VibChecker

User Guide

NB. Important instructions and technical specifications for the Ex version of VibChecker, see Instruction 71919B.

This instruction covers technical specifications for the non-Ex version only. Operating instructions and functionality are identical for both versions.

SPM®

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Contents

Introduction

This User Guide contains useful information about the VibChecker, describing the hands-on use of the instrument and how to confirm and evaluate measurement results. References to icons, displays and modes in the instrument are in bold text. References to instrument buttons are in capital letters.

Condition based maintenance

Condition Based Maintenance is by now a widely accepted concept in industry. The idea is simple and not new: keep plant machinery in good working condition by locating and repairing minor faults before they grow large enough to cause expensive breakdowns and production stops.

The challenge is to assess machine condition and detect a slow deterioration long before a piece of plant grinds to a shuddering halt. In the past, a skilled operator could do this largely without the help of instruments, by listening, touching, smelling. Modern machinery is often unattended, soundproofed, out of easy reach. It rotates faster and is less massively constructed, which means that even a minor deterioration of its working condition can have very serious consequences. Therefore, personal skill and subjective judgement have to be supported by monitoring systems and instrument readings.

Vibration monitoring

Vibration monitoring is a very useful method for overall assessment of machine condition. Changes in the vibration level always imply changes in the operating condition. Excessive vibration basically has three causes: something is loose, misaligned or out of balance. These three causes cover virtually all possible mechanical faults.

Moreover, the assessment of machine vibration has been much simplified by international standards which define the acceptable vibration level for a given type of machine and recommend monitoring methods suitable for industrial purposes.

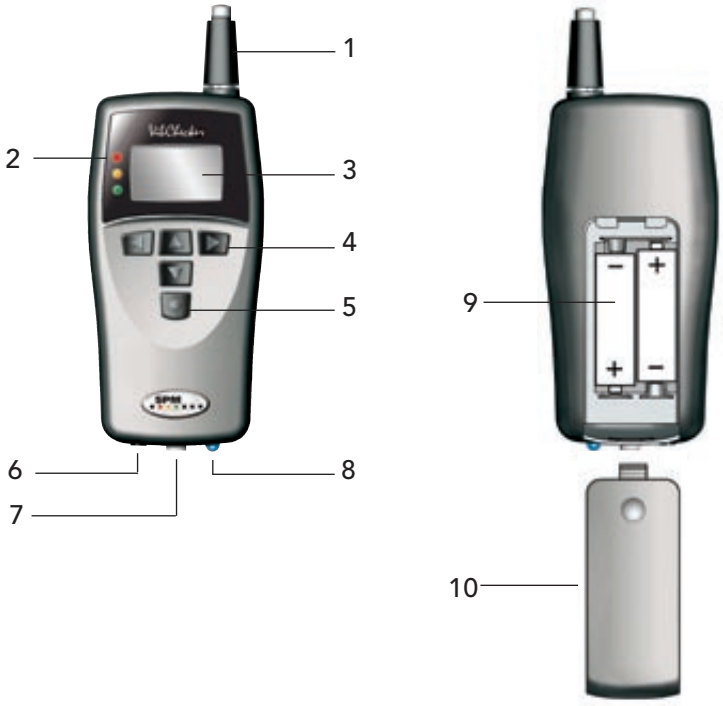
Effective Condition Based Maintenance requires economical and simple monitoring methods which can be applied by maintenance personnel without special training. Their primary task is to locate trouble spots early and direct the efforts of the maintenance crews to the right place at the right time. Fault analysis and repairs are a secondary step which may require expert knowledge and a different type of instrumentation.

VibChecker is designed as a maintenance aid. In accordance with the international standards, it measures vibration severity over the frequency range 10 to 1000 Hz. It allows a practical classification of machine condition in relative terms: good, acceptable, just tolerable or bad. Regular measurements will also show the development trend of the vibration level and thus the urgency of the maintenance problem: stable condition, slow deterioration or fast deterioration.

Instrument Overview

Instrument parts

1 Measuring probe
2 Condition indicators
3 Graphical display
4 Navigation buttons
5 Measuring button and power on
6 Connector for calibration and software update
7 Transducer input
8 Measuring LED
9 Battery compartment
10 Serial number label



General description

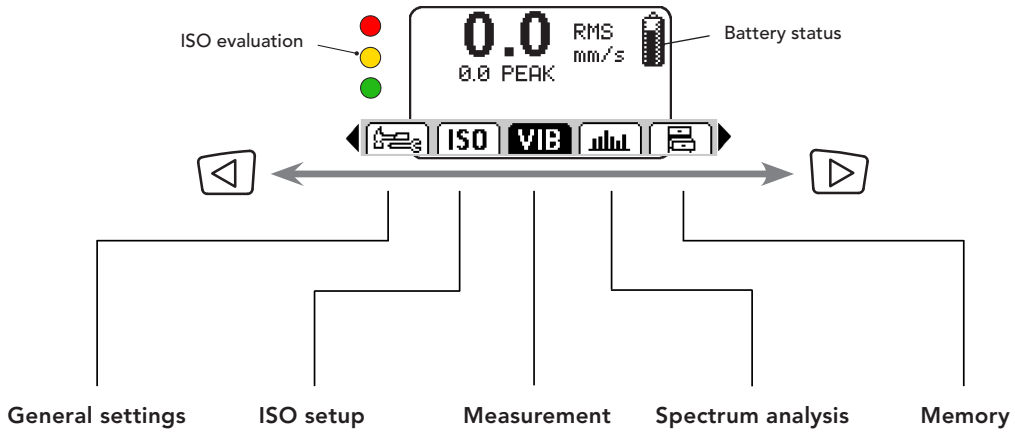
VibChecker is an instrument for fast and easy measurement of machine condition in preventive maintenance. The instrument and the monitoring techniques are based on the recommendations of ISO2372 and ISO10816 (Part 2, 3, 4 >600 rpm) standards for broad band measurements of vibration. These standards make the assumption that limited information, obtained easily and at a low cost, is often as useful as a detailed analysis using expensive equipment and elaborate techniques.

VibChecker is battery powered and designed for use in harsh industrial environments. The graphic display (3) gives the condition readings and the LED indicators (2) give an immediate evaluated machine condition in green-yellow-red.

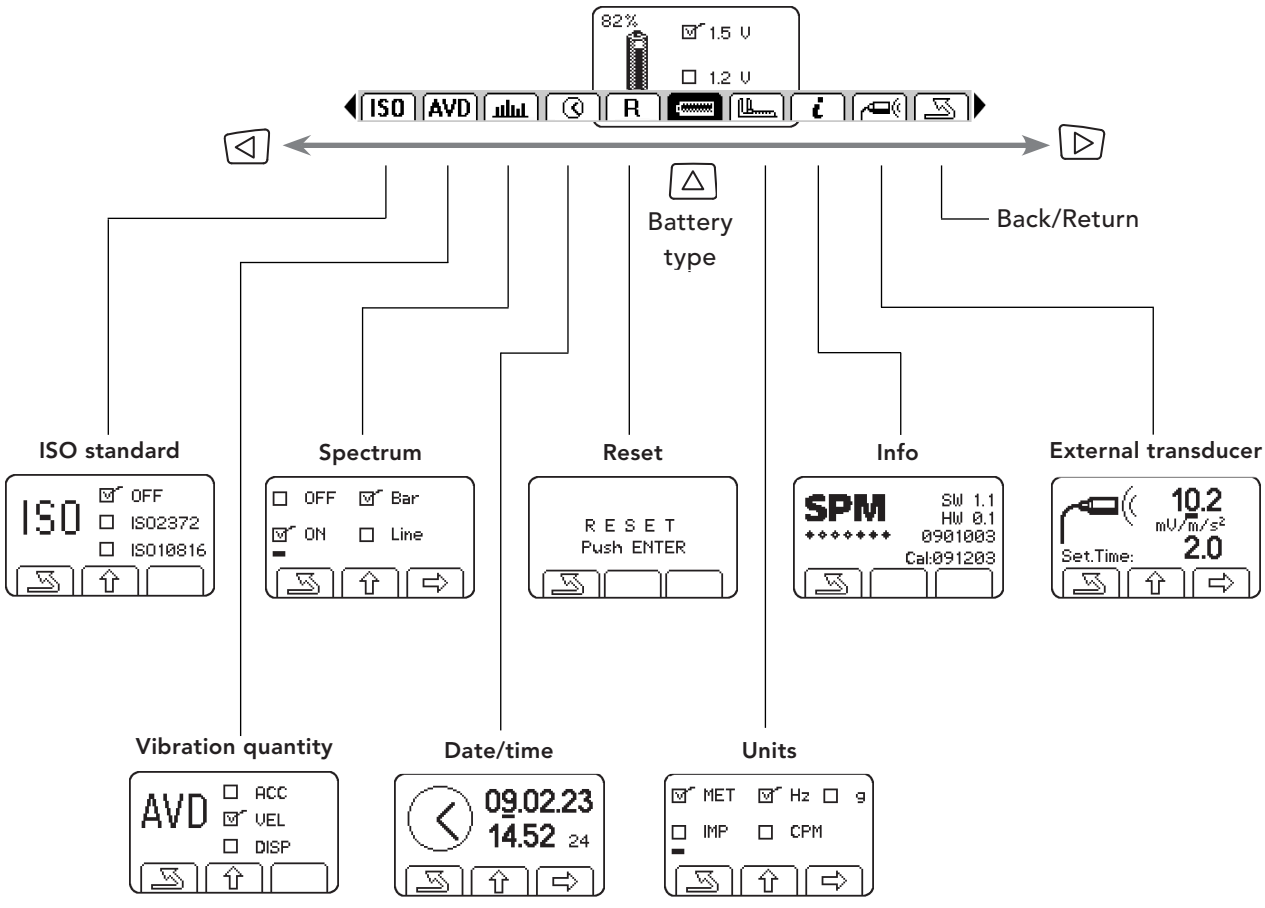
The instrument has a built in probe transducer (1). The external transducer with magnet TRM100 and all types of SPM vibration transducer series SLD for permanent installation can also be used, connected to the transducer input (7). It is push button controlled and basic measurement setup information are entered manually. Evaluated measuring results are indicated by green-yellow-red condition indicators (2) and a real-time FFT spectrum is produced for pattern recognition. Up to 12 measuring samples can be saved in memory.

