VIBROTEST 60

More than just a vibration analyser
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 costeffective significance of this strategy for an entire company.

In practice two methods of data acquisition can be implemented:

- On-line acquisition of data showing the machines’ 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.
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 analyzer 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.
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 and the possibility of
  - Manual entry
  - 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.
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 gearboxes, 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.
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.

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

1. **xms**
exended 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
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, µm, 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 ≤ S/R ≤ 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 soft ware, 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
VIBROPORT 80
Vibration Analysis.
Rotor Balancing.
Machine Monitoring.
VIBROPORT 80
Vibration monitoring and analysis made easy

Professional machinery diagnostics to optimize uptime
Vibration, within expected limits, is an inherent characteristic of all rotating machines. However, vibration levels exceeding tolerance limits, as in the case of a machine defect, can result in machine failure and bring production to a total, unexpected halt. In extreme cases, nearby machines are damaged, toxic compounds released and personnel injured.

Since the early 1970s, Brüel & Kjær Vibro has been successfully developing solutions for maintenance-based condition monitoring and field balancing of all kinds of machines in numerous industrial applications. From the first portable vibration measuring instrument VIBROTEST up to today’s VIBROPORT 80, this fundamental design concept continues.

The VIBROPORT 80 is the newest generation of Brüel & Kjær Vibro’s portable measuring instruments. Ease of operation and flexibility in demanding applications continues being important functionality, but the VIBROPORT 80 has been designed to be even more powerful than its predecessors and is equipped with an assortment of new analysis functions.

Brüel & Kjær Vibro’s VIBROPORT 80 is the ideal portable vibration measuring device for capturing machinery vibration and undertaking detailed diagnostics to determine the nature and cause of many developing faults. Its versatility, flexible modular setup and user-friendly operation makes the VIBROPORT 80 the ideal portable vibration instrument for helping deliver machine uptime to your plant.
VIBROPORT 80
For newcomers and professionals

Flexible modules for every need
The VIBROPORT 80 is modular in construction. For the newcomer, there are two useful starter packages available:

The **Analyzer Select** package is for vibration diagnostics. It includes rotational speed, FFT spectra, and rolling-element bearing fault diagnosis (envelope analysis).

The **Balancer Select** package provides one or two plane field balancing functionality using polar plots.*

A variety of modules are available to the professional user. These include functions for: rotational speed, order analysis, time signals and transfer functions. As a result of this modular flexibility, VIBROPORT 80 is ideally suited for both the simplest measurement tasks and the most demanding monitoring and analysis tasks.

Pre-set and customized setups, together with direct access to predefined measurement tasks, simplify the process of working with the device. An optional auto-range function and predefined Brüel & Kjær Vibro sensor settings complete the overall setup concept.

The large colour monitor, alphanumeric keyboard, quick access keys and colour-coded connections make operation intuitive and easy. The enclosure of the VIBROPORT 80 is especially rugged, sealed to IP65 and is available with certification for use in areas with potentially explosive atmospheres.

The report and analysis software **ReX** running on Windows™ completes the performance package.

*A list of the measurement modules that are contained in the newcomer packages can be found at the end of the brochure.

★ The VIBROPORT 80 at a glance
- Modular construction - Additional measurement modules that can be added at any time
- Starter packages
- Frequency range: (DC) 0.18 Hz to 80 kHz
- Field balancing with 2-channel polar plots
- Order analysis (phase + amplitude)
- Time signal displayed and saved for post-processing
- Transfer function (for impact hammer modal analysis)
- Up to 4 measurement channels + rotational speed (triaxial measurements possible)
- Cross-channel function (dual channel measurements such as max. X/Y, orbit, etc.)
- Large colour display (VGA)
- Lithium-ion rechargeable battery (8 hours duration)
- Robust, ergonomic housing (IP65)
- ATEX, IECEx and CSA (explosion protection)
- ReX PC vibration analysis software (Windows™)
VIBROPORT 80
Early fault detection for preventing machine damage

Uncorrected faults on bearings, gears, shafts and couplings can lead to machine degradation and catastrophic failure. Vibration analysis with the VIBROPORT 80 Analyzer Select package enables you to detect developing faults at an early stage, diagnose the cause and trend these, so maintenance can be planned ahead time without risking degradation and machine failure.

Characteristic values
The overall condition of a machine and its bearings can be evaluated by means of characteristic values that can then be compared with limit values in accordance with DIN ISO 10816 or those provided by the manufacturer. Characteristic values are the total root mean square (RMS) value of the vibration components in a defined frequency range. The FFT Analyzer module is the perfect tool for determining the individual components, which are vital for correlating with the source/cause of the vibration.

