

# balancing news

Information for the quality and performance of rotating equipment - From the Schenck Balancing & Diagnostic Systems Group

## Schenck Turner To Join Forces With Schenck Pegasus

Senior executives from Schenck Turner Incorporated, Orion, MI, and Schenck Pegasus Corporation, Troy, MI, have put the finishing touches on an agreement that will relocate the operations of Schenck Turner from Orion to the Schenck Pegasus facility in Troy. The move is expected to begin within the first quarter of 2003.

Schenck Turner will then continue to manufacture its line of dynamic balancing machines and diagnostic test systems under a new name, Schenck RoTec Corporation. The announcement comes as part of a re-alignment between two sister organizations that operate within 20 miles of each other and market to the same customer base within the automotive industry. With the two organizations under one roof they can then capitalize on the synergies that exist more effectively.

The Schenck Pegasus facility is on 12 acres of property and has nearly 80,000 square feet of office and manufacturing space which will allow Schenck Turner to expand its manufacturing capability. "The merge between Schenck Pegasus and Schenck Turner, and the move to the facility in Troy, will provide greater efficiency for both organizations. The larger facility in Troy also lends itself to further expansion and therefore greater capabilities for Schenck Turner," said Schenck Turner's President, Heinz Gerst.

In anticipation of the move, engineers from Schenck Turner have already started working with the staff at Schenck Pegasus in order to integrate some of its manufacturing processes more effectively. The 52,000 square foot facility in Orion, MI, has also been listed on the commercial market.



Schenck Turner facility, Orion, Michigan



Schenck Pegasus facility, Troy, Michigan

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## High-Speed Balancing Using Damped Roller Carriages

**Our new technology expands capabilities of high-speed applications**

by Ron Green

**Why high-speed balancing?** High-speed balancing is recommended for rotors that are flexible at service speed because they exhibit bending modes at service speed that may not be readily identifiable at lower balancing speeds where the rotor remains rigid. Bending at service speed may result in vibration levels that reduce efficiency, and can contribute to premature bearing failure. It also may result in hard rubs that can damage seals, buckets, stator cases and other hardware.

In the past, high-speed balancing of large rotors at service speeds could only be accomplished on oil film type bearings, i.e. sleeve or pad type bearings. This was normally done using DH-type machines with additional hydraulically actuated stiffening devices and oil film type bearings. Oil film type bearings of various

more on page 5

# The New PC-Based CAB 802 Instrumentation is Here!

by Joseph Alberto

**Our new CAB 802 is designed to provide operators with complete versatility to view balancing results,** manipulate measurement data and provide comprehensive analysis in an easy to use Windows environment. It features an industrial PC-based microprocessor and a wide variety of advanced balancing functions for horizontal and vertical machine applications.

**Schenck's Windows-based Computer Aided Balancing Software** guides the operator through the balancing process in a few simple steps and offers a wide variety of display options to graphically present measurement results on a clear, easy to read TFT display. Operators can navigate through common balancing functions using softkeys on the front of the unit and a slide-out QWERTY keyboard with touchpad mouse which is also available to enter data and run programs. The PC-based system allows balancing and measurement data to be exported to nearly any

Windows program as well as communication via e-mail or on-line. The entire system can also be integrated within a corporate network to exchange data with other departments such as production, management and quality control.

**Configurations** — The CAB 802 Instrumentation is available for horizontal and vertical balancing machines. Hard-bearing and soft-bearing

balancing machine designs are fully supported. The CAB 802H has been developed for use with horizontal hard-bearing applications. The CAB 802R fully supports horizontal soft-bearing balancing machines. For vertical static balancing machines measuring in a single plane, the CAB 802VE is available for both hard-bearing and soft-bearing applications. The CAB 802V was developed for two-plane vertical dynamic balancing machines, and is capable of supporting both hard-bearing and soft-bearing balancing machines. The CAB 802 offers several unique features and options to maximize productivity and versatility.

**Features** — The CAB 802 is supplied with an active high contrast TFT color display of digital and graphic data. It features a true polar vector display with simultaneous digital indication. The intuitive rotor configuration graphics encourage step-by-step setup instructions. Set-up and operation are accomplished using an operator-friendly front panel incorporating an integrated sealed membrane and an external QWERTY keyboard with touch pad.



The display offers brightly lit unbalance readout values with tolerance comparison and high visibility "IN TOLERANCE" displays when tolerances in each plane have been achieved.