Displays and menus

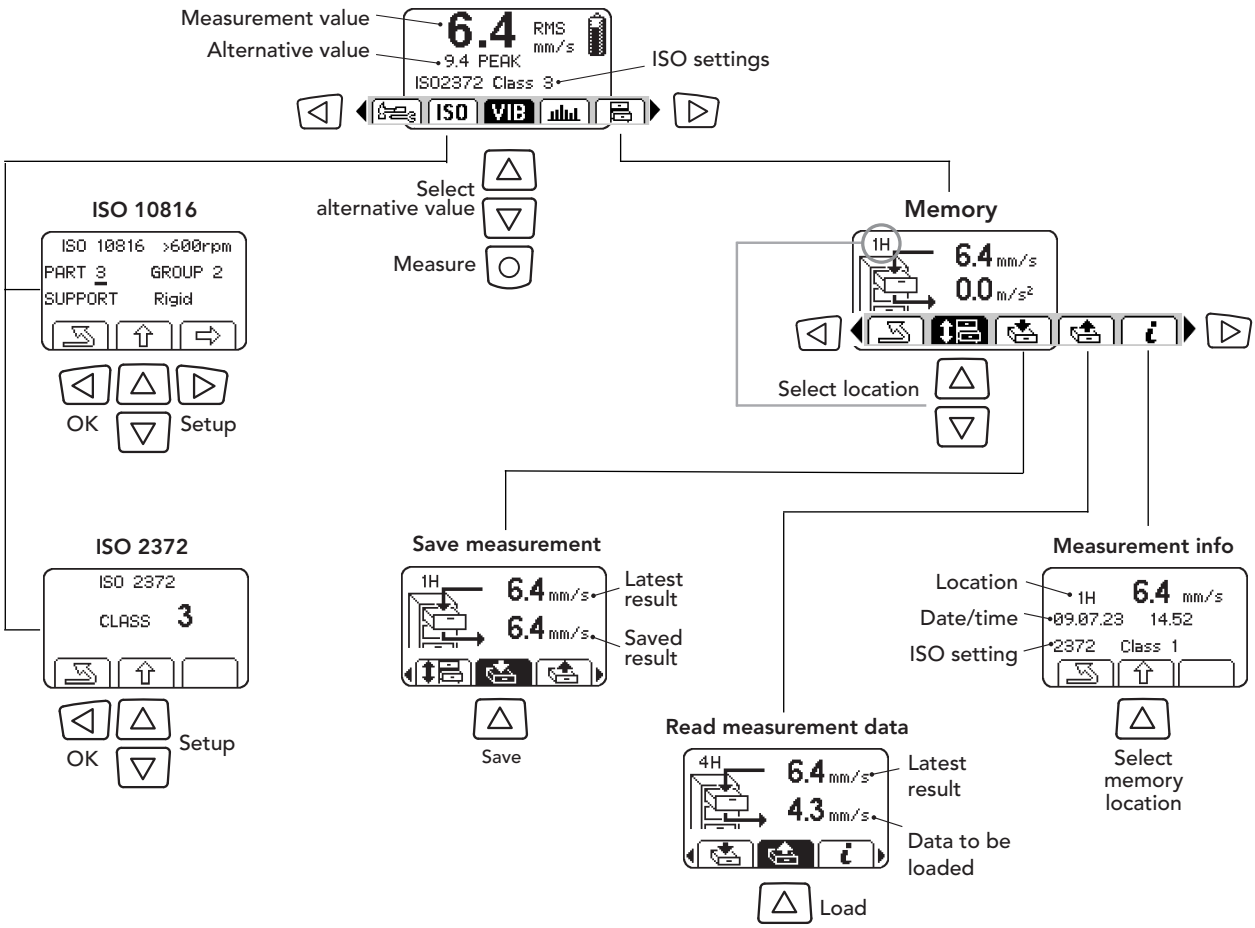
Measurement Display



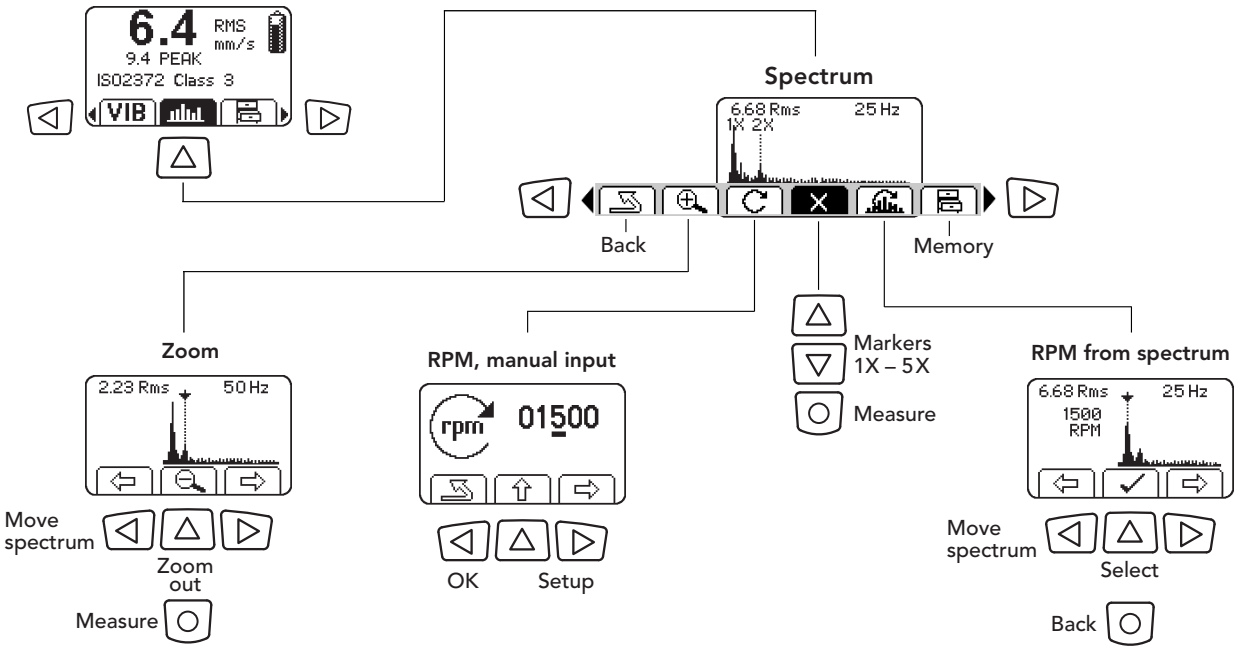
General Settings



Measurement



Spectrum Analysis



Batteries

The instrument is powered by two batteries size AA, type MN 1500 LR6. Alkaline or rechargeable batteries can be used. Please note that rechargeable batteries must be removed from the instrument before recharging. The battery compartment is located at the back. Press and push the lid to open the compartment.

The battery status icon will show on the **Measurement** display when the batteries are low and have to be replaced or recharged. The battery check on the **General settings** menu shows the present battery capacity in percent.

Battery life depends on how the instrument is used. Full power is only consumed while a reading is in progress: from pressing the measuring button until a measured value is displayed.

VibChecker has a power backup for approx. 45 seconds. Longer time without power will result in loss of date/time setting and latest reading.

Before long-time storage of the instrument, keep in mind to remove the batteries.

Start up

Pressing the measuring button (5) switches on the instrument.

If not used, the instrument will automatically shut off the backlight after 15 seconds. Briefly pressing any button will switch on the backlight.

If the instrument is on and the backlight is off, nothing happens at first keypress, except that the backlight comes on. Next keypress will perform the intended action.

When the instrument has been de-energized for a longer period it will start up showing the **Info** display. To go to the **Measurement** display, press the LEFT arrow button. Use LEFT/RIGHT arrow buttons in the **General settings** menu to highlight the **Return** icon, then press the UP arrow button.

