User Manual

Measurer and Analyzer

Ver.: 2.0

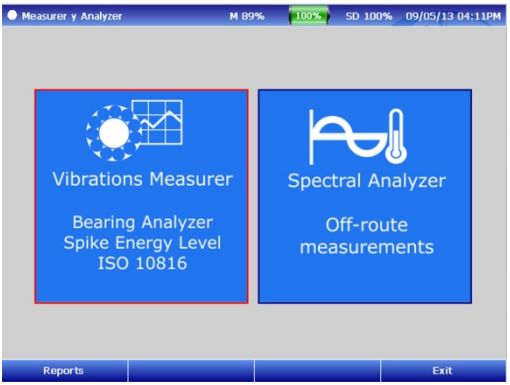
Measurer and Analyzer

Introduction:

This module measures and analyzes mechanical vibrations and variable AC and DC power. It groups all the measurements of the DSP Logger Expert on all its inputs, allowing the user to select vibration measurements with pre-configured settings for expert analysis or configurations designed to search for other sources of or complex analyses of vibrations.

The firmware contained in Option 1 of the DSP Logger Expert is selected with the arrow keys or directly with the 1 key.

Entering this firmware shows two options on the screen, as shown in the following display.



Quick Measurement:

This firmware contains 3 types of vibration analysis, which are performed fully automatically.
It enables a simple load of the machine parameters to be analyzed, allowing the system to capture, analyze, and monitor vibration levels associated with mechanical failures.

Bearing Analysis:

This tool defines an accurate calculation of the state and condition of the bearing to test for bearing and/or lubrication failure.
To do this, you must enter the estimated RPM of the machine.

Spike Energy Level:

This tool defines an enveloping measurement value of the Energy Spike ® analyzing bearing condition and the values of bearing failure frequencies.
These calculations are performed automatically, requiring the value of the estimated RPM, the model, and the manufacturer of the bearing.

ISO 10816 Measurements:

This measurement tool performs an analysis of machine speed, adjusting the settings to the requirements of ISO 10816 and evaluating the condition of the states covered by the rule.
The input data that this tool requires involves the classification of the machine in the norm groups.

In addition to the input of the RPM value, the meter system expert shows vibrational levels for the balancing, alignment, and rotation of the machine backlash.

Home:

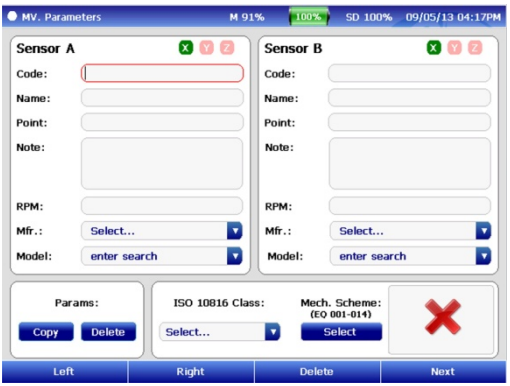
When entering the quick measurement by the icon you will enter the settings window:

Input parameters:

The parameter display indicates the status of the six (6) inputs of the DSP Logger Expert according to the connected and disconnected sensors.

The entries are grouped into 3 (three) groups for Channel A and Channel B, each taking the X, Y, or Z direction.
Red indicates no sensor signal.
Green confirms that the sensor and cable are in good condition.

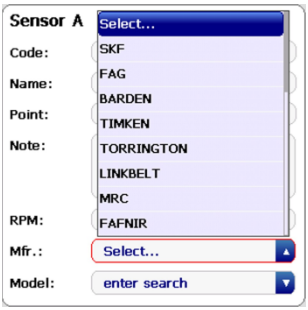
The parameter window displays all the fields necessary for analysis calculations.
The only required field for the use of the tools is the RPM.



The parameter window is divided into two (2) segments. The left corresponds to Sensor 1, and the right corresponds to Sensor 2.

Code	Identification Number or TAG
Name	Machine Name
Point	Name or Nomenclature of the point
Obs.	Specific observations
RPM	The approx. revolutions of the point
Manufacturer	Bearing Mark of the point
Model	Bearing Model of the point

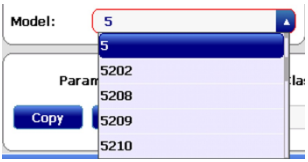
The input bearing manufacturer can be viewed by selecting the list that has the system and factory preloaded.



Model selection is performed via a selection of all the bearings corresponding to the selected manufacturer.

Recommendation

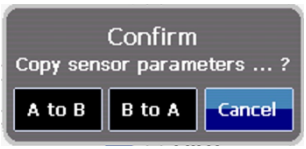
You can enter the bearing model by placing the first number or the complete number of the bearing, so the position will be close to or an accurate bearing.



Parameters copy:

The parameter window contains a tool to copy the parameters entered in sensor A or B.
The parameters that are not copied from one sensor to the other bear manufacturer and model data.

When activated, the system will request the copy from one sensor to the other.

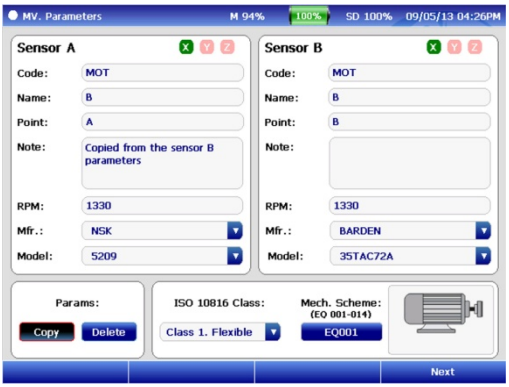


Class ISO10816:

ISO class is selected depending on the measuring machine.
Part 3: Industrial machines with nominal power above 15 kW and speeds between 120 and 15000 RPM.
The criteria for the vibration of this standard apply to a set of machines with a capacity exceeding 15 kW and a speed between 120 RPM and 15,000 RPM. The criteria are only applicable to vibrations produced by the machine itself and not to vibrations that are transmitted to the machine from external sources. The effective value (RMS) vibration velocity is used to determine the condition of the machine.

