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CONATEX BLEN_1124090 Function Generator Instruction Manual

Contents

CONATEX

CONATEX BLEN_1124090 Function Generator

Function Generator

- 0.001 Hz to 10.0 MHz in one range
- Frequency control with smart, smoothly accelerating characteristics

- Step function: Jump through an overtone series easily- or through octaves – or decades (seep. 3)
- Waveform: sine, triangle, square (bipolar, – square pulse, triangle pulse, ramp up & down (positive)
- Custom-defined wavefonn
- Sweep function – spot any resonances in a frequency range (see p. 4)
- Built-in 10 W power amplifier

QUICK GUIDE

- **Preparation:** Tum down the Output knob almost completely. Turn the generator On.
- **Waveform:** Select waveform by pressing Waveform. Sine (°'7) is a good starting point.
- **Frequency setting:** The Frequency knob is speed sensitive. Tum quickly to get near the desired frequency and slower to fine-tune.
- To go far, buttons ⓐ Up and ⓥ Down may be used.
- **Connections:** A speaker or vibrator normally con-nects to the Power jacks. Other devices connect to the 50 Ohm output with coaxial cable. (The power output is disabled for frequencies exceeding 100 kHz.)
- **Amplitude:** Adjust the level appropriately with the Output knob. The peak voltage for the output is indicated briefly in the display. The amplitude is also shown when the Display button is pressed.
- **Step:** The fundamental frequency for the step func-tion is set to the current frequency by pressing (0 /M ode once. Fast, repeated presses will switch between the modes hannonics (overtones), octaves and decades – indicated as Harm, Oct, and Dec.
- Use buttons ⓐ Up and ⓥ Down to step through a series of overtones, octaves or decades.
- **Sweep:** The first four times the button Sweep is pressed, a sweep parameter may be set. By the fifth press, the sweep starts. Yet another press stops the sweep and the generator is again in nonnal mode.

Waveforms

- The first three waveforms: sine, triangle and square – are the familiar signals with equal positive and ne-gative extent.
- The following four waveforms: square pulse, triangle pulse, ramp up and ramp down – has no negative values.
- The display can show the signal amplitude, either when it is changed, or by pressing the Display but-ton. In any case, the unloaded signal's amplitude -i.e. the pos ive peak value – is shown.
- For other popular specification of amplitude, such as effective value (RMS) or peak-to-peak (p-p), you will have to do the math yourself.
- The last waveform: Prog. – is user defined. It can only be selected with the Waveform button it is de-fined. (See section Advanced use).

Frequency control

- The frequency knob is speed sensitive. A steady movement will give a frequency variation that is useful, e.g., when searching for resonance frequencies in a column of air. Turning slower, 1 "click" on the knob will ultimately correspond to a change of the last digit by 1. Conversely, higher speeds result in greater and greater frequency changes.
- We have chosen the acceleration characteristic of the knob after many practical experiments with com-mon

physics equipment. Such a choice will always reflect subjective preferences. Therefore, it is possi-ble to select other characteristics. This is described in the section Advanced use.

- For large frequency changes, it can often be a shortcut to use the step function (see below).
- The function generator 2502.50 is based on digital frequency synthesis and therefore has a sharp up-per cut-off frequency. Moreover, the analogue amplifier circuits impose their own limitations on the bandwidth. Sine waves are reproduced in the whole frequency range from 0.001 Hz to 10 MHz with very low distortion, while the other waveforms will have slightly rounded corners at high frequencies. This is a natural consequence of their harmonics being attenuated. However, even at 10 MHz, the diverse built-in waveforms remain recognizable.
- When you define a waveform yourself (described in the section Advanced use), remember these limitations. It is not possible to take a shortcut to a 100 MHz function generator by defining a waveform consisting of a sine wave that oscillates 10 times.

Outputs

- The Power output is used for power-consuming devices. This output operates in the frequency range from 0.001 Hz to 100 kHz. Al higher frequencies the output is disabled.
- Please note that the output is disabled completely in sweep mode even if only part of the sweep is above the limit of 100 kHz.
- The power output is thermally protected against overload but should not be deliberately exposed to larger loads than specified (maximum output cur-rent: 1 A).
- The 50 Ohm output is active throughout the generator frequency range.
- This output impedance is matched to 50 n coaxial cable, which is significant at high frequencies: If the cable is properly terminated with 50 n, there should be no reflections in the cable. In this setup, the amplitude of course, decreases by half.
- Be aware that the display shows the amplitude "on the inside" of the output impedance and, therefore, does not reflect the amplitude of the loaded output.
- Note – check that the tennination resistor can handle the deposed power (up to 0.5 W).
- Normal use in the low frequency range (e.g. audio) does not require termination.
- The 50 Ohm output is short circuit protected, but you should not operate the unit for longer at full amplitude and high frequencies in a low impedance load, as this leads to substantial power dissipation within the generator.
- The two previously mentioned outputs will have identical (adjustable) signal amplitudes when not loaded.
- The Sync Out output is an extra output with fixed amplitude. The wavefonn of this output is always (positive) square pulses. Voltage levels are O and 5 V.
- Sync Out is primarily intended as an external trigger signal to an oscilloscope. For small or noisy signals, it may prove helpful in order to get a stable image.

The step function

- In many applications, you will study a physical system at a fundamental frequency and at different multiples of this frequency. The step function is created to facilitate this work.
- The fundamental frequency for the step function is set to the current frequency by pressing fo!Mode once. Fast, repeated presses will switch between the modes hannonics (overtones), octaves and decades – indicated as Harm, Oct and Dec.
- The fundamental frequency is indicated in the display Vo = xxxx).

- The Up and Down buttons can then be used to jump up and down in the selected set of frequencies as described below. The current overtone, octave or decade is indicated by the display (N = xx).

Harmonic (Harm):

- The frequency steps through the overtone series: $f = f_0 \cdot N$
- Negative N-values should be interpreted as fractions: -2, -3 … means ½, Y • . . . (N-values 0 and -1 do not occur.)

Octaves (Oct):
The frequency steps through octaves: $f = f_0 \cdot 2^n$

Decades (Dec):

- The frequency steps through decades: $f = f_0 \cdot 10^n$

Application example – Step

- In a study of standing waves on a string, one finds a resonance at 175.0 Hz. The standing wave shows 5 anti-nodes (the string is 5 half-wavelengths long). Push fol Mode to set fo = 175.0 Hz. If the display doesn't already display Harm, press again until it does. The display now shows N = 1.
- Press 0 Down four times to set N to -5 – the fre-quency is now f0/5 = 35.00 Hz.
- This is the fundamental of the string, and you observe a standing wave with 1 anti-node. In order to set the generator's fundamental frequency to 35.00 Hz also, press the fo!Mode once. Subsequently, you can observe the harmonics of the string one by one by pressing Up. (After each frequency jump: Wait until the previous resonance has died out and the new one has evolved.)

Sweep

- The function generator can perform linear and logarithmic frequency sweeps. (A linear sweep passes "equal numbers of Hz per se-cond", a logarithmic one "eq ual numbers of octaves per second').
- A sweep is defined by four parameters: type (Lin/ Log), start frequency, stop frequency, and sweep time.
- To set up these parameters in the order mentioned, you press Sweep and use the knob Frequency. The display indicates the parameter currently being set.
- The step function can be used when setting start and stop frequencies
- After the four parameters have been set, the next press of Sweep activates the sweep.
- The sweep function is interrupted by yet another press of Sweep.
- While a sweep is active, the frequency span may be changed with the buttons Up and Down. The start frequency changes as described in the section The step function. The stop frequency is changed according to the following principle: For a linear sweep the difference stop frequency – start frequency is preserved. For a logarithmic sweep the fraction stop frequency I start frequency is preserved.
- The parameter type and sweep time can not be changed while a sweep is active.

Application example – Sweep

- The very sharp resonances in a Chladni plate can be demonstrated by letting the frequency slowly sweep through an interval. With a little sand on the plate, the nodal patterns will stand out.
- Press Sweep and rotate the (frequency-) knob slight-ly until the display shows Un.
- Press again (Start is now blinking in the display), and set the desired start frequency. (50 Hz is a good bet.)
- Press Sweep again (Stop blinking) and set the desi-red stop frequency. (600 Hz is a good bet.)
- After the next push (7ime flashes on the display) sweep time is set to for example 20 seconds.
- Now the sweep is ready and will start running at the next press of Sweep.
- Sweep parameters are remembered. If a single parameter is to be changed, simply step forward by pressing the Sweep button. The values not actively changed remain the same.

Advanced use

- The function generator behaves as a 1 MB memory stick when connected to a PC via USB.
- The drive contains the following folders:
- The root folder"\" (may eventually contain a editable setup file) "firmware" (hidden folder – aviod changing anything here) "settings" (hidden folder – editable text files) "waveforms" -with these sub-folders: "Custom" (the definition of a custom-defined waveform may be placed here) "predefined" (hidden folder – aviod changing anything here)

It is recommended that you make a backup of the drive before making changes.

- Note that it is very important that you close the USB connection properly down before the cable is removed, or any of the applian-ces turned off. Always use the function "Sa-fely remove hardware" when you are finished using the connection.

Automatic mode

- It is possible to define a sequence of settings to be carried out by the function generator. This may just be the automation of a single setting – or it could be a long series of e.g. frequency changes.
- Setting up automatic mode is done in the file "setup.zup". The file should be in the USB drive's root folder. The possible commands are specified below.
- Activation of the automatic mode is achieved by holding the Display button down and pressing the fo! Mode The function is indicated as AM in the display.
- The generator returns to normal operation by pres-sing a button or by tu ming the frequency knob.

Commands in "setup.zup"

- This text file contains one command per line. Each command line starts with a letter, eventually followed by a number. Empty lines and comments are allowed. A comment is a line that does not start with any of the letters below. It is recommended always to start a comment with two forward slashes:"//".

The commands are executed from top to bottom (except when an A-command is executed – see below).

- D Dump
  - Prints the current settings to the file dump.txt. Each line consists of three fields:
  - Parameter name, e.g. "Waveform"
  - Parameter value, e.g. "Ramp Up.
  - Corresponding command, e.g. "W6"
- Fx Freq.
  - Set the frequency to the value x. For example, F234500 will set f to 234.5 kHz.
- Wn Waveform
  - The number n indicates the waveform. W1 means sine, and W6 is an upward ramp.
  - If there is no custom waveform, WS means the same as W1.
- Bx Base freq.
  - Sets f0 to the frequency x.
- Mn Step Mode
  - M1: harmonics, M2: octaves, M3 decades.
- Ni N-value
  - The current N-value is set to the integer i – which can take both positive and negative values. If step mode is M1, i=0 and i=-1 will be ignored
- Sn Sweep mode
  - SO: normal operation, S1: linear sweep, S3: logarithmic sweep.
- Ix Initial freq.
  - Set the start frequency of sweep to x.
- Ex. End freq.
  - Set the stop frequency of the sweep to x.
- Tx Sweep Time
  - The time x is a decimal number in seconds.
- Px Pause
  - Wait x seconds before the next line executed. The signal from the generator continues with the current parameters.
- R Repeat
  - Jump to the top of the file and repeat from there.
  - Lines following an A-command are never executed.
- Frequencies can be specified with 0.001 Hz resolution.
- Precision is better than 0.005 %.

Custom-defined wavefonn

- There are two possible formats for the specification of a waveform.
- The file is placed in the folder "\waveforms\Custom".
- If you want the display to show the amplitude (peak value) correctly, you must ensure that the maximum value occurs in the file (4095for "custom.csv" resp. 100 lor "custom.wdf". "custom.csv• (comma separated values)
- This text file consists of 16384 lines, each consisting of one integer between o and 4095 (inclusive).
- The value O corresponds to the voltage -100% and the value 4095 corresponds to 100%. Comments may be inserted in the fonn of lines that do not start with a digit.
- The content is generated easily by using a spread-sheet – copy a column to a text file and rename it.

- If "custom.csv" exists, the function generator crea-tes the file"custom.wfr" in its internal lormat. It is a binary format and is not directly editable. This trans-formation takes time, so the first time you select the waveform Prog. you will experience a few seconds response delay.
- Then "custom.csv" is automatically renamed "custom. $cs". "custom.wdf" (wavefonn description file)
- This file is a quick way to define a wavefonn that consists of line segments. Note that if "custom. wfr" exists, "custom. wdf" is ignored.
- Each line in the file describes an endpoint of a linear ramp given by two numbers:
- A time (0 to 100%) and a voltage (from -100% to 100%) – separated by semicolons or tabulation.
- If the time entry in the first point is not 0, the curve starts at (0,0). If the last time is less than 100, the last defined voltage continues for the rest of the period.
- Comments may be inserted in the form of lines that do not start with a digit.
- Wavefonn description file – example / /friangle Wave
  - 25; 100
  - 75; -100
  - 100; 0 (Since the first time is 25%, the starting voltage is implicitly O V.)
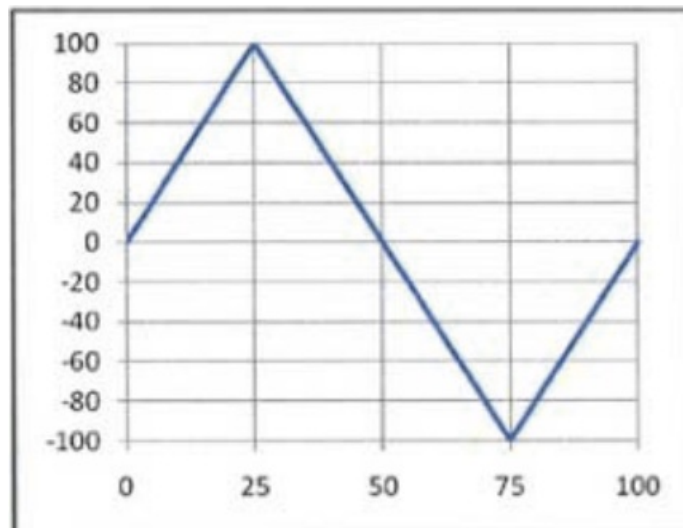
Note that it is very important that you close the USB connection properly down before the cable is removed or any of the appliances turned off. Always use the function "Safely remove hardware" when you are finished using the connection.

System parameters
The file "system.ini" lies in the hidden folder "settings". This file makes it possible to specify a few more unusual parameters. Here, we shall only mention a few. Normally there will be no need to change these parameters:

VoltComp = ON/OFF
Analogue components of the generator have a finite bandwidth, and the amplitude therefore decrease a bit at high frequencies. The decrease depends on the wavefonn. With VoltComp = ON, the amplitude, as shown in the display, reflect this. With VoltComp = OFF the "ideal" value is displayed.

Encoder = 0/112/3/ 4

- The frequency control is, as previously mentioned, speed sensitive. You can choose from 5 different built-in acceleration characteristics.
- This parameter will be ignored if is a file called encoder.ini" in the folder. Such files with additional characteristics will be available at the Frederiksen website (search for 2502.50).

Note – In the "system.ini" file there is one space on each side of the equal sign.

Specifications

Wavefonns

- Bipolar: Sine, triangle, square
- Positive: Square pulse, triangle pulse, ramp up, ramp down
- Additionally, user defined, arbitrary waveform.
- Distortion (sine): < 0.1 % up to 20 kHz;< 1 % otherwise

Frequency range

- **50 n output:** 0.001 Hz to 10.00 MHz
- **Sync output:** 0.001 Hz to 10.00 MHz
- **Power output:** 0.001 Hz to 100.0 kHz
- **Frequency stability:** Better than 0.005 %

Amplitude

- **50 n output, no load:** 0 to 10 V (20 V p-p for bipolar waveforms)
- **50 n output 50 n termination:** 0 to 5 V (10 V p-p for bipolar wavefonns)
- **Sync output:** 5 V (TTL signal: 0 to 5 V)
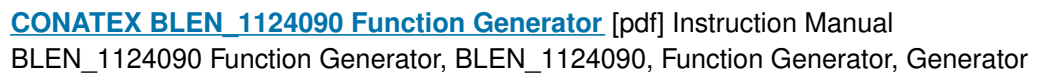- **Power output:** 0 to 10 V (20 V p-p for bipolar waveforms)

Max current

- **50 n output:** 200 mA (short circuit – only briefly)
- **50 n out 50 n termination:** 100 mA (unlimited)
- **Sync output:** 100 mA (short circuit – unlimited)
- **Power output:** 1 A

Misc.

- **Mains voltage:** 230 V; 50-60 Hz
- **Power consumption:** 85 W (max); 21 W (idle)
- **Fuse:** 1 A (slow)
- **Dimensions r,v x D x H):** 312 x 205 x 117 mm

Documents / Resources

CONATEX BLEN_1124090 Function Generator [pdf] Instruction Manual
BLEN_1124090 Function Generator, BLEN_1124090, Function Generator, Generator

References

- **User Manual**