



Brüel & Kjær Vibro



VIBROTEST 60

More than just a vibration analyser

Predictive Machine Maintenance Holds the Aces!



Years of experience and countless applications have clearly demonstrated the advantages of predictive machine maintenance.

- Higher levels of machine availability
- Prevention of unscheduled production stoppages
- Limitation of machine damage by early fault diagnosis
- Lengthening of intervals between inspections, and
- Timely planning of optimally scheduled repair action

are the bases for the cost-effective significance of this strategy for an entire company.

The prerequisite for this is continuous knowledge of the “current” machine condition during operation. Mechanical vibrations, bearing condition values, speeds and process values are authoritative indicators with which the machine condition can be assessed and faults diagnosed. Which characteristic parameters should be acquired and how often, depends not only on the complexity and absolute value of the machines, but also on the criticality of the machines for the production process.

In practice two methods of data acquisition can be implemented:

- On-line acquisition of data showing the machine's condition with permanently-installed measurement, monitoring and diagnosis systems, and
- Off-line acquisition of the same important data with portable data-collectors and analysing instruments.

Brüel & Kjær Vibro offers the most modern solution for both methods.

The unique feature!

All hardware and software components can be combined.

This provides the power for the data acquisition and evaluation to be done selectively in an “off-line”, an “on-line”, or a “mixed” operation.

This is achieved through a modular design for the PC software concept and a common database for all measured data.

VIBROTEST 60

offers the optimal solution:

- Vibration Analyser
- Data-collector and
- Field Balancer

three essential functions combined in one device as an ideal tool for Condition Monitoring.

VIBROTEST 60- A Modular Concept

The concept

The modular concept of VIBROTEST 60 allows individual combinations of measurement functions and thus opens up many applications. Any time you are able to complement expanded functional modules and upgrade with future improvement and development of measurement functions without difficulties.

VIBROTEST 60 is the ideal instrument for "single-task" or "first-time" users who have future expanded needs for the instrument in mind. At the same time VIBROTEST 60, with its multiple functions, provides the "diagnostics expert" with a solution for universal applications. All this together in an extremely small compact and lightweight instrument operated with only one hand!

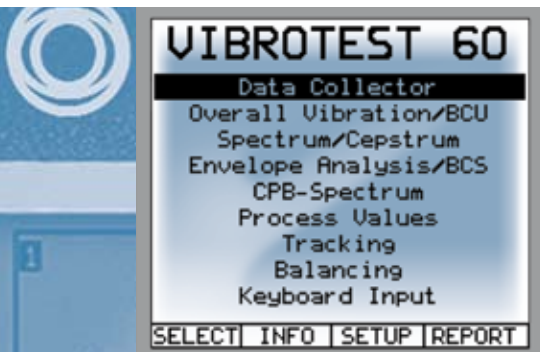
The unique advantages of VIBROTEST 60:

- For the first time an FFT-analyzer, data-collector and field balancer in one handy instrument
- Easy to understand operator dialogue in a number of languages; English, German, French, Italian, Dutch, Czech, Hungarian, Polish, Spanish, Portuguese
- Genuine 2-channel instrument with additional speed measurement channel
- Compact, lightweight (approx. 900g / 2 lb)

- New level of quality in data-collector technology through
 - Extreme speed of measurement and simultaneous processing of up to 5 measurements
 - Multiple Routes and random processing of points in the Route
 - Random switching between analyser and data-collector modes
- State of the art, high-tech digital signal processor (DSP)
- Long instrument life through modular, expandable measurement functions for future developments
- High measurement accuracy and dynamic resolution with 16 Bit ADC
- Excellent FFT-spectrum resolution with 12,800 lines
- Standard acceleration, velocity and displacement sensors can be used
- Brilliant, high-contrast graphic display with backlight
- Unlimited storage capacity and high security for measured data with PC-cards (Compact Flash / PCMCIA)
- Exceptionally attractive price: performance ratio.



Accurately Identifying Machine Condition and Faults



Module 1: Comprehensive Evaluation of Machine Condition

The task

The machine condition can be quickly and simply evaluated with the help of overall measurements such as vibration, displacement, and process values. To do this the relevant parameters are measured, compared with limit values and, usually, the trend of the measurements are monitored over some time period.

From the results a decision can be made whether the machine can continue to operate, detailed diagnostic measurements are necessary or repair action must be initiated.

