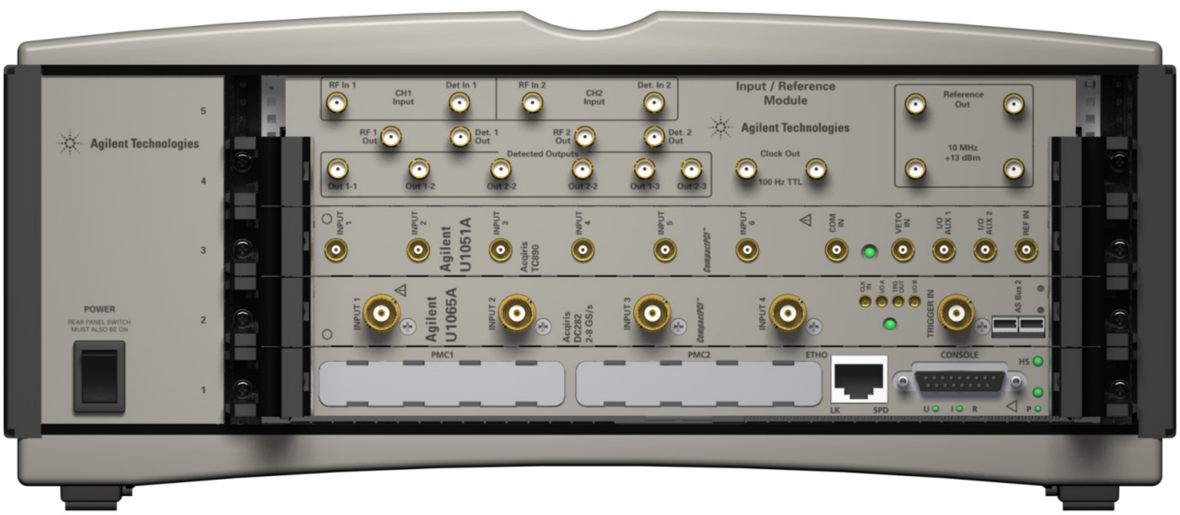
Agilent Technologies

Z2090B-170 (-171)

Pulse Analyzer System (PAS)



User’s Manual

Rev D

Agilent Technologies

User's Manual Outline

1.0 Overview – The Z2090B-170 Pulse Analyzer System (PAS) is a Pulsed and Pulsed RF analyzer system designed to provide precise timing measurements of RADAR and other pulsed waveforms. The PAS base configuration will provide timing measurements using a Time to Digital Converter (TDC) module to measure edge event times with 50ps accuracy.

Optionally a digitizer module (PN Z2090B-171) will provide a 10-bit 8Gsa/sec Analog to Digital Converter (ADC) module to complement the timing measurements of the base system with the ability to provide amplitude, frequency, and modulation information on pulsed RF or standard RF signal inputs.

Figure 1.0-1 below shows a partial block diagram of the PAS hardware. The user applies a pulse, detected RF pulse, or pulsed RF input signal to the Input Reference Module (IRM). The IRM will then route the input signal to the TDC and optional ADC modules to perform the pulse analysis measurements. The IRM also has internal RF detectors to perform signal detection or these detectors may be bypassed depending on the signal routing (see section 2.0 for details).

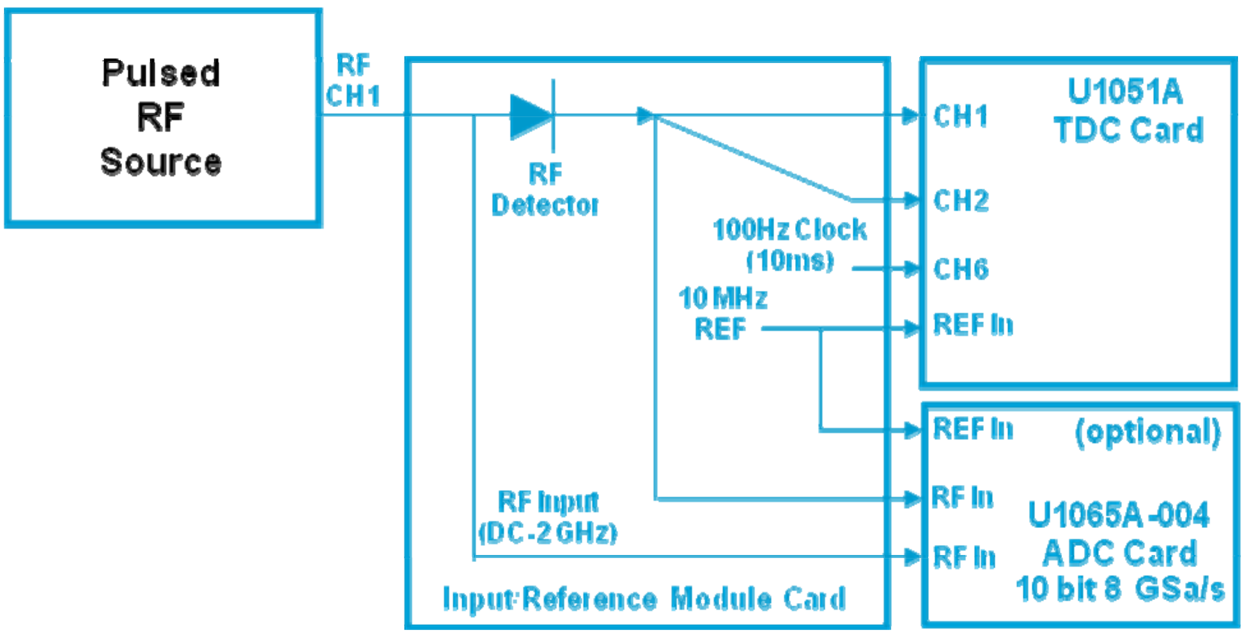


Figure 1.0-1 – PAS Block Diagram

The IRM also provides a very low phase noise 10 MHz clock reference to the TDC and ADC modules. Additional 10 MHz ports are available for external equipment. The TDC module performs the time measurements of the pulse edges, and the optional ADC module will sample the input RF signal up to 2 GHz input frequency to provide frequency, RF power, and RF power versus time measurements. The ADC is also compatible with the 89601A Vector Signal Analysis (VSA) software to provide extremely detailed time, frequency, and modulation domain signal analysis.

PAS Measurements – Figure 1.0-2 below shows how the TDC module makes measurements on the pulsed input signals. TDC channel 1 is assigned to the leading edge of a pulsed waveform and channel 2 is assigned to the trailing edge of the pulse. Pulse polarity can be set to either positive or negative via the PAS control software. Pulse width measurements are made by subtracting channel 2 from channel 1 (shown below as T2-T1). Pulse Repetition Interval (PRI) or period measurements are made by comparing subsequent channel 1 measurements (shown below as T3-T1).

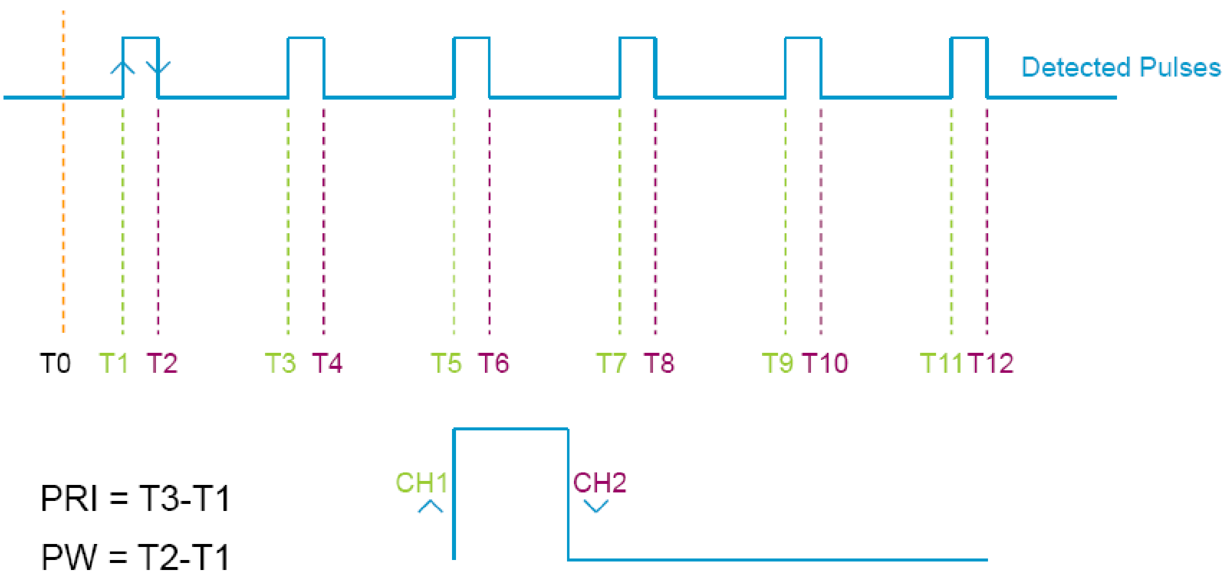


Figure 1.0-2 – PAS Measurement of Pulses

The 3rd and 4th inputs of the TDC module perform the same function as the input channels 1 and 2 for a second full measurement port. For notation purposes RF1 refers to the combination of TDC channels 1 and 2 and RF2 refers to the combination of TDC channels 3 and 4. Once the data is collected from the TDC module, the PAS system presents the measured data in the following formats:

- Pulse Envelope vs Time
- PRI vs Time
- PW vs Time
- PRI Histogram and Statistics
- PW Histogram and Statistics
- Frequency vs Time from Channels 1,2,3, and 4 (RF1 & RF2)
- Raw Time Data from Channels 1,2,3, and 4 (RF1 & RF2)

The raw time data is available to be exported to a remote computer or stored in a file on the PAS controller to be analyzed off line.

ADC Measurements (Option -171) – Adding the 4 channel ADC module will add in the following additional measurements:

- Volts vs Time
- RF Power vs Time
- RF Spectrum vs Frequency
- Compatibility with the 89601A VSA Software

The core option 171 ADC capability and its corresponding control interface offers a limited set of analysis capability. For detailed digitizer signal analysis measurements the VSA software (89601A or Z2090B-172) provides this capability. Refer to the documentation included with the 89601A VSA software for details on this software solution.

2.0 Hardware Configuration

The PAS system leverages from the U1051A (TC890) TDC module and the U1065A-004 (DC282) ADC module. Refer to Agilent documents U1092-90017 and U1092-90004 for instructions on installation and replacement of the installed modules in the PAS system. This section will describe the specific configuration issues as they pertain to the PAS system. The manuals mentioned above also provide specifications and descriptions of each of the key modules installed in the PAS system.

2.1 Hardware Components

The PAS system Z2090B-170 includes the following hardware components:

- 1 - 5 Slot cPCI Mainframe
- 1 - Embedded PC Controller Module (1cPCI Slot)
- 1 - U1051A TDC Module (1cPCI Slot)
- 1 - Input Reference Module (2cPCI Slots)
- 1 – RF PAS Cable Set

The PAS system with optional ADC (Z2090B-171) includes the following hardware components:

- 1 - 5 Slot cPCI Mainframe
- 1 - Embedded PC Controller Module (1cPCI Slot)
- 1 - U1051A TDC Module (1cPCI Slot)
- 1 - Input Reference Module (2cPCI Slots)
- 1 - U1065A-004 ADC Module (1cPCI Slot)

2.2 Z2090B-170 TDC Configuration Setup

Pulsed RF Signal Routing

Figure 2.2-1 below shows the cable configuration when applying an external pulsed RF signal. Connecting into the RF in 1 input port on the IRM will route the signal through the internal RF Detector contained inside the IRM. Also shown is the external trigger input port for the TDC module. This trigger is optional since the system may be triggered using a software trigger from the controlling software. If hardware triggering is used, the trigger input is routed to the TDC COM IN port. The PAS cable set includes cables to perform module interconnect.

TO	FROM	Signal Description
TDC CH1 IN	IRM Out 1-1	CH1 TDC Input Leading Edge
TDC CH2 IN	IRM Out 1-2	CH2 TDC Input Trailing Edge
TDC CH3 IN	IRM OUT 2-1	CH3 TDC Input Leading Edge
TDC CH4 IN	IRM OUT 2-2	CH4 TDC Input Trailing Edge
TDC CH6 IN	IRM 100Hz TTL	10 mS Absolute Clock Reference
TDC REF IN	IRM 10MHz #1	Clock Reference for TDC Module

IRM DET IN 1	IRM DET OUT 1	Routing of Detected Signal #1
IRM DET IN 2	IRM DET OUT 2	Routing of Detected Signal #2

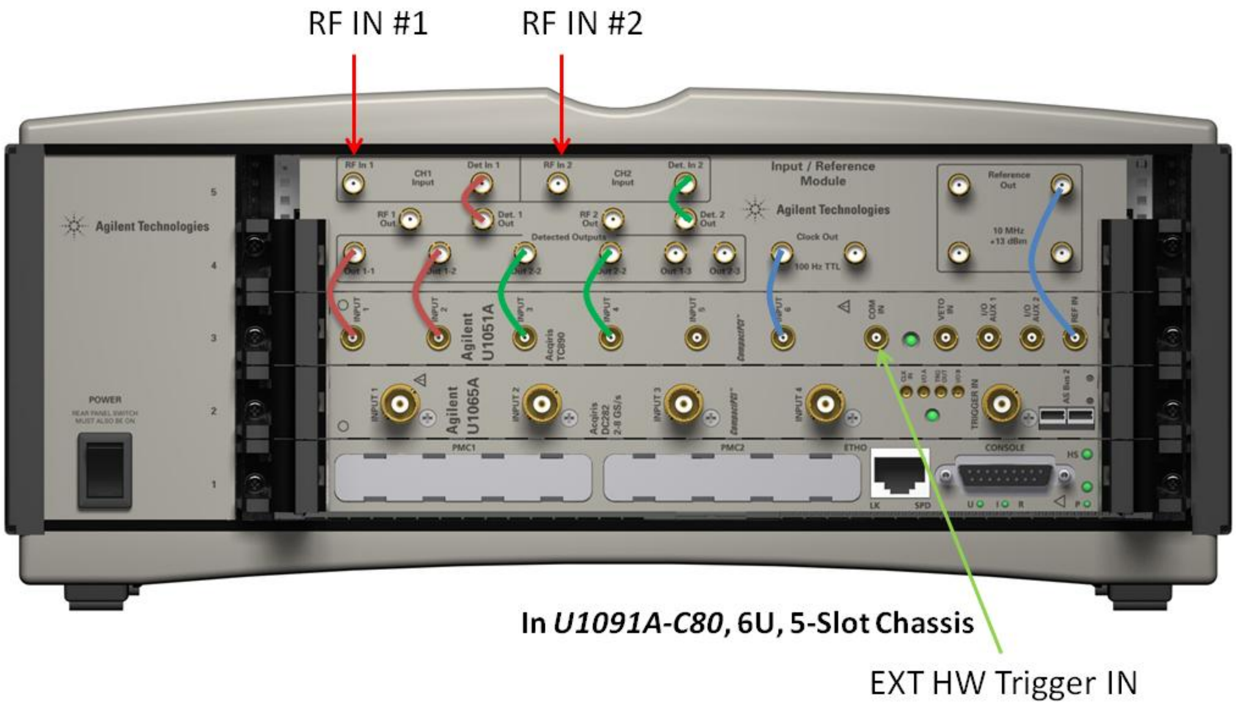


Figure 2.2-1 – PAS Cable Configuration for Pulsed RF Measurements

Externally Detected Pulse or Pulsed Signal Routing

Figure 2.2-2 below shows the cable configuration when the user has already detected the pulsed RF signal (i.e. detected video) or if the user is analyzing pulses and not pulse modulated RF signals. In this configuration, the user provides the signal input after the internal detector(s) contained in the IRM. Also shown is the external trigger input port for the TDC module. This trigger is optional since the system may be triggered using a software trigger from the controlling software. If hardware triggering is used, the trigger input is routed to the TDC COM IN port. The PAS cable set includes cables to perform module interconnect.

TO	FROM	Signal Description
TDC CH1 IN	IRM Out 1-1	CH1 TDC Input Leading Edge
TDC CH2 IN	IRM Out 1-2	CH2 TDC Input Trailing Edge
TDC CH3 IN	IRM OUT 2-1	CH3 TDC Input Leading Edge
TDC CH4 IN	IRM OUT 2-2	CH4 TDC Input Trailing Edge
TDC CH6 IN	IRM 100Hz TTL	10 mS Absolute Clock Reference
TDC REF IN	IRM 10MHz #1	Clock Reference for TDC Module

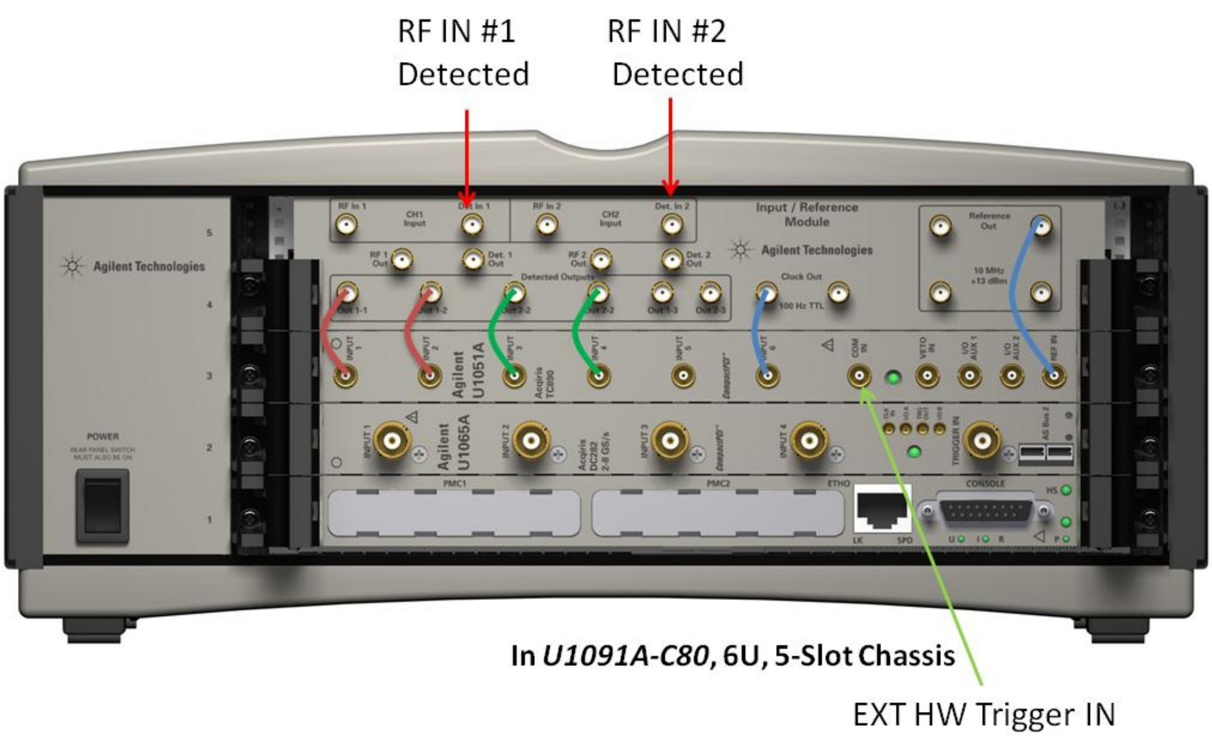


Figure 2.2-2 – PAS Cable Configuration for Pulse and Detected RF Pulse Inputs (As Shown: detector jumpers removed)

Figure 2.2-3 below shows a partial block diagram (RF1 Path Only) of the IRM to help visualize the signal flow within this module.

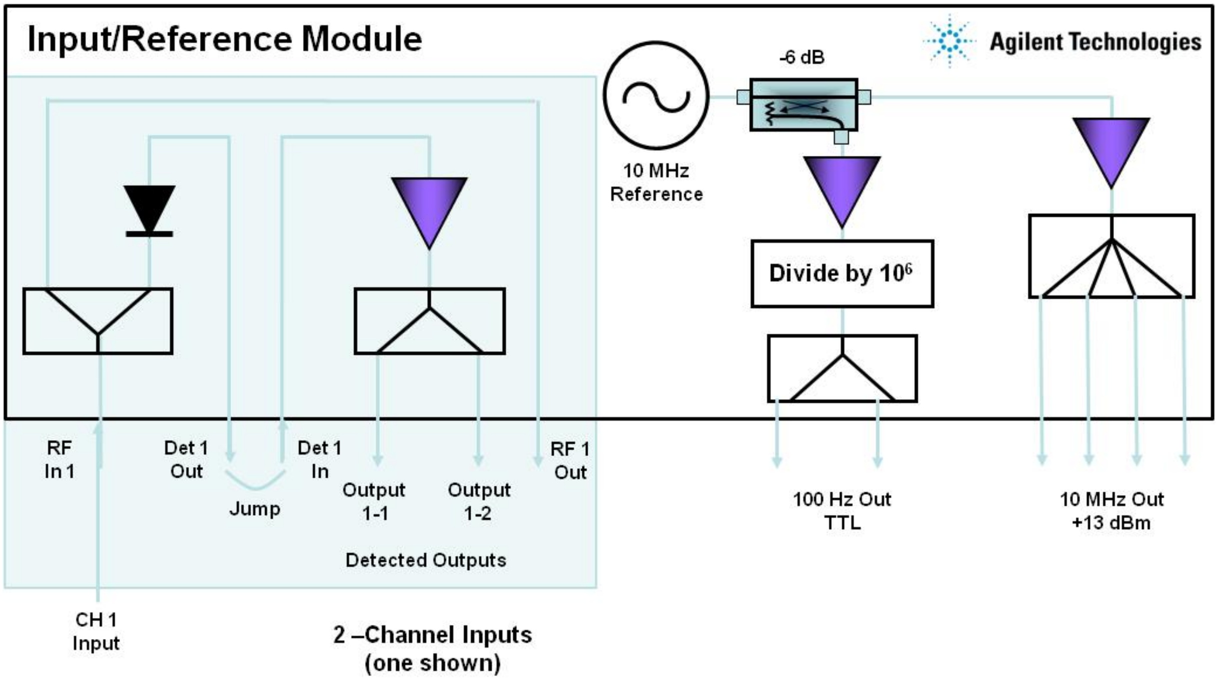


Figure 2.2-3 – Input Reference Module Block Diagram

2.3 Z2090B-171 ADC Configuration Setup

Pulsed RF Signal Routing

Figure 2.3-1 below shows the cable configuration when applying an external pulsed RF signal with the added option 171 ADC. This system is configured very similarly to the previous configurations; however, there is an RF output from the IRM that is routed to the channel inputs of the ADC. The user connects the test signal into RF in 1 input port on the IRM as before. Also shown is the external trigger input port for the TDC module and ADC module. These triggers are optional since the system may be triggered using a software trigger from the controlling software. If hardware triggering is used, the trigger input is routed to the TDC COM IN port and the ADC TRIGGER IN port. The PAS cable set includes cables to perform module interconnect.

