Polished Rod Transducer Troubleshooting Guide

This document will help you troubleshoot and identify problems with acquiring data using your Polished Rod Transducer, PRT. To determine if the PRT is working properly, there is a multi-step process that should be followed to checkout the well analyzer, cables, and/or PRT. Follow the steps in the order listed:

1. Verify PRT Wiring is intact
2. Use the **Equipment Check Tab** to verify that the Well Analyzer is communicating with TWM software
3. Test the Operation of the Electronic Hardware and Cables
4. Check the Dynamometer Sensor Coefficients
5. Simulate acquisition of a Valve Test with Dynamometer Sensor in Office

Please follow the procedures outlined below:

Step 1 – Verify PRT Wiring is intact

This step assumes that the connector on the PRT is not broken (If connector has been broken then send PRT to Echometer for repair). Normally, the PRT requires some cleaning for handling purposes. Use a degreaser or electrical contact cleaner sprayed on a cloth rag to wipe off dirt and grime. You should use an OHM-meter to verify that the PRT wiring is intact and is capable of working correctly. Test the PRT by measuring the resistance between the various lettered electrical conductors (A-F) housed with-in the cable input connector on the PRT. The readings should be as follows.

Resistance values for the Polisher Rod Transducers:

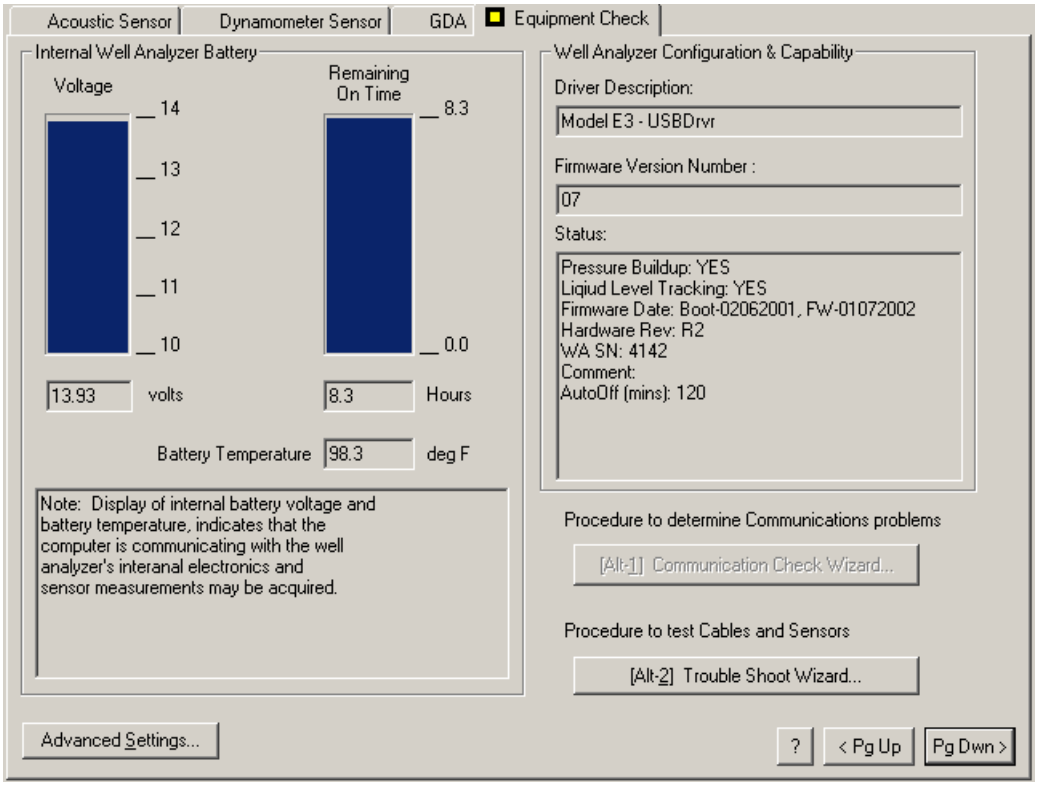
Echometer Polisher Rod Transducer Resistance Values All values are +/- 25%		
Pins	**Values**	**Circuit**
Pins A to B	600 Ohms	Load
Pins A to F	600 Ohms	Load
Pins D to B	375 Ohms	Load
Pins D to F	375 Ohms	Load
Pins A to C	2.2 K Ohms	Accel.
Pins A to E	2.2 K Ohms	Accel.
Pins D to C	2.2 K Ohms	Accel.
Pins D to E	2.2 K Ohms	Accel.
Pins A to D	600 Ohms	Load and Accel.
Pins B to F	600 Ohms	Load bridge output
Pins C to E	4.3 K Ohms	Accel. bridge output

Pin-out for the PRT

If the measured readings are not within 25% of these stated values, then you should send the PRT to Echometer for repair.

2) Use the Equipment Check Tab to verify that the Well Analyzer is communicating with TWM software

Equipment Check Screen – Make sure the Laptop Computer is connected to the Echometer Well Analyzer using the proper cable. Turn on the computer, execute the TWM software, and from the **Acquire Mode** select the **Equipment Check** tab. Blue bars in the upper left hand corner of the screen indicate the battery is charged and the Well Analyzer is communicating with the Laptop computer. Verify that the voltage values are within the indicated limits. Discrepancies could be caused either by faulty batteries or by faulty electronics or cables and connectors.



