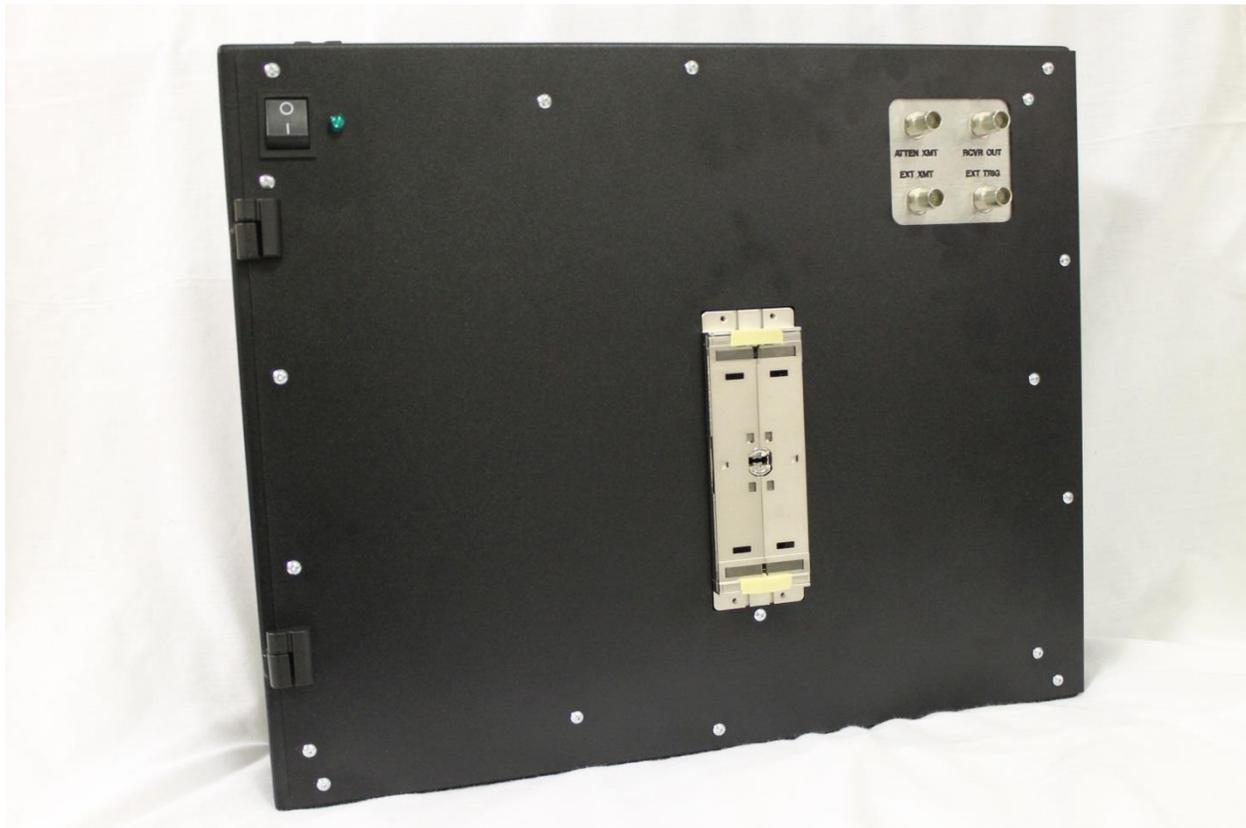# ACERTARA
acoustic laboratories

Acceptance Testing
Linked Acoustic System - ATLAS™
User's Manual

ATLAS^{TM} - User's Manual

THE ATLAS SYSTEM IS INTENDED FOR USE ONLY BY PROPERLY TRAINED TECHNICAL PERSONNEL OR UNDER THE SUPERVISION OF SUCH A TRAINED TECHNICAL PERSON (HENCEFORTH "THE USER").

PRIOR TO OPERATING THE SYSYTEM, THE USER MUST THOROUGHLY READ AND UNDERSTAND THIS MANUAL. IMPROPER USE OF THE SYSTEM MAY CAUSE PERSONAL INJURY AND/OR DAMAGE TO THE SYSTEM THAT MAY INVALIDATE THE WARRANTY AGREEMENT.

NOTE: THIS USER GUIDE DESCRIBES THE OPERATION OF THE ATLAS SYSTEM ONLY.

Contact Information

United States Headquarters:
Acertara Acoustic Laboratories, LLC
Address: 1950 Lefthand Creek Lane
          Longmont, CO 80501
          United States
Phone: 303.834.8413
Website: www.acertaralabs.com
E-mail: sales@acertaralabs.com

Table of Contents

1 INTRODUCTION

Congratulations on your purchase of the ATLAS ultrasound probe analysis system. The ATLAS is a high quality, easy to use ultrasound array and complete probe testing device that is stable, highly mobile and designed to be convenient and comfortable to operate.

1.1   Intended User

This user manual is intended as a reference for operators using the ATLAS ultrasound array/probe testing and analysis system. It is designed for a reader generally familiar with ultrasound, basic electronic measurements, and probe testing devices; it does not provide training in these areas or in general metrology practices.

1.2   Notation and Acronyms

- Items enclosed in `backticks` are artifacts specific to the ATLAS software application, such as display items, filenames, locations, etc.
- ATTEN - Attenuated
- RCVR, Rx - Receiver, Receive
- S/N - Serial Number
- TRIG - (Signal) Trigger
- XMTR, XMT, Tx - Transmitter, Transmit
- ZIF - Zero Insertion Force (connector)

1.3   References

- Detailed software appearance and behavior will vary across software versions and the reader is referred to the *ATLAS Software Manual* for version-specific software details. This can be found within the ATLAS application under the menu choice `Help >> Software Manual`.
- PR5800 - Panametrics/Olympus model PR5800 ultrasonic pulser-receiver test equipment (legacy equipment). More details here: https://www.olympus-ims.com/en/5800pr/

1.4   Calibration

ATLAS requires calibration, recommended annually. Call Acertara at (303) 834-8413 or email sales@acertaralabs.com to arrange for calibration.

The calibration date is stored in the unit's on-board nonvolatile memory and it is also stored on the PC where ATLAS software is installed. In the event that the calibration dates in these two locations do not match, the user is warned that a factory calibration may be necessary or that they are using an older calibration file.

