



# User Manual

PCE-VC 21 Portable Shaker Vibration Calibrator



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## 1 Safety notes

Please read this manual carefully and completely before you use the device for the first time. The device may only be used by qualified personnel and repaired by PCE Instruments personnel. Damage or injuries caused by non-observance of the manual are excluded from our liability and not covered by our warranty.

- The device must only be used as described in this instruction manual. If used otherwise, this can cause dangerous situations for the user and damage to the meter.
- The instrument may only be used if the environmental conditions (temperature, relative humidity, ...) are within the ranges stated in the technical specifications. Do not expose the device to extreme temperatures, direct sunlight, extreme humidity or moisture.
- Do not expose the device to shocks or strong vibrations.
- The case should only be opened by qualified PCE Instruments personnel.
- Never use the instrument when your hands are wet.
- You must not make any technical changes to the device.
- The appliance should only be cleaned with a damp cloth. Use only pH-neutral cleaner, no abrasives or solvents.
- The device must only be used with accessories from PCE Instruments or equivalent.
- Before each use, inspect the case for visible damage. If any damage is visible, do not use the device.
- Do not use the instrument in explosive atmospheres.
- The measurement range as stated in the specifications must not be exceeded under any circumstances.
- Non-observance of the safety notes can cause damage to the device and injuries to the user.

We do not assume liability for printing errors or any other mistakes in this manual.

We expressly point to our general guarantee terms which can be found in our general terms of business.

If you have any questions please contact PCE Instruments. The contact details can be found at the end of this manual.

## 2 Specifications

Vibration frequencies	Vibration magnitudes (RMS values)				
	1 m/s <sup>2</sup>	2 m/s <sup>2</sup>	5 m/s <sup>2</sup>	10 m/s <sup>2</sup>	20 m/s <sup>2</sup>
15.915 Hz	X	X			
40 Hz	X	X	X		
80 Hz	X	X	X	X	
159.15 Hz	X	X	X	X	X
320 Hz	X	X	X	X	X
640 Hz	X	X	X	X	X
1280 Hz	X	X	X	X	X

Accuracy of magnitudes	±3 % max. at 0 to 40 °C ±5 % max. at -10 to 55 °C
Accuracy of frequencies	±0.05 % max. at -10 to 55 °C
Harmonic distortion	<1 % (15.915 Hz: <5 %)
Level indicator	Percent value display, above ±3 % beep tone
Settling time	<10 s

Maximum weight of test object for stated accuracy in grams					
f [Hz]	1 m/s <sup>2</sup>	2 m/s <sup>2</sup>	5 m/s <sup>2</sup>	10 m/s <sup>2</sup>	20 m/s <sup>2</sup>
<b>15.92</b>	500	500			
<b>40</b>	500	500	500		
<b>80</b>	500	500	500	500	
<b>159.2</b>	500	500	500	500	250
<b>320</b>	500	500	500	500	200
<b>640</b>	500	500	500	400	100
<b>1280</b>	500	500	500	200	50
Vibration exciter					
Dynamic force	10 N				
Max. torque	2 Nm				
Nominal torque	1 Nm				
Max. transverse force	20 Nm				
Transverse vibration (14 mm above shaker)	15.92 / 40 / 80 / 159.2 / 1280 Hz: <10 % 320 / 640 Hz: <20 %				
Mounting of test object	M5 tapped hole, 90° ± 0.5°, 7 mm deep Clamping magnet Adhesive				
Operating temperature ranges for 3% accuracy 5% accuracy	0 ... 40 °C -10 ... 55 °C				
Humidity	<90 % at 30 °C, no condensation				
Magnetic scatter field at shaker	<0.2 mT				
Power supply	Built-in NiMH accumulator; 7.2 V / 1.6 Ah				
Battery operating time	approx. 5 h with m = 100 g				
Automatic shut-off time	1 to 30 min				
Charge time of accumulator	3 h				
Charge socket	DIN 45323 (5.5 / 2.1) Positive terminal at center pin				
Charge voltage	11 ... 18 V DC				

Charge current	<1 A
Protection grade	IP30
Dimensions	100 x 100 x 120 mm
Weight	2.2 kg

### 3 System description



### 4 Purpose

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

### 5 Properties

- Handy and robust battery device for laboratory and field use.
- 7 selectable vibration frequencies from 15.915 to 1280 Hz<sup>1</sup>.
- Up to 5 selectable vibration magnitudes from 1 to 20 m/s<sup>2</sup>.
- Load-independent vibration magnitude.
- Suitable for test objects weighing up to 500g.



The vibration calibrator PCE-VC21 generates mechanical vibration with quartz stabilized frequency and precisely controlled magnitude. Vibration sensors, including connected cables, signal conditioners and readout instruments can be calibrated in acceleration, velocity or displacement units.

Thanks to its lowest frequency of 15.915 Hz, the PCE-VC21 can also calibrate whole-body vibration meters to ISO 2631 / ISO 8041 or building vibration meters to DIN 4150.

