



# PC Generator PCG10 / K8016



**CHECK THE Pc-Lab2000™ GETTING STARTED GUIDE  
FOR SOFTWARE INSTALLATION**

**Reference Manual**

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HPCG10\_GB- 2001– 1

## FCC information for the USA

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### ***Important***

This equipment was tested for FCC compliance under conditions that include the use of shielded test leads between it and the peripherals. It is important that you use shielded cables and connectors to reduce the possibility of causing Radio and Television interference.

**Shielded probes, suitable for the PCG10 unit can be obtained from the authorized Velleman dealer.**

If the user modifies the PCG10 unit or its connections in any way, and these modifications are not approved by Velleman, the FCC may withdraw the user's right to operate the equipment.

The following booklet prepared by the Federal Communications Commission may be of help: "How to identify and Resolve Radio-TV Interference problems". This booklet is available from the US Government Printing Office, Washington, DC20402 Stock No. 044-000-00345-4.

## Features:

- Frequency range from 0.01Hz to 1 MHz.
- Crystal-based stability.
- Optically isolated from the PC.
- Low sine wave distortion.
- TTL level synchronization output.
- Stores up to 32K of waveform points.
- Standard waveforms: Sine, Square, and Triangle.
- Predefined library waveforms included: Noise, Sweep,...
- Extended bode plot option together with PC scope.
- You can create your own waveforms with the integrated signal wave editor.
- Can be chained with Velleman PC oscilloscopes to the same PC printer port (LPT1, 2 or 3).

## Specifications:

- Power supply: Standard 12V DC adapter, 800mA (PS1208).
- Direct Digital wave synthesis (DDS), 32K wave table.
- Frequency setting resolution: 0.01%.
- Amplitude range: 100mVpp to 10Vpp @ 600 Ohm load.
- Amplitude resolution: 0.4% of full scale.
- Offset: from 0 to -5V or +5V max. (resolution 0.4% of full scale).
- Vertical resolution: 8 bits (0.4% of full scale).
- Maximum sample rate: 32MHz.
- Typical sine wave distortion (THD): < 0.08% (with 0dB and <100 KHz, 1v RMS)
- Output impedance: 50 Ohm.
- Dimensions (wxdxh): 235x165x47mm (9.3"x6.5"x1.9").

### **system requirements**

- IBM compatible PC
- Windows 95, 98, ME, (Win2000 or NT possible)
- SVGA display card (min. 800x600)
- mouse
- free printer port LPT1, LPT2 or LPT3
- CD Rom player

### **Options**

- Soft carry case: **GIP**

## SAFETY and WARNINGS

Symbols displayed on the unit



Important safety information, see user manual.

**The PCG10 / K8016 is optically isolated from the PC, but even then it is advisable to use only on safe devices.**

⇒ Measurements should be avoided in case of polluted or very humid air.

Before making measurements and for safety reasons, it is important to know some information about the measured unit.

### Safe devices are:

- Battery operated equipment
- Equipment supplied via a transformer or adapter.

### Unsafe devices are:

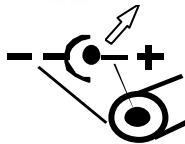
- Equipment directly connected to mains (e.g. old TV sets)
- Equipment that contains components that are directly connected to mains
- It is advisable, when measuring on above equipment, to use a isolation transformer.

**Use of unsafe devices can result in damage to the generator circuit!**

## CONNECTIONS

### *Survey of the connections and controls*

1. BNC signal output connector (50ohm max 10Vpp)
2. BNC external trigger output (TTL level)
3. Output ready LED (indicates if output signal is present)
4. Power indication LED (software driven)
5. Adapter connection (observe the polarity!)
6. Parallel port connector to computer
7. Parallel pass through connector for optional PC scope (PCS500, PCS100 / K8031)



The unit is connected to the printer port (LPT) of the computer, using a standard 25P male/female parallel cable.

### **Connection**

Connect the unit to the printer port **LPT1**, **LPT2** or **LPT3**.

A Velleman PC scope can be connected to the "To PC Scope" connector.

To select the LPT port address click **Hardware Setup** on **Options** menu of the oscilloscope window, or run **Pc-Lab2000** software.

Connect the mains voltage DC adapter to the unit : 12VDC / 800mA. (pin = positive).

⚠ **ATTENTION:** Only use adapter with correct voltage otherwise the unit could be damaged.

Using a wrong power supply could blow the internal fuse. The fuse is soldered onto the PCB, please contact an experienced service center, to replace the fuse. The best way is to cut the leads of the fuse , and to solder a new (1A PICO) fuse onto the old leads.

