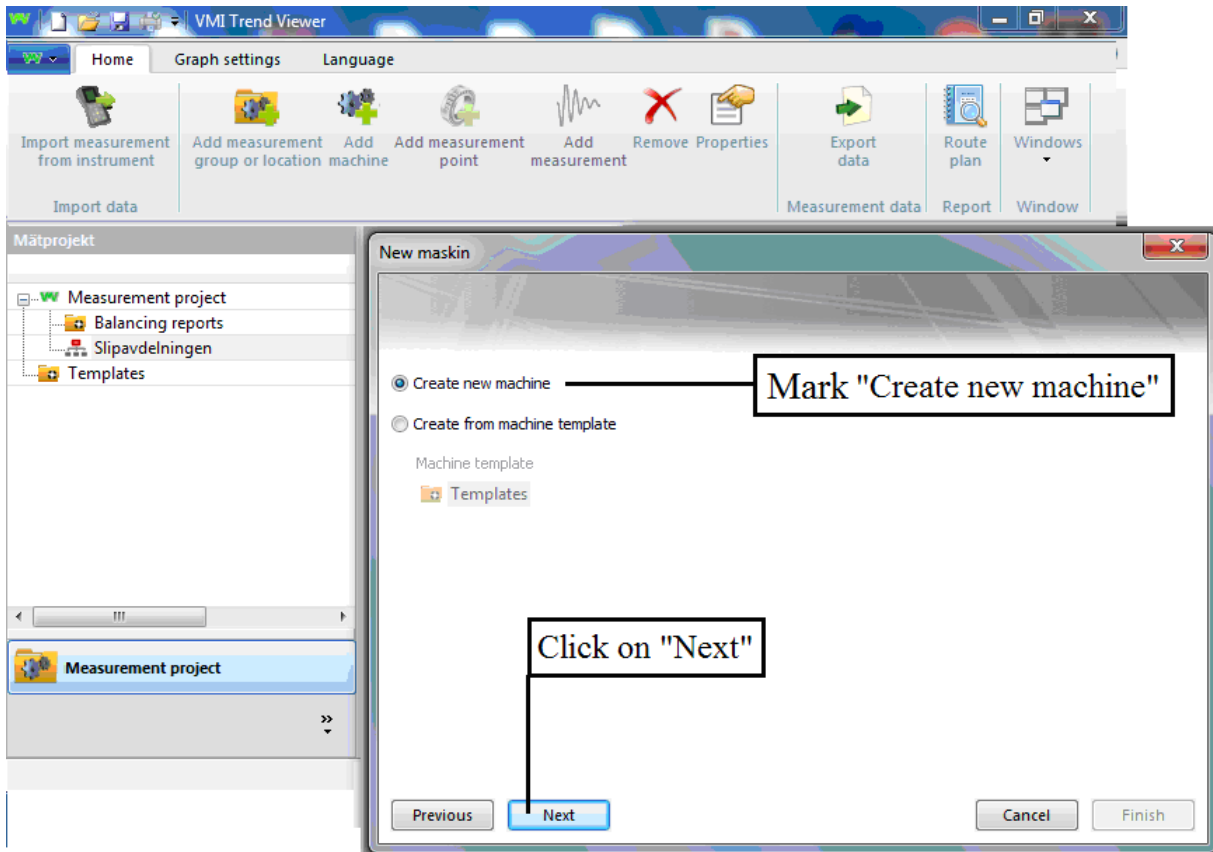
Select the type of measurement you want to do "Measuring Project" or "Balancing reports". In our ex. We choose "Measurement Projects" because we will perform trend measurements. Click "Finish".

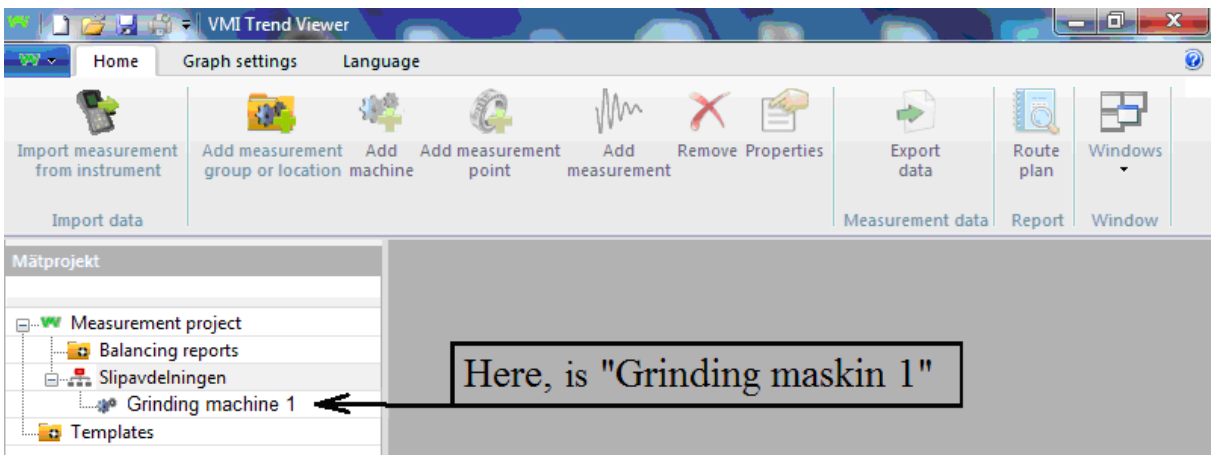
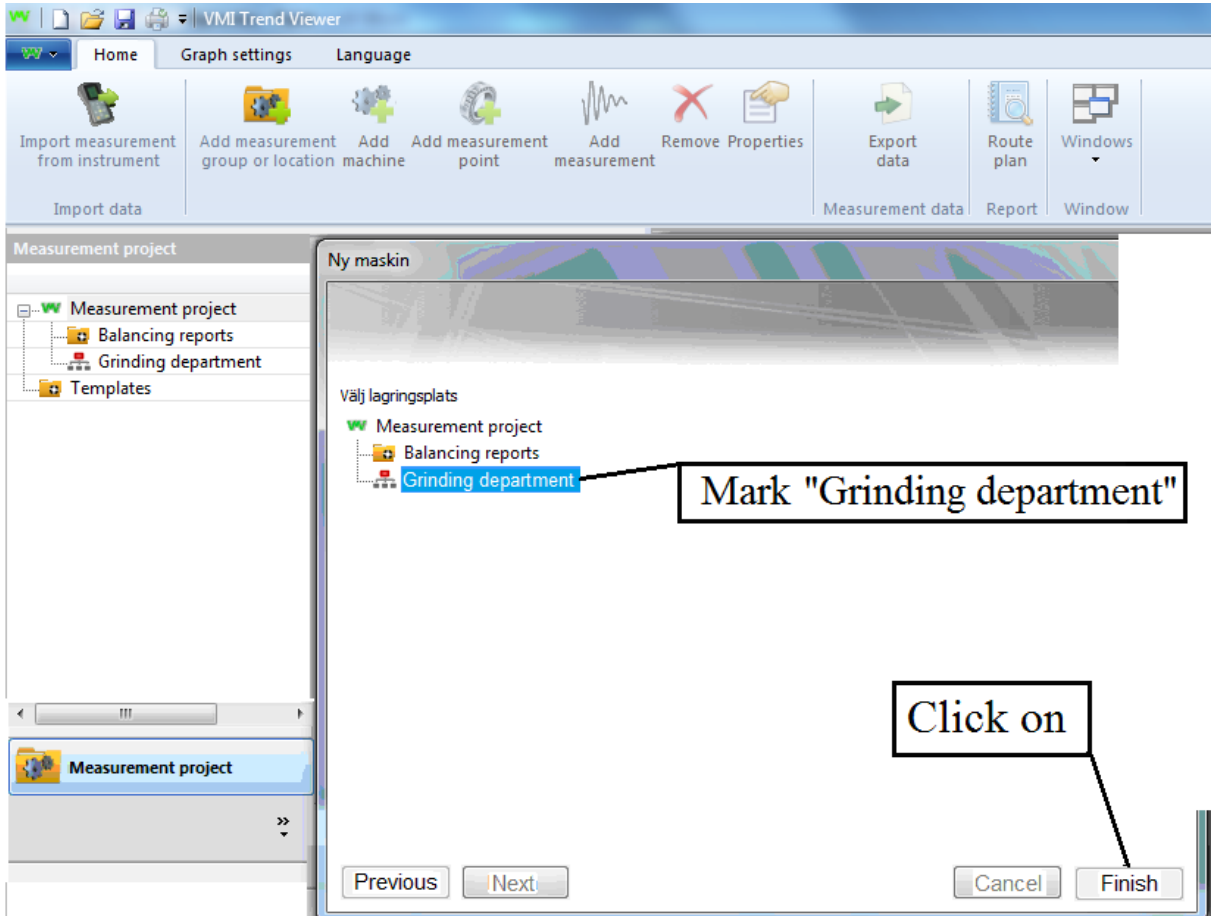


The next step is to add a machine

1 Click on "Add Machine"

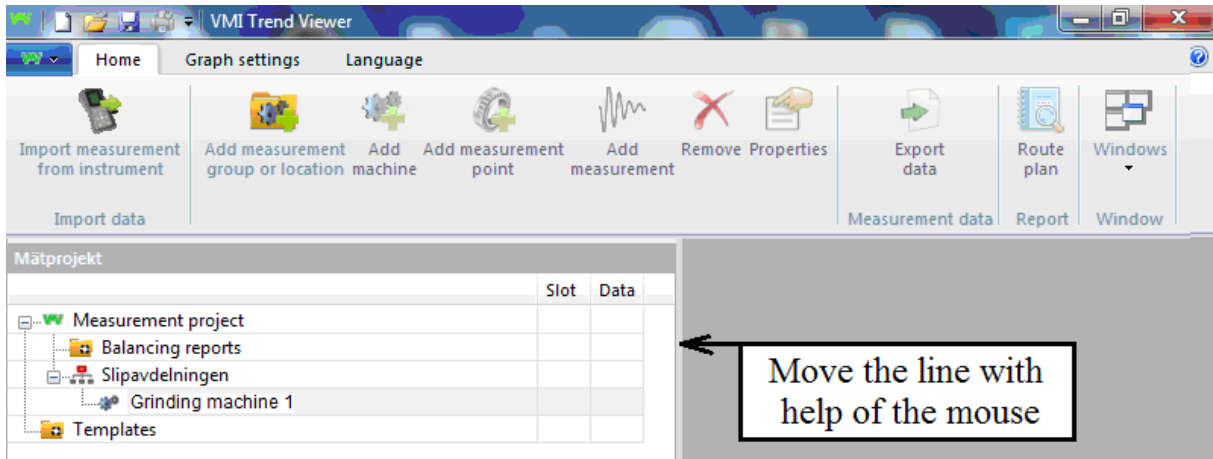
The screenshot shows the VMI Trend View software interface. The main window has a menu bar with 'Home', 'Graph settings', and 'Language'. Below the menu bar is a toolbar with icons for 'Import measurement from instrument', 'Add measurement group or location', 'Add machine', 'Add measurement point', 'Add measurement', 'Remove Properties', 'Export data', 'Route plan', and 'Windows'. The 'Add machine' icon is highlighted with a callout box labeled '1'. On the left side, there is a tree view under 'Mätprojekt' with 'Measurement project', 'Balancing reports', 'Grinding department', and 'Templates'. The 'Grinding department' is highlighted with a callout box labeled '2'. A dialog box titled 'Ny maskin' is open in the foreground. It has two text input fields: 'Name' with the text 'Grinding machine 1' and 'Description' with the text 'Electric motor free side'. A callout box labeled '3' points to the 'Name' field with the text 'Enter name and possibly comment'. A callout box labeled '4' points to the 'Next' button with the text 'Go ahead by press next'. At the bottom of the dialog box are four buttons: 'Previous', 'Next', 'Cancel', and 'Finish'.



