VIBROTEST 60

Technische Dokumentation
Technical Documentation
Dokumentation Technique

Contents

Brüel & Kjær Vibro

VIBROTEST 60

Technische Dokumentation
Technical Documentation
Dokumentation Technique

Brüel & Kjær Vibro

Brüel & Kjær Vibro

1   Precautionary information

Application

The VIBROTEST 60 is specifically conceived for the purpose of overall vibration, spectrum, process-value and tracking analysis measurements.

Use of the instrument for any purpose other than these is therefore outside of the design purpose.

The VIBROTEST 60 is of the latest technological design and is operationally secure.

Unrelated and unpredictable events may occur if the VIBROTEST 60 is used by untrained persons for any indiscriminate purpose. Any person given the task of using the VIBROTEST 60 should have first read and understood the operating instructions and in particular the precautionary information it contains.

Indiscriminate usage

in the operating instructions is emphasized by the following:

Note:

Non-observance of the precautionary information may result in the possibility of damage (in particular component damage) to the instrument.

Service work

Service work to the instrument may only be carried out by Brüel & Kjær Vibro service personnel or Brüel & Kjær Vibro authorised service personnel.

Note:

Please check the power in your region and compare it with the power range capability of the battery charger unit of the instrument before commissioning.

The battery set of the VIBROTEST 60 must **not remain in the instrument** during transportation!

The connections of the battery set must **not** be short-circuited!

Note:

- VIBROTEST 60 should only be operated with its covers on.

- Do not touch the charging contacts under the instrument. This could result in faulty operation of the functions due to electro-static discharge.

- The use of mobile telephones within a distance of 5 m could lead to malfunction.

2 Introduction

2.1 Tasks the VIBROTEST 60 can perform

VIBROTEST 60 offers extensive measuring functions in a modular concept as a

- Vibration analyser
- Field Balancing instrument
- Data-collector.

VIBROTEST 60 is the realisation of a measuring instrument technically designed for evaluation of machine condition, accurate diagnosis of damage and faults and achievement of the most modern standard for „condition-based„ maintenance strategy.

2.1.1 The concept

The modular concept of the VIBROTEST 60 permits individual combinations of measurement functions and therefore opens up a number of applications.

Functional modules of the instrument can be expanded at any time and therefore future development of the measurement functions can be easily supplemented.

2.1.2 Advantages of the VIBROTEST 60

- Unique FFT-analyser, Field Balancer, Data-collector in one handy instrument
- Easily-understood operator dialogue, selectable in the following languages:
  - German,
  - English,
  - French,
  - Italian,
  - Dutch,
  - Portuguese,
  - Spanish,
  - Czech,
  - Hungarian,
  - Polish

Brüel & Kjær Vibro

- Real 2-channel measurement plus speed

- Small, light-weight (900 g), single-hand operated instrument

- Latest quality in Data-collector technology with

  - extreme speed of measurement and simultaneous processing of up to 5 different measurement types

  - multiple Routes and random Point processing in measurement Routes

  - random switching between analyser, field balancing, and Data-collector modes

- High-tech signal processing with true Digital Signal Processor (DSP)

- Guaranteed long product life-cycle through modular expandable measurement functions for future developments

- High accuracy and dynamic resolution with 16-Bit ADC

- Excellent FFT resolution with up to 12,800 lines

- Commercially-available accelerometers, velocity and displacement sensors can be used

- Brilliant, high-contrast graphic display with back-light

- Extreme storage capacity and high measurement data security through use of PC-cards

2.2   Module overview

The following documentation describes all available modules of the VIBROTEST 60. In any individual case those modules which correspond to the order acknow-ledgement are released.

Module	Functions
Module 1.1: Basic Module Overall values for machine evaluation	• Absolute bearing vibration • Relative shaft vibration • BCU / Bandpass (BP) • Process values • Manual entry • Listing function • Speed measurement
Module 1.2 : Extension Module Overall values for machine evaluation	• Measurement vs. speed (f(n)) • Measurement vs. time (f(t))
Module 2.1: Basic Module Machine diagnosis	• FFT-Spectrum
Module 2.2: Extension Module Machine diagnosis	• Envelope analysis (BCS / SED) • Cepstrum
Module 3 Tracking analysis	• Free-running measurement • Measurement vs. speed f(n) and time f(t) (Run-up, Coast-down)
Module 5 Two-channel function	• Two-channel function

Module 6
 	
Data-collector single-channel measurement Measurement module not included
	Following optional modules can be used in Data-collector operation.
	• Module 1.1 Basic Module
	  Overall values for machine evaluation
	• Module 2.1 and 2.2
	  Machine diagnosis
	• Module 8
	  CPB-Spectrum

Module 7 Field balancing	• 1-plane balancing • 2-plane balancing • 1-/2-plane balancing with Prognosis • Polar-, component and unit mass correction • On- / Off Adaptive mode
Module 8 CPB-spectrum	• CPB-spectrum

Brüel & Kjær Vibro

2.3   Extent of delivery

The extent of delivery of the basic VIBROTEST 60 instrument consists of the following components:

1 x   VIBROTEST 60 measuring instrument
       incl. Basic Module   1.1:
       „Overalls for machine evaluation"

1 x   Power / charger unit   AC-601

2 x   Battery set   AC-602

1 x   PC-card   AC-603

1 x   Vibration acceleration pickup   AS-065

       with cable   AC-437

       Mounting magnet   AC-172

       Probe   AC-272

       Threaded stud   AC-350

1 x   Case   AC-605
       for transport of instrument and accessories

1 x   Technical documentation

2.4   Mechanical construction

Sensors connections
1   Pickup channel 1
2   Pickup channel 2

REF   Ref.- / speed pickup

Display unit

LED: GREEN
        Instrument On
        RED
        Residual battery life < 2 Min.
        (LED is „RED" only when VIBROTEST 60
        has been on for more than 10 min.)

Softkeys

Cursor control buttons

*The back-light is switched On by pushing any
button. The function of the respective button is
also executed.*

Function buttons

ON / OFF

After removal of the lower housing cover
the compartment for the battery set and
PC-card is accessible.

Battery set

PC-Card

PC-Card ejector

Exchanging the PC-Card:

• Switch the VIBROTEST 60 Off (ON button)

• Push card ejector

• Remove the PC-Card

*When inserting a PC-card take care that the label of the
card faces up and the card is inserted in the direction of
the arrow on the card. Never use excessive force to
remove or insert the card !*

Brüel & Kjær Vibro

2.4.1   VIBROTEST 60 measuring instrument

The single-hand housing has the following components

- Display unit

- Push-button area

- Sensor connections

- Battery set

- PC-card drive

Display unit

Backlit graphic LCD display

- Resolution of 160 x 140 pixels

- Display form: Black on white

Push-button area

Foil push-buttons with tactile operation, divided into the following groups:

- Softkeys

- Cursor buttons

- Function buttons

- ON / OFF button

Sensor and sensor connections

See chapter 12.3. for information about sensors which can be connected.

Brüel & Kjær Vibro

AC-602 battery set

The power for the VIBROTEST 60 is provided by rechargeable cells built as a unit, together with a current limiter circuit, into a separate housing called a battery set. This battery set is inserted into a compartment which can be accessed after removing the lower housing cover.

Note:

The discharge current of the battery set is monitored by an integrated protective circuit. When there is an increased discharge (e.g. in the case of a short-circuit) the electrical connection between battery set and electronics is automatically broken by a thermal switch. After this switch has cooled down sufficiently the electrical connection is again automatically made and the VIBROTEST 60 can be switched on once more.

PC-card drive

The VIBROTEST 60 is equipped with a drive for PC-cards. This is located below the battery set and can be accessed after removing the lower housing cover.

The PC-cards are used for storage of measurements and transfer of data between the VIBROTEST 60 and a PC.

2.4.2   AC-601 power / battery charger unit

The power / charger unit provides the VIBROTEST 60 with power and automatically charges the battery set in the VIBROTEST 60.

In addition the power / charger unit charges the supplementary battery set installed in the charger unit.

The operational status of the power / charger unit and the battery sets being charged is indicated by LEDs.

Mechanical and electrical connection to power

Mechanical and electrical connection between VIBROTEST 60 and the power / charger unit is made by simply laying the VIBROTEST 60 on the power / charger unit cradle.

2.5   Operation

2.5.1   Softkeys

Various menus corresponding to the selected measurement, analysis or configuration tasks are displayed. The bottom row in each menu is reserved for the display of softkey text. By pushing the softkey below the text the respective function is selected.

```
 VIBROTEST 60



 OK  INSERT DELETE NEXT
```
Command line
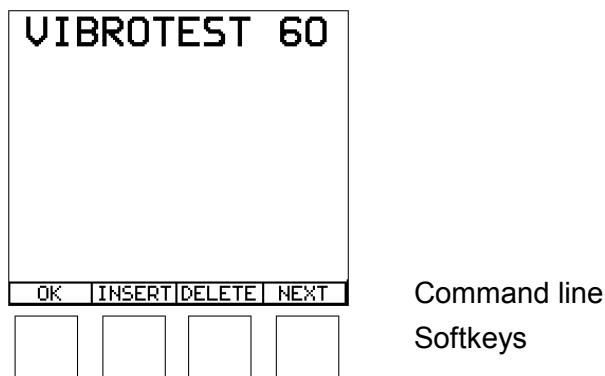
Softkeys

Advice:

The command line shows functions that can be activated using the softkeys.

The softkey text will be displayed in inverted form when the function is activated.

⌐ >>> ⌐ If more than four softkeys exist for a specific measurement task, further functions can be called using the »More« softkey. Using this key all the functions of the measurement task can be displayed.

```
START      AVERAGE >>>
```
»More« softkeys
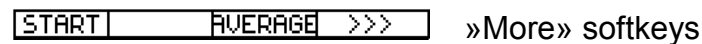
Advice:

Only those softkey functions that can be activated are displayed. If further functions are possible after a measurement, the command line will change and further softkeys will be displayed.

2.5.2 Cursor buttons ◀, ▶, ▲, ▼

Depending on the menu being displayed, various functions can be performed in connection with the cursor position.
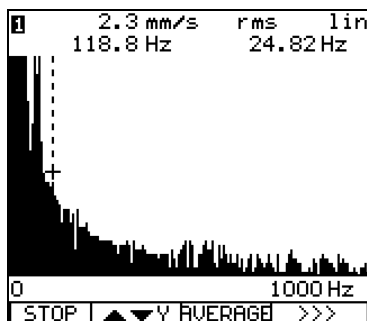
Cursor display with FFT-, Envelope Analysis and CPB-spectra

The cursor can be moved along the X-axis using the cursor control buttons.

The value corresponding to the position of the cursor is displayed on the screen as a numeric value.

Note:

The back-light is switched on by pushing any button. The function of the respective button is also executed; because of this it is better to use the cursor buttons for switching on the back-light.

2.5.3 The function buttons

The function buttons located below the cursor control buttons are assigned *fixed* functions as follows:

STORE   Store the measurement on the PC-card. After a measurement is completed the values can be stored on the PC-card as a Report.

1 / 2   Switching the measurement display between the two measuring channels (only in analyser mode and with 2-channel operation of the instrument).
This button has no influence on the measurement function of the instrument.
The selected channel number is displayed on the screen as shown in chapter 2.5.4.

SETUP   Changing the configuration of the respective meas-
urement function.
The configuration is only displayed and cannot be ed-
ited in the:

- Listing mode and

- during the acquisition of data in the Data-collector
mode.

EXIT   Exit from the current function menu and return to the
previous menu.
All changes to the configuration in the current menu
or displayed measurements in the current menu are
deleted.

ON   ON / OFF toggle switch for the VIBROTEST 60

2.5.4   The window display
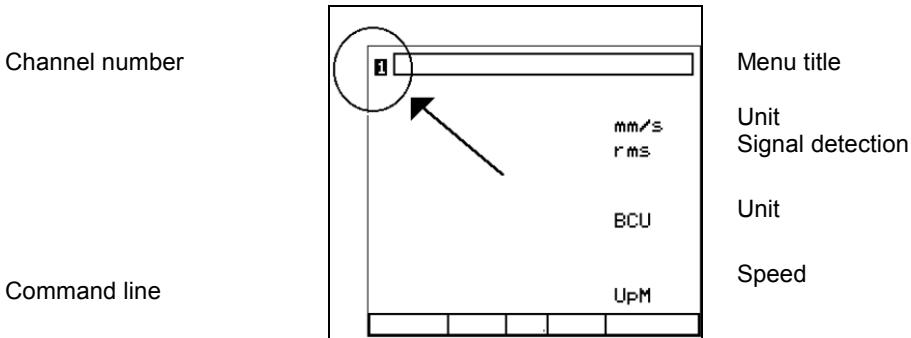
2.5.5   Zoom function without the cursor

During the acquisition of a spectrum and after a spectrum measurement is completed the X- and Y-axes can be zoomed.

Note:

If „Setup 1=2: Yes„ has been defined in the System Setup, all actions in the X-axis (zoom and cursor movement) will be effected simultaneously at both channels.

⎡▲▼Y⎤ Zooming the X-axis

The softkey shows which zoom function will be currently active !

Using the cursor buttons ⊛, ⊽ the X-axis can be zoomed; for example a displayed spectrum from 0-1000 Hz can be spread out over a display section from 0 Hz - 200 Hz. The display section is spread out from 0 Hz.
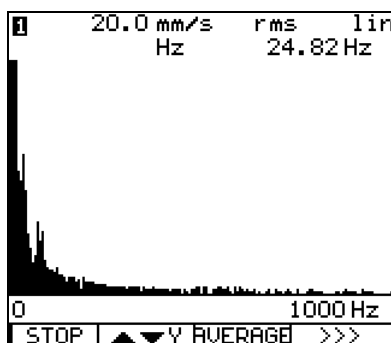
X-axis without zoom   *X-axis with zoom around the cursor*
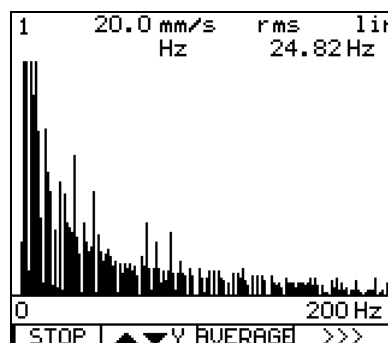
Because of the limited resolution of the display a diagram with only 160 lines can be displayed. If a spectrum with a larger number of lines than the display can accommodate is to be evaluated, the total number of lines is divided into 160 equal groups and the largest amplitude value in each group is displayed as a single line.

⬛⬛⬜ Zooming the Y-axis

The softkey shows which zoom function will be currently active !

Using the cursor buttons ⓐ, ⓥ the Y-axis can be zoomed. These buttons alter the full scale value of the Y-axis. The full scale value of the Y-axis is numerically displayed.
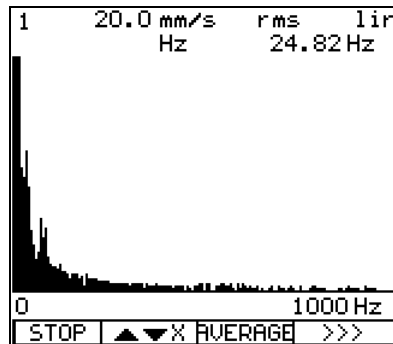
Y-axis without zoom   *Y-axis with zoom*
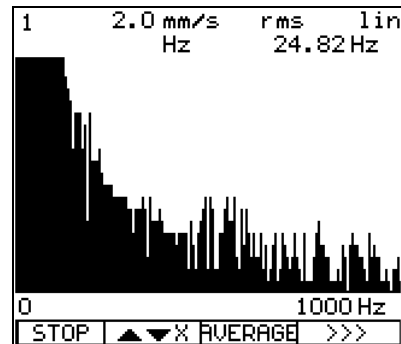
The full scale value of the Y-axis is automatically determined, corresponding to the largest amplitude, in the ranges 1, 2, 5 or the power of ten thereof. Starting from the initial display the full scale range can be reduced in predefined steps.

With a linear scaling of the Y-axis the amplitude resolution can be increased in which the display range is sequentially changed in steps of 1 - 2 – 5. Individual lines in the display are cut off when their amplitudes are greater than the currently selected full-scale value. The numeric displays of frequency and amplitude are not influenced by the lines being cut off.

If the Y-axis is scaled logarithmically, the display range can be extended, also in steps, by 1 decade in the direction of smaller amplitudes. A maximum of 10 further decades can be displayed. The full scale value is thereby retained.

2.5.6   Zoom functions with activated cursor

During spectrum acquisition and after a spectrum has been measured.

- Information about individual spectral lines can be displayed with the cursor and

- The X- and Y-axes can be zoomed.
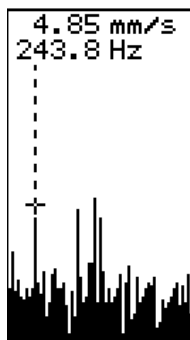
Cursor

With the cursor (cursor buttons ◀, ▶) information (amplitude and frequency) about the individual spectral lines is displayed.

Using the cursor, information about the frequency is dependent on the selected zoom factor of the X-axis.

The larger the zoom factor, the more accurate the frequency information.

Switching on the cursor display

By pushing the cursor button ◀,or ▶ once, the cursor display is switched on.

Thereafter the cursor can be moved across the spectrum using the cursor buttons ◀, ▶.
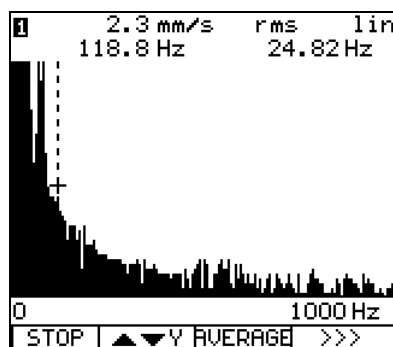
Cursor
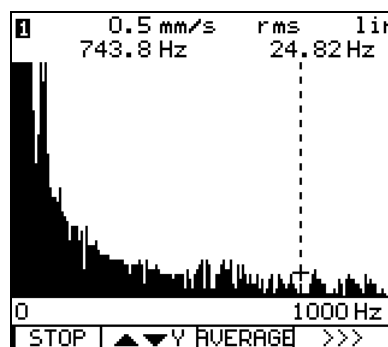
Cursor shifted

The spectrum is displayed in the form of a number of lines. This means that each calculated line of the spectrum is displayed on the X-axis as far as the resolution of the display allows. The cursor, which is controllable along the X-axis, can be positioned on any displayed frequency line in the spectrum.

Brüel & Kjær Vibro

Corresponding to the frequency line at which the cursor is positioned, the amplitude and frequency are displayed in numeric form above the diagram. In addition to the numeric values the associated units and the selected signal-detection type are also displayed.

▲▼Y Zooming the X-axis

The softkey shows which zoom function will be currently active !

Using the cursor buttons ⊛, ⊛ the X-axis can be zoomed; for example the displayed 0-1000 Hz spectrum can be spread out to display a section from 196 Hz - 396 Hz. The displayed section is always spread out equally around the current position of the cursor.
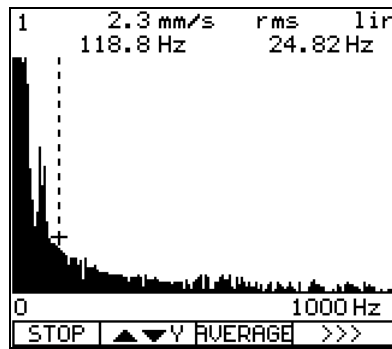
X-axis without zoom   *X-axis with zoom around the cursor*
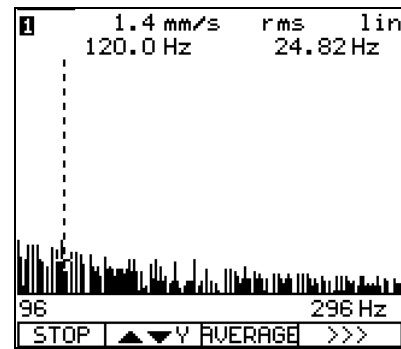
Because of the limited resolution of the display a diagram with only 160 lines can be displayed. If a spectrum with a larger number of lines than the display can accommodate is to be evaluated, the total number of lines is divided into 160 equal groups and the largest amplitude value in each group is displayed as a single line.

▲▼X Zooming the Y-axis

The softkey shows which zoom function will be currently active !

Using the cursor buttons Ⓐ, Ⓥ the Y-axis can be zoomed. This alters the scaling of the Y-axis.
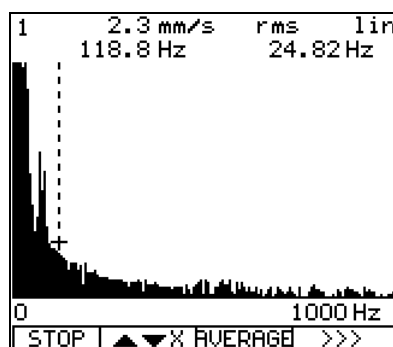
Y-axis without zoom   *Y-axis with zoom*
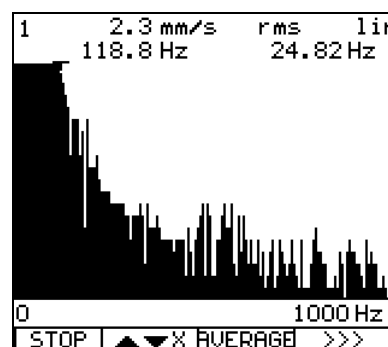
The full scale value of the Y-axis is automatically determined, corresponding to the largest amplitude, in the ranges 1, 2, 5 or the power of ten thereof. Starting from the initial display the full scale range can be reduced in predefined steps.

With a linear scaling of the Y-axis the amplitude resolution can be increased in which the display range is sequentially changed in steps of 1 - 2 – 5. Individual lines in the display are cut off when their amplitudes are greater than the currently selected full-scale value. The numeric display of frequency and amplitude are not influenced by the lines being cut off.

If the Y-axis is scaled logarithmically, the display range can be extended, also in steps, by 1 decade in the direction of smaller amplitudes. A maximum of 10 further decades can be displayed. The full scale value is thereby retained.

Brüel & Kjær Vibro

3   Operational modes

Note:

> If a measurement was started prior to starting the rotating machine and stopped first, after the machine has finished rotating, it might happen that he displayed measurement spectra shows higher measurement values than at the beginning of the measurement cycle. This is NOT a malfunction. After restarting the measurement the display updates to the correct values.

3.1   Analyser mode

In the analyser mode, after setting up the required configuration and connecting the corresponding sensors, the desired data can be acquired and, if required, stored to the PC-card. Each stored data set, in future called a Report, can be given a description with a maximum of 12 characters.

According to the selected function, the display of the measurements can be averaged or non-averaged.

Measurement of the speed, if selected in the configuration, is done in parallel with measurement of the over-all or spectrum signal. Speed measurement acquisition is activated in the menu »System Setup«.

Listing function

In the modes »Vibration / BCU« and »Process-values« up to 100 measurements can be stored in a buffer memory during measurement using the Listing function. These values stored in the buffer memory can be permanently stored to the PC-card and analysed later using either the VIBROTEST 60, or the PC programs XMS or VIBRO-REPORT.

3.2   Data-collector mode

In the Data-collector mode measurements on a Route are acquired and stored. The Route is specified using the PC program XMS. Details and information about the Route are loaded onto the PC-card by the PC.

The measurement orders on the Route are displayed and processed in the specified sequence at the VIBROTEST 60 with the PC-card installed.

During data acquisition a Comment can be stored with each measurement order.

During the Route changes to the sequence of the measure-ments at Points in the Route can be made at any time. If any changes to the predefined measurement orders or the configuration for measurements are to be made these can only be made through the XMS program.

3.3   Field Balancing mode

In the Field Balancing mode rotors can be balanced in one or two planes. Unbalance correction can be done in polar, component or unit mass format.

VIBROTEST 60 offers the option, at rotors that have previously been balanced and the balancing procedure stored on the PC-card, to execute „Repeat balancing„ without conducting any new test runs.

Advice:

When „Repeat Balancing" is performed, the Adaptive Mode is switched off. (See chapter 7).

4   SETUP - Adjustments

4.1   System setup

The System setup is selected using either the softkey »Setup« in the main menu or via the function button SETUP.
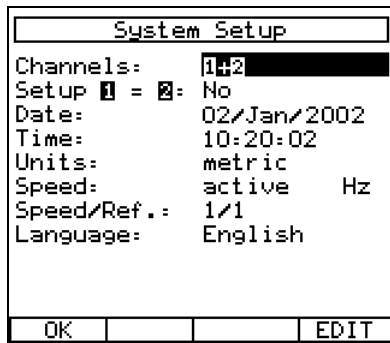
```
┌─────────────────────────┐
│     System Setup        │
├─────────────────────────┤
│ Channels:    1+2        │
│ Setup 1 = 2:  No        │
│ Date:        02/Jan/2002│
│ Time:        10:20:02   │
│ Units:       metric     │
│ Speed:       active  Hz │
│ Speed/Ref.:  1/1        │
│ Language:    English    │
│                         │
│                         │
├──────┬──────┬─────┬─────┤
│  OK  │      │     │EDIT │
└──────┴──────┴─────┴─────┘
```

OK   The displayed parameter setup resp. adjustments are accepted and the previous menu appears.

EDIT Switch to the functional selection/ entry menu for editing the para-meter values.

4.1.1   Channels

Measurement channel 1   Channel 1 is active

Measurement channel 1+2   Channels 1 and 2 are active

Note:

When measurement channel 1 is selected, only the channel that is designated as channel 1 will be active !

4.1.2   Setup 1=2

Identical configuration for channel 1+2   Yes*

Identical configuration for channel 1+2   No

∗   With the selection »Yes« the configuration of channel 2 is overwritten by the configuration of channel 1. This provides the user the option to quickly copy the setup from channel to channel 2.

4.1.3   Date

Format: dd / mmm / yy

mmm / dd / yy

yy / dd / mmm

yy / mmm / dd

dd = Day, mmm = Month, yy = Year

Note: See chapter 9.9

4.1.4   Time

Format   am / pm

24 hour

4.1.5   Units

Metric   All measured units based on the Metric system

Imperial   All measured values based on the Imperial system.

4.1.6   Speed

Speed measurement is: active

Speed measurement is: inactive

Speed measurement must be active for averaging in the time domain.

Note:

Speed measurement must be set to inactive when it is not required otherwise the system may be too slow.

In this case no speed measurements will be acquired !

```
┌──────────────────────────┐
│      System Setup        │
├──────────────────────────┤
│ Channels:   1+2          │
│ Setup 1 = 2: No          │
│ Date:       02/Jan/2002  │
│ Time:       10:20:02     │
│ Units:      metric       │
│ Speed:      inaktiv   Hz │
│ Speed/Ref.: 1/1          │
│ Language:   English      │
│                          │
│                          │
├──────────────────────────┤
│  OK  │      │     │ EDIT  │
└──────────────────────────┘
```
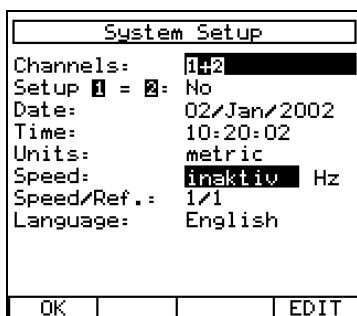
4.1.6.1   Speed unit

Hz

rpm

cpm

4.1.7   Speed / Ref.

The values for calculating the ratio between machine speed / reference impulses have to be entered

| 1 ... 999 Revolutions | (Counter) |
| 1 ... 999 Reference impulses | (Denominator) |

Note:

The minimum ratio is 1/99 and the maximum 99/1.

4.1.8   Language

The language can be changed.

The following languages are possible:

German, English, French, Italian, Dutch, Polish, Portuguese, Spanish, Czech, Hungarian

4.2 The Cursor control

Four buttons are arranged above the function buttons, corresponding to the defined directions, for controlling the movement of the cursor and for shifting of digits when entering parameter values. The position of the cursor appears in the form of an inverse text or character.

In the process of editing numbers the decimal point should first be positioned at the desired location and then the change in the number executed.

4.2.1 Entry of decimal points, numbers and units

Decimal points and numbers are selected in the VIBROTEST 60 using the cursor buttons ◀, ▶, ▲, ▼. The process is explained in the following example.

