Instruction Manual

Vibration Severity Meter

VM12

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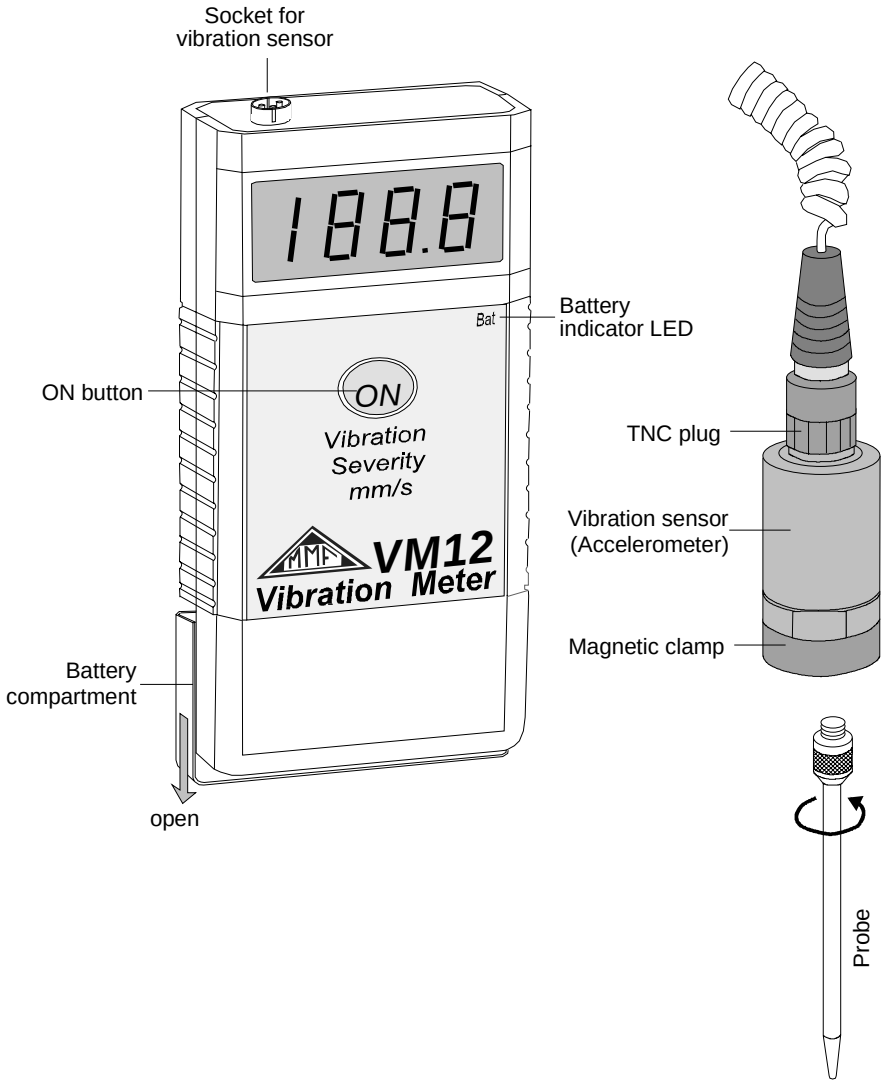
Socket for
vibration sensor
188.8
Bat
Battery
indicator LED
ON button
ON
Vibration
Severity
mm/s
VM12
Vibration Meter
TNC plug
Vibration sensor
(Accelerometer)
Magnetic clamp
Battery
compartment
open
Probe

Dear customer,
thank you for choosing an MMF Vibration Meter. We wish you convenient operation and successful work with your Vibration Meter VM12

1. Properties

The vibration meter VM12 is designed for measuring vibration velocity (also called vibration severity) in the frequency range from 10 to 1000 Hz. It comes with an external piezoelectric accelerometer.
The instrument is very easy to operate and you will become familiar with its operation within shortest time.

2. Application

The Vibration Meter VM12 was designed for offline vibration monitoring of all kind of rotating machinery to assess their running condition based on standard ISO 10816-1. A typical application is cyclic monitoring of machine vibration as part of a maintenance plan. A maintenance interval may be one day or some days up to weeks, depending on type and importance of the machine.
Machine condition monitoring at an early stage helps to prevent unexpected breakdowns. Thus expensive secondary damage and manufacturing loss can be avoided.

3. Function

Figure 1 shows the signal path of the VM12.