1.5   Cleaning and Preventive Maintenance

Clean the outside of the ATLAS probe testing and analysis system with a damp cloth as needed to remove dust and dirt. Do not open the ATLAS case. ATLAS is designed to be serviced only by authorized service personnel. Contact Acertara at the number listed in the Service and Technical Support section below. Performing maintenance procedures not described in the user guide will void the warranty.

1.6　Service and Technical Support

Contact Acertara via email techsupport@acertaralabs.com with any questions you may have about your ATLAS system.

2　GETTING STARTED

2.1　Unpacking ATLAS

When unpacking the ATLAS unit please ensure that the following components are present:

- Main ATLAS Unit
- Software Installation CD
- Unit Support Files CD
- Probe Adapter/Adapters
- AC Power Cable
- USB System Cable
- USB Temperature Sensor with Extension Cable

Any missing or damaged items should be reported to Acertara immediately.

2.2　Computer Requirements and Operational Software

The following PC specifications are necessary to optimally run ATLAS:

1) Operating System: Windows XP Professional, Windows 7 Professional, Windows 10 Professional
2) USB 2.0 Port: At least two available
3) Processor: 1GHz or faster 32-bit (x86) or 64-bit (x64)
4) RAM: 1GB (32-bit) / 2GB (64-bit)
5) Hard Disk Space: 1GB available for the software. More space is required for measured data (up to 5 MB per measurement).
6) Resolution: 1280×768 or higher resolution video adapter and monitor

2.3　Software Installation

NOTE: Do not connect ATLAS to computer with USB cable prior to software installation. To install the software, place the CD in your computer and follow the on-screen directions. Alternatively, if you have obtained an `.iso` installation file through email, the Internet, or other digital channel, mount that `.iso` file and double-click the `install.exe` file. If errors are encountered during the initial system operation after the installation, they will typically not prevent the installation of the ATLAS application. In these cases, troubleshooting steps can be found in the *ATLAS Software Manual* which is accessible from the ATLAS application by selecting the menu choice `Help >> Software Manual`.

The Unit Support Files CD contains the unit specific calibration file and parameter file templates. Install this software after the main application software and prior to applying power to ATLAS. IMPORTANT: Following an annual calibration ATLAS will be returned with a new Unit Support Files CD. This CD will contain the latest calibration file for this unit. To complete the calibration process the user must install the file contained within this CD on their computer.

2.4   Powering ATLAS

Operating Line Frequency and Voltage Range: 100-250 Volts, 47-63Hz

2.5   System Installation

Place the ATLAS on a flat surface with the ZIF connector and BNC panel facing upward. Note that if vertical mounting is desired, rack mount brackets are available.

Connect the AC power cord and connect the USB system cable between the ATLAS and the computer.

Connect the USB temperature sensor to the computer with the sensor installed in the Acoustic Tank. An extension cable is provided if extra cable length is needed.

The user may choose not to use the USB temperature sensor. If the sensor is not detected the application will warn the user and then proceed with an assumed temperature of 22°C. If desired, the user may inhibit this warning by setting 'Disable Thermistor' to True in the Options.ini file.

2.6   Functional Check

Perform the following steps for a basic functional check:
- Turn on the ATLAS unit and verify that USB drivers are successfully installed for the ATLAS unit and temperature sensor.
- Turn on the ATLAS and then start the ATLAS software.
- Verify that the proper Hardware S/N for the ATLAS unit is displayed on the main window and that there are no error messages.
- Select the "AllElementsTest" parameter file provided and run an impedance test verifying that you hear relays clicking, data is displayed for all elements, the data for all elements is similar and the impedance magnitude is large.

3 ATLAS OPERATION

3.1   System Components

The major components of ATLAS are discussed below:
- Main Unit
- Temperature Sensor
- Mainframe Test Peripheral

3.1.1   Main Unit

The ATLAS Main Unit is comprised of a connector for attaching probe adapters and a Connectivity panel. Probe adapters are connected to the DLP408-R ZIF connector on the Main Unit. They are necessary to adapt the element wiring for a specific probe connector family. An example probe adapter is shown in the photo below:

ATLAS Antares/Aplio Adapter

The Main Unit's Connectivity Panel provides access to trigger, transmit, and receive signals. A photo of the Connectivity Panel is shown below and each connection is discussed below:

ATLAS Signal Connectivity Panel

- ATTEN XMT BNC - This BNC output provides the User the ability to view the transmit pulse amplitude divided by 500. This signal may be directly connected to an oscilloscope, but it must be terminated with 50 Ohms at the oscilloscope input.
- EXT XMT BNC - In external transmit mode this BNC is the input from an external pulser. Note that the external pulser must be triggered by the ATLAS unit by connecting the external pulser's trigger input to the EXT TRIG BNC on ATLAS. In internal transmit mode this BNC is an output and can be used to monitor the transmit pulse. Should the user wish to monitor the internally generated transmit pulse via this BNC without a load (probe) being connected to ATLAS, they should terminate the pulser into a suitable load by terminating EXT XMT into 50Ω using a BNC-T.
- RCVR OUT BNC - The analog receiver output signal is available from this BNC. It must be terminated into 50 Ohms at the oscilloscope or other digitizing device. The amplitude of the signal is up to ± 1V.
- EXT TRIG BNC - This BNC provides the TTL pulse that must be used to trigger an external pulser (in external transmit mode).