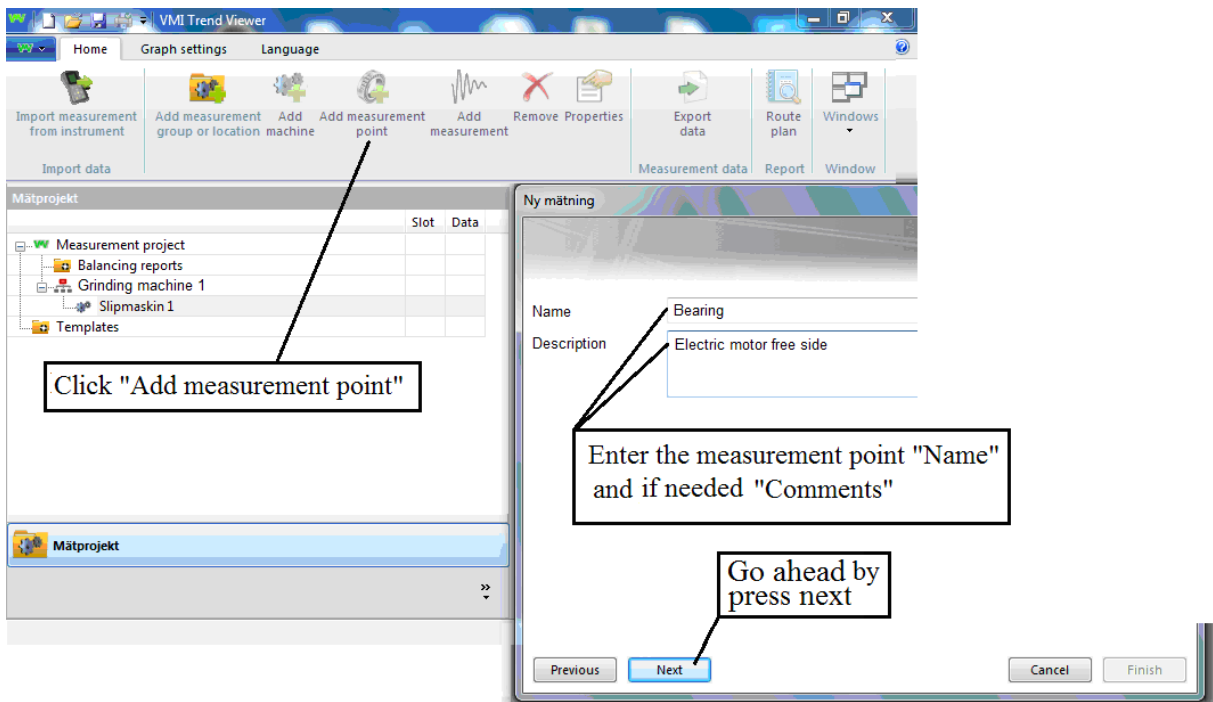


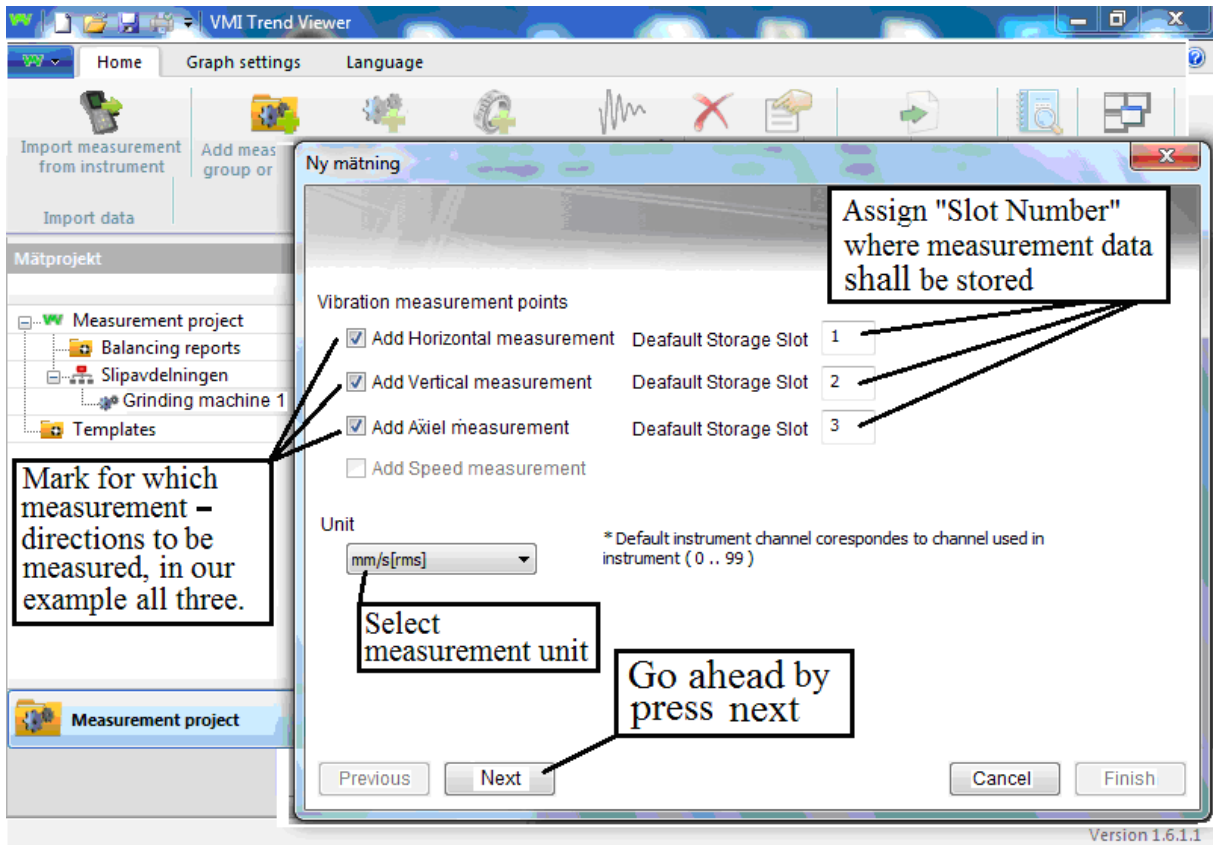


Mark "Grinding machine 1", drag the line to see "Slot" and "Data".



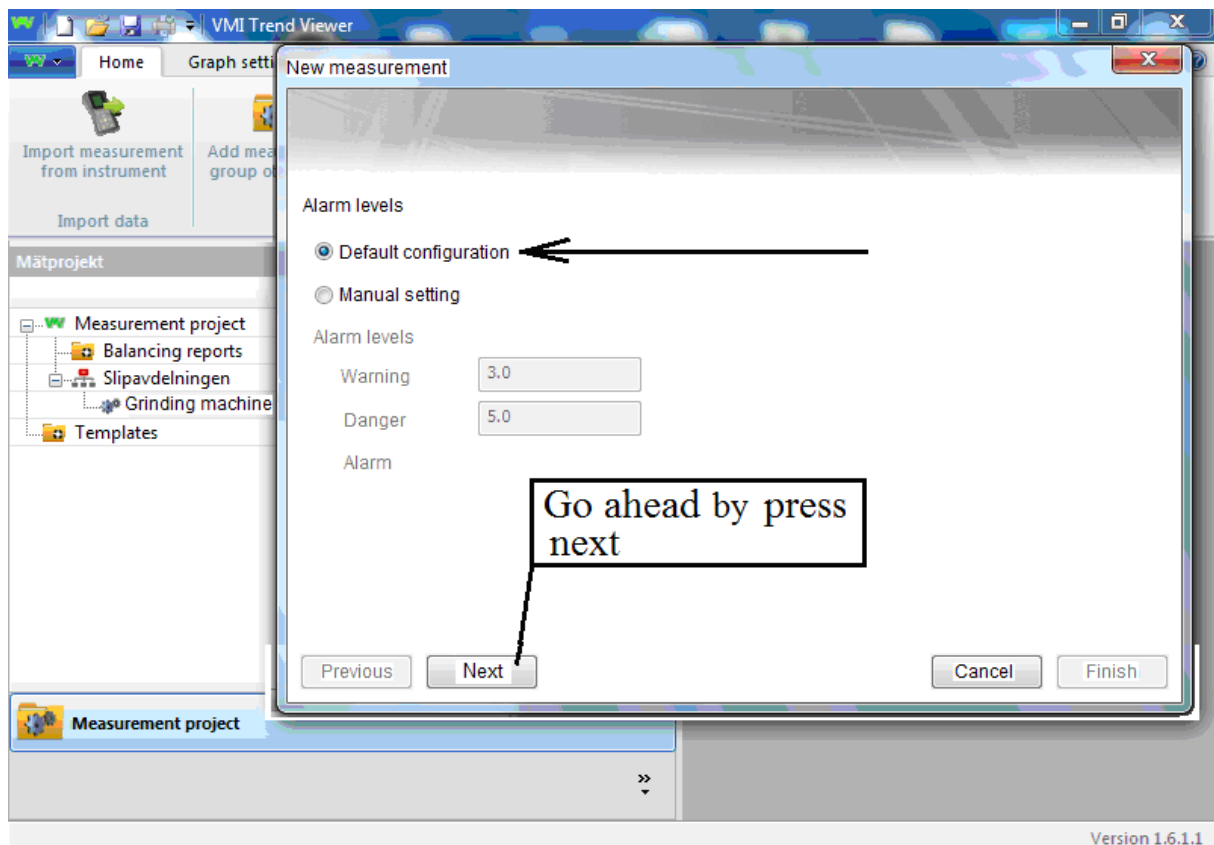
The next moment is to add a measurement point (usually a bearing). In this example we want to measure two bearings in three directions for each machine, and also the temperature.





Vibration and temperature are stored in different tables, so you can use the same numbers in the "slots" (Memory cells). You can skip the allocation of "Slot number" and, at a later time, perform an automatic sorting of storage slots locations (Auto Assign), see pages 56 - 58.

The next dialog box allows to select alarm levels, manually or from a standard table. In the example, the default values are choose.





New measurement

Bearing condition

Alarm levels

Warning	3.0	g(rms)
Danger	5.0	g(rms)
Alarm	7.0	g(rms)

Preset alarm levels

Go ahead by press next

Previous Next Cancel Finish

The graph shows a log-log plot of acceleration (g(rms)) vs. frequency (Hz). The y-axis ranges from 0.02 to 50, and the x-axis ranges from 1.0 to 500. Five horizontal lines represent different bearing conditions: CHANGE (red, ~10g), WORN (red, ~2g), USED (blue, ~0.5g), ACCEPTABLE (yellow, ~0.2g), and GOOD (green, ~0.1g). All lines show a positive slope, indicating that acceleration increases with frequency.

