

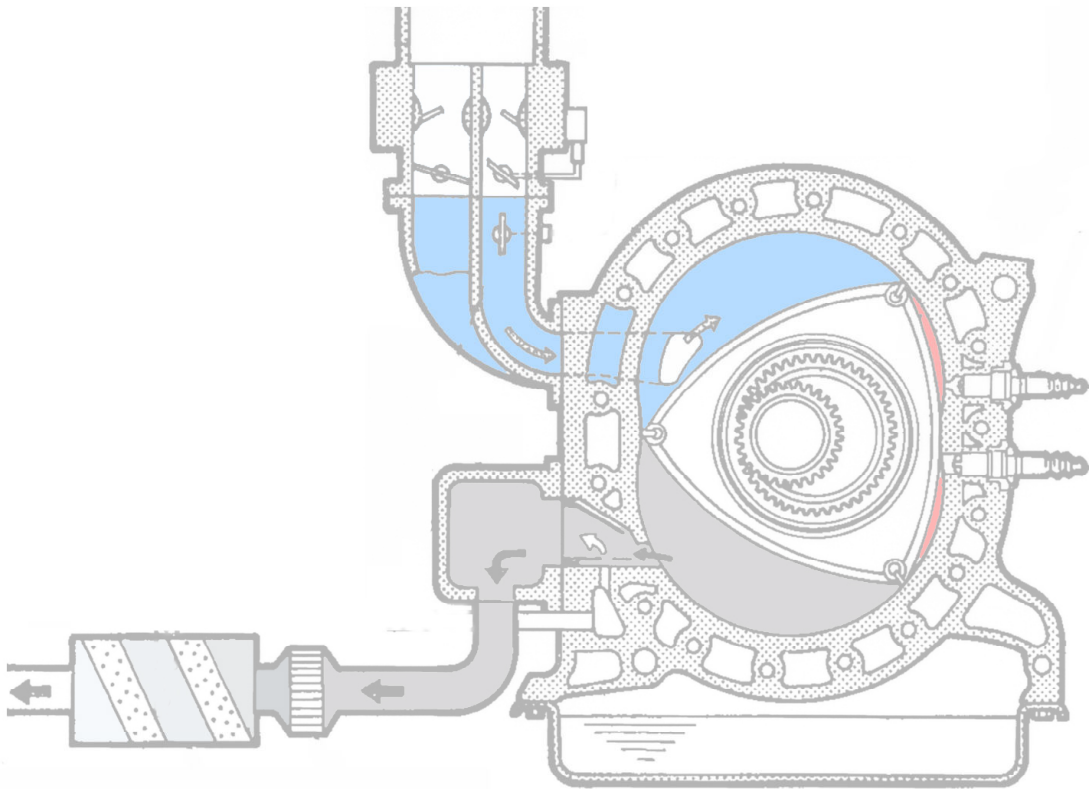
S/N:

Build Date:

User Manual

Model ReCT-03b

The Rotary-engine Compression Tester



Rotary Diagnostics Systems

P.O. Box 524

Mont Alto, PA 17237

<http://RotaryDiagnostics.com>

Using the Rotary-engine Compression Tester System

Introduction

The Rotary-engine Compression Tester can be used to obtain accurate engine compression measurements in a rotary (i.e., Wankel) engine. The Tester combines the output from an AST pressure transducer with the data conversion function of a DATAQ analog-to-digital device to acquire and record accurate compression readings for each face of each rotor in a rotary engine. This system also allows the calculation of engine cranking RPM during the test for data normalization.



Figure 1. Rotary-engine Compression Tester system Model ReCT-03b components¹.

This system is useful in diagnosing suspected engine or engine-related issues, to monitor engine health over time and to demonstrate engine health in real-time.

¹ A computer, preferably a notebook/laptop, with an available USB port is required for use with this system. A computer is not included with the tester. For connecting the tester to a remotely-located computer, a USB extension cable up to 10 feet in length can be used with the supplied cable. USB extension cables are available from a number of sources including RDS (<http://rotarydiagnostics.com>). Do not exceed 16 feet total length of any USB cable or cable-extension combination.

It should be clearly understood that this system requires installation and configuration of software and manual extraction of the compression readings and engine cranking RPM from the recorded data. The readings are not automatically presented to the user, as is the case with much more expensive, rotary-engine compression testers.

This user manual contains all the information you will need to install and configure the associated software and to operate the system to conduct a compression test on your rotary engine. However, should you wish to know more about the DATAQ data conversion hardware or the WinDaq software, manuals for both are installed on your computer with the programs and are available via the WINDAQ program group under the Programs menu. You can also go to the DATAQ web site for more information. Links to that site, as well as to the AST web site, are in the *References* section of this manual. All support for the Tester is provided by RDS. The user should not contact the component manufacturers directly for support. (See the Warranty section for instructions on how to obtain support for this system.)

Installing the DATAQ software²

The software installation and configuration³ task involves the following 3 steps:

1. Installation of the hardware drivers associated with the DI-148U unit.
2. Installation of the WinDaq programs.
3. Configuration of the DATAQ Instruments Hardware Manager.

The main programs associated with the DI-148U data converter are the DATAQ Instruments Hardware Manager (hereinafter referred to as the Hardware Manager) and the WinDaq Waveform Browser. The Hardware Manager is used to record the compression data during the test, and the WinDaq Waveform Browser is used to view and analyze the compression readings. Both programs are provided on The WinDaq Resource CD and must be installed on your computer.

To begin software installation, first install the hardware drivers for the DI-148U data conversion device and an associated USB Serial Port. (All drivers are on the Resource CD.) Only then can installation of the WinDaq programs, and finally configuration of the Hardware Manager program, be completed. If you are an advanced computer user, you can probably work through the install process with little or no assistance. However, detailed installation instructions are provided in Appendix A to assist the user with hardware driver and program installation. Refer to Appendix A for step-by-step installation instructions and then return to this page to continue with configuration of the Hardware Manager program.

The installation of all hardware drivers and programs, and the configuration of the Instruments Hardware Manager program are a one-time exercise. All settings in the Hardware Manager are specific to the Tester hardware and the settings are retained for future tests. If you have successfully completed the software installation, you can proceed with configuring the Hardware Manager.

² These instructions apply specifically to the DATAQ DI-148U, the associated WinDaq Lite program, and AST4100 pressure transducer (0-200 PSI, 10-28VDC input, 1-5VDC output).

³ This task does not require access to a vehicle. It can be completed anywhere as long as the computer you will use for the compression tests is connected to the enclosure during the installation and configuration process.

Hardware Manager Configuration

To begin the Hardware Manager configuration, connect the main enclosure to the computer using the USB cable provided. The DI-148U is powered via the USB connection so it is not necessary to connect the battery clips to a 12VDC power source at this time. The 12VDC source only powers the pressure transducer. If you installed the DI-148U drivers successfully, the operating system will automatically activate the drivers for the DI-148U when the cable is plugged into the USB port. Launch the Hardware Manager program from the Start>Programs>WINDAQ program group menu. When the devices list appears, highlight the DI-148U device and press the Start WinDaq. Continue with the following configuration settings.

Edit>Channels

Make sure that only Channel 1 is checked then click OK. (i.e., uncheck all channels except Channel number 1 as shown below.)

