

VIBSCANNER®
Balancing
FFT frequency analysis
Signal analysis

Operating instructions

Dear Customer,
If you have any suggestions for
improving this product or this manual,
please let us know.
eMail: info@pruftechnik.com



VIBSCANNER type:	VIB 5.400 / VIB 5.400 EX
Firmware version:	2.0x
Edition of this manual:	November 2010
Order number:	VIB 9.664.G
Original manual	

Contents

Registration	6
Chapter 1: Balancing	8
Transducer set VIB 5.486-HW	8
Installation	9
Notes on balancing	13
Balancing report	15
Balancing in one plane	16
Measure initial unbalance	17
Trial run	18
Trim run	19
Display options	21
Displaying results	22
Saving the results	23
Undoing balancing steps	24
Combine balancing masses	26
Correction mode: Fixed location	28
Correction mode: fixed mass	30
Correction mode: Tape measure	32
Machine setup	34
Balancing in two planes	38
Preparation	39
Measuring initial unbalance	40
Trial run	42
Trim run	44
Balancing without a machine setup	47
Measuring procedure	47
Tools	49
Chapter 2: Frequency analysis (FFT)	50
Zooming and scaling	52
Scaling the Y axis	52
Zooming the X axis	53
Line zoom	54
Max10 function	55
Max10 zoom	55
Info on the measurement	56
Series spectra ('Waterfall diagram')	57
Chapter 3: Signal analysis	58
Time waveform	58
Zoom and scaling	60
Info on the measurement	61

Phase measurement	62
Orbit	64
Recording	66
Time-synchronous FFT analysis	70
Appendix	71
Measurement tasks for frequency analysis	71
Balancing quality grades and groups of rigid balancing bodies	74
Machine types	74
Technical data	75
Accessories	75
Channel switchbox (VIB 5.445 / VIB 5.446)	75

Foreword

This manual describes the firmware modules ‘Balancing’ (VIB 5.486-FM), ‘Frequency analysis - FFT’ (VIB 5.485-FM) and ‘Signal analysis’ (VIB 5.488-FM) that are available as options. You will learn how to balance machines under operational conditions in one or two planes, and you will learn about the new functions for frequency and signal analysis.

The description of the basic functions of the instrument is given in the manual ‘VIBSCANNER - Machine diagnostics and data collection’ (VIB 9.638.G) that is delivered with each instrument as part of the standard package.



Authorized use

VIBSCANNER is intended for exclusive use as a portable balancing instrument for balancing in industrial environments. VIBSCANNER may be used for the balancing of rigid rotors without restriction. Only experienced users may use the VIBSCANNER to balance elastic (soft) rotors within the range of the resonating frequency ($\pm 25\%$). The balancing instrument and accessories may only be operated by trained personnel.

VIBSCANNER is a portable measuring instrument that may only be used to record machine signals within industrial environments.

Transducers and cables may only be used in the specified applications. These applications are given in the corresponding technical datasheets.

Any other use constitutes improper use and is prohibited. PRÜFTECHNIK AG assumes no liability for damage resulting from improper use.

Safety

- The housing is made of an electrically conducting plastic. Consequently, the instrument may only be used to measure small signal voltage ($\pm 30V$) or small signal current ($\pm 20mA$).
- For signal measurement and for data transmission, only use the connecting cable provided for this (see VIB-SCANNER product catalog VIB 9.661-4DG).

- The relevant safety regulations must be observed during measurements on machines.
- When assembling the measuring components, ensure that no fixtures, cables, etc. project within the vicinity of rotating machine parts.
- Follow the directions of the manufacturer when attaching balancing weights.
For balancing weights to be welded on, ensure that the points for adhesion are clean; the earthing electrode of the welding apparatus must be connected to the rotor and not to the machine.
For balancing weights to be screwed on, observe the maximum permissible RPM of the rotor.
- In order to carry out work on the rotor, the machine must be disconnected and measures taken in accordance with the applicable regulations to ensure that it cannot be inadvertently switched on again.
- Before the first measurement (original unbalance), ensure that the preparations have been carried out correctly and completely. In addition to the installation of the measuring components, pay particular attention to the correct input of the setup parameters. A trial mass that is too large can be calculated from an incorrectly entered rotor mass. This can have grave consequences for personnel and machines!
- During the trial and balancing runs no personnel are allowed to remain within the radial vicinity of the machine. This area must be properly secured against unauthorized access. If the trial mass comes off the rotor while the machine is running, danger to life and limb may result in this area!
- If the rotor is located in a protective housing, the hatches in the housing must be closed before the machine is switched on.
- The number of times the machine is allowed to be started must not be exceeded. Otherwise, the motor could be damaged.
- Before the balancing, the cause of the unbalance must be determined and cleared if necessary (e.g. remove any material caked on the rotor, weld cracks in the impeller or replace the impeller, etc.).

Registration

From version 1.3 onwards, the firmware modules ‘Balancing’, ‘FFT analysis’ and ‘Signal analysis’ are contained in each VIBSCANNER instrument and can be activated for use with the respective registration password.



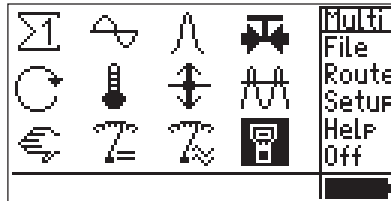
Note

The password for your VIBSCANNER instrument is given on the ‘Balancing’ (VIB 5.486-B), the ‘FFT Analysis’ (VIB 5.485-FFT) and the ‘Signal analysis’ (VIB 5.488-A) password certificates.

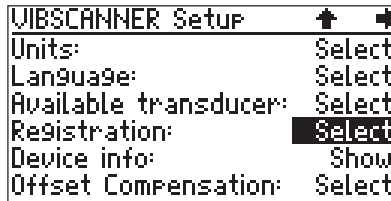
To enter the password, proceed as follows:



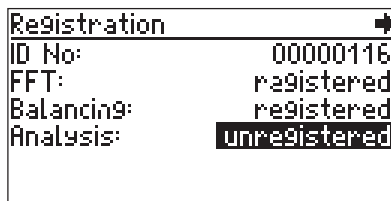
- Switch on the VIBSCANNER.
Press the joystick upwards for approx. 2 seconds and then release it.



- Click on the ‘VIBSCANNER setup’ symbol



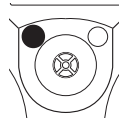
- Click on the ‘Registration’ option in the VIBSCANNER setup:



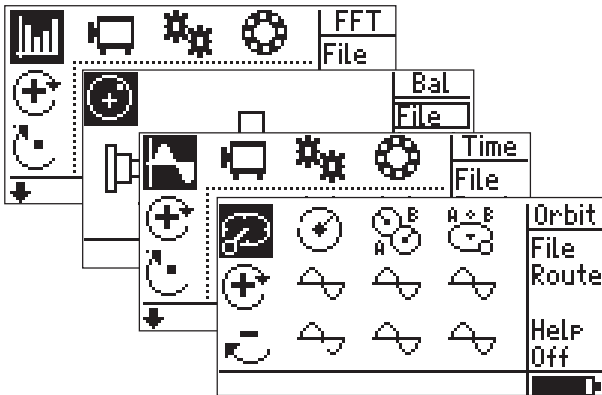
- Click on the module to be registered and enter the password in the text editor.
- Then click on OK:



- Acknowledge the message and press the ESC key until you reach the start screen again.



By repeatedly clicking on the top left screen symbols you reach the newly registered firmware module:



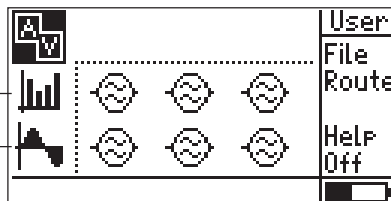
Optional firmware modules

The following selection menu is available for measuring a spectrum or time waveform with a user-defined quantity*:

*The quantity can be set in the sensor setup.

Available with 'FFT analysis' module

Available with 'Signal analysis' module

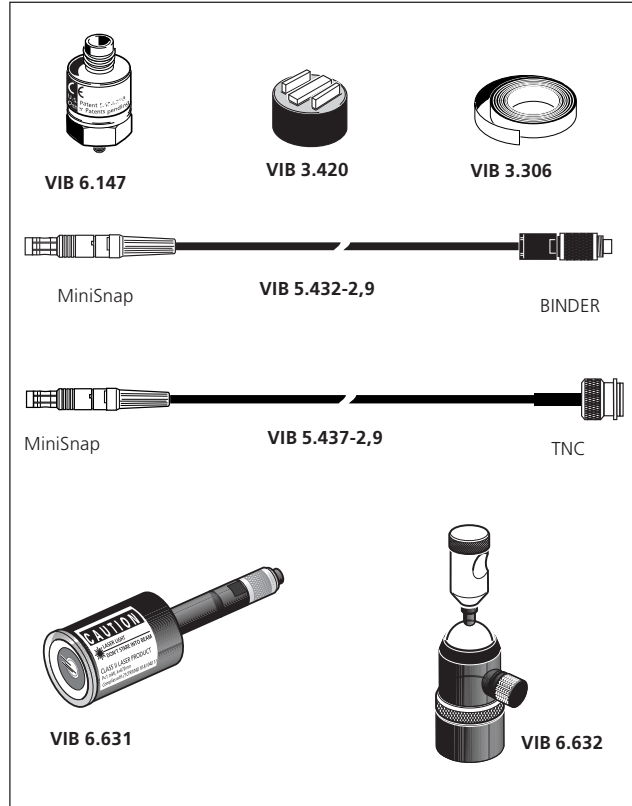


User-defined measurement tasks

Chapter 1: Balancing

Transducer set VIB 5.486-HW

All components that are required for balancing in one plane are given in this accessory package.



- | | |
|---------------|---|
| VIB 6.147 | Mobile industrial transducer for slow-speed machines, M5 plan |
| VIB 3.420 | Magnet for curved surfaces |
| VIB 3.306 | Reflective tape, 10 mm wide |
| VIB 5.432-2,9 | VIBSCANNER cable for trigger sensor, length 2.9 meters |
| VIB 5.437-2,9 | VIBSCANNER cable for LineDrive transducers, length 2.9 meters |
| VIB 6.631 | Laser optical trigger sensor |
| VIB 6.632 | Trigger bracket |

Installation

When working on the machine, it must be disconnected and secured against being switched on inadvertently!



WARNING!

1. Try to find the cause of the unbalance by visually checking the machine and correct this if possible.

Example: Remove any deposits from the impeller, reattach any lost correction masses and tighten any loose screws on the foundation.

2. Determine the measuring and balancing plane and mount the vibration transducer on the bearing housing at the measurement location with the highest vibration values. Pay attention to the following points:

- The measuring plane should be in the middle of the bearing if possible and should lie close to the correction mass plane and significant mass plane (e.g. impeller side, rotor). You can find the most suitable measurement location by searching for the direction with the highest vibration values, e.g. with a hand-held probe (take note of the measurement directions according to DIN ISO 10816-3).
- Attach the transducer with a magnetic adapter* directly to the bearing housing as close as possible to the middle of the shaft. Do not attach transducers to components with their own vibrations such as covers, etc.
- The measurement direction must correspond with the main vibration direction. For a horizontal measurement direction, attach the transducer on the lower half of the bearing housing.
- Hand-held probes are not suitable for balancing!
- Only for dynamic balancing in two planes: Determine the second plane (B) in the same way.

If the machine is not balanced on site in the condition in which it will be installed, it must be permanently installed on a rigid foundation (directly on the frame or on vibration dampers).

*VIB 3.422 or VIB 3.420
Adapter for planes and curved surfaces

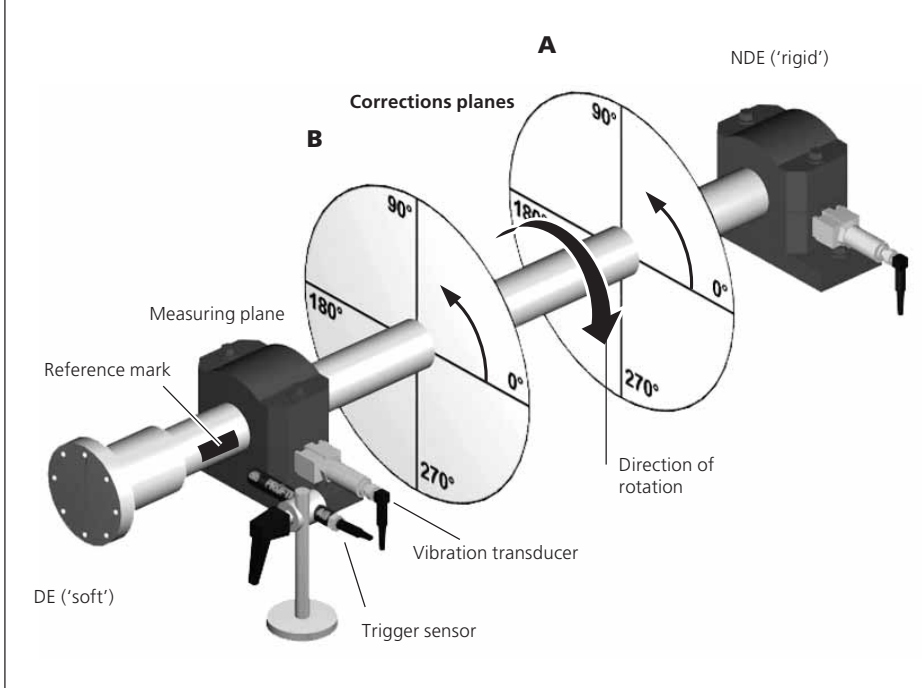
Plane A should be on the non-driving side and plane B should be on the driving side (see next page).



