

WaveView
and
WaveCal

WaveView

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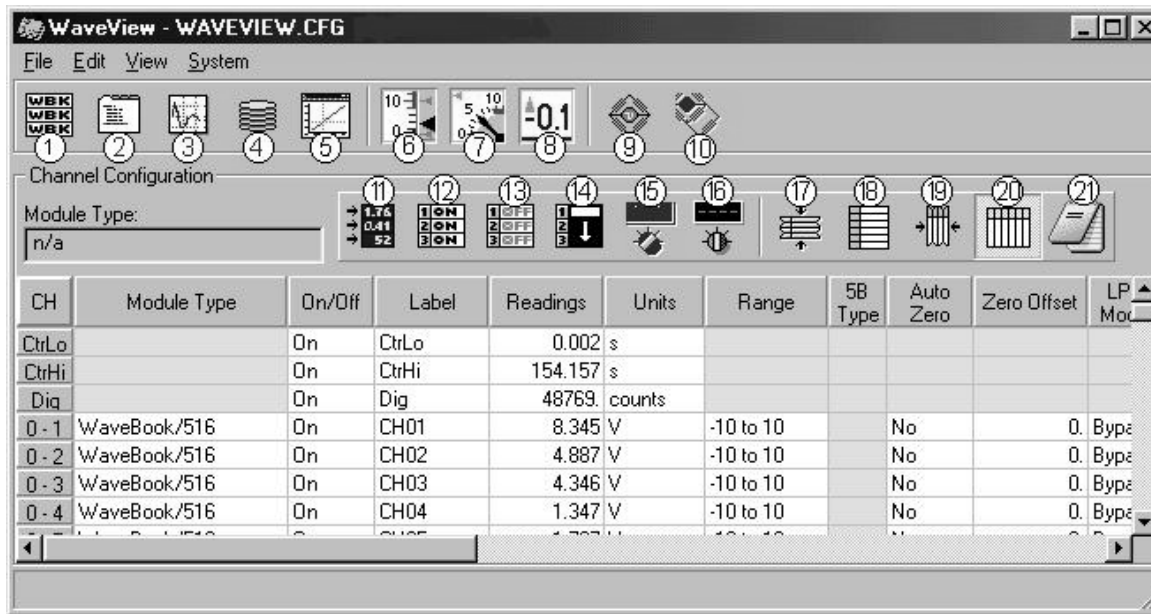
* The asterisk indicates that the mode applies only to WBK17 applications.

Introduction

WaveView is a graphical Windows-based program for use in WaveBook applications. The program allows users to acquire data for immediate viewing or for storage to the PC's hard disk. No previous programming knowledge is required.

From *WaveView* you can:

- Set up all analog or digital input parameters.
- Acquire and save data to disk.
- View the acquisition in real-time.
- Send data to other Windows applications, such as spreadsheets and databases.
- Launch an independent post-data acquisition application, such as *DIAdem*, *PostView*, or *eZ-View*, to view file data recorded by *WaveView*. Refer to the applicable document module for detailed information.



WaveView Configuration Main Window

| WaveView Configuration Main Window, Button Identification | | | |
|---|---|---|---------------------------|
| # | Item | Description | See Page... |
| 1 | Module Configuration | The Module Configuration column displays the current inventory of WaveBooks and relevant WBK options. Note that the WaveView Configuration main window provides a means of setting certain parameters for WBK options, e.g., LPF Type and LPF cutoff for WBK12 and WBK13, and excitation source amplitude and offset for WBK14. When applicable, the WBK options will be listed in the Module Type column. | 10 |
| 2 | Acquisition Configuration | Opens the Acquisition Configuration display window to allow selection of the number of scans, scan rate, and the triggering method to be used for starting the scan. | 22 |
| 3 | Scope Window | Opens the Scope Window to display data acquisition waveforms in real-time. | 27 |
| 4 | Direct to Disk Window | Provides a means of writing acquired data to disk files. | 7 |
| 5 | View File Data | Starts an independent, post-data acquisition viewing program. | 7 |
| 6 | Bar Graph Meters | Used to display one or more channels in bar graph format. | 32 |
| 7 | Analog Meters | Used to display one or more channels in analog meter format. | 33 |
| 8 | Digital Meters | Used to display one or more channels in digital meter format. | 34 |
| 9 | WBK16 Sensor Calibration | Use of this button temporarily disables WaveView and opens a sensor calibration spreadsheet so that each channel on a WBK16 can be calibrated to the specifications of the sensor in use. Note: This selection is available only if WaveView detects a WBK16 module. | See WBK16 Document Module |
| 10 | WBK16 Shunt Mode | With shunt mode enabled WBK16 channels are set to their shunt position for all acquisition operations if they were most recently calibrated using the shunt method. | See WBK16 Document Module |
| 11 | Enable [Disable] Spreadsheets Readings Column | This is an Enable/Disable toggle button. Use of this button to "enable" causes all channels that are "On" to display an actual reading of the input signal in the channel reading column. The readings column is updated about twice per second. A status indicator "READINGS" appears above the spreadsheet when the column is enabled. Since this is a toggle button, pressing it while the readings column is enabled will disable it. | -- |

| WaveView Configuration Main Window, Button Identification | | | |
|---|-------------------------------|---|-------------|
| # | Item | Description | See Page... |
| 12 | Make All Channels Active | Makes all channels active. When this button is pressed, the word "On" appears in the On/Off column for every channel. | -- |
| 13 | Make All Channels Inactive | Makes all channels inactive. When this button is pressed, the word "Off" appears in the On/Off column for every channel. If your channel scan includes only a few channels, it may be easier to make all of the channels inactive, then turn on the few desired channels. | -- |
| 14 | Fill Down | When multiple cells within a column are selected, this command takes the top-most selected cell and copies its contents to the selected cells below. | -- |
| 15 | Auto Zero Active Channels | This button zeros out a DC offset signal on all channels that are "On" and have Auto Zero set to "Yes." Note that Auto Zero does not apply to WBK17. | -- |
| 16 | Clear All Zero Offsets | This button clears the zero offset that was set with the Auto Zero Active Channel button. Note that Auto Zero does not apply to WBK17. | -- |
| 17 | Hide Inactive Channel Rows | Hides all inactive channels, thus only the active (On) channels are displayed. A status indicator "HIDDEN ROWS" appears above the spreadsheet when one or more channels are hidden. Note: When a channel is hidden, its configuration settings cannot be changed. Block operations and other "All" actions, like the Make All Channels Active menu item, have no effect on hidden channels. | -- |
| 18 | Show All Rows | Makes all channel rows visible. Can be used to restore the full spreadsheet after a Hide Inactive Channels action has been performed. | -- |
| 19 | Customize Column Layout | Opens a Customize Column Layout window that allows you to select the columns that you want to have displayed. This feature allows you to hide columns that do not apply to your application. For example, WBK17 users may want remove the Auto Zero, Source Level, Bridge Type, and Invert columns. | -- |
| 20 | Show All Columns | When this push-push button is depressed, all spreadsheet columns are shown and the button remains indented. Pushing the button again shows the spreadsheet with the customized column layout, as set up using button 19. | -- |
| 21 | Copy Visible Cells to Notepad | Places a tab-delimited text version of the spreadsheet into Microsoft's Notepad application. The information can be imported into various spreadsheet programs, such as Microsoft Excel. | 9 |

Software Startup & Sample Acquisition

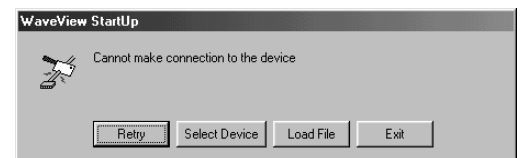
The program installation CD-ROM contains both a 16-bit and a 32-bit version of *WaveView*. The figures in this document module reflect the 32-bit version, only. Note that the 16-bit version has fewer toolbar buttons and exhibits minor screen differences.

Startup WaveView

Start *WaveView* by double-clicking on its icon. *WaveView* holds user-configured parameters that can be saved to disk. The default configuration filename is **WAVEVIEW.CFG**. When *WaveView* starts up, it searches the working directory for this configuration file. One of the following situations will occur:

- **If the default configuration file is found**, all the required setup information is extracted from it, and the application's main window opens.
- **If the default configuration file is not found**, *WaveView* attempts to connect with WaveBook using the following default parameters: Printer Port LPT1, Interrupt Level 7, and 4-bit Standard Protocol. If this fails, the program tries LPT2 and Interrupt Level 5.
- **If connection is established**, *WaveView*'s main window opens.

Note: If connection to the device can not be established, a *WaveView StartUp* box appears with the following options: **Retry**, **Select Device**, **Load File**, and **Exit**.



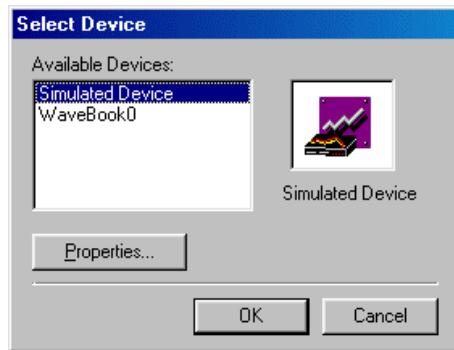
WaveView StartUp Box



Reference Note:

Refer to the *WaveBook User Manual's Troubleshooting* chapter for advice regarding connection problems.

- **If no user-configuration file is found, or if no communication established**, a dialog box prompts you to choose an actual WaveBook from the device inventory, or to select a *simulated device*.



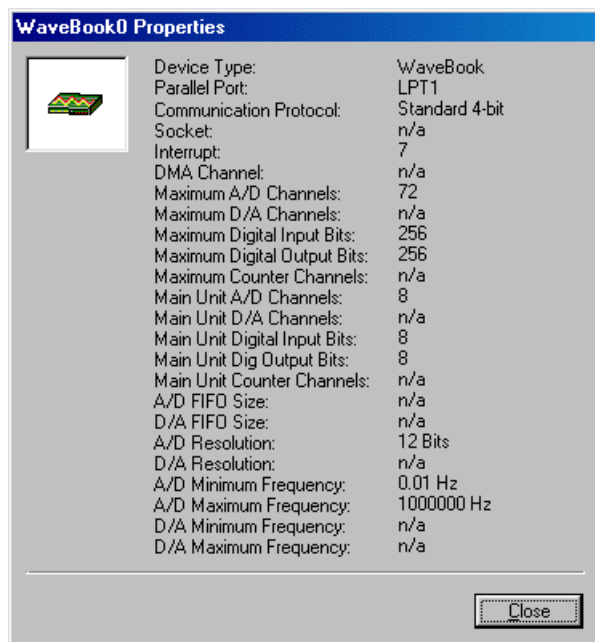
Select Device Box

Simulated WaveBook. If the hardware is not available, or if you just want to practice using the software, select *Simulated Device*. The *Simulated Device* allows you to run various software functions with no hardware concerns.

The *Simulated* mode is also available from *WaveView's* pull-down menu. To select the simulated mode:

1. Choose *Select Device* from the *System* pull-down menu.
2. Select *Simulated Device* from the *Available Devices* list.

WaveBook Attached. If the WaveBook hardware is connected and switched on, select the applicable WaveBook device. Then click on the *Properties* button to view the *Device Properties* screen (see following figure).



Devices Properties (example)

After you have selected the device parameters, click *Close*.

WaveView attempts to find the WaveBook at the specified port. One of the following situations will occur:

- **The hardware is found**, the *WaveView* main window opens.
- **The hardware is not found**, a dialog box informs you and provides another chance to select parameters.

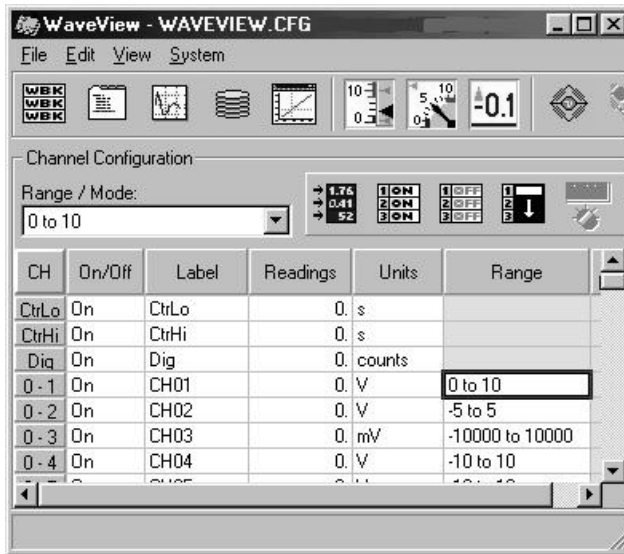


If *WaveView* cannot identify the hardware, and you have verified that the selected hardware parameters are correct, exit *WaveView* and then use the “Test Hardware” feature of the *Daq** Configuration control panel. A discussion of *System Testing* is included in the *System Setup and Power Options* chapters of *WaveBook Manuals 481-0901 and 489-0901*.

WaveView interrogates the hardware after it starts up to see what options and expansion modules are actually connected to the WaveBook. The number of channels (shown on the configuration menu) represents the number of channels actually connected to WaveBook.

Configure Channels

Once *WaveView* determines the options and expansion modules, the individual channels can be configured, as described in the text that follows.



Configuring Channels from WaveView’s Main Window (Partial View)

- **On/Off** - To acquire data with *WaveView*, channels must be properly connected to signal sources, and must be enabled (On). Channels can be enabled as follows:
 - (1) Click in a channel’s *On/Off* cell, then select “On” from the drop-down menu (that appears above the range column), or
 - (2) Double-click in a channel’s *On/Off* cell to toggle to “On.” Note that the on/off status will change with each double-click, or
 - (3) Click on the toolbar’s “On” button (Make All Channels Active) to turn all channels on. Note that the “Off” button (Make All Channels Inactive) turns all channels off.
 - **Label** - Channels have default labels, such as CH05. You can change the label by clicking on the cell, then typing in the new label. Labels must be unique, i.e., each channel must have its own label. Attempts to use duplicate labels, or use no label will result in a warning message.
 - **Readings** - Not user configurable. This column displays values of enabled channels.
 - **Units** - Select a channel’s units in one of two ways.
 - (1) Click in a channel’s *Units* cell, then select the desired units from the pull-down menu.
 - (2) Double-click in a channel’s *Units* cell to cycle through the units. Note that when the **mX+b** dialog box appears you need to click “OK” to continue cycling.
- Note:** You can enter user-defined units from the **mX+b** dialog box, and you can use the **mX+b** equation to adjust a channel’s scale and offset. Refer to *Units* on page 14 for more information and an example of the **mX + b** equation being used.
- **Range** - Select a channel’s range in one of two ways.
 - (1) Click in a channel’s *Range* cell, then select the desired range from the drop-down menu.
 - (2) Continue to double-click in the applicable channel’s *Range* cell to cycle through the available ranges. Stop double-clicking when the desired range is indicated.



Configure Acquisition

The following text describes how to configure an acquisition.

After completing channel configuration, select the *Acquisition Configuration* option from the *View* menu or the tool bar. The following figure represents the *Acquisition Configuration* dialog box. The parameters shown are a result of the values entered below.

| Scanning | |
|--------------------------|-----------------------|
| Duration | Rate |
| Pre-Trigger: 1000 scans | Internal: 50 kHz |
| Post-Trigger: 5000 scans | External: 50 kHz |
| Convention: Scans | Convention: Frequency |

Triggering
Type: Manual

Acquisition Configuration Dialog Box

Triggering

Type: *Manual*

Scanning Duration

Convention: *Scans*

Pre-Trigger: 1000 scans

Post-Trigger: 5000 scans

Scanning Rate

Clock: *Internal*

Convention: *Frequency*

Pre-Trigger: 50 kHz

Post-Trigger: 50 kHz

After entering the values, click the Close button to set the acquisition parameters.



Collect and View Data

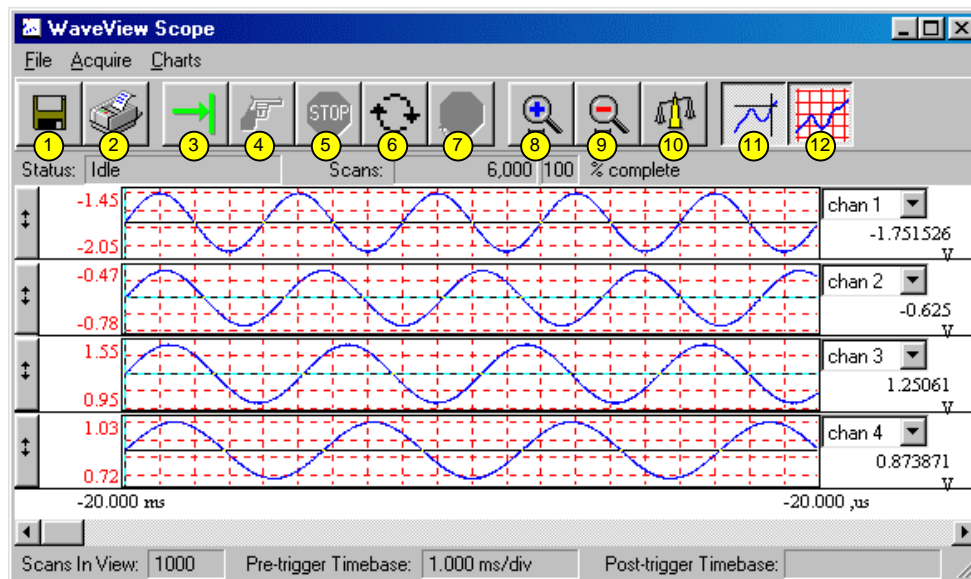
The following text describes how to collect data for a sample acquisition, and how to view a graphic representation of the data.