A display of internal battery voltage and battery temperature, indicates that the computer is communicating with the well analyzer's internal electronics and additional testing of the PRT may be performed using the well analyzer. Otherwise a warning message will be displayed indicating problems with communication.

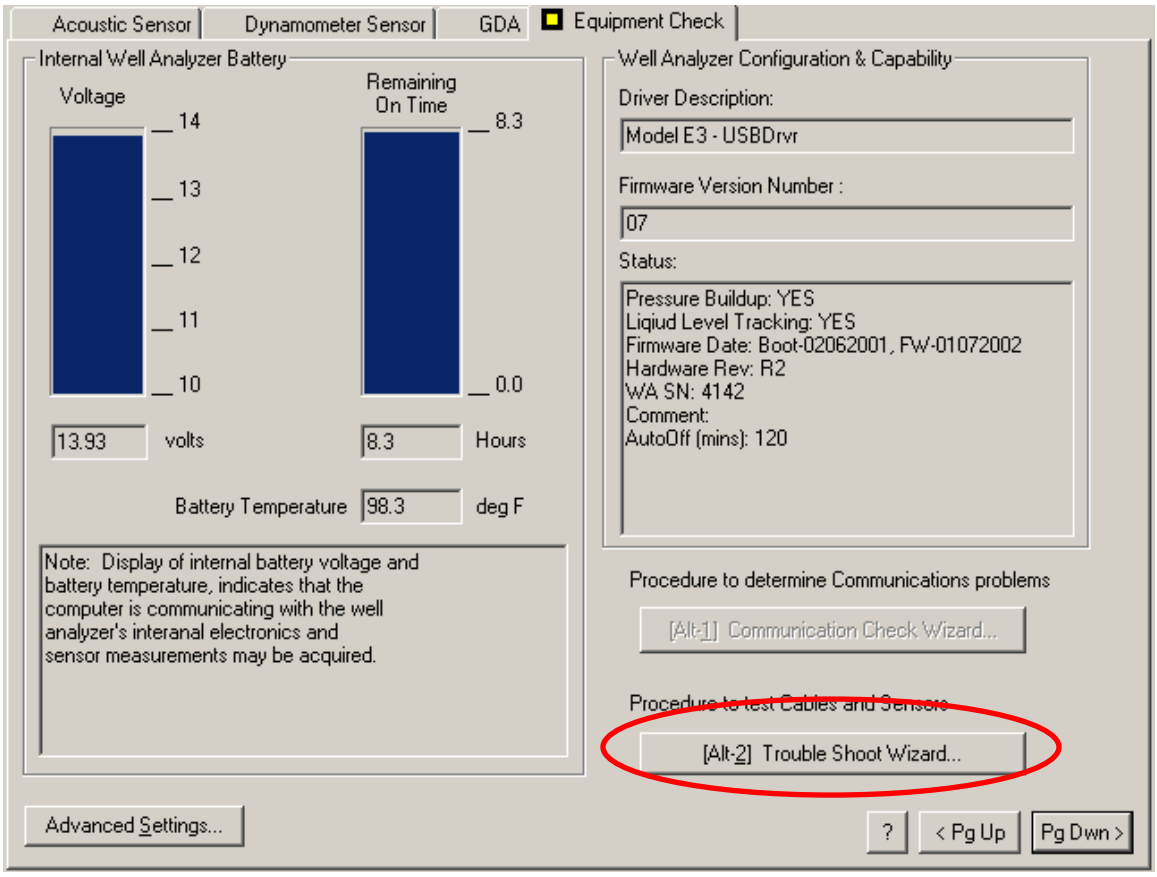
3) Test the Operation of the Electronic Hardware and Cables

The most common problem is that the cables may have been damaged or the connections could be wet. Be sure there is no moisture in any of the ends of the connectors on the cables or PRT. A bad cable can make the PRT appear to not be functioning properly. A defective well analyzer can make the cables or PRT appear to not be operating properly.

Trouble Shoot Wizard - When communication between the Well Analyzer and the Computer is operating properly, the data acquisition functions are tested using the Troubleshoot Wizard.

Testing the operation of the electronic hardware and cables is undertaken using the Trouble Shoot Wizard in the Equipment Check Tab from the SETUP module. The purpose of the utility is to quickly determine whether a hardware fault is present and in particular test that the batteries are properly charged, the transducer circuits are not shorted, the cables and connectors are not shorted or open, and that the Well Analyzer amplifiers are operating within specifications.