Bearing Analyzer:

The first step is the entry of the parameters in sensor 1 and/or 2.



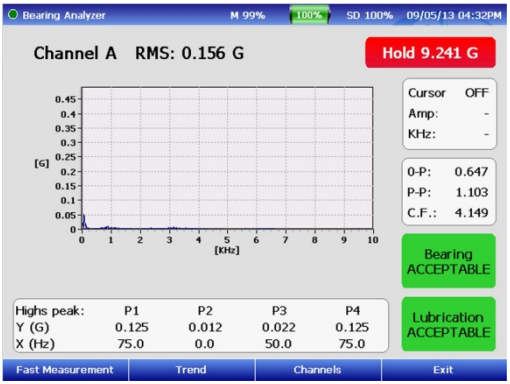
Once the parameters load, press F4 to activate NEXT.

The menu functions F1 to F4 will change to the next options.
Function F1 allows you to select analysis options.

This is done by pressing the F1 key until you reach the desired option.

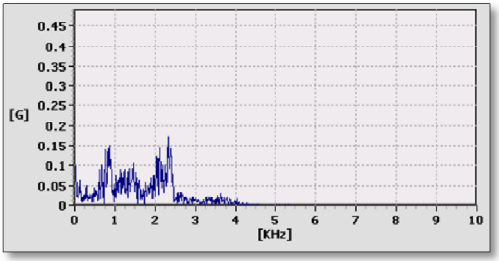
Once there, confirm with the ENTER key.

Once confirmed, the measurement screen will be presented online as measured from the first moment of visualization.

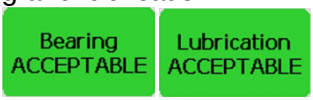


The Bearing Analysis screen, shown above, measures the input channel to the RMS value. The red HOLD frame on the right keeps the maximum value detected from the start of measurement or since reset to zero using the #key.

The spectral measurement corresponds to an acceleration range of 800 lines with a maximum frequency of 10 kHz.



On this configuration, the system calculates the state of bearing and lubrication.



Each of these indicators shows a different status:

Bearing	Lubrication
ACEPTABLE	ACCEPTABLE
ACCEPTABLE	CAUTION
CAUTION	EMERGENCY
CHANGE IMMEDIATE	

The measurement is presented online.

To stop the measurement, press the ESCAPE button.

To restart the measurement, press the ENTER button.

The status indicator measurement is at the top of the screen, indicated by different colored circles.

○	In process measurement outside
●	Measurement stopped (flashing indicator)
●	Continuous measurement process

Additional indicators:

The following values are shown on the right side of the screen:
0.P.: 0-Peak scalar value.
PP: Peak-Peak scalar value.
F.C.: Crest Factor scalar value.

Also shown are four (4) detected maximum peaks in the spectrum, which indicate amplitude and frequency.

Highs peak:	P1	P2	P3	P4
Y (G)	0.125	0.012	0.022	0.125
X (Hz)	75.0	0.0	50.0	75.0

The cursor function is activated with 1 key.

The indication appears for amplitude and frequency.

Cursor	OFF
Amp:	-
KHz:	-

Channel change:

Press F3 to change the channel.

This key will display the measurement of the selected channel.

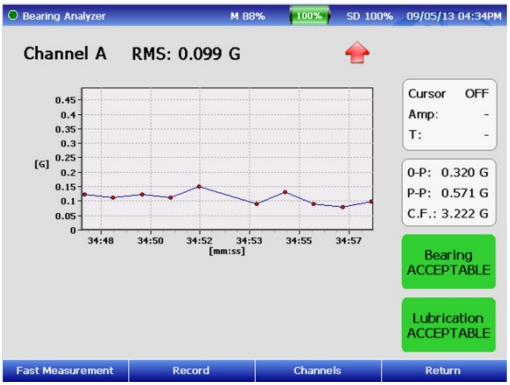
Another channel change option is to select the function Overall Dual Channel (see pages 25 to 29)

Save data:
Press F4 to save measurement data.

Trend function:

The F2 key activates the screen that shows a trend graph of the measurement on the selected channel.

The trend graph shows all measurements for a maximum of 2 (two) minutes.



The trend display shows the trend of the values entered, with an up or down arrow coinciding with the comparison of the last inserted value.

Declining value 

Increasing value 

Channel change:

Press F3 to change the channel.

Record:

Using F2, you can save a time period of entered measurements.

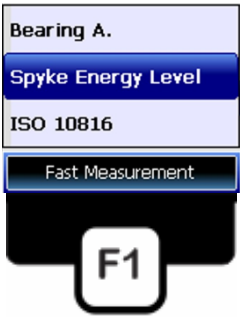
Once activated, start and end data recording by pressing the F2 key again. Recording will also end automatically when the set time of maximum recording is completed.

Return:

F4 will return spectrum measurements.

Measurement Change:

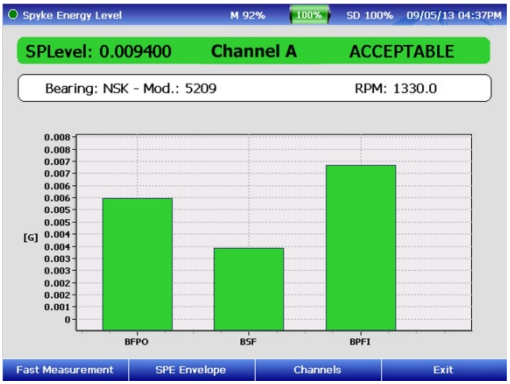
From the trend screen, you can directly access the other tools by pressing F1.



