VM2800A & VM3800A VIBRA-CHECK® METERS

Installation Manual

VM2800A **VM3800A**

OVERVIEW

The VM2800A & VM3800A portable Vibration Meter Kits have been designed for use as both an entry level and also a comprehensive vibration monitoring instrument for maintenance engineers across all types of industry.

The kits consist of the compact vibration meter, a hand held probe, a magnetic mount for more permanent installations, a protective carrying case, an instruction manual and battery chargers for both mains and in-car use.

The meters are microprocessor based and, by selection of the controls, can be easily set up to monitor acceleration (g) levels, velocity (in/sec), displacement (µm) and bearing condition (Bg or Bv). A display hold function is also included.

The units, which conform to ISO 2954 and ISO 10816-3 also have an automatic alarm check for bearing condition.

Operating from an internal re-chargeable Lithium battery, the meters offer 48 hours of continuous operation. From flat, the units can be recharged in 3 hours using either the mains or in-car charger supplied with the kit.

Because of their compact size, ease of use and battery operation, the VM2800A & VM3800A allow engineers to monitor vibration levels on important machinery anywhere around the factory.

The VM3800A has all the basic features of the VM2800A plus temperature monitoring capability.

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	Product
1	Vibration Meter (VM2800A or VM3800A)
2	Hand-Held Probe
3	Magnetic Mount with ¼-28” UNF Male Mounting
4	Stainless Steel Vibration Spike 75 mm
5	80 cm Cable with BNC & TNC Connectors
6	In-Car Battery Charger
7	Mains Battery Charger
8	Carry Case

The above accessories are included with each kit.

CONTENTS

1. OVERVIEW

The VM2800A Vibration Meter Kit is a reliable and easy to use hand-held machine condition inspection instrument. It provides vibration measurement, alarm indication and a bearing status check facility. The VM3800A kit provides an additional facility for non-contact temperature measurement. The meter enables plant maintenance technicians to monitor their machines, find potential problems in advance of failure, and to ensure machine reliability.

1.1 VM2800A/VM3800A Kit Contents

- Vibration meter/Vibration meter with temperature, with lithium battery fitted
- Hand-held Accelerometer with TNC Connector
- 80cm cable with TNC to BNC connectors
- Magnetic Mount
- Vibration Spike
- 2 x Battery Charger (Mains + Car)
- Manual
- Carrying Case

1.2 Overall Vibration Mode

The meter can measure vibration Velocity in mm/s RMS, Acceleration in g peak, and Displacement in mm peak to peak. When measuring Velocity, and on switching to the 'Hold' mode, the meter display will indicate an alarm status according to ISO10816-3.

1.3 Bearing Status Mode

The meter measures Bg value in g RMS and Bv value in mm/s RMS which represent the bearing status. The lower frequency machine vibrations are attenuated by a 1 kHz high pass filter. In the 'Hold' mode, the meter display indicates the bearing alarm status.

1.4 Measurement Units

The meters are available in three different configurations for measurement units. These are: Metric 1, Metric 2 and English – see table on page 7 for units used in each mode. In order to change the units, the procedure outlined in 1.5 below must be used. Metric 1 settings are used throughout the manual.

1.5 Configuring Measurement Units

Figure 1 - The VM2800A

Enter Setup Screen

While in a powered off state, push and hold **VIB + BRG**, then push and release **SEL** key, while still holding down **VIB + BRG**. The menu below (Figure 2) should appear.

Figure 2 - Setup Screen

Enter Unit Change Screen

At the Setup Screen, highlight the Information menu (already selected by default) and push **SEL** key. This will enter the Unit Change Screen (Figure 3).

Figure 3 - Unit Change Screen

Changing Units

While in the Unit Change Screen, use **VIB** or **BRG** to cycle through Metric1, Metric2, and English measurement units. See Section 2.3, Table 1 and Table 2 to view the corresponding units used for each monitoring mode. When the desired unit configuration is displayed, push **SEL** to confirm. The device will then return to the initial Setup Screen.

Exit Setup Screen

After confirming the desired units, the initial Setup Screen will be displayed. Press **VIB** once to highlight the **Exit** menu (Figure 4), and then press **SEL** to exit the Setup Screen. The device will enter Overall Vibration Mode and will be ready for normal operation with the preferred units.

NOTE: Do not modify any of the parameters found in the Sensor or Cal. Adj menus. These values are configured by Metrix during initial calibration. Modifying them could result in device inaccuracy or damage.