VIBROTEST 60 offers the solution:

With the measuring functions

Module 1.1:

- Absolute bearing vibrations
- Relative shaft vibrations
- Bearing Condition Unit (BCU)
- Bandpass measurements
- Process values
- Speed measurement
- Manual entry

and the possibility of all relevant indicators for comprehensive machine evaluation are available. VIBROTEST 60 is perfected with the measurement functions of

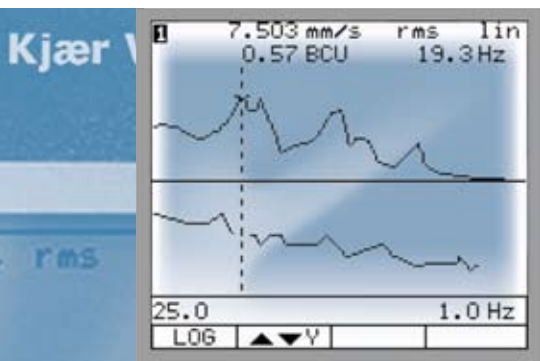
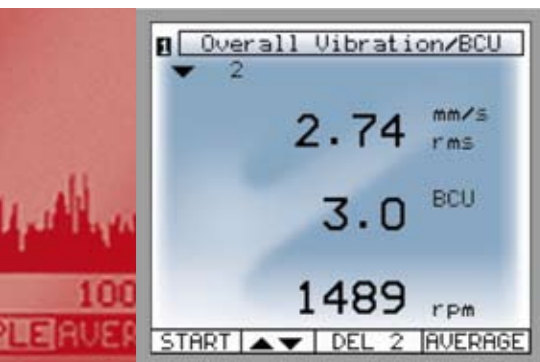
Module 1.2:

- Overall Vibration vs. Speed
- Overall Vibration vs. Time

opening up for you the possibility to observe the behaviour of a machine over a longer time period or an almost freely-definable speed range. This is often required for example in the case of acceptance tests.

The advantages:

- All measurements can be acquired in a measurement list, stored and extended at any time with the "Listing function".
- The Report memory allows an almost unlimited storage capacity with the use of PC-cards. For transfer of data the PC-card is simply inserted in the PC and "read". This means the VIBROTEST 60 itself is always available during this time for your measurement tasks.
- Observation time period of more than 24 hours through a maximum number of data sets (up to 6,400) when recording vs. time.
- The extraordinarily flexible instrument configuration allows different setups of the high- and lowpass filters for broad-band measurement. This guarantees optimum adaptation to the individual measurement task.
- Simultaneous processing of vibration and bearing condition values
- Averaging function for noise influence and beat-effect reduction.



Analysing Measured Data and Diagnosing Machine Faults

Module 2: Machine Diagnosis by FFT-analysis

The task

If unacceptably high overall vibrations or bearing condition units are found in the course of the machine evaluation, the causes must be identified so progressive and specific action can be taken. A frequency analysis (FFT) and envelope analysis, in BCS mode (Bearcon Signature) or in SED mode (Selective Envelope Detection), provides the answer so the increased vibrations can be traced to unbalance, misalignment, a bearing or gear fault or some other source. In those cases where functions already mentioned are not completely authoritative for selective analysis of gear damage, a Cepstrum function delivers additional invaluable information.

VIBROTEST 60 offers the solution:

With the diagnosis methods of

Module 2.1:

- FFT-spectrum and the extended method of an envelope analysis using

Module 2.2:

- Bearcon Signature
 - Selective Envelope Detection and a
 - Cepstrum function
- the causes of faults and damage can be reliably diagnosed.