TO	FROM	Signal Description
TDC CH1 IN	IRM Out 1-1	CH1 TDC Input Leading Edge
TDC CH2 IN	IRM Out 1-2	CH2 TDC Input Trailing Edge

TDC CH3 IN	IRM OUT 2-1	CH3 TDC Input Leading Edge
TDC CH4 IN	IRM OUT 2-2	CH4 TDC Input Trailing Edge
TDC CH6 IN	IRM 100Hz TTL	10 mS Absolute Clock Reference
TDC REF IN	IRM 10MHz #1	Clock Reference for TDC Module
IRM DET IN 1	IRM DET OUT 1	Routing of Detected Signal #1
IRM DET IN 2	IRM DET OUT 2	Routing of Detected Signal #2
ADC CH1 IN	IRM RF1 OUT	ADC Channel 1 Input RF
ADC CH2 IN	IRM RF2 OUT	ADC Channel 2 Input RF
ADC CLK IN	IRM 10MHz #2	10 MHz External Clock Source

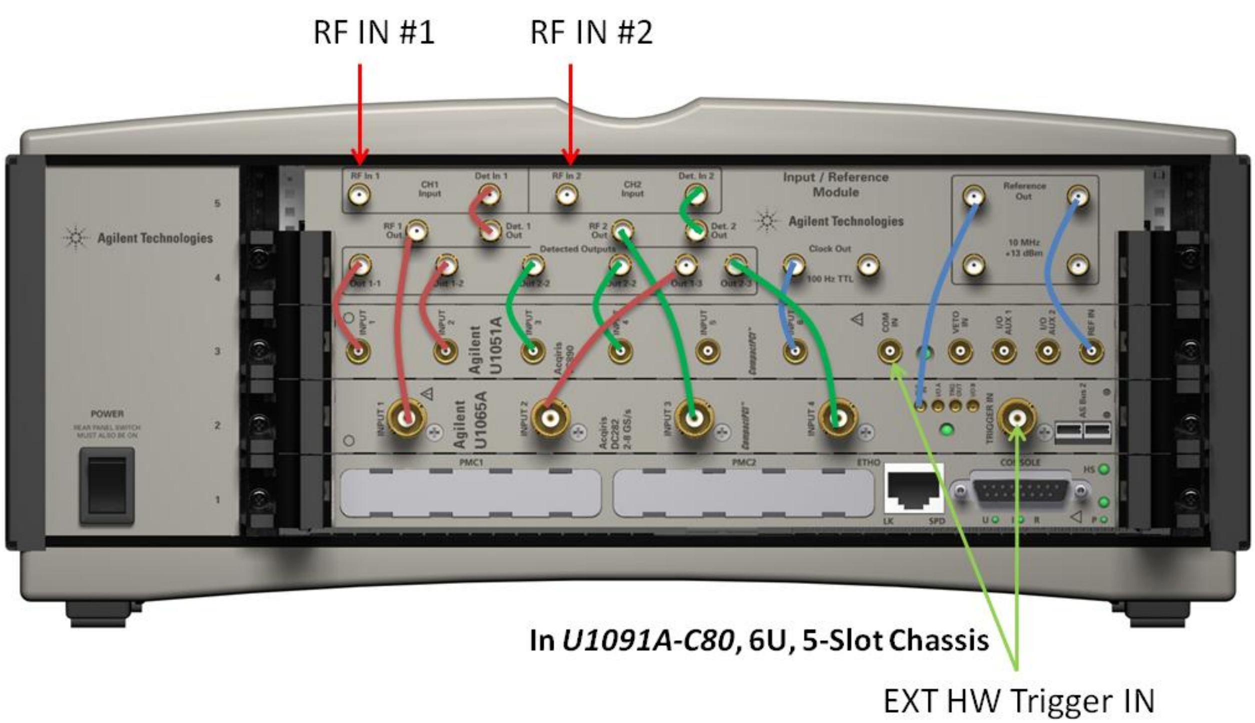


Figure 2.3-1 Interconnect Diagram for the Z2090B-171 Configuration

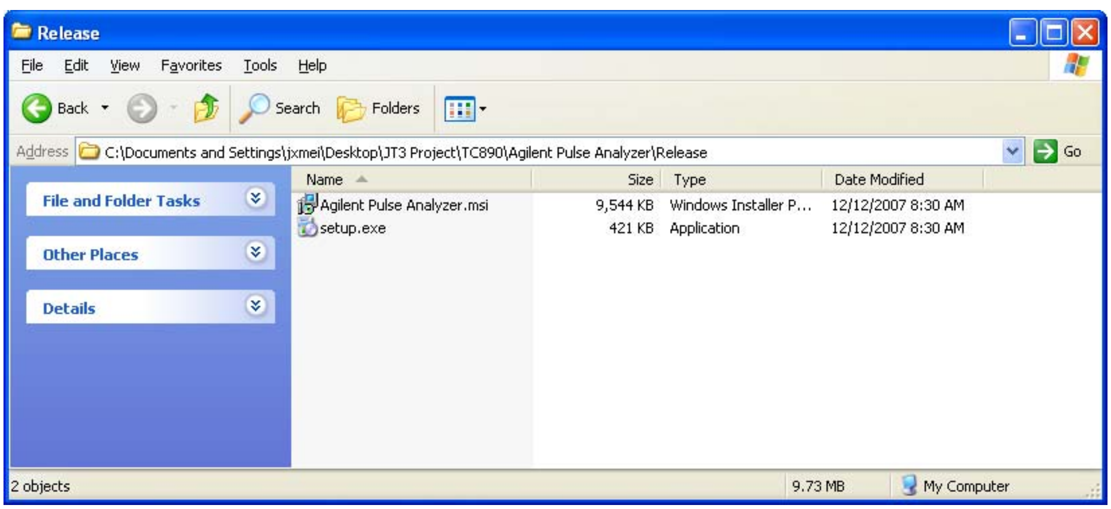
3.0 Software Installation

The PAS system is delivered with all software installed and configured for the hardware set installed. If, however, a system needs to be rebuilt or modified a complete set of instructions follows for software installation.

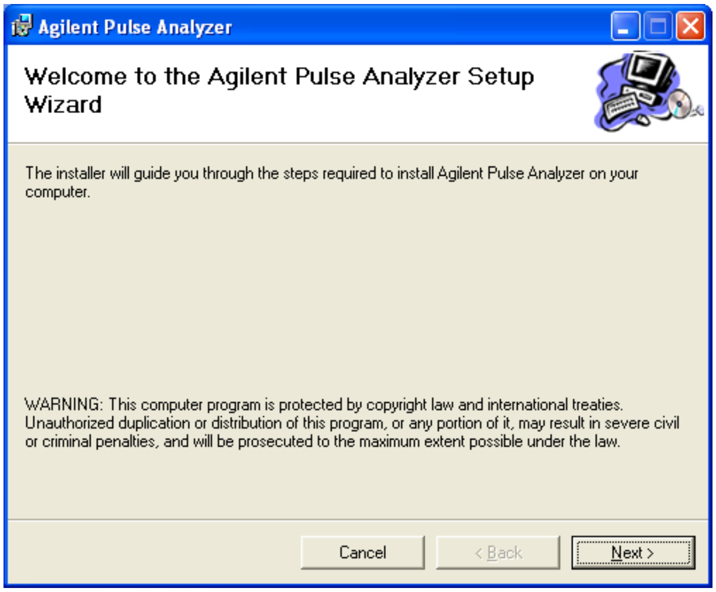
3.1 Z2090B-170 TDC Software Setup

The software setup for the PAS system leverages from the U1051A (TC890) TDC module and the U1065A-004 (DC282) ADC module. Refer to Agilent documents U1092-90017 and U1092-90004 for instructions on software setup and installation of the Agilent drivers and initial OS configuration of the embedded PC controller. Once the installation steps are completed and the drivers are installed for the hardware follow the procedure outlined below to configure the PAS software.

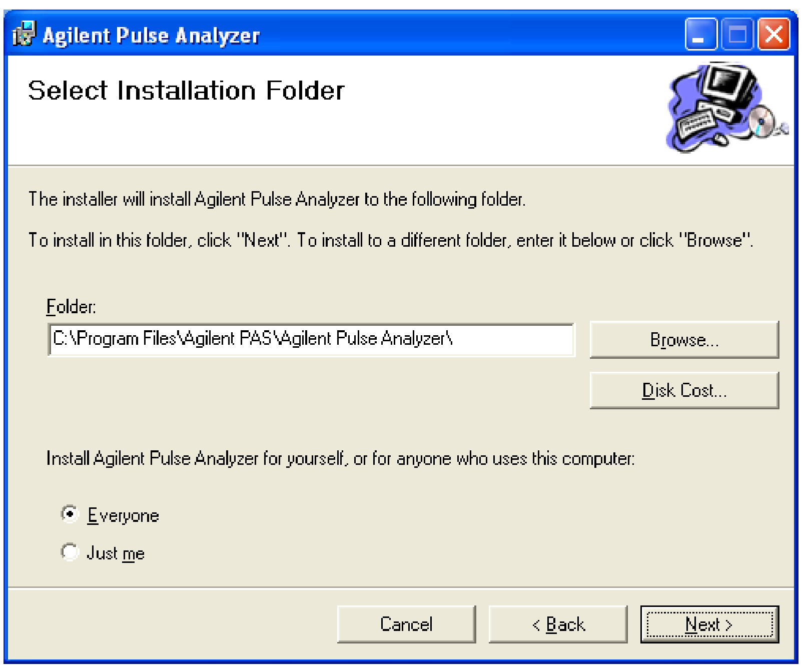
1) Using the delivered PAS Software installation CD insert this CD into a PC computer that contains a CD drive and a free USB port.
2) Copy the two files (Agilent Pulse Analyzer.msi & setup.exe) to a USB memory stick so that they can be transferred to the embedded PC workstation on the PAS mainframe. The embedded controller does not contain a CD drive thus the installation media (if not already present on the system) needs to be transferred via USB memory stick or using the Local Area Network (LAN) interface.
3) Double click on the setup.exe application and it will begin the installation process for the software.



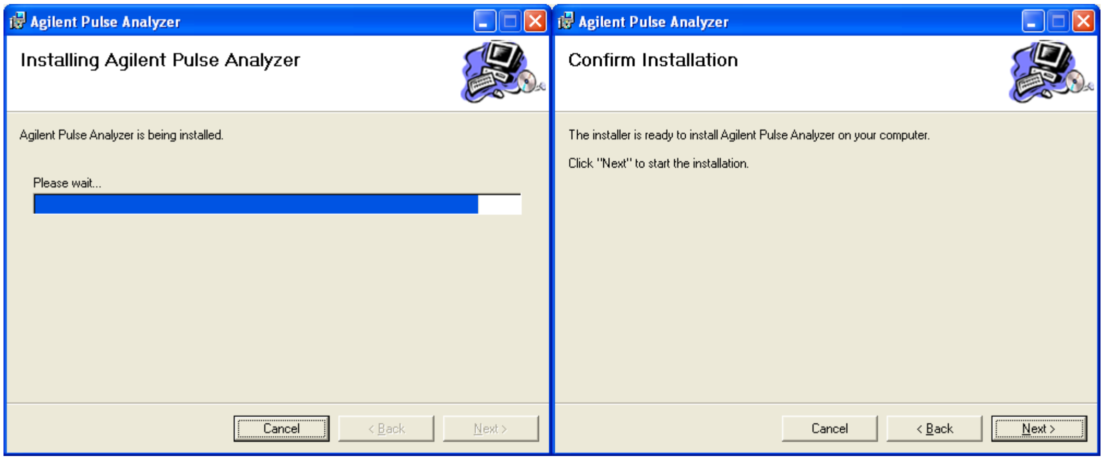
4) When the installer launches click Next (see below)

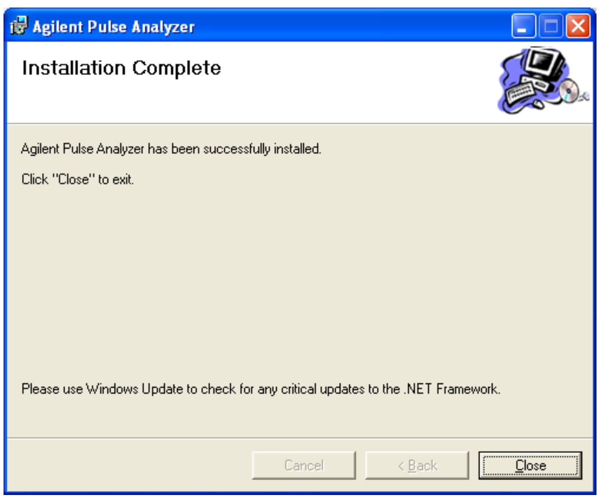


5) On the Select Installation Folder prompt (below) **leave all of the default choices** selected and click Next.



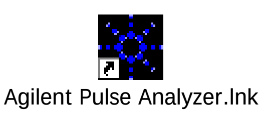
6) On the next menu click the Next Button (below) and the software will complete installation





At this point the software is installed.

There should now be a shortcut on the desktop that looks like this:



Licensing the PAS Software –

Now that the software is installed, it needs to be licensed against the hardware that is installed in the mainframe. This license file needs to reside in the following directory on the PAS embedded PC controller:

C:\Program Files\Agilent PAS\Agilent Pulse Analyzer\Licenses

The license file will resemble what is shown below in Figure 3.1-1

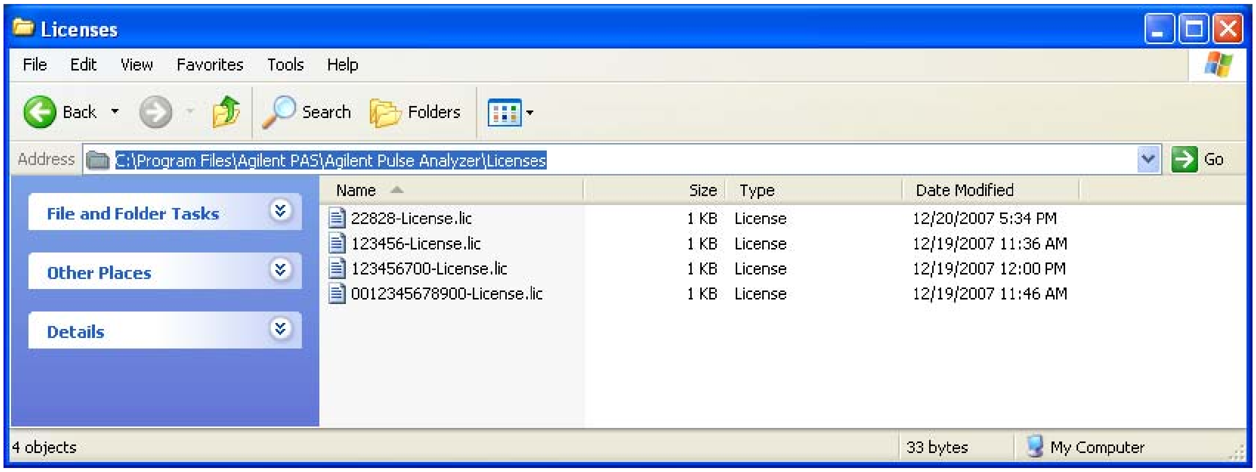


Figure 3.1-1 Example License File Directory

The license file names will contain the serial number for the installed TDC module. For example if the serial number of the TDC was 22828 then the license file name would be 22828-License.lic

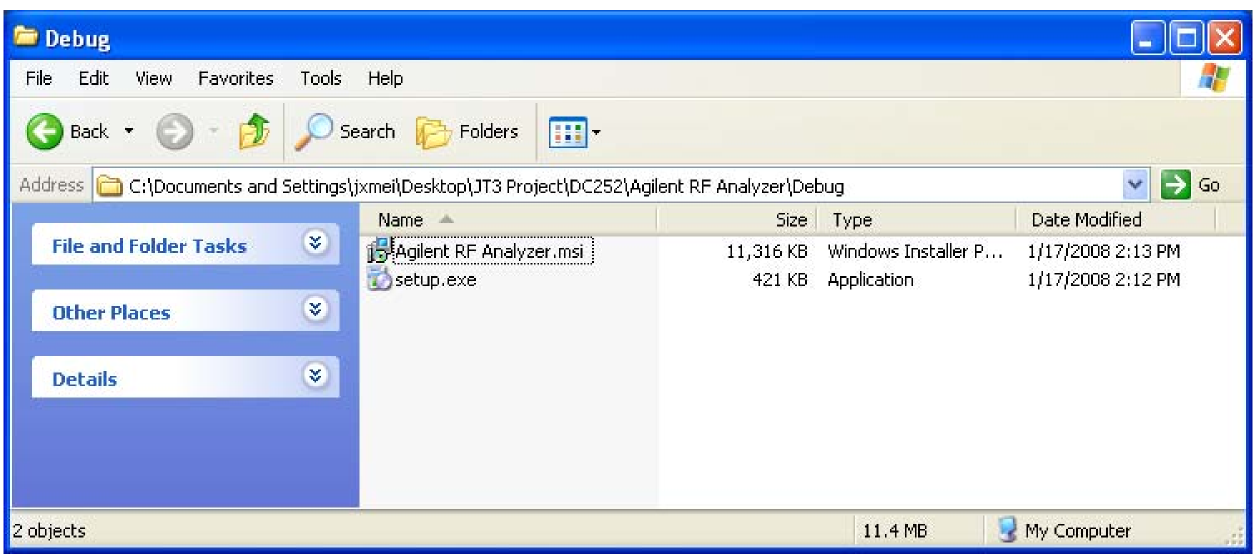
The license files (if not already present on the system) can be obtained by contacting your Agilent Technologies representative. **Without the proper license file the software will only work in the simulation mode and will not connect to the hardware**. When the new license file is obtained from Agilent, then the file simply needs to reside in this directory:

C:\Program Files\Agilent PAS\Agilent Pulse Analyzer\Licenses

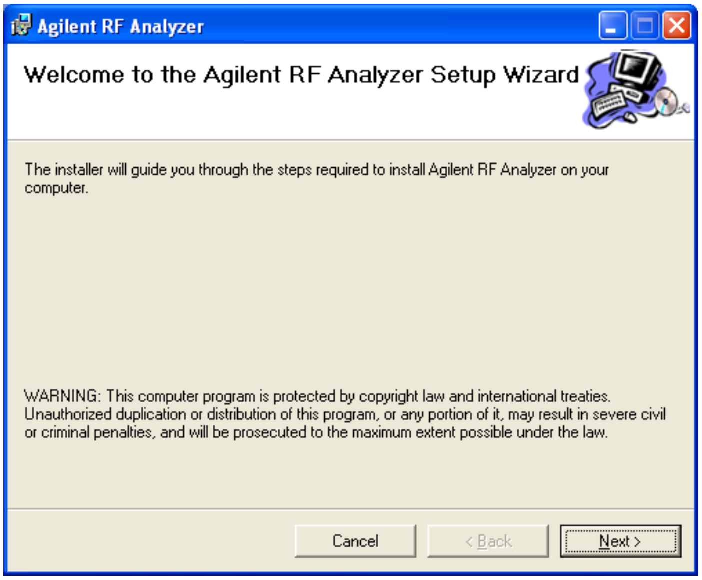
3.2 Z2090B-171 ADC Software Setup (**Only for Optional ADC**)

The software setup for the PAS system leverages from the U1051A (TC890) TDC module and the U1065A-004 (DC282) ADC module. Refer to Agilent documents U1092-90017 and U1092-90004 for instructions on software setup and installation of the Agilent drivers and initial OS configuration of the embedded PC controller. Once the installation steps are completed and the drivers are installed for the hardware follow the procedure outlined below to configure the PAS software.

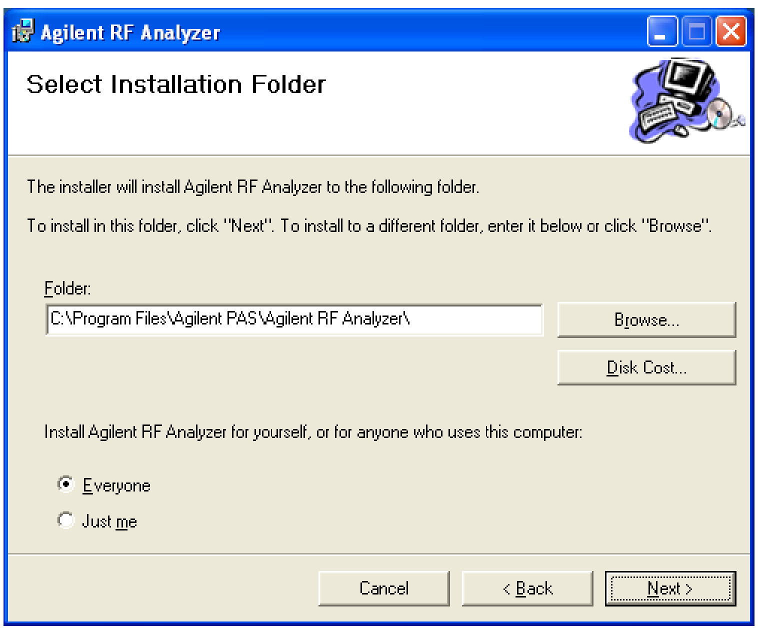
1) Using the delivered PAS Software installation CD insert this CD into a PC computer that contains a CD drive and a free USB port.
2) Copy the two files (Agilent RF Analyzer.msi & setup.exe) to a USB memory stick so that they can be transferred to the embedded PC workstation on the PAS mainframe. The embedded controller does not contain a CD drive thus the installation media (if not already present on the system) needs to be transferred via USB memory stick or using the Local Area Network (LAN) interface.
3) Double click on the setup.exe application and it will begin the installation process for the software.



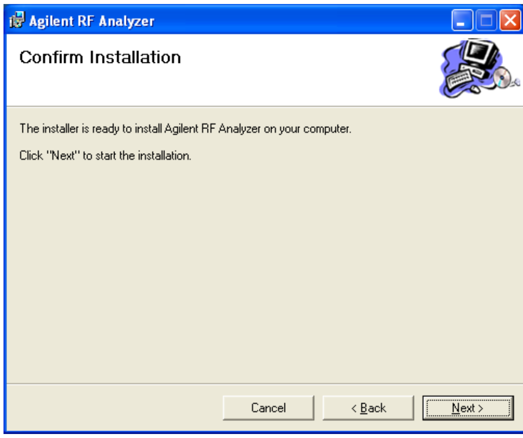
4) When the installer launches click Next (see below)

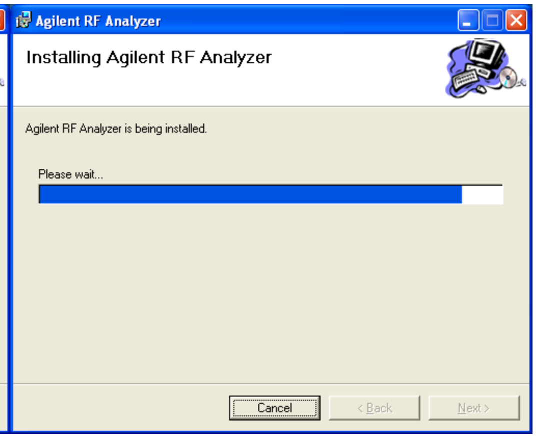


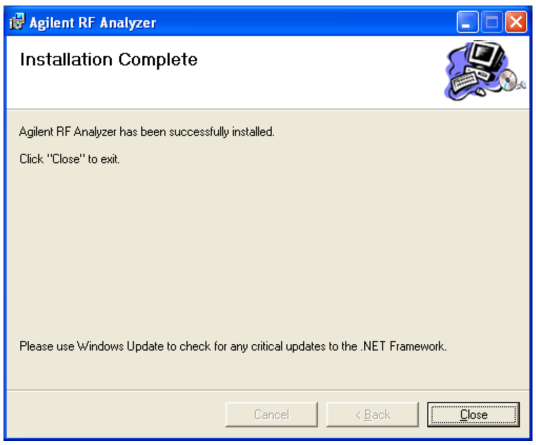
5) On the Select Installation Folder prompt (below) **leave all of the default choices** selected and click Next.



