

## How to Use MVC (Amplitude Normalization) in MR3

March 2<sup>nd</sup>, 2020

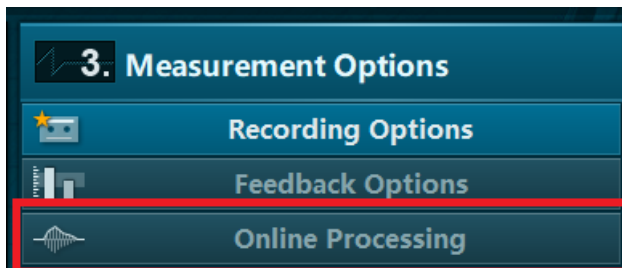
Applies to MR3 versions 3.10 and newer

EMG data can vary greatly depending on external conditions such as electrode placement, skin impedance, difference between subjects, and even the difference from day-to-day muscle activation. In order to account for these external conditions, the data can be normalized to a reference value. The most used reference value for EMG data is the maximum voluntary contraction (MVC) of a specific muscle (the measurement subject will need to perform a maximum voluntary contraction for each muscle). There are two ways to process the signal using MVC: **online processing** (real-time) and **post processing**. Instructions for utilizing both of these methods are listed below:

**Note:** It is recommended (although not required) that Smoothing and Rectification processing methods are also applied to the signal when using Amplitude Normalization.

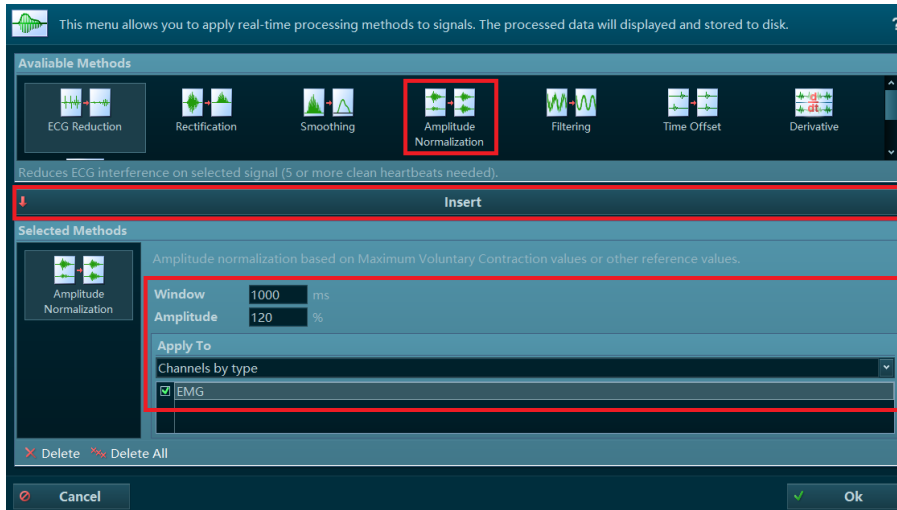
### Online Processing:

If you choose to use online processing for amplitude normalization, the EMG signals will be displayed as a % of the MVC recording. This feature is only available with the MyoMuscle module of MR3. To utilize real-time processing, follow the steps below:



Enter the measurement configuration and open Online Processing (located in the Measurement Options menu).

Next, highlight the Amplitude Normalization option and select the Insert button.



**Note:** The Window and Amplitude settings will default to the values shown here but can be changed according to the needs of the user. The Window refers to the window of time the MVC value is calculated over. The Amplitude only refers to the maximum value shown on the y-axis after the MVC is created.

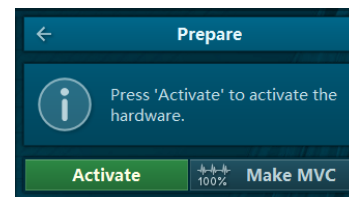


Finish setting up the measurement configurations appropriately, then select **Start Measure** to start the sensors.