After starting the software (see also getting started manual), the LED on the front panel should lid.

## SOFTWARE CONTROLS

- Remark: Due to software upgrades, the actual menus can differ from the ones described in this manual, please also refer to the Help file (English only)

### Function Generator Mode

Four standard waveforms and DC are included:

**Sine**

**Square**

**Triangle**

**Sine(x)/x**

Each of these waveforms is generated using Direct Digital Synthesis to insure very low noise, and low output distortion. Direct digital synthesis (DDS) enables 5-digit frequency resolution. The output signal is smoothed by a **low pass filter**.

### Library Functions (LIB)

This mode can be found by clicking the **More Funct.** button and then the **LIB** button. A set of library waveform files are included on the disk.

#### Waveforms of 32000 data points:

File name	Description
BURST1.LIB	Sine burst (1 cycle)
BURST2.LIB	Sine burst (2 cycles)
DAMP_WAV.LIB	Damping wave
EXP_DEC.LIB	Exponential decay
EXP_INC.LIB	Exponential rise
GAUSSIAN.LIB	Gaussian pulse
RAMP_DN.LIB	Ramp down
RAMP_UP.LIB	Ramp up

#### Following files are easy to modify with Wave Editor:

BURST01.LIB	Sine burst (Only 21 data points)
PULSES1.LIB	Pulses of different amplitude
RECT1.LIB	Rectangular pulse (Easy to change duty cycle with Wave Editor)
SAW1.LIB	Sawtooth wave
SINE1.LIB	Sine wave (Only 21 data points)
STAIRS1.LIB	Stairs wave
TRAP1.LIB	Trapezoidal wave
TRI_SKW.LIB	Triangle wave with skew
TRI1.LIB	Triangle wave

There are also following sample files on the disk:

PIANO1.LIB          Piano sound

SAMPLE\_1.LIB      Song sample (Listen on 1Hz range at 0.1Hz frequency)

The library file is a text file including 2 to 32000 points of waveform data. The data is entered either in floating point format or integer format. The data range for floating point format is -1.0 to +1.0 and for integer format 0 to 255. Entered values are separated by line feed.

In this mode you can activate or deactivate the low pass filter of the generator output.

### Sweep Generator

You can enter the Start and Stop frequencies. The sweep ranges are indicated on the buttons.

The sweep repetition rate is proportional to the sweep frequency range selected.

Sync output supplies a high going pulse at the start of each sweep. This pulse is useful for triggering scopes or other equipment at the start of each sweep.

Repetition rate	Sweep range
1ms	1kHz-1MHz
10ms	100Hz-5kHz
100ms	10Hz-500Hz
1s	1Hz-50Hz
10s	0.1Hz-5Hz

### Noise Generator

In this mode the generator output is a noise sequence. The peak amplitude is equal to the Amplitude Vpp value. The amplitude of the signal is Gaussian distributed. The sequence repetition rate is proportional to the noise frequency range selected.

Repetition rate	Noise frequency range
1ms	2kHz-16MHz
10ms	200Hz-1.6MHz
100ms	20Hz-160kHz
1s	2Hz-16kHz
10s	0.2Hz-1.6kHz
100s	0.02Hz-160Hz

## Setting the Frequency

There are two alternative ways to set the output frequency:

1. Move the track bar below the frequency display.
2. Click the frequency display frame, type the value and press the Enter key.

## Setting the Output Voltage

There are two alternative ways to set the output voltage and the offset:

1. Move the track bar adjacent to the voltage display frame.
2. Click the voltage display frame, type the value and press the Enter key.

## Output Filter

The output of the generator is equipped with a low pass filter. This filter is used to eliminate any imperfections and noise caused by the D/A converter. When generating user defined waveforms in LIB mode you can activate or deactivate the filter. When generating the standard waveforms, the filter is automatically set by default.

## *Editing and creating the waveform library file*

### Library files

Waveform library files are normal text files. Files can be created and edited with standard text editors (such as Notepad or Wordpad) or with a spreadsheet (such as Microsoft Excel). Spreadsheet is useful when extracting the data from PC oscilloscope files. Most of the files can be created and edited using this Wave Editor.

### **There are two methods to construct the waveform file:**

1. All data values, point by point, are written to the file.  
This method is usable for complicated waveforms and for the waveforms extracted from the oscilloscope data files.
2. Only the corner values of the waveform data are written to the file.  
The software generates automatically the values between the corners.  
This method is fast and easy way to generate waveform consisting of horizontal, vertical or diagonal straight lines. Below there are some example files and the corresponding waveform images.