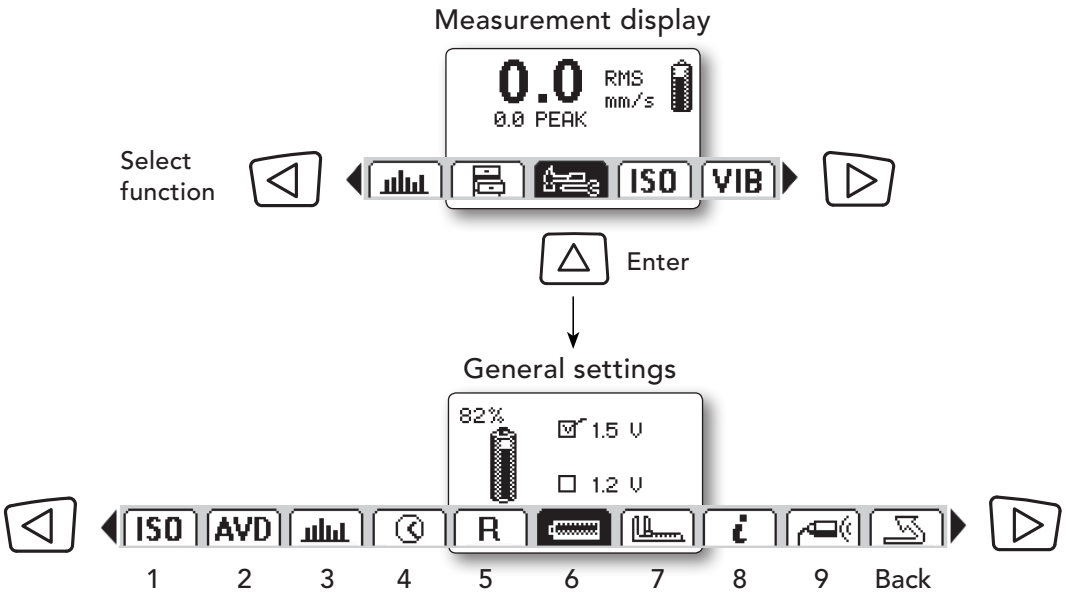
General settings, ISO set up, Spectrum and Memory are selected with the arrow buttons (4) in the **Measurement** display (3). Measurement is started with the MEASURING button (5).

The blue measuring LED (6) stops lighting when a measurement cycle is completed. The green, yellow and red LEDs (2) beside the display indicate the machine condition after an ISO measurement. When ISO measurement is switched off, no condition evaluation is done.

If not used, the instrument will automatically shut off after two minutes. It can also be shut off by simultaneously pressing the LEFT and RIGHT arrow buttons.

When switched back on, the instrument will resume its last mode.

General Settings



The lower part of the **Measurement** display contains five function icons. Use LEFT/RIGHT arrow buttons to highlight the **General settings** icon, then press the UP arrow button to enter.

The lower part of the **General settings** display contains ten icons for general instrument settings. Use LEFT/RIGHT arrow buttons for selection, then press the UP arrow button to open when the desired function is highlighted. To return to the **Measurement** display, press the MEASURING button or use LEFT/RIGHT arrow buttons to highlight the **Back** icon and then press the UP button.

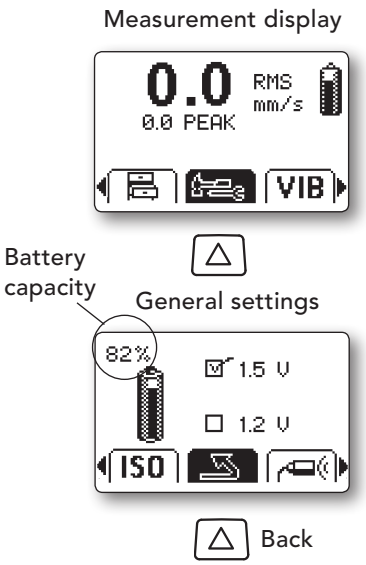
General instrument settings

1. **ISO STANDARD**: select ISO2372 or ISO10816 for evaluation of machine condition. The green, yellow and red LEDs will indicate the machine condition. Press BACK to save. Default setting is OFF.
2. **VIBRATION QUANTITY**: select ACCELERATION, VELOCITY or DISPLACEMENT. Press BACK to save setting. VEL is default.
3: **SPECTRUM**: select spectrum ON/OFF and the type of spectrum you prefer, BAR or LINE spectrum. Press BACK to save setting. Bar spectrum is default.
4. **DATE/TIME**: adjust when needed. Select 24 hour or 12 hour/day (AM/PM). Press BACK to save.
5. **RESET**: press enter (MEASURING button) to reset all general settings to factory default settings.
6. **BATTERY TYPE**: select 1.5 V for alcaline (default), 1.2 V for rechargeable batteries. Actual battery capacity in percent is shown in the upper left corner in the **General settings** display.
7. **UNITS**: select metric or imperial units, frequency in Hz or CPM and acceleration in g.
8. **INFO**: shows software version, hardware version, serial number and calibration date.
9. **EXTERNAL TRANSDUCER**: select transducer sensitivity, unit and settling time (sec.) when using an external transducer connected to the instrument.

Battery check

For exact battery capacity, use LEFT/RIGHT arrow buttons to highlight the **General settings icon**, then press the UP arrow button to enter the **General** settings display. The present battery capacity in percent is shown in the upper left corner. To return to the **Measurement** display, press the MEASURING button or use LEFT/RIGHT arrow buttons to highlight the **Back icon** and then press the UP button.

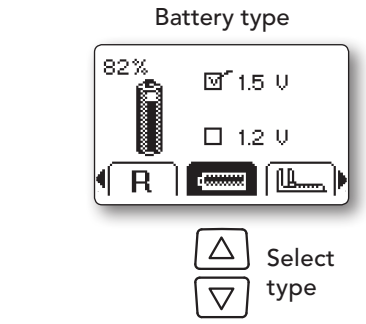
A "low battery warning" display will show up when the battery capacity is 0%.



Battery type

Alcaline or rechargeable batteries can be used. The battery type has no influence on instrument functionality or operation, but should be set for correct display of battery status icon and battery capacity.

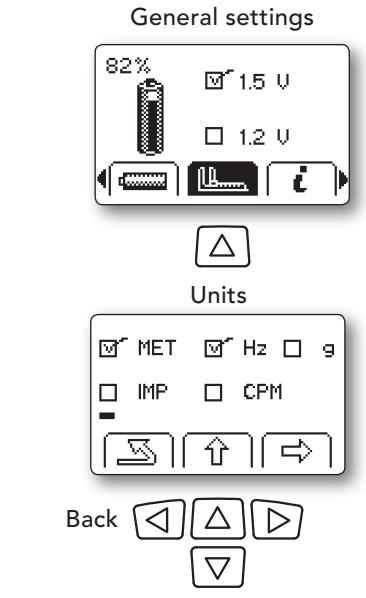
From the **General setting** display, use LEFT/RIGHT arrow buttons to highlight the **Battery icon**, then press the UP arrow button to enter battery type setup. Use UP/DOWN arrow buttons to set the battery type of your choice (1.2 V for rechargeable, 1.5 V for alcaline batteries).



Units

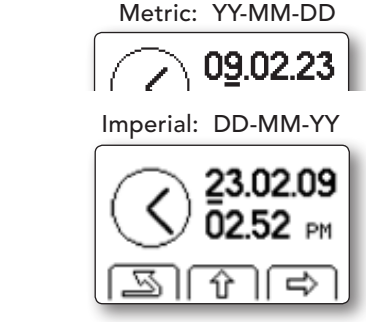
Select desired units for measuring results and spectrum. Go to the **Units icon** in the **General settings** display, then press the UP button to enter.

Select with UP/DOWN arrow buttons and go to next position with the RIGHT arrow button. Marking IMP (Imperial) changes from mm to inch and marking CPM (cycles per minute, similar to rpm) changes from Hz (Hertz = cycles per second). Mark g for acceleration in g instead of m/s^2.



Setting of units will affect the date format. With the MET (Metric) setting, the date format is YY-MM-DD. With the IMP setting, it is DD-MM-YY.

To save and return, press the LEFT arrow button.



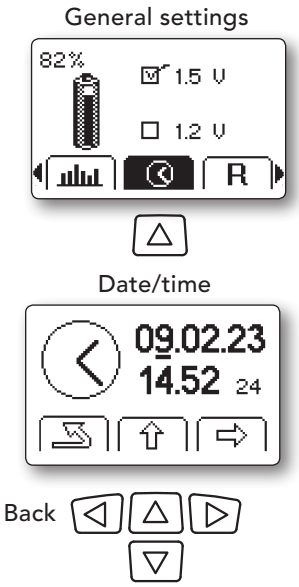
Date/time

It is essential to have the correct date and time to avoid confusion when storing measuring results in the memory. To set date and time, select the **Date/time icon** in the **General settings** display, then press the UP arrow button to enter.

Select with UP/DOWN arrow buttons and go to next position with the RIGHT arrow button. Select time format in the last position (small characters). You can select 24 or 12 hour/day (the display shows 24 or AM/PM). To save and return, press the LEFT arrow button.