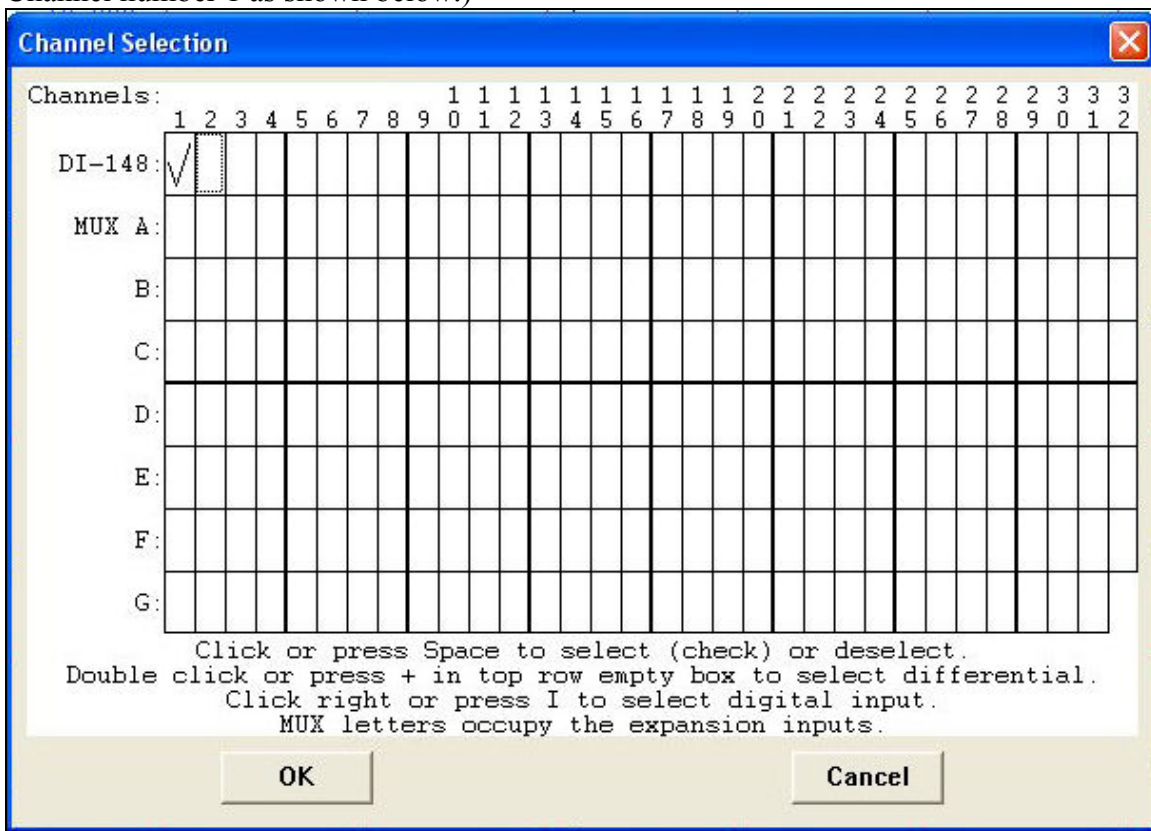


Figure 2. Hardware Manager channel selection.

NOTE: It is important to check only one channel since the throughput sampling rate of 240 samples/second (S/s) is divided by the number of channels activated. For example, if 8 channels are checked, the sample rate for your one channel test will be reduced to 30 S/s, resulting in a very notchy-looking trace. Accuracy will not be significantly affected, but the data display will appear to be very crude.

View>Format Screen

Check 1 Waveform only

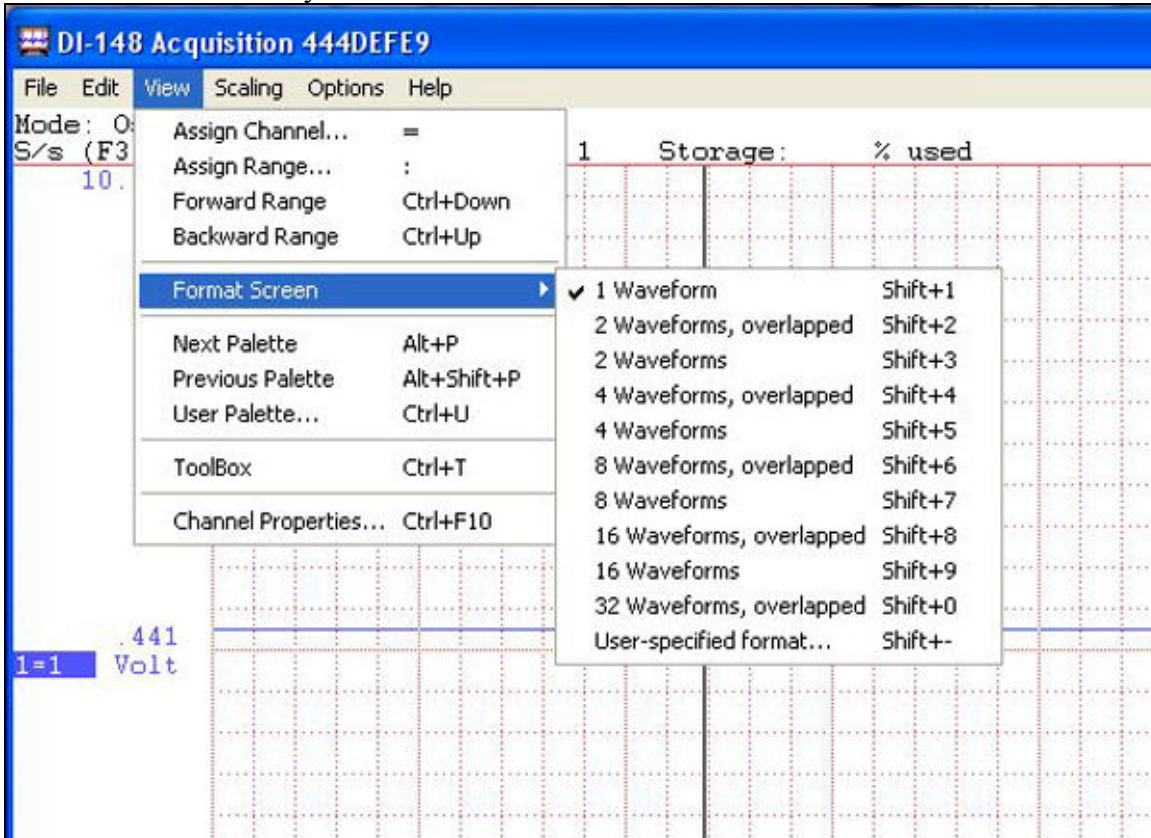


Figure 3. Hardware Manager screen display setting

Edit>Low Calibration⁴:

Input Level=1 volt
Low Cal (Calibrator) Value=0
Engr.Units=PSI
Click OK

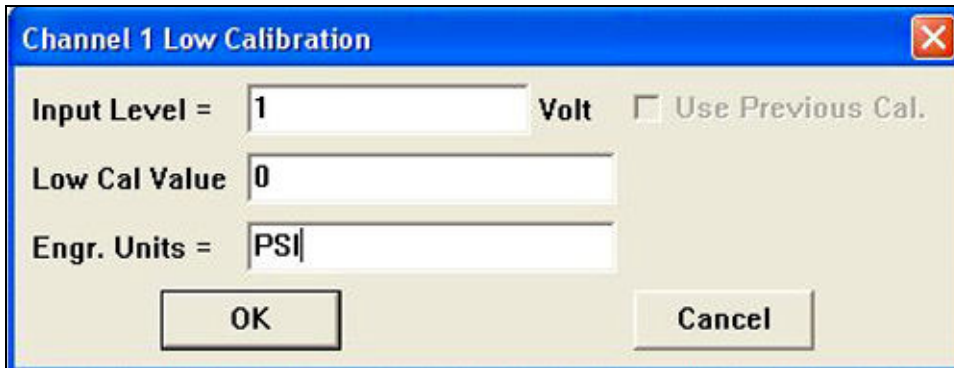


Figure 4. Hardware Manager Low Calibration setting.

⁴ Your screen may look a little different from the example, but the settings should be set the same.

Edit>High Calibration⁵:
Input Level=5 volts
High Calibrator Value=200
Engr.Units=PSI
Click OK

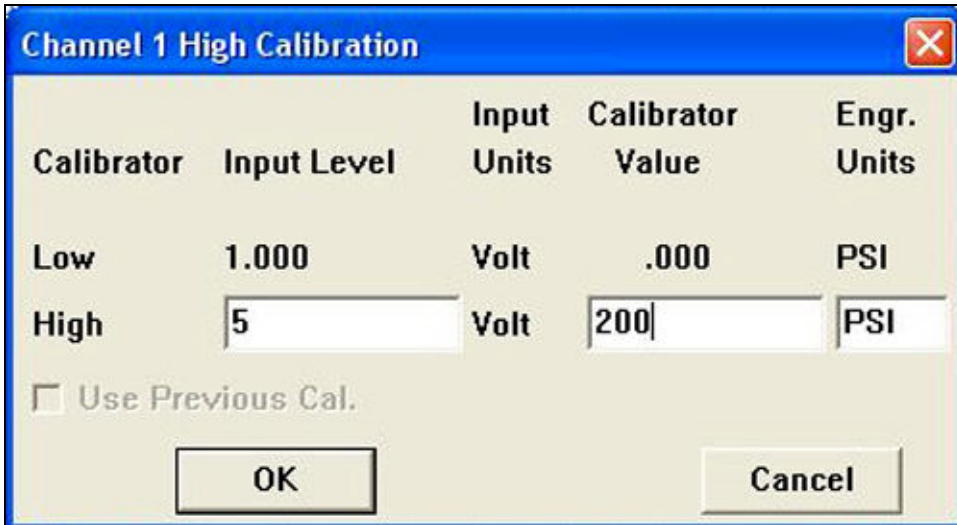


Figure 5. Hardware Manager High Calibration setting.