Spike Energy Level:

If the parameter data were pre-loaded for another application, you can directly enter this function. If not, you must complete the input parameter steps (Pages 4, 5 and 6)

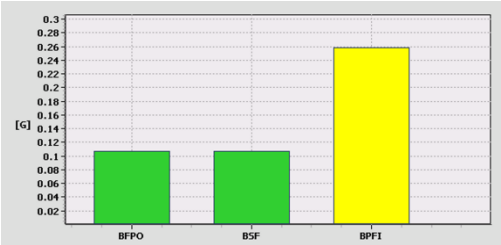
The tool screen shows the most relevant parameter values of the measurement.



The main screen shows the value or level Energy ® Spike with the color that corresponds to status of the measurement.

Below the levels level status, data shows the bearings, including the make and model.

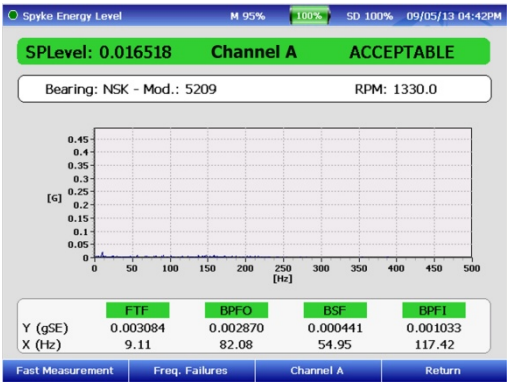
The graph shows the values and status of the fault frequencies:



The bearings are composed of several clearly differentiated components: inner race, balls or rollers, cage, and outer race. The deterioration of each of these elements will generate one or more characteristic frequencies in the spectrums, allowing for quick and easy identification. The four possible frequencies of bearing damage are:

BPFO (Ball pass frequency of the outer race): The physical number of balls or rollers that go through a point outside the track each time the axis makes a full rotation.
BPFI (Ball pass frequency of the inner race): The physical number of balls or rollers that go through a point inside track each time the axis makes a full rotation.
BSF (Ball spin frequency):
The physical number of turns made by a ball bearing each time the axis makes a full rotation.

To view the envelope spectrum, press function key F2.



In the spectrum envelope, the components can be observed corresponding to bearing failure, identifying the fault frequencies, and the values of the peaks corresponding to each frequency.

It also shows the Energy ® Spike level with the color that corresponds to status of the measurement.

Below the state with the SP level, bearings data is shown, including make and model.

Channel change:

Change the channel by pressing F3.

When activated, this key will display the measurement of the selected channel.

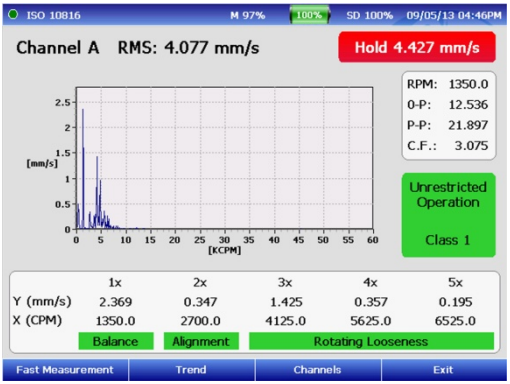
To return to the screen bearing fault frequencies, press function key F2.

Measurement change:

From the Trend screen you can directly access the other tools by pressing F1.

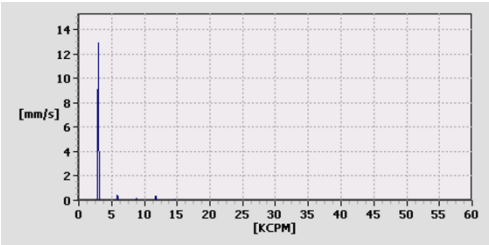
Measuring ISO 10816 analyzes the values measured by the DSP Logger Expert against the standards values.

Once confirmed with the ENTER key, the measurement is presented from the first moment of the visualization.



The ISO 10816 screen is presented at the top, with the input channel measurement to the RMS value on the left and left the red HOLD frame at the right. You can keep this maximum value detected from the start of the measurement or reset it to zero by pressing the # key.

The spectral measurement on the screen corresponds to a velocity spectrum of 800 lines with a maximum frequency of 1000 Hz.



On the left side of the screen is a table with the RPM, calculated according to the data entered in the parameter screen. It identifies the actual RPM of the scanned machines.

RPM:	2925.0
0.P.:	23.419
P.P.:	45.635
F.C.:	1.454

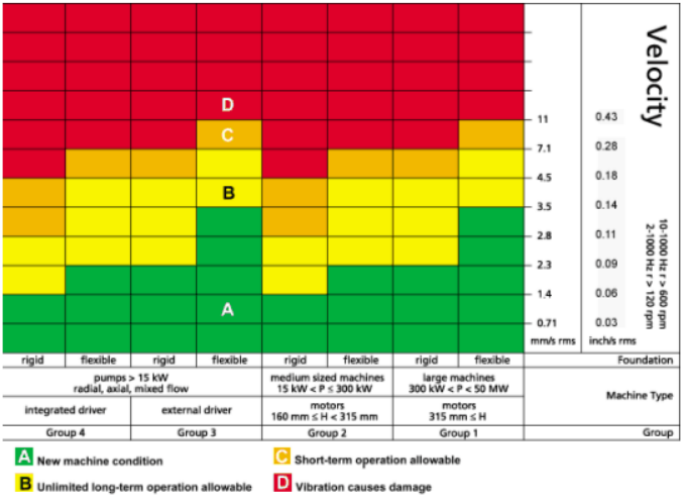
Within the same table you can view the value of:
0.P.: 0-Peak scalar value.
PP: Peak-Peak scalar value.
F.C.: Crest Factor scalar value.
All expressed in mm/s.

