

Application Note 255 Artifact Rejection—Verification Procedure

When on-line averaging is invoked, some signal amplitude excursions may need to be excluded during the averaging process. Artifact Rejection is a feature for just this purpose.

Occasionally during an acquisition, extreme levels of artifact will be present for one reason or another. Checking artifact rejection allows users to determine what signal levels constitute artifact, and have the MP System (MP160, MP150 or MP36R) reject these trials.

When artifact rejection is enabled, the MP System will ignore any trials that contain signals exceeding the artifact rejection thresholds, keep track of how many trials have been rejected, and add that number of trials to the total number of trials to be acquired. This allows users to “re-try” a trial that was rejected due to the presence of artifact.

To set these parameters, a high threshold and a low threshold must be set. Both thresholds refer to the scale limits (normally ± 10 V).

If the high and low artifact rejection thresholds are set to 80% and 30% (respectively), the MP System (MP160, MP150 or MP36R) will reject any trial where the signal exceeds +8 Volts or -3 Volts.

When the channel scaling feature is used to change the range of Map (Scale) values to something other than ± 10 V, the artifact rejection formula for symmetrical limits is:

$$y = ((2 \cdot PV)/100) \cdot x - PV \quad (\text{Eq. 1})$$

where y = voltage threshold
 PV = Peak Value
 x = percent threshold (whole number)

If non-symmetrical limits are used, the following equation is used:

$$y = ((V1 - V2)/100) \cdot x + V2 \quad (\text{Eq. 2})$$

where y = voltage threshold
 V1 = Higher Peak Value
 V2 = Lower Peak Value
 x = percent threshold (whole number)

Hardware Set Up

Figure 1 is a schematic of the signal connections between modules.

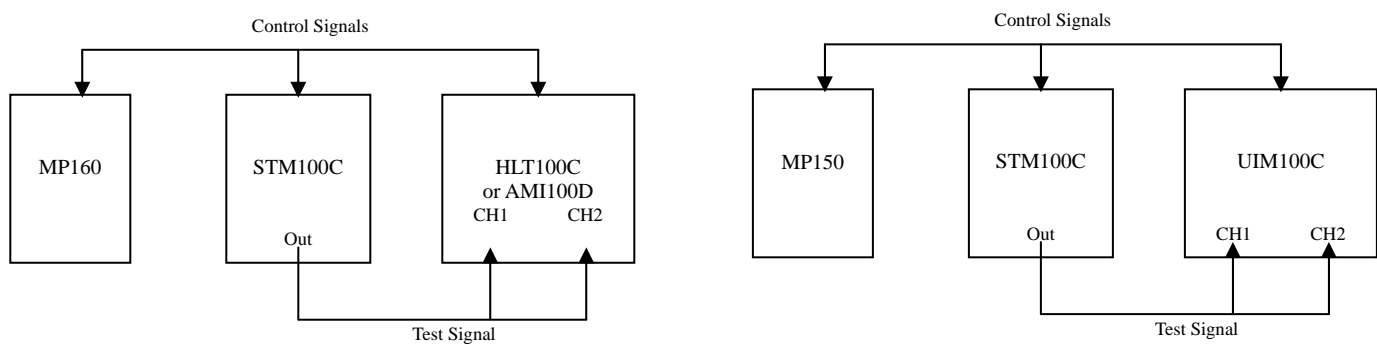


Figure 1 Schematic of test set up (MP160 with HLT100C/AMI100D on left, MP150 with UIM100C on right)

The MP160 will use an external stimulator (STM100C) to generate a 100 μ s, 1 V pulse into CH1, CH2 of the HLT100C or AMI100D. CH1 will be subjected to averaging/artifact rejection. The signal entering CH2 will be a reference point for comparison to CH1.

The MP150 will use an external stimulator (STM100C) to generate a 100 μ s, 1 V pulse into CH1, CH2 of the UIM100C. The newer-model MP160 will also use an external stimulator (STM100C) to generate a 100 μ s, 1 V pulse into CH1, CH2, but uses the HLT100C or AMI100D (High Level Transfer unit) in place of the UIM100C. CH1 will be subjected to averaging/artifact rejection. The signal entering CH2 will be a reference point for comparison to CH1.

