

PCE Americas Inc.
711 Commerce Way
Suite 8
Jupiter
FL-33458
USA

From outside US: +1
Tel: (561) 320-9162
Fax: (561) 320-9176
info@pce-americas.com

PCE Instruments UK Ltd.
Units 12/13
Southpoint Business Park
Ensign way
Hampshire / Southampton
United Kingdom, SO31 4RF

From outside UK: +44
Tel: (0) 2380 98703 0
Fax: (0) 2380 98703 9
info@pce-instruments.com

www.pce-instruments.com/english
www.pce-instruments.com

Manual Accelerometer PCE-VM 40A/B



Contents

1	Introduction	3
2	Safety notes	3
3	Specifications	4
4	System description	5
5	Operation	6
5.1	Selecting the measurement mode.....	6
5.2	Measuring in accordance with DIN 4150-3	7
5.3	Measuring in accordance with BS7385	10
5.4	Measuring in accordance with SN 640312a	12
5.5	Non-standardized measurements	13
5.6	Overload indication	14
5.7	Saving measured values	14
5.8	Displaying saved data	17
5.9	Deleting the data memory	18
5.10	Event Reporting.....	18
5.11	Transferring the recorded data to a PC	18
5.12	Relay output	18
5.13	Receiving alerts via SMS (PCE-VM 40B).....	19
5.14	Connection to a mobile network	21
5.15	SMS alerts	22
5.16	Phone book	23
5.17	Writing an SMS.....	24
5.18	Making phone calls.....	24
5.19	Disconnect from mobile network	25
5.20	Miscellaneous settings	25
5.21	Data transfer.....	28
5.22	Firmware update.....	34
5.23	Charging the battery	34
5.24	External power supply	35
5.25	Reset	35
5.26	Mounting	36
6	Calibration	37
7	Disposal	37
8	Contact.....	37
8.1	PCE Instruments UK	37
8.2	PCE Americas	37

1 Introduction

Thank you for purchasing a vibration monitor PCE-VM 40 A/B from PCE Instruments.

The vibration monitor PCE-VM 40 is able to measure and log vibration in certain buildings and surroundings. The vibrations are evaluated in accordance to established standards such as DIN 4150-3, BS 7385 and SN 640312a. Because of that, it is possible to make statements on the condition of the building structure which includes damage of the buildings. The memory makes it possible to save up to 100000 measurement values which can be recorded event- or time-driven.

The clear menu navigation makes it easy to set up the instrument wherever you need to. After choosing the standardised operating mode, the operator can choose between short-time vibrations and long-term vibrations and select the building type. When threshold values are exceeded, this is immediately shown on the instrument and the PCE-VM 40B is also able to send an SMS via the GSM module.

Besides being able to save (and send (PCE-VM 40B)) measured data, the instrument also allows you to read out the data on site. The vibration monitor makes it possible to form the vector sum. In addition, it shows the main frequency and the three directions in space as well as the direction in space with the highest oscillation amplitude. On the display, the FFT spectrum is shown and also the threshold value for the chosen standard.

2 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. There is no warranty of damages or injuries caused by non-observance of the manual.

- The device may only be used in the approved temperature range.
- The case should only be opened by qualified personnel of PCE Instruments.
- The instrument should never be placed with the user interface facing an object (e. g. keyboard side on a table).
- You should not make technical changes to the device.
- The appliance should only be cleaned with a damp cloth / use only pH-neutral cleaner.

This user's handbook is published by PCE Instruments without any guarantee.

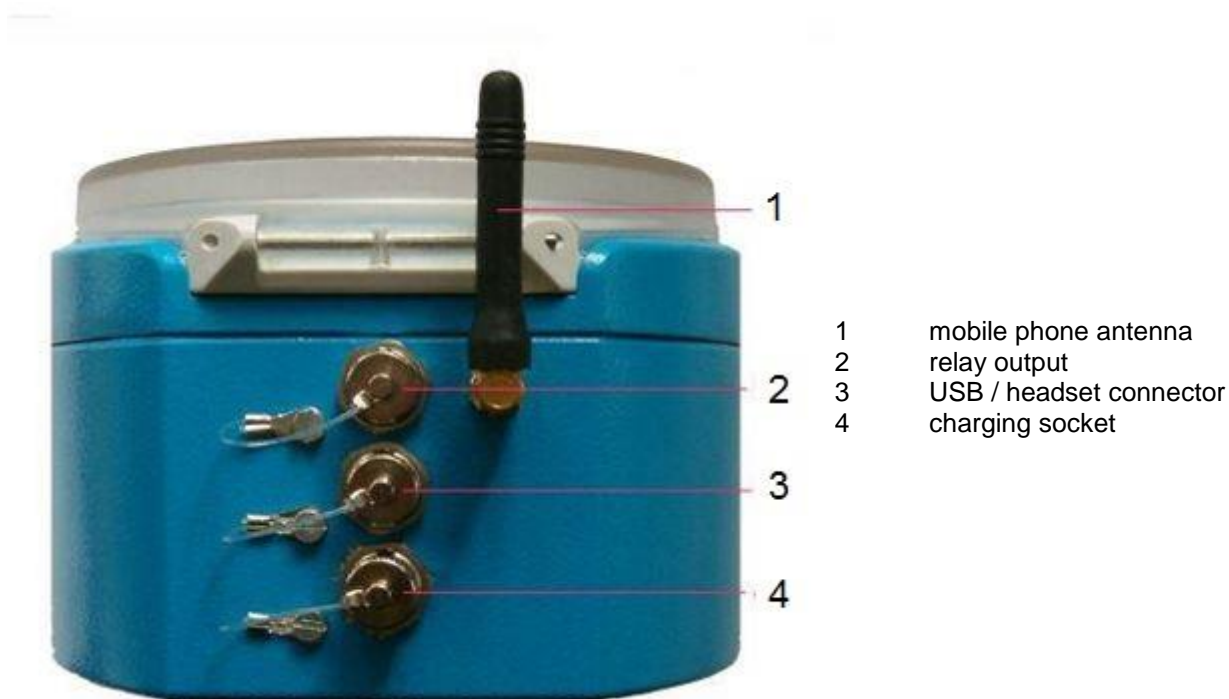
We expressly point to our general guarantee terms which can be found in our general terms of business.

If you have any questions please contact PCE Instruments.

3 Specifications

Measuring variable	Peak value of vibration velocity Peak value of vibration acceleration
Standards	DIN 4150-3; BS 7385, SN 640312A
Vibration sensor	Triaxial piezoelectric shear-type-accelerometer
Indication range vibration velocity (peak value)	0.001 ... 15 m/s ²
Indication range vibration acceleration (peak value)	0.01 ... 2400 mm/s at 1 Hz 0.01 ... 30 mm/s at 80 Hz (full-scale value, depends on the frequency)
Measurement accuracy (16 Hz)	±3 %, ±2 digits, 100 Hz low-pass ±3 %, ±2 digits, 398 Hz low-pass
Display	LCD (black / white), 128 x 64 pixels, backlight, 3 peak values (X/Y/Z) or vector sum main frequency 50-lines-FFT-spectrum battery condition date and time
Alarm	Alarm LEDs next to the display Relay output (changeover contact, max. 100 VDC/2 A)
GSM modem (PCE-VM 40B)	Quad-band (850, 900, 1800, 1900 MHz)
SMS alarm (PCE-VM 40B)	SMS delivery when alarm is given (includes measurement values of X/Y/Z frequencies, date, time and the name of the device)
Additional function GSM (PCE-VM 40B)	Phone call with headset (via adaptor VM-40 HS)
Data logger	Installed micro SD card with a maximum of 100000 measurement values (X/Y/Z, frequency, date, time, name of the device)
Digital/analogue converter	24-bit, Sigma-Delta
USB interface	USB 2.0, CDC mode, via USB-cable
Battery	NiMH, 4.8 V / 9 Ah, charging time: 10 h, no battery is needed in buffer mode (when device is connected to power supply)
Battery operation time per charged battery	5 ... 15 days, depending on temperature, duty cycle of backlight and usage of the GSM function (PCE-VM 40B)
Languages	German / English
Operating temperature	-20 ... +60 °C
Protection class	IP64
Dimensions	150 x 140 x 80 mm
Weight	2 kg
Optional accessories	Tripod mounting plate, headset adaptor

4 System description



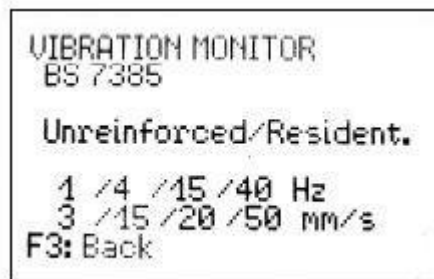
5 Operation

5.1 Selecting the measurement mode

Switch on the PCE-VM 40 by pressing the ON-OFF button. After the start screen, the measurement value display with the most recently selected settings appears. Press F3 to open the main window and select "measuring mode".



You can choose between adjustable measured value (non-standard) and the three supported standards which are described in the following sections. In the measurement value display you can view the selected settings by pressing the F1 button.



Here you will see your chosen standard with its specified settings as well as the four frequency and amplitude dots of the limit value curve.

Note: The following chapters include abstracts of the most relevant standards for building vibration. For a compliant evaluation, it is necessary to study the standard documents to the full extent.