3.1.2 Temperature Sensor

The ATLAS temperature sensor is a USB thermistor that simply plugs into any available USB port on the PC running ATLAS software. The sensing end of the thermistor is intended to be placed inside the acoustic tank during probe measurements. A photo of the thermistor is shown below:

ATLAS USB Thermistor

3.1.3 Mainframe Test Peripheral

The ATLAS Mainframe Test (MFT) peripheral is a hardware device that connects to the ATLAS at the adapter connector. The MFT device exercises various aspects of the ATLAS unit to verify proper operation of the ATLAS hardware. The device is a high-speed test instrument, intended to give ATLAS users a tool to evaluate the functionality and calibration of their ATLAS mainframe, and assist the user in determining whether hardware problems are due to their mainframe or their adapter. A photo of the MFT is shown below:

ATLAS Mainframe Test Peripheral

3.1.3.1 Setup and Operation

The MFT peripheral is simply connected to the ATLAS mainframe unit in the same fashion as any ultrasound probe adapter is connected to ATLAS. Once the MFT device is connected, the ATLAS software will automatically detect the presence of the MFT device and it will then permit the execution of the MFT test suite. Normal ATLAS tests (Pulse, Impedance) are not permitted while the MFT device is connected to the ATLAS mainframe. Further details about the software operation can be found in the *ATLAS Software Manual* which is accessible from within the ATLAS application by selecting `Help >> Software Manual`. When a mainframe test is initiated, the following subsystems are tested as part of the MFT test suite:

- Power Supplies - This tests the +12V, -12V, +5V, +HV Mux, -HV Mux, +LV Mux, and -LV Mux supplies (HV = High Voltage, LV = Low Voltage).
- Control Interface - This tests the digital control lines between internal printed circuit boards within the ATLAS unit.

- Cp Accuracy - This tests the measured accuracy of the reference capacitor component installed on Channel 1 of the MFT device.
- Channel Test - This tests for correct normal capacitance values on all 256 internal channels of the unit.
- Tx Unipolar 90V - This tests the pulse characteristics of the a unipolar transmit pulse at a 90V setpoint. Characteristics checked include pulse width, fall time, and amplitude.
- Tx Unipolar 115V - This tests the pulse characteristics of a unipolar transmit pulse at a 115V setpoint. Characteristics checked include pulse width, fall time, and amplitude.
- Tx Bipolar 60V - This tests the pulse characteristics of a bipolar transmit pulse at a 60V setpoint. Characteristics checked include pulse width and amplitude.
- Rx Low Gain - This tests the pulse characteristics of a synthesized receive pulse at a low gain setpoint. Characteristics checked include amplitude and frequency.
- Rx High Gain - This tests the pulse characteristics of a synthesized receive pulse at a high gain setpoint. Characteristics checked include amplitude and frequency.
- Drift Analysis - This test is not shown on the GUI but it does appear in the PDF report. The results of the drift analysis are based on the historical measured values of the power supplies. A trend is computed for these values and the resulting slope of this trend is available in the PDF report. The drift analysis requires 90 days of MFT data to be valid.

3.1.3.2 Calibration and Service

The MFT device requires annual calibration which can be performed only at Acertara facilities. Call Acertara at (303) 834-8413 or email sales@acertaralabs.com to arrange for calibration. The MFT device is not field-upgradeable and there are no components which can be repaired or replaced by the end user -- the device must be returned to Acertara for repair or replacement.

3.2   Software Quick Start

This section provides quick start instructions on performing introductory measurements with the ATLAS unit. Because this is intended as a quick start, not all features of the ATLAS software are described in this section. For complete and detailed information about ATLAS software features and capabilities, please refer to the *ATLAS Software Manual* which can be accessed from within the ATLAS application under the menu selection `Help >> Software Manual`.

3.2.1   Main Window

Upon launching the ATLAS software with all hardware properly configured, the main window will appear. The main window allows the operator to select a probe and provide information for the test record -- a representative image of this window is shown below:
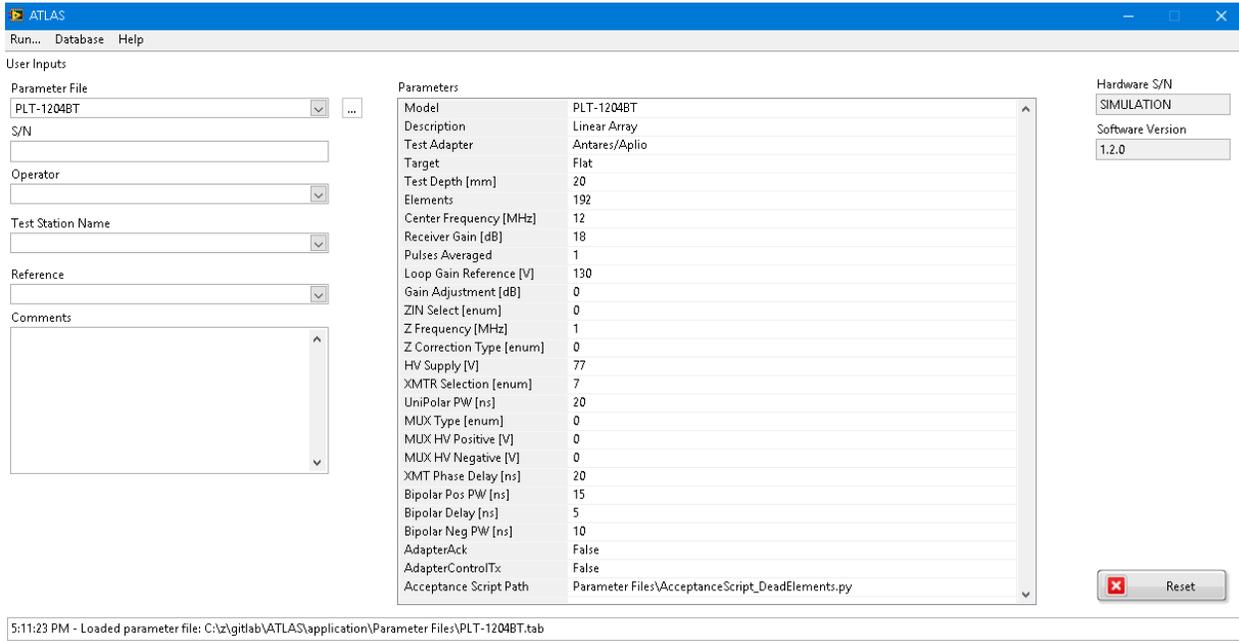
Main Window

The Main window is where all test parameters are initially selected or entered by the user before initiating an alignment, a pulse/echo test, an impedance test, or reviewing the measurement database. Details about the Main window are provided in the *ATLAS Software Manual*, but the following core features are supported:

- Allows selection of a parameter file for the probe under test -- this is the first step in running a test and the probe parameter file contains all important parameters which define how a probe will be tested.
- A displayed summary of relevant parameters extracted from the selected parameter file. Primary parameters include the probe model, test adapter, target, and test depth. Many secondary parameters are also displayed but these primary parameters represent a bare minimum to get started -- for additional information on all parameters, please refer to the *ATLAS Software Manual*. Among these primary parameters, the probe model is determined by the parameter file, the "test adapter" is the adapter connected to the ZIF connector to provide the correct pin-out for the device being tested, the "target" is the type of reflecting target used in the acoustic tank, and the "test depth" is the distance between the probe and the target.
- Controls to allow the user to provide additional information about the test setup: serial number of the device under test, operator, comments, etc.
- A reset button to clear all current entries and selections.
- Displays of miscellaneous status information: ATLAS hardware serial number, software version, and a status message area.

