

Instruction Manual

Vibration Calibrators

VC10

VC11

VC12

VC13



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Notice: The latest version of this manual can be found at
<http://www.mmf.de/produktliteratur.htm>

Specifications subject to change without prior notice.

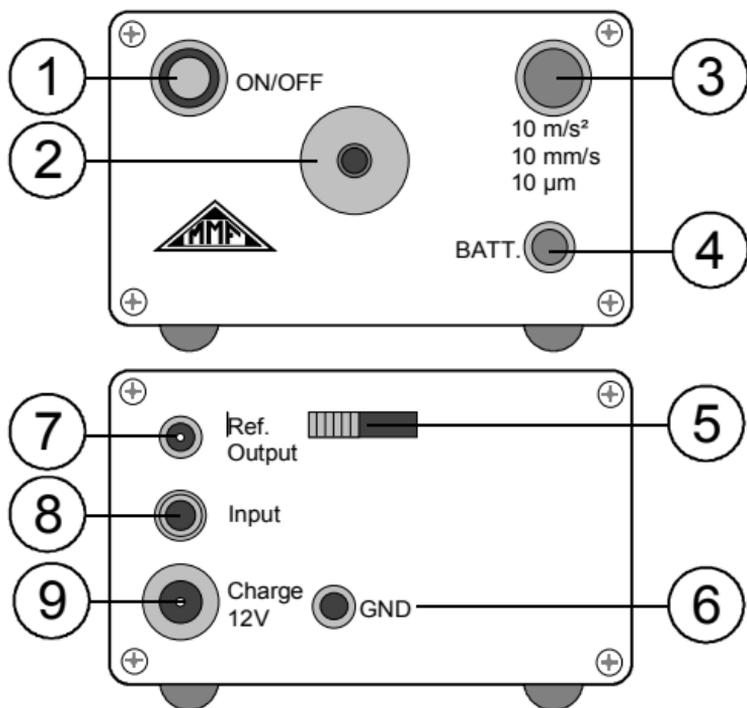
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- 1 ON / OFF switch
- 2 Shaker head
- 3 Level check LED
- 4 Battery condition LED
- 5 Slide switch:
 - calibrator (a) or force source (F) (**VC13**)
 - range 1 g = 9.81 m/s² or 10 m/s² (**VC12**)
- 6 Ground connector (case potential)
- 7 Reference output (**VC13**)
- 8 Force signal input connector (**VC13**)
- 9 Battery charge / power supply socket

Thank you for purchasing this precise and versatile instrument. In spite of its ease of use, please read the following carefully!

1. Applications

- Easy and simple calibration of vibration metering, recording and control equipment
- Regular checks of such devices and installations
- Fault finding

2. Properties

- Handy battery-operated instrument for mobile calibration
- Load-independent RMS vibration level of 10m/s^2 , 10mm/s , $10\mu\text{m}$ and $1\text{ g} = 9.81\text{ m/s}^2$, 9.81 mm/s , $9.81\text{ }\mu\text{m}$ (**VC12**)
- Quartz precise vibration frequency of 159.15Hz (radian frequency of $1000/\text{s}$)
- Suitable for calibrating objects weighing up to 300g (**VC10**) or 520g (**VC11/12/13**)
- Force source for testing of mechanical structures (**VC13**)

The vibration calibrators VC10/11/12/13 generate a mechanical vibration at a crystal-precision frequency and a very stable signal level.

Vibration sensors including connected cables, signal conditioners and readout instruments can be calibrated in acceleration, velocity or displacement units.

A reference accelerometer inside the shaker head and a control circuit keep the vibration level constant and independent of the weight of the attached measuring object.

An LED and a beeper provide monitoring for the exact value to be maintained.

Because of its internal power source, the VC10/11/12/13 are well suited for mobile applications. The rechargeable battery features an automatic switch-off function preventing accidental discharging. The unit comes with an external mains supply allowing both battery-buffered operation and quick battery charging. A two-color-LED indicates its charging or discharging condition.