5.2 Measuring in accordance with DIN 4150-3

Measurement procedure

DIN 4150-3 is the most widely applied standard internationally for measuring structural vibrations. The measurement procedure can be found in a similar form in other national standards, for example the Italian UNI 9916.

The assessment parameter is the maximum value v_i of the three individual components (peak values) of vibration velocity at frequencies of 1 to 80 Hz. The measurements are carried out at the foundation.

Vibrations in the ceiling of the upper most outer walls also provide valuable information for analysis.

These detect the horizontal response of the building to the vibration at the foundation. Only the greatest value of both the horizontal components is then used for the analysis.

The standard provides reference values for permissible vibration velocities for short-time and sustained vibration in three types of buildings.

Guide values for vibration velocity v_i for analyzing the effects of transient vibration					
Building Type	Foundation Frequency of the Significant Vibration			Upper ceiling	
Frequency range	1 – 10 Hz	10 – 50 Hz	50 – 100 Hz	all Frequencies	
Direction	X / Y / Z	X / Y / Z	X / Y / Z	X / Y	Z
Reinforced or framed structures. Industrial and heavy commercial buildings	20 mm/s	20 – 40 mm/s	40 – 50 mm/s	40 mm/s	20 mm/s
Unreinforced or light framed structures/ Residential or light commercial type buildings	5 mm/s	5 – 15 mm/s	15 – 20 mm/s	15 mm/s	20 mm/s
Delicate, listed buildings e.g. historical monuments	3 mm/s	3 – 8 mm/s	8 – 10 mm/s	8 mm/s	20 mm/s

- For massive civil engineering structures, e. g. reinforced concrete constructions for abutments or block foundations, you can increase the reference values for industrial buildings up to two times.
- If short-time vibrations occur in ceilings at below 20 mm/s in vertical direction, a reduction in the serviceability does not have to be expected.

The standard also gives reference values for short-time vibration on pipelines of different types:

Reference values for short-time vibration on pipelines	
Pipe material	Vibration velocity v_i
Steel, welded	100 mm/s
Stoneware, concrete, reinforced concrete, pre-stressed concrete, metal	80 mm/s
Brickwork, plastic	50 mm/s

For sustained vibration, the following reference values apply:

Reference values for vibration velocity v_i for analysing the effects of sustained vibration		
Building type	Upper ceiling level, all frequencies	
Direction	X / Y (horizontal)	Z (vertical)
Reinforced or framed structures industrial and heavy commercial buildings	10 mm/s	10 mm/s
Unreinforced or light framed structures, residential or light commercial type buildings	5 mm/s	10 mm/s
Sensitive buildings, listed buildings e. g. historical monuments	2.5 mm/s	-

Vertical sustained vibrations with a vibration velocity below 10 mm/s normally do not cause damage to ceilings in houses. For sensitive buildings, there are no reference values available.

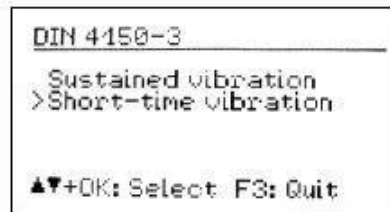
For sustained vibration on pipelines, the reference values for short-time vibration, reduced by 50 %, can be applied.

The following advice is given in DIN 4150-3 for the placement of the sensor:

- For foundation vibrations, the transducer should be placed on the lowest floor at the foundation of the outer wall or on the outer wall.
- In the upper ceiling level the sensor should be placed inside or very close to the outer wall.
- For buildings without a basement, the measurement location must not be higher than 0.5 m above the ground level.
- The measurement location should predominantly be on the side of the building facing the excitation.
- One of the lateral measuring directions (X / Y) should be parallel to one outside edge of the building.
- Buildings with larger ground areas should be measured at several points.
- In addition to measuring at the foundation and the upper ceiling, if required, measurements can be carried vertically on the ceilings, where the strongest vibration can be expected (mostly central).
- When measuring pipelines, where possible, the sensor should be placed on the pipeline itself.

Measurements with the PCE-VM 40

After choosing the operating mode „DIN 4150-3“, please select whether you will be measuring short-time or sustained vibration.



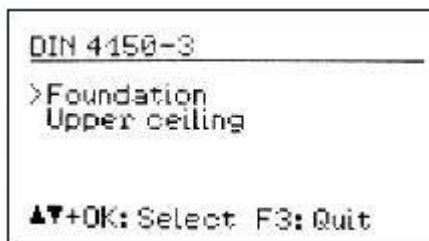
Please select the building type next:



The following types are available, when selecting “pipeline”:



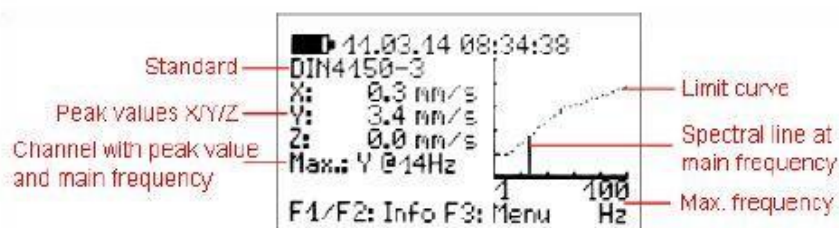
In case of short-time vibrations, the measurement location needs to be selected:



The standard frequency range is 1 ... 80 Hz. In special cases, e. g. blasting operations, the frequency range can be increased to 1...315 Hz:



Press F3 to exit the menu in order to go to the measurement value display:



The three peak values X/Y/Z of the vibration velocity and the highest amplitude together with its main frequency are displayed every second. On the right side of the screen a graph displays this value in the frequency range. The diagram is scaled according to the limit curve. Higher magnitudes will be cut off.

Note: For the measurement of floor ceiling vibrations, there are different reference values for the vertical (Z) direction. They are evaluated by the PCE-VM 40 and considered for alarms. In the FFT spectrum and frequency display, however, only the horizontal directions (X / Y) are shown.

If the limit value curve is exceeded, "ALARM" is displayed below the main frequency. If the limit value is exceeded, the following will happen:

- The red light will flash.
- The measurement values will be saved if event recording has been activated.
- The relay output will switch if it has been activated.
- A text message (SMS) will be sent if this option has been set up on the PCE-VM 40B.

Note: The alarm and recording functions will be activated after a delay of 30 seconds after leaving the menu.

5.3 Measuring in accordance with BS7385

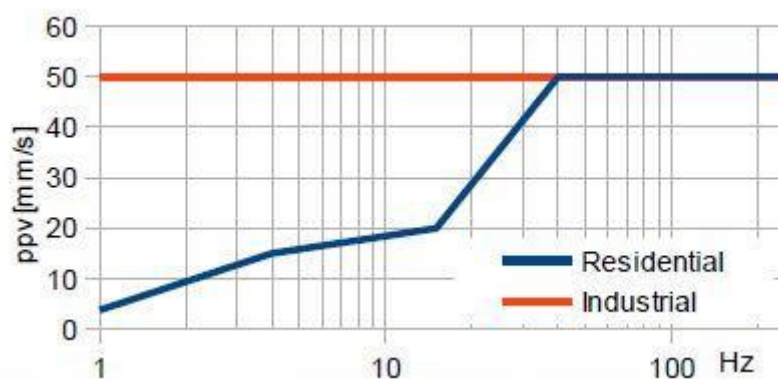
Measurement procedure

The British Standard BS 7385 is mainly used in the Commonwealth countries. It is less complex than the DIN standard. Similarly to the DIN standard, it also measures the peak value of the vibration velocity in all spacial dimensions. It is called "peak particle velocity" (ppv). The frequency range is not precisely specified. The PCE-VM 40 uses the ranges 1 to 80 Hz and 1 to 315 Hz.

The standard provides reference values for short-time vibrations which are measured at the foundation (see table). The reference values mark the limit above which cosmetic damage may occur, such as cracks in the walls or ceilings. More minor damage is to be expected at twice the reference value and greater damage at four times the guide value. In the case of sustained vibrations or excitation from building resonance, the reference values need to be reduced by at least 50 %.

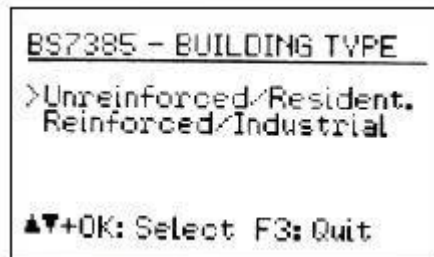
Residential and industrial buildings are differentiated.

Reference values for short-time vibrations without excitation of building resonances		
Main frequency	Residential buildings	Industrial buildings
1 ... 4 Hz	<0.6 mm displacement	-
4 Hz	15 mm/s	50 mm/s
15 Hz	20 mm/s	50 mm/s
40 Hz	50 mm/s	50 mm/s
250 Hz	50 mm/s	50 mm/s



Measurements with the PCE-VM 40

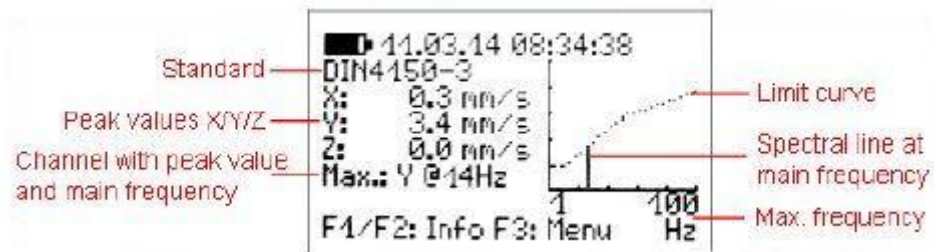
Once you have selected the measuring mode "BS7385", select the building type to be assessed.



