

# Instruction Manual

## **Vibration Calibrating System VC120**



Manfred Weber

Metra Mess- und Frequenztechnik in Radebeul e.K.

Meissner Str. 58 - D-01445 Radebeul

Phone. +49-351 836 2191 Fax +49-351 836 2940

Email: [Info@MMF.de](mailto:Info@MMF.de) Internet: [www.MMF.de](http://www.MMF.de)

**Published by:**

Manfred Weber  
Metra Mess- und Frequenztechnik in Radebeul e.K.  
Meißner Str. 58  
D-01445 Radebeul  
Phone 0351-836 2191  
Fax 0351-836 2940  
Email [Info@MMF.de](mailto:Info@MMF.de)  
Internet [www.MMF.de](http://www.MMF.de)

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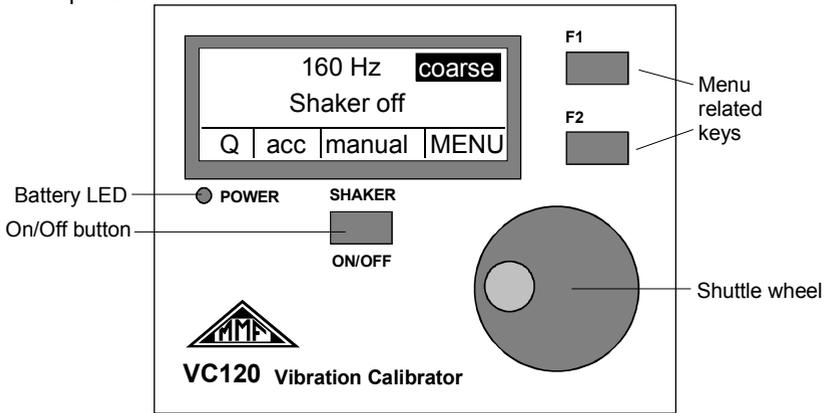
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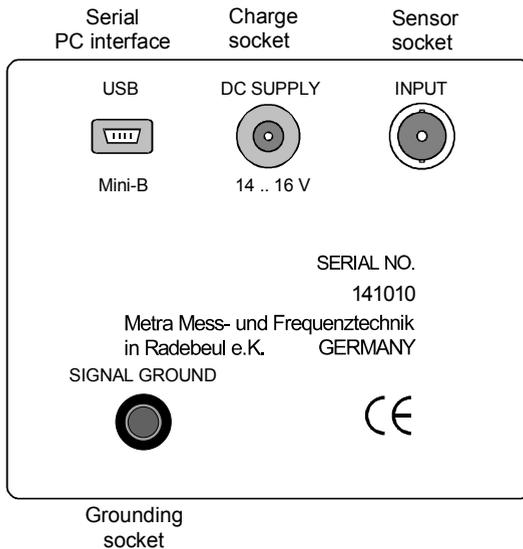
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# 1. The Instrument at a Glance

Front panel controls:



Rear panel connectors:



*Dear Customer,*

*We are glad about your decision to work with our Vibration Calibrating System VC120. This instrument can be easily operated by means of its self-explaining display. Nevertheless, you should spend some time to read this manual. This way you will be ensured to use all functions of the instrument in the best possible manner.*

## **2. Functions**

The Vibration Calibrating System VC120 has been designed for calibration of various kinds of vibration transducers. In spite of its compact case the instrument is portable and features a variety of functions, which have been known only from far more expensive systems up to this time. The most important features are:

- Vibration exciter for sine wave vibration from 70 Hz to 10 kHz
- Control of vibration level by an internal reference loop to the constant value of 1 m/s<sup>2</sup> (RMS)
- Calibration of specimen with a maximum weight of 400 g
- Calibration at fixed frequencies as well as measurement of frequency response
- Internal signal conditioning channel for transducer output, on screen display of sensor sensitivity
- Menu controlled dialog for operation via LCD display and shuttle wheel
- PC software for automatic sensor calibration, report generation and data management
- ASCII command strings for controlling the VC120 by customer software via USB Serial Port (virtual COM-Port)
- Automatic switching the VC120 on/off controlled by the PC software or Windows energy management to reduce power dissipation

A piezoelectric actuator is used as vibration exciter allowing the compact size of the instrument. This principle of excitation requires a sophisticated electronic correction to suppress harmonic distortion. For this purpose Metra developed a special technique with the trademark ACHD (Active Compensation of Harmonic Distortion).

### 3. Mounting of Test Object

The head of the shaker system is situated at the upper side of the case. The coupling surface has a diameter of 20 mm. It possesses an M5 tapped hole in its center for mounting the specimen.

The most reliable kind to attach the sensor under test is screwing. Vibration transducers have a variety of different mounting threads. The VC120 therefore includes some threaded adapters from M5, M8, 1/4"-28 and UNF 10-32 to the M5 tapped hole of the shaker head. Other adapters are available on demand. Screw attachment should be preferred at frequencies above 1 kHz to prevent coupling resonances. In addition, a thin layer of grease applied to the coupling surface is recommended.

At lower frequencies a strong permanent clamping magnet may be used for mounting. The shaker head therefore consists of magnetic steel.

⇒ Do not drop the magnet onto the shaker head to protect the VC120 and the sensor from shock acceleration. Gently slide the sensor with the magnet to the place.

Especially small transducers often have no mounting hole. In this case it is recommended to use adhesive wax or cyanoacrylate glue.

Under no circumstances the specimen must wobble or come into contact with the shaker head at only a few points. In such cases, as a result of the coupling resonances, the measuring error may increase in a two-figure percentage.

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 (see the following figure).

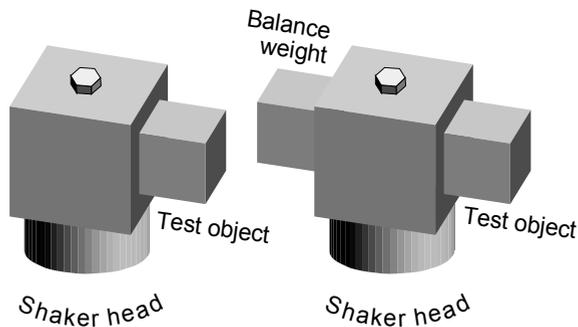


Figure 1: Balancing the weight of the object under test

For a perfect transmission of frequencies in the kilohertz range it is very important to have a coupling surface without any scratches at the VC120 shaker head as well as at the sensor under test. The surface of the shaker head of VC120 is flat grinded. If it shows scratches after intensive use please send the instrument back to the manufacturer for revision.

The accessories include a plastic washer which can be put between the shaker and the test object. This will protect the shaker surface from scratches. It is not recommended, however, to use the plastic washer above 1 kHz.

⇒ Important: The maximum torque when attaching a sensor must not exceed 5 Nm, otherwise the vibration exciter may get damaged.

The input for the sensor to be calibrated (BNC socket) is located at the rear of the VC120. Some transducers have cables with UNF 10-32 type or Microdot plugs. An adapter for these cables is included in the accessories of the VC120.

## 4. Operation of the VC120

This section exclusively describes operation via the VC120 front panel. These operations and adjustments can also be done in an easier way by means of the included PC software. For field use or cases where no PC is at hand, it may be useful to study this chapter.

### 4.1. Switching the Unit On and Off

Press the **SHAKER ON/OFF** key about 1 s to switch on the VC120. The instrument now runs a self test and then displays the operation screen.

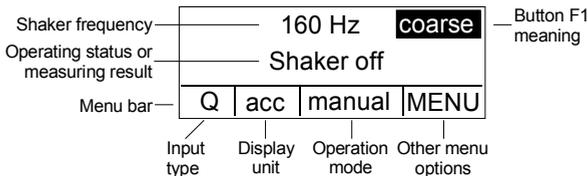


Figure 2: Display

In the upper part of the window vibration frequency and below the measuring result or the operating status are displayed. The menu bar at the lower part of the screen shows the last before the instrument was switched off.

To switch off the instrument press the **SHAKER ON/OFF** button about 2 s, until **power off** is indicated. After releasing the key the instrument switches off.

The current configuration of the instrument is automatically stored before it is switched off. The VC120 will start with the same configuration, when it is switched on next time.

To start the VC120 with the default manufacturer settings, press the **SHAKER ON/OFF** key and the **F1** key simultaneously.

In case of a faulty operation press the key **SHAKER ON/OFF** about 5 s until **System reset...** is displayed. The VC120 will start with the last settings.

If the battery voltage becomes too low, i.e. the accumulator is discharged, the VC120 will switch off automatically after saving the current configuration.

The VC120 switches off immediately when the external power supply is interrupted by disconnecting it from mains. It will start with the default configuration, when it is switched on next time.

### 4.2. Basic Settings

Depending on the sensor type some settings of the signal conditioning channel must be made. For this purpose, press the **F2** key. The display shows a menu bar in its bottom line:

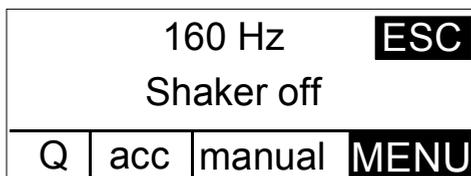


Figure 3: Menu bar

Use the shuttle wheel to select a menu option. The selected option is inversely indicated. Select the left option in the menu and press the **F2** key again. Select the desired input type by the shuttle wheel.

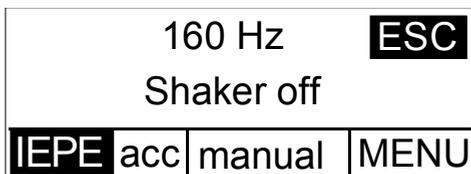


Figure 4: Input type

The following options are available:

- IEPE:** For sensors with integrated impedance converter to IEPE standard. The input features a 4 mA constant current source.
- U:** The input is configured for AC voltage. Its impedance is higher than 1 MΩ. This mode is suitable, for instance, for calibration of electrodynamic vibration transducers.
- Q:** The signal conditioning channel works as charge amplifier for piezoelectric transducers.
- Off:** The measuring amplifier is switched off. This option is useful, if the VC120 is used as vibration exciter only.

To confirm your choice press **F1** (the display indicates **OK**). Leave the menu by pressing **F1** again (the display indicates **ESC**).