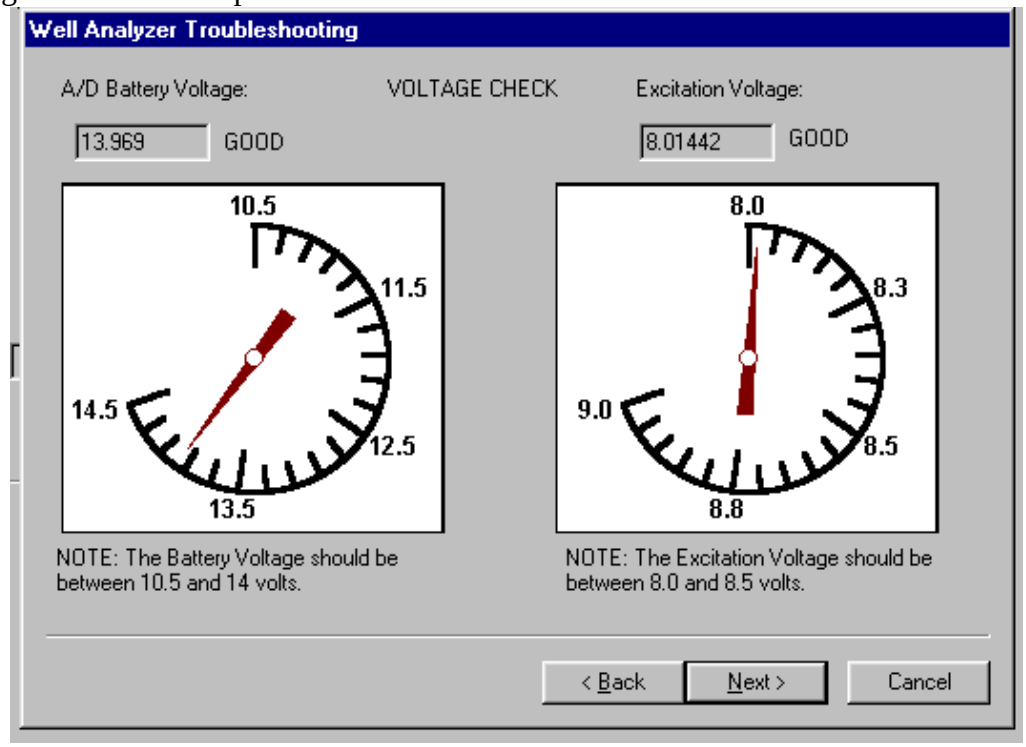
If the cables fail the Trouble Shoot Wizard, then you will probably need to purchase new cables.



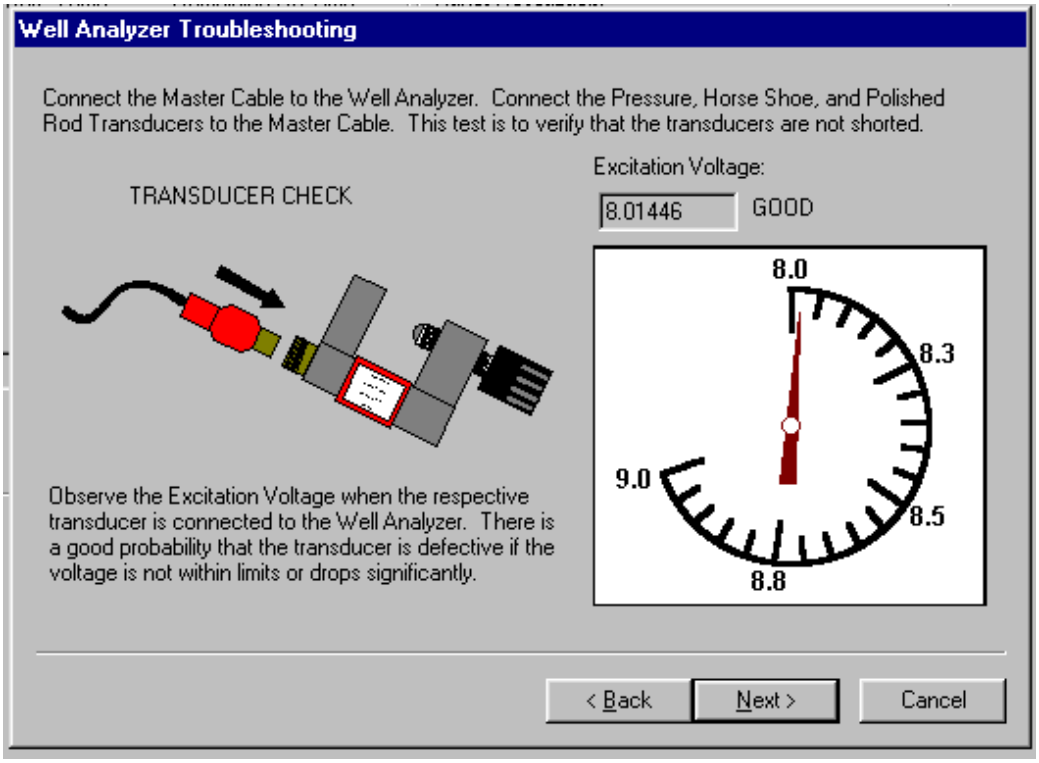
Tapping the (Alt-2) keys will begin the Trouble Shoot Wizard (Alt-2) .