In the example below the objective is to set up the sensor's sensitivity for 20 mV/mm in the Process-values Setup.

Setting the decimal point
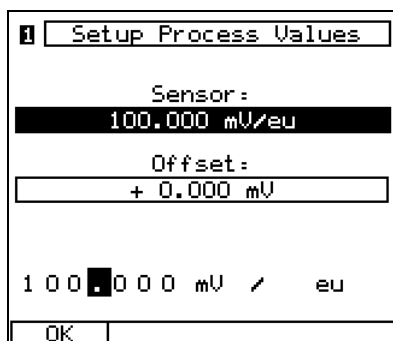
Position the cursor on the decimal point using the ◀, ▶ cursor buttons.
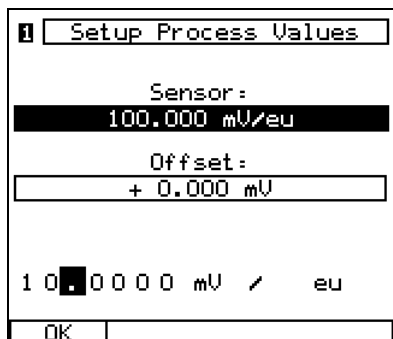
Shift the decimal point using the cursor buttons ▲, ▼.

Brüel & Kjær Vibro

Entering the numeric values

```
█ | Setup Process Values |

       Sensor:
     ▓100.000 mV/eu▓

       Offset:
      + 0.000 mV


 █0 . 0 0 0 0  mV  ╱    eu
 ──────────
 | OK |
```
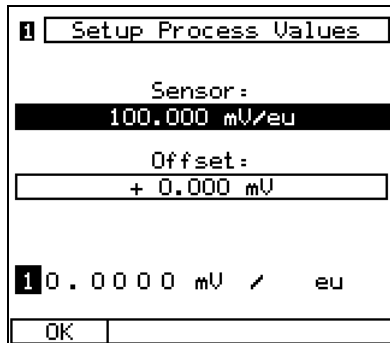
Using the cursor buttons ◄, ►, position the cursor on the numeric value which is to be changed.

```
█ | Setup Process Values |

       Sensor:
     ▓100.000 mV/eu▓

       Offset:
      + 0.000 mV


 █0 . 0 0 0 0  mV  ╱    eu
 ──────────
 | OK |
```
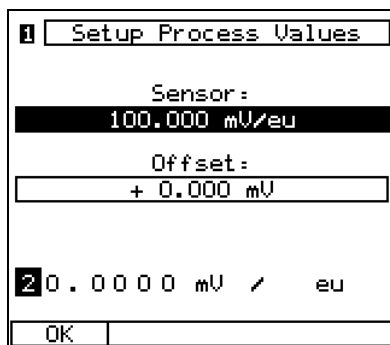
Select the numeric value using the cursor buttons ▲, ▼.

Selecting the unit

```
█ | Setup Process Values |

       Sensor:
     ▓100.000 mV/eu▓

       Offset:
      + 0.000 mV


 2 0 . 0 0 0 0  mV  ╱  ▓eu▓
 ──────────
 | OK |
```
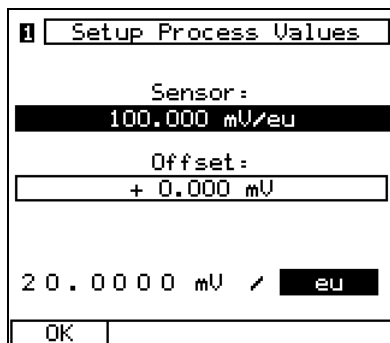
Position the cursor on the unit that is to be changed using the cursor buttons ◄, ►.

```
█ | Setup Process Values |

       Sensor:
     ▓100.000 mV/eu▓

       Offset:
      + 0.000 mV


 2 0 . 0 0 0 0  mV  ╱  ▓mm▓
 ──────────
 | OK |
```
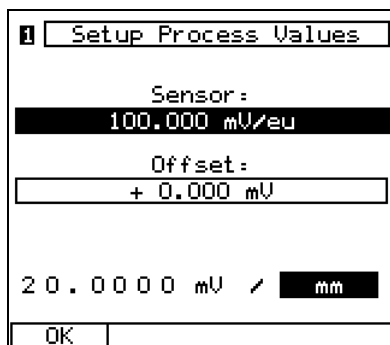
Select the units with the cursor buttons ◄, ►.

Finally store the complete entry with the softkey »OK«.

4.3   Vibration measurement
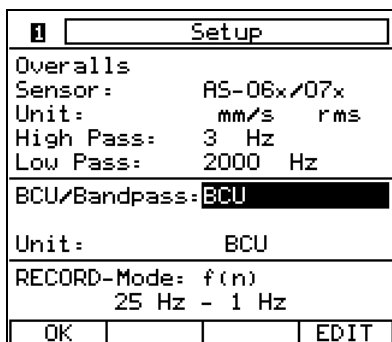
```
 ┌──────────────────────────┐
 │ ▐ ▌        Setup         │
 ├──────────────────────────┤
 │ Overalls                 │
 │ Sensor:       AS-06x/07x │
 │ Unit:          mm/s   rms│
 │ High Pass:     3  Hz     │
 │ Low Pass:      2000  Hz  │
 ├──────────────────────────┤
 │ BCU/Bandpass:▐BCU▌       │
 │                          │
 │ Unit:          BCU       │
 ├──────────────────────────┤
 │ RECORD-Mode: f(n)        │
 │         25 Hz - 1 Hz     │
 ├──────────────────────────┤
 │  OK    │    │    │  EDIT  │
 └──────────────────────────┘
```

OK   The displayed parameter setup resp. adjustments are accepted and the previous menu appears.

EDIT Switch to the functional selection/ entry menu for editing the para-meter values.

4.3.1   Overall Vibration

4.3.1.1   Sensors

AS-06x/07x	Vibration acceleration sensor
AS-1x/2x/3x	Vibration acceleration sensor (only with additional adapter AC-630)
VS-079	Vibration velocity sensor
VS-080	Vibration velocity sensor
IN-085	Displacement sensor (only with additional adapter AC-630)
Variable	Sensor not requiring power from the VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Sensor requiring power from the VIBROTEST 60 + 24 V, 2 ...4 mA 0.01 ... 1000.00 mV / unit V / unit

Note:

When moving-coil vibration velocity sensors of the type VS-079 and VS-080 are connected a linearisation between 1 Hz…20Hz is active.

With moving-coil vibration velocity sensors which are „variable„ this linearisation is not active.

∗   CCS :   Constant Current Supply

4.3.1.2   Unit / Signal detection

Unit	**Signal detection**	
g	rms	
m/s²	p	peak
mm/s	pp	peak peak
ips	pc	peak calculated
µm	ppc	peak peak calculated
mils		
eu		

Note:

The possible selection of the unit is dependent on the sensor type and the predefined unit system in the menu »System Setup« under the title Unit.

The unit »eu« is available only when the pickup type »Variable« is selected and in the same menu in the counter the unit »eu« is also selected.

4.3.1.3   Filter

High-pass

1 Hz	80 Hz	1000 Hz
3 Hz	100 Hz	1250 Hz
10 Hz	125 Hz	1600 Hz
12.5 Hz	160 Hz	2000 Hz
16 Hz	200 Hz	2.5 kHz
20 Hz	250 Hz	3.15 kHz
25 Hz	315 Hz	4 kHz
31.5 Hz	400 Hz	5 kHz
40 Hz	500 Hz	6.3 kHz
50 Hz	630 Hz	8 kHz
63 Hz	800 Hz	10 kHz

Low-pass

10 Hz	125 Hz	1600 Hz
12.5 Hz	160 Hz	2000 Hz
16 Hz	200 Hz	2.5 kHz
20 Hz	250 Hz	3.15 kHz
25 Hz	315 Hz	4 kHz
31.5 Hz	400 Hz	5 kHz
40 Hz	500 Hz	6.3 kHz
50 Hz	630 Hz	8 kHz
63 Hz	800 Hz	10 kHz
80 Hz	1000 Hz	12.5 kHz
100 Hz	1250 Hz	16 kHz
		20 kHz

Note:

The low-pass frequency must be at least double that of the high-pass frequency. Therefore according to the selected filter not all options will displayed.

The upper corner frequency is limited by the type of sensor and the selected units.

Measurement	max. upper corner frequency
With VS sensors	5 kHz
Velocity with AS sensors	10 kHz
Displacement with AS sensors	10 kHz
Acceleration with AS sensors	20 kHz
Displacement with IN sensors	20 kHz

Brüel & Kjær Vibro

4.3.2   BCU / Bandpass

4.3.2.1   Sensors

BCU:

AS-06x/07x	Vibration acceleration sensor
AS-1x/2x/3x	Vibration acceleration sensor (only with additional adapter AC-630)
Variable	Only acceleration sensors not requiring power from the VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Only acceleration sensors requiring power from the VIBROTEST 60 + 24 V, 2 ...4 mA 0.01 ... 1000.00 mV / unit V / unit

Bandpass:

AS-06x/07x	Vibration acceleration sensor
AS-1x/2x/3x	Vibration acceleration sensor (only with additional adapter AC-630)
Variable	Sensor not requiring power from the VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Sensor requiring power from the VIBROTEST 60 + 24 V, 2 ...4 mA 0.01 ... 1000.00 mV / unit V / unit

4.3.2.2   Unit / Signal detection

BCU

Unit	Signal detection
BCU	none

Bandpass

Unit	Signal detection
AS - Sensors:	
g	rms
m/s²	

Variable sensors:	
Sensor-definition unit	rms

4.3.2.3   Filter

If Bandpass is selected the desired high-pass and low-pass must be set up.

High-pass :

630 Hz	6.3 kHz
800 Hz	8 kHz
1000 Hz	10 kHz
1250 Hz	12.5 kHz
1600 Hz	16 kHz
2000 Hz	
2.5 kHz	
3.15 kHz	
4 kHz	
5 kHz	

Low-pass :

800 Hz	8 kHz
1000 Hz	10 kHz
1250 Hz	12.5 kHz
1600 Hz	16 kHz
2000 Hz	20 kHz
3,15 kHz	
2.5 kHz	
4 kHz	
5 kHz	
6,3 kHz	

Advice:

The corner frequency series of the high-pass and low-pass are planned in the same steps; the relative distance between two filters is approx. 23 %. The frequency selection ensures that the high-pass and low-pass are always at least one frequency step from each other.

4.3.3   RECORD Mode

RECORD Mode means that vibration / BCU measurements can be recorded vs. speed or time.

Advice:

A maximum of 6,400 measured values can be recorded. The system limits this number of measured values automatically.

4.3.3.1   RECORD Mode f(n)

If the RECORD Mode f(n) is selected the following parameters must be set up.

```
┌─────────────────────────────┐
│       Minimal Speed         │
├─────────────────────────────┤
│ │ │ │ │ █1█ │      Hz        │
├─────────────────────────────┤
│       Maximal Speed         │
├─────────────────────────────┤
│ │ │ │ │25│       Hz          │
├─────────────────────────────┤
│      Direction of run       │
├─────────────────────────────┤
│        │ Run Down │          │
├─────────────────────────────┤
│  OK  │   ▲   │   ▼   │       │
└─────────────────────────────┘
```

4.3.3.1.1 Minimum speed

1 - 9997 Hz*

4.3.3.1.2 Maximum speed

4 - 10000 Hz*

Smallest difference between minimum speed and maximum speed = 3 Hz (180 rpm)

All speed entries are valid with a speed/reference ratio of 1/1. With all other speed/reference ratios the speeds must be set correspondingly up or down.

4.3.3.1.3 Speed-change direction

Run-down*
Run-up*

∗   The setup is effective for both channels.

At the end of the setup confirm with «OK».

4.3.3.2   RECORD Mode f(t)

If the RECORD Mode f(t) is selected the following parameters must be set up:

```
 ┌───────────────────────────────┐
 │ ┌───────────────────────────┐ │
 │ │             T             │ │
 │ └───────────────────────────┘ │
 │     ┌─────────────┐           │
 │     │ 2 4 0       │    s      │
 │     └─────────────┘           │
 │ ┌───────────────────────────┐ │
 │ │            ∆t             │ │
 │ └───────────────────────────┘ │
 │     ┌─────────────┐           │
 │     │ 0 . 5 0 0   │    s      │
 │     └─────────────┘           │
 │                               │
 │ ┌────┬─────┬─────┬────┐       │
 │ │ OK │  ▲  │  ▼  │    │       │
 │ └────┴─────┴─────┴────┘       │
 └───────────────────────────────┘
```

4.3.3.2.1 Measurement time T

T   maximum 99,999 seconds

minimum 10 seconds

4.3.3.2.2 Interval ∆ t

∆ t   maximum 80 seconds

minimum 0.1 seconds

Advice:

Within the measuring time interval ∆ t an average of the measurement is calculated.

At the end of the setup confirm with «OK».

4.4   Spectrum / Cepstrum
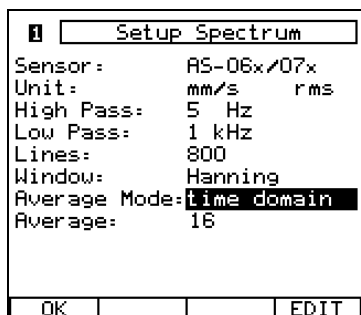
```
┌─────────────────────────┐
│ ▣    Setup Spectrum     │
│ Sensor:      AS-06x/07x  │
│ Unit:        mm/s    rms │
│ High Pass:   5   Hz      │
│ Low Pass:    1 kHz       │
│ Lines:       800         │
│ Window:      Hanning     │
│ Average Mode:▐time domain▌│
│ Average:     16          │
│                          │
│                          │
│  OK  │      │      │ EDIT │
└─────────────────────────┘
```

OK   The displayed parameter setup resp. adjustments are accepted and the previous menu appears.

EDIT Switch to the functional selection/ entry menu for editing the parameter values.

4.4.1   Sensors

AS-06x/07x	Vibration acceleration sensor
AS-1x/2x/3x	Vibration acceleration sensor (only with additional adapter AC-630)
VS-079	Vibration velocity sensor
VS-080	Vibration velocity sensor
IN-085	Displacement sensor (only with additional adapter AC-630)
Variable	Sensor not requiring power from the VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Sensor requiring power from the VIBROTEST 60 + 24 V, 2 ... 4 mA 0.01 ... 1000.00 mV / unit V / unit

Note:

When moving-coil vibration velocity sensors of the type VS-079 and VS-080 are connected a linearisation between 1 Hz…20Hz is active.

With moving-coil vibration velocity sensors which are „variable„ this linearisation is not active.

∗   CCS :   Constant Current Supply

Brüel & Kjær Vibro

4.4.2   Unit / Signal detection

Unit	Signal detection	
g	rms	
m/s²	peak	
mm/s	pp	peak peak
µm		
BCU		
eu		

4.4.3   Filter

High-pass

    1 Hz
    2 Hz
    5 Hz
   10 Hz

Low-pass

20 Hz	1 kHz
50 Hz	2 kHz
100 Hz	5 kHz
200 Hz	10 kHz
500 Hz	20 kHz

4.4.4   No. of Lines

100	1600
200	3200
400	6400
800	12800

4.4.5   Window

Flat-top

Hanning

Uniform

4.4.6   Averaging mode

Off

Frequency domain

Time domain

Advice for the setup „Time domain":

This is active only when the speed measurement is switched on in the System setup and the speed signal is acquired.

4.4.7   No. of Averages

Frequency domain	Time domain
4	4
16	16
64	64
Exponential	
Peak Hold	

Brüel & Kjær Vibro

4.5 Envelope Analysis / BCS

4.5.1 Envelope analysis - BCS mode (**B**earing **C**ondition **S**ignature)
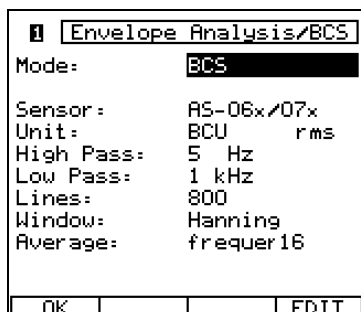
```
┌─────────────────────────┐
│ ▣ │Envelope Analysis/BCS│ │
│ Mode:        ▐BCS      ▌ │
│                         │
│ Sensor:      AS-06x/07x │
│ Unit:        BCU    rms │
│ High Pass:   5  Hz      │
│ Low Pass:    1 kHz      │
│ Lines:       800        │
│ Window:      Hanning    │
│ Average:     frequer16  │
│                         │
│ ┌─────┬────┬────┬─────┐ │
│ │ OK  │    │    │EDIT │ │
│ └─────┴────┴────┴─────┘ │
└─────────────────────────┘
```

OK   The displayed parameter setup resp. adjustments are accepted and the previous menu appears.

EDIT Switch to the functional selection/ entry menu for editing the parameter values.

4.5.1.1 Sensors

AS-06x/07x	Vibration acceleration sensor
AS-1x/2x/3x	Vibration acceleration sensor (only with additional adapter AC-630)
Variable	Only acceleration sensors not requiring power from the VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Only acceleration sensors requiring power from the VIBROTEST 60 + 24 V, 2 ...4 mA 0.01 ... 1000.00 mV / unit V / unit

4.5.1.2 Unit / Signal detection

Unit	**Signal detection**
BCU	rms
	peak
	pp peak peak

4.5.2   Envelope analysis - SED mode (**S**elective **E**nvelope **D**etection)
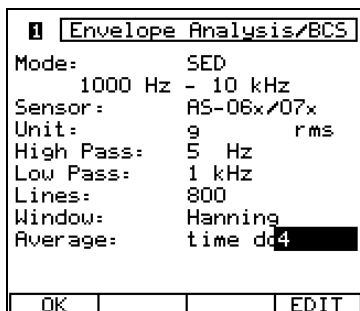
```
┌─────────────────────────┐
│ ▌ │Envelope Analysis/BCS││
│ Mode:        SED        │
│     1000 Hz - 10 kHz    │
│ Sensor:      AS-06x/07x │
│ Unit:        g      rms │
│ High Pass:   5  Hz      │
│ Low Pass:    1 kHz      │
│ Lines:       800        │
│ Window:      Hanning    │
│ Average:     time do4   │
│                         │
│ ┌──────┬─────┬──────┐   │
│ │  OK  │     │ EDIT │   │
│ └──────┴─────┴──────┘   │
└─────────────────────────┘
```

OK   The displayed parameter setup resp. adjustments are accepted and the previous menu appears.

EDIT Switch to the functional selection/ entry menu for editing the parameter values.

4.5.2.1   Sensors

AS-06x/07x	Vibration acceleration sensor
AS-1x/2x/3x	Vibration acceleration sensor (only with additional adapter AC-630)
Variable	Sensor not requiring power from the VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Sensor requiring power from the VIBROTEST 60 + 24 V, 2 ...4 mA 0.01 ... 1000.00 mV / unit V / unit

4.5.2.2   Unit / Signal detection

Unit	**Signal detection**	
AS - Sensors:		
g	rms	
m/s²	peak	
	pp	peak peak
Variable Sensors:		
Sensor-definition unit	rms	
	peak	
	pp	peak peak

4.5.2.3   Filter

High-pass :

630 Hz	6.3 kHz
800 Hz	8 kHz
1000 Hz	10 kHz
1250 Hz	12.5 kHz
1600 Hz	16 kHz
2000 Hz	
2.5 kHz	
3.15 kHz	
4 kHz	
5 kHz	

Low-pass :

800 Hz	8 kHz
1000 Hz	10 kHz
1250 Hz	12.5 kHz
1600 Hz	16 kHz
2000 Hz	20 kHz
2.5 kHz	
3.15 kHz	
4 kHz	
5 kHz	
6.3 kHz	

Advice:

The corner frequency series of the high-pass and low-pass are planned in the same steps; the relative distance between two filters is approx. 23 %. The frequency selection ensures that the high-pass and low-pass are always at least one frequency step from each other.

4.5.3   Frequency analysis parameters

4.5.3.1   Filter

High-pass

  1 Hz
  2 Hz
  5 Hz
10 Hz

Low-pass

20 Hz	200 Hz	2 kHz	20 kHz
50 Hz	500 Hz	5 kHz	
100 Hz	1 kHz	10 kHz	

The span between high and low-pass must be smaller than the span selected for the SED filter setups.

```
1  Envelope Analysis/BCS
Mode:         SED
      630 Hz - 800 Hz
Sensor:       AS-06x/07x
Unit:         g        rms
High Pass:    5   Hz
Low Pass:     100  Hz
Lines:        800
Window:       Hanning
Average:      time dc4


   OK              EDIT
```
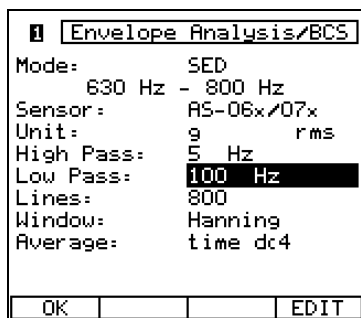
e.g.

The SED filter spans 170 Hz;
the maximum filter span for the frequency analysis is 100 Hz. This is automatically limited by the system.

4.5.4   No. of Lines

100	1600
200	3200
400	6400
800	12800

4.5.5   Window

Flat-top

Hanning

Uniform

Brüel & Kjær Vibro

4.5.6   Averaging mode

Off

Frequency domain

Time domain

Advice for the setup „Time domain":

This is active only when the speed measurement is switched on in the System setup and the speed measurement is acquired.

4.5.7   No. of Averages

Freqency domain	Time domain
4	4
16	16
64	64
Exponential	
Peak Hold	

4.6   CPB-spectrum

Constant **P**ercentage **B**andwidth

```
┌─────────────────────────┐
│ 🔢  Setup CPB-Spectrum   │
│ Sensor:       AS-06x/07x │
│ Unit:         mm/s    rms│
│ Bandwidth:    23 %       │
│ High Pass:    4.5  Hz    │
│ Low Pass:     1.1 kHz    │
│ Average Time: 10s        │
│                          │
│                          │
│                          │
│   OK              EDIT   │
└─────────────────────────┘
```

OK   The present parameter entries or setups are accepted. The program returns to the previous menu.

EDIT Switch to the selection/entry menu associated with the function for editing the parameter values.

4.6.1   Sensors

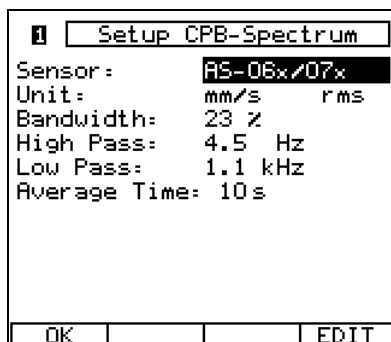|	
AS-06x/07x	Vibration acceleration sensor
AS-1x/2x/3x	Vibration acceleration sensor (only with additional adapter AC-630)
VS-079	Vibration velocity sensor
VS-080	Vibration velocity sensor
IN-085	Displacement sensor (only with additional adapter AC-630)
Variable	Sensor not requiring power from the VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Sensor requiring power from the VIBROTEST 60 + 24 V, 2 ... 4 mA 0.01 ... 1000.00 mV / unit V / unit

Note:

When moving-coil vibration velocity sensors of the type VS-079 and VS-080 are connected a linearisation between 1 Hz…20Hz is active.

With moving-coil vibration velocity sensors which are „variable„ this linearisation is not active.

∗   CCS :   Constant Current Supply

Brüel & Kjær Vibro

4.6.2   Unit / Signal detection

Unit	Signal detection	
g	rms	
m/s²	peak	
mm/s	pp	peak peak
ips		
µm		
mils		
eu		

Note:

The possible selection of the unit is dependent on the sensor type and the predefined unit system in the menu »System Setup« under the title Unit.

The unit »eu« is available only when the pickup type »Variable« is selected and in the same window in the counter the unit »eu« is also selected.

4.6.3   Bandwidth

You can select between:

70 %

23 %

  6 %

4.6.4   Filter

High-pass

  1,1 Hz
  2.2 Hz
  4.5 Hz
  9   Hz
18   Hz
35   Hz

Low-pass

  1,1 kHz
  2.2 kHz
  4.5 kHz
  9   kHz
18   kHz

4.6.5   Averaging time

3 to 999 seconds

4.7   Process Values
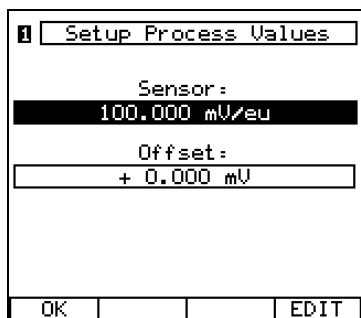
```
┌─────────────────────────┐
│ ▯ Setup Process Values │
│                         │
│       Sensor:           │
│ ▐ 100.000 mV/eu ▌       │
│                         │
│       Offset:           │
│ │    + 0.000 mV    │    │
│                         │
│                         │
│                         │
│  OK │     │    │ EDIT   │
└─────────────────────────┘
```

OK   The displayed parameter setup resp. adjustments are accepted and the previous menu appears.

EDIT Switch to the functional selection/ entry menu for editing the parameter values.

4.7.1   Sensor sensitivity

Physical Signal	**Units**		
mV	eu	Upm	m³/s
V	°C	rpm	t/h
mA	F	MW	kg/s
	N	kW	MPa
	kN	A	kPa
	µm	%	bar
	mm	°	psi
	mils	Nm	dB
	in	m³/h	

4.7.2   Off-set

Offset positive / negative

mV
V
mA

Advice:

Offset and sensor sensitivity always use the same physical signal unit.

4.8   Tracking Analysis

```
┌─────────────────────────┐
│ ▣    Setup Tracking     │
│                         │
│ Sensor:      AS-06x/07x │
│ Unit:        m/s²  peak │
│ Additional              │
│ Order:       2          │
│                         │
│ RECORD-Mode: f(t)       │
│     T= 240 s ∆t= 0.5 s  │
│                         │
│                         │
│ ───────────────────────  │
│  OK            EDIT     │
└─────────────────────────┘
```

OK   The displayed parameter setup resp. adjustments are accepted and the previous menu appears.

EDIT Switch to the functional selection/ entry menu for editing the parameter values.

Note:

The setup affects both channels, regardless of the setting „Setup 1 = 2„ in the System Setup.

4.8.1   Sensors

AS-06x/07x	Vibration acceleration sensor
AS-1x/2x/3x	Vibration acceleration sensor (only with Adaptor AC-630)
VS-079	Vibration velocity sensor
VS-080	Vibration velocity sensor
IN-085	Displacement sensor (only with Adaptor AC-630)
Variable	Sensor not requiring power from the VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Sensor requiring power from the VIBROTEST 60 + 24 V, 2 ... 4 mA 0.01 ... 1000.00 mV / unit V / unit

Note:

When moving-coil vibration velocity sensors of the type VS-079 and VS-080 are connected a linearisation between 1 Hz…20Hz is active.

With moving-coil vibration velocity sensors which are „variable„ this linearisation is not active.

∗   CCS :   Constant-current supply

4.8.2   Unit

Unit	Signal detection
g	rms
m/s²	peak
mm/s	pp peak peak
µm	
ips	
mils	
eu	

4.8.3   Additional Order

2. - 99. Order*

0 = additional order is not active

Note: The 1st order is always measured

4.8.4   RECORD

4.8.4.1   RECORD Mode f(n)

When the RECORD Mode f(n) is selected the following parameters must be set up.

```
┌──────────────────────────┐
│      Minimal Speed       │
│  ┌──┬──┬──┬──┬──┬──┐      │
│  │  │  │  │  │  │▉2│  Hz  │
│  └──┴──┴──┴──┴──┴──┘      │
│      Maximal Speed       │
│  ┌──┬──┬──┬──┬──┬──┐      │
│  │  │  │  │  │2 │5 │  Hz  │
│  └──┴──┴──┴──┴──┴──┘      │
│      Direction of run    │
│      ┌──────────┐        │
│      │ Run Down │        │
│      └──────────┘        │
│ OK  │   ▲   │   ▼   │    │
└──────────────────────────┘
```

4.8.4.1.1   Minimum speed

1 - 9997 Hz*

4.8.4.1.2   Maximum speed

4 - 10000 Hz*

the minimum difference between minimum speed and maximum speed = 3 Hz

All speed entries are related to a speed/ref. ratio of 1/1. With all other speed/ref. ratios the speeds must be correspondingly set up.