To read and view a graphic representation of WaveBook data, select the *Scope* option from the *View* menu or use the toolbar button. This accesses the *WaveView Scope* window. Complete the acquisition setup as follows:

- **Number of Charts.** First, the *Scope* window should be configured to display 4 charts since 4 channels were previously selected for the acquisition. Select the *Number of Charts* option from the *Charts* menu item. When the flyout appears showing a selection of up to 8 channels for display, click on 4.
- **Arm and Trigger.** The system is now set to start collecting data. At this point, you may acquire one acquisition or continuous acquisitions. For this sample acquisition, click the *Arm* button, then click the *Trigger* button.
- **Data Acquisition.** The system has now collected 1000 pre-trigger scans and 5000 post-trigger scans.

If desired, you may modify the current *Scope* window display as follows:

- View additional channels (up to 8) simultaneously by changing the entry in the *Number of Charts* menu.
- Change the channels viewed. Use the channel select list box at the right of the waveforms to display waveforms of other active channels.
- To scale the waveforms, click on the *Scale All Charts* button. All 4 waveforms should then be visible.
- Examine the waveforms at any point along the timeline by using the horizontal scroll-bar.
- Vary the number of scans displayed by using the *Zoom In* or *Zoom Out* buttons.



WaveView Scope Window

| Item | Description | Item | Description |
|------|----------------|------|--------------------|
| 1 | Save | 7 | Stop Rearming |
| 2 | Print Window | 8 | Zoom In |
| 3 | Arm | 9 | Zoom Out |
| 4 | Trigger | 10 | Scale All Charts |
| 5 | Stop Acquiring | 11 | Toggle Cross Hairs |
| 6 | Auto-Rearm | 12 | Toggle Grids |

Store Data [and View File Data], Option



Data to be viewed with the post acquisition data viewer must be in the appropriate binary format. From *WaveView*, you can select the format by navigating as follows: *WaveView Main Window* ⇒ *File* ⇒ *Data Conversion Preferences* and check the appropriate box.

Save collected data to disk by clicking on the *Save* button ("floppy disk" or left-most button) of the *WaveView Scope* window, and then giving the file a name. Note that you can analyze the saved data with a post-acquisition data-viewer program, such as *PostView*, *DIAdem*, or *eZ-View*.

To open an installed post-acquisition data viewer application, return to the *WaveView Configuration* main window then click on the *View File Data* toolbar button (button 9 in the following figure).



Reference Note:

For detailed information regarding post acquisition data analysis programs, refer to the applicable document module(s), e.g., *DIAdem*, *PostView*, or *eZ-View*.

WaveView, A Detailed Reference

When *WaveView* starts it interrogates the system hardware to see what options and expansion modules are actually connected to the WaveBook. Unless you are using WaveView's simulated mode, the channels displayed on the WaveView.cfg window correspond to actual connected channels.

WaveView functions are initiated through toolbar buttons and pull-down menu selections. The [toolbar buttons](#) were identified on page 2. An explanation of menu functions, in order of the menu structure, begins in the "Pull-down Menu Commands" section, below.

Toolbar Buttons



Reference Note:

Toolbar buttons are identified and explained in the figure of the [WaveView Configuration Main Window](#), and in the related table. Both can be seen on page 2.

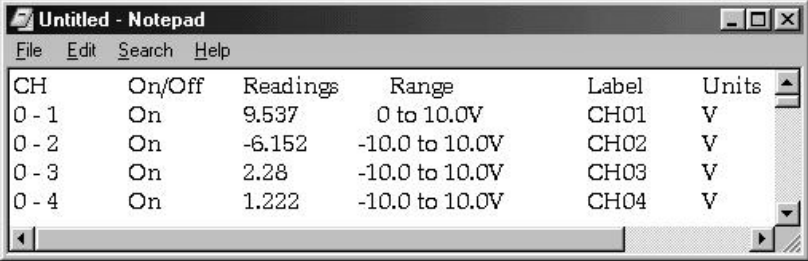
Pull-Down Menu Commands

The following menu descriptions apply to corresponding toolbar buttons (as depicted in the WaveView Configuration Main Window, and in the related table (as seen on page 2). Note that some menu items have no corresponding toolbar button.

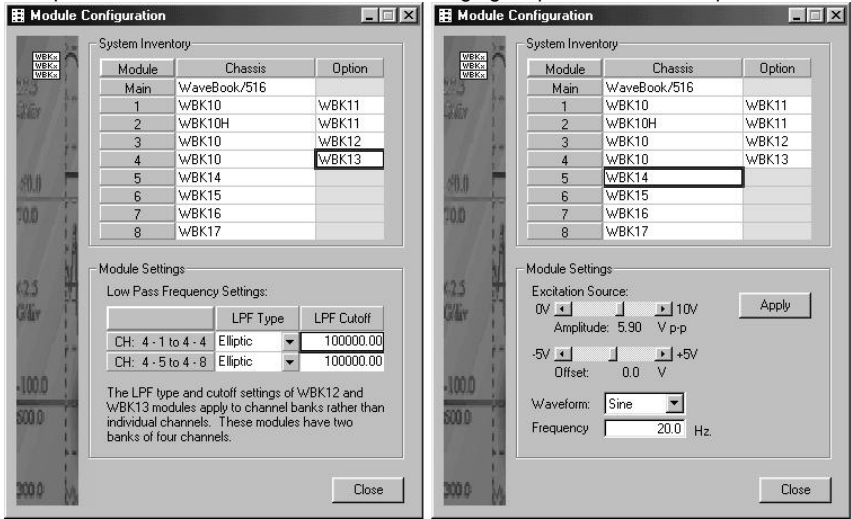
File

| | |
|---|---|
| New | Sets all parameters to their default startup settings. |
| Open | Loads a saved configuration. |
| Save | Saves the existing configuration for later recall. |
| Save As | Prompts for a file name and saves the current configuration to that file name. |
| Convert Data Files | Runs the File Converter, which converts any acquired data file to any of the supported data types. |
| Data Conversion Preferences | Opens a dialog box, which lets you set the data file conversion options that WaveView will apply automatically whenever you acquire data. |
| Open WBK16 Calibration File (WBK16 Only) | Loads a WBK16 sensor calibration table. This command loads saved WBK16 calibration data. Note: This selection is not available unless WaveView detects the presence of a WBK16. |
| About | Provides software version number and provides access to a list of device properties. |
| Exit | Closes WaveView. Note: Before WaveView exits, it saves the current configuration in a file named WAVEVIEW.CFG. The next time you run WaveView, this file is loaded automatically. |

Edit

| | |
|--|--|
| Make All Channels Active | This command places an "On" in the "On/Off" field of all channels. |
| Make All Channels Inactive | This command places an "Off" in the "On/Off" field of all channels. If your channel scan includes only a few channels, it may be easier to make all of the channels inactive, then turn on only those few channels that you want. |
| Fill Down | When multiple cells within a column are selected, this command takes the top-most selected cell and copies its contents to the selected cells below. |
| Hide Rows of Inactive Channels | Temporarily removes all inactive channels from the channel configuration spreadsheet. If there are inactive ("Off") channels, this results in a smaller spreadsheet showing just the currently active channels. A status indicator "HIDDEN ROWS" appears above the spreadsheet when one or more channels are hidden. Note: When a channel is hidden, its configuration settings cannot be changed. Block operations and other "All" actions, like the Make All Channels Active menu item, have no effect on hidden channels. |
| Show All Rows | Makes all channel rows visible. Can be used to restore the full spreadsheet after a Hide Inactive Channels action. |
| Customize Column Layout | Opens a Customize Column Layout window that allows you to select the columns that you want to have displayed. This feature allows you to hide columns that do not apply to your application. For example, WBK17 users may want remove the Auto Zero, Source Level, Bridge Type, and Invert columns. |
| Reset Column Layout | This resets the custom column layout settings to the default values. All adjustments to column widths will be lost and hidden columns will return to the spreadsheet. Once the column layout is reset, there is no automatic recovery of the customized layout. Compare this command with "Show All Columns." |
| Show All Columns | Displays all columns, including the <i>Module Type</i> column, which is typically not displayed. This button and the Customize Column Layout button can be used to switch back-and-forth between the full view of the spreadsheet (all columns) and the customized layout. |
| Copy Visible Cells to Notepad | Places a tab-delimited text version of the spreadsheet into Microsoft's Notepad application. The information can be imported into various spreadsheet programs, such as Microsoft Excel.  <i>An Example of Visible Cells Copied to Notepad</i> |
| Enable Spreadsheet Reading Column | This causes all channels that are "On" to display an actual reading of the input signal in the channel reading column. This column is updated with new readings about twice per second. A status indicator "READINGS" appears above the spreadsheet when the reading column is enabled. |
| Auto Zero Active Channels | This zeros out a DC offset signal on all channels that are "On" and have Auto Zero set to "Yes." Note that Auto Zero does not apply to WBK17. |
| Clear All Offsets | This clears the zero offset that was set via the Auto Zero Active Channel. Note that Auto Zero does not apply to WBK17. |

View

| | |
|---|---|
| <p>Module Configuration</p> | <p>Displays the current inventory of expansion modules that are in the WaveBook system. In addition, the window provides a means of setting certain expansion module parameters, i.e., LPF Type and LPF cutoff for WBK12 and WBK13 options and excitation source amplitude and offset for WBK14. The following figure provides two examples.</p>  <p style="text-align: center;"><i>Two Examples of the Module Configuration Display Window</i></p> <p>The window can be accessed from the View pull-down menu or by using the associated toolbar button (1).</p> |
| <p>Acquisition Configuration</p> | <p>Opens the display window to allow selection of the number/speed of the scan and the triggering method to start the scan.</p> |
| <p>Scope Window</p> | <p>Opens the display window to allow real-time viewing of the acquired data.</p> |
| <p>Direct to Disk Window</p> | <p>Opens the display window to allow the writing of acquisition data to disk files.</p> |
| <p>View File Data</p> | <p>Starts the independent application to view file data.</p> |
| <p>Bar Graph Meters</p> | <p>Used to display one or more channels in bar graph format.</p> |
| <p>Analog Meters</p> | <p>Used to display one or more channels in analog meter format.</p> |
| <p>Digital Meters</p> | <p>Used to display one or more channels in digital meter format.</p> |

System

| | |
|---|---|
| <p>Select Device</p> | <p>Brings up a dialog box that lets you select a WaveBook device. It also provides access to the Simulated Device, which is listed as an option.</p> |
| <p>Options</p> | <p>Brings up the WaveView System Options dialog box. From there, you can enable or disable WaveView options. The options dialog box has three tabs: Performance, Memory Module, and WBK17. The three tab selections are discussed, following this table.</p> |
| <p>Note: The following System selections apply only to WBK16 and are only available if a WBK16 module is detected. Refer to the WBK16 document module [in the 489-0902 WBK options manual] for additional information.</p> | |
| <p>WBK16 Sensor Calibration</p> | <p>This command runs the sensor calibration program. Selecting this option will temporarily disable WaveView and open a sensor calibration spreadsheet so that each channel on a WBK16 can be calibrated to the specifications of the sensor in use.</p> |
| <p>WBK16 Shunt Mode</p> | <p>This command places WaveView in a shunt mode. When in this mode, all enabled WBK16 channels are set to their shunt position for all acquisition operations, providing that the channels were last calibrated using the shunt method.</p> <p>During shunt mode operation, spreadsheet updating, scope window operations, analog meter operations, and direct-to-disk operations result in data that represents the raw value of the shunt resistor.</p> <p>Note that the shunt mode can be used to verify that the acquired shunt value agrees with the expected shunt value.</p> |
| <p>WBK16 LPF Corner Frequencies</p> | <p>This command brings up a dialog box to select new cutoff frequencies for the LPF on a WBK16. The WBK16 has a Low Pass Filter with two selectable cutoff frequencies. Although the frequencies are factory configured at 10 Hz and 1 kHz, changing the resistor packs inside the WBK16 can modify them. After the cutoff frequencies are altered, the values that WaveView displays can then be modified to match the LPF frequencies using this command.</p> |

“Performance” Tab

- **Acquisition Data Packing**

(WaveBook/512 and /512H Only):

WaveBook/512 and /512H devices acquire 12-bit data and transfer it to WaveView in 16-bit words. Data can be compressed so four 12-bit samples are packed into three 16-bit words. This reduces transfer time and data storage requirements. Use packed data if buffer overrun errors occur. Disadvantages include extra processing time for unpacking data and some loss in resolution (less than 1/2 LSB).

The Data Packing option does not apply to the WaveBook/516, /512A, /516A, or to WavePorts, and is disabled for these devices.

- **Calibration:**

Factory Calibration Table (*default*), the software uses the factory generated calibration constants of each system component to achieve calibration of the system. This is useful if the system calibration changes often.

User Calibration Table, the WaveCal program lets you perform a calibration of the complete signal path from input to A/D stage. The cal constants are stored in the Calibration Table on the WaveBook main board. Recalibration is required when any part of the signal path changes. This method is useful when the configuration remains stable and you want slightly better accuracy.



WavePort devices should only be calibrated at the factory, or by a factory-authorized service representative. In regard to WavePort devices, leave the Calibration Radio Button selected to Factory Calibration Table.

WBK17 modules should only be calibrated at the factory, or by a factory-authorized service representative. For WBK17, leave the Calibration Radio Button selected to Factory Calibration Table.

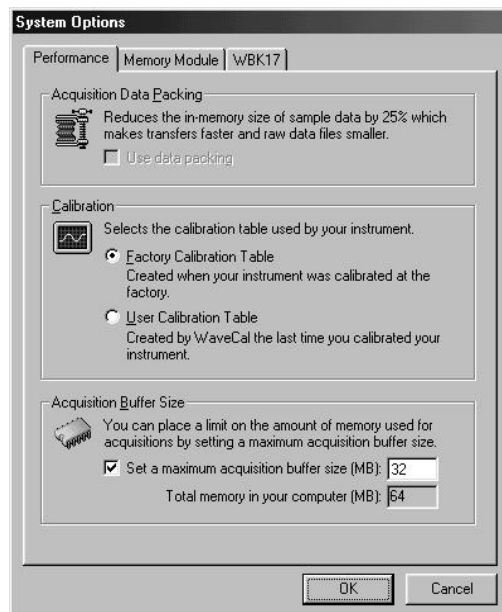
- **Acquisition Buffer Size:**

Allows you to set a new buffer size for data acquisition. The dialog displays the maximum size of the acquisition buffer. The buffer is never sized larger than needed by the acquisition. For a one-channel, 1000 scan acquisition the buffer will be 2000 bytes, *not* the size shown in the dialog.

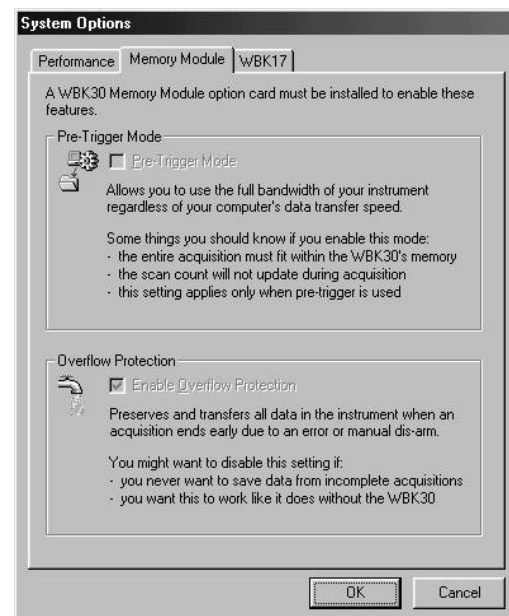
“Memory Module” Tab

Note: The WaveView System Memory Module Option settings are only pertinent if a WBK30 Memory module option card is installed in your WaveBook.

- **Pre-Trigger Mode:** This allows you to use the full bandwidth of your instrument regardless of the computer's data transfer speed. Note that when Pre-Trigger is in effect, certain conditions apply: (1) The entire acquisition must fit in the WBK30's internal memory, (2) The scan count will not update during acquisition, and (3) The Pre-Trigger Mode selection only applies if pre-trigger is used.
- **Overflow Protection:** This preserves and transfers all data in the instrument when an acquisition ends early due to an error or manual disarm. This option should not be used if you: (1) Never want to save data from an incomplete acquisition, or (2) You want the option to work like it does without a WBK30 installed.