In the next menu, select the frequency range:



Press F3 to exit the menu and to go the measurement value display



The three peak values X/Y/Z of the vibration velocity and the highest amplitude together with its main frequency are displayed every second. On the right side of the screen, a graph displays this value in the frequency range. The diagram is scaled to the limit curve. Higher magnitudes will be cut off. If the limit value is exceeded, "ALARM" is displayed below the main frequency and the following will happen:

- The red light will flash.
- The measurement values will be saved if event recording has been activated.
- The relay output will switch if it has been activated.
- An SMS will be sent if this option has been set up on the PCE-VM 40B.

Note: The alarm and recording functions will be activated after a delay of 30 seconds after leaving the menu.

5.4 Measuring in accordance with SN 640312a

Measurement procedure

The Swiss Standard SN 640312a is also based on the peak values of the vibration velocity. However, it uses the vector sum as assessment parameter:

$$v_i = \sqrt{v_x^2 + v_y^2 + v_z^2}$$

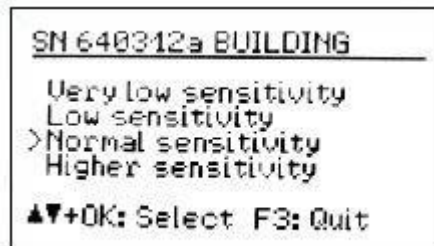
It measures between 5 and 150 Hz. The frequency range is divided into three sections: 8 to 30 Hz, 30 to 60 Hz and >60 Hz. For frequencies below 8 Hz, the reference value for 8 to 30 Hz reduced by one third is applied.

As a basis for the reference values, four building types with different levels of sensitivity and the frequency at which the vibration influence occurs are taken as a basis for the reference values.

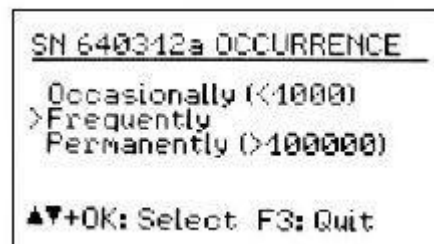
	very low sensitivity			low sensitivity			normal sensitivity			increased sensitivity		
Occurance of vibrations	occasio- nally	frequently	perma- nently	occasio- nally	frequently	perma- nently	occasio- nally	frequently	perma- nently	occasio- nally	frequently	perma- nently
1 Hz	45 mm/s	18 mm/s	9 mm/s	30 mm/s	12 mm/s	6 mm/s	15 mm/s	6 mm/s	3 mm/s	7,5 mm/s	3 mm/s	1,5 mm/s
30 Hz	60 mm/s	24 mm/s	12 mm/s	40 mm/s	16 mm/s	8 mm/s	20 mm/s	8 mm/s	4 mm/s	10 mm/s	4 mm/s	2 mm/s
60 Hz	90 mm/s	36 mm/s	18 mm/s	60 mm/s	24 mm/s	12 mm/s	30 mm/s	12 mm/s	6 mm/s	15 mm/s	6 mm/s	3 mm/s

Measurements with the PCE-VM 40

After selecting the measuring mode "SN 640312a", define which sensitivity class the building belongs to:



Once you have selected the building type, select the occurrence of the vibrations. The figures represent the vibration emissions at which the velocity vector exceeds the reference value 0.7 times. The assessment period is the time duration during which the building is exposed to vibration.



Press F3 to exit the menu and to go to the measurement value display



The vector sum of the vibration velocity in the three directions X/Y/Z and the highest amplitude together with its main frequency are displayed every second. On the right side of the screen, a graph displays this value in the frequency range. The diagram is scaled to the limit curve. Higher magnitudes will be cut off. If the limit value is exceeded, "ALARM" is displayed below the main frequency and the following will happen:

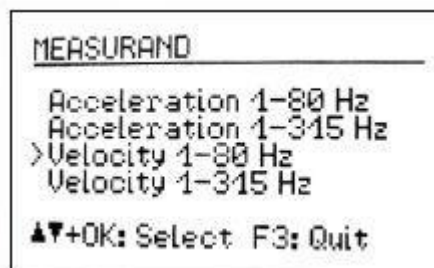
- The red light will flash.
- The measurement values will be saved if the event recording has been activated.
- The relay output will switch if it has been activated.
- An SMS will be sent if this option has been set up on the PCE-VM 40B.

Note: The alarm and recording functions will be activated after a delay of 30 seconds after leaving the menu.

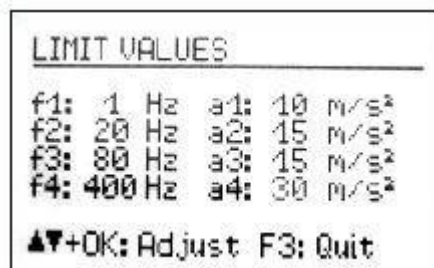
5.5 Non-standardized measurements

If a standardized measurement is not desired, the vibration quantity (acceleration or velocity), the frequency range and the limit values can be entered manually. For this option, select the measuring mode "non-standardized".

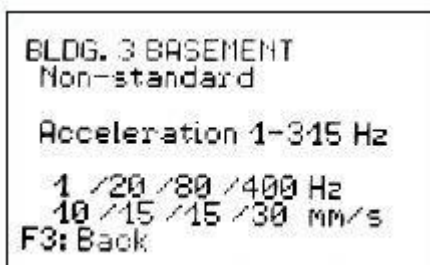
You can select the vibration quantity and frequency range in the next step.



After this, the points which define the limit value curve can be entered. The lowest and highest frequencies are fixed. The amplitudes and the two middle frequencies can be freely selected within the range limits.



As with the other measuring modes, your chosen measuring settings can be viewed during the measurement by pressing F1.



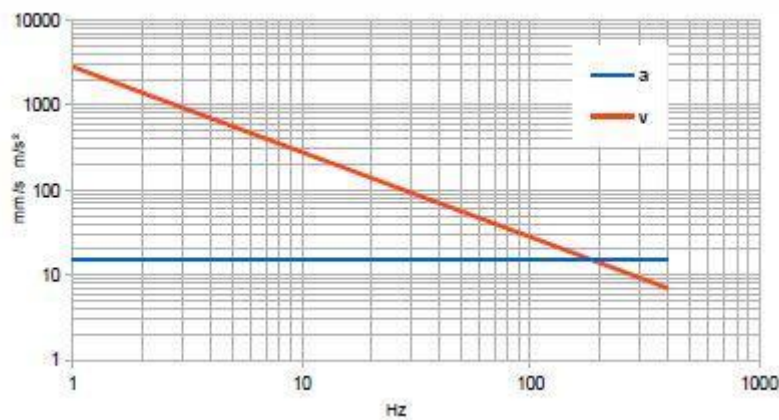
5.6 Overload indication

If the vibration magnitude exceeds the limits shown in the Technical Data section, the PCE-VM 40 will indicate "OVERLOAD" instead of the measuring value for the respective direction.



In addition, the warning and alarm LEDs flash simultaneously.

Due to integration, the overload limit for the vibration velocity is frequency-dependent.



5.7 Saving measured values

Introduction

The PCE-VM 40 has memory space for 100,000 measurements. The saved data can be viewed via the instrument menu or transferred to the PC via the USB interface.

A measurement record includes:

- Date and time
- Measurement values X/Y/Z or the vector sum
- Main frequency
- Trigger event

The instrument saves the data if any of the following events (triggers) occur:

- a warning or alarm event occurred
- a predefined time interval expired

Alarm events occur if the limits described in Section 3 are exceeded.

Warning events occur if the warning threshold is exceeded

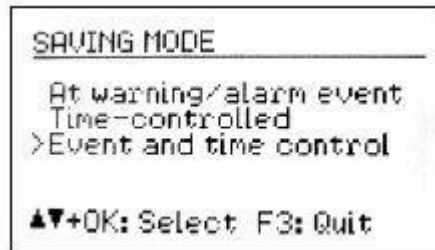
Saved measurements are sorted in to data files in the PCE-VM 40. A file contains related measurements with the same settings.

Setting for recording data

To start recording, open the main menu by pressing F3 and select "Recording".



Select "start". Now you can define the events (triggers), when the data should be saved.

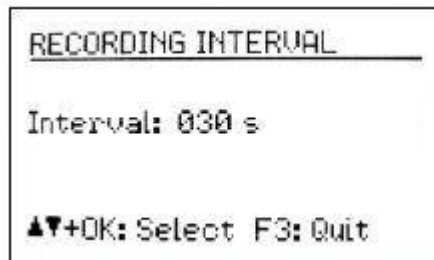


In the setting "Warning/Alarm", the measurement value is saved as soon as a change in status occurs, as follows:

- Normal to Warning
- Normal to Alarm
- Warning to Alarm
- Alarm to Warning
- Alarm to Normal
- Warning to Normal

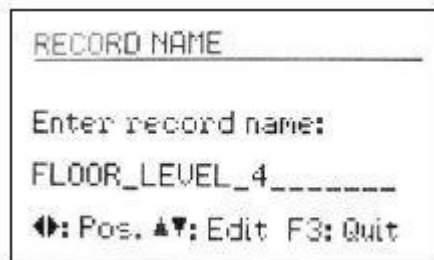
If the warning or alarm status persists, no further measured values will be saved. This keeps the quantity of saved data down to a minimum. The type of status change is saved with the measurement.