The VIBROPORT 80 Overalls module uses up to four vibration measurement channels. This enables triaxial measurements to be carried out in parallel (as stipulated in DIN ISO 10816). Naturally, VIBROPORT 80 supports the measurement and display of characteristic values as a function of rotational speed (optional upgrade) and as a function of time.

FFT Spectrum
FFT analysis resolves the total vibration into its individual frequency components. Each spectral line has its specific frequency and amplitude. The amplitude typically represents the “fault severity” while the frequency represents the “fault location”. This makes it easier to reliably diagnose machine faults such as unbalance, gearbox damage, misalignment and rolling-element bearing damage.

Rolling-element bearing diagnosis
Characteristic values and spectral analysis are methods typically used for the detection and diagnosis of rolling-element bearing faults. The characteristic values are particularly effective for fault detection and trending, so maintenance can be planned ahead of time.

Spectral analysis techniques such as an FFT and envelope analysis are ideal for diagnosing the type and location of the rolling-element bearing fault. VIBROPORT 80 offers two spectral analysis techniques: BCS (Bearing Condition Signature) analysis and the SED (Selective Envelope Detection) analysis. Both techniques are based on the fault amplitude modulation of a carrier frequency, i.e. envelope analysis. BCS analysis...
A significant proportion of all machine faults can be attributed to unbalance of rotors. Although rotors are, as a rule, built into the machine precisely balanced after the manufacturing process, unbalance can result because of mounting tolerances and the residual unbalance of components over a period of time. These machines can be effectively balanced on-site.

For this purpose VIBROPORT 80 offers the Balancing module. In-situ balancing of rotors (field balancing) has several advantages:

- No dismounting and transport of the rotor
- Takes into account on-site mounting conditions (e.g. bearing clearances)
- Field balancing is independent of the size and weight of the rotor

The balancing procedure can be viewed on the screen in a tabular form (numerical display with bar graph) or using individual polar plots. Every balancing procedure can also be stored as a report and called up later to save time whenever the balancing procedure has to be repeated.
Modal analysis determines the natural frequencies, i.e. resonances of machines. For optimal operation of a machine, it is important to avoid (or minimize the duration) with coincidence between the rotational speed frequency and the structural resonance frequencies. This will minimize excessively high vibrational loads during the run up, coast down or steady-state operation of the machine.

These critical frequencies can be determined by two different methods: rotational excitation or impact excitation. Order analysis establishes the resonance frequencies by rotational excitation, induced through the inertial force produced by the residual unbalance during shaft rotation. The transfer function determines the structural resonances by impact excitation on a shaft that is not rotating.

The VIBROPORT 80 facilitates modal analysis by offering both the Tracking and Transfer Function modules.

Order analysis (Tracking)
Order analysis is carried out during operation of the machine and serves to analyze the rotor frequency-induced vibration components and their harmonics. The VIBROPORT 80’s Tracking measurement module can be utilized for both run-up and coast-down of the machine.

The new feature here is the two-step procedure:

Step 1: During the run-up or coast-down, the raw vibration signal and the rotational speed are recorded by using up to three measurement channels plus the rotational speed.

Step 2: After successful measurement, you select the modal analysis technique to evaluate the recorded signals. Since the raw vibration signal remains available in the unit, you can repeat the analysis as often as you want with different setups. That is a particular advantage if a second measurement is very time-intensive (long machine coast-down times) or if the machine is critical for production and the process should not be interrupted unnecessarily.

Highlights of the TRACKING MODULE (Order analysis)
- Identifying machine resonances
- Innovative measurement approach in 2 steps:
  1) Recording the raw vibration signal
  2) Post-processing the raw signal: Bode, Nyquist, FFT waterfall, spectrogram, table (overall value plus 2 harmonics)
- Up to 3 input channels for vibration signals (triaxial measurements possible)

Transfer function (impact hammer)
For modal analysis of machines with shafts that are not rotating as well as for the analysis of immovable objects such as, for example, foundations or frameworks, the impact method is employed.

The transfer function is determined with an impact hammer having a built-in load sensor. It is the ratio between the input signal (load introduced by the hammer blows) and the output signal (measured vibration).
VIBROPORT 80
Documenting success

Highlights of the
TRANSFER FUNCTION
MODULE

- Identifying structural resonances using an instrumented impact hammer
- Determination of machine component relative movement
- All conventional evaluation methods available (load, acceleration, displacement)
- Coherence analysis (in percent, with colour coding)
- Up to 3 input channels for vibration (triaxial measurements possible)

VIBROPORT 80 also offers the Time Signal and Acceptance Test modules.

The Time Signal function enables you to visualize the raw signal and store it in a standard (.wav) format. This format permits subsequent post-analysis by, for example, the ReX software or MatLab™.