ISO 10816 values are indicated by the legend below and in four associated colors.

Unrestricted Operation

Class 1

Standard table:



Additional indicators:

The screen displays a table with the amplitude and frequency and its harmonics from 1X to 5X.

	1x	2x	3x	4x	5x
Y (mm/s)	2.369	0.347	1.425	0.357	0.195
X (CPM)	1350.0	2700.0	4125.0	5625.0	6525.0
	Balance	Alignment	Rotating Looseness		

The mechanics related to 1X and its harmonies are shown on the same screen.

Each color indicates a different status:

Color	Balancing	Alignment	Rotating Looseness
GREEN	Normal	Normal	Normal
YELLOW	Caution	Caution	Caution
RED	Emergency	Emergency	Emergency

The measurement is presented as On Line.

To stop the measurement, activate the ESCAPE key.

To restart the measurement, activate the ENTER key.

The status indicator measurement is at the top of the screen, indicated with a circle of different colors.

○	In process measurement outside
●	Measurement stopped; flashing indicator
●	Continuous measurement process

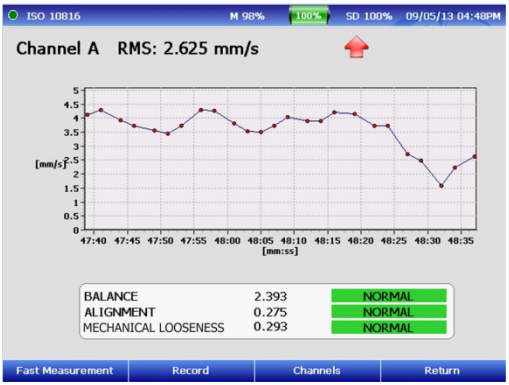
Channel change:

To change the channel, press F3.

Trend function:

F2 activates the screen showing a graph of the trend measurement of the selected channel.

The trend graph shows all measurements for a maximum period of two (2) minutes.



The Trend display shows value drifts as indicated by an up or down arrow, coinciding with the comparison of the last value entered.

Declining value 

Increasing value 

This trend function screen also shows the status of the balancing, alignment, and rotation looseness.

The statuses are:

Color	Balancing	Alignment	Rotating looseness
GREEN	Normal	Normal	Normal
YELLOW	Caution	Caution	Caution
RED	Emergency	Emergency	Emergency

Where the status of balancing and alignment, shows the value of the component corresponding to the vibratory phenomenon.

Channel change:

The channel can be changed by pressing F3.

Record:

By pressing F2, you can save a time period of the measurements entered.

Activate starting and stopping the recording of data with the F2 key. Recording will also stop automatically when you complete the set maximum recording time.

Return:

Press F4 to return spectrum measurements.

Measurement Change:

Pressing F1 from the trend screen will access the other tools.

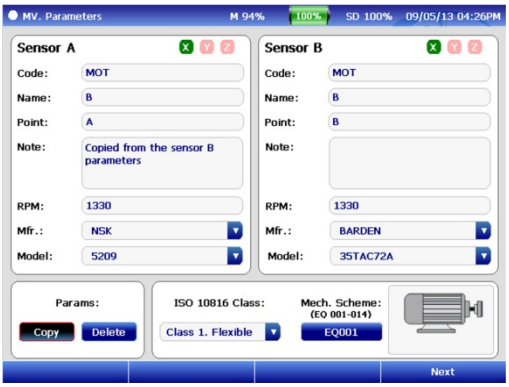
Function Dual Channel:

This function, available on two simultaneous channels,, makes it possible to verify all the mechanical parameters of equipment on a single screen.

This application brings together the different calculations of bearing failure analysis, bearing lubrication, and low frequency faults such as unbalancing, misalignments, and rotating looseness on the machine.

This application is available from the first screen. Once the equipment parameters or points are entered from the measurement screen you will receive bearing and ISO 10816 analysis.

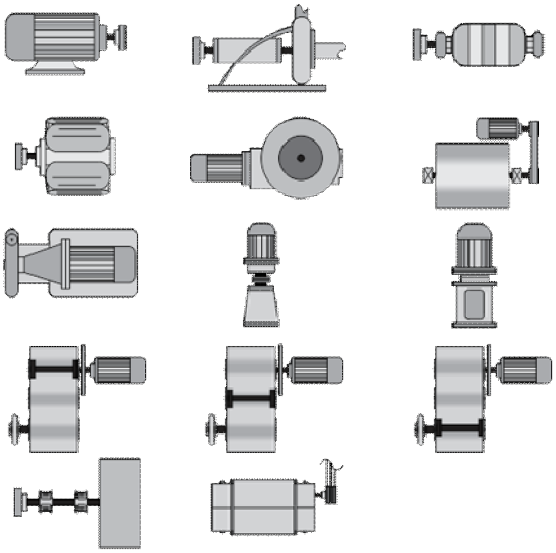
The required parameters for the operation of this application are RPM, ISO 10816 class, and the mechanical schematic of the machine.



The mechanical schematic is preloaded in the database of the DSP Logger Expert.

If the drawing of the scheme being analyzed is not within the base, you can apply it by sending a file containing details of the machine and your plan or upload instructions to dsptech@semapi.com.