Polished Rod Transducer Troubleshooting Guide

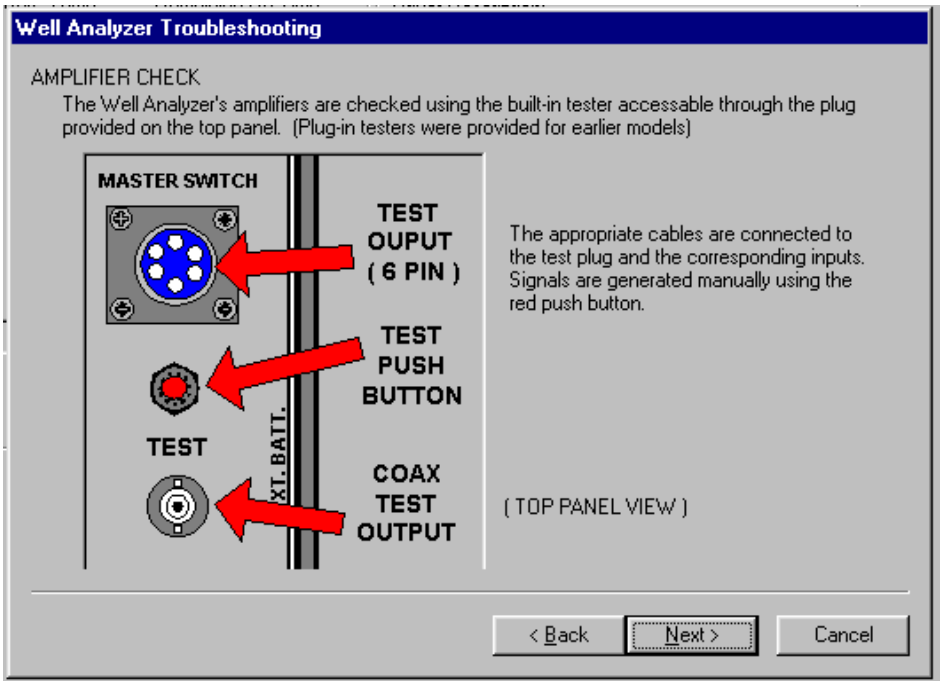
Voltage Check - The screen displays the existing Well Analyzer battery voltage and the voltage used to power the transducers. If the values were not within the accepted limits, the battery should be recharged and the test repeated later.

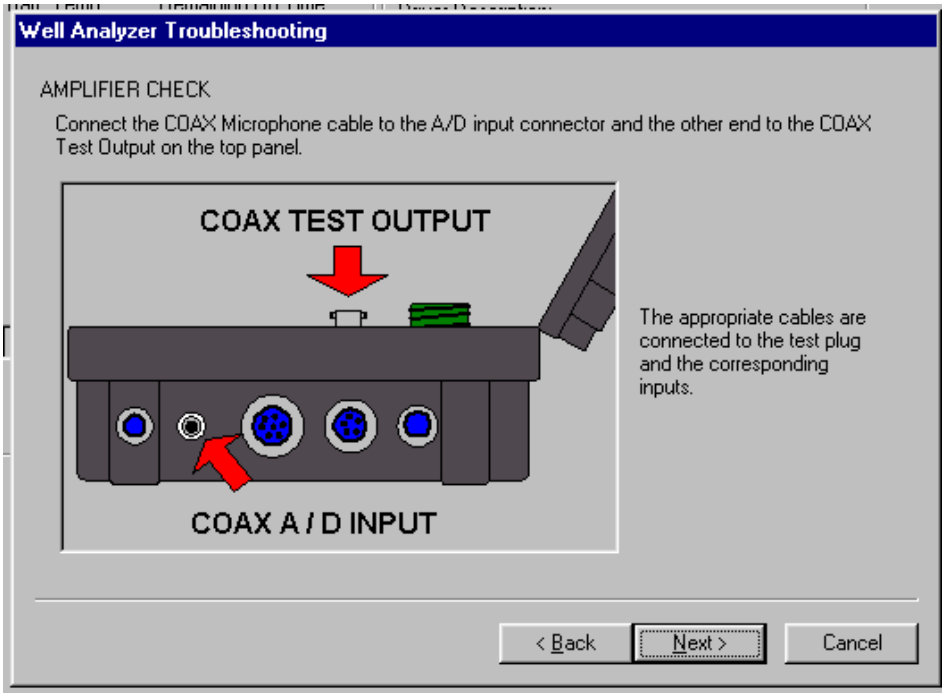


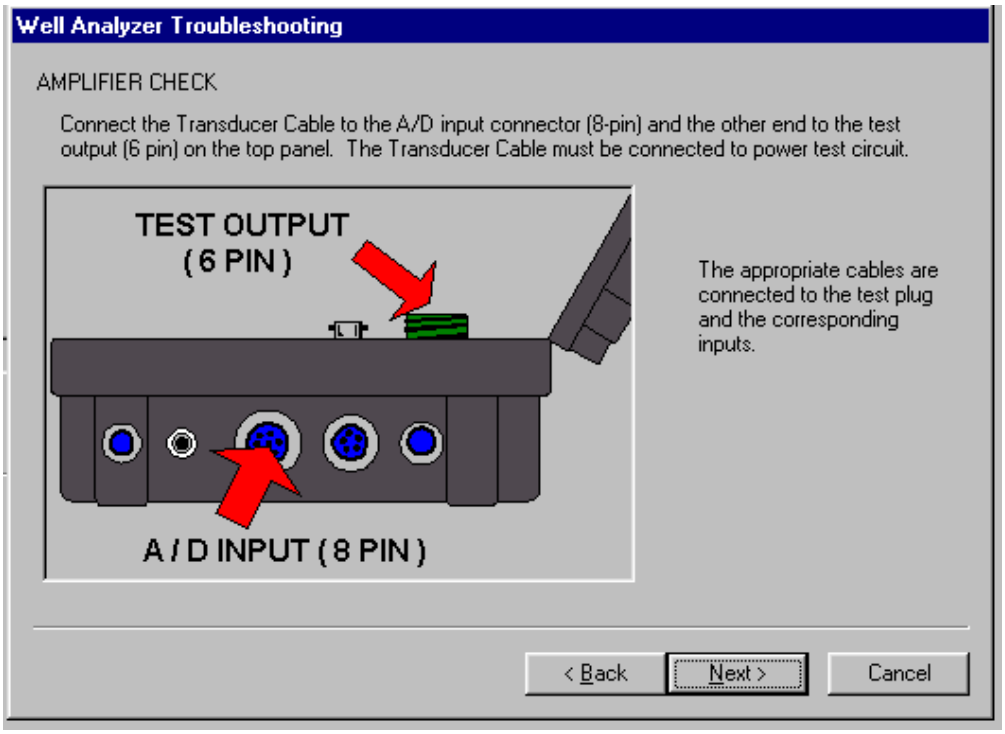
Transducer Check - If the battery voltage is within limits but the excitation voltage is not within limits or it drops significantly when the PRT is connected to the Well Analyzer (using the master cable) there is a good probability that the transducer is defective.