Scaling>Limits:
Top Limit=200
Bottom Limit=0 (may show as .00)
Click OK

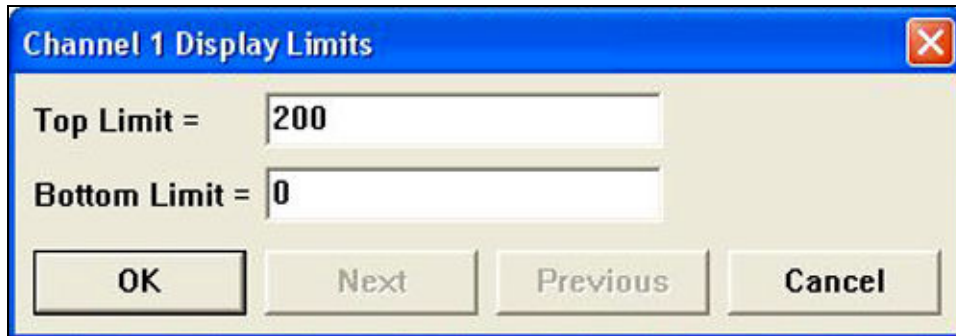


Figure 6. Hardware Manager scaling limit setting.

⁵ Your screen may look a little different from the example, but the settings should be set as shown

Edit>SampleRate:

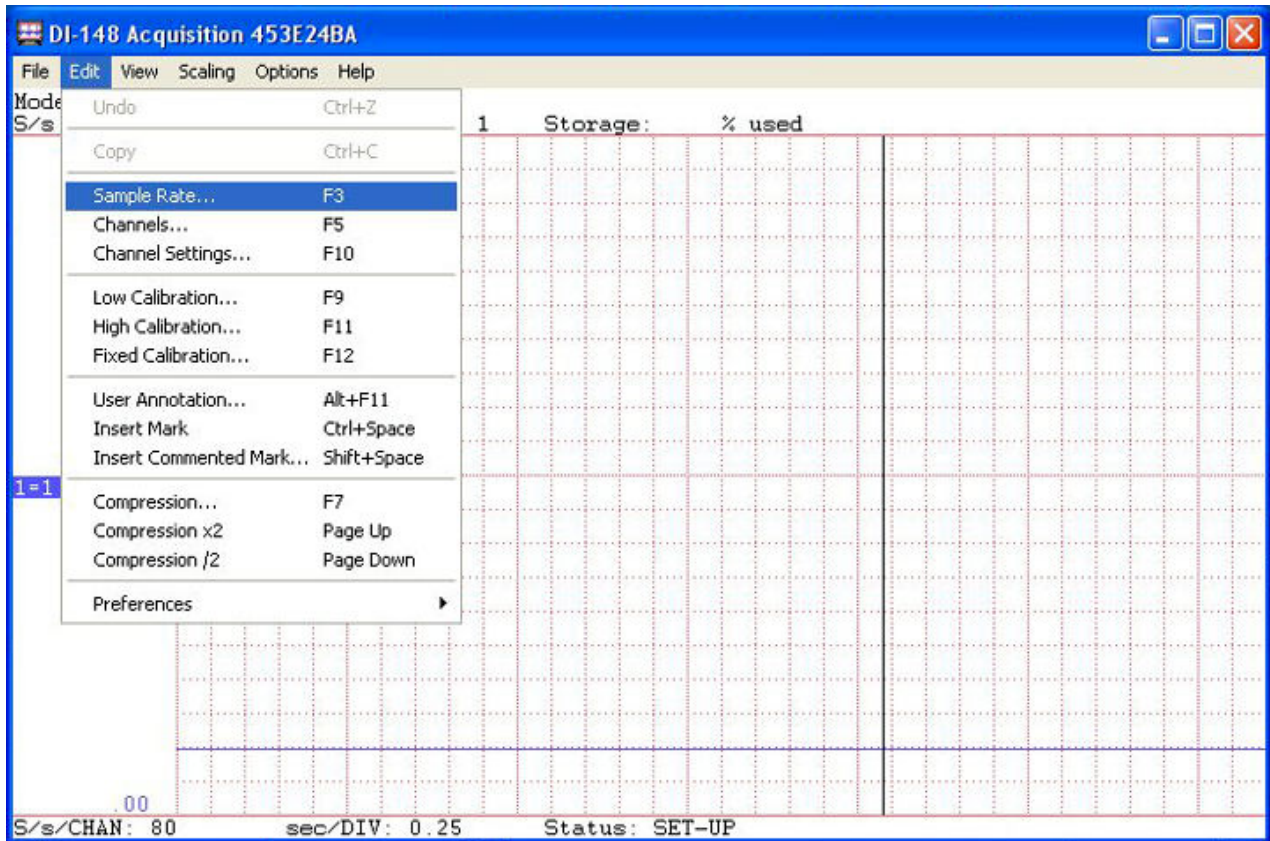


Figure 7. Sample rate selection.

Make sure that the Sample Rate is set at 240⁶. If it is not, type in 240.

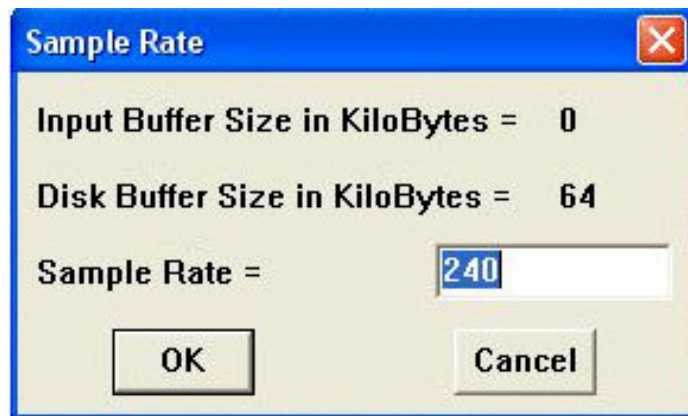


Figure 8. Sample rate menu.

⁶ The default total throughput sample rate for the WinDaq/Lite program supplied with this system is 240 samples/second. Use the default rate for the most pleasing data display. See additional comments below for information on higher sample/rate testing.

Note the per-channel S/s rate setting in the lower left of the display.

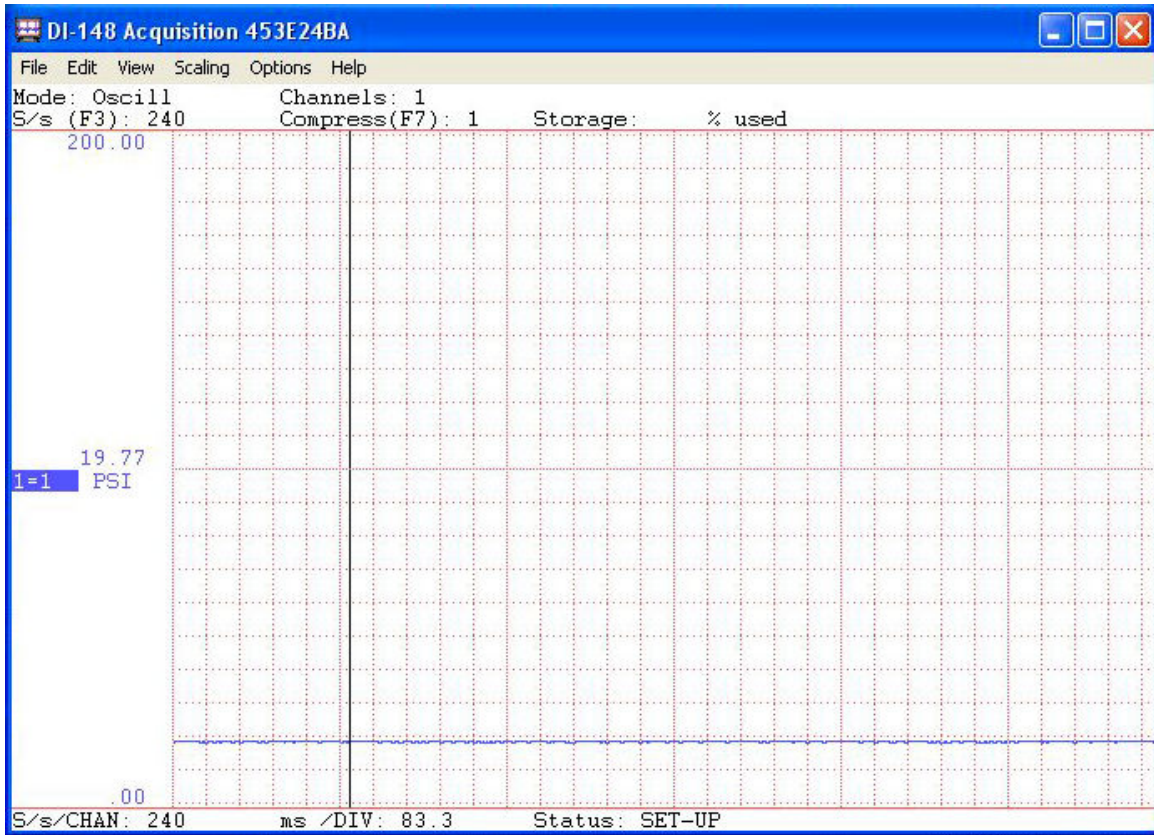


Figure 9. Sample rate set at 240 S/s.