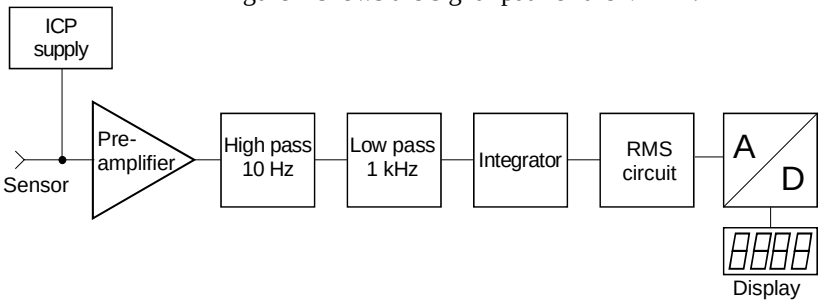

Figure 1: Signal path of the VM12

Vibration Sensor

The Vibration Meter VM12 is supplied with a piezo ceramic planar shear accelerometer. This rugged type of accelerometer features highest precision and resolution. The accelerometer is equipped with an integrated ICP® compatible impedance converter.

Signal Processing

The accelerometer input is connected to an ICP® compatible constant current source, which supplies the integrated electronic circuit of the sensor. The accelerometer signal passes a preamplifier and the following 10 Hz low pass and 1 kHz high pass filter. After filtering the signal is integrated to obtain vibration velocity from the sensor's acceleration signal.

After integration the signal passes a true rms rectifier.

Display

The rectifier is followed by the analog-to-digital converter and the display. The display indicates 3½ digits that means, the highest indication is 1999. The indication is updated three times a second. The decimal point is before the last digit.

4. Operation

The Vibration Meter VM12 is very easy to operate:

- Mount the accelerometer
- Push the “ON” button
- Read the measuring value

4.1. Selection of Measuring Points

General

Before using the Vibration Meter VM12 suitable measuring points at the machine need to be selected. For this purpose it is recommended to turn to specialists with experiences in the field of vibration monitoring on rotating machinery.

In general it is advisable to measure vibration near to its source to minimize distortion by transmitting mechanical components. Suitable measuring points are rigid components, for instance the housing of bearings or gearboxes.

Unsuitable for these measurements are fixing points at lightweight, flexible and soft components.

Recommendations to ISO 10816-1

The standard ISO 10816-1 recommends for vibration measurements on machines the housing of bearings or nearby measuring points.

For routine monitoring it is sufficient in many cases to measure vibration only in vertical or in horizontal direction. Rigid mounted machines with horizontal shafts have their highest vibration levels usually in horizontal direction. Flexible mounted machines may have high vertical components of vibration, too.

For inspections vibration should be measured in all three directions (vertical, horizontal and axial) at all bearings.

The following illustrations show some examples for suitable measuring points.

You will also find recommendations for measuring points at different types of machines in ISO 13373-1.

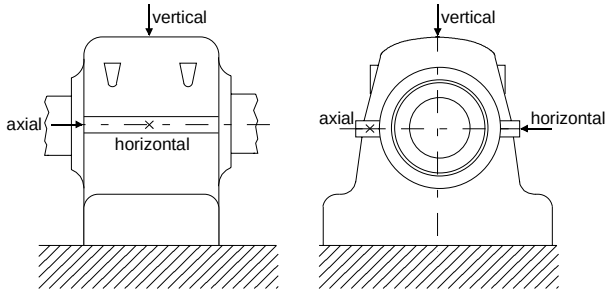

Figure 2: Measuring points on pillow block bearings

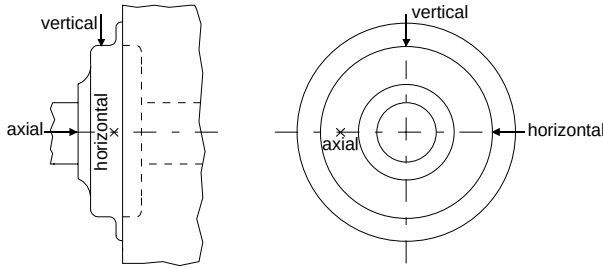

Figure 3: Measuring points on end shield bearings

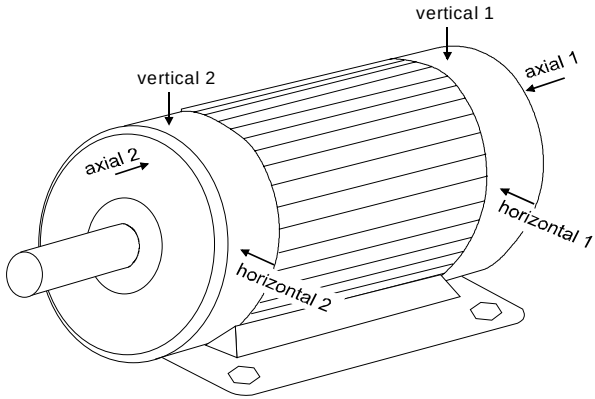

Figure 4: Measuring points on electric motors

4.2. Mounting of the Accelerometer

Magnetic Clamp

The easiest way to attach the accelerometer to the measuring point is the use of a magnetic clamp (delivered together with the accelerometer). It is screwed into the M5 threaded hole in the bottom of the accelerometer. A thin film of grease, for instance silicone oil, between accelerometer and magnetic clamp and on the measuring point improves the quality of mechanical coupling.