*System Options
Performance Tab Selected*



*System Options
Memory Module Tab Selected*

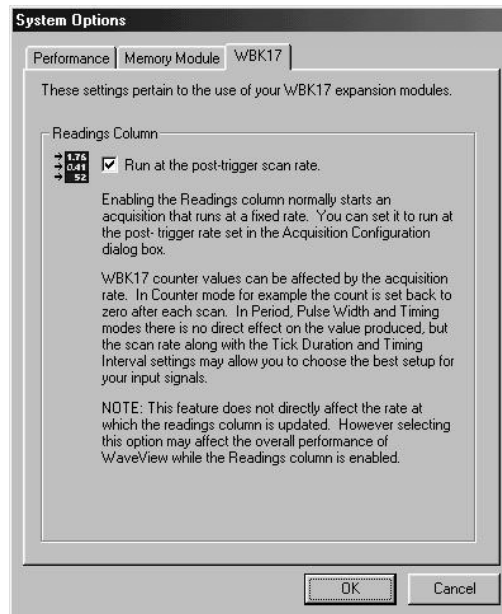
“WBK17” Tab

The “WBK17” tab provides a means of setting the Readings column to run at the post-trigger scan rate.

This system option applies only to WBK17 modules and impacts the Readings Column of WaveView’s main window.



Setting the Readings column to run at the post-trigger scan rate does not directly affect the rate at which the Readings column is updated; However, implementing this feature may affect the overall performance of WaveView while the Readings column is enabled.



System Options, WBK17 Tab Selected

Input Channel Configuration

| CH | Module Type | On/Off | Label | Readings | Units | Range | 5B Type | Auto Zero | Zero Offset | LPF Mode | LPF Cutoff | HPF Cutoff | Source Level | Bridge Type | Invert |
|-------|-------------|--------|-------|----------|-------|-----------|---------|-----------|-------------|----------|------------|------------|--------------|-------------|--------|
| 6 - 7 | WBK15 | Off | CH55 | | mV | -10 to 10 | 5830 | No | 0. | | | | | | |
| 6 - 8 | WBK15 | Off | CH56 | | mV | -10 to 10 | 5830 | No | 0. | | | | | | |
| 7 - 1 | WBK16 | Off | CH57 | | V | -5 to 5 | | No | 0. | Bypass | 10.00 | DC | 10.0 V | Full Bridge | No |
| 7 - 2 | WBK16 | Off | CH58 | | V | -5 to 5 | | No | 0. | Bypass | 10.00 | DC | 10.0 V | Full Bridge | No |

Columns of the Channel Configuration Spreadsheet



Reference Note:

The above figure does not include WBK17-exclusive columns. See page 17 in regard to additional columns that are dedicated specifically to the WBK17 module.

WaveView’s configuration spreadsheet provides is used to configure channels and display channel readings. The top few rows are used for the high-speed digital input and other non-analog channels. The remaining rows (up to 72) are used for analog input channels. The number of rows varies depending on system configuration.

The various columns contain the configuration information for each channel. Some columns allow blocks of cells to be altered simultaneously, while others allow one cell to be changed at a time. Some columns may be static and cannot be altered. Clicking a column header will select the entire column if applicable.

A discussion of each column follows.

CH - The channel number column labeled CH is static and cannot be altered. This column identifies the analog (or digital) input channel to be configured in that row. This number includes all channel numbers from the WaveBook and any attached expansion chassis (WBK10/10H, WBK14, WBK15, WBK16, and WBK17). The channels are numbered as follows:

| CH | Description | Default Label |
|------------|---|---------------|
| CtrlLo | External Clock Period (Lo); Applies to WaveBook/516, /512A, /516A | CtrlLo |
| CtrlHi | External Clock Period (Hi); Applies to WaveBook/516, /512A, /516A | CtrlHi |
| Dig | WaveBook Digital Channel | Dig |
| 0-1 to 0-8 | WaveBook Analog Channels | CH01 to CH08 |
| 1-1 to 1-8 | First Expansion Channels | CH09 to CH16 |
| 2-1 to 2-8 | Second Expansion Channels | CH17 to CH24 |
| etc. | etc. | etc. |

Module Type – This column is hidden by default, but can be displayed by selecting it in the “Customize Column Layout Window” that is activated by toolbar button (17), or by clicking the “Show All Columns” button (18). The column identifies the types of modules and their installed option cards, if applicable. The column’s information is automatically derived from the WaveBook system’s actual hardware.

On/Off - This column allows you to enable and disable channels. Double-clicking a cell in this column will toggle the channel status, i.e., On to Off and visa versa. The *Make All Channels Active* and *Make All Channels Inactive* menu items under the *Edit* menu can be used to simultaneously enable or disable all channels.

⇒ **WBK17 Note** -The On/Off column will contain a list of 8 different On/Off combinations, i.e., one for each combination of the analog, counter low word, and counter high word values that can be acquired for each WBK17 channel. The selected 16-bit values will be written to acquisition files and be available for display in the Scope window. **Only one of the selected values will be shown in WaveView’s Readings Column.** The complete contents of the “On/Off” list are: “Off”, “Volts (V)”, “CtrlLo (L)”, “CtrlHi (H)”, “Volts and CtrlLo (VL)”, “Volts and CtrlHi (VH)”, “CtrlLo and CtrlHi (LH)”, and “Volts and CtrlLo and CtrlHi (VLH)”. Long strings will fit in the selection list, but the On/Off column itself would use an abbreviation, as follows: “Off”, “On;V”, “On:L”, “On:H”, “On:VL”, “On:VH”, “On:LH”, “On:VLH.”

Label - This column contains a descriptive name for the input channel. By default, it contains a label that is similar to its channel number, but this can be changed to any combination of 8 characters. Click on the desired cell, and type in the desired label name.

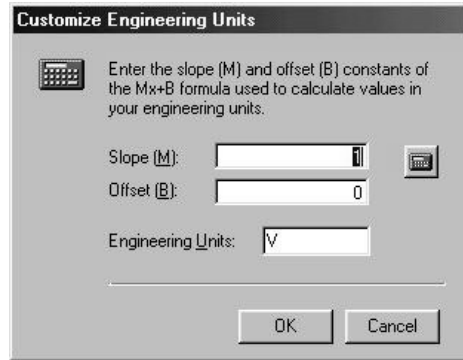
⇒ **WBK17 Note** -There will only be one user-defined label for all three 16-bit values. To distinguish between the values: Volts, Counter Low, and Counter High, a “-V”, “-L” or “-H” is appended to the label.

Readings - Not user configurable. This column displays values for all enabled channels.

⇒ **WBK17 Note** -The Readings column will show, at most, one 16-bit value associated with the channel. If the On/Off column selection indicates multiple 16-bit values, WaveView will make an automatic selection of which value to display in the Readings column. This automatic selection will be according to the following rule: the CtrlLo value is preferred over the Volts value, and the CtrlHi value is preferred over the CtrlLo value.

Unlike the Readings Column, acquisition data will include all selected WBK17 16-bit data channels. For example, if “Volts and CtrlLo and CtrlHi” were selected as the “On/Off” value for all 8 channels of a WBK17, the acquisition data file would contain data from twenty-four 16-bit channels.

Units - This column allows you to change the voltage scale setting of each analog channel displayed when the Scope option is selected. When a cell is selected, a selection box gives you a choice between volts (V) or millivolts (mV). You can also enter user units and mX+b scales from this point. Making a selection sets the choice into the individual cell or block of cells. This option has no effect on the Digital Input channel. A discussion of mX +b follows.



Customize Engineering Units Dialog Box

From the *Customize Engineering Units* dialog box, you can enter values for *m* and *b* components of the equation that will be applied to the data. There is also an entry field that allows you to enter a label for the new units that may result from the **mX+b** calculation.

An example of mX + b equation use follows.

Engineering Units Conversion Using mx + b

Most of our data acquisition products allow the user to convert a raw signal input (for example, one that is in volts) to a value that is in engineering units (for example, pressure in psi). The products accomplish this by allowing the user to enter *scale* and *offset* numbers for each input channel, using the software associated with the product. Then the software uses these numbers to convert the raw signals into engineering units using the following “**mx + b**” equation:

$$\mathbf{Engineering\ Units = m(Raw\ Signal) + b} \quad \mathbf{(1)}$$

The user must, however, determine the proper values of *scale* (**m**) and *offset* (**b**) for the application in question. To do the calculation, the user needs to identify two known values: (1) the raw signal values, and (2) the engineering units that correspond to the raw signal values. After this, the scale and offset parameters can be calculated by solving two equations for the two unknowns. This method is made clear by the following example.

Example

An engineer has a pressure transducer that produces a voltage output of 10.5 volts when the measured pressure is 3200 psi. The same transducer produces an output of 0.5 volt when the pressure is 0 psi. Knowing these facts, m and b are calculated as follows.

A - Write a pair of equations, representing the two known points:

$$\mathbf{3200 = m(10.5) + b} \quad \mathbf{(2)}$$

$$\mathbf{0 = m(0.5) + b} \quad \mathbf{(3)}$$

B - Solve for m by first subtracting each element in equation (3) from equation (2):

$$\mathbf{3200 - 0 = m(10.5 - 0.5) + (b - b)} \quad \mathbf{(4)}$$

Simplifying gives you: $3200 = m(10)$ (5)

This means: $m = 320$ (6)

C - Substitute the value for m into equation (3) to determine the value for b:

$$0 = 320(0.5) + b \quad (7)$$

So: $b = -160$ (8)

Now it is possible to rewrite the general equation (1) using the specific values for m and b that we just determined:

$$\text{Engineering Units} = 320(\text{Raw Signal}) - 160 \quad (9)$$

The user can then enter the values of m and b into the appropriate location using the facilities provided by compatible data acquisition software, for example: WaveView, DaqView, Personal DaqView, LogView, and TempView. The software uses equation (9) to calculate signal values in engineering units from that point on.

Range – This column allows you to set the gain and polarity for the selected channel(s). Clicking the mouse in any of the analog channel *Range* boxes brings up the "Select Range" selection box.



The range of gains available in the selection box depends on the hardware installed in the system. Double-clicking on a channel's *Range* box will cycle through the available ranges. The *Range* selections have no effect on the Digital Input channel.

5B Type – If a 5B module is being used, the type will be displayed when this column is visible.

Auto Zero (32-Bit WaveView Only). Auto-zero is used to null out any DC offset that might be present in a channel. WaveView nulls out the offsets of all channels set to "Yes" in the Auto Zero column, providing the channels are enabled ("On").

⇒ **WBK17 Note** - The Auto Zero function does not apply to WBK17.

LPF Mode - Applies to: WBK12, WBK13, WBK14, WBK16, and WBK17. This column allows you to include or bypass a channel's low-pass filter. The bypass mode is the default. Double-clicking a cell in the LPF Mode column will cycle through the available options, i.e., "On" and "Bypass."

⇒ **WBK12 and WBK13 Note** – The LPF type (linear or elliptic) is set in the Module Configuration window, accessible via the associated toolbar button "1," or from the View pull-down menu. The LPF type and Cutoff settings apply to channel banks, not to individual channels. WBK12 and WBK13 each have two banks of four channels. Setting one channel of a bank updates the banks remaining channels.

⇒ **WBK14 Note** – For WBK14 applications, the LPF Mode column allows you to select "On", "Bypass", or "External." The later is used to select an external filter.

LPF Cutoff – Applies to: WBK12, WBK13, WBK14, WBK16, and WBK17. This column allows you to set the low-pass filter cut-off frequency for the selected channel(s). Since the WBK12 and WBK13 filters are assigned to banks, setting one channel of a bank updates the banks remaining channels. Note that LPF Cutoff can only be set in the *Module Configuration window* accessible via the associated toolbar button (1) and the *View* pull-down menu.

HPF Cutoff – Applies to: **WBK14, WBK16, and WBK17**. This column allows you to set the high-pass filter cut-off frequency for the selected channel(s), or in the case of the WBK17, to select AC or DC coupling. When a spreadsheet cell is selected [in the HPF cutoff column], a selection box above the spreadsheet will display the options available for configuring the filters. Double-clicking a cell in this column will toggle the cut-off frequency status. A change in the high-pass filter cut-off frequency for one channel will appropriately update other affected channels.

| HPF Cutoff Options | | |
|--------------------|-------|-------|
| WBK14 | WBK16 | WBK17 |
| 0.1 Hz | DC | Off |
| 10 Hz | 1 Hz | AC |
| -- | -- | DC |

WBK17 users should note that each WBK17 channel has a *programmable* input-coupling feature. Input coupling can be turned off, or be selected for AC or DC coupling. The inclusion [or exclusion] of DC offsets is important when calculating the appropriate comparator threshold for the input waveform. In regard to WBK17’s **AC coupling option** – select “AC” to reject unwanted DC offsets. In other words, to prevent DC offsets from reaching the comparator. AC coupling works well when the input is constantly changing. If the input stops for longer than one second, it will appear as DC and may cause the comparator to switch on the decaying DC input.

In regard to WBK17’s **DC coupling option** – use “DC” coupling when both AC and DC components are to be presented as input to the comparator DC coupling does not reject anything. If the input can have periods of stability longer than one second, use DC coupling so the comparator does not switch on a decaying DC input.

Source Level – Applies to: **WBK14 and WBK16**. This column allows you to apply or remove the source level for the selected channel(s). When selecting a cell or block of cells in this column, a selection box above the spreadsheet may or may not appear, depending upon your particular hardware. If the selection box appears, it will display the appropriate source level selections (such as “Off”, “2 mA”, or “4 mA” for a WBK14 or an excitation voltage level for a WBK16) allowed by your hardware to configure a source or block of sources. Double-clicking a cell in this column will toggle the source level status. A change in the source level for one channel will appropriately update any other affected channels.

↪ **WBK14 Note** – For WBK14, when using an ICP transducer, either 2 mA or 4 mA must be selected. Set the current-source level to “Off” before measuring voltage.

Bridge Type – Applies to **WBK16 Only**. This column allows you to select the specific bridge configuration for a strain gage or load cell sensor. When a cell is selected, a selection box above the spreadsheet will display the appropriate bridge configuration selections (such as *Full Bridge*, *Half-Bridge* and *Quarter-Bridge*). Double-clicking a cell in this column toggles the Bridge Type. Detailed information is included in the *WBK16 Document Module*.

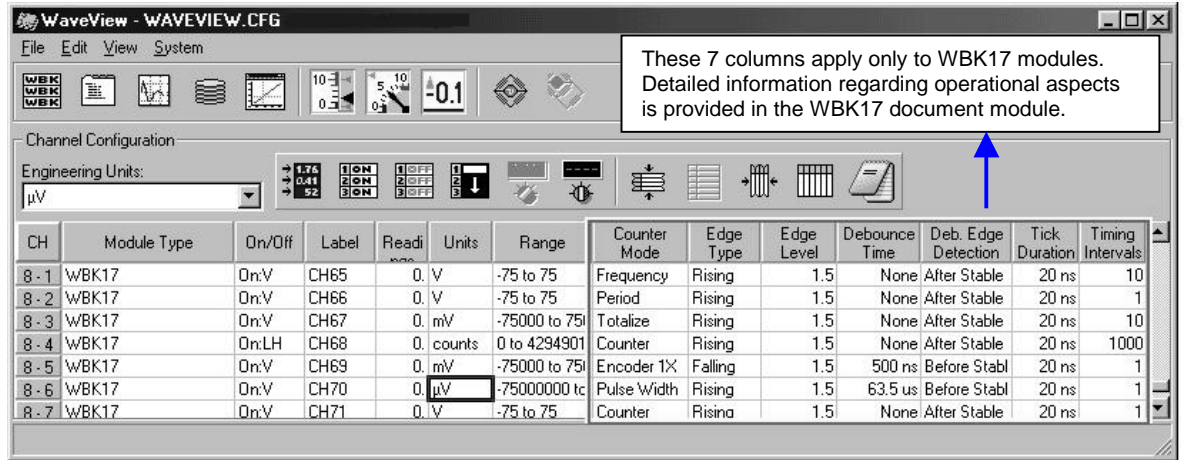
Invert – Applies to: **WBK16 Only**. This column allows you to invert the signal level of a channel. When a cell is selected, the selection box above the spreadsheet allows “Yes” or “No” options to determine whether the channel is inverted. Double-clicking a cell in this column will toggle the invert status.

The remaining columns apply only to the WBK17 module.



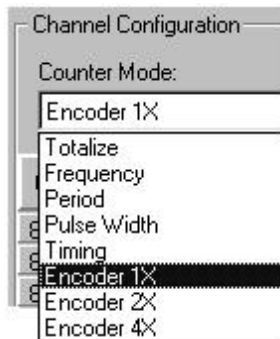
Reference Note:

Refer to the *WBK17 Document Module* (in the *WBK Option Cards and Modules User’s Manual*, p/n 489-0902) for detailed information regarding the various modes. The WBK17 document module includes explanations, block diagrams, and examples.



WaveView Configuration Window Showing WBK17-Dedicated Columns

Counter Mode – Applies to WBK17 Only.