The PCE-VM 40 also offers you the possibility of saving measurements at pre-set time intervals. The time intervals are to be entered in seconds, with a minimum of 5 seconds.



The time interval recording can also be combined with the status change recording (“Event and time control”).

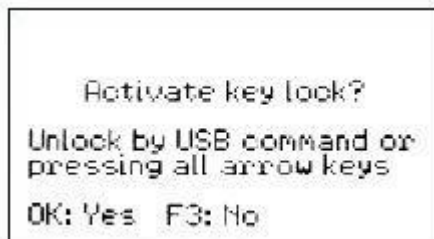
After determining the recording settings, you will be asked to enter the name of the data record.



The record name identifies a block of related measurements with the same saved settings. Here you can enter, for example, the measurement location.

With the arrow keys, you can enter up to 20 upper case characters and digits. The last entered name appears as the default name.

To exit the menu, press OK. After defining all the recording settings, you can activate the keypad lock by pressing OK, to ensure that no unintended interference occurs. You can also start recording without using the keypad lock by pressing F3.



The instrument will now display “Recording started”. Five seconds later, the evaluation of the recording trigger (event or time interval) will begin. The currently active recording can be seen in the measurement value display as a flashing text “Rec.#xxx”, where xxx is the number of the previously saved measurements.

During recording, the menu cannot be opened. If you press the menu button F3, you will be asked whether you wish to stop recording. The same will happen if you press OK/ON-OFF.

After reaching the memory end, the PCE-VM 40 will display the error message “Memory full”.

5.8 Displaying saved data

After recording, you can view the saved measurements in the "Recording" menu. Select the menu point "View/edit/delete files" and then use the arrow keys ▲▼ to select the data file you wish to view.

```
File No. 2 of 3
FLOOR LEVEL 4
Start: 11.03.14 08:43:44
BS 7385 (1-80Hz)
unreinforced/Res.
5 s + events
F1: Edit name  ◀: Delete
▲▼+OK: Select  F3: Quit
```

A data file is displayed by its number and name, together with the start time, chosen standard and trigger source. The following abbreviations are used:

Sust: sustained
 Shrt: short
 Ind: industrial
 Res: residential
 List: listed
 Pipe: pipe
 Foun: foundation
 Ceil: ceiling
 Steel: steel pipe
 Conc: concrete (pipe)
 Plas: plastics
 Unreinf./resid.: unreinforced/residential
 Reinform./ind.: reinforced/industrial
 Very low: very low sensitivity
 Low sens.: low sensitivity
 Normal: normal sensitivity
 Higher: higher sensitivity
 Occas.: occasionally
 Freq.: frequently
 Perm.: permanent
 acc.: acceleration
 vel.: velocity

Note: The file numbers are not always in the order of saving. A previously erased file number will be re-assigned to the next saved file.

Pressing ◀ deletes the file together with all of its recorded measurements.
 Press F1 to change the file name.

Press OK to open the file. The first saved record is then displayed. Below the file name, you see the record number with the total number of records in the file, date and time and the trigger event. The abbreviations mean:

(T): time interval controlled
 0→W: normal to warning transition
 0→A: normal to alarm transition
 W→A: warning to alarm transition
 W→0: warning to normal transition
 A→W: alarm to warning transition
 A→0: alarm to normal transition

When the data was measured in line with SN 640312a, you see the vector sum, otherwise you will see the three measuring values of X / Y / Z. The main frequency f(max) of the highest value is also displayed.

```

FLOOR LEVEL 4
Rec. No. 1 of 5
11.03.14 08:43:44 (T)
X: 0.0 mm/s
Y: 0.7 mm/s
Z: 1.1 mm/s
f(max): 1 Hz
▲▼: Scroll F3: Quit

```

Use the ▲ and ▼ keys to scroll through the records. Press F3 to exit the menu.

5.9 Deleting the data memory

In the “Recording” menu, the entire memory can be deleted by selecting “Delete all files”. This can take several seconds, depending on the amount of data stored.

5.10 Event Reporting

In the measurement value display, press F2 for an overview of the warning and alarm events that have occurred. These are displayed together with the number of saved measured values.

```

ALARM STATISTICS
Warning events: 745
Alarm events: 2501
Recordings: 10312
Sent SMS: 1
F1: Delete F3: Back

```

The SMS function is only available with the PCE-VM 40B.

5.11 Transferring the recorded data to a PC

For transferring saved data from the PCE-VM 40 to a PC, a support program is available.

The program converts the measurement data into a table of comma-separated values (CSV). This data format can be imported to all common spreadsheet programmes such as Excel or OpenOffice Calc. This enables you to carry out your own analysis and generate reports according to your own requirements.

5.12 Relay output

The PCE-VM 40 has a relay output for controlling external signalling devices. These can be, for example, warning lights and acoustic signalling devices.

Please pay attention to the maximum contact load. The relay output is not suitable for direct connection of mains operated devices.

To adjust the settings, open the main menu and select “Alarms” and then “Relay output”. You can pre-set the relay to energize or de-energize when warning status or alarm status occurs.

RELAY OUTPUT SETTINGS	RELAY OUTPUT SETTINGS
>Switches at alarm	>Non-latching
Switches at warning	Latching (reset by OK)
Relay disabled	
▲▼+OK: Select F3: Quit	▲▼+OK: Select F3: Quit

In addition, you can determine whether the relay should stay energized ("Latching") or de-energize after the event finishes, until the OK-button is pressed ("Non-latching").

Note: The relay function will be activated after a delay of 30 seconds after leaving the menu.

The figure below shows the output socket and its contact assignment. In neutral (de-energized) position the contacts "C" and "n.c." are connected, during warning or alarm status (energized) the contacts "C" and "n.o." are connected.



5.13 Receiving alerts via SMS (PCE-VM 40B)

General information

The PCE-VM-40B contains a GSM mobile phone modem for sending text message alerts when vibration events occur. In this way, the PCE-VM 40B is completely self-sufficient and can be used on remote grid-bound infrastructures.

The built-in modem supports the frequency bands 850, 900, 1800 and 1900 MHz and can, therefore, be used worldwide.

Inserting the SIM

To use the GSM functions, a SIM card is needed. In order to insert the SIM card, the PCE-VM 40 case needs to be opened. To do this, unscrew the antenna and remove the transparent plastic cover by loosening four cross-headed screws.

Next, loosen the four cross-headed screws of the case and carefully swing the lid towards the connector side, at the same time ensuring you do not pull the cables.

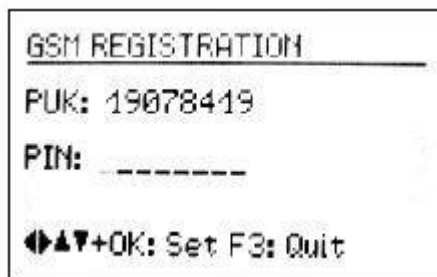


Open the SIM card holder by sliding its upper part across and opening it, as shown. Place the SIM card in the holder, as shown, and return the holder to its original position. Then put the lid back on. Please ensure that you do not trap any cables while doing this and please check the position of the flat cable plug which establishes the connection to the sockets.

5.14 Connection to a mobile network

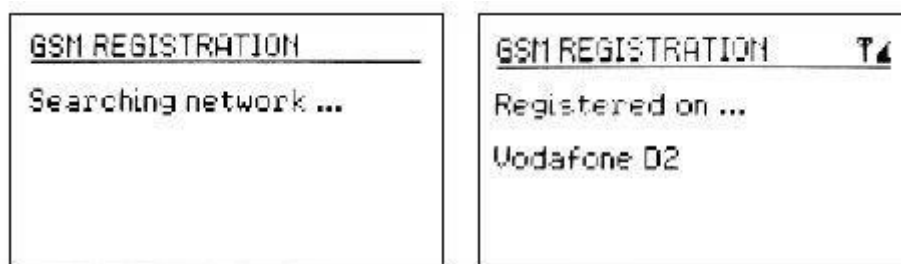
Once you have inserted the SIM card, open "Alarms/GSM" from the main menu and then select "GSM/SMS".

When you use the card for the first time, you will be asked to enter the PIN. If the card has been locked (e. g. after entering the wrong PIN three times), you will additionally need to enter the PUK number (Personal Unblocking Key)



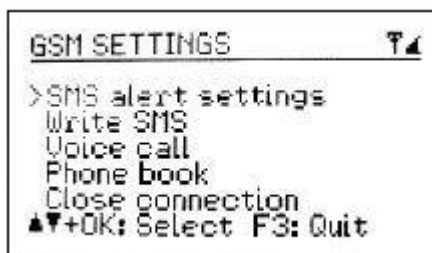
Note: The PCE-VM 40B deactivates the password request after the first registration, so that the password does not need to be entered again.

Now the PCE-VM 40B will try to connect to the mobile phone network. This takes a few seconds. If the registration is successful, the name of the network provider will appear on the display.



The antenna symbol and the reception quality display with five levels in the upper right corner of the display indicate that a connection has been established. If the reception quality is too low, a question mark appears next to the antenna symbol.