The VC120 works in all operation modes with a constant acceleration of 1 m/s<sup>2</sup> (RMS). Nevertheless, the instrument can be used not only for calibration of accelerometers, but also for calibration of velocity and displacement transducers. This is realized by internal mathematical conversion of the physical quantities in dependence of the frequency:

$$v = \frac{a}{2\pi f} \text{ for velocity}$$

and

$$d = \frac{a}{(2\pi f)^2} \text{ for displacement.}$$

Please note that the shaker magnitude limits the maximum calibration frequency at calibration in velocity and even more at calibration in displacement quantities. At high frequencies a very high amplification of the sensor signal would be required. Therefore, the usable frequency range depends on transducer sensitivity. The minimum input signal of the sensor is 0.12 mV for voltage input and 0.12 pC for charge input.

Select the required physical quantity in the menu bar, which is accessed by pressing the **F2** key. Use the shuttle wheel to select the second position from the left and press **F2** again:

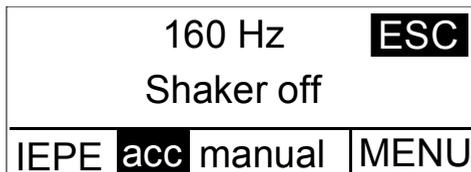


Figure 5: Vibration quantity

The following options are available:

- acc:** Vibration acceleration
- vel:** Vibration velocity
- disp:** Vibration displacement
- bias:** Bias voltage of IEPE compatible sensors.

Select the required physical quantity by the shuttle wheel and confirm by pressing **F1**. Leave the menu by pressing **F1** again.

IEPE bias voltage is measured only when IEPE input was selected. The vibration exciter is switched off during this operation.

Occasionally accelerometers are not calibrated in the SI standard unit  $m/s^2$ , but in units of  $g$  (gravitational constant,  $1g = 9.807 m/s^2$ ). The VC120 may display acceleration in  $g$ , although it still calibrates at  $1 m/s^2$ . Switch to  $g$  display in the right field of the menu bar (**MENU**). To enter the **MENU** option press **F2** key. The screen displays the sub-menu **OPTIONS**. Use the shuttle wheel to select **Signal Cond.** and confirm by pressing **F2** (the display indicates **SEL**):

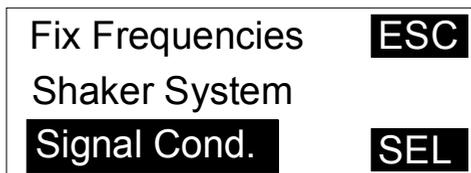


Figure 6: Signal conditioning options

Now the sub-menu **Signal Conditioner** will appear:

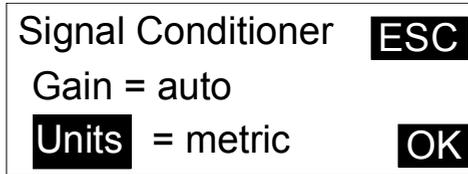


Figure 7: Selecting metric or imperial units

Select **Units** by the shuttle wheel and confirm by **F2** (the display indicates **SEL**). Choose by the shuttle wheel between:

**metric** (indication in units of  $m/s^2$ ) or

**imperial** (indication in units of g).

Confirm the selection by pressing **F2** again (the screen displays **OK**) and leave the menu by pressing **F1** three times (the screen displays **ESC**).

After finishing all basic settings of the VC120 you can start now with calibration.

### 4.3. Calibration

After the specimen has been mounted and connected and all basic settings have been completed, you can start with calibration.

The VC120 provides 3 modes of calibration which differ by their frequency control.

- **Manual:** The calibration frequency is adjusted by the shuttle wheel. Coarse or fine tuning are available.
  - **Table of fixed frequencies:** You can select from a table of up to 10 frequencies. Switch from one to the other frequency by the shuttle wheel.
  - **Frequency response:** The VC120 automatically sweeps through the frequency range. The minimum and maximum frequency as well as the increment can be selected in advance.
- ⇒ The vibration exciter is activated only during measuring operation. It is ready within 2 s after switching on the instrument. We recommend to keep measurements as short as possible to reduce power consumption and to extend battery operating life.

### 4.3.1. Manual Calibration

The simplest way to calibrate a sensor is calibration at a fixed frequency adjusted by the shuttle wheel. At first switch the VC120 into the **manual** calibration mode. Then press **F2** to enter the menu and select the third field from the left using the shuttle wheel. Activate it by pressing **F2** again. Now select **manual** by the shuttle wheel and confirm by **F1** (indication on the display: **OK**)

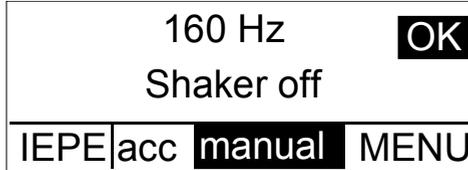


Figure 8: Manual calibration

Leave the menu by pressing **F1** again (indication on the display: **ESC**).

Now you can adjust the frequency by the shuttle wheel. The frequency is indicated in the upper line of the display. The VC120 offers two modes of tuning: **fine** and **coarse**. Switch from one to the other mode by pressing **F1**.

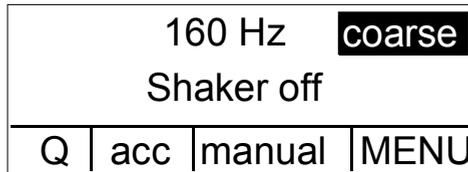


Figure 9: Tuning mode

In the coarse tuning mode the frequency is changed in steps of:

- 5 Hz from 70 Hz up to 100 Hz
- 20 Hz from 100 Hz up to 1000 Hz
- 100 Hz at frequencies higher than 1000 Hz.

In the fine tuning mode the frequency is tuned in steps of 1 Hz for frequencies below 1000 Hz. At higher frequencies the steps become wider due to the digital frequency synthesis of the VC120.

The vibration exciter is switched on by pressing the **SHAKER ON/OFF** button, and measurement is started. The line in the center of the display indicates the sensitivity of the tested sensor with the selected unit.

The calibration frequency can be changed during measurement by the shuttle wheel.

The instrument automatically searches for the optimal gain range (display: **autorange xx dB**), provided that the autoranging function is activated (see chapter 4.6).

The measurement will be terminated by pressing the **SHAKER ON/OFF** key again. By pressing **F1** the measuring value will be saved (display: **SAVE**, see chapter 4.4).

### 4.3.2. Calibration at Fixed Frequencies

Sometimes it is advisable to calibrate a sensor at more than one frequency. For this purpose a table of up to 10 frequencies can be stored in the VC120. Switch from one to the other frequency using the shuttle wheel.

Fixed frequencies are set in the menu bar (activated by **F2**, select **MENU** by shuttle wheel, press **F2** again). Now select **Fix Frequencies** by the shuttle wheel.

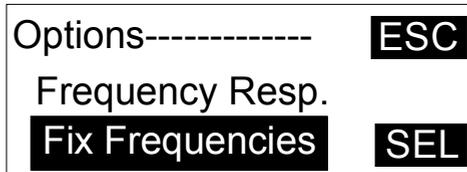


Figure 10: Selecting fixed frequencies

Activate **Fix Frequencies** by pressing **F2** again and enter the setup menu.

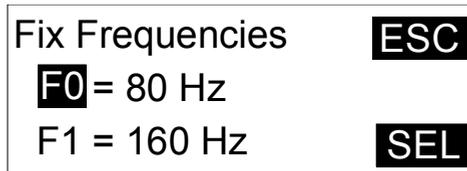


Figure 11: Entering fixed frequencies

Fixed frequencies are marked F0 to F9. To set a fixed frequency (for instance F1) select it by the shuttle wheel and press the **SEL** key (**F2**). Now adjust the frequency by the shuttle wheel. After pre-selecting in the coarse mode activate the fine-tuning mode by pressing **F2** (display: **fine**). After selecting the required frequency press **F2** again (indication on the display: **OK**). Now you can adjust the other fixed frequencies in the same way. Leave the menu by pressing **F1** three times (display: **ESC**).

Each change of an entry in the menu can be aborted by pressing **F1** (**ESC**). The original value will be restored.

To delete a fixed frequency select it by the shuttle wheel (for instance **F3**) and press the **SEL** key (**F2**). Now turn the shuttle wheel to the left (anti clockwise) until 70 Hz is reached. The display now indicates instead of a frequency: **none**. Leave this mode by pressing **F2** twice and the selected fixed frequency is deleted.

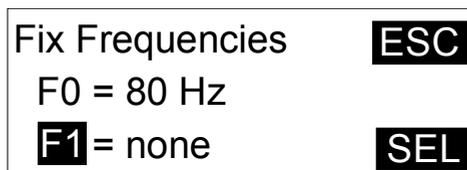


Figure 12: Deleting a fixed frequency

The fixed frequency **F0** cannot be deleted.

To calibrate with the selected fixed frequencies enter the menu by the **F2** key. Select in the third field from the left (by shuttle wheel and **F2**) the function **fix** and confirm by **F1**. Leave the menu by pressing **F1**.

Pressing the **SHAKER ON/OFF** key starts the measurement. Change between the fixed frequencies by the shuttle wheel.

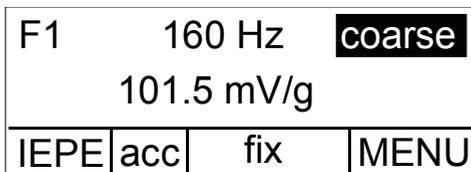


Figure 13: Calibration at fixed frequencies

Fixed frequencies are only indicated, if they have been set before (**F...**). Fixed frequencies remain stored even if the instrument is switched off.

Pressing the **SHAKER ON/OFF** key again finishes the measurement. By pressing **F1** the measuring value will be stored (indication on the display: **SAVE**, see chapter 4.4).

### 4.3.3. Frequency Response Measurement

Measuring frequency sweep diagrams allows a better function check of vibration transducers. Frequency sweeps allow to detect sensor defects which may cause sharp resonance peaks particularly at higher frequencies. Such resonances would possibly not be noticed at calibration with fixed frequencies. The VC120 allows frequency response measurements between 70 Hz and 10 000 Hz. This covers the linear frequency range of most vibration transducers. Measured data will be downloaded from the VC120 via the serial interface to a PC and visualized by the included software (see chapter Fehler: Referenz nicht gefunden). Frequency sweep diagrams cannot be displayed by the VC120 itself.

Frequency response parameters are set in the menu as follows: Activate the menu by **F2**, select **MENU** by the shuttle wheel, press **F2** again, select **Frequency Resp.** by the shuttle wheel.



Figure 14: Selecting frequency response menu

After pressing **F2** again the display shows the set up menu for frequency response.