The date format is set under the **Units** display, see page 8.

VibChecker has a power backup for approx. 45 seconds. Longer time without power will result in loss of date/time setting.

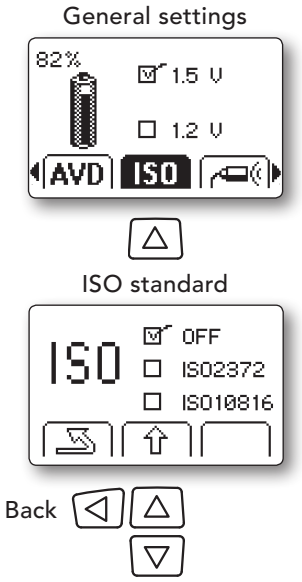


ISO standard

When an ISO standard is activated, the instrument will automatically evaluate the readings and indicate machine condition with the green, yellow and red LED indicators.

To activate an ISO standard, select the **ISO icon** in the **General settings** display, then press the UP arrow button to enter.

Select evaluation according to ISO 2372 or ISO 10816 standard with UP/DOWN arrow buttons, then press LEFT arrow button to save and return.



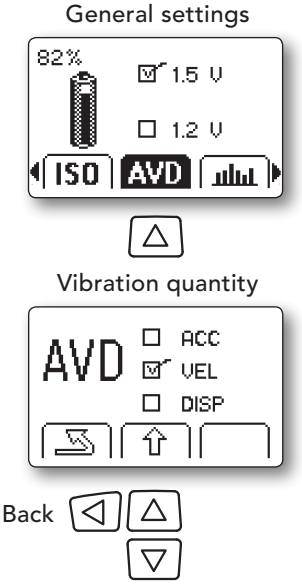
Vibration quantity

The vibration quantity depends on the selected vibration transducer and affects the unit for the result shown in the **Measurement display** as well as spectrum unit. Velocity (VEL) is default.

To set quantity, select the **Vibration quantity icon** (AVD) in the **General settings** display, then press the UP arrow button to enter.

Select quantity (velocity, acceleration or displacement) with the UP/DOWN arrow buttons. To save and return, press the LEFT arrow button.

When an ISO standard is activated the vibration quantity is velocity (VEL) and can not be changed.

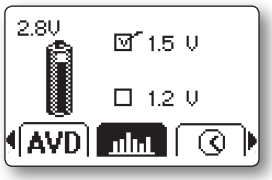


Spectrum

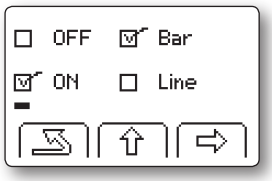
To activate the spectrum function, select the **Spectrum icon** in the **General settings** display, then press the UP arrow button to enter.

Select spectrum ON or OFF with UP/DOWN arrow buttons. Step to spectrum type with RIGHT arrow button and select type, bar or line spectrum, with UP/DOWN buttons. To save and return, press the LEFT arrow button.

General settings



Spectrum settings



Back

Reset

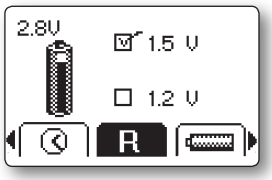
Use LEFT/RIGHT arrow buttons to highlight the **Reset icon** (R) in the **General settings** display. Pressing the ENTER button will reset all general settings to factory settings. To return press the LEFT arrow button.

The default settings are:

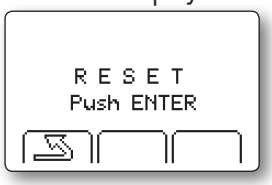
- ISO standard = OFF
- Vibration quantity = VEL
- Spectrum = OFF
- Spectrum type = Bar
- Date / Time = YY-MM-DD / 24 hours
- Units = Metric, Hz
- Ext. transducer = 10.2 mV/m/s^2, Set. time 2.0 seconds

After resetting the instrument it will start up in the **Info** display.

General settings



Reset display



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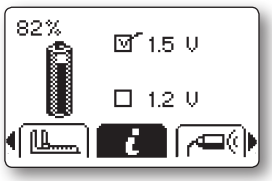
Reset

Info

To check which software/hardware version is in your instrument and find out the instrument serial number, use LEFT/RIGHT arrow buttons to highlight the **Info icon** (i), then press the UP arrow button to see the software version, hardware version and serial number. To return, press the LEFT arrow button.

If a "next calibration" date is stated when calibrated of a by SPM authorized service establishment, this date can be seen in this display.

General settings



Info display

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External transducers

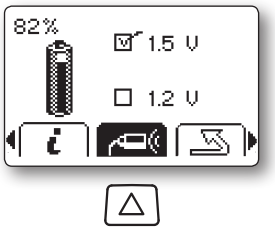
VibChecker can be used with all vibration transducers of type IEPE (ICP®) with voltage output.

Connect the external vibration transducer to the input connector (mini coax).

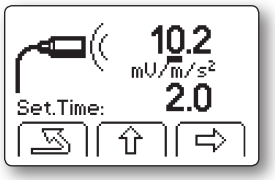
Select the **External transducer icon** in the **General settings** display and then press the UP arrow button to enter. Adjust the sensitivity by using UP/DOWN arrow buttons and step to the next position with the RIGHT arrow button. Select quantity and adjust the settling time in the same way. To save and return, press the LEFT arrow button.

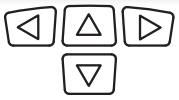
Vibration transducers of type SLD and transducers from other manufacturers have actual sensitivities and settling times written on their calibration cards. When several transducers are in use, they should be marked to assure that the readings are calibrated.

General settings



External transducer



Back 

Transducer with magnet (option)

The vibration transducer with a magnet TRM100 (option) can be used for attachment to ferrous metal parts to reach measuring points in narrow spaces and has the same construction and method of operation as the built-in transducer.

The firmer the contact with the machine, the better the measuring result. Plain, clean metal makes the best contact surface for the vibration transducer. To get comparable results, the measuring points should be clearly marked, so that measurements can always be taken in the same spots.

Before starting vibration measurements, make sure that the sensitivity for the vibration transducer you are using is properly setup. The transducer with integral magnet TRM100 has a nominal sensitivity of 10.2 mV/m/s² (individual value given on the calibration chart). The settling time is 2 seconds.

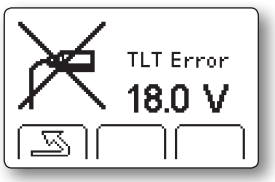
Transducer with integral magnet

Transducer Line Test (TLT)

When measuring vibration with external transducers, a transducer line test (TLT) will automatically be made to check the quality of the signal transmission between transducer and instrument. Part of your signal will be lost in a poor transducer line, so your measuring results will be incorrect. If a measurement is made with a poor transducer line, the instrument will display TLT Error and voltage.

If there is an open circuit (broken cable or no transducer connected) the TLT value is >13 V. If the TLT value is <4 V you need to check connectors, cable and transducer for short circuit.

Press the LEFT arrow button to return to the **Measurement** display.



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Vibration Severity Measurement

If a fan is out of balance, it will shake at its speed of rotation, i.e. move backwards and forwards once per revolution. The number of vibrations per time unit is the vibration frequency, measured in **Hz** (Hertz = cycles per second) or **CPM** (cycles per minute).

The rotational speed of any piece of plant is known as its fundamental frequency. For a fan with a speed of 1500 rpm the fundamental frequency is 25 Hz (1500 rpm ÷ 60).

In practice, machine vibration usually consists of many different frequency components. For a general assessment of machine condition one uses wide frequency band measurements, meaning all vibrations within a large frequency range are measured simultaneously.

Vibration parameters ACC, VEL, DISP

Cyclic movement can be measured and described in three different ways, as displacement, acceleration and velocity.

A part that is moving from rest, speeding up, slowing down and stopping twice per cycle is obviously accelerating and decelerating continuously. **Acceleration** (ACC) is measured in m/sec^2 or g (1g = 9.81 m/sec^2).

The second measuring parameter is the speed at which the object moves, the vibration **velocity** (VEL). Velocity is expressed in mm/sec.

Displacement (DISP) means the actual distance the object moves, measured either from its rest position in one direction (peak) or as the total movement in both directions (peak to peak). Displacement is measured directly in micrometers.

Both acceleration and speed are constantly changing. One can measure a peak value of either, but a mean value often gives a better indication of the forces involved in the movement. Most instruments measure the **RMS** value (root mean square value) of the movement and use a scaling factor to indicate the peak levels, if they are given at all.

All three vibration parameters - acceleration (ACC), velocity (VEL), displacement (DISP) - are mathematically related. The accelerometer signal can be converted, via integrating circuitry in the measuring instrument, into a reading of vibration velocity or displacement.

The choice of displayed parameter (the instrument reading) depends on the problem to be solved and on the cost, the complexity and the reliability of the measuring equipment.

Experience has shown, that the RMS level of vibration velocity, measured over a frequency range of **10 to 1000 Hz**, is most useful for general assessment of machine condition. The technical term used is vibration severity, defined as above and displayed in mm/s RMS or in/s RMS on the instrument. Vibration severity is directly related to the energy level of machine vibration, and thus a good indicator of the destructive forces acting on the machine.