Higher sampling rates are possible with the upgrade program, WinDaq/HS. A trial version of WinDaq/HS is integrated with this program. If a sampling rate higher than 240 samples/second is set, a nag screen will inform the user when activating the Record function during test setup. The nag screen will indicate that the trial version of the higher sampling rate program will allow a given number of recordings before expiring. A total of 40 recordings at rates up to 14,400 samples/second are allowed before the trial version expires. After 40 recordings at the higher rate have been conducted, the maximum sampling rate will be limited to 240 samples/second. Upgrades to WinDaq/HS are available from RDS through our web site.

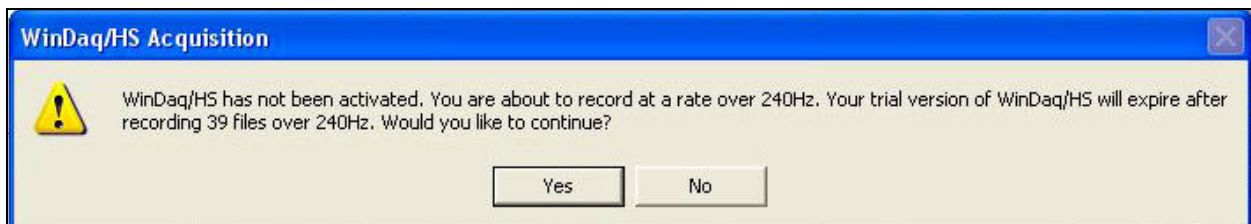


Figure 10. WinDaq/HS nag screen.

Do *File>Save default setup* and you have completed configuration of the Hardware Manager (see Note below). You are now ready to conduct compression tests. To conduct a test, follow the instructions on the next few pages.

Note: The settings just configured are associated only with the specific DATAQ unit installed in the enclosure. (Each Tester has a unique serial number that is the same as the DATAQ unit serial number.) You may have noted that the unit serial number is listed along with the DATAQ unit description in all hardware windows. The settings should be retained in your computer for future use. However, if for some reason when you launch the Hardware Manager in the future, the Scaling max and min limits are not 200 and 0, you should go through the Hardware Manager configuration again.

Conducting the compression test

Preparing the vehicle and recording program:

1. Warm up the engine.
2. Remove both leading (lower) spark plugs.
3. Remove the EGI fuse from the engine fuse box. [For carbureted engines, disable the ignition system and fuel pump by removing the appropriate fuse(s) before conducting the test.]
4. Screw the spark plug hole adapter into the leading plug hole in one of the rotor housings.
Make sure the adapter is screwed in finger-tight, but snugly and that the O-ring is sealing. You can use a little dielectric grease to lubricate the O-ring and facilitate sealing. But **DO NOT** use a petroleum-based oil or grease on the O-rings.
5. Connect the pressure transducer-quick disconnect to the adapter and to the enclosure using the attached cable and DIN connector. Use the cable extension if more length is required.
*[NOTICE: The pressure transducer used in this system is a precision instrument and should be handled accordingly. While the unit is not fragile, **extreme** mishandling, especially involving high, lateral G forces, may damage the internal sensor elements in the pressure transducer, rendering it inoperable.]*
6. Plug the power cord into the connector on the side of the enclosure and connect the battery clips to the appropriate car battery terminals (Red=Pos; Black=Neg), or another 12VDC power source. [Be very careful when making this connection. Connect red clip to positive battery post, then black clip to negative battery post. Remove in reverse order when the test is completed.]
7. Verify that the green LED power indicator is lit. If it is not, see the *Troubleshooting* section.
8. Boot up your computer and connect the USB cable to the Tester enclosure and to the computer. Allow computer to fully boot up, allowing time for Windows to automatically initialize the Tester hardware.
9. Launch Hardware Manager from the Start>Programs>WINDAQ program group. Select the DI-148U when it appears in the list and click *Start Windaq*.

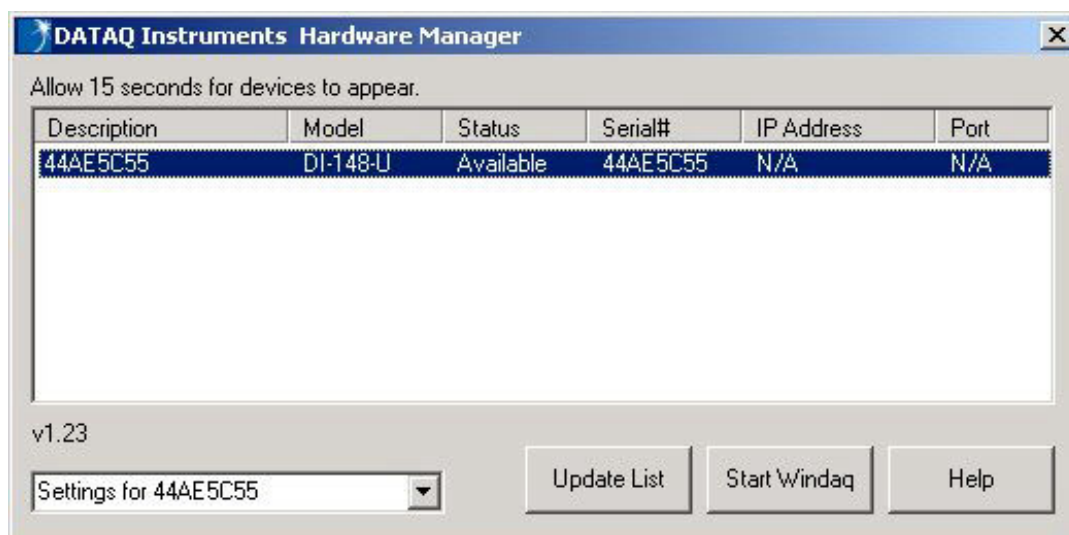


Figure 11. Hardware Manager hardware listing of DI-148U.

10. Verify that the upper and lower limits are 200 and 0 (or .00) respectively. If they are not, you will need to run through the Hardware Manager configuration again before proceeding.

11. Select File>Record from the Hardware Manager menu to start data recording. Select a folder for storing the data file and name the file something meaningful, like the device serial number and the date, then click Open.

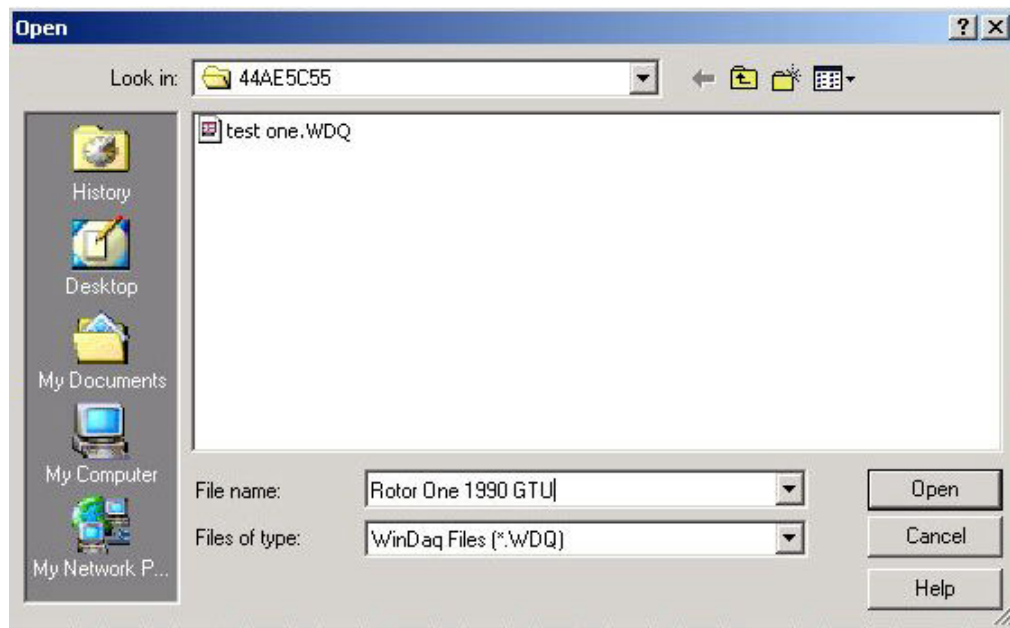


Figure 12. Hardware Manager Record file name selection.

12. Select the recording time and file size desired and when you are ready, **and only when ready**, to conduct the test and to start the recording, click OK.⁷ Continue with “Conducting the test” when ready. [Make sure that the sampling rate is set at the default of 240 Samples/second. If it is not, select Edit>Sample rate from the menu, type 240 into the box and click OK.]