## **Permanent Calibration:**

Like our other hard-bearing instrumentations, the CAB 802 is permanently calibrated for all sizes and configurations of rotors that can be placed in the machine.

**Automatic Sensitivity Selection:** The CAB 802 automatically selects the proper internal sensitivity level so that the instrumentation will always display the correct amount of unbalance, with proper decimal position, for any unbalance magnitude without the operator entering any additional file parameters. This is true regardless if the values are large initial unbalances, or ultra precise, low-level, tolerance values.

## **On-line HELP System:**

The CAB 802 Instrumentation features an On-line HELP feature that can be accessed by the push of a soft key. The On-line HELP screen appears on the monitor with information pertinent to the operation currently being conducted. The On-line HELP feature has the potential to reduce training requirements and increase operator efficiency.



**Biasing or Single Compensation:** This program can be used as a simple and fast means of checking the balancing machine by allowing the operator to artificially create a "zero balanced" test article. Because of this, rotor diagnostics and troubleshooting capabilities are greatly enhanced. This program is also used when balancing complete rotor assemblies during a build-up such as multi-stage impellers. To correct for the unbalance of each component as it is added to the assembly eliminates the potential of creating internal bending moments which can be induced if this feature is not employed.

**Index Balancing:** Also included with the CAB 802 Instrumentation is the Index Balancing software extension, necessary for tooling error compensation. When tooling is used to mount a rotor on a balancing machine, there will be an error resulting from the eccentricity of the tooling. The mounting interface between the balancing tooling and a rotor stage possesses an assembly tolerance, which will result in a runout. If this tolerance, and the resulting runout are not taken into consideration, reported unbalance will reflect this source of error. Therefore, it is advisable to verify the existence of, and to compensate for tooling errors that can adversely influence reported unbalance measurements.

Following the initial run, the Index Balancing program instructs the operator to reposition the rotor by an indexing angle. Another run is performed, and results from the two runs are used to electronically compensate for errors associated with the assembly tolerance between rotor and tooling, as well as the residual unbalance of the balancing tooling. This software option is required for any rotor setup employing rotating balancing tooling.

**Key Compensation:** This program eliminates the need of using keys for balancing by electronically biasing the unbalance caused by the missing key. After a master key is inserted on the rotor and a compensation run is completed the operator can store the key compensation in the rotor file and balance subsequent rotors without having to add the half key or full key.

**Asymmetric Components (Unevenly Distributed Components):** The asymmetric program facilitates accurate corrections when the position of the unbalance is in the area where it is not possible to add or remove material, i.e., on the location of a mounting bolt or similar restricted position. This software extension eliminates guesswork for the operator.

#### SOFTWARE EXTENSIONS AND OPTIONS:

**Printer Documentation System:** The CAB 802 is designed for direct attachment to an on-line printer for printing full page graphics, rotor set-up data, and balancing data including the amount and angle of unbalance for both correction planes. A battery backed, buffered memory prevents loss of data in the event of a power failure.

With a Printer Documentation System, the CAB 802 can print full-page graphics, rotor set-up data, and record the amount and angles of unbalance for both correction planes for each balancing run. Using the print screen feature, in combination with the instrumentation's self-diagnostic system, the user can initiate an effective technical support process with Schenck personnel. The Printer Documentation System also enables the operator to print documentation from the operations manual using the On-line Help function, a standard feature of the CAB 802 instrumentation.

**Averaging Over Runs/Marking of Values:** This function is invaluable when one is balancing rotors with large, loose components that demonstrate a

Your Schenck balancing machine is designed to provide dependable service far beyond your initial performance expectations. However, as electronic technology progresses, many instrumentation components are no longer available and the availability of spare parts for our older units are limited or even non-existent.

We support these instruments to the best of our ability. However, we often cannot guarantee that some of our older instruments can be repaired if replacement parts are no longer available.

#### Instrumentation with non-existent or limited availability of spare parts:

- All M-200 Series
- All M-400 Series
- CAB 500
- CAB 570
- CAB 590

While many of these instruments are still in operation today, an instrument upgrade should be seriously considered in order to avoid production interruptions in the future.