Counter Mode Pull-Down List

WaveView supports several counter modes and can receive input from up to two encoders (in 1X, 2X, or 4X modes).

All WBK17 modes are detailed in the *WBK17 Document Module*.

Note: The Encoder Mode can only be selected on WBK17 channels x-1 and x-5. Inputs “B” and “Z” must be connected to the next consecutive channels.



Reference Note:

Refer to the *WBK17 Document Module* (in the *WBK Option Cards and Modules User’s Manual*, p/n 489-0902) for additional information regarding the following counter modes.

- **Counter**

The *counter* makes use of a 16-bit counter (Counter Low), or a 32-bit counter (Counter High). While in this mode, the channel’s input increments the counter. The counter is cleared at the beginning of each scan, and the value [just prior to clearing] is latched and returned to the WaveBook/516, /512A, or WaveBook/516A. See the upcoming Programmer Note.

- **Totalize**

The *totalize mode* makes use of a 16-bit counter (Counter Low), or a 32-bit counter (Counter High). While in this mode, the channel’s input increments the counter and *rolls it over*, resulting in a cumulative total for the counter value. (see the following Programmer Note)

Programmer Note:

In regard to programming, the “Counter Mode” involves selecting the “*Clear on Read*” option within a single “Counter/Totalize Mode;” and the “Totalize Mode” involves selecting the “*Totalize*” option. In WaveView, the Counter and Totalize modes are treated as two distinct modes. Note that the “*Clear on Read*” mode is not available when using an external clock. Refer to the *WBK17 Document Module* (in the *WBK Option Cards and Modules User’s Manual*, p/n 489-0902) for additional information.

- **Frequency**

This mode provides a means of displaying the frequency of the channel input, even though the WBK17 does not actually supply frequency data. This is possible since frequency is reciprocal function of the period, i.e., “1 divided by period.” When the frequency mode is selected, WaveView automatically performs the conversion (1/period).

The frequency data is latched as it becomes available and the data is sent to the Wavebook/516, /512A, or /516A at the scan rate. Therefore, if the scan period is much faster than the input waveform, there will be a great deal of repetition in the frequency values.

The “[Timing Intervals](#)” feature, page 21, determines the number of periods to time [per measurement]. This relates to frequency since the frequency reading is the reciprocal of the period value. Possible timing interval values are: 1, 10, 100, and 1000. The “Timing Intervals” feature only applies to the Period and Frequency modes.

Note: Frequency is 1/Period. The Timing Interval and Tick Duration set the Period Range.



Reference Note:

Refer to the [Period Mode](#) section of the *WBK17 Document Module* for additional information that pertains to frequency (1/period).

Counter Mode (continued) – Applies to WBK17 Only.

- **Period**

This mode allows for period measurement of the channel input. The measurement period is the time from edge-to-edge, either both rising or both falling. Period data is latched as it becomes available and the data is sent to the Wavebook/512A, /516A, or /516 at the scan rate. Therefore, if the scan period is much faster than the input waveform, there will be a great deal of repetition in the period values. This repetition is due to the fact that updates take place only when another full period becomes available.

The “[Timing Intervals](#)” feature, page 21, determines the number of periods to time [per measurement]. Possible values are: 1, 10, 100, and 1000. The “Timing Intervals” feature only applies to the Period and Frequency modes. The frequency mode makes use of the reciprocal of the period value.

Note: The Timing Interval and Tick Duration set the Period Range. Details are included in the *WBK17 Document Module*.



Reference Note:

Refer to the [Period Mode](#) section of the *WBK17 Document Module* for additional information.

- **Pulsewidth**

This mode provides a means of measuring a channel’s pulsewidth. The measurement is the time from the rising edge to the falling edge, or visa versa. The measurement will be either pulsewidth low, or pulsewidth high, depending upon the edge polarity set in the debounce module.

Every time the pulsewidth measurement is latched from the counter, the counter is immediately cleared and enabled to count the time for the next pulsewidth. The pulsewidth measurements are latched as they become available.

Note: If the scan period is much slower than the input period, then the acquisitions will miss some pulsewidths. Decreasing the scan period will increase the number of different pulsewidths received.

Note: The Tick Duration sets the Pulsewidth Range. Details are included in the *WBK17 Document Module*.



Reference Note:

Refer to the [Pulsewidth Mode](#) section of the *WBK17 Document Module* for additional information.

- **Timing Mode**

This mode provides a means of measuring time between two subsequent events, i.e., the edge of one channel with respect to the edge of another channel. The edge selection is done in each channel's debounce setup. Whenever the time measurement is latched from the counter, the counter is immediately cleared and enabled for accepting the subsequent time period, which starts with the next edge on the main channel.

The data returned is interpreted as time measured in ticks. This data represents the number of ticksize intervals counted during the timing measurement. There are four timebase settings: 20 ns, 200 ns, 2 μ s, and 20 μ s. These are often referred to as tick-sizes. The WBK17 uses a 50 MHz, 10 ppm oscillator as a timing source.



If the input signal has a poor slew rate the timing mode will provide variant results, dependant upon the comparator threshold.

In timing mode, time can be measured with a **16-bit** (Counter Low), or a **32-bit** (Counter High) counter. Since the time measurements always have a “stop at the top” option enabled, the 16-bit and 32-bit options dictate whether the measurement has a range of 0 to 65535 ticks or 0 to 4,294,967,295 ticks.



Reference Note:

Refer to the [Timing Mode](#) section of the *WBK17 Document Module* for additional information.

- **Encoder**

The *encoder mode* allows the WBK17 to make use of data from optical incremental quadrature encoders. When in the *encoder mode*, the WBK17 accepts either *differential* or *single-ended* inputs and provides power for up to four encoders. When reading phase A, phase B, and index Z signals, the WBK17 provides positioning, direction, and velocity data.



The WBK17 can receive input from up to four encoders; however, the WaveView data acquisition program can accept input from only one or two encoders. To receive input from three or four encoders [with one WBK17] refer to the [Programmer's Manual](#) (p/n 1008-0901).

The WBK17 supports quadrature encoders with a 16-bit or 32-bit counter, 5 MHz frequency, and x1, x2, and x4 count modes. With only phase A and phase B signals, 4 channels are supported; with phase A, phase B, and index Z signals, 2 channels are supported.



Reference Note:

Refer to the [Encoder Mode](#) section of the *WBK17 Document Module* for additional information.

This completes the Counter Mode section of the *WaveView Document Module*.

The *WBK17 Document Module* contains additional information regarding each counter mode.

Edge Level – **Applies to: WBK17 Only.** Each WBK17 channel has its own comparator that can be programmed for comparator threshold. WaveView's Edge Level column is used to set the comparator input threshold to a value within the range of -12.5 to +12.5 Volts. Each channel can have a different threshold setting. The effects of different comparator thresholds can be easily observed since the counter output and analog waveform can be scanned together.

The comparator threshold should be set such that ringing on the waveform does not cause extraneous switching of the comparator, causing false counts to be measured. Ideally, the comparator threshold should be set so that the comparator switches at the point of fastest slew rate on the input waveform.

Amplitude modulated noise may also cause false switching of the comparator. The effects of amplitude modulated noise can be minimized by setting the threshold at the point of fastest slew rate on the input waveform.



Reference Note:

Refer to the [Comparator](#) section of the *WBK17 Document Module* for additional information regarding edge level.

Edge Type – **Applies to WBK17 Only.** The Edge Type column is used to set the edge to be detected as a “Rising” or “Falling” edge. Each WBK17 channel’s edge type setting is independent of the settings for the other channels.

Debounce Time – **Applies to WBK17 Only.** Each WBK17 channel has its own programmable debounce module. The modules can be used to eliminate switch-induced transients that are typically associated with electro-mechanical devices including relays, proximity switches, and encoders. The 16 possible selections for debounce time reside within the range of 500ns to 25.5ms [inclusive].

Debounce times should be set according to the amount of instability expected in the input signal. Setting a debounce time that is too short may result in unwanted glitches clocking the counter. Setting a debounce time too long may result in an input signal being rejected entirely. Some experimentation may be required to find the appropriate debounce time for a particular application.

To see the effects of different debounce time settings, simply view the analog waveform along with the counter output.



Reference Note:

Refer to the [Debounce Module](#) section of the *WBK17 Document Module* for additional information.

Debounce Edge Detection – **Applies to WBK17 Only.** The Debounce Edge Detection column allows for one of two debounce trigger-mode selections. These are: (1) after stable, and (2) before stable.

The “trigger **after stable**” mode behaves like a traditional debounce function, i.e., rejecting glitches and only passing state transitions after a specified period of stability (the debounce time). Trigger after stable mode is used with electro-mechanical devices like encoders and mechanical switches to reject switch bounce and disturbances due to a vibrating encoder that is not otherwise moving. The debounce time should be set short enough to accept the desired input pulse but longer than the period of the undesired disturbance.

In the “trigger **before stable**” mode, the output of the debounce module immediately changes state, but will not change state again until a period of stability has passed. For this reason the mode can be used to detect glitches.

Use the trigger **before stable** mode when the input signal has groups of glitches and each group is to be counted as one. The trigger before stable mode will recognize and count the first glitch within a group but reject the subsequent glitches within the group if the debounce time is set accordingly. In this case the debounce time should be set to encompass one entire group of glitches.



Reference Note:

Refer to the [Debounce Module](#) section of the *WBK17 Document Module* for detailed information.

Tick Duration – **Applies to WBK17 Only.** The “tick duration,” also referred to as “ticksiz,” is a fundamental unit of time. WaveView’s Tick Duration column permits four possible settings: 20ns, 200ns, 2000ns, 20000ns. For measurements that require a timebase reference, such as period or pulsewidth, the ticksiz is the basic unit of time. The count value returned in the scan is the number of ticks that make up the time measurement.



Reference Note:

Refer to the [WBK17 Document Module](#) for explanation on how the tick duration affects the range for period, pulsewidth, and timing modes.

Timing Intervals – Applies to: **WBK17’s Period and Frequency Modes Only**. The WBK17 has the ability to measure 1, 10, 100 or 1000 periods (Timing Intervals). This allows the device to divide sampling error by 1, 10, 100, or 1000, accordingly. Because this division is done within the WBK17, the need averaging to be done in the PC may be eliminated. For high accuracy on high frequency inputs, multiple period measurement and PC-based averaging can be done.

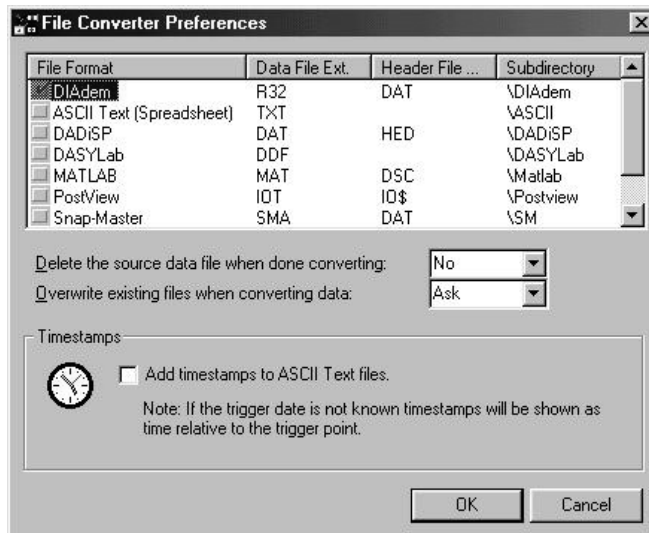


Reference Note:

Refer to the *WBK17 Document Module* for explanation on how the timing interval affects the range of the period mode. Frequency is 1/period.

Data Conversion

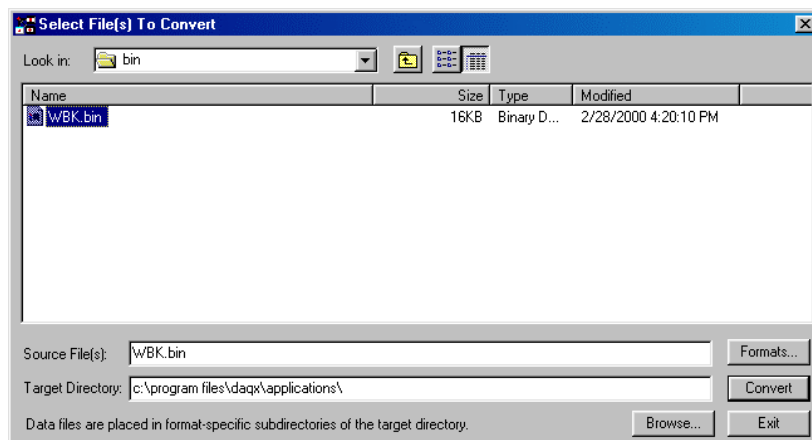
WaveView contains a file converter capable of converting raw binary data to other file formats. From the *File* pull-down menu, select *Data Conversion Preferences* to choose the desired file formats. Note that the application for viewing file data is selected by default. The following window is displayed:



File Converter Preferences, Accessed via the File Pull-Down Menu

Check any box to set the file conversion options that WaveView will apply automatically to acquired data.

WaveView’s *Convert Data Files* option of the *File* menu allows you to run the File Converter on previously acquired data. A dialog box is displayed for you to select files from:



Convert Data Files Option, Accessed via the File Pull-Down Menu

During the conversion, a “Converting File” box shows an animated completion bar, the format of the source and target files, and the file paths of the source and target.



Acquisition Configuration



Reference Note:

For additional trigger-related information refer to the *WaveBook User's Manual* chapter entitled, *WaveBook Operation Reference*.

General Information

You can access the *Acquisition Configuration* dialog box from the main window's *View* pull-down menu or toolbar.

The **Duration** column has text-boxes for pre-trigger scans, post-trigger scans, and convention (number of scans or time period).

The following formula determines the maximum number of scans that can be stored for use in the Scope mode.

This does not apply to storage to disk.

$$(\text{Scan duration}) * (\# \text{ of Channels}) * 4 < \text{Available PC Memory}$$

A scan includes all channels that are set to "On" in the analog input configuration spreadsheet.

The **Rate** column allows you to set pre-trigger and post-trigger scan rates. Timebase settings can be for *Frequency* or *Period*.

Timebase units are as follows:

Frequency - Hz, kHz, or MHz.

Period - seconds, milliseconds, or microseconds.

The scan rate can also be driven by the **External** clock of the digital input port. With this option, enabled scans occur as pulses are input on the external clock pin. The scan rate is set as a fraction of the external clock rate by the **Clock Divider** setting. The fastest scan rate is obtained from a clock divider setting of 1. A setting of 10 would take one scan every tenth pulse.

The screenshot shows the 'Acquisition Configuration' dialog box with the 'Internal' clock mode selected. The 'Scanning' section contains a table with the following data:

| | Duration | Rate |
|--------------|------------|-----------|
| Pre-Trigger | 1000 scans | 50 kHz |
| Post-Trigger | 5000 scans | 50 kHz |
| Convention | Scans | Frequency |

The 'Triggering' section shows 'Type: Manual'.

Acquisition Configuration (Internal Clock)

Note: The check-box for "Use Post-Trigger rate for Readings Column acquisitions" is, by default, **not checked**. The option is intended for WBK17 counter mode applications and forces WaveView's Readings column to update at the Post-Trigger rate.

The screenshot shows the 'Acquisition Configuration' dialog box with the 'External' clock mode selected. The 'Scanning' section contains a table with the following data:

| | Duration | Rate |
|--------------|------------|---------------------------|
| Pre-Trigger | 1000 scans | Clock Divider (1-255): 88 |
| Post-Trigger | 5000 scans | |
| Convention | Scans | |

The 'Triggering' section shows 'Type: Immediate'.

Acquisition Configuration (External Clock)



In addition to the acquisition configuration aspects just discussed, WaveBook/516, /512A, and /516A include a pin for receiving external clock input, a counter-timer, Digital-Pattern Trigger, and a Pulse Trigger. Since these features do not apply to the WaveBook/512 or /512H, they are discussed separately in the following section.

Trigger Types

The *Trigger* selection pull-down list allows you to select the triggering method to start the scan. The figure shows the various triggering options available.

Immediate

Triggering starts immediately when the *Arm* toolbar button of *WaveView Scope* is clicked.

Manual

Prior to acquiring data, the system must first be armed by clicking on the *Arm* toolbar button of *WaveView Scope*. Triggering starts when the *Trigger* button is clicked.

Digital

Selecting *Digital* brings 2 triggering options to the *Trigger* selection box, allowing you to select either a "Rising" or "Falling" edge trigger. The TTL trigger signal connects to pin (TTLTRG) of the Digital I/O & Trigger port on the WaveBook front panel.

Channel 1 Analog

This option allows you to set up additional parameters for the acquisition of analog data. Several new items are added to the *Trigger* selection box, including options for the *Trigger Condition* and *Trigger Threshold*.

The selections for trigger correspond to the following trigger conditions: (1) "Rising Edge", where the signal level must have a positive slope as it crosses the *trigger threshold*, or (2) "Falling Edge", where the signal level must have a negative slope as it crosses the *trigger threshold*.