3.2.2 Alignment Window

When conducting pulse/echo tests on a probe for the first time, it is recommended to run an alignment with the probe. To run an alignment, the operator must place the probe or array in the probe holder at the distance and with the target specified in the probe's parameter file. From the main window, select the menu choice `Run >> Alignment` to initiate an alignment procedure. When an alignment has been started but the target is not optimally positioned, the user will be notified to adjust the probe alignment in the acoustic tank. Once the probe has been properly positioned, the Alignment window will appear as shown below:
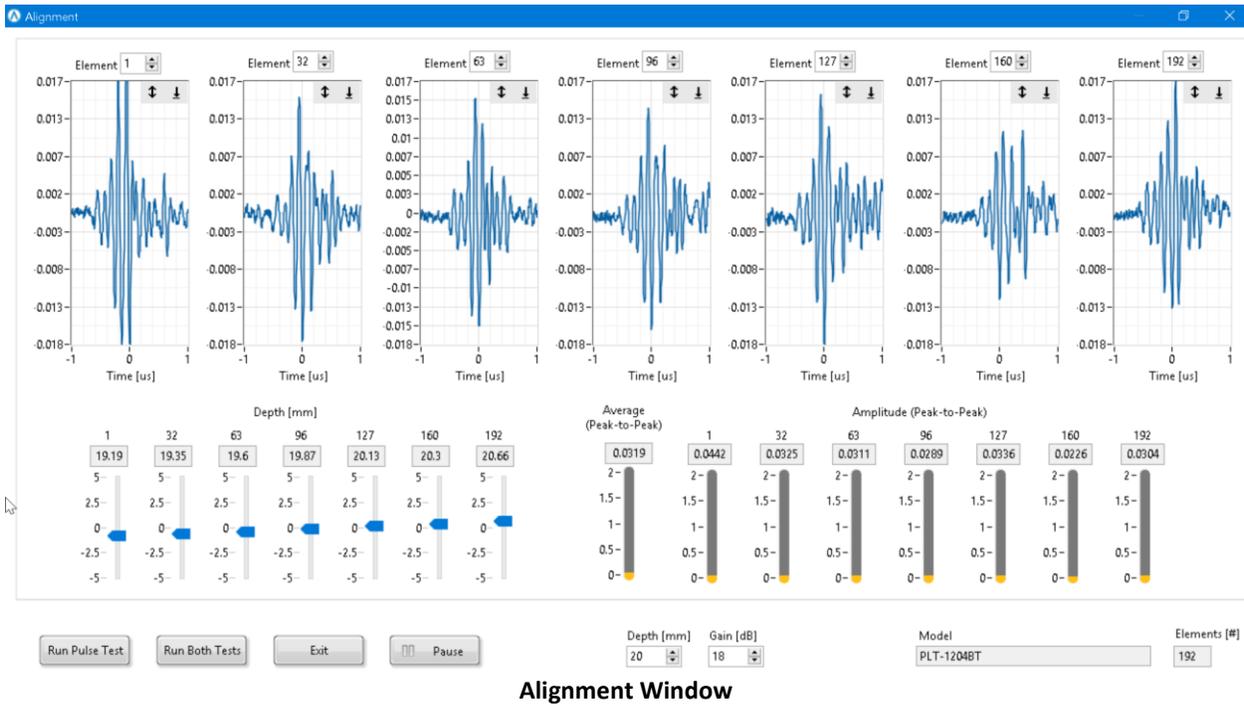
Alignment Window

Details about the Alignment screen can be found in the *ATLAS Software Manual*, but the following general features are supported:

- The waveform displays show a reflected pulse for several sample elements. This allows the operator to verify that a pulse is being received on these sample elements. The sample elements displayed can be changed by the user on this window. Once adequate signals are displayed on all waveforms, then the "Depth" and "Amplitude" sections of this window can be used to assess the probe alignment further.
- A "Depth" indicator section displays the distance between the target and each sample element. This information allows convenient adjustment of the probe holder in the acoustic tank to make all depth values equal. The Depth indicator displays both the measured depth for each element and the difference between the element depth and the nominal depth as set in the probe's parameter file.
- An "Amplitude" indicator shows the peak-to-peak voltage for the return signal of each of the displayed elements. This is helpful for adjusting the probe to achieve the maximum output across the entire probe. Individual amplitude is shown for the sampled elements and these can be used to achieve uniformity of the amplitude across the probe.
- From the Alignment window, the user can initiate a pulse/echo test or a "Both" test (pulse/echo and impedance test).
- A pause/resume button is provided to freeze the state of the Alignment window.
- The Alignment window also provides controls to change other test parameters such as gain, depth, etc.