The following figure shows the GSM settings menu:



Note: GSM devices regularly establish connections to the nearest transmission mast at high transmission power. This is called Periodic Location Update. The length of the intervals may vary, depending on the network, between 6 minutes (rarely) and some hours. These high-performance transmission pulses are also known from occasional interference in audio equipment. Such interference may also occur in the sensitive PCE-VM 40B measuring channel and result in display values of 1 or 2 mm/s. This should be considered when monitoring very low magnitudes with the PCE-VM 40B.

5.15 SMS alerts

The PCE-VM 40B can send SMS messages including measurement values and the time when a limit value is exceeded. To set up the automatic SMS alerts, you need to enter the following information in the sub-menu "SMS Alert Settings".

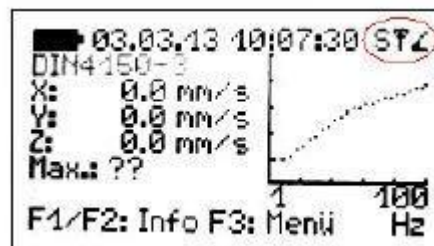


Within the submenu "Max. alerts/day", you can choose the maximum number of text messages the PCE-VM 40B can send in one day. This allows you to control the connection costs.

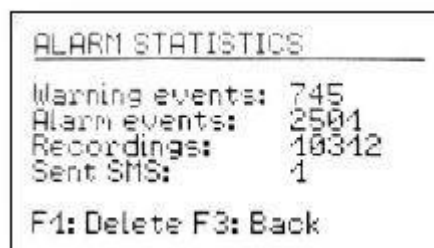
Within the submenu "Time betw. SMS", you can set how many minutes the PCE-VM 40B should wait before sending another SMS. This information also helps to avoid unnecessary costs or disturbances.

Furthermore, one or two telephone numbers need to be entered, to which the SMS messages should be sent. The numbers are selected from the phone book which is saved on the SIM Card.

Thirty seconds after leaving the menu, the SMS alert function will be activated. During measurement operation, this is indicated by an "S" displayed in the top left corner next to the antenna symbol.



The number of text SMS messages already sent can be viewed during the measurement operation by pressing F2.



The message will be displayed on the recipient's mobile (varying slightly dependent on the receiving phone) as shown in the figure below.

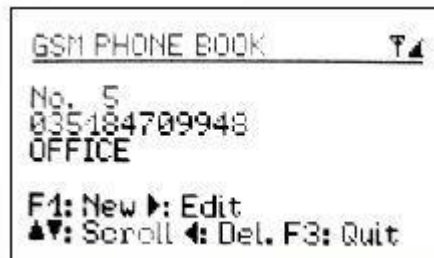
Under the heading "!!VIBRATION ALERT!!", the instrument name is displayed. Below this, the date and time of the alarm event are displayed, followed by the three vibration values measured at the time of the alarm signal. Lastly, the main frequency and the remaining battery power of the PCE-VM 40B are shown.



5.16 Phone book

The phone book is saved to the SIM card. If you already have contacts saved to the inserted SIM card, these will also appear in the PCE-VM 40B. New contacts can be added to the phone book via the PCE-VM 40B.

The phone book is found in the main menu under "Alarms/GSM", sub-menu "GSM/SMS" and from there under "Phone book". To edit the phone book, you need to be connected to the network.



Press F1 to create a new entry. First enter the telephone number without spaces and then the name.

Press OK to save the entry.

With the ▲ and ▼ keys, you can scroll through the existing entries.

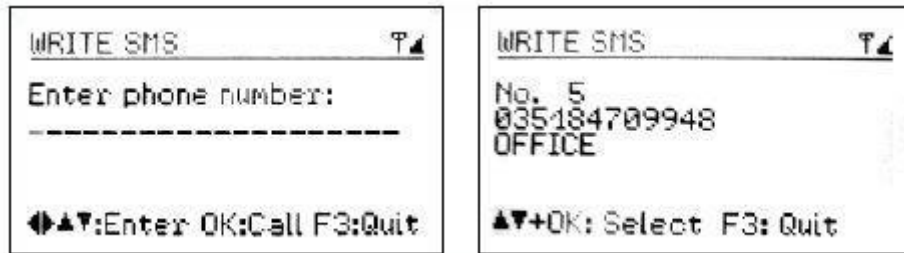
Press ◀ to delete an entry.

Press ▶ to edit an existing entry.

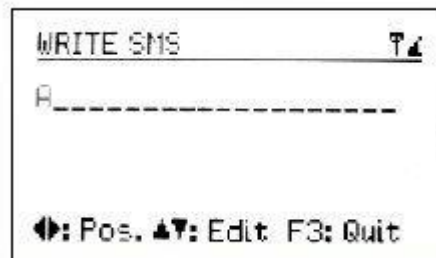
The phone book can store a maximum number of 50 entries.

5.17 Writing an SMS

In the menu "Write SMS" under "Alarm/GSM", sub-menu "GSM/SMS" you can write and send a short text message. You will then need to enter the recipient's telephone number or select it from the phone book.



Next you can enter 4 rows of text, each up to a maximum of 20 characters long. At the end of each row, press OK. After entering the fourth row, the message will be sent.

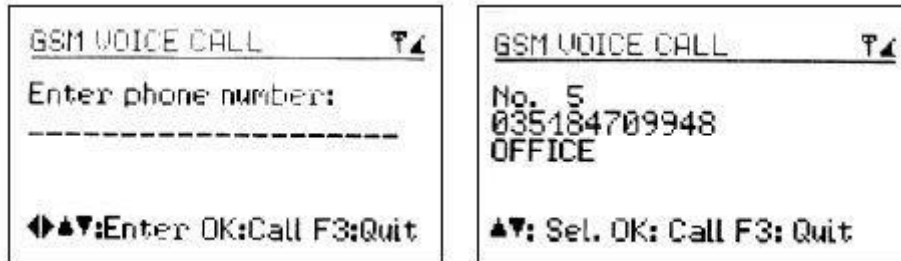


5.18 Making phone calls

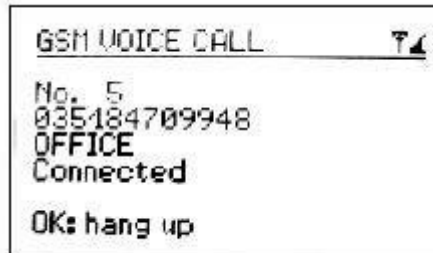
For making calls via the GSM modem, you will need a standard PC headset which can be connected to the second socket of the PCE-VM 40B, using the VM40-HS adapter.



You can select the telephone number from the phone book or enter it directly.

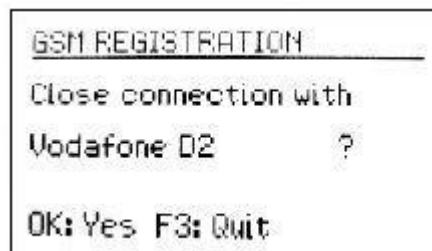


Press OK to start the call. Press OK again to end the call.



5.19 Disconnect from mobile network

In the sub-menu “GSM/SMS”, you will find the option “close connection”. Press OK to confirm you want to close the connection with the mobile phone network. To enlarge the life of the rechargeable battery, we recommend to close the connection with the mobile network when not in use.

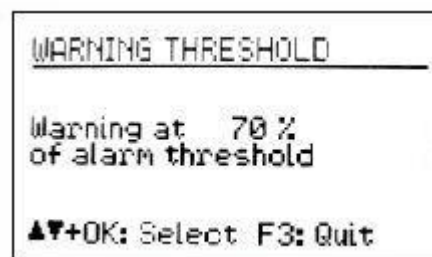


5.20 Miscellaneous settings

Warning threshold

The warning threshold is an adjustable percentage value, which relates to the alarm threshold of the selected standard. This enables you to automatically save measurement values or activate signalling even below the alarm limit of the applied standard.

If the warning threshold is exceeded, the yellow light next to the display will flash. To adjust the warning threshold, open the main menu by pressing F3, then select “Alarm/GSM” and “Warning Threshold”.



By pressing the ▲ and ▼ keys, you can set the value between 10 and 95 %.

Keypad lock

To prevent manipulation during ongoing monitoring, it can be advantageous to activate the key lock. This function can be found in the main menu under “Key Lock”.



When the key lock has been activated and you left the menu, you may only retrieve information using the keys F1 and F2.

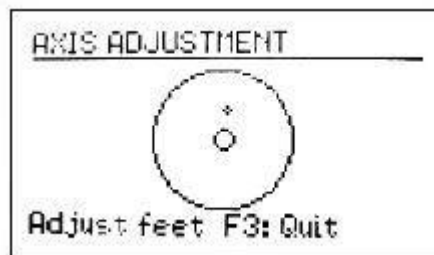
To release the key lock, press all four arrow keys simultaneously until the instrument displays “unlocked”.

Alternatively, the key lock can be switched on and off by a command sent via the USB interface.

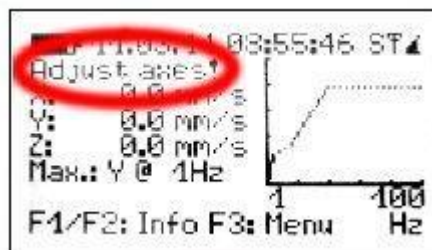
Adjusting the axes

The PCE-VM 40 contains a tilt sensor for adjusting and monitoring the vertical alignment. The menu item for axes adjustment is located in the main menu under “Device settings”. Here, you will see a graph which resembles a spirit level. The moving point has to be located within the circle. If this is the case, “OK” will be displayed on the left of the screen.