Note

Typical configuration:

Measurement and balancing planes A & B, reference mark, mounting angle ϕ

**Note**

As VIBSCANNER has only one transducer channel, you must work sequentially when balancing in two planes . To do so, use the channel switchbox (automatic - VIB 5.446 or manual - VIB 5.445 see page 76).

3. Evaluate the operating condition of the machine using a summation vibration measurement according to DIN ISO 10816-3.
 - Low-speed machines (<600 rpm):
Measure the vibration speed using a suitable setup* and the industrial accelerometer for low-speed machines (VIB 6.147). If the values no longer lie within the acceptable range, take an FFT spectrum measurement.

* Setups in window $\Sigma 2$

- Medium-speed machines (>600 rpm):

Measure the vibration speed using a suitable setup* and the industrial accelerometer (VIB 6.142R). If the values no longer lie within the acceptable range, take an FFT spectrum measurement. If high vibration signals appear at the rotational frequency, start with the balancing procedure. Record the measurements for later comparison.

Example: If peak values of around 25 Hz occur in a machine at 1500 rpm, this is referred to as rotational frequency vibrations that indicate an unbalance.

* Setups in window $\Sigma 2$

At high axial measurement values, a large couple unbalance is present that cannot be corrected using the measures described here.



Note

4. Attach a reference mark* on the shaft for the trigger sensor. Pay attention to the following points:

- As the reference mark use VIB 3.306 reflective tape or a contrasting mark (e.g. black color on a light shaft background) and attach it perpendicular to the direction of rotation.

Set the mark as close as possible to the slot of the adjusting spring. The mark can then be found again more easily and the measurement results are easier to reproduce.

- Angle convention: The angle reference mark is at 0°; the angle ϕ of the correction masses is measured counter to the direction of rotation of the shaft. The default trigger reference edge is the 'outgoing' signal edge (see Tech-Note CM 22).

* Only one mark may be attached to the shaft as only one pulse per revolution is processed!

In fans, number the blades according to the direction in which the mounting angle is measured. Blade no. 1 is at the 0° position (see 'Fixed location' on page 28).



Note

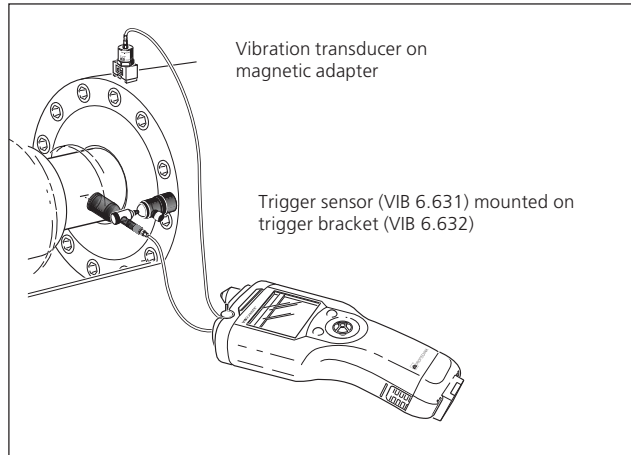
5. Mount the trigger sensor with the trigger bracket (VIB 6.632). Pay attention to the following points:

- Maximum distance to the shaft:

2 m (reflective tape) / 0.75 m (contrasting mark)

To adjust the trigger sensor, the laser beam is pointed toward the reference mark while the machine is at a standstill. As far as possible, the laser beam should be perpendicular to the shaft surface and shaft axis.

- Avoid external reflections (e.g. discharge lamps, etc.) as these can interfere with the trigger signal. If the shaft is shiny, the trigger must be mounted at an angle (approx. 15°) to the shaft surface.



6. Connect the vibration transducer and the trigger sensor to the VIBSCANNER.

**Note**

To complete the preparations, pay attention to the following instructions:

- The balancing speed should be as close as possible to the operating speed. If this is not possible as a result of high vibration values, you must start at a lower speed and approach the operating speed gradually over several balancing runs. During a balancing run, the speed must be constant! If not, the balancing run must be started again.
- During measurement, the rotor must be under warm running conditions (e.g. if the rotor operates in a hot air stream).
- Often static unbalance is dominant at vibration values greater than 10 mm/s. Correct for this first using 1-plane balancing before continuing with 2-plane balancing.

Notes on balancing

Before you start the measurement, pay attention to the following notes on specific procedures and special features of the balance mode.

Setup

The measurement setups that already exist in the basic version are expanded by the following parameters:

'Pulse/rev.': Number of trigger measurement marks on the shaft

The 'Settling time' for the trigger sensors that are being used can be selected:

Device setup /Available transducers-> Menu: Time

Data on the machine to be balanced are managed in the 'Machine setup' *. Parameters which can be changed during the balancing appear in the 'Tools' menu (see p. 34).

* These data are required for determining the trial mass, the residual unbalance and the balancing quality. Balancing without a machine setup should only be performed by an experienced user (see page 47).

Display

- The measured unbalance is displayed in a polar diagram (see below). The distance of the pointer from the origin is a measure of the vibration quantity (velocity, acceleration, displacement). The angle indicates the phase position of the unbalance pointer.
- The display range is automatically set to the current measured value (autoscaling).
- For more than two balancing runs, only the current run and the last run are displayed in the polar diagram. You can hide or display the unbalance pointer of previous balancing runs with the joystick (up / down).



Navigation

- After completing a measurement or an entry, move to the next step with the joystick (to the right). The result is accepted while doing so.
- To scroll backwards or forwards, press the joystick to the right or to the left.

0. Initial unbalance

1. Trial run

2...N. Trim run

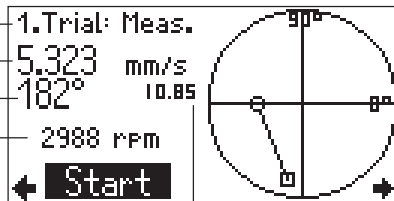
Measured value

Phase angle

RPM

Previous step

Balancing run with current number:



Next step

Measurement



Note

Check again that all measuring components have been mounted correctly. Check all the data in the current machine setup, before you begin with the measurement. Incorrect rotor data can lead to the calculation of a trial mass that is too big – with serious consequences for personnel and machine under certain conditions.

Follow the safety instructions on page 4!

Only an external trigger sensor may be used for balancing with VIBSCANNER. The internal trigger sensor is not suitable for balancing.

The following section describes the balancing in one plane, the display and saving the results as well as the individual options that are available during the balancing process.

As VIBSCANNER only has one analog measuring channel, you must proceed sequentially when balancing in two planes.



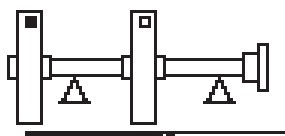

Balancing report in the
 'Alignment Printing Tool'
 (see page 15)

Balancing report


The balancing result can be printed out as follows:

1. Install the 'PRÜFTECHNIK alignment printing tool' from the CD, and start the program.
2. Connect the VIBSCANNER after the measurement to the PC.
3. Press the function key in the last results screen, and click on 'Data':




4.Trim: Mount mass! A	Bal
	Data
← 6:8.79	Undo
7:3.29	Save
	Setup
	Tools
	

4. Press the function key, and click on 'Reprt' (Report):

Balance Data	Bal
Name: VIB-Demon	Ok
Date & Time: 17.09.03 02:	Save
Planes: tw	Sum
Number of av:	Setup
Speed [rpm]:	Reprt
Bal. Quality:	

5. Select the contents of the report which should be printed out together with the measurement data.
'None' = Entry is not printed out. Text can be selected and created using the 'Chng' (Change) menu item.

Select report contents	Reprt
Company: PRUFTE	Ok
User/Operator: None	Help
Customer: None	Chng
Department: None	Info
Asset: None	Print
Location: None	

6. Click on 'Print' in this menu. The data are transferred to the PC and the report is assembled in 'Printing tool'.
7. Print out the report using the 'Printing tool'.

Balancing in one plane



Note

The following balancing procedure is described as an example in the correction mode 'Free' (page 28f., 35).

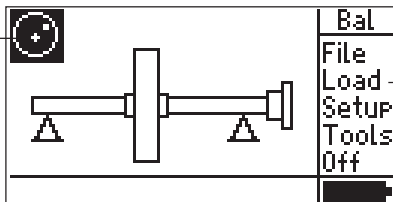


- Switch the VIBSCANNER on.
Press the joystick upwards for approx. 2 seconds and then release it.



- Activate the 'Balance' mode.
Click repeatedly on the screen symbol at the top left until the 'Balance' symbol appears. Then move the joystick to the right.

'Balance' screen symbol

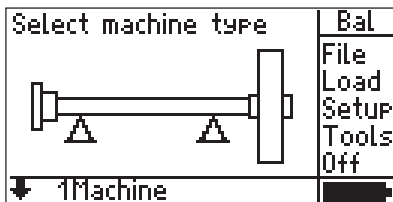


Opening last saved file



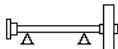
- Select a suitable machine type for balancing in one plane with the joystick.
An overview of the machine types is given on page 75.

'Balance' start screen



Note

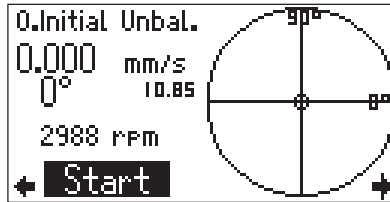
The *machine* that is assigned to the selected *machine type* is displayed in the status line:

- Machine type: 
(e.g. rotor/floating bearing/1 plane)
- Machine: User-defined machine setup
(e.g. '1Machine', 'Fan15',...).

The machine/ machine setup can be changed in the Setup menu (see page 34, 37).

Measure initial unbalance

- Click ENTER to open the measurement screen:

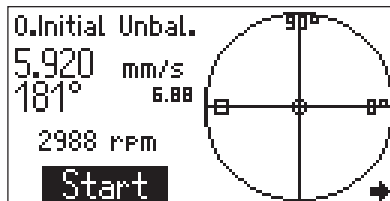


- Switch on the machine.
*Wait until the machine has reached the balancing RPM and, if necessary, operating temperature.
 The vibration transducer and trigger are already connected to the VIBSCANNER.*

Click on START to start the measurement.



If the RPM fluctuates too strongly, an error message appears. Check the connection and mounting of the trigger sensor.



- When the measured values have stabilized, click on PAUSE to stop the measurement.
 To repeat the measurement, click on START again.
- Switch the machine off.

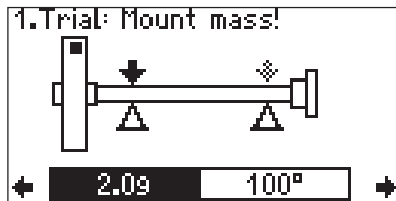




Trial run

- Move the joystick to the right to move to the input screen for the trial run:

Input screen:
Suggestion for trial mass and
mounting angle (correction
mode: 'free', see also page28f.)



If the 'Auto trial mass' option is activated in the machine setup or in the 'Tools' menu, VIBSCANNER calculates the trial mass and the mounting angle. You can change the proposed values for the trial mass (2.0 g) and the mounting angle (100°).



- Attach the trial mass under the specified angle (see Angle convention page 11), and switch the machine on again.



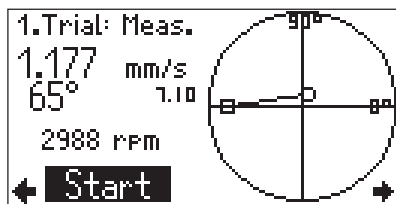
- Move the joystick to the right to open the measurement screen for the trial run.



- Click on START to start the trial run.



- When the measured values have stabilized, click on PAUSE to stop the measurement.



- Switch the machine off.



- Move the joystick to the right to take over the measurement in the trial run.

During the trial run the unbalance should change sufficiently to achieve a continuous reduction of the residual imbalance in the following balancing runs.

If the unbalance pointer changes only slightly, the trial mass must be increased.

If the vibration value has more than doubled, the trial mass must be reduced (message: 'pointer change too large'; see also parameter 'Check bad influence, page 36).