New measurement

Temperature measurement point

One temperature for each measurement point

One temperature for each measurement direction

Default Storage Slot

Select the desired option

Fill in the "Slot Number"

enhet

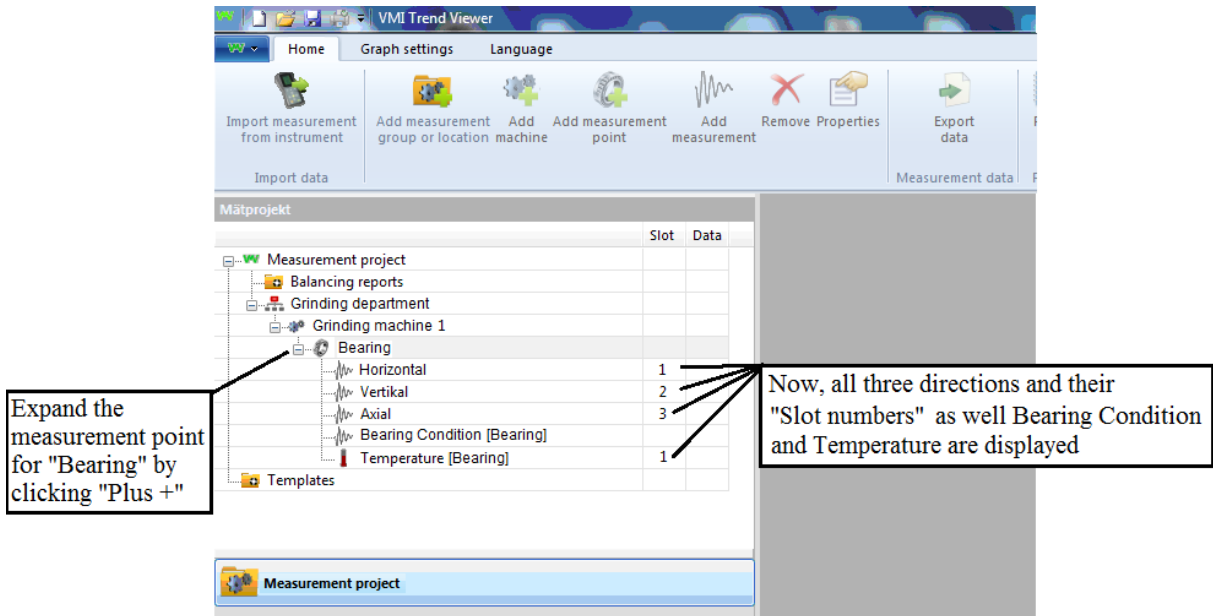
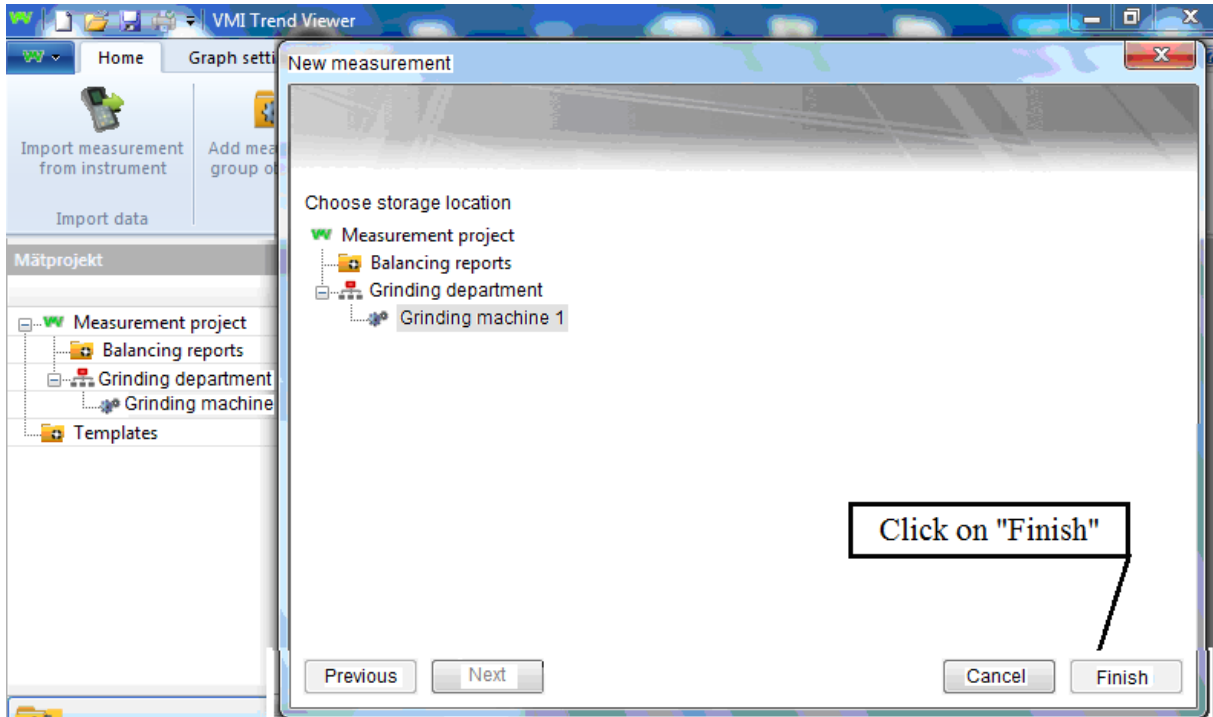
enhet °C

Select unit

Go ahead by press next

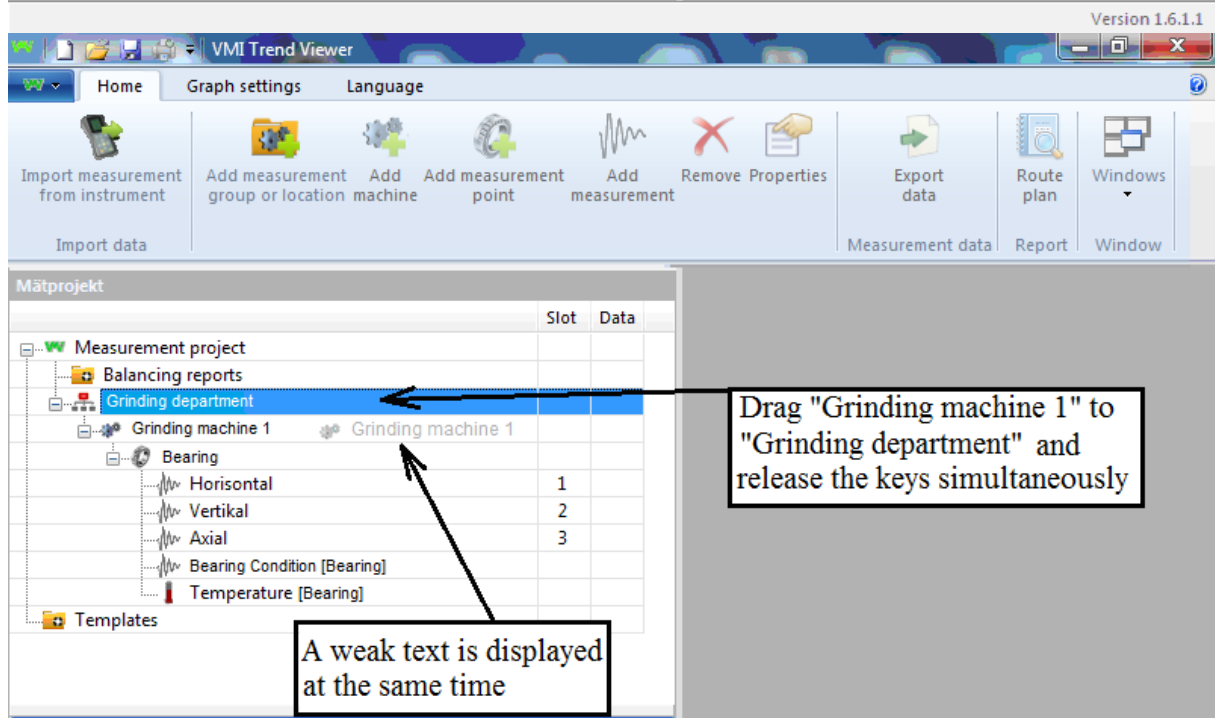
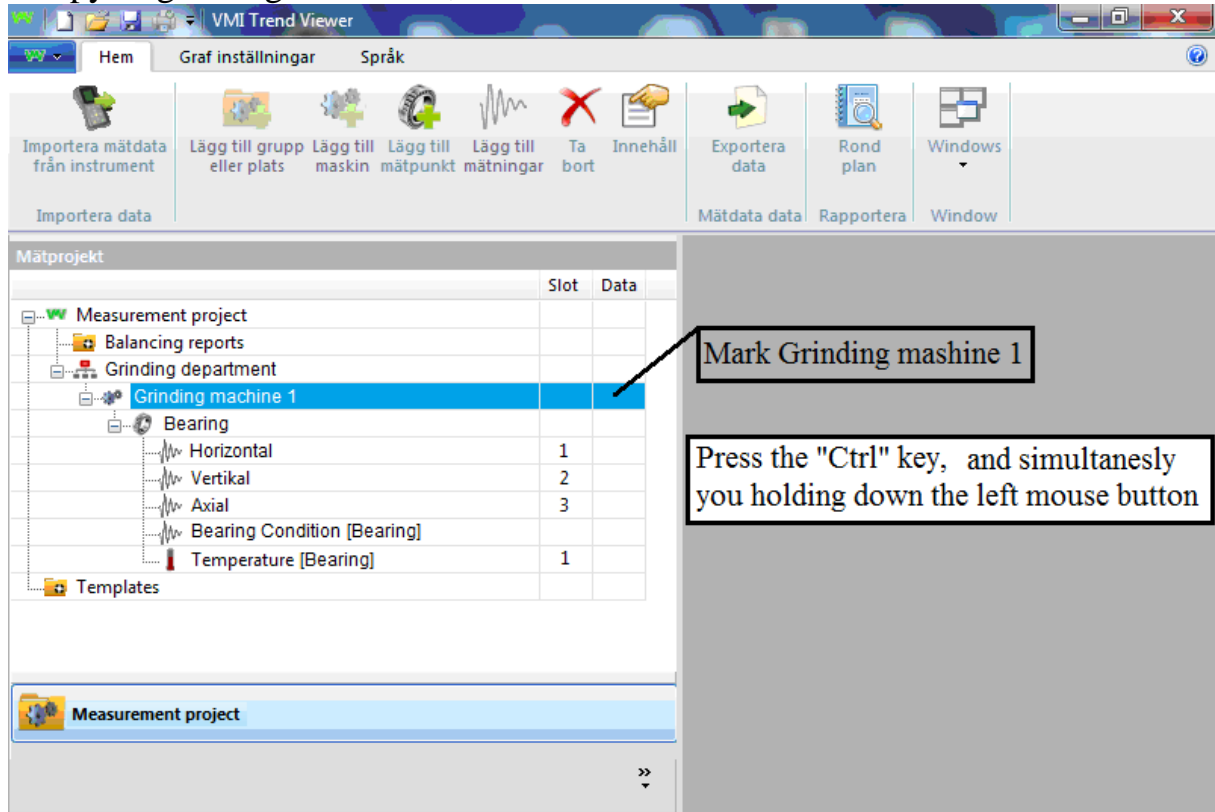
Previous Next Cancel Finish

Version 1.6.1.1





"Grinding machine 1" is finished. To create "Grinding machine 2" you can make a copy of grinding machine 1, and then edit it.