In both cases the values are written on separate lines in the text file.

## Data formats

In both cases the voltage values can be written in decimal or integer format. In the decimal format -1.0 represents the negative peak voltage and +1.0 represents the positive peak voltage. In integer format 0 represents the negative peak voltage and 255 represents the positive peak output voltage.

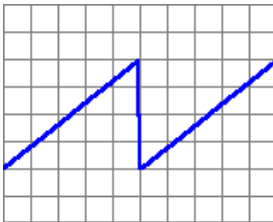
The software detects the data format as 'decimal' if there is at least one decimal separator in the data file. Both comma ',' and dot '.' are interpreted as decimal separators.

## Writing the waveform file

The data points in the waveform file make up one function generator output cycle.

There must be at least two data points in the wave data file: Start and stop of the wave.

Two cycles of the wave are displayed.

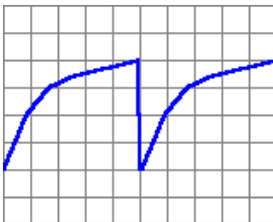


The contents of the file:

```
-1.0
1.0
```

## Adding the data points

With additional points between the start and the stop points you can create corners to the wave. All data values are equally spaced in time. Any number of data points (up to 32000) can be added to the file to get the desired shape of the wave.

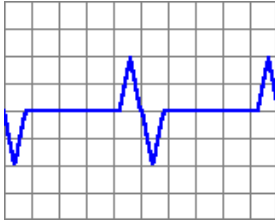


The contents of the file:

```
-1.0
0.0
0.5
0.7
0.8
0.9
1.0
```

### Repeating the same data value

If you like to repeat same data value for consecutive data points you can type the value only once and type in parenthesis, on the same line, the count how many times the value is repeated.

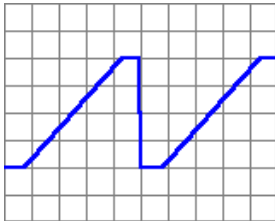


The contents of the file:

```
0.0
-1.0
-0.0 (10)
1.0
0.0
```

### Increasing the space between the data points

In normal case the data points are connected with diagonal or horizontal lines together. All the data points are equally distributed over the wave period. If you like to increase the distance between two data points you can type the distance in parenthesis on separate line between the data values.

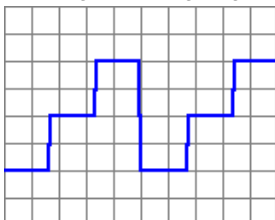


The contents of the file:

```
-1.0 (3)
(10)
1.0 (3)
```

### Removing diagonal line between the data points

To get fast edges to the wave you can prevent the software from connecting the consecutive data points with a diagonal line. To do this, write (0) on separate line between the data values. The data points are connected with rectangular line going immediately to the level of the next data value.



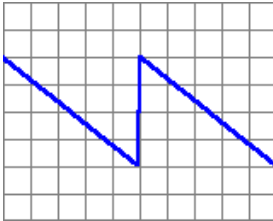
The contents of the file:

```
-1,0
-1.0
(0)
0.0
(0)
1.0
```

**Sample files included on the disk**

**Ramp down**

File name: ramp\_dn.lib

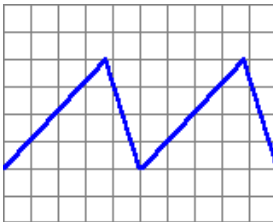


The contents of the file:

1.0  
-1.0

**Triangle wave with skew**

File name: tri\_skw.lib

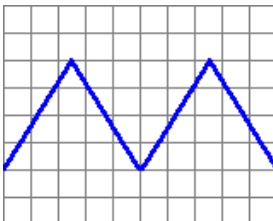


The contents of the file:

-1.0  
(30)  
1.0  
(10)  
-1.0

**Triangle wave**

File name: tri1.lib

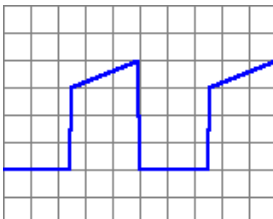


The contents of the file:

-1.0  
1.0  
-1.0

**Trapezoidal wave**

File name: trap1.lib

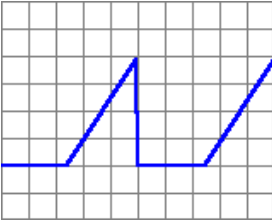


The contents of the file:

-1.0 (1000)  
(0)  
0.5  
(1000)  
1.0

**Sawtooth wave**

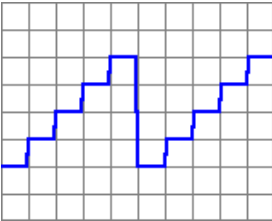
File name: saw1.lib



The contents of the file:  
 -1.0 (10)  
 (10)  
 1.0

**Stairs**

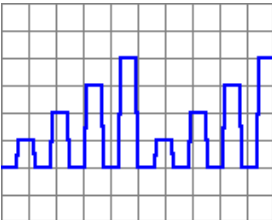
File name: stairs1.lib



The contents of the file:  
 -1.0  
 -1.0  
 (0)  
 -0.5  
 (0)  
 0.0  
 (0)  
 0.5  
 (0)  
 1.0

**Pulses of different amplitude**

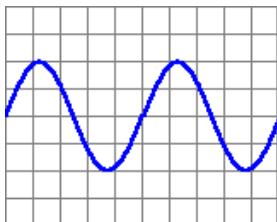
File name: pulses1.lib



The contents of the file:  
 -1.0  
 -1.0  
 (0)  
 -0.5  
 (0)  
 -1.0  
 (0)  
 0.0  
 (0)  
 -1.0  
 (0)  
 0.5  
 (0)  
 -1.0  
 (0)  
 1.0

**Sine wave**

File name: sine1.lib

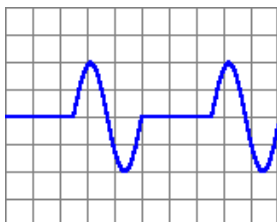


The contents of the file:

0,00	-0,31
0,31	-0,59
0,59	-0,81
0,81	-0,95
0,95	-1,00
1,00	-0,95
0,95	-0,81
0,81	-0,59
0,59	-0,31
0,31	0,00
0,00	

**Sine burst**

File name: burst01.lib

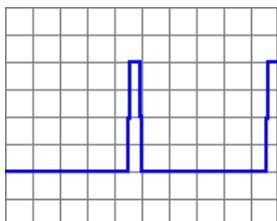


The contents of the file:

0,00 (21)	-0,31
0,31	-0,59
0,59	-0,81
0,81	-0,95
0,95	-1,00
1,00	-0,95
0,95	-0,81
0,81	-0,59
0,59	-0,31
0,31	0,00
0,00	

**Rectangular pulse**

File name: rect1.lib



The contents of the file:

-1.0 (1000)
(0)
1.0 (100)

## Menu Options

### File menu

**Exit** - Terminates the program.

### Options menu

**Hide Oscilloscope** - Hides oscilloscope's control panel

**Fine Tune** - Allows to set a +/-5% level adjustment to the output voltage and +/-120mV adjustment to the offset voltage when the square wave output mode is selected.

### Tools menu

**Wave Editor** - Opens the waveform data editor.

**Bode Plotter** - Starts the Circuit Analyzer for frequency response measurements.

### Help menu

**Contents** - Displays this help file

**About** - Displays information of the program version.

## Circuit Analyzer as a Bode Plotter

Bode Plotter enables you to evaluate the frequency response of devices such as amplifiers and filters.

The frequency response is a representation of the device's output response to sinusoidal input voltage at varying frequencies. The device under test is connected between the signal output of the function generator (PCG10 or K8016) and the CH1 input of the oscilloscope (PCS500, PCS100 or K8031). The function generator automatically steps a sine wave over a specified frequency range and the oscilloscope measures the output voltage of the device under test at each step. These readings are plotted to the frequency response curve on the screen.

### Operation of the Bode Plotter

Assume that you want to measure the frequency response of an amplifier.

- Connect the function generator signal output to the input of the amplifier.
- Set proper output voltage to the generator (e.g. 1Vpp).
- Connect the output of the amplifier to CH1 input of the oscilloscope.
- Click oscilloscope's **Run** button and adjust the Y position until the trace is in the middle of the screen.

Make following selections on the Bode Plotter interface:

- Select proper Frequency Range
- Select proper Frequency Start
- Click the **Start** button

The frequency response graph will be plotted on the screen.

You can take a look to the oscilloscope display to see the amplifier output waveform.

If the graph is too low position or partly out of the display area change the **V Range** (or oscilloscope's Volts/div setting), so that the graph is at the desired vertical position on the screen and click the **Start** button again.