The actual schemes are:

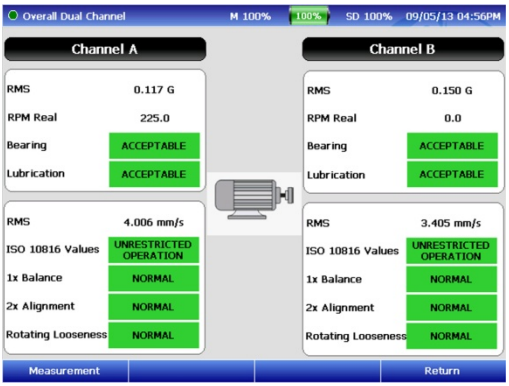


Once you have loaded the parameters, press F4 to select NEXT.

Dual channel:

The dual channel screen was designed to control all the parameters of the machine, and failure detection can measure on two channels simultaneously.

On one screen you can see the acceleration and velocity measurements, bearing analysis, lubrication, ISO 10816 measurements, balancing, alignment, and rotational looseness.



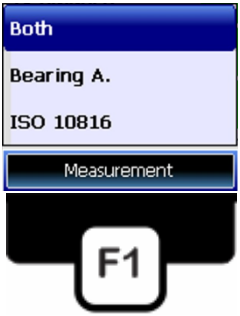
The acceleration measurement can be seen in the middle of the screen above, showing a table for each channel:

RMS Value
RPM Real
Bearing status
Lubrication status

The velocity measurement is under acceleration and is shown in the table for each channel:

RMS Value
Measurement status: ISO 10816
Balancing status
Alignment status
Rotational looseness status

Pressing F1 allows for visualization of the values of acceleration and velocity separately or together.



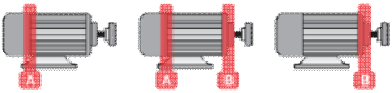
Record:

Pressing F2 can save a time period of measurements and status data entered in both channels.

Alerts of machine status:

In dual channel measurement, when a status stops being normal or acceptable, this abnormality will be indicated by a red line.

This can produced in either measurement point or both simultaneously, as shown below.

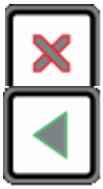


This indication of failure may shift as you change measurements and their statuses.

The measurement is presented as On Line.

To stop the measurement, ESCAPE.

To restart the measurement, activate ENTER.



The status indicator measurement is at the top of the screen, indicated by different colored circles.

○	In process measurement outside
●	Measurement stopped; indicator flashing
●	Continuous measurement process

Exit the application by selecting F4.

Vibration analyzer:

This firmware allows for route measurement, fully configured by the user analyst, and can measure all variables and settings that the DSP Logger Expert provides.
A simple load of the machine parameters is needed if further analysis with expert tools is requested or if you want to save the measurement.

Input parameters:

For instructions on how to input parameters, see pages 3-6.

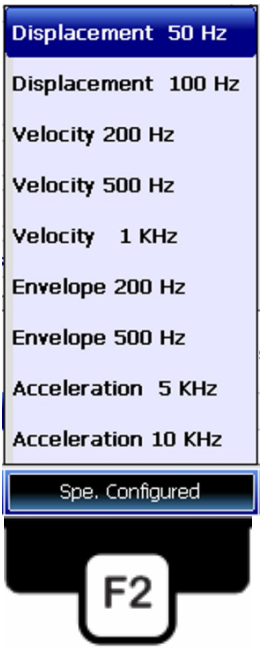
Once you have entered the equipment parameters to measure, you can access the various measurement options.

The firmware contains preconfigured measurements of vibration variables that can be measured in Channel A and Channel B with sensor 1 and sensor 2 respectively. The input of the measurement parameters in fully configurable.

Use F2 and F3 to enter these options.

Preconfigured measurements:

Preconfigured measurements are accessed by pressing F2, which will bring up a list of pre-configured measurements with a spectral resolution of 800 lines, predefined variables, and maximum frequencies.



Recommendation

When you perform a quick analysis of a machine or a point, it is advisable to start with preconfigured measurements. This is because the same analysis requires measurements of other variables, such as vibration, which can move easily from one to another when measuring.

After selecting the preconfigured measurement, begin measuring the equipment.

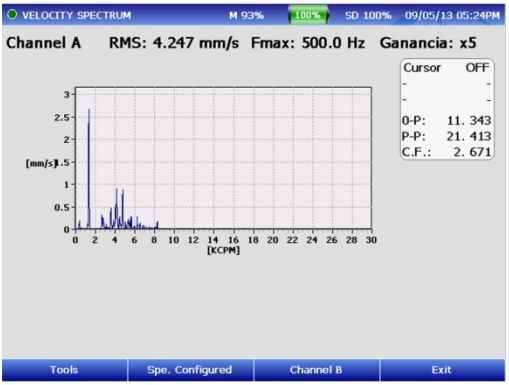
The preconfigured measurements of acceleration and speed variables have analysis tools:

Acceleration:

Bearing analysis in measurements of fmax 5 kHz and 10 kHz.
Lubrication analysis at fmax 10 kHz measurements.

Velocity:

ISO 10816 status, balance state,, alignment, and rotational looseness.



The tools applied to the variables of acceleration and speed are activated by F1. Pressing F1 again will bring up the trend function, which can be confirmed by selecting ENTER.

Repeat the operation by pressing F2, which will move to another preconfigured measurement spectrum.

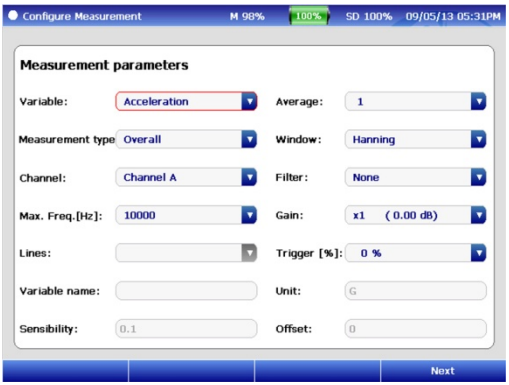
You must activate F2 to go from one measurement to another. Confirm with ENTER.