The screenshot shows the VMI Trend Viewer interface. The menu bar includes 'Hem', 'Graf inställningar', and 'Språk'. The toolbar contains icons for 'Importera mätdata från instrument', 'Lägg till grupp eller plats', 'Lägg till maskin', 'Lägg till mätpunkt', 'Lägg till mätningar', 'Ta bort', 'Innehåll', 'Exportera data', 'Rond plan', and 'Windows'. The main area displays a project tree under 'Mätprojekt' with columns for 'Slot' and 'Data'. The tree structure is as follows:

Measurement project	Slot	Data
Balancing reports		
Slipavdelningen		
Slipmaskin 1		
Lager		
Horizontal	1	
Vertikal	2	
Axial	3	
Lager kondition[Lager]		
Temperature [Lager]		
Slipmaskin 1(copy)		
Templates		

An arrow points to the 'Slipmaskin 1(copy)' entry. A text box on the right contains the text: "Now there is a copy of 'Grinding machine 1'". The version number 'Version 1.6.1.1' is visible in the bottom right corner.

The screenshot shows the VMI Trend Viewer interface with the menu bar set to 'Home', 'Graph settings', and 'Language'. The toolbar contains icons for 'Import measurement from instrument', 'Add measurement group or location', 'Add machine', 'Add measurement point', 'Add measurement', 'Remove Properties', 'Export data', 'Route plan', and 'Windows'. The main area displays a project tree under 'Mätprojekt' with columns for 'Slot' and 'Data'. The tree structure is as follows:

Measurement project	Slot	Data
Balancing reports		
Grinding department		
Grinding machine 1		
Bearing		
Horizontal	1	
Vertikal	2	
Axial	3	
Bearing Condition [Bearing]		
Temperature [Bearing]		
Grinding machine 1 (copy)		
Templates		

The 'Grinding machine 1 (copy)' entry is highlighted in blue. An arrow points to this entry. A text box on the right contains the text: "Mark the copy of 'Grinding machine 1' and right-click on it."

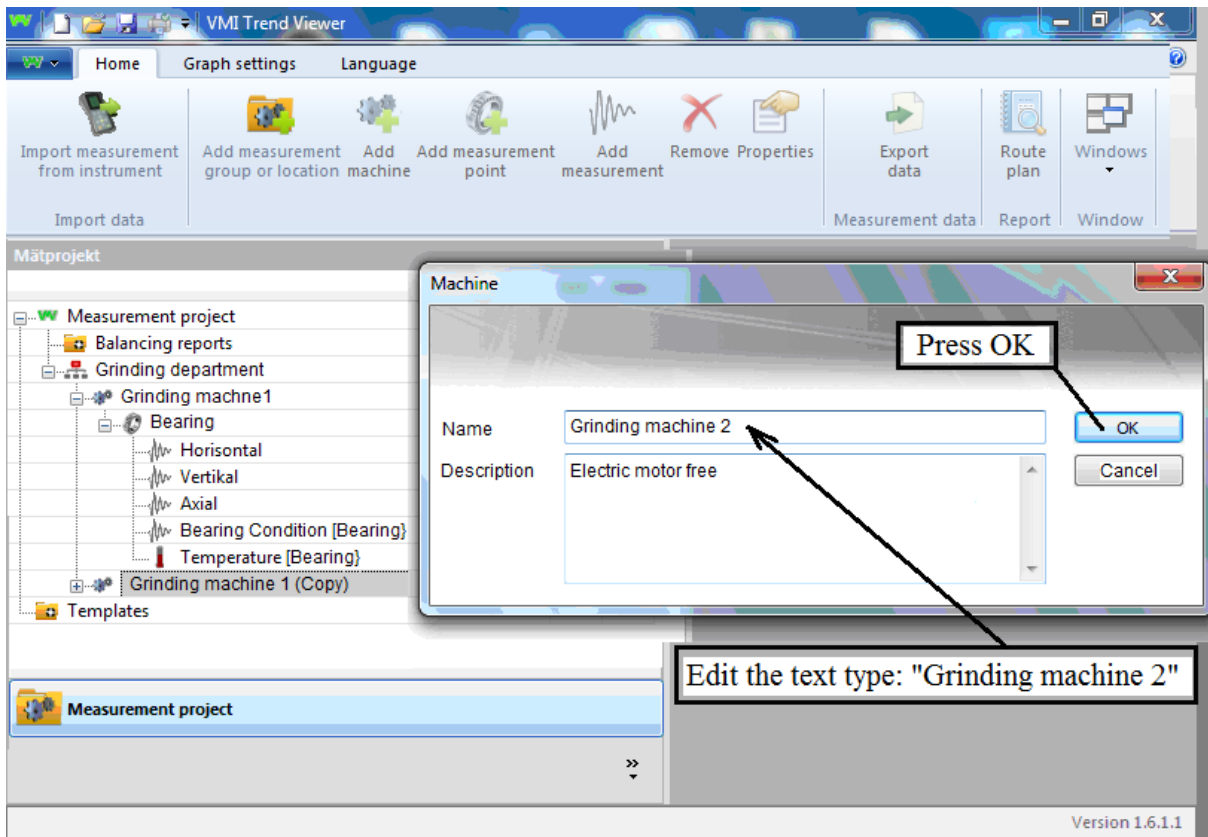


The screenshot shows the VMI Trend Viewer software interface. The top ribbon contains tabs for 'Home', 'Graph settings', and 'Language'. Below the ribbon is a toolbar with icons for 'Import measurement from instrument', 'Add measurement group or location', 'Add machine', 'Add measurement point', 'Add measurement', 'Remove Properties', 'Export data', 'Route plan', and 'Windows'. The main area is divided into a left sidebar and a central workspace. The sidebar shows a tree view of the measurement project structure. A table below the tree view lists the data points.

	Slot	Data
Measurement project		
Balancing reports		
Grinding department		
Grinding machine1		
Bearing		
Horizontal	1	
Vertikal	2	
Axial	3	
Bearing Condition [Bearing]		
Temperature [Bearing]		
Grinding machine 1 (copy)		
Templates		

A context menu is open over the 'Grinding machine 1 (copy)' item. The menu items are: Add measurement group, Add machine, Add measurement point, Add measurement, Delete, View trend, Export, Sort storage slots, Route plan (Ctrl+Shift+P), Move up, Move down, Create template from machine, and Properties. A callout box with an arrow points to the 'Properties' option.

Select "Properties" from the dialog





We now need to assign "Grinding machine 2" slot number (Storage locations).

The screenshot shows the VMI Trend Viewer software interface. The main window displays a measurement tree under the heading "Mätprojekt". The tree includes several measurement groups: "Horizontal", "Vertikal", "Axial", "Bearing Condition [Bearing]", and "Temperature [Bearing]". Under "Bearing Condition [Bearing]", there is a sub-entry "Grinding machine 2" which is currently selected and highlighted in blue. To the right of the tree is a table with columns "Slot" and "Data".

	Slot	Data
Horizontal	1	
Vertikal	2	
Axial	3	
Bearing Condition [Bearing]		
Grinding machine 2		
Bearing		
Horizontal		
Vertikal		
Axial		
Bearing Condition [Bearing]		
Temperature [Bearing]		

A context menu is open over the "Grinding machine 2" entry. The menu items are: "Add measurement group", "Add machine", "Add measurement point", "Add measurement", "Delete", "View trend", "Export", "Sort storage slots", "Route plan" (with a keyboard shortcut "Ctrl+Shift+P"), "Move up", "Move down", "Create template from machine", and "Properties".

Two callout boxes provide instructions:

- The first callout box, pointing to the "Grinding machine 2" entry, contains the text: "Mark 'Grinding machine 2' and right-click with the mouse, a new dialog box appears."
- The second callout box, pointing to the "Sort storage slots" menu item, contains the text: "Select 'Sort storage slots'"



VMI Trend Viewer

Home Graph settings Language

Import measurement from instrument | Add measurement group or location | Add machine | Add measurement point | Add measurement | Remove Properties | Export data | Route plan | Windows

Import data | Measurement data | Report | Window

Mätprojekt

	Slot	Data
Horizontal	1	
Vertikal	2	
Axial	3	
Bearing Condition [Bearing]		
Temperature [Bearing]		
Grinding machine 2		
Lager		
Horizontal		
Vertikal		
Axial		
Bearing Condition [Bearing]		
Temperature [Bearing]		
Templates		

Sortera slots

1. Mark "Vibration slots"

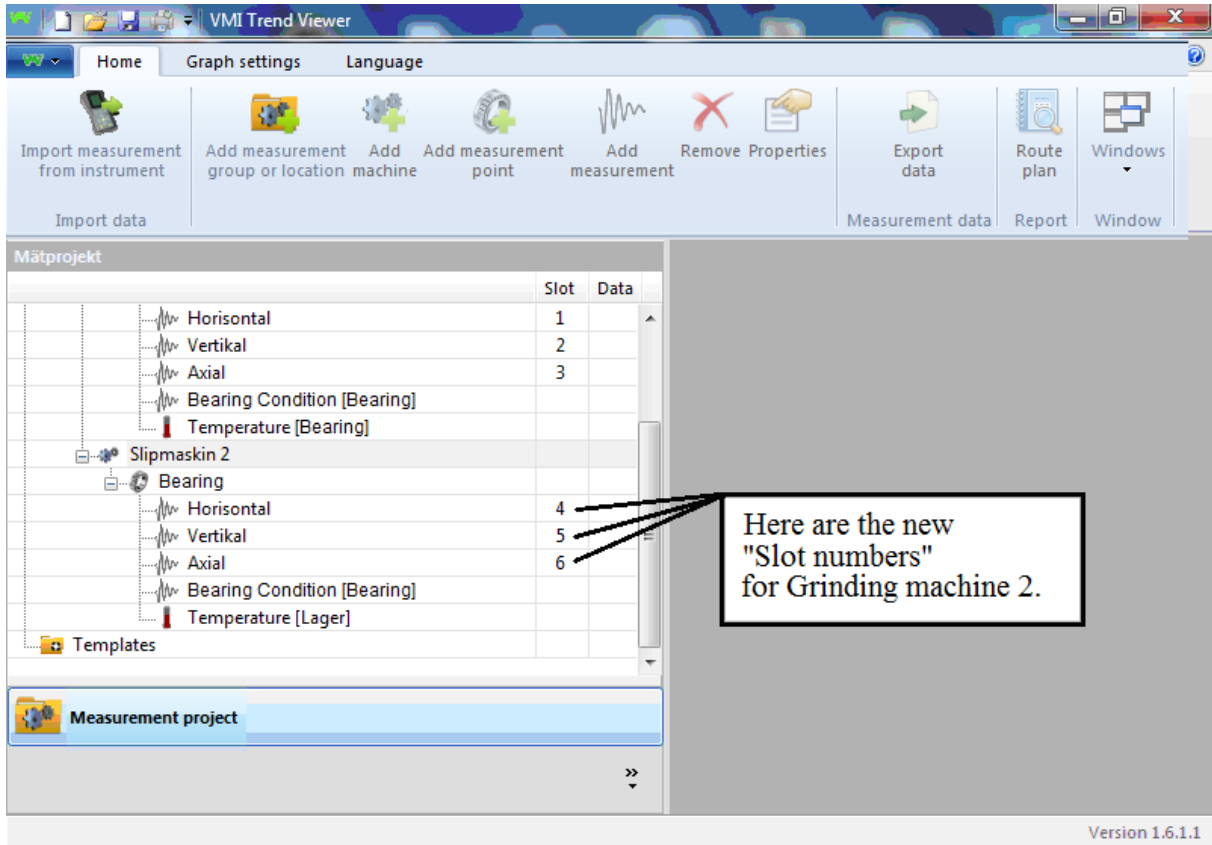
Vibration slots | Temperatur slots

Name	Objekt
Assigned slot	
1 Horizontal	Grinding machine 2 \Bearing
2 Vertical	Grinding machine 2 \Bearing
3 Axial	Grinding machine 2 \Bearing
Allocate slot	
1 Horizontal	1 Grinding machine 1 \Bearing
2 Vertical	2 Grinding machine 1 \Bearing
3 Axial	3 Grinding machine 1 \Bearing
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	

3. Click on OK

OK | Cancel | Move up | Move down | Assign | Unassign | Auto assign

2. Click on "Auto assign"



Repeat the sorting procedure also for temperature.