The Acceptance Test function is often used for quality inspections in batch production (final acceptance). It compares characteristic values with limits established by standards, such as DIN ISO 10816. The module also allows you to draw on predefined or personally defined measurement tasks (setups).

ReX – Report and EXaminer Software

The ReX software supports the VIBROPORT 80’s measurement modules. The software can be installed on all current Windows™ PCs and the standard version is included in the Analyzer Select and Balancer Select packages. Reports can be generated quickly and easily from measurements stored in the instrument. VIBROPORT 80 is connected to the PC via a USB port.

The optional premium version enables you to analyse the previously stored time signal data sets (.wav files) so they can be post-processed for calculating FFT and waterfall spectra. For the analysis of rolling-element bearing defects, ReX provides an OEM database that lists the characteristic fault frequencies of all common rolling-element bearing manufacturers.

Highlights of the
ReX PC SOFTWARE

- Powerful reporting and analysis functions
- Windows™ operating system (up to Windows™ 7, 32 and 64 bit)
- Supports all available measurement modules
- Single and multi-user + client/server
- Premium version
  - Can be retrofitted
  - Supports post-processing of .wav files (time signal) for subsequent calculation of FFT and waterfall spectra
  - Integrated rolling-element bearing data base with error-indicating markers
- Test version running 3 months after initial installation and including premium version functionality
**Technical Data**

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### 1. UNITS AND MEASUREMENT TASKS

**Units**
- Acceleration
- Velocity
- Displacement

**Measurement tasks**
- Overalls (characteristic values)
  - Total vibration and rolling-element bearing fault frequencies
- Overalls vs. rotational speed f(n) and time f(t)

**VP**
- CREST factor
- Max. X/Y (2-channel function)
- FFT spectrum (100 to 25,600 lines)
- FFT window functions: Hanning, Hamming, flat-top, rectangular (overlap 0 to 99%)

**传感器**
- Envelope spectrum (BCS, SED)
- Orbit (2-channel function)
- Time signal (raw signal) of the vibration and the reference signal
- Phase
- Cross-channel phase (2-channel function phase difference)
- Transfer function
- Process value (DC, Volt)
- Gap (DC, Volt)

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### 2. SENSORS AND INPUT CHANNELS

**Sensors**
- Vibration acceleration
- Vibration velocity
- Vibration displacement
- Process (no sensor supply)
- OK monitoring

**Input channels**
- Channel CH1: measurement channel 1 or Triax 1, 2, 3 (vibration)
- Channel CH2: measurement channel 2 (vibration)
- Channel USB HOST/ CH R: measurement channel 4 (vibration), impact hammer, head phone (audio out)
- Channel USB DEV / TRIG/PWR: Rotational speed/reference, USB (out)

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### 3. MEASUREMENT RANGE

- Input channels: Nominal maximum +/- 25 Volts peak-to-peak (Over-voltage protection +/- 50 V, transient)
- Input range: sensor units, auto-range or maximum 25 V
- Dynamic range: >90 dB
- Frequency range: (DC) 0.18 Hz to 80 kHz (max. frequency dependent upon number of channels)
- Rotational speed: 1 to 99,000 rpm (limited by standard reference sensor, higher rotational speed possible)

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### 4. MEASURING INSTRUMENT

**Enclosure**
- Dimensions: 220 x 220 x 71 mm
- Weight: 1.54 kg
- Display: 6.4" TFT VGA, LCD, Backlight (640x480, 18-bit colour)
- LED: blue, green, yellow and red
- Rechargeable battery: Li-Ion 6600 mAh (operating time 8 hours)

**Storage**
- Internal: 128 GB DDR SDRAM
- External: max. 16 GB SD/SDHC card

**Environment**
- Protection class: IP65 (dust and water spray, EN60529)
- Drop height: 1.2 m (4 ft) – in accordance with MIL STD-810F
- Operating temperature: -10 to +60 °C (+14 to +140 °F)
- Storage temperature: -20 to +60 °C (-4 to +140 °F)
- Humidity: 10 to 90% relative humidity, not condensing 0 to +50 °C (+32 to +122 °F)
- Shock/vibration: according to MIL STD-810

**Approvals/Certificates**
- CE, RoHs, C-Tick

**Explosion protection**
- ATEX and IECEx II 3G Ex ic IIC T4 Gc Ta= -10 °C to +50 °C in conformity with 94/9/EC (only VP-80 E)
- CSA Class I, Div 2 Groups A, B, C & D, temperature code T4A@Ta=50°C (only VP-80)

**Communication**
- USB (directly on the measuring instrument or via the docking station)
- Microsoft® ActiveSync®
- Mobile Device Center (Windows™ 7)
- Operating system: Microsoft® Windows™ Embedded CE 6.0
- Processor: Marvell 806 MHz PXA320
- DSP: Motorola Freescale DSP56311