6) On the next menu click the Next Button (below) and the software will complete installation

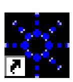






At this point the software is installed.

There should now be a shortcut on the desktop that looks like this:



Agilent RF Analyzer.lnk

Licensing the PAS RF ADC Software –

Now that the software is installed, it needs to be licensed against the hardware that is installed in the mainframe. This license file needs to reside in the following directory on the PAS embedded PC controller:

C:\Program Files\Agilent PAS\Agilent RF Analyzer\Licenses

The license file will resemble what is shown below in Figure 3.2-1

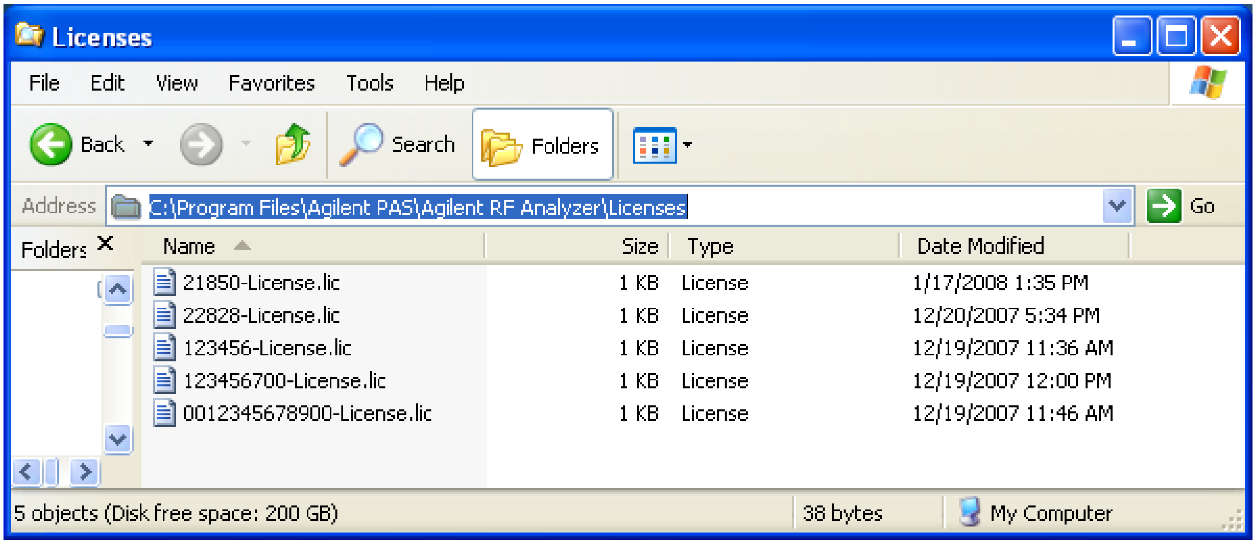


Figure 3.2-1 Example License File Directory

The license file names will contain the serial number for the installed ADC module. For example if the serial number of the ADC was 12345 then the license file name would be 12345-License.lic

The license files (if not already present on the system) can be obtained by contacting your Agilent Technologies representative. **Without the proper license file the software will only work in the simulation mode and will not connect to the hardware**. When the new license file is obtained from Agilent, then the file simply needs to reside in this directory: C:\Program Files\Agilent PAS\Agilent Pulse Analyzer\Licenses

3.3 Z2090B-172 (89601A) VSA Software Setup (**Only for Optional VSA**)

The VSA software is a standard off-the-shelf PC software package used to perform detailed signal analysis of digitized signals. The specifications, operation, and installation instructions can be downloaded from the following web link:

http://www.agilent.com/find/89600

4.0 PAS Operation

The PAS system is controlled via the operational software installed on the embedded PC workstation. The basic configuration Z2090B-170 is controlled using the Agilent Pulse Analyzer software, while the optional ADC configuration Z2090B-171 is operated from a different controlling application called the Agilent RF Analyzer. Furthermore if the ADC configuration is ordered, the optional Z2090B-172 VSA software may be added and used as a controlling software package for the PAS ADC system. The VSA provides the full feature set of time, frequency, and modulation domain analysis (including demodulation). The option 171 Agilent RF Analyzer software does accommodate control of the ADC PAS systems and is capable of making signal recordings compatible with the VSA software. Simultaneous operation of Agilent Pulse Analyzer and Agilent RF Analyzer software is available, and the Agilent Pulse Analyzer software may be run simultaneously with the VSA software to control the ADC if the Agilent Pulse Analyzer software is launched before the VSA software.

4.1 PAS Detected Pulse Application

To launch the Agilent Pulse Analyzer application the user may double-click on the Agilent Pulse Analyzer shortcut that is on the desktop of the PAS controller PC.

Agilent Pulse Analyzer.lnk

When the application launches a hardware search will commence and the software will look for any installed TDC modules. If a TDC module is located, the software will check to see if a valid license file exists for the installed hardware. If either of the previous checks fails, the software will launch in a simulation only mode. Simulation mode will allow the user to analyze previously recorded waveforms but will not access the hardware for measurements.

PAS Operation

Figure 4.1-1 below shows the main user interface screen along with the software control sections outlined.

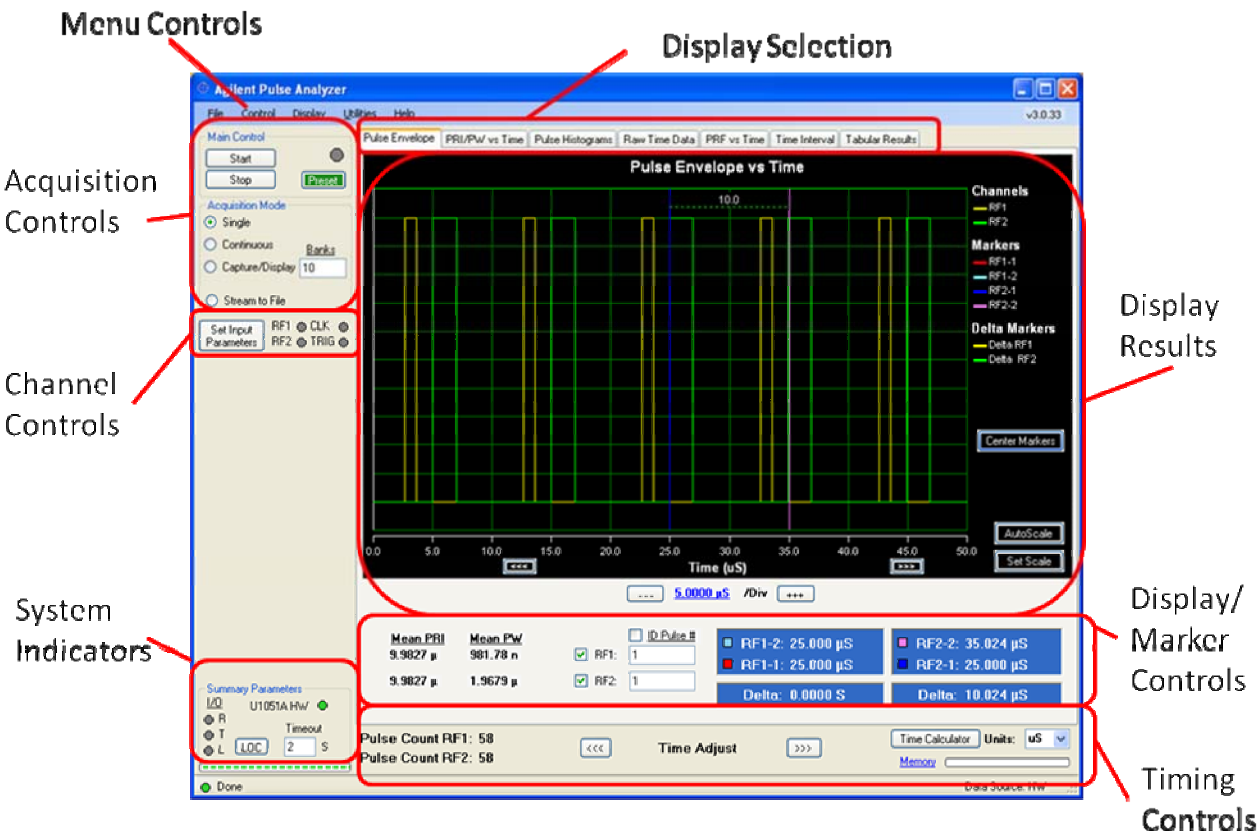


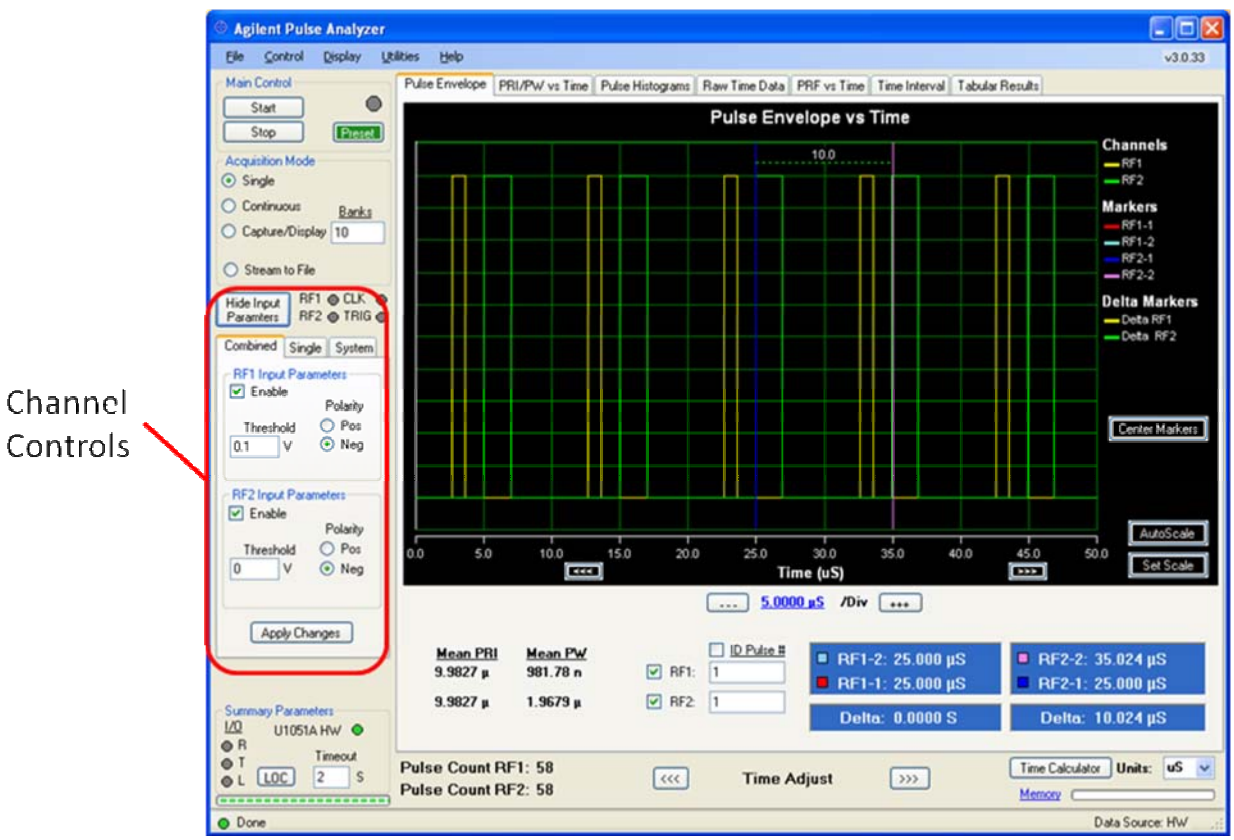
Figure 4.1-1 Agilent Pulse Analyzer Software Display

The figure above lists the different control sections:

- Menu Controls – provides direct mouse control to perform the following menu functions
    - File – perform save/recall state and recording functions, preset instrument, and exit the application
    - Control – alternative method of starting or stopping the application, select hardware input (vs recorded input), select local control of hardware
    - Display – clear displays
    - Utilities – perform TDC reset and calibration, and display current system hardware parameters
    - Help – display PAS version and display help documentation for system.
- Acquisition Controls – provides the overall control of how data is collected and enables/disables the PAS measurement. The 3 modes of acquisition are:

- o Single – provide a single shot capture or collection of time data up to the selected memory size
- o Continuous – provides a continuous update of single captures of measurement data up to the selected memory size
- o Capture – provides a set of multiple captures of data using the dual memory bank nature of the TDC module to allow the system to stitch together multiple acquisitions. The number of acquisitions (banks) is entered next to this selection.
- o Stream to File – provides capability of collecting very large acquisition of pulses by streaming the collected pulse data directly to the hard disk. This mode doesn't display the data during acquisition to maximize speed and throughput. This mode is described in more detail later in this section.

Clicking on the Set Input Parameters button will display the Channel Controls panel. This panel is broken into three sections: Combined, Single, and System controls. This panel may be hidden as well after parameters are entered.



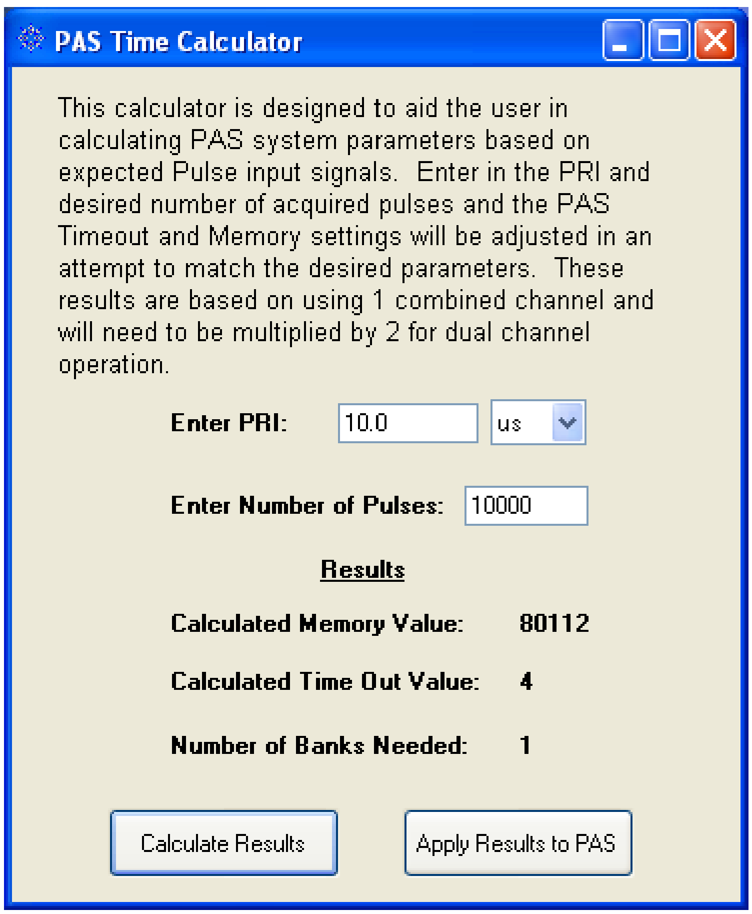
- Combined Channel Controls – These controls allow the user to enable the input channel for combined mode operation, set the channel threshold and polarity
  - Enable Checkbox – enables or disables the channel pair
  - Threshold – sets the level where the edge event is measured
  - Polarity – sets the pulse direction polarity for the incoming signal
  - RF1 Indicator – will turn green if a RF1 event is detected during an acquisition
- Single Channel Controls – Single Channel Mode will disable the first three display choices and allow the user to measure raw time data (or PRF vs Time) on each of the 4 channels. Separate measurements will treat the measurements on the four channels as individual channel collections and doesn't attempt to combine the results. For example, to calculate pulse width the results on channels 1 and 2 (or RF1) are combined to make this calculation. If, however, the user is interested in looking at the raw data or frequency vs time displays of a modulated pulse (FM Chirp for example) the user can enable this checkbox to prevent the system from trying to combine the results of both channels. When this mode is activated, the first three display choices (Pulse Envelope, PRI/PW vs Time, and Pulse Histograms) will not be visible, and only the Raw Time and Frequency vs Time displays will be available.

- System Controls – to prevent inadvertent adjustments on the system tab, most of the controls are locked and can be enabled by clicking on the Modify System Parameters button. This section provides indication and control of system parameters
  - CLK and COM Level – threshold voltage settings for the CH6 input (used as an absolute time reference) from the IRM, and for the COM input (used for HW trigger). Alternatively, CH5 may be used as the CLK source and may be selected here.
  - CLK and COM Indicators – will turn green when either a CLK or COM (trigger) event is detected
  - CLK and COM Polarity – sets the polarity of the trigger (COM) or clock signal to positive or negative.
  - CLK source – normally TDC channel #6 is used as the clock input reference signal, however, the user may select CH5 using this control.
  - Ext 10MHz Reference Clock – This checkbox (normally this should be checked or enabled) sets the TDC card to use the external 10 MHz reference signal.
  - Use HW Trigger Checkbox – if enabled the system will look for a trigger event on the COM input to trigger the acquisition, if disabled, the system will use a software trigger to begin acquisition. ***Note: If multiple trigger***

events are applied to the COM input port, the TDC module will reset and a new acquisition will begin. Ensure only 1 trigger event per desired acquisition is sent when using hardware trigger.

  - HW/Rec Indicators – This indication is on the lower right hand corner of the display GUI. HW on means that the software is connected to and controlling the system hardware, Rec on means that the user is analyzing a recorded signal (also available in simulation mode).
  - U1051A HW Indicator – displays green when hardware is detected and blue when in simulation mode
  - I/O R,T,L Indicators – display the status when the PAS is in remote control by an external computer. R green = remote, T blinking = PAS is talking to remote computer, L blinking = PAS is receiving information from the remote computer.
  - LOC Button – button to select local control of the PAS application away from a remote computer user. This control matches the operation performed under the Control menu choice.
  - Timeout Box – this entry will specify the hardware timeout parameter for a collection. For example, if the user selects hardware trigger input and a trigger event has occurred the system will look for signal edge events until the timeout parameter time has been achieved. This may require the user to adjust this parameter based on a given measurement condition. The timeout value and the memory size are adjusted based on an expected signal condition. If only 10 events are collected prior to the system timing out, the user will see the 10 event result times but a timeout would occur.
- Display Selection – Each display selection will have display specific controls and indicators that will be covered in a later section where we discuss each of the measurement displays.
- Timing Controls – These controls (located at the bottom of the GUI) configure the time window of acquisition (or X-axis) of the majority of the displays of the PAS.
  - Time Adjust Buttons – These left/right button choices will adjust the time by altering the memory size for a given acquisition. The greater the memory size, the longer the time capture. Thus when these buttons are clicked, the memory size will change by a factor of 2 either up or down. The user may also enter in a specific memory capture size by clicking on the Memory link in the Acquisition Controls section.
  - Memory – this control (link) allows direct entry of memory size for acquisition. Normally users would use the time adjustment arrows in the timing section to control memory but the user may override these values by clicking this link.

- Time Calculator – the time calculator may be accessed by pressing the Time Calculator button on the lower right portion of the PAS GUI. This calculator provides a method of setting the memory and timeout parameters along with the number of banks needed for a given acquisition state. The user simply enters in the expected PRI and number of pulses to be analyzed, and the calculator will determine the necessary parameters needed to be used for this acquisition. For complex signals with varying PRI values, the user will have to estimate an average PRI value to use with the calculator. The user can then click on the Calculate Results button to view the needed parameter settings for the TDC card. Pressing the Apply Results to PAS button will apply these settings to the hardware.



- Display/Display Selection/Marker Results – These sections control and display the data collected by the PAS hardware in a variety of formats for the user. The display selections across the top are used to select one of the display modes (to be covered in a later section below). The display results are shown on the central display and the marker results section will display the marker readout for up to 2 markers on a given trace including the delta marker display results.

PAS Displays

The PAS system will display the TDC signal measurements in the following formats:

1. Pulse Envelope
2. PRI vs Time/PW vs Time
3. Pulse Histograms
4. Raw Time Data
5. PRF vs Time
6. Time Interval
7. Tabular Results

Pulse Envelope vs Time

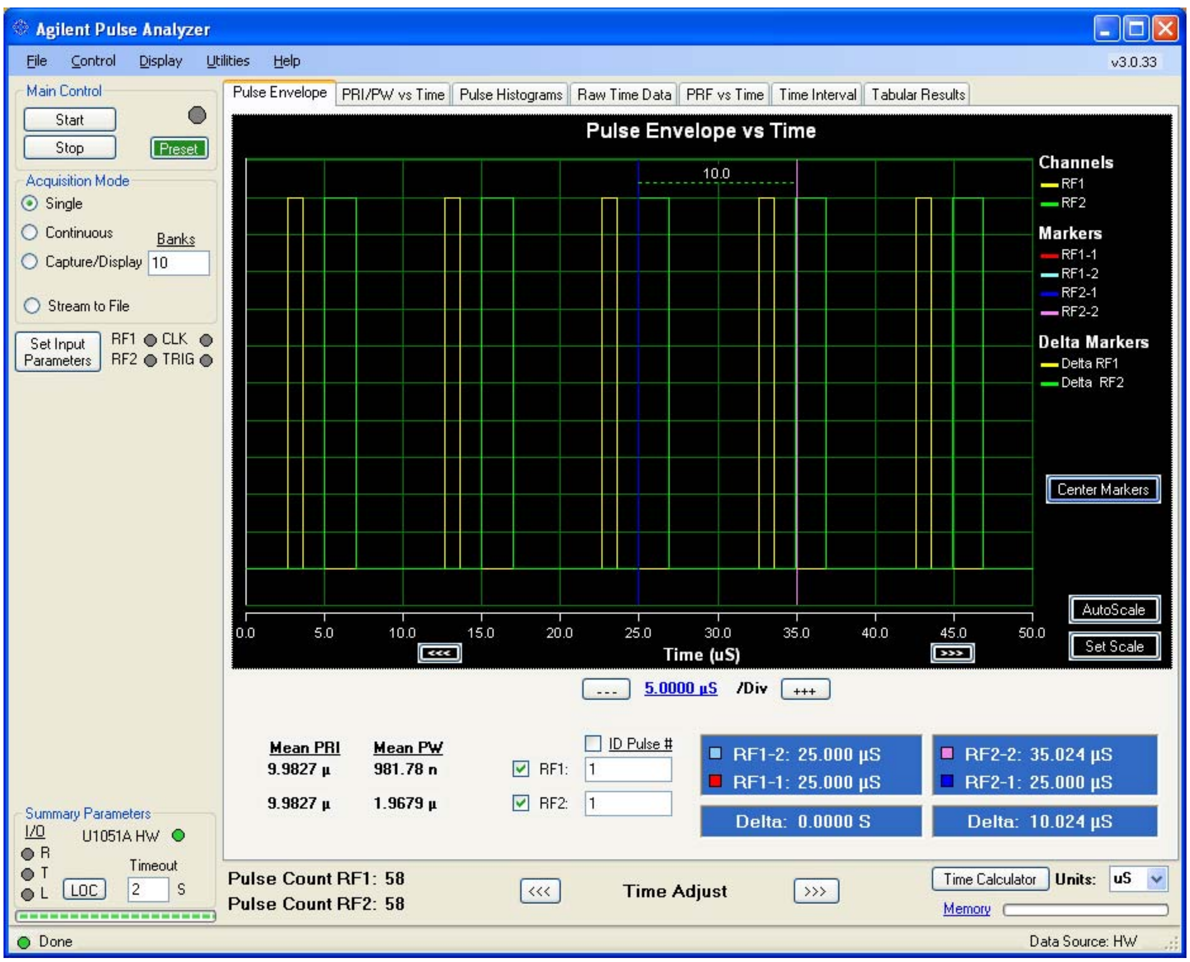


Figure 4.1-2 Pulse Envelope versus Time Display

The figure above shows a signal that has been captured on both RF inputs. The signal on channel 1 is a pulsed signal with a 1usec pulse width and a 10usec period (shown in yellow) and the second RF input is a pulse with a 700ns pulse width and 10usec period (shown in green). These signals were applied to the PAS hardware and the start button was clicked to provide a single capture. The first tab labeled Pulse Envelope is selected to display the pulse envelope vs time. This signal capture has been zoomed in with several pulses displayed. The user can then drag across a portion of the graph to zoom in on a portion of the waveform for more detailed analysis as shown in Figure 4.1-3 below.