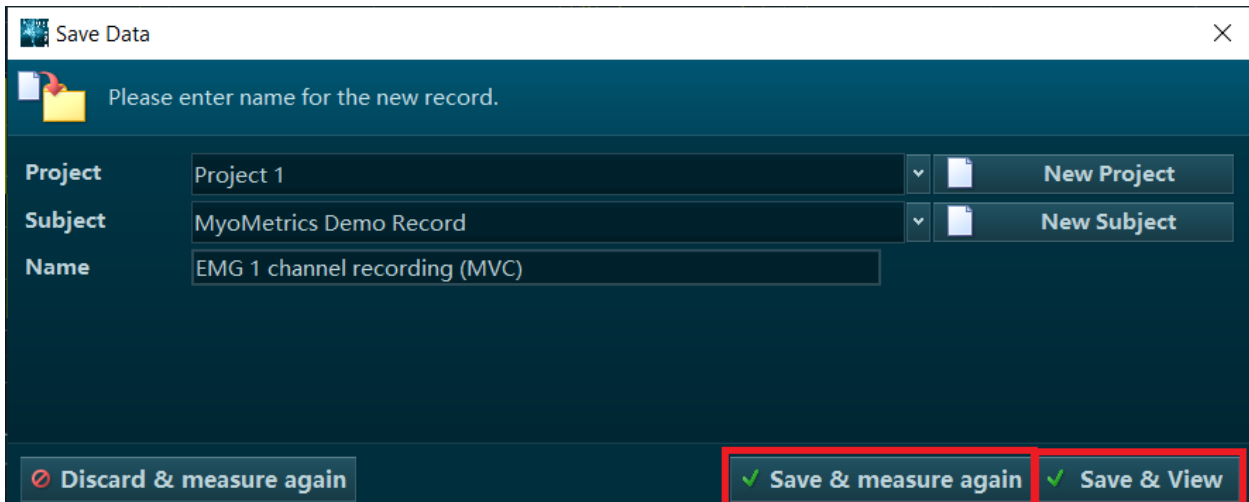
Once in the Measurement tab, choose the **Make MVC** button located in the Actions tool bar. You **MUST** choose this option before recording.

**Note:** If you are using MR 3.16 or newer, you will be given the option to Make MVC or Activate on the tool bar.



Choose Record to begin the MVC measurement and Stop when the MVC is complete.

You can choose **Save & measure again** to begin your normalized recording immediately or **Save & View** to view the MVC recording.



Save Data

Please enter name for the new record.

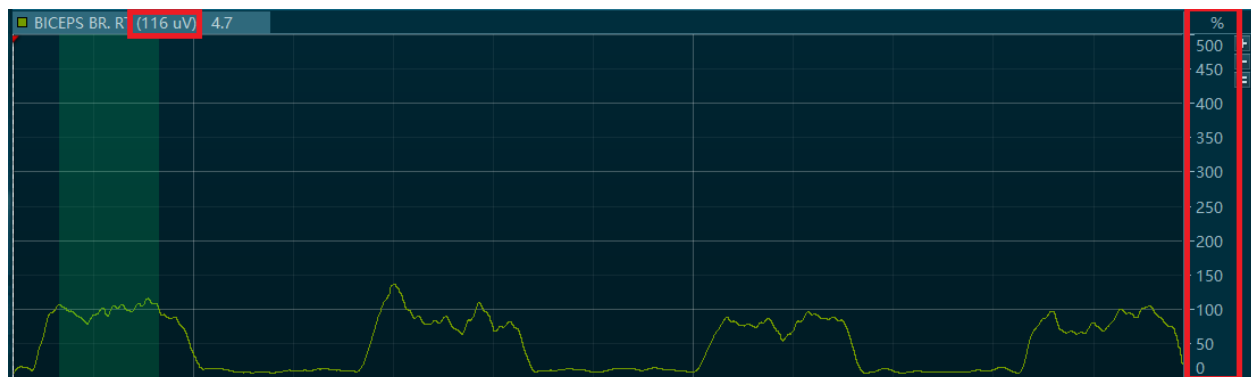
Project: Project 1 [New Project]

Subject: MyoMetrics Demo Record [New Subject]

Name: EMG 1 channel recording (MVC)

Discard & measure again | Save & measure again | Save & View

If you choose **Save & View**, the MVC recording will be displayed with the area used for the MVC calibration highlighted in green and the data will be presented as a percentage. The microvolt value that the MVC is calculated to is shown in parenthesis in the channel name.



After verifying the MVC calibration, you can select the **Measure** tab to continue your recording using MVC normalized data.

If you chose to **Save & measure again**, you will be brought back to the measure window, where the values for the muscles you conducted amplitude normalization are now shown as a percentage of the recorded MVC value.

**Note:** All subsequent records measured with this configuration will normalize to the last MVC record created. For this reason, it is crucial to follow the steps above every time a new subject or new trial are being conducted.