If necessary, scroll back again in the input screen of the trial run, change the mass appropriately and repeat the trial run.



Note

If the unbalance has changed sufficiently, continue with the trim run. Depending on whether an improvement has occurred, you can leave the trial mass on the rotor or remove it again:

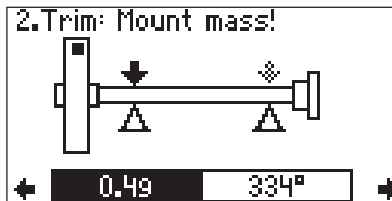


- Click on the required option to move to the input screen for the trim run.

If necessary, remove the trial mass.



Trim run



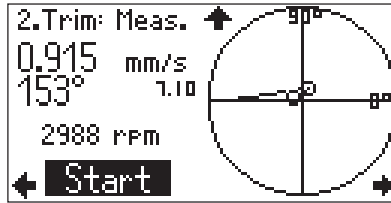
- Attach the proposed trim mass under the specified angle, and switch the machine on again.



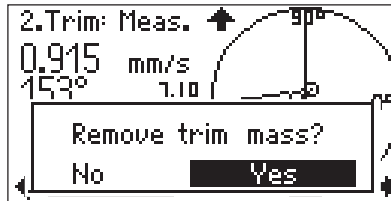
- Move the joystick to the right and click on START to measure the trim run.



- Click on PAUSE when the unbalance pointer is stable, and switch the machine off again.



- Move the joystick to the right to take over the measurement in the trim run.



- If the unbalance in the trim run has improved, you can leave the trim mass on the rotor. In this case, click on 'No'.
Otherwise, remove the trim mass from the rotor.



Note

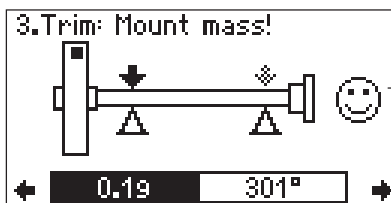
After the 1st trim run, the program checks whether the unbalance in each trim run has improved. If this is not the case, the following message appears: 'No improvement'. Repeat the trim run with another trim mass.

Restarting the balance measurement is recommended if the vibration values deteriorate and, at the same time, the trim mass is not substantially smaller than the preceding trim mass.

- Continue the balancing procedure with the next trim run.

The balancing is complete as soon as the selected balancing quality (see machine setup, page 35, 74) has been reached.

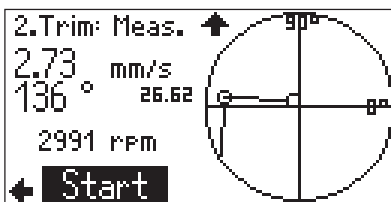
The 'smiley' then appears in the input screen for the next trim run:





Smiley:
Balancing quality reached!

Display options

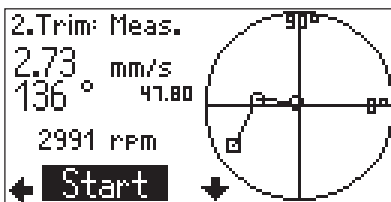
The polar diagram only shows the last balancing run and the one before last after a measurement has been completed.



Symbols in the display field:

-  Trial/trim run
-  Initial unbalance run

To display earlier runs, press the joystick upwards:

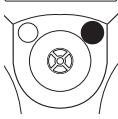


Press the joystick downwards to return to the original display range.

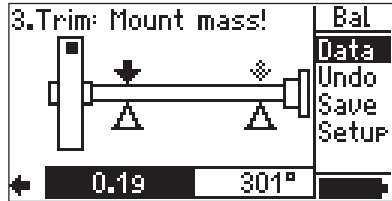


Displaying results

The measurement results can be displayed and saved after each trim run:



- Press the function key in the input screen of the trim run to display the menu:



- Click on 'Data':

In addition to the general data for the measurement of the calculated balancing quality, the centrifugal force and the residual imbalance for the last valid trim run is displayed:

Balance Data		↓
Name:	UIB-Demomachine	
Date & Time:	29.10.02 09:30	
Planes:	two: A,B	
Aver.:	10	
Speed:	1193	
Bal. Quality:	5.77	



- Press the joystick downwards to display the results of the preceding balancing runs:

Data window

Initial unbalance
Trial run
1st trim run
2nd trim run
...

Balance Data					↑
No	Mass [g]	Ang. [°]	Vib [mm/s]	Ang. [°]	
0			5.58	301	
1	5.5	300✓	4.47	5	
2	4.3	51✓	0.29	177	
3	0.3	225*	0.36	194	

Trial/ trim mass

Meas. value

Phase angle

Mounting angle

Mass left on rotor: ✓

Mass removed from rotor: *

Balancing quality: The program calculates the balancing quality from the rotary frequency of the rotor and the specific residual unbalance in the last balancing step.

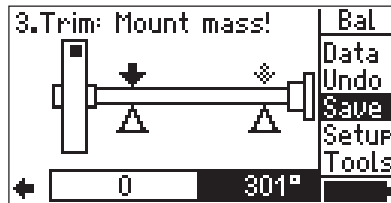
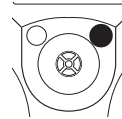
If the calculated quality lies below the quality selected in the machine setup, the balancing is complete ('Smiley').

Centrifugal force: Resulting force on the bearing in the individual planes caused by the remaining residual unbalance.

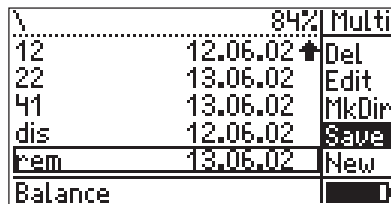
Residual imbalance Product of the unbalanced mass and corresponding radius.

Saving the results

- Press the function key in the input screen of the trim run to display the menu:



- Click on 'Save' to open the file manager:



- Press the function key, click on 'Save' and enter the filename in the text editor.

The results can also be saved from the data window (see previous page).



Note

Undoing balancing steps

If the measurement results deteriorate from a specific trim run, it is possible to return to this still acceptable run and to continue the balancing process with other masses and angles.

In the following example, the measured values in the third and fourth run deteriorate. To undo these steps, proceed as follows:

Data window (see page 22)
after the fourth balancing run



	[g]	[°]	[mm/s]	□
0			10.09	34
1	2.0	90 *	8.26	3
2	2.0	360 ✓	1.90	107
3	0.1	75 ✓	2.95	160
4	1.0	180 ✓	3.90	56

Measured values
deteriorate



- Press the ESC key to leave the data window.
- Press the joystick to the left until you reach the input screen for the still acceptable balancing run, here the second run:



2.Trim: Mount mass!		Bal
		Data
		Undo
		Save
		Setup
		Tools
←	2.0 g	360°

- Press the function key and click on 'Undo' in the menu.

- If you acknowledge the following message, all subsequent balancing runs are deleted (3rd & 4th runs here).



Make sure that the masses that you attached in the 'deleted' steps are removed from the rotor again.



Note

Press the function key in the input screen again and click on 'Data' to open the data window. The third and fourth runs are deleted, and the balancing process can now be continued with other masses and angles.

	[g]	[°]	[mm/s]	□
0			10.09	34
1	2.0	90 *	8.26	3
2	2.0	360 ✓	1.90	107

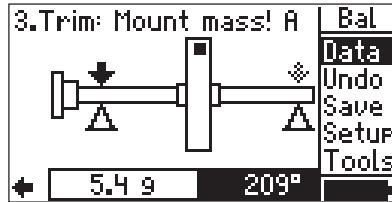
↑

Combine balancing masses

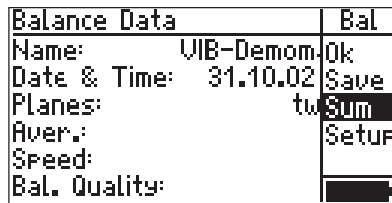
If you have already attached several balancing masses to the rotor, you can combine these into a single mass. To do this, the program adds the vectors of the individual masses and displays the calculated mass and the angle of attachment.



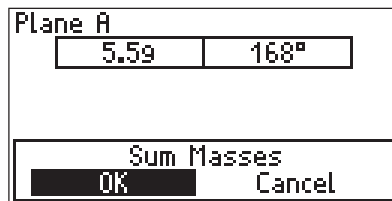
- Press the function key in the input screen of the trim run to display the menu:



- Click on 'Data' to open the data window:



- Press the function key and click on 'Sum':



The resulting mass and the corresponding mounting angle are displayed for each plane.

- Click on 'OK'.

Then remove all masses already mounted on the rotor, and attach the new balancing mass on the rotor.

- Confirm the following message:

Sum Masses
Masses combined Undo all other masses!
OK

- Perform the next balancing run.

If the parameter 'Recalc. coeff.' was set to 'active' in the machine setup, it is set to 'inactive' after the summary of the masses (see page 36).



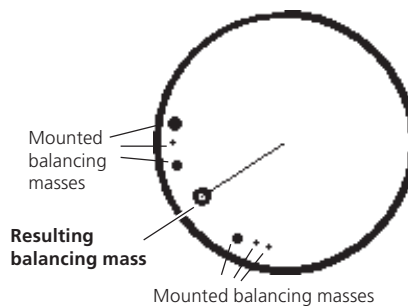
Note

The balancing run, in which the masses were summarized, is marked with an 'S' (=sum) in the data window.

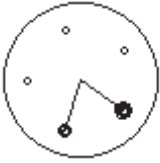
Balance Data				
No	Mass [g]	An9. [°]	Vib [mm/s]	An9. [°]
0			5.02	297
1	2.4	300*	4.26	3
2	2.4	50√*	0.56	111
3	5.5	168 S	0.66	119

*: Remove mass

S : Masses summarized



Combine balancing masses



'Fixed location' correction mode.

Correction mode: Fixed location

If the balancing masses can only be attached at specific positions on the rotor (e.g. on the blades of a ventilator), select the 'Fixed location' correction mode in the machine setup. The program then calculates two masses for the specified fixed positions.

- Open the machine setup of the machine concerned (see page 34).

UIB-Demomachine		↕↔
→	UIB-Demomachine	
Machine Name:	Select	
Planes:	one	
Correction:	free	
Trial/Trim Masses:	add	
Bal. Quality:	0.4	



- Click on 'Correction' until the 'Fixed location' mode is selected:

UIB-Demomachine		↕↔
→	UIB-Demomachine	
Machine Name:	Select	
Planes:	one	
Correction:	fixed location	
Num.of locations:	24	
Trial/Trim Masses:	add	

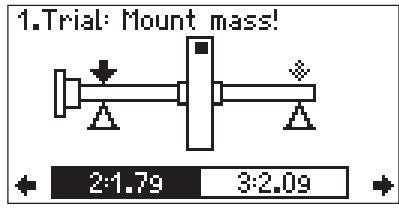
- Enter the number of fixed locations on the rotor:
- If necessary, change the remaining parameters.
- Finally, press the function key and click on 'Save' to save the changes.
- Begin with the measurement (see page 17).

The program calculates the balancing masses for two locations. The location/blade #1 corresponds to the 0° position.

In the 'Fixed location' correction mode, attach the reference mark at the position of a blade (see page 10,11).



Note



Input screen for 'fixed location' correction mode

- Press the joystick downwards to show the proposed masses and positions in the detailed display:



	<p>1.Trial: Mount mass !</p> <p>Mass[9]: 3.6</p> <p>Angle[°]: 46</p> <p>Pos 2/12 at Angle 30°</p> <p>Mass[9]: 1.7</p> <p>Pos 3/12 at Angle 60°</p> <p>↓</p>
Mass/angle for 'free' correction	<p>Mass[9]: 3.6</p> <p>Angle[°]: 46</p>
Position/angle for first mass	<p>Pos 2/12 at Angle 30°</p>
Position/angle for second mass	<p>Mass[9]: 1.7</p> <p>Pos 3/12 at Angle 60°</p>

Input screen (detailed view)

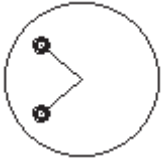
Attach the proposed masses to the specified positions on the rotor, or change these with ENTER.

- To accept the changes, press the function key and click on 'OK'.
- To leave the detailed view, press the ESC key.





'Free' correction mode



'Fixed mass' correction mode



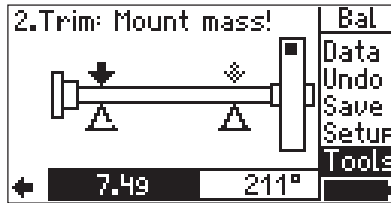
Correction mode: fixed mass

Activate the 'Fixed mass' option in the 'Tools' menu if only certain masses (e.g. 2g, 5g, 10g) are available to you during balancing. The program then calculates two angle positions to which two equally heavy balancing weights must be attached.