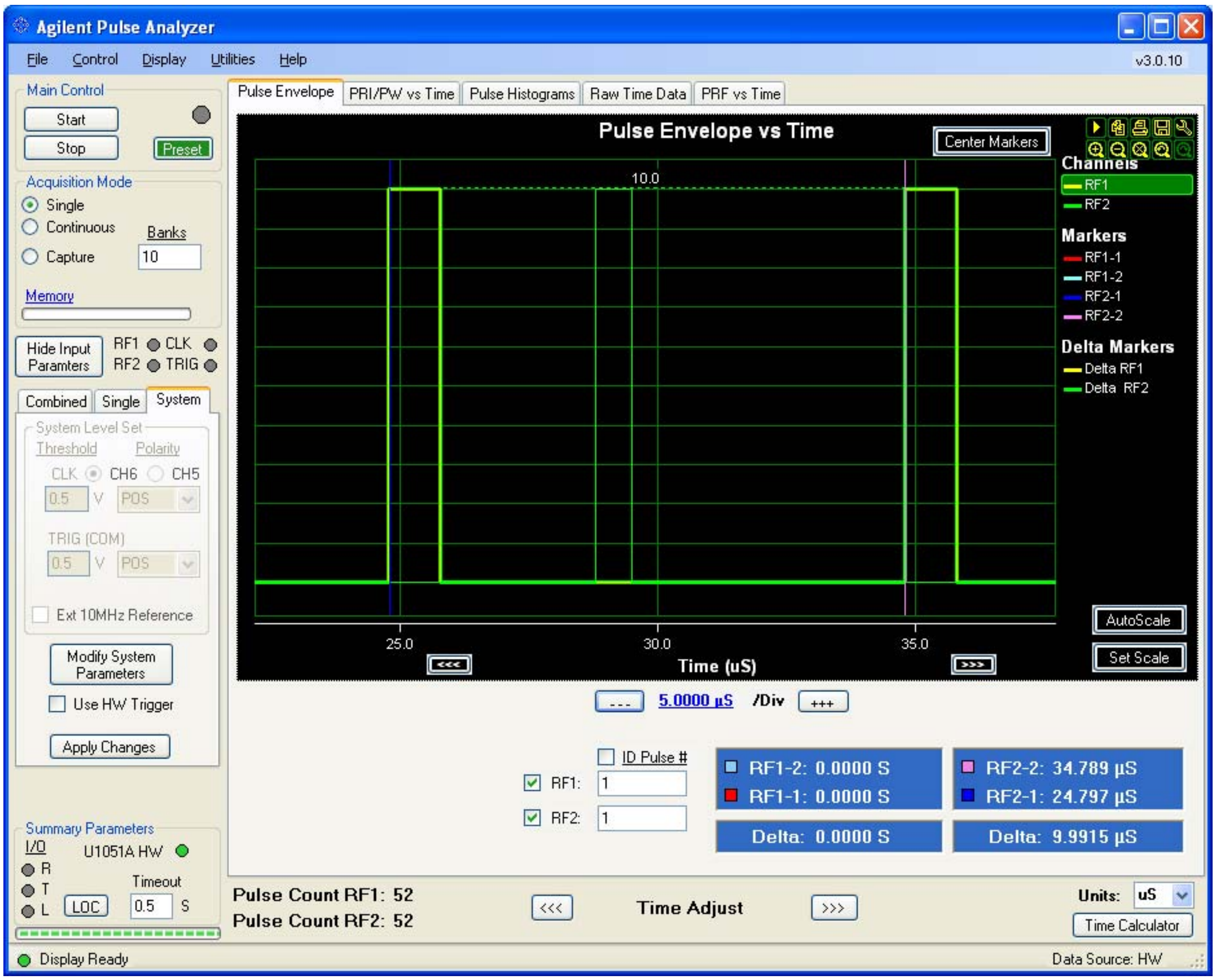
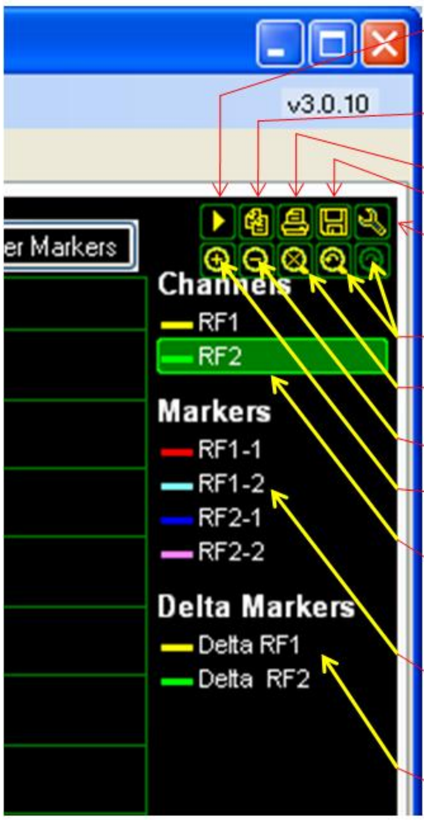


Figure 4.1-3 Pulse Envelope versus Time Display Zoomed View



Display Legend Controls and Information

- Play/Pause – Triangle means the display is paused and the display is NOT updating. Two bars means the display is updating. Clicking this control will toggle pause and update. Zooming ALWAYS pauses the display.
- Copy display to clipboard – this button will copy the entire display section with markers to the clipboard. This allows the user to easily import the screen to a reporting application.
- Print Display – this button will print the display with all markers
- Save Display – this button will save the display as a bitmap image for documentation purposes.
- Setup Display – this button provides control of markers and marker links
- Undo Last Zoom
- Re-Do Last Zoom
- Undo Any/All Zooming – **This is a very important control because the zoom state will remain until this button is clicked to release all zooming. The results can be confusing if zooming is left on.**
- Zoom both axis In – Scaling purposes
- Zoom both axis Out – Scaling purposes

Channels / Markers / Delta Markers

- Channels – A trace is referred to as a Channel on the display. Each trace will be color coded on this legend to match the signal being analyzed. Highlighting any of the legend items will correspondingly highlight them on the display
- Markers (or Cursors) – are a set of vertical and or horizontal lines on the display that are used to make measurements on the display. The number of markers varies with the display result.
- Delta Markers (or Marker Links) – provide a method of doing delta measurements between two markers. Each display has a default pairing of markers to enable delta measurements

Figure 4.1.3b – Display Legend Information

The figure above shows the display legend present on all displays in both the TDC and ADC PAS applications. Clicking on the display will reveal this display legend and provides display control features described above.

***NOTE *** Whenever the user performs a zoom operation on a display, the display is paused (even if the measurement system is still acquiring data. To re-enable display operation, the user needs to push the play/pause button shown above. Also, whenever a zoom operation is performed either with the mouse (by dragging over a region) or using the zoom tools in the toolbar, it is important to remove the zooming using the Undo All Zooming button described above. This will ensure that the display is set to match what the measurement acquisition.

From the zoomed view (Figure 4.1.3 above) we see a couple of pulses displayed in this view. The pulse envelope view is essentially constructed by combining the rising edge time of the pulse with the falling edge time of the pulse. The resulting display is a reconstructed waveform of the time domain pulse response. The magnitude of the pulse is normalized to 1 and is unit-less because the TDC module does not measure amplitude directly. For accurate amplitude information, the optional ADC solution (-171) may be added.

The timing parameters, however, are accurately collected to within 50ps accuracy.

At this point, the user may select and control the two markers to position them for measurements of waveform features. If the two markers are not visible, the user may right click on the display and select the View Marker option. The user then may position the markers by clicking on the markers and positioning each one independently. Figure 4.1-4 below shows a zoomed in view of the marker display which shows that the time difference from the leading edge of one pulse to the falling edge (pulse width – yellow). The delta measures 702ns (or the pulse width of RF2), and the other marker pair measuring the period at about 10us. The marker colors will correspond to the display legend to help identify the selected marker.

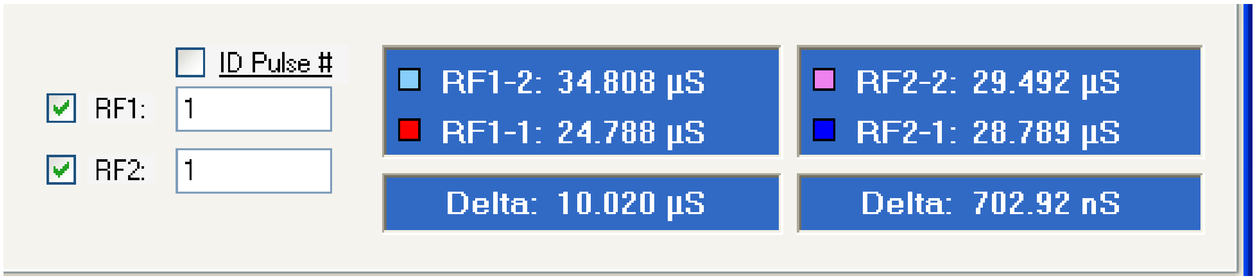


Figure 4.1-4 Marker Display

Pulse ID Feature: The PAS software also provides a pulse identification feature which allows a user to enter in a specific pulse number and the pulse is highlighted on the display trace as shown in Figure 4.1-5 below. Notice that the 3rd pulse of RF1 (yellow) is identified and the 9th pulse of the RF2 signal (green) is also identified. Furthermore, the pulse count for each RF input is displayed in the lower portion of the GUI.

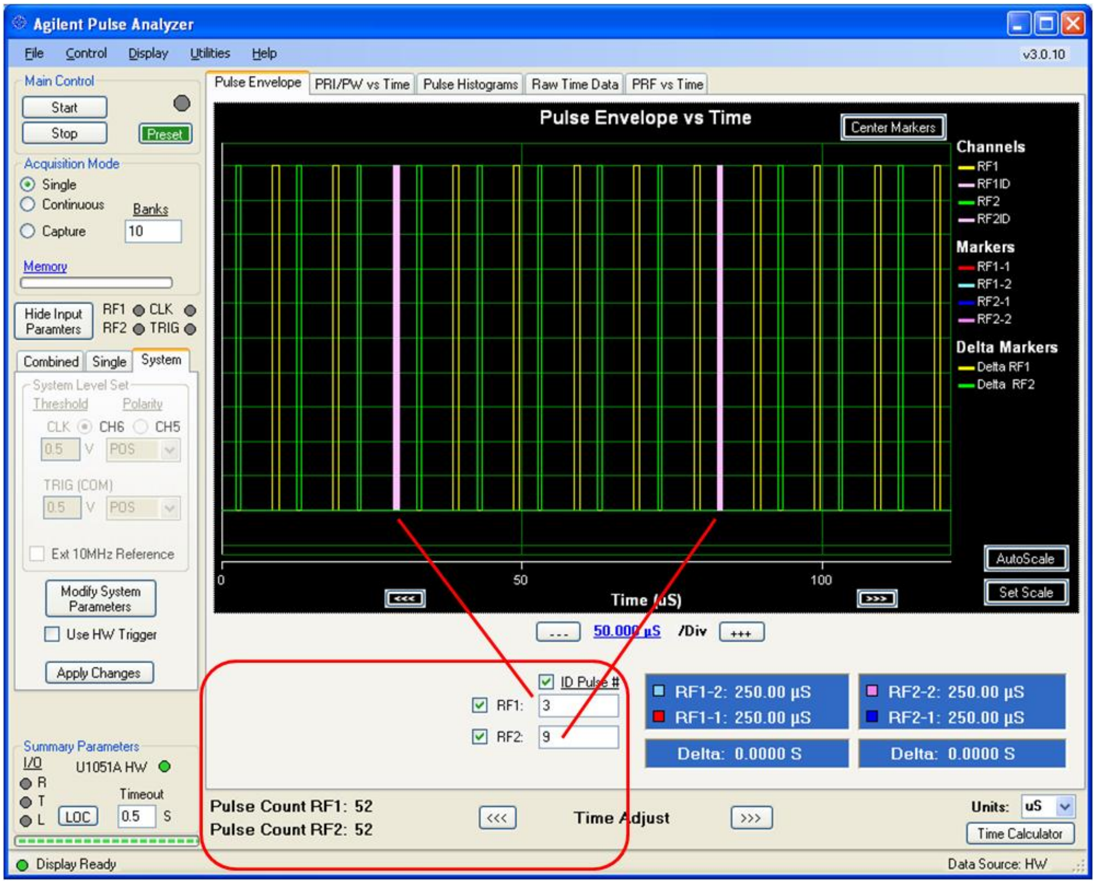


Figure 4.1-5 Envelope Display Controls and Information

Every display contains an Autoscale, Set Scale, and Center Marker button. The autoscale is designed to zoom the display around the signal and round the result to provide an even scaled optimal viewing result. The Set Scale button allows the user to adjust the start and stop X and Y axis scale. The center marker button will center all markers in the middle of the display whether zoomed or not.

Every display also contains a set of white-on-black scroll bars. These horizontal and vertical scroll bars will step the display in 1 graticule increments up, down, left, or right.

The Display Control section (Figure 4.1-5 above) displays the total pulse count that was acquired during this capture for all enabled channels (i.e. 52 pulses were collected during this measurement on both channels). This section allows the user to enable or disable the results from either of the channels using the checkbox on the left. If no data was measured for a channel this control will have no effect since there is no valid data for that channel. Since the pulse envelope display requires additional data points to represent the results, there are cases with high pulse count signals and settings where the envelope display will become disabled. When this occurs, the other (more efficient) data displays will be available to obtain the results.

PRI vs Time/PW vs Time

The second tab display choice is PRI/PW vs Time. PRI stands for Pulse Repetition Interval and PW stands for Pulse Width. PRI is the pulse period which is a common parameter for RADAR and pulsed RF signals. Figure 4.1-6 below shows the dual display of PRI vs Time and PW vs Time. These displays show how the PRI or PW change as a function of time. For figure 4.1-6 below, we see that the Y axis is about 10us for PRI and about 1us for PW, thus, we see that the PRI and PW are not changing for this capture.

Figure 4.1-6 PRI/PW vs Time Display

Shown in red above are selection controls to allow the user to toggle between the results measured on RF1 and RF2. The top display will show RF1 PRI and RF2 PW, and the bottom display will show RF1 PW and RF2 PRI. This flexibility allows the user to compare PRI's and PW's from both channels simultaneously.

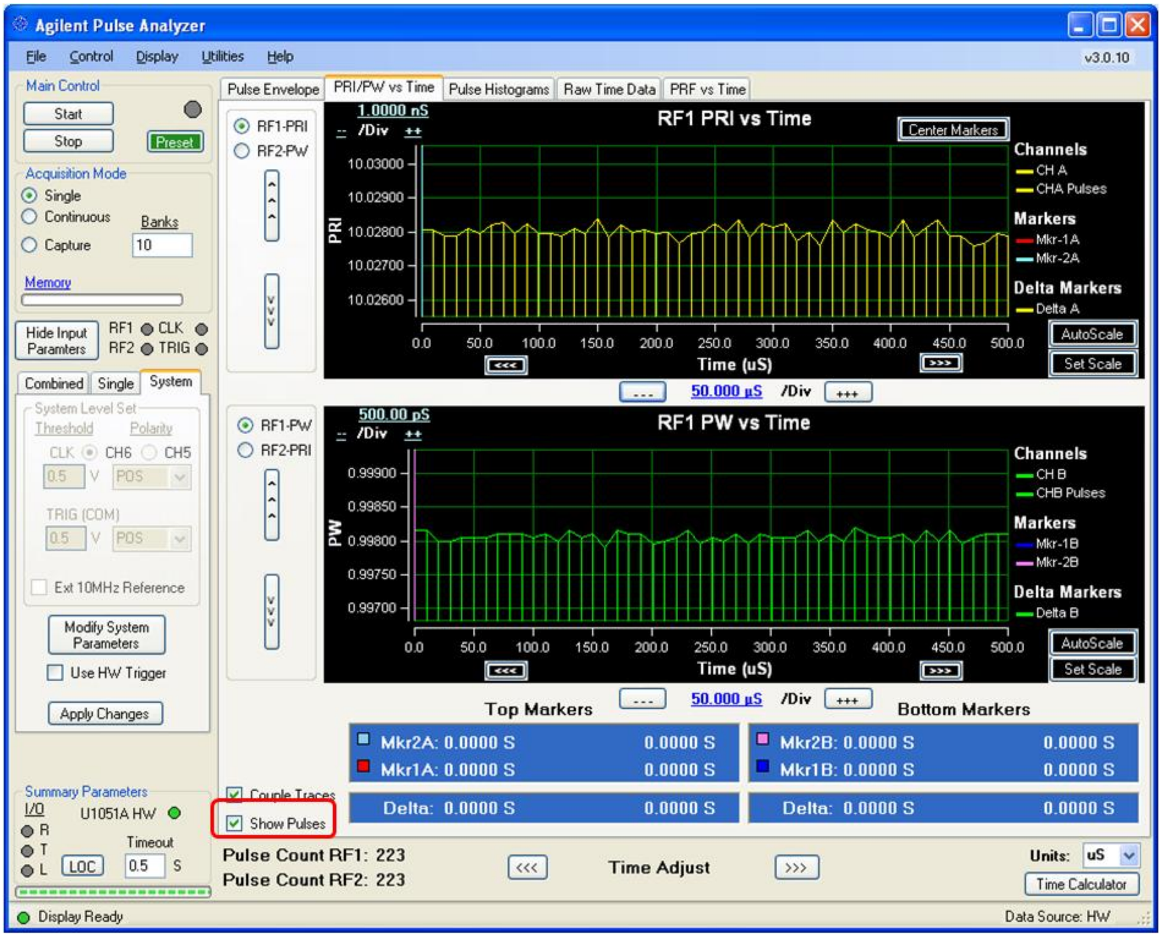


Figure 4.1-7 PRI/PW vs Time with Pulses Shown

Since this display contains two graphs, each one has a corresponding marker display section at the bottom of the displays. The other controls on this display are again the Autoscale control (which operates identically to the Envelope vs Time display) and the Show Pulses check box. When the user clicks on this check box, an additional trace is added to each window to help identify when the pulses were captured during this display trend. Figure 4.1-7 above shows this. The Couple Traces checkbox will force the bottom display scale to track the top scale X axis to maintain time alignment.

While this display may not be optimal for a steady-state signal, the power in this display can be seen if we analyze a signal that changes PRI or PW during the collection. Figure 4.1-8 below shows a collection that has 3 different PRIs and 3 different PWs. The 3 different PRI values can clearly be shown on this display and also measured using the markers. Here we start to see the power in this sort of display, as a RADAR changes mode, the PRI and PW will typically vary and the PAS will track these changes.

Figure 4.1-8 PRI/PW vs Time 3 Mode Signal

Pulse Histograms

The next display selection is the Pulse Histograms display. This trace is also a dual trace display showing the statistics of a given series of pulses. The first trace is a histogram of the PRI results and the second trace is a histogram of the PW results. Figure 4.1-9 below shows an example of this display. In addition to the histogram, a set of statistics including Mean, Standard Deviation, Min, and Max are displayed for both the PRI and PW count results.

The marker features are similar to the other displays previously discussed.

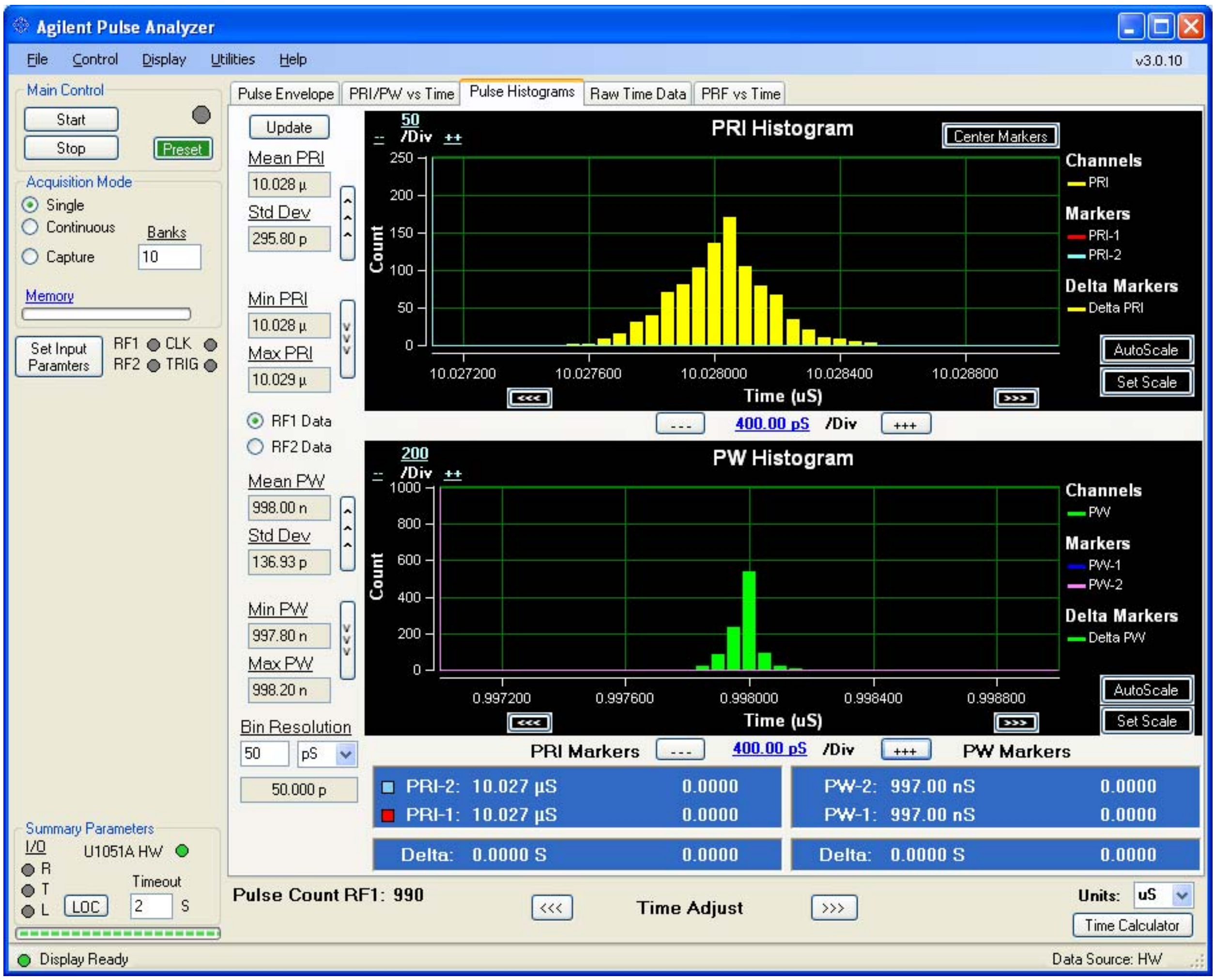


Figure 4.1-9 Pulse Histogram Display

Again the autoscale check box works as before. The Bin Resolution is a parameter that may be modified by the user to set the number of bins (X-axis) for a given collection.