The magnetic clamp has a very strong pulling force and is, therefore, suitable for transmission of high vibration levels. Please note, however, that careless dropping of the magnetic clamp to the measuring point may generate very high g levels which can overload the accelerometer. Therefore, put on the sensor with the magnetic clamp to the measuring point like shown in Figure 5 by gently rolling it over the edges.

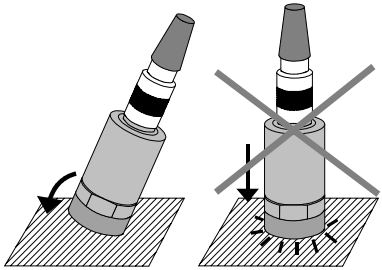

Figure 5: Attaching the magnetic clamp

Coupling Surface

For defined coupling conditions to the measuring object, it is recommended to use a coupling plate of steel with a flat coupling surface. It should have at least the diameter of the accelerometer bottom. Suitable for this purpose is, for instance, a steel plate according to Figure 6. It can be epoxy glued or welded to the measuring point.

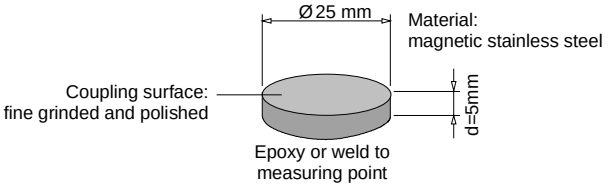

Figure 6: Preparing the coupling point

Accelerometer Probe The probe is an useful accessory for rough estimating measurements of vibration severity at measuring points which are difficult to access. It is screwed into the M5 threaded hole in the bottom of the accelerometer. However, some experience is required to get reproducible results.

Accelerometer Cable Make sure that the cable connector at the accelerometer is tightly screwed. The connection of the cable to the measuring instrument is removed by pulling it out. Please don't try to turn it!

4.3. Measurement

Switching on The VM12 is switched on by pressing the "ON" button. After some seconds the measuring result can be read.

Shut-off Timer About 1 to 2 minutes after pressing the "ON" button, the instrument switches off automatically. This way an unintentional discharge of the battery is avoided.

4.4. Replacing the Battery

The Vibration Meter VM12 is powered by a 9 V battery type IEC 6F22 (PP3 or equivalent). The battery compartment is located at the rear of the instrument. The battery compartment is opened by pressing on the grooved part of the cover and sliding it downwards (see figure page 3).

The power consumption amounts to about 7 mA. It is recommended to use alkaline batteries. With an alkaline battery an operational life of about 30 h can be reached. The use of accumulators is possible as well. A fully charged accumulator works about 7 h.

When the VM12 is switched off its stand-by current is only 4 µA which is in the range of the self-discharge current of typical batteries.

Battery Indicator

The LED "BAT" below the display indicates if the battery voltage drops below 7.5 V. Down to 7 V the instrument works properly.

Please take flat batteries out of the compartment immediately, to avoid leakage. It is advisable to do the same, if the instrument will not be used for longer time.

5. Vibration Severity Measurement

A common procedure for monitoring the unbalance of rotating machines is to measure vibration velocity (vibration severity). It is a measure of the energy content of the emitted vibration. Reasons for unbalance may be, for instance, loose screws, bent components, worn out bearings with too much clearance or dirt on blower fans. Often several of these effects increase one another.

ISO 10816-1

If no reference values of vibration severity are available on the relevant machine, you may refer to the recommendations of ISO 10816-1 (see table below). Here you will find permissible values of the vibration severity of different machine types. The basis of the assessment is the maximum value of all measured points on the machine.

Machine Type	**Power Rating or Shaft Height**	**Speed** min^{-1}	**Foun-dation**	**Max. Continu-ous value** mm/s
Steam Turbines	300 kW – 50 MW		rigid	7.1
	300 kW – 50 MW		flexible	11
	> 50 MW	< 1500	rigid	7.1
	> 50 MW	< 1500	flexible	11
	> 50 MW	1500 – 1800		8.5
	> 50 MW	3000 – 3600		11.8
	> 50 MW	> 3600	rigid	7.1
	> 50 MW	>3600	flexible	11
Electrical Engines	< 160 mm		rigid	2.8
	< 160 mm		flexible	4.5
	160 – 315 mm		rigid	4.5
	160 – 315 mm		flexible	7.1
	> 315 mm	120 – 15000	rigid	7.1
	> 315 mm	120 – 15000	flexible	11
Gas Turbines	< 3 MW		rigid	7.1
	< 3 MW		flexible	11
	> 3 MW	3000 – 20000		14.7
Generators	> 50 MW	1500 – 1800		8.5
	> 50 MW	3000 – 3600		11.8
Blowers, Compressors	< 15 kW		rigid	2.8
	< 15 kW		flexible	4.5
	15 – 300 kW		rigid	4.5
	15 – 300 kW		flexible	7.1
	> 300 kW		rigid	7.1
	> 300 kW		flexible	11
Pumps with separate drive	< 15 kW		rigid	4.5
	< 15 kW		flexible	7.1
	> 15 kW		rigid	7.1
	> 15 kW		flexible	11
Pumps with integrated drive	< 15 kW		rigid	2.8
	< 15 kW		flexible	4.5
	> 15 kW		rigid	4.5
	> 15 kW		flexible	7.1

