1   Using the Oscilloscope Function

This chapter explains how to use ASI BACDoor software's built in oscilloscope to capture real time drive performance data. Topics covered include:

- How to set up triggering
- How to acquire data
- How to adjust display scaling and position waveforms

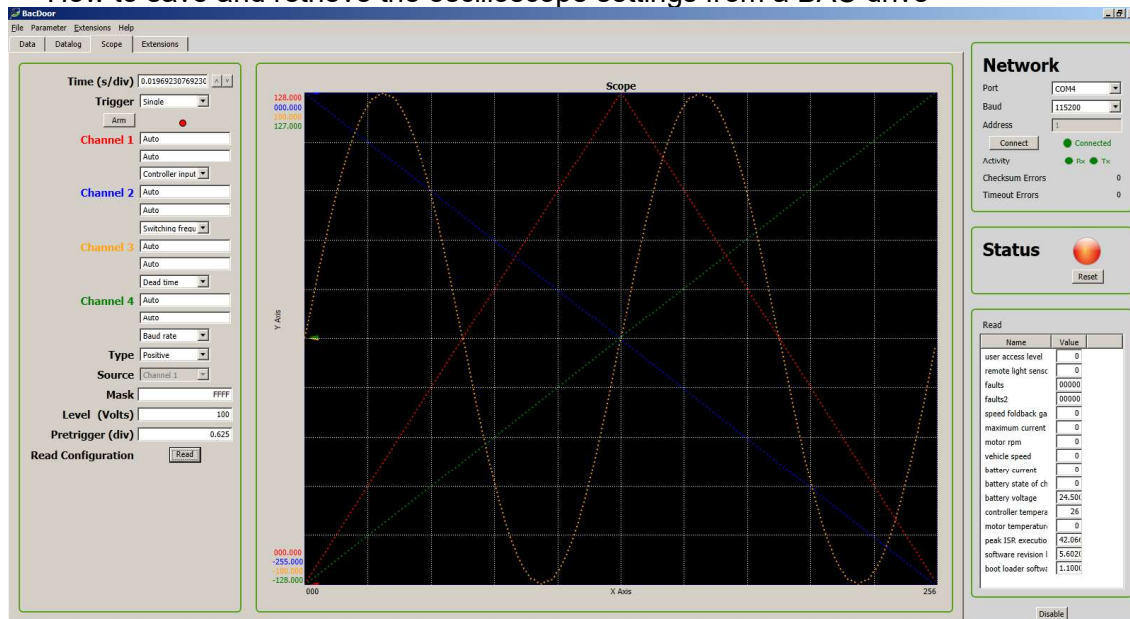How to save and retrieve the oscilloscope settings from a BAC drive

Figure 1

1.1   Triggering

The trigger determines when the oscilloscope starts to acquire data and display a waveform. When a trigger is set up properly, it can convert unstable displays or blank screens into meaningful waveforms.

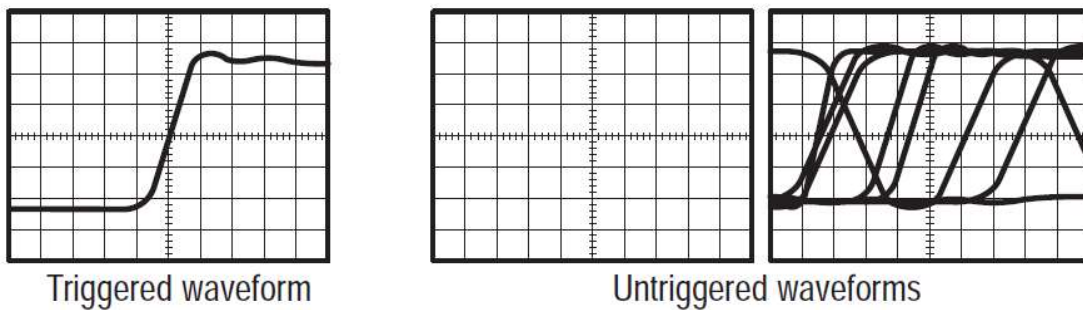Triggered waveform   Untriggered waveforms

Figure 2

When the oscilloscope starts to acquire a waveform, it collects enough data so that it can draw the waveform to the left of the trigger point. The oscilloscope continues to acquire data while waiting for the trigger condition to occur. After it detects a trigger, the oscilloscope continues to acquire enough data so that it can draw the waveform to the right of the trigger point.

1.1.1 Source

The trigger source is derived from Channel 1 only.

1.1.2 Types

The oscilloscope provides four types of triggers: positive, negative, equal, and not equal.

Positive: An edge type trigger that occurs when the trigger input passes through a specified level in the positive going direction.

Negative: An edge type trigger that occurs when the trigger input passes through a specified level in the negative going direction.

Equal: A trigger occurs when the trigger input is equal to a specified level.

Not Equal: A trigger occurs when the trigger input is not equal to a specified level.

1.1.3 Modes

The trigger mode determines how the oscilloscope behaves in the absence of a trigger event. The oscilloscope provides two trigger modes: Normal and Single.

Normal: The Normal mode allows the oscilloscope to acquire a waveform only when it is triggered. If no trigger occurs, the oscilloscope will not acquire a new waveform, and the previous waveform, if any, will remain on the display.