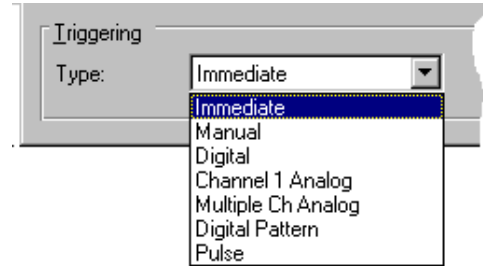
Multiple Ch Analog

This Trigger Source provides a scroll list of Trigger Conditions for use with AND, or OR Logical Operators, as follows:

- (1) Selecting "**OR channels**" causes the acquisition to trigger when any of the selected channel conditions become true
- (2) Selecting "**AND channels**" issues a trigger when all the selected channel conditions become true.

If *Multiple Ch Analog* is selected, the *Trigger Condition* option has the following choices:

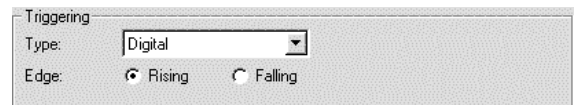
- ◇ **No Trigger**. The channel will not be included in the list of channels to examine for trigger conditions.
- ◇ **Rising Edge**. The signal level must first go below the trigger level by the user-set hysteresis amount. Then, the trigger channel is valid whenever the signal level is above the trigger level and stays valid until the signal level goes below the trigger level by at least the hysteresis amount.



Trigger Source Pull-Down List

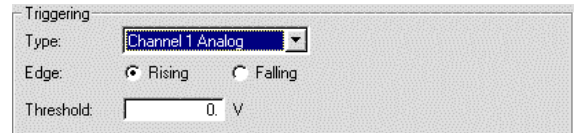
(On Acquisition Configuration Dialog Box)

Provides the means of selecting the desired Trigger Type.



Digital Trigger

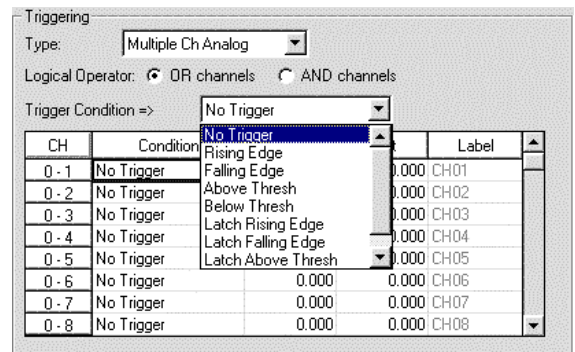
With Digital Trigger, the user must indicate Rising or Falling Edge.



Channel 1 Analog Trigger

Allows you to set a Trigger Threshold Value and indicate whether the signal is to be Rising or Falling in relation to the trigger line.

Note: *Channel 1 Analog* triggering is only valid for channel 1.



Multiple Ch Analog

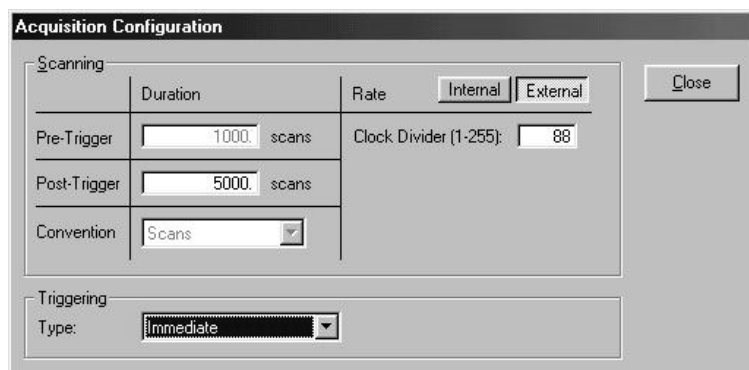
Provides a variety of Trigger Conditions and the use of **And** or **Or** Logic Operators.

- ◇ **Falling Edge.** The signal level must first go below the trigger level by the user-set hysteresis amount. Then, the trigger channel is valid whenever the signal level is below the trigger level and stays valid until the signal level goes above the trigger level by at least the hysteresis amount.
- ◇ **Above Thresh.** A trigger channel is valid whenever the signal level is above the trigger level and stays valid until the signal level goes below the trigger level by at least the user-set hysteresis amount.
- ◇ **Below Thresh.** A trigger channel is valid whenever the signal level is below the trigger level and stays valid until the signal level goes above the trigger level by at least the user-set hysteresis amount.
- ◇ **Latch Rising Edge.** The signal level must first go below the trigger level by the user-set hysteresis amount. Then, the trigger channel is valid whenever the signal level is above the trigger level and stays valid until the acquisition is complete.
- ◇ **Latch Falling Edge.** The signal level must first go below the trigger level by the user-set hysteresis amount. Then, the trigger channel is valid whenever the signal level is below the trigger level and stays valid until the acquisition is complete.
- ◇ **Latch Above Thresh.** A trigger channel is valid whenever the signal level is above the trigger level and stays valid until the acquisition is complete.
- ◇ **Latch Below Thresh.** A trigger channel is valid whenever the signal level is below the trigger level and stays valid until the acquisition is complete.

Note: The threshold voltage and hysteresis level may be set for each channel as required. Position the cursor per channel and enter the desired value(s).

External Clock and Counter-Timer

WaveBook/512A, /516, and /516A can receive an **external clock** input through pin 20 of the DB25 connector labeled DIGITAL I/O, EXTERNAL CLOCK, TTL TRIGGER. This enables data scanning to be correlated with an **external pulse train**. To enable the **external clock**, select “External” for the Scanning Rate in the *Acquisition Configuration Dialog Box* (see following screen shot). When the external clock is enabled, the WaveBook will **begin a scan, only after a rising edge on the TTL level occurs**. Optionally, the external clock may be divided [by a factor of 1 to 255]. This “pre-scaling” allows the user to select a reduced scan rate.



Note: The Clock Divider can be set at a value from 1 to 255.

Acquisition Configuration Dialog Box with External Clock Enabled

WaveBook/516, /512A, and /516A each have a 32-bit **internal counter** that calculates and reports the external clock’s period. The counter can be read with each scan of the analog data. This is often beneficial in later analysis, when there is a need to correlate physical phenomena with speed.

The counter channel actually consists of two independent channels (CtrLo and CtrHi). These can be turned “On” in the *Channel Configuration Spreadsheet*. When enabled, the low (CtrLo), then high (CtrHi) words of the counter will be configured in each scan. Note that the spreadsheet’s **Units** column can be used to view a predefined period in units of seconds, ms, or μ sec.

WaveView can be configured to read *only the low word* of the counter data (CtrLo:“On,” CtrHi: “Off”). This decreases the minimum scan period by 1 usec. This *LoCtr only option* can be used *only* when the external clock frequency is greater than 305 Hz (20,000,000 MHz / 65536]. Note that WaveView does not enforce this.

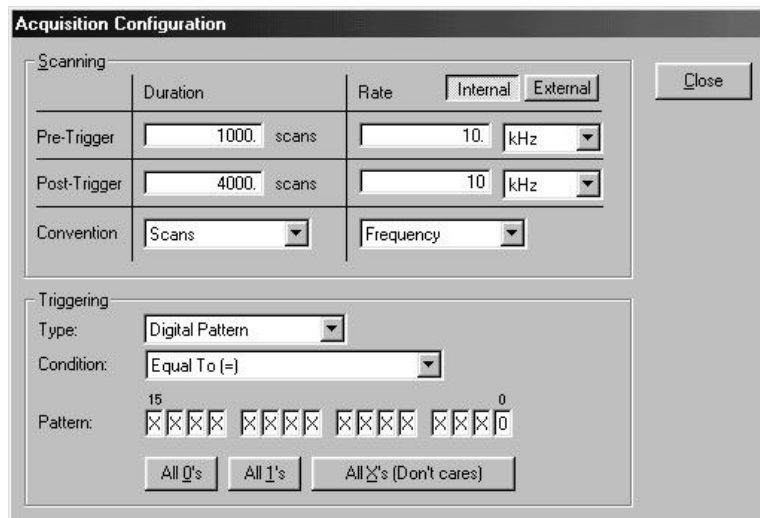
Digital-Pattern Trigger

In addition to digital trigger, each WaveBook/512A, /516, and /516A supports a digital-pattern trigger. This expanded capability allows data collection to start when a user-defined 16-bit digital pattern is matched on the digital I/O connector. This feature is useful when trying to capture noise, vibrations or some other physical disturbance that occurs at a particular point in a digitally-sequenced process (from a PLC or relay-logic-control system).

When “Digital Pattern” is selected as the Triggering *Type*, the 16-bit pattern extension appears (as indicated in the following figure). The *Condition* box allows the following choices:

Equal To (=) / Not Equal To (< >) – These options treat each digital line as a separate input to be compared to logical 1 or 0. Selecting “Equal To” triggers only on the exact pattern of 1’s and 0’s selected., while “Not Equal” triggers on all others. You can also set any of the inputs to “don’t care” (X), which excludes it from the comparison.

Greater Than (>) / Less Than (<) – These options interpret the digital inputs as a single 16-bit value and allow a threshold trigger.

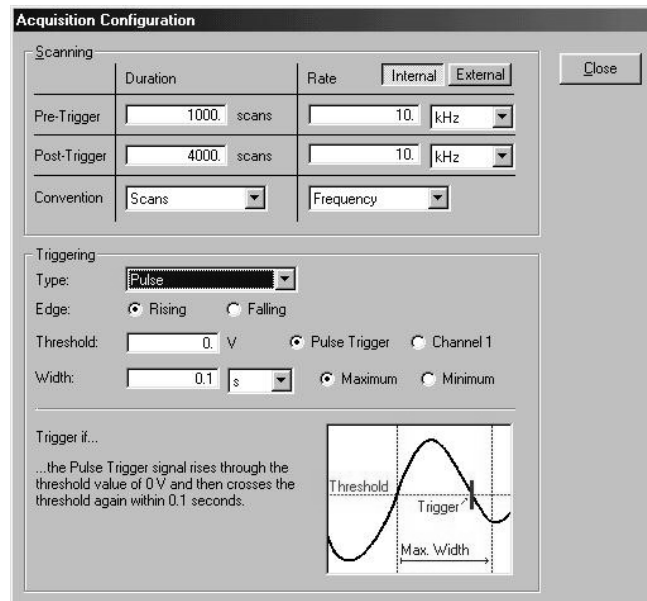


Acquisition Configuration Dialog Box, with Digital Pattern Extensions

Note: The “Internal” and “External” buttons in the top row of the dialog box are used to select Internal Clock, or External Clock, respectively.

Pulse Trigger

WaveBook/512A, /516, and /516A each support Pulse Trigger. This allows the use of a high-bandwidth input for triggering, and the correlation of lower-speed waveforms with the occurrence of a high-speed pulse. You can set a **pulse amplitude** to a value between +5 V and -5 V, and set a **pulse width** to a value in the range of 10 ns to 10 μ s.



Pulse Trigger Selected

This option allows you to trigger on analog level “pulses” on either the Channel 1 input or the Pulse Trigger input. This trigger type is similar to the Channel 1 Analog trigger but places an additional time-based condition on the signal. Depending on whether the pulse width is set as a minimum or a maximum, the signal either must or must not cross the threshold again within the given amount of time.

The red horizontal line (Threshold) and blue vertical lines (defining maximum width) will vary according to the parameter settings. You can specify either one or two thresholds for the level and width settings. The number of labels matches the number of thresholds and the placement follows the polarity.

- For **positive polarity**, the text is “**Rise Above... Stay Below.**”
- For **negative polarity**, the text is “**Fall Below and Stay Above.**”

Note: In the triggering section (see figure, above) you can select “**Maximum**” width to capture signal pulses. The “**Minimum**” width selection is useful when you desire to ignore pulses.

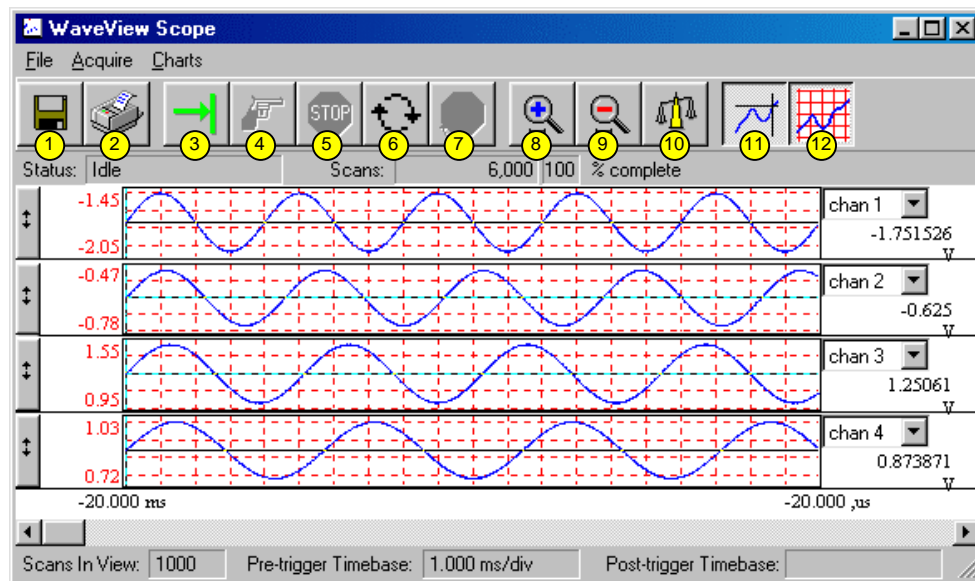


WaveView Scope Window

Scope mode is a WaveView utility that can display data acquisition waveforms in real-time. Before this mode can be enabled, at least one channel must be "ON." Up to eight channels can be displayed at a time.

Note: The following formula determines the maximum number of scans that can be stored for use in the *Scope mode*. The formula does not apply to disk storage.

$$(\text{Total Scans}) * (\# \text{ of Channels}) * 4 < \text{Acquisition Buffer Size}$$



WaveView Scope Window

| Item | Description | Item | Description |
|------|----------------|------|--------------------|
| 1 | Save | 7 | Stop Rearming |
| 2 | Print Window | 8 | Zoom In |
| 3 | Arm | 9 | Zoom Out |
| 4 | Trigger | 10 | Scale All Charts |
| 5 | Stop Acquiring | 11 | Toggle Cross Hairs |
| 6 | Auto-Rearm | 12 | Toggle Grids |

➔ **WBK17 Note** – For Scope applications [pertaining to WBK17], the channels will be identified by the same names used in the **Label** column on the WaveView Configuration spreadsheet.



To view additional channels in Scope Display, simply change the entry in the *Number of Charts* selection of the Charts pull-down menu. You can simultaneously view up to eight channels in Scope Display.

A *Channel* pull-down menu box is located at the right end of each chart and is used to select the desired channel. Click on the box to display the channel list; then click on the desired channel.

The waveform display is actually a window looking at a section of the acquisition. The window size may be increased or decreased and moved to any location on the time-line. The waveforms may be examined during or after the acquisition.

Menu Items & Toolbar Buttons

You can control the acquisition process and the Scope display from the menu selections and toolbar buttons. There are more pull-down menu selections available than there are buttons; however, each button does have a corresponding menu item.