Built-in transducer with probe

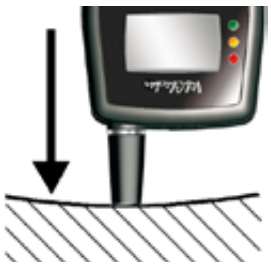
Measuring points for the built-in probe should be clearly marked. Always measure in the same spot.

The probe tip is spring loaded and moves within a sleeve of hard rubber. To maintain a steady pressure on the tip, press the probe tip against the measuring point until the rubber sleeve is in contact with the surface.

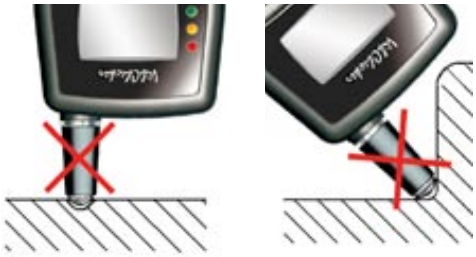
Hold the probe steady to avoid rubbing between probe tip and surface.

The probe is directionally sensitive. The centre of the probe tip should touch the surface. Avoid pressing the probe tip against cavities and fillets which are smaller than the probe tip.

The only part likely to wear out is the rubber sleeve for the probe tip. It is made of chloroprene rubber (neoprene) and tolerates 110° C (230° F). Spare sleeves have part number 13108.



Rubber sleeve in contact with the surface. Hold steady.

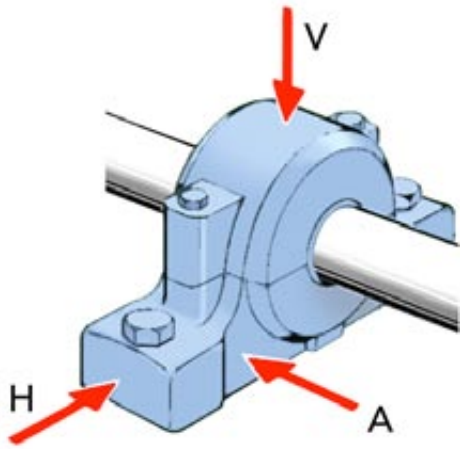


Avoid small cavities and fillets.

Measuring points

Vibration severity is primarily a measure for general machine condition. Vibration at the measuring point should be representative for the overall vibration of the machine. Typical measuring points are the bearing housings. By measuring in three directions, one can get an indication of the causes for increased vibration.

- Horizontal vibration (H) in the plane of rotation is most representative of balance condition.
- Vertical vibration (V) in the plane of rotation is most representative of structural weakness.
- Axial vibration (A) along the line of the shaft is most representative of faulty alignment and bent shafts.



To get comparable results, the measuring points should be clearly marked, so that measurements can always be taken in the same spots.

The firmer the contact with the machine, the better the measuring result. Plain, clean metal makes the best contact surface for the vibration transducer.

Measurement

If the instrument is on and the backlight is off, nothing happens at first keypress, except that the backlight comes on. Next keypress will perform the intended action. Make sure ISO standard, date/time, units etc. are setup under **General settings** and go to the **Measurement** display.

To measure, point the VibChecker straight at the measuring point and press the probe tip until the rubber sleeve is in contact with the surface.

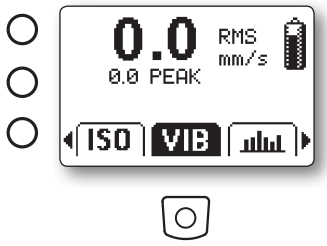
Press the **Measuring** button briefly to start measurement. Hold the instrument steady during measuring until the blue measuring LED stops lighting and a new measurement result is displayed.

When using an **external transducer** the measuring starts after the selected settling time (Set.Time, normally 2 seconds). A new measurement with the external transducer within 15 seconds (backlight on) requires no new settling time.

If you press and hold the **Measuring** button repeated measurements will be performed until the button is released. The instrument will display an average of the measurement results.

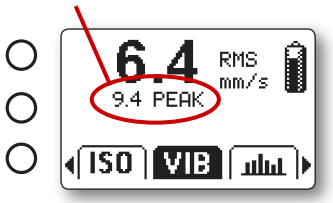
The measuring result is shown in large numbers and an alternative value is shown below in small numbers. The alternative value can be shifted with the UP/DOWN arrow buttons. Alternative values are RMS, peak and peak-to-peak, depending on selected vibration quantity.

Measurement display



Measuring button

Alternative value



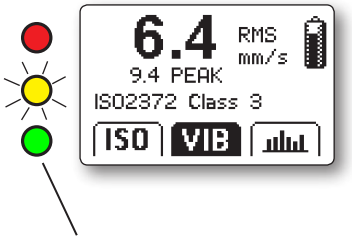
Shift alternative value

Evaluated readings

When ISO2372 or ISO10816 is activated in the **General settings** display, the instrument will automatically evaluate the readings and indicate machine condition with the green, yellow and red LED indicators.

VibChecker is based on the ISO recommendations with the exception that both good and acceptable condition together are indicated with the green LED.

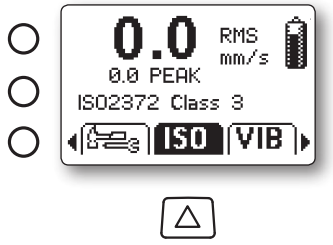
Measurement display



Machine condition indicators

Select **ISO setup icon** (ISO) in the **Measurement** display with the LEFT/RIGHT arrow buttons and press the UP button to enter. For ISO2372, input machine class and for ISO10816, input part, group etc. Machine condition evaluation according to the ISO standards require correct classification of the monitored machine. See the chapters ISO 2372 and ISO 10816 later in this manual.

Measurement display

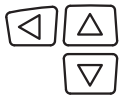


ISO setup

When ISO 2372 is activated in the **General settings** display, the machine CLASS (1-6) is selected in the **ISO setup** display with the UP/DOWN arrow buttons. Save and return with LEFT arrow button.

ISO setup

Back



ISO 2372 setting

When ISO 10816 (Part 2, 3, 4 >600 rpm) is activated in the **General settings** display, the machine PART is selected in the **ISO setup** display with the UP/DOWN arrow buttons.

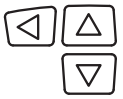
When PART 2 is selected, step to RPM with RIGHT arrow button and select "1500 or 1800" alternatively "3000 or 3600" with UP/DOWN buttons.

When PART 3 is selected, step with RIGHT arrow button and select GROUP with UP/DOWN. Then step to SUPPORT with RIGHT arrow button and select "Flexible" or "Rigid" with UP/DOWN arrow buttons.

To save and return, press the LEFT arrow button. VibChecker is now ready for measurement with evaluated machine condition according to the selected ISO standard.

ISO setup

Back



ISO 10816 settings

Overrange warning

If a measurement is made that exceeds the instrument's measuring range, the VibChecker will display an "Overrange" sign and the reading will not be accepted.

Recording of readings

The VibChecker follow-up form provides space for readings in all three directions at up to four different points, which should adequately cover most industrial machines. Experience will soon show which of the points and directions provide the most useful information for diagnosing a specific problem on any particular piece of plant.

A graph is the best way to show clearly all significant changes of the vibration level. To keep the form simple, draw only the graph for the most significant direction, normally the one giving the highest readings.

Follow-up forms for copying are found on the last pages in this manual. You will also find printable follow-up forms in pdf format on the VibChecker CD.

Storing measurement results

This function is useful for easy comparison of measurement results for a particular machine. It can also be used to store measurement results temporarily until they can be recorded on paper for trending and follow-up. On the last page of the User Guide is a follow-up form which can be copied and used for this purpose.

VibChecker can store up to twelve measurement results together with date/time, ISO settings and spectrum (if used).

In the **Measurement** display, use LEFT/RIGHT arrow buttons to highlight the **Memory icon**, then press the UP arrow button to enter **Memory** mode.

Storing readings

To store a reading in the memory, select one of the twelve memory locations by using the UP/DOWN arrow buttons. The memory locations are numbered 1H, 1V, 1A, 2H, 2V, 2A, 3H, 3V, 3A, 4H, 4V and 4A (four locations with measurements in three directions, Horizontal, Vertical and Axial).

Go to the **Store icon** with LEFT/RIGHT arrow buttons and press the UP arrow button to store the reading. This action will overwrite any previously stored value in the memory location selected.