Software Set Up: Channel/Acquisition/Averaging/Stimulator

Beginning with Figure 2, MP160/150 > Set Up Data Acquisition > Channels..., the enabled channels are analog CH1, CH2.

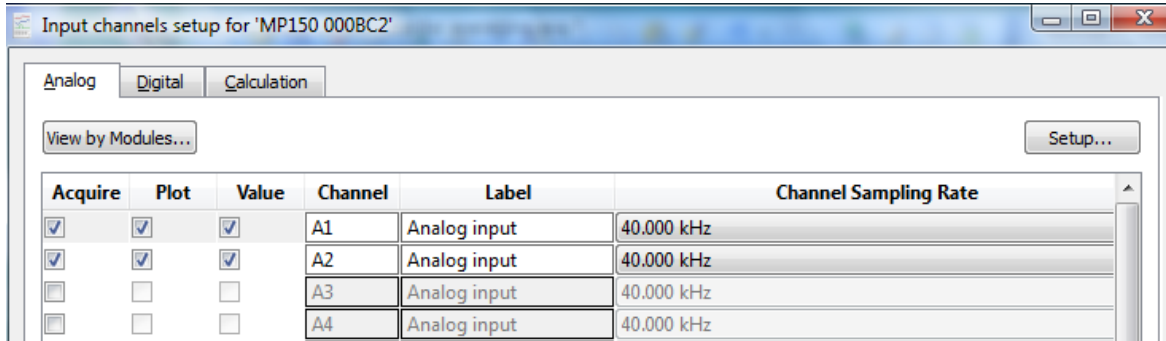


Figure 2 Channel Set Up

Figure 3a shows the acquisition (Length/Rate) parameters with Figure 3b displaying Averaging setup. Note that while two channels are available, only CH1 is enabled for averaging.

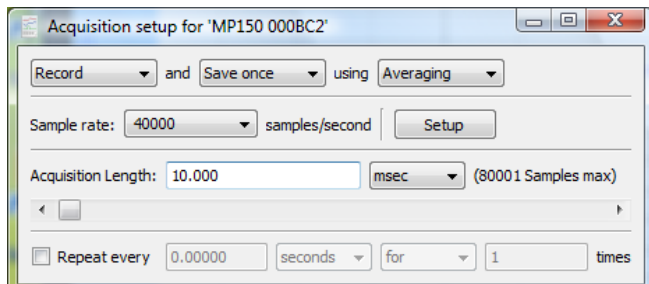


Figure 3a Acquisition Parameters

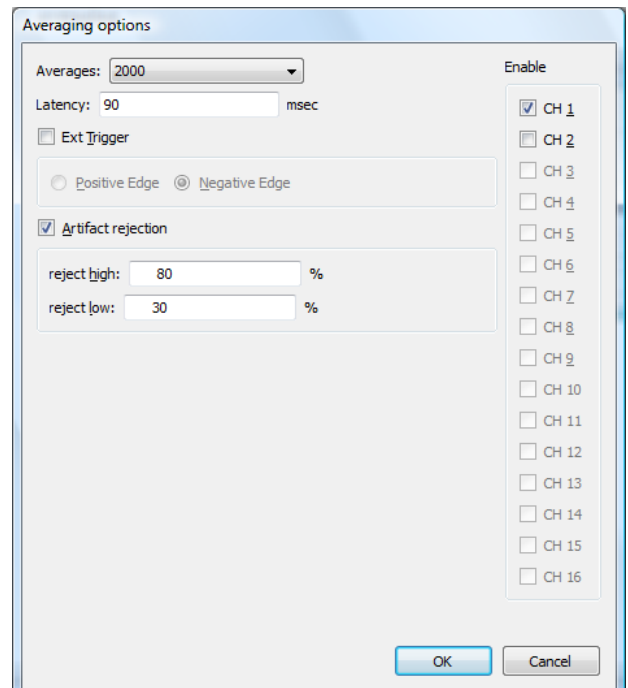


Figure 3b Averaging/Artifact Rejection parameters through Setup button in Figure 3a

The STM100C module is controlled by the MP160/150 module. Enable the control through the dialog checkbox shown in Figure 4 and accessed through MP160/150 > Manual control... During the acquisition, the attenuation slider can be actively engaged or set to a pre-determined value.