File

| | |
|--------------------------|--|
| Save Data Files | Saves data in the file name and data formats that have been previously assigned. |
| Save Data File As | Prompts you for a name for the data file before saving the data. |
| Print Window | Prints the contents of the display screen. |
| Close Scope | Closes the Scope display and returns to the configuration menu. |

Acquire

| | |
|-----------------------|--|
| Arm | Arms the WaveBook to acquire data. Data acquisition will commence as soon as the triggering conditions are satisfied. |
| Trigger | Issues a Software Trigger to the WaveBook. Whenever the WaveBook is armed and waiting for a trigger, you can take this action to force data acquisition to start. |
| Stop Acquiring | Ends the current acquisition immediately. All data collected prior to this action will be retained in memory and displayed in the chart control. If auto-rearm is enabled, this action stops the rearming as well. |
| Auto-Rearm | When enabled, the WaveBook is automatically re-armed whenever an acquisition ends. With this feature, you can use WaveView like an oscilloscope to display a rapid series of your channel inputs. |
| Stop Rearming | With auto-rearm enabled, this action stops auto-rearming but allows the current acquisition to complete. (Pressing "Stop Acquiring" ends the current acquisition immediately.) |

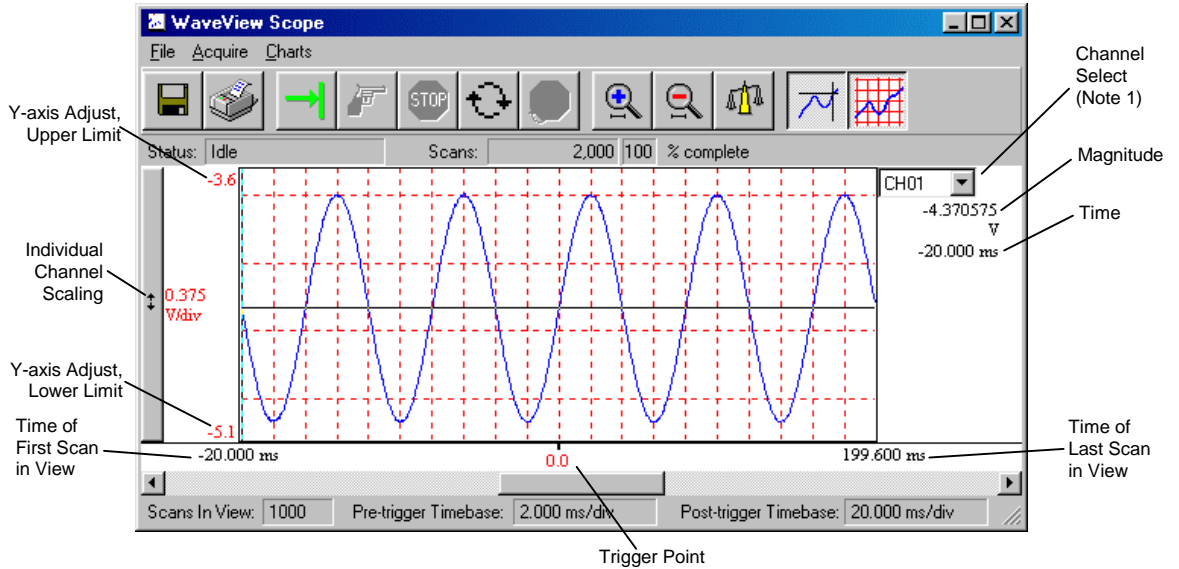
Charts

| | |
|----------------------------|--|
| Number of Charts | Sets the number of charts (maximum of 8) to be displayed simultaneously. |
| Zoom In | Halves the visible timebase. Example: if 10 ms of information is visible, clicking Zoom In will show 5 ms. Maximum Zoom In is 2 samples. |
| Zoom Out | Doubles the visible timebase. Example: if 10 seconds of information is visible, clicking Zoom Out will show 20 seconds. Maximum Zoom Out is 2000 samples. |
| Enable AutoScaling | Continuously adjusts the Y-axis for all channels so that the visible waveform fills 90% of the graph's range. |
| Scale All Charts | Adjusts the Y axis for all channels so that the visible waveform fills 90% of the graph's range. |
| Display Cross Hairs | A cross hair is a marker that shows the numerical values of time and amplitude at its present location in the waveform. Toggle button to turn cross hairs on or off. |
| Display Grids | Displays a grid for each chart. Toggle button to turn grids on or off. |

Individual cross-hairs can be moved by holding down the left mouse button and dragging the selected cross-hair to the new location on the chart. Holding the right mouse button and dragging, moves all the cross-hairs simultaneously to a new location. The voltage and time display at the side changes as you do this. Cross-hairs are disabled during an acquisition.

Scope Display

The following figure identifies features of the WaveView Scope display.



Note 1: For Scope applications [pertaining to WBK17], the channels will be identified by the same names used in the **Label** column on the WaveView Configuration spreadsheet.

| Scope Mode Indicators & Descriptions | |
|--------------------------------------|--|
| Y-axis Adjust | Allows adjustment of the displayed range. Clicking on the value highlights the number. Enter desired new value and press Enter. |
| Individual Channel Scaling | Adjusts the scaling of the individual channels so that the visible waveform fills 90% of the graphs range. |
| Time of First Scan in View | Displays the acquisition time of the first scan currently displayed on the chart. |
| Trigger Point | Displays the trigger event. Note: Depending on the current acquisition parameters and chart display configuration, the trigger point may or may not appear on the chart. |
| Time of Last Scan in View | Displays the acquisition time of the last scan currently displayed on the chart. |
| Channel Select | Clicking on this control displays the list of all channels selected in the WaveView configuration menu. A maximum of 8 channels may be displayed at one time with the remaining channels available through the scroll bar. |
| Magnitude | Displays the magnitude of the signal at the point where the marker cross-hair intersects the waveform. Moving the marker to different locations on the waveform changes the value of the displayed voltage. |
| Time | Displays the point on the acquisition time-line where the marker cross-hair intersects the waveform. This value changes as the marker is moved along the X-axis (time scale). |

In addition to the above features of the Scope window, there are status bars above and below the charts that display information about the timebase of the current display and the status of the current acquisition:

Status – Indicates the current acquisition state of the WaveBook. If there is no acquisition in progress, the status is Idle. During an acquisition, the status steps through all or part of the following sequence: Configuring, Waiting For Trigger, Triggered, Transferring, Graphing, and then back to Idle.

Scans – During an acquisition, this field displays the current transfer count. Afterwards, it is the total scans in the previous acquisition. A percent complete value is shown to the right of the scan count. After an acquisition, this normally reads 100%.

Activity Indicator – During an acquisition, a small window appears next to the status field that shows an animated sine wave. This indicator is active whenever the acquisition status is not “Idle.”

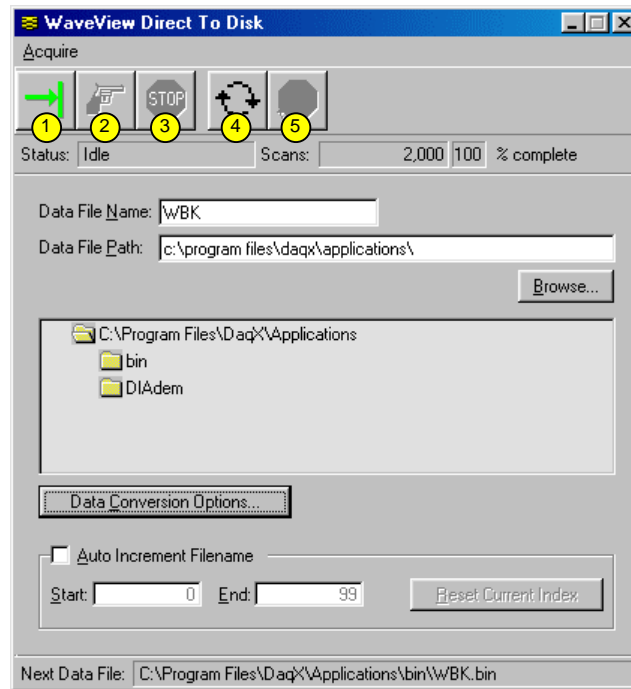
Scans in View – The number of scans displayed across the X-axis.

Pre-trigger Timebase – The pre-trigger timebase in time units per division. This field is blank when no pre-trigger data is currently on the chart.

Post-trigger Timebase – The post-trigger timebase in time units per division. This field is blank when no post-trigger data is currently on the chart.



WaveView Direct-To-Disk Window



WaveView Direct-to-Disk Window

| Item | Description |
|------|----------------|
| 1 | Arm |
| 2 | Trigger |
| 3 | Stop Acquiring |
| 4 | Auto-Rearm |
| 5 | Stop Rearming |

Control functions in the *WaveView Direct-To-Disk* window are available through the pull-down menu or the toolbar. The figure shows the menu, the toolbar, and each tool button. In addition to the tool buttons, there are status bars that display information about the data file and data conversion:

Status – Indicates the current acquisition state of the WaveBook. If there is no acquisition in progress, the status is Idle. During an acquisition, the status steps through all or part of the following sequence: Configuring, Waiting For Trigger, Triggered, Transferring, Graphing, and then back to Idle.

Scans – During an acquisition, this field displays the current transfer count. Afterwards, it is the total scans in the previous acquisition. A percent complete value is shown to the right of the scan count. After an acquisition, this normally reads 100%.

Activity Indicator – During an acquisition, a small window appears next to the status field that shows an animated sine wave. This indicator is active whenever the acquisition status is not “Idle.”

Data File Name – Displays base filename; allows user to input filename using keyboard or Browse button.

Data File Path – Displays the path of the root data directory. All acquired and converted data is placed in subdirectories of this location. You can press the Browse button to display a tree of all directories available to your computer.

Subdirectory Tree Display – Shows the directory structure of the location where the data files are stored. The presence of data subdirectories in the tree indicates the current data conversion setting. For example, if you see a “DIAdem” subdirectory, you know that your data is automatically converted to the DIAdem format at the end of every acquisition.

Note: If you double-click on a branch of the tree, Windows Explorer opens a folder view of that subdirectory.

Data Conversion Options – Opens a dialog that allows you to set the data file conversion options that WaveView will apply automatically whenever you acquire data.

Auto Increment Filename checkbox – If checked, allows automatic change to the suffix of the Current Filename using the base Filename and the numbers in the “Start – End” range. If not checked, Current Filename will be equal to base Filename. The current Filename is shown at the bottom of the dialog box.

Reset Current Index button – Resets current index and Current Filename to the “Start Index.”

Next Data File - Displays the full path and file name of the next acquisition data file that will be created. This field is most useful when the Auto-Increment feature is enabled since WaveView constructs the filenames by combining the User File Name with the current file increment.

Note: During an acquisition this field displays the path of the file that will be created at the end of the acquisition. With auto-increment enabled, as soon as the acquisition has ended the field is updated to display the name of the next data file that will be created, not the name of the file just created.

In the following sections, menu functions are explained in order of the menu structure. Note that not all menu items have a corresponding toolbar button.

Acquire

Selecting **Acquire** [from the WaveView Direct-to-Disk menu bar] displays a pull-down menu with the following command options (see table).

| | |
|-----------------------------|--|
| Arm | Arms the WaveBook to acquire data. Data acquisition will commence as soon as the triggering conditions are satisfied. |
| Trigger | Issues a Software Trigger to the WaveBook. Whenever the WaveBook is armed and waiting for a trigger, you can take this action to force data acquisition to start. |
| Stop Acquiring | Ends the current acquisition immediately. All data collected prior to this action will be retained in memory and displayed in the chart control. If auto-rearm is enabled, this action stops the rearming as well. |
| Auto-Rearm | When enabled, the WaveBook is automatically re-armed whenever an acquisition ends. When this feature is used in conjunction with the Auto-Increment feature, you can create a series of acquisition files with no user intervention. Once armed, the WaveBook will continue to wait for triggers and acquire data unattended until the desired number of acquisitions has been done. |
| Stop Rearming | With auto-rearm enabled, this action stops auto-rearming but allows the current acquisition to complete. (Pressing “Stop Acquiring” ends the current acquisition immediately.) |
| Close Direct to Disk | Closes the Direct-To-Disk display and returns to the Configuration menu. |

Meters

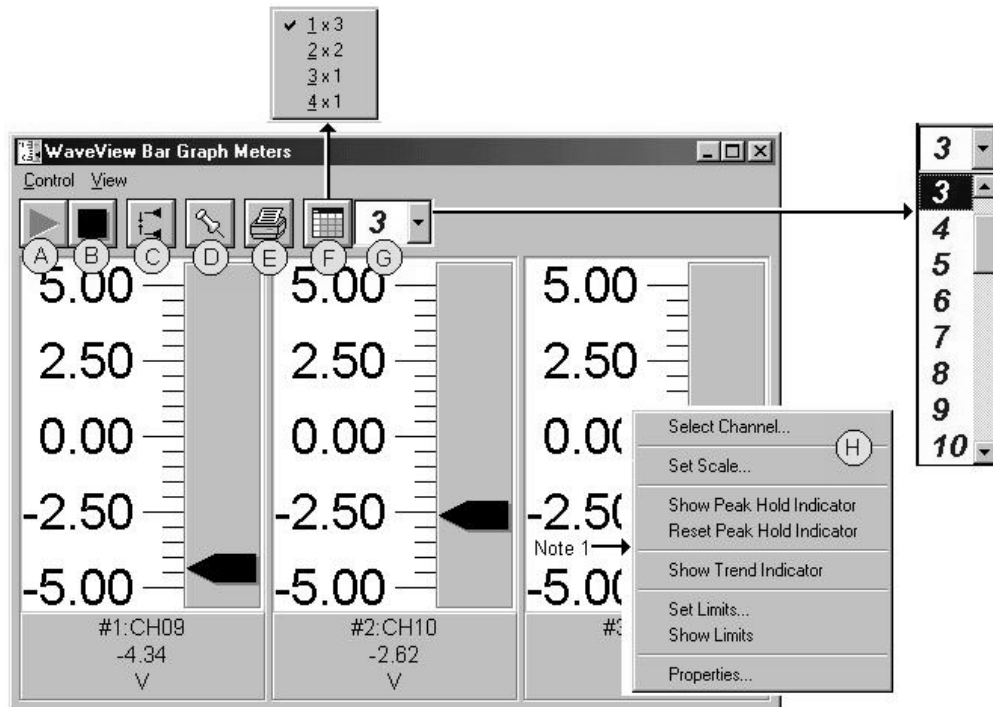


Bar Graph Meters



You can use the Bar Graph Meters button or select Bar Graph Meters from *WaveView's* **View** pull-down menu to access the Bar Graph window. This window displays several channels in bar graph format. To activate the display, select the Start button (A) from the toolbar. You can select to view up to 32 meters at a given time.

Note: To view an active meter, at least one **active** (On) channel must be assigned to the meter, and the Reading's column (on *WaveView's* main window) must be enabled.



Bargraph Meters, Shown with 3 Meters Selected for Viewing

The items in this window are as follows:

A - Start **C - Reset Peak Hold** **E - Print** **G - Number of Meters**
B - Stop **D - Stay On Top** **F - Rows x Columns** **H - Configuration Pop-Up Menu**

These items are discussed in more detail, following the description of Digital Meters.

Configuration Note:

.... for Bar Graph Meters

For Bar Graph Meters, configure the meter settings by first clicking the right mouse button anywhere within the meter display area. A pop-up menu will appear, allowing you to reconfigure the meter in regard to scale, limits, channel selection, adding peak hold indicators, etc. Refer to the upcoming section entitled *Meters Configuration Menu* for more detail.

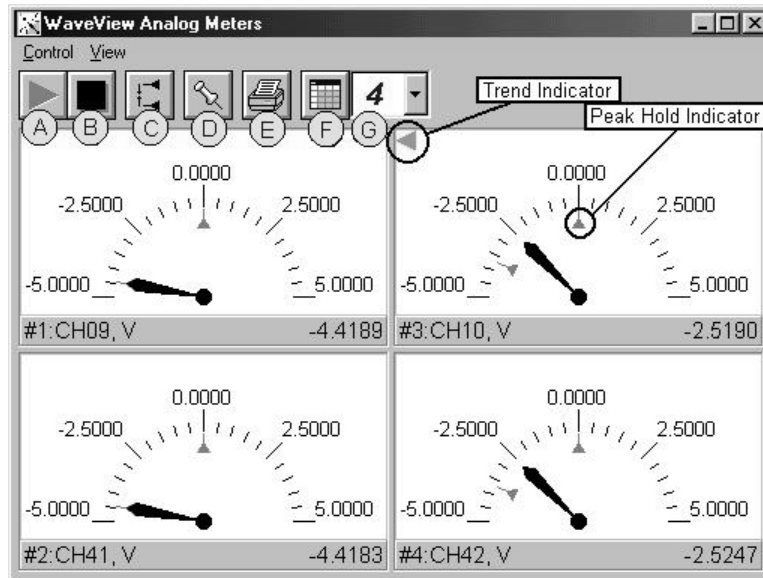
Note 1: Double-clicking the left mouse button in a meters scale area brings up a channel selection pop-up menu. A single click with the right mouse button in this same area brings up a configuration pop-up menu (**item H**). Both of these pop-up menus are discussed in the upcoming section, *Meters Configuration Menu*.

Analog Meters



You can use the Analog Meters button or select Analog Meters from WaveView's **View** pull-down menu to access the Analog Meters window. This window displays several channels in a dial/gage format. To activate the display, select the Start button (A) from the toolbar. You can select to view up to 32 meters at a given time.

Note: To view an active meter, at least one **active** (On) channel must be assigned to the meter, and the Reading's column (on WaveView's main window) must be enabled.



Analog Meters, Shown with 4 Meters Selected for Viewing

Double-clicking the left mouse button in a meters scale area brings up a channel selection pop-up menu (not shown). A single-click with the right mouse button in this same area brings up a configuration pop-up menu (see Bar Graph Meters figure, item H). Both of these pop-up menus are discussed in the section, *Meters Configuration Menu*.

The items in this window are as follows:

- | | | | |
|------------------|----------------------------|---------------------------|-----------------------------|
| A - Start | C - Reset Peak Hold | E - Print | G - Number of Meters |
| B - Stop | D - Stay On Top | F - Rows x Columns | |

These items are discussed in more detail, following the description of the Digital Meters.