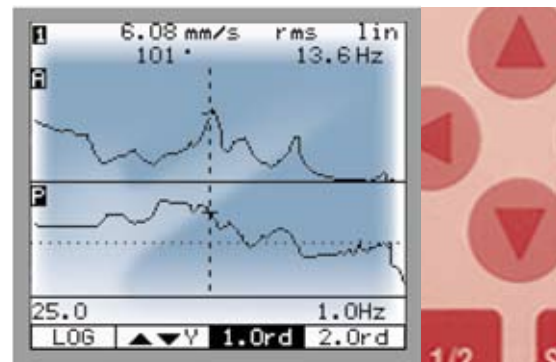
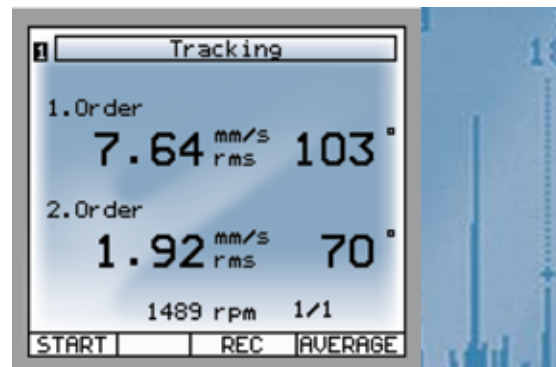
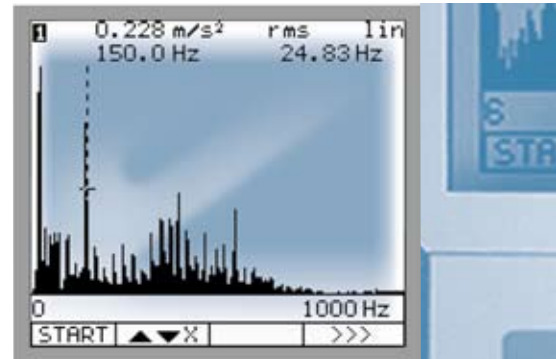
Module 3: Tracking Analysis

The task

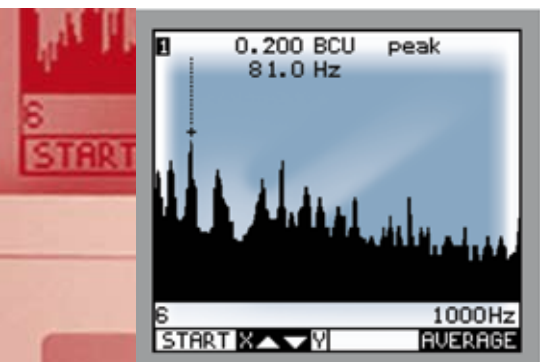
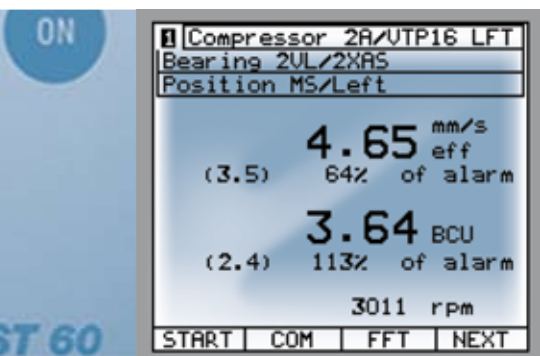
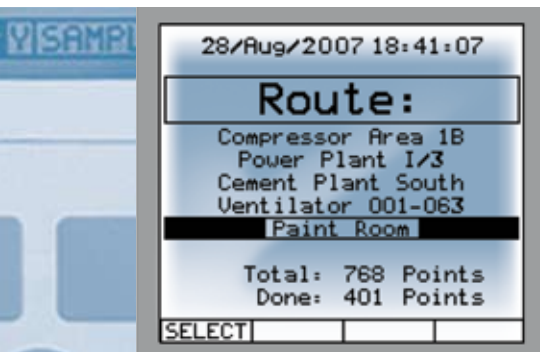
Many faults and types of damage in machines lead to mechanical vibrations with a frequency directly related to the rotational speed of the rotor. Of special interest are e.g. unbalance, alignment errors, blade-pass frequencies, gear-mesh frequencies in gear-boxes, that occur as rotor-synchronous vibrations or harmonics (orders) of the rotor's rotational frequency.

VIBROTEST 60 offers the solution:

The tracking analysis allows an extremely fast and selective narrow-band measurement of rotor-synchronous vibrations. Thus the most important vibration signals from the machine can be analysed specifically during stationary operation or run-up / coast-down or over a longer time period due to thermomechanical events of the machine. At the same time the vibration behaviour the machine exhibits over the entire speed range provides important information about the resonance behaviour of the machine.



Complete Data Acquisition and Selective Evaluation



Module 6: Data-collector

For systematic condition-oriented machine maintenance.