3.2.3   Test Window -- Pulse Test

A pulse/echo test may be initiated by selecting `Run >> Pulse Test` from the main window which will display the Pulse Test window as shown below:

Pulse Test Window

ATLAS executes the pulse/echo test on the probe and updates the plots as elements are measured to track the progress of the test. The display of this window is configurable through the software and the reader is referred to the *ATLAS Software Manual* for details. In short, the following data and features are supported within the Test window:

- Waveform plots which show the received pulse waveform and its pulse spectrum for the most recent element tested -- the transmit waveform can be optionally displayed through configuration settings.
- Criteria plots which will typically display the following, but the exact Criteria will depend on the software version being used: sensitivity, pulse length, center frequency, fractional bandwidth, time of flight, and insertion loss.
- The operator can re-test any individual element by specifying an "active element". The element selected will be re-measured and highlighted in the Criteria plots.
- A pause/resume button is provided to freeze and re-start testing at any point.
- The operator can click on the Criteria plots to highlight an element and view the waveform data for that element.
- Controls for Gain and Sample Depth are provided to allow the operator to adjust these across tests.
- The ability to save the test results to a database and exit the Test window.
- A "Results" tab or pane which shows statistical values for the probe. Results can be configured to omit dead elements from the statistical calculations -- refer to the *ATLAS Software Manual* for details about that feature. An example of the Results is shown in the figure below:

Results Tab on the Tests Window

3.2.4   Test Window -- Impedance Test

An Impedance Test may be initiated by selecting `Run >> Impedance Test` from the main window . This test measures the complex impedance of each array element at a test frequency specified in the probe's parameter file. The results are displayed in Test window along with statistical values for various impedance criteria. An example Impedance Test window is shown below:
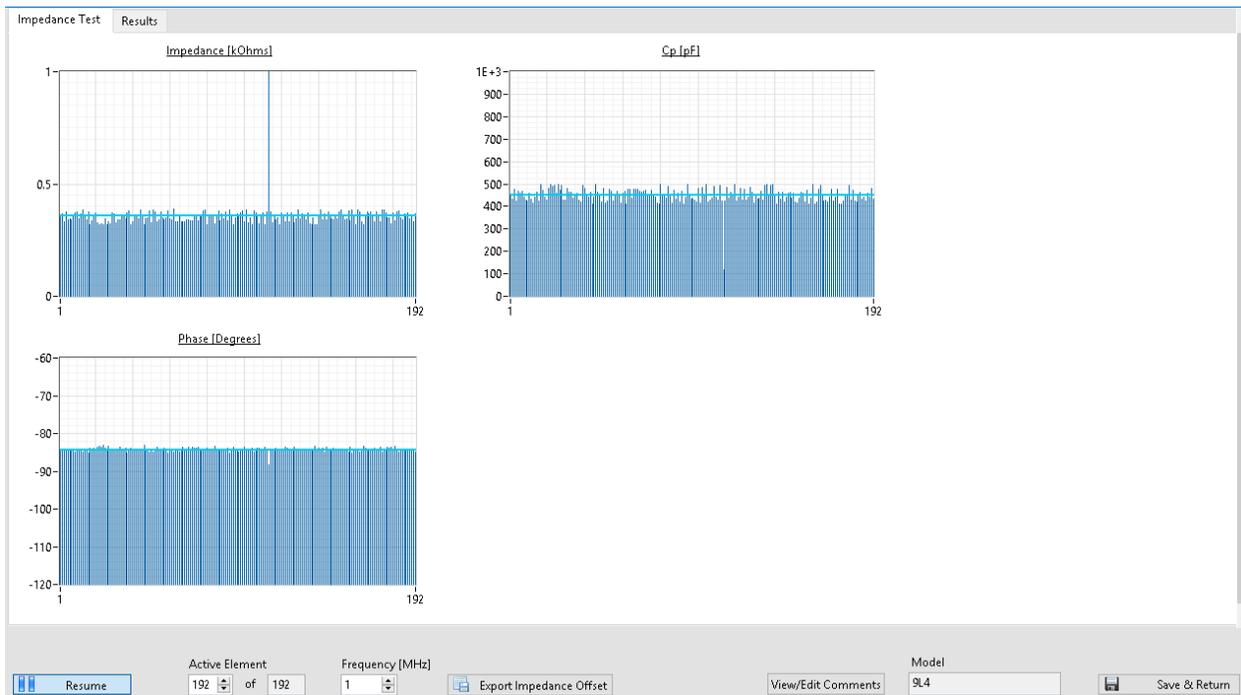
Impedance Tab on Tests Window

While in impedance mode, the Test window has the following interface features, details of which can be found in the *ATLAS Software Manual*:

- Plot displays of impedance, phase, and equivalent parallel capacitance of the probe and cable derived from the measured impedance (non-capacitive reactive loads are displayed as negative values).
- A pause/resume button for freezing and re-starting a test at any point.
- The ability to change the frequency at which impedance measurements are conducted.
- An export feature for applying correction values to the measurements through the probe's parameter file.
- A "Results" display which shows statistical parameters and pass/fail results regarding the impedance measurements.
- The ability to save the test record to a database and return to the main window.

3.2.5 Test Window -- Both Tests

A "Both Test" executes a Pulse Test followed immediately by an Impedance Test. Both measurements are executed as described in their individual sections above. A "Both Test" may be initiated by selecting `Run >> Both Tests` from the main window. All controls associated with Pulse and Impedance tests as described above are available -- the "Both Tests" option is provided as a convenience to allow the user to execute both tests in succession.

3.2.6 Test Database

The user can save individual test results in a database for later retrieval -- this database information includes items such as parameter file name, operator-provided information, water temperature, device information, captured waveform data, etc. To view database entries, select `Database >> View Main Database` from the main window -- the Database window will appear as shown below (exact appearance may differ across software versions) :
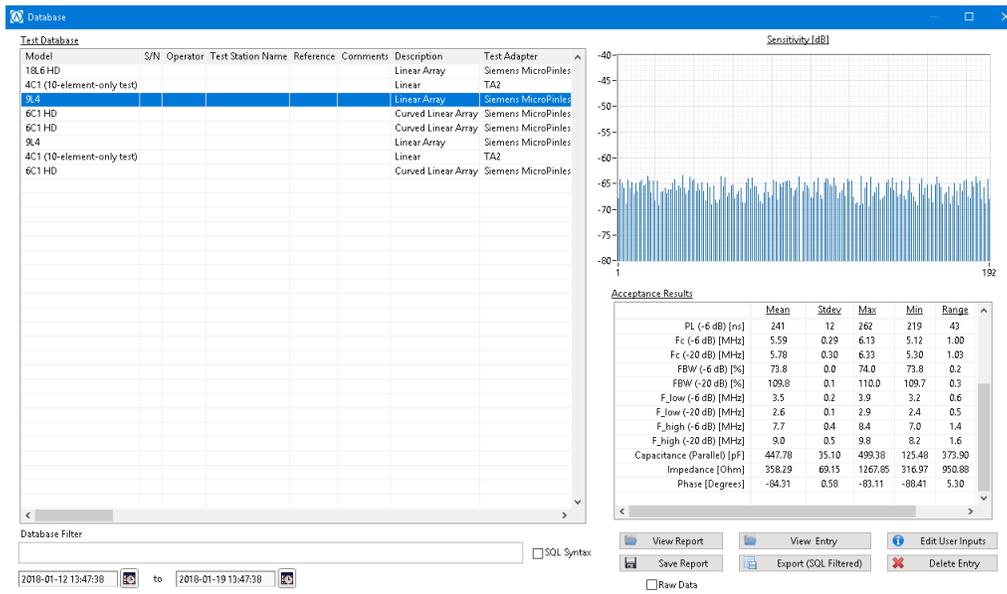
Database Window