Figure 4 - Setup Screen Exit

2. OPERATING INSTRUCTIONS

2.1 Sensor Connection

Fit the vibration sensor to the machine measurement position via a magnetic base or stud. Connect the sensor cable to the BNC connector on the meter. When a satisfactory sensor connection is made, the sensor fault icon on the LCD display will disappear. Conversely, the sensor fault icon will appear if the meter detects a poor sensor connection.

2.2 Power On/Off

Power On - Push **SEL** key only for " sec. The meter defaults to the overall vibration velocity range.

Power Off - Push two keys, **SEL + BRG or SEL + VIB** for 1 sec.

The meter will power-off on release of the keys.

The meter will automatically power-off after 3 minutes of no key operation.

2.3 Key Functions

SEL key - Press **SEL** to switch-on the meter. In the Overall Vibration mode press **SEL** to toggle through the measurement parameter options:

OVERALL VIBRATION MODE	MEASUREMENT UNITS - SPECIFIED ON ORDER		
	Metric 1	Metric 2	English
Vel	mm/sec RMS	mm/sec RMS	IPS RMS
DISP	µm pk-pk	µm pk-pk	mils pk-pk
ACC	g pk	m/sec^2 pk	g pk

Table 1

BEARING STATUS MODE	MEASUREMENT UNITS - SPECIFIED ON ORDER		
	Metric 1	Metric 2	English
Bg	g RMS	m/sec^2 RMS	g RMS
Bv	mm/sec RMS	mm/sec RMS	in/sec RMS

Table 2

VIB key - Press **VIB** to toggle between Measure and Hold modes. The Hold mode is indicated by an 'H' in the display.

In the BRG mode press VIB to enter the Overall Vib. Mode.

BRG key - In the Overall Vib. Mode press **BRG** to enter the Bearing Status mode.

In the Bearing Status measurement mode press BRG to toggle between this and the Bearing Status hold mode indicated by an '**H**' on the display.

When the overall velocity reading is in the Hold mode, the meter display indicates the vibration alarm status of the machine according to ISO10816-3 as defined in section 3.

When the BRG velocity or g reading is in the Hold Mode the meter display indicates the bearing status according to a rule-of-thumb assessment as defined in section 4.

2.4 Overall Vibration Measurement & Assessment

At switch-on the meter defaults to the Velocity measurement mode, with the units 'mm/s RMS' indicated at the bottom right of the display.

If required, press **SEL** to select acceleration or displacement. Note that no vibration assessment is available on these ranges.

When the vibration reading has settled, press **VIB** to move to the Hold Mode. An 'H' icon is displayed.

In the velocity range the meter will then indicate either a tick icon for **OK**, a single bell for vibration alert or two bells for danger.

The meter makes this assessment depending on the vibration level and one of the four machine group options selected using the **SEL** key.

The machine groups are defined in ISO10816-3 and the meter categorises these as 'ISO1&3-R', 'ISO2&4-R', 'ISO2&4-F'. R and F refer to rigid and flexible machine mounting respectively.

A label on the back of the meter gives detail of the ISO10816-3 machine groups. The user can refer to this to confirm the appropriate group number for the tested machine. The information contained is as follows in section 2.5.

2.5 ISO Machine Groups

Group 1 - Large machines rated power above 300 kW; Electrical Machines with shaft dia. > 315 mm. Normally sleeve bearings, speed 120 RPM - 15000 RPM.

Group 2 - Medium-sized Machines rated power 15 kW < P < 300 kW; Electrical Machines with shaft 160 mm <dia.> 315 mm. Normally element bearings, speed above 600 RPM.

Group 3 - Pumps with multi-vane impeller and with separate driver (centrifugal, mixed flow or axial flow) with rated power above 15 kW.

Group 4 - Pumps with multi-vane impeller and with integrated driver (centrifugal, mixed flow or axial flow) with rated power above 15 kW.

Support Class - **R** = Rigid Mount. **F** = Flexible Mount.

2.6 Bearing Status Check

Fix the sensor directly to the bearing housing as close to the bearing as possible. Note that valid high frequency readings are unlikely to be measured using hand-pressure and the spike.

Press the **BRG** key to enter the **Bearing Status** mode.

Press the **SEL** key to select either Bg (g RMS) or Bv (mm/s RMS).

When the bearing status reading has settled, press the **BRG** key to enter the Hold Mode (**H**). The bearing status reading is then held and the rule-of-thumb alarm status displayed.

Press the **SEL** key to toggle through and select the appropriate speed range of the bearing shaft. (RPM: < 500, RPM: < 1000, RPM: < 2000, RPM: < 5000, RPM: < 10000).