You can afterwards change the display mode, frequency scale and the voltage scale (V Range) to survey the details of the graph.

**Note:** Pay careful attention to the input and output signal levels of the amplifier to get correct test results. PCG10 and K8016 generators can output 0.1V to 10V peak-to-peak signal. If high sensitivity phono inputs are being tested, an extra voltage divider (potentiometer) should be used to connect the signal to the amplifier input.

The maximum signal amplitude that can be plotted to the graph is 10Vrms. Use the probe's attenuator position x10 or some other means to bring the maximum expected level below 10Vrms.

### **Display mode**

The magnitude can be expressed either in volts or in decibels.

There are four vertical scale display modes: Volts (RMS), 10dB/div, 5dB/div and 1dB/div.

Horizontal scale can be either logarithmic or linear. In linear mode it is possible start the measurement from DC (0Hz).

### **Frequency stepping**

There are two alternative stepping modes: logarithmic and linear. If the checkbox **Log. Freq. Steps** is checked the frequency step is at the first decade equal to the start frequency and on the next decades equal to the first frequency of the decade.

If the checkbox is not checked the frequency step is equal to the start frequency.

It is possible change the frequency step "on-the-fly" by selecting the **Options** menu item **Frequency Step Size**.

## Menu options

### File Menu

#### Save /Open modes

The graph can be saved and opened either as a bitmap image or as a data. The saved data can be afterwards retrieved for further examination. Select **Multiple Trace Mode** from Options menu if the saved data contains more than one trace. In this mode it is possible to continue the measurements. The new trace data will be appended to the retrieved data. The bitmap image can only be viewed "as is".

### Edit Menu

#### Copy

Copies the image to the Windows' clipboard.

#### Paste

Pastes the image residing in Windows' clipboard to the screen.

### Options Menu

#### Automatic Voltage Scale

When this option is selected the oscilloscope automatically changes the voltage scale if the input signal is too low or too high. To avoid oscilloscope's voltage scale overdrive by DC it is good to do the following operations before the start of the measurements:

- Turn the oscilloscope's input switch to AC position.
- Adjust the scope's trace to the middle of the screen.

**Note:** When oscilloscope's input switch is in AC position there is attenuation at frequencies below 5Hz. For the tests at low frequencies use DC coupling and be aware of the possible oscilloscope display overdrive at the most sensitive Volt/DIV ranges.

#### Show Multiple Traces

This option allows you to display many traces on the same graph. You can even change the frequency scale between the measurements.

#### Frequency Step Size

This option allows the change of the frequency step size. The size can be set in % of the default step size. The default step is equal to the **Start** frequency if the checkbox **Log. Freq. Step** is not checked and equal to the first frequency of each decade if the checkbox is checked.

#### Wait Time

Use this option to add a delay of 1s to 10s before the RMS value is measured at each frequency. Delay may be needed for circuit stabilization.

## **Colors**

Select the color for various items on the waveform display.

To change the color of an item, click the corresponding button. This will open a dialog in which you can select the new color.

## **Colors of Multiple Traces**

Use this option to change the trace colors when Multiple Trace Mode is selected .

## **View Menu**

### **Markers**

Marker function for absolute and relative voltage measurement is provided. The absolute voltage level in dBV or the voltage difference in decibels (dB) can be measured.

One vertical marker is provided for the frequency measurement.

### **Moving the markers**

Place the mouse pointer over a dashed marker line.

Press and hold the left mouse button. The marker line turns solid.

Drag the marker to the appropriate position

## Troubleshooting

### **The Power LED is not ON**

No communication with the computer (check that the cable is connected to parallel printer port, LPT )

Check the printer port setting in the BIOS SETUP of the computer. Select standard parallel port mode (SPP), also named "compatible" mode or "Centronics" mode.

### **No output signal (Ready LED on the front panel is out)**

No wave form is selected, select a waveform.

If the above tips have no effect, then test on a different computer or replace the printer port card.

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## WARRANTY

This product is guaranteed against defects in components and construction from the moment it is purchased and for a period of ONE YEAR starting from the date of sale. This guarantee is only valid if the unit is submitted together with the original purchase invoice. VELLEMAN Components limits its responsibility to the reparation of defects or, as VELLEMAN Components deems necessary, to the replacement or reparation of defective components. Costs and risks connected to the transport, removal or placement of the product, or any other costs directly or indirectly connected to the repair, will not be reimbursed by VELLEMAN Components. VELLEMAN Components will not be held responsible for any damages caused by the malfunctioning of a unit.