The Database window has the following features -- further details about these features can be found in the *ATLAS Software Manual*:

- A main table which displays columns of stored data values and rows of test entries -- entries can be filtered, edited, exported, and deleted using the controls on the Database window.
- Loading and highlighting test entries from the database.
- A summary plot from the test entry.
- An "Acceptance Results" area which displays calculated criteria and statistics from the test run, as well as customizable pass/fail conditions.
- Report-quality PDF documents can be generated from any of the database entries. The user can customize the content, format, and styling of PDF reports to a high degree.
- Test data can be exported in text format for review and processing.

3.2.7 Software Configuration and Options

The ATLAS application uses configuration and option files to define the display and behavior of the software. These files can be edited by the user to provide custom appearance and behavior from the ATLAS software. There are many configuration and option items which can vary across software versions -- please refer to the *ATLAS Software User Manual* -- the following is a representative list of items which can be customized by the user:

- File paths for data storage and retrieval.
- GUI appearance, including numeric formats, selection of criteria plots and waveform plots, and selective display of notification windows.
- Hardware options, including data simulation and thermistor configuration.
- Behavioral items such as transmit waveform adjustment, cross-channel configurations, and default behaviors for report generation.
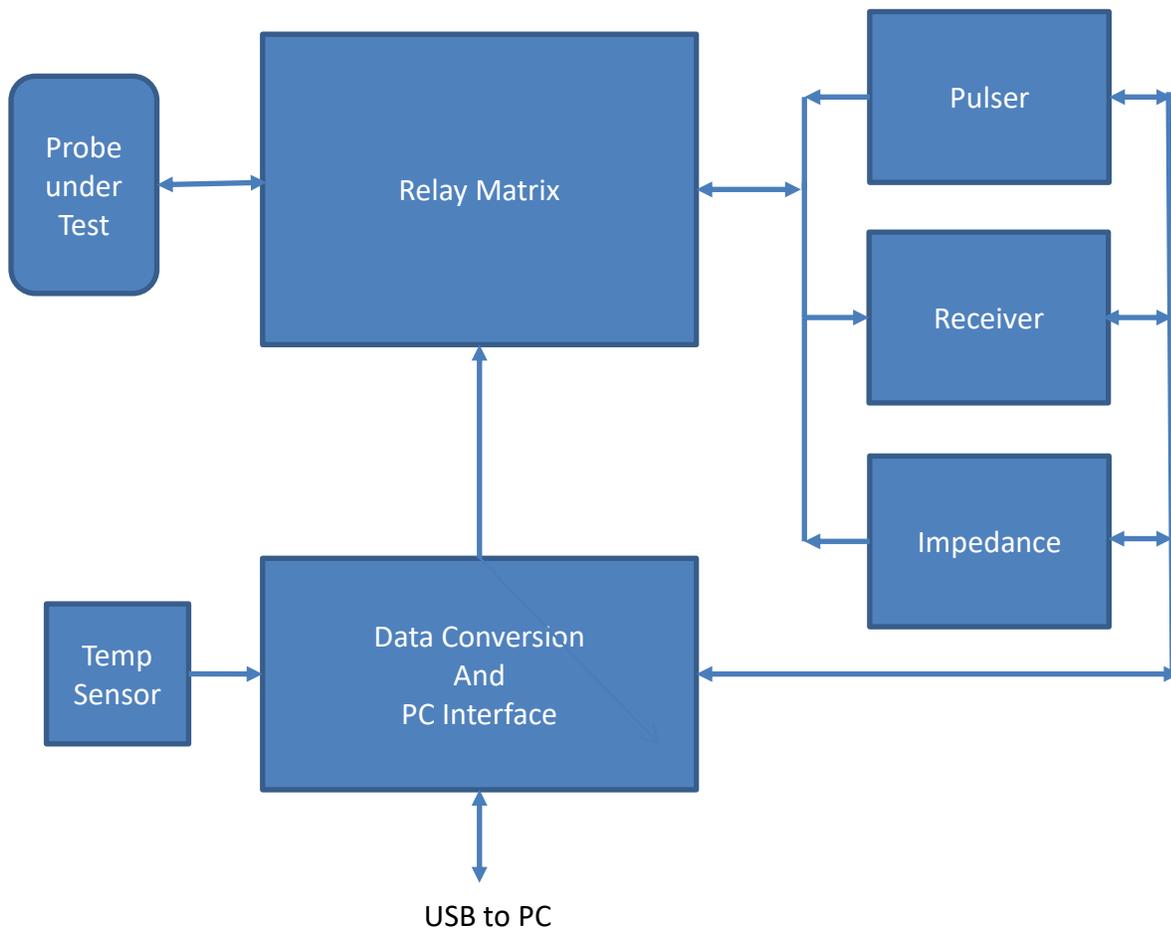
3.2.8 Probe Parameter Files