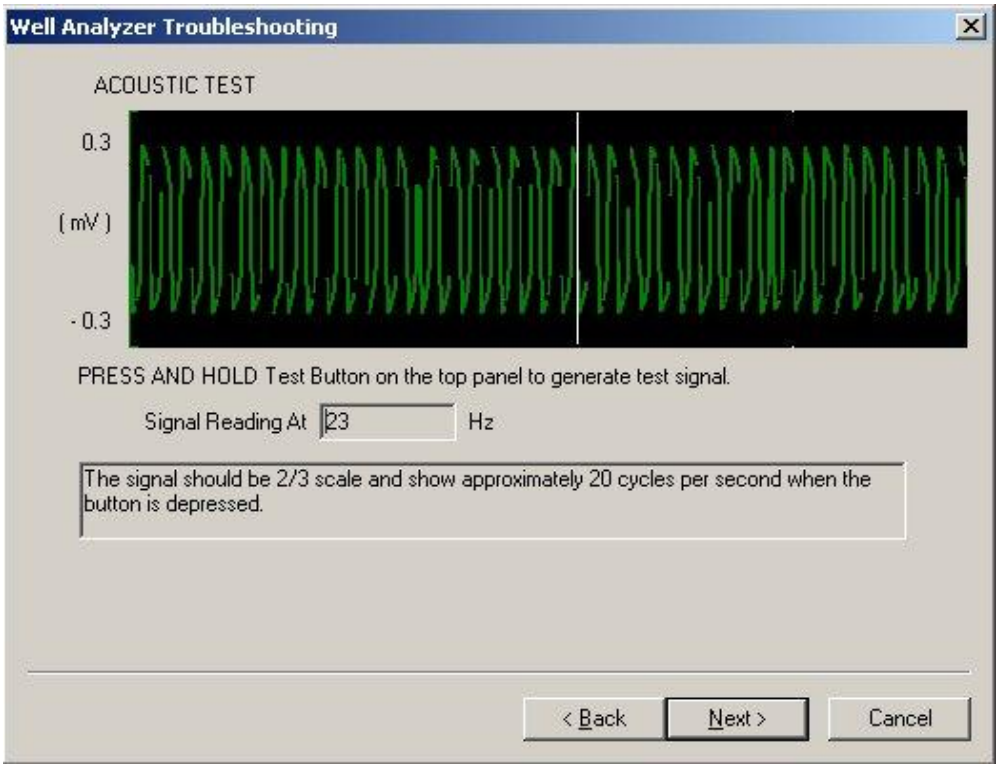
Amplifier Checks - The Well Analyzer's amplifiers are checked using the built-in tester, accessible through the plug provided on the top panel. The appropriate cables are connected to the test plug and to the corresponding inputs. Signals are generated manually using the push button. When the appropriate response is not obtained it is important to check that the failure is not due to a faulty cable or connector. Either a spare cable should be used or continuity and ground checks using an Ohmmeter, should be made on the questionable cable before concluding that the amplifiers are not operating properly. The instructions presented in the following screens should be followed in order to check both the cables and the amplifiers.