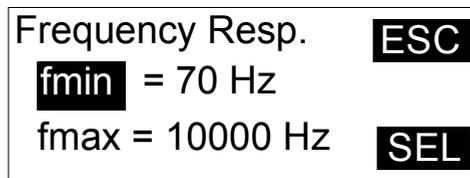


Figure 15: Frequency response settings

Select the position to be edited by the shuttle wheel and press **SEL (F2)**. Select the value or option using the shuttle wheel. Press **F2** when the required value or option is indicated (display: **OK**).

Now other frequency response settings can be made.

The following options are selectable:

- fmin:** Start frequency for frequency response measurement,
- fmax:** Stop frequency for frequency response measurement,
- Increase:** Mode of frequency increase. The following options are available:
- geom.:** Frequency points with geometric progression, i.e. two successive frequencies are connected by the same constant factor. A constant distribution with equal intervals will be obtained in a logarithmic frequency scale.
- linear:** Frequency points with arithmetic progression, i.e. the difference between two successive frequencies has always the same amount.
- Hz/Points:** Indicates the density of frequency points. Possible values are 10, 25, 50 and 100. In case of geometric progression this value corresponds to the number of frequency points of a frequency decade. With arithmetic progression this value is the increase in Hz.
- fflip:** Switch frequency to a higher density of frequency points. With **geometric progression** from this point on the density of frequency points increases to 100 frequency points per decade. With **arithmetic progression**, from this point on the frequency step, selected under **Hz/Points**, is reduced to one tenth.

Increasing the density of frequency points may be useful, for instance, if the expected changes in the frequency response are in a particular frequency range. This will often be near the resonant frequency, as shown in the following illustration:

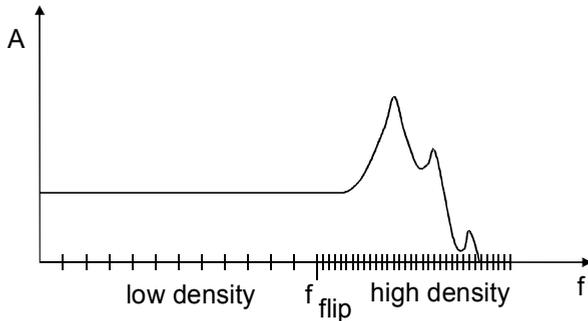


Figure 16: Increasing the density of frequencies

Exit the menu by pressing **F1** three times (display: **ESC**).

After all adjustments have been completed, you can start frequency response measurement. To activate the frequency response mode select in the menu (**F2**) the third field from the left (shuttle wheel and **F2**), choose the function **sweep** and confirm with **F1**.

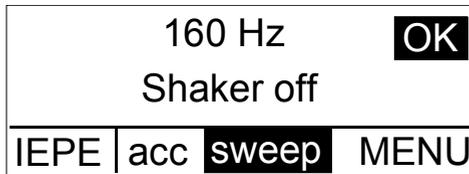


Figure 17: Selecting sweep mode

Leave the menu by pressing **F1** again. The display now indicates the start frequency **fmin** and the measurement is started by pressing **F1** (**Start**).

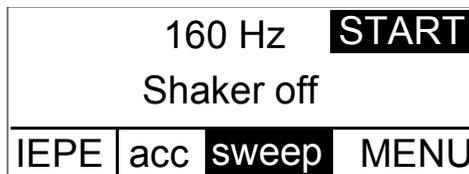


Figure 18: Starting sweep measurement

Pressing **F1** (**Stop**) again interrupts the measurement.

A PC is necessary to display the frequency response curve. Further operation in the frequency response mode is done by the supplied software (see chapter Fehler: Referenz nicht gefunden).

#### 4.3.4. Calibration Errors and Their Reasons

Stable condition of the sensor signal is checked permanently by the reference and measuring circuit of the VC120. Over a time interval of 200 ms 30 values are measured and averaged. If the standard deviation becomes higher than 0.5 % the instrument will show no result. If this condition persists longer than 4 s the display will indicate **unstable signal**. If the standard deviation drops below 0.5 % a measuring value is indicated again. In case of an unstable signal during frequency response measurement the concerned frequency points will be skipped and not be indicated.

If the indication **Unstable signal** frequently appears, a reliable calibration cannot be achieved. Reasons can be:

- A noisy sensor signal,
- Interference between mains and sensor signal,
- Low frequency vibrations for example impact sound by footsteps

For measurements under inadequate conditions the accuracy criterion of the VC120 can be reduced. Select **MENU** (confirm by **F2**) in the sub-menu **Signal Cond.** (confirm by **F2**). Now use the shuttle wheel to select **Accuracy**, press **F2** and select again by the shuttle wheel **high** or **low**. The difference between these two options is:

- **high**: The standard deviation must not exceed 0.5 %.
- **low**: The standard deviation may reach up to 10 %.

Calibration in the **low** position has only informative character. This position should be used only in particular cases, if a more accurate result in the **high** position cannot be reached.

If the sensor signal is out of the measuring range for any reason, the VC120 indicates this as follows:

**too low**: The sensor signal is lower than 0.12 mV or 0.12 pC. Possible reasons are a defective sensor or a short-circuited cable.

**overload**: The sensor signal is higher than 1.2 V or 1200 pC. A possible reason is interference from mains due to a broken cable.

When the instrument continuously indicates **too low** or **overload**, check in the **MENU** under **Signal Cond.** if the option **Gain** is set to **auto**.

If the VC120 frequently indicates errors or does not reach a stable operating condition, it may be restarted with default settings (see chapter 4.1).

## 4.4. Saving Measuring Results

The VC120 features an internal memory for calibration results. Stored data can be downloaded later to a computer for archiving. The VC120 can store up to 100 records. The following parameters are stored in a record:

- Measuring value (sensitivity, bias voltage)
- Unit
- Frequency
- Name with consecutive record number

Measurement of sensitivity or IEPE bias voltage is finished by pressing the **SHAKER ON/OFF** key.

The display indicates the last measured value with the belonging frequency and next to the **F1** button the indication **SAVE**:

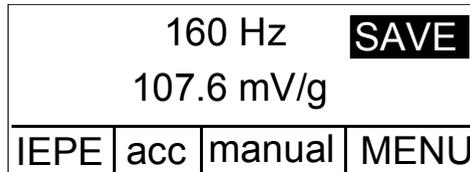


Figure 19: Entering the save menu

Enter the saving mode by pressing **F1**:

Figure 20: Saving a result

Now you have two options:OK: Add a new record to an existing name (in the example the name is DEFAULT). The three-figure number after the name is the record number. The next free record number appears automatically. The measuring value will be stored by pressing the F1 key. To overwrite an existing record number, select the desired number by the shuttle wheel:

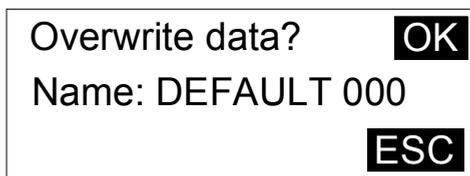


Figure 21: Overwriting an existing value

Confirm by **F1** or press **F2** to abort.

**NEW:** A new record name can be created as well. For this purpose, press **F2**. In the next menu screen you are asked for the name:

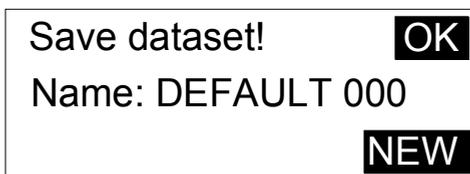


Figure 22: Entering a name

Fill in the name by the shuttle wheel. Turning it to the left (anti-clockwise) the numerals will appear, turning it to the right the letters will appear. Enter the next text position by pressing **F2**. The name may consist of letters or numerals in any order. Its maximum length is 8 digits. Confirm the entered name by **F1**. Press **F1** again to save the first record with the automatically added number 000 or abort by **F2**.

#### 4.5. Retrieval of Stored Data

As described in the previous chapter all measured calibrating results can be stored in the internal memory of the VC120. For retrieval of the stored data the instrument has a **view** function. To enter this mode activate the menu by the **F2** key. Mark the third field from the left side by the shuttle wheel and confirm this by pressing **F2** again. Select the **view** mode by the shuttle wheel and confirm this by pressing **F1** twice.

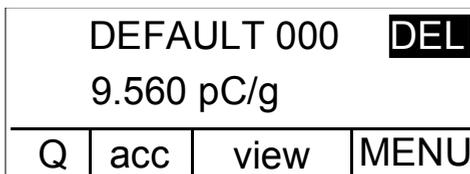


Figure 23: Viewing stored results

Now you can search by the shuttle wheel for the stored records. They appear in the order they have been stored (not in the order of their numbers). The upper line on

the display shows the name and number of the record. Below the stored measuring value is displayed.

Records are deleted by pressing the **F1** key (display indication: **DEL**). Press **F2** (**OK**) to confirm. Pressing **F1** (**ESC**) will abort the operation.

Return to the menu by **F2** and select in the third field from the left another mode (once more **F2**).

## 4.6. Other Settings

### 4.6.1. Autostart

In the sub-menu **Shaker System** you will find some settings, which are not often required. To enter this sub-menu press **F2** for the menu bar, select **MENU** by the shuttle wheel and use **F2** again. Now select **Shaker System** by the shuttle wheel and press **F2** once more:

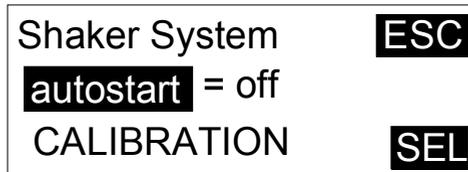


Figure 24: Selecting the start mode

Select the **autostart** function by the shuttle wheel and confirm by **F2**. The **autostart** function refers to the activation of the vibration exciter and the start of measurement after switching on the instrument. The following options are available:

- off:** The **autostart** function is switched off. The vibration exciter will be inactive after switching on the VC120 until the **SHAKER ON/OFF** button is pressed.
- last:** The vibration exciter will work immediately and measurement will start with the last settings when the VC120 is switched on. The frequency is the same as before last switching off.
- F0:** The vibration exciter will work immediately and measurement will start with the last settings when the VC120 is switched on. The frequency has the value of the F0 setting of the frequency table (see chapter 4.3.2).

### 4.6.2. Distortion Calibration

The VC120 automatically checks distortion of the exciting signal after it is switched on and after a frequency change. During operation this check is carried out in intervals of 20 s.