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*A detailed specification can be found in the download section of our website at [www.bkvibro.com](http://www.bkvibro.com)*
Included in the newcomer packages

VIBROPORT 80 – “Analyzer Select” Package consisting of:
One VIBROPORT 80 measuring instrument with standard accessories in a carrying case AC-7101 with a license for ReX Standard/client (USB dongle)

- Rechargeable battery AC-7003 (built-in)
- SDHC-storage card 4 GB (enclosed)
- Docking station AC-7307
- Mains power supply AC-7001
- USB connection cable (PC) AC-1390
- Y-cable USB-Power AC-1389
- Shoulder strap AC-7309
- Protective case AC-7305
- Hand straps (2x) AC-7308
- Leather bag for small parts AC-7306
- Protective covers for input sockets AC-7301
- One vibration acceleration sensor AS-063 (with threaded bolt AC-350)
- One magnet AC-273
- One measuring aluminium probe AC-272
- One sensor connection cable AC-1384/0050 (5 m, flat)

Includes the following modules:
Overall (basic characteristic values): Module 1.1
FFT-Analyser: Modules 2.1 and 2.2 (Envelope spectrum BCS/SED)
2-channel function: Module 4

VIBROPORT 80 – “Balancer Select” Package consisting of:
same as VIBROPORT 80 – “Analyzer Select” and, in addition,

- Second vibration accelerometer AS-063 (with threaded bolt AC-350)
- Second magnet AC-273
- Second sensor connecting cable AC-1384/0050 (5 m, flat)
- Option 806 (reference sensor P-98 with accessories)

Includes the following module:
Balancing: Module 7

Additional modules, as described in this brochure, can be retrofitted at the owner’s option. For more detailed information on this, please see the Order Information for VIBROPORT 80 that you can get from our sales representative or by sending an e-mail to info@bkvibro.com.
VIBROCONTROL 4000

Sensitive Machine Monitoring
Reliable Machine Protection with
VIBROCONTROL 4000

Brüel & Kjaer Vibro
has for many years been one of the leading manufacturers of machine protection systems. From our extensive product range VIBROCONTROL 4000 is one of the most tried and tested machine protection systems on the market. Highest precision and reliability are distinctions of the systems.

VIBROCONTROL 4000 offers optimum protection through permanent condition monitoring.
This means:
• Acquisition of current machine condition through continuous measurement of relevant condition and operating parameters
• Recognition of deviations from the desired condition
• Alarming at violation of limit values
• Plant shutdown when dangerous conditions exist
• Communication with control systems

VIBROCONTROL 4000 meets all important requirements of internationally recognised guidelines such as API 670 and DIN 45670

Measured values are processed and compared with adjustable limit values in the individual monitoring modules of VIBROCONTROL 4000. 4 limit relays are available for each module for alarm signalling. In addition to the general customary limit values for pre- and main-alarms, in this protection system the measured values trend is also monitored. Unexpected sudden changes in the measured value which indicate abnormal behaviour initiate a trend alarm and thus permit an extraordinary level of sensitive monitoring of the machine condition.

VIBROCONTROL 4000 guarantees high operational security through:
• Variable time delay of the alarm signalling
• Adjustable limit value multiplier for monitoring transient operating conditions with elevated limit values
• Power-up error protection switching for prevention of false alarms after a power failure
• Self-monitoring of the measurement circuits for recognition of defective measurement circuits
• Limit value blocking at disturbances in the input measurement circuits

VIBROCONTROL 4000 passes every practical test
• Digital display for monitored variables
• Status displays for self-monitoring and limit value signalling
• Buffered analogue outputs for each channel
• The Modbus interface simplifies communication with any control system
• Standard 19" technique with short rack depth for standard cabinets.
• Plug-in terminals blocks permit extremely easy cabling connection
• Power supply module with extraordinary wide power tolerances.
• Small variety of universal modules and therefore lower spare parts inventory costs
• Sheet-steel encapsulated modules guarantee ruggedness and interference suppression
VIBROCONTROL 4000 allows continuous monitoring of all measurement variables that are monitored today for assessment of machine condition:

- Absolute case vibrations
- Relative shaft vibrations
- Relative axial shaft position
- Rolling-element bearing condition
- Speed
- Temperature
- Shaft and casing expansion
- Eccentricity
- Pressure, bearing forces, etc.

**Quality and operational security**

The high quality standard and operational security are guaranteed through consistent checking and control from manufacturing to delivery.

The Brüel & Kjær Vibro test programme includes, amongst others, 100% product input testing, "Burn In" methods for component selection, pre-ageing and testing of equipped printed circuit boards as well as testing and function checking of complete constructional units with the most modern, automatic test systems.