The plastic carrier case allows convenient handling and safe transport.

3. Operation

3.1. Calibration

Prior to taking any measurement, use one of the supplied stud bolts or a magnetic clamp to attach the sensor to be calibrated to the shaker head of the **VC10/11/12/13**.

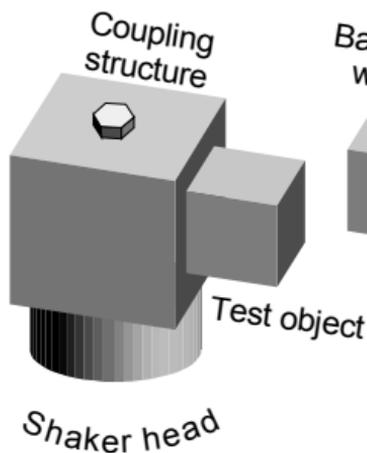
For protecting the shaker head from scratches the supplied protection disk may be used.

For light transducers adhesive wax or double sided adhesive tape can be used for mounting. A flat surface for adhesive mounting can be obtained by using the M5 insulating flange Model 029 which is available from Metra.

Magnetic and adhesive attachment are allowable only for estimate calibrations. Accuracy is guaranteed only for screw attachment.

When mounting the specimen, pay attention to the symmetrical distribution of the object weight. Otherwise the vibrating system may be deflected from its main axis. Especially, when using coupling structures for calibration of transducers, symmetrical attachment becomes very important (for instance at the calibration of the x and y axis of a triaxial accelerometer). In this case it is recommended to use a balance weight as shown in the following illustration:

Wrong:



Good:

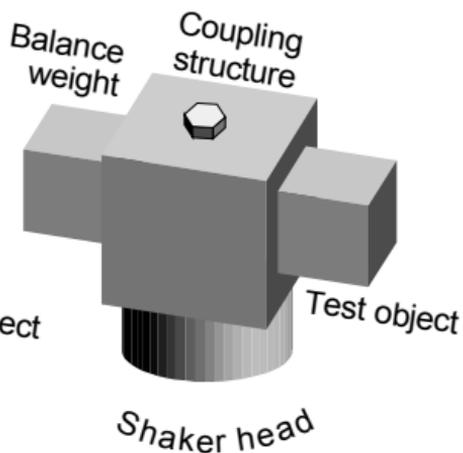


Figure 1: Load balancing

Caused by the suspension system of the shaker head, higher transverse vibrations are generated in horizontal direction than in vertical direction (Figure 2). This may be important if test objects with high transverse sensitivity are calibrated.

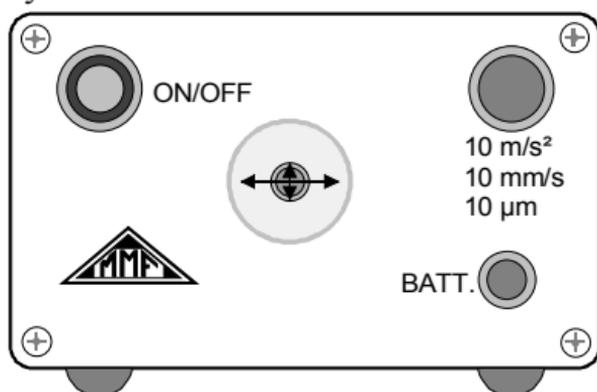


Figure 2: Transverse vibrations

- ☞ The maximum torque rating of **1Nm** at the shaker head must not be exceeded since this may damage the vibration exciter.

The vibration calibrator can be operated in the following positions:

- standing on its bottom side,
- standing on its rear side,
- hand-held.

Press the **ON-OFF** push-button to switch the calibrator on and make sure the **BATT** LED is flashing green which shows the battery is sufficiently charged. The acoustic level check beeps for some seconds until the nominal value is reached. Also the green level LED **10m/s² 10mm/s 10µm** lights up.