Raw Time Data Display

To supplement the internal display modes within the PAS, the user may select or export the raw measured time data. This data may be post processed by the user to provide additional display choices or reports. Individual channel data may be selected for local display. Figure 4.1-10 below shows an example of a set of raw time data displayed.

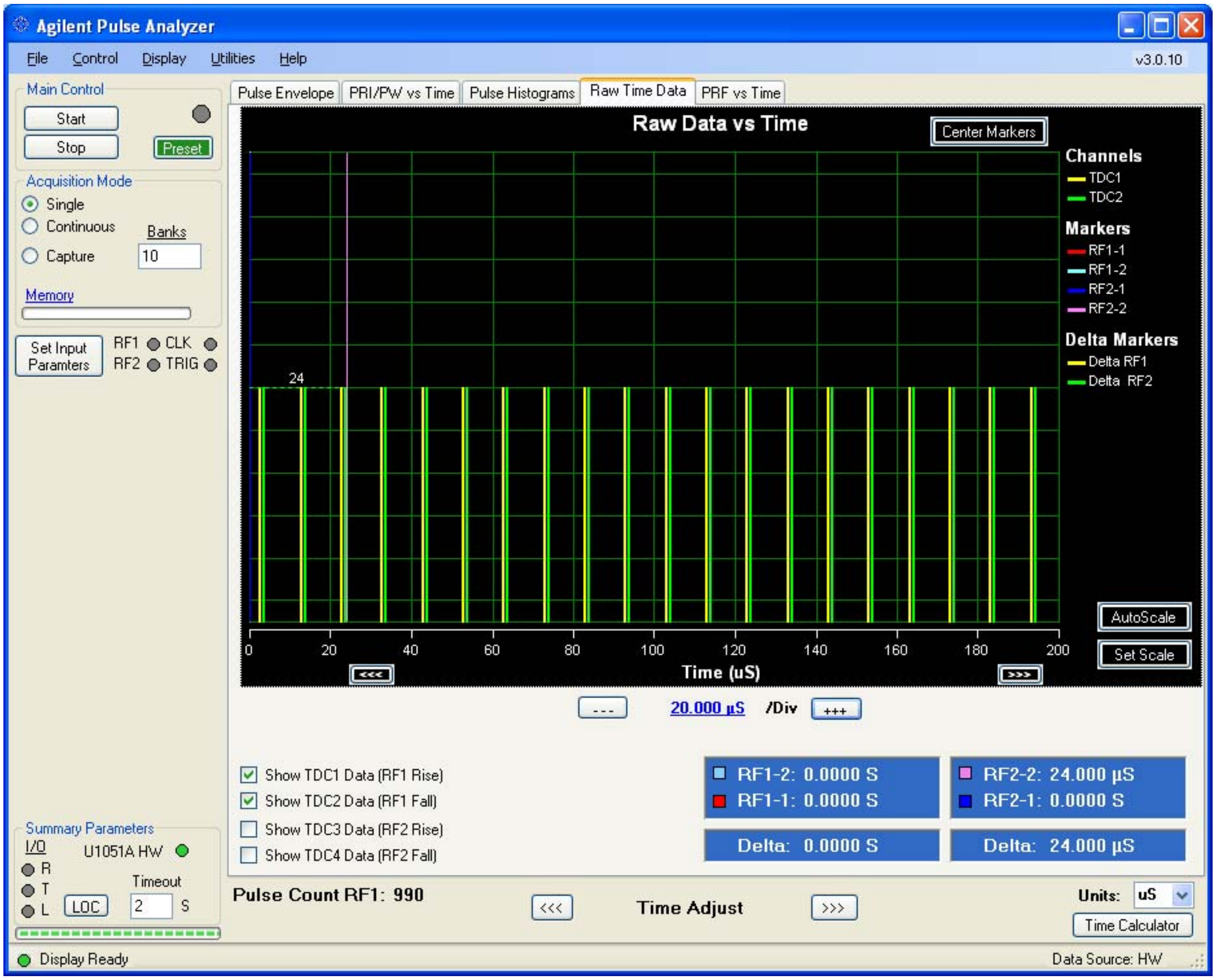


Figure 4.1-10 Raw Data vs Time Display

Again, the user may select to have the display automatically scaled when the measurement is refreshed. The user may also select each available channel (i.e. TDC1 – TDC4) and the markers may be used to analyze the data as before.

PRF vs Time Display

Another PAS display shows PRF (Pulse Repetition Frequency) versus time. This data is similar to the PRI vs time except that by taking the reciprocal of the PRI the result is PRF. Keeping the X axis as time the result is PRF change versus time. Figure 4.1-11 below shows this display.

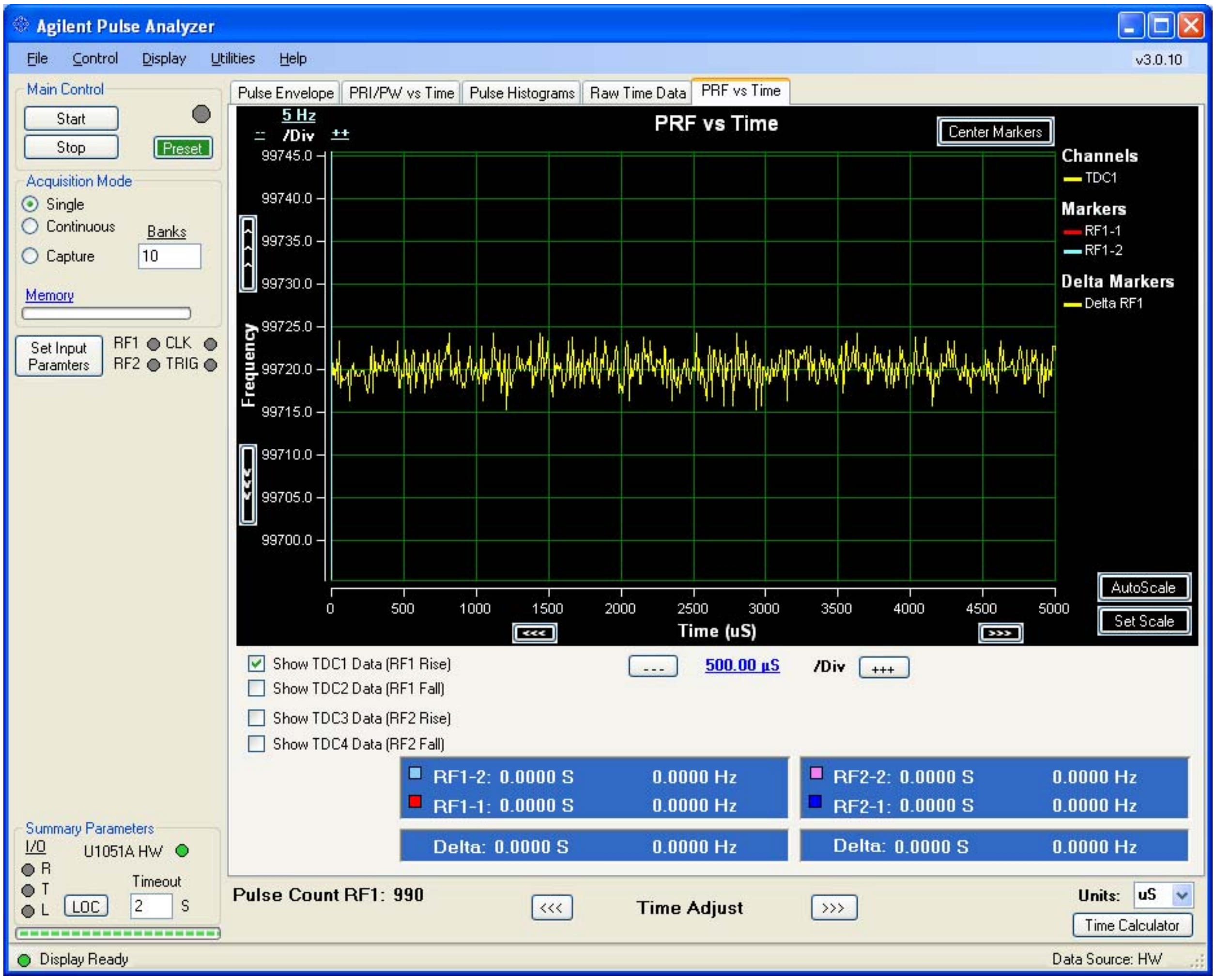


Figure 4.1-11 PRF versus Time Display

Time Interval Display

Two-channel time interval and delay measurements may also be performed using the PAS. These results are displayed on the Time Interval panel. NOTE: If only 1 signal channel is active, then this display will remain blank. If inputs are provided, however, on both RF1 and RF2, then time interval measurements may be performed. This panel displays the Mean, Std Deviation, Min, and Max time interval results for a given acquisition along with the number of measured results acquired. Additionally, Time Interval vs Time is plotted on the upper graph along with a time interval histogram displayed on the lower graph. All of the marker and display features are similar to the other displays. Figure 4.1-12 below shows an example of this display. Measurement results relative to either channel may be selected in the upper left corner selection.

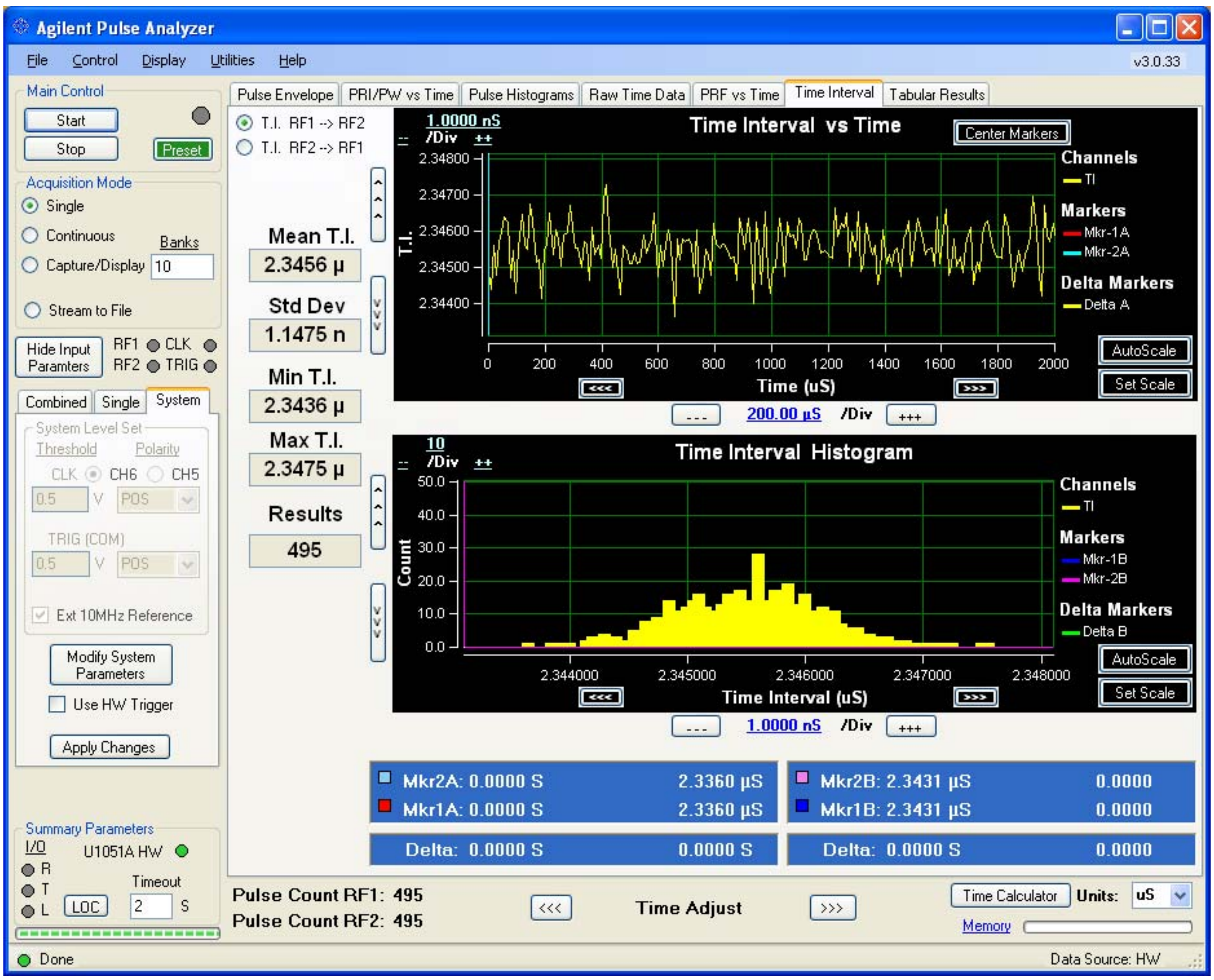


Figure 4.1-12 Time Interval Display Panel

Tabular Results Display

The tabular results display provides a summary collection of data parameters displayed for each time event. This provides a quick-look capability of the PAS. This tabular data may be exported to a *.csv file using the File→ Save→ Formatted Results section from the menu. The maximum number of displayed results is controlled from this panel to optimize update rate given a set of acquired measurements. Selection controls also are used to select RF1 or RF2 data inputs, or if running 2 channel measurements – Time Interval results may also be displayed.

NOTE: in single channel mode, this display is not active.

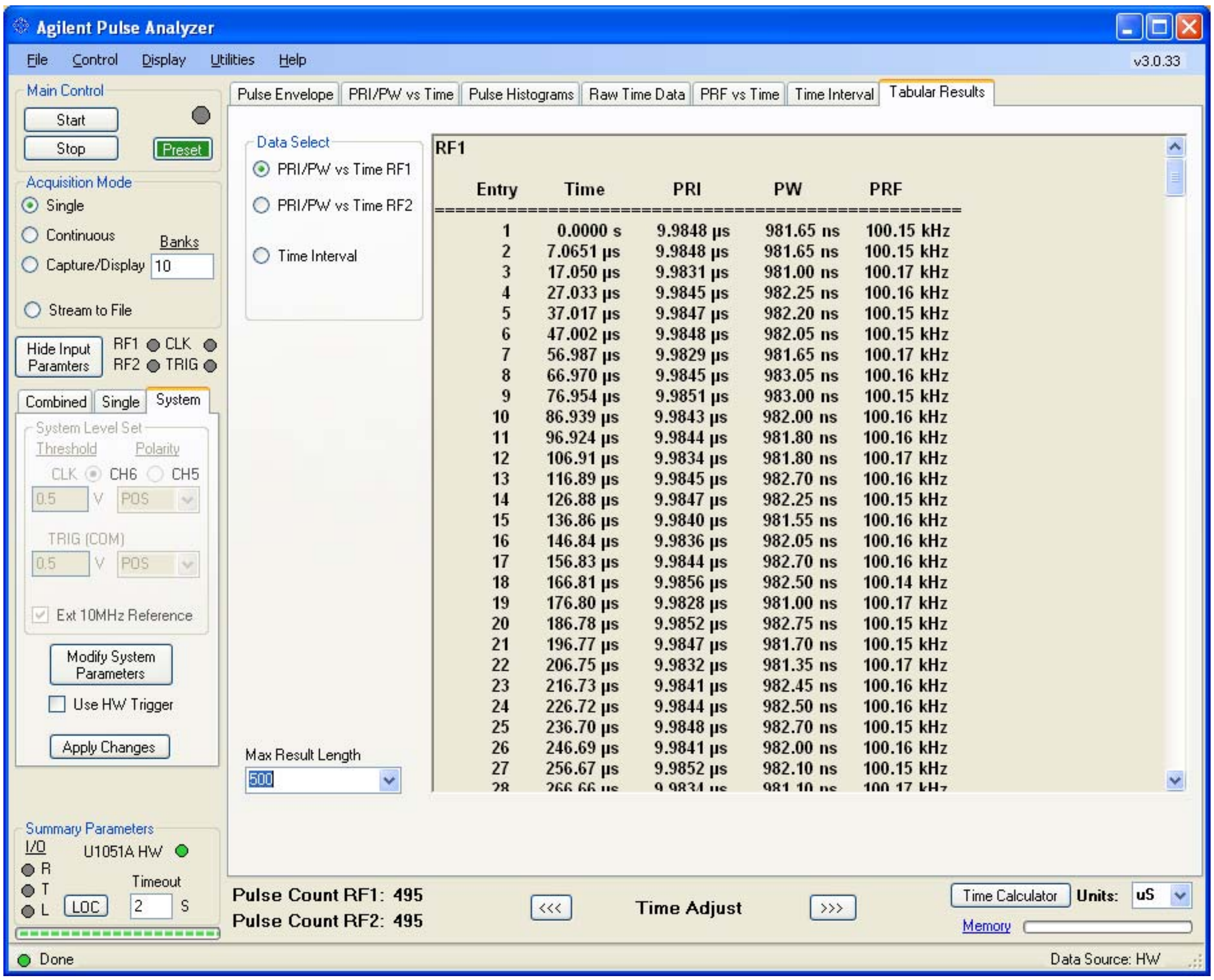


Figure 4.1-13 Tabular Results Display

Save /Recall Operations

The PAS software supports the ability to save and recall both signals and instrument states. These functions are controlled using the File menu dialog at the top of the PAS control interface.

Signals: Once a measurement has been acquired, the user may save the signal as a recording in either a binary or text readable *.csv format. These recordings may be analyzed by the software at a later time or analyzed off line using the same PAS software package running in simulation mode. Further, the files may be imported into other software packages for further analysis. Signals may also be recalled into the PAS analysis software in binary format.

Signals may also be saved as formatted trace data results for any of the display modes on the pulse analyzer.

States: An instrument states defines the configuration of all of the PAS parameters. These states may be stored as a state file under the File→Save/Recall→ State operation. Instrument states identify all system configuration parameters and may also be tied to either a hardware or recorded signal input.

Save /Recall Operations

The PAS software supports the ability to save and recall both signals, instrument states, and formatted data results. The display results and signal formats may be saved as *.csv files for good portability. In addition, signal files may be stored as *.bin files to be a more compact file format for captures allowing users to capture signals with one PAS hardware set and perform off line analysis on another computer with PAS software running in a no hardware mode. These functions are accessed using the File menu dialog at the top of the PAS control interface.

Making PAS Measurements

The process to make measurements with the PAS can be summarized in this manner:

1) Set the acquisition parameters using the Time Calculator or manually setting the memory and timeout values. Verify the input threshold levels are set appropriately.
2) Select the Acquisition Mode (Single, Continuous, Capture/Display, or Stream to File. These different modes are explained in further detail in the next paragraph.
3) Select the desired display tab.
4) Press the start button to begin the acquisition.
5) If desired, perform the on screen analysis using the markers or zooming features of the display.
6) If desired, save the formatted or raw data for further analysis or reporting.

PAS Modes

Single: This mode is a single (one-shot) acquisition. The PAS will collect enough signal events to fill the selected memory or if no signal is present the system will time out.

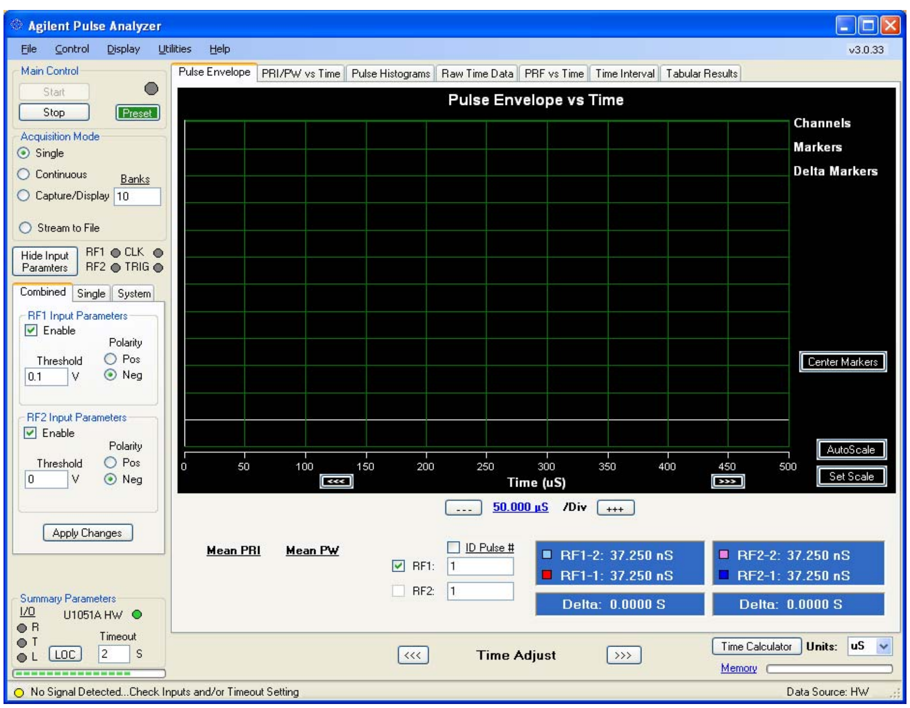


Figure 4-1.14 Timeout Example

If the system does not detect a signal prior to the timeout setting the display will not update and you will see a status message stating that no signal was detected.

Continuous: This mode is a free running collection of single acquisitions. A single acquisition (based on the parameters) is performed and displayed and then the process repeats providing a dynamic updating display.