To install/mount the PCE-VM 40 on various floors or surfaces in conformity with a standard, PCE Instruments offers a tripod floor plate with adjustable feet.



The axis adjustment is monitored during measurement operation. If the axes have been adjusted incorrectly, the flashing warning “Adjust Axes!” will appear in place of the standard.



Date and time

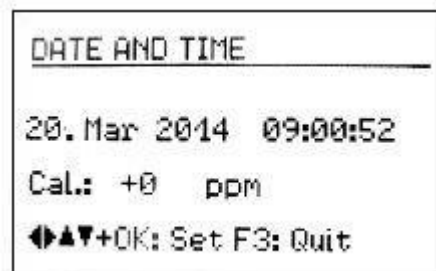
To retrace vibration events in the saved values, the exact date and time are important. To set the date and time, open the main menu by pressing F3. From the main menu, go to the menu option "Device settings" and press OK. From within this sub-menu, go to "Date and time".

Use the ▲ and ▼ keys to change the flashing value and with the ◀ and ▶ keys, move between second, hour, minute, month, day and year.

The date also takes the leap year into account.

In the same menu, you can also correct clock inaccuracy. This can be done using the setting at "Cal." in ppm (parts per million). The clock frequency can be increased with positive values and decreased with negative values. The symbol is changed to minus at +254 ppm.

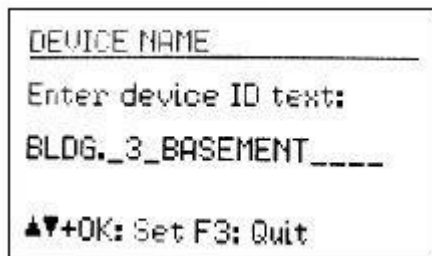
Example: The clock is 5 seconds slow. There are $24 * 60 * 60 \text{ s} = 86400 \text{ seconds}$ in a day. The difference amounts to $5 \text{ s} / 86400 \text{ s} = 58 * 10^{-6} = 58 \text{ ppm}$. The adjustable value is -58 ppm. Press OK to apply the settings.



Instrument name

The PCE-VM 40 can be given an individual name, which, for example, identifies the location of installation. The instrument name is retrievable via the USB interface and is also used for the SMS alerts (PCE-VM 40B).

In order to change the name, open the main menu, go to "Device settings" and then to "Device name".



Using the arrow keys, you can enter up to 20 upper case characters and digits.

Language

Enter the sub-menu "Menu language" in the "Device Settings", where you can select between German and English.

5.21 Data transfer

Connect the device to a PC

The PCE-VM 40 has a USB interface. For connecting to a PC, you can use the VM2x USB cable, which is connected to the second socket on the PCE-VM 40. As soon as the other end of the cable is connected to the computer USB socket, the device identification begins.

If the instrument is being connected to a PC for the first time, you will be asked to carry out a driver installation. The required driver data MMF_VCP.zip can be found on our website:

www.pce-instruments.com

Save both data files in a directory on your computer.

If Windows requests details of the source of the device driver, this directory should be entered.

The device driver is digitally signed and runs with Windows XP, Vista, 7 and 8.

If the PCE-VM 40 is connected to a PC, the signal "USB" appears on the measurement screen in place of the battery symbol. The battery power is then switched off and the instrument obtains its power supply via the USB connection.

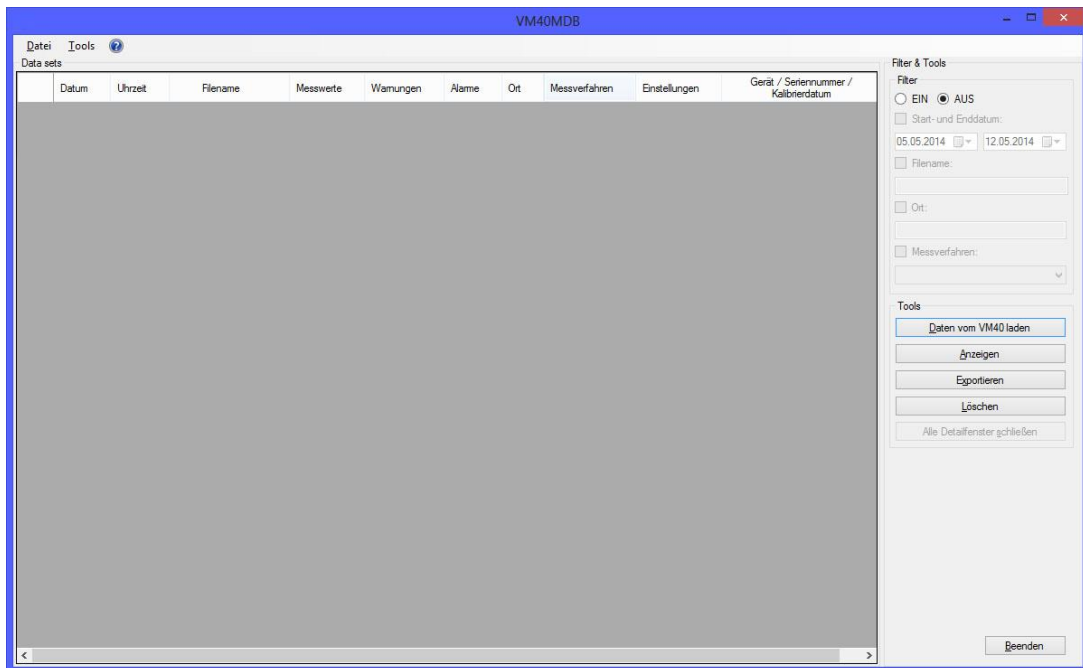
Software VM40MDB

The PC software VM40MDB is used to archive and display measuring data from the PCE-VM 40. In addition, it generates reports in accordance with the relevant standards.

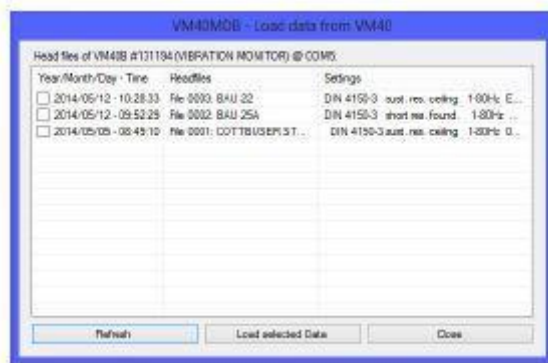
You can download the license-free software from the web page www.pce-instruments.com

VM40MDB runs under Windows 7, 8 and 8.1.

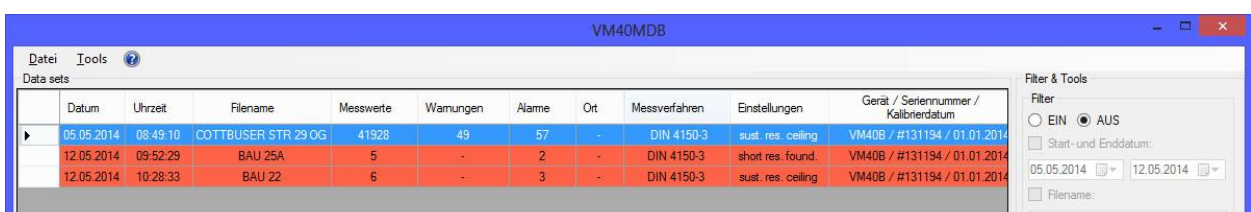
Connect the PCE-VM 40 to the USB port of the PC, switch it on and install the device driver, if necessary. Install VM40MDB and start it from the Windows start menu. The main window will appear.



To start the data transfer from the PCE-VM 40 to the PC, click “Load data from PCE-VM 40”. The software will read the header data first. Now you can select the files to be imported by ticking the checkboxes.



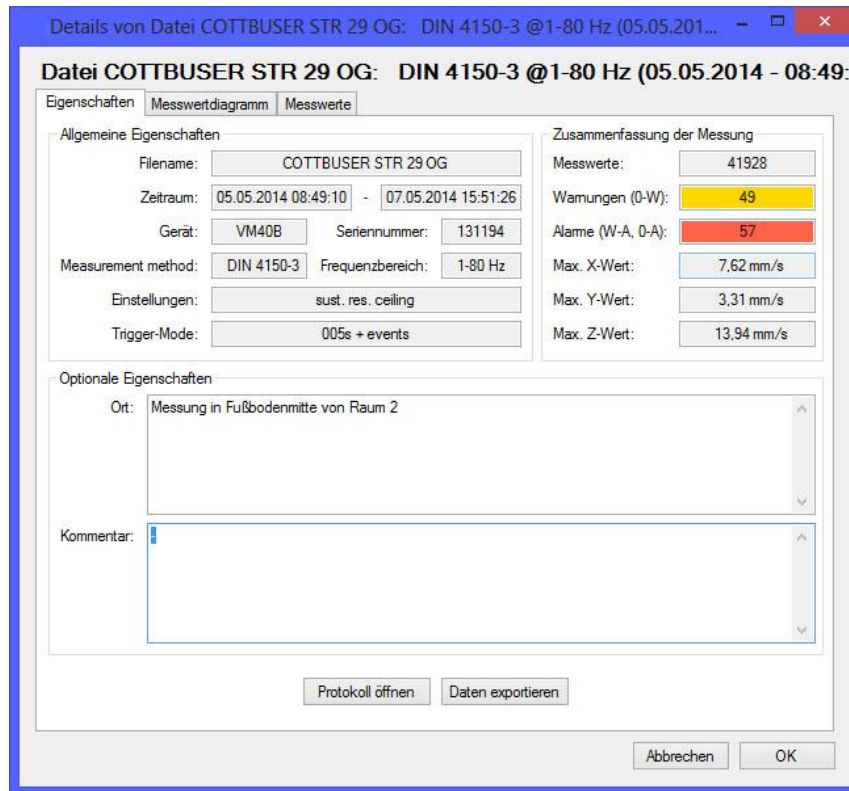
Click on “Load selected data” to start the transfer. This may take some minutes for larger amounts of data. The progress is indicated above the list of header data.