4.8.4.1.3 Direction

Coastdown*
Run-up*

∗　The setting is relevant for both channels.

At the end of the setup, confirm by pushing »OK«.

4.8.4.2　RECORD Mode f(t)

When the RECORD Mode f(t) is selected the following parameters must be set up:

```
┌─────────────────────────────────┐
│ ┌─────────────────────────────┐ │
│ │              T              │ │
│ └─────────────────────────────┘ │
│      ┌───────────┐              │
│      │ 2 4 0 │    s            │
│      └───────────┘              │
│ ┌─────────────────────────────┐ │
│ │             ∆t              │ │
│ └─────────────────────────────┘ │
│      ┌───────────┐              │
│      │ 0 . 5 0 0 │  s          │
│      └───────────┘              │
│                                 │
│ ┌────┬──────┬──────┬─────────┐  │
│ │ OK │  ▲   │  ▼   │         │  │
│ └────┴──────┴──────┴─────────┘  │
└─────────────────────────────────┘
```

4.8.4.2.1 Measurement time T

T　　　　　maximum 9999 seconds

minimum 10 seconds

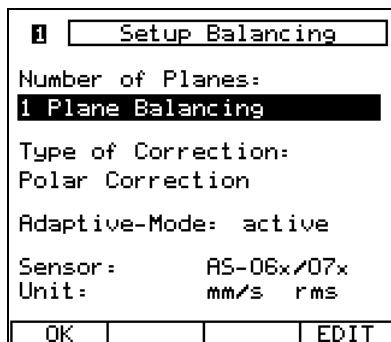4.8.4.2.2 Interval ∆ t

∆ t　　　　maximum 80 seconds

minimum 0.1 seconds

Note:

Within the measurement time interval ∆ t the measured values are averaged.

At the end of the setup confirm by pushing »OK«.

4.9   Balancing

```
┌─────────────────────────────┐
│ ▣      Setup Balancing       │
│                             │
│ Number of Planes:           │
│ █1 Plane Balancing█         │
│                             │
│ Type of Correction:         │
│ Polar Correction            │
│                             │
│ Adaptive-Mode:  active      │
│                             │
│ Sensor:       AS-06x/07x    │
│ Unit:         mm/s   rms     │
│                             │
│   OK    │      │     │ EDIT  │
└─────────────────────────────┘
```

OK   The displayed parameter setup resp. adjustments are accepted and the previous menu appears.

EDIT Switch to the functional selection/ entry menu for editing the para-meter values.

Note:

After the initial run only the parameters „Correction type" and "Adaptive Mode" may be changed. If any other parameters are to be changed the entire balancing procedure must be aborted with the softkey »RESET« (see chapter.7.2.3).

4.9.1   Sensors

AS-06x/07x	Vibration acceleration sensor
AS-01x/02x/03x	Vibration acceleration sensor (only with additional Adapter AC-630)
AS-1x/2x/3x	Vibration acceleration sensor (only with Adaptor AC-630)
VS-079	Vibration velocity sensor
VS-080	Vibration velocity sensor
IN-085	Displacement sensor (only with Adaptor AC-630)
Variable	Sensor not requiring power from VIBROTEST 60 0.01 ... 1000.00 mV / unit V / unit
Variable CCS*	Sensor requiring power from the VIBROTEST 60 + 24 V, 2 ... 4 mA 0.01 ... 1000.00 mV / unit V / unit

Note:

> When moving-coil vibration velocity sensors of the type VS-079 and VS-080 are connected a linearisation between 1 Hz…20Hz is active.
>
> With moving-coil vibration velocity sensors which are „variable„ this linearisation is not active.
>
> ∗   CCS :   Constant-current supply

4.9.2   Unit

Unit	Signal detection	
g	rms	
m/s²	peak	
mm/s	pp	peak peak
µm		
ips		
mils		
eu		

The signal detection must be the same in both measurement channels (channel 1 and 2).

4.9.3   No. of planes

1-plane Balancing

2-plane Balancing

1 / 2- plane Balancing with prognosis calculation

4.9.4   Correction type

- Polar correction

- Unit masses: The masses are selectable between 1 - 999 in the mass units

- Components: 3 - 99

The correction type can be different for each correction plane.

Brüel & Kjær Vibro

4.9.5   Adaptive Mode

aktive

inaktive

Advice:

The parameter for the Adaptive Mode is preset to active. When Repeat Balancing is performed the Adaptive Mode is automatically set inactive by the System.

4.9.6   Mass Units

g
oz
in
eu
cm

The mass units are not defined in the Setup but are determined when the first test weights are attached during the balancing procedure.

Exception: The unit for unit mass correction – these are defined in the Balancing Setup.

4.10   Service functions

The »Service« menu is opened using the following steps:

- Softkey »INFO« in the menu VIBROTEST 60.

- Softkey »SERVICE« in the menu VIBROTEST 60 / INFO.

```
┌─────────────────────────┐
│        Service          │
│      Test Keys          │
│     Test Display        │
│     Test Memory         │
│   Calibration Info      │
│    Error Messages       │
│       Upgrade           │
│   Formatting PC Card     │
│                         │
│                         │
│ ┌──────┐ ┌────┐ ┌────┐  │
│ │SELECT│ │    │ │    │  │
│ └──────┘ └────┘ └────┘  │
└─────────────────────────┘
```

The individual functions are activated by selecting them using the cursor buttons ⊙, ⊙ and then the softkey »SELECT«.

Leave the menu »Service« using the function button »EXIT«.

4.10.1   Buttons test

This service function allows the functions of the control and command buttons to be checked. Corresponding to the flashing symbol, the respective button must be pushed. The functionality of the respective button is displayed by changing from flashing to a permanent display.

This function is automatically ended after all the buttons have been pushed.

4.10.2   Display test

The entire display appears alternately white and then black with a frequency of approx. 1 Hz. This makes faulty pixels easy to identify.

This function is ended with the button »EXIT«.

4.10.3   Memory test

With this function the PC-card, the Flash ROM and the RAM can be tested. The respective test is selected using the cursor buttons; the start of the selected test by the corresponding softkey. After the selected test is completed a marker is displayed in the selection line and a corresponding status signal in the data field.

PC-CARD

During the test data is written to the PC-card and then deleted after the test is ended. The test of the PC-card is only executed when the following criteria are met:

- The maximum number of stored Routes (5) and Reports (1000) should not have been reached.

- No entries on the PC-card may have the status »Write-protected«.

- The available storage space must be enough to accommodate the test data.

- The card must be correctly formatted.

Caution

It is mandatory to note and to follow the instruction, that only 32 MB PC cards AC-603/32 shall be used. These PC cards shall be ONLY formated in the VIBROTEST 60 and NOT in the PC-card drive! To guarentee the functionality the PC card formating has to be performed in the VIBROTEST 60 according to the instructions described in section 4.10.

Flash ROM

The Flash ROM contains the current Setup, the calibration values and the Upgrade code. If during the test a fault is found a fault-free operation of the VIBROTEST 60 can no longer be guaranteed. In this case the instru-ment should be checked out at the Brüel & Kjær Vibro factory or an authorised Brüel & Kjær Vibro service station.

RAM

The RAM is used as a working memory and temporary inter-mediate memory. The result of the test is displayed by the operational status LEDs.

LED	YELLOW	Test in progress
	GREEN	RAM is OK
	RED	RAM is defective

Note:

The contents of the RAM are deleted during the test. After the test is over the VIBROTEST 60 must be switched off and then on again. The duration of the test is approx. 2 minutes.

4.10.4 Calibration info

In the System calibration measurement results determined on the basis of predefined calibration constants are written to the file »Calibration check« and their contents are displayed in the associated menu. This data and the guaranteed accuracy are valid until the date of the next scheduled System calibration.

The date for the next scheduled System calibration can be found in the menu VIBROTEST 60 / INFO.

4.10.5 Error reports

Errors which require the VIBROTEST 60 to be switched off are stored with a number and the time the error occurred in an error report as instructed by the error code.

In the case of an actual error this report should be recorded and sent to the nearest Brüel & Kjær Vibro service station.

4.10.6 Upgrade

Upgrading of the VIBROTEST 60 is based on the releasing of disabled functions. For a specific instrument a 6-character code is given as the »Upgrade Code« and this is entered in the code field.

After entering the Upgrade code and pushing the »OK« softkey the function release is activated and the corresponding function is available.

Note:

A reversal of the „Upgrade„ action is only possible at the Brüel & Kjær Vibro factory or an authorised Brüel & Kjær Vibro service station.

4.10.7 Formatting the PC Card

With this function the PC-card presently in the VIBROTEST 60 is completely formatted. This deletes all data and directories on the PC-card.

To prevent any accidental loss of data a confirmation of the deletion is requested and can be confirmed by pushing a button.

5   Acquiring and displaying measurements

General

In this chapter all the functions are described which can be carried out using a VIBROTEST 60 which is equipped with all modules.

Functions which have not been released are identified by the „* *„ and are not active.

Note:

Always check before taking any measurements whether the free capacity on the PC-card is sufficient for all the measurements you want to store. If the amount of data is larger than the free capacity on the PC-card there will be no possibility to store the measured data.

Advice about the memory requirement for measurements can be found in chapter 8.3.

Brüel & Kjær Vibro

Operation as an analyser

When operating as an analyser the task is the acquisition of measurement in the following modes

- Overall Vibration / BCU

- Spectrum / Cepstrum

- Envelope Analysis / BCS

- CPB - spectrum

- Process-values

- Tracking Analysis

- Keyboard Input

Selection of the measurement mode is done at the VIBROTEST 60 main menu.

```
VIBROTEST 60
    Data Collector
Overall Vibration/BCU
  Spectrum/Cepstrum
Envelope Analysis/BCS
   CPB-Spectrum
  Process Values
     Tracking
     Balancing
  Keyboard Input
SELECT| INFO | SETUP |REPORT
```
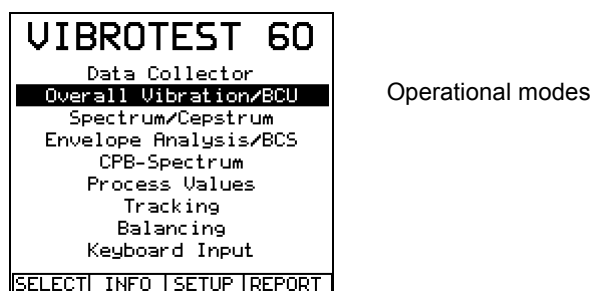
Operational modes

SELECT The item on the menu highlighted by the cursor will be selected.

INFO   Switch to the information display menu.

SETUP   Opens the menu „System Setup„

REPORT Opens the Reports selection list.

Measurement task configuration

The VIBROTEST 60 must be configured for the current measurement task. The configuration menu is selected using the »SETUP« button *after* the operating mode has been selected.

Two-channel measurement acquisition

The VIBROTEST 60 can acquire measurements at two channels simultaneously. Two-channel measurement acquisition is activated in the „System Setup„ under „Channels„. The measurement display is switched between the two channels using the button »1/2«.

5.1   »Overall Vibration / BCU measurement«
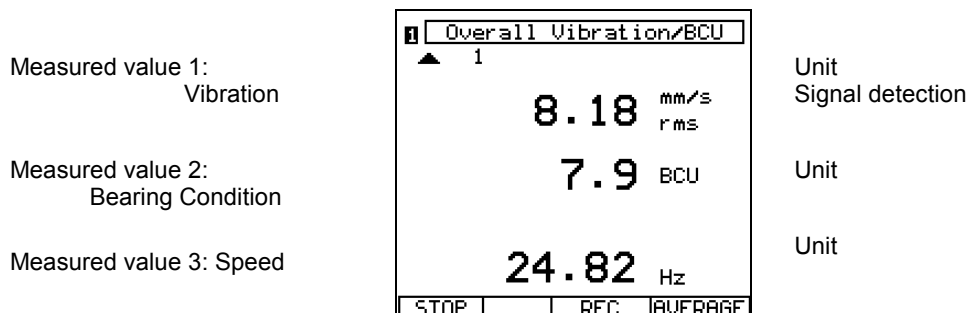
Measured value 1:
           Vibration

Measured value 2:
           Bearing Condition

Measured value 3: Speed

Unit
Signal detection

Unit

Unit

```
┌─────────────────────────┐
│ ▯ Overall Vibration/BCU │
│  ▲   1                  │
│             8.18  mm/s  │
│                   rms   │
│             7.9   BCU   │
│                         │
│            24.82   Hz   │
│ STOP │     │ REC │AVERAGE│
└─────────────────────────┘
```

START   The measurement is started. „STOP„ is displayed
        and the channel number flashes to indicate that the
        measurement is in progress.

STOP   The measurement is ended. „START„ is displayed to
        indicate that the measurement has stopped.

REC   Activate the measurement recording vs. speed or
        time. The measurement process is ended manually
        with „STOP" or automatically when f_{max}/f_{min} is reached
        (run-up / coast-down).

AVERAGE On / Off switch for the averaging function.

The measurement process for »Overall / BCU«, or »Process-
value« remains active until the »STOP« button is pushed.

The display or updating of the measurement is done after each
acquisition step. The last measured value is retained until a
new measurement is started or selection of a new measure-
ment order is made.

The units displayed conform to the configuration »Overall
Setup« and »System Setup«.

Note:

If measured values and their units (e.g. BCU or RPM) are not
displayed, these measurement types have not been activated.
These measurement types can be activated using the »Overall
Setup« and »System Setup« functions.

Averaging the measured values

The acquired measurements can be averaged.

The averaging function is switched on using the »AVERAGE« softkey. The active averaging function is indicated by the inverse display of the text „AVERAGE„. The averaging function remains active until the function is switched off by pushing the softkey »AVERAGE« again.

5.1.1   Listing function

Displayed measurements can be temporarily stored in a Listing memory. The maximum capacity of the Listing memory is 100 entries.
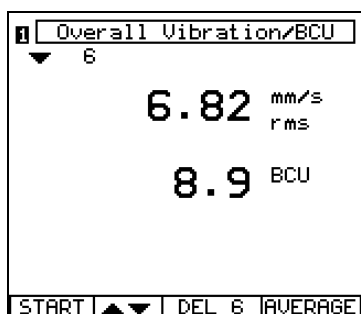
<table>
<tr>
<td>

```
┌──────────────────────┐
│█ Overall Vibration/BCU│
│▼   6                  │
│                       │
│      6.82 mm/s        │
│           rms         │
│                       │
│      8.9  BCU         │
│                       │
│                       │
├──────────────────────┤
│START │▲▼│ DEL 6 │AVERAGE│
└──────────────────────┘
```

</td>
<td>

▲▼   Deletes ***all data sets*** from memory without a confirmation request. The data sets on the PC-Card are retained.

DEL 6   Deletes ***one data set*** from the Listing memory (here data set No. 6)

</td>
</tr>
</table>

Storing in the Listing memory

During measurement the current measurement can be temporarily stored in the Listing memory using the Ⓐ cursor button. With each entry in the Listing memory the memory counter is incremented. The measurement process is not interrupted by the storage process.

There are two possibilities for sending measured values to the Listing memory.

Procedure: Storing in the Listing memory during a measurement

The following example is used to illustrate the procedure.

- Start the measurement with the softkey »START«. The measurement is numbered „1„ in the display.

- Store the measurement in the Listing memory with the cursor button ⊕. The new measurement is numbered „2„ in the display.

- Stop the measurement with the softkey »STOP«. The measured value is numbered „2„ in the display and is stored in the Listing memory together with measured value no. 1.

- Start the measurement again with the softkey »START«. The new measurement is numbered „3„ in the display.

- Stop the measurement with the softkey »STOP«. The measured value is numbered „3„ in the display and is stored in the Listing memory.

- Store the measured values in the Listing memory to the PC-card with the button »STORE«.

Expanding a Listing already stored on a PC-card

In this case new measurements are added to already stored measurements in the Listing memory with continuation of the measurement counter.

Example 1:   Expanding the number of values in the Listing memory

- Load a »Report« with e.g. 10 Listing measured values from the PC-card.

- Start the measurement with the softkey »START«. The counter is increased from „10„ to „11„.

- Store a further measurement with the cursor button ⊕. The counter number is increased from „11„ to „12„.

- Store the expanded Listing to the PC-card with the button »STORE«. With this storage action to the PC-card a new Report is not created. The additional new measurements are added to the existing Listing Report on the PC-card with a new storage date.

Example 2:   Starting a new Listing memory.

- Load a »Report« with *one* measurement from the PC-card.

- Push the cursor button Ⓐ. The loaded measure-ment is given the number „1„ in a Listing memory. The counter number on the display shows the number „2„. The VIBROTEST 60 is now ready to take the new measurement number „2„.

- Start the new measurement with softkey »START«.

- Store the new measurement with cursor button Ⓐ. The counter number is increased from „2„ to „3„.

Displaying measurements in the Listing memory:

After ending the measurement task (button »STOP«) the respective measurements in the Listing memory can be displayed using the cursor buttons Ⓐ, Ⓥ.

Deleting measurements in the Listing memory:

After ending the measurement task (button »STOP«) you may:

- Delete single measurements in the Listing memory with the softkey »DEL 3« (in this example measured value no. 3) or

- Delete all measurements in the Listing memory with the softkey »▲▼«.

Note:

If you use the softkey »▲▼« or you exit the operating mode »Overall / BCU« (button »EXIT«) all measurements in the Listing memory will be deleted. If however you want to use these measurements for later evaluation, they must be stored on the PC-card using the button »STORE«.
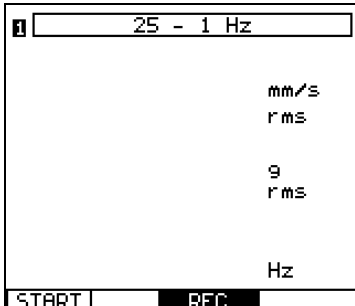
Storing Overall values to the PC-card

See section 8 „Storing measurements (Reports) on the PC-card".

5.1.2 Recording measurements in a specific speed range or time interval

5.1.2.1 Measurement vs. speed f(n)

Measurement window

	Start - Stop speed
1 25 - 1 Hz	
Meas. value 1: mm/s rms	Unit: Signal detection
Meas. value t 2: g rms	Unit: Signal detection
Meas. value 3: Hz	Speed
START REC	

START   The measurement is started. „STOP„ is displayed and the channel number flashes to indicate that the measurement is in progress.

REC   Activate the measurement recording vs. speed or time. The measurement process is ended manually with „STOP" or automatically when f_{max} / f_{min} is reached (run-up / coast-down).

DEL REC Deletes the entire measurement without a confirmation request. DEL REC deletes only measurements in the memory but not data on the PC-Card.

DISPLAY Displays the measurement recording in an amplitude diagram after completion.

STOP   The measurement process is stopped. The word „START" is displayed to indicate that the process has stopped.

AVERAGE On / Off switch for the averaging function

Brüel & Kjær Vibro

Operating sequence for Measurement vs. Speed

```
 1 |      25 - 1 Hz      |


                    mm/s
                    rms


                    9
                    rms



                    Hz
 START |      REC      |
```
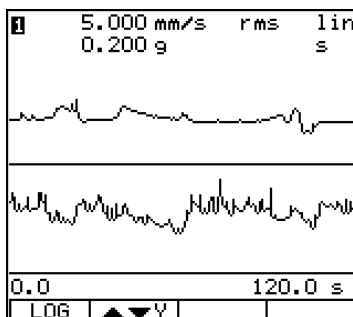
- Activate the measurement recording with »REC«.
  Can also be activated after Start of measurement.

  `START |    REC    |`

- Start the measurement process with »START«.

  `STOP |    REC    |`
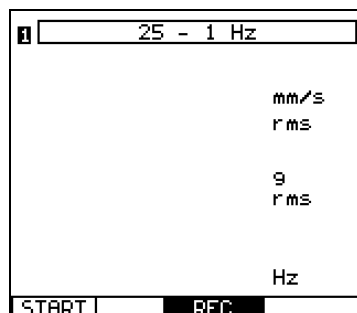
- The VIBROTEST 60 stores the measurements. The process ends automatically when f_{min} / f_{max} is reached or can be manually with »STOP«.

  `|    DEL REC DISPLAY |`

- Display the measurement result in the form of an amplitude diagram with »DISPLAY«. With »DEL REC« the acquired measurement result will be deleted.

Advice:

If there are any previously acquired measurements already in the memory, they must first be deleted with »DEL REC« before any further measurement can be performed.

Amplitude diagram without cursor
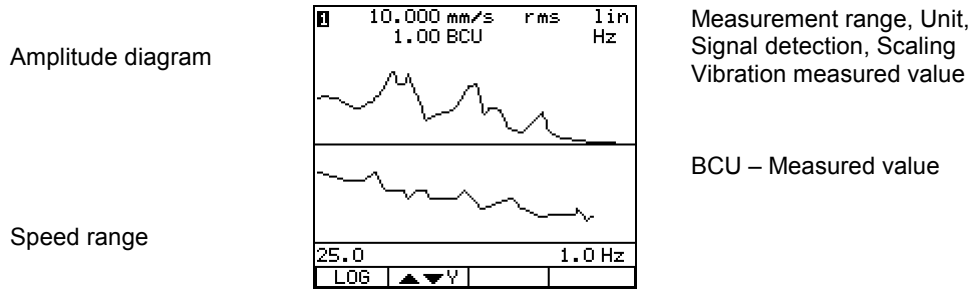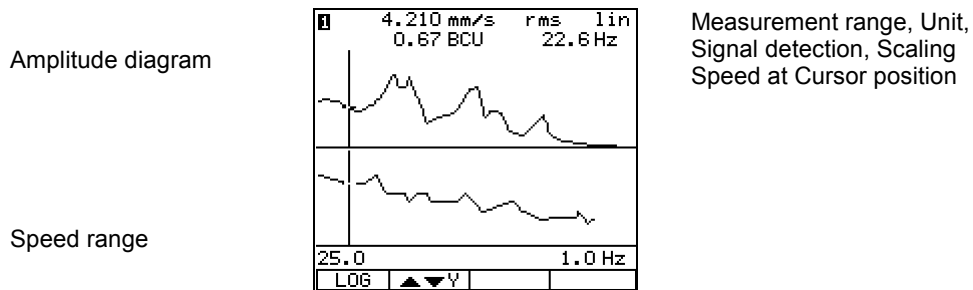
Amplitude diagram

Speed range

```
┌─────────────────────────────┐
│ 1   10.000 mm/s   rms   lin │
│       1.00 BCU           Hz  │
│    ╱╲      ╱╲               │
│  ╱    ╲  ╱    ╲   ╱╲        │
│ ╱      ╲╱      ╲ ╱  ╲       │
│─────────────────────────────│
│ ╲                           │
│  ╲___      ___              │
│      ╲____╱   ╲___      ___ │
│                   ╲____╱  ╲ │
│ 25.0                 1.0 Hz │
│ ┌─────┬──────┬──────┬─────┐ │
│ │ LOG │ ▲▼Y  │      │     │ │
│ └─────┴──────┴──────┴─────┘ │
└─────────────────────────────┘
```

Measurement range, Unit,
Signal detection, Scaling
Vibration measured value

BCU – Measured value

Amplitude diagram with cursor

Amplitude diagram

Speed range

```
┌─────────────────────────────┐
│ 1   4.210 mm/s   rms   lin  │
│       0.67 BCU      22.6 Hz  │
│    │╱╲      ╱╲               │
│  ╱ │  ╲  ╱    ╲   ╱╲        │
│ ╱  │   ╲╱      ╲ ╱  ╲       │
│────│────────────────────────│
│ ╲  │                        │
│  ╲_│_      ___              │
│    │ ╲____╱   ╲___      ___ │
│    │              ╲____╱  ╲ │
│ 25.0                 1.0 Hz │
│ ┌─────┬──────┬──────┬─────┐ │
│ │ LOG │ ▲▼Y  │      │     │ │
│ └─────┴──────┴──────┴─────┘ │
└─────────────────────────────┘
```

Measurement range, Unit,
Signal detection, Scaling
Speed at Cursor position

▲▼Y   X-axis zoom is active.

Using the cursor buttons ◀, ▶ the cursor can be moved.

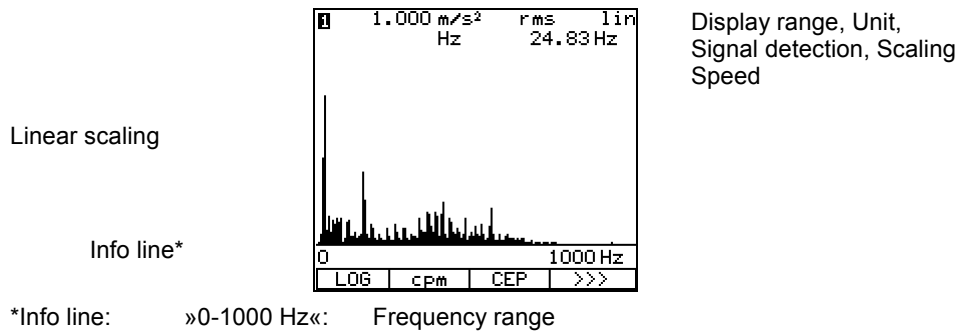▲▼X   Y-axis zoom is active.

Using the cursor buttons ◀, ▶ the cursor can be moved.

Switching between X- and Y-axis is done by pushing the softkey.

LOG   The Y-axis is logarithmically scaled. The currently selected display type will appear on the screen.

LIN   The Y-axis is linearly scaled.

You can exit the amplitude diagram using the function button »EXIT«.

Graphic resolution

- A maximum of 6400 single measured values per channel can be recorded.

- the maximum resolution amounts to 1 rpm resp.
  $(f_{max} - f_{min}) / 6400$

- The number of single measured values is:

$$<\sim \; 2 \sqrt{\Delta f \cdot T}$$

  with $\Delta f = f_{max} - f_{min}$ [Hz]; T = total measuring time in seconds.

Cursor displays

Two cursor display types are available – continuous-line and dotted-line.

- With the continuous-line cursor the measured value on the signal stored in the measurement memory is displayed.

- With the dotted-line cursor the interpolated value is displayed. The values are calculated only for display purposes and are not contained in the measurement memory.
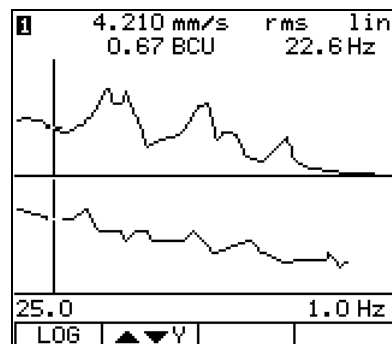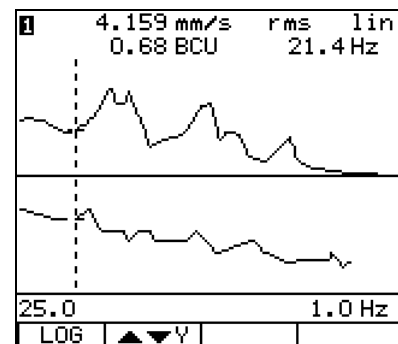
Continuous-line cursor   *Dotted-line cursor*

Zoom functions with and without cursor

The zoom function can be used on the diagram. The individual measured value at the position of the cursor on the signal can be displayed.

Details on the operation of the zoom function can be found in chapter 2.5.5 and 2.5.6

5.1.2.2   Measurement vs. Time f(t)

Measurement window

Meas. Value 1:

```
 1 ┌──────────────────────────┐
   │   T=240s    ∆t=0.5s      │
   │                          │
   │                   mm/s   │
   │                   rms    │
   │                          │
   │                          │
   │                          │
   │                          │
   ├──────────────────────────┤
   │ STOP │      REC │DISPLAY │
   └──────────────────────────┘
```

Total meas. time, time interval

Unit
Signal detection

START	The measurement process is started. „STOP„ is displayed and the channel number flashes to indicate that the measurement is in progress.
REC	Activate the measurement recording vs. time. The measurement process is ended manually with „STOP" or automatically when the set time has elapsed.
DEL REC	Delete the entire measurement without confirmation. DEL REC deletes only the values in the buffer memory and not data on the PC-card.
DISPLAY	Display the measured values **during** measurement and the recorded measurement values **after** the measurement process is completed in the form of an amplitude diagram. With the function button »EXIT« you can switch back to a numeric display.
STOP	The measurement is stopped. „START" is displayed to indicate that the measurement has stopped.