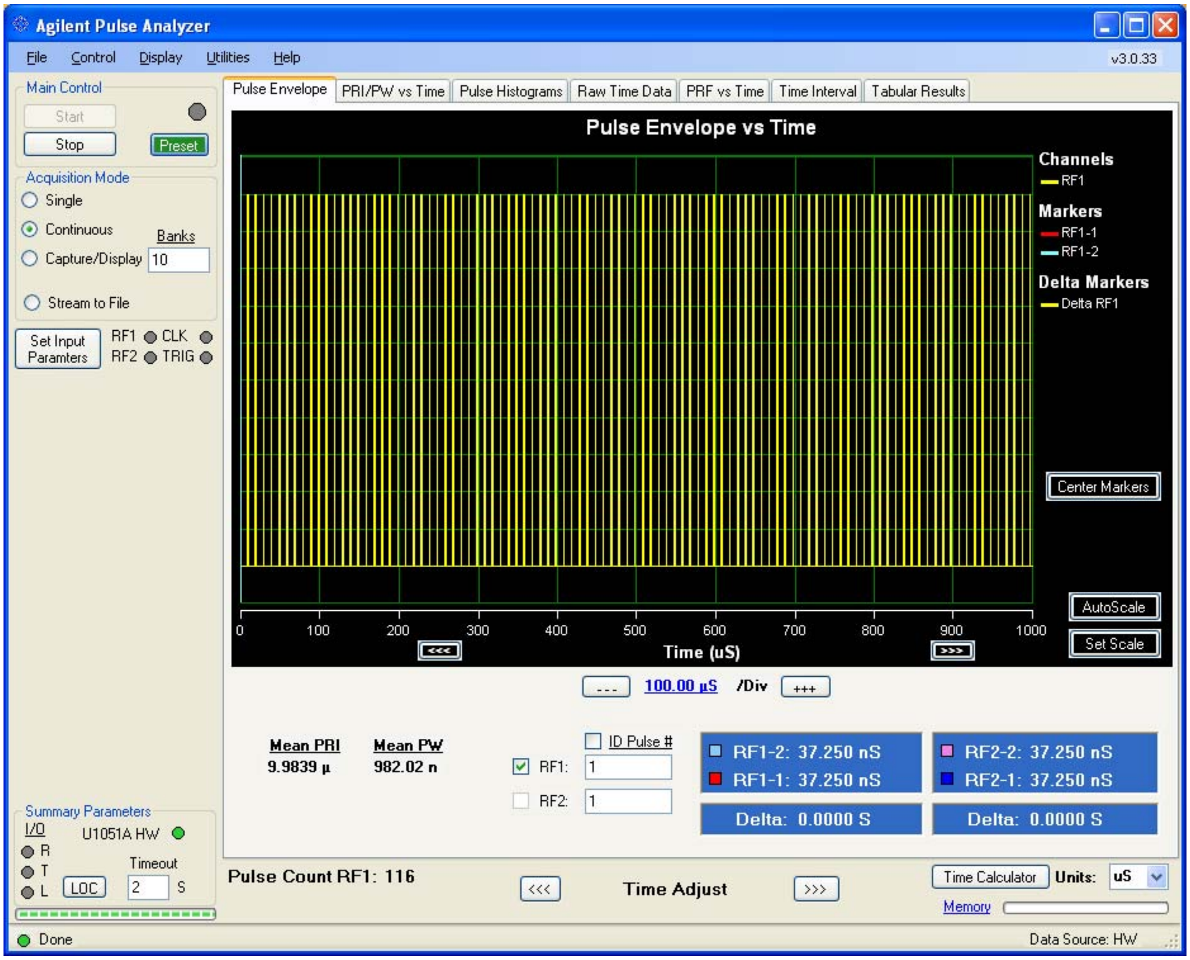


Figure 4-1.15 Continuous Mode Display

In this example the result length is slightly larger than 1000us (or 1ms) per acquisition.

Capture/Display: This mode utilizes the dual banked memory structure of the card and provides a way of collecting additional pulses and displaying the results. In this mode, the user selects the number of memory points and timeout as before but now an additional choice of the number of memory Banks is entered. The number of banks is also set if the user uses the time calculator. In capture mode, the TDC performs an acquisition; bank switches the memory, and performs another acquisition. This process repeats until all of the selected banks are filled. Then the application will combine the data results and display them on the selected display.

IMPORTANT NOTE ABOUT CAPTURE/DISPLAY MODE: Since the PAS is capable of measuring millions of pulses, display points and array sizes can grow to extremely large values. The result of this is that the PC and OS can become overtaxed and OS memory overflow errors can occur if you are trying to display too much information. To help protect against these overflow errors, the software will guard against these errors by limiting either the memory size or number of banks that can be selected for a given acquisition. If extremely large acquisitions are needed, a better choice is to use the Stream to File mode discussed next.

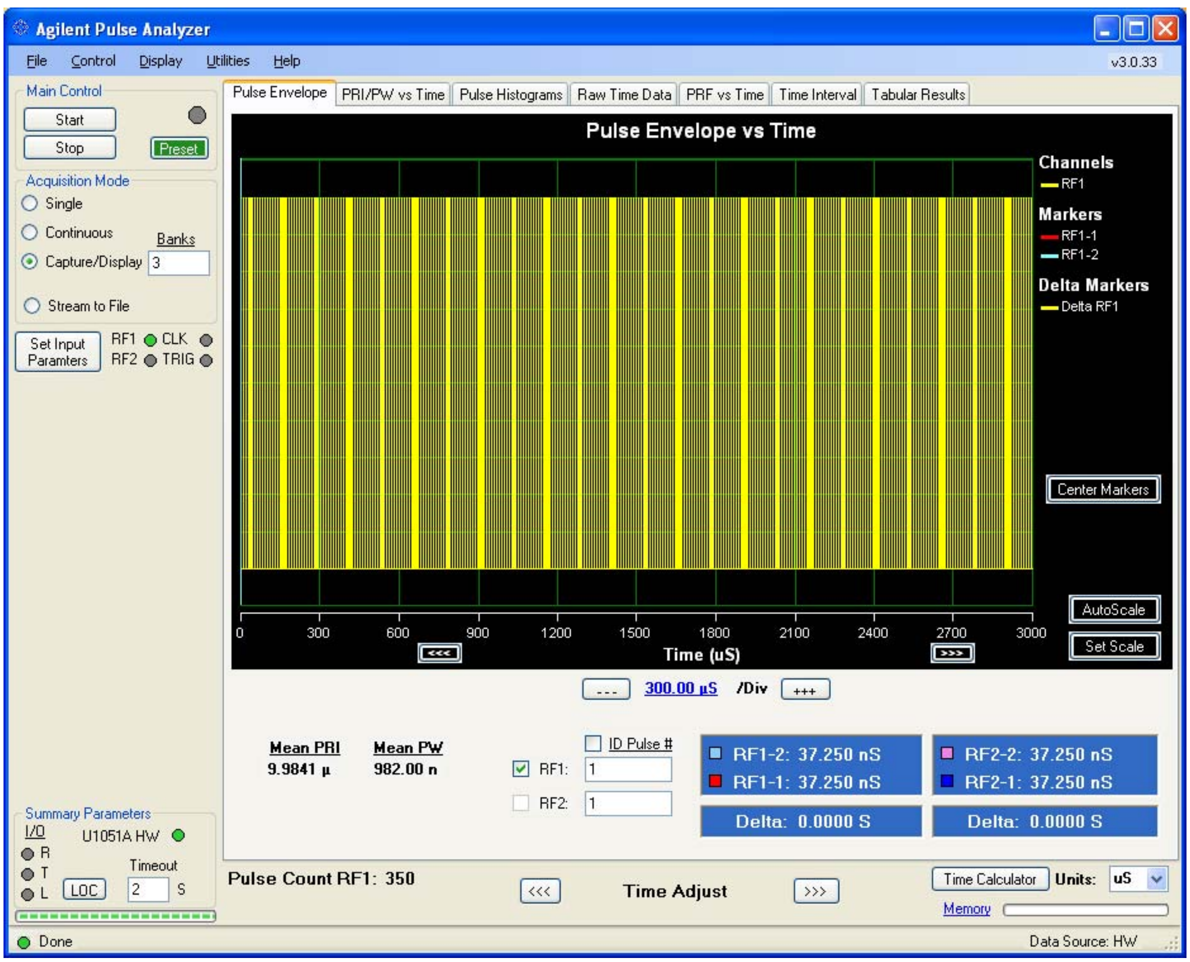


Figure 4-1.16 Capture/Display Mode Example

In this example the same signal is applied but this time capture mode was selected and 3 banks of capture were collected resulting in a 3000uS (or 3ms) collection.

Stream to File: This mode also utilizes the dual banked memory structure of the card but instead of displaying all of the results post capture, it will stream the TDC data directly to a file to provide a very efficient and fast collection mechanism for PAS. To perform a streaming capture first the user selects the Stream to File mode under the Acquisition Mode section of the GUI. Immediately the main GUI is replaced with the streaming control GUI shown below:

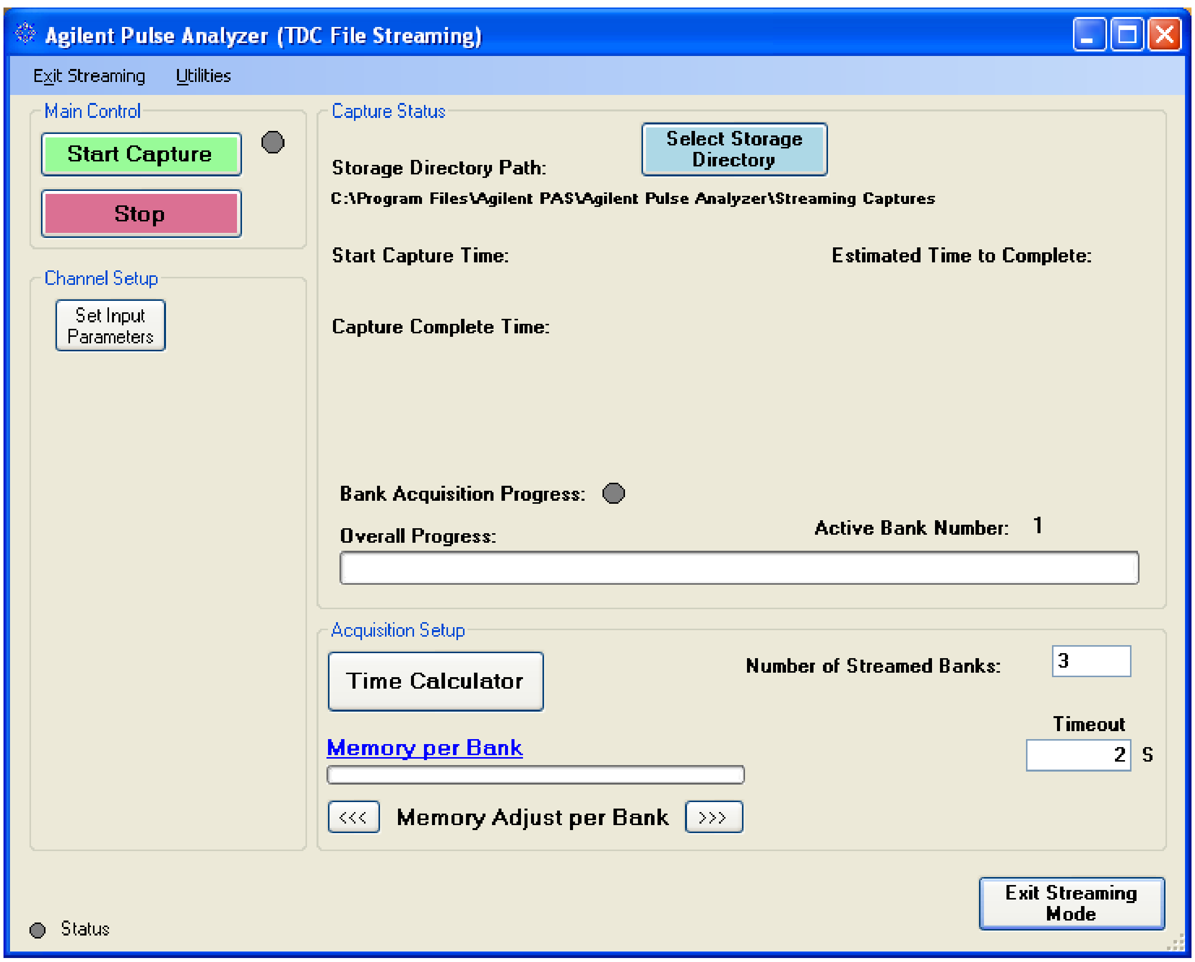


Figure 4-1.17 TDC File Streaming Control GUI

This control GUI provides a simple user interface to set up the TDC for file streaming. The acquisition process is as follows.

1) The user selects the storage directory using the blue Select Storage Directory button. If no selection is made the default folder used is: C:\Program Files\Agilent PAS\Agilent Pulse Analyzer\Streaming Captures
2) The user then selects the size of the acquisition by adjusting the memory and timeout settings. The easiest way to do this is to use the Time Calculator. In the example below we've selected an acquisition of 1 Million pulses running at a 10us PRI. The calculator determined that 3 banks would be needed and adjusted the memory and timeout settings appropriately. (see below)

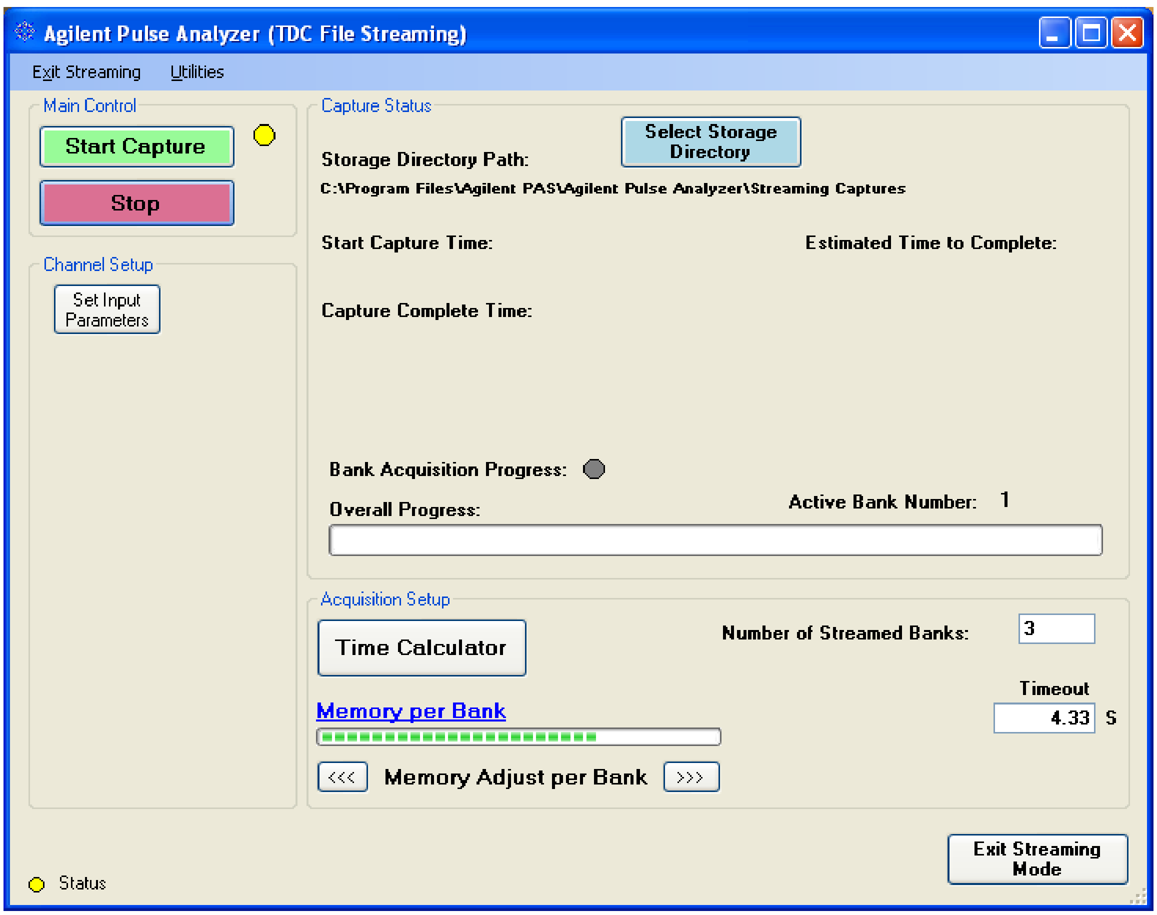
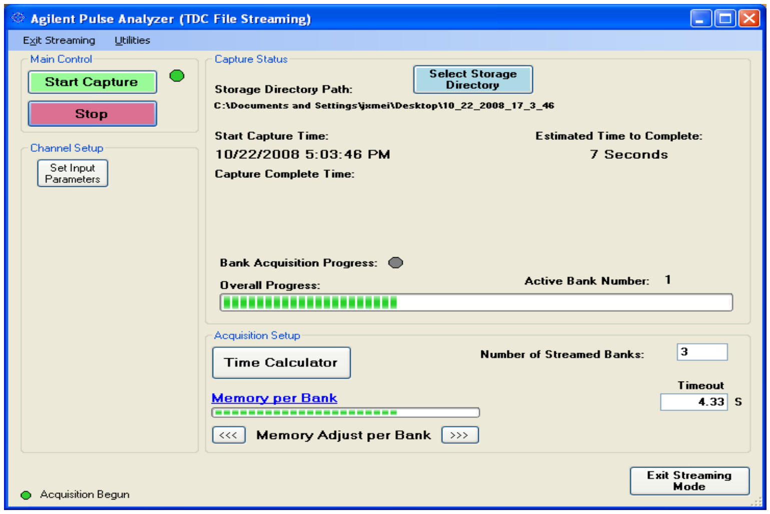


Figure 4-1.18 File Streaming Setup Example

Notice that since a change was applied to the hardware the acquisition LED changed to yellow. At this point the system is ready to begin acquisition.

3) The user then clicks the Start Capture button to begin capturing TDC data segments. The GUI will indicate the overall acquisition process and identify when the acquisition is complete. Additionally, the acquisition start and stop time is identified as shown below.



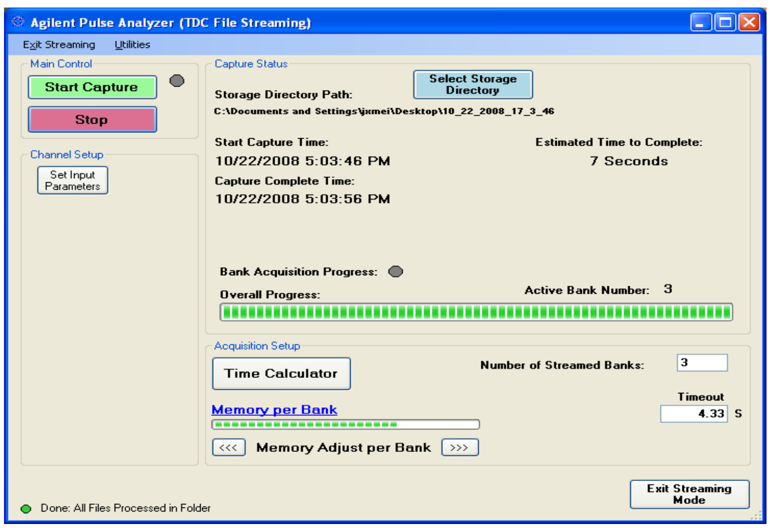


Figure 4-1.19 Acquisition in Progress Displays

Upon completion of acquisition you will see the message Done All Files Processed in Folder.

4) When the acquisition has finished, the user can navigate to the folder where the file data has been written. The figure below shows an example of a streamed signal capture on RF1.

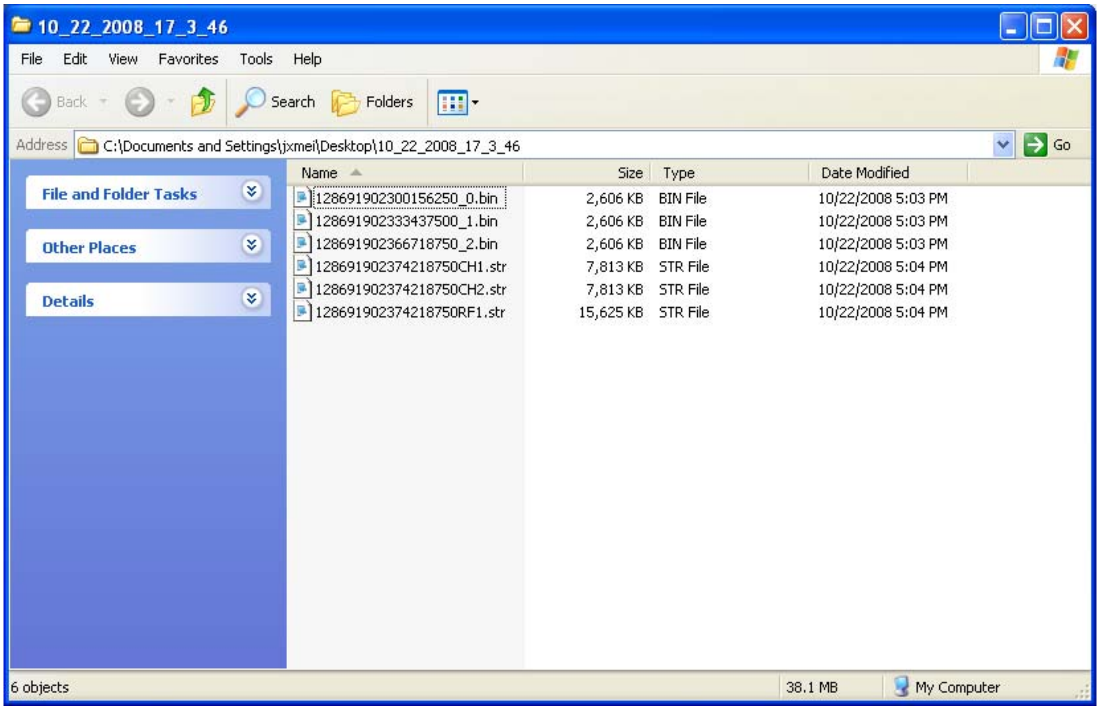


Figure 4-1.20 File Structure Post Stream Capture

Notice that there are several files that have been written to this folder. First, the folder is named using the date and time of the beginning of the acquisition (for example the folder shown was created on Oct 22, 2008 at a start time of 17:03:46 [17h, 03min, 46sec]). Contained in this folder are the 3 raw segment binary files. After all of these raw files are captured, the application will process the signal files into a set of *.str files. These are the actual files used for analysis. The file named ***CH1.str contains the raw time events collected on TDC channel 1. The file named ***CH2.str contains the raw time events collected on TDC channel 2. The file named ***RF1.str is a combined file which represents the combined RF signal on RF1 containing rise and fall events. This is normally the file that will be analyzed.

Analyzing Captured Stream Files

Once the streaming acquisition is completed, the user can analyze the stream file captures or *.str files using the standard PAS GUI. When the user exits the TDC Streaming GUI the standard PAS GUI will re-appear.

To analyze a streaming file use the menu and select File → Recall →Streaming Capture

A dialog box will allow the user to navigate to the folder containing the desired *.str file for analysis. Select this file and a streaming file player display will appear as shown below.

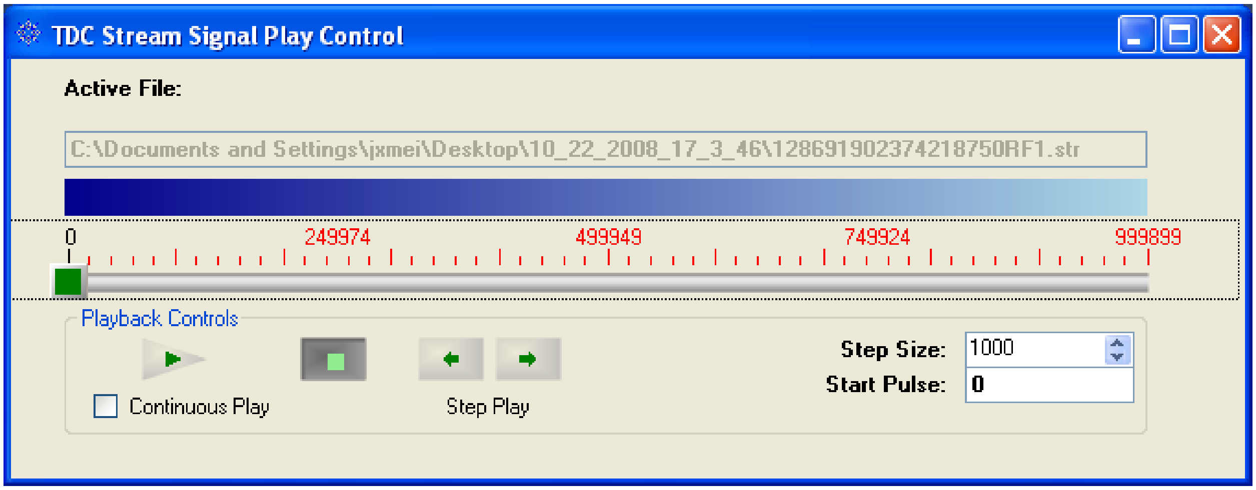


Figure 4-1.21 Streaming File Player Control

Here you can see the file that has been selected. The user can then play any portion of the file captured and display the results on the different PAS GUI displays. The size of display is set on this utility along with the start point of display. To guard against memory overflow errors, an individual step size is limited to 100,000 pulses, but any portion of the signal capture may be analyzed with this utility. Furthermore, the user can dynamically play through the capture by selecting the Continuous Play option. Other controls include Play, Stop, and Forward or Reverse Step. Additionally, the user can use the slider box to select any portion of the waveform to be analyzed. The figure below shows the pulse envelope of the first portion of the streamed capture.