Configuration Note:

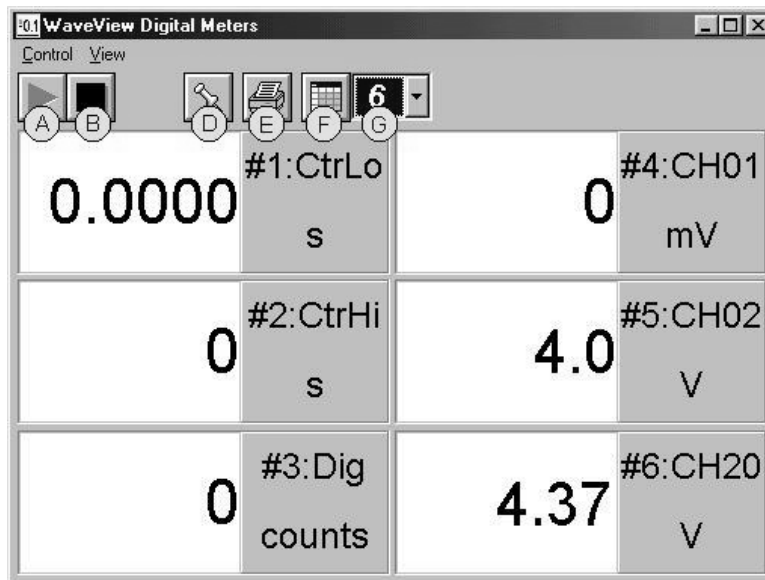
.... for Analog Meters

For Analog Meters, configure the meter settings by first clicking the right mouse button anywhere within the meter display area. A pop-up menu will appear allowing you to reconfigure the meter in regard to scale, limits, channel selection, adding peak hold indicators, etc. Refer to the section entitled *Meters Configuration Menu* for more detail.

Digital Meters



Selecting Digital Meters from *WaveView's* **View** pull-down menu brings up the Digital Meters window to display several channels in numeric format. To activate the display, select the Start button from the toolbar. At least one meter must be assigned to an **active** (On) channel. You can select to view up to 32 meters at a given time.



Digital Meters, Shown with 6 Meters Selected for Viewing

Note: Although the Digital Meters instrument is capable of displaying 6 decimal places, there is not 6-place accuracy in the readings. Due to transducer and transient noises, the accuracy of voltage readings is $\pm 0.02\%$.

Double-clicking the left mouse button in a meters scale area brings up a channel selection pop-up menu. A single-click with the right mouse button in this same area brings up a configuration pop-up menu (see Bar Graph Meters figure, item H). Both of these pop-up menus are discussed in the upcoming section, *Meters Configuration Menu*.

The items in this window are as follows:

| | | | |
|------------------|------------------------|---------------------------|-----------------------------|
| A - Start | C - N/A | E - Print | G - Number of Meters |
| B - Stop | D - Stay On Top | F - Rows x Columns | |

Toolbar items A through G are discussed in more detail in the following section, *Meter Toolbars*.

Configuration Note:

.... For Digital Meters

Configure the Digital Meters settings by first clicking the right mouse button anywhere within the digital meter display area. A pop-up menu will appear allowing you to reconfigure the meter in regard to scale, limits, channel selection, etc. Refer to the section entitled, *Configure Meter Settings* for more detail.

Meter Toolbars

The toolbars for the three meter types are identical, with exception that the Digital Meters toolbar does not have a **Reset Peak Hold button** (item C in the following figure).

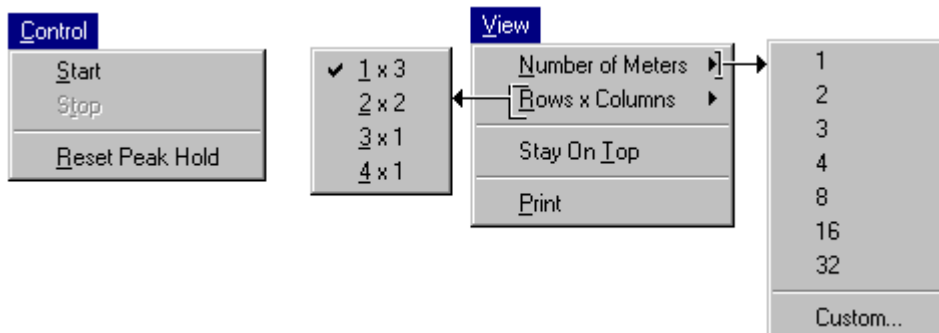


Meters Toolbar Buttons

| Item | Name | Function |
|------|----------------------------------|--|
| A | Start | Starts the meters. |
| B | Stop | Stops the meters. |
| C | Reset Peak Hold Indicator | Resets the floating markers. Upon reset, the markers will instantly adjust to indicate the highest and lowest values reached since the time of the reset. This feature (Item C) does not apply to the Digital Meters. |
| D | Stay On Top (Push pin) | Locks or unlocks the meter window on top of other windows. |
| E | Print | Sends the meter(s) display image to connected printer. |
| F | Rows x Columns | Opens a small menu with “row x column” arrangement options. <i>Example:</i> When the number of meters is 6 the grid options will be: <u>6</u> x1, <u>3</u> x2, <u>2</u> x3, and <u>2</u> x4 with the first number being the number of rows. If you then select <u>3</u> x2, you will have 3 rows of meters with 2 meters per row. |
| G | Number of Meters | Specifies the number of meters to appear on the screen. A maximum number of 32 meters can be selected. |

Meter Pull-Down Menus

The meters windows each have a Control and View pull-down menu, as indicated by the following figure. The functions of these menus can also be implemented by using the toolbar buttons.

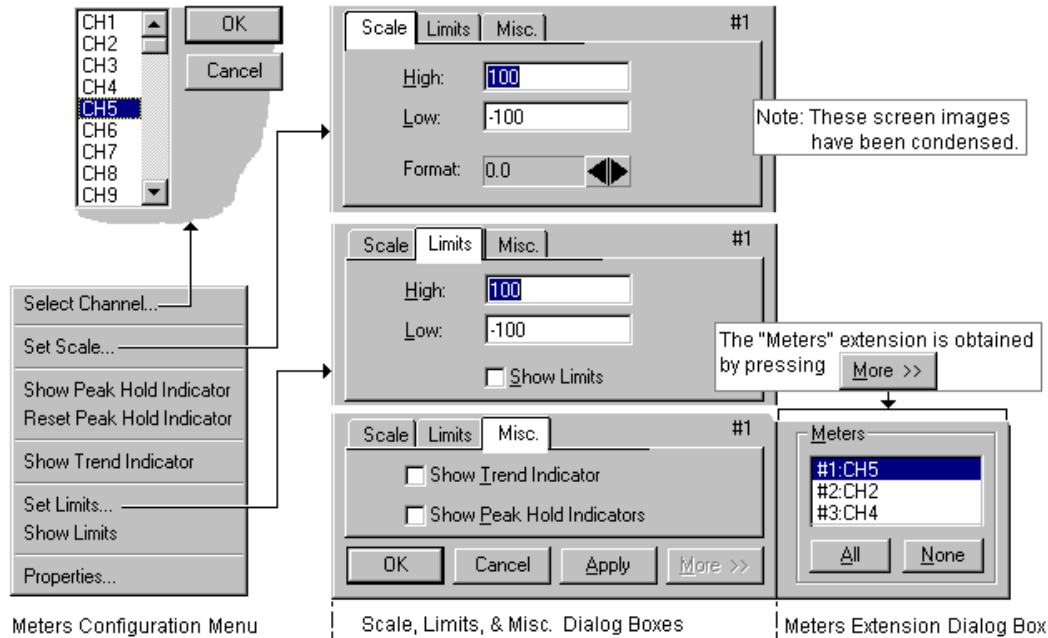


Control and View Pull-Down Menus

Meters Configuration Menu

A meters configuration menu (lower left corner of figure) will appear when you place the mouse pointer over a meter and click the right-hand mouse button. The menu allows you to access various dialog boxes for changing parameters for an individual meter, or simultaneously for a group of meters. The steps for configuring a meter are detailed below.

Note: The *Show Peak Hold Indicator / Reset Peak Hold Indicator* selections are not an option for Digital Meters and do not appear on the configuration window for digital meters.



Meter Configuration Menu and Related Dialog Boxes

Configuring a Meter

1. Bring up the desired meter group (Bar Graph, Analog, or Digital).
2. Place the mouse cursor over the meter you desire to reconfigure.
3. Click on the right mouse button. A Meters Configuration Menu, similar to that in the above figure, will appear.

Note: The *Show Peak Hold Indicator / Reset Peak Hold Indicator* selections are not an option for Digital Meters and do not appear on the configuration window for digital meters.

4. Select the desired option from the meter configuration menu.
5. If a dialog box is required, for example, to change a limit, simply enter in the new value in the appropriate parameter box and press "Apply" or "OK." Pressing "Apply" implements your changes, but keeps the dialog box open, allowing you to make additional changes. Pressing "OK" implements your changes and closes the dialog box.

The following table and the preceding figure serve as a quick reference to meters configuration.

Configure Meter Settings, Function Descriptions

| <u>Function</u> | <u>Description</u> |
|-----------------------------------|---|
| 1 Select Channel | Select a new channel for display. The selected channel will replace the one currently seen in the meter. Note, double-clicking the left mouse button in the meter region will also bring up a dialog box that allows you to select a new channel. |
| 2 Set Scale | Set the high and low points of the scale, as well as define the decimal place format. |
| 3 Show Peak Hold Indicator | Places high and low uni-directional floating markers on the scale to indicate the highest and lowest values reached up to the present time. This feature does not apply to the Digital Meters selection. |
| Reset Peak Hold Indicator | Resets the floating markers. Upon reset, the markers will instantly adjust to indicate the highest and lowest values reached since the time of the reset. This feature does not apply to the Digital Meters selection. |
| 4 Show Trend Indicator | Displays a pointer to indicate the direction of the trend. Note, during rapid meter fluctuations the increase and decrease pointers will appear to blink simultaneously. |
| 5 Set Limits | Provides a way of establishing high and low limit set-points. |
| Show Limits | Displays limits in color (red for high, blue for low). The color is applied to scale regions \geq the set limit values. For Digital Meters, the limits are indicated by red numbers and an upper red bar for hitting or exceeding the high limit; and blue numbers and a lower blue bar when reaching or exceeding the low limit. |
| 6 Properties | Allows setting and showing limits, as well as opening the Scale dialog box. |

You can access a different dialog box from the one initially selected. For example, from the Set Scale dialog box you can select Limits to access the Set Limits/Show Limits display, as well as select “Misc.” to “Show Trend Indicator” and “Show Peak Hold Indicators.” You can use the Simulated Instrument mode to familiarize yourself with various meter configuration options.



WaveCal

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[A Note Regarding WaveView and Calibration Tables 8](#)

Prior to shipment, each WaveBook-related product (including WavePort) is factory-calibrated to its rated accuracy. Depending on your operating guidelines, your equipment will require periodic calibration to ensure this accuracy is maintained. We recommend that you have your WaveBook system calibrated at least once a year.



- **Calibration is required whenever a change is made to the signal path, for example, adding a WBK11 to the system.**
- **WavePort Applications: Use of WaveCal for WavePort is not recommended, consult the factory regarding WavePort calibration.**
- **WBK17 Applications: WaveCal is not supportive of WBK17. Consult the factory regarding WBK17 calibration.**

Overview

WaveCal is a Windows-based application intended for periodic calibration of WaveBook systems. The calibration process makes use of internal references and a voltage source (such as a calibrator) capable of supplying all required voltages for WaveBook's channel ranges.

For each channel, WaveCal uses 2-point linear approximation to calculate Gain and Offset Errors for every range. WaveCal is installed in the system's host PC and its icon is generated in the *WaveBook* program group during installation of WaveBook software.

You can launch WaveCal from the WaveBook software program group.

The calibration tables are stored physically in the WaveBook. The calibration constants are also stored within the WBK10 series expansion chassis and the WBK11 simultaneous-sample-and-hold card.

Configuring System Calibration

Upon loading, *WaveCal* performs a system inventory of all equipment connected to the WaveBook main chassis. For each WaveBook, the system inventory includes any option cards installed and the date that the unit was last calibrated.

WaveCal's *WaveBook Calibration Tool* window (following figure) contains columns that display the *Module Type*, *Option* [option cards] and *Last Cal* [last known calibration date]. Two additional columns provide a means of selecting *Calibrate* and *Concurrent*. An explanation of these columns follows.

- ***Module Type*** displays the type of WaveBook main chassis found at the specified address. Valid entries for this column include modules such as WaveBook/512, WaveBook/516, and WBK10.
- ***Option*** displays the type of card (if any) that is installed on the corresponding module. Valid entries for this column include WBK11, WBK12 and WBK13.

| Mod # | Module Type | Option | Last Cal | Calibrate | Concurrent |
|-------|--------------|--------|------------|-------------------------------------|--------------------------|
| 0 | WaveBook/516 | | 03/20/2000 | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 1 | | | | <input type="checkbox"/> | <input type="checkbox"/> |
| 2 | | | | <input type="checkbox"/> | <input type="checkbox"/> |
| 3 | | | | <input type="checkbox"/> | <input type="checkbox"/> |
| 4 | | | | <input type="checkbox"/> | <input type="checkbox"/> |
| 5 | | | | <input type="checkbox"/> | <input type="checkbox"/> |
| 6 | | | | <input type="checkbox"/> | <input type="checkbox"/> |
| 7 | | | | <input type="checkbox"/> | <input type="checkbox"/> |
| 8 | | | | <input type="checkbox"/> | <input type="checkbox"/> |

WaveCal – WaveBook Calibration Tool

Note: If no option cards are used, the column remains blank for the applicable module.

- *Last Cal* displays the date the system was last calibrated. The date indicates when calibration constants were last written to WaveBook's internal EEPROM.
- *Calibrate*: Checking the *Calibrate* check-box informs *WaveCal* that the applicable module and its related options are to be calibrated for at least one channel.
- *Concurrent*: Checking the *Concurrent* check-box informs *WaveCal* that all module channels are to be calibrated simultaneously, instead of individually. If this box is not checked the 2-point calibration process calibrates each channel (of the applicable module) on an individual basis.



By using the *Concurrent* method you will greatly reduce your system's calibration time.

Make sure all of the system modules and options are properly connected and correctly listed in the *WaveBook Calibration Tool* window. After this verification you may select the module(s) to calibrate and whether their channels are to be individually or concurrently calibrated.

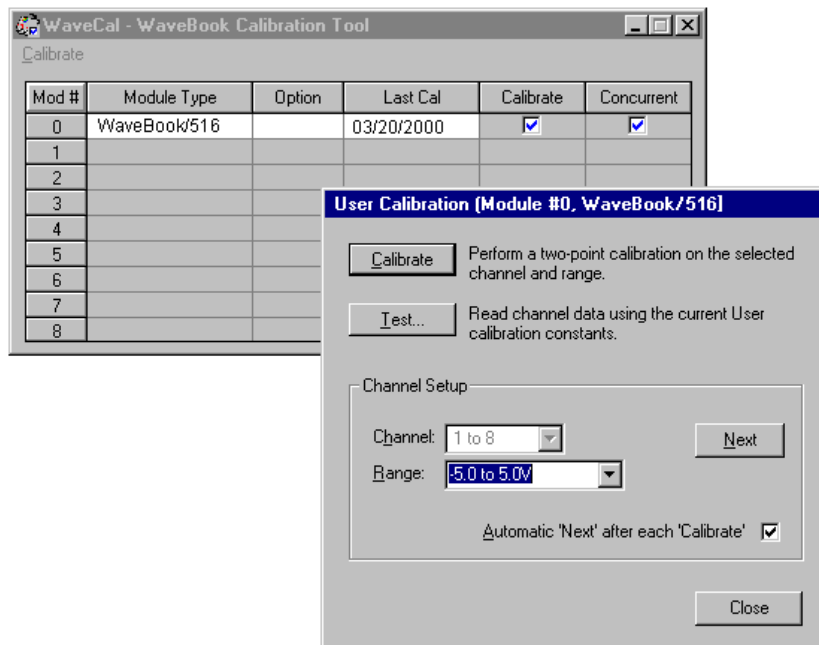
Performing System Calibration



The Calibrate Pull-Down Menu

Open the Calibrate pull-down menu and click *Start* to access a *User Calibration* box for the selected module (see following figure).

Aspects of the *User Calibration* dialog box are discussed on the following page.



WaveCal's WaveBook Calibration Tool and User Calibration Box

- **Title Bar:** Identifies the module number and module type.
- **Calibrate** [button]: Brings up the *Calibrate Channel* box (see following figure). *Calibrate* causes *WaveCal* to perform a two-point calibration on the selected channel and range as identified in the *Channel Setup* portion of the *User Calibration* box.
- **Test** [button]: Reads channel data using the current *User Calibration Table* or the *Factory Calibration Table* (whichever is selected). *Test* is used to verify proper calibration by checking a channel reading with a known source value. The following page contains more detailed information and includes a screen shot.
- **Channel:** Identifies the channel (or channels, if concurrent) to be calibrated or tested. The pull-down arrow provides a means of selecting a specific channel when concurrent is not selected.
- **Range:** Identifies the range and provides a means of selecting a specific range.
- **Next** [button]: Proceeds to the next calibration or test. A check-box provides a means to choose an “automatic next” to occur after each calibration, instead of needing to manually click the “Next” button.