Brüel & Kjær Vibro

Operating sequence for Measurement vs. Time

```
┌─────────────────────────────┐
│1│ T=240s    ⊿t=0.5s  │      │
│ └──────────────────────┘     │
│                              │
│                    mm/s      │
│                    rms       │
│                              │
│                              │
│                              │
│                              │
│                              │
│                              │
│                              │
│ STOP  │       │ REC │DISPLAY │
└─────────────────────────────┘
```

- Activate the measurement recording with »REC«.
  Can also be activated after Start of measurement.

```
│ START │       │ REC │DISPLAY │
```

- Start the measurement process with »START«.

```
│ STOP  │       │ REC │DISPLAY │
```
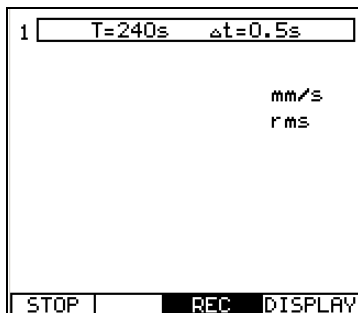
- Display the current measurements in the form of an amplitude diagram with »DISPLAY«. The actual recorded values are displayed live.
  With the function button »EXIT« you can switch back to a numeric display.

```
┌─────────────────────────────┐
│█│ 5.000 mm/s   rms    lin│   │
│   0.200 g             s      │
│                              │
│      ╭╮    ╭─╮                │
│ ╭─╮╱  ╰╮ ╱╮  ╰╮╭──╮╭╮╱╲      │
│╯  ╰    ╰╯ ╰──╯   ╰╯╰    ╰    │
│                              │
│ ╷╷╷  ╷ ╷╷    ╷╷╷╷╷  ╷        │
│╷╵╵╵╷╷╵╷╵╵╷╷╷╵╵╵╵╵╵╷╵╷╷      │
│                              │
│0.0              120.0 s      │
│ LOG  │ ▲▼Y   │     │         │
└─────────────────────────────┘
```

- The VIBROTEST 60 stores the measurements. The measurement ends manually with »STOP« or automatically after the set time has elapsed.

```
│       │       │DEL REC│DISPLAY │
```
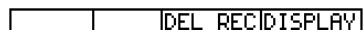
- Display the measurement in the form of an amplitude diagram with »DISPLAY«. With »DEL REC« the recorded measurement is deleted.

Advice:

If there are already measurements in the memory, they must be deleted using »DEL REC« before any further measurement can be stored.

Amplitude Diagram

Amplitude diagram

Meas. range, Unit,
Signal detection, Scaling
Vibration measured value

Bandpass value

Time range
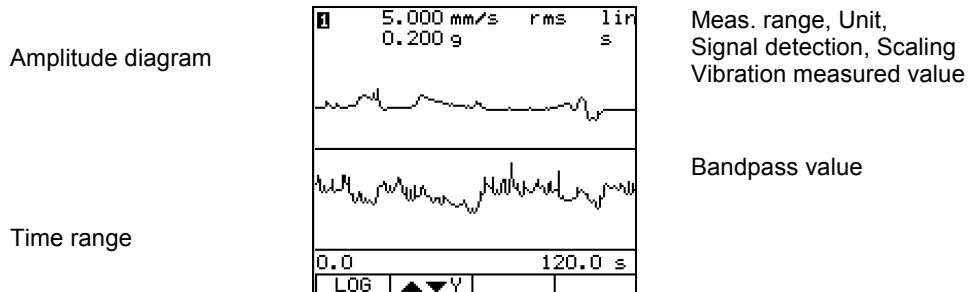
The graphic functions are identical to those in the display of Measurement vs. Speed.

5.2 »Spectrum / Cepstrum«

5.2.1 Executing the measurement

logarithmic scaling

Display range, Unit,
Signal detection, Scaling
Speed
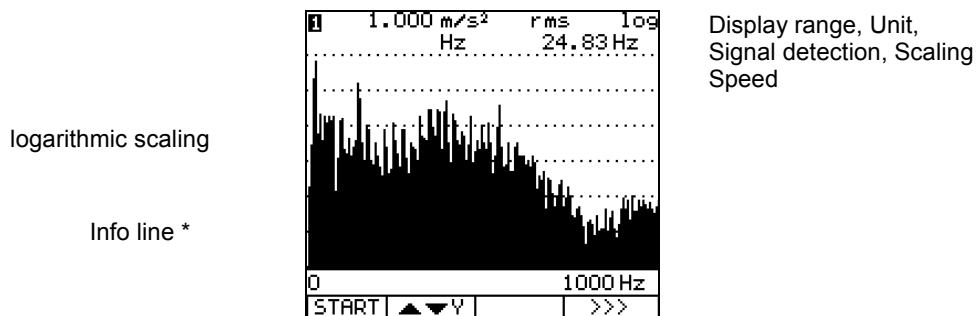
Info line *

* Info line: »#1«:   Number of averages completed (e.g. 1)
                 »0-1000 Hz«:   Frequency range

Depending on the settings in SETUP for the type and number of averages the VIBROTEST 60 proceeds in various different ways. Defining the averaging function is done in the window »Setup Spectrum«.

START   The measurement process is started. „STOP„ is displayed and the channel number flashes to indicate that the measurement is in progress.

STOP   The measurement process is ended. „START" is displayed to indicate that the measurement process has stopped.

With the averaging function switched on (softkey »AVERAGE«) and number of averages 4/16/64 the measurement process is ***automatically*** stopped when the set number of averages is reached.

AVERAGE On / Off switch for averaging. The type of averaging is defined in the SETUP.

⬚ Y-axis Zoom is active.

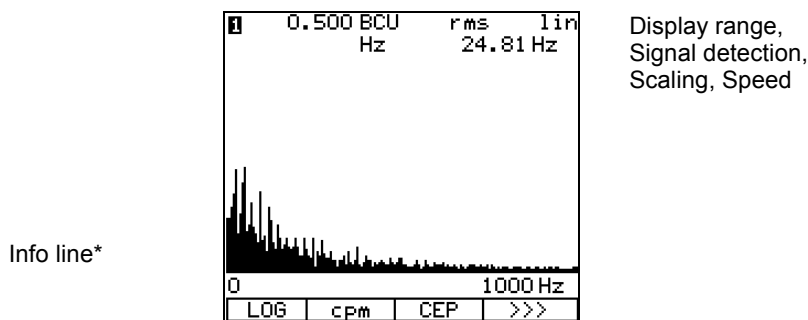Using the cursor buttons ◀, ▶ the cursor can be moved.

⬚ X-axis Zoom is active.

Using the cursor buttons ◀, ▶ the cursor can be moved.

Switching between X- and Y-axis zoom is done by pushing the softkeys.

> > >   The „More" softkey leads to further functions

The cursor and zoom functions are also active during a measurement process. When a new measurement is started the current cursor and zoom setups are retained.
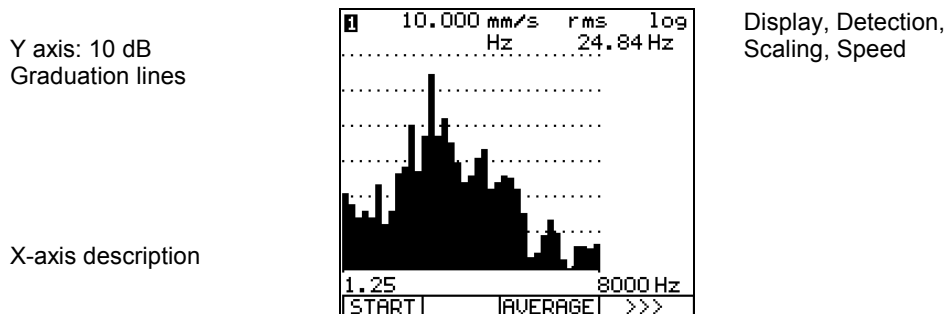
```
 1   1.000 m/s²    rms    lin
              Hz      24.83 Hz




Linear scaling




Info line*
              0              1000 Hz
                  LOG   cpm   CEP   >>>
```

Display range, Unit,
Signal detection, Scaling
Speed

*Info line: »0-1000 Hz«:   Frequency range

CPM	The X-axis can be displayed in either Hz or cpm units. The selected unit is displayed directly on the screen. The softkey buttons indicate which functions can be selected.
CEP	This softkey button produces a Cepstrum, calculated from the spectrum. The measurement process must first of all be stopped using the „STOP" button.
SPEC	This softkey button switches the display back to the original spectrum.
	The Cepstrum is not stored, but is always newly calculated from the displayed spectrum.
LOG/LIN	The Y-axis is displayed in either a linear or logarithmic format. The indication of the selected format is at the upper right of the display. The softkey button shows what can be selected. The X-axis is always displayed in a logarithmic format for a CPB spectrum.
	Wenn das Kepstrum angezeigt wird, entfällt diese Funktion.
> > >	The „More" softkey leads to further functions.

Cepstrum :

```
 1   50.000 dB   Cepstrum lin
          ms             Hz




              0              313 ms
                  cpm   FFT   >>>
```

Display range, Unit,
Signal detection, Scaling, Speed
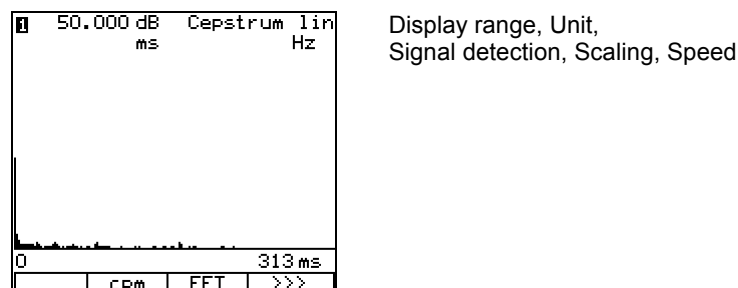
A Cepstrum display calculated from the above spectrum. With a Cepstrum display both axes are linearly scaled.

5.2.2   Averaging functions

The averaging functions available in the   VIBROTEST 60 are explained in the following:

Averaging in the frequency domain

Averaging in the frequency domain is a pure arithmetic amplitude averaging of the spectral lines over time.

This type of averaging function is used especially when short-term variations occur in the vibration behaviour of the machine.

Activating frequency-domain averaging in the VIBROTEST 60:

This is active in the VIBROTEST 60 when:

- In the SETUP

    - the averaging function „Frequency domain" is configured,

    - the „No. of averages" is set at 4, 16, 64.

- Averaging is activated with the »AVERAGE« Softkey.

Averaging in the time domain

Averaging in the time domain is used to suppress non-synchronous components and emphasize rotor-synchronous components in the spectrum. A trigger signal provided by a reference sensor is required for this averaging function.

Activating time-domain averaging in the VIBROTEST 60:

This is active in the VIBROTEST 60 when:

- In the SETUP

    - the speed has been activated,

    - the averaging function „Time domain" is configured,

    - the „No. of averages" is set at 4, 16, 64.

- Averaging is activated with the »AVERAGE« Softkey.

Exponential averaging

With exponential averaging the spectra are averaged in such a way that the most recent spectrum is given a higher weighting than the oldest spectrum. This method of applying a weighting function to spectra depending on their order of occurrence follows an exponential function.

Activating exponential averaging in the VIBROTEST 60:

This is active in the VIBROTEST 60 when:

- In the SETUP

    - the averaging function „Frequency domain" is configured,

    - the „No. of averages" is configured to „Exponential".

- Averaging is activated with the »AVERAGE« softkey.

Peak Hold

The „Peak Hold" method stores the maximum amplitude of each line in the spectrum over the total signal observation time.

The start and stop for the signal observation time is manually given by the pushing the softkeys »START« and »STOP«.

Activating the Peak Hold method in the VIBROTEST 60:

This is active in the VIBROTEST 60 when:

- In the SETUP

    - the averaging function „Frequency domain" is configured,

    - the „No. of averages" is configured to „Peak Hold".

- Averaging is activated with the »AVERAGE« softkey.

5.2.3   Display of low frequencies

Fading out of frequency lines

At maximum zoom in the X-axis (Line spacing of display = Line spacing of the measurement):

- The frequency line at 0 Hz is not displayed; the amplitude is „0„.

- Depending on the settings in the spectrum Setup, the following are not displayed:

    - The 1st freq. line with a Uniform window.

    - The 1st and 2nd freq. lines with a Hanning window.

    - The 1st, 2nd and 3rd freq. lines with a Flat-top window

Frequency range between 0 – High-pass frequency

All input signals are assessed between 0 - high-pass frequency by an 8-pole, digital high-pass filter.

Frequency components in this frequency range are strongly attenuated.

Displaying a Cepstrum

The first line is set at "0".

Advice:

This applies also to the function Envelope Analysis / BCS. (see chapter 5.3)

5.3   »Envelope Analysis / BCS«

Display range,
Signal detection,
Scaling, Speed
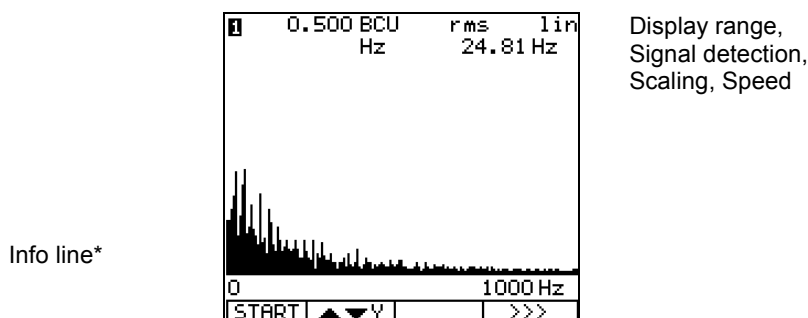
Info line*

* Info line: »0-1000 Hz«:   Frequency range

Depending on the selections made in the SETUP for the type and no. of averages the VIBROTEST 60 behaves in different ways. Determination of the averaging function is done in the window »Setup«.

START   The measurement process is started. „STOP" is displayed and the channel number flashes to indicate that the measurement is in progress.

STOP   The measurement process is ended. „START" is displayed to indicate that the measurement has stopped.

When the averaging function is switched on (softkey »AVERAGE«) and the number of averages 4/16/64 is selected, the measurement process is *automatically* ended when the selected number of averages is reached.

▲▼X   Y-axis zoom is active.
Using the cursor buttons ◀, ▶ the cursor can be moved.

▲▼Y   X-axis zoom is active.
Using the cursor buttons ◀, ▶ the cursor can be moved.

Switching between the X- and Y-axis is done by pushing the softkeys.

AVERAGE On / Off switch for the averaging function. The type of averaging is determined in the SETUP.

> > >   This „More" button leads to further functions.

The cursor and zoom functions are also active during measurement. When a new measurement is started the current cursor and zoom settings are retained.

```
┌──────────────────────────┐
│ 🔳  0.500 BCU   rms    lin│     Display range,
│        Hz       24.81 Hz │     Signal detection,
│                          │     Scaling, Speed
│                          │
│ ▌                        │
│ ▌▌                       │
│ ▌▌▌▖                     │
│ ▌▌▌▌▖▖▗▖                 │
│ ▌▌▌▌▌▌▌▌▌▖▖▗▖▖▗▖▖        │
│0                  1000 Hz│
├──────┬──────┬──────┬─────┤
│ LOG  │ cpm  │ CEP  │ >>> │
└──────┴──────┴──────┴─────┘
```

Info line*

* Info line: »0-1000 Hz«:   Frequency range

LOG   The scaling for the Y-axis can be switched between logarithmic „LOG" and linear „LIN" format. The selected format is displayed at the upper right of the screen. The softkey shows which function can be selected.

CPM   The X axis can be displayed in Hz or CPM units. The selected units are instantly displayed and the softkey shows which unit can be selected.

CEP   This softkey button produces a Cepstrum, calculated from the spectrum. The measurement process must first of all be stopped using the „STOP" button. The Cepstrum is not stored.

BCS   This softkey switches the Cepstrum display to a BCS-spectrum display.

SED   This softkey switches the Cepstrum-display again to an SED-spectrum display.

> > >   The „More" softkey leads to further functions.

5.4 »CPB Spectra«

5.4.1 Executing a measurement

Y axis: 10 dB
Graduation lines

X-axis description

Display, Detection,
Scaling, Speed

```
┌─────────────────────────┐
│ ▣  10.000 mm/s  rms  log│
│              Hz    24.84 Hz│
│ ........................ │
│ ........................ │
│ ........................ │
│ ........................ │
│ ........................ │
│ 1.25              8000 Hz│
│ START      AVERAGE   >>> │
└─────────────────────────┘
```

START   The measurement process is started. „STOP" is dis-
        played and the channel number flashes to indicate
        that the measurement is in progress.

STOP   The measurement process is ended. „START".is dis-
        played to indicate that the measurement process has
        ended.

AVERAGE On / Off switch for the averaging function.

        The averaging time is set in the SETUP. The averag-
        ing time starts as soon as the complete graphic dis-
        play appears.

LOG   The Y-axis can be displayed in either a linear or loga-
        rithmic format. The type of format selected can be
        seen displayed in the upper right of the window. A
        softkey button in the command line shows which for-
        mat can be selected. The X-axis is always displayed
        in logarithmic format.

CPM   Switches the speed display between Hz and cpm.
        The selected type is displayed at the right of the X-
        axis. A softkey shows the alternative speed unit that
        can be selected.

> > >   The „More" softkey leads to further softkey functions.

The graphic display of the measurement appears from right to
left because the transient time for the lower frequencies is
longer than it is for the higher frequencies. If the amplification
changes due to a change in the measured value the graphic
display is updated and newly constructed. When the averaging
function is active the graphic display is retained and updated
step by step.

Cursor

Using the cursor (cursor-buttons ◁, ▷) information (amplitude and frequency) associated with the individual spectral lines can be displayed.

Activating the cursor display

Pushing any of the cursor-buttons ◁ or ▷ once activates the cursor display.

Then the cursor can be moved in the spectrum display using the cursor-buttons ◁, ▷ further.

Y-axis: 10 dB
Graduation lines

X-axis description

Display, Detection, Scaling, Speed
with cursor position
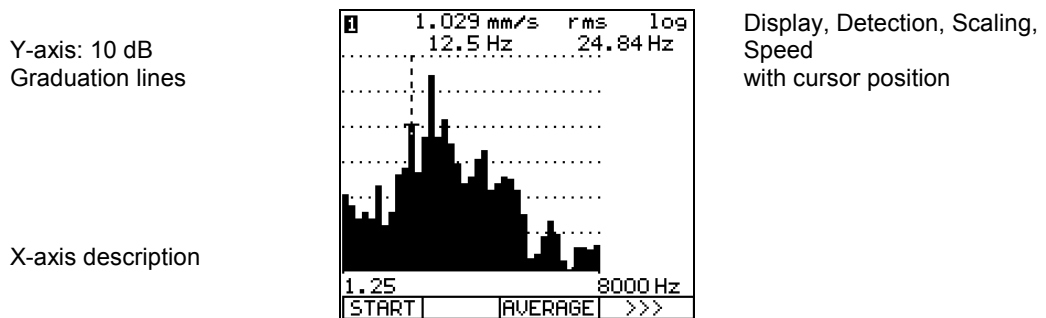
With a display of a CPB spectrum no zoom function is available in the X-axis.

Depending on the frequency resolution it may happen that the spectrum is in fact wider than width of the display of the VIBROTEST 60. Using the cursor-buttons ◁, ▷ the spectrum display can be shifted to the left or right on the instrument's display.

5.5   »Process-value« measurement

Measured value:
Process-value

Unit

Measured value: Speed

Unit

```
┌─┬──────────────────────┐
│▪│     Process Values   │
│ ▼    3                 │
│                        │
│        91.0  eu        │
│                        │
│                        │
│        24.82 Hz        │
├─────┬─────┬─────┬──────┤
│START│ ▲▼  │DEL 3│AVERAGE│
└─────┴─────┴─────┴──────┘
```
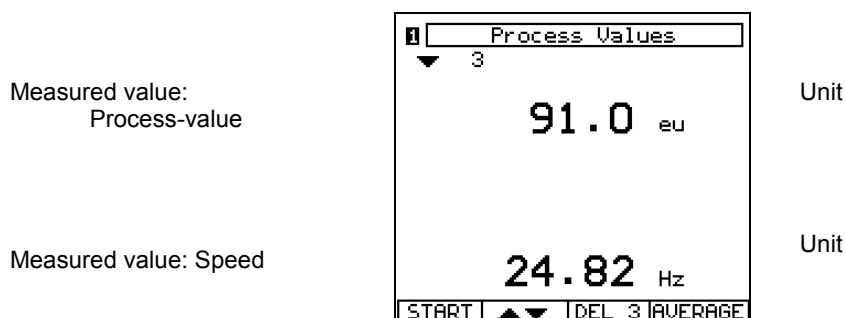
START   The measurement is started. „STOP„ is displayed to indicate that the measurement is in progress.

STOP   The measurement is ended. „START„ is displayed to indicate that the measurement has stopped.

▲▼   Delete the *entire* Listing memory without confirmation request.

DEL 3   Deletes *one data set* from the Listing memory (here data set No. 3).

AVERAGE On / Off switch for the averaging function.

The measurement process remains active until »STOP« is pushed.

The display or updating of the measurement is done after each acquisition step. The last measured value is retained until a new measurement is started or selection of a new measurement order is made.

The units displayed conform to the configuration »Process-value Setup« and »System Setup«.

Note:

If the speed and its unit are not displayed, they have not been activated. The speed measurement can be activated in the »System Setup«.

Process-values can only be acquired through channel 1 of the instrument.

Brüel & Kjær Vibro

Averaging the measured values

The acquired measurements can be averaged.

The averaging function is switched on using the »AVERAGE« softkey. The active averaging function in indicated by the inverse display of the text „AVERAGE„. The averaging function remains active until the function is switched off by pushing the softkey »AVERAGE« again.

5.5.1   Listing function

Displayed measurements can be temporarily stored in a Listing memory. The maximum capacity of the Listing memory is 100 entries.

For details of the Listing function see chapter 5.1.1.

5.6   »Tracking Analysis« measurement

In Tracking Analysis there are two operational modes:

- **Free-running measurement** with a manual control of Start/Stop of the measurement, and the option of storing the individual measurements in the Listing memory.

- **Measurement vs. Speed or vs. time** with automatic storage of the measured values, automatic stop of the measurement process and display of the results. The method "Measurement vs. Speed " is normally used for run-up and run-down procedures.

Note :

- Phase measurement is only possible with an integral ratio between speed and reference. No measurement of phase is possible with a non-integral ratio between these.

- The maximum measurable frequency is 10 kHz, the minimum frequency is 0,8 Hz. No measurement is possible outside of this range. As an example the 50th overtone of 3 kHz cannot be measured as it lies outside this range.

- If no measurement is possible there will be no display.

_____

5.6.1   Free-running measurement

<div align="center">Measurement window</div>

Meas. value 1st order Amplitude/Phase		Unit Signal detection
Meas. value nth order Amplitude/Phase		Unit Signal detection
Speed / Unit		Speed / Reference

```
┌─┬──────────────────────┐
│■│     Tracking         │
├─┴──────────────────────┤
│▲▼ 3                    │
│ 1.Order                │
│  11.82 mm/s 166°       │
│        rms             │
│ 2.Order                │
│   1.29 mm/s 130°       │
│        rms             │
│         2985 rpm  1/1  │
├────────┬────┬───┬──────┤
│ START  │▲▼ │DEL 3│AVERAGE│
└────────┴────┴───┴──────┘
```

START   The measurement process is started. „STOP„ is displayed and the channel number flashes to indicate that the measurement is in progress.

STOP   The measurement is ended. „START„ is displayed to indicate that the measurement process has stopped

▲▼   Deletes the *entire* Listing memory without a confirmation request.

DEL 3   Deletes *one data set* from the Listing memory (in the above example data set no. 3).

AVERAGE Switches the averaging function On/Off.

Displayed measurements can be temporarily stored in the Listing memory. The capacity of the Listing memory is 100 entries.

The capacity of the Listing memory is 100 entries. For details of the Listing function see chapter 5.1.1

Note:

If there are measured values in the Listing memory, the memory must first be deleted using ▲▼ before Measurement vs. Speed can be activated.

_____

5.6.2   Measurement vs. Speed

Measurement window

Meas. value 1st order

Meas. value nth order

Speed / Unit

```
┌─────────────────────────┐
│■│      Tracking         │
│                         │
│ 1.Order                 │
│           mm/s        □ │
│           rms           │
│                         │
│ 2.Order                 │
│           mm/s        □ │
│           rms           │
│                         │
│           rpm    1/1    │
├──────┬──────┬───────────┤
│START │  REC │ AVERAGE   │
└──────┴──────┴───────────┘
```

Unit
Signal detection

Unit
Signal detection

Speed / Reference ratio

START   The measurement is started. "STOP" is displayed and the channel number flashes to indicate that the measurement is in progress.

REC   Store the measurement vs. speed. The measurement process is stopped either manually with "STOP" or automatically when the range f_{max} / f_{min} is completed.

DEL REC Deletes the last measured values without a confirmation request.
         DEL REC deletes only values in the intermediate memory but not data on the PC-card.

DISPLAY Displays the measured values in the form of an amplitude/phase diagram after the measurement is completed.

STOP   The measurement is ended. "START" is displayed to indicate that the measurement process has stopped.

AVERAGE Switches the averaging function On/Off

Brüel & Kjær Vibro

_____

Sequence for Measurement vs. Speed

```
┌─────────────────────────────┐
│■┌─────────────────────────┐ │
│ │       Tracking          │ │
│ └─────────────────────────┘ │
│ 1.Order                     │
│           mm/s           □  │
│           rms               │
│                             │
│ 2.Order                     │
│           mm/s           □  │
│           rms               │
│                             │
│           rpm    1/1        │
├───────┬─────┬─────┬─────────┤
│ START │     │ REC │ AVERAGE │
└───────┴─────┴─────┴─────────┘
```

- Activation of the measurement recording with »REC«.
  This can also be activated after the measurement is started.

  ```
  ┌───────┬───────┬───────┬────┐
  │ START │       │  REC  │    │
  └───────┴───────┴───────┴────┘
  ```

- Start the measurement using »START«.

  ```
  ┌───────┬───────┬───────┬────┐
  │ STOP  │       │  REC  │    │
  └───────┴───────┴───────┴────┘
  ```

- VIBROTEST 60 stores the measurement. Measurement is stopped manually with »STOP« or automatically when the range f_{min} / f_{max} is completed.

  ```
  ┌──────────┬─────────┬─────────┐
  │          │ DEL REC │ DISPLAY │
  └──────────┴─────────┴─────────┘
  ```

- Display the measurement as an amplitude/phase diagram using »DISPLAY«. With »DEL REC« the last measurements are deleted.

Note:

If there are any measurements stored in the memory, they must first be deleted using »DEL REC« before further measurements can be carried out and stored.

_____

Amplitude/Phase diagram without cursor
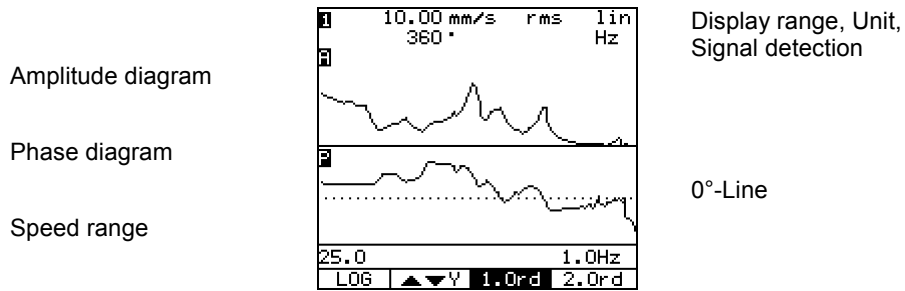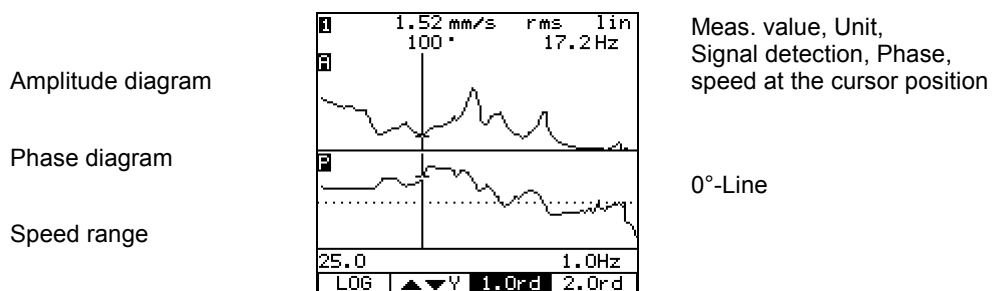
Amplitude diagram

Phase diagram

Speed range

| 1 | 10.00 mm/s | rms | lin |
| | 360° | | Hz |

Display range, Unit,
Signal detection

0°-Line

| 25.0 | | 1.0Hz |
| LOG | ▲▼Y | 1.Ord | 2.Ord |

Amplitude/Phase diagram with cursor

Amplitude diagram

Phase diagram

Speed range

| 1 | 1.52 mm/s | rms | lin |
| | 100° | | 17.2 Hz |

Meas. value, Unit,
Signal detection, Phase,
speed at the cursor position

0°-Line

| 25.0 | | 1.0Hz |
| LOG | ▲▼Y | 1.Ord | 2.Ord |

▲▼Y   X-axis zoom is active.