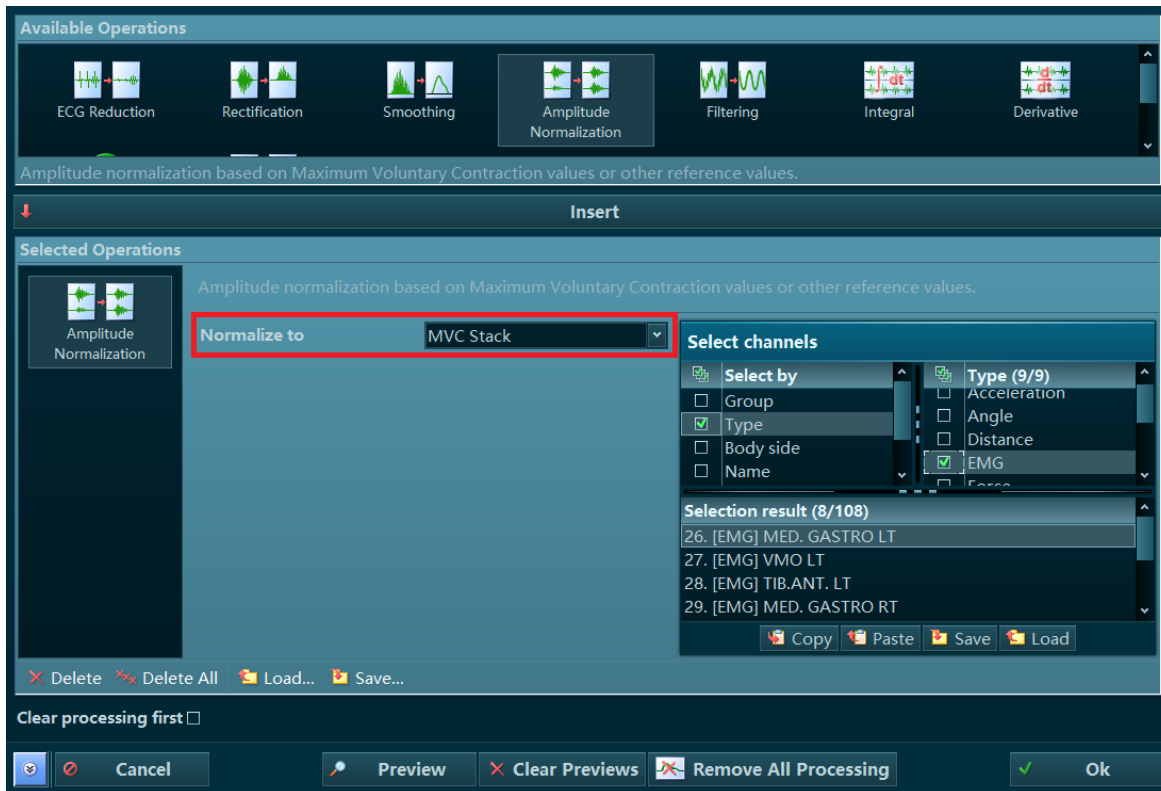
### Post Processing:

Amplitude normalization can also be applied after the record has been made. In order to utilize MVC via post-processing, it is necessary to have the subject perform a maximum contraction (for MVC calibration) or create a separate normalization record.

To apply amplitude normalization in post processing MVC:

Open the recording you want to the normalized and open the Signal Processing option in the right-hand tool bar.

Highlight the Amplitude Normalization option, select the Insert button. Next, choose the normalization method using the dropdown and select which signals to apply normalization to with the selection menu on the right.



There are multiple options for normalization available. Choose the best one for your applications as described below:

- **Manual Value** – The user enters a value (in microvolts) that all selected channels will be normalized to.
- **Peak Value** – Values will be normalized to the peak value within the record, this may be used if a maximum contraction was performed in this recording.

**Note:** This is the option you would use to create the MVC recording if you did not use online processing for amplitude normalization.

- **Mean Value** – Normalization method the amplitude mean value is calculated for each channel and taken as a reference value for the normalization.

**Note:** This type of normalization is often used in gait analysis where time normalized EMG patterns are amplitude normalized again, each to its own mean value.

- **MVC Stack** – Loads the current MVC values from the MVC stack (the most recent MVC values recorded).

**Note:** The MVC stack is updated whenever you record an MVC when the amplitude normalization applied with online processing. After your MVC is saved, the words “MVC Stack Updated” briefly flashes at the top of the screen.

- **Values from other records** – Accesses normalization values found or applied from another selected record.

**Note:** The other record must already be normalized – either recorded with amplitude normalization via online processing or normalized to Peak Value.

Select OK to apply the configured processing method.

When amplitude normalization is successfully applied, the values will be displayed as a percentage of the MVC with the value the record is normalized to in parentheses. The percentage value at the location of the cursor is to the right of the parentheses.