Analyzer:

This option allows the measurement setup with all its options, as defined by the operator analyst.

It is activated with function key F3.

The main screen shows selectable measurement configuration fields for all measurement parameters.



Variable: Acceleration

Variable: acceleration, velocity, displacement, enclosure, AC amplitude, and DC amplitude.

Measurement type Overall

Measurement type: scalar, spectrum, waveform.

Channel: Channel A

Channel: this option defines the inputs to be measured and the selected variable.

The channels options are:
Channel A, which only activates channel 1, input A.

Channel B, which only activates channel 2, input B.

Dual channel activates the simultaneous measurement channels 1 and 2 to inputs A and B respectively.

Triaxial A activates channels 1, 3, and 5 of input A.

Triaxial B activates channels 2, 4, and 6 of input B.

Max. Freq.[Hz]: 10000

Maximum frequency: fmax can be selected for any of the measurements except the DC amplitude.

Fmax are the configurable minimum 10 Hz, 20 Hz, 50 Hz, 100 Hz, 200 Hz, 500 Hz, 1000 Hz, 2000 Hz, 5000 Hz, 10000 Hz, 15000 Hz, and 20000 Hz maximum.

Recommendation

Fmax settings directly affect the response time of the measurement, so it is recommended to check the measurement time table described in Chapter 1: HARDWARE, page 19.

Recommendation

The best selection of fmax can be found by calculating the 1x you want to see in the spectrum and at least 10 harmonics of this component. If it exceeds the fmax, a measurement may be lost between component definition, which means you will have to configure the spectra to a higher resolution and increase the measurement time.

Lines:

These are the lines of resolution of the spectra or the points of a waveform.
The selection of the spectrum lines of resolution are: 400, 800, 1600, 2400, 3200, 6400, 12800, and 25600.

Recommendation

The configuration of the resolution lines directly affects the response time of the measurement, so it is recommended to check the measurement time table described in Chapter 1: HARDWARE, page 19.

Variable name:

Variable Name: This field is to assign a name to the measurement, amplitude, or variable amplitude AC and DC.

Sensibility: 0.1

Sensitivity: The input field measurement factor expressed in volts / measurement unit.

Average: 1

Averages: The average that is set is linear and is obtained by adding a number of spectrums and dividing the total by the number of spectrums used. This is done for each line of the spectrum, and the result is an arithmetic average true, line by line, the average possible values of which are 1, 2, 5, 10, 20, and 50.

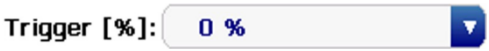
Window: Hanning

Window: allows you to choose between different options for windows that act on the waveform. (View details for applications on the next page).
After setting these options they are passed directly to the measurement window. In this mode the machine makes the measurement according to the settings chosen. You will have to access the screen menu to save the measurement or re-measure and also to access diagnostic tools.

At the end of this configuration, the program will request confirmation. Once accepted, the selected measurement window will be blank. Pressing ENTER will take the measurement system according to the parameters. Type window, Hanning, Flattop rectangular.

Filters: measurements and options are enabled by each measurement. The filters are available in most low-frequency filtering and continuous signals that may appear in measurements or integration.
Options: 1%, 5%, and 10% of fmax. ISO 10816 filters is applied to perform measurements from 10Hz to 1000Hz, depending on the requirements of the standard vibration. Measurement filters are 1.25 kHz to 2.5 kHz, 2.5 kHz to 5 kHz, and 5 kHz to 10 kHz.

Gain: allows you to switch the resolution of the AD converter between X1 and X100. In order to measure a very low value, you will have better resolution by setting the maximum gain.



Shooting: edit and adjust the sensitivity of the external trigger when doing a natural frequency test. This must be entered with the keyboard and can be set with values from 0 to 100 %, where 0 disables the function and 1-100 % decrease sensitivity.

Unit: This field is to be able to name the unit of measurement inputs: AC amplitude and DC amplitude.

Offset: After selecting the measurement parameters, confirm with function key F1.

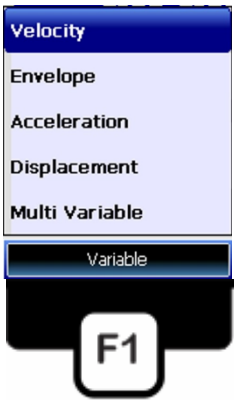
Scalar measurements:

When selecting a scalar measurement of any variable vibration, the screen displays the RMS, 0-peak, and peak-peak crest factor.

The scalar measurement screen also shows the input channel signal, the unit scalar values, and the measurement setup in fmax and gain.

The function keys are enabled for different options.

With the F1 key you can change the variable to measure. You can also switch between pre-set and determined variables.

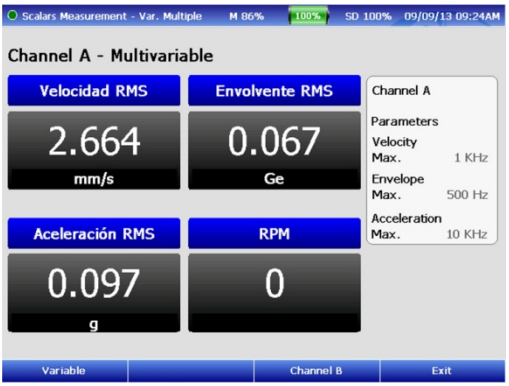


Other variables measuring vibration can be selected from this function with the following configuration:

Velocity:	1 kHz
Envelope:	500 Hz
Acceleration:	10 kHz
Displacement:	100 Hz

Multivariable:

This screen shows RMS velocity measurements, RMS Envelope, RMS acceleration, and RPM acceleration.