Single: The Single mode allows the oscilloscope to acquire one waveform each time you press the **Arm** button, and the trigger condition is detected.

1.1.4 Pre-trigger

Triggers are not recognized during the pre-trigger time (the period that follows each acquisition). For some signals, you need to adjust the pre-trigger period to produce a stable display.

The trigger signal can be a complex waveform with many possible trigger points on it, such as a digital pulse train. Even though the waveform is repetitive, a simple trigger might result in a series of patterns on the screen instead of the same pattern each time.

1.1.5 Arming the Trigger

In order for the oscilloscope to begin capturing data, the trigger needs to be armed. In order to arm the trigger, click the **Arm** button. This will turn the trigger status button red. When the scope has been successfully triggered, the status indicator will turn grey in the case of **Single** event trigger or repeatedly flash each the scope has triggered when operating in **Normal** mode.
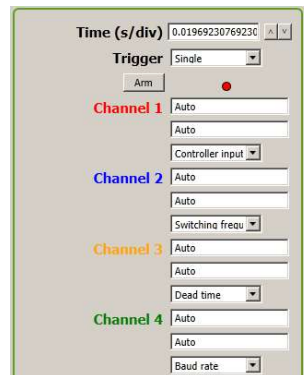

Figure 3

1.1.6 Level

The **Level** control determines where on the edge the trigger point occurs. The units automatically update based on the parameter selected to trigger the scope. To adjust the **Level** value, double click on the **Level** box and adjust the value. You must hit enter on the keyboard in order for the change to be retained.

1.1.7 Trigger Mask

If a bit vector is being used to trigger the oscilloscope, the **Trigger Mask** provides the user with the ability to mask off bits in order to trigger on a specific value. To adjust the **Trigger Mask** value, double click on the **Level** box and input a hexadecimal number adjust the value. You must hit enter on the keyboard in order for the change to be retained. The non-masking condition is represented by a value of FFFFh.

1.2 Acquiring Data

When you acquire analog data, the oscilloscope converts it into a digital form. The time base setting affects how rapidly data is acquired.

1.2.1 Data Acquisition

The BACDoor oscilloscope acquires data by sampling the signal in evenly spaced intervals to construct the waveform. This mode accurately represents analog signals most of the time.

1.2.2 Time base

The oscilloscope digitizes waveforms by acquiring the value of an input signal at discrete points. The time base allows you to control how often the values are digitized. To adjust the **Time**

value, double click on the **Time** box and adjust the value. You must hit enter on the keyboard in order for the change to be retained.

It should be noted that time scale on the BACDoor oscilloscope is based on the number of controller interrupts between sampling periods. This produces the limitation on the value the user requests for the time scale as well as a lower bound on the time scale's value. The number of samples used to limit the time scale's minimum value is 25. For example, if the **Switching frequency** is set at 19000 Hertz:

$$Time\ Scale_{min} = 25\ \times\ \frac{1}{Switching\ frequency}$$

$$Time\ Scale_{min} = 1.315\ ms$$

The oscilloscope will automatically adjust the Time value to this lower limit if the user tries to set it to something lower. The oscilloscope will also adjust a user requested time scale to the nearest number of interrupts divisible by 25 multiplied by the switching frequency. For example, if the **Switching frequency** is set at 19000 Hertz and the user requests **Time** to be set to 2 ms, the **Time** will actually be set to 2.630 ms:

$$Time\ Scale_{min} = 1.315\ ms$$

$$Time\ Scale = Time\ Scale_{min} \times 2$$

$$Time\ Scale = 2.630\ ms$$

1.2.3 Channel Selection

The BACDoor oscilloscope provides the user with access to all the parameters defined in the **ASI Object Dictionary**. To change the parameter that a given scope channel displays, the user single clicks on the pull down menu below each channel's vertical scale value, finds the desired parameter and then single clicks on it to select it.

1.3 Scaling and Positioning Waveforms

The user can change the scaling of data in the vertical axis if desired. The oscilloscope's default setting is to auto scale the vertical axis when displaying captured data. To adjust the vertical scale value, click on the textbox directly beside the coloured channel label and adjust the value. You must hit enter on the keyboard in order for the change to be retained.

The vertical position of displayed waveforms can also be adjusted. The default setting is to automatically center the data inside the scope and show 0-crosses as small triangles on the left hand margin. To adjust the vertical position, click on the textbox directly below the scale textbox and adjust the value. You must hit enter on the keyboard in order for the change to be retained.

The user can change the horizontal position of displayed waveforms by adjusting the **pre-trigger** value as discussed in section 1.1.4.

1.4   Oscilloscope Parameters

1.4.1   Saving Oscilloscope Parameters

After the user has set up BACDoor's oscilloscope function, they may desire to save the setup for future use on a particular drive. An example would be using one drive to tune several different motors. A user can save the oscilloscope's parameters by clicking on the **Parameters** menu and then selecting the **Save to Flash** option.

1.4.2   Reading Oscilloscope Parameters

When the user first activates BACDoor's oscilloscope function, many of the setting such **Time** per division and **Pre Trigger** are set a default value or blank in the case of the **Channel** selections 1 to 4. A user can opt to manually populate the oscilloscope's parameters or retrieve the parameter settings on the drive under test by clicking on the **Read** button in the oscilloscope display. This action reads the parameters values that are saved in flash on the BAC drive.