Measurement functions in Data-collector operation

- All the measurement functions of Modules 1.1, 2.1, 2.2 and 8 are possible, i.e. all Overall vibrations, spectra, envelope analysis, Cepstrum and CPB-spectrum
- Measurement channels: 1 channel plus speed measurement

Special advantages of the VIBROTEST 60 data-collector

Simultaneous processing of up to 5 measurements:

- 1 Overall vibration value
- 1 Bearing Condition value or 1 bandpass value
- 1 FFT-spectrum or 1 CPB-spectrum
- 1 Bearcon Signature or 1 Selective Envelope Detection
- 1 Speed measurement

is done with one measurement.

- Multiple Routes, i.e. up to 5 Routes, each with 1,000 measurement points can be processed.
- Random jumping within a Route or between Routes is possible
- Random switching between analyser and data-collector function at any time offers maximum possible flexibility.

- Maximum information on site; with overall measurements, the current value, previous value and the relationship with the alarm value (in %) are always displayed.
- Practically unlimited memory through the quick-change PC-cards. The standard delivered PC-card offers storage space for 5,000 Points (5 Routes each with 1,000 Points), each with typically 1 broad-band measurement and 1 x 400-line spectrum.
- Time-saving and top data security. A direct load and unload between the instrument and PC is no longer necessary. Data transfer takes place between PC-card and PC and the instrument never needs to be connected to the PC interface.

Modul 8: CPB

Constant Percentage Bandwidth is the optimum measurement method for early detection of machine damage in a data-collector operation. False alarms are almost impossible and the important frequencies in the machine spectrum are clearly highlighted. CPB spectra are clearly superior to FFT spectra in the data-collector operation because of their resolution.

Field Balancing with BALANCING EXPERT

Module 7: BALANCING EXPERT Field Balancing at a new level

The task

Unbalance is the most common cause of excessive vibrations and thus damage to bearings, foundations and the rotor itself.

Field balancing offers a number of important cost- and time-saving advantages:

- No dismantling and transporting of the rotor
- The constructional features of the machine and the effects of the mounting conditions are automatically compensated
- Rotors of almost any weight and size can be balanced

VIBROTEST 60 offers with the dual-channel Module 7 BALANCING EXPERT the following Field Balancing functions:

- 1-plane balancing
- 2-plane balancing
- 1 – 2-plane balancing with Prognosis

The unbalance vibrations are measured at both planes simultaneously. *After the first test run the correction weight for 1-plane correction is calculated as well as the anticipated residual vibrations for both measuring planes. This allows many 2-plane machines to be balanced to within the required tolerance by correcting at only one plane.

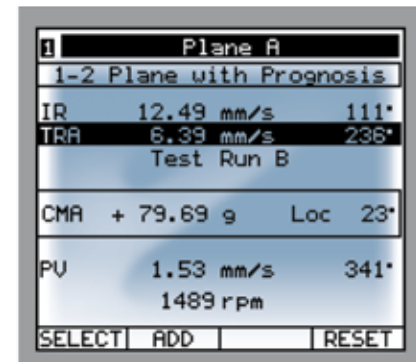
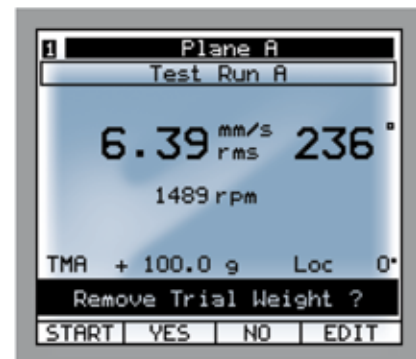
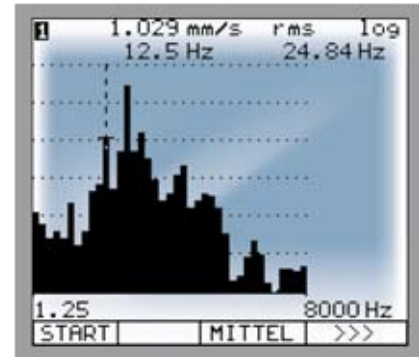
* Module 5 (dual-channel) is not required.