Thus, the first "project" is finish and you can now start measuring on the machines and then transfer measurement data to "Trend View".



10.2 Create a "Route Plan" and edit a project

The screenshot shows the VMI Trend Viewer software interface. The main window displays a project tree on the left under 'Mätprojekt'. The tree includes 'Measurement project', 'Balancing reports', 'Grinding department', 'Grinding machine 1', 'Bearing', 'Horizontal', 'Vertikal', 'Axial', 'Bearing Condition [Bearing]', 'Temperature [Bearing]', 'Grinding machine 2', and 'Bearing'. A context menu is open over the 'Bearing' node, listing options: 'Add measurement group', 'Add machine', 'Add measurement point', 'Add measurement', 'Delete', 'View trend', 'Export', 'Sort storage slots', 'Route plan' (with keyboard shortcut 'Ctrl+Shift+P'), 'Move up', 'Move down', and 'Properties'. Three callout boxes provide instructions: one points to the 'Route plan' option, another to the 'Properties' option, and a third explains the 'Export' function.

One can retrieve and print a list (Route Plan) that shows where the measurement points are located, and as a reminder list.

Select the department where the measurement is to be performed and right-click, select "Route plan" from the dialog box.

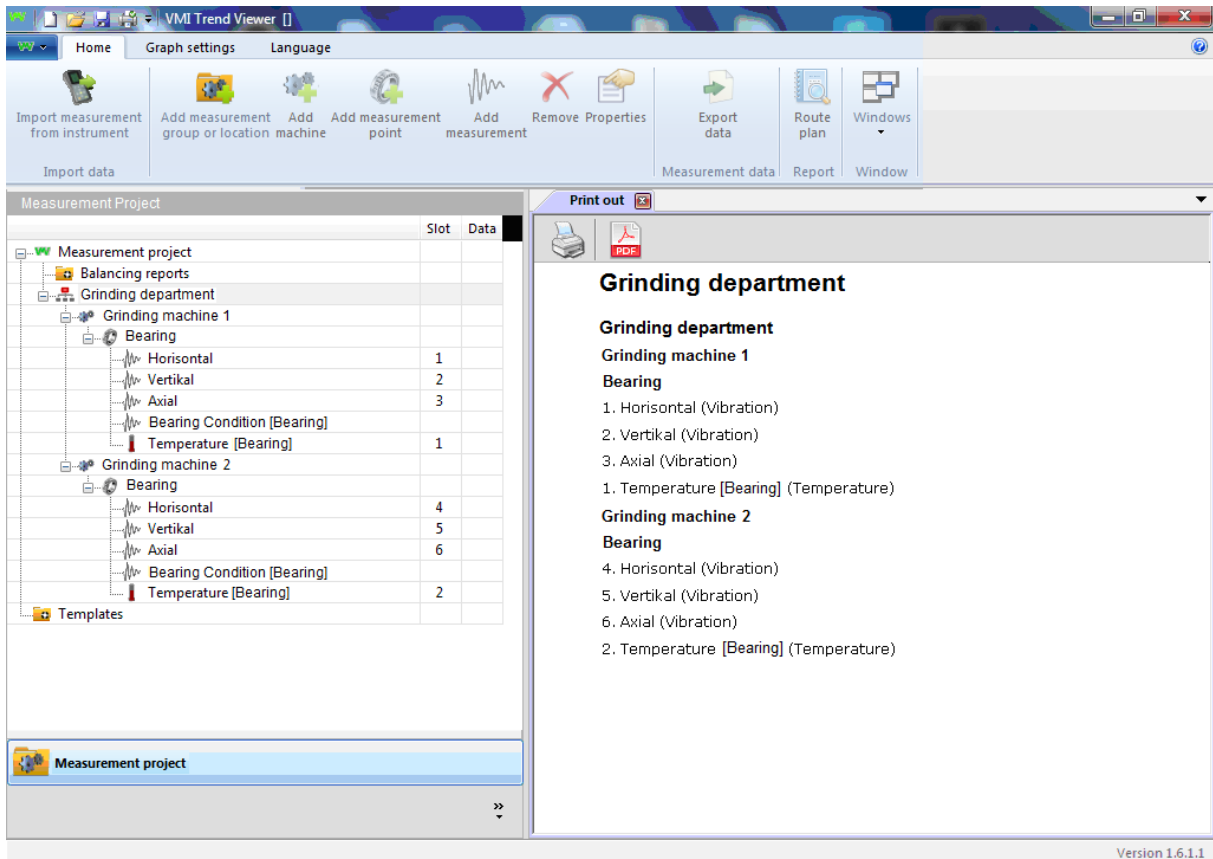
You can "export" measurement data to excel if you want to do some form of documentation.

Select "Properties" If you want to edit

We recommend to print out a route plan and used every time same machines are measured. Make the route plan based on how often the machines should be measured, such as week, month, half year etc.



When selecting "Route plan", a list appears to the right in the picture, that can be printed out.



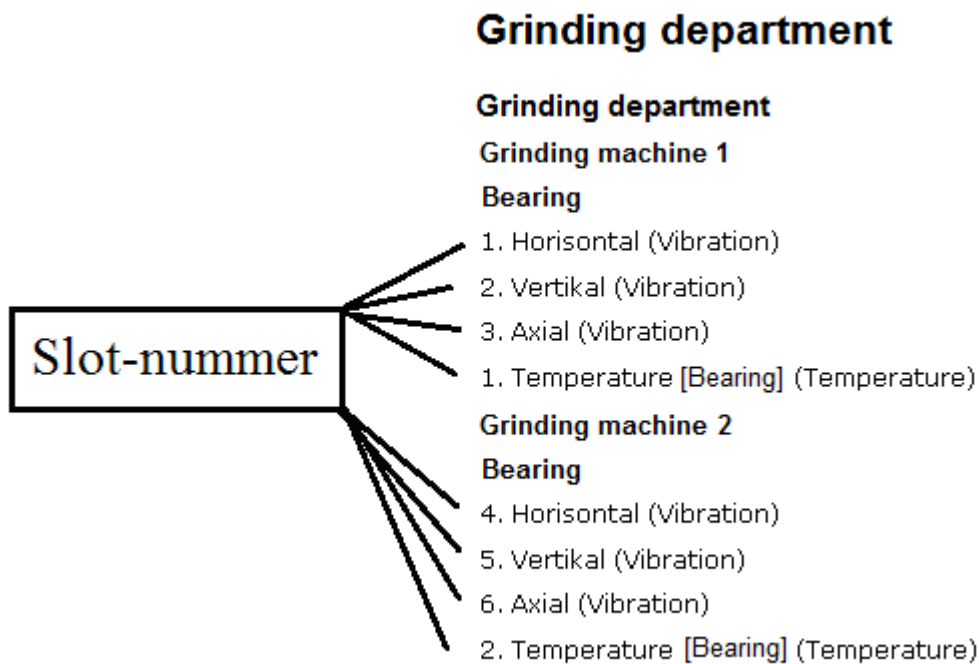
Save all Route plans in a binder.



10.3 Trend measurements


Perform the project (database) with the machines you want to measure within the same interval, (weekly, monthly, etc.).

Mark the machines according to the printed list:





Each new measurement performed on the same machine must be stored in the same "slot number" (memory cell) as the previous measurement. **Before a new measurement is performed, first the previous measurement must be transferred to the "Project" in Trend View.**




Press the SAVE key  to save a measurement, and the vibration storage table appears on the instrument display:


Vibration	
1	15,71 0,12
2	
3	
4	
5	

 Vibration (mm/s)
 Bearing Condition (BC)

If you want to place the measurement value in "slot number 1" confirm with the

green key.  If you want to move the measurement value to another slot number, use the arrow keys. When measurement of "temperature", shows the Temp table:

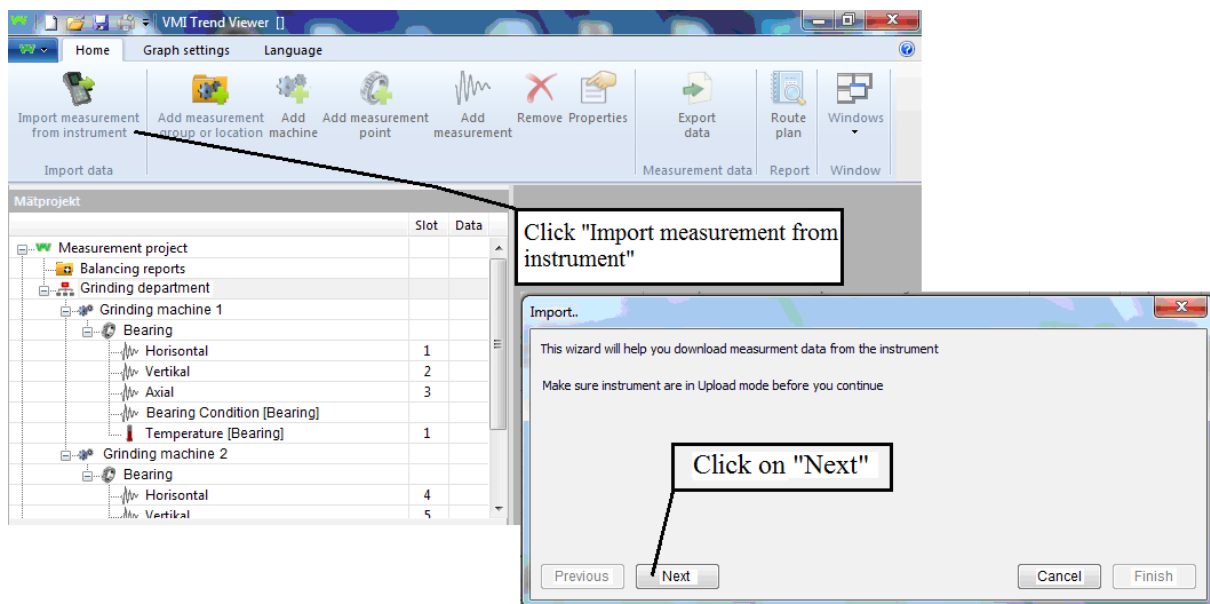
Temp.	
1	27,0
2	
3	
4	
5	
6	
7	
8	
9	
10	