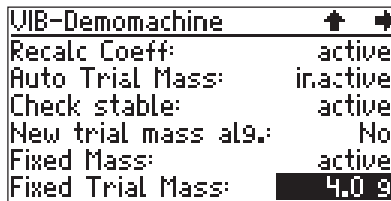
Fixed mass balancing can be activated in any trial run. The fixed balancing mass can be changed at any time. The following requirements must be fulfilled:

- 'Free' correction mode is selected
- 'Add mass' option is selected.

- Press the function key in the input screen to open the menu:



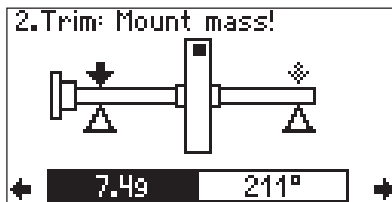
- Click on 'Tools':
- Set the 'Fixed mass' and the 'Recalc Coeff.' option to 'active' and enter the fixed balancing mass.



Note

The fixed mass must be greater than half the proposed mass.

- Store the changes (menu -> 'Save').
- In the input screen press the joystick downwards to display the proposed mounting angle:



Input screen
(detailed view)

2.Trim: Mount mass !	
Mass[g]:	7.4
Angle[°]:	211
Fixed mass[g]:	4.0
1.Angle[°]:	317
2.Angle[°]:	127

Mass/ angle for
'free' correction

Mounting angles

- Attach a balancing mass at each of the specified angle positions.

In the example shown above 4g must be attached at 317° and 4g must be attached at 127°.

In subsequent balance runs, the value of the fixed mass can also be changed directly in the input screen (for a detailed view, see above). The mounting angles are automatically recalculated.



Note

Correction mode: Tape measure

This correction mode enables you to determine the position of the balancing masses comfortably using a tape measure, without having to take into account a reference system with angular degree division. The distance on the rotor surface from the trigger mark (0° position) is calculated in millimeters and counted against the direction of rotation. That is to say, you must only place a tape measure around the outside diameter and attach the balancing mass at the specified position.

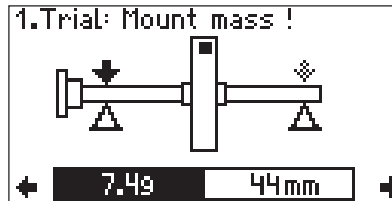
The distance of the balancing mass from the axis of rotation is the balancing radius. This is normally smaller than the outer radius (see parameter in the machine setup, page 35).

- Set the correction mode to 'Tape measure' in the machine setup in the same way as in the section, 'Fixed location' (page 28).

t. Name	1machine
Planes:	one
Correction:	meas tape
Outer Diam.[mm]:	120
Bal.Qual.:	6.3
Foundation:	flexible
	↓

- Enter the outside diameter of the rotor.
- Save the changes and start the measurement.
- The mass and the tape measure length appear in the input screen.

Input screen for 'Tape measure' correction mode



- Press the joystick downwards to the tape measure distance display in the input screen (see page 27):

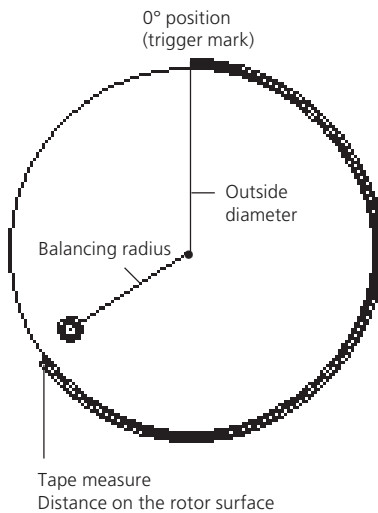


1.Trial: Mount mass !		
Mass	Mass(g):	7.4
	Angle(°):	42
Tape measure distance	Meas.Tape(mm):	44

Input screen
(detailed view)

- Attach the specified mass at the calculated position.
Note that the outer radius and the balancing radius can be different under certain conditions (see figure above).

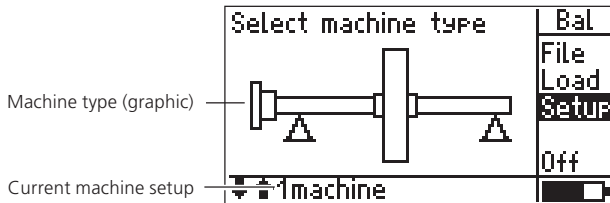
Tape measure



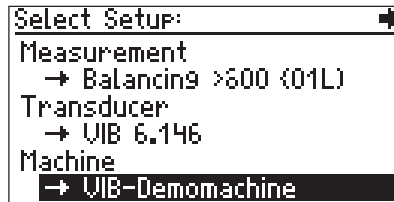
Machine setup

To calculate the trial mass, residual unbalance and balancing quality, machine data must be entered in the machine setup and the correction mode (see page 28f.) selected.

The graphic in the start screen is a component of the machine setup and specifies the type of the machine to be balanced (e.g. rotor overhung - 1 plane, see page 75). The current machine setup that is used for the measurement appears in the status line.

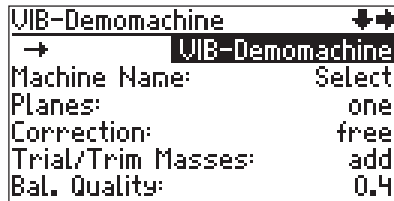


- Press the function key in the start screen (see page 16) and click on 'Setup' in the menu:



- Click on 'Machine' to open the machine setup:

Machine setup



Note

During the measurement you can change the following parameters in the machine setup: Correction mode, Add/remove masses, Meas. sequence (2-plane), Test functions.

Parameter in the machine setup

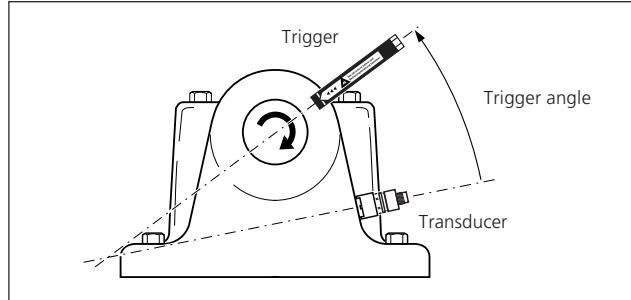
Name:	Name of the machine setup; <i>Appears in the start screen in the status line and specifies the machine setup that is used to measure.</i>
Planes:	One; Two:A,B <i>The number of planes cannot be changed here because the selection is made via the machine graphic.</i>
Correction:	Correction mode; Default= 'free'; <i>Takes into account restrictions on the machine (fixed locations, e.g. on fan blades) or the circumstances on site (tape measure). Depending on the selection, further parameters must be set up (see below).</i>
No. of locs.:	In the 'fixed location' correction mode, the number of fan blades must be specified; <i>3-99 locations with the same angular distance.</i>
Out. diam.:	Rotor diameter in 'Tape measure' correction; <i>The tape measure enables the position of the balancing mass to be determined independent of the angle.</i>
Trial/Trim Mass:	add/ remove; <i>Whether the balancing mass should be attached to or removed from the rotor can be selected here; the setting can also still be changed during the balancing run.</i>
Bal. qual.:	Values acc. to DIN ISO 1940; see page 74 <i>For evaluating the balancing results</i>
Foundation:	flexible, rigid; <i>Type of foundation acc. to ISO 10816. On flexible foundations and the same excitation, the machine vibrates more strongly than on rigid foundations. Thus, the limits for an flexible foundation lie higher and smaller balancing masses can be selected.</i>
Radius:	Distance of balancing mass* to rotor axis of rotation; <i>The larger the balancing radius, the smaller the balancing mass for the same RPM.</i>

* Explanation of term:
Balancing masses =
trial mass & trim mass

Rotor mass: The rotor mass is used in the calculation of the trial and trim mass*.

Trig. angle: Angle between the transducer and trigger;
For calculating the mounting angle of the trial mass. The trigger angle is counted counter the direction of rotation of the rotor.

Trigger angle:
The angle between transducer and trigger is counted counter to the direction of rotation of the shaft



Speed: RPM at which trim is performed.
*This RPM should be as close as possible to the operating RPM (see also page 12).
During balancing only one trigger pulse per revolution is processed. Thus, make sure that only one trigger mark is attached to the shaft.*

Meas. sequ.: AB-BA, AB-AB
Measuring sequence for balancing in two planes (A,B); see page 40.

Check speed: active / inactive
Before each measurement, a check is made ('On') of whether the measured RPM corresponds to the specified balancing RPM.

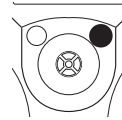
Check bad influence: active / inactive
Change of the unbalance pointer is checked ('On'); if the change is too large/ too small, a corresponding message appears. You must then return to the previous balancing run and reduce or increase the attached mass.

Reclac. coeff.: active/ inactive (only in 1-plane balancing)
The influence coefficient for calculating the balancing mass can be taken over from the trial run ('inactive') or from the preceding balancing run ('active').

- Auto trial mass: active/ inactive (only in machine setup)
VIBSCANNER calculates a trial mass from the machine data and proposes it in the trial run ('active'). In the 'inactive' setting no trial mass appears and you must enter the trial mass that is used.
- Check stabl. active / inactive
Stability of the unbalance pointer is checked

Options in the machine setup

- Press the function key in the machine setup to open the menu:



VIB-Demomachine	Setup
→ VIB-Demom	Save
Machine Name:	Help
Planes:	Chng
Correction:	
Trial/Trim Masses:	
Bal. Quality:	

- SAVE Saves changes on the current machine setup
- CHNG Change current machine setup*

* The selection list is also displayed if you click on the first line ('->') of the machine setup

Select a Machine:	Multi
VIB-Demomachine	Ok
Default	New
	Del
	Help

If you have created several machine setups for one machine type, you can select these here:



Press the function key to open the menu:

- NEW Creates a new machine setup
- DEL. Deletes current machine setup

Balancing in two planes



Note

Balancing in two planes is performed sequentially, i.e. the measurements take place one after the other in plane A and then in plane B as VIBSCANNER has only one measuring channel.

The following example of a balancing procedure corresponds in principle to balancing in one plane (page 16ff.). There are three prerequisites:

- Correction mode: 'Free'
- Measuring sequence: 'AB-AB'
- Balancing is carried out using two transducers (same sensitivity!) and the automatic channel switchbox (VIB 5.446).

In EX areas, only manual channel switchboxes (VIB 5.445) may be used!



Overview

0. Initial unbalance

Measurement in plane A
Measurement in plane B
Result

1A. Trial run with mass in plane A

Suggestion for trial mass in plane A
Measurement in plane A
Measurement in plane B
Result

1B. Trial run with mass in plane B

Suggestion for trial mass in plane B
Measurement in plane A
Measurement in plane B
Result

Measuring sequence:
AB-AB

2. Trim run

Suggestion for trim mass in plane A
Suggestion for trim mass in plane B
Measurement in plane A
Measurement in plane B
Result

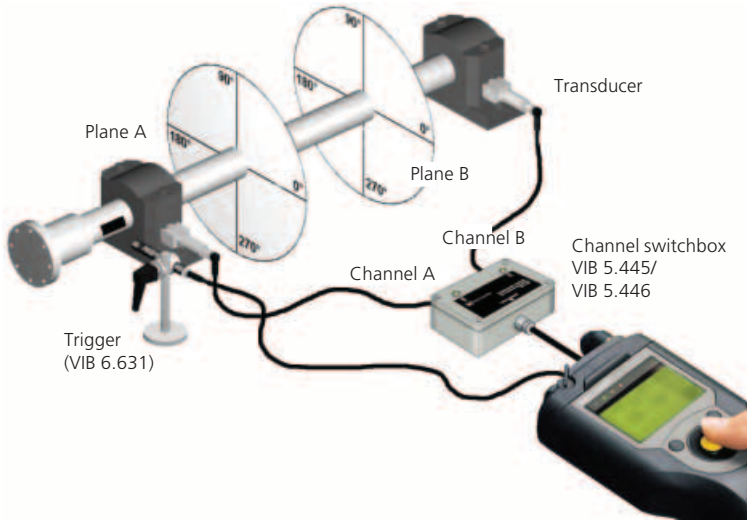
....

N. Trim run

Preparation

- Install the transducer and the trigger according to the following diagram:

The transducers are connected to the channel switchbox, which is connected in turn to the analog (blue) input. The trigger is connected to the digital (yellow) input.

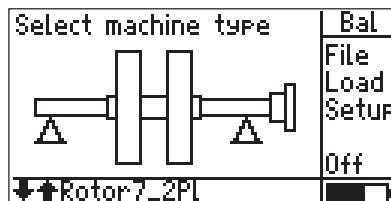


When using the automatic channel switchbox, you can activate channel A and B individually in order to check the connections with one signal measurement (for more details, see 'Tips & Tricks / Signalcheck' in the VIBSCANNER Operating Manual, VIB 9.638.G)



Note

- Select the machine type and, if necessary, set up the setup parameters (measurement, transducer, machine; see page 35).