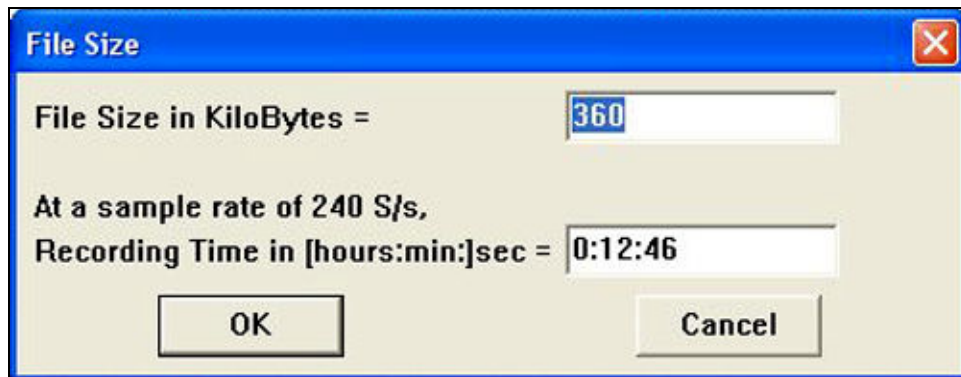


Figure 13. Hardware Manager recording time and file size selection.

⁷ To pause the recording at any time during the test, do File>Stop. To resume recording do File>Record. To completely stop recording, do File>Close.

Conduct the test:

Now that your car has been prepared for the test, your Tester hardware has been connected to the car and to the computer, and the Hardware Manager program has been set up and ready to record, you are ready to conduct the test.

1. Check all your connections before proceeding and make sure the EGI fuse has been removed. (*Note: Make sure all connections are well clear of engine rotating parts.*)
2. Start the recording function in Hardware Manager (Click OK as instructed above.)
3. Get in the car, **depress the gas pedal to the floor** and activate the starter for about 5 seconds.⁸
4. Put the software on standby (File>Stop).⁹
5. Remove the spark plug hole adapter from the first rotor plug hole, screw it into the plug hole of the other rotor and reattach the pressure transducer-quick disconnect.
6. Resume the record function in the Hardware Manager program (File>Record).
7. Get in the car, **depress the gas pedal to the floor** and activate the starter for about 5 seconds.
8. Stop recording (File>Stop). The test is completed so you can save the recording (File>Close). Remove the tester hardware and exit the Hardware Manager program. If the Hardware Manager window is still open, close it. You are finished with the test.
9. Reinstall and reconnect the spark plugs and reinstall the EGI fuse.

The recorded data can now be viewed and analyzed using the WinDaq WaveForm Browser as described in the following sections.

Extracting and interpreting the data

Launch the WinDaq Waveform Browser from the Start>Programs>WINDAQ program group and open the “.wdq” file created during the test. Using the slider at the bottom of the window, scan for and locate the recorded compression pulses. [A helpful hint is in order at this point. The total record time for the test is likely to be several minutes long, and a 5-second burst of compression pulses, therefore, may be difficult to locate or keep track of in the data record. Before concluding that no data was recorded, scan the entire record for the compression pulses. It actually may be there somewhere, essentially hiding in the long data record.]

A cursory examination of the recorded data will quickly reveal any significant problems with engine compression. The absence of pulse peaks where expected or very low compression readings are indications of rotor seal failure and one need go no further with data extraction and analysis. The engine will likely require rebuilding or replacement. However, additional compression tests should be conducted to verify any questionable numbers. (See the section *Meaning of the compression readings* for additional information.)

Significant differences between the peak pulse amplitudes is also an indication of failing rotor seals, and depending on the extent of the difference, this may also be an indication the need to

⁸ You may choose to have someone else do this part while you monitor the tester, connections and computer.

⁹ This is optional, but your data record will be much longer if you don't pause the recording when switching plug holes and you may have difficulty keeping track of the compression pulse locations in the record.

rebuild or replace an engine. In this case, continue with data extraction and analysis to determine the relative health of the engine. Proceed with the following instructions to extract the recorded values and to normalize the data for comparison to the Mazda specifications. Only then can the recorded readings be used to determine the exact status of engine health.

Referring to the sample record in Figure 14, note that the compression pulses are represented by the peaks in the recording, each peak representing a compression pulse of a single rotor face. The compression of each rotor face is repeated every third pulse. The maximum compression of each face is represented by the peak value at that point in the test. Peak compression readings for each rotor face are viewed by moving the line cursor in the display to the peak of each pulse and noting the compression number displayed at the left side of the window (119.44 PSI in the sample).

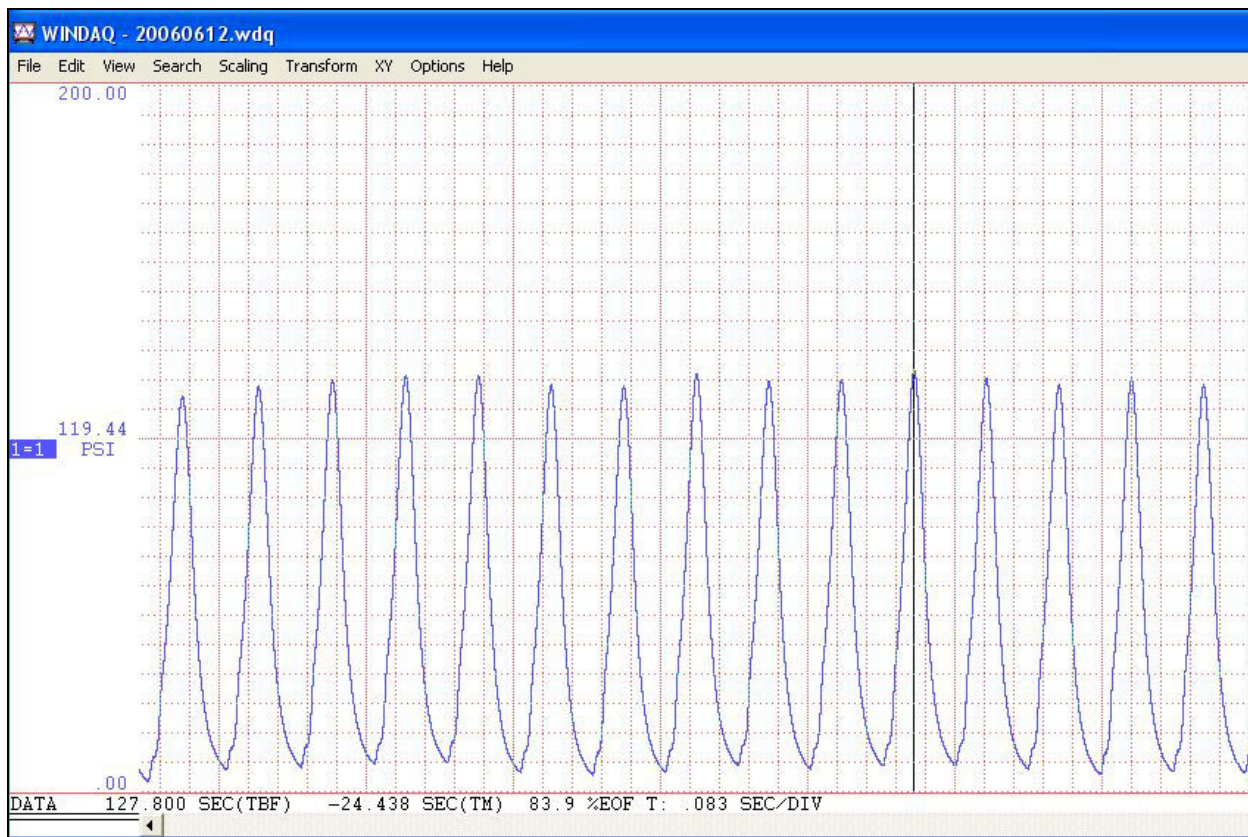


Figure 14. Sample recorded compression readings for a single rotor.

To move the line cursor, place the mouse cursor on the “DATA” bar at the bottom of the display directly below the line cursor, hold down the left mouse button and drag the line cursor to the desired position in the display. Move the line cursor left and right slightly until the maximum reading for the peak of interest is shown at the left. After you have read and made note of a meaningful series of peak pulses, you can easily calculate the differences between the compression readings of rotor faces and between rotors in order to compare the readings with the engine manufacturers specification.

To spread out the peaks for a clearer display of the data, select *Edit>Compression* from the menu and type in a negative number like -2 in the *Compression* box. Higher negative numbers will spread out the display even further. [The term compression as used here refers to data compression, not engine compression.]

However, if the engine cranking speed at the time of the test was significantly higher or lower than 250 RPM, and the elevation of your location was considerably higher than sea level, you may want to normalize the readings in order to compare them to the Mazda¹⁰ engine specifications. The following section addresses the normalization process.