Probe parameter files (or simply "parameter files") provide the probe-specific test parameters that are used to perform a test.   A parameter file must be created for each probe model to be tested. Template files and example files are provided with the software to aid in the generation of new parameter files. To create a new parameter file, a template file or an existing parameter file can be copied and edited -- refer to the *ATLAS Software Manual* for details regarding parameter file creation.
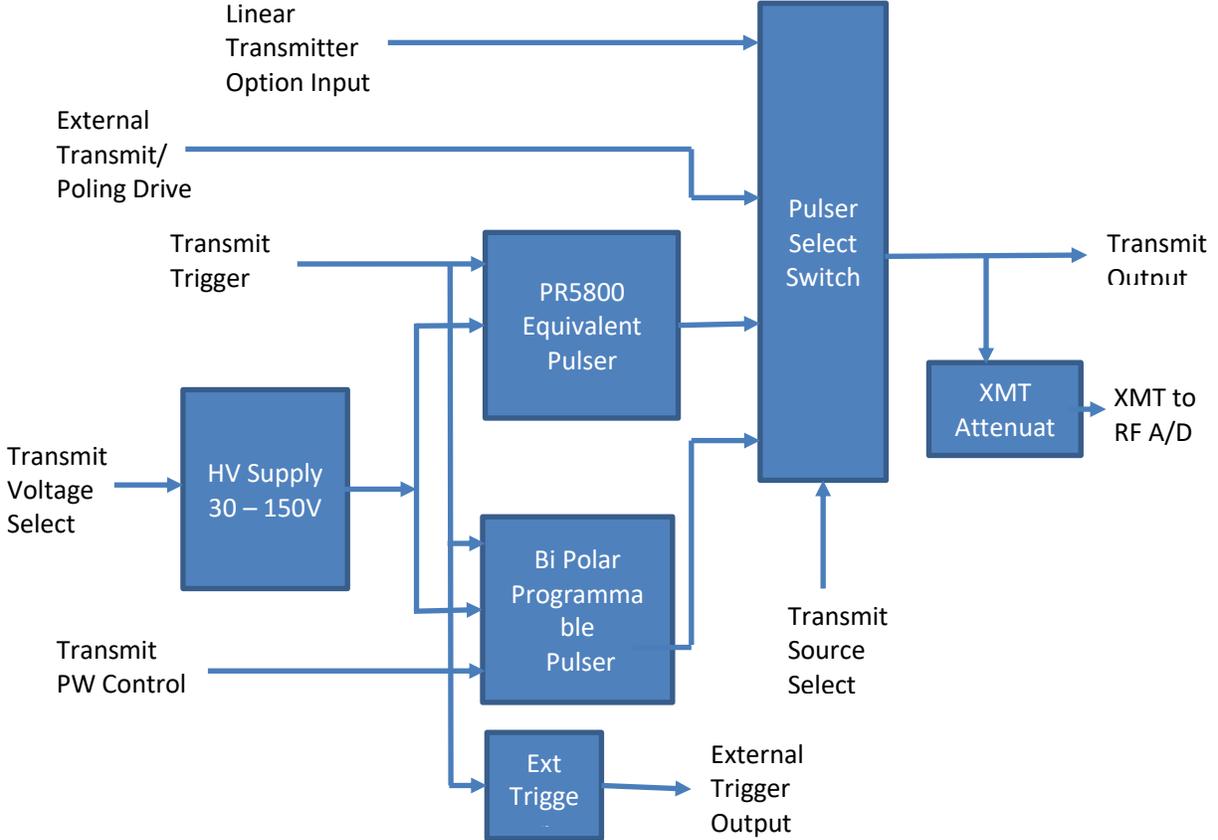
The contents of a parameter file will vary depending on software version, but the following categories may be included in a parameter file (refer to the *ATLAS Software Manual* for detailed information specific to the version of ATLAS software which is being used):