Using the cursor buttons ◀, ▶ the cursor can be moved.

▲▼X   Y-axis zoom is active.

Using the cursor buttons ◀, ▶ the cursor can be moved.

Switching between the X- and Y-axis is done by pushing the softkeys.

1st order   Display of the 1st order is active.

nth order   Display of the 2nd designated order is active.

You can exit the amplitude/phase diagram using the function button »EXIT«.

The graphic resolution

- A maximum of 6,400 measured values per order and per channel can be recorded.

- the maximum resolution is 1 rpm resp. $(f_{max} - f_{min}) / 6,400$

- The number of measured values is:

$$<\sim\ 2\ \sqrt{\Delta f \cdot T}$$

with $\Delta f = f_{max} - f_{min}$ [Hz]; T = total measurement time in seconds.

_____

Cursor displays

There are two types of cursor displays - a straight-line cursor and a dotted-line cursor.

- With a straight-line cursor, the measured values (amplitude and phase) stored in the measurement memory are displayed.

- With the dotted-line cursor, the interpolated values (amplitude and phase) are displayed. These values are calculated only for display purposes and are not available in the measurement memory.
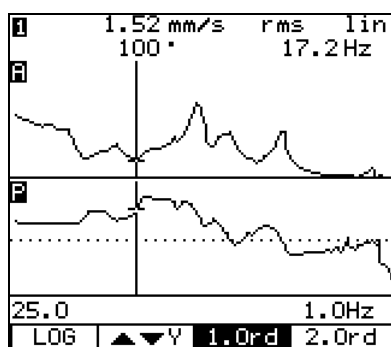
Straight-line cursor   *Dotted-line cursor*
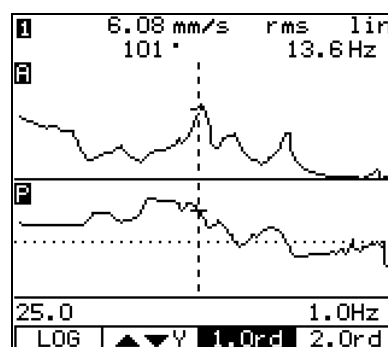
Zoom function with and without cursor

You can use a zoom function in the diagram. The individually recorded measurements can be traversed and displayed.

For details of the operation of the zoom function see chapter 2.5.5 and 2.5.6.

_____

5.6.3　Measurement vs. time

Measurement window

```
┌─────────────────────────────┐
│ ▮┌──────────────────────┐   │
│  │    Tracking          │   │
│  └──────────────────────┘   │
│                             │
│  1.Order                    │
│             m∕s²          ▫ │
│             peak            │
│                             │
│  2.Order                    │
│             m∕s²          ▫ │
│             peak            │
│                             │
│             Hz    2∕1       │
├─────────────────────────────┤
│ START │     │ REC │AVERAGE  │
└─────────────────────────────┘
```

Meas. value 1st Order — (pointing to 1.Order block)

Unit
Signal detection

Meas. value nth Order — (pointing to 2.Order block)

Unit
Signal detection

Meas. value nth Order — (pointing to Hz 2/1 block)

Speed/Ref. ratio

START The measurement is started. "STOP" is displayed and the channel number flashes to indicate that the measurement is in progress

REC　　Activates the measurement recording vs. time. The measurement process is stopped either manually with "STOP" or automatically when the set time has elapsed.

DEL REC　　Deletes the last measured values without a confir-mation request. DEL REC deletes only values in the intermediate memory but not data on the PC-card..

DISPLAY　　Display the measured values **during** measurement and the recorded measurement values **after** the measurement process is completed in the form of an amplitude/phase diagram. With the function button »EXIT« you can switch back to a numeric display.

STOP The measurement is stopped. „START" is displayed to indicate that the measurement has stopped.

AVERAGE Switches the averaging function On / Off.

Brüel & Kjær Vibro

_____

Operational steps for measurement vs. time
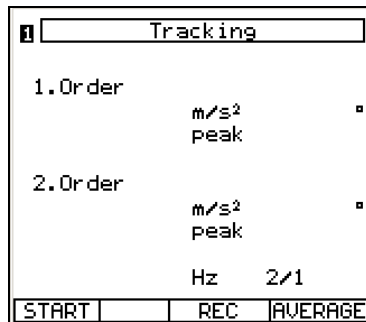
```
┌─────────────────────────┐
│🔳┌───────────────────┐  │
│  │     Tracking      │  │
│  └───────────────────┘  │
│  1.Order                │
│              m/s²     ▪ │
│              peak       │
│                         │
│  2.Order                │
│              m/s²     ▪ │
│              peak       │
│                         │
│              Hz    2/1  │
│ START │   │ REC │AVERAGE│
└─────────────────────────┘
```

- Activate the measurement recording with »REC«.
  This can also be activated after the measurement has started.

  `START │   │ ▮REC │DISPLAY`

- Start the measurement with »START«.

  `STOP │   │ ▮REC │DISPLAY`

- Display the actual measurements in the form of an amplitude/phase diagram with »DISPLAY«. The actual recorded values will be displayed live. With the function button »EXIT« you can switch back to a numeric display.

```
┌─────────────────────────┐
│🔳 5.000 mm/s  rms    lin│
│   360·              s   │
│🅰                       │
│                    ╱╲   │
│   ╱‾╲___╱‾‾╲___╱╲_╱  ╲  │
│                         │
│🅿                       │
│                         │
│   _╱‾‾‾‾‾‾‾‾‾╲___╱╲_    │
│                         │
│0                 240 s  │
│1.Ord │▲▼X│ 2.Ord │ >>> │
└─────────────────────────┘
```
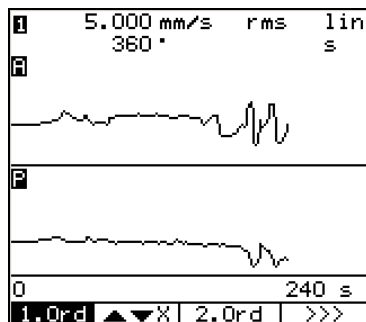
- The VIBROTEST 60 saves the measurements. Tzhe measurement process is ended either manually by pushing »STOP« or automatically when the set time has elapsed.

- Display the measurements in the form of an amplitude/phase diagram with »DISPLAY«. With »DEL REC« the recorded measurement will be deleted.

  `│   │   │ DEL REC│DISPLAY`
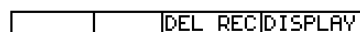
Note:

If there are already measurements saved in the memory, they must be deleted with »DEL REC« before any further measurement recordings can be carried out.

_____

Amplitude/Phase diagram without cursor

Amplitude diagram

Phase diagram

Time range

Display range,
Unit, Signal detection

Amplitude/Phase diagram with cursor

Amplitude diagram

Phase diagram

Time range

Measured value, Unit,
Signal detection, Phase,
Time at cursor position
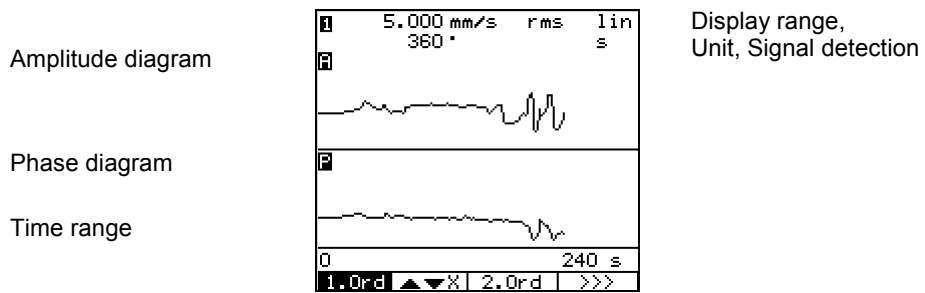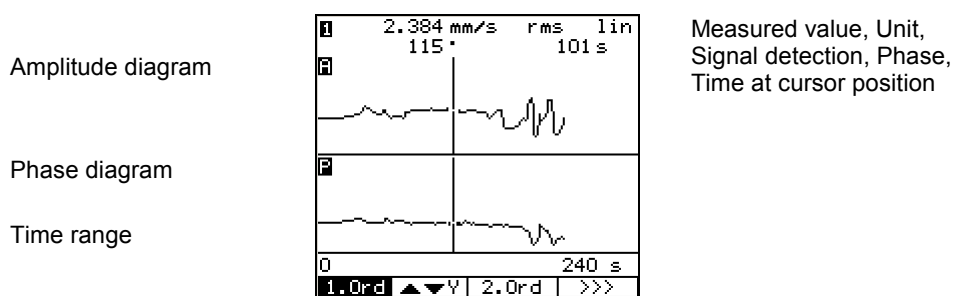
⌐▲▼Y⌐   Zoom X-axis is active.
Using the cursor buttons ◀, ▶ the cursor can be shifted.

⌐▲▼X⌐   Zoom Y-axis is active.
Using the cursor buttons ◀, ▶ the cursor can be shifted.

Switching between X- and Y-axis is done using the softkeys.

1st Order   Display of the 1st order is active.

2nd Order   Display the other order that was selected.

Exit the amplitude/phase diagram with the function button »EXIT«.

Resolution of the graphics

- A maximum of 6,400 values for each order and each channel can be recorded.

Brüel & Kjær Vibro

_____

Cursor displays

There are two types of cursor display – a continuous line and a dotted line.

- With a continuous line cursor the measured values (Amplitude, Phase) saved in the memory are displayed.

- With a dotted line cursor the interpolated values (amplitude, phase) are displayed. These values are calculated only for dsplay purposes and are not in the measured value memory.
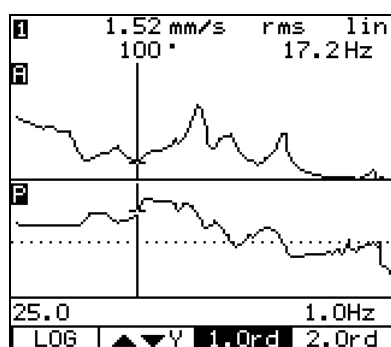
continuous line cursor   *dotted line cursor*
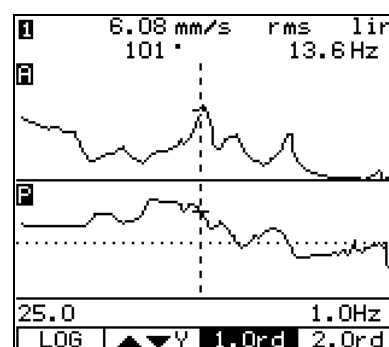
Zoom function with and without cursor

The diagram can be zoomed. The individual measured values are traversed and displayed with a cursor.

For details of the operation of the zoom function see chapter 2.5.5 and 2.5.6.

_____

5.7   »Keyboard Input«

In Manual Entry measured values (numeric values) can be entered and stored in the measurement memory of the VIBROTEST 60.

```
┌─────────────────────────────┐
│ ▣        Keyboard Input      │
│                             │
│                             │
│  ┌─┐ ┌─┐┌─┐ ┌─┐┌─┐┌─┐ ┌──┐  │
│  │+│ │1││0│.│0││0││0│ │mm│  │
│  └─┘ └─┘└─┘ └─┘└─┘└─┘ └──┘  │
│                             │
│                             │
│                             │
│  OK          CLEAR          │
└─────────────────────────────┘
```
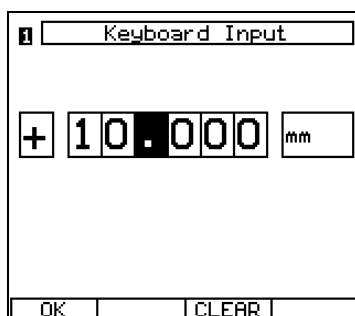
The measured values (in numeric form) are entered using the cursor-buttons (see also chapter 4.1).

When entering the window again the last entered value will be displayed.

The entered value (numeric) remains until it is deleted with the softkey button »CLEAR« or until it is overwritten by a new value.

If the measured value is to be stored for a long period of time, it should preferably be stored on the PC-card as a Report.

Storing of measured values (as Reports) on the PC-card is described in chapter 8.

Optional units for Keyboard Input

Eu	in	m³/s
°C	rpm	t/h
F	MW	kg/s
N	kW	MPa
kN	A	kPa
µm	%	bar
mm	Nm	psi
mils	m³/h	dB

6   Data-collector mode

The task in the Data-collector mode is the acquisition of measurements at predefined measurement intervals and Points.

This operational mode is selected in the VIBROTEST 60 main window.

Operating mode:

```
VIBROTEST 60
Data Collector
Overall Vibration/BCU
Spectrum/Cepstrum
Envelope Analysis/BCS
CPB-Spectrum
Process Values
Tracking
Balancing
Keyboard Input
SELECT INFO SETUP REPORT
```

Menu title
Data Collector

SELECT   The item on the menu highlighted by the cursor will be selected.

INFO   Switch to the information display menu.

SETUP   Opens the menu „System Setup„

REPORT Opens the Reports selection list.

6.1   Selecting the Route

The task configuration, i.e. the sequence of measurements and the Point-specific Setup configuration in the form of Routes are established in the PC program XMS and stored on the PC-card.

Date

```
May/05/2001 09:13:00 am
Route:
Air condition 3
Compressor area 2 B
Paint room P2
Pump area B1
Rolling train 2

Total:   8 Points
Done:    0 Points
SELECT
```

Time

Menu title
Route name

Measurement Point statistics

SELECT Select the highlighted Route name for processing.

6.2   Selecting the measurement Points

As a rule the measurement Points are processed one after the other in the displayed sequence. To begin, the first Point in the Route is selected.

Skipping measurement Points and machines

If any Points on the Route cannot be measured at the required time, it is possible to skip over one or more measurement Points.

The following softkeys are available for this:

• SKIP is used for skipping over a single Point

• SKIPM is for skipping over all Points of a Machine

All skipped Points are given the status »X« in the display of the Points in the Route.

Plant Name		
Train Name		
Machinen Name		
Point Name		Status of the Point
»		
”		
”		
”		
Command line		

SELECT   Selects the highlighted Point for processing.

SKIPM   All Points for the respective Machine are skipped over. All these Points are marked with an »X«.

SKIP   The selected point is skipped over. The skipped Point is marked with an »X«.

COM   Assign a Comment to the respective Point.

Information about the status of the Point processing

Each measurement Point is given a mark to identify its processing status:

» « Measurement not yet executed

» ✓ « Measurement is complete and data is stored

» - « Measurement cannot be executed

» X « The Point has been skipped over

» C « The Point was not measured and a Comment has been allocated to the Point.

Note:

If a measurement order is defined which cannot be executed by the VIBROTEST 60 with its present hardware, the identification mark » - « is allocated to the Point
(for details see chapter 4.10.6 Upgrade)
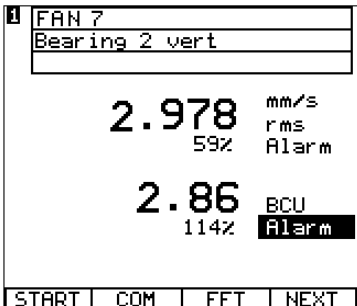
6.3   Measurement acquisition

After selecting the measurement Point the measurement menu appears.

The following are displayed:

* The acquired measurement value and, if available,

* The ratio between: Measurement / Alarm value in % and

* The previous measurement at this Point

If the alarm value is exceeded the word „Alarm„ is inverse displayed.

Channel No.

Machinen Name
Point Name
Point description

```
1  FAN 7
   Bearing 2 vert

            2.978   mm/s
                    rms
              59%   Alarm

            2.86    BCU
             114%   Alarm

 START   COM    FFT    NEXT
```

Previous
measurement

Units, Signal detection, Ratio:
Measurement: Alarm value [%]

START	The measurement process is started. „STOP„ is displayed and the channel number flashes to indicate that the measurement is in progress.
COM	Assign a Comment to the respective Point.
FFT	Switch to the »Spectrum« menu
BCS	Switch to the display window » BCS«
CPB	Switch to the display window »CPB spectrum«
SED	Switch to the display window »SED«
NEXT	Switch to the next Route point and store the acquired measured value
END	Store the last measurement in the Route and end the Route. As a rule this softkey text is displayed only at the last Point in the Route.

The measurement is done according to the SETUP data.

This SETUP data cannot be changed in the VIBROTEST 60 but can only be displayed (button »SETUP«).

Start measurement acquisition

The measurement is started with the softkey »START«.

Brüel & Kjær Vibro

Duration of measurement acquisition

The duration of the measurement depends on the measurement task defined in the Route. In the Data-collector mode measurement is automatically ended as soon as all the requirements of the measurement task are fulfilled.

- **Spectra and Envelope analysis measurements** where a specific number of averages must be acquired cannot be manually ended. The required number of averages must first be acquired. The spectrum window shows the progress of this measurement averaging process. The display window is activated by the softkeys »FFT«, »BCS « or »SED«.

  CPB spectra cannot be manually ended. The measurement time must be completed.

- **Overall measurements** are automatically ended when the measured value is stable to within 5 % of its value. Only in the case of very large short-term variations in the measured value should the measurement be manually stopped using the softkey »STOP«.

- **Measurement acquisition by Manual Entry** is always possible. If a Manual Entry is to be made the Manual Entry window is activated and the measured value can be directly entered.

Ending the measurement acquisition

After all the measurements at the Point are completed

- »Measuring finished!« is displayed and

- acquisition is automatically ended.

After measurement has ended a Comment can be allo-cated to the measurement Point by pushing the softkey »COM«.
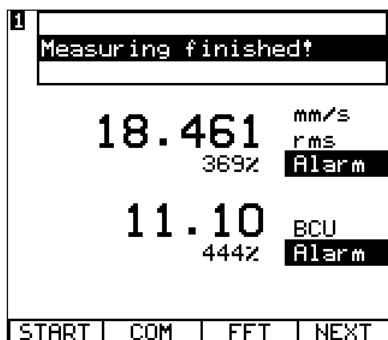
Storing the measurement and stepping to the next measurement Point

After a successful measurement there are two options with VIBROTEST 60:

- Push the softkey »NEXT«.
  This stores the measurement and steps to the next measurement Point.

- Push the button »STORE« and then push the softkey »NEXT«.
  With STORE the measurement is stored but the step to the next measurement Point is not made. At this stage the measured values for the current Point can be displayed for your information. Only once the softkey »NEXT« is pushed is the step taken to the next measurement Point.

Brüel & Kjær Vibro

6.4   Allocation of Comments

A maximum of 100 Comments are available when they have been created using the PC-software XMS.

With the softkey »COM« the list of Comments is displayed.

Only one Comment can be allocated to the current measurement task for the Point. If a Comment is allocated to a skipped Point, the skip marker »X« is replaced by the marker »C«

Comment list

```
Bearing is very hot
Driving belt is damaged
Foundation damages
Gear box is very noisy
Machine is very noise
Machine not operating
SELECT
```
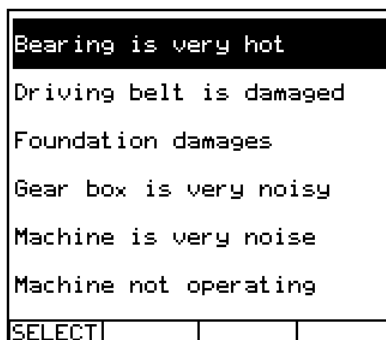
SELECT   The highlighted Comment is allocated to the current measurement Point.

7   Field Balancing

7.1   Balancing overview

Number of balancing planes

Balancing of rotors in 1 plane
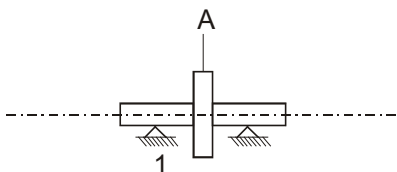
With single-plane balancing the user must specify one measuring plane (1) and one correction plane (1).

After the initial unbalance run a test run A is necessary. Using the results of the test run the correction weight (AMA) is calculated.
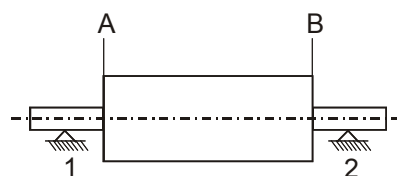
Balancing of rotors in 2 planes

With two-plane balancing the user must specify two measuring planes (1 and 2) and two correction planes (A andB).

After the initial unbalance run two separate test runs (A and B) are necessary. After test run B the correction weights (AMA and AMB) for correction panes (A and B) are calculated.

Balancing of rotors in 1 / 2 planes with prognosis

With this setup in the VIBROTEST 60 two balancing problems are resolved.
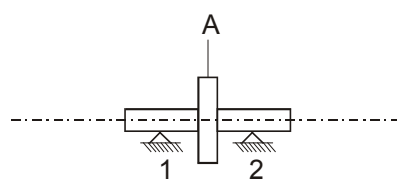
1-plane balancing with measurement at both bearings

With this procedure the correction weight for correction plane A is calculated after the initial unbalance run and test run A. The residual vibration at measuring plane 1 and measuring plane 2 are prognosed by the VIBROTEST 60.
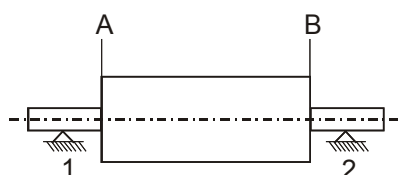
2-plane balancing with prognosis

With this procedure the correction weight for correction plane A is calculated after the initial unbalance run and test run A. The residual vibration at measuring plane 1 and measuring plane 2 are prognosed by the VIBROTEST 60.

If the prognosed residual vibration is acceptable test run B can be skipped.

If the prognosed residual vibration is not acceptable the balancing procedure can be continued with test run B.

Note

For all balancing procedures at two planes, two vibration sensors are required. This means that measurement must always be simultaneously done with two sensors.

Unbalance correction types

Unbalance correction with VIBROTEST 60 can be done in one of three ways.

- Polar correction
  With polar correction the location for the correction weight is freely selectable.

- Component correction
  With component correction up to a max. of 99 fixed locations can be selected (e.g. fan blades, equidistant holes at the rotor circumference). The test weights are attached at a fixed location for the test runs. VIBROTEST 60 calculates the correction weights for two fixed locations per plane.

- Unit mass correction
  With unit mass correction the weights are pre-defined. The unit mass is attached at any arbitrary location for the test run. The VIBROTEST 60 calculates the required locations for the identical unit masses.

Adaptive Mode

The Adaptive Mode in the VIBROTEST 60 has the settings "Active" or "Inactive".

- Active
  In this setting the influence co-efficients determined by the VIBROTEST 60 during the initial run, test run and check run are adapted to the present rotor condition from run to run. This accelerates and optimises the balancing procedure.

- Inactive
  With this setting the influence co-efficients determined by the VIBROTEST 60 during the initial run and test run are not changed when executing the check run.

Advice:

In the "1 / 2-plane Balancing with Prognosis" and "Repeat Balancing" the Adaptive Mode is automatically switched off by the VIBROTEST 60 and is not available.

When you have selected »active«" the correction weights you select should not differ by a large amount from the correction recommended by the VIBROTEST 60. If you cannot be sure of this you should deactivate the Adaptive Mode and select the setting »inactive«.

Balancing procedure

The balancing procedure follows four steps:

- Enter data in the Balancing Setup (Select the number of balancing planes and type of unbalance correction).

- Initial unbalance run

- Test run (one or more)

- Check run

The Check run with VIBROTEST 60 has two functions:

- Measurement of the residual unbalance after attaching the correction weights.

- Automatic calculation of additional correction weights for „trim balancing„ of the rotor.

Repeat Balancing

VIBROTEST 60 offers the option, once the rotor is balanced, to store the balancing procedure for the rotor on the PC-card so that „Repeat Balancing„ can be done in the future.

A Check run at which the residual unbalance and the corresponding correction weights are calculated is necessary for this.

Phase position; positions for fixed locations

The phase position is measured counter to the rotational direction, starting from the zero mark (reference mark). The direction for counting fixed locations (e.g. four components) is also counter to rotational direction.
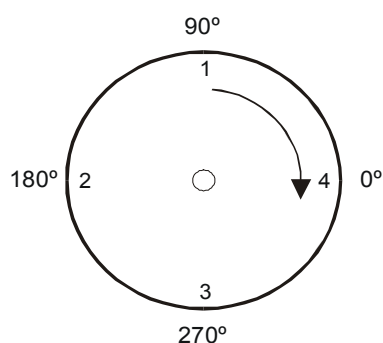
7.2 Balancing user-interface

7.2.1 Main Balancing menu

The entire balancing procedure with results of the measuring runs and corrections is displayed in the main Balancing menu.

Main menu at the start of the Balancing procedure:

Channel no. / Meas. plane

Initial unbalance run
Test run

A = Correction type

Check run

```
┌─────────────────────────┐
│█         Plane A         │
│     1 Plane Balancing    │
│                          │
│       Initial Run        │
│       Test Run A         │
│                          │
│                          │
│A: Polar Correction       │
│                          │
│       Check Run          │
│                          │
│SELECT│        │        │ │
└─────────────────────────┘
```

Displayed correction plane
Number of planes

Display: Polar correction

The respective measuring run is selected using the cursor buttons ⓐ, ⓥ.

7.2.2 Main menu with all measuring runs:

Channel no. / Meas. plane

Initial unbalance run
Test run

Correction weight / location

Check run

```
┌─────────────────────────┐
│█         Plane A         │
│     1 Plane Balancing    │
│IR      6.34 mm/s      79°│
│TRA     8.36 mm/s     166°│
│                          │
│CMA  + 11.11 g    Loc 211°│
│                          │
│CR      0.85 mm/s     232°│
│        2985 rpm          │
│SELECT│ ADD │CR=IR│ RESET │
└─────────────────────────┘
```

Displayed correction plane
Number of planes
Display: Initial run measurement
Display: Test run measurement

Display: Calculated correction

Display: Check run measurement
Display: RPM of the selected measuring run

The RPM corresponding to the respective measuring run can be displayed by selecting that measuring run using the cursor buttons ⓐ, ⓥ.

7.2.3   Softkeys

According to the instrument status additional softkeys are active during balancing:

+/-   Allows you to select between „Add weights„ and „Remove weights„ during unbalance correction.

ADD   In the main menu:
        All correction weights attached to the rotor during the current balancing procedure can be combined into one single correction weight. VIBROTEST 60 calculates the resultant weight and its correct location.

        In the test weight entry menu:
        The selected test weight is added to the existing test weight.

CR=IR   A new balancing procedure is started after the Check run. The result of the Check run is used for the Initial unbalance run in the new procedure. The data from the previous balancing procedure is deleted.

AVERAGE Switching the averaging function On/Off.

RESET   Deletes all information from the measuring runs of the entire balancing procedure.

SELECT The marked measuring run is selected.

START   The measurement is started. „STOP„ is displayed and the channel number flashes to indicate that the measurement is in progress.

STOP   The measurement is stopped. „START„ is displayed to indicate that the measurement has stopped.

SUBST   The entered test weight replaces the existing test weight.

7.3   Storage of the balancing procedure

In the VIBROTEST 60 there are two memories on the PC-card; the Flash memory and the Report memory.