Normalizing the recorded data

Mazda specifications for engine compression are generally specified with an engine cranking speed of 250 RPM at sea level. If your engine cranking RPM (see below for how to calculate RPM) is close to 250 RPM, and your location is not at high altitude (i.e., several thousand feet above sea level), you can use the readings as recorded. However, as stated above, if either of those factors deviates significantly from the Mazda criteria, you may want to proceed with normalization of the recorded readings. Mazda workshop manuals provide simple graphs that can be used for this purpose.

Essentially, slower engine cranking RPM during the test will result in readings lower than the Mazda “standard”, and conversely, a faster cranking speed will result in higher readings. Higher elevations¹¹ will result in readings lower than the Mazda standard. To illustrate the potential difference between recorded readings and normalized numbers, the normalized readings for an example test conducted at 950 feet altitude and engine cranking speed of 293 RPM, resulted in recorded readings about 4-5 percent higher than the Mazda specification. The individual user should decide if the parameters of his or her test environment require a normalization of the recorded numbers.

The following instructions provide procedures for calculating engine cranking RPM from the recorded data to convert the readings for comparison to the Mazda specification. For altitude correction of the readings, consult the appropriate Mazda workshop manual.

Engine RPM calculation. As stated above, to normalize the measured compression readings, the engine cranking RPM at the time of the test must be determined. Using the WinDaq Waveform Browser, the engine cranking RPM during the test can be determined by measuring elapsed time between a number of compression peaks and converting that to the equivalent revolutions of the eccentric shaft per minute. [Note: For the highest accuracy, use a series of compression peaks near the middle of recorded data to eliminate any start-up lag at the beginning of the test and possible minor battery voltage drop-off near the end of the test.]

Using the example in Figure 15 for reference, calculate the engine RPM as follows: First, place your cursor in the “DATA” bar at the bottom of the display directly below the line cursor on the screen. Holding the left mouse button down, move the cursor to one of the compression peaks and record the time displayed at the lower left corner of the window.

In the example, the elapsed time at peak #1 is 127.19 (rounded from 127.188) seconds. Move the line cursor 9 peaks further along the data record (i.e., peak #10), recording the time—129.03. Subtracting 127.19 from 129.03 gives an elapsed time of 1.84 seconds. Since 10 peaks equates to

¹⁰ This discussion assumes that the Tester is being used with a Mazda rotary engine. For other rotary engines, consult the appropriate workshop manual for engine compression specifications.

¹¹ The term “altitude” as used in this manual is meant to be synonymous with the term “elevation”.

9 compression cycles or 9 eccentric shaft revolutions (i.e., 3 eccentric shaft revolution per rotor revolution x 3), the elapsed time of 1.84 seconds equates to the elapsed time for 9 eccentric shaft revolutions. In the example, engine RPM calculation is determined by solving for “x” in the simple ratio of $9/1.84=x/60$, where “x” equals engine cranking RPM at the time of the test. (That is, $1.84x=9*60$; therefore $x=540/1.84$ or 293.)

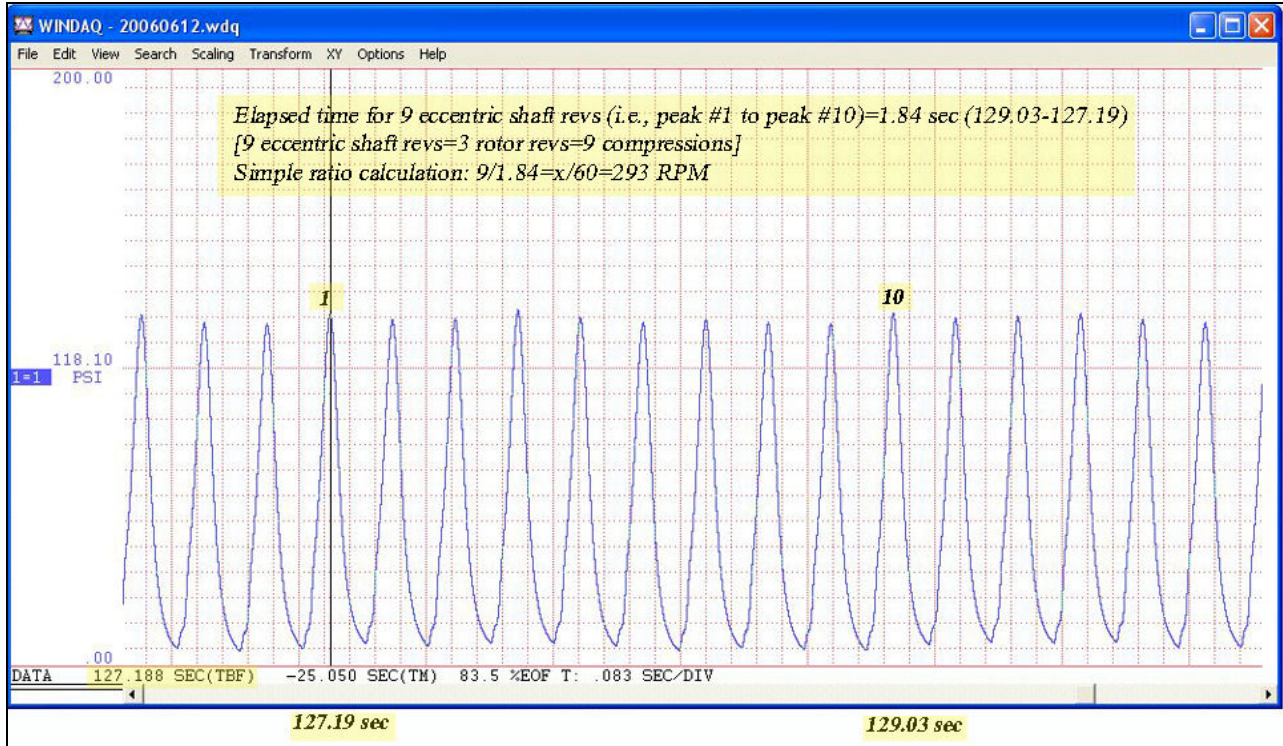


Figure 15. Example of engine cranking RPM calculation.

Figure 16 provides an example of the compression readings that can be extracted from the record and the impact of normalization on those reading. The annotations were added to the graphic by the System Developer for illustration purposes only.

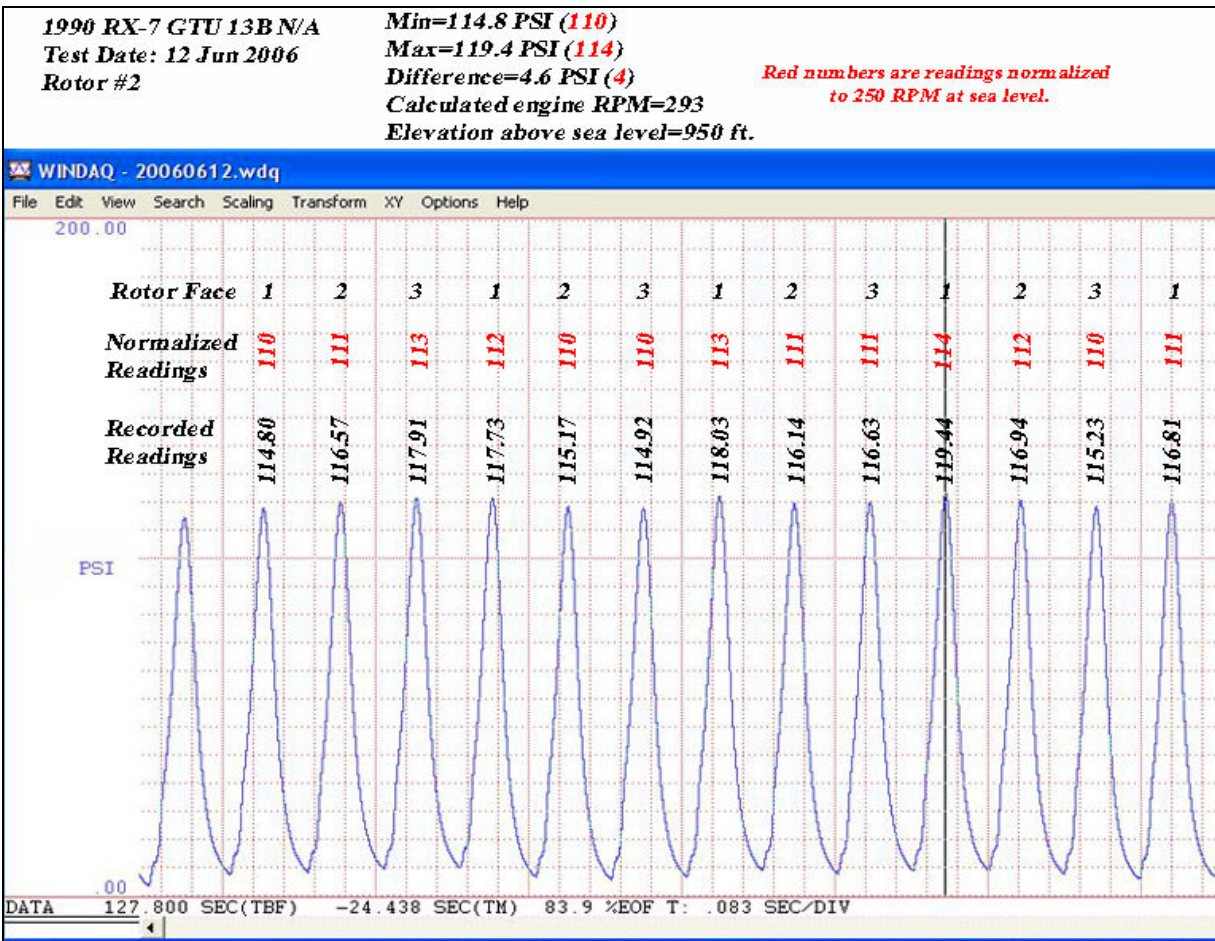


Figure 16. Compression readings extracted and normalized¹².