VM40MDB can archive all measurements ever recorded with the PCE-VM 40. They can also come from different PCE-VM 40 units.

To search in larger amounts of data, there are filter functions on the right side of the header list. You may search for a certain range of calendar dates, parts of the file name or the content of the “place” field or for the measurement mode. The wild-card character “*” is allowed.

Select a record with the mouse pointer and click “Show”. A window showing “Properties” of the opened file will appear.



Details von Datei COTTBUSER STR 29 OG: DIN 4150-3 @1-80 Hz (05.05.2014 - 08:49:)

Datei COTTBUSER STR 29 OG: DIN 4150-3 @1-80 Hz (05.05.2014 - 08:49:)

Eigenschaften | Messwertdiagramm | Messwerte

Allgemeine Eigenschaften

Filename:	COTTBUSER STR 29 OG		
Zeitraum:	05.05.2014 08:49:10	-	07.05.2014 15:51:26
Gerät:	VM40B	Seriennummer:	131194
Measurement method:	DIN 4150-3	Frequenzbereich:	1-80 Hz
Einstellungen:	sust. res. ceiling		
Trigger-Mode:	005s + events		

Zusammenfassung der Messung

Messwerte:	41928
Warnungen (0-W):	49
Alarmer (W-A, 0-A):	57
Max. X-Wert:	7,62 mm/s
Max. Y-Wert:	3,31 mm/s
Max. Z-Wert:	13,94 mm/s

Optionale Eigenschaften

Ort: Messung in Fußbodenmitte von Raum 2

Kommentar:

Protokoll öffnen | Daten exportieren

Abbrechen | OK

You will find the following information:

- Record name which was entered in the PCE-VM 40
- Period of recording
- Device name and serial number
- Used standard with detailed settings
- Record settings (triggers and interval)
- Number of saved measurements, warnings and alarms (coloured)
- Maximum values for X, Y and Z

You may manually enter a description of the place of measurement, measuring conditions, etc. Two text fields are available for this purpose.

Click “Open protocol” to generate a report to DIN 4150-3, Appendix A. Under several menu tabs, the necessary information is gathered. These include:

- Purchaser and person in charge
- Details about the source of vibration
- Description of the monitored structure
- Information about the location and the measuring point
- Environmental and other conditions
- Measuring results to be included

In the menu “Location and position”, pictures can be entered. Click inside the white space and load the image file from a specified storage position.

Press “OK” to complete the report. The following figures show an example of such a report.

The header data of the report, including company address data and a logo, are entered in the menu “File” / “Settings” of the main window.

VM40MDB - Einstellungen

Firma


Bezeichnung:

Straße:

PLZ / Ort:

Telefon / Fax:

Web / Email:

Logo: 

Hauptfenster

Hauptfenster starten: ☐ maximiert ☒ mit letzter Größe und Position

PCE Instruments



Messprotokoll

1 Allgemeines

- 1.1 Auftraggeber: TU Dresden
Institut für Bauphysik
Im Auftrag für die Wasserwerke der Stadt Dresden
Universitätsallee 12
D-01234 Dresden
- 1.2 Auftragskennzeichen: EK-2014/2348
- 1.3 Bearbeiter: Christian Richter
- 1.4 Messzeitraum: 05.05.2014 08:49:10 - 07.05.2014 15:51:26

2 Art der Erschütterung

- 2.1 Erreger: Sprengung mehrerer Wohngebäude in unmittelbarer Nähe des Bauwerkes unter Punkt 3.
Sprengstoff: C4
Zündung: manuell elektrisch
Sprenglöcher: 200
Sprengserien: 2 a 100 Löcher
- 2.1 Betriebsbedingungen: keine weiteren Erschütterungsquellen im Radius von 1 Kilometer.

3 Bauwerk

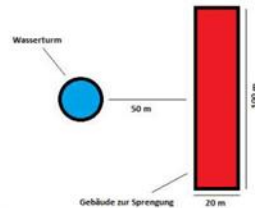
- 3.1 Benennung: Fußbodenplatte in Raum 2
- 3.2 Zuordnung: Baudenkmal nach DIN 4150-3
- 3.3 Beschreibung: Bauart: Wasserturmgebäude
Größe: Grundfläche 20m x 20 m / Höhe 30 m
Gründung: 1889
Baulicher Zustand: 1992 saniert, keine Schäden erkennbar.

PCE Instruments

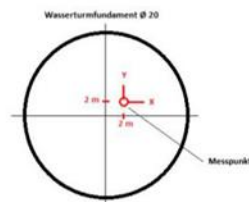


4 Ort und Lage

4.1 Erschütterungsquelle



4.2 Messpunkt



5 Umgebungsverhältnisse

Bodenart: 2 m lehmiger Boden
Gesteinsart: Sandstein
Grundwasser: nicht festgestellt
Wetter: sonnig, 23°C bei 52% rLF
Durch weitläufige Abspernung sind Fremderschütterungen ausgeschlossen.

PCE Instruments



6 Subjektive Beobachtungen

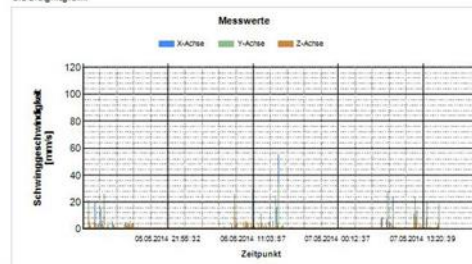
An der Abspergrenze (1 km von Sprengung entfernt) waren keine sekundären Nebeneffekte außer der Explosion an sich zu spüren.

7 Messtechnik

Triaxial Vibration Meter VM40B
Serial number: 131194
Calibration Date: 01.01.2014
Measurement method: DIN 4150-3
Settings: suit. res. ceiling
Frequency range: 1-80 Hz
Trigger mode: 005s + events
Measurement processing and report generation done with VM40MDB software.

8 Messergebnis

8.1 Ereignisgrafik



8.2 Einzelwerte

Datum	Uhrzeit	X-Achse [mm/s]	Y-Achse [mm/s]	Z-Achse [mm/s]	Frequenz [Hz]	Trigger-Ereignis
05.05.2014	09:35:49	1,79	5,8	1,79	11	Alarm (D-A)
05.05.2014	09:42:49	2,26	6,19	2,11	9	Alarm (D-A)
05.05.2014	10:22:57	4,7	20,47	7,32	9	Alarm (D-A)
05.05.2014	10:32:45	5,18	1,52	1,26	3	Alarm (D-A)
05.05.2014	10:33:51	19,42	4,33	2,46	5	Alarm (D-A)
05.05.2014	11:22:48	9,54	2,13	1,6	11	Alarm (D-A)
05.05.2014	11:22:59	15,62	1,97	1,98	2	Alarm (D-A)

PCE Instruments



07.05.2014	12:19:35	0,99	5,77	13,42	11	Alarm (D-A)
07.05.2014	13:19:53	1,68	5,19	2,97	9	Alarm (D-A)
07.05.2014	13:41:33	5,55	6,75	2,97	11	Alarm (D-A)
07.05.2014	13:52:43	7,01	1,18	1,52	10	Alarm (D-A)
07.05.2014	13:53:51	5,44	3,09	2,55	9	Alarm (D-A)
07.05.2014	13:53:59	10,96	20,41	9,22	8	Alarm (D-A)
07.05.2014	15:44:36	8,57	18,34	4,08	2	Alarm (D-A)
07.05.2014	15:44:45	1,3	5,74	5,49	11	Alarm (D-A)
07.05.2014	15:47:31	1,94	6,11	5,04	8	Alarm (D-A)
07.05.2014	15:51:14	97,62	99,31	76,33	3	Alarm (D-A)
07.05.2014	15:51:25	7,84	4,69	1,12	2	Alarm (D-A)

9 Auswertung

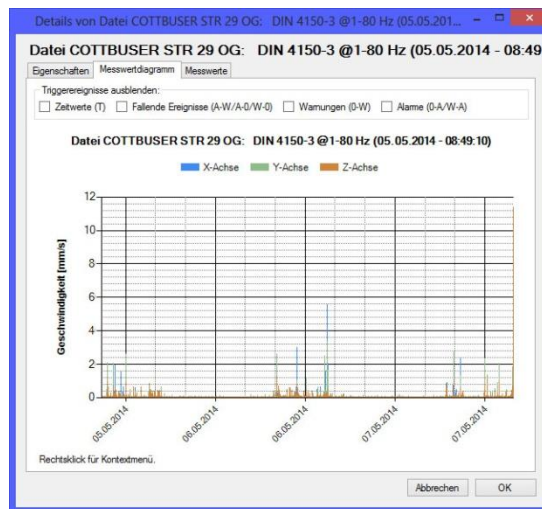
Die Messwerte befinden sich alle innerhalb der geforderten Grenzen.
Es wurden keine Schäden am Gebäude beobachtet.