Moreover the operational security of VIBROCONTROL 4000 is further heightened through microprocessor techniques.

These include:
- Permanent RAM and ROM tests
- Watchdog check of all cyclic sequences
- Redundant archiving of all data.
Central Components and their Functions

The RC-400 rack corresponds to the international 19" system. The connections for all modules slots are provided through the transverse wiring (back panel). When extending an existing monitoring system, no further back panel wiring is necessary. Two slots in the RC-400 rack are fixed. On the extreme left is the Power Supply module with the Control Panel in front. Next to this in module slot position "0" is the first Computer-Interface. The remaining 12 module slots can be arbitrarily equipped with monitoring modules or multiplexer modules.

**Dimensions:**
- 6 HE high, 19" wide
- 84 TE for modules

**RC-400 rack**

1. Control panel for display and reset functions
2. Backlit LCD display for measurements and limit values
3. Status displays and LEDs
4. Sheet-steel encapsulated 19" rack
5. Service interface for connection of programming instruments
6. Fields for measurement point labelling
7. Alarm signalling through LEDs
8. Diagnosis outputs at BNC sockets

**PS-410/420/430**

**Power Supply**

This Power Supply module provides the necessary power to the rack, modules and all connected sensors.

**Input power**

**PS-410:**
- 93 ... 140 VAC
- 184 ... 264 VAC
- 45 ... 400 Hz

**Power consumption**

**PS-410:**
- 160 VA

**Input power**

**PS-420:**
- 19 ... 38 V DC

**Power consumption**

**PS-420:**
- 205 W
**TP-419**
**Control panel**
Using the pushbuttons on the TP-419 Control Panel, the various measurements and setup values can be displayed at the monitoring modules.

In addition the
- Alarm signals can be reset and
- the trend monitoring can be adapted to changing operational requirements.

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**MX-410**
**Multiplexer**
This module operates in conjunction with the CI-421 Measurement and Interface module as a programmable measurement point selection switch. Controlled by the programme the desired measurement channel is selected and the existing signal is processed in the CI-421 according to the predefined measurement instruction.

**Inputs**
- 31; dynamic and static signals

**Output:**
- 1; selected input signal

**Signal span:**
- 50 V p-p in the range ± 25 V

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**CI-411**
**Interface module for**
- Communication between PC and monitoring module through the RS-232 interface

**CI-412**
**Modbus Interface module for**
- Communication between PC and monitoring modules through the RS-232 interface
- Communication between process control system and monitoring modules through the supplementary Modbus interface

This Interface module provides the RS-232 interface through a Modbus interface with the following features:
- rear panel, RS-232-C full duplex, asynchronous point-to-point

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**CI-421**
**Measurement and Interface module for**
- Communication between PC and Monitoring modules through the RS-232 interface
- Control of Multiplexer modules MX-410
- Measurement processing and intermediate storage
- analogue measurement preparation
- digital signal processing (characteristic variable formation, FFT)
- frequency-selective measurement when operating with a shaft reference sensor
# VIBROCONTROL 4000 Monitoring Modules

## Vibration and dynamic signals

All types of vibrations, such as:
- absolute case vibrations
- relative shaft vibrations

can be monitored with this module in the frequency range 1 Hz...10 kHz

**VB-430**

**Inputs:** 2  
**Signal span:**  
- max. 30 V p-p in the range ± 25 V  
**Measurement variables:**  
1) Vibration displacement  
- vibration velocity  
- vibration acceleration  
2) Radial shaft displacement in V  
**Signal detection:**  
- RMS  
- Peak value (p)  
- Peak-peak value (p-p)  
- Calculated peak value (pc)  
- Maximum excursion (smax)  
- 1X integration selectable  
**Measurement ranges:**  
- freely programmable  
**Limit values:**  
- LIM 1 / LIM 2 (Measurement variable 1)  
- Trend (ISO 7919)  
- LIM x (Measurement variable 2)

**VB-410**

This module contains additionally the frequency linearisation for Brüel & Kjær Vibro vibration velocity sensors and thus is suitable for monitoring low-frequency case vibrations.

**VB-420**

This module offers additionally the possibility for rolling-element bearing condition monitoring with Brüel & Kjær Vibro acceleration sensors. Simultaneous monitoring of:
- case vibrations and  
- bearing condition  

is possible with **one** acceleration sensor at each measurement point.