"scatter" phenomenon, which is associated with uncontrolled components motion exhibited during balancing, and resulting in run-to-run repeatability problems. When a scatter phenomenon is suspected, Schenck recommends the results from several balancing runs be averaged together to derive a more representative measurement of unbalance. This averaging over multiple runs technique is easily accomplished using the CAB 802 Instrumentation. Averaging Over Runs/Marking of Values facilitates using this technique. The Averaging Over Runs/Marking of Values software extension permits the operator to save the results from several unbalance measurement runs, and display the results of each run on a vector display as numbered points. A plot can be produced from a pre-selected number of points, or a mean value can be calculated for a single result. Balancing runs can be added to, or deleted from the calculated mean value or from the multiple-run plot.



**Electronic Protractor:** This option assures accurate locating of the heavy or light spot for the unbalance correction. With it, a positioning accuracy of 1 to 2 degrees is possible. This accuracy will substantially enhance the operator's ability to achieve the balancing machine's specified unbalance reduction ratio, and possibly decrease the required balancing time for any given part. Note that an angle error of only 6 degrees would create an overall amount error in excess of 10 percent.

(This option requires additional hardware for the drive system of existing balancing machines).

**Recalculation for Unbalance Correction with Weight Distribution Software:** This program facilitates accurate corrections by calculating the exact amount of material for standard correction methods, i.e., drilling, milling or the addition of weights. The drilling program calculates the depth based on the drill diameter, the material density, the minimum drilling distance and the maximum drilling depth. The milling program calculates the correction for a cut to a maximum plunge depth. If there is insufficient unbalance correction at the maximum plunge depth a swing angle is additionally calculated. For the addition of weights the program can calculate equal weights, different predefined weights or material length.



Continued on page 4

# New CAB 802 Instrumentation...

From previous page...

**Rotor Specific Calibration Software:** The Rotor Specific Calibration software will improve the ability to transpose the bearing plane measurements to the correction planes (plane separation). Rotor Specific Calibration should be used when a large cross effect is noted between correction planes separated by a small distance. Rotor Specific Calibration is also useful when the result of rotor weight and balance speed approaches or slightly exceeds the weight-speed squared ( $Wn^2$ ) rating of the machine, or when the rotor deforms while balancing (e.g., fan blades with variable pitch). Balancing machines employing offset roller bearings, which significantly affect the stiffness of the support bearing system, will also benefit from the employment of Rotor Specific Calibration. This program can also allow for a "fine tuning" of the machine to compensate for balancing tooling whose dynamic stiffness is insufficient.

**Static/Dynamic Readout:** This option is particularly useful for balancing rotors with static and dynamic unbalance tolerances, both of which must be achieved.

Static/Dynamic Readout displays the unbalance in three planes. The outside planes display the left and right dynamic unbalance and the center displays the static unbalance. The software allows for independent tolerances for the dynamic and static planes. When used in conjunction with the electronic protractor, the static angle indication is displayed only after both dynamic planes are in tolerance.



For more information, request brochure RC1026e on the reader reply card on page 7.

## Improving the Reliability of Production Processes

Vertical balancing machines — modular, highly reliable and versatile...

by Achim Ertl

**Disc-shaped rotors** such as brake discs, clutch discs, fans, pump rotors or flywheels are fairly common. They only differ in shape, size and weight. Therefore, the optimum balancing machine for such rotors must be flexible to meet all customer requirements.

Vertical balancing machines from Schenck cover the entire spectrum from semi-automatic to fully automatic operation, with unbalance correction methods ranging from drilling, milling, punching and riveting to welding.

Series VM balancing machines with their different modules cover the entire range of customer requirements, making sure that the customer is provided exactly with the machine he requires for his work pieces.

Schenck's modular design enables balancing

machines to be converted easily by the customer for balancing of new rotor types. The machines can be upgraded from simple manual operation to fully automatic systems integrated directly in the production line. Balancing on a vertical balancing machine is fast and cost effective. Unbalance correction can be performed directly on the machine, thus saving time over other systems, where

measurement and unbalance correction are performed on two separate machines. Installation is easy — machines come as one compact unit. Simply place the machine at the intended installation site, connect electrical power and compressed air, and soon your machine will be ready for use.

Measuring units for the VM series are easy to operate and can be tailored for different user requirements. Available measuring units include the CAB 700 measuring units for standard balancing tasks, the Windows NT based CAB 802 for demanding balancing applications and the CAB 850 for production balancing, which is specially adapted to the requirements of large production volumes.

Clear operator prompting, and operation with only a few function keys and touch screen operation make all measuring units easy to operate. Only essential information is displayed on the screen. VM machines require very little training. The machines are therefore suitable for a wide range of applications in different industries from small repair shops to large volume production for automotive manufacturers and their suppliers.