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. A display indicates the error in percent. There is an acoustical warning when the error limit is exceeded.

Because of its internal rechargeable battery, the PCE-VC21 is well suited for mobile applications. The instrument features an automatic switch-off function preventing accidental discharging. The display indicates the battery charging condition. The unit comes with an external mains supply for charging.

The supplied plastic carrying case allows convenient handling and safe transport.

## 6 Operation

### 6.1 Attaching the Test Object

The vibration exciter of the PCE-VC21 has a tapped M5 hole with 7mm depth for the attachment of the device under test. The supplied stud bolts and stud adapters or a climbing magnet can be used for mounting.

The surface of the vibration exciter has been made extremely resistant by plasma nitride coating.

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 attachments are only allowable for roughly estimated calibrations. Accuracy is only guaranteed 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. When using coupling structures for calibration of transducers, symmetrical attachment becomes especially important, for instance, at the calibration of the x and y axis of a triaxial accelerometer. In the case, using a balance weight as shown in the following illustration is recommended.

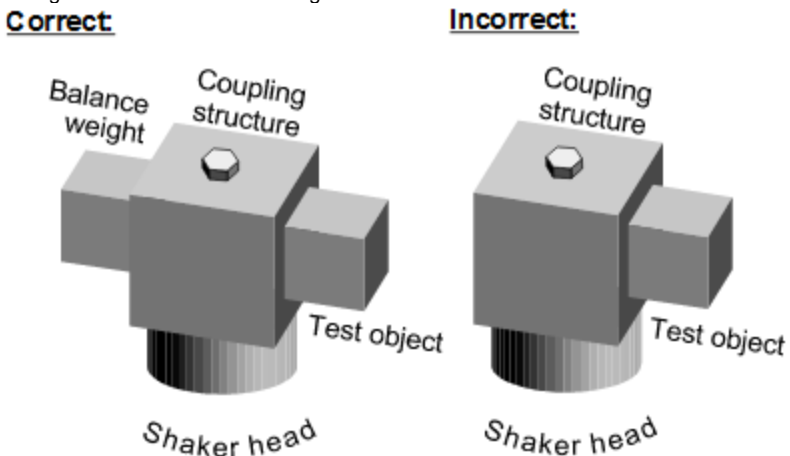


Figure 1: Load balancing

Please note that heavy connecting cables should be supported close to the test object. However, an application of force via the cable must be avoided.

The maximum torque rating of **1 to 2 Nm** at the vibration exciter must not be exceeded since this may damage the instrument.

The PCE-VC21 should be placed on a rigid surface. Hand-held operation is not recommended because of possible errors.

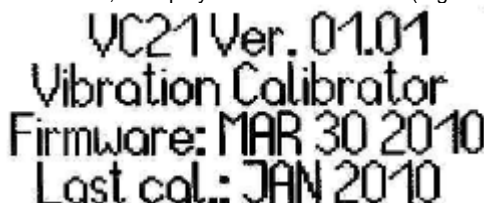
The supplied disk-shaped steel test piece is screwed onto the shaker head. It is made of 2CrMo4 which is the reference steel for sensitivity statements in the data sheets of proximity probes. The sensor under test is screwed into the thread adapter and inserted into hole in the slider. A fastening screw is provided for the thread adapter. Heavy or stiff cables are to be supported so that no transverse forces act on the clamping device. After loosening two fastening screws on the side, the slider can be shifted vertically to adjust the air gap between the probe tip and the steel disk. The optimum air gap is reached when the DC output of the sensor (or its oscillator) is approximately half its full-scale value (typically 10 to 12 V). A thickness gauge can be useful to adjust the right gap. Now you can switch the PCE-VC21D on to calibrate the proximity probe dynamically.

The calibration of proximity probes is performed at 159.2 Hz (radian frequency  $1000 \text{ s}^{-1}$ ). This is the frequency where the magnitude value of acceleration in  $\text{m/s}^2$  are the same as the displacement value in  $\mu\text{m}$ . Hence the PCE-VC21D provides displacement magnitudes of 1, 2, 5, 10 and 20  $\mu\text{m}$  RMS. Calibration at other frequencies is not recommended because the damping elements of the clamping device have been optimized only for 159.2 Hz.

The clock output of Model PCE-VC21d is described in section.

## 6.2 Calibration


After attaching the device under test, switch the PCE-VC21 on by depressing the "On/Off" button until the display lights up. Device information, such as hardware and software version and the date of the last calibration, is displayed for a few seconds (Figure 3).




VC21 Ver. 01.01  
 Vibration Calibrator  
 Firmware: MAR 30 2010  
 Last cal.: JAN 2010

Figure 3: Version and calibration date

After short time the vibration signal becomes stable. The display shows the values of vibration frequency and magnitude (Figure 4). Please note that these are not measuring values but only nominal values.