## Static signals (<10 Hz)

This module offers universal measurement processing of static and quasi-static signals. The two input signals can be coupled with one another, e.g. for monitoring:
- axial shaft position  
- relative and absolute expansion  
- any current / voltage signals

**GP-410**

**Inputs:** 2  
**Signal span:**  
- max. 50 V, in the range ± 25 V  
**Measurement variables:**  
- static and quasi-static  
**Limit values:**  
- LIM 1 / LIM 2 (pos. violations)  
- Trend (ISO 7919)  
- LIM 1 / LIM 2 (neg. violations)

**GP-420**

This module is used for monitoring of quasi-static signals. A typical application is monitoring of eccentricity.

**Speed, Rotation direction and speed change**

Using only one sensor, monitoring of:
- speed, speed change and  
- zero-speed is possible.  
Through the use of a second sensor, monitoring the rotation direction is also possible.

**TA-410**

**Inputs:** 2 (Impulse)  
**Impulse frequency / input:**  
- 1 Hz ... 20 kHz / > 0.5 V... 60 Vpp  
**Translation:**  
- 5-character multiplier/divider  
**Measurement variables:**  
1) Speed; 2) Speed change  
**Limit values:**  
- LIM 1 / LIM 2 (pos. violations)  
- Trend (speed change)  
- LIM 1 / LIM 2 (neg. violations)
VIBROCONTROL 4000 – the Hardware

Generally valid technical data for the modules

<table>
<thead>
<tr>
<th>Configuration:</th>
<th>through computer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement processing:</td>
<td>digital with microprocessor</td>
</tr>
<tr>
<td>Connections:</td>
<td>Plug-in terminal strips</td>
</tr>
<tr>
<td>Inputs:</td>
<td>2</td>
</tr>
<tr>
<td>Measurement range:</td>
<td>freely programmable</td>
</tr>
<tr>
<td>Display:</td>
<td>LCD, digital, 2-line, graphic-capable for displaying measured values and units at the monitoring modules.</td>
</tr>
<tr>
<td>Status displays:</td>
<td>with LED With self-monitoring and limit value signalling</td>
</tr>
<tr>
<td>Buffered outputs:</td>
<td>2 per channel (Original signal) Front panel BNC sockets; Rear panel terminals</td>
</tr>
<tr>
<td>Analogue outputs:</td>
<td>2 at the rear panel 0 ... 20 mA, 4 ... 20 mA 0 ... 10 V, 2 ... 10 V Update rate 0.5 s</td>
</tr>
<tr>
<td>Limit value delay:</td>
<td>0...999 s, programmable</td>
</tr>
<tr>
<td>Limit value multiplier:</td>
<td>Factor 1 ... 10 for dynamic measurements</td>
</tr>
<tr>
<td>OK monitoring:</td>
<td>effective at LED and central OK relay</td>
</tr>
</tbody>
</table>

limit relays: 4 per monitoring module

Relay data: max. switch load: 1.25 KVA (AC) Ohmic load: 96 W (DC) max. switching voltage 250 V (AC) 48 V (DC) max. switching current: 5 A (AC/DC)

Control inputs: **central**, at the Power Supply module for the entire rack ■ Limit value multiplier ■ Alarm override ■ Alarm reset ■ Trend reset **local** at the monitoring module ■ Limit value multiplier ■ Alarm suppression ■ Switch off self-monitoring ■ Switch over the monitoring of channel A to channel B

Sensor power 2 x -24 V; max. 30 mA; Short-circuit proof

Operating temperature range: 0°... 50°C

Storage temperature range: -20°... 70°C

VIBROCONTROL 4000 – an information centre for machine diagnosis

By connecting to the prepared interfaces of VIBROCONTROL 4000 a problem-free system for diagnostic monitoring of machine condition is available.

In conjunction with the VIBROEXPERT CM-400 Software and a commercially-available PC, VIBROCONTROL 4000 forms a network-capable on-line system for intermittent monitoring the machine condition in a complete machine plant. Simple operation and overview displays distinguish the VIBROEXPERT CM-400 software. It is a powerful tool for trend analysis of vibration characteristics and process parameters or for analysis of spectra, time signals or harmonics. With the help of this system, the optimum maintenance time can be reliably assessed and damaged machine components can be clearly identified.
VIBROCONTROL 6000™

Dependable Safety Monitoring
Brüel & Kjær Vibro has developed the VIBROCONTROL 6000™ Safety Monitoring system (VC-6000™) to the highest technical standards for reliability, scalability, performance in an uncomplicated design. This plant-wide safety monitoring system, representing the accumulation of over 50 years of experience in vibration monitoring and analysis, has been designed in close cooperation with both machine manufacturers and end-users. The system is also fully supported by our renowned worldwide sales and support network to ensure all components are optimally selected, installed and commissioned to satisfy the client’s requirements for the most demanding applications.