Special benefits of the BALANCING EXPERT

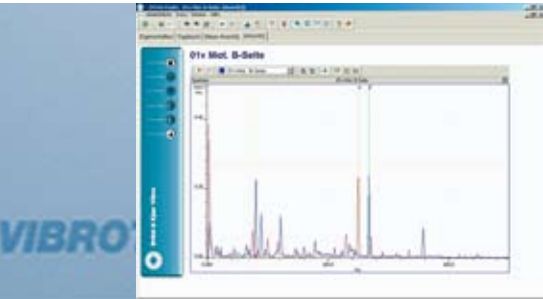
BALANCING EXPERT is the first to offer balancing in the shortest possible time with a minimum number of balancing runs

due to

- optimisation of the residual vibrations at both bearings already after correction in one plane with “1 – 2-plane balancing with prognosis”
- Selectable compensation mode for non-linear machine behaviour, e.g. due to machine mounting
- Elimination of interference, e.g. vibrations originating from neighbouring machine
- Storage of all relevant measurement data. Repetition of measuring runs is unnecessary
- User-friendly, dialogue-assisted operation
- Integrated balancing computer offers a choice of mass correction in polar, component or unitmass form
- Extremely selective tracking filters of 0,3 Hz to 0,01 Hz
- Simplified procedure in case of repeat balancing
- Automatic error-messaging in case of unacceptable speed variations or unsuitable test weights
- Generation of a balancing report with VIBRO-REPORT



Working in a System: PC-software for VIBROTEST 60



Two powerful PC-software packages operating under Windows are available for VIBROTEST 60:

1. xms extended monitoring software

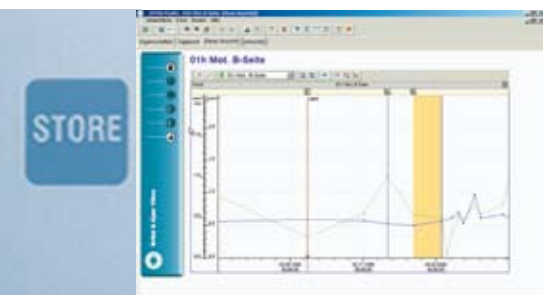
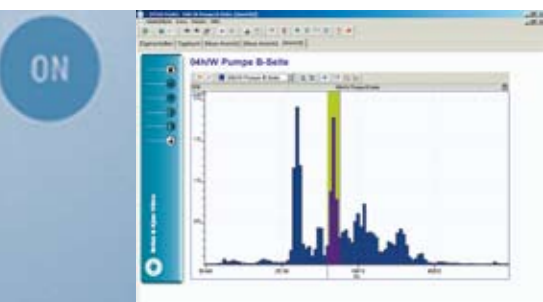
xms is the professional software for optimum implementation of the concept „condition-oriented machine maintenance” and provides perfect support through an intelligent database for systematic use of the entire machine data.

The modular construction of xms offers all the options to structure the full extent of its functions completely according to your individual requirements. In addition to the Basic Module, whether the VIBROTEST 60 is used in the analyser or the data-collector mode, two Interface Modules are available. xms is complemented and perfected by various Analysis and Diagnosis Modules.

You can find out more about the merits of the software and other important information from the xms product brochure.

Furthermore, in a combined „Technical Specification” especially prepared for the purpose, a summary of the extent of the functions of each software Module is compiled in a compressed overview.

xms, the software that impresses even the professionals.



2. VIBRO-REPORT

VIBRO-REPORT allows all measurements to be displayed, in graphic diagram form or as a measurement list, and printed out for documentation purposes.

An overview of the most important features of the VIBRO-REPORT:

- For use in a pure off-line operation, i.e. only for individual measurements in the Analyser mode of the instrument
- For fast data transfer between instrument and PC via the PC-card
- Graphic display of the measurements, including cursor and Zoom functions
- Zoom-preview for better orientation in the graphics routine
- For Producing Reports in a Field Balancing Operation
- For specific entry of headers and footers for descriptions in preformatted report documentation
- Fast printout of measurements and diagrams, including documentation of the instrument setup
- Export of measured data for further processing in Windows programs
- For Printing of Field Balancing Reports