 Temp-value C°

10.4 Transfer of data to Trend View

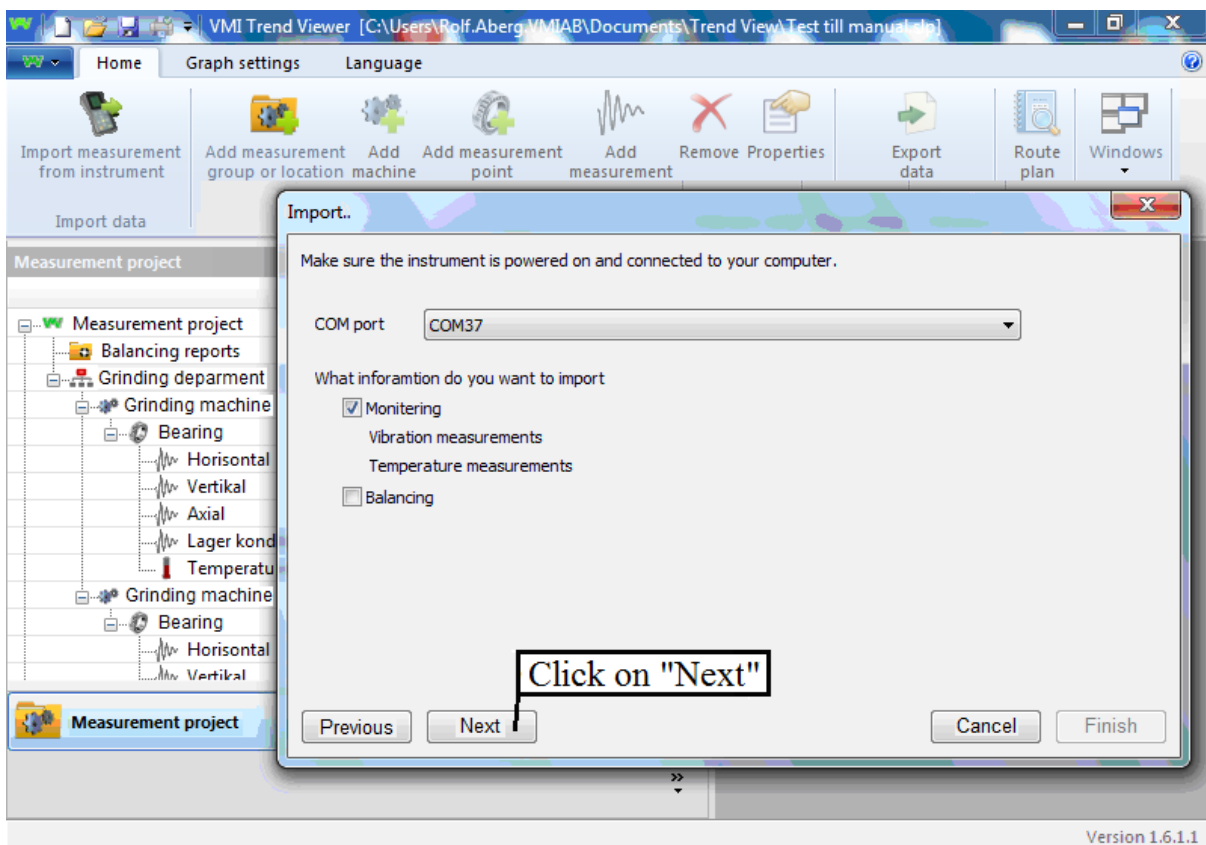
When each measurement in a route is complete, measurement data must be transferred to the “**Trend View**” computer software. Note. It is important that you make the "transfer" in the correct order, see below.

- 1) Connect "(USB - 3.5mm plug)- cable" to the instrument "Serial data connector" (This is the same connector as the headphones, see page 7), and the USB side to the computer's USB input. You must verify that the correct serial port is selected by the computer (If a problem occurs, see the special installation instructions for the PC software.
- 2) Start the **VIBER X3™** instrument, and select "Upload" from the function menu.
- 3) Open "Trend View" and select "Import measurement data from instrument"



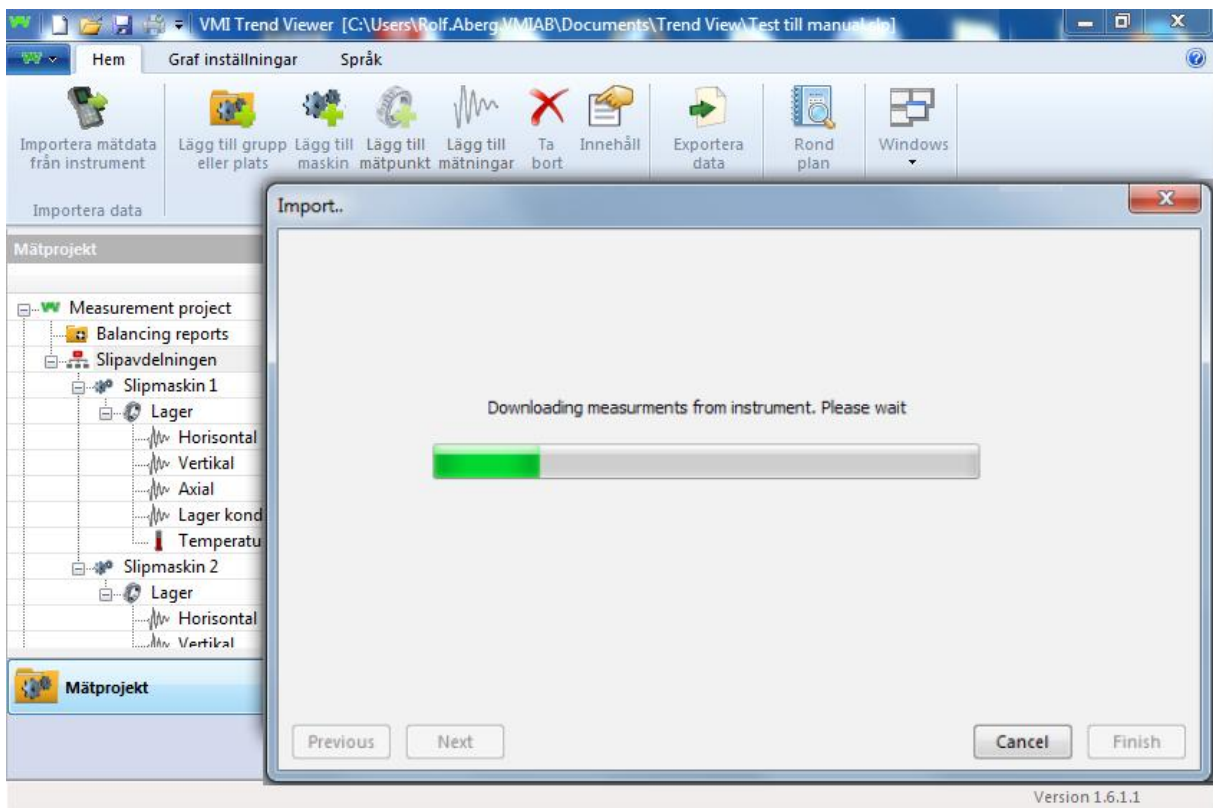


Note. The **VIBER X3™** instrument must be "on" and upload must be selected from the function menu, confirm with the green key. A rotating symbol appears on the screen. In this mode, you continue in "Trend View" by clicking "Next" in the dialog box.



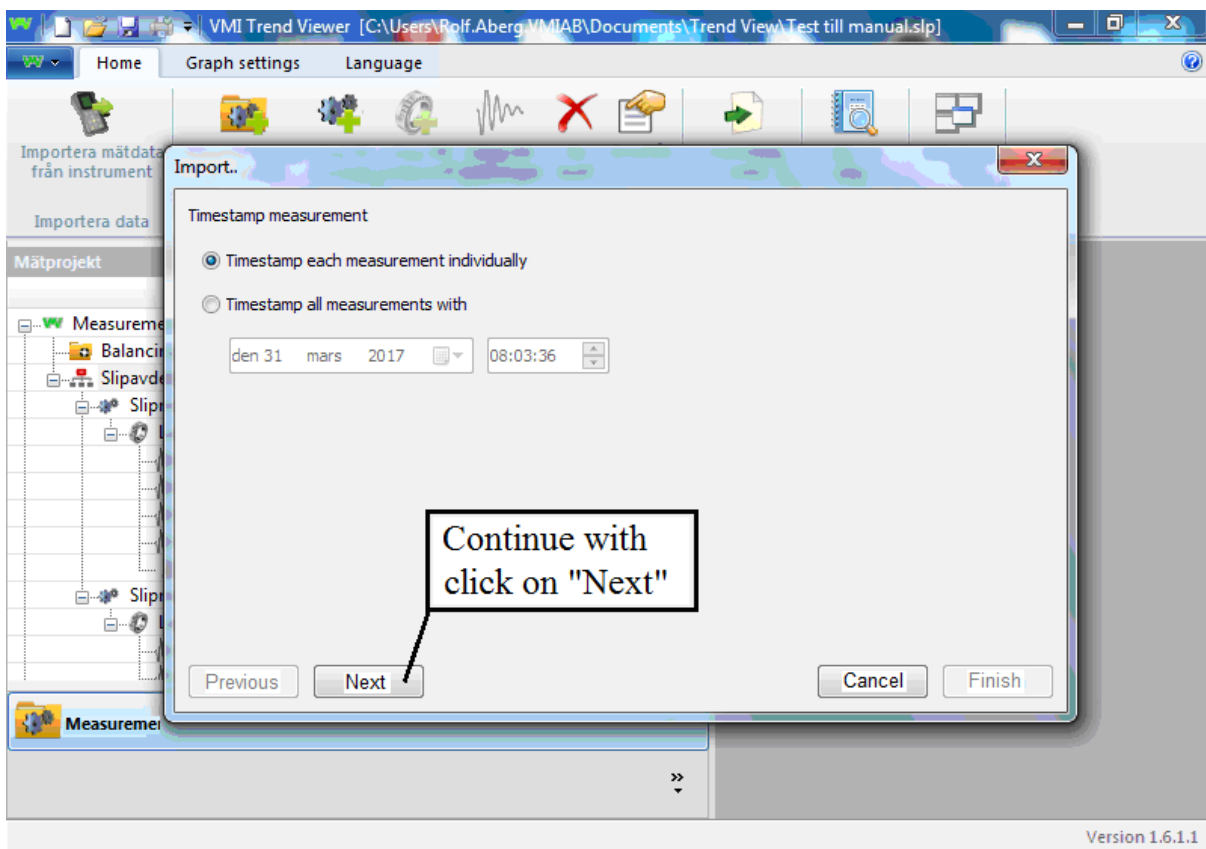


Wait a while, and the transfer procedure will start.





Since the instrument does not store times when the **measurement was performed**, but only time **for the transfer**, you have to change the date manually. If you want to save the times when the measurement was performed select: "**Timestamp each measurement individually**".





Here shows all **vibration data** from the first measurement.