The user will not notice this check, because it runs in the background. In case of distortion higher than 2 % the VC120 automatically carries out a distortion compensation cycle at the adjusted frequency. This takes about 5 s. The display indicates **Autocalibration** during this process. By means of this feature it is ensured, that the exciting signal is corrected to an optimum grade, independent of frequency and the weight of the specimen.

If the indication **Autocalibration** appears frequently during calibration of a sensor with a particular weight, a distortion compensation can be made for this particular

sensor weight. You will find this function in the sub-menu **Shaker System** and the option **CALIBRATION**. Pressing **F2** selects this option. The following screen appears:

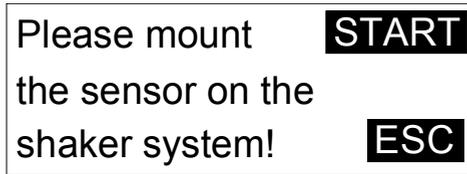


Figure 25: Starting distortion calibration

By pressing **F1** you start the distortion compensation process for the exciting system. The display shows a new screen:

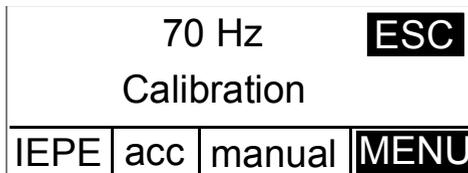


Figure 26: Distortion calibration running

Distortion calibration is carried out at several frequencies, which are indicated on the display. This procedure takes about 60 s. After termination of the self-calibration the indication switches back to the **Options** menu. You leave this menu by pressing the **F1** key three times.

The distortion compensation process can be interrupted by the **F1** key. In this case distortion remains unchanged.

### 4.6.3. Autoranging

The measuring channel is usually operated in the autoranging mode. This way the VC120 will always process the sensor signal with the optimum resolution. It is possible, however, to switch off the autoranging function. For this purpose, enter the sub-menu **Signal Cond.** in the option **MENU** of the menu bar by the shuttle wheel and the **F2** key. Now activate the function **Gain** by the shuttle wheel and press **F2** again. Here you can choose between **auto** (autoranging switched on) or a fixed gain of 0 dB, 20 dB, 40 dB or 60 dB. Confirm your choice by **F2** and leave the menu by pressing **F1** three times.

## 5. PC software VC1xxCDB

The PC software *VC1xxCDB (Calibration Data Base)* is used to control the VC120 and to manage the calibration data in a local data base.

With the help of this software it is possible to design calibration templates to automate calibration cycles and to generate calibration reports automatically.

The data base is used to manage the measuring results as well as the specific sensor values and customer data.

### 5.1. Installation

#### 5.1.1. Requirements

To operate the program you require the following:

- PC with Windows® Vista 32 bit / 64 bit or later versions.
- Internet access, for installing the necessary components
- Microsoft® .NET.Framework 3.5 SP1, which can be downloaded from the manufacturers website.
- Microsoft® SQL Server® Compact SP2, which can be downloaded from the manufacturers website.

#### 5.1.2. Download and installation of the Software VC1xxCDB

First of all please download the software VC1xxCDB from the MMF website. The latest version of the program is available at:

[http://www.mmf.de/software\\_download.htm](http://www.mmf.de/software_download.htm)

To start the installation, run the program and follow the steps as prompted by the assistant.

#### 5.1.3. Installation of the USB-Driver for Windows 7 and 8

Connect the VC120 Vibration Calibrator to an available USB port on your computer using the cable provided. The driver installation will start automatically and search for available drivers on the network.

Click on the icon in the information area of the task bar to display the installation progress window.

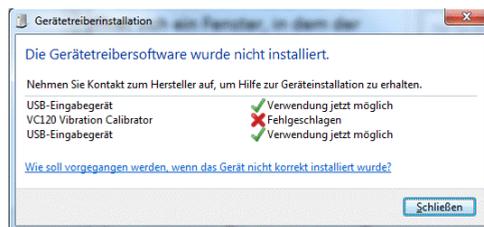


Figure 27: Device driver installation

The driver **VC120 Vibration Calibrator** will not be located during an automatic installation. It has to be installed manually.

Open the **Device Manager** by clicking on **Start / Control Panel / Device Manager**.

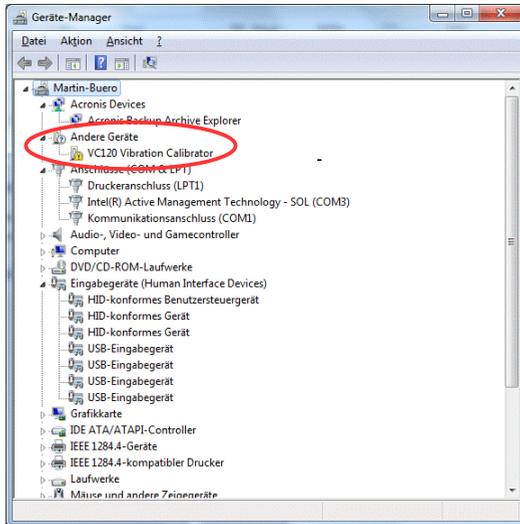


Figure 28: Device Manager

The **VC120 Vibration Calibrator** (for which the driver is not installed automatically) will be displayed below the **Other Devices** node.

To install the driver manually click on **VC120 Vibration Calibrator**, and use right-click to open the context menu and left-click to select **Update Driver Software**.

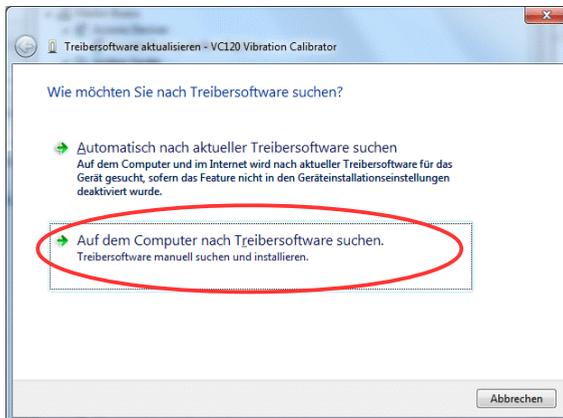


Figure 29: Update driver software

Select the option **Search for Driver Software on the Computer**, using left-click.

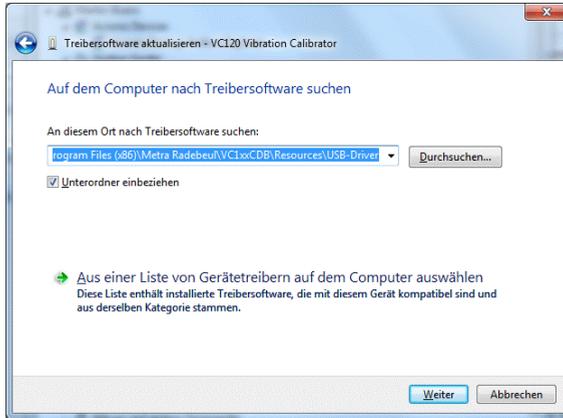


Figure 30: Update driver software

Select the directory containing the USB-Driver. The default path is:

**C:\Program Files (x86)\Metra Radebeul\VC1xxCDB\Resources\USB-Driver**

Press **Continue** to install the USB Driver.

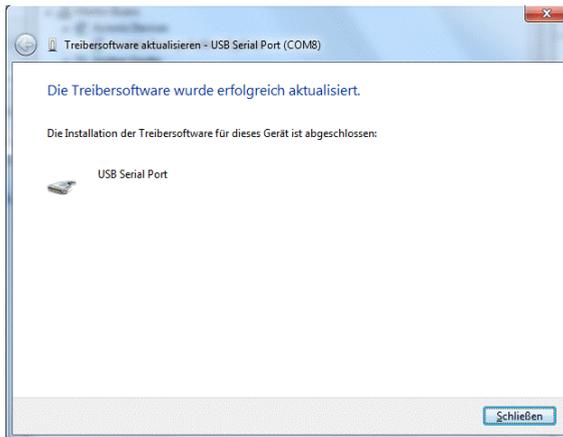


Figure 31: Driver installation successful

The USB Driver has now been successfully installed and the device can now be used.

If the installation was done correctly a new driver **USB Serial Port** will appear below the **(COM & LPT)** node in the Windows Device Manager.

### 5.1.4. First steps

After you have installed the PC software and the USB-Driver on your computer you can start the program. Please double-click the program icon VC1xxCDB on the Windows Desktop.



When you first start the program, the following information window will appear:

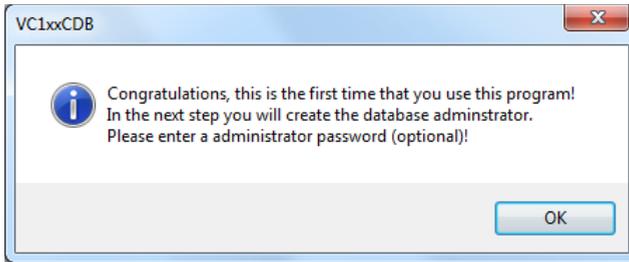


Figure 32: Information window at first start up

Next, you will be asked to enter the administrator password in the following box:



Figure 33: Password entry

This entry is optional. You can change or add the password later within the menu **Settings / Database**.

You can also add new users to the program using the administrator account. Therefore the administrator account cannot be deleted.

To finish the password entry press **OK** or Enter.

If you have already connected the VC120 to the computer, it will switch on automatically. A message box appears that the software is currently not unlocked for this VC120 device. Confirm the message with OK.



Figure 34: Message: Device not unlocked

If the new VC120 was not detected by the software, check:

- if the VC120 is connected to a USB-Port on the computer
- if the USB-Driver has been installed correctly (using Device Manager)

If the USB-Driver is not loaded, disconnect the USB cable between computer and device and connect it again to reload the driver.

After this restart the PC software.