¹² This graphic was created by the System Developer for illustration purposes only. The Tester system does not provide for the addition of the added information as shown on the graphic.

Meaning of the compression readings. The recorded compression readings will indicate whether or not your engine is healthy or requires rebuilding or replacement. A healthy engine will exhibit readings that are above the Mazda minimum standard. In the example below (Figure 17), the compression pulses are well above the minimum specification and the readings of all 3 faces are very close to the same. This is what you hope to see.

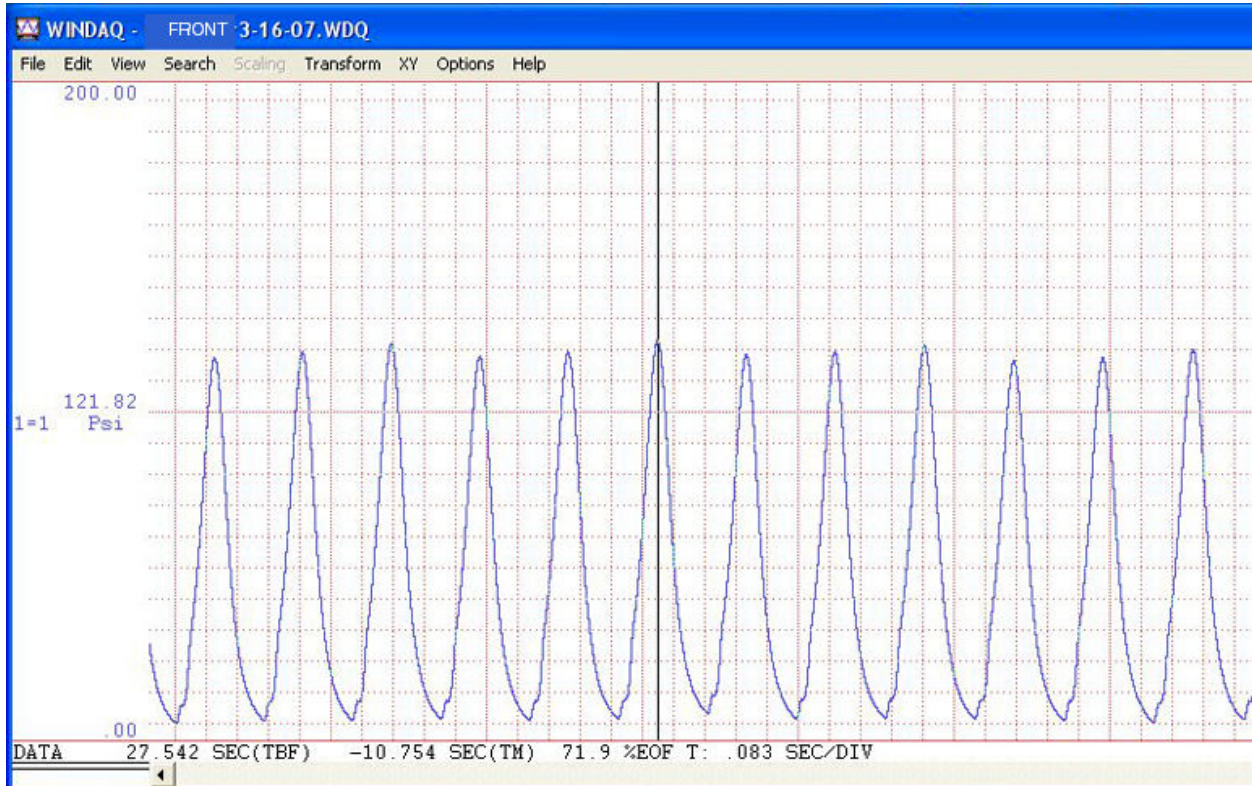


Figure 17. Indication of healthy engine, front rotor readings from 3rd generation RX-7.

If any rotor faces are well below the Mazda minimum standard, your engine probably requires rebuilding or replacement. The example (Figure 18) below was recorded from the same 3rd generation RX-7 engine as the above example, but as you can see, compression readings for two of the rear rotor faces are significantly lower than the third face and well below the Mazda minimum. This is definitely an indication of apex seal failure and the engine will need to be rebuilt or replaced. Obviously, if any of the recorded readings are at or near zero, your engine is definitely sick and will need to be rebuilt or replaced. For questionable compression readings, it is advisable to run additional tests to verify the numbers and to verify that you prepared the tester system correctly for a test with questionable results.

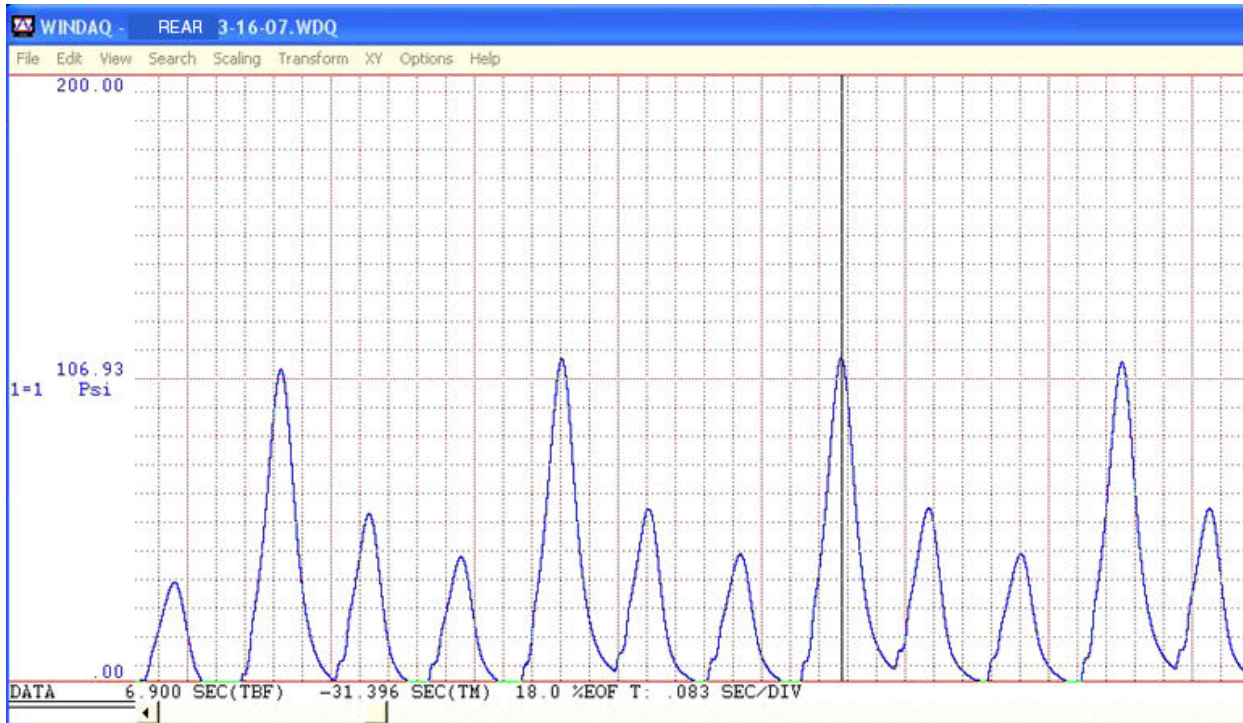


Figure 18. Evidence of failed apex seal(s), rear rotor readings from 3rd generation RX-7.