Measurement information

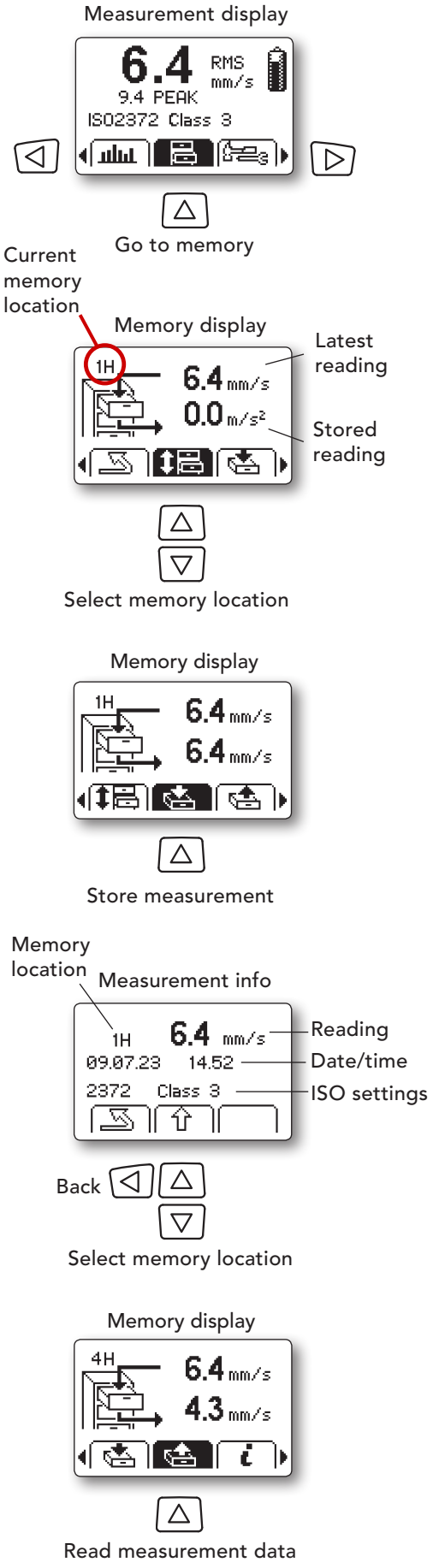
To see stored measurement results, select **Measurement info** icon (i) with LEFT/RIGHT arrow buttons and press the UP arrow button to enter. The **Measurement info** display shows memory location, measuring result, date/time and ISO settings (if used). Spectrum will be stored in the memory if spectrum is activated in the **General settings** display. Select memory location with the UP/DOWN arrow buttons.

To return to the **Memory** display, press the LEFT arrow button.

Reading measurement data

To load ISO settings or see spectrum and results stored in the memory, read memory data to the **Measurement** display. Select a memory location, then select the **Read icon** with LEFT/RIGHT arrow buttons and press the UP arrow button to read. The data in the memory (the lower result) will relocation the latest reading in the **Memory** display (the upper result) as well as in the **Measurement** display.

To return to the **Measurement** display, press LEFT/RIGHT arrow buttons to highlight the **Back icon** and press the UP arrow button.

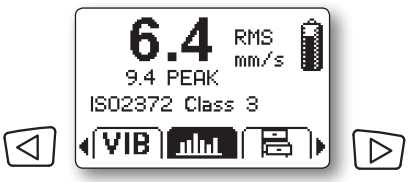


Spectrum Analysis

The purpose of a spectrum is to reveal line patterns associated with machine faults. VibChecker generates a real time FFT spectrum for pattern recognition.

This function requires that spectrum is activated in the **Spectrum settings** display under the **General settings** display.

Measurement display



Go to spectrum

Spectrum display

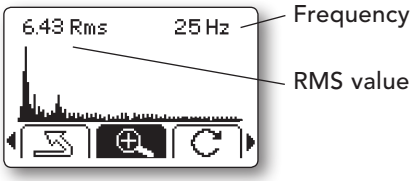
In the **Measurement** display, use LEFT/RIGHT arrow buttons to highlight the **Spectrum icon**, then press the UP arrow button to enter.

The **Spectrum** display shows a spectrum with 200 lines, compressed to screen resolution for full view.

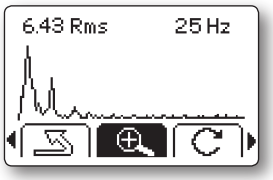
Type of spectrum, bar or line, is selected under the **General settings** display. The upper part of the display shows the highest RMS value and its frequency.

Press the MEASUREMENT button briefly for a new reading. For a continuously updated spectrum, keep pressing the MEASUREMENT button.

BAR spectrum



LINE spectrum



Zoom in

Measure

Zoom

Step with LEFT/RIGHT arrow button to the **Zoom in icon** and press the UP arrow button to enter.

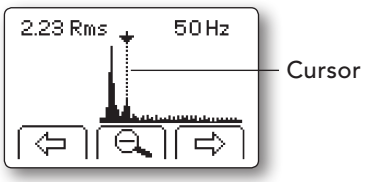
The **Zoom** display shows the spectrum in full resolution. The upper part of the **Zoom** display shows RMS value and frequency for the line in the centre of the display, marked with a cursor.

To move the spectrum (X axis) in the display, press LEFT/RIGHT arrow buttons.

To zoom out, press the UP arrow button.

To return to the **Measurement** display, press LEFT/RIGHT arrow buttons to highlight the **Back icon** and press the UP arrow button.

Zoom display



Move Move

Zoom out

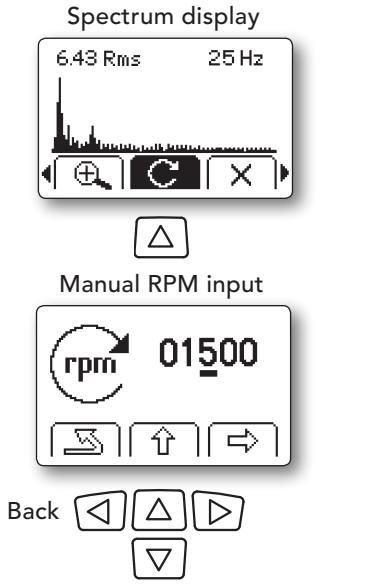
RPM, manual input

To be able to input markers in the spectrum, the rpm has to be entered. RPM can be input manually or picked up from spectrum.

In the **Spectrum** display, use LEFT/RIGHT arrow buttons to highlight the icon for **Manual RPM input**, then press the UP arrow button to enter.

Select with UP/DOWN arrow buttons and go to next position with the RIGHT arrow button. VibChecker will accept up to 60000 rpm.

To save RPM and return, press the LEFT arrow button.



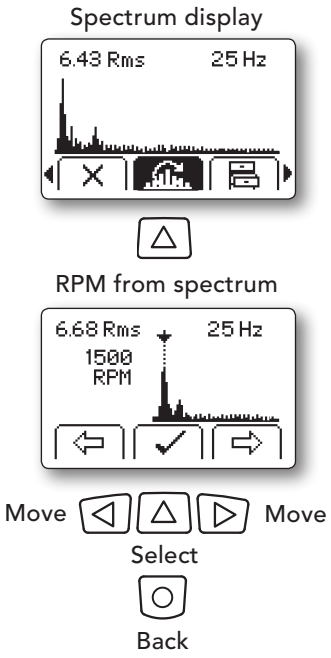
RPM from spectrum

In the **Spectrum** display, use LEFT/RIGHT arrow buttons to highlight the icon for **RPM from spectrum**, then press the UP arrow button to enter.

The upper part of the display shows RMS value and frequency for the line in the centre of the display, marked with a cursor. RPM at the cursor position is shown on the left side of the cursor.

Move the spectrum (X axis) in the display by pressing LEFT/RIGHT arrow buttons to find the peak matching the RPM.

Select RPM by pressing the UP arrow button. To return to the **Spectrum** display, press the MEASUREMENT button.

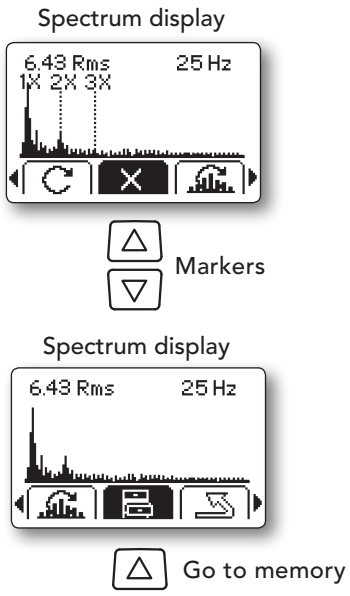


Markers

Characteristic for many fault patterns is the presence of 'multiples' or 'harmonics', which means that the line (or group of lines) is repeated two, three or more times further up in the spectrum. The spacing is a multiple of the rpm frequency. To display harmonics, one can input markers in the spectrum. The rpm has to be input before using this function.

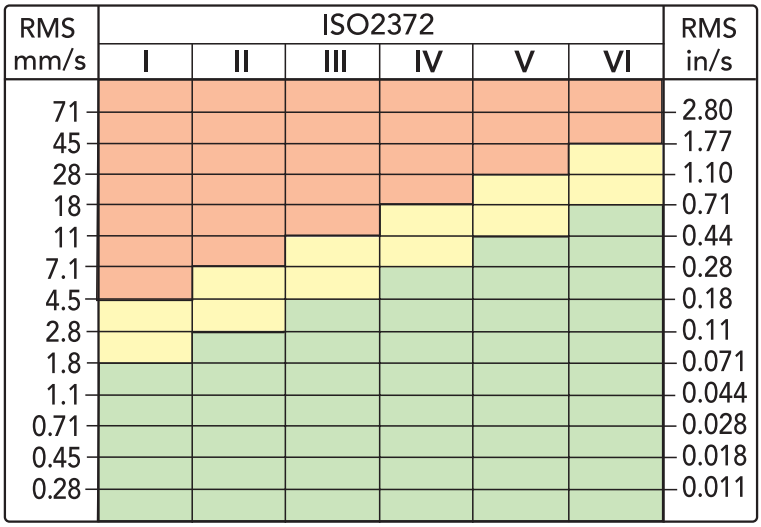
Go to the **Marker icon** (X) with LEFT/RIGHT arrow button and press UP to enter. You can input up to five markers (1X, 2X, 3X ...) by pressing the UP button. The marker 1X is shown above the stated RPM. Erase markers with the DOWN button.