New, VM machine with drill correction



New, fully automatic vertical machine.

# High-Speed Balancing Using Damped Roller Carriages

Continued from page 1...

sizes are required to accommodate a variety of journal diameters, depending upon the journal dimensions of various rotors. Oil film type bearings used in balancing machines typically have hydrostatic pockets and contours to accommodate jacking oil at low-speed (to about 300 rpm) and are designed to retain hydrodynamic oil film to ensure lubrication at speeds from 300 rpm to service speed.

Some manufacturers require that their rotors are balanced in fluid film type bearings. In addition, heavy rotors operating at high-speeds, or light rotors operating with high journal surface velocities, require fluid film type bearings. For all of these applications, Schenck DH or similar type supports are essential.

## **Vibration damping is key to high-speed**

**balancing:** The oil film of sleeve or pad type bearings possesses damping characteristics, which normally reduce the maximum vibration amplitude to a safe limit, thus allowing a rotor to pass through a critical speed without causing damage to the rotor.

Standard H-Type machines employ supports that are rigidly mounted for low-speed balancing in permanent calibration mode. The conventional twin roller carriages used in hard-bearing type supports possess little or no damping, thus producing significantly larger vibration amplitudes than would be experienced when operating in an oil film type bearing. Operating with these large vibration amplitudes is more prone to cause rotor damage and pose safety risks.

## **Modular machine design offers new potential:**

Schenck recently introduced a new modular machine design for our universal balancing machines that allow users to interchange pedestals for different applications. The new modular split support design also permits exchange between sleeve bearing housings and horn assemblies. The new insert features modular horn assemblies that allow the operator to exchange twin roller carriages to accommodate differing journal diameters and interchange standard twin roller carriages with damped roller carriages.

**What are Damped Roller Carriages?** Schenck's new damped roller carriages feature an elastomeric film or wedge between the twin roller carriage assembly and the horn assembly. The elastomeric film changes the damping characteristics of twin roller carriages, making them suitable for high-speed balancing of flexible rotors (see Figure 1). Damped roller carriages may be used for high-speed balancing most rotors under 44,000 pounds with speeds under 4,500 rpm without experiencing rotor journal damage. With modular supports, conventional rollers can also be used.

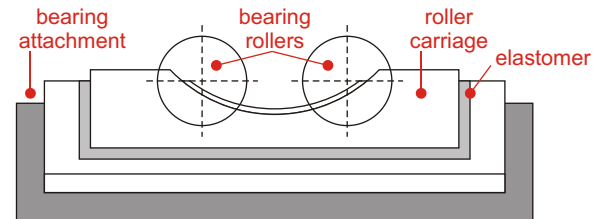
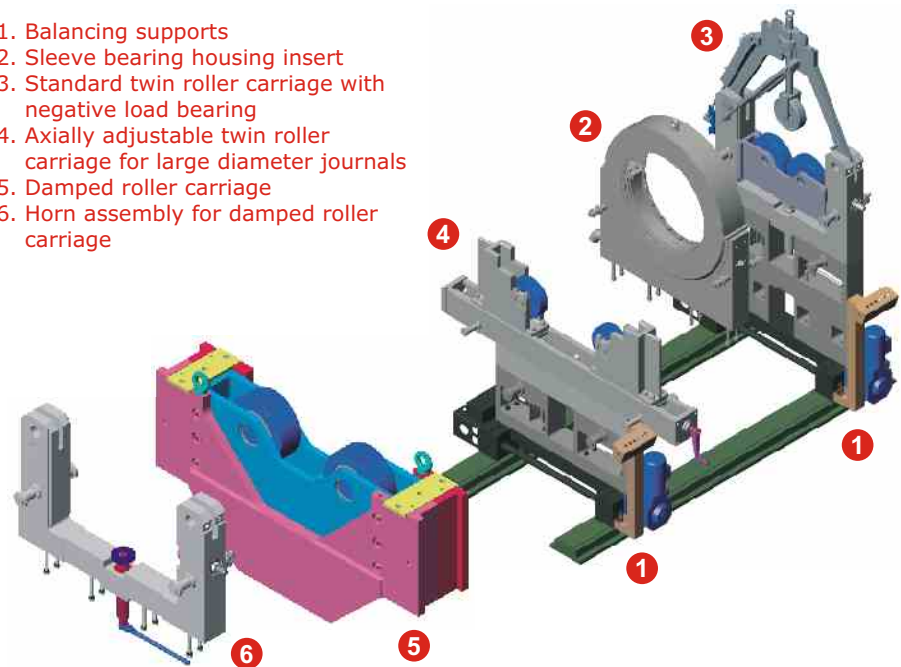


Fig 1. New, damped roller carriage design.