6. Maintenance and Calibration

The VM15 should be protected from dirt and liquids. The case is not water tight.

Please protect the vibration sensor from hard impact on metallic surfaces to maintain its measuring accuracy.

The accuracy of the Vibration Meter VM12 can be checked easily by means of a vibration exciter. for instance the Vibration Calibrator **VC10** of MMF. This calibrator excites the accelerometer at a frequency of 159.2 Hz with a definite vibration level of 10 mm/s.

The manufacturer Metra Mess- und Frequenztechnik recommends a yearly check of the VM12 and offers a calibration service. During this check your equipment is adjusted based on a reference standard certified by the PTB (Physikalisch-Technische Bundesanstalt. the Federal Calibration Authority of Germany). The calibration laboratory provides a calibration certificate for the equipment on demand.

Important: Please note. that calibration is valid only for the instrument together with its accelerometer. You will find the serial number of your VM12 on its rear. The accelerometer has an engraved serial number. Both serial numbers are put down in the chapter “Technical Data” of this instruction manual. By means of these numbers you will find the right set in case of any mix-up.

7. Technical Data

Instrument:

Measuring range	199.9 mm/s vibration velocity2 .. 200 °C
Frequency range	10 .. 1000 Hz. 2-pole filters. -40 dB/decade
Accuracy	± 5% referred to full scale output. ± 2 digits
Vibration input	ICP® compatible Connector: *Binder* series 719. 3 pins. male Constant current: 1 mA Compliance voltage: 10 V
Display	LCD. 3 ½ digits. character height 8.9 mm Refresh rate: 3 Hz
Power supply	9 V battery type IEC 6F22 / PP3 Current consumption: approx. 7 mA Stand-by current: approx. 4 µA Life time: approx. 30 hours (Alkaline) approx. 7 hours (NiMH Accum.) Battery indicator: LED at U_{BATT} < 7.5 V Auto shut-off timer: after 1 .. 2 min
Operating temperature	-20 .. 55 °C Rel. humidity 95 %. no condensation
Dimensions	125 x 60 x 25 mm³ (without connectors)
Weight	130 grams

Vibration Sensor:

Type	piezoelectric accelerometer
Sensitivity	approx. 25 mV/g
Output	ICP® compatible
Bias voltage	4 .. 5 VDC
Resonant frequency	approx. 28 kHz
Transverse sensitivity	< 5 %
Mounting	M5 thread
Connector	TNC socket
Cable	spiral cable. stretched length approx. 1.5 m plug: TNC / *Binder* series 719. 3 pins. female
Dimensions	height 45 mm. ∅ 21 mm. SW19
Weight	50 grams

Accessories:

Standard	Instrument Vibration sensor Cable for vibration sensor Probe for vibration sensor Magnetic clamp Instruction manual Plastic case	
Optional	Belt case	Ordering no.: VM15-G

Serial Numbers:

(To be filled out by the manufacturer)

Instrument	.....
Vibration Sensor	.....

Limited Warranty

Metra warrants for a period of
24 months
that its products will be free from defects
in material or workmanship
and shall conform to the specifications
current at the time of shipment.

The warranty period starts with the date of invoice.
The customer must provide the dated bill of sale as evidence.
The warranty period ends after 24 months.

Repairs do not extend the warranty period.

This limited warranty covers only defects which arise as a result
of normal use according to the instruction manual.

Metra's responsibility under this warranty does not apply to any
improper or inadequate maintenance or modification
and operation outside the product's specifications.

Shipment to Metra will be paid by the customer.
The repaired or replaced product will be sent back
at Metra's expense.

CE

Declaration of Conformity

Product: Vibration Meter
Model: VM12

Hereby is certified that
the above mentioned product
complies with the demands
pursuant to the following standards:

EN 50081-1
EN 50082-1

Responsible for this declaration is the producer

Metra Mess- und Frequenztechnik
Meißner Str. 58
D-01445 Radebeul

Declared by
Manfred Weber
Radebeul. 4th of January. 2002