Channel change:

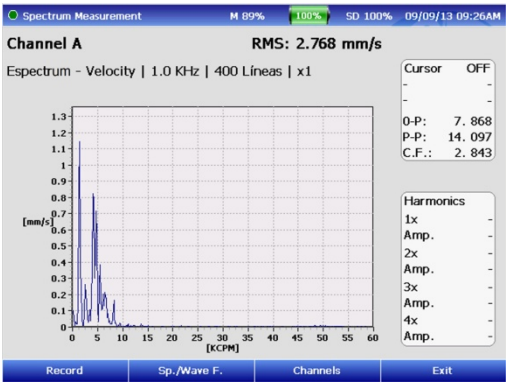
The channel can be changed by pressing F3.

Exit the application with function key F4.

Completed measured values and parameters can be recorded.

Spectral measurements:

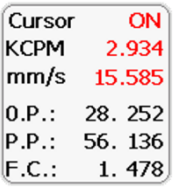
Once selected and configured, all the parameters for a spectral measurement can be shown in a broad spectrum on the display.



In this type of measurement, markings remain active. The harmonic cursor is activated by the 1 key.

The line runs point to point, and spectral values are automatically positioned on the widest point. Their frequency can be moved up and down with the pictured keys:

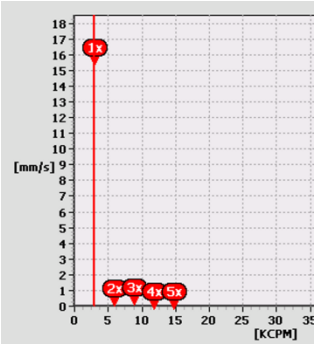
Repeatedly touching the key advances the point in small amounts, and pressing the key continuously makes larger changes.
The details of the marking cursor may be in a box on the right side of the screen.

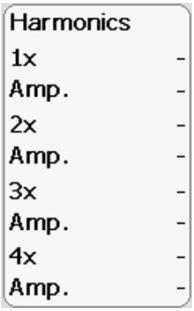


Also included are 0.Pico values, Peak-Peak, and Crest Factor.

Once you locate the cursor, you can start dialing the harmonics with the 3 key.

Markings are activated in the harmonic peaks.





The values of the frequency and the amplitude of harmonics are found in the box.

A yellow mark on the top left of the screen indicates functions since cursor measurement stops.

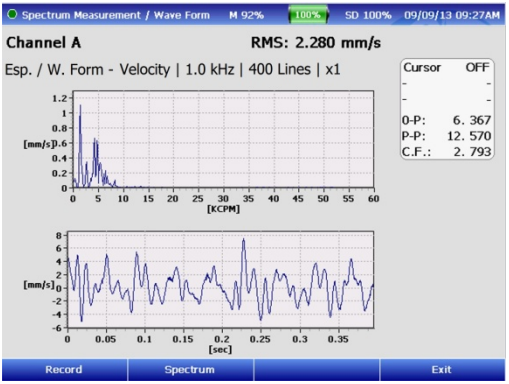
You can re-activate the measurement, disabling the cursor mark, with the 1 key.

To record the measurement you must activate function key F1.

Spectrum / waveform:

The function is activated by pressing F2.

F2 activates a waveform graphic, shown below.

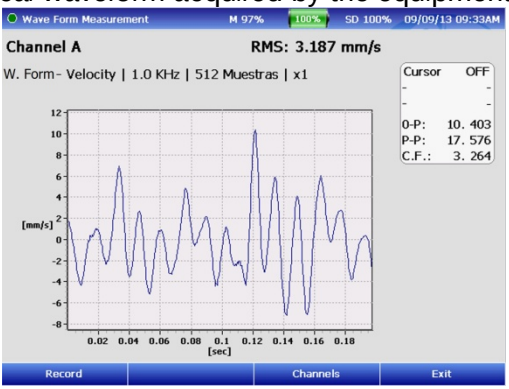


Pressing F2 can return to the spectrum.

To record the measurement you must activate the function key F1.

Waveform Measurements:

Like the spectrums, the display shows the full graphical waveform acquired by the equipment.



To record the measurement you must activate the function key F1.

Channel change:

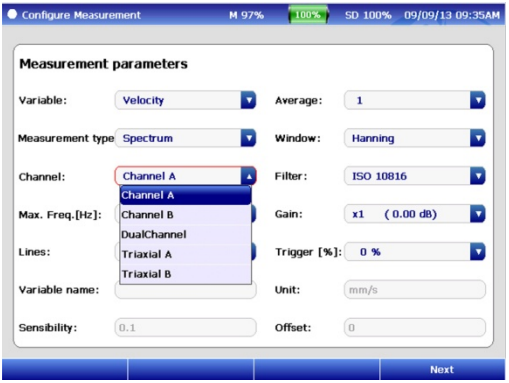
Use key F3 to change the channel.

To exit the measurement, activate the function key F4.

Dual channel measurements and triaxial:

All measurements of spectrums and waveform can be displayed on a single screen, with each of these signals occupying a different input channels.

To enable simultaneous measurements of different channels, you must select the input channel in the parameter screen.

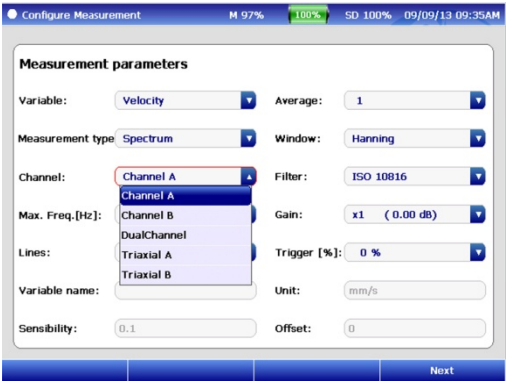


The dual mode channel enables channels 1 and 2 of the inputs of Channel A and Channel B of the equipment patch panel, respectively.

