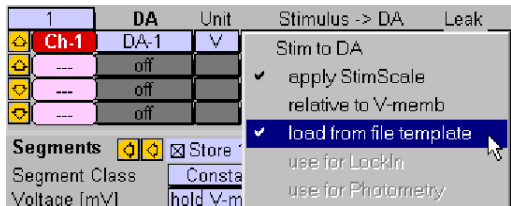

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1. Using a Recorded Waveform as Stimulus

1.1 Introduction

The DAC-stimulus template output by PATCHMASTER can either be computed by the program or loaded from a file if you activate "load from file template" in the Stimulus → DA section in the Channel Settings of the Pulse Generator of PATCHMASTER. This way, you can stimulate any complex pulse pattern that PATCHMASTER can not otherwise calculate. You can even stimulate a prerecorded voltage trace such as an action potential.



1.2 Rules

There are the following things to consider when using the "load from file template" feature:

1. **Location of the template file:** The template must be in a file in the folder where the **pgf**-files are. You can also put the files into a sub-folder inside the folder where the **pgf**-files are. In this case, the folder name must be the same as the name of the stimulus.
 2. **Name convention:** The file names of the templates define how the templates are used. PATCHMASTER offers the following options:
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- (a) One template file per DA-channel should be common for all sweeps of the series: For this option, the name of the template would be ..."stimulus name]-[channel number].tpl". E.g., if the stimulus name is "IV", then PATCHMASTER looks for the template file "IV_1.tpl" to be used as the template file for all sweeps of the first (1.) DA-channel.
 - (b) Different template files per DA-channel and sweep: For this option, the name of the template would be ..."stimulus name]-[sweep index]-[channel number].tpl". E.g., if the stimulus name is "IV", then PATCHMASTER looks for the template file "IV_1.1" to be used as template for the first sweep of channel one, "IV_1.2" to be used as template for the second sweep of channel one etc. Please note, that the location of the template files is in the "[stimulus name]" folder inside the folder where the pgf file is originated.
3. **Data format:** The file must contain one voltage value per stimulus point. The voltage value must be a "short" (4 byte), binary IEEE-floating point format number. All values must be in volt, i.e., if a voltage of -80 mV has to be output, then the required value is -0.080.

1.3 An Example

In the following we will demonstrate how the "File Template" feature is applied to stimulate with a prerecorded pulse pattern. You can easily test this procedure using the model circuit:

1. **PGF Series for recording the template:** In order to record an "action potential" we generate a simple Pulse Generator Series named "RecTemplate" with one sweep per series (No of Sweeps = 1) and three Constant segments (Duration: 20, 10, and 50 ms). The first and third segment we set to holding current and in the second segment we inject some current into the cell (Imem, 100 pA, Imem). The Sample Interval should be 0.1 ms and one input channel has to be acquired (AD = Imon).

2. **PGF Series for applying the template:** The name of the pgf Series and the template that is used by the series must have the same base name. We therefore create a Series with name "ApplyTemplate" by duplicating the series "RecTemplate" using the Copy function. In the "Stimulus → DA" section we select "load from file template" and adjust other parameters (e.g. switch to "voltage clamp mode", sample from the current monitor etc.
3. **Setting up the model circuit and amplifier measuring mode:** If you are using the model cell first establish a whole cell recording situation by putting the model cell in the 500 MOhm position and choose the appropriate amplifier settings. E.g. use a holding potential of -80 mV. Then switch to current clamp mode.
4. **Record the template:** In the Protocol Editor window, execute the "RecTemplate" stimulus. You should see the voltage response with its corresponding "action potential" shape. Let's assume that the response is about 80 mV in amplitude. Note: the Store button must be on in the oscilloscope, otherwise the sweep will not be stored.
5. **Export the template file:** Select the Trace to be exported in the Replay window and select "Export Trace → As Stimulus Template" from the Replay menu. A file selector will pop up. Store the template to disk into the folder where the PATCHMASTER pgf-files are located as "ApplyTemplate_1"
6. **Apply template** Finally, execute the "ApplyTemplate" stimulus in the Protocol Editor window. The file template is read and used as the template, and you should see the corresponding current response.

Alternatively, you can use third party programs such as Igor Pro to generate the stimulus template file.