The screenshot shows the VMI Trend Viewer interface. The 'Import..' dialog box is open, displaying a table of measurement data. The table has four columns: 'Timestamp', 'Measurement (mm/s[rms])', and 'Target'. The 'Unit' is set to 'mm/s[rms]'. The table contains three rows of data:

	Timestamp	Measurement (mm/s[rms])	Target
1	2017-03-31 08:31:03	23.729223	Horizontal
2	2017-03-31 08:31:03	23.590397	Vertikal
3	2017-03-31 08:31:03	4.730167	Axial

A callout box with an arrow pointing to the 'Timestamp' column contains the text: "You can manually change the date of the measurements." The dialog box also includes 'Previous', 'Next', 'Cancel', and 'Finish' buttons.

Version 1.6.1.1



Here shows all **temperature data** from the first measurement.

The screenshot shows the VMI Trend Viewer interface. The 'Import..' dialog box is open, displaying a table with the following data:

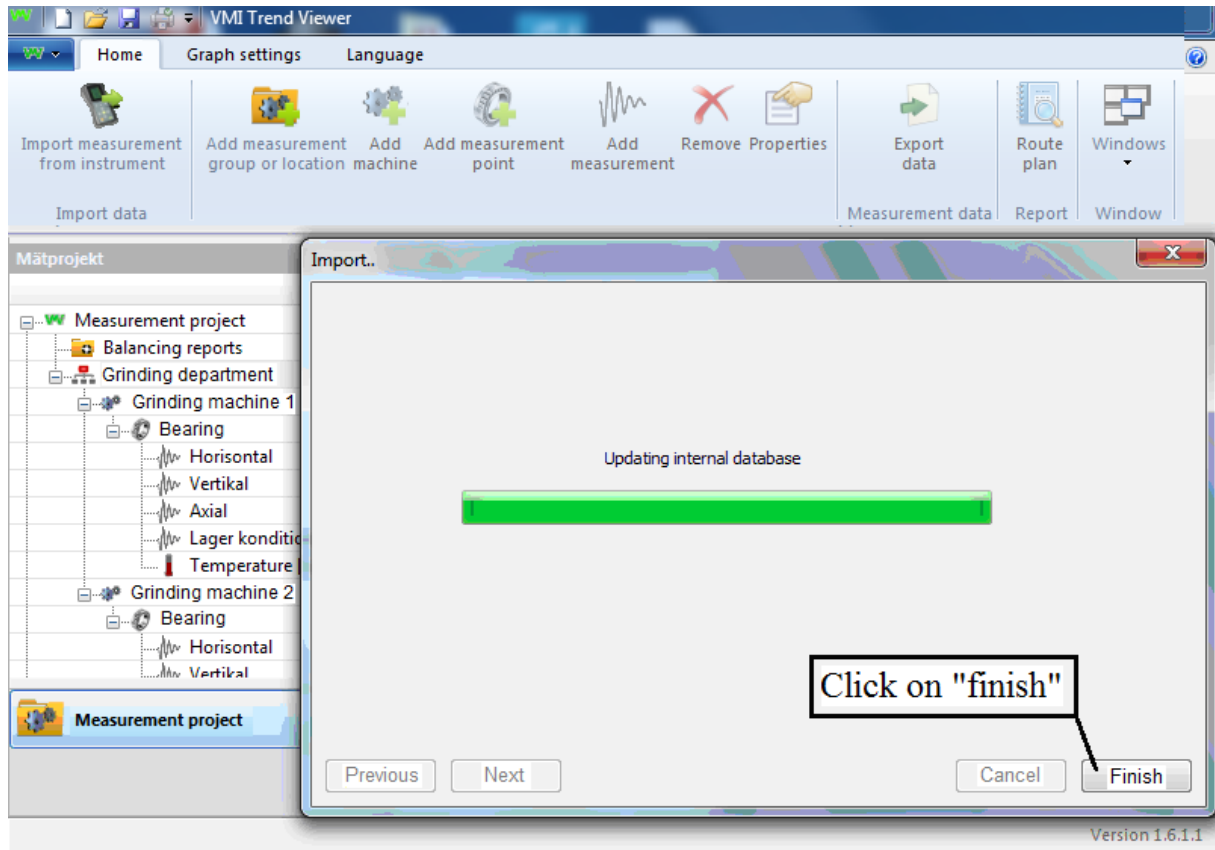
	Timestamp	Measurement (°C)	Target
1	2017-03-31 08:41:19	22.1	Temperature [Lager]

At the bottom of the dialog box, there are four buttons: 'Previous', 'Next', 'Cancel', and 'Finish'. A callout box with the text 'Continue with click on "Next"' points to the 'Next' button.

Version 1.6.1.1

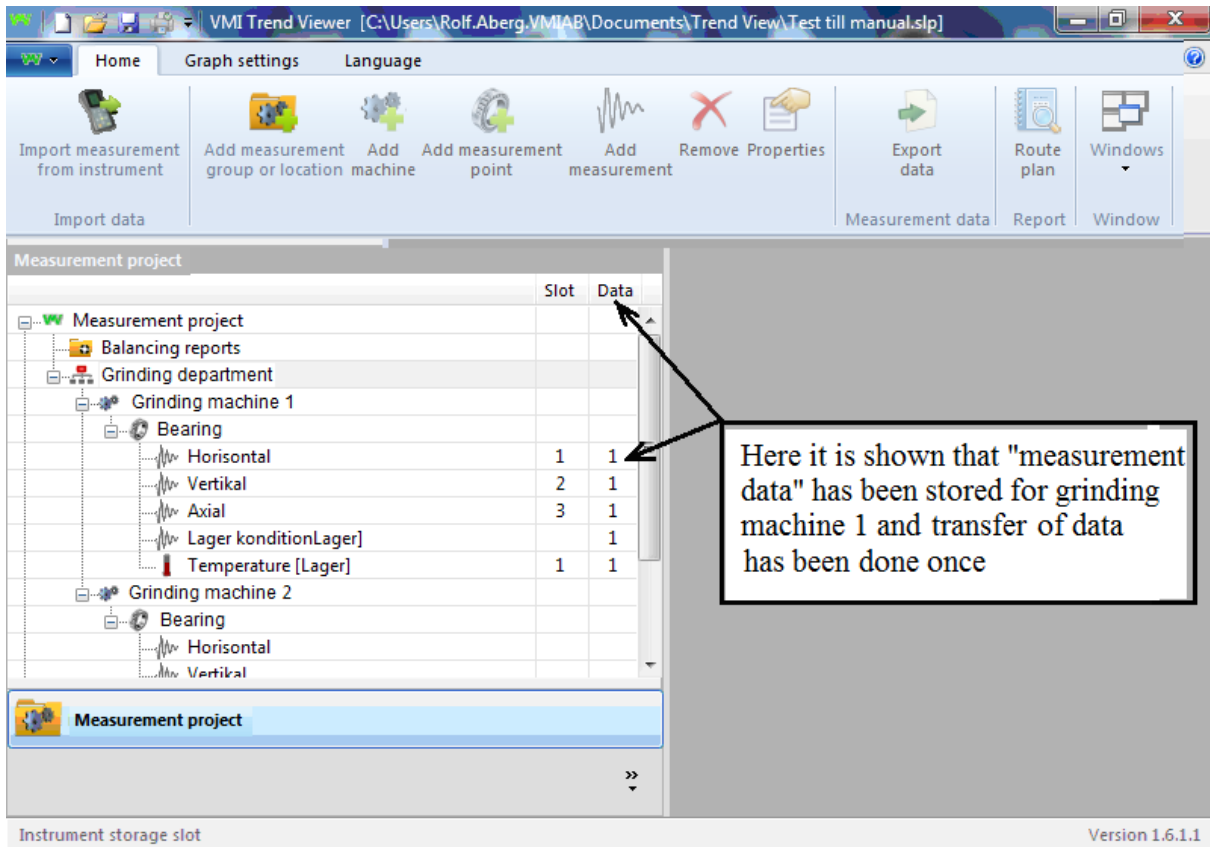


Data is transferred to the project,





Transmission of measurement data for "Grinding machine 1" is now complete. In order to see a graph showing the trend, at least two "2" measurements, at different times, must be performed and transferred to the project.



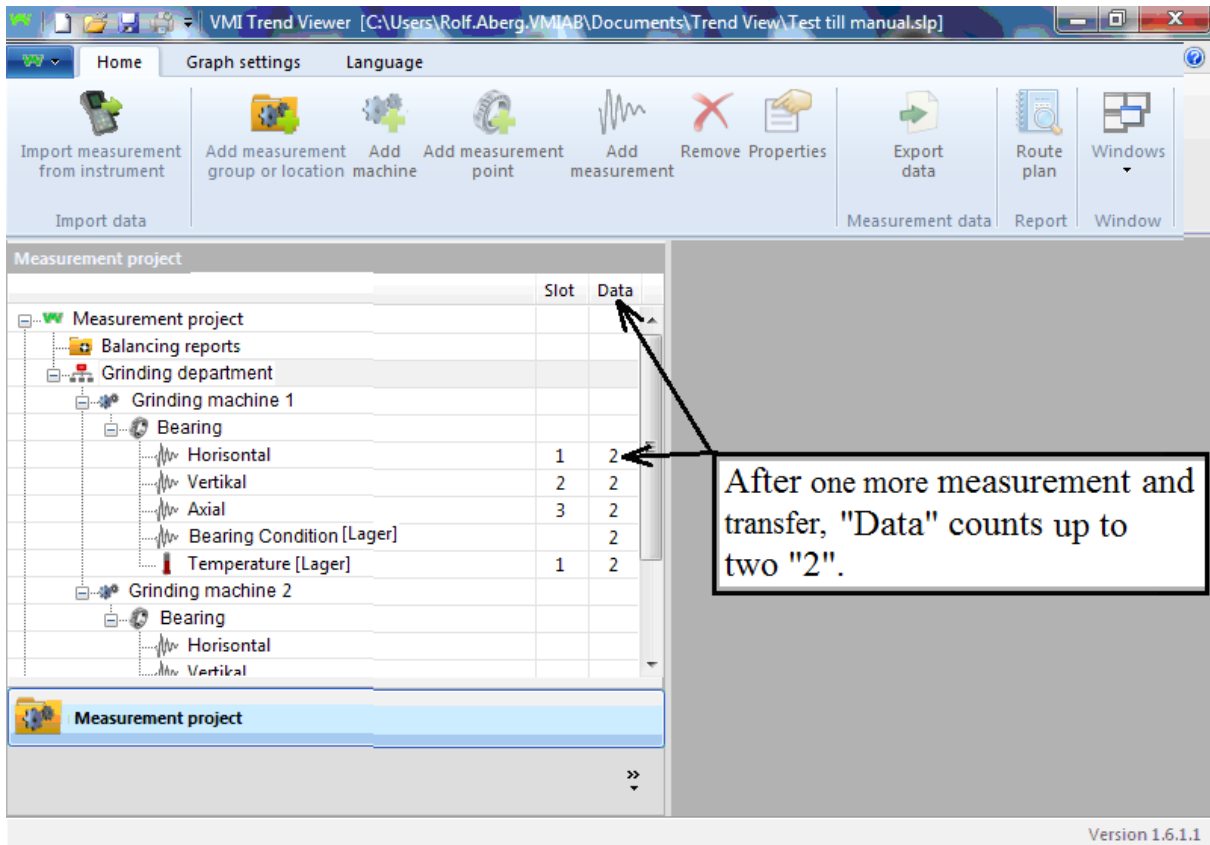
Slot nr: för vib. BC	Measurement No 1		Slot nr: för Temp
	Vibration	V = mm/s B.C = g-value	Temp.
Horizontal	1	23,73 0,24	1
Vertical	2	23,59 0,09	2
Axial	3	4,73 0,10	3
	4		4
	5		5
			6
			7
			8
			9
			10

Data for vibrations and temperature are stored in different tables and may therefore have the same "Slot number"

Where to find these menus in the instrument, see page 12.