The meter will then indicate either a tick icon for **OK**, a single bell for vibration **alert** or two bells for **danger**.

The meter makes the assessment based on the rules-of-thumb defined in section 4.

2.7 Battery & Charger

The vibration Meter is powered by an internal rechargeable Lithium-Ion battery which can operate for 48 hours continuously following full charge. The battery condition is indicated by an icon at the top right of the meter display.

The battery charger supplied requires 3 hours to fully charge the battery. An LED on the charger indicated the charge status, being orange when charging and green when charging is complete.

3. THE ISO 10816-3 MACHINE VIBRATION STANDARD

Industrial machines covered by the ISO10816-3 standard include:

- Steam Turbines with nominal power less than 50 MW
- Steam Turbines with nominal power above 50 MW with speeds less than 1500 RPM or above 3600 RPM (i.e. excludes machines included in ISO10816-2)
- Rotating Compressors
- Industry Gas Turbines with nominal power less than 3 MW
- Centrifugal, Mixed Flow or Axial Flow Pumps
- Electric Generators excluding Hydro-electric or pump stations
- Electrical motors of all types
- Blowers or Fans

The standard classifies machine groups as in section 2.5 and defines vibration levels for each group, shown in the chart on page 11, as follows:

- Green - levels expected for a new machine.
- Yellow - levels considered as acceptable for long periods.
- Amber - levels not acceptable for long periods.
- Reds - levels likely to cause machine damage.

It further classifies machines as being either rigid or flexible mounted with the flexible mounted machines being allowed higher vibration levels. The meter indicates a tick box for levels in the green and yellow sections and uses the lower limit for the amber sections and the red sections in its vibration assessments.

INDUSTRIAL MACHINES WITH POWER ABOVE 15 kW AND NOMINAL SPEEDS BETWEEN 120-15000 REV/MIN				
Unit	Group 1 and 3		Group 2 and 4	
mm/s	Rigid	Flexible	Rigid	Flexible
0-1.4				
1.4-2.3				
2.3-2.8				
2.8-3.5				
3.5-4.5				
4.5-7.1				
7.1-11				
11-				

Figure 5 - ISO 10816-3 Vibration Levels

The machine mountings affect the resonances related to the basic running speed of the machine. Machines with rubber or spring mountings often vibrate at low speeds following start-up, and as the speed increases the vibration level is reduced. Such a machine is considered to be flexible mounted.

Modern high speed machines having flexible bearing supports can also be considered as flexible mounted even though not mounted on rubber or springs.

A great advantage of using proper vibration measurements and standards is that future maintenance requirements and costs can be assessed reliably on machine commissioning. For example, if levels of 3 mm/s RMS are measured for a new machine, it is likely to require high maintenance activity. The specific requirement of this is dependant on the machine design and the advice of the machine manufacturer should be sought.

4. BEARING STATUS ASSESSMENT

When the rolling elements move inside a bearing, broadband noise and vibration is generated. This increases if the bearing is not properly lubricated, or is overloaded sue to misalignment or damaged surfaces.

The bearing vibration Bg or Bv measured by the meter is the RMS value of all high frequency bearing vibrations between 1 kHz and 12 kHz.

The vibrations below 1 kHz are suppressed in the Bg and Bv modes to eliminate the measurement vibrations caused by imbalance or misalignment. A practical problem arises in gearboxes, and other machines where steel meets steel, in which vibrations are produced in the same frequency range as bearing vibrations. For this reason bearings should not normally be exchanged on the basis of a high bearing value only. A high bearing condition value is an indication that further analysis is required, and an FFT analyser will indicate if there are frequencies corresponding to the calculated bearing frequencies.

4.1 Bg Value

Bg Value is vibration acceleration within 1-12 kHz in units of g RMS. The reason for using acceleration is that it gives larger values at higher frequency than velocity measurements. The rule-of-thumb assessment of Bg is shown in the chart below.