When using a **VC12**, select the vibration level by the switch on the rear panel. The vibration level of 1 g is indicated by a red level LED.

Now you can proceed with calibration.

As soon as reading is over, release the **ON-OFF** push-button to save battery power. Should this be omitted, a timer is provided which switches the calibrator off after 10 minutes. New measurements can be taken by simply pushing and releasing the **ON-OFF** switch.

If the **BATT** indicator starts flashing **red**, the battery is almost empty. Measuring can proceed, however, as long as the level indicator is lit and there is no acoustic signal. A -3 % incremental error of the RMS value

may occur with the distortion factor possibly increasing.

The same error occurs for objects exceeding the maximum weight given in the Technical Data chapter. As long as the level indicator is lit and there is no alarm, the incremental error will not exceed 3 % of the RMS value.

The battery can be buffered with a 12 V DC power supply during operation. It is useful to recharge the battery as soon as possible after reading is finished. Constant charging is allowable and desirable.

3.2. External Control (VC13 only)

The vibration system of Model **VC13** can also serve as an externally controlled vibration or force source. This function may be useful, for instance, for vibration tests or resonance detection. It is not intended for calibration purposes.

In position **F** of the selector switch on the VC13 rear panel the internal generator and the level control loop of the calibrator are disabled. The input signal coming from an external generator can be fed into the input connector on the rear panel. It will be amplified by the internal booster and so activate the vibration exciter.

Model VC13 can generate alternating forces in the range of 1 to 5 N at frequencies between 80 and 3000 Hz.

The amplified signal of the reference accelerometer inside the shaker head is accessible via the socket **Ref. Output** on the rear panel. It can be used for monitoring and controlling of the shaker magnitude. The sensitivity of the reference output may vary with the specimen. The following table shows individually measured sensitivities at several frequencies for your VC13:

VC13 Serial No.	
Frequency	Sensitivity
80 Hz mV/ms ⁻²
160 Hz mV/ms ⁻²
320 Hz mV/ms ⁻²
640 Hz mV/ms ⁻²
1200 Hz mV/ms ⁻²
2400 Hz mV/ms ⁻²

Signal clipping and resonances may lead to a distorted shaker signal. It is advisable to check the signal

shape at the reference output. Distortion usually becomes lower with a lower generator magnitude.

The magnitude of the generated vibration depends on the generator frequency and the mass attached to the shaker head. The resonant frequency of the unloaded vibration exciter is at approximately 150 Hz. The higher the attached mass, the lower the resonant frequency. The following diagram shows the frequency response curve at a constant generator input voltage of $10 \text{ mV}_{\text{rms}}$ for a mass of 50 g and 250 g.

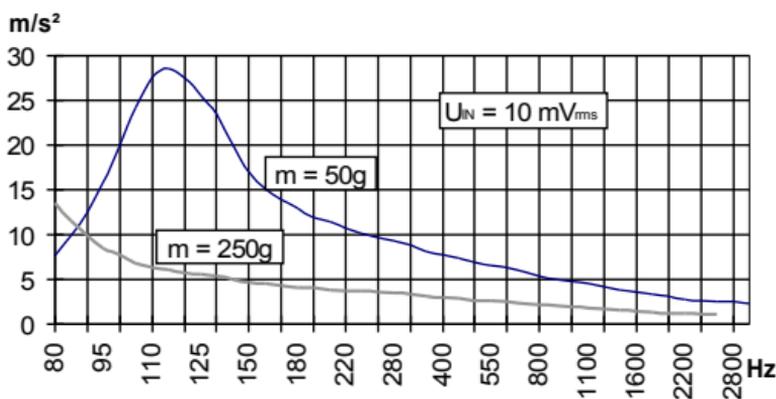


Figure 3: Frequency response curve of VC13

- ☞ Please do not exceed the **maximum torque of 3 Nm** and **do not overdrive** the vibration system. The maximum displacement is 0.6 mm. The maximum force at the shaker head must not exceed **25 N**.

