

Model BPG-1P Biphasic Pulse Generator

Owner Manual



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Description



The BPG-1P is a portable pulse generator for neuroscientific experimentation. The unit is lightweight, versatile and battery operated for convenience. It can generate single or dual pulses of either positive or negative polarity as well as alternating positive and negative pulses. The output amplitude is adjustable from 0 Volts to +/-10V peak. It operates in either free-running mode or triggered mode. When in **triggered** mode, a single pulse train will be generated for each trigger pulse inputted or for each press of the **manual trigger** button. To trigger a pulse-train, either press the **manual trigger** button or connect a signal 2.5V (minimum) to the “ext. trig” port. The output can also be “gated” (allowed) only when an externally connected signal is above the 2.5 Volt threshold. Like our legacy BPG-1, if a pulse-train (single or double pulse) began and the gate signal goes low, the BPG-1P will complete the (already started) pulse-train.

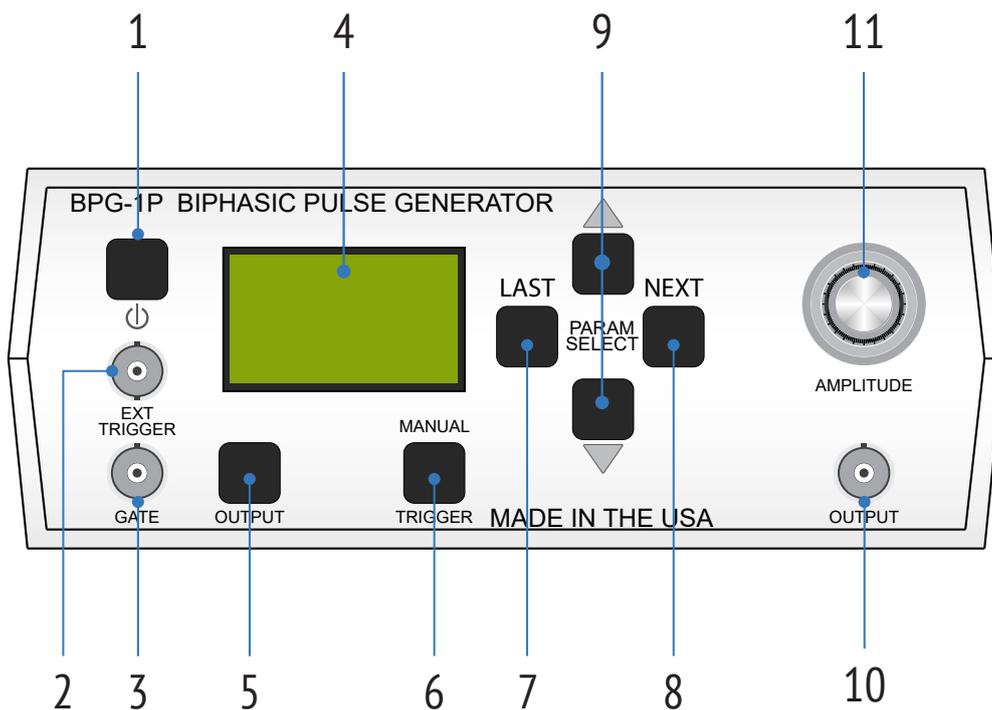
When first powered on, the graphic liquid-crystal display turns on and shows the **waveform** selected, **pulse width, interval** (for double pulses), **period** (when in “free run” mode) and the **battery status**. When in triggered (TRIG'D) mode, the **delay time** (trigger pulse → start of pulse-train) is also displayed. All parameters are user adjustable by pressing one of the four **next parameter, last parameter, increment, or decrement** buttons. The signal is present at the output connector after the output signal is pressed (**Output: On** displayed on LCD).

Specifications



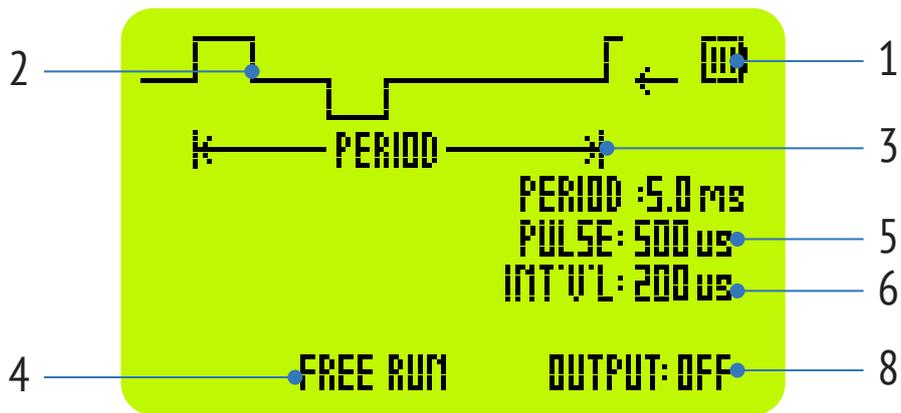
Pulse Width	10us to 980ms in 4 ranges 10us → 99us - 100us → 990us, 1ms → 99ms - 100ms → 980ms
Accuracy of Pulse width	within 1 percent of selected value
Period	1ms to 990ms in 3 ranges 1ms → 9.9ms - 10ms → 99ms, 100ms → 990ms
Accuracy of period	within 1 percent of selected value
Interval	10us to 99ms in 4 ranges 10us → 99us - 100us → 990us, 1ms → 9.9ms - 10ms → 99ms (time between two double pulses)
Delay (start of train after trigger)	10us -> 990ms in 4 ranges
Waveforms	Single Positive, Single Negative Alternating negative and positive, Double positive or Double negative
Output Voltage (peak)	continuously variable from 0 to 10V (+/-)
Rise Time/Fall Time	< 50 ns from 0 to +10V or 0 to -10V
Input impedance (trig & enable)	100 kilo Ohms
Minimum Trigger Pulse Width	5 microseconds
Power	(2) 3.6 Volt lithium-metal C-cell batteries
Current Draw	< 16mA (typical)
Battery Life	> 500hrs. Continuous duty (typical)
Dimensions	9" (22.9cm) W x 3.5" (8.9cm) H x 7.5" (19cm) D
Weight	1 lb. (454mg)

Control Layout

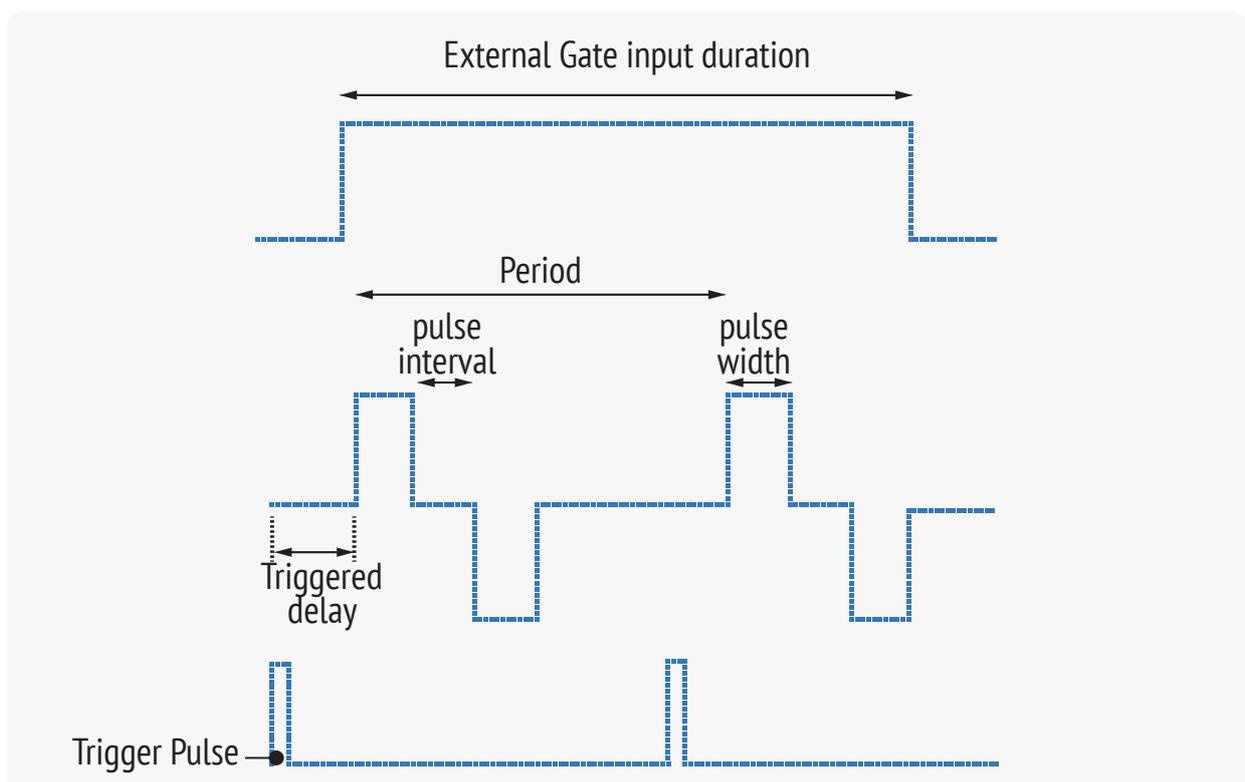


1. Power Button
2. Ext. Trigger Input
3. Gate Input
4. Measurement Display
5. Output Enable
6. Manual/Trigger Button
7. Last Button
8. Next Button
9. Mode Toggle
10. Signal Output
11. Amplitude Knob

Measurement Display



1. Battery status
2. Waveform
3. Period
4. Triggered/free run mode
5. Pulse-width
6. Interval (double pulses)
7. Delay (when in “triggered” mode)
8. Output status (on or off)



After turning on the power by pressing the power button and holding it for ½ second, the arrow points to the waveform as shown in panel display above. This indicates the waveform is selected and pressing the up or down buttons will change the selected waveform.

- Press the up or down buttons until you see the waveform that you want.
- Press the Next button and the arrow now points to the mode (free run or triggered). Press “up” for free run and down for “triggered”.
- Press the “Next” button again and the arrow will point to the “period range”. Here you will select the range of the period. Press the up or down buttons to select the range of the period you want.
- Press the Next button again and the arrow will point to the “period”. Press the up or down buttons to adjust the period.
- Press the “Next” button again and the arrow will point to the “pulse-width range”. Here you will select the range of the pulse-width. Press the up or down buttons to select the range of the PW that you want.
- Press the Next button again and the arrow will point to the “PULSE”. Press the up or down buttons to adjust the pulse-width.
- Pressing the Next button again will select the “interval range”. Again, choose the range by pressing either the up or down buttons.
- The Next button will the move the arrow to the “interval”. Again, use the up or down buttons to adjust the interval.
- If you want to go back and change a previously set parameter, press the “Last” button until the arrow points to the parameter that you wish to change.

- If you shut the unit off, it will recall the last settings upon power up.
- Press the “Run” button and the waveform will be present at the output. While running, the waveform cannot be altered (except for the amplitude).
- Press the “Run” button and the waveform will be present at the output. While running, the waveform cannot be altered (except for the amplitude).
- If you wish to trigger the start of pulse trains from an external source (for synchronization, as an example), this is accomplished by connecting a positive going trigger pulse to the “external trigger” input and having already selected “triggered” mode. The trigger pulse must be at least 2us in duration to trigger the BPG-1P but we recommend 5us (or greater).

Resetting the System

If power is removed by unplugging the DC adapter while the unit is on or if the batteries go dead while the unit is on, the internal firmware may hang up and the display seems incorrect or you can't change the parameters, you can reset the internal microcontroller by doing the following:

1. Loosen the battery cap enough so that the display goes blank.
2. After 15 seconds, retighten the battery cap.
3. Press and hold the  button
4. Press and hold the “Power” button.
5. Release the  button
6. Release the power button

The BPG-1P will restart at the default setting of:

PW = 94us

Period = 500ms

Waveform = single negative

You should now be able to adjust the settings to your needs.

The BPG-1P uses a microcontroller to operate the display, enable the operator's button switches and generate the different waveforms. The firmware has internal routines that prevent the operator from entering values that are illogical.

About Illogical Settings

An example of an illogical input would be for example, a pulse-width or pulse-widths (double pulse waveforms) and an interval whose total time is greater than the period. It is impossible to enter something like that as the BPG-1P will not allow it. Also, for example, assume that you have selected a single pulse waveform of say 5ms and a period of 10ms. This would work fine but if you attempt to change the waveform to a double pulse, the firmware will not allow it.

This is because two pulses of 5ms each plus any interval exceeds the period (in this example, 10ms). Total Pulse-width(s) + Interval must be < the Period.

In a case like the one above and you want to change to a double pulse waveform, you should first increase the "Period Range" to maximum. This will allow you to change from a single pulse to a double pulse. Next select the desired waveform. Then adjust the pulse-widths and intervals. After these have been set, go back and set the period range and period.

Using the BPG-1P



Once the parameters are set and you're ready for the signal, press the output button and you'll see the words "Output: On" have replaced "Output: Off". The output is now active and if the unit is in free run mode, a repeating pulse or pulse pair is present on the output. If the unit is in "Trig'd" mode, an output pulse or pulse pair will be present at the output after receiving an externally applied trigger pulse. In triggered mode, only one pulse or pulse pair is generated for each trigger pulse present at the "Ext Trigger" port. A manual trigger will also generate a single pulse or pulse pair with each press of the "manual trigger" button.



For safety reasons, when switching from triggered mode to free running mode, the period will change to 990ms but can be changed. This is to reduce the chance of inadvertently selecting a high pulse rate after having used the triggered mode.

The Gate input also allows the user to enable or disable the output by applying a positive voltage to the Gate input. The positive voltage can be anything from 3 to 50 Volts. Apply a low voltage (0 to 0.7 Volt) to the Gate port to disable it. If a waveform has already started when the Gate signal goes low, the waveform will complete its cycle before stopping. This is especially helpful when using bi-phasic waveforms as the number and duration of positive and negative pulses will be equal.

EXAMPLE 1

Desired Period (or $1/F$) = 20ms

(Since you have selected a period, you must first set the BPG-1P to "free running" as opposed to "triggered".)

Desired Waveform = biphasic negative then positive

Desired Pulse width = 500us

Desired Interval (time between the pulse pairs) = 300us

Procedure: Press and hold the power button until the display comes up.

1. Notice that the small arrow points to the waveform. Press the  or  button until the desired waveform is displayed. In this example, you want the negative pulse followed by the positive pulse.
2. Press the parameter “Next” button and the arrow will point to either “triggered” or “free run”. If it points to “triggered”, press the  button and the arrow will point to “free run”. (pressing the  button selects “triggered” mode).
3. Press the parameter “Next” button and the arrow points to the period “Range”. Press the  or  button until “10-99ms” is displayed.
4. Press the parameter “Next” button and the arrow points to “Period”. Here you will set (using the  or  buttons) until the period = 20ms.
5. Press the parameter “Next” button and the arrow points to pulse-width “Range”. As before, press the  or  buttons until the PW Range = 100-990us.
6. Press the parameter “Next” button and the arrow points to “Pulse”. Press the  or  arrows until the Pulse = 500us.
7. Press the parameter “Next” button and the arrow points to interval “Range”. As before, press the  or  buttons until the interval Range = 100-990us.
8. Press the parameter “Next” button and the arrow points to “Interval”. Press the  or  arrows until the Pulse = 500us.
9. Adjust the 10-turn knob until the desired peak voltage is set.
10. In the lower right of the display, you’ll see “Output: Off”. Press and hold BRIEFLY the “output” button until the display changes to “Output: On”. The output is now present at the “output” BNC connector.

11. Press the “Output” button to stop the output or if the experiment is complete, press the “Power” button. When the unit switches off, it first saves the parameters that were last set. This saves time when an experiment is to be performed several times with the same parameters.



When the output is ON, the parameters and \triangle ∇ buttons are disabled. The only controls that are useable now are: Amplitude, Output (ON/OFF) and Power (ON/OFF).

Servicing the BPG-1P

The batteries are the only items that are user serviceable. When the battery level indicator shows only one bar, it's time for a fresh set of batteries. To replace them, unscrew the cap on the rear of the unit and remove the two c-cells. These are 3.6V lithium-metal batteries so don't try to use 1.5Volt batteries as the unit will not function. Be sure to install them with the “positive” terminals facing outward.

Certification

Microprobes for Life Science certifies that this instrument has been tested and inspected thoroughly and was found to meet all published specifications before shipment from the factory.

Warranty

All Microprobes for Life Science products are warranted against defects in materials and workmanship for one full year from the date of delivery. Products that prove to be defective during the warranty period will be repaired or replaced without charge provided they are returned to the factory. No other warranty is expressed or implied. We are not liable for consequential damages.

Service



Microprobes for Life Science will provide for servicing and calibration after the warranty period for a reasonable service charge. The instrument should be shipped to the factory postage prepaid. There is a minimum service charge of one hundred dollars (\$100.00) and all instruments will be repaired, calibrated and returned promptly. Please enclose a cover letter with the instrument explaining deficiencies and identify by serial number in all correspondence pertaining to any instrument.

Contact Information



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