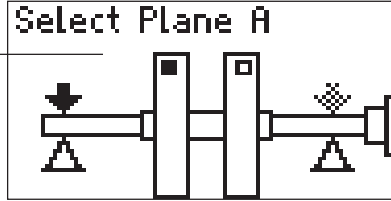


Balancing in two planes: Initial unbalance



- Press the joystick and select which correction plane (see page 10) should be labeled with 'A' in the following screen.

Correction plane A



Measuring initial unbalance



- Press the joystick.

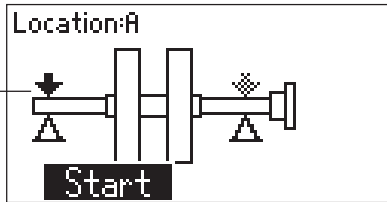


Note

When using the manual channel switchbox (VIB 5.445) the channel specified in the following screen must be set up.

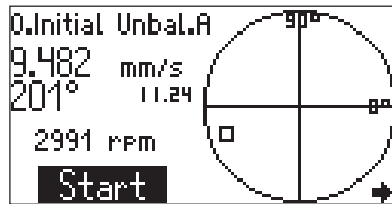
In the case of the automatic channel switchbox (VIB 5.446, the setting is made automatically.

Measurement plane A



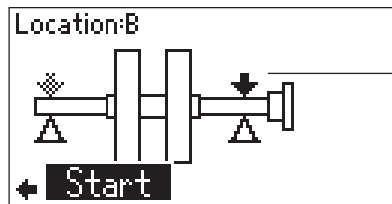
- Switch on the machine and click on START.

- Click on PAUSE when the measured values have stabilized.



Initial unbalance in plane A

- Move the joystick to the right to call up the next screen:



Measurement plane B

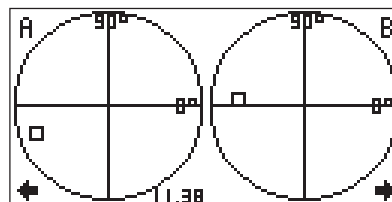
- In the case of the manual channel switchbox, switch to channel B and click on START.



- Click on PAUSE when the measured values have stabilized and switch the machine off.



- Move the joystick to the right to display the result of the initial unbalance run:



Initial unbalance in plane A and plane B

- Move the joystick to the right to switch to the input screen of the trial run:

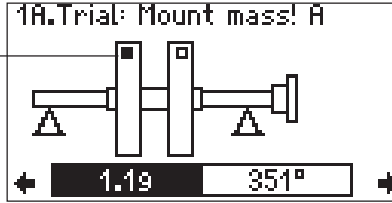


Trial run



You can change the proposed values for the trial mass (1.1 g) and the mounting angle (351°) (see note on page 19).

1A = trial mass in plane A

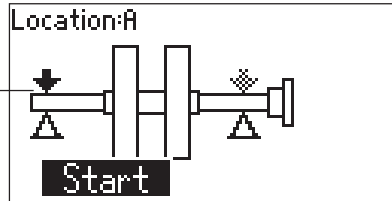


- Attach the trial mass in the correction plane A under the specified angle (see Angle convention, page 11); switch the machine on again.



- Move the joystick to the right to call up the next screen:

Measurement plane A

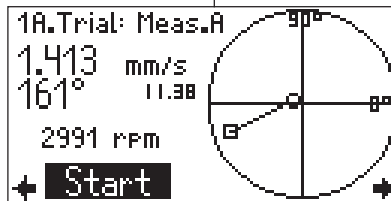


- In the case of the manual channel switchbox, switch to channel A and click on START.

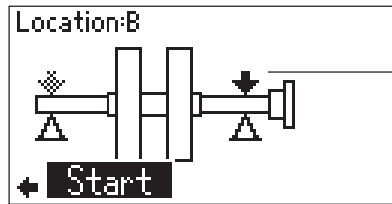


- Click on PAUSE when the measured values have stabilized.

A = measurement in plane A

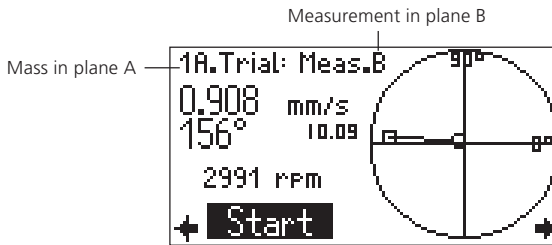


- Move the joystick to the right to call up the next screen:

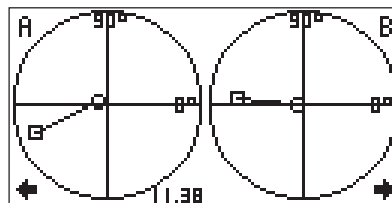


Measurement plane B

- In the case of the manual channel switchbox, switch to channel B and click on START.
- Click on PAUSE when the measured values have stabilized and switch the machine off.



- Move the joystick to the right to display the result of the trial run (mass in plane A):
If the unbalance has improved sufficiently, you can leave the trial mass in plane A:



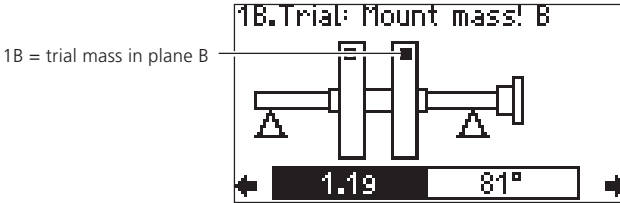
Result of trial run with mass in plane A

- Move the joystick to the right and specify whether or not you want to remove the trial mass in plane A.



Balancing in two planes: Trim run

- Attach the trial mass in plane B under the specified angle; switch the machine on again.



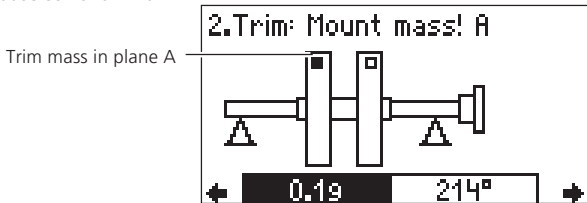
- Measure the trial run (mass in plane B) as previously described.

Trim run

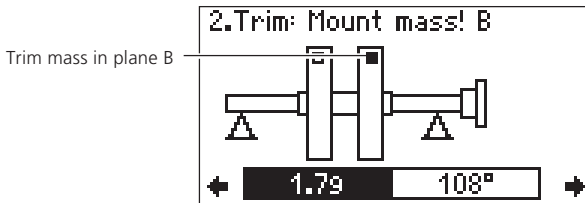


- After the trial runs, switch the machine off; move the joystick to the right to change to the input screen of the trim run:

Input screen of trim run

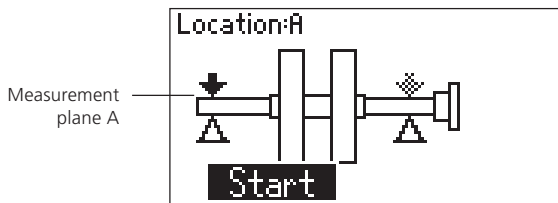


- Attach the trim mass in plane A; move the joystick to the right:

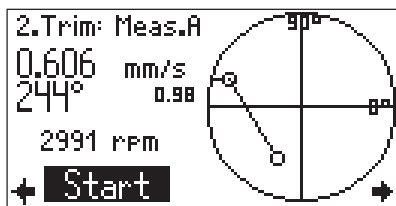


- Attach the trim mass in plane B and switch the machine on again.

- Move the joystick to the right to open the next screen:

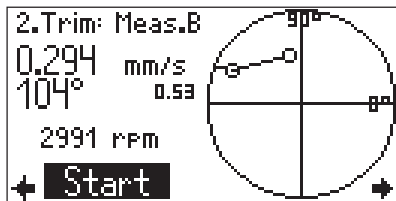


- In the case of the manual channel switchbox, switch to channel A and click on START.
- Click on PAUSE when the measured values have stabilized.



Result of trim run
in plane A

- Move the joystick to the right; In the case of the manual channel switchbox, switch to channel B and click on START.
- Click on PAUSE when the measured values have stabilized and switch the machine off.



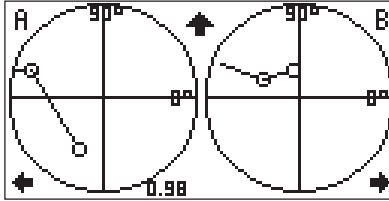
Result of trim run
in plane B

Balancing in two planes: Trim run



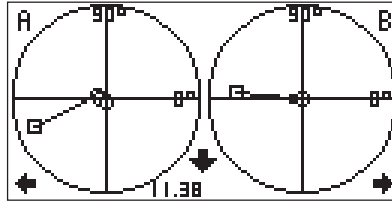
- Move the joystick to the right to display the result in both planes:

Result in plane A
and plane B



Note

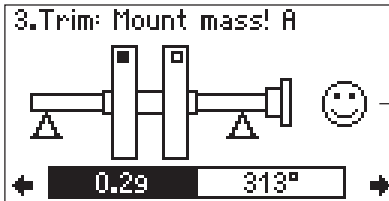
When you move the joystick upwards, you can display prior balancing runs (see also page 21).



Display of all balancing runs (unzoom)



- Move the joystick to the right to switch to the input screen for the next trim run:



Smiley:
Balancing quality reached!

- Repeat the procedure for the next trim run.
The balancing is completed if the specified balancing quality (see page 35, 74) is reached and the 'smiley' appears on the screen.

Balancing without a machine setup

Balancing without a machine setup is provided if the rotor data are not available on site, or a measurement is to be started without the rotor data being created in a machine setup ('quick start'). This option should only be used by the experienced user who is conscious of the effect of the attached balancing masses (see Safety instructions, p. 5).

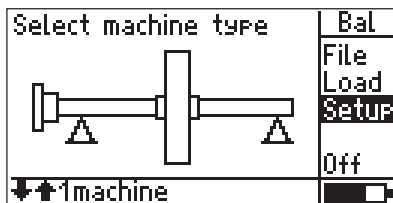
No trial mass is specified for balancing without a machine setup. There is no evaluation of the results either (no balancing quality, no 'Smiley'). The parameters and functions that can be set during the measurement appear in the 'Tools' menu (see page 49 and page 34).

Measuring procedure

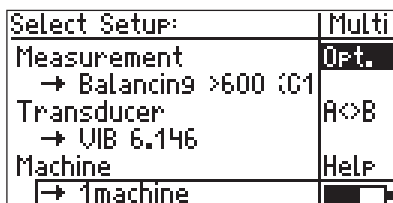
- Select a suitable machine type in the start screen (1-plane or 2-plane balancing).

If the machine setup for the selected machine type is deactivated, 'No machine setup' appears in the status line. You can then immediately start the measurement (press the joystick, see next page).

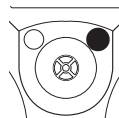
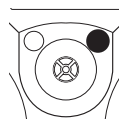
- Press the function key and click on 'Setup'.



- Press the function key and click on 'Opt.' (optional setup).



Note



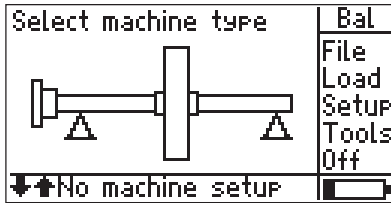
Balancing without a machine setup



- Press the joystick to deactivate the machine setup.



- Press the function key and click on 'OK'. Return to the start screen again with the Escape key.

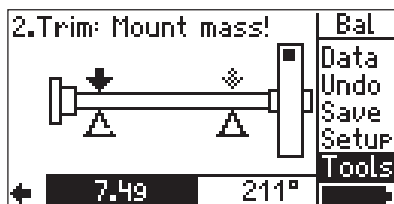


- Press the joystick and carry out the measurement as described in the respective section (page 17ff. for 1-plane balancing and page 39ff. for 2-plane balancing).

Tools

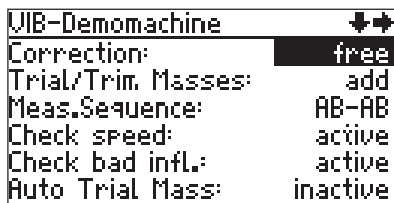
The 'Tools' menu in the input screen is required for balancing without a machine setup. It contains the parameters and functions that are crucial for the measurement and can be changed in any balancing run. For example, you can select whether the proposed balancing mass should be attached to the rotor or removed ('negative mass') in any balancing run.