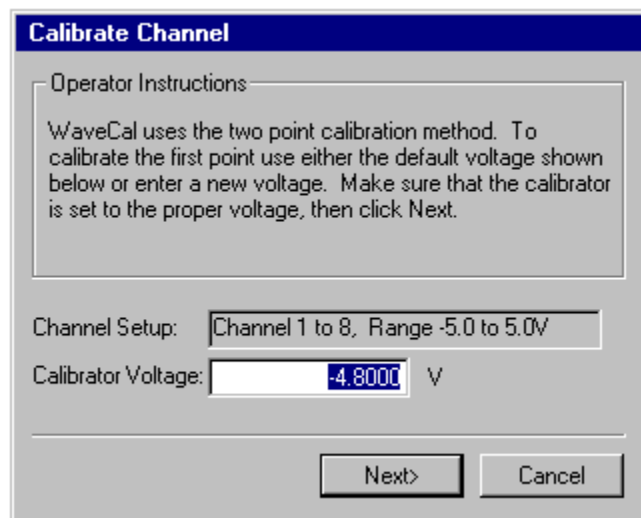
You can use the <ENTER> key of your host PC’s keyboard in place of the computer screen’s *Calibrate* or *Next* button.

Calibrate [button]

Brings up the *Calibrate Channel* box (see following figure). *Calibrate* causes *WaveCal* to perform a two-point calibration on the selected channel and range, as identified in the *Channel Setup* portion of the *User Calibration* box (previous figure).

WaveCal prompts you to apply a voltage source to the appropriate channel at the level indicated. After the voltage level has been applied, click the *Next* button to begin the calibration of the first point. *WaveCal* will then prompt you to apply a new voltage level to the channel (for calibration of the second point). After applying the second-point voltage value, click the *Next* button. The 2-point calibration for the selected channel(s) is now complete.

Note that *WaveCal* automatically updates the current calibration parameters, depending on their current settings and user events.

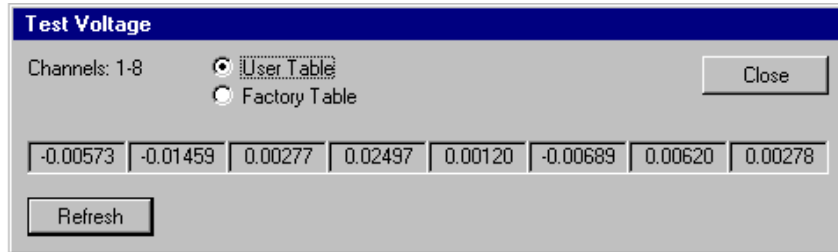


The Calibrate Channel Box (Appears After Clicking the Calibrate Button)

Test [button]

The test button can be used to test channel voltage levels both before and after calibration. The command causes *WaveCal* to display the current voltage level for the selected channel(s). If *concurrent* calibration has been selected, then the voltage levels for all 8 channels will be displayed at once, as indicated in the following figure. Otherwise, only the voltage level for the selected individual channel will be displayed.

A sample test is shown below. Note that readings from the User Calibration Table can be compared with those resulting from the Factory Calibration Table, by toggling between the two radio button options.



WaveCal - Test Voltage Dialog Box with Calibration Results for the “Concurrent” Method

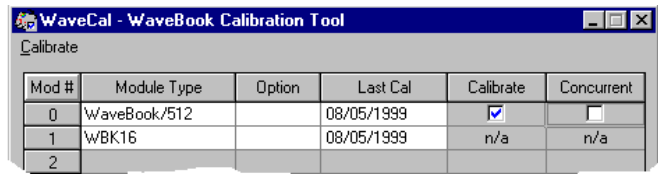
A Calibration Example

The following example includes screen shots taken from calibration of a WaveBook/512. The calibration process will be the same for other WaveBook systems.

The example makes use of the *non-concurrent* mode for two channels. With *WaveCal* running, the steps are as follows:

1. We have placed a check in the Calibrate box for Module #0, a WaveBook/512 (in this example).

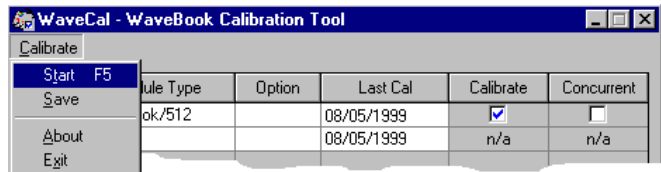
The module is now selected for calibration.



Selecting a Module to Calibrate

2. We pull down the Calibrate menu and select Start. Note that the <F5> key can also be used.

The User Calibration Dialog Box appears as seen in the figure for step 3.



Selecting Start from the Calibrate Pull-Down Menu

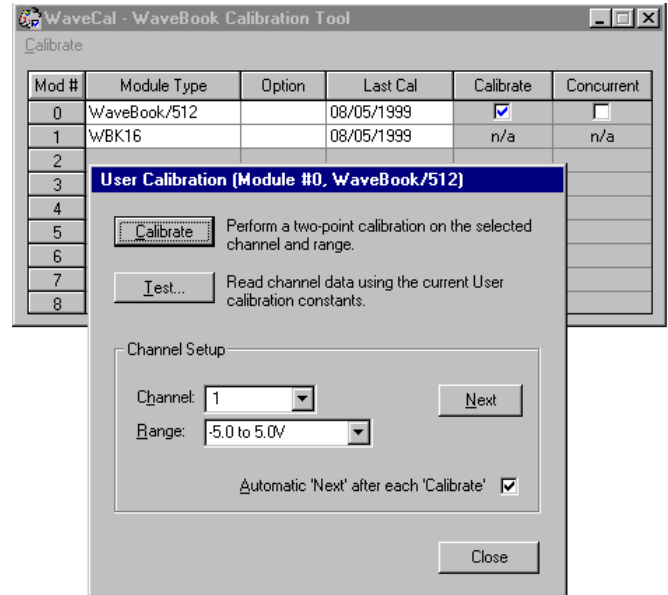
- The User Calibration dialog box indicates the Channel and the Range that are currently scheduled for calibration.

Notice that we have elected to use the Automatic “Next” feature by placing a checkmark in the feature’s selection box.

At this point, click your keyboard’s <ENTER> key to continue.

Note that using your keyboard’s <ENTER> key has the same result as if you were to click on the “on-screen” Calibrate button.

After hitting <ENTER>, the Calibrate Channel box appears for First Point calibration (see figure for step 4).



The User Calibration Dialog Box Showing Channel 1, Range –5.0 to 5.0 V Currently Scheduled for Calibration

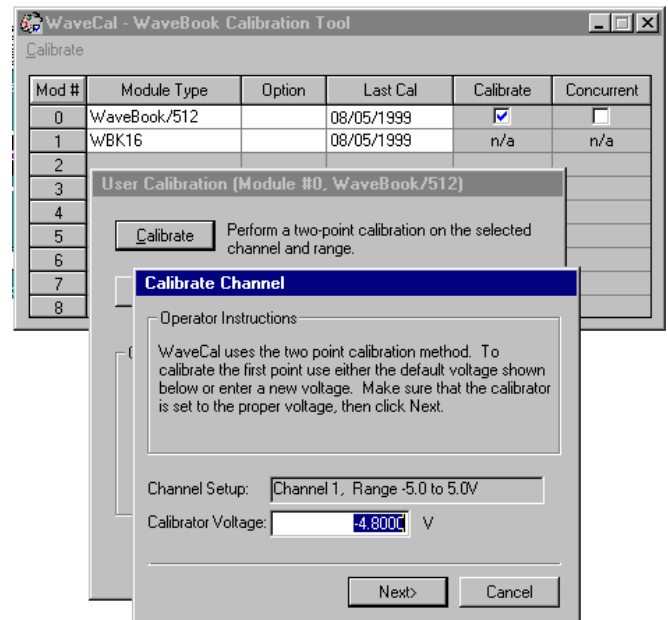
- Adjust the Calibrator Voltage to the recommended value.

In the example we have a range of -5.0 to +5.0 Volts.

We have set our Calibrator Voltage to -4.8 Volts, as recommended.

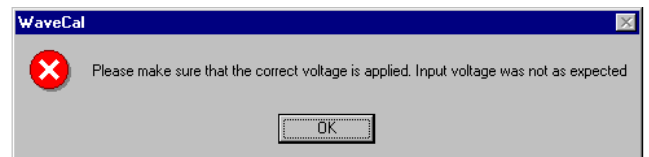
- Hit <ENTER> on your keyboard, or click on the screen’s Next button.

The Calibrate Channel box appears for the “Second Point” as indicated in the step 6 figure.



Channel 1, Range –5.0 to 5.0 V Scheduled for First Point Calibration Using –4.8 V

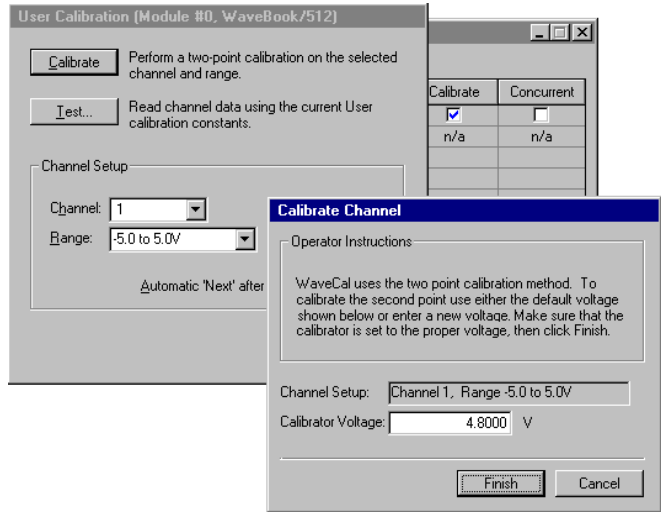
Note: If you input an unacceptable voltage value, such as -4.8 Volts when +4.8 Volts is expected, WaveCal notifies you with a message box, as seen to the right.



Message Resulting from Attempting to Enter an Unacceptable Voltage

- Apply the recommended calibrator voltage for the range, then hit <ENTER> on the keyboard (or the Finish button on your screen).

WaveCal is now ready for the “first point” calibration of the next range (as indicated by the figure for step 7.)

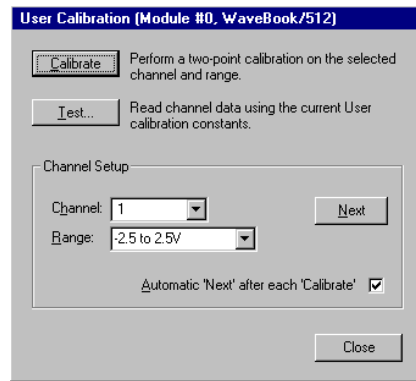


**Channel 1, Range -5.0 to 5.0 V
Scheduled for
Second Point Calibration using +4.8 V**

- WaveCal displays the channel setup for the next two-point calibration. In our example this is:
Channel 1, range -2.5 to +2.5 Volts.

- Hit <ENTER> on your keyboard, (or use an on screen button if preferred).

After hitting <ENTER>, the Calibrate Channel box appears for First Point calibration (see figure for step 9).



**The User Calibration Dialog Box Showing
Channel 1, Range -2.5 to 2.5 V
Currently Scheduled for Calibration**

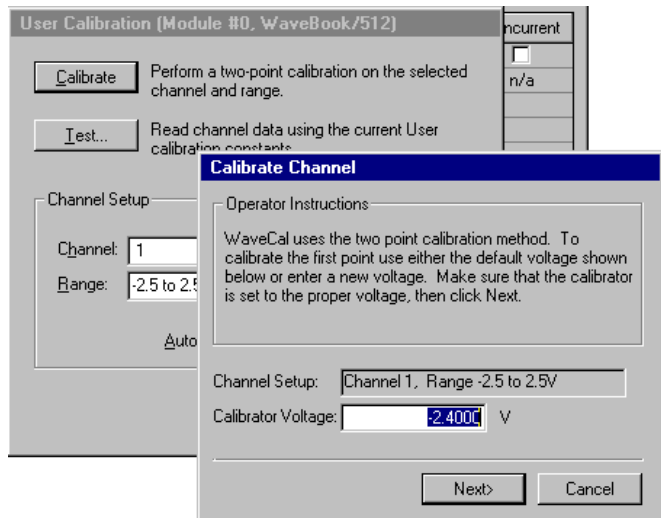
- Adjust the Calibrator Voltage to the recommended value.

In the example we have a range of -2.5 to +2.5 Volts.

We have set our Calibrator Voltage to -2.4 Volts, as recommended.

- Hit <ENTER> on your keyboard, or click on the screen’s Next button.

The Calibrate Channel box appears for the “Second Point” as indicated in the step 11 figure.

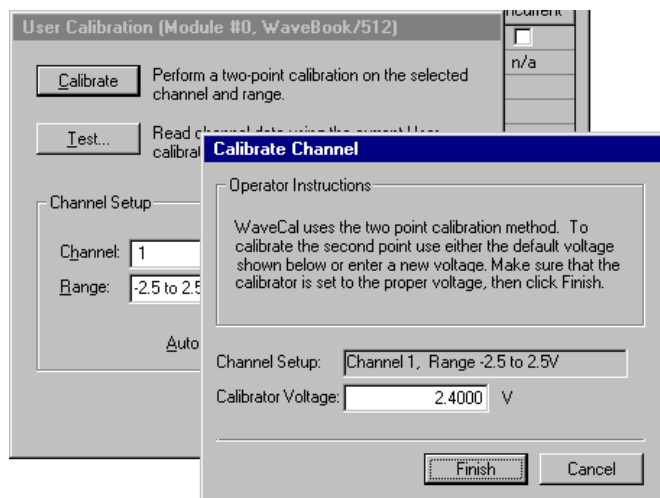


**Channel 1, Range -2.5 to 2.5 V
Scheduled for
First Point Calibration Using -2.4 V**

- Apply an acceptable “Second Point” calibrator voltage for the range, then hit <ENTER> on the keyboard (or the Finish button on your screen).

WaveCal is now ready for the “first point” calibration of the next range.

- Continue this method for the remaining ranges and for each channel. Remember, if Concurrent is selected (on the Workbook Calibration Tool window, the Channel box will show 1-8 and the eight channels will be calibrated simultaneously.



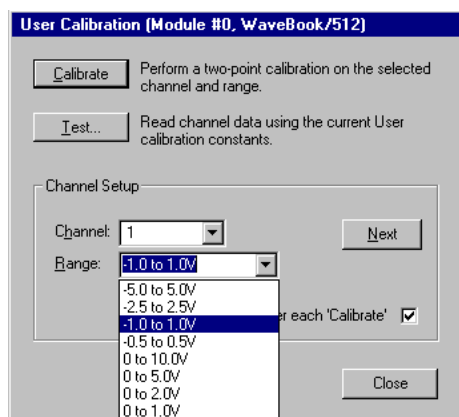
**Channel 1, Range -2.5 to 2.5 V
Scheduled for
Second Point Calibration Using +2.4 V**



WaveCal allows you to select individual channels and ranges for calibration. For example:

If you have a channel with questionable values for one range, but all other channels and ranges appear fine, you can:

- Use “non-concurrent” (no check-box in Concurrent)
- Select the applicable channel.
- Select the range that is in question.
- Calibrate for First Point.
- Calibrate for Second Point.



**Channel 1, Range -1.0 to 1.0 V
Selecting a Specific Channel and Range for Calibration**

A Note Regarding WaveView and Calibration Tables

In this section of the document module we are discussing *WaveView*, not *WaveCal*.

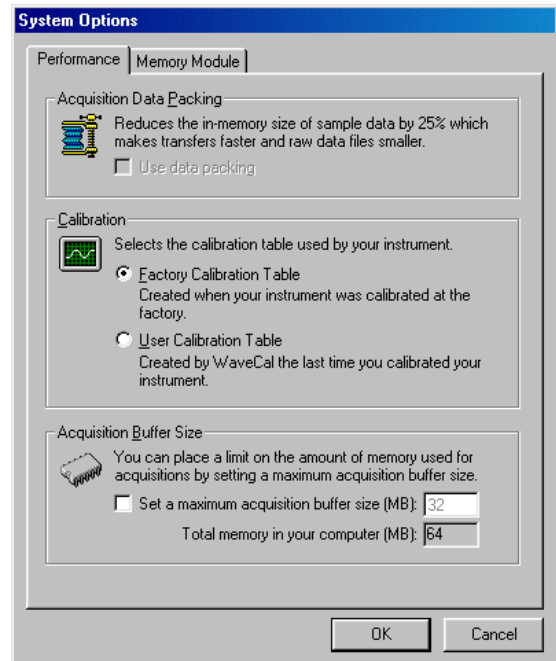
WaveView Channel Readings can be adjusted from either of two calibration tables (Factory or User). The determination is made by Selection in *WaveView*'s *System Options* dialog box. System Options is accessed from the System pull-down menu in *WaveView*'s menu toolbar.

The Calibration Table selected does not affect *WaveCal*.



Reference Note:

If needed, refer to the *WaveView Document Module* regarding selection of the User Calibration Table.



WaveView Channel Readings can be adjusted from
Either of Two Calibration Tables