## **Damped Roller Carriages increase range of**

**operation:** Damped roller carriages expand the range of a standard machine to permit high-speed balancing of flexible rotors. High-speed balancing of flexible rotors on normal rigid twin roller carriages is limited to relatively small lightweight rotors. This limitation is due to high vibration levels from excitation of rotor/system resonances with insufficient damping. Subsequently, high contact pressure between the roller and rotor journal occurs when the rotor passes through a critical speed.

1. Balancing supports
2. Sleeve bearing housing insert
3. Standard twin roller carriage with negative load bearing
4. Axially adjustable twin roller carriage for large diameter journals
5. Damped roller carriage
6. Horn assembly for damped roller carriage



Completed on page 7

# Seconds That Count...

**New, fully automatic balancing for electric armatures — superior features, competitive prices!**

by Lutz Graf

The new 440 KBTU-N fully automatic balancing machine is even faster than its predecessor, reducing cycle times for balancing of electric armatures by up to 20 percent. This significantly lowers the cost per component being balanced. The new balancing machine also requires only a minimum of commissioning time. All components are mounted on a common base plate and can be easily transported to the production floor for installation.

Due to its compact design, the 4- or 6-station machine has a small footprint that enables cycle times to be reduced considerably. This is due in particular to the reduced operating radius of the transport unit so electric armatures can be transferred more quickly from one station to the next. This saves around one second during the balancing process. At a given correction method, the floor-to-floor time is reduced from five to four seconds. In dual-shift operation, at 80 percent of maximum capacity, the number of armatures balanced in one year increases from 2.7 million to 3.3 million. This means that the cost per unit goes down by up to 25 percent.

The machine is also being offered at a highly competitive price. Whereas previous machines usually had a welded housing, the housing of the new KBTU-N is designed as a mineral casting which is more cost-effective. For further time and cost savings, finished machined surfaces with tapped holes for mounting of the different stations are already provided on the machine base. To install the machine on the shop floor, you simply need a crane to transport the machine to its installation site and within a short time, your machine will be ready for use.

Aside from being extremely cost-effective, a base made from mineral casting will offer further benefits, one of them being improved damping properties. Vibrations originating from adjacent machines or internal handling equipment are absorbed to a large extent. In addition, the design is service friendly. Pneumatic lines and electrical cables are routed in cast-in channels with screw-on covers. This means that the machine is easy to service and, above all, easy to keep clean. A modem is provided for connecting to a worldwide remote service network for remote diagnosis or remote maintenance.

The system is equipped with the CAB 850 measuring instrumentation. All functions are controlled from a touch screen terminal. Milling cutter touch points are signalled to the measuring instrumentation for accurate removal of material. Milling curves are automatically adjusted. Theoretical milling curves are monitored on the basis of the floating arithmetic mean of the last 100 rotors and corrected, if necessary. Likewise, change-over from one rotor to the next has become easier, with displays showing the different steps to be performed. Built-in plausibility checks make sure that nothing can be forgotten. This helps to avoid unnecessary operator errors and reduce down time.

Another user-friendly feature of the machine is the mounting bracket that supports the measuring instrumentation. The bracket allows the measuring unit to be adjusted to any desired position, for comfortable, ergonomically correct operation. The new 440 KBTU balancing machines are the ideal solution for wound armatures of all types. They are compact in design, fast, cost-effective and easy to operate.



Compact design, ease of operation and short cycle time are some of the features in the new 440 KBTU-N Automated Balancing Systems.