Flash memory

The Flash memory is an internal memory that secures the data against loss. All information about the current balancing procedure (balancing setup, number of measured values, test weights, measuring runs) are stored here.

Measured values for a measuring run are stored in the Flash memory from the moment the user accepts a measurement with the softkey »OK« (resp. »YES«/ »NO« during a test run).

The information remains in the Flash memory when the balancing procedure is closed with »EXIT« and when the VIBROTEST 60 is switched off (button »ON«).

Thus a balancing procedure can be interrupted at any time to use another function of the instrument or to switch the instrument off without losing data.

The information in the Flash memory from the balancing procedure is deleted only in the case where one of the following three actions are performed by the user.

- Deletion of the balancing procedure with the softkey »RESET«. This is possible at any point in the balancing procedure at the main balancing menu.

- Acceptance of the results of a Check run of the current balancing procedure as the Initial run measurements for a new balancing procedure using the softkey »CR=IR«.

- Loading of a balancing procedure stored on the PC-card using the softkey »REPORT«. In this case the information from the current balancing procedure in the Flash memory is overwritten by the information from the PC-card.

Report memory PC-card

The PC-card is the storage medium for storing a balancing procedure.
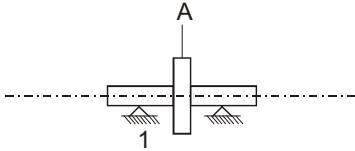
The data from the current balancing procedure is stored.
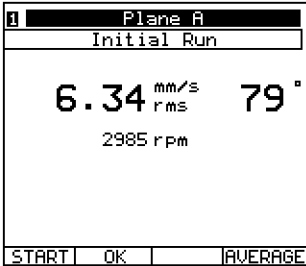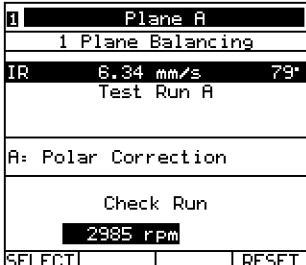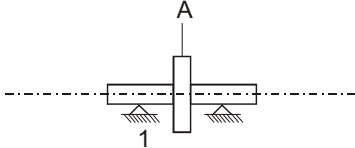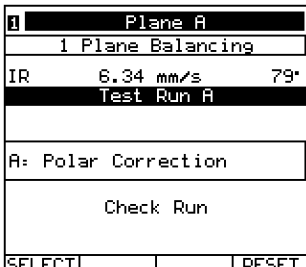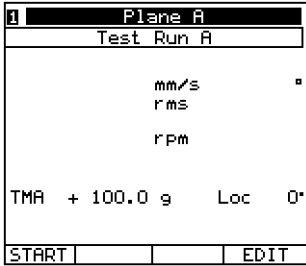
7.4   Selecting Balancing / Executing the Setup

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
VIBROTEST 60 Data Collector Overall Vibration/BCU Spectrum/Cepstrum Envelope Analysis/BCS CPB-Spectrum Process Values Tracking **Balancing** Keyboard Input `SELECT` `INFO` `SETUP` `REPORT` Select Balancing with »SELECT«.	**1. Start Balancing program**	

Plane A
1 Plane Balancing
IR   6.34 mm/s   79°
Test Run A
 	
A: Polar Correction
 	
Check Run
 	
`SELECT`   `RESET`
 	
Delete all data with »RESET«.
 	
Plane A
1 Plane Balancing
Initial Run
Test Run A
 	
A: Polar Correction
 	
Check Run
 	
`SELECT`
 	
	2. Starting new / Continue with current balancing procedure
	
	VIBROTEST 60 displays the data from the last balancing procedure.
	
	Starting new balancing procedure:
	
	To execute a new balancing procedure all data from the last procedure must be deleted with »RESET«. Only then can the required entries be made in the „Balancing Setup".
	
	Continue with last balancing procedure:
	
	The last balancing procedure can be continued with »SELECT«.
		Ensure that
		
		• the mechanical setup between reference pickup and reference mark, and
		
		• the position of the vibration sensors
		
		corresponds to the last balancing pro-cedure.

Select „Balancing Setup„ with the function button »SETUP«. **Setup Balancing** Number of Planes: **1 Plane Balancing** Type of Correction: Polar Correction Adaptive-Mode: active Sensor: AS-06x/07x Unit: mm/s rms `OK` `EDIT` Open the menu for selecting the correction planes with »EDIT«.	**3. Entries in „Balancing Setup„** In „Balancing Setup„ you must define the: • Number of correction planes • Type of correction • Adaptive Mode • Sensor • Unit • Signal detection After the initial unbalance run is completed during the balancing procedure only the unba-lance correction type can be changed.	

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
| ```
┌─────────────────────┐
│   Number of Planes  │
├─────────────────────┤
│                     │
│                     │
│  1 Plane Balancing  │
│  2 Plane Balancing  │
│ 1-2 Plane with Prognosis │
│                     │
│                     │
│ OK │             │   │
└─────────────────────┘
```<br><br>• Select the number of correction planes.<br><br>• Confirm your selection with »OK«. | **4.    Select the number of correction planes** | |
| ```
┌─────────────────────┐
│ ▣   Setup Balancing │
├─────────────────────┤
│ Number of Planes:   │
│ 1 Plane Balancing   │
│                     │
│ Type of Correction: │
│ Polar Correction    │
│                     │
│ Adaptive-Mode: active │
│                     │
│ Sensor:    AS-06x/07x │
│ Unit:      mm/s  rms │
│ OK │        │ EDIT │
└─────────────────────┘
```<br>Open the menu for selecting the correct-ion type with »EDIT«.<br><br>```
┌─────────────────────┐
│  Type of Correction │
├─────────────────────┤
│                     │
│                     │
│   Polar Correctio   │
│    Components       │
│   Fixed Weights     │
│                     │
│                     │
│                     │
│ OK │             │  │
└─────────────────────┘
```<br>• Select the correction type.<br><br>• Confirm your selection with »OK«.<br><br>Only in case of 2-plane balancing:<br><br>• Switch to plane B using the function button »1/2«.<br><br>• Select the correction type for plane B. | **5.    „Select the correction type" and the "Adaptive Mode".**<br><br>The correction type can be changed during the balancing procedure.<br><br>The VIBROTEST 60 then re-cal-culates the correction weights and locations after your change.<br><br>In the case of two-plane balancing the selection for correction type must also be changed for plane B. The function switch »1/2« is used to switch to plane B.<br><br>See chapter 7.1 for the settings of the Adaptive Mode.<br><br>After the entries in the „Balancing Setup" are completed the initial run can be started. | |

7.5   Single-plane balancing steps with polar correction example

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
Initial Run	A 1	
| ```
┌1█ Plane A ████┐
│  1 Plane Balancing │
│  ▐Initial Run▌   │
│    Test Run A     │
│                   │
│ A: Polar Correction│
│                   │
│    Check Run      │
│                   │
│ SELECT│   │   │  │
└───────────────────┘
``` <br> Select Initial Run with »SELECT«. | **1.    Select Initial run in the main menu** | |
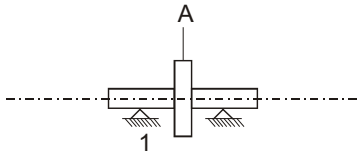| ```
┌1█ Plane A ████┐
│   Initial Run     │
│                   │
│      mm/s      ▫  │
│      rms          │
│                   │
│      rpm          │
│                   │
│                   │
│ START│   │ │AVERAGE│
└───────────────────┘
``` <br> Start measurement with »START«. | **2.    Start    Initial    run measurement** <br><br> The VIBROTEST 60 starts measurement with »START«. | • Attach the reference pickup. <br> • Attach the vibration sensor at measuring plane 1. <br> • Bring the rotor to operational speed. |
| ```
┌1█ Plane A ████┐
│   Initial Run     │
│                   │
│ 6.34 mm/s  79 ▫  │
│      rms          │
│    2985 rpm       │
│                   │
│                   │
│ STOP │   │ │AVERAGE│
└───────────────────┘
``` <br> Stop the measurement with »STOP«. | **3.    Execute    initial    unbalance measurement** <br> The VIBROTEST 60 measures the initial unbalance. <br> If the measurement is varying strongly activate the averaging function with »AVERAGE«. <br> Measurement is stopped with »STOP«. This can be done no earlier than 3 secs. after the first value is displayed. | |

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
| ```
┌──────────────────┐
│ 1 ▐██ Plane A █████│
│    Initial Run    │
│                   │
│  6.34 mm/s  79°   │
│       rms         │
│     2985 rpm      │
│                   │
│                   │
│START│ OK  │AVERAGE│
└──────────────────┘
```<br><br>Store the measurement with »OK«. | **4. Store the Initial unbalance measurement**<br><br>The measurement is stored with »OK«.<br><br>With storage the trigger level is determined in the VIBROTEST 60.<br><br>Even the smallest variations in the relation between reference mark and reference pickup will cause angle errors.<br><br>The measurement can be repeated with »START« | <br><br><br><br><br><br><br><br><br>Stop the rotor |
| ```
┌──────────────────┐
│ 1 ▐██ Plane A █████│
│  1 Plane Balancing│
│IR  6.34 mm/s   79°│
│    Test Run A     │
│                   │
│A: Polar Correction│
│                   │
│     Check Run     │
│ ▐███ 2985 rpm ████│
│SELECT│    │ RESET │
└──────────────────┘
``` | **5. End the Initial run**<br><br><br><br><br><br>The Initial run can be repeated as often as necessary with »SELECT«. | |
| **Test run** | A

1 | |
| ```
┌──────────────────┐
│ 1 ▐██ Plane A █████│
│  1 Plane Balancing│
│IR  6.34 mm/s   79°│
│ ▐███ Test Run A ██│
│                   │
│A: Polar Correction│
│                   │
│     Check Run     │
│                   │
│SELECT│    │ RESET │
└──────────────────┘
```<br><br>Select Test run with »SELECT«. | **1. Select Test run in the main menu** | |
| ```
┌──────────────────┐
│ 1 ▐██ Plane A █████│
│    Test Run A     │
│                   │
│         mm/s    ° │
│         rms       │
│         rpm       │
│                   │
│TMA  + 100.0 g Loc 0°│
│                   │
│START│    │   EDIT │
└──────────────────┘
```<br><br>Open the test weight entry menu with »EDIT«. | **2. Change the test weight**<br><br>The VIBROTEST 60 recommends a test weight. The magnitude of the test weight can be changed.<br><br><br><br><br>The test weight (TMA) is displayed in the measurement menu. | |

Brüel & Kjær Vibro

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
| ```
 Change Trial Weight A

   Attached Weights


  + 1 0 0 . 0 g     0 °


 OK
```  • Enter test weight and location.  • Confirm the entry with »OK«. | **3.    Enter test weight details**  The VIBROTEST 60 stores the test weight details.  After confirmation of the test weight the following is deter-mined:  • Test weight units  • Polarity of the test weight (+ = add weight, - = remove weight). The polarity can be changed with »+/-« at the check run or when repeating the test run. | Attach the test weight to the rotor (e.g. 100 g at 0°). |
| ```
1    Plane A
     Test Run A

          mm/s
          rms

          rpm

TMA  + 100.0 g    Loc   0°

START          EDIT
```  Start the measurement with »START«. | **4.    Start the Test meas-urement**  The VIBROTEST 60 starts measurement with »START«.      The test weight (TMA) is dis-played in the measurement menu. | Bring the rotor to operational speed. |
| ```
1    Plane A
     Test Run A

7.36 mm/s 166°
     rms

   2985 rpm

TMA  + 100.0 g    Loc   0°

STOP          AVERAGE
```  Stop the measurement with »STOP«. | **5.    Execute the Test measurement**  The VIBROTEST 60 executes the measurement.  Stop the measurement with »STOP«.  The VIBROTEST 60 checks the measurement quality by:  • Speed difference to the initial run  • Magnitude of the test weight | |
| ```
1    Plane A
     Test Run A

7.36 mm/s 166°
     rms

   2985 rpm

TMA  + 100.0 g    Loc   0°
 Remove Trial Weight ?
START  YES   NO   EDIT
```  Open the test weight entry menu with »EDIT«. | **6.    Repeat the Test run with a different test weight**  The Test run can be repeated with »START«.  The magnitude of the test weight can be changed with »EDIT. | Stop the rotor. |

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor

``
Change Trial Weight A
 	
  Attached Weights
TMA + 100.0 g   Loc   0°
 	
   + 150.0 g   0
 	
ADD SUBST
``
 	
• Enter the new test weight and location.
• Confirm the entry with »SUBST«.
• Repeat the test run (see points 4 and 5).
	7. Change the test weight and repeat the Test run
	
	The VIBROTEST 60 displays the existing test weight (TMA) on the rotor.
	
	• »ADD«:
	  The new test weight is added to the existing test weight.
	
	• »SUBST«:
	  The existing test weight is removed and replaced by the new test weight.
	
	Note:
	
	The VIBROTEST 60 automatically stores each test weight that is removed or added and takes them into consideration in the calculation of the final correction weights.
		With »ADD«:
		Attach the additional test weight to the rotor.
		
		With »SUBST«:
		Remove the existing test weight (100 g) and add the new test weight (150 g) to the rotor.

``
1   Plane A
       Test Run A
 	
  8.36 mm/s 166°
        rms
 	
      2985 rpm
 	
TMA + 150.0 g   Loc   0°
  Remove Trial Weight ?
START YES   NO   EDIT
``
Store the measurement with »NO«.
	8. Store the Test measurement
	
	Before calculating the correction weight the VIBROTEST 60 must be informed if the test weight will be removed.
	
	• »YES« - the test weight will be removed.
	
	• » NO« - The test weight will remain and is to be taken into consideration in the calculation.
		Stop the rotor.
		
		With »YES«:
		Remove the test weight from the rotor.

``
1   Plane A
    1 Plane Balancing
IR   6.34 mm/s   79°
TRA   8.36 mm/s   166°
 	
TMA + 93.04 g   Loc   55°
 	
     Check Run
      2985 rpm
SELECT ADD   RESET
``
	9. Calculate the correction
	
	The VIBROTEST 60 calculates the correction weight and location taking into consideration a test weight that is not removed.
	
	The Test run can be repeated with »SELECT«.
		Attach the correction weight to the rotor (e.g. 93,04 g at 55°).
		
		In a case where the correction weight must be changed this should be done at the check run.

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
Check Run	A ‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾ 1	
| ```
1   Plane A
  1 Plane Balancing
IR    6.34 mm/s    79°
TRA   8.38 mm/s   166°

CMA  + 93.04 g   Loc 55°

     Check Run

SELECT  ADD      RESET
```<br>Select Check Run with »SELECT«. | **1.   Select Check run in the main menu** | |
| ```
1      Plane A
     Check Run

       mm/s    ▫
       rms

       rpm

CMA  + 93.04 g   Ort 55°

START       +/-   EDIT
``` | **2.   Change the correction weight**<br><br>The correction weight can be changed.<br><br>• »+/-«: Change the displayed correction weight from „Add weight„ to „Remove weight„ or vice versa.<br><br>• »EDIT«: Change the magni-tude and location of the correction weight.<br><br>It is recommended to use the calculated correction weight. Only in a case where the calculated correction weight is not available should some other weight be used. The VIBROTEST 60 must then be informed of the change in weight with »EDIT«. | |
| ```
1      Plane A
     Check Run

       mm/s    ▫
       rms

       rpm

CMA  + 93.04 g   Ort 55°

START       +/-   EDIT
```<br>Start the measurement with »START«. | **3.   Start Check run**<br><br>The VIBROTEST 60 starts measurement with »START«.<br><br><br><br><br>The correction weight (CMA) is displayed in the measurement menu. | Bring the rotor to operational speed. |

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
| ```
1 ▬▬▬ Plane A ▬▬▬
┌─────────────────┐
│    Check Run    │
└─────────────────┘

  0.85 mm/s  232°
       rms

      2985 rpm


CMA  + 93.04 g   Loc 55°

┌────┐       ┌───────┐
│STOP│       │AVERAGE│
```<br><br>Stop the measurement with »STOP«. | **4.       Execute Check meas-urement**<br><br>The VIBROTEST 60 executes the measurement.<br><br>Stop the measurement with »STOP«. | |
| ```
1 ▬▬▬ Plane A ▬▬▬
┌─────────────────┐
│    Check Run    │
└─────────────────┘

  0.85 mm/s  232°
       rms

      2985 rpm



┌─────┬──┐   ┌───────┐
│START│OK│   │AVERAGE│
```<br><br>Store the measurement with »OK«. | **5.       Store Check meas-urement**<br><br>The measurement is stored with »OK« and an additional correction weight is calculated. | Stop the rotor. |
| ```
▮ ▬▬▬ Plane A ▬▬▬
  1 Plane Balancing
IR    6.34 mm/s    79°
TRA   8.36 mm/s   166°

CMA  + 11.11 g   Loc 211°

CR    0.85 mm/s   232°
      2985 rpm
┌──────┬───┬─────┬─────┐
│SELECT│ADD│CR=IR│RESET│
``` | **6.       Calculate the residual unbalance**<br><br>The VIBROTEST 60 calculates the additional unbalance correction weight.<br><br><br>»SELECT«<br>The Check run can be repeated with »SELECT«. When the Check run is repeated the VIBROTEST 60 assumes that the additional correction has been done at the rotor.<br><br>»CR=IR«<br>The Check run will be regarded as the Initial run for a new balancing procedure when »CR=IR« is used.<br><br>Function button »STORE«<br>The balancing procedure can be stored on the PC-card with the function button »STORE«. The VIBROTEST 60 assumes that the additional correction will ***not*** be carried out on the rotor. | Assess whether the residual vibration is low enough and the recommended correction is required.<br><br><br>Perform the addi-tional correction at the rotor if the Check run will be repeated with »SELECT«.<br><br><br>The additional correction is not to be carried out at the rotor. |
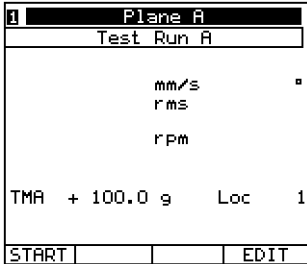
VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
Combine all weights with »ADD«. ``` Plane A 1 Plane Balancing IR 6.34 mm/s 79° TRA 8.36 mm/s 166° CMA + 11.11 g Loc 211° CR 0.85 mm/s 232° 2985 rpm SELECT ADD RESET ```	**7. Combine all correction weights (Weight Combining)** With »ADD« all weights (correction, test and additional weights) attached to the rotor during the balancing procedure can be combined and replaced by a single correction weight. The VIBROTEST 60 calculates the new single correction weight (AMA). Changing a Check run into an Initial run in a new balancing procedure can no longer be done with »CR=IR« after the combining of all weights is carried out.	• Remove all test and correction weights from the rotor. • Attach the new correction weight to the rotor.

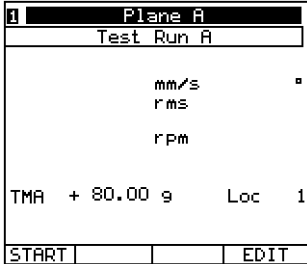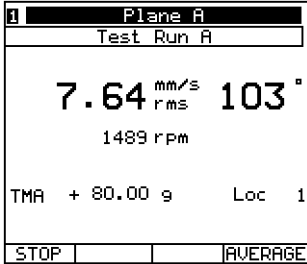## 7.6 Single-plane, repeat balancing steps with polar correction example

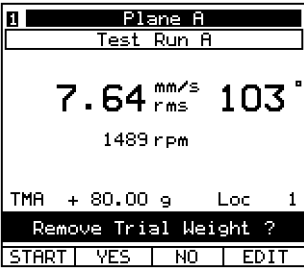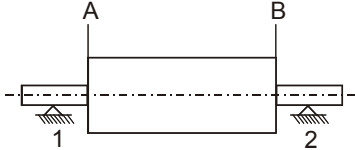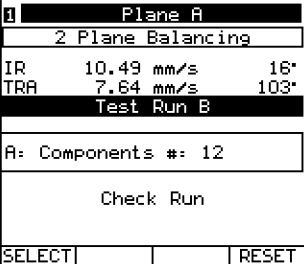| VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
	1. Load a completed balancing procedure from the PC-Card to the VIBROTEST 60 See section 8.2.	
Check Run	A 1	
1 Plane A 1 Plane Balancing A: Polar Correction CR 1.699 mm/s 36° 1489 rpm SELECT RESET Select the Check run with »SELECT«.	**2. Select Check run in the main menu**	• Attach the reference pickup. • Attach the vibration sensor at measuring plane 1.
1 Plane A Check Run mm/s rms rpm START AVERAGE Start the measurement with »START«.	**3. Start the Check run** The VIBROTEST 60 starts the measurement with »START«.	Bring the rotor to operational speed.
1 Plane A Check Run 5.85 mm/s rms 232° 2985 rpm STOP AVERAGE Stop the measurement with »STOP«.	**4. Execute the Check measurement** The VIBROTEST 60 executes the measurement. Stop the measurement with »STOP«.	

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
| ```
1        Plane A
      Check Run

  5.85 mm/s  232°
       rms

     2985 rpm


START   OK        AVERAGE
```  Store the measurement with »OK«. | **5.  Store the Check measurement**<br><br>The measurement is stored with »OK« and the correction weight is calculated. | Stop the rotor. |
| ```
1        Plane A
    1 Plane Balancing



CMA  + 9.500 g    Loc   0°

CR      5.85 mm/s    232°
        2985 rpm
SELECT  ADD  CR=IR  RESET
``` | **6.  Store the measure-ment with »OK**<br><br>The VIBROTEST 60 calculates the correction weight.<br><br>The following are displayed in the main menu:<br><br>• Calculated correction weight (CMA).<br><br>• Result of the Check run (CR).<br><br>• Speed of the Check run<br><br>»SELECT«<br>The Check run can be repeated with »SELECT«. In the case of a repeat the VIBROTEST 60 assumes that the correction has been carried out at the rotor.<br><br>»CR=IR«<br>The Check run can be accepted as the Initial run in a new balancing procedure with »CR=IR«.<br><br>Function button »STORE«<br>With the function button »STORE« a new balancing proce-dure is stiored on the PC-card. | Carry out the correction at the rotor.<br><br><br><br>The correction should not be carried out at the rotor. |
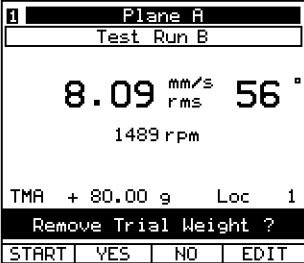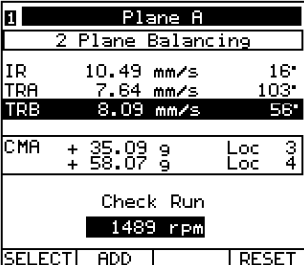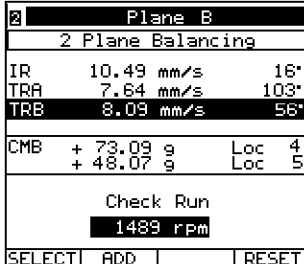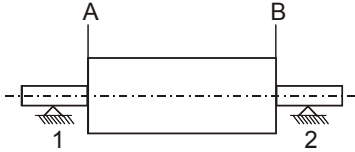
7.7 Two-plane Balancing steps with component correction example

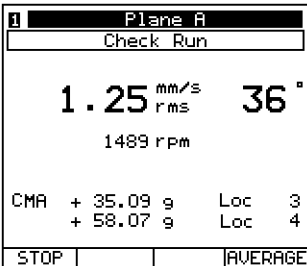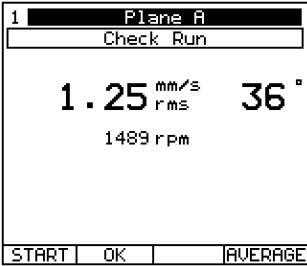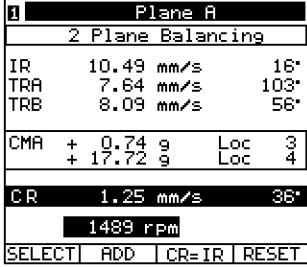| VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
Initial Run	A B 1 2	

``
1   Plane A
  2 Plane Balancing
    Initial Run
    Test Run A
    Test Run B
 	
A: Components #: 12
 	
    Check Run
 	
SELECT
``
Select Initial run with »SELECT«.
	1. Select Initial run in the main menu	

``
1   Plane A
    Initial Run
 	
        mm/s
        rms
 	
        rpm
 	
START   AVERAGE
``
Start the measurement with »START«.
	2. Start Initial unbalance measurement
	
	The measurement is executed by VIBROTEST 60 in the two planes with »START«.
		• Attach the reference pickup.
		
		• Attach the vibration sensors in measuring planes 1 and 2.
		
		• Bring the rotor to operational speed.

``
1   Plane A
    Initial Run
 	
10.49 mm/s 16°
        rms
     1489 rpm
 	
STOP   AVERAGE
``
Switch over to the display of plane 2 using the button »1/2«.
	3. Execute the Initial measurement
	
	The VIBROTEST 60 executes the measurement in the two planes.
	
	The measured values from plane 1 are displayed.
	
	Falls die Messwerte zu stark If the measured values are varying strongly the averaging function can be activated with »AVERAGE«.	

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
``` 2 ▇▇▇▇▇ Plane B ▇▇▇ ┌─────────────────┐ │ Initial Run │ │ │ │ 7.34 mm/s 276°│ │ rms │ │ │ │ 1489 rpm │ │ │ └─────────────────┘ STOP │ │ AVERAGE ``` Stop the measurement with »STOP«.	With the function button »1/2« the measured values for measuring plane 2 are displayed. The measurement at both planes is stopped with »STOP«. This should not be done earlier than 3 secs. after the first values appear.	
``` 2 ▇▇▇▇▇ Plane B ▇▇▇ ┌─────────────────┐ │ Initial Run │ │ │ │ 7.34 mm/s 276°│ │ rms │ │ │ │ 1489 rpm │ │ │ └─────────────────┘ START │ OK │ AVERAGE ``` Store the measurements with »OK«.	**4.** **Store Initial measurement** The measurements for both planes is stored with »OK«. With storage the trigger level is determined in the VIBROTEST 60. Even the smallest variations in the relation between reference mark and reference pickup will cause angle errors. The measurement can be repeated with »START«.	Stop the rotor.
``` 1 ▇▇▇▇▇ Plane A ▇▇▇ ┌─────────────────┐ │ 2 Plane Balancing│ │IR 10.49 mm/s 16°│ │ Test Run A │ │ Test Run B │ │─────────────────│ │A: Components #: 12│ │ │ │ Check Run │ │ 1489 rpm │ └─────────────────┘ SELECT │ │ RESET ```	**5.** **End the Initial run** With the function button »1/2« the measured values for measuring plane 2 are displayed. The Initial run can be repeated as many times as required with »SELECT«.	
Test Run A		
``` 1 ▇▇▇▇▇ Plane A ▇▇▇ ┌─────────────────┐ │ 2 Plane Balancing│ │IR 10.49 mm/s 16°│ │ Test Run A │ │ Test Run B │ │─────────────────│ │A: Components #: 12│ │ │ │ Check Run │ │ │ └─────────────────┘ SELECT │ │ RESET ``` Select Test run A with »SELECT«.	**1.** **Select Test run A in the main menu**	

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
☰ **Plane A** Test Run A mm/s rms rpm TMA + 100.0 g Loc 1 START EDIT Open the test weight A entry menu with »EDIT«.	**2.** **Change Test weight A** The VIBROTEST 60 recommends a test weight magnitude for plane A. This test weight magnitude can be changed.	
Change Trial Weight A Attached Weights + 0 **8** 0 . 0 g 1 OK • Enter the test weight and loca-tion. • Confirm the entry with »OK«.	**3.** **Enter test weight A** The VIBROTEST 60 stores the details of test weight A. When the entry for the test weight is confirmed the following are defined for the procedure: • The test weight units • The test weight polarity (+ = Add weight, - = Remove weight). The polarity can be changed with softkey »+/-« in the Check run.	Attach the test weight to the rotor in plane A (e.g. 80 g at location 1).
☰ **Plane A** Test Run A mm/s rms rpm TMA + 80.00 g Loc 1 START EDIT Start the measurement with »START«.	**4.** **Testlauf A starten** The measurement is executed by VIBROTEST 60 at both planes with »START«. The test weight (TMA) is dis-played in the measurement menu	Bring the rotor to operational speed.
☰ **Plane A** Test Run A 7.64 mm/s 103° rms 1489 rpm TMA + 80.00 g Loc 1 STOP AVERAGE Stop the measurement with »STOP«.	**5.** **Execute test measure-ment A** The VIBROTEST 60 executes the test measurement in both planes. The measurement at both planes is stopped with »STOP«. The VIBROTEST 60 checks the measurement quality by: • Speed difference with the Initial run measurement and • Magnitude of the test weight. With the function button »1/2« the measured values for plane 2 are displayed.	