Wide reaching applications
The VC-6000™ continuously monitors vibration and process signals from permanently installed sensors on machines in a number of different industries, such as the Oil & Gas, Petro-chemical, Power and other heavy process industries. It is scalable and can be used as a plant-wide monitoring system covering a wide range of machines such as steam turbines, gas turbines, hydro turbines, axial, centrifugal and reciprocating compressors, motors and generators, pumps, ventilators, extruders, agitators, gearboxes, etc. It is well suited for both machine OEM installations and new or retrofit end-user installations.

One of the important applications for the VC-6000™ is replacing the growing number of ageing safety systems in the market; many of which are obsolete or no longer reliable. As Brüel & Kjær Vibro is completely independent of machine manufacturers, unbiased monitoring solutions can be provided to both OEM suppliers and end-users. The VC-6000™ is compliant to many international standards and is designed to be highly compatible with existing installations, thus simplifying retrofits. Safety systems no longer belong to the “install and forget” product concept. There is valuable information that can actively be used by operators on a daily basis. Powerful communications capability allows the VC-6000™ to be interfaced to most process control systems for visualization without jeopardizing its safety monitoring functionality. Of course the VC-6000™ can also be used as the data acquisition platform for the Compass 6000 Condition Monitoring system.

Most importantly, the VC-6000™ is based on a modular application design concept that allows it to cost-effectively fit most monitoring applications with minimal setup. High reliability with powerful performance and technology does not need to be complicated or expensive.
The unique VC-6000™ design gives added value to your application

The VC-6000™ design concept includes a number of features and functions that give you the high reliability and performance needed for today’s machine operation and maintenance requirements.

**Modular application concept**
The VC-6000™ economically fulfills the most demanding applications quickly and easily. A number of factory pre-configured standard modules can be ordered to monitor specific machine types, thus reducing installation time and the risk of improper setup. For those special applications that require a non-standard monitoring strategy, Brüel & Kjær Vibro offers general-purpose modules with fully configurable measurements, outputs and voting logic relay control.

**Compliance**
The VC-6000™ fulfills all the important requirements of ISO-7919, ISO-10816 and API-670; the leading standards for vibration measurement and safety monitoring of machines.

**Compatibility**
The VC-6000™ can be delivered in high-quality 19” rack-based cabinets, or placed in existing cabinets on-site with a minimum depth of 400 mm. The high channel density monitor modules (half normal height) can easily replace existing 19” rack-based safety systems with room to spare. The VC-6000™, with its versatility, can process signals from all commonly available sensors; vibration displacement, vibration velocity, vibration acceleration, temperature, pressure sensors, etc.

**Reliability designed from the onset**
All monitoring modules in the VC-6000™ operate completely independently of one another, so local faults remain local and do not affect the other modules. Applications using data visualization have no affect on the safety monitoring functions. Comprehensive self-monitoring with the control of a local OK-relay is provided in each module to annunciate errors due to sensor or cable faults. Redundant power supplies can also be configured for additional security.

**Performance**
Many safety systems provide “standard” broadband radial and axial safety related measurements and little else. This is fine for protecting machinery, but provides little help with operation & maintenance decisions. In addition to standard safety measurements, the VC-6000™ also offers more advanced monitoring functionality without requiring a condition monitoring system or software. These include:
- Shaft eccentricity
- Vector measurements for various orders
- X-Y relative shaft vibration
- Casing vibration
- Shaft relative expansion
- Casing absolute expansion
- User-defined narrow band measurements (absolute and tracking)
- Speed, zero-speed
- Any process values, e.g. temperature, pressure, and many others
- Rolling-element bearing condition measurements
- Rod-drop for reciprocating compressors
Primary components and their functions

The system racks consist of 1 to 4 Safety Monitoring modules (SM-610), 1 to 2 Power Supply modules (PS-610) and one removable Communication interface module (CI-620), all within a 3U high 19" rack (RC-600). Several racks can be mounted within a cabinet, which can include racks specifically designed for external power supplies (RC-610). The 7126 Setup and Data Display software runs on a Windows-based PC, utilizing data transferred from the CI-620 module.

SM-610 Safety Monitor modules

There are a number of different monitor modules designed for specific applications or tasks. Contact your Brüel & Kjær Vibro Sales representative for the current list. There can be up to four modules in a single RC-600 rack, and all monitoring modules in the VC-6000™ operate completely independently of one another. A local fault in one module will not affect the other modules.

Generic characteristics

Most of the modules include the following:
- DSP-based signal processing
- Up to 12 input channels (AC/DC)
- Up to 12 different output channels
- Trip Override and Trip Multiplier functions activated by binary signals, speed range or global (i.e. rack-wide) external control
- 10 ms reaction time (typical)
- Sensor power supply
- Time series signal export for post-processing analysis by the Compass 6000 Condition Monitoring system
- Potential-free relay outputs for alarms signalling
- Galvanically separated DC outputs
- Differential inputs
- “Fail-safe” operation
- Independently-operating measurement and monitoring
- Local Logbook.