The conventional cable connection sensor is sufficient for these measurements.

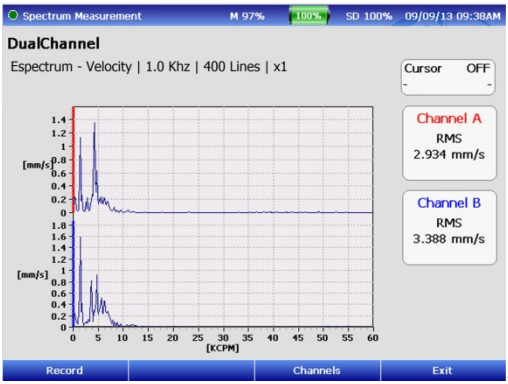
After selecting the type of channel for measurement parameters, confirm by selecting F4 and NEXT.

The functions of the display will change, enabling measurement with the function key F1.



Start measurement by pressing the function key F1.

The display shows the spectrums of the two inputs, the RMS values of each title, and the selected configuration parameters for that measurement.

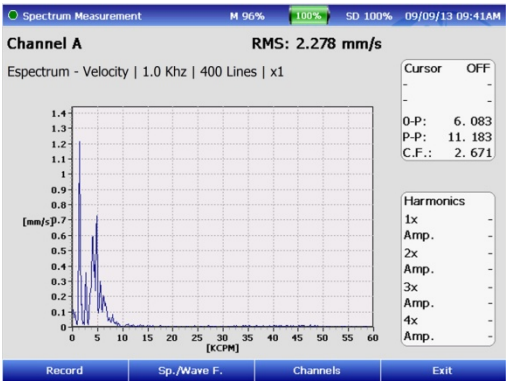


To record the measurement press function key F1.

Channel change:

Key F3 can change between channels A and B.

Options of spectrum measurements are activated on a single channel.



You can access the spectrum display and simultaneous waveform of the selected channel or access the cursor and its harmonics.
To return again to the measurement dual channel, select function key F3.

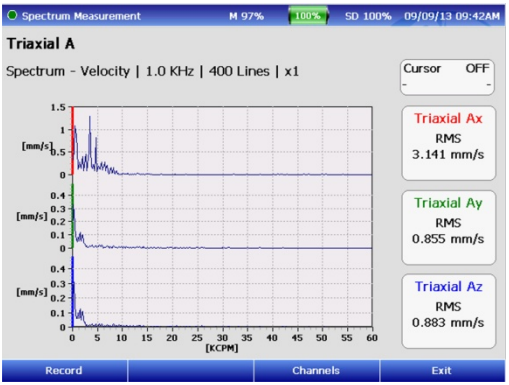
Press F4 to exit the measurement.

Triaxial measurements:

With the DSP Logger Expert equipment, you can connect two triaxial sensors and measure the 3 signals of each simultaneously.

You must set the parameters of the measurement and triaxial channel option A or B as appropriate.

After selecting the type of channel for measurement parameters, confirm by selecting F4 and NEXT.



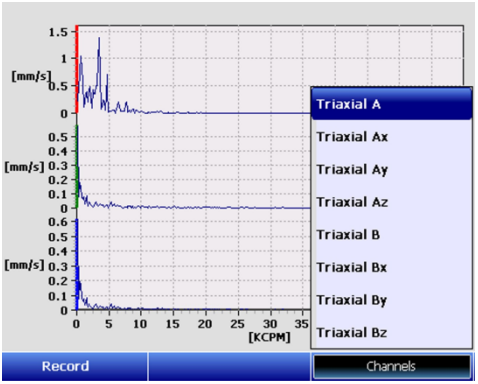
The measurement screen displays three simultaneous measurements of the three axes, with RMS values and the configuration parameters.

To record the measurement you must activate the function key F1.

Channel change:

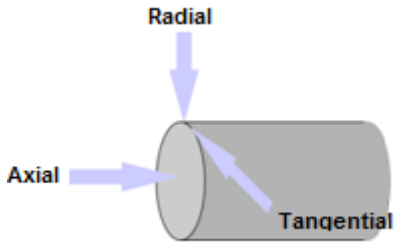
The application can be changed via key F3.

For triaxial measurement, changing the channel has individual measurement options for each sensor measurement axis. The measuring inputs are grouped in Channel A and Channel B.



Instructions for use:

To aid in determining machine problems, it is very useful to obtain vibration data of each measurement point in three directions. These addresses are called Axial, Radial, and Tangential.



The axial direction is the direction parallel to the arrow. It is the direction radial from the transducer towards the center of the arrow and is 90 degrees tangential radial to the shaft.

The sensor uses the DSP Logger Expert to identify the top measuring axes of vibration.

Troubleshooting:

Problem	Possible solution
The channel indication disappears, or the sensor input displays the word ***Desc***	The sensor in the channel is offline. Check that you are connected to the correct channel and verify the integrity of the cable.
In the parameter screen, the 3 sensors are flashing red.	Check that the input channels have the cables connected and that the cables are in good condition.
You are prompted to complete the measurements when attempting to start measuring.	You must have defined parameters before measuring, and you must complete the parameters for proper operation.

SEMAPI provides technical information on the Internet, to help use their products:
www.dsplogger.com , can find technical manuals, a database with frequently asked questions and application notes.
You can also find instructional videos Firmware of the DSP Logger Expert in:
https://www.youtube.com/user/semapicorp