Brüel & Kjær Vibro

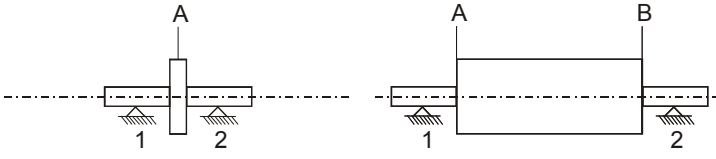| VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor

``
1   Plane A
─────────────────
    Test Run A
 	
  7.64 mm/s 103°
       rms
 	
     1489 rpm
 	
TMA + 80.00 g   Loc 1
─────────────────
 Remove Trial Weight ?
START YES NO EDIT
``
 	
Store the measurement with »NO«.
	6. Store Test run A
	
	To calculate the correction weight the VIBROTEST 60 must be informed whether the test weight A will be removed from the rotor.
	
	• »YES« - the test weight A will be removed.
	
	• »NO« - the test weight A will remain and is taken into consideration in the calcu-lation of the correction weight.
		Stop the rotor.
		
		With »YES«: Remove the test weight from the rotor.

Test Run B		

``
1   Plane A
─────────────────
  2 Plane Balancing
IR   10.49 mm/s   16°
TRA   7.64 mm/s   103°
    Test Run B
─────────────────
A: Components #: 12
 	
    Check Run
 	
─────────────────
SELECT   RESET
``
 	
Select Test run B with »SELECT«.
	1. Select test run B in the main menu	

Open the test weight B entry menu with »EDIT«.	**2. Change test weight B** The VIBROTEST 60 recommends a magnitude for the test weight for plane B. The magnitude of this test weight can be changed.	
• Enter the magnitude and location of test weight B. • Confirm the entry with »OK«.	**3. Enter test weight B** The VIBROTEST 60 stores the details of test weight B.	Attach the test weight at plane B on the rotor (e.g. 80 g at location 1).
Start the measurement with »START«.	**4. Start Test run B** The measurement is executed by VIBROTEST 60 with »START«. Test weight B (TMB) is displayed in the measurement menu.	Bring the rotor to operational speed.

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
Stop the measurement with »STOP«.	**5. Execute Test run B** The VIBROTEST 60 executes the measurement in both planes. The measurement is stopped at both planes with »STOP«. The VIBROTEST 60 checks the measurement quality by: • Speed difference from Initial measurement, • Magnitude of the test weight and • If balancing in only one plane is sufficient.	
⬛1 **Plane A** Test Run B **8.09** mm/s rms **56** ° 1489 rpm TMA + 80.00 g Loc 1 Remove Trial Weight ? START | YES | NO | EDIT Store the measurement with »NO«.	**6. Store Test run B** Before calculating the correction weights the VIBROTEST 60 must be informed if the test weight B will be removed from the rotor. • »YES« - the test weight B will be removed. • »NO« - the test weight B will remain and must be taken into consideration in the correction weights calculation.	Stop the rotor. With »YES«: Remove test weight B from the rotor.

⬛1   **Plane A**
2 Plane Balancing
IR   10.49 mm/s   16°
TRA   7.64 mm/s   103°
TRB   8.09 mm/s   56°
 	
CMA   + 35.09 g   Loc   3
       + 58.07 g   Loc   4
 	
Check Run
1489 rpm
SELECT | ADD | | RESET
 	
Switch to the display of the corrections for plane B with »1/2«..
 	
⬛2   **Plane B**
2 Plane Balancing
IR   10.49 mm/s   16°
TRA   7.64 mm/s   103°
TRB   8.09 mm/s   56°
 	
CMB   + 73.09 g   Loc   4
       + 48.07 g   Loc   5
 	
Check Run
1489 rpm
SELECT | ADD | | RESET
	7. Calculate correction
	
	The VIBROTEST 60 calculates the correction weights and their locations, taking into conside-ration any test weights that remain on the rotor in both planes.
	
	With function button »1/2« the calculated correction weights (CMB) and their locations for plane B are displayed.
	
	The Test run B can be repeated with »SELECT«.
	
	The Initial run and Test run A can no longer be repeated from this point.
		Attach the correction weights to the rotor:
		
		In plane A e.g. at locations:
		
		• 35,09 g
		
		• 58,07 g
		
		If the correction weights are to be changed this must be done at the Check run.
		
		In plane B e.g. at locations:
		
		• 73,09 g
		
		• 48,07 g
		
		If the correction weights are to be changed this must be done at the Check run.

Brüel & Kjær Vibro

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
Check Run	A B 1 2	
| ```
┌─────────────────┐
│▌     Plane A    │
│  2 Plane Balancing│
│IR   10.49 mm/s   16°│
│TRA   7.64 mm/s  103°│
│TRB   8.09 mm/s   56°│
│CMA + 35.09 g  Loc  4│
│    + 58.07 g  Loc  3│
│     Check Run    │
│SELECT│ADD│    │RESET│
└─────────────────┘
```<br>Select the Check run with »SELECT«. | **1.  Select Check run in the main menu** | |
| ```
┌─────────────────┐
│1     Plane A    │
│    Check Run     │
│        mm/s    ▫│
│        rms       │
│        rpm       │
│CMA + 35.09 g Loc 3│
│    + 58.07 g Loc 4│
│START│  │+/-│EDIT│
└─────────────────┘
``` | **2.  Change the correction weights**<br><br>The correction weights for both planes can be changed.<br><br>• »+/-«: Convert the dis-played correction weights from „Add weight„ to „Remove weight„ or vice versa.<br><br>• »EDIT«: Change the magni-tudes and locations of the correction weights.<br><br>It is recommended that you attach the calculated correction weights to the rotor. Other correction weights should only be used when the calculated correction weights are not available.<br><br>The VIBROTEST 60 should then be informed of the correction weight changes with »EDIT«. | |
| ```
┌─────────────────┐
│1     Plane A    │
│    Check Run     │
│        mm/s    ▫│
│        rms       │
│        rpm       │
│CMA + 35.09 g Loc 3│
│    + 58.07 g Loc 4│
│START│  │+/-│EDIT│
└─────────────────┘
```<br>Start the measurement with »START«. | **3.  Start the Check run**<br><br>The measurement is executed by the VIBROTEST 60 with »START«.<br><br><br>The correction weights (CMA) for plane A are displayed in the measurement menu. | Bring the rotor to operational speed. |

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
| ```
┌──────────────────┐
│ 1  Plane A       │
│ ┌──────────────┐ │
│ │  Check Run   │ │
│ └──────────────┘ │
│                  │
│  1.25 mm/s  36°  │
│       rms        │
│                  │
│     1489 rpm     │
│                  │
│ CMA  + 35.09 g   Loc  3 │
│      + 58.07 g   Loc  4 │
│ ┌─────┐    ┌─────────┐ │
│ │STOP │    │ AVERAGE │ │
│ └─────┘    └─────────┘ │
└──────────────────┘
```<br><br>Stop the measurement with »STOP«. | **4. Execute Check measurement**<br><br>The VIBROTEST 60 executes the measurement at both planes.<br><br>With function button »1/2« the measurement from plane 2 is displayed.<br><br>The measurement at both planes is stopped with »STOP«. | |
| ```
┌──────────────────┐
│ 1  Plane A       │
│ ┌──────────────┐ │
│ │  Check Run   │ │
│ └──────────────┘ │
│                  │
│  1.25 mm/s  36°  │
│       rms        │
│                  │
│     1489 rpm     │
│                  │
│                  │
│ ┌─────┬────┐  ┌─────────┐ │
│ │START│ OK │  │ AVERAGE │ │
│ └─────┴────┘  └─────────┘ │
└──────────────────┘
```<br><br>Store the measurements with »OK«. | **5. Store Check measurement**<br><br>With »OK« the measurements from both planes are stored and the additional correction weights are calculated. | Stop the rotor. |
| ```
┌──────────────────┐
│ 1  Plane A       │
│ ┌──────────────┐ │
│ │ 2 Plane Balancing│
│ IR    10.49 mm/s   16° │
│ TRA    7.64 mm/s  103° │
│ TRB    8.09 mm/s   56° │
│ ┌────────────────────┐ │
│ │CMA  + 0.74 g  Loc 3│ │
│ │     + 17.72 g Loc 4│ │
│ └────────────────────┘ │
│ ┌────────────────────┐ │
│ │CR   1.25 mm/s  36° │ │
│ └────────────────────┘ │
│     1489 rpm           │
│ ┌──────┬───┬─────┬─────┐ │
│ │SELECT│ADD│CR=IR│RESET│ │
│ └──────┴───┴─────┴─────┘ │
└──────────────────┘
``` | **6. Calculate residual unbalance**<br><br>The VIBROTEST 60 calculates the additional correction weights for both planes.<br><br>In the main menu the following are displayed for plane A:<br><br>• Calculated correction weights (CMA) and their locations.<br><br>• Measurements from the Check run (CR).<br><br>• Speed of the Check run<br><br>With the function button »1/2« the respective results for plane B are displayed.<br><br>»SELECT«,»CR=IR«, »ADD«,<br><br>see 1-plane Balancing;<br><br>Section 7.5, Check run, point 7 | Assess whether the recommended additional correction is necessary. |

7.8 Single and 2-plane Balancing with prognosis and polar correction example

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
Initial run/Test run A	The 2-plane balancing procedures for the Initial run and Test run A correspond in their operational steps. See section 7.7.	
	7. Calculate the correction and prognosis The VIBROTEST 60 calculates: • The correction for plane A allowing for test weights that remain on the rotor. • The prognosis of residual unbalance forboth planes. The prognosis value for both planes is identical. The following are displayed in the main menu: • Effect of the test weight A (TRA) on plane A. • Calculated correction (CMA) for plane A. • Prognosis of residual unba-lance (PV) in plane A	Assess whether the prognosis of the residual vibration is low enough. In case of a prognosed value that is not low enough Test run B should be carried out.
⊞ **Plane A** 1-2 Plane with Prognosis IR 12.49 mm/s 111° TRA 6.39 mm/s 236° Test Run B CMA + 79.69 g Loc 23° CR▶PV 1.53 mm/s 341° 1489 rpm SELECT ADD RESET		Attach the correction weight at plane A on the rotor (e.g. 97,7 g at 23°).
	With the function button »1/2« the values for plane B are displayed.	
Switch to the display of the correction and prog-nosis for plane B with »1/2«. ⊞ **Plane B** 1-2 Plane with Prognosis IR 5.30 mm/s 21° TRA 3.10 mm/s 91° Test Run B CMA + 0.000 g Loc 0° CR▶PV 1.53 mm/s 341° 1489 rpm SELECT ADD RESET	The Test run A can be repeated with »SELECT«. The user can now choose between two options in the balancing procedure: • Carry out Test run B • Do a Check run	No correction weights are attached in plane B.

VIBROTEST 60 dialogue	VIBROTEST 60 steps	Activity at Rotor
Check Run	A, 1, 2 A, 1, B, 2	
Select Check run with »SELECT«.	**1. Select Check run in the main menu**	
	The remaining operational steps correspond with the standard 2-plane balancing procedure. See section 7.7, Check run.	

8 Storing and displaying measurements (Reports) on the PC-card

8.1 Storing Reports on the PC-card

```
┌─────────────────────────────────┐
│ ┌─────────────────────────────┐ │
│ │      Store Report           │ │
│ │ May/04/2001 │ 12:16:00  am  │ │
│ │┌───────────────────────────┐│ │
│ ││ PUMP_A246                 ││ │
│ │└───────────────────────────┘│ │
│ │                             │ │
│ │                             │ │
│ │                             │ │
│ │ OK      │DELETE│ EDIT       │ │
│ └─────────────────────────────┘ │
└─────────────────────────────────┘
```

Menu title
Storage date and time

Report name:

OK   The current measured data is stored under the dis-
          played Report name and the previous menu is dis-
          played. If a new name is to be given to the Report it
          is entered after pushing EDIT.

DELETE   The displayed name is deleted for entry of a new
          name.

EDIT   Enter a Report name.

Using the button »STORE« the contents of the display memory
resp. Listing memory are stored on the PC-card. The Setup for
the respective measurement is stored together with the
measured data.

A name for the Report can be freely entered (max. 12
characters). In addition the current date and time are also
stored.

Note:

Storage on the PC-card is only possible when the current
measurement is stopped or ended, ie when the softkey
»START« is displayed.

Entering a Report name

This menu is selected using the softkey »EDIT«. The individual characters are selected using the cursor buttons ◀, ▶, ▲, ▼.

```
┌─────────────────────────┐
│  Report  identification │   Menu title
│ ▉ B C D 1 2   ▉ ▉       │
│ E F G H 3 4   = *       │   Available characters
│ I J K L 5 6   + -       │
│ M N O P 7 8   _ ]       │
│ Q R S T 9 0   \ /       │
│ U V W X Y Z   . :       │   Report name:
│ ▉ U M P _ A 2 4 6       │
│  OK  │INSERT│DELETE│ NEXT│
└─────────────────────────┘
```

OK   The current measured data will be stored under the displayed Report name. After storing the program returns to the previous menu.

INSERT   The selected character is entered in the Report name line.

DELETE   Deletes the current character from the Report name.

NEXT   Step to the next character for the Report name.

8.2   Displaying Reports

All available Reports can be selected in the menu VIBROTEST 60 by pushing the softkey »REPORT«.

```
VIBROTEST 60
    Data Collector
Overall Vibration/BCU
   Spectrum/Cepstrum
Envelope Analysis/BCS
     CPB-Spectrum
    Process Values
       Tracking
       Balancing
   Keyboard Input
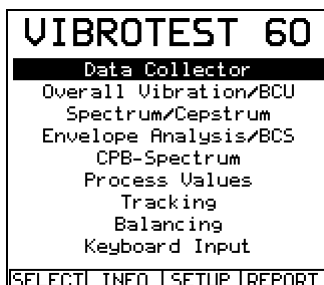
SELECT  INFO  SETUP REPORT
```

The selection list displays all the Reports stored on the PC-card and the remaining free capacity of the PC-card.

Report name
Date of storage

```
PUMP_A246      🗓2 Overall
Jul/07/2001 01:08:00 pm
FAN_C02        🗓2 Overall
Jul/07/2001 01:17:12 pm
FAN_03         🗓2        FFT
Jul/07/2001 01:21:36 pm
FAN_04         🗓1       PROC
Jul/07/2001 01:24:06 pm


   3645.568 kB free
SELECT  INFO  DELETE
```

Type of measurement
Time of storage

Free storage capacity

SELECT   Select the highlighted Report from the list.

INFO   Switch to the Report information menu.

DELETE   Delete the selected Report

The desired Report is selected using the cursor buttons ⊕, ⊖.

The measurement type is displayed next to the Report name.

Abbreviations of the measurement type are as follows:

Ov/BCU	Overall/BCU Measurement
FFT	Spectrum/BCS Measurement
Proc.V.	Process value measurement
Bala	Balancing
Track	Tracking analysis
CPB	CPB spectrum
Env.	Envelope analysis
Hand	Manual entry
▲▼	Reports with List entries
f(t)	Measurement vs. Time
f(n)	Measurement vs. Speed

Brüel & Kjær Vibro

Displaying the measured data in the Report („SELECT")

The stored measurement is displayed; with measurements stored in a Listing, the other measurements in the Listing can be selected using the cursor but-tons ⓐ, ⓥ.

Renewed measurement

While in the Report display menu, the measurement can be renewed. Execution of this measurement renewal is done the same way as in normal Overall or Spectrum measurement.

The measurement is executed using the stored SETUP configuration.

Meas. type: Overall

Measurement: Bearing
Condition
Measurement: Speed

Unit
Signal detection

Unit

Unit

START   The measurement is started. „STOP" is displayed and the channel number flashes to indicate that the measurement is in progress.

STOP   The measurement is ended. „START" is displayed to indicate that the measurement process has stopped.

AVERAGE Activate the averaging function.

Storing individual measurements:

Storage of the new measurement is possible with the button »STORE«. A new Report is added. The data from the old Report is not overwritten. If the data from the old Report is to be deleted, this Report must be selected and deleted using the »DELETE« softkey.

Storing Reports with Listing measurements

While in a Report with Listing data, if a further measurement is to be carried out, this new measurement can be added to the existing number of measurements in the Listing. When storing the new measurement (button »STORE«) the new data is added to the existing data with a new storage date.

Report Info (INFO softkey

Information about the selected Report is displayed in the Report Info menu.

Report name

Type of signal source
Measurement type

```
┌─────────────────────────────┐
│      Report Info:           │
│  ┌───────────────────────┐  │
│       FAN_C03               │
│                             │
│                             │
│ Measured:     Jan/04/2001   │
│               12:50:21 am   │
│ Stored:       Jul/07/2001   │
│               01:17:12 pm   │
│ Memory:       357           │
│ SELECT│    │DELETE│ NEXT     │
└─────────────────────────────┘
```

Start of measurement:
        Date and time
Data storage:
        Date and time
File size in Byte

Command line

SELECT   Switch to the associated Report menu.

DELETE   Delete the selected Report DELETE.

NEXT   Step to the next Report

C102 853.002 © VTEST60E July 2013 4.46ff

Brüel & Kjær Vibro

8.3 Memory requirement and management

8.3.1 In Analyser mode

The required memory space for a Report can be read in »Report Info Dialogue«.

8.3.2 In Data-collector mode

With the loading of Routes to a PC-card the necessary memory space for data security is automatically reserved. Exceedance of this range is not possible.

The maximum number of measurement Points per Route may not exceed 1000.

8.3.3 Storage capacity of each (4 MB) PC-card

Maximal possible is storage of:

- Reports   1000
- Routes   5

9   Commissioning

When the VIBROTEST 60 is switched on the main VIBROTEST 60 menu is displayed. The dialogue language can be changed with the softkey »SETUP« in the menu „System Setup".

Selectable
Measurement and
Service Functions

```
VIBROTEST 60
       Data Collector
   Overall Vibration/BCU
     Spectrum/Cepstrum
   Envelope Analysis/BCS
        CPB-Spectrum
       Process Values
          Tracking
          Balancing
       Keyboard Input
SELECT| INFO |SETUP|REPORT
```

SELECT   The highlighted item on the menu will be selected as the next function menu.

INFO   Switch to the Information menu.

SETUP   Opens the menu „System Setup".

REPORT   Opens the Reports selection list.

Using the cursor buttons the highlight bar can be moved to the desired function. With the softkey »SELECT«, the desired function is selected.

Independent of the position of the highlight bar, pushing the softkey »INFO« will produce the following menu:

Version number
Fabrication number
Instrument
manufacturer

```
VIBROTEST 60
Version:        4.24.0FDF
Device Id:      00000000
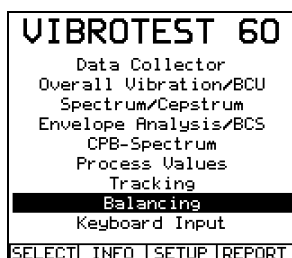
Manufacturer:
Brüel & Kjær Vibro GmbH
D 64293 Darmstadt

   Next Calibration:
        20/May/2004
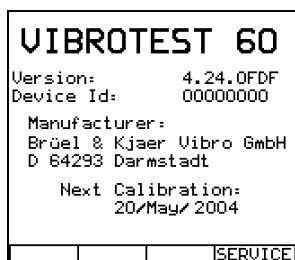
                  SERVICE
```

SERVICE
Opens the menu „Service"
(see section **Fehler!
Verweisquelle konnte
nicht gefunden werden.**).

Note:

The accuracy stated by the manufacturer is binding only until the date of the „Next calibration".

The recommended date of the next calibration is displayed. In some cases an earlier date for the next calibration may be sensible.

A System calibration on the date of the next recommended calibration can be done by any authorised Brüel & Kjær Vibro service station. At each System calibration the recommended date is automatically changed.

9.1   Selecting the language

If some dialogue language other than the one with which the instrument was delivered is to be used, the following steps should be followed:

Menu »VIBROTEST 60« is displayed

- Push the softkey »SETUP«

Menu »System Setup« is displayed

- Move the bar cursor to the line »Language«

- Push the softkey »EDIT«

Menu »Dialogue language« is displayed

- Move the bar cursor to the desired language

- Push the softkey »OK«

Menu »System Setup« is displayed

- Switchover to the selected language is not yet activated.

- Push the softkey »OK«

The main »VIBROTEST 60« menu is displayed

- The dialogue language is changed to your selection and automatically stored.

- Each time the VIBROTEST 60 is switched on in future the dialogue will be displayed in the language you selected.

Brüel & Kjær Vibro

9.2   Basic settings for the System Setup

Before the VIBROTEST 60 is finally put to use the operating parameters must be adapted to the actual requirements by entry or selection. All the selected or entered parameter values are retained in the event of a power failure including the „Date„ and „Time„.

The menu »System Setup« is selected in the main menu »VIBROTEST 60« with the softkey »SETUP«.

```
┌─────────────────────────────┐
│      System Setup           │
│ Channels:    1+2            │
│ Setup 1 = 2: No             │
│ Date:        02/Jan/2002    │
│ Time:        10:20:02       │
│ Units:       metric         │
│ Speed:       active    Hz   │
│ Speed/Ref.:  1/1            │
│ Language:    English        │
│                             │
│                             │
│  OK               EDIT      │
└─────────────────────────────┘
```

OK   The current parameter entries or settings are OK. The display returns to the previous menu.

EDIT The text highlighted by the cursor bar is the target for switchover to the next selection or entry menu.

The meanings and functions of the parameters in the menu »System Setup« are described in chapter 4.1.

Note:

At the initial switch-on the current date and time must be entered.

When the battery set is changed the date and time are buffered for at least one minute. The setup of the date and time should be checked and, if necessary, corrected after each change of a battery set or any long pause in operation.

If this is not done new PC-cards are locked and can no longer be read, because the identification of PC-cards is done on a date and time basis.

If the card should lock take the following action:

•   Set up the date and time in the VIBROTEST 60

•   Format the PC-card (see chapter 4.10)

9.3   System-error messages

At any operational conditions which do not allow a controlled ending of the current VIBROTEST 60 function the instrument reacts with a System-error message.

In such cases the following menu will be displayed:

System-error message

Reboot the VIBROTEST 60
Switch the instrument off and
then on again.

```
System Error Message
       000001
 Reboot VIBROTEST 60.
    Switch off and
    restart System.
```

Error code

The only solution is to end operation of the VIBROTEST 60 by switching it off.

Note:

When the VIBROTEST 60 is switched off after a System-error message all setups and measurements executed up till the time the error occured are lost if they were not stored.

Each time the instrument is switched on again after a system error the date and time should be checked.

10   PC-cards - Handling and action

All information such as Routes, Reports and measurements are stored by the VIBROTEST 60 on a PC-card.

„Only PC-cards of the type AC-603 are recommended for use with the VIBROTEST 60."

Changing the PC-card

- Switch the instrument off (ON button)

- Remove the battery set cover

- Push the card ejector

- Remove the PC-card.

Caution:

When inserting a card make sure that the label faces up and the card is inserted in the direction of the arrow on the label. *Never use excessive force to insert or remove a card!*

Caution

It is mandatory to note and to follow the instruction, that only 32 MB PC cards AC-603/32 shall be used. These PC cards shall be ONLY formated in the VIBROTEST 60 and NOT in the PC-card drive! To guarentee the functionality the PC card formating has to be performed in the VIBROTEST 60 according to the instructions described in section 4.10.

File structure

The PC-card is read simply as another storage medium and in the ideal case possesses a sub-directory with the name „VTCRD„. The archived data is laid in various files in this sub-directory in an internal format.

Behaviour of the PC-card under an uncontrolled System condition

If the PC-card is removed from the VIBROTEST 60 while its contents are being accessed, or an uncontrolled system condition occurs during operation of the VIBROTEST 60 the filing system will be regulated via a built-in mechanism. This means the data on the card can still be read but data cannot be written. This guarantees that all data stored on the card up to the time of the mistake will be retained.

If any blocked PC-card is inserted into the VIBROTEST 60, each time you attempt to access the card the message

„PC-Card is write-protected.

*Please read all routes and reports and delete
the PC-Card."*

will be displayed. Reading data from or writing data to this PC-card will not be possible.

Write-protected PC-cards

What possibilities are there for using blocked PC-cards or for resetting them again?

There are four options:

1. If there is no PC or PC-card drive available

Access to the data on the blocked card is not possible. There is only the option to reset the PC-card; using the Service function „Formatting„, to a condition where you can write to it. All data already stored on the card will in any case be lost.

2. A PC with PC-card drive is available

(which can be read like a standard drive) *is available but no VIBRO-REPORT or XMS-software*

To reset the blocked PC-card it is sufficient to delete the directory „VTCRD„, all its sub-directories and the data they contain.

Caution !

All data on the PC-card will be lost !

3. VIBRO-REPORT is available

(this must be installed in a PC with a PC-card drive)

With the VIBRO-REPORT software there is the possibility to read from a blocked PC-card, print out the measurements and, via the Clipboard, use the data in another application or export it as an ASCII file.

However it is still not possible to reset the PC-card using this software. To do this you have to either follow the procedure described above by switching to the DOS mode and delete the „VTCRD„ directory from the PC-card or use the VIBROTEST 60 internal Service-function „Formatting".

4. XMS is available

(this must be installed in a PC with a PC-card drive)

With the XMS it is also possible to read from a blocked PC-card and thus archive the measurement data it contains.

However it is still not possible to reset the PC-card using this software. To do this you have to either follow the procedure described above by switching to the DOS mode and delete the „VTCRD„ directory from the PC-card or use the VIBROTEST 60 internal Service-function „Formatting".

Brüel & Kjær Vibro

11   Battery sets: Handling and Disposal

11.1   General

Only re-chargeable batteries may be used in the VIBROTEST 60 for power. A limiter circuit which is active in case of excessive charging current or a short-circuit is built into the encapsulation housing for the batteries. If the battery set is fully charged, the battery set capacity guarantees a typical operating time of at least 3 hours.

The battery set is housed in a suitable compartment within the handle of the VIBROTEST 60. The electrical connection between the battery set in the VIBROTEST 60 and the charger unit is made through spring-loaded contacts under the VIBROTEST 60.

Caution

Opening the battery set housing may lead to damage!

The use of primary cells is not permitted!

The battery set of the VIBROTEST 60 must **not remain in the instrument** during transport by aircraft.

The connections of the battery set must **not** be short-circuited!

11.1.1   Battery set voltage monitoring

An internal circuit monitors the battery set voltage. When the battery set voltage falls below a certain specified level the user is warned by a „RED„ LED which lights up next to the display screen of the instrument that the remaining operating time is at most 2 minutes. This function is only available when the VIBROTEST 60 has been on for more than 10 minutes (see Chapter 2.4)

If the battery set voltage falls below a second specified level the VIBROTEST 60 switches off automatically. At this point any measurement currently under progress is stopped and the measured data is discarded.

The VIBROTEST 60 can only be switched on again if it is rested on the power / charger unit cradle or another charged battery set is inserted.

11.1.2 Exchanging battery sets

Caution

Exchanging the battery set must only be done when the VIBROTEST 60 is switched off !

Operation of the internal clock of the VIBROTEST 60 will be correctly maintained by a buffer for a period of 10 minutes.

If the VIBROTEST 60 is without power of any kind for longer than the buffer time, when it is powered up again the parameters of the „System Setup„ must be checked and corrected if necessary.

To remove the battery pack from the battery compartment, it is necessary to first unlock it. To unlock the battery pack, push the battery pack tab gently downward. You will hear a clear "click" when it is unlocked. Then the battery pack can be pulled out.

When re-inserting the battery pack make sure that it is correctly locked into position! You will hear a "click" when it is corrrectly locked.