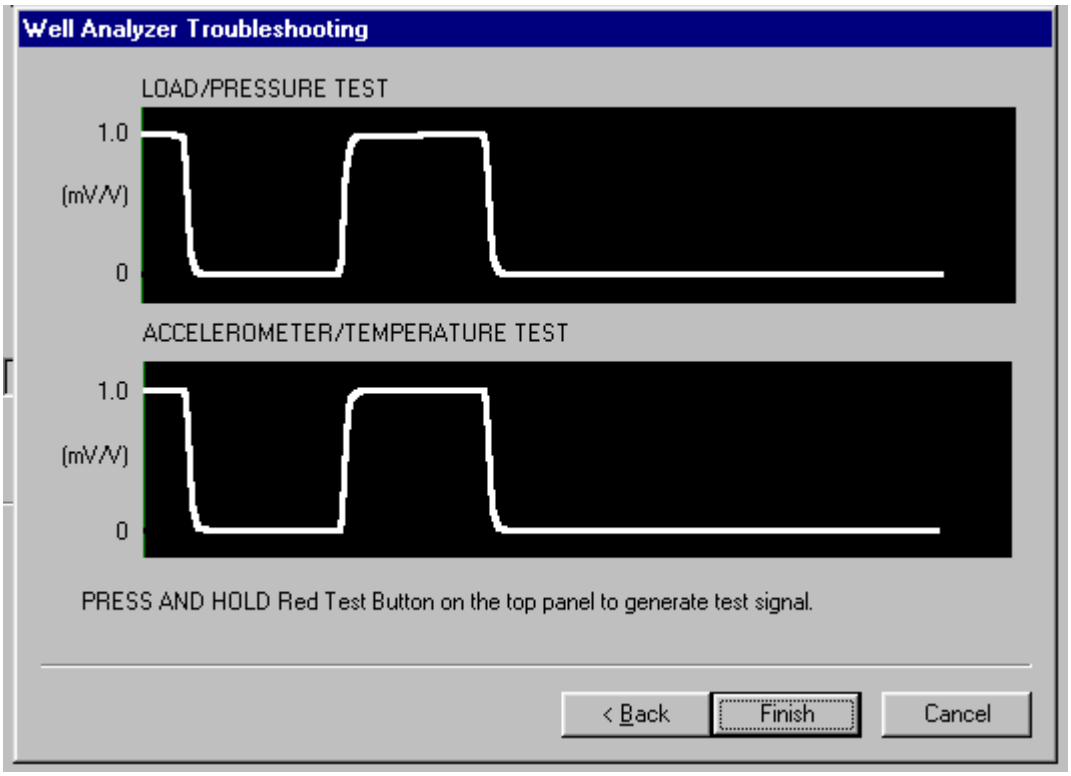




Acoustic Channel Test - This tests both the coaxial cable and the Acoustic channel amplifier. Depressing the test button should display approximately a 20 Hz frequency signal of constant amplitude, as shown in the following figure:



Cables, amplifiers and A/D converter check - This test verifies that the main transducer cable and the A/D converter are performing properly. The coiled cable can also be checked using the Trouble shoot wizard, but should be tested in both un-stretched and stretched conditions. The test should be repeated using all the cables individually and connected in series so as to check the connectors as well as the cable. One last check would be to wiggle and pull on all of the connections and cables while holding down the test button. Whenever the test button is depressed the signal should increase from zero to 1 mV/v as shown below.

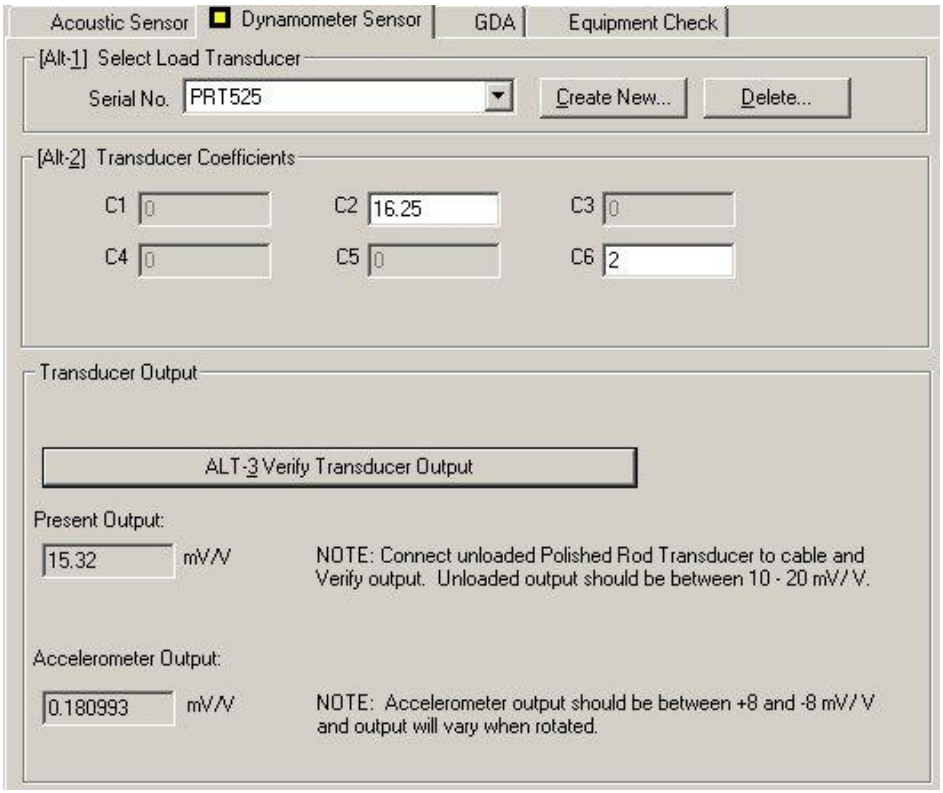


This completes the testing sequence. If all of the tests have been completed successfully, then the TWM software, the Well Analyzer Electronics, and the cable tested are working properly.

4) Verify PRT Coefficients on Dynamometer Sensor Tab

The polished rod transducer is designed so that when it is not mounted on the polished rod (and not loaded) its voltage output is at an elevated value. Therefore it does not require zeroing. In general this transducer will be used in the automatic scaling and calibration mode, where the program will calculate the absolute load level of the surface dynamometer card from the calculated pump card. The output of the transducer is linearly related to the change in diameter of the polished rod caused by a change in axial load. The sensitivity is of the order of 1 mV per 3000 LB change in load.