- Press the function key in the input screen in order to display the menu column:



Input screen

- Click on 'Tools':



'Tools'

The following parameters or functions can be changed (see 'Machine setup' on page 35):

- Correction mode
- Add/remove balancing mass
- Measuring sequence (2-plane)
- Test functions
- Fixed mass option

Chapter 2: Frequency analysis (FFT)

For the diagnosis of rolling bearing damage, machines and gear faults, amplitude and envelope spectra can be recorded with the VIBSCANNER. The respective measurement tasks are preset for the type of machine and RPM range.

In addition, you can measure frequency spectra that are based on an alternating current or voltage signal of your choice (not necessarily a machine vibration). Example: Motor current spectrum, sensor: clamp-on ammeter .

- Switch on the VIBSCANNER, and open the frequency analysis selection screens:

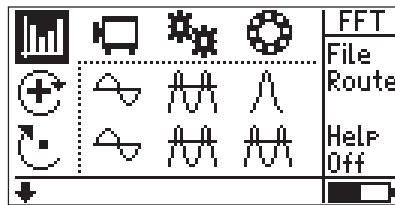
Measurement tasks for frequency analysis (FFT)

Machines (general) Gears Rolling bearing

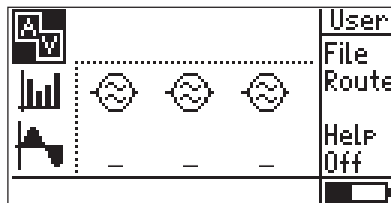
High RPMs

Medium RPMs

(Scroll for low RPM ranges)



User defined measurement tasks for frequency analysis



- Select the measurement task.

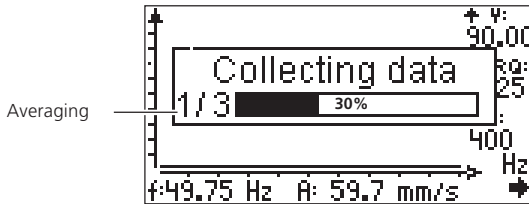


Note

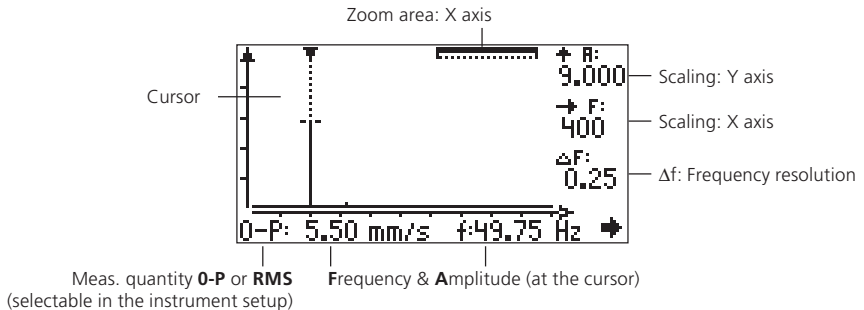
You can set up the measurement parameters in the Setup menu. For the three user-defined measurement tasks, you can select one of the following sensor types: ICP, voltage (AC), current (AC).

A detailed description of the measurement tasks is given in the appendix or in the online help.

- Connect the transducer to the measurement location and press the joystick to start the measurement.



After the measurement is completed, the cursor appears on the line with the highest amplitude in the spectrum:



Cursor

If the triangular point of the cursor line points down, the amplitude lies within the display range. If it points upwards, the line runs out of the display range.

To move the cursor along the frequency axis, move the joystick to the right or to the left. The speed of the cursor increases continually if you push the joystick permanently to the side.



Saving the measurement

- Press the function key and click on 'Save' in the menu (see also 'VIBSCANNER operating instructions').

Repeating the measurement

- Double-click with the joystick to repeat the measurement.



'Scale mode' is active



'Zoom mode' is active



Note



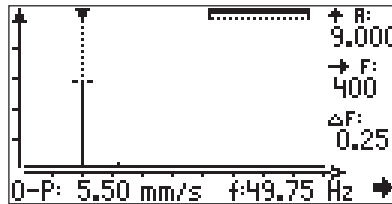
Zooming and scaling

For evaluation, the spectrum can be zoomed along the X axis (frequency) and can be scaled along the Y axis (amplitude).

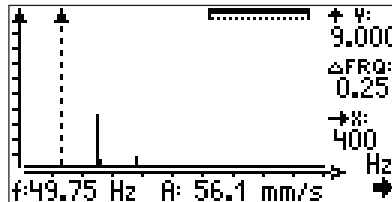
Scaling the Y axis

Check whether the scaling mode is active: This is the case if the 'Zoom' option is displayed in the menu. Otherwise, click on 'Scal.' (scaling). Open the menu with the function key.

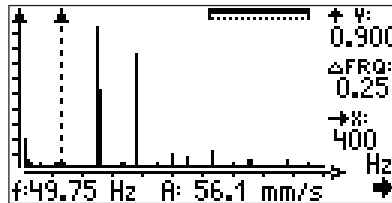
- Press the joystick repeatedly upwards to increase the scaling of the Y axis and to display the weaker lines. By doing so, the scaling changes in steps of a factor of 2.



Max. display range of the Y axis = 90 mm/s



Max. display range of the Y axis = 9 mm/s



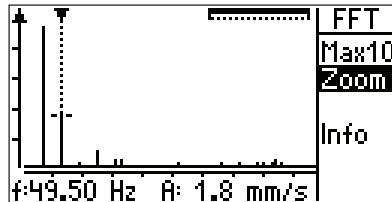
Max. display range of the Y axis = 0.9 mm/s



- To reduce the scaling again, press the joystick down.

Zooming the X axis

- Activate the Zoom mode:
Press the function key to open the menu and click on 'Zoom'.

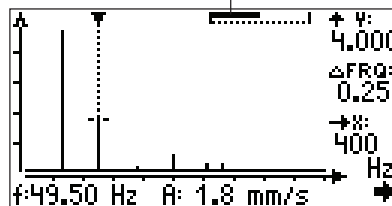


Zoom area
of the X axis = 100%

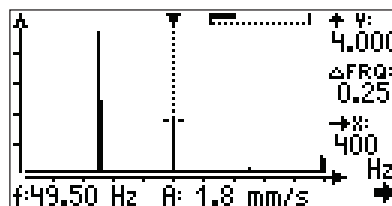
- Press the joystick repeatedly upwards to increase the frequency range around the cursor and to resolve lines with a small frequency interval.



Zoom area of the X axis



Zoom area
of the X axis = 50%



Zoom area
of the X axis = 30%

The visible zoom area of the X axis is displayed on the bar at the top right of the screen.



Note

- To undo the zoom function step-by-step again, press the joystick down.



Line zoom

The line zoom function enables the area around the selected frequency to be zoomed directly up to the maximum size. This enables all the measured lines to be displayed individually.

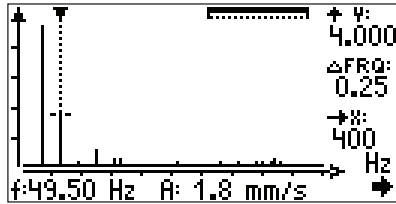


- Mark the required line with the cursor in the spectrum and press the joystick.

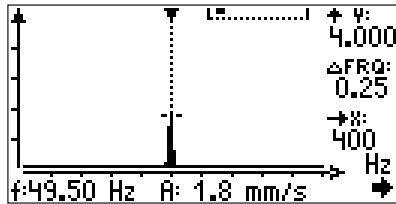


Note

While doing so, the scaling of the Y axis remains unchanged.



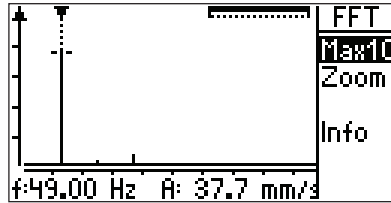
Zooming of the 49.5 Hz line



Max10 function

The 10 highest amplitudes in the spectrum are displayed using the Max10 function.

- Press the function key to open the menu and click on 'Max10':



Max-10 Amplitude list		
1.	37.7 mm/s	49.00 Hz
2.	3.7 mm/s	147.0 Hz
3.	1.5 mm/s	98.00 Hz
4.	0.4 mm/s	196.0 Hz
5.	0.2 mm/s	294.0 Hz
6.	0.2 mm/s	47.00 Hz

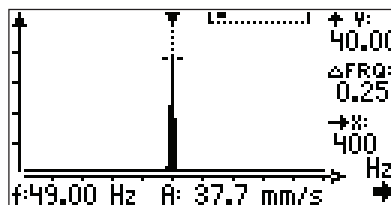
The 10 highest amplitudes in the spectrum

If you want to sort the list by frequency, press the function key.

Max10 zoom

The 'Max10 zoom function' enables the frequency range to be directly zoomed to the maximum size around one of the selected 10 highest amplitudes:

- Select a line in the Max10 list and press the joystick.



Max10 zoom of line #1 (see figure above)

The menu cannot be displayed because the function key is not active in this screen.

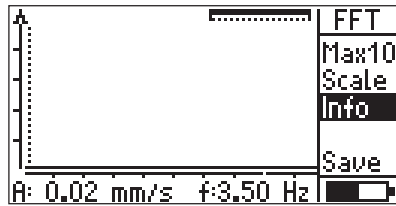
Changes to scaling and zooming in this screen do not affect the main measurement screen (see above).



Note

Info on the measurement

Click on 'Info' in the menu:



Information: ↓	
Δf (Lines):	0.13 Hz
Peak:	0.023 mm/s at pos 3.5 Hz
RMS (Spectrum):	0.057 mm/s
Meas. time:	8.0 s
Samples:	4096

The following data are displayed:

Date and time of the measurement

Δf: Frequency resolution

Peak: Highest amplitude

RMS: RMS value

Measuring time: Total measuring time

Checkpoints: Number of checkpoints
(=2.56 x line count)

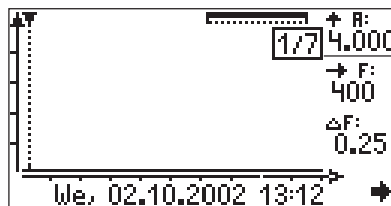
Return to the starting screen with the ESC key.

Series spectra ('Waterfall diagram')

As in the case of the characteristic values trend, spectra can also be recorded over a period of time in order to determine changes to individual lines more easily. If the signal analysis module is registered in VIBSCANNER, series spectra can be recorded automatically on a time-controlled basis ('Recording', page 66). Alternatively, you can measure several spectra consecutively and save them in a file (see 'Trend' in the manual, VIB 9.638.G).

To evaluate the spectra with the aid of a 'waterfall diagram', the data must be read in by the 'multimode import' in OMNITREND. VIBSCANNER can only display the spectra individually:

- Click on 'File' in the FFT selection screen and open a file with series spectra:

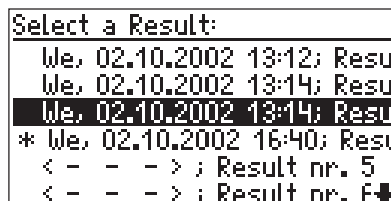
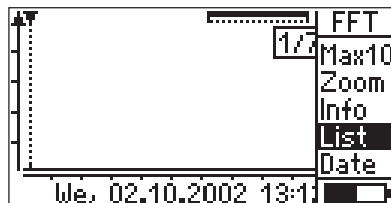


Consec. no. / Number of spectra

Double-click to scroll forwards to the last recorded spectrum.



To display a specific spectrum of the series, press the function key and click on 'List' in the menu:



The asterisk (*) marks the current spectrum.

Date & time only appear if the spectrum has already been displayed. Otherwise, a dummy place holder appears.

Chapter 3: Signal analysis

The signal analysis module (VIB 5.488-FM) expands the scope of performance of the VIBSCANNER by the following measurement functions:

- Time waveform
- Phase measurement (1-plane/2-plane)
- Sequential orbit measurement
- Recording
- FFT spectrum with time-synchronous averaging












Time waveform

For vibration analysis on rolling bearings, machines and gears, time waveforms can be recorded with VIBSCANNER. The measurement tasks are preset for high, medium and low RPMs.








In addition, you can measure time waveforms that are based on an alternating current or power signal of your choice (not necessarily machine vibration). Example: pressure fluctuations, sensor: pressure gauge.

- Switch on VIBSCANNER, and open one of the selection screens for time signal analysis:

Vibration analysis with time signals

	Machine (general)	Gear	Rolling bearing	
				Time
High RPMs				File Route
Medium RPMs				Help Off
(Scroll for low RPM ranges)				

User defined measurement tasks for timewaveform analysis

				User
				File Route
				Help Off
				

- Select a measurement task.