10 Unterschriften

Bearbeiter & Firmenstempel

Auftraggeber

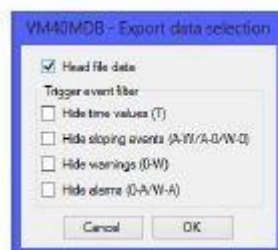
Apart from the report function, you can display the measuring data graphically by selecting the menu tab “Measurement chart”. You will see all measurements in a magnitude/time diagram. Displayed events can be filtered depending on their trigger event. For example, you may want to see alarm events only. By right mouse click, individual axes can be disabled. You may also save the diagram as an image or in CSV table format to be further processed in Excel, OpenOffice Calc, etc.



Select the menu tab “Measurement values” to switch to chart view. Like in the diagram window, you have the possibility to filter the data displayed according to their trigger source.

Datum	Uhrzeit	X-Achse	Y-Achse	Z-Achse
05.05.2014	08:45:10	0,61	0,99	1,18
05.05.2014	08:49:15	0,58	1,23	0,61
05.05.2014	08:49:19	3,54	0,87	0,87
05.05.2014	08:49:25	0,33	0,34	0,17
05.05.2014	08:49:30	0,29	0,21	0,19
05.05.2014	08:49:34	0,24	0,17	0,16
05.05.2014	08:49:39	0,11	0,07	0,09
05.05.2014	08:49:44	0,11	0,08	0,07
05.05.2014	08:49:48	0,12	0,08	0,13
05.05.2014	08:49:53	0,1	0,11	0,1
05.05.2014	08:49:58	0,18	0,22	0,16
05.05.2014	08:50:02	0,08	0,13	0,11
05.05.2014	08:50:07	0,11	0,15	0,09
05.05.2014	08:50:13	0,07	0,13	0,16
05.05.2014	08:50:17	0,08	0,09	0,07
05.05.2014	08:50:22	0,23	0,09	0,07

If you click “Export” in the main window, you will be asked to select the events to be saved into an export file. Available export formats are text and CSV.



Finally, you can use the “Delete” button to erase data files from the PCE-VM 40 memory.

5.22 Firmware update

The device software (firmware) can be updated via the USB interface. First check whether an updated version of the currently installed software is available. This can be found on our website under:

https://www.pce-instruments.com/deutsch/geraete-software-downloadbereich-win_4.htm

There you will see the most recently updated firmware version. The version number is composed of three digits for the hardware and three for the software (hhh.sss). Only the last three digits are relevant for the Firmware. The currently installed version is displayed on the PCE-VM 40 start screen. If firmware with a higher version number is available on the website, please proceed as follows:

1. Download the firmware file vm40.hex from the above-named website. This contains the firmware for the instruments PCE-VM 40A and PCE-VM 40B.
2. Also download the program "Firmware Updater" from the above-named website and install it on your PC.
3. Connect the PCE-VM 40 to the PC, using the supplied USB cable, and switch it on. The PC will then recognize it as a USB device.
4. Start the "Firmware Updater", then select the instrument type "PCE-VM 40" and the virtual COM port assigned by the PC. If you are not sure which of the available COM ports is correct, you can check in the Windows system control manager in the device manager.
5. Click on "Load" in the "Firmware Updater" and enter the path to the file where the downloaded firmware file vm40.hex is located.
6. Within the PCE-VM 40 "Device settings", select the option "Update firmware" and confirm the subsequent warning by pressing OK. By carrying out this step, the old firmware is deleted. The PCE-VM 40 will then indicate that it is awaiting new firmware data from the USB interface ("Waiting for update").



7. Click on "Send" in the "Firmware Updater" and confirm the subsequent note. Transfer of the firmware data has now begun. The transfer progress is displayed as a time bar on the PC and also on the PCE-VM 40. When the update is finished, the PCE-VM 40 will carry out a restart and the "Firmware Updater" will close. Please do not interrupt the update process. After transfer failures, the update can be restarted at point 3.

5.23 Charging the battery

The integrated NiMH battery has a capacity of 9 Ah, which enables the PCE-VM 40 to operate independently for more than 10 days. The charge level is displayed in the top left corner of the display. Shortly after the battery symbol displays empty, the PCE-VM 40 switches off. The device measures according to the specifications until it reaches this state. To recharge the battery, please connect the charger provided to the charge socket of the device.

After connecting the charger, you need to switch the device on in order to start the charging process. After a few seconds, "Chg" appears in the top left corner of the screen in place of the battery symbol. The battery has started charging only when the "Chg" indicator appears and only while measurements are being displayed. If you open a menu or switch off the device, the charging process will be interrupted. If the battery is completely flat, it takes approximately 10 hours to be fully recharged. You can continue taking measurements while the battery is being charged.



5.24 External power supply

For measurements of very long duration, an external power supply is recommended. To operate the PCE-VM 40 using an external power supply, connect the USB cable provided with the device's USB socket.

To operate the device via USB power supply, you may use a standard USB power supply unit or alternatively a "USB Power Bank". If the PCE-VM 40 is connected via USB, the text "USB" appears on the measurement screen in place of the battery symbol. The internal rechargeable battery then switches off and the PCE-VM 40 receives its power via the USB connection.

Rechargeable NiMH batteries have a self-discharge rate of 0.5 to 1 % per day.

Note: The battery charger VM40-CH is not suitable for buffer operation of the PCE-VM 40 for battery backup. Current from the charger only flows as long as the battery is being charged.



5.25 Reset

In rare cases, the PCE-VM 40 may not respond to any key operation. You can restart the firmware by pressing the internal reset button. The location of the reset button is shown below.

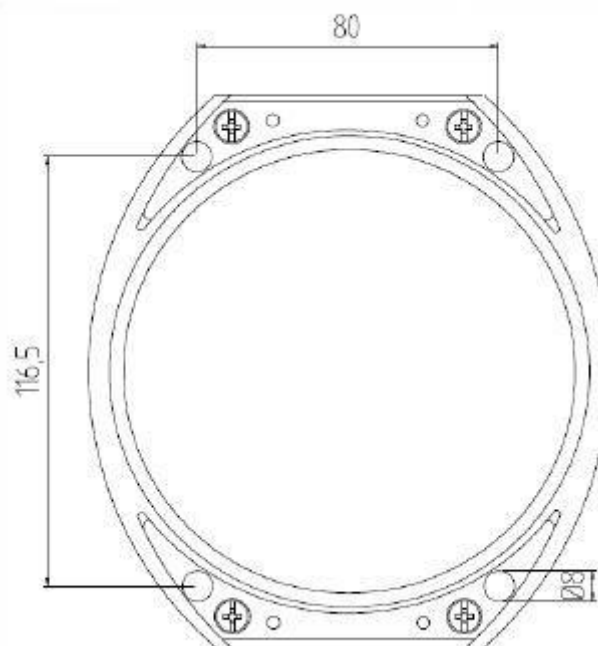


Pressing the reset button does not affect data in the memory. Only time and date need to be readjusted.

5.26 Mounting

The cast aluminium case of the PCE-VM 40 is suitable for direct mounting because of its weight. However, we recommend using the tripod floor plate VM40-BP, available from PCE Instruments as an optional accessory. The VM40-BP has adjustable feet for aligning the axes, including exchangeable tips for different floor types.

At higher magnitudes, the PCE-VM 40 should be attached by screws. According to SN 640312a, free placement is not allowed at accelerations above 3 m/s^2 . The corresponding velocity is, for example, 24 mm/s at 20 Hz or 12 mm/s at 40 Hz . For screw attachment, the PCE-VM 40 has four through holes for screws up to M5 with a maximum head diameter of 8 mm . It is not necessary to open the case in order to mount the device. You only need to remove the two plastic shades.



6 Calibration

A PCE-VM 40 stands out by its long-term stability. Depending on the intensity with which it is used, we recommend a recalibration after approximately 1 to 2 years. The month and year of the last calibration are displayed on the start screen.

The calibration is performed through mechanical excitation with known vibration amplitudes.

Due to the weight of the device and the required low frequencies and high amplitudes, a particular kind of vibration generator is needed.

The calibration menu is not accessible to the user in order to avoid manipulation.

PCE Instruments offers a calibration service. For calibrations in other laboratories, we also provide the necessary technical documentation, upon request.

7 Disposal

For the disposal of batteries, 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.

If you have any questions, please contact PCE Instruments.



8 Contact

If you have any questions about our range of products or measuring instruments please contact PCE Instruments.

8.1 PCE Instruments UK

By post:

PCE Instruments UK Ltd.
Units 12/13 Southpoint Business Park
Ensign Way, Southampton
Hampshire

United Kingdom, SO31 4RF

By phone:

02380 987 035

8.2 PCE Americas

By post:

PCE Americas Inc.
711 Commerce Way
Suite 8
Jupiter
33458 FL
USA

By phone:

561 320 9162