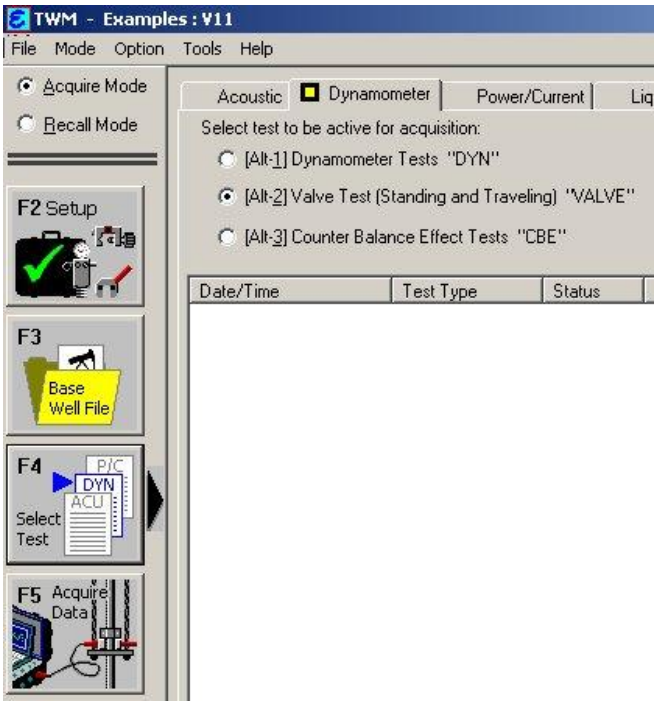
Using the well analyzer, with the TWM software running, and the dynamometer setup page open, select the proper PRT serial number and verify that the proper coefficients are entered (C2 and C6), then click on the "Verify Transducer Output" button. The present unloaded output of the transducer should be a number between 10 – 20 mV/V. A value outside this range may indicate that the PRT may have been damaged and needs to be sent to Echometer for re-calibration and/or repair.

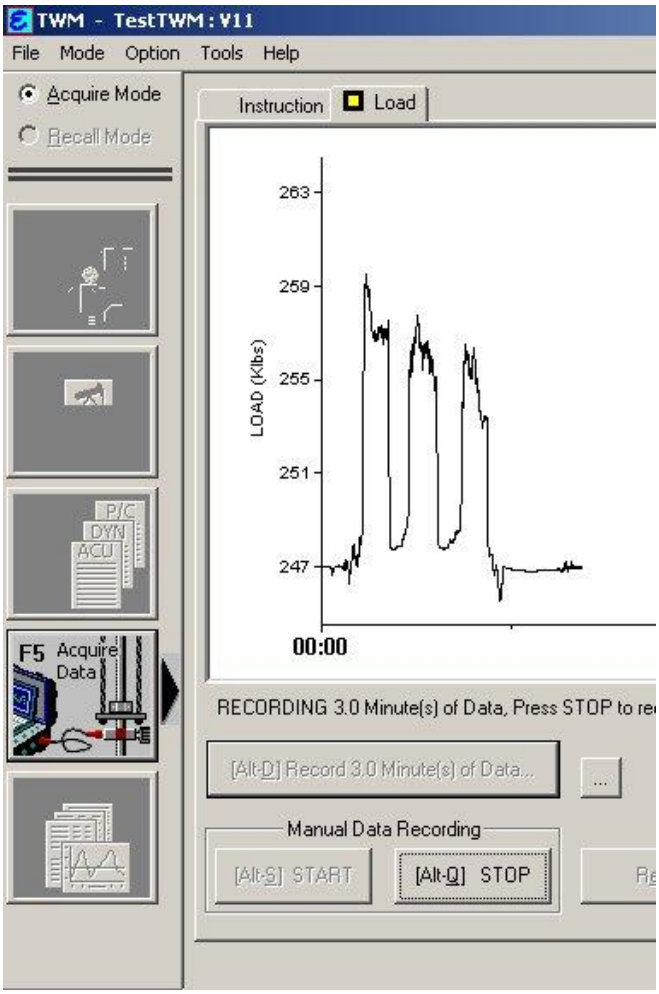


Set the PRT with the patents label facing up on a flat surface, this is the normal upright operating position. The Accelerometer Output in the lower left hand corner of the screen should display a reading near 0.0mV/V. Turn the PRT 90 degrees (on edge) and set on the flat, then the reading should be a negative number close to the value of the C6 coefficient. Turn the PRT over and set the PRT upside down, then the reading should be a negative number about double the reading when rotated 90 degrees. This test indicates that the accelerometer is working properly and communicating with the Well Analyzer and laptop computer. Although the accelerometer, which is housed in the load transducer, is capable of sustaining an impact of 40g, it is likely to suffer permanent damage if it is dropped onto a hard surface. These precision instruments should be handled with care at all times.

If the transducer fails to pass any of these tests, it would indicate some type of failure with-in the PRT and the PRT should be sent to Echometer for repair.

5) Simulate Acquisition of a Valve Test with Dynamometer Sensor in Office





The PRT should be connected to the well analyzer by the transducer cable and the coiled cable. The well analyzer should be powered on, with the TWM software operating in the Acquire mode.

A Base Well File should be opened to perform this test. Select the "Valve Test (Standing and Traveling) "VALVE"" type of test from the Dynamometer tab.

Hold the PRT in your hand in its normal upright operating position. Press F5 to begin acquiring load data. Tap the Alt-S key to begin acquiring load and acceleration data.