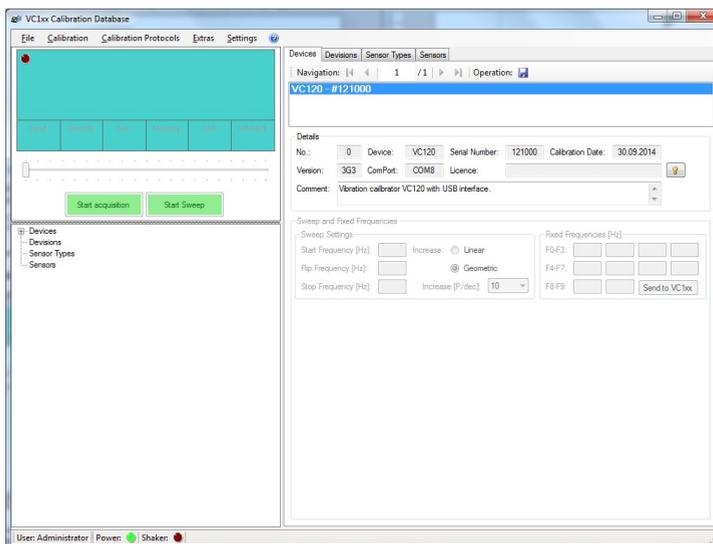


Figure 35: Main window before unlocking

## 5.2. Unlock Device

You need a software licence key to unlock the software to use all functions. You have already purchased the licence key together with the VC120 calibrator. You can find the key in the software licence document of the VC1xxCDB.

To enter the licence key click the unlock button  in the main window and copy the licence key to the entry field. Click OK to confirm the entry and to close the window.



Figure 36: Enter licence key

Your calibrator VC120 is now unlocked. The device number and the associated COM-Port is shown as **Connected Device** in the status bar of the program.

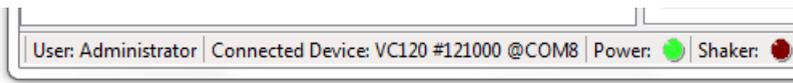


Figure 37: Status bar of the main window

## 5.3. First steps

### 5.3.1. The main window

After you have started the program the VC120 is switched on automatically and its current parameter set is transferred to the software.

The device settings always appear in the **Devices** tab on the right-hand side of the main window. These settings can also be changed here.

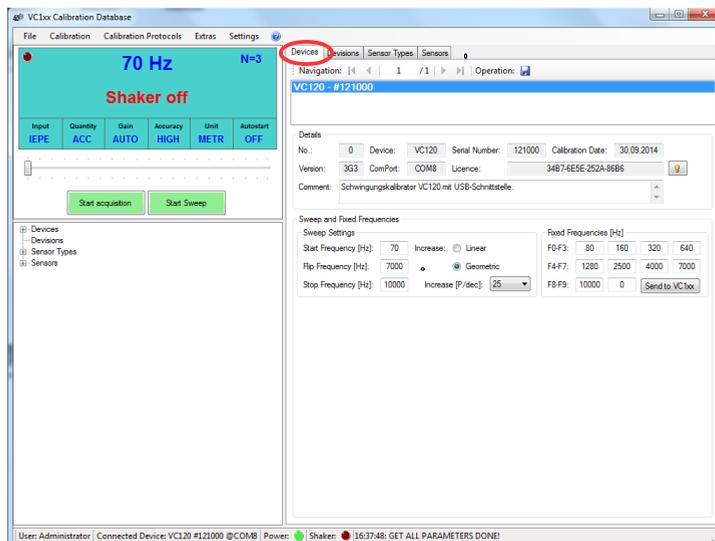


Figure 38: Main window / Devices tab

The **Device Control Panel** is shown in the upper left-hand side of the main window. The design is almost the same as the VC120 display.



Figure 39: Device Control Panel

In the upper half of the **Device Control Panel** you can see the current frequency and the measuring value followed by the accuracy and the unit. The displayed value is always the average of **N** single measurements. The number of averages **N** is displayed in the upper right corner.

In the lower half of the **Device Control Panel** you can see the basic device settings like **Input**, **Quantity**, **Gain**, **Accuracy**, **Unit** and **Autostart**.

By clicking the buttons **Start acquisition** or **Start Sweep** the shaker of the VC120 starts for manual measurement (see chapter 5.3.3).

Move the mouse pointer over the corresponding value within the **Device Control Panel** to change basic device settings, the frequency or the number of averages **N**.

On the lower left-hand side of the main window you can find the **List View**.

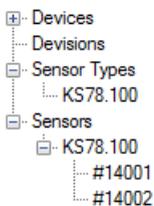


Figure 40: List View

The List View visualizes the available data (customers, sensor types and sensors) and enables fast navigation of the data records. By left-clicking on a data node the program will be forced to jump to the relevant data view.

### 5.3.2. Starting the Help function

Please click on the icon  within the main menu and select **Help** to start the program help function.

There you can find detailed information about the structure of the database and the different data views and program windows.

### 5.3.3. Manual Mode

In manual mode you can start measurements without the use of the database. Please click the button **Start acquisition** to start a manual measurement.



Figure 41: Device Control Window

It is not possible to change any settings beside the frequency while the measurement is active. Please click the button **Stop acquisition** to finish the manual measurement. If the display indicates **unstable signal** the accuracy level of the VC120 can be reduced. Click in the field **Accuracy** and change it to **LOW** (see chapter 4.3.4). For reliable calibration results select the **High** option.

Click the button **Start Sweep** to get the frequency response of a sensor. The frequency sweep will be done according to the sweep settings (see chapter 4.3.3). The result is shown in a diagram in the lower right-hand side of the main window. Right-clicking into the diagram will open a context menu to change the view and to export the sweep data.

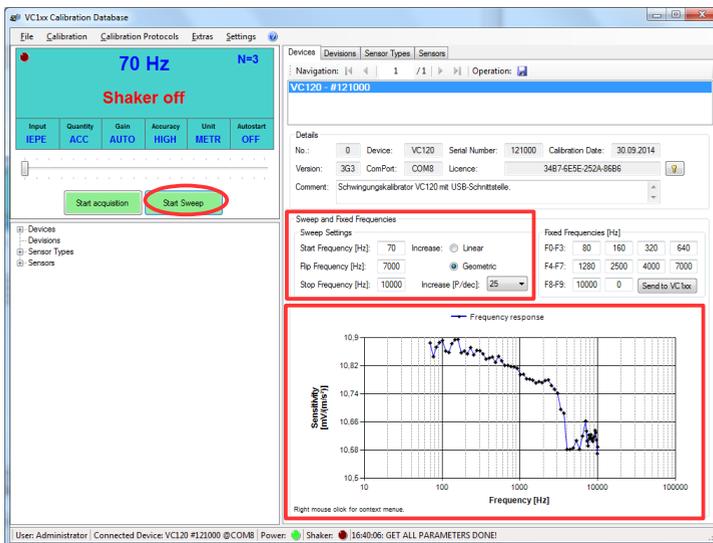


Figure 42: Measurement in Manual Mode

## 5.4. Sensor Calibration

Beside manual measurement sensors can also be calibrated with the help of the database. In this case the calibration is done automatically according to the settings of the chosen **Calibration Template**. The calibration results will be stored in the data base and can be compared with previous or reference calibrations of the same **Sensor Type**. Furthermore the calibrated sensors can be assigned to customers or departments. Finally a calibration report can be generated easily clicking a push button.

### 5.4.1. Creating a Sensor Type

If you calibrate a sensor for the first time you have to add a new sensor type to the database **Sensor Types**. This occurs in the **Sensor Type View** of the main window. First click on the Sensor Types tab and then on the icon  to add a new sensor type.

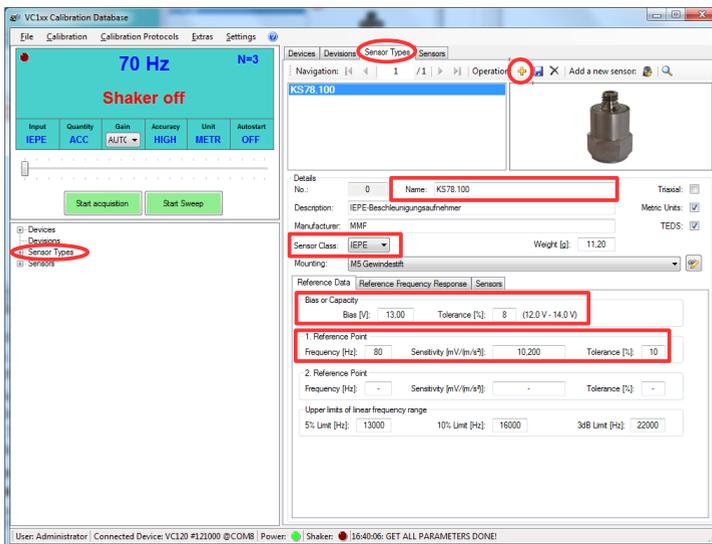


Figure 43: Sensor Types tab of main window

Alternatively, you can use the **List View** to go to the Sensor Types View. This is the quickest way to jump to a particular entry if the sensor type already exists.

All typical sensor data required to set up the signal conditioner of the calibrator is stored in the Sensor Types panel. Additionally you can define **Reference Data** for Bias and sensitivity measurements together with tolerance ranges. The tolerance range is used to determine the limit during sensor calibration.

Values for the **Name** of the sensor type, the **Sensor Class**, the **Bias** and the **1. Reference Point** need to be entered in the Sensor Types panel.

Please complete the data mask according to the explanations in the program documentation using the Help function (see chapter 5.3.2). Click the icon  to save all entries.

## 5.4.2. Creating a Calibration Template

Furthermore a **Calibration Template** needs to be created describing the calibration process. To do this first click in the **Main Menu** on **Settings / Calibration Templates** and then on the **icon**  to create a new calibration template.

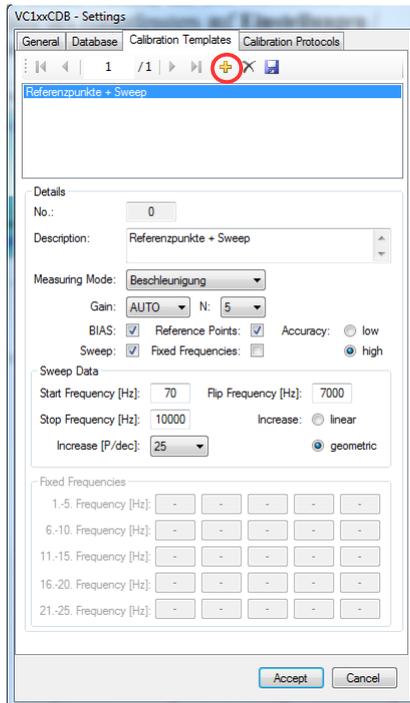


Figure 44: Calibration Template

The following measuring values can be defined:

- **Bias**
- Sensitivity at the **Reference Points** (see chapter Sensor Types 5.4.1)
- **Sweep** of sensitivity
- Sensitivity for up to 25 **Fixed Frequencies**

Please complete the data mask according to the explanations in the program documentation using the Help function (see chapter 5.3.2). Click the **icon**  to save all entries.