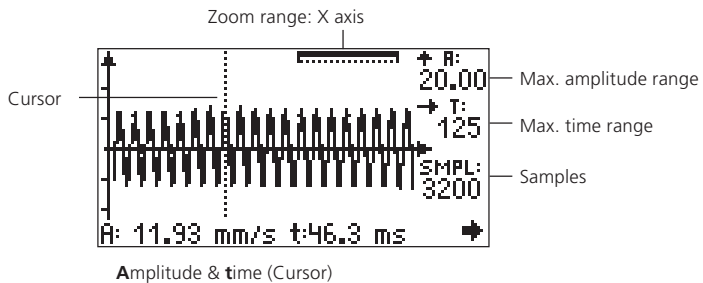
The measurement parameters can be adjusted in the Setup menu. For the three user-defined measurement tasks, you can select one of the following as the sensor type: ICP, voltage (AC), current (AC).

A detailed description of the measurement tasks is given in the appendix or in the online help.



Note

- Connect the transducer to the measurement location, and press the joystick to start the measurement.
- Press the joystick to stop the measurement:



To move the cursor along the time axis, press the joystick to the right or left respectively.



Saving/repeating a measurement

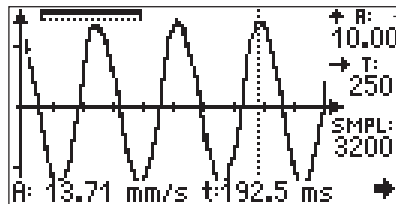
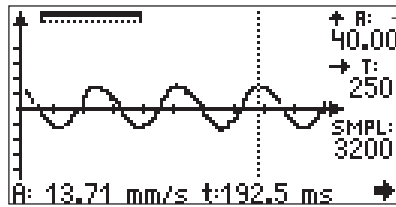
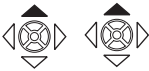
The saving and repetition of a measurement is carried out as described in the section 'FFT Analysis' (see page 51).

Zoom and scaling

For the evaluation, the time signal along the X axis (time) can be zoomed and scaled along the Y axis (amplitude). The zoom and scaling function for the time signal works as in the FFT spectrum (see page 52ff.). Thus, only a brief description is given below:

Scaling the Y axis

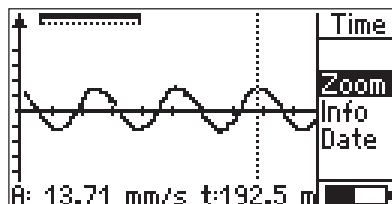
- Is the scaling mode active (s. p. 52)?
- Press the joystick upwards to increase the scaling. The scaling changes step-by-step by a factor of approximately 2.



- To cancel the scaling, press the joystick downwards.

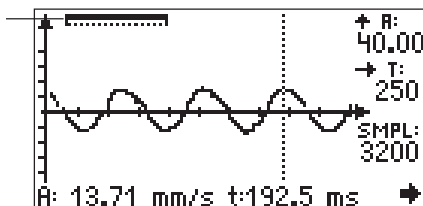
Zooming the X axis

- Activate the zoom mode.

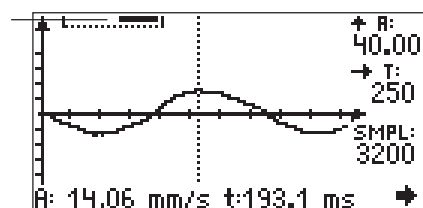


- Press the joystick upwards to increase the time range at the cursor position:

Max. display range
of the X axis = 100%



Max. display range
of the X axis = 40%



Line zoom

The line zoom function increases the time range at the cursor position with a click (see also page 54).



Info on the measurement

Click on 'Info' in the menu (see also page 56):

Information:	
Meas. time:	250 ms
Samples:	3200
RMS (Time):	7.584 mm/s
ESC - to go back	

The following data are displayed:

- date and time of the measurement
- RMS value
- the specified section on the time axis is converted into Hertz ('Left ... Cursor ... Right').
- total measuring time
- number of samples

Phase measurement

To identify machine errors, which cause the same spectral components in the spectrum (e.g. static/ dynamic unbalances), the amplitude and phase position of the vibration pointer is determined from the rotational frequency components of the vibration signal.

The phase measurement can be carried out in one or two measurement planes. The measurement configuration corresponds to the configuration during balancing (see page 10: 1 or 2 transducers, trigger, channel switchbox).

- Connect the transducer(s) and the trigger.



When mounting on the machine while it is running, follow the relevant safety regulations.



- Switch on VIBSCANNER.
- Press the joystick until the selection screen for phase measurement / orbit appears:

Machine diagnosis with phase measurement and orbit

High RPMs

Low RPMs

	Phase (1-ch.)	Phase (2-ch.)	Orbit (2-ch.)	
				Orbit
				File
				Route
				Help
				Off



A description of the measurement tasks is given in the Appendix and in the online Help:

Mark the respective symbol, and click on 'Help' in the menu.

The transducers, frequency range, averages, measured quantity, order filter, number of trigger marks on the shaft and number of measurements can be changed in the Setup menu.

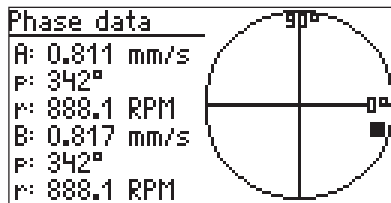
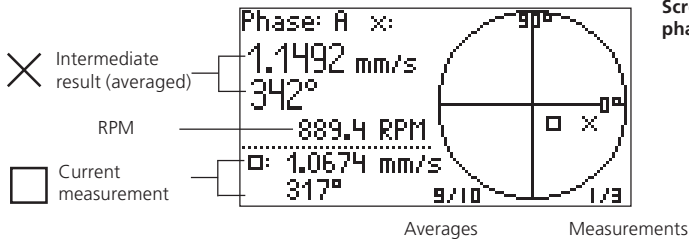
In 2-channel measurements, make sure that the two transducers have the same sensitivity.

The settling time for the trigger sensor is set in the device setup (see page 13).

- Select a measurement task (e.g. 2-channel phase, high RPM).
- If the machine is not yet switched on, switch it on and wait until the operational RPM is reached.
- Press the joystick to start the measurement.



VIBSCANNER checks first that the transducer and cable are correctly connected and that the trigger signal can be measured (green LED flashes on each trigger pulse). If the trigger signal fails during the measurement, the yellow LED flashes; the measurement must then be repeated.



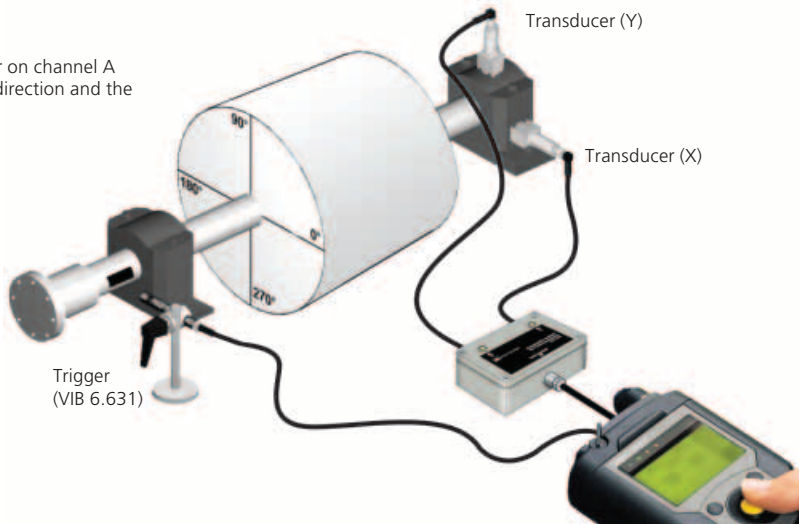
Saving/repeating a measurement

The saving and repetition of a measurement is carried out as described in the section 'FFT Analysis' (see page 51).

* A description of the measuring sequence is given in the following norms: ISO 7919, ISO 10817-1, VDI 3839 sheet 1.

** Settling time for trigger sensor: see page 13.

The transducer on channel A defines the X direction and the 0° position.



WARNING!



Note

Orbit*

This measurement task is used for detecting machine and bearing errors that cause changes to the ellipse in the orbit, such as unbalance, faulty alignment, shaft crash, concentricity error (for more details, see VDI 3839 sheets 1 and 2). Only accelerometers can be used for an orbit measurement with VIBSCANNER.

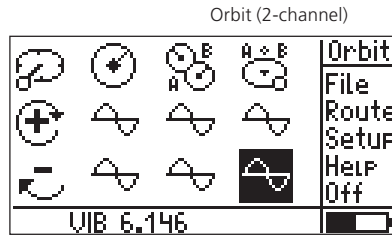
- Install the two transducers in one measurement plane displaced by 90° (X/Y).
- Connect the transducer to the channel switchbox (VIB 5.445/ 5.446) and, in turn, connect this to the VIBSCANNER analog input (blue socket).
- Install the trigger and connect it to VIBSCANNER (yellow socket**).

When mounting on the machine while it is running, follow the relevant safety regulations.

The measurements are performed sequentially: the measurement is carried out first for the signal on channel A and then for the signal on channel B.

In the case of the orbit measurement, only one trigger pulse per revolution is processed. Therefore, attach only one trigger mark to the shaft.

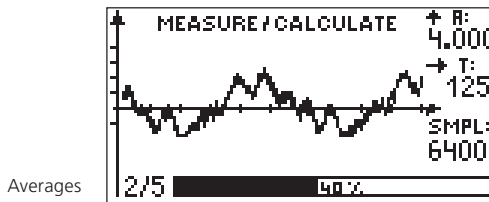
- If the machine is not yet switched on, switch it on, and wait until the operational RPM is reached.
- Click on the measurement task in the selection screen to start the measurement.



Orbit for high-speed (>600 RPM) and low-speed (>120 RPM) machines

First VIBSCANNER records the RPM, and thus automatically sets the sampling rate and sampling time for the following vibration measurement*:

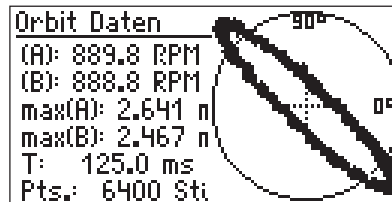
*If the 'Auto-Orbit' option is activated in device setup, the measurement of the shaft movement starts automatically after the RPM measurement.



Measurement

T: Sampling time

SMPL: Sampling rate ('Samples')



Final result of orbit measurement

If the RPM measurements differ by more than 1%, the deviation in the end result is also specified. In the case of deviations of more than 10%, the vibration measurement on channel B is not carried out.



Note

Saving/repeating a measurement

The saving and repetition of a measurement is carried out as described in the section 'FFT Analysis' (see page 51).

Recording

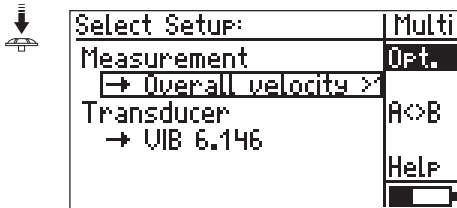
The time-controlled recording of characteristic values and spectra over a specific period of time makes it possible to record and analyze irregularly occurring fault signals on the machine (e.g. vibration behavior when starting up).

The recording function is not available for the following measurements:

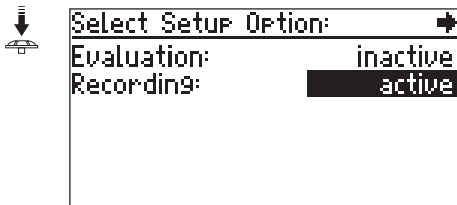
- Time signal
- Manual input

To activate recording

- Mark a measurement task in the selection screen.
- Click on 'Setup' in the menu to open the Setup menu.
- Press the function key and click on 'Opt.' (optional setups) in the menu:



- Click on 'Recording' to activate the function.



- Press the function key and click on 'OK'.

The Recording setup is opened where the following parameters can be set up:

```

\RECORD01.UEL  →
Start mode:      Delayed
Start delay:     00:00:15
Repeat mode:     Rpt.cnt.
Number of meas.: 20
Repeat delay:    00:00:30
File:           Select
  
```

START MODE	Delayed/immediate <i>Recording starts after the selected time delay or immediately after clicking on 'Start'.</i>
START DELAY	Can only be selected if 'Start mode' is set to 'delayed'.
REPEAT MODE	Rpt.cnt. / Duration / Memory <i>Recording is terminated when either the selected number of measurements has been completed, or the selected time has expired, or the memory is full.</i>
NUMBER OF MEAS.	Number of measurements in the 'Rpt.cnt.' repeat mode
DURATION	In the 'Duration' repeat mode, recording is terminated after the selected time.
REPEAT DELAY	Pause between measurements.
FILE	Click on 'Select' and enter a filename in the text editor. Otherwise, the results are saved under the name that is displayed in the top line (in this example: 'RECORD01')

Before starting the recording, make sure that the rechargeable battery is fully charged.



Note

Start recording

When all parameters have been selected, press the function key and click on 'Start'.