 - 0.2%  
 15.92 Hz 1  $\text{m/s}^2$   
 Frequ.: ◀ Amplitude: ▶▶



Press the keys "f+" or "f-" to choose between the seven available frequencies. The magnitude can be selected by the "a+" and "a-" keys. Depending on the frequency, up to five magnitudes can be selected.

**Note:** At 159.2 Hz (radian frequency  $1000 \text{ s}^{-1}$ ) the unit of the magnitude alternates between  $\text{m/s}^2$  for acceleration, mm/s for velocity and  $\mu\text{m}$  for displacement. This is the frequency where the magnitude values of acceleration in  $\text{m/s}^2$  are the same as the velocity values in mm/s and the displacement values in  $\mu\text{m}$ .

**Example:**  $10 \text{ m/s}^2$  are 10mm/s and  $10 \mu\text{m}$ .

In the upper right hand corner you will see the actual accuracy of the vibration magnitude in percent. After short period of time the percent value should converge on zero.

If the absolute error exceeds 3%, the percent value will change to inverse characters and a beep sound will be generated. In the case no calibration can be performed.

When the maximum weight of the test object is exceeded, instead of the percent value, an error message "OVERL" will appear and the shaker will be switched off. To proceed with calibration, first switch the calibrator off. Then reduce the weight of the test object and switch the calibrator back on. The admissible weight is up to 500 grams, depending on the selected frequency. The overload message can be eliminated by lowering the vibration magnitude.

The PCE-VC21 can be switched off by depressing the "ON/OFF" key for least one second. Should this be omitted, a timer is provided which switches the calibrator off after a preselected time from 1 to 30 minutes.

**Caution:** The vibration calibrator is not to be used in dirty and dusty environments. Particular care should be taken that no ferromagnetic particles get inside of the instrument. They may damage it within short time. Defects due to dirt and dust are not covered by the warranty.

### 6.3 Settings

Press the "Menu" key to enter the setup menu (Figure 5).

```
SETTINGS
1/2: Shut-off timer
Select: ←→+OK Quit: ESC
```

Figure 5: Setup menu

Select "1/2 Shut-off timer" by pressing the "On/Off" key. The time for automatic shut-off can be entered between 1 and 30 minutes by means of the "a+" and "a-" keys.

Menu item "2/2: Calibration" is intended for factory calibration only. It is protected from manipulation by a password.



## 6.4 Charging the Accumulator

The battery indicator is located in the upper left hand corner of the display. A full bargraph is displayed when the battery is fully charged. Even if the bargraph is empty the instrument can still be used within its specifications for a certain period of time. When the battery voltage drops under a critical value, the PCE-VC21 is switched off automatically.

The instrument is equipped with a NiMH accumulator providing power for approximately 5 hours of operation.

To charge the battery, connect the supplied mains plug adapter (15 VDC) to the DIN socket at the side of the case. The unit should preferably be switched off during charging. Charging will take about 3 hours. During the charging process the battery indicator will be continuously moving (Figure 6).



Press OK to switch on.

Figure 6: Charging indication

During the charging process the PCE-VC21 can be used for calibration. However, this will extend the necessary charging time.

The accumulator should be charged at room temperature. At higher temperatures charging can be stopped before recharging the full capacity because of the build-in temperature sensor.

The battery has no memory effect. Partial charging is permissible.

Permanent connection of the main adapter is not recommended. This may lead to premature wear of the battery. In order to avoid overcharging the battery, it is not recommended that you disconnect and connect the main adapter immediately after charging is finished.

When the unit is not in use, the battery should be charged at least once a year.

The built-in battery is maintenance-free. Like all accumulators it has a limited number of charging cycles. If the operating time with a fully charged battery becomes insufficient, the battery should be replaced. In this case, the calibrator should then be returned to the manufacturer. In addition to replacing the battery, the manufacturer will also test the accuracy of the calibrator.



## **6.5 Reset**

In the unlikely event that your PCE-VC21 cannot be switched on by the “On/Off” key, it may be necessary to press the Reset button. This button is found on the bottom side of the case near the key pad. Use a thin non-metallic object, such as a toothpick, to press the button inside the hole. This will start the instrument. Pressing the Reset button has no effect on accuracy.

## **7 Calibration**

The vibration characteristics of the PCE-VC21 are very stable even after intensive use. Typical changes are below 1% per year. We recommend annual re-calibration. In case of shock load, dropping the instrument, etc. immediate recalibration is advised.

## 8 Contact

If you have any questions, suggestions or technical problems, please do not hesitate to contact us. You will find the relevant contact information at the end of this user manual.

## 9 Disposal

For the disposal of batteries in the EU, the 2006/66/EC directive of the European Parliament applies. Due to the contained pollutants, batteries must not be disposed of as household waste. They must be given to collection points designed for that purpose.

In order to comply with the EU directive 2012/19/EU we take our devices back. We either re-use them or give them to a recycling company which disposes of the devices in line with law.

For countries outside the EU, batteries and devices should be disposed of in accordance with your local waste regulations.

If you have any questions, please contact PCE Instruments.





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