In the shop manual for the second generation RX-7, Mazda states the compression specifications for the 13B engine at sea level with engine cranking speed of 250 RPM. The minimum compression for this engine is given as 85 PSI. So, in general, compression higher than that should indicate a relatively healthy engine. Mazda also indicates that the maximum difference between the rotor faces should be no more than 21 PSI.

The workshop manual for the RX-8 states the “standard” compression as 120 PSI at 250 RPM, and the minimum as 98.6 PSI at 250 RPM. Standard difference in chambers should be within 21.8 PSI, and difference between rotors within 14.5 PSI.

Readings outside of those levels, i.e., lower compression readings or greater difference in readings between rotor faces or between rotors, indicate a less-than-healthy engine that may require rebuilding or replacement in the near future.

Consult the appropriate workshop manual for compression specifications for other rotary engines.

Troubleshooting

Problem: When I connect the power cord to the battery, the green LED power-on indicator does not light and the system does not function.

Answer: Double check the battery clip attachments and make sure the red clip is attached to the positive/plus pole of the battery and the black clip is attached to the negative/minus pole. If the connections seem to be in order, disconnect the battery clips and remove the enclosure cover. Check to see if the 1A fuse is blown. If it is, replace it with a comparable fuse and see if the system now powers up. If the fuse is not blown or if you replaced it and the system still does not power up, try connecting the system to another, known-good, 12VDC battery. If none of that solves the problem, contact the RDS for assistance.

Problem: When I run the test, nothing is recorded by the Hardware Manager.

Answer: First, carefully scan through the entire data record using the WinDaq Waveform Browser to verify that nothing was recorded. Remember, if the recording ran for say 3 minutes, a 5-second burst of compression pulses may be difficult to locate in the data stream. So, scan the data to verify that the compression data is, in fact, not there. If it is definitely not there, then go through a full test setup as follows:

Shut down the Hardware Manager program, disconnect all cables and basically start over. Plug the USB cable into the DATAQ port on the side of the enclosure and launch the Hardware Manager program. Run through the instructions in the section entitled *Hardware Manager Configuration* to verify that the program is configured correctly. [Note: the USB cable must be connected to the DATAQ port and to the computer before launching the Hardware Manager program.]

If still no data is recorded, contact the RDS for further instructions.

Problem: The test seems to run OK, but the data shows what look like irregularly-spaced compression pulses.

Answer: Compare your recording to the sample record in Figure 17. As you can see in the sample, the compression pulses are very regularly spaced and similar in amplitude. If your recorded data shows what would be gaps where a pulse or pulses should be shown, this is probably due to lack of compression on one or more rotor faces—most likely the result of one or more failed/failing apex seals. If you like, you can e-mail a copy of the *.wdq* file RDS for evaluation.

Problem: I ran the test but the data is difficult to “read” because the pulses are too close together.

Answer: The sample rate may have been inadvertently set too low. Either re-run the test at 240 samples/second (see page 7) or set the data display compression as instructed on page 13. Re-running the test at the higher sampling rate will result in a “smoother” display of the data.

Problem: My recorded readings show compression pulses with differences in amplitude. What does that indicate?

Answer: In order to answer that question, you must first extract and compare the readings from all rotor faces. Then consult the appropriate workshop manual to determine the engine compression specifications for your particular engine to see if the readings fall within the manufacturers limits for a healthy engine. In general, however, if the differences in the compression readings between rotor faces and/or between rotors are significant, your engine is less than healthy. And depending on the specific compression numbers, your engine may require rebuilding or replacement.

Problem: When I launch the Hardware Manager program, the DATAQ device is recognized, but when I click on *Start Windaq* I get an error message.

Answer: Occasionally, internal program component linkages are “lost” or the installation of a program or security fix after installation of the DATAQ software will modify a required component of the program. Try closing and re-launching the Hardware Manager program. If that does not eliminate the error, reboot the computer or reinstall the DATAQ software.

NOTE: Rotary Diagnostics Systems has made a good-faith effort to build and deliver a working test device that will provide accurate compression measurements for many years. However, we strive constantly to improve our products, so your constructive criticisms and your suggestions will be greatly appreciated. Do not hesitate to contact the RDS if you have problems with the system or if you would like to pass on any comments.

Contact Information

For assistance or questions, contact Larry at:

Rotary Diagnostics Systems
P.O. Box 524
Mont Alto, PA 17237 USA
(717) 352-7096 (In case no one answers, leave a message and you will be contacted ASAP.)
(717) 360-3633 (cell)
Rotary13b@RotaryDiagnostics.com
<http://RotaryDiagnostics.com>

Warranty

The Tester is warranted for a period of one year from the date of purchase. This warranty is limited to repair or replacement of any components necessary to restore the system to full functionality. Rotary Diagnostics Systems (RDS) will restore the system to full functionality at no cost to the customer unless the malfunction is the result of improper use or abuse of the Tester. In rare cases, the Tester may be replaced with a new system at the option of RDS. Contact RDS for instructions on returning a system for service or for a warranty claim.

Safe and effective operation of each unit is verified prior to sale. Any modifications to this system by anyone other than RDS totally voids the stated warranty. The customer is authorized to remove the enclosure cover to check and/or replace the fuse if necessary. No other servicing of, or modifications to, the Tester by the customer are authorized.

Beyond the stated warranty, RDS is not liable for any system failures due to improper or abusive use of the system. For example, reversing battery connections resulting in component damage constitutes an improper use of the Tester. Nor is RDS responsible for resultant damage to an engine or engine component due to misuse of the Tester system.

CAUTION: Do not attempt to disassemble the spark plug hole adapter. The threads are sealed with an epoxy and any attempt to separate the components will almost certainly render this component inoperable, requiring replacement at the owners expense.

NOTICE: Customer service requests, particularly those that potentially involve component warranty claims, must be handled through RDS. Do not contact component manufacturers directly without first contacting RDS for assistance. Support services and warranties on individual system components fall to the original component purchaser--namely Rotary Diagnostics Systems--and not to the purchaser of the Tester system. For further guidance, contact RDS.

Appendix A: Tester System software installation.

The following instructions detail the procedure for installation of drivers associated with the DI-148U data conversion hardware and the installation of the WinDaq programs. These instructions apply to the Windows 2000 and Windows XP operating systems, but the process should be similar for other operating systems. Proceed with software installation.

A1: DI-148U hardware drivers.

Power up your computer and allow it to fully boot up. Insert the Resource CD into your computer drive and when the *What Do You Want to Do?* window appears, click **Exit** but leave the Resource CD in the drive. (Remember, the hardware drivers must be installed before the programs.) Connect the enclosure to your computer using the USB cable supplied with the Tester. Make sure the cable snaps into the enclosure port. When the USB cable is connected to the computer, a *Found New Hardware Wizard* window will appear. Click **Next** at that window. The next window that appears should list the DI-148U as the device found. Verify that the button adjacent to *Search for a suitable driver...* is selected then click **Next**. On the next window, check only the box adjacent to *CD-ROM drives* and click **Next**. The operating system will search for the driver on the Resource CD and should eventually report that it has found the driver. Click **Next**. When a window appears indicating that the Wizard has finished installing the driver software, click **Finish**.

Another *Found New Hardware Wizard* window may appear immediately following the previous "finished" window. Click **Next** when that window pops up. This Wizard will install the drivers for a USB Serial Port. Follow the same procedure used in the previous Wizard install process, again directing the Wizard to the CD-ROM drive for the drivers. (The Resource CD should still

be in the drive at this time.) Both hardware devices have been installed and will be automatically configured by Windows whenever you connect the enclosure in the future.

Once this process is completed, you can proceed with installation of the WinDaq programs. See the instructions in Appendix A2 for details on installing the programs

A2: WinDaq programs.

Assuming the Resource CD is still in the drive, eject it and reinsert it to automatically start the program install process. If the CD is not in the drive, insert it. If the install does not start automatically, access the CD drive in Windows Explorer and double click on the *Setup.exe* file in the root folder.

When the *What Do You Want to Do?* window appears, make sure that the button adjacent to *Install Software* is selected and then click **OK**. In the next window, select the option for installing software for the DI-148 and click **OK**. Work through the next few windows. Selections should be obvious. When a window appears displaying a message, *Searching for hardware*, wait for the DI-148U to be found. Your DI-148U unit will eventually appear as a single entry. Make sure that entry is highlighted and click **OK**. Complete the software installation by selecting the default name (*WINDAQ*) for the program group when that window appears and click **OK**. Copying and installation of the program files will follow automatically from this point and it should take no more than a few minutes. When the *Installation Complete!* window pops up, click **Finish**.

Congratulations! You have successfully installed all the software required by the Tester. You can remove the Resource CD from the computer drive, but if you plan to complete the Hardware Manager configuration at this time you can leave the Tester enclosure connected to your computer. Return to page 4 when ready to configure the Hardware Manager program and complete the software installation and configuration process.