To return to the **Measurement** display, press LEFT/RIGHT arrow buttons to highlight the **Back icon** and press the UP arrow button. To store the reading in the memory, step to the **Memory icon** and press the UP arrow button.



ISO 2372

Vibration severity measurement according to ISO 2372 is a broad band measurement over the frequency range 10 to 1000 Hz. It returns the RMS value of vibration velocity in mm/s (or inch/s). This value is representative of the energy contents of machine vibration, and thus of the destructive forces acting on the machine. It is widely regarded as a good and easy to obtain indicator of general machine condition.



Evaluation of machine condition

The evaluation consists of a comparison of the measured value with the ISO limit values recommended for 6 different classes (see definition on the next page).

The majority of industrial machinery belongs to the vibration classes 2, 3, and 4:

Class II: Medium size machines without special supports

Class III: Large size machines on rigid supports

Class IV: Turbomachines and large machines on flexible supports

For example, most smaller process pumps in a chemical plant would be Class 2. A 100 kW fan on a concrete foundation would be Class 3. However, the same fan fastened to the less rigid metal deck of a ship could be considered as Class 4.

Class 1 refers to independent parts of machines, for example electric motors up to 15 kW. Classes 5 and 6 are used for heavy reciprocating prime movers and machines which are intended to vibrate, such as vibrating screens.

VibChecker is programmed with the ISO limit values and will evaluate the measuring result, provided the ISO machine class number is input under the ISO menu. On the instrument, the green LED will light for good and acceptable ISO values, the yellow LED will light for just tolerable and the red LED will light for unacceptable values.

Definition of machine classes according to ISO 2372

The following text is a quotation from ISO 2372 (1974, E, page 6, Annex A). This ISO recommendation has also been published as British Standard (BS 4675, part I). A similar vibration classification of industrial machinery can be found in VDI 2056.

In order to show how the recommended method of classification may be applied, examples of specific classes of machines are given below. It should be emphasized, however, that they are simply examples and it is recognized that other classifications are possible and may be substituted in accordance with the circumstances concerned. As and when circumstances permit, recommendations for acceptable levels of vibration severity for particular types of machines will be prepared. At present, experience suggests that the following classes are appropriate for most applications.

Class I

Individual parts of engines and machines, integrally connected with the complete machine in its normal operating condition. (Production electrical motors of up to 15 kW are typical examples of machines in this category.)

Class II

Medium-sized machines, (typically electrical motors with 15 to 75 kW output) without special foundations, rigidly mounted engines or machines (up to 300 kW) on special foundations.

Class III

Large prime movers and other large machines with rotating masses on rigid and heavy foundations which are relatively stiff in the direction of vibration measurement.

Class IV

Large prime movers and other large machines with rotating masses on foundations which are relatively soft in the direction of vibration measurement (for example turbogenerator sets, especially those with lightweight substructures).

Class V

Machines and mechanical drive systems with unbalanceable inertia effects (due to reciprocating parts), mounted on foundations which are relatively stiff in the direction of vibration measurement.

Class VI

Machines and mechanical drive systems with unbalanceable inertia effects (due to reciprocating parts), mounted on foundations which are relatively soft in the direction of vibration measurements; machines with rotating slack coupled masses such as beater shafts in grinding mills; machines, like centrifugal machines, with varying unbalances capable of operating as self-contained units without connecting components; vibrating screens, dynamic fatigue-testing machines and vibration exciters used in processing plants.

ISO 10816

ISO 10816 consists of several parts, each stating measurement conditions and a table of limit values for a defined machine type. Like ISO 2372, the evaluation of machine condition is based on the RMS values obtained by broad band measurement over a frequency range up to 1000 Hz. Machine condition evaluation according to the ISO 10816 standard requires a correct classification of the monitored machine. VibChecker covers ISO 10816 Part 2, 3 and 4 > 600 rpm.

ISO 10816 Part 2

In case the machine you want to monitor is a 'large land-based steam turbine generator set in excess of 50 MW', part 2 is your obvious choice.

This machine class has no sub group. Instead, the choice of limit value table depends on machine speed, either '1500/1800 r/min' or '3000/3600 r/min'.

Marking the appropriate speed range leads to the final display which shows the ISO recommended frequency range (10 to 500 Hz), the recommended measurement quantity (vibration velocity = VEL) and the limit values or 'zone boundaries'.

A measurement result below the zone boundary of 5.3 mm/s RMS is acceptable and will be marked green. Results from 5.3 mm/s to below 8,5 mm/s will be marked yellow and 8.5 mm/s and higher will be red.

Evaluation zone boundaries based on bearing housing/pedestal vibration velocity.

Condition Zone boundary	**Shaft rotational speed**			
	1500 / 1800 rpm		3000 / 3600 rpm	
	Vibration velocity VEL			
	mm/s	in/s	mm/s	in/s
Green / Yellow	5.3	0.20	7.5	0.30
Yellow / Red	8.5	0.33	11.8	0.46

ISO 10816 Part 3

Part 3 treats most of the common industrial machines and is divided into four groups. Further criteria for Part 3 are the rigidity of the foundation and the rotational speed. Concrete foundations are rigid, every thing else falls under flexible. The RPM affects the lower measuring range as well as the limit values.

For machines under Part 3, VibChecker returns both VEL and DISP values. Machine condition is determined by the quantity that has the relatively highest measurement results.

Group 1

Evaluation zone boundaries for machines of Group 1: Large machines with rated power above 300 kW and not more than 50 MW; electrical machines with shaft height $H \geq 315$ mm.

Support class	Condition Zone boundary	DISP RMS displacement µm	 mils	VEL RMS velocity mm/s	 in/s
Rigid	Green / Yellow	57	2.24	4.5	0.18
	Yellow / Red	90	3.54	7.1	0.28
Flexible	Green / Yellow	90	3.54	7.1	0.28
	Yellow / Red	140	5.51	11.0	0.43

Group 2

Evaluation zone boundaries for machines of Group 2: Medium-size machines with rated power above 15 kW up to and including 300 kW; electrical machines with shaft height 160 mm $\leq H <$ 315 mm.

Support class	Condition Zone boundary	DISP RMS displacement µm	 mils	VEL RMS velocity mm/s	 in/s
Rigid	Green / Yellow	45	1.77	2.8	0.08
	Yellow / Red	71	2.80	4.5	0.18
Flexible	Green / Yellow	71	2.80	4.5	0.18
	Yellow / Red	113	4.45	7.1	0.28

Group 3

Evaluation zone boundaries for machines of Group 3: Pumps with multivane impeller and with separate driver (centrifugal, mixed flow or axial flow) with rated power above 15 kW.

Support class	Condition Zone boundary	DISP RMS displacement µm	 mils	VEL RMS velocity mm/s	 in/s
Rigid	Green / Yellow	36	1.42	4.5	0.18
	Yellow / Red	56	2.20	7.1	0.28
Flexible	Green / Yellow	56	2.20	7.1	0.28
	Yellow / Red	90	3.54	11.0	0.43

Group 4

Evaluation zone boundaries for machines of Group 4: Pumps with multivane impeller and with integrated driver (centrifugal, mixed flow or axial flow) with rated power above 15 kW.

Support class	Condition Zone boundary	DISP RMS displacement µm	 mils	VEL RMS velocity mm/s	 in/s
Rigid	Green / Yellow	22	0.87	2.8	0.08
	Yellow / Red	36	1.42	4.5	0.18
Flexible	Green / Yellow	36	1.42	4.5	0.18
	Yellow / Red	56	2.20	7.1	0.28

ISO 10816 Part 4

Part 4 is limited to 'Gas turbine driven sets excluding aircraft derivates'. The standard also states a power output of at least 3 MW.

Evaluation zone boundaries based on bearing housing/pedestal vibration velocity, valid for shaft rotational speed 3000 rpm to 20 000 rpm.

Condition Zone boundary	**Vibration velocity VEL** mm/s	in/s
Green / Yellow	9.3	0.37
Yellow / Red	14.7	0.58

Note: These values, which are the upper limits of the zones, should apply to radial vibration measurements on all bearing housings or pedestals and to axial vibration measurements on housings containing an axial thrust bearing, under steady-state operating conditions at rated speed.