## 5.4.3. Sensor Calibration Procedure

After you have defined the new **Sensor Type** of the sensor to be calibrated (see chapter 5.4.1) and have created a **Calibration Template** (see chapter 5.4.2) you are ready to calibrate the sensor.

Please click in the main menu on **Calibration** to open the window **Sensor calibration**.

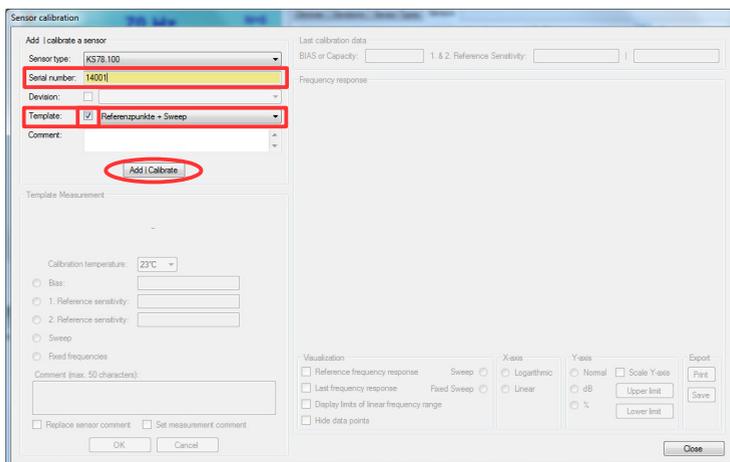


Figure 45: Add a new sensor

Before starting the measurements you have to enter the **Sensor Type** and the **Serial number** in the data fields of the mask.

If you are calibrating a sensor for the first time you must also define the **Calibration Template** used to calibrate this sensor. This Calibration Template will be used automatically for all subsequent calibrations of the same sensor. Subsequent change to the Calibration Template can only be made in the **Sensor View** of the database (see chapter 5.4.4).

Click the button **Add|Calibrate** to add the new sensor to the **Sensor View** of the database (see chapter 5.4.4) and to start the calibration process.

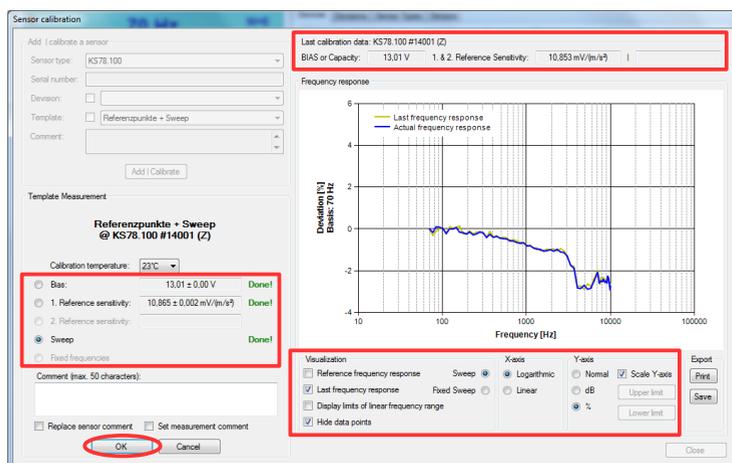


Figure 46: Measuring results of the Sensor calibration

All measuring results are shown in the **Sensor calibration** window and compared with the tolerance specifications defined in the **Sensor Types** tab. A green coloured message **Done!** appears if the result is inside the tolerance range. Otherwise a red coloured message **Failed!** appears behind the result.

The results of the **Last calibration** are shown on the upper right-hand side for comparison.

The diagram below shows either the result of the **Sweep** or the **Fix Frequency** measurement. The axis of the diagram can be adjusted. Additional reference functions can be displayed for comparison.

By clicking the **OK** button, all measurement results and comments are saved in the database. Click the **Close** button to close the **Sensor calibration** window again.

You can find detailed explanations in the program documentation using the Help function (see chapter 5.3.2).

#### 5.4.4. The Sensor View

The Sensor View of the main window contains all measuring results, comments and setting for sensor calibration.

Please click on the **Sensor** tab to display the Sensor View.

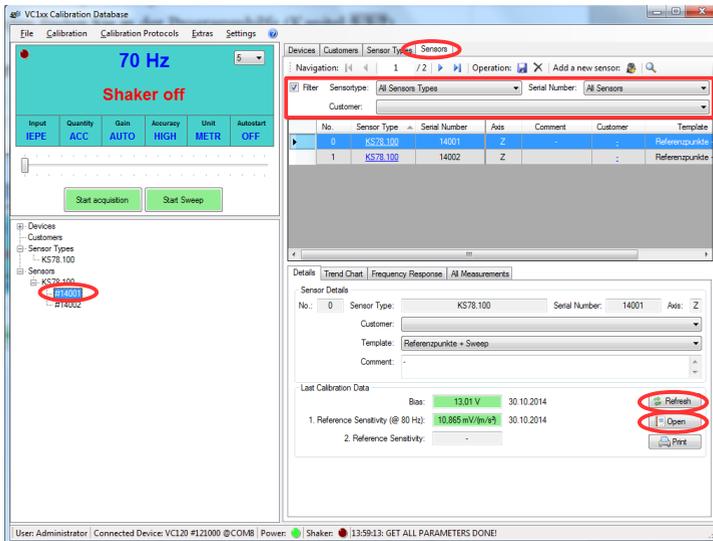


Figure 47: Sensor View

All sensors are displayed row by row in a table. Please click on a row of the table to select a specific sensor. The selected row is highlighted blue and marked with an arrow.

There is a filter check box above the table to reduce the table contents. The filter masks consists of three input fields: **Sensor type**, **Serial number** and **Customer**. The fields are logically linked with AND.

Alternatively, you can view a specific sensor directly by clicking on its serial number in the **List View**.

The data of the selected sensors is shown below the table using four tabs: **Details**, **Trend Chart**, **Frequency Response** and **All Measurements**.

The tab **Details** contains the results of the last sensor calibration, the used calibration template as well as the customer to whom the sensor belongs. There are three buttons in the panel of the tab. The **Refresh** button is used to start a new calibration measurement. Please click the button **Open** to generate and open the calibration report or the button **Print** to print it directly.

All additional information can be found in the program documentation using the Help function (Section 5.3.2).

### 5.4.5. Creating a Calibration Report

As described in the previous section, a calibration report can be generated or printed directly in the **Details** tab of the **Sensors View**.

The content of the calibration report always corresponds to the last measurement and is printed according to the layout settings under **Settings / Calibration Protocols**.

Alternatively, calibration reports can be generated for single or multiple sensors using the tool **Data Selection & Protocol Generation**. You can create **Single Protocols** or **Protocol Lists** as well as protocols of previous **Calibration Sets**.

Click on **Calibration Protocols** in the main menu.

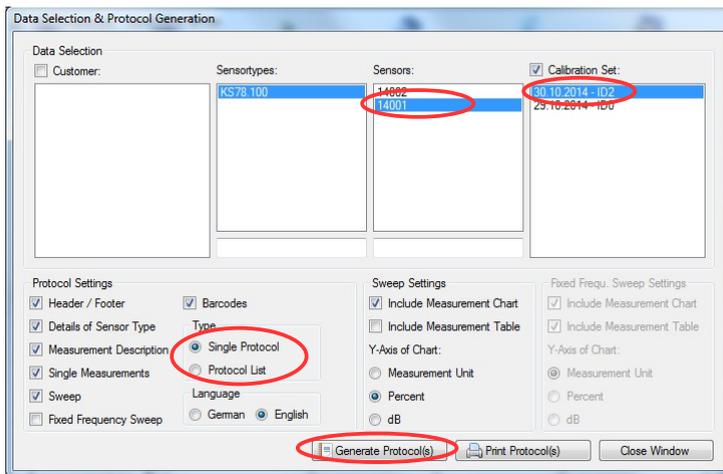
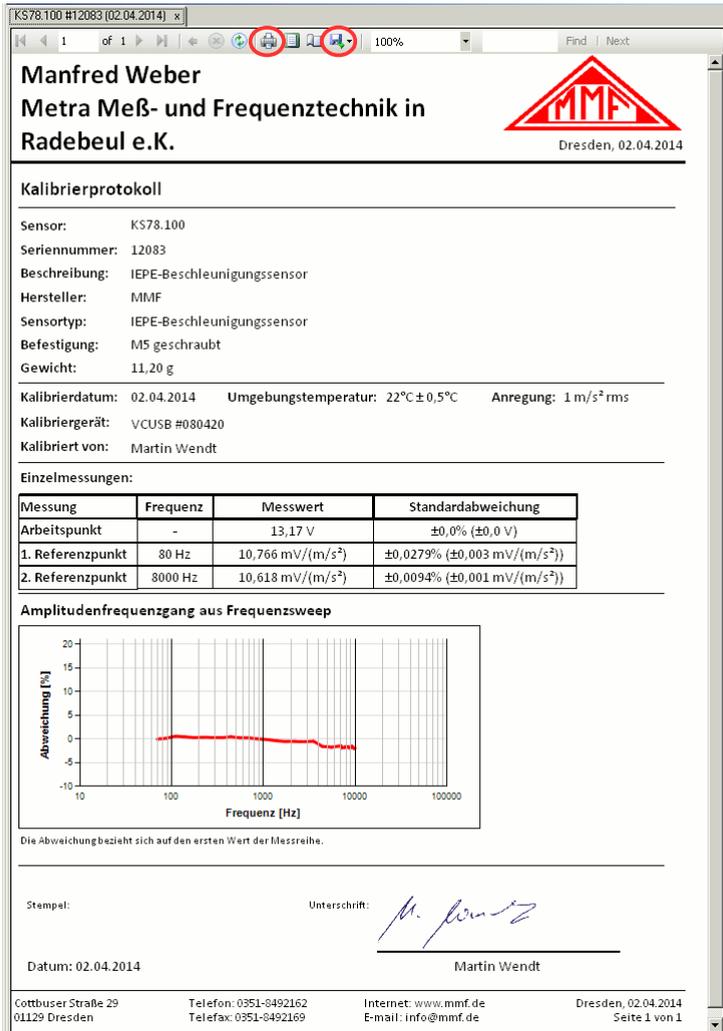


Figure 48: Protocol Generation

You can use the filter mask with 4 fields for data selection: **Customer**, **Sensortypes**, **Sensors** and **Calibration Set**. All fields are logically linked with AND. Use left-click to select data.