After the second measurement for the same machine, the new measurement values are stored in the same "Slot-places" as before, in our case: 1, 2, 3 for vibration and slot: 1 for temperature.

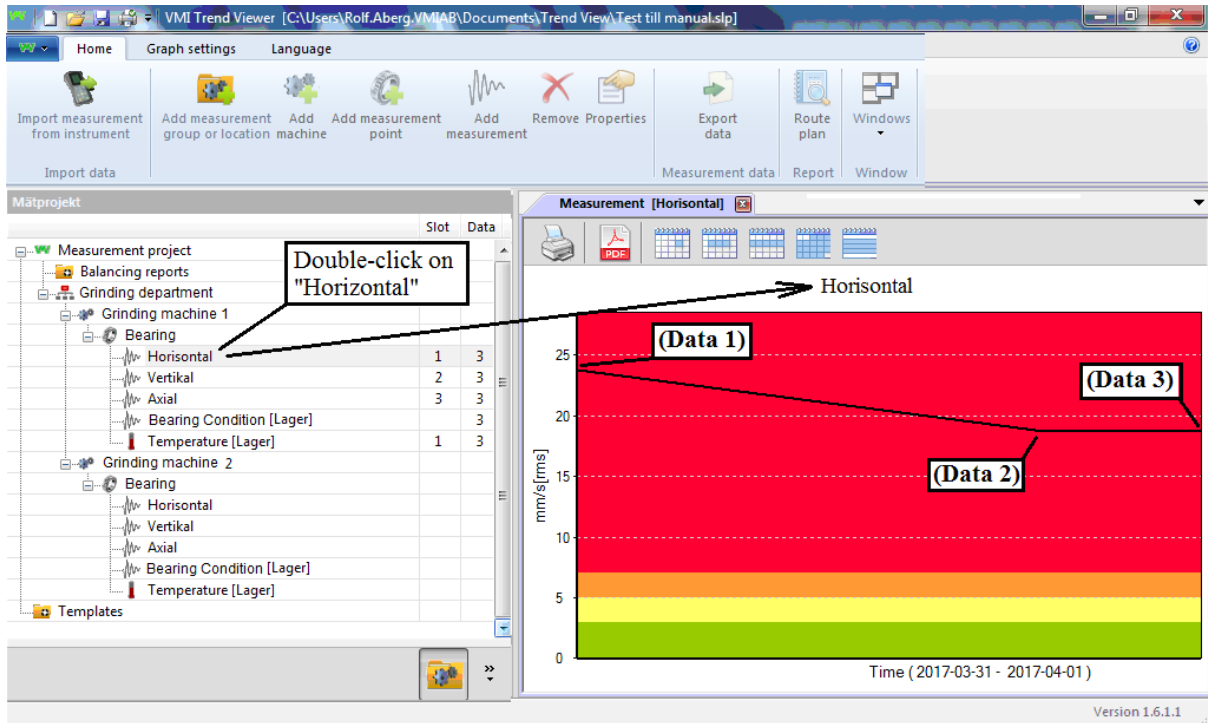


Slot nr: för vib. BC	Measurement No. 2		Slot nr: för Temp
	Vibration	V = mm/s B.C = g-value	Temp.
Horizontal	1 18,75 2 0,12		1 23,0
Vertical	2 20,46 3 0,09		2
Axial	3 2,28 4 0,06		3
	4		4
	5		5
			6
			7
			8
			9
			10

Data for measurement number 2 is stored on the same slot number as before for the same machine.



To see a "Graph", double-click on the vibration direction or temperature you want to see. The graph below shows "measurement data" after three measurements (those blue-marked in horizontal direction) and after three data transfers.



Slot nr: för vib. BC	Measurement No. 3		Slot nr: för Temp
	Vibration	$V = \text{mm/s}$ $B.C = g\text{-value}$	Temp.
Horizontal	1	18,75 0,12	1 23,0
Vertical	2	20,46 0,09	2
Axial	3	2,28 0,06	3
	4		4
	5		5
			6
			7
			8
			9
			10

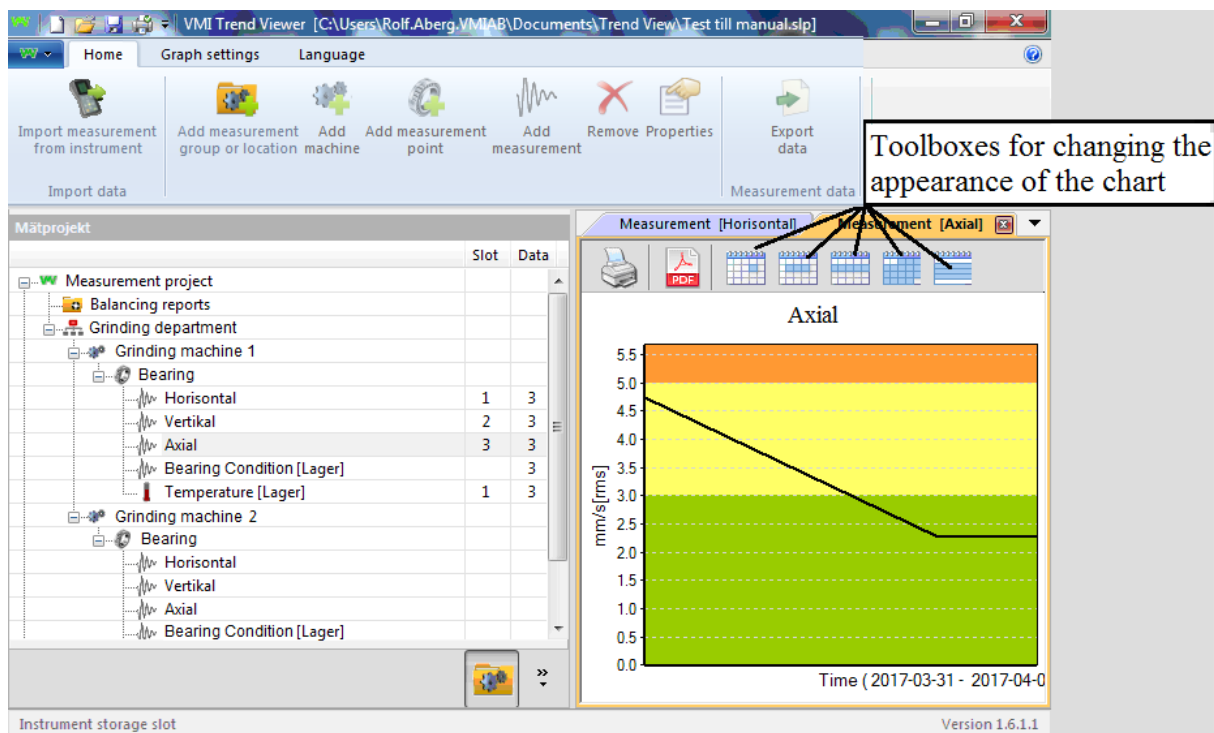
Data for measurement number 3 is stored on the same slot number as before for the same machine.

10.5 General description and viewing trends

After all measurements are saved, you can choose to study a graph to see any change of the vibration.

To see the "Trend chart", select and double-click the project tree and the direction you want to study.

The window that shows the graph is automatically adjusted according to the number of measurements performed. To change the window view, use the "toolboxes" in the chart header.



Properties can be used to change units in the chart, all measurement points can be expressed in the following units: Vibration (mm/s), Acceleration (m/s^2) or expressed as a g-value, and displacement (μm).

If the Trend measurement shows a large change in vibration or Bearing Condition, then you should measure the machine for shorter intervals.



Technical data VIBER X3™

Vibration	Accelerometer	Standard nom 100 mV/g	(Selectable sensitivity in the instrument) 0,1 - 99999 mV/g
Input amplitude range	Vibration	Max 50 g RMS	With other sensor up to 500 g and 50gBC
	Bearing condition	Max 5 gBC	
Dynamic range	80 dB (159,16 Hz with auto ranging)		
Frequency range	Vibration	2 - 400 Hz 10 - 1000 Hz 6 - 1600 Hz 11 - 3200 Hz	Note 1
	Bearing condition	0,5 to 16 kHz	
Vibration units	g-value, m/s ² , mm/s, in/s, μm, mils		Note 2
Amplitude presentation	RMS, Peak, Peak-Peak		Note 2
Analysis	Five highest peaks can be displayed		VMI Trend View Software included for PC
Frequency range of peak detection	Frequency range		Note 3
	2 - 400 Hz		
	6 - 1600 Hz		
	11 - 2000 Hz		
	10 - 1000 Hz		
Storage capacity	100 measurements can be stored		
Three-point balancing	10 balancing results can be stored		
Communication interface	USB 2.0		
Sound frequency Filter enabled	60 Hz - 10 kHz	+26 dB to -4.1 dB	
	500 Hz - 10 kHz	+26 dB to -4.1 dB	
Temperature sensor Range	Built-in infrared sensor		
	-20 to +120°C		
Accuracy	Vibration	± 3 %	Note 4
	Bearing condition	± 5 %	Note 4a
	Frequency/RPM	± 0.2 Hz / ± 30 RPM	
	Temperature		Note 4b
Battery	Rechargeable Lithium	2300 mA/h, max 60°C	Note 5
Operating time	1 week normal use		Note 6
External charger	5,0 V regulated @2000 mA		
LCD display	B&W 64 x 120 pixels with background light		Note 7
Enclosure protection	IP65		
Operating temp. range	0 to 50°C		Note 8
Weight	415 gram		Note 9
Size	(L x W x H)		165mm x 80mm x 50mm



VMI declares that the **VIBER X3™** is manufactured in conformity with national and international regulations.

The system complies with, and is tested according to, following requirements:

EMC Directive:	2004/108/EC
Low Voltage Directive:	2006/95/EC



Vibration Measurement Instrument International AB (VMI)

- Note 1** User selectable, between Hz and RPM.
When measuring displacement with an accelerometer is the lowest measurable frequency 3 Hz.
- Note 2** User selectable.
- Note 3** Same as "frequency range", except for 11-3200 Hz range, where peak detection ends at 2000 Hz.
- Note 4** Full scale is 50g for acceleration other units are frequency dependent.
- Note 4a** Over 0.15 gBC.
- Note 4b** Emissivity factor must be set in accordance with the target surface.
- Note 5** Capacity of the batteries can vary depending on hardware revision. Max 2300 mAh. (storage temp. -20 to max 60°C).
- Note 6** Operating time depends on backlight, volume level and batteries used. Backlight adds 40mA and the sound volume up to 150 mA. Charging time is approx: 6-12 hours.
- Note 7** Operating temp. min 0°C to max 50°C, storage temp. max 72°C.
- Note 8** The restriction concerns display.
- Note 9** Instrument, including battery and transducer.

OBS.

If you change to another accelerometer, then you have to change the sensitivity (mV/g). This is done in the menu under "Transducer".



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