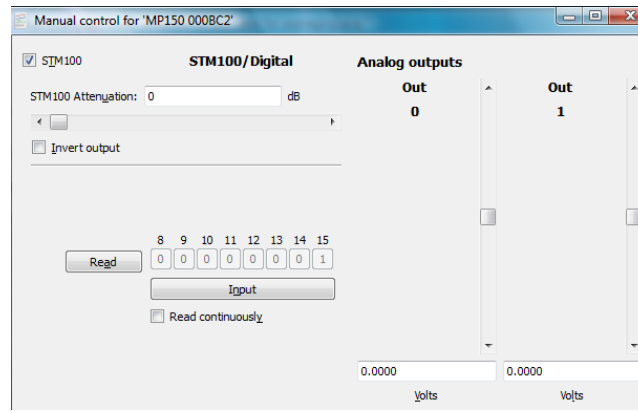


Figure 4 Manual controls for the STM100C module

When specifying the pulse characteristics, use the parameters displayed in the Stimulator dialog box, as shown in Figure 5. Bipolar amplitude is specified to test both limits of Artifact Rejection. Positive and negative amplitudes can be separately specified.

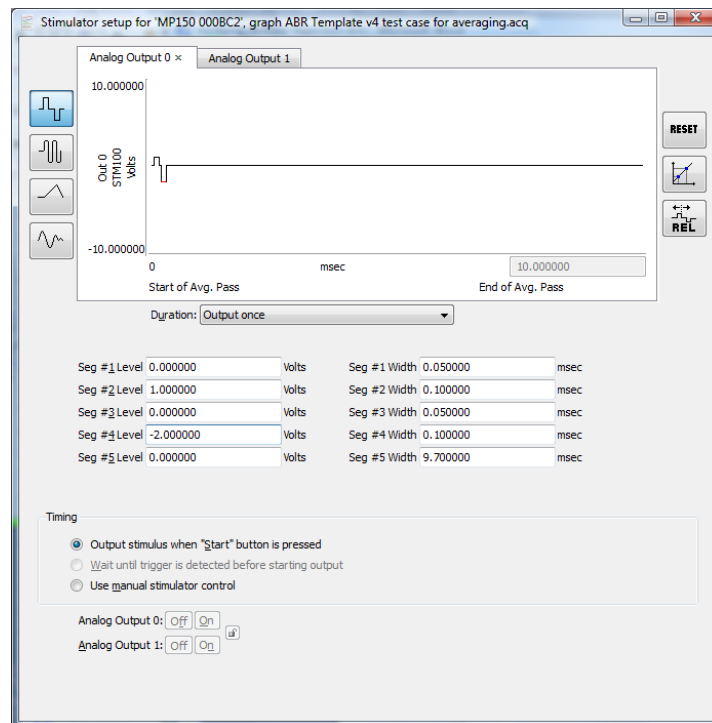


Figure 5 Pulse specification

Using the attenuator knob on the STM100C, during acquisition, the pulse’s averaged amplitude variation, as seen in CH1 of the graph window, will lag the amplitude variation of the pulse displayed in CH2. Artifact Rejection is set by the percentage values as shown in Figure 3b. For the +/-2 V amplitude profile of the pulse signal, one can establish rejection limits using the formula given in Part 3 of this note.

For instance, to set rejection limits of -1.7, the following calculation is performed:

From Eq. 2

$$y = \frac{(V_1 - V_2)}{100} \cdot x + V_2$$

where,

V_1 = upper signal voltage limit, +10 V

V_2 = lower signal voltage limit, -10 V

y = signal threshold

x = percentage, whole number

For a lower threshold limit of $y = -1.7\text{ V}$, the equation becomes

$$-1.7 = \frac{(20)}{100} \bullet x + (-10)$$

where $x = 41.5$

The upper AR limit would be set to 100 to allow all positive pulse excursions.