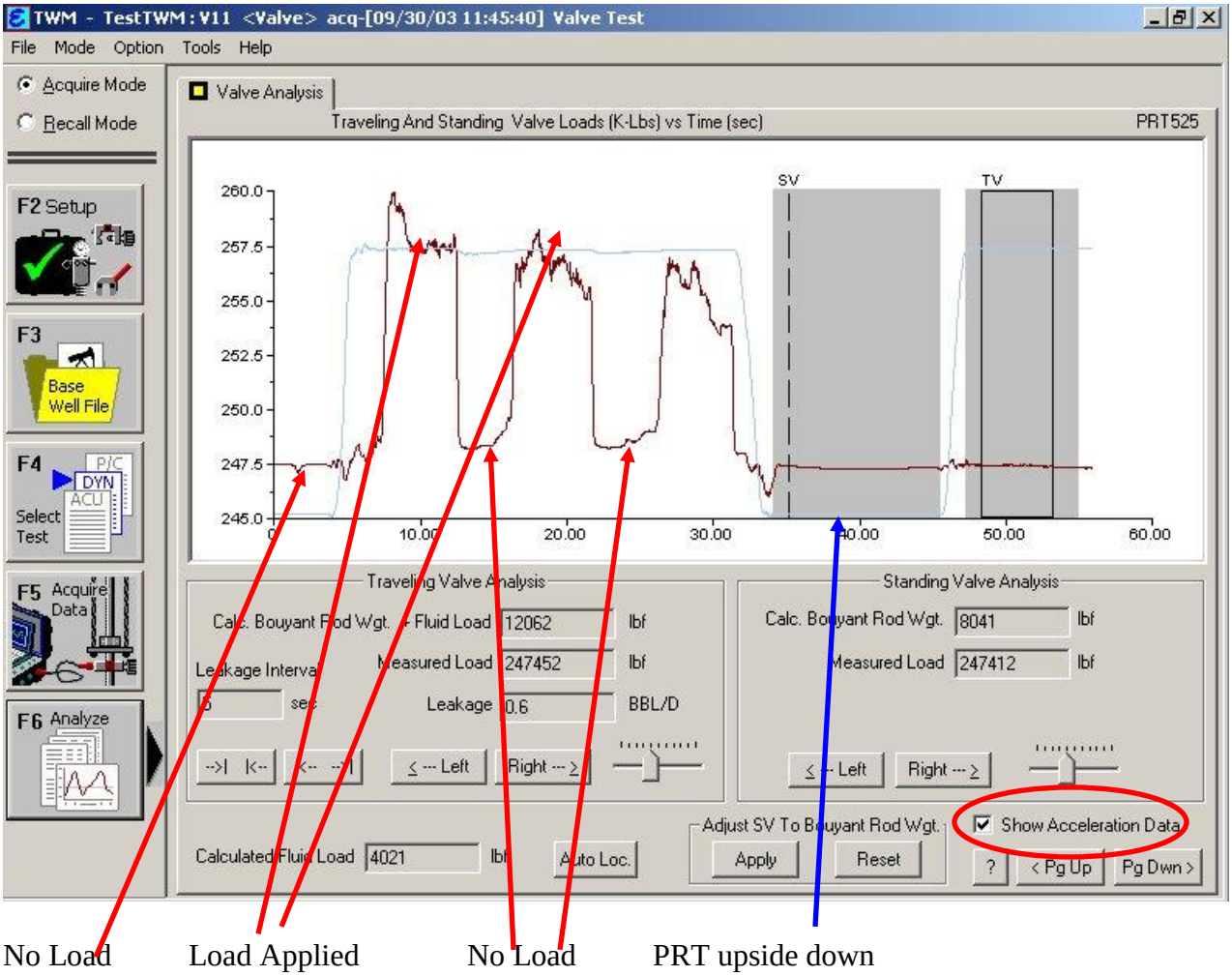
With the PRT resting in its normal operating position, apply a slight force to across the open area of the PRT for a short period of time. Stop pressing for a short time and notice the load drop back down. Again, apply a fairly uniform force for a period of time and then release the force. While applying the force to the PRT, observe the screen for any spikes.

Flip the PRT over 180 degrees and rest it on the patent label. Wait approximately 15 seconds and then rotate the PRT back to its normal mounting position. The load line will continue to travel across the bottom of the plot.

The value of the loads indicated by the PRT will be large, because it has not been attached to a polished rod and is unloaded. As you lightly squeeze the PRT, the increase in load values are as if the polished rod had become smaller in diameter due to an increase in load.

Tap the Alt-Q key to stop acquiring data, then save the data.

Polished Rod Transducer Troubleshooting Guide



No Load Load Applied No Load PRT upside down

Click the F6 button to analyze the data collected. Check the Show Acceleration Data box to display the acceleration data. The load trace should be uniformly flat when no force is being applied and should increase when pressure is applied. The acceleration data should be flat when the PRT is resting on the surface and quickly change when turned over.

If the test results are different from the above figure, the probable cause is some type of internal damage to the PRT or a faulty connector. If the test results are good, then Dynamometer data can be acquired with the PRT mounted on a well.

One last check would be to wiggle and pull on all of the connections and cables while acquiring load data. If the measurements become erratic than the cable may have a short or bad connector,