11.1.3 Charging

The battery set is charged via the AC-601 power / charger unit. The battery set can be charged in the VIBROTEST 60 or in the power / charger unit.

Advice:

Before starting a lengthy measurement procedure, you should ensure that a fully discharged batttery set has been charged for a minimum of 1 hour in the instrument that is switched off.

Procedure

A.   Charging the battery set in the VIBROTEST 60

   1. Lay the VIBROTEST 60 in the charger unit cradle

   2. Switch the charger unit on (connect it to main power)

   3. Charging time: max. 4 hours with VIBROTEST 60 switched off

B.   Charging the spare battery set in the charger unit

   1. Insert the spare battery set into the charger unit

   2. Switch the charger unit on

   3. Charging time: max. 8 hours

11.1.4 LED Charge monitoring

A monitoring curcuit is built into the power / charger unit which checks the charge condition of the battery set. When the battery set voltage approaches the fully-charged condition the charging current is reduced. When the fully charged state is reached the electronics switches to a maintenance charge. These conditions are displayed by the LEDs.

Permanently lit:

GREEN   Power to the charger unit is on

YELLOW 1*   Battery set in the VIBROTEST 60 is charging.

YELLOW 2*   Battery set in the charger unit is charging

∗   If the battery set is fully charged the yellow LED switches off.

Flashing:

YELLOW 1   Battery set in the VIBROTEST 60 is defective

YELLOW 2   Battery set in the charger unit is defective

Caution:

When charging make sure that the VIBROTEST 60 is correctly positioned on the charger unit. If the instrument is not correctly positioned on the charger the battery in the VIBROTEST 60 will be either insufficiently or not charged at all. When the YELLOW LED 1* lights up the VIBROTEST 60 is correctly positioned.

11.1.5   Battery maintenance with a VIBROTEST 60 in storage

When the VIBROTEST 60 is not used for long periods (longer than one week) the battery set in the instrument and the power / charger unit should be removed and stored at the appropriate temperature.

11.1.6   Disposal

Caution:

Defective batteries or batteries which can no longer be used are not household garbage! Please dispose of them in an environmentally friendly manner.

11.1.7   Battery replacement

The battery set should be renewed every 2 years to maintain the full founctionality! Typically the maximum number of charging cycles is then realized!

12   Technical Data

12.1   Safety conformance

The VIBROTEST 60 corresponds to the following prescriptions or rules:

The CE mark confirms the conformity to the EMC guideline 2004/08/EG and the low-voltage guideline 2006/95/EG.

The C-checkmark of the Australian Authority for conformity (ACMA) to their EMC requirements.

Safety

EN 61010-1:2002-08   „Safety requirements for electrical instruments   for measurement, control and laboratory application."

EMC Disturbance emission and distrubance resistance

DIN EN 61326-1: 2006 „Electrical operating devices for cable techniques and laboratory employment - EMC requirements".

Use for industrial applications to EN55011 Class A

WEEE-Reg.-No. 69572330

product category / application area: 9

12.2   Technical Data

12.2.1 VIBROTEST 60

Housing	Single-handed construction
Material	ABS
Weight (with battery set)	approx. 0,9 kg
Operating time with fully-charged battery set	typically 2 x 3 hours

Display

Type	Text and graphics LCD
Resolution	160 x 140 Pixel (W x H)

Ambient temperatures

Operation	0 ... 50 °C
Storage	-10 ... 60 °C

Type of protection

With covered connectors	IP 41
Without covered connectors	IP 41

12.2.2 Power / charger unit AC-601

Main power supply	84 ... 265 V
Frequency	47 ... 400 Hz
Current consumption	15 VA

Ambient temperatures

Operation	0 ... 40 °C
Storage	-10 ... 60 °C
Connections	Cold instrument plug connection According to EN 60320, sheet C14
Protection class	IP 22
Weight	0,3 kg

Battery set charging times

in VIBROTEST 60	max. 4 hours
in AC-601	max. 8 hours with VIBROTEST 60 switched off

Optical status signals

LED-GREEN	Power / Charger: Power ON
LED YELLOW 1	Battery set in VIBROTEST 60 is charging
LED YELLOW 2	Battery set in Power / Charger is charging

12.2.3   Measurement acquisition

Overall vibrations

Input 1 + 2
Sensor = variable

Input resistance	60 kΩ
Signal voltage	< 30 V pp
Frequency band:	1 Hz ... 20 kHz
Signal-detection:	peak, peak-peak, rms, pc, ppc
Accuracy	2 % of measured value

The use of constant current supply acceleration sensor (CCS), an addition-error of < = 3% may occur related to the measured value.

Brüel & Kjær Vibro

BCU

Accuracy: 4 % of measured value

Process-values (only possible through channel 1)

Frequency band: 0 Hz ... 20 kHz

Voltage input range: -30 V ... +30 V

Input resistance: 150 kΩ

Current input range: 0/4 ... 20 mA

Input resistance. R_E 100 Ω

Accuracy: Voltage: ± 0,3 V
                                   Current: ± 0,5 mA

Spectra

Freq. range: 1 Hz ... 20 Hz,
                                   1 Hz ... 20 kHz

No. of Lines: 100, 200, 400, ... 6400, 12800

Window types: Flat-top, Hanning, Uniform

Speed

Signal voltage: 0,5 ... 30 Vpp

Input frequency range: 0,5 Hz ... 10 kHz

Input resistance   22 kΩ

Translation ratio: Impulse / Revolution
                                   1 ... 99 / 1 ... 99

With a translation ratio of 1 : 1 this gives a Speed range:
30 ... 600,000 RPM

Accuracy: 1_*10^{-3} of measured value
                                   (0,01 Hz or 1 RPM)

Tracking Analysis (Balancing)

Amplitude   Reproducibility ± 4 %

Phase   Accuracy ± 1 degree

Freq. range (tracking)   1,0 Hz … 10 kHz

Freq. range (balancing)   0,8 Hz ... 10 kHz

Reference frequency   max. 20kHz

12.2.4 PC-Cards

Card capacity	max. 128 MB
	latest version on enquiry

Advice:

Only PC-cards supplied by Brüel & Kjær Vibro are recommended. Other cards could lead to a malfunction.

12.2.5 Battery set   AC-602

Battery set type	AC-602
Extent of delivery	2 off
Battery data	6 V / 2,1 Ah

12.3   Sensor connections

The following sensors can be connected:

- AS-06x/07x

- VS-079 / VS-080

- IN-085 (only with the additional Adapter AC-630)

- AS-10x/02x/03x (only with the additional Adapter AC-630)

- Current-powered signal sources (CCS)   2 ... 4 mA, +24 V

- Optical reference pickup P-95   5 V / 30 mA

- Sensors from the Brüel & Kjær Vibro range

Plug type	Round-pin connector, 6-pole (Tuchel)
Execution	F (socket component)

Brüel & Kjær Vibro

Contact layout: Connector 1

1

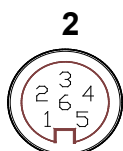Contact → Function

1 →	nc
2 →	Signal[1]
3 →	Signal [2]
4 →	TE
5 →	SE (Shield)
6 →	+5 V/20 mA (Output)

[1] = Sensor or Process value (U)
[2] = Sensor or Process value (I)

When connecting an AS-065 (CCS) sensor the power supply and the signal voltage are both carried through the contact 2s.

Contact layout: Connector 2 (not for Process-values)

2

Contact	Function
1 →	nc
2 →	Signal
3 →	nc
4 →	TE
5 →	SE (Shield)
6 →	+5 V/20 mA (Output)

Contact layout: Connector REF

3

Contact	Function
1 →	Reference signal
2 →	+24 V / 5 mA (Output)
3 →	0V / 5 V, R_L > 1 kΩ (Control output)
4 →	TE / Ref. for power & signal
5 →	SE (Shield)
6 →	+5 V/20 mA (Output)

*   The power for the pickup is switched on when the associated measurement menu is selected.

12.4   Acceleration Sensor, AS-065

12.4.1 Application

The AS-065 acceleration sensor is mainly used to measure acceleration when used in conjunction with the VIBROTEST 60 analyser and data collector.

ACCELERATION
SENSOR
Type: AS-065
S/N:

ca.60
46
15
ø21,6
SW 22

M8; 6mm tief
M8; 6mm deep
M8; 6mm de profondeur

AS065-1 (050818)

Fig. 1   Acceleration sensor

12.4.2 Measuring Principle

Acceleration sensors operate in accordance with the piezo-electric compression principle. Inside the sensor, a spring/mass damping system is formed by a piezo-ceramic disk and an internal sensor mass.

When introducing vibrations to this system, the mass exerts an alternating force on the ceramic disk and, due to the piezo-electric effect, an electric charge is induced that is proportional to the vibration acceleration.

An integrated charge amplifier converts this charge signal to a usable voltage signal.

Brüel & Kjær Vibro

12.4.3   Technical Data

Type	Piezo-electric acceleration sensor with integrated charge amplifier
Transmission factor	100 mV/g $\pm$ 5 % 10,2 mV/m/s^2 $\pm$ 5 %

Fig. 2   Typical frequency response of the transmission factor

Overload capacity	Continuous 500 g Shock 5000 g (all directions) equiv. to a fall from 1,5 m on concrete without damage
Operating temperature range	- 50 °C ... + 120 °C
Storage temperature range	- 50 °C ... + 120 °C
Measuring range	$\pm$ 80 g (U_{max} = + 24 V ... + 30 V) $\pm$ 40 g (U_{max} = + 20 V) $\pm$ 20 g (U_{max} = + 18 V)
Linearity error	$\leq$ 0,1 % (0,1 g ... 10 g)
Transverse sensitivity (80 Hz)	$\leq$ 7 %
Frequency range	3 ... 10 000 Hz ($\pm$ 0,5 dB) 1 ... 15 000 Hz ($\pm$ 3 dB)
Resonance frequency	35 kHz $\pm$ 3 kHz

Noise	**Frequency range**	**Noise density**
	at 1 H z	280 μg/$\sqrt{Hz}$
	> 100 Hz	6 μg/$\sqrt{Hz}$

Constant current supply I_B	4 mA (2 mA ... 10 mA)
max. supply voltage U_{max}	+ 24 V (+ 18 V ... + 30 V)
Dynamic impedance at the output	$\leq$ 300 Ω (1 Hz ... 10 kHz)
	approx. 2 kΩ (38 kHz)
	(Modulation 1 V_{eff} I_B = 4 mA)
Open-circuit potential (-50 °C ... + 100 °C)	+ 13 V $\pm$ 1,5 V
Temperature sensitivity	< 0,01 g/K
Expansion sensitivity	< 0,0003 g/(μm/m)
Magnetic field sensitivity	< 0,003 g/mT
Insulation resistance (Housing-supply voltage 0V)	$\geq$ 20 MΩ
Dielectric strength of insulation	500 VRMS (> 3 min)
Interference voltage suppression between housing and 0 V (frequency-dependent)	< 0,5 kHz $\geq$ 110 dB
	< 1 kHz $\geq$ 100 dB
	10 kHz $\geq$ 60 dB
Protection system	IP 40 when mounted

EMC

	as per DIN EN 61326-1: 2006
Housing	Stainless steel, industrial design
Weight	82 g (81,9 g)
Mounting	Central hole mounting by means of M8 x 14 stud; Max. tightening torque 4,5 Nm or M8 / 1/4" 28 UNF; Max. tightening torque 3,5 Nm

Connection

TNC plug connector

Accessories

AC-436 spiral cable	AS-065 with VIBROTEST 60
AC-437 cable	AS-065 with VIBROTEST 60

Brüel & Kjær Vibro

12.4.4   Mounting

Coupling

General rule:

The weight of the acceleration sensor should be at least ten times lower than the technically-vibrating weight of the object being meaured and to which the sensor is attached.

General rule:

The weight of the acceleration sensor should be at least ten times lower than the technically-vibrating weight of the object being meaured and to which the sensor is attached.

Attachment options

There are three options for attaching the pickup to the machine:

- Threaded stud

- Probe

- Magnet

Mounting of acceleration sensor

Note:

The acceleration sensor requires a friction-locked, contact-resonance free and rigid mounting to the measuring object, especially for measurement of high frequencies.

♦ AS-065 is to be mounted with the threaded stud supplied. Selectable:

- Stud M8 x 14 or

- Stud M8 / 1/4" 28 UNF

The sensor can be mounted in any position.

Fig. 3   Mounting

- The mounting surface in the area of AS-065 must be flat and machined.

- Prepare the mounting surface with an M8 or 1/4„ threaded hole 12 mm deep.

- Apply a thin film of silicone grease to the mounting surface to prevent contact resonance.

- Screw the stud into the mounting surface in accordance with fig. 3 and secure it (e.g. with LOCTITE 243 medium-bond, LOCTITE 270 heavy-duty bond).

- Max. protrudance of the stud ≤ 5 mm for acceleration sensors must be observed.

- Screw AS-065 onto the stud.
  Observe max. tightening torque in accordance with the stud

12.5   Optical reference pickup P - 95

FIg. 4   *Reference pickup P-95*

12.5.1   Application

The reference pickup P-95 is used predominantly for ***speed measurement*** and for establishing an ***angular reference*** with a rotating machine component.
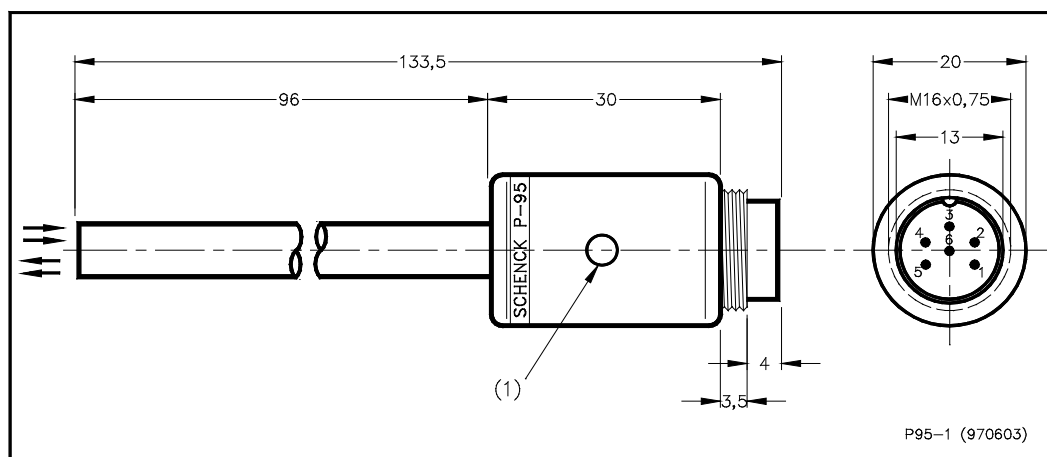
Using the AC-185 connecting cable; it is connected directly to the VIBROTEST 60 vibration measuring instrument.

12.5.2   Operating Principle

The reference pickup operates according to the photoelectrical principle. It transmits a light beam to the rotating machine part. The light transmitted by the pickup is reflected by a ***reference mark*** that has been applied to the rotating component. A photo-transistor at the tip of the reference pickup is triggered by the reflected light, causing a change in the pickup's output signal.

The reference pickup is functioning correctly as long as the LED (1) is lit. This guarantees that the connected measuring instrument acquires the correct speed signal.

12.5.3   Technical Data

Optimum operating distance   ***30 ... 40 mm***;
                                    with reflective tape type SCOTCHLITE
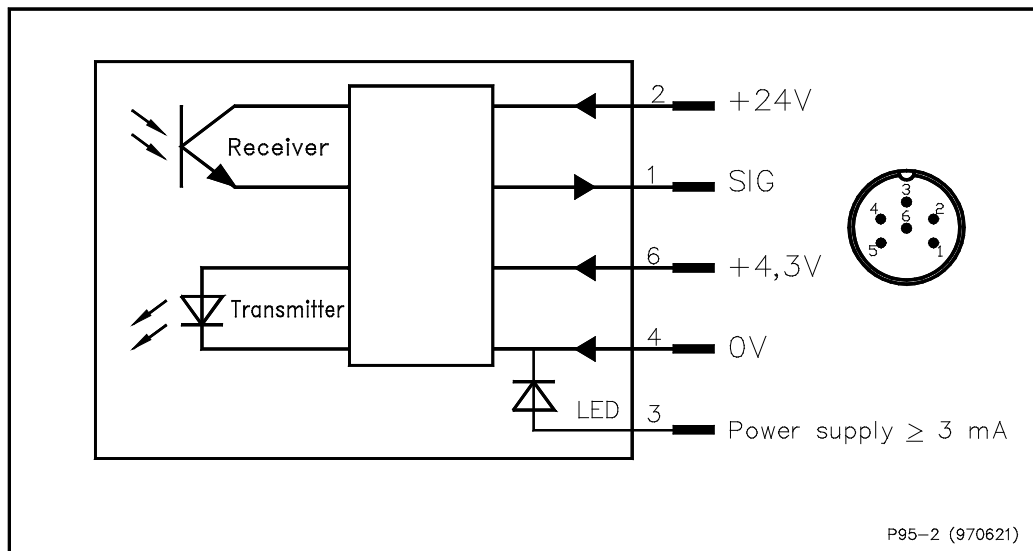   HIGH GAIN-RP 7610 ***up to 100 mm***

Power supply   see figure 5

Fig. 5   Connections of the P-95

Max. output level with vertical installation
optimum operating distance and a highly reflective
reference mark (shiny shaft, reflecting foil)   approx. -16,5 V

Max. output level with vertical installation
optimum operating distance and a highly reflective
reference mark (shiny shaft, reflecting foil)   approx. 0 V

Input resistance R_E of connected
measuring instrument $\geq$ 10 kΩ

Length of connecting cable $\leq$ 100 m

Operating temperature   0 °C ... + 50 °C

Storage temperature   -30 °C ...+ 100 °C

Protection class   IP 30

Weight   approx. 70 g
                                                          (excluding
                                                          connection cable)

12.5.4   Reference mark

The reference mark, also called "light/dark mark", is applied to a suitable point on the shaft surface. Its reflecting power should be clearly distinguishable from the surrounding surface.

It can be either light-absorbing or light-reflecting. The colour is of no importance.

The mark may be attached to the circumference or to one end face of the shaft.

The *light-absorbent* mark can be, e.g. a:

- matt black paint finish

- matt black adhesive tape

- sand-blasted surface

The *light-reflective* mark can be, e.g. a:

- part of the shiny shaft itself

- strip of aluminium bronze

- piece of reflective tape (see page 148)

The mark must be at least 5 mm wide !

12.5.5 Mounting / Adjustment

To fasten the reference pickup, we recommend using a magnetic stand.

Normally the reference pickup needs to be installed perpendicular to the surface to be scanned, so that a sufficient quantity of the reflected light is received by the pickup.

This is not necessary if the recommended reflective tape is used. This tape reflects the light in all directions and thus enables the pickup to be installed at an angle (see next section).

The tip of the reference pick-up should be at a distance between 30 and 40 mm from the reference mark.

The signal from the reference pick-up depends on the width and reflecting power of the reference mark and its distance to the reference pickup (see figure. 6)
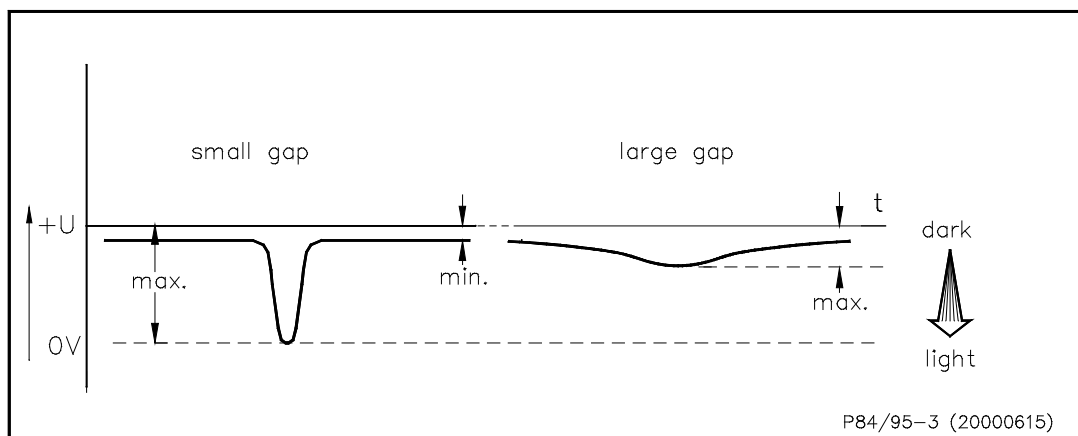

Fig. 6   Output signal as a function of distance

12.5.6 Problems with the reference signal ?

Even in a case where the reference pick-up is correctly connected and the measuring instrument is correctly set up, the output signal of the reference pickup might not clearly distinguish between the reference mark and the surface of the rotating component. The electronic circuit is not able to trigger reliably.

Fig. 7a) to d) illustrate and describe the most frequent causes of this problem.

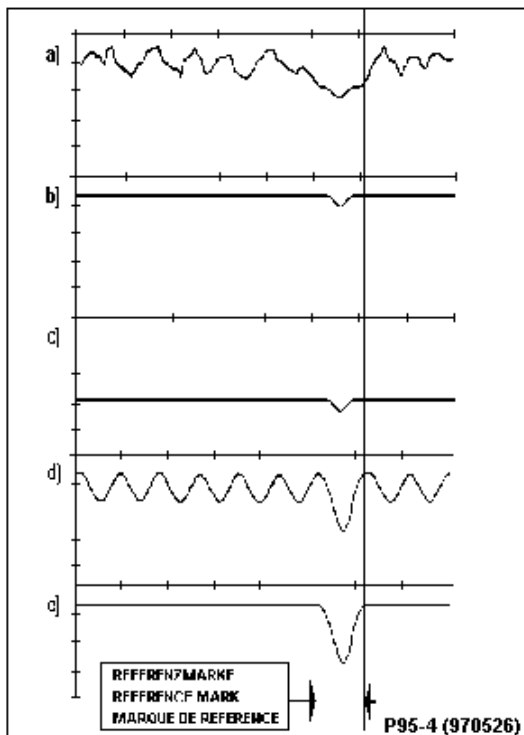Fig. 7e) shows an ideal output signal.

Fig. 7   Output signal of the reference pickup under different conditions

a) Strong "noise" from the shaft surface (irregular reflections due to striations or surface irregularities) and the relatively low voltage rise in the area of the reference mark cause **multiple triggering**.

b) If the distance is **too large**, the amount of light emitted is insufficient. This causes insufficient rise of the output voltage and thus **loss of reference**.

c) If the distance is **too small** (saturation of the receiving diode) or when ambient light is too strong, the voltage rise of the output signal might be drastically reduced and thus **reference will be lost** as mentioned under b.

d) Foreign scattered light from artificial light sources might cause **multiple triggerin**.

e) With correct conditions the signal level in the area of the reference mark can be clearly distinguished from that of the surrounding area and thus supplies a **stable reference**.

Recommendations and corrective action:

The problems described above can safely be avoided by using reflecting tape SCOTCHLITE GAIN RP 7610 (Manufacturer: 3M).

This tape has the following decisive characteristics:

- **Factor 1000 of Reflection compared with a white surface.**

  The foil can thus be used as a white mark even on highly shiny shaft surfaces.

- **Reflection of light in all directions.**

  This characteristic permits an inclined setup of the reference pickup. This helps absorption of a large amount of reflected light whereas undesired reflections from the shaft are very weak or have no effect at all.

The typical problems described and the characteristics of the reflecting foil result in the following recommendations:

- The optimum distance between the reference pickup and the surface with the reference mark should be **30 ... 40 mm**. The diode might reach saturation if the distance is < 20 mm.

- The optimum angle of the reference pickup vertical to the axis of shaft rotation should be **0 ... 15°** (see Figure 8). Right-angled installation might lead to scattering of the reflected light; the reflected signal level will be too low at angles above 30°.
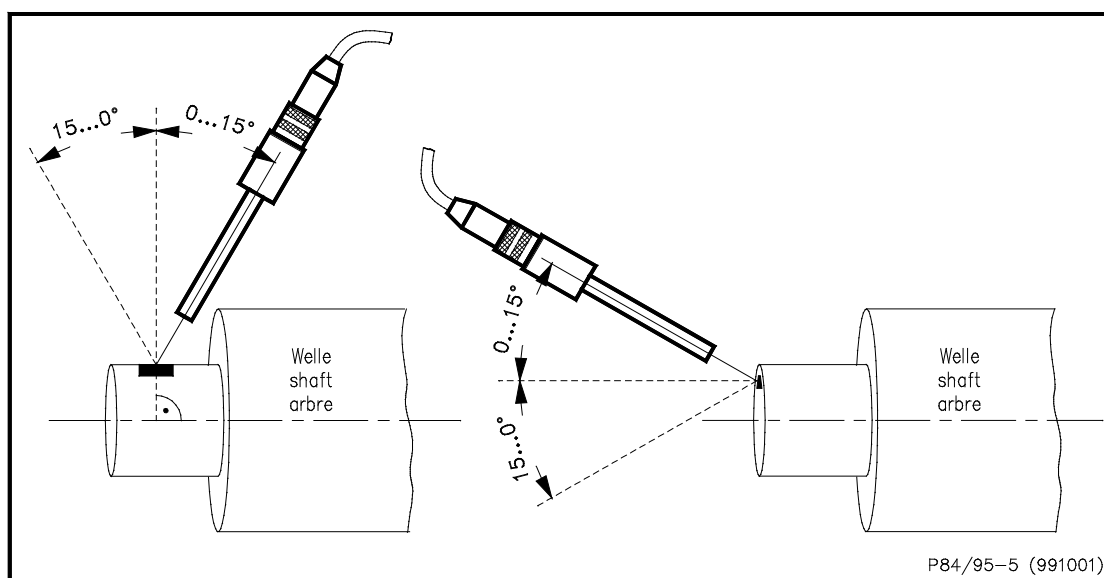

Fig. 8   *Optimum installation angle of the reference pickup*

Setting up using an oscilloscope

In case of doubt or problems, use an oscilloscope to examine the output signal of the reference pick-up.

13   Appending EG-conformance statements

Brüel & Kjær Vibro

EG-Konformitäts-Erklärung
Declaration of conformity

Hiermit bescheinigt das Unternehmen / *The company*

Brüel & Kjær Vibro GmbH
Leydheckerstraße 10
D-64293 Darmstadt

$C\,E$

die Konformität des Produkts / *herewith declares conformity of the product*

Schwingungsmessgerät / Vibration measuring equipment

Typ / *Type*

VT-60 (VIBROTEST 60)

mit folgenden einschlägigen Bestimmungen / *with applicable regulations below*
EG-Richtlinie / *EC directive*

2004/108/EG	**EMV-Richtlinie / EMC-Directive**
2006/95/EG	**Niederspannungsrichtlinie / Low voltage equipment**

Angewendete harmonisierte Normen / Harmonized standards applied

EN 61326-1 : 2006
EN 61010-1 : 2002

Angewendete nationale technische Spezifikationen / *National technical specifications applied*

Bereich / Division
Brüel & Kjær Vibro GmbH

Unterschrift / Signature
CE-Beauftragter

Ort/*Place*   **Darmstadt**
Datum / *Date* **02.12.2008**

(N. Karg)

Brüel & Kjær Vibro

EG-Konformitäts-Erklärung
Declaration of conformity

Hiermit bescheinigt das Unternehmen / *The company*

Brüel & Kjær Vibro GmbH
Leydheckerstraße 10
D-64293 Darmstadt

$C \epsilon$

die Konformität des Produkts / *herewith declares conformity of the product*

Beschleunigungssensor / Acceleration Sensor

Typ / *Type*

AS-065

mit folgenden einschlägigen Bestimmungen / *with applicable regulations below*
EG-Richtlinie / *EC directive*

2004/108/EG　　　EMV-Richtlinie / EMC-Directive

Angewendete harmonisierte Normen / Harmonized standards applied

EN 61326-1:2006

Angewendete nationale technische Spezifikationen / *National technical specifications applied*

Bereich / Division
Brüel & Kjær Vibro GmbH

Unterschrift / Signature
CE-Beauftragter

Ort/*Place*　　**Darmstadt**
Datum / *Date*　**08.12.2008**

(N. Karg)

Brüel & Kjær Vibro