It is possible to select several sensors at once within the **Sensors** field. Hold down Shift or Control key on your keyboard and click on the desired sensors. By clicking

the button **Generate Protocol(s)** a preview of the calibration report is generated. The headers and footers contain the company name and address as described in the main menu under **Settings / General**. Finally you can print  or export  the calibration report by clicking on the icons of the preview.



**Manfred Weber**  
**Metra Meß- und Frequenztechnik in**  
**Radebeul e.K.**

  
Dresden, 02.04.2014

---

**Kalibrierprotokoll**

Sensor: KS78.100  
Seriennummer: 12083  
Beschreibung: IEPE-Beschleunigungssensor  
Hersteller: MMF  
Sensortyp: IEPE-Beschleunigungssensor  
Befestigung: M5 geschraubt  
Gewicht: 11,20 g

---

Kalibrierdatum: 02.04.2014    Umgebungtemperatur: 22°C ± 0,5°C    Anregung: 1 m/s<sup>2</sup> rms  
Kalibriergerät: VCUSB #080420  
Kalibriert von: Martin Wendt

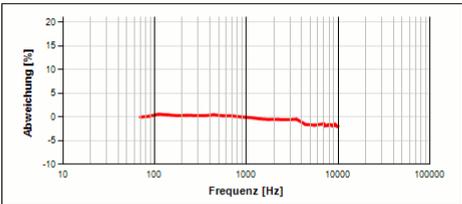
---

**Einzelmessungen:**

Messung	Frequenz	Messwert	Standardabweichung
Arbeitspunkt	-	13,17 V	±0,0% (±0,0 V)
1. Referenzpunkt	80 Hz	10,766 mV/(m/s <sup>2</sup> )	±0,0279% (±0,003 mV/(m/s <sup>2</sup> ))
2. Referenzpunkt	8000 Hz	10,618 mV/(m/s <sup>2</sup> )	±0,0094% (±0,001 mV/(m/s <sup>2</sup> ))

---

**Amplitudenfrequenzgang aus Frequenzweep**



Die Abweichung bezieht sich auf den ersten Wert der Messreihe.

---

Stempel: \_\_\_\_\_      Unterschrift:   
Datum: 02.04.2014      Martin Wendt

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Cottbuser Straße 29      Telefon: 0351-8492162      Internet: www.mmf.de      Dresden, 02.04.2014  
01129 Dresden      Telefax: 0351-8492169      E-mail: info@mmf.de      Seite 1 von 1

Figure 49: Single Protocol

Detailed information can be found in the program documentation using the Help function (see Section 5.3.2).

## 6. Interface Protocol

The VC120 can be linked to other test and control equipment by means of its standardized hardware protocol for serial interfaces. Customized control software can be created in a simple way and may be used instead of the supplied PC software.

### 6.1. Introduction

An USB Serial Port (virtual COM-Port) is used for communication between the VC120 and the PC. The required interface parameters are as follows:

- Baud rate: 19200
- Data bits: 8
- Stop bits: 1
- Parity: off
- Flow control: off

The VC120 checks every 100 ms if the PC wants to send data. For this purpose the handshaking line CTS is activated by the VC120. After that the PC sends all available data to the VC120. If no data is received the connection is interrupted again by the VC120.

All instructions and parameters consist of ASCII characters. The instructions are not case sensitive. An instruction string can be up to 120 characters long. It must end with the character CR (0Dh) or CRLF (0D0Ah):

Instruction:	max. 120 ASCII characters	CR or CRLF
--------------	---------------------------	---------------

An instruction string can be transmitted byte by byte or as one block. Several instructions divided by CR or CRLF can be transmitted as a sequence.

After receiving an instruction the VC120 sends a confirmation or the requested data.

The answer consists of a start character, a data block and an end character CR:

Answer:	start char. (1 Byte)	Data (x Bytes)	CR or CRLF
---------	-------------------------	-------------------	---------------

The start character describes the type of data sent by the VC120. The following characters are used:

Start Character	hex	Data type
!	21h	Acknowledge
#	23h	Measured data
\$	24h	Parameter set
%	25h	EEPROM set of measured data

An acknowledge message always starts with the character “!”. It is used as an answer after instructions which do not require data to be sent back or if an error occurred. The following acknowledgments are used:

!OK	Instruction executed	
!ERROR=x	Instruction could not be executed Meaning of error codes (x):	
	1	Buffer overrun, more than 128 characters sent
	2	COM Port hardware error
	4	Unknown instruction
	8	Wrong parameter range
	9	Time-out
	C	Wrong parameter code
!START=x	Shaker and data acquisition started. The transmitted parameter (x) describes the operating mode:	
	0	Off
	2	Frequency range
	4	Sensitivity
	5	Bias voltage
!End	Data acquisition finished	

The acknowledgments !START=x and !END are also sent if the data acquisition of the VC120 is started or stopped. Therefore they can be used as start / stop signal for PC data processing.

## 6.2. Instructions Without Data Return

The following instructions do not request data from the VC120. An acknowledge string is sent back to the PC as answer after the instruction was executed.

### 6.2.1. Parameter Instructions

The abbreviation \r is used for the end character CR (0Dh) in the following section.

#### SET\_..... Set Parameter

*Syntax:* SET\_ <parameter1>;<...>\r

*Acknowledgment:* !OK\r

Transmits one or more parameters to the VC120.

The instruction consists of the string SET\_ followed by the parameter identifier and the parameter value.

*Example:* SET\_F120\r  
(Set frequency to 120 Hz)

To change several parameters by one instruction semicolons are used to separate the parameters:

*Example:* SET\_F120;I2\r

If a parameter requires more than one value semicolons are used to separate these values.

*Example:* SET\_S100;10000;0;3;5000\r

It is not necessary to transmit all parameter values if only the first values are to be changed. The parameter sequence may end after the last parameter to be changed.

*Example: SET\_S100;10000\r*

**SET\_F**    **Set Frequency**  
Sets the vibration frequency in Hz.  
*Identifier:*            **Fx**  
*Parameter range:*     $x=[70..10000]$

**SET\_G**    **Set Gain**  
Sets the gain of the measuring channel.  
*Identifier:*            **Gx**  
*Parameter range:*     $x=[0..4]$   
                           $x=0$ : auto  
                           $x=1$ : 0 dB  
                           $x=2$ : 20 dB  
                           $x=3$ : 40 dB  
                           $x=4$ : 60 dB

The parameter value 0 can be omitted.

*Example:*            SET\_G0  $\equiv$  SET\_G

**SET\_I**    **Set Input**  
Selects the input type of the measuring channel.  
*Identifier:*            **Ix**  
*Parameter range:*     $x=[0..3]$   
                           $x=0$ : off  
                           $x=1$ : Charge  
                           $x=2$ : AC voltage  
                           $x=3$ : IEPE

**SET\_L**    **Set Low Accuracy**  
Selects the limit for calibration error check.  
*Identifier:*            **Lx**  
*Parameter range:*     $x=[0..1]$   
                           $x=0$ : High  
                           $x=1$ : Low

**SET\_P**    **Set Power On Autostart**  
Defines the condition of the shaker after switching on the VC120.  
*Identifier:*            **Px**  
*Parameter range:*     $x=[0..2]$   
                           $x=0$ : off  
                           $x=1$ : last  
                           $x=2$ : F0

**SET\_Q**    **Set Quantity**  
Vibration quantity of measuring channel.

*Identifier:*        **Q***x*  
*Parameter range:*  $x=[0..3]$   
                   $x=0$ : Acceleration  
                   $x=1$ : Velocity  
                   $x=2$ : Displacement  
                   $x=3$ : IEPE bias voltage

**SET\_S**    **Set Sweep**  
Settings for frequency sweep measurement .

The identifier is followed by up to 5 parameters, separated by semi-colons

*Identifier:*        **S***f1;f2;Inc;Po;f3*  
*Parameter range:* *f1*: Start frequency  
                           $f1=[70..10000]$ Hz  
                          *f2*: End frequency  
                           $f2=[70..10000]$ Hz  
                          *Inc*: Frequency increase  
                           $Inc=0$ : linear  
                           $Inc=1$ : geometric  
                          *Po*: **linear**:  
                              steps width in Hz  
                              **geometric**:  
                              steps per decade  
                           $Po=0$ : 10  
                           $Po=1$ : 25  
                           $Po=2$ : 50  
                           $Po=3$ : 100  
                          *f3*: Switch frequency for higher density  
                           $f3=[70..10000]$ Hz

**SET\_U**    **Set Unit System**  
Selects the type of measuring units.

*Identifier:*        **U***x*  
*Parameter range:*  $x=[0..1]$   
                           $x=0$ : metric  
                           $x=1$ : imperial

**SET\_X**    **Fix Frequencies**  
Sets frequencies of the frequency table.

The identifier is followed by up to 10 frequencies, separated by semi-colons

Undefined frequencies are deleted  
*Identifier:*        **X***F0;F1;...;F9*  
*Parameter range*  $Fx=[70..10000]$ Hz

## 6.2.2. Instructions for Data Acquisition

Data acquisition starts together with the vibration exciter provided the measuring channel is switched on. Each second a value is measured and saved in the internal VC120 memory. This memory serves as data buffer between the VC120 and the PC. It can hold up to 49 values. The memory contents is read by the instruction **Get Data**. If the memory is full further measurements are not saved.

The abbreviation \r is used for the end character CR (0Dh) in the following section.

- SHON\r**    **Shaker on**  
Starts vibration exciter and data acquisition.  
*Acknowledgment: !START=x\r*
- SWON\r**    **Sweep on**  
Starts frequency sweep measurement.  
*Acknowledgment: !START=x\r*
- STOP\r**    **STOP**  
Stops vibration exciter and data acquisition.  
*Acknowledgment*  
**!END=x\r**    if data acquisition was active  
**!OK\r**        if data acquisition was not active

## 6.2.3. Instructions for Calibration

- CALS\r**    **Calibrate Shaker**  
Starts the self-calibration process to minimize distortions.  
*Acknowledgment: !OK=x\r*

## 6.3. Instructions With Data Return

This chapter features instructions which receive data from the VC120 as answer provided no transmission error occurred. In case of an error an error message is sent instead of data.

The abbreviation \r is used for the end character CR (0Dh) in the following section.