Technical Data

1. Measurement processing

- Measurement channels
(Basic instrument plus Module 5)
Real Dual-channel with 4 internal measurement paths for parallel acquisition of machine vibrations and bearing condition at each channel Plus speed channel
- AD converter
AD converter 16 Bit (96dB)
dynamic 1 Hz – 20 kHz usable frequency range
1 AD converter for BCU 10 Bit (60dB) dynamic 0 – 48 kHz frequency range
- Vibration measurement types
Vibration acceleration
Vibration velocity
Vibration displacement
- Signal detection types:
RMS value
Peak value (true & calculated)
Peak-peak value (true & calculated)
Bearing Condition Unit (BCU)
- Units:
g, m/s², mm/s, inch/s, μ m, mils, BCU, eu
- Broad-band Overall values
High-pass:
1 Hz to 10 kHz (selectable in 1/3 octave steps)
Low-pass:
10 Hz to 20 kHz (selectable in 1/3 octave steps)
- Bandpass measurements
High-pass:
630 Hz to 16 kHz (selectable in 1/3 octave steps)
Low-pass:
800 Hz to 20 kHz (selectable in 1/3 octave steps)
- Bearing Condition Unit (BCU)
13 kHz – 48 kHz
- FFT/BCS-spectrum
Frequency ranges
High-pass 1/2/5/10 Hz
Low-pass 20/50/100/200/500 Hz
1/2/5/10/20 kHz
- FFT/BCS/SED No. of lines
100/200/400/800/1,600/3,200/
6,400/12,800
- FFT/BCS/SED Averaging
RMS, linear, exponential,
peak-hold
- FFT/BCS/SED Windowing
functions:
Uniform, Hanning, Flat-top
- Process values inputs
+/- 30 V, 0/4 - 20 mA
- Speed:
Speed range
30 – 600,000 rpm
Speed / Ref. Ratio (S/R)
xxx / yyy
 $0.01 \leq S/R \leq 99$
- Measurement accuracy
Vibration measurement typically
+/- 2% of measured value
Speed measurement typically
+/- 0.01% of measured value
Phase angle typ. +/- 1°
Process values
+/- 0.3 V, +/- 0.5 mA
- Tracking / Field Balancing
Frequency range 1 Hz – 10 kHz
Automatic selection of bandwidth:
Tracking 2 – 0.01 Hz
Balancing 0.3 – 0.01 Hz
Orders in tracking mode:
1st order plus selectable
additional order 2 – 99
- CPB-spectrum
Bandwidth:
Steps 70% / 23% / 6%
(selectable)
High-pass:
1,1/2,2/4,5/9/18/35 Hz
(selectable)
Low-pass:
1,1/2,2/4,5/9/18 kHz
(selectable)
Averaging time:
3 – 999 seconds

2. Connections for sensors

- Inputs:
2 connectors for measurement sensors
1 connector for speed/ ref. sensor, each via 6-pole sockets
- Sensor types
a/v/s to max. 36 Vpp
Process values +/-30 V
0/4 - 20 mA
Reference sensor P-84/P-95
- Sensor power supply
2-4 mA/24 V current source
+5 V/20 mA
+24 V (only reference channel)

3. Hardware

- Display
Backlit LCD with high brilliance
160 x 140 pixel
- Slot for PC-card (PCMCIA)
Compact Flash (CF) with adapter
- Battery operation
Period typically 2 x 3 h
(2 quick-change batteries supplied, simultaneous charging)
- Main power operation
With power charger unit 84 – 265 VAC, 48 – 400 Hz
- Operating temp. range
Display 0 - +50°C
Instrument -10 - +60°C
- Dimensions
Approx. 255 x 90 x 50 mm
- Instrument weight
Approx. 900 g incl. battery

VIBROTEST 60

Extent of Delivery and Ordering Information

VIBROTEST 60

Single channel basic instrument with Speed Channel and Module 1
“Overall measurements” Consisting of:

- 1 Measuring instrument type VIBROTEST 60, with selectable operator dialog in German, English, French, Dutch, Italian, Spanish, Portuguese, Hungarian, Czech and Polish languages
- 1 Power and charger unit, type AC-601, for power operation and simultaneous charging of 2 batteries
- 2 Batteries, type AC-602
- 1 PC-Card, type AC-603/32 as storage media for measured data 32 MByte (approx. 15,000 overall values) extension with larger PC-Cards possible
- 1 Acceleration sensor, type AS-065 with connecting cable, 5 m (16,4 ft) long type AC-437 mounting magnet type AC-172 probe tip AC-272, threaded stud AC-350
- 1 Short-form operators manual in the language of the instrument dialog (please order the required language)
- 1 Set technical documentation in German, English or French (please order the required language)
- 1 Case, type AC-605, for transporting the instrument and accessories
- Measurement functions:
 - 1 Module Overall measurements
 - Vibration values
 - Bearing Condition Units
 - Process values
 - Speed
 - Manual entry of values (Reference sensor Option 606 not included)