# High-Speed Balancing Using Damped Roller Carriages

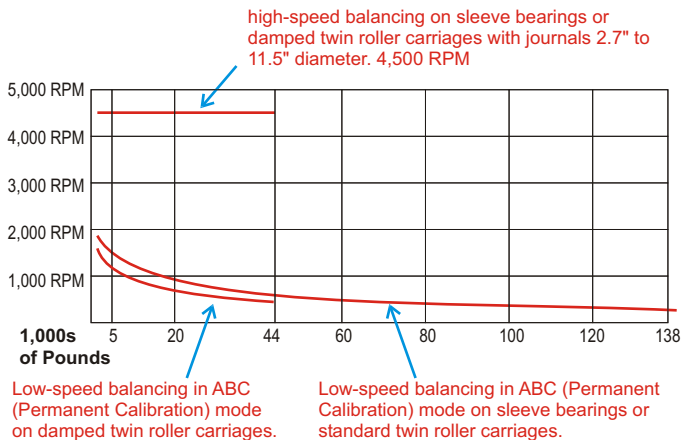
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The Schenck HM Damped Roller Carriage permits high-speed balancing of flexible rotors up to their full rated service speed, provided that the support centrifugal force limit and roller speed ratings are not exceeded. This expanded range of high-speed balancing is due to the unique characteristics that our damped roller carriages exhibit. At low-speed (low centrifugal force ) they exhibit the characteristics of a

incorporating sleeve bearings. As a result, changeover and setup time can be significantly reduced, increasing rotor throughput efficiency.

The new damped roller carriage design offers new opportunity and greater flexibility for smaller service shops handling a variety of rotor sizes. Shops that are subject to harsh environmental regulations will also benefit.

## High and Low-Speed Balancing Rotor weight vs. speed limits on a Schenck HM70 with Damped Roller Carriages



### HM Machine Capacities with Damped Roller Carriages

HM70 . . .	44,000 Pounds . . .	2.7 to 11.5 inch Journals
HM7 . . . .	27,500 Pounds . . . .	2.4 to 9.8 inch Journals
HM60 . . . .	17,500 Pounds . . . .	2 to 7.9 inch Journals
HM6 . . . .	12,000 Pounds . . . .	1.6 to 7 inch Journals

Damped Roller Carriages are registered under US Patent #6,007,252.

normal rigid twin roller carriage. When passing through a critical speed, where the highest amplitudes occur, the damped roller carriages exhibit characteristics closely resembling operation in an oil film bearing (sleeve bearing), thus minimizing contact pressure, damping centrifugal force, and reducing potential of rotor journal damage.

A balancing machine equipped with damped roller carriages is advantageous, because one can balance a variety of both rigid and flexible rotors with the appropriate balancing machine accessories. Therefore, your balancing capabilities are significantly enhanced compared to a conventional hard-bearing design.

**Adjustable for Various Journals:** Damped roller carriages feature a height adjustment to accommodate a range of bearing journal diameters. This height adjustment feature facilitates quick and easy setup of the balancing machine for a variety of journal diameters and rotor configurations. Further, there is no requirement to disconnect and connect oil lines after changeover from one journal diameter to another, as is the case with a balancing system



Please send the following information...

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# VibroTest 60 *New!* VERSION 4

by Roland Kewitsch

The all new Vibrotest 60 Version 4 offers even more features for comprehensive vibration analysis. In addition to Overall Machine Evaluation, Machine Diagnostic Functions, Tracking and Balancing, the latest Version 4 allows the user to observe machine behavior over longer periods, or over a freely definable speed range. New features include Manual Entry to input machine process values, Band-pass Measurement to evaluate bearing condition on low-speed machines, Overall Vibration vs. Speed and Overall Vibration vs. Time.

Two additional features have been included to accurately diagnose the cause of faults and damage including a Cepstrum Analysis Function and Selective Envelope Detection (SED) to diagnose bearing problems on low-speed machines.

A completely new module has also been added with Constant Percentage Bandwidth (CPB) spectrum functions for maximum analysis capability. Traditionally, FFT spectral analysis has been used for fault detection and signal analysis, but it can be time

consuming. The CPB analysis feature guarantees maximum spectral analysis in broad-band fault detection so on-going damage can be identified earlier. This new function provides faster measurement results through reduced number of frequency components (bands) and easier interpretation of the measurement data. Limit values can also be set closer to reference values under "normal" operating conditions so early fault detection is improved because of the high reproducibility of the measurement.

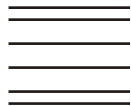


**Now with more features for comprehensive vibration analysis...**

- Cepstrum Analysis
- Selective Envelope Detection (SED)
- Constant Percentage Bandwidth
- Manual Entry mode to input process values
- Band-pass Measurement to evaluate bearing condition on low-speed machines
- Overall Vibration vs. Speed
- Overall Vibration vs. Time

**For more information, request brochure BBF0009e on the reader reply card.**

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