Type these values into the appropriate parameter text box shown in Figure 3b.

Measurement

Click OK on the Start button of the AcqKnowledge graph window. The graph should appear as shown in Figure 6a.

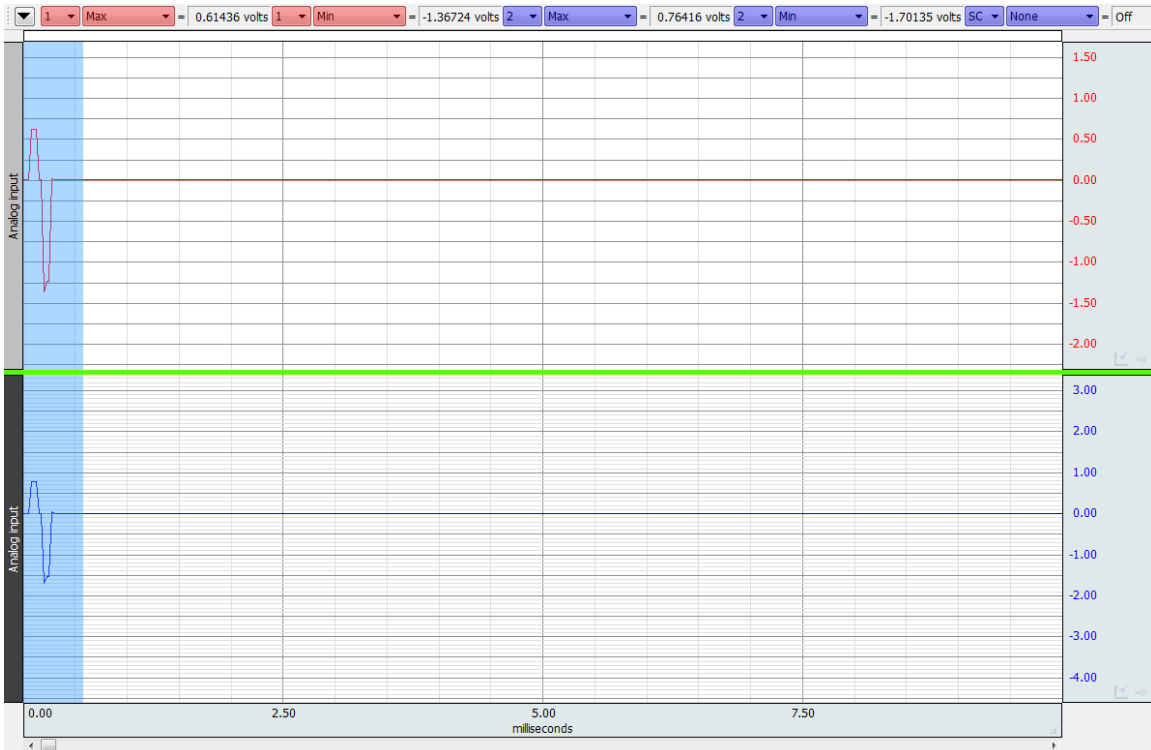


Figure 6a Graph window displaying the two channels, CH1 is the averaged signal, CH2 is the un-averaged, real-time sampled signal. Figure 6b shows an amplitude measurement at the time of threshold crossing, where the red circle highlights the amplitude on CH2. CH1 waveform is an averaged signal, as such; it is not an accurate reflection of the real-time voltages presented to analog port at the UIM100C or HLT100C/AMI100D; that is what CH2 represents.

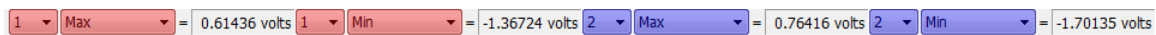


Figure 6b

Figure 6c shows the running totals of acquisition passes that were averaged and rejected near the time of threshold crossing.

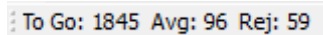


Figure 6c Rejection count as the lower signal waveform reached the -1.7 V limit.

From the Figures, the Artifact Rejection feature appears to be functioning as expected.