Module 1.2: Extension Module for Machine Evaluation

- 1 Module Overall measurements vs. speed $f(n)$ and time $f(t)$

Module 2.1: Basic Module for Machine Diagnosis

- 1 Module Machine Diagnosis FFT-analysis

Module 2.2: Extension Module for Machine Diagnosis

- 1 Module Machine Diagnosis BCS/SED envelope-analysis, Cepstrum-analysis

Module 3: Tracking Analysis

- 1 Module tracking analysis (Reference sensor Option 606 is not included)

Module 5: Dual-channel Function

- 1 Module Dual-channel function for acquisition of all measurement types for measurement modules “Overall measurements”, “Machine Diagnosis”, “Order tracking analysis” and «CPB-spectrum»

Module 6: Data-collector

- 1 Module Data-collector Measurement functions:
 - “Overall values”
 - “Spectra/Cepstra”
 - “BCS/SED envelope-analysis”
 - “CPB-spectra”, «Speed»
- 1 holster AC-604
- 1 Spiral cable AC-436

Module 7: BALANCING EXPERT Dual-channel field balancing

- 1 Module Dual-channel Field Balancing for 1-plane balancing 2-plane balancing, and 1–2-plane balancing with prognosis

Attention:

Second vibration sensor and ref. sensor, with accessories, not included (see Options)

Module 8: CPB-spectrum

- 1 Module CPB-spectrum

PC Software Packages

XMS

- for professional condition-oriented machine maintenance

VIBRO-REPORT

- for transfer of measured data to a PC, display and printout of measurements (no database, no Route management)

Options

Option 602/X

Additional acceleration sensor type AS 065 with accessories

Available order codes

Option 602/1

- with 1 connecting cable type AC-437, 5 m (16,4 ft) long

or

Option 602/2

- with 1 spiral cable AC-436
- Operating frequency range: 1...15,000 Hz
- Operating temperature range: -50...+121°C (-58...+250°F)
- Transmission factor: 100 mV/g
- Extent of delivery:
 - 1 Acceleration sensor type AS-065
 - 1 Mounting magnet, type AC-172
 - 1 Probe tip AC-272
 - 1 threaded stud AC-350

Option 603

Vibration velocity sensor type VS 080 with accessories

- Operating frequency range: 1...2,000 Hz
- Operating temperature range: -40... +100°C (-40...+212°F)
- Transmission factor: 75 mV/mm/s
- Extent of delivery:
 - 1 Vibration velocity sensor type VS-080
 - 1 Connecting cable, type AC-435, 5 m long (16.4 ft)
 - 1 Mounting magnet, type AC-273
 - 1 Probe tip AC-171
 - 1 Threaded stud AC-350

Option 606

Photo-electric reference sensor

Option 606-1

- 1 Reference sensor type P-95

Option 606-2

- 1 Connecting cable, type AC-185/5, 5 m long (16.4 ft)

Option 606-3

- 1 Magnetic stand, type AC-525

Option 606-4

- 1 Roll reflective tape, type AC-526, 5 m long (16.4 ft)

Option 610

Extension cable for all sensor types

Option 610-1

- 1 cable, type AC-185/5, 5 m long (16.4 ft)

Option 610-2

- 1 cable type AC-185/20, 20 m long (65 ft)

Option 611

Additional batteries

- 1 Exchangeable battery pack, type AC-602

Option 612

Additional PC-Card for data storage

Option 612-2

- 1 PC-Card type AC-603/32

Option 615

Connecting cable for acceleration sensor AS-065

Option 615-1

- 1 cable type AC-437, 5 m long (16,4 ft)

Option 615-2

- 1 spiral cable type AC-436

Order information and completion

- All instrument modules, software modules and Options can be combined as desired
- Future extensions (upgrades) are easily executed by software unlocking of the desired instrument functions, by delivery of the extension software, by delivery of further hardware

As a rule all extensions can be carried out by the user.

Please provide the following information when ordering:

Initial orders:

- VIBROTEST 60
 - desired instrument modules
 - language for the short operators manual (one of the instrument dialog options)
 - language for the technical documentation (German, English or French)
- PC-Software
 - desired Software modules
 - language version for the documentation (English, German or French)
- Options
 - desired option number/s

Upgrades:

- Instrument and software:
 - desired modules
 - The instrument number and software fabrication number are required

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