Manual of Operation and Instruction

Troxler
Plus
Calibration Suite

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HOW TO USE THIS MANUAL

Congratulations on purchasing the **Troxler Plus Calibration Suite.**

The **Troxler Plus Calibration Suite** *Manual of Operation and Instruction* explains how to install and register the software, and provides procedures for using the Calibration Suite to calibrate Troxler gauges.

GUIDE TO SYMBOLS

Throughout this manual symbols often reveal the purpose of the text. The symbols and their purpose are as follows:

NOTE

Indicates important information that must be read to ensure proper operation.

⟨**KEY**⟩ Angle brackets and a different typestyle indicate a key or character (number or letter) to press on the gauge keypad. For example, "Press ⟨**START/ENTER**⟩" means to press the key labeled *START/ENTER.*

DISPLAY A different typestyle is used in text to indicate information or messages displayed on the gauge.

```
DISPLAY - Typestyle
and shading used to
simulate the gauge
display
```

♦ Diamonds indicate a list of things needed (such as equipment) or things to know.

✓ Check marks indicate the performance of an action. With lists of check marks, follow the instructions in the order of the check marks.

► Triangles indicate that more than one option is available. Carefully select the option that applies.

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CHAPTER 1

INTRODUCTION AND INSTALLATION

This chapter contains a general introduction to the Troxler Plus Calibration Suite. The information includes a list of the hardware and software requirements for using the Troxler Plus Calibration Suite software, and instructions for installing the software.

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INTRODUCTION

The Troxler *Plus* Calibration Suite provides a group of software applications that can be used to calibrate Troxler Model 3430 Plus, 3440 Plus, and 3451 Enhanced RoadReader Plus gauges. The software is designed to operate on a personal computer (PC) equipped with a Microsoft® Windows® XP Professional Edition, Windows XP Home Edition, Windows XP Media Center Edition, or Windows 2000 operating system.

NOTE

The Troxler Legacy Calibration Suite does *not* include calibration applications for Troxler Model 3401-B, 3411-B, 3430, 3440, 3450 RoadReader™ Plus, 4640-A, and 4640-B gauges. Calibration software for these gauges is contained in the Troxler *Legacy* Calibration Suite.

The user-friendly software prompts the user for needed information. The software then reads and records the counts from the gauge, loads the calibration constants into the gauge, prints a calibration report, and stores the data in the computer for later use.

The following manual provides instructions on how to calibrate the gauges listed above using the applications in the Troxler Plus Calibration Suite. In addition to this document, you will need the *Manual of Operation and Instruction* (user manual) for the particular gauge model that is being calibrated.

The user manuals for the Model 3430 Plus, 3440 Plus, and 3451 gauges are available for download from the Troxler web site at www.troxlerlabs.com.

Note that this manual does not purport to address **any** of the safety concerns involved in the calibration and/or use of these Troxler products. Refer to the appropriate *Manual of Operation and Instruction*, or contact a Troxler representative if any such questions or concerns should arise.

This manual also does not purport to describe the manner in which a nuclear gauge calibration facility is designed, constructed, or maintained. Information on nuclear gauge calibration facilities can be obtained from ASTM D7013-04, *Standard Guide for Nuclear Surface Moisture and Density Gauge Calibration Facility Setup*, or by contacting a Troxler representative.

This manual also does not describe the two “special” quality assurance (QA) measurements that Troxler takes on all new gauges after their calibration – the measurements on the special QA limestone block, and the measurement on the special QA mag/poly block.

COMPUTER REQUIREMENTS

The following sections list the hardware and software requirements for using the Troxler Plus Calibration Suite with the following operating systems.

NOTE

In addition to the hardware listed below, an RS-232 cable is required to connect the gauge to the computer's RS-232 connection. To connect a Model 3451 gauge, the cable must be a standard RS-232 cable, with a DB9 female connector on one end and a DB9 male connector on the other. To connect a Model 3430 Plus or Model 3440 Plus gauge, the cable must be an RS-232 *null modem* cable (Troxler PN 106514), with a DB9 female connection on both ends.

WINDOWS XP PROFESSIONAL EDITION

Minimum Hardware

Personal computer with a Pentium® 300 MHz processor or better and:

- 512 MB RAM
- Hard disk with 10 MB of free disk space
- CD-ROM drive
- VGA graphics adapter and monitor (default) with 256 colors or better
- Mouse
- Keyboard
- PCI serial card or an available USB port with an RS-232 serial-to-USB adapter

Recommended Hardware

- Pentium 1 GHz processor
- 1 Gigabyte RAM
- SVGA graphics adapter and monitor (default) with 1024 colors

WINDOWS XP HOME EDITION

Minimum Hardware

Personal computer with a Pentium 300 MHz processor or better and:

- 256 MB RAM
- Hard disk with 10 MB of free disk space
- CD-ROM drive
- VGA graphics adapter and monitor (default) with 256 colors or better
- Mouse
- Keyboard
- PCI serial card or an available USB port with an RS-232 serial-to-USB adapter

Recommended Hardware

- Pentium 1 GHz processor
- 512 MB RAM
- SVGA graphics adapter and monitor (default) with 1024 colors

WINDOWS XP MEDIA CENTER EDITION

Minimