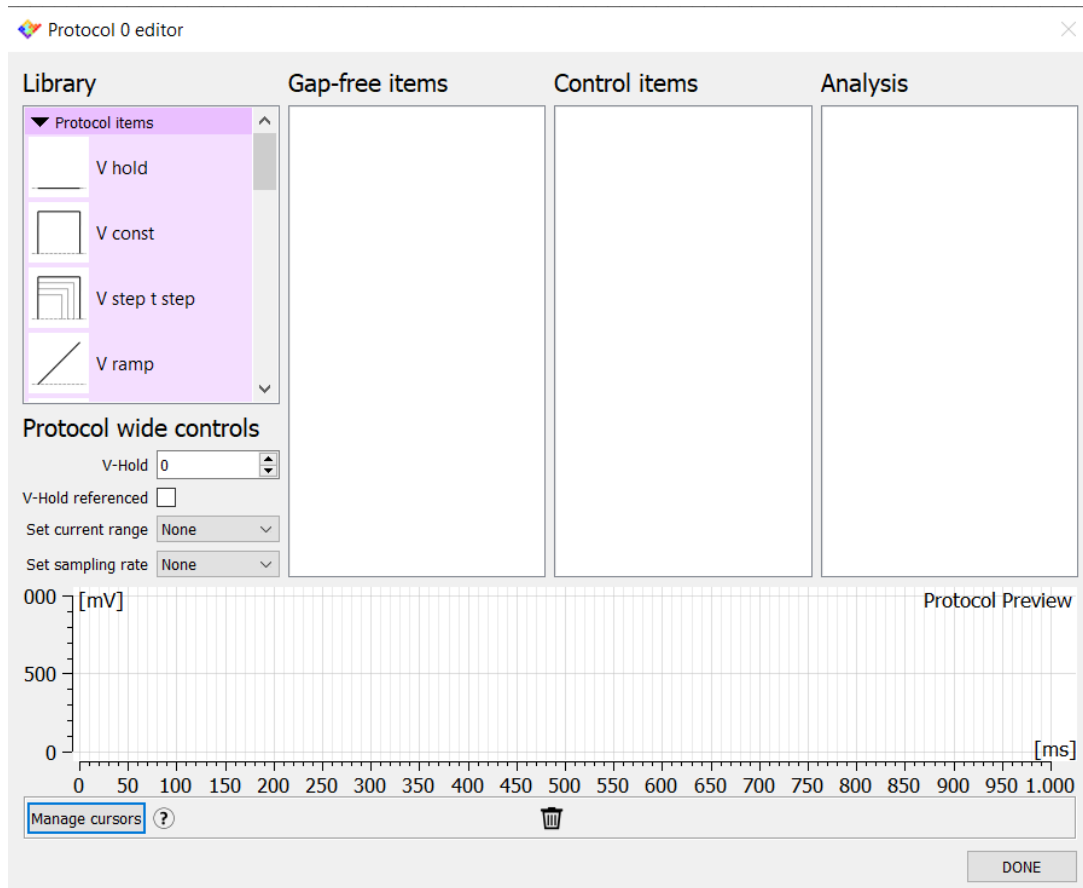


EZ Patch quick guide

Protocol Editor

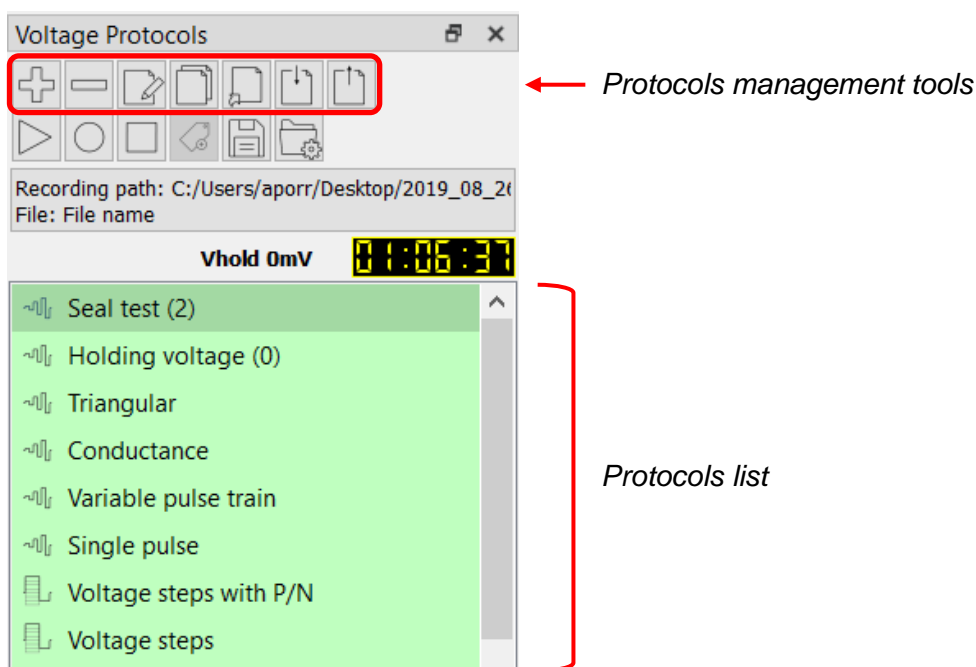


This short guide illustrates how to use the protocol editor tool of EZ Patch software.

The protocol editor contains options for setting up various parameters of data acquisition: the acquisition mode, the trial length, the shape of the command waveform and real time analysis.

When a new acquisition protocol has been configured, this is automatically saved and reopened within the protocol list when a new session of the software is launched.

EZ Patch is equipped with a series of editable commonly used default protocols; alternatively, users can create their own protocols from scratch using the create new protocol button.

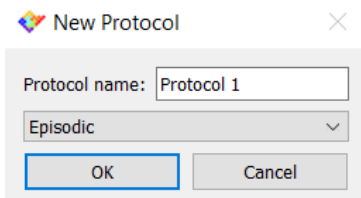


The protocols that are in the list can be modified, duplicated, imported and exported using the dedicated buttons. Place the mouse cursor over the buttons to bring up the pop-up window with a short the description of its use.

Create a new protocol



Click on “create a new protocol” button to start to design the new protocol.



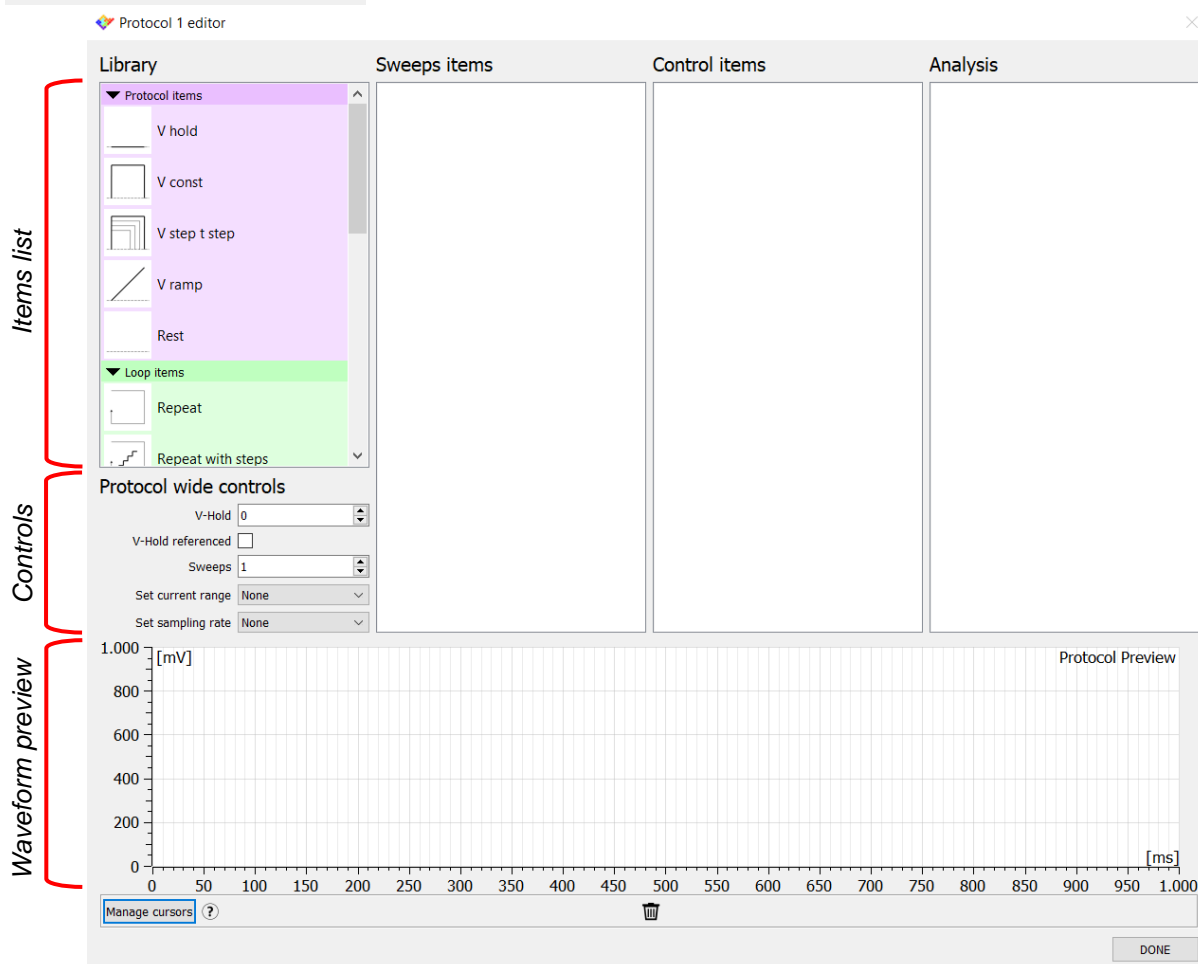
New Protocol

Protocol name:

Episodic

OK Cancel

The first step is to type the **name of the protocol** and to choose an acquisition mode: **gap free or episodic stimulation**. Click ok and proceed with the creation of the waveform.



Protocol 1 editor

Library

- Protocol items
 - V hold
 - V const
 - V step t step
 - V ramp
 - Rest
- Loop items
 - Repeat
 - Repeat with steps

Protocol wide controls

V-Hold: 0

V-Hold referenced:

Sweeps: 1

Set current range: None

Set sampling rate: None

Sweeps items

Control items

Analysis

Items list

Controls

Waveform preview

1.000 [mV]

800

600

400

200

0

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1.000 [ms]

Protocol Preview

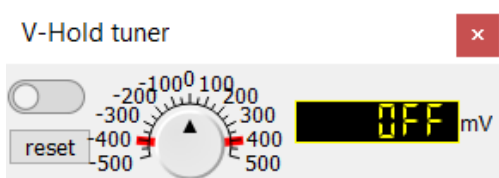
Manage cursors (?)

DONE

The protocol editor tool consists of a series of **items** (grouped in the library box) that can be used to assemble the desired waveform. The items consist of a holding potential, a constant potential, a series of steps with variable voltage and duration, a ramp, and a rest time; the latter consists of a voltage, having a defined amplitude, applied without receiving the current data. The items of the library must be dragged into the “sweeps items”, “control items” and “analysis” boxes to start to set the waveform.

The **protocol wide control** section (see image above) allows to set the number of the sweeps and the holding voltage, as well as to associate a current range and a sampling rate

to the protocol. If needed, check the V-hold referenced box to make all the voltage values of the protocol connected to the set holding potential.



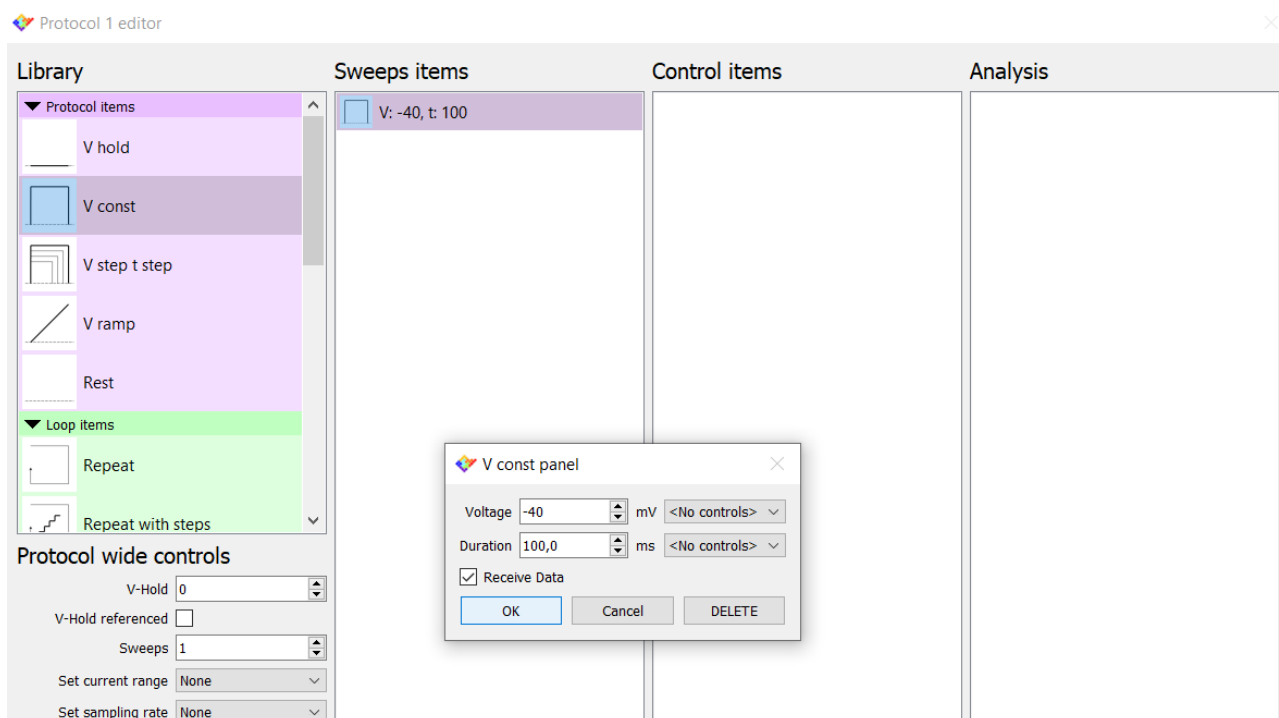
The V-hold tuner widget (or I-hold when in CC mode) allows you to promptly set a positive or negative holding command with a knob-like interface. Set the desired value by placing the cursor over the knob and rotating the mouse wheel. This enables a fine adjustment of the V-hold tuner. Alternatively, keep the “Ctrl” key pressed to speed up the knob rotation and quickly reach the desired value. Alternatively, click on the display and type the desired number. If the button in the upper left corner of the widget is enabled the value indicated by the display is added to the applied protocol. Some protocols may become red (unavailable) if adding the hold tuner value makes the protocol exceed the DAC range. The red wings around the knob instead indicate the range in which the tuner can be set in order to be added to the currently applied protocol.

Alternatively, keep the “Ctrl” key pressed to speed up the knob rotation and quickly reach the desired value. Alternatively, click on the display and type the desired number. If the button in the upper left corner of the widget is enabled the value indicated by the display is added to the applied protocol. Some protocols may become red (unavailable) if adding the hold tuner value makes the protocol exceed the DAC range. The red wings around the knob instead indicate the range in which the tuner can be set in order to be added to the currently applied protocol.

Design a voltage step protocol

As an example, let’s build an episodic voltage step protocol that starts with a constant potential of -40 mV, followed by a series of steps ranging from +100 to -100 mV, with -20 mV increment, and ends with another constant potential of -20 mV.

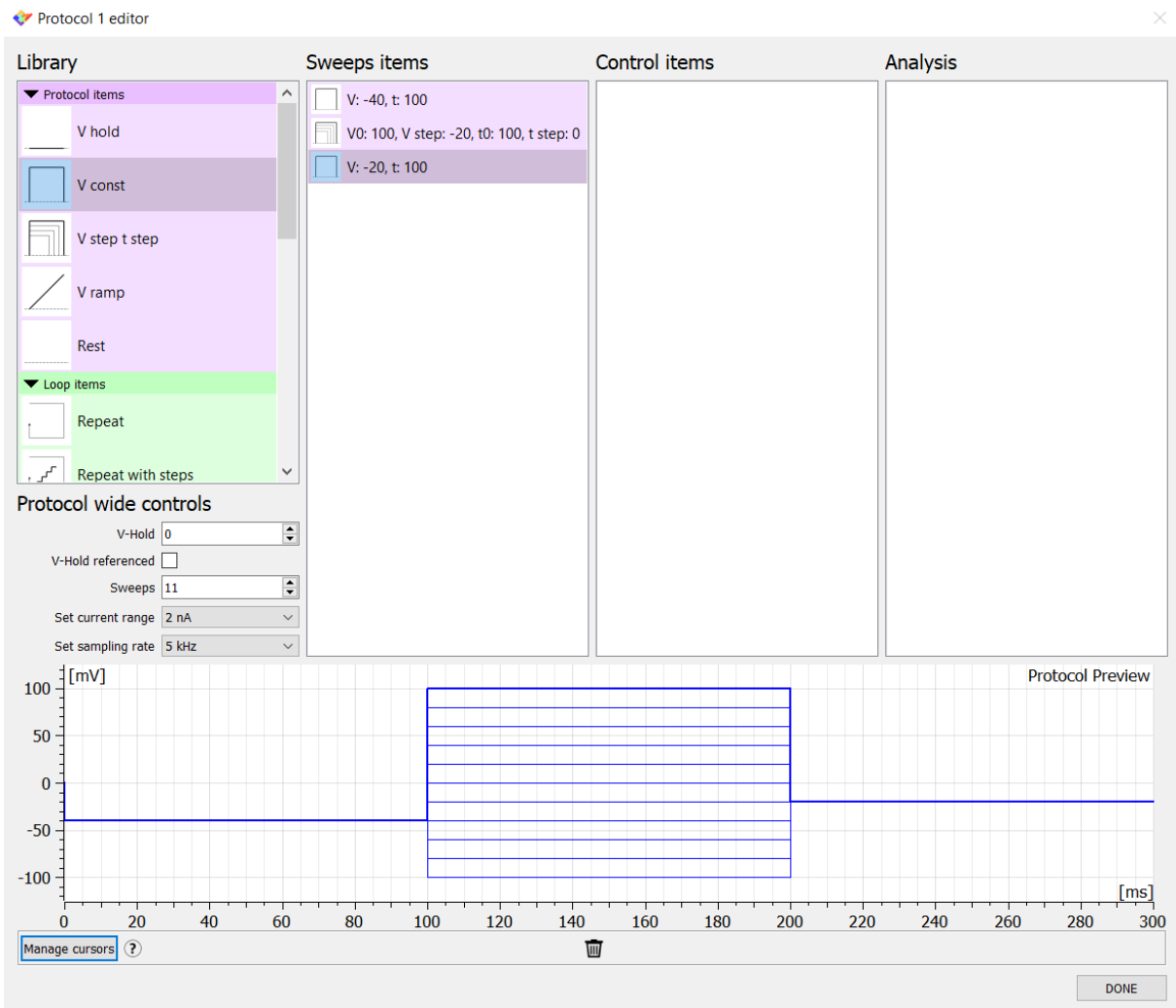
Start with dragging a constant voltage item (V const) into the sweep item box and double click to open the item control panel in order to set amplitude and duration.



Drag the “Voltage step - Time step item” and double click to set its parameters. Finally, drag another “voltage constant” item and set the values.

In the “**protocol wide controls**” set the “number of the sweeps and choose gain and a sampling rate to associate with the protocol.

While you are building the command waveform, you can look at the **waveform preview** box to check how it looks like. If needed, left click and drag to zoom the waveform preview, or right click to autoscale it to fit the whole waveform into the plot.



The screenshot shows the "Protocol 1 editor" window. It is divided into several sections:

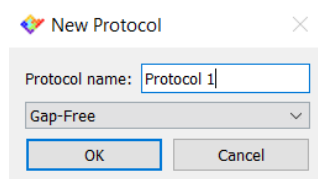
- Library:** Contains "Protocol items" (V hold, V const, V step t step, V ramp, Rest) and "Loop items" (Repeat, Repeat with steps).
- Protocol wide controls:** Includes fields for V-Hold (0), V-Hold referenced (checkbox), Sweeps (11), Set current range (2 nA), and Set sampling rate (5 kHz).
- Sweeps items:** A list of items to be added to the protocol, including "V: -40, t: 100", "V0: 100, V step: -20, t0: 100, t step: 0", and "V: -20, t: 100".
- Control items:** An empty panel for defining control parameters.
- Analysis:** An empty panel for defining analysis parameters.
- Protocol Preview:** A plot showing the waveform. The y-axis is labeled "[mV]" and ranges from -100 to 100. The x-axis is labeled "[ms]" and ranges from 0 to 300. The waveform shows a constant voltage of -50 mV from 0 to 100 ms, followed by a step to -20 mV for 100 ms, and then returns to -50 mV.

At the bottom right of the window, there is a "DONE" button.

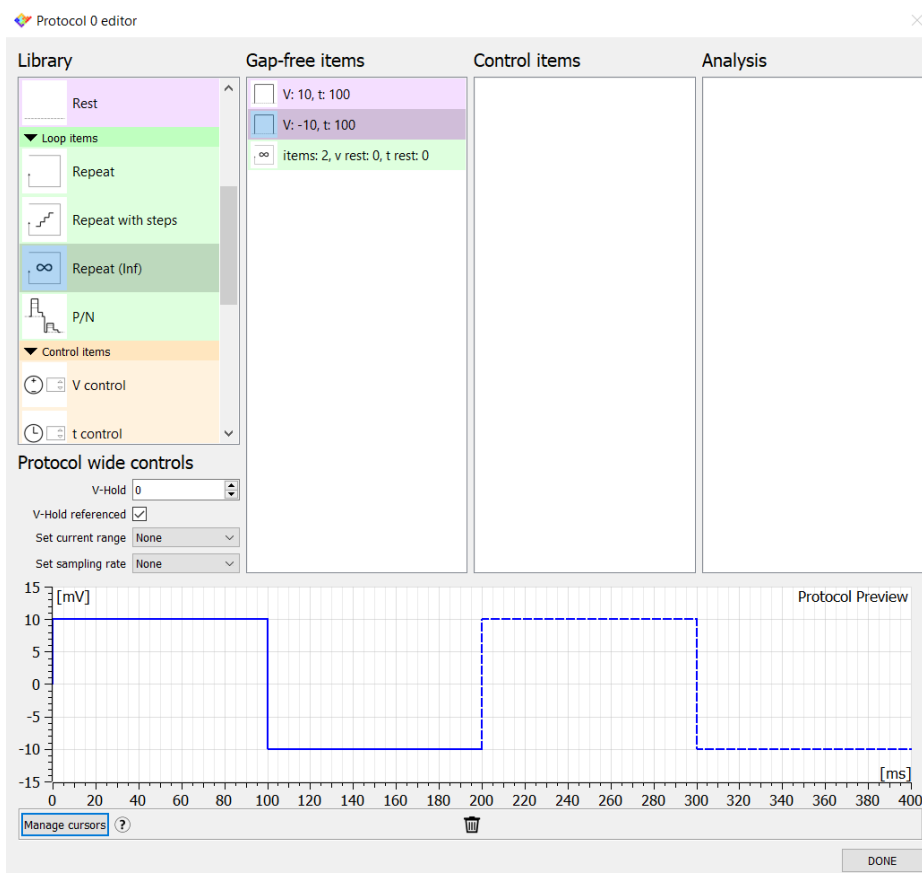
Click on “DONE” to save the protocol within the protocols list.

Design a gap-free protocol

As an example, let's design a continuous square wave pulse having a 20-mV amplitude that oscillates uniformly about the holding level. Click on "create new protocol" and select the gap-free modality.



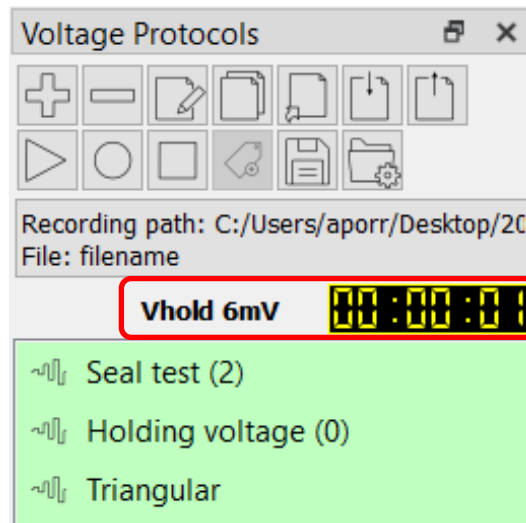
Form the protocol items list drag two "V const" items into the "gap-free items" box. Once they are in the box, double click on them to set the duration and the amplitude of each. Set the first constant voltage to +10 mV and set the other to -10 mV in order to define the 20-mV amplitude of the square wave. Then, scroll the library to find the "loop items" list. The **loop items** allow to repeat a set of items either for defined or undefined times. Drag a "repeat (inf)" item in the sweeps item box and double click on it to set the number of items that you need to repeat indefinitely (in this example set 2).



After clicking “OK” the second half of the waveform preview become dashed to indicate the portion of the waveform that will be repeated indefinitely (if you cannot see the whole waveform preview right click on it with the mouse to autoscale the graph).

In the “protocol wide control”, tick the **V-hold referenced** checkbox: in doing so, any change in the holding voltage are reflected in all the voltage values of the waveform. On the contrary, when unchecked, the holding voltage that is set in the V-hold box is automatically applied only when the “stop recording” button is pressed.

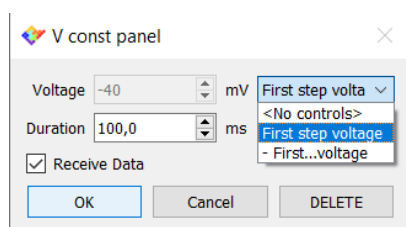
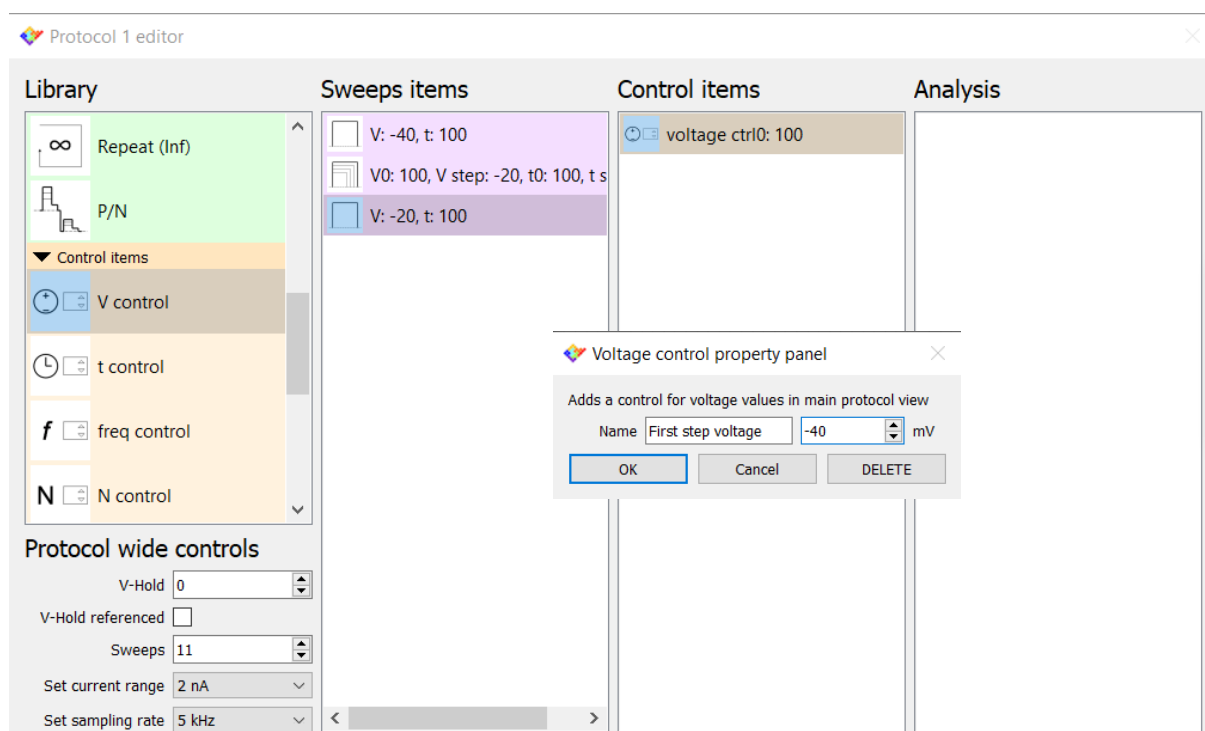
The holding voltage that is applied when the protocol has been stopped is always shown (when the acquisition finishes) in the voltage protocol widget, next to the protocol timer.



The control items

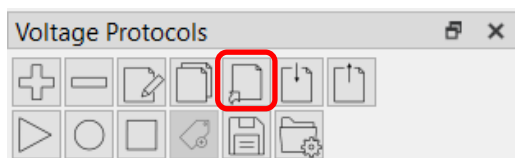
The “protocol wide controls” are always quickly accessible by double clicking on the name of the protocol within the protocols list. The same can also be set for all the other parameters of the waveform by using the control items. In other words, **the control items** can be associated with the sweep items in order to quickly modify the desired parameters without opening the protocol editor.

As an example, let’s add a control item in order to rapidly change the first voltage step value. Drag the voltage control item in the control item list, and double click to rename it and change its value.



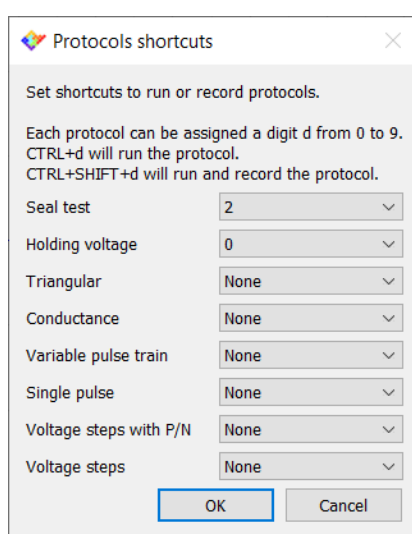
Then double click on the “voltage step” item (within the “sweeps item” list) and link the value of the first voltage parameter to the newly created control item. Now the control of the first step amplitude can be quickly set by double clicking on the protocol name (within the protocols list), without the need to open the protocol editor.

Run a protocol with a keystroke action

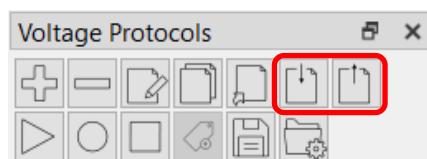


The shortcuts tool lets you **run or record a protocol with a keystroke action**. Click on the “set protocol shortcuts” button and assign a number to the desired protocol. The assigned number appears in parenthesis next to the protocol name. To run the

protocol, press the control key on your keyboard together with the associated number. Add the shift key to this sequence to run the protocol and record the data.



Import and export protocols



If you have accidentally deleted a default protocol from the protocol list use the “import protocol” command to call it back. Click the “import protocol” and then the “browser” buttons and select the “default.epml” file located in the path *user > EZ Patch > Protocols*. Tick the checkbox of the protocol that you need to call back and press OK.

The protocols included within the protocol list (i.e both the default protocol customized by the user and those created from scratch) can be saved as a .epml file using the “export protocol” command. In this way if you accidentally remove a protocol that is not in the default list you can simply call it back by applying the above described procedure.