- ☞ In **calibration mode** (switch position **a**) the cables at the generator input and reference output should be removed to avoid interference.

3.3. Charging the Battery

To charge the battery, connect the 12 VDC mains plug adapter to the **CHARGE 12V** socket on the back panel.

You may also use any other 12 or 15 VDC power supply, for example a car battery. Connect it to the calibrator by using a 5.5/2.1 mm DIN 45323 plug. The center pin is the positive terminal.

With proper charging voltage polarity, the **BATT** indicator will be red. If the light intensity clearly diminishes, the battery has reached some 90% of its capacity. Increasing charge makes color slowly change through orange to green. Fluttering of the **BATT** indicator does not affect operation. The charging procedure should cover one or two days to completely charge the battery. Permanent charging ensures long life for the battery. The built-in lead accumulator has no memory effect.

4. Maintenance

If constant charging is not possible, and if the calibrator is not used often, the calibrator should be charged for one day once or twice a year.

The built-in accumulator is maintenance-free.

If the typical running time can not be reached at a full charging period, the accumulator should be replaced.

This should be done at the manufacturer's site where also the charging voltage and the vibration values will be rechecked.

5. Technical Data

Vibration acceleration: 10 m/s² (RMS) ± 3 %

VC12 additionally: 1 g = 9.81 m/s² ± 3 %

Vibration velocity: 10 mm/s ± 3 %

VC12 additionally: 9.81 mm/s ± 3 %

Vibration displacement: 10 μm ± 3 %

VC12 additionally: 9.81 μm ± 3 %

All vibration levels given above are RMS values.

Vibration frequency: 159.15 Hz ± 0.05 %

Radian frequency: 1000 /s ± 0.05 %

Level control: LED / beeper

Threshold of level control: ± 3 % error

Settling time:	<10 s
Maximum weight of test object for accuracy given above:	
VC10	300 g
VC11/12/13	520 g
<i>Vibration system:</i>	
Dynamic force:	10 N
Maximum static force:	25 N
Maximum torque:	3 Nm
Nominal torque:	1 Nm
Maximum transversal force:	30 Nm
Mounting of test object:	magnetic clamp, M5 thread
Stud bolt adapters:	
<i>Force source (VC13):</i>	
Frequency range:	80 .. 3000 Hz
Generator input:	3.5 mm earphone socket (mono) $U_{IN} < 0.1 \text{ V}$ $R_{IN} = 100 \text{ k}\Omega$

Reference output:	socket type LEMO 00 $U_{OUT} < 5 V_{pk-pk}$, via $1 \mu F$
Temperature range for :	
3 % accuracy	10 .. 40 °C
5 % accuracy	-10 .. 55 °C
Humidity:	< 90% at 30 °C, no condensation
Mounting of test object:	magnetic clamp, M5 thread
Power supply:	built-in accumulator
Accumulator type:	DRYFIT A206/1.0S or Yuasa NP 1,0-6
Running hours with one battery charge:	4 h with $m = 100$ g or 250 readings of 1 min each
Switch-off timer:	10 min
Charging time for empty battery:	2 1/2 h for 50 %, 6 h for 90 % capacity
Charge socket:	DIN 45323 (5.5/2.1)

Supplied accessories:	12 VDC mains plug adapter (100 .. 240 VAC, 50 / 60 Hz) plastic carrying case stud bolts: M3 (021), M5 (003) stud adapters: M5/M3(tap) (022), M5/UNF 10-32 (045), M5/1/4"-28 (046), M5(tap)/M8 (044) protection disc signal cable (VC13) reference cable (VC13)
Optional accessories:	car supply adapter cable VC10-030 M5 adhesive flange 029



Declaration of Conformity

Product: Vibration Calibrators

Models: VC10 / 11 / 12 / 13

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

EN 50081-1

EN 50082-1

responsible for the manufacturer

Metra Mess- und Frequenztechnik

Meissner Str. 58

D-01445 Radebeul

Manfred Weber

Radebeul, February 14, 1997

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 purchase.

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.