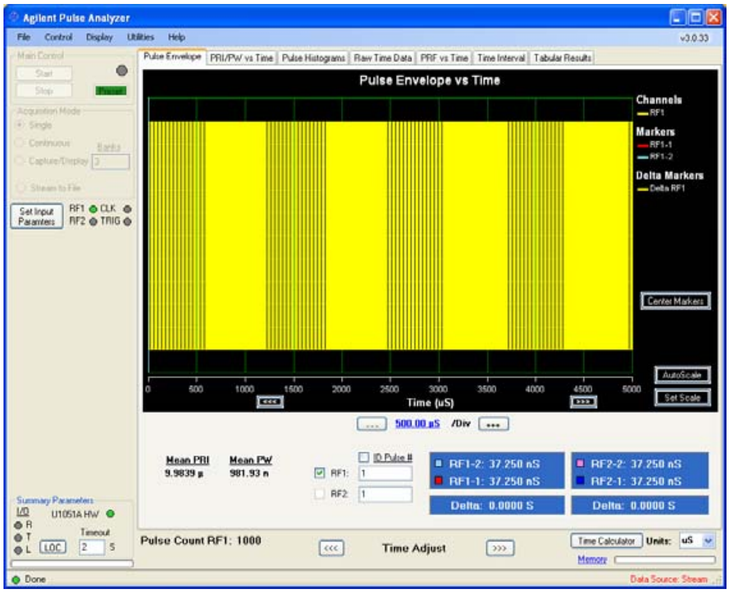


Figure 4-1.22 Streaming File Analysis

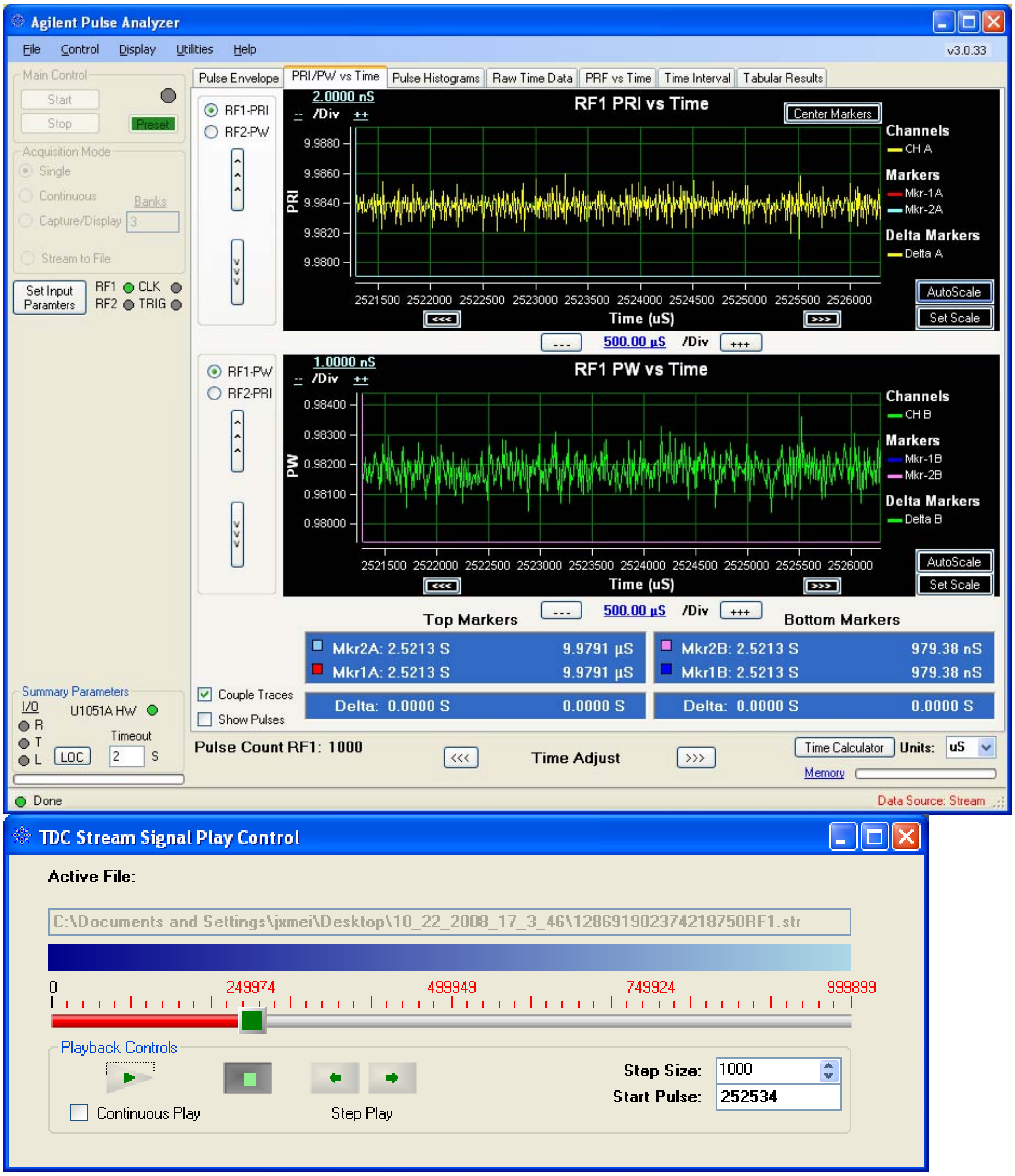


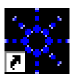
Figure 4-1.23 Additional Streaming Analysis

The figure above shows how a portion of the streaming capture can be analyzed using this display tool. Here the user has selected 1000 pulses to be analyzed starting at pulse number 252534.

4.2 PAS RF Digitizer Application (-171 Option)

To control the optional ADC hardware for the Z2090B-171 configured PAS systems, the user may use the included operational software or the optional-172 VSA software (89601A) to communicate with the ADC module. The VSA software will be discussed in section 4.3 below. It should be noted, however, that either application may interact with the hardware and either application will run with the standard TDC based pulse application. If simultaneous TDC & ADC measurements are required, it is recommended to launch the TDC application first (as outlined in section 4.2 above) then the ADC application (either the standard -171 or VSA -172 application). Refer to the U1065A documentation for ADC parameters referred to in this document.

To launch the Agilent RF Pulse Analyzer application the user may double-click on the Agilent RF Analyzer shortcut that is on the desktop of the PAS controller PC.


Agilent RF Analyzer.lnk

When the application launches a hardware search will commence and the software will look for any installed ADC modules. If an ADC module is located, the software will check to see if a valid license file exists for the installed hardware. If either of the previous checks fails, the software will launch in a simulation only mode. Simulation mode will allow the user to analyze previously recorded waveforms but will not access the hardware for measurements.

RF PAS Operation

Figure 4.2-1 below shows the main user interface screen along with the software control sections outlined.

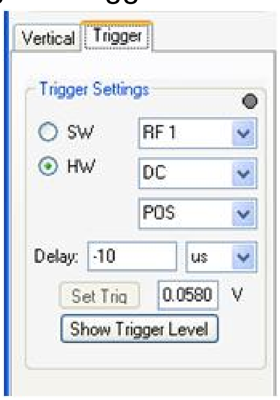
Figure 4.2-1 Agilent RF Pulse Analyzer Software Display

The figure above lists the different control sections:

- Menu Controls – provides direct mouse control to perform the following menu functions
  - File – perform save/recall state and recording functions, preset instrument, and exit the application
  - Control – alternative method of starting or stopping the application, select hardware input (vs recorded input), select local control of hardware
  - Utilities – perform ADC reset and calibration, modify system parameters, and show current system hardware parameters
  - Help – display PAS version and display help documentation for system.
- Acquisition Controls – provides the overall control of how data is collected and enables/disables the PAS measurement. The 3 modes of acquisition are:

- Single – provide a single shot capture or collection of time data up to the selected memory size
- Continuous – provides a continuous update of single captures of measurement data up to the selected memory size
- Capture – provides a set of multiple captures of data using the dual memory bank nature of the TDC module to allow the system to stitch together multiple acquisitions. The number of acquisitions (or Banks) is entered next to this selection.
- Start – This control button will initiate a measurement in the selected capture mode.
- Stop – This control button will stop the measurement currently running.
- Preset – This control button will set the acquisition mode to Continuous and begin running the measurement system with a default configuration.

- Channel Controls – provides channel controls such as enabling the channel, setting the channel threshold and polarity
  - Fs Voltage – ADC full scale voltage setting for digitizer
  - Offset – ADC offset voltage setting
  - Coupling – Set the channel coupling to AC or DC for the input
  - BW – Select the ADC reconstruction filter (LPF) setting for the input
- Trigger Controls – provides control of ADC trigger parameters. This control panel is visible by selecting the Trigger tab.



  - SW/HW Selection – used to specify software trigger (trigger immediately on a software request) or hardware trigger
  - Set Trig Button – will apply all hardware trigger parameter changes to the ADC. If there is a modification to the trigger subsystem this button will turn green representing the fact that this button must be clicked to apply the trigger settings.
  - Trigger Source – used to select internal channel (RF1-RF4) or external trigger
  - Trigger Coupling – specifies the coupling (DC/AC) for the trigger input
  - Trigger Polarity – specifies positive or negative trigger polarity

- Trigger Voltage – trigger voltage threshold value is entered in volts
- Trigger Delay – this control box is used to adjust the time delay setting of the ADC relative to the trigger input. Negative values represent pre-trigger delay.
- Show Trigger Level – this control button will display the current trigger level on the Time Domain display. The trigger level will be displayed as a solid white line on the display. This trigger level will remain displayed for approximately 10 seconds. The user may then adjust the trigger level by re-positioning this line with the mouse. The Set Trig button must be clicked to apply the modified trigger level setting.

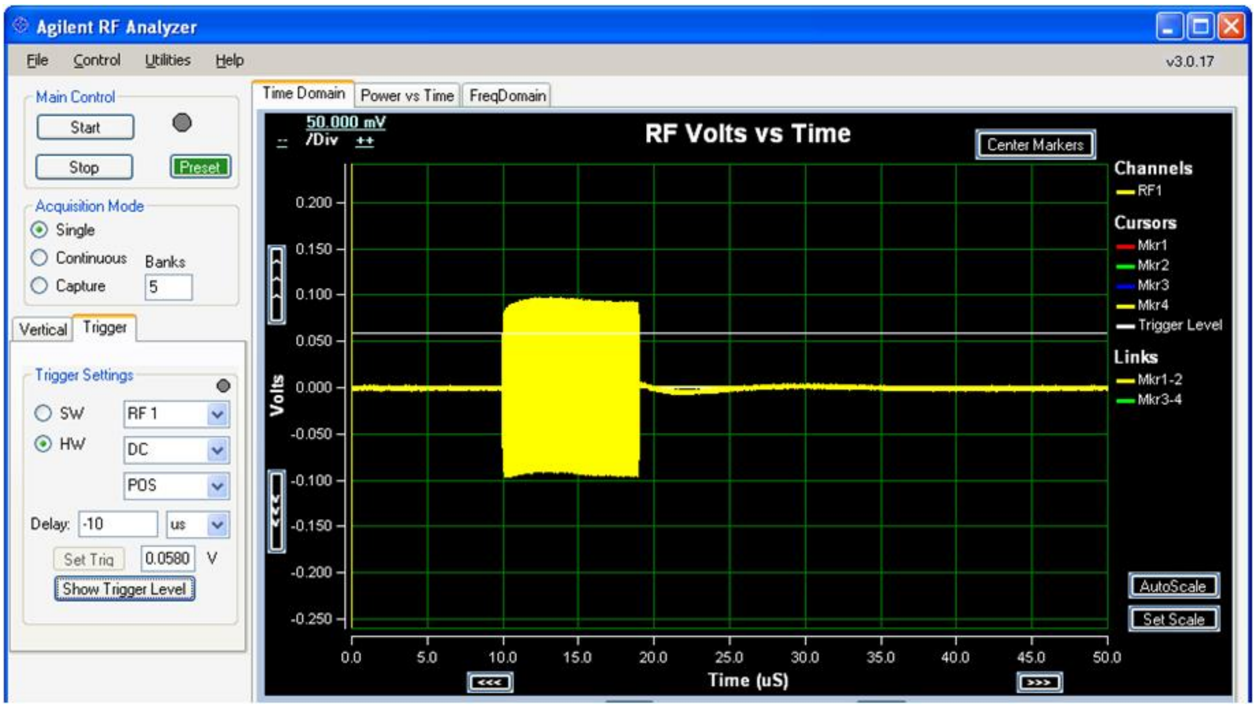
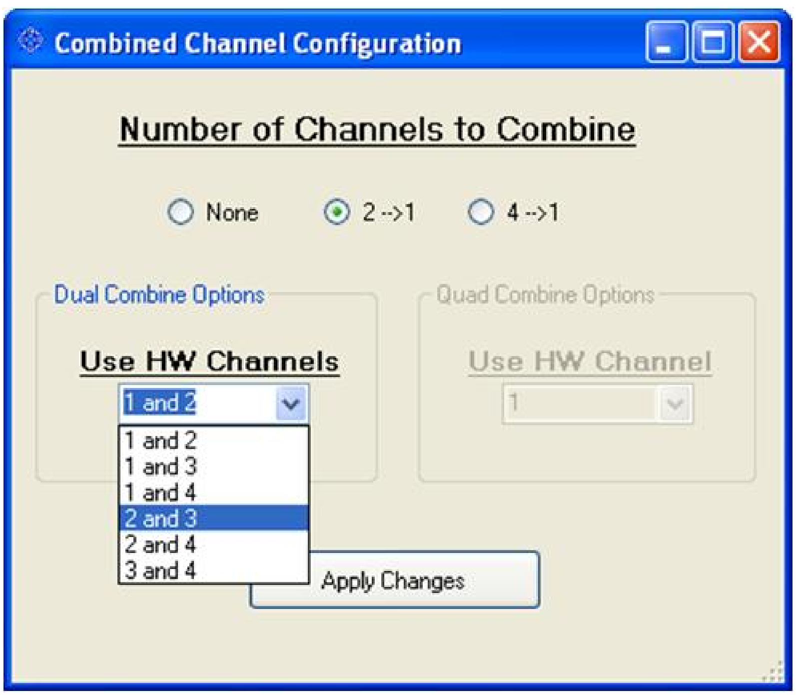


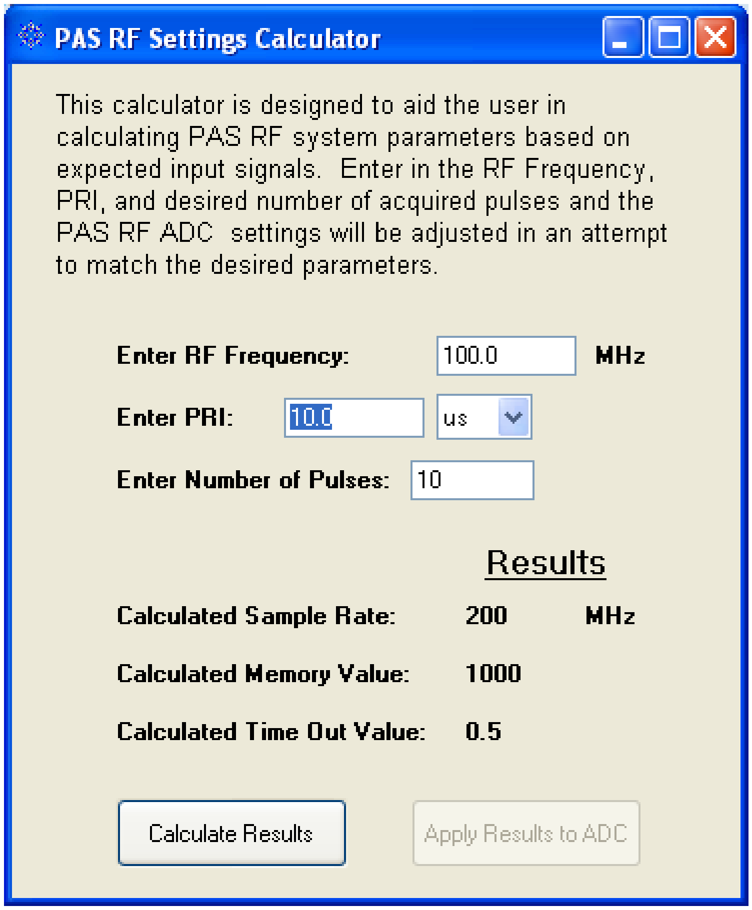
Figure 4.2-1b Show Trigger Level Display

- System Controls– displays the data source for the current result (recording or hardware as well as indicates the status of the U1065A ADC hardware (green is active, blue is simulation). The timeout entry is used to set the ADC timeout for acquisition duration.
- Timing/Memory Controls – These controls configure the time parameters of the ADC including sample rate, sample length, and delay for acquisition.
  - Time Adjust Buttons – These left/right button choices will adjust the time window length by altering the sample clock and memory size for a given acquisition. As values are adjusted, the display windows will update the sample rate and delay.

- Time Window Manual Set– Allows manual configuration of the acquisition time window. Entries must be input using the entry box and terminator drop down box and then the Set button must be clicked after they are entered to be accepted by the ADC.
- Manual Set – This button will bring up a menu to manually control the sample rate, sample points, and delay for acquisition.
- Combine Channels – this check box is used to combine the resources from both channels into a single channel. This will improve the maximum sample rate and memory length for acquisition. When the button is pressed, the control panel (shown below) will appear to allow the user to select the channel combination configuration. The U1065A supports combining 2 channels into 1 or 4 channels to 1. The 2 to 1 combination allows the user to double the sample rate to 4 Gsa/sec. The Use HW Channels will allow the user to select which physical hardware channels are used after combination is applied. The user may also select a 4 to 1 combination allowing the maximum sample rate to be set at 8 Gsa/sec. Again the user selects which of the 4 physical hardware channels are used after combination.



- ADC Calculator – this tool is used as an aid to the user to provide a method of setting up the sample rate and memory of the ADC based on carrier frequency, PRI, and number of pulses to be analyzed.



- Display/Display Selection/Marker Results – These sections control and display the data collected by the PAS hardware in a variety of formats for the user. The display selections across the top are used to select one of the display modes (to be covered in a later section below). The display results are shown on the central display and the marker results section will display the marker readout for the markers on a given trace including the delta marker display results. Traces are color coded to match the channel control section. Marker colors match the marker readout section and may be positioned using the mouse to click and position the marker to the desired position.

RF PAS Displays

The PAS system will display the ADC signal measurements in the following formats:

1. Time Domain
2. Power vs Time
3. Frequency Domain

NOTE: The PAS RF Analyzer software provides limited display capability so for detailed signal analysis beyod this capability, the VSA software option is recommended (Z2090B-172).

Time Domain

Figure 4.2-2 below shows the time domain display for a pulsed RF signal result that has been acquired by the ADC. The signal analyzed in this section is a 8us wide RF pulse with an 80us PRI (or period). The time domain trace will display RF volts versus time. Since this is now an ADC measurement, it is important to review the process in making a measurement:

Measurement Process with ADC

1. Set the input settings by adjusting the Fs voltage until the OV indication appears on this input settings window. You will need to click on the start button to test your settings. Also adjust the coupling and reconstruction filter adjustments to match your input frequency. Typically, you would set the BW to a frequency higher than your input frequency but low enough to prevent aliasing by the digitizer.
2. Adjust the trigger parameters to either software control or hardware control with the appropriate settings.
3. Adjust your sample rate and timing parameters to properly sample the signal of interest.
4. Repeat this process until the acquisition is set properly.

Figure 4.2-2 Pulse Envelope versus Time Display

The figure above shows the pulsed RF signal that has been captured by the ADC on RF input 1. Note that the system was set to perform a single capture of a 320uSec time window. The Sample rate frequency was set to 2 GHz which was more than adequate for the carrier frequency of 100MHz that was measured. You can also see on the left side of the form that we've set the full scale voltage to 0.2V with no offset voltage and we've bypassed the reconstruction filter. This view allows the user to view the voltage of the waveform as a function of time. Using the built in marker display capability, allows us to view the period of the waveform and also measure the voltage at various points of the waveform.

The user may zoom in on any portion of the signal by using the right click functions on the display see Figure 4.2-3 below.