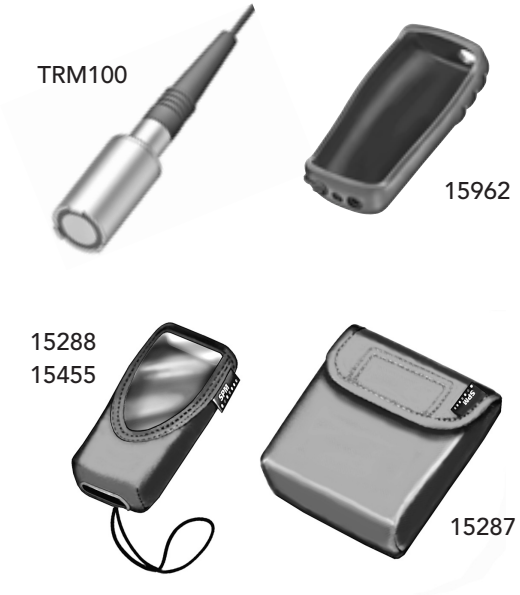
Technical Specifications

VibChecker VC100

Frequency range:	10 to 1000 Hz
Readings:	RMS / peak / peak-to-peak
Measuring range, RMS:	(using internal probe or external accelerometer with a nominal sensitivity of 100 mV/g)
Velocity	0.5–49.9 mm/s (0.02–2.0 in/s)
Acceleration	0.5–49.9 m/s^2 (0.05 – 5.1 g)
Displacement	0.5–99.9 µm (0.02–3.94 mils)
Condition evaluation:	according to ISO 2372 and ISO 10816 Part 2, 3, 4 > 600 rpm
Spectrum:	linear, 200 lines, Hanning window, Hz/cpm, optical zoom, markers
General functions:	battery status display, transducer check, metric or imperial units, language independent menus with symbols, storage of up to 12 measuring samples
Condition indication:	green, yellow and red LED
Measurement indication:	blue LED
Display:	graphic monochrome, 64 x 112 pixels, LED backlight
Keypad:	sealed membrane (silicone rubber)
Material, casing:	ABS/PC
Power supply:	2 x 1.5 V AA batteries, alcaline or rechargeable
Battery life:	> 20 hours of typical use
Internal transducer:	accelerometer type MEMS
Input connector:	mini coax, for external transducer
External transducers:	vibration transducer TRM100 or IEPE (ICP®) type transducers with voltage output
Output connector:	3.5 mm stereo mini plug for calibration and software update
Operating temperature:	0 °C to +50 °C (32 °F to 122 °F)
Dimensions:	158 x 62 x 30 mm (6.2 x 2.4 x 1.2 in)
Weight:	approx. 185 g (6.5 oz) including batteries

Accessories

TRM100	External transducer with integral magnet and 1.5 m cable
15287	Belt case for accessories
15288	Protective cover with wrist strap
15455	Protective cover with belt clip
15962	Protective sleeve, soft plastic
93363	Cable adapter, mini coax- BNC
93062	Cable adapter, BNC - TNC, plug-jack
CAB52	Measuring cable, 1.5 m, mini coax- BNC slip-on



Spare parts

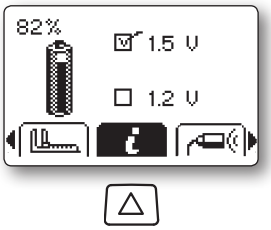
13108	Rubber sleeve for probe tip, chloroprene, maximum 110 °C (230 °F)

Maintenance and calibration

An instrument calibration, e.g. for the purpose of compliance with ISO quality standard requirements, is recommended once a year. Please contact your SPM representative for service, software upgrade or calibration.

If a calibration date is stated when calibrated, this date can be seen in the **Info (i)** display under **General settings**.

General settings



Info display

Calibration reminder

The calibration reminder will be shown at switch-on when the VibChecker has been in use for the recommended period and is to be sent to an authorized SPM service establishment in your local area.

Warranty

One (1) year limited warranty from date of purchase against defects in workmanship or materials. Warranty is void if instrument is altered or repaired by unauthorized service center, or if warranty seal is broken. Warranty does not apply on any instrument subjected to misuse or damaged by leaking batteries. Warranty is for instrument only and does not cover batteries or cables. SPM reserves the right to determine disposition as to repair or replacement of goods.

Should the instrument require any service whether under warranty or not, you should contact SPM Instrument or your local distributor for instructions before returning the goods.

To get maximum use of your VibChecker, we recommend that you register your purchase at

www.vibchecker.com

in order to access technical support, product information and documentation.

EU Directive on waste electrical and electronic equipment

WEEE is EU Directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment.

The purpose of this directive is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste.

This product must be disposed of as electronic waste and is marked with a crossed-out wheeled bin symbol in order to prevent it being discarded with household waste.

Once the life cycle of the product is over you can return it to your local SPM representative for correct treatment, or dispose of it together with your other electronic waste.

Follow-up form, ISO 2372, mm/s

SPM

VibChecker ISO2372 mm/s

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CLASS			DATE														CLASS		
I	II	III															IV	V	VI
11	18	28															45	71	110
7.1	11	18															28	45	71
4.5	7.1	11															18	28	45
2.8	4.5	7.1															11	18	28
1.8	2.8	4.5															7.1	11	18
1.1	1.8	2.8															4.5	7.1	11
0.7	1.1	1.8															2.8	4.5	7.1
0.5	0.7	1.15															1.8	2.8	4.5
0.3	0.5	0.7															1.1	1.8	2.8
1	H																		
	V																		
	A																		
11	18	28															45	71	110
7.1	11	18															28	45	71
4.5	7.1	11															18	28	45
2.8	4.5	7.1															11	18	28
1.8	2.8	4.5															7.1	11	18
1.1	1.8	2.8															4.5	7.1	11
0.7	1.1	1.8															2.8	4.5	7.1
0.5	0.7	1.15															1.8	2.8	4.5
0.3	0.5	0.7															1.1	1.8	2.8
2	H																		
	V																		
	A																		
11	18	28															45	71	110
7.1	11	18															28	45	71
4.5	7.1	11															18	28	45
2.8	4.5	7.1															11	18	28
1.8	2.8	4.5															7.1	11	18
1.1	1.8	2.8															4.5	7.1	11
0.7	1.1	1.8															2.8	4.5	7.1
0.5	0.7	1.15															1.8	2.8	4.5
0.3	0.5	0.7															1.1	1.8	2.8
3	H																		
	V																		
	A																		
11	18	28															45	71	110
7.1	11	18															28	45	71
4.5	7.1	11															18	28	45
2.8	4.5	7.1															11	18	28
1.8	2.8	4.5															7.1	11	18
1.1	1.8	2.8															4.5	7.1	11
0.7	1.1	1.8															2.8	4.5	7.1
0.5	0.7	1.15															1.8	2.8	4.5
0.3	0.5	0.7															1.1	1.8	2.8
4	H																		
	V																		
	A																		

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Follow-up form, ISO2372, inch/s

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VibChecker ISO2372 inch/s

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CLASS			DATE														CLASS		
I	II	III															IV	V	VI
0.43	0.71	1.10															1.77	2.80	4.30
0.28	0.43	0.71															1.10	1.77	2.80
0.18	0.28	0.43															0.71	1.10	1.77
0.11	0.18	0.28															0.43	0.71	1.10
0.07	0.11	0.18															0.28	0.43	0.71
0.04	0.07	0.11															0.18	0.28	0.43
0.03	0.04	0.07															0.11	0.18	0.28
0.02	0.03	0.04															0.07	0.11	0.18
0.01	0.02	0.03															0.04	0.07	0.11
1	H																		
	V																		
	A																		
0.43	0.71	1.10															1.77	2.80	4.30
0.28	0.43	0.71															1.10	1.77	2.80
0.18	0.28	0.43															0.71	1.10	1.77
0.11	0.18	0.28															0.43	0.71	1.10
0.07	0.11	0.18															0.28	0.43	0.71
0.04	0.07	0.11															0.18	0.28	0.43
0.03	0.04	0.07															0.11	0.18	0.28
0.02	0.03	0.04															0.07	0.11	0.18
0.01	0.02	0.03															0.04	0.07	0.11
2	H																		
	V																		
	A																		
0.43	0.71	1.10															1.77	2.80	4.30
0.28	0.43	0.71															1.10	1.77	2.80
0.18	0.28	0.43															0.71	1.10	1.77
0.11	0.18	0.28															0.43	0.71	1.10
0.07	0.11	0.18															0.28	0.43	0.71
0.04	0.07	0.11															0.18	0.28	0.43
0.03	0.04	0.07															0.11	0.18	0.28
0.02	0.03	0.04															0.07	0.11	0.18
0.01	0.02	0.03															0.04	0.07	0.11
3	H																		
	V																		
	A																		
0.43	0.71	1.10															1.77	2.80	4.30
0.28	0.43	0.71															1.10	1.77	2.80
0.18	0.28	0.43															0.71	1.10	1.77
0.11	0.18	0.28															0.43	0.71	1.10
0.07	0.11	0.18															0.28	0.43	0.71
0.04	0.07	0.11															0.18	0.28	0.43
0.03	0.04	0.07															0.11	0.18	0.28
0.02	0.03	0.04															0.07	0.11	0.18
0.01	0.02	0.03															0.04	0.07	0.11
4	H																		
	V																		
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