- Test pulse definitions (amplitude, test depth, gain, etc.)
- Element order and mapping
- Impedance measurement offsets
- GUI plot scale factors
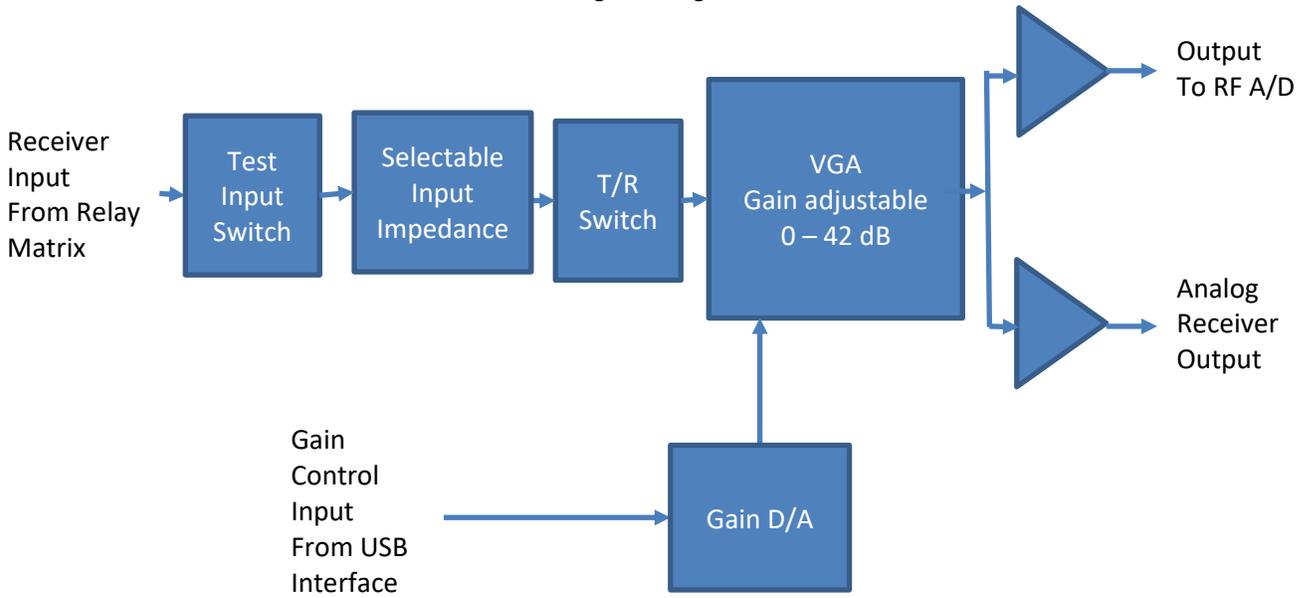- Acceptance script specification
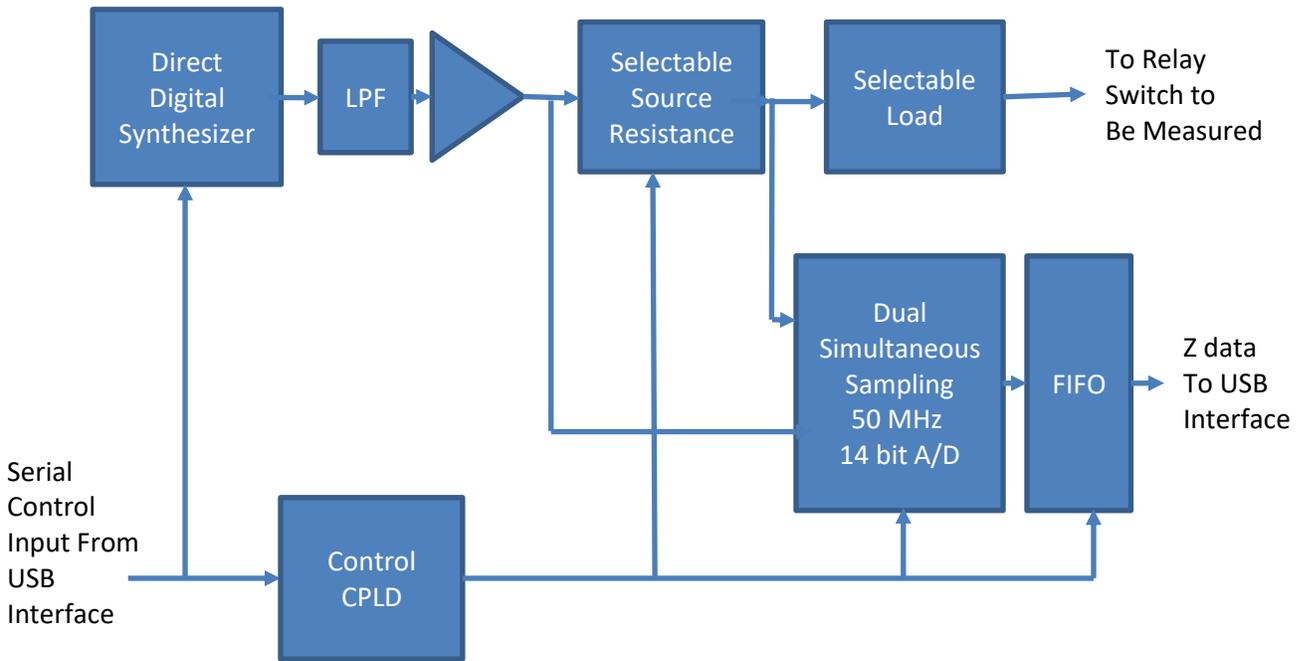
Appendix: System Block Diagrams
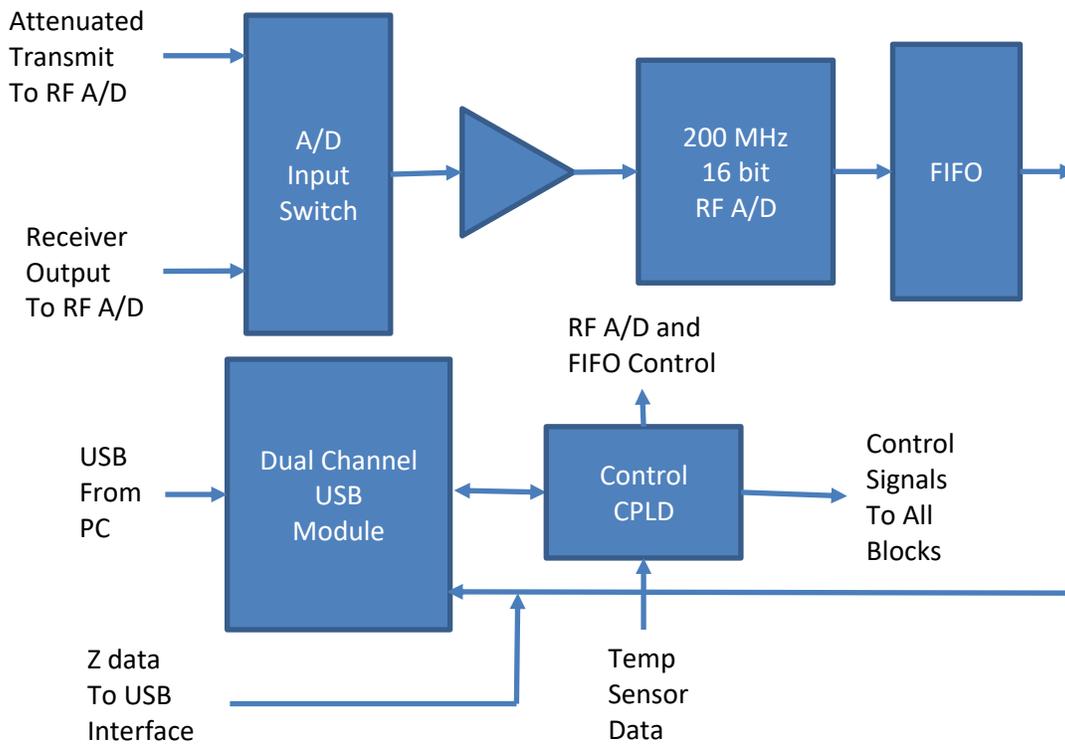

ATLAS Block Diagram

Linear Transmitter Option Input

External Transmit/ Poling Drive

Transmit Trigger

PR5800 Equivalent Pulser

Transmit Voltage Select

HV Supply 30 – 150V

Pulser Select Switch

Transmit Output

XMT Attenuat

XMT to RF A/D

Bi Polar Programmable Pulser

Transmit PW Control

Transmit Source Select

Ext Trigge

External Trigger Output

Pulser Block Diagram – Signal Flow

Receiver Input From Relay Matrix

Test Input Switch

Selectable Input Impedance

T/R Switch

VGA Gain adjustable 0 – 42 dB

Output To RF A/D

Analog Receiver Output

Gain Control Input From USB Interface

Gain D/A

Receiver Block Diagram

Impedance Measurement Block Diagram

Data Conversion Block Diagram

Acertara Acoustic Laboratories
1950 Lefthand Creek Lane
Longmont, Colorado, 80501 – USA
www.acertaralabs.com
sales@acertaralabs.com