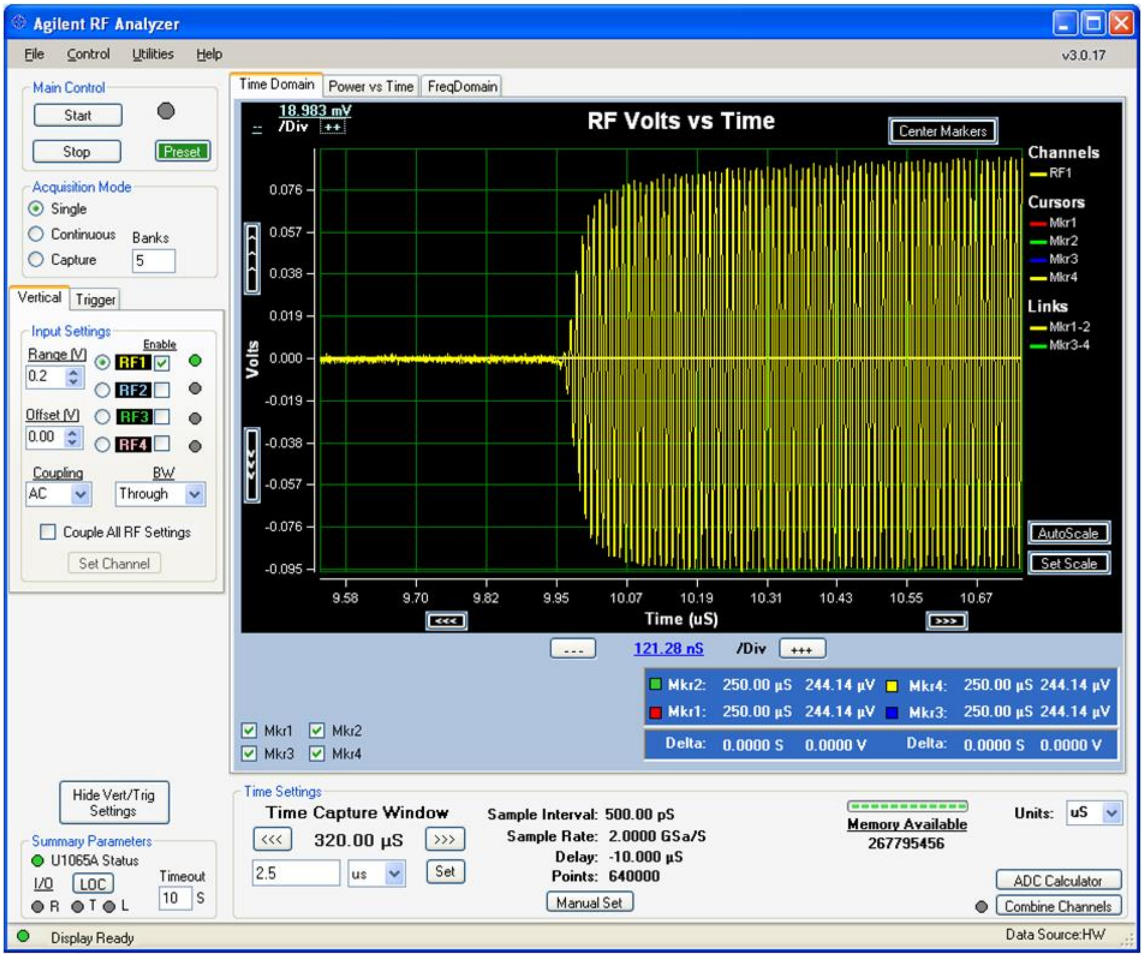
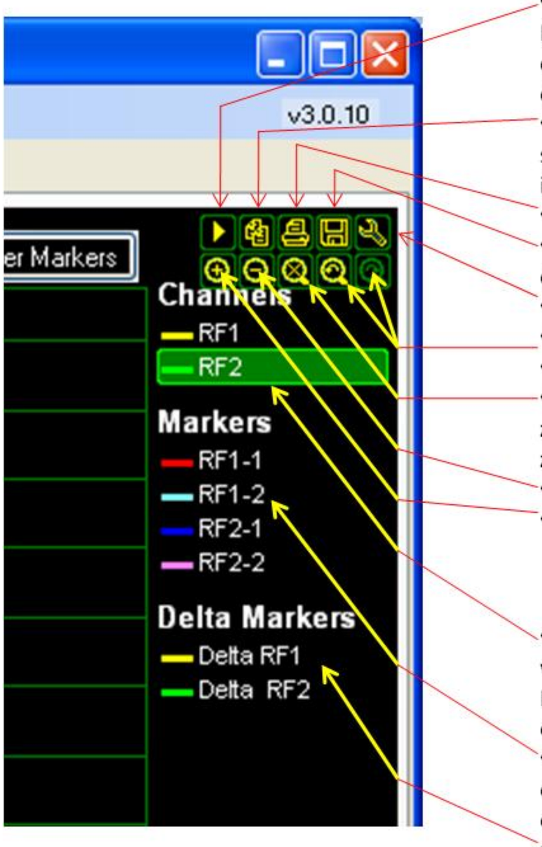


Figure 4.2-3 Zoomed in View of Volts vs Time

Display options (***which are available on all displays***) include:

<u>Display Legend Controls and Information</u>



- Play/Pause – Triangle means the display is paused and the display is NOT updating. Two bars means the display is updating. Clicking this control will toggle pause and update. Zooming ALWAYS pauses the display.
- Copy display to clipboard – this button will copy the entire display section with markers to the clipboard. This allows the user to easily import the screen to a reporting application.
- Print Display – this button will print the display with all markers
- Save Display – this button will save the display as a bitmap image for documentation purposes.
- Setup Display – this button provides control of markers and marker links
- Undo Last Zoom
- Re-Do Last Zoom
- Undo Any/All Zooming – **This is a very important control because the zoom state will remain until this button is clicked to release all zooming. The results can be confusing if zooming is left on.**
- Zoom both axis In – Scaling purposes
- Zoom both axis Out – Scaling purposes

<u>Channels / Markers / Delta Markers</u>

- Channels – A trace is referred to as a Channel on the display. Each trace will be color coded on this legend to match the signal being analyzed. Highlighting any of the legend items will correspondingly highlight them on the display
- Markers (or Cursors) – are a set of vertical and or horizontal lines on the display that are used to make measurements on the display. The number of markers varies with the display result.
- Delta Markers (or Marker Links) – provide a method of doing delta measurements between two markers. Each display has a default pairing of markers to enable delta measurements

Figure 4.2-3b – Display Legend Information

The figure above shows the display legend present on all displays in both the TDC and ADC PAS applications. Clicking on the display will reveal this display legend and provides display control features described above.

***NOTE *** Whenever the user performs a zoom operation on a display, the display is paused (even if the measurement system is still acquiring data. To re-enable display operation, the user needs to push the play/pause button shown above. Also, whenever a zoom operation is performed either with the mouse (by dragging over a region) or using the zoom tools in the toolbar, it is important to remove the zooming using the Undo All Zooming button described above. This will ensure that the display is set to match what the measurement acquisition.

Power vs Time

The second tab display choice is RF Power vs Time. This display uses the measured voltage versus time as was previously discussed and identifies the peak values and formats the results to display only these results. The voltage is converted to RF power in dBm as a function of time. Figure 4.2-4 below shows an example of this display.

Figure 4.2-4 – RF Power vs Time Display

Frequency Domain

The final display selection is the Frequency Domain display which displays RF Power as a function of frequency. This spectrum view of the waveform resembles that obtained using an RF spectrum analyzer. Figure 4.2-5 below shows an example of this display.

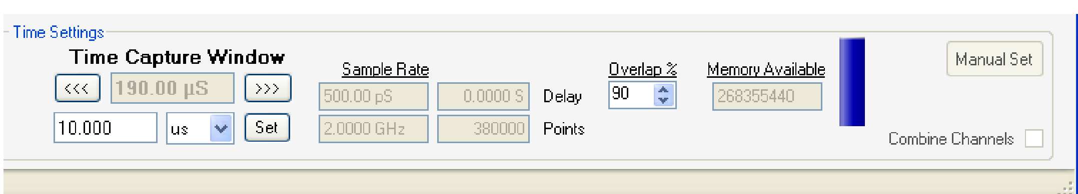
Figure 4.2-5 RF Spectrum Display

The PAS spectrum response is a Hanning windowed spectrum (which may be disabled using the checkbox). This display does not have the detailed analysis that the VSA software has, but it does provide a quick look display of the signal spectrum.

To support detailed analysis of the RF signals captured by the PAS system, this utility can store the captured waveform as a *.csv file which may be imported into the 89601A VSA software. Section 4.3 below details this and the other features available within the VSA software application.

Basic Recording Analysis – The RF Pulse Analyzer Software supports state and recording recall/playback under the File menu. Figure 4.2-6 below shows a recalled signal file being analyzed.

Figure 4.2-6 Recalled Recording



The Time Display Section is updated to reveal the overlap % setting which is used to control the speed of the playback by applying the difference percentage of new data into the display result window. This feature is similar to the overlap processing used by the VSA software.

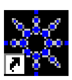
4.3 89601A Vector Signal Analysis (-172 Option)

The Z2090B-172 option (to the PAS ADC-based systems) adds the 89601 Vector Signal Analysis (VSA) software. This software is designed to provide detailed analysis of waveforms using the PAS ADC module. Refer to the 89601A help and user documentation for detailed information on the VSA software as only a limited set of information on the product is included in this guide. Specifications, data sheets, and installation instructions may be located on the web at http://www.agilent.com/find/89600

The VSA software connects to the installed ADC through the Acqiris VSA Server application.

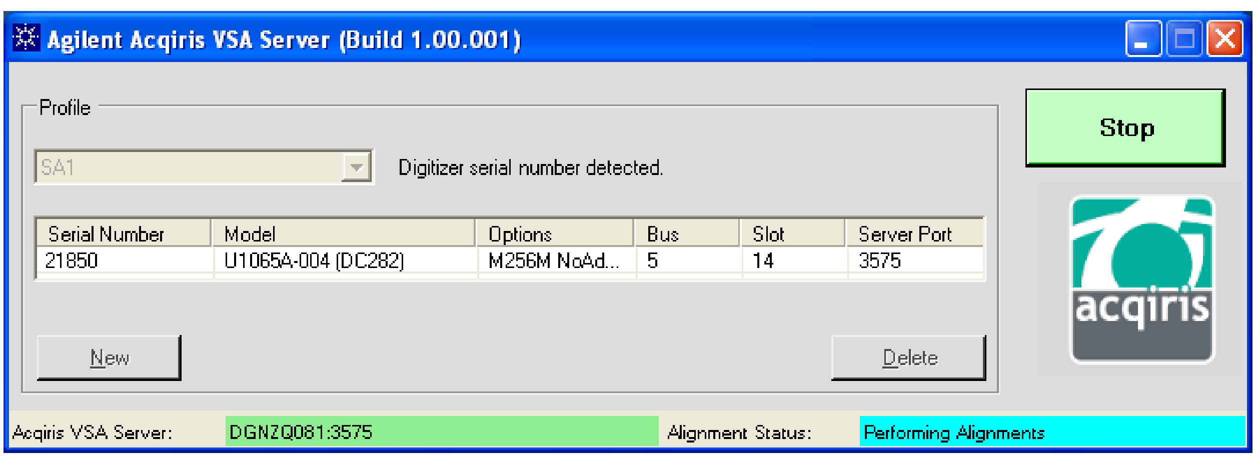
NOTE: This application cannot run simultaneously with the PAS RF Analysis software since both applications utilize the same driver set to communicate with the ADC module. The VSA may be used simultaneously as the PAS Pulse Analysis software running the TDC module if the PAS Pulse Analysis software is launched first.

To launch the VSA server click on the following icon on the PAS desktop.



Acqiris VSA Server (2).lnk

The VSA server window will now be displayed. Click on the Start button and the connection will be made to the hardware.



Once the status shows OK, the VSA application may be launched by clicking on the following icon on the PAS desktop:

Vector Signal Analyzer.lnk

The VSA software can now communicate with the ADC module. Figure 4.3-1 below shows an example of some of the analysis capability of the VSA software.

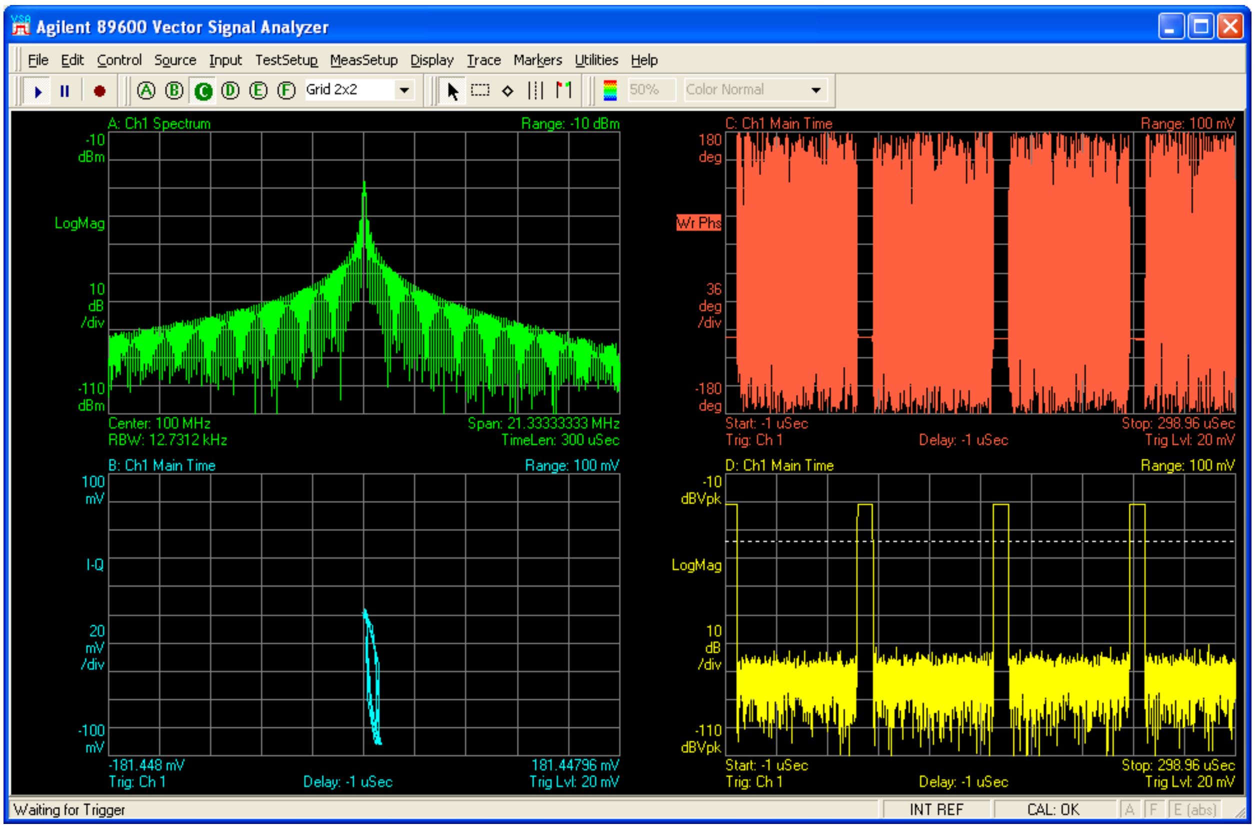


Figure 4.3-1 VSA Analysis Display

The VSA software supports time domain, frequency domain, and modulation domain analysis of RF signals. The VSA is also capable of performing Modulation on Pulse (MOP) analysis including FM Chirp and Barker Code modulation. Refer to the VSA documentation and on line help for instructions on using this software.

5.0 Remote Software Interface

The PAS Pulse Analysis software that communicates with the TDC module supports a remote LAN interface to allow remote applications and computers to connect to the PAS application software. This remote interface allows users to configure hardware, initiate measurements, and retrieve raw measurement data from the PAS application. The remote interface is accomplished using a LAN TCP/IP Socket interface. The PAS network is set using the Windows XP LAN settings under the Control Panel. Once the IP address is set on the PAS hardware, the socket port 8000 is assigned to the PAS. Thus to communicate with the PAS the remote application the user needs only to command the LAN socket using the IP address and the socket Port number 8000.

The table below shows the remote command and status set for the PAS remote interface. Initially the user selects remote by sending the command:
Connect:<ip address>,<client socket port number> to the IP address and socket port 8000 for the PAS workstation.

Table 1 - Remote Socket Commands & Status

Socket Communication is via ASCII Bytes for Strings

Signal Group	Command	Signal Type	Parameters	Description	Example
System					
Select Remote	Connect:	Command	ip address - of remote controller (as string), TCP/IP port (as integer)	Initial command to place PAS in remote (user must send their local IP address and port to use)	"Connect:192.168.2.210,8001"
Remote Reply		Status		Reply from PAS (PAS:Remote means command was executed, PAS:Error means the PAS system has an error)	"PAS:Remote" "PAS:Error"
Select Local	Disconnect:	Command	NONE	Remote command will place PAS in Local if not already in local. User may also locally select local control	"Disconnect:
Local Reply		Status		Reply from PAS (PAS:Local means command was executed, PAS:Error means the PAS system has an error)	"PAS:Local" "PAS:Error"
Preset PAS	Preset:	Command	NONE	Presets the PAS to default state	"Preset:"
Acquisition Mode	AcqMode:	Command	(Sing,Cont,Capt) (as string) if Capt then number of captures (as integer)	Command to set acquisition mode to either single, continuous, or capture	"AcqMode:Sing" or "AcqMode:Cont" or "AcqMode:Capt:10"

Acquisition Mode Reply		Status		Remote response to Acquisition Mode changes.	"PAS:AcqMode:Sing" or "PAS:AcqMode:Cont" or "PAS:AcqMode:Capt:10" or "PAS:Error"
Acquisition Mode Query	AcqMode?:	Query	Send query command and reply shown in Example		"AcqMode?:Sing"
Data Source	DataSource:	Command	(HW,Rec) (as string) if recording then pass filename (as string)	Command to set the system for hardware acquisition or recording analysis. Default path choices are used for recordings.	"DataSource:HW" or "DataSource:Rec:SampleFile.bin"
Data Source Reply		Status		Remote response to data source command.	"PAS:DataSource:HW" or "PAS:DataSource:Rec:SampleFile.bin" or "PAS:Error"
Data Source Query	DataSource?:	Query	Send query command and reply shown in Example		"PAS:DataSource?:HW"
Save Data	SaveData:	Command	(path & filename) as string	Command to save	"SaveData:C:\Program Files\Agilent PAS\Agilent Pulse Analyzer\Recordings\testsignal.bin
Save Reply		Status			"PAS:File <path and name > Saved" or "PAS:Error No Data"
Start	Start:	Command	NONE	Command to start acquisition	"Start:"
Start Reply		Status		Remote response to start command	"PAS:Start" or "PAS:Error"
Start Query	Start?:	Query	Send query command and reply shown in Example		"PAS:Running" or "PAS:Stopped"
Stop	Stop:	Command	NONE	Command to stop acquisition	"Stop:"
Stop Reply		Status		Remote response to stop command	"PAS:Stop" or "PAS:Error"
Timeout	Timeout:	Command	(timeout val) (as real)	Sets the timeout value for acquisition (in seconds)	"Timeout:5"
Timeout Reply		Status		Remote response to timeout command	"PAS:Timeout:5" or "PAS:Error"
Timeout Query	Timeout?:	Query	Send query command and reply shown in Example		"PAS:Timeout?:5"

Memory Size	MemSize:	Command	(memory size val) (as integer) up to max ch limit	Sets the acquisition depth or memory size for the capture	"MemSize:10000"
Memory Size Reply		Status		Remote response to set memory size	"PAS:MemSize:10000" or "PAS:Error"
Memory Size Query	MemSize?:	Query	Send query command and reply shown in Example		"PAS:MemSize?:10000"
External Clock Enable	ExtClock:	Command	(Enable,Disable) (as string)	Enables the External Clock. By default PAS system uses external clock.	"ExtClock:Enable"
External Clock Enable Reply		Status		Remote response to set external clock	"PAS:ExtClock:Enable" or "PAS:Error"
External Clock Enable Query	ExtClock?:	Query	Send query command and reply shown in Example		"PAS:ExtClock?:Enable"
Reset TDC Module	Reset:	Command	NONE	Resets the TDC Hardware	"Reset:"
Reset TDC Module Reply		Status		Remote response to reset command	"PAS:Reset" or "PAS:Error"
Calibrate TDC Module	Calibrate:	Command	NONE	Executes the TDC hardware calibration	"Calibrate:"
Calibrate TDC Module Reply		Status		Remote response to reset command	"PAS:Calibrate" or "PAS:Error"
CH12 Enable	CH12Enable:	Command	(On,Off) (as string)	Enable CH12	"CH12Enable:On"
CH12 Enable Reply		Status		Remote response to stop command	"PAS:CH12Enable:On" or "PAS:Error"
CH12 Enable Query	CH12Enable?:	Query	Send query command and reply shown in Example		"PAS:CH12Enable?:On"
CH12 Set Level	CH12Level:	Command	(V) (as real)	Sets the threshold level in V	"CH12Level:0.5"
CH12 Set Level Reply		Status		Remote response to stop command	"PAS:CH12Level:0.5" or "PAS:Error"
CH12 Set Level Query	CH12Level?:	Query	Send query command and reply		"PAS:CH12Level?:0.5"

			shown in Example		
CH12 Set Polarity	CH12Polarity:	Command	(Pos,Neg) (as string)	Set the CH12 polarity	"CH12Polarity:Pos"
CH12 Set Polarity Reply		Status		Remote response to stop command	"PAS:CH12Polarity:Pos" or "PAS:Error"
CH12 Set Polarity Query	CH12Polarity?:	Query	Send query command and reply shown in Example		"PAS:CH12Polarity?:Pos"
Separate Channels	CH12Channels:	Command	(Combine,Separate) (as string)	Combines or separates CH12 channels	"CH12Channels:Combine" or "CH12Channels:Combine"
CH12 Separate Channels Reply		Status		Remote response to stop command	"PAS:CH12Channels:Combine" or "PAS:CH12Channels:Combine" or "PAS:Error"
CH12 Separate Channels Query	CH12Channels?:	Query	Send query command and reply shown in Example		"PAS:CH12Channels?:Combine"
CH6 Set Level	CH6Level:	Command	(V) (as real)	Sets the threshold level in V	"CH6Level:0.5"
CH6 Set Level Reply		Status		Remote response to stop command	"PAS:CH6Level:0.5" or "PAS:Error"
CH6 Set Level Query	CH6Level?:	Query	Send query command and reply shown in Example		"PAS:CH6Level?:0.5"
COM HW Trigger Enable	COMEnable:	Command	(On,Off) (as string)	Enable COM Port for HW triggering	"COMEnable:On"
COM HW Trigger Enable Reply		Status		Remote response to stop command	"PAS:COMEnable:On" or "PAS:Error"
COM HW Trigger Enable Query	COMEnable?:	Query	Send query command and reply shown in Example		"PAS:COMEnable?:On"
COM Trigger Set Level	COMLevel:	Command	(V) (as real)	Sets the threshold level in V	"COMLevel:0.5"
COM Trigger Set Level Reply		Status		Remote response to stop command	"PAS:COMLevel:0.5" or "PAS:Error"
COM Trigger Set Level Query	COMLevel?:	Query	Send query command and reply shown in Example		"PAS:COMLevel?:0.5"
COM Trigger Set Polarity	COMPolarity:	Command	(Pos,Neg) (as string)	Set the COM or trigger in polarity	"COMPolarity:Pos"
COM Trigger Set Polarity Reply		Status		Remote response to stop command	"PAS:COMPolarity:Pos" or "PAS:Error"

COM Trigger Set Polarity Query	COMPolarity?:	Query	Send query command and reply shown in Example		"PAS:COMPolarity?:Pos"
CH1 Request Data	CH1Data?	Command	NONE	Query command to collect CH1 Data	"CH1Data?:"
CH1 Request Data Reply		Status	(number of bytes to be returned) (as integer)	Response to query command	"PAS:CH1Data?:952"
Data Socket Read		Data Read	stream of 8 bit Bytes containing the CH1 data	The data to be read back will be sourced on the next highest socket port as a dedicated stream of 8bit Byte values representing the CH1Data. Each CH1 data value is a double precision number thus 8 Bytes represent 1 measured data point.	"<data to be streamed>"
CH2 Request Data	CH2Data?	Command	NONE	Query command to collect CH2 Data	"CH2Data?:"
CH2 Request Data Reply		Status	(number of bytes to be returned) (as integer)	Response to query command	"PAS:CH2Data?:952"
Data Socket Read		Data Read	stream of 8 bit Bytes containing the CH2 data	The data to be read back will be sourced on the next highest socket port as a dedicated stream of 8bit Byte values representing the CH2Data. Each CH2 data value is a double precision	"<data to be streamed>"

				number thus 8 Bytes represent 1 measured data point.	
CH3 Request Data	CH3Data?	Command	NONE	Query command to collect CH3 Data	"CH3Data?:"
CH3 Request Data Reply		Status	(number of bytes to be returned) (as integer)	Response to query command	"PAS:CH3Data?:952"
Data Socket Read		Data Read	stream of 8 bit Bytes containing the CH3 data	The data to be read back will be sourced on the next highest socket port as a dedicated stream of 8bit Byte values representing the CH3Data. Each CH3 data value is a double precision number thus 8 Bytes represent 1 measured data point.	"<data to be streamed>"
CH4 Request Data	CH4Data?	Command	NONE	Query command to collect CH4 Data	"CH4Data?:"
CH4 Request Data Reply		Status	(number of bytes to be returned) (as integer)	Response to query command	"PAS:CH4Data?:952"
Data Socket Read		Data Read	stream of 8 bit Bytes containing the CH4 data	The data to be read back will be sourced on the next highest socket port as a dedicated stream of 8bit Byte values representing the CH4Data.	"<data to be streamed>"

Each CH4 data value is a double precision number thus 8 Bytes represent 1 measured data point.

Printed in USA, November 10, 2008
Z2090B-92001

Agilent Technologies