\RECORD01.UEL	Setup
Start mode:	De Start
Start delay:	00 Help
Repeat mode:	Re Deflt.
Number of meas.:	Save
Repeat delay:	00
File:	

If the recording starts with a delay, the following screen appears:

Residual time = time until the start of the first measurement

Residual time:	TIME:
00:00:13	00:13
Writing new file	DONE:
\RECORD01.UEL	0/20
Free Mem: 84%	BATT.

During the measurement, the measured values, the number of already processed measurements and the time until the next measurement are displayed:

RMS	0-P	TIME:
	mm/s	00:25
3.21	10.94	DONE:
		2/20
3/3		BATT.
Internal transducer		

25 seconds until the next measurement

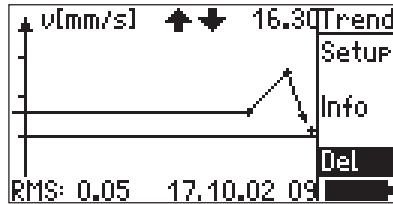
2 of 20 measurements already carried out

Recording can only be interrupted between individual measurements with the ESC key.

Recording	
Stop recording or continue?	
27 s to auto continue	
Continue	Stop

Evaluating recorded data

The recorded data are saved as a characteristic value trend or as a series spectrum. For the evaluation, see section 'Trend measurement' (operating manual, VIB 9.638.G) or section 'Series spectra' (page 57).



If faulty measurements occur during recording, these can be deleted as follows:

- Mark the concerned measurement in the trend.
- Press the function key to open the menu.
- Click on 'Del.' (delete) in the menu.

- Normalized shock pulse measurement:

After starting the recording function, the normalization screen, where the parameters and the RPM mode are set up, appears. If the mode is set to 'Measure external/ internal', a test measurement can be started with 'Measure RPM' to check the RPM.

Click on 'OK' to start the recording of shock pulse measurements. The machine should run at a constant speed during the recording, because the RPM is only recorded once at the beginning of the recording.



Note

Shock pulse normalization			
Mode: Measure RPM extern			
dBa: 0		dBia: --	
⊙	--	1/MIN	Meas. RPM
⊙	0	MM	OK

- Saving recordings in a file:

Make sure that the settings of the current recording and the settings in the file are compatible to one another.

Time-synchronous FFT analysis

In order to emphasize RPM-dependent lines more strongly in a spectrum, a time-synchronous averaged spectrum must be measured. The required trigger signal is measured with an external RPM transducer.



Note

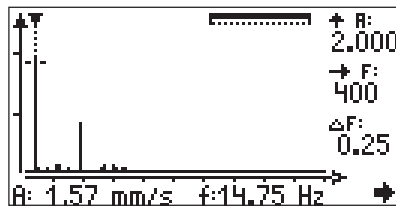
VIBSCANNER processes only one trigger pulse per revolution in time-synchronous averaging. Therefore, attach only one trigger mark to the shaft.

- Mark the FFT measurement task.
- Click on 'Setup' in the menu and open the setup for measurement:

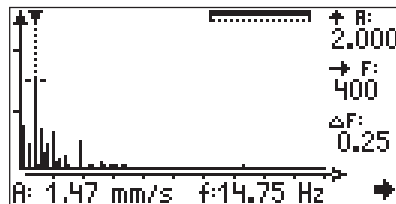
```
Machine spectrum >600 ↑ →
Number of av.:          3
Av. delay(s):          1.0
Average type:          time sync
Meas. range:           AUTO
Setup Name:            Select
Pulse/Rev.:            1
```

- Set the 'Type of averaging' to 'Time synchronous'.
- Start the measurement:

Spectrum with
time-synchronous averaging
($n = 885$ RPM; $f = 14.75$ Hz)



Spectrum with
linear averaging

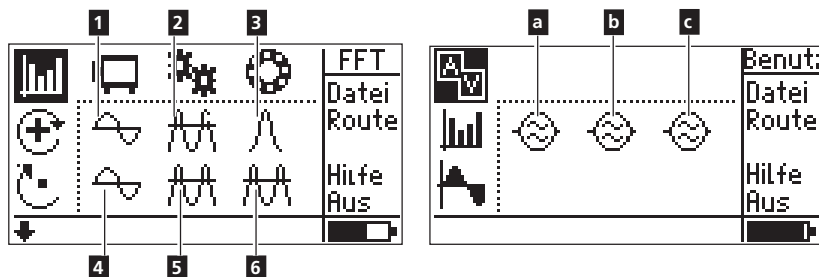


In the same spectrum with linear averaging RPM-independent lines clearly stand out.

Appendix

Measurement tasks for frequency analysis

The following section gives a brief description of the measurement tasks:



1 / a b c

Measured quantity: Vibration velocity
 Frequency range: 10 Hz - 400 Hz
 Lines: 1600
 Resolution: 0.25 Hz
 Setup number in
 OMNITREND: 103

For the diagnosis of machine errors on machines with
 RPMs > 600 1/min.

2

Measured quantity: Vibration acceleration (envelope)
 Frequency range: 0 Hz - 5000 Hz
 Filter: 1 kHz (highpass)
 Lines: 3200
 Resolution: 1.56 Hz
 End frequency: 3200 Hz

For the diagnosis of faults of the gear mesh in gears (only
 suitable to a certain extent for rolling bearings in gears).

3

Measured quantity: Vibration acceleration (envelope)
 Frequency range: 0 Hz - 1000 Hz
 Filter: 36 kHz (bandpass)
 Lines: 1600
 Resolution: 0.63 Hz

Setup number in
OMNITREND: 108

For the diagnosis of bearing race damage on rolling bearing components with RPMs > 600 1/min. Only use transducers and mountings for 36 kHz.

4

Measured quantity: Vibration velocity
Frequency range: 2 Hz - 400 Hz
Lines: 800
Resolution: 0.5 Hz
Setup number in
OMNITREND: 104

For the diagnosis of machine errors on low-speed machines with RPMs > 120 1/min. and with rigid machine constructions on rigid foundations.

5

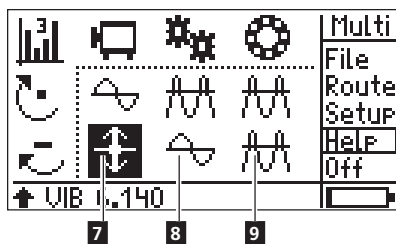
Measured quantity: Vibration acceleration
Frequency range: 2 Hz - 5000 Hz
Lines: 3200
Resolution: 1.56 Hz

For the diagnosis of tooth damage in gears with RPMs > 120 1/min.

6

Measured quantity: Vibration acceleration (envelope)
Frequency range: 0 Hz - 400 Hz
Filter: 1 kHz (highpass)
Lines: 800
Resolution: 0.5 Hz
Setup number in
OMNITREND: 143

For the diagnosis of bearing race damage on rolling bearing components with RPMs < 600 1/min and outputs > 300 kW.

**7**

Measured quantity: Vibration displacement
 Frequency range: 2 Hz - 400 Hz
 Lines: 800
 Resolution: 0,5 Hz
 Setup number in OMNITREND: 133

For the diagnosis of faults in the running condition of machines and gears with relatively elastic machine constructions on elastic foundations with RPMs > 120 1/min. Only use transducers for low-speed machines.

8

Measured quantity: Vibration velocity
 Frequency range: 2 Hz - 5000 Hz
 Lines: 3200
 Resolution: 1.56 Hz

For the diagnosis of faults in the running condition on gears with RPMs > 120 1/min.

9

Measured quantity: Vibration acceleration (envelope)
 Frequency range: 0 Hz - 200 Hz
 Filter: 1 kHz (highpass)
 Lines: 1600
 Resolution: 0.13 Hz
 Setup number in OMNITREND: 171

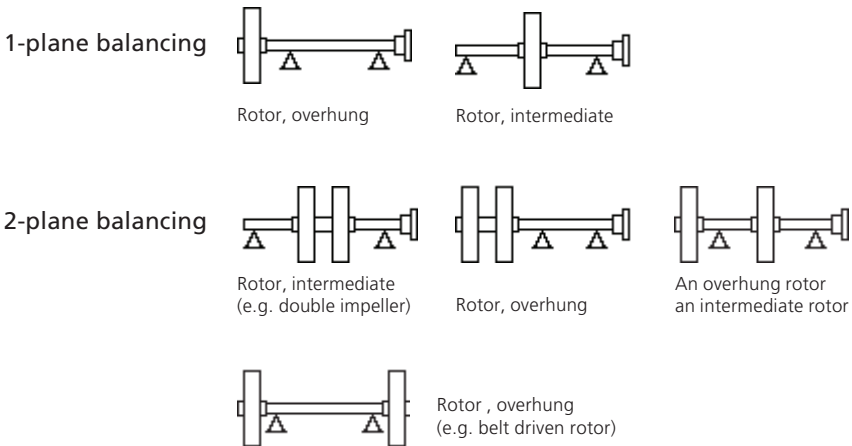
For the diagnosis of bearing race damage on rolling bearing components with RPMs < 120 1/min. Only use transducers for low-speed machines.

Balancing quality grades and groups of rigid balancing bodies

(excerpt from DIN ISO 1940)

Grade	Examples of balancing bodies or machines
630	Crankshaft drive of rigidly-mounted four-stroke motors & soft-mounted ship diesel motors
250	Crankshaft drive of rigidly-mounted, high-speed 4-cylinder diesel motors
100	Crankshaft drive of rigidly-mounted, high-speed diesel motors with six or more cylinders
40	Auto wheels, wheel rims, wheel sets, drive shafts
16	Crankshaft drive of soft-mounted, high-speed four-stroke motor with six or more cylinders
6.3	Crankshaft drive components of automobile, truck and train motors, crankshaft drive of six and more cylinder motors with special requirements
2.5	Fans, flywheels, centrifugal pumps, machine building & machine tool building parts
1	Turbines of jet power plants, gas and steam turbines, turbo blowers and generators
0.4	Gramophone and tape deck drives, Grinding machine drive parts
	High precision grinding machine ' rotor, shafts and discs. Gyroscopes.

Machine types



Only those machine types are shown in each figure that have one of the drives shown on the facing page.

Technical data

FFT module - VIB 5.485-FM

f_{max}	0.1 / 0.2 / 0.4 / 1 / 5 / 10* kHz
Number of lines	400 to 6400 lines
Line width	> 0.03 Hz
Display	Axes are linear within the frequency range
Zoom	Freely adjustable X / Y axes
Envelope curve	For bearing, gear and machine diagnosis
Meas. setups	Optimized setups for different machine types

* option for VIBSCANNER EX

Balancing module - VIB 5.486-FM

Balancing modes	1-plane balancing and sequential 2-plane balancing
Correct. methods	Fixed loc., fixed mass, tape measure, free, comb. masses
Display & operat.	Graphics-oriented user guidance with machine diagrams and explanatory text
Measured values	Vibration velocity, acceleration and displacement

Signal analysis module - VIB 5.488-FM

Time signal

f_{max}	200/ 500/ 1000/ 2000/ 5000 Hz
Meas. time	[125 - 4000] ... [7.8 - 250] ms

Add. averaging time synchronous

Recording overall values and spectra

Start delay adjustable

Repetition adjustable

Pause adjustable

Accessories

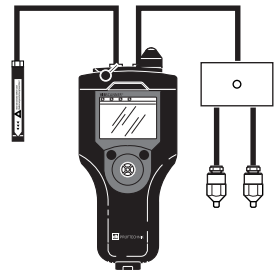
Channel switchbox (VIB 5.445 / VIB 5.446)

The optional channel switchbox is used for measurements that are carried out with 2 transducers and one trigger (2-plane balancing, 2-plane phase, orbit)

The channel switchbox is connected to the blue analog input of the VIBSCANNER. The channel switchover is made either manually (VIB 5.445), or automatically (VIB 5.446).

Trigger
(VIB 6.631)

VIB 5.445/
VIB 5.446



Note

In EX areas, only the manual channel switchbox (VIB 5.445) may be used!

In the case of transducers of the type 'Voltage/current (AC/DC)', ICP® and 'VIBRONET', the automatic channel switchbox is not unambiguously identified. Although the switchover after measurement on a channel is carried out automatically, the message for manual switchover nevertheless appears. Confirm this message and continue the measurement.

PRÜFTECHNIK
Condition Monitoring
Oskar-Messterstr. 19-21
85737 Ismaning, Germany
www.pruftechnik.com
Tel. +49 (0) 89 99 61 6-0
Fax +49 (0) 89 99 61 6-300
eMail: info@pruftechnik.com



PRÜFTECHNIK

Printed in Germany VIB 9.664.11.2010.0G
VIBSCANNER® is a registered trademark of
PRÜFTECHNIK AG. Contents subject to change
without further notice, particularly in the interest of
further technical development. Reproduction, in
any form whatsoever, only upon express written
consent of PRÜFTECHNIK AG.
© Copyright 2001 by PRÜFTECHNIK AG

Productive maintenance technology