- GETD\r**    **Get Data**  
After this instruction the contents of the measuring buffer is transmitted to the PC. The sent data has the following format:

#	Mode=M	\r	Measuring mode M M=0: Measur. off M=2: Frequ. sweep M=4: Sensitivity M=5: Bias voltage
	Unit=U	\r	Unit
	State=S	\r	Status of measuring channel, S=[Autoranging, Signal overflow, Signal too low, Signal unstable, Data Acquisition, Shaker off, Shaker on, Wait, VC120 present]
	Number=N	\r	Number of records
	f; Meas. data	\r	1 <sup>st</sup> record: frequency in Hz and measuring data with Unit U
	..... ; .....	\r	2 <sup>nd</sup> record
	..... ; .....	\r	N <sup>th</sup> record

The start character is “#” followed by four headlines including measuring mode (MODE=), measuring unit (UNIT=), status of measuring channel (State=) and number of records to be transmitted (Number=). Each headline ends with the character CR.

The headlines are followed by the measured data consisting of frequency and measuring value divided by a semicolon and ending with the character CR.

**GETP\r Get Parameter**

After sending this instruction the entire set of parameters of the VC120 is transmitted to the PC. The parameter set has the following format:

\$	A=a	\r	Magnitude
	F=f (Hz)	\r	Frequency
	G=x (Auto / 0 20 / 40 / 60dB)	\r	Gain
	I=x (off / Q / U / IEPE)	\r	Input
	L=x (low / high)	\r	Accuracy
	P=x (off, last, F0)	\r	Autostart
	Q=x (acc / vel / disp / bias)	\r	Quantity
	U=x (metric / imperial)	\r	Unit system
	S=f1;f2;l;P;f3 (start / end / increase / points / flip)	\r	Frequency sweep
	X=f0;f1;...;f9 (F0 ... F9 Hz)	\r	Fixed frequencies

The start character is „\$“ followed by 10 parameters. Each parameter consists of name and value divided by the character “=” (3Dh). After a space character (20h), follows a short description of the parameters in brackets. Each parameter ends with CR. If a parameter requires several values, for instance Sweep or Fix Frequencies, semicolons are used as dividers.

## LOADr Load Dataset

After sending this instruction the VC120 transmits N records which have been saved by the SAVE function.

Start character is “%” followed by a headline specifying the number of records to be transmitted (Number=). The headline ends with CR.

After the headline the measured data is sent. Each record consists of name, frequency, Value and unit divided by semicolons. Each record ends with CR.

%	Number=N	\r	Number of records
	name; frequency; value; unit	\r	1 <sup>st</sup> record
	.... ; .... ; .... ; ....	\r	2 <sup>nd</sup> record
	.... ; .... ; .... ; ....	\r	N <sup>th</sup> record

## 6.4. First Connection with the PC

A simple way to check the function of instructions is to use a terminal program like “Termite” by CompuPhase.

Connect the VC120 to an available USB Port of your PC and switch on the VC120. Start the terminal program and create a new connection for the used virtual COM-Port. Set the properties of the interface as shown below:

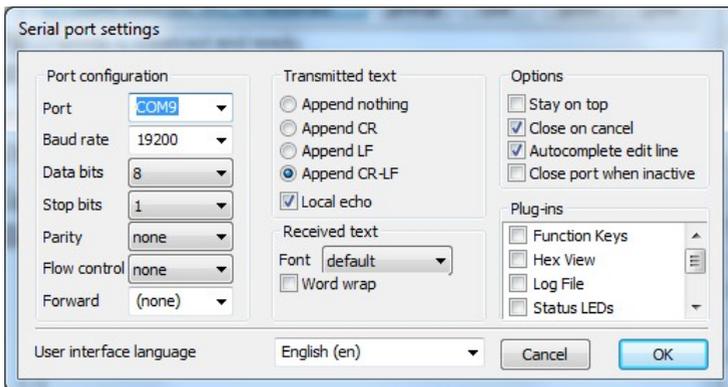


Figure 50: Interface settings in “Termite” by CompuPhase

Type in the instruction, for instance GETP, and press ENTER. The VC120 responds with the appropriate acknowledgment:

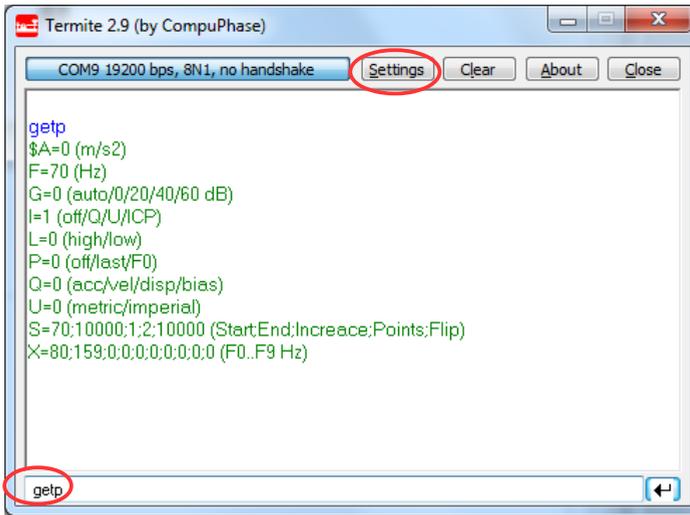


Figure 51: Received data in terminal window

## 7. Power Supply

The VC120 is powered by an internal accumulator or by means of the supplied mains adapter.

⇒ Do not use the VC120 with other power supplies than the supplied mains adapter since this may damage the instrument.

The VC120 includes a powerful NiMH accumulator. If the external mains adapter is disconnected or switched off the VC120 is supplied by the internal accumulator. In this case the accumulator must be sufficiently charged.

If the VC120 cannot be switched on without mains supply the reason may be a discharged accumulator.

The charge condition is indicated by an. It can show the following conditions:

**LED permanently green:** The instrument is powered by the accumulator. The accumulator is sufficiently charged.

**LED flashes green:** The instrument is powered by the accumulator. The remaining capacity of the accumulator is less than 10 % of full charge.

**LED permanently red:** The VC120 is operated from mains or switched off. The accumulator is being charged.

**LED flashes red:** The VC120 is operated from mains or switched off. The accumulator is fully charged. Trickle charging maintains the battery charged.

If the accumulator is completely discharged the VC120 switches off without prior warning. Setup and measured data are saved before.

When the mains adapter is unplugged during operation the VC120 switches off without saving setup and measured data.

Charging the accumulator starts as soon as the mains adapter is connected. The accumulator is monitored to prevent overcharging. Two charge modes are available:

**Rapid charging** charges the accumulator with the highest possible current. The battery LED is permanently red.

**Trickle charging** is activated when the accumulator is fully charged. In this mode a minimum current flows to maintain the accumulator charge. The battery LED flashes red.

The accumulator is also charged if the VC120 is switched on.

Rapid charging is interrupted when the vibration exciter is active. This will increase the charge time.

Rapid charging is not possible at temperatures below 10 °C.

## **8. Transport and Maintenance**

Hard mechanical shocks to the instrument during transport, particularly shocks onto the shaker head must be avoided. Therefore, it is recommended to use the supplied plastic carrying case for transport. The design of the case allows the instrument to remain in the case during operation.

The internal battery is a pack of rechargeable NiMH accumulators. It works maintenance-free and has a long operating life due to the intelligent charging circuit. If the operating time after full charge will not satisfy your requirements after several years of, please return the VC120 back to the manufacturer. Metra will replace the accumulator pack and check the instrument. A change of the accumulator pack by the customer is not recommended.

## 9. Technical Data

### Exciter System

Vibration acceleration (RMS)	1 m/s <sup>2</sup>
Vibration frequency	70 .. 10,000 Hz
Specimen weight maximum	400 g
Basic accuracy at T = 23 °C ± 10°C	
f = (80, 160, 315, 630) Hz <sup>1</sup>	± 2 %
70 Hz ≤ f < 1000 Hz	± 2 % typ.
1 kHz ≤ f < 10 kHz	± 5 % typ.
Temperature coefficient	0.02 %/K
THD	
70 Hz ≤ f < 3000 Hz	2 % max.
m < 200 g	3 % max.
m > 200 g	8 % max.
Transverse vibration	
m < 200 g , 70 Hz ≤ f < 400 Hz	10 % max.
Settling time	
after switching on	2 s
after frequency change	0.4 s
Sensor mounting	M5 thread, clamping magnet
Torque maximum	5 Nm
Torque nominal	2 Nm

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<sup>1</sup> Calibration at these frequencies traceable to a PTB reference standard

## Signal Conditioner

Input	single ended, BNC socket
Input voltage (pulse)	$U_{\max} = 500 \text{ V}$
Input resistance in voltage and IEPE mode	100 M $\Omega$
IEPE constant current source	3.8 .. 5.6 mA, $U_s > 22 \text{ V}$
Gain ranges	
Charge	1/10/100/1000 mV/pC
Voltage / IEPE	0/20/40/60 dB
Sensitivity range of sensor to be calibrated	0.12 mV/ms <sup>2</sup> .. 1.2 V/ms <sup>2</sup> 0.12 pC/ms <sup>2</sup> .. 1.2 nC/ms <sup>2</sup>
A/D converter	16 bit
Indication	transducer sensitivity (true RMS), IEPE bias voltage
Accuracy of measuring channel	
T = 23 °C $\pm$ 10°C	
Voltage, IEPE Mode	$\pm 0.3 \%$
Charge mode	$\pm 0.6 \%$
Temperature coefficient measuring channel	$\pm 0.01\%$
Accuracy of IEPE bias voltage display	$\pm 3 \%$
Accuracy of frequency display	$\pm 0.5 \%$

## General

Temperature range	-10 .. 55°C
Operating time per battery charge	2 .. 4 h
Battery charging time	2 h
PC interface	USB Serial Port; Mini-B socket
Dimensions	205 x 105 x 90 mm <sup>3</sup>
Weight	3 kg
Accessories	plastic carrying case, mains adapter, PC software, stud adapters (M5, M8, 1/4"-28, UNF 10-32), plug adapter BNC / UNF 10-32, shaker protection disk



## 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.

## Declaration of Conformity

According to EMC Directive 2014/30/EC

Product: Vibration Calibrating System  
Type: VC120 (from Ser. no. 160000)

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

DIN EN 61326-1: 2013  
DIN EN 61010-1: 2011  
DIN 45669-1: 2010

The producer is responsible for this declaration

Metra Mess- und Frequenztechnik  
in Radebeul e.K.

Meißner Str. 58, D-01445 Radebeul

declared by



Michael Weber  
Radebeul, April 22, 2016