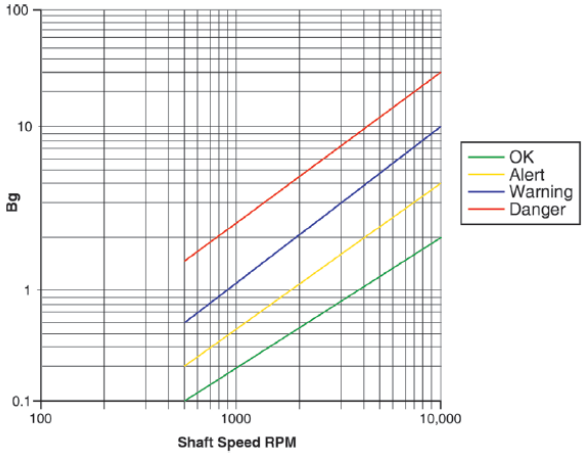

Figure 6 - Shaft Speed RPM Versus Bearing Vibration

4.2 Bv Value

Bv measurement is a long established method for detecting bearing faults which gives reliable indication of bearing condition in 80-90% of cases. The rule-of-thumb assessment used in the metre is as follows:

- Bv < 1 mm/s - Healthy bearing, correctly greased
- Bv = 1-2 mm/s - Possibly damaged or un-greased bearing
- Bv > 2 mm/s - Bearing seizure likely

5. TEMPERATURE MODE RING (VM3800A ONLY)

The VM3800A uses a thermopile infra-red sensor to indicate temperature in Deg. C or Deg. F on the display. An alignment laser beam is provided to indicate the area where the temperature is being measured. Ambient temperature is also indicated in the bottom left of the display.

Figure 7 - VM3800A

CAUTION: Laser radiation - Do not stare into the laser beam

5.1 Surface Temperature Measurement

The temperature sensor measures the average temperature in a circle of diameter one-eight of the distance between the surface and the sensor. For example, when the meter is held 1m from a surface, the sensor will respond to a 125 mm spot diameter on the surface. Thus, the measuring distance will define the size surface to be measured. The maximum recommended distance from the surface to sensor is 2m and hence the maximum spot diameter is 250 mm. The measurement is made as follows:

Switch on the meter using the **SEL** key.

Press the **F/°C** for the temperature mode. Aim the laser beam at the surface to be measured at a suitable distance from the surface, remembering that the temperature sensor spot diameter is one-eight of the distance (i.e. not the laser spot size).

The temperature reading can be toggled between °F and °C using the **SEL** key. Ambient temperature is indicated at the bottom left of the display.

Exit the temperature mode by pressing the **VIB** or **BRG** key.

6. SPECIFICATIONS

Input:	Constant Current Accelerometer 100 mV/g other inputs on request
Vibration:	Acceleration: 0-50 gPk, Frequency Range 10 Hz - 12 kHz
	Velocity: 0-350 mm/s RMS, Freq. Range 10 Hz - 1 kHz
	Automatic Alarm Check: ISO10816-3.
	Displacement: 0-4000 µm Peak-Peak (0-158 mils Peak-Peak),
	Freq. Range 10 Hz - 1 kHz
Bearing:	Bg: 0-20 g RMS, Freq. Range 1 kHz -12 kHz Applies to Bg line & Bv line.
	Bv: 0-25 mm/s RMS, Freq. Range 1 kHz - 12 kHz
	Automatic Alarm Check for Bg and Bv: Rule-of-thumb
Temp. Range:	-40°C to 150°C or -40°F to +300°F (VM3800A only)
Laser Guide:	Red, λ=650 nm <1 mW, IEC 60825-1 compliant (VM3800A only)
Distance Range:	For Temp. measurement 0 to 2 meters (VM3800A)
Accuracy:	+/-5%
Display:	LCD
Power:	Lithium rechargeable battery, 3.6V 1700 mAh, Recharge time 3 hours, >48 hours continuous operation
Temperature:	Operation: -10°C to +50°C; Storage: -20°C to +60°C
Meter Sealing:	IP54 – Dust tight and splash resistant
Spike Length:	75 mm
Magnetic Base:	Diameter 25 mm, H 17 mm, pull strength 12 Kg
Meter Size:	L 115 mm x W 70 mm x D 25 mm
Carry Case Size:	W 342 mm x D 265 mm x H 80 mm
Weight:	Full kit including carry case 1.25 Kgs
Cable Length:	0.8 m (other lengths available)

7. ACCESSORIES

We will provide the following accessories with the VM2800A/VM3800A.

- Hand-Held Probe (VMA - 10005)
- Magnetic Mount with ¼-28” UNF Male Mounting (VMA - 10010)
- Stainless Steel Vibration Spike 75 mm (VMA - 10015)
- 80 cm Cable with BNC & TNC Connectors (VMA - 10020)
- In-Car Battery Charger (VMA - 10025)
- Mains Battery Charger (VMA - 10030)
- Carry Case (VMA - 10035)
- Replacement Battery (VMA - 10040)

Note: Metrix is continuously improving our products. Please refer to our website to download the latest version of this document.

For warranty information, please refer to our warranty policy located on our website - metrixvibration.com/about-us/warranty-policy

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