Inputs

The modules accept most types of vibration and process sensor inputs. Contact your Brüel & Kjær Vibro Sales representative for the current list.

Outputs

Up to 12 buffered galvanically separated DC output signals and potential-free relay outputs.

Local display

- 3 LEDs displaying monitoring status (Alarm, Danger, Relay latching)
- 4 LEDs displaying system status (OK, TM, TO, Aux.)
- 12 LEDs displaying for sensor status (OK).

Inputs

The modules accept most types of vibration and process sensor inputs. Contact your Brüel & Kjær Vibro Sales representative for the current list.

Outputs

Up to 12 buffered galvanically separated DC output signals and potential-free relay outputs.

Local display

- 3 LEDs displaying monitoring status (Alarm, Danger, Relay latching)
- 4 LEDs displaying system status (OK, TM, TO, Aux.)
- 12 LEDs displaying for sensor status (OK).
**PS-610 Power Supply module**

The PS-610 Power Supply module provides all the modules installed within a rack and their connected sensors with the necessary power. The modules can be used for different redundant power supply concepts.

The following input voltages can be used (in parallel):
- AC input (100-240 VAC, 2 A, 50-60 Hz)
- DC input (24-48 VDC, 7.2 A)

The following variants are available:
- PS-610/0 for installation into the RC-600 rack (including blind panel, length adapter, connection set)
- PS-610/1 for installation into the RC-610 rack for RC-600 external power supply

**CI-620 Communication Interface module**

The CI-620 is used to configure the VC-6000™ and for scalar data transfer (i.e. data visualization using the Type 7126 software). It has a LAN connection (Ethernet TCP/IP) and two serial interfaces (RS-232 and RS-485) for Modbus communication. The export of a digitized time series is carried out through the LAN interface for signal analysis and storage by the Compass 6000 Condition Monitoring system.

The CI-620 features and functions include:
- OPC display interface with RC-600 rack and SM modules
- Single / dual Modbus RTU
- Setup and Service functions (Firmware download)
- Data export
- Data import
- System OK relay
- Trip Multiply (binary input)
- Trip Override (binary input)
- LED display "Run" for the operating condition
- Reset relay function
- Time-synchronisation of modules
**RC-600 19” rack**

The rack has a standard 19” design with a depth of 325 mm (and half the height of conventional safety systems).

- Up to 36 input channels per rack with an internal PS-610/0 Power Supply module
- Up to 24 input channels per rack with two internal PS-610/0 Power Supply modules
- Up to 48 input channels per rack with an external Power Supply module in a RC-610 rack

**RC-610 19” rack**

A power supply rack, in 19” design and with a depth of 235 mm, is available for the external power supply for up to six RC-600 racks. Each RC-610 rack can hold up to six PS-610 Power Supply modules.

**Type 7126 Setup and data display software**

This basic software, which comes standard with the VC-6000™, is used to configure the communications and the monitoring modules of the VC-6000™. The easy-to-use Windows-based software can also be used as a control room user-interface for displaying measurement data, alarm status and setups, and for acknowledging of alarms from any number of VC-6000™ monitors. During machine commissioning, all measurement values and setups can automatically be stored at regular intervals in a file for baseline documentation.

**VC-6000™ Accessories**

**AC-4608 Buffer panel**

The 12-channel buffer panel is directly connected to a Safety Monitor module via a cable and provides the galvanically separated output signals at BNC sockets.
The VC-6000™ has a versatile high-speed communications interface capability for remote system setup, data visualization, resetting of relays, and condition monitoring.

**Integration to process control systems**

Scalar vibration and process data can not only be exported to SCADA and distributed control systems (DCS) via relays and DC outputs (4-20mA), but also via digital interfaces (RS-232, -485 and 100 Mbit Ethernet) using the widely used communication protocols of OPC (OLE for process control) and also Modbus RTU (Modbus / Dual-Modbus). The digital interfaces also allow alarm and setup information to be exported, as well as for operators to reset relays from a remote location.

**VC-6000™ in combination with the Compass 6000 Condition Monitoring System**

The VC-6000™ can at anytime be upgraded as a data acquisition platform with the Compass 6000 Condition Monitoring system, without interfering with its safety monitoring functions. An OPC interface is used for sending scalar measurement data and alarm information over the LAN for processing in the Compass 6000 Condition Monitoring software and subsequent storage in a database. Time series data is continuously exported from the VC-6000™ by proprietary means over the LAN enabling more advanced post processing and analysis in the condition monitoring software, e.g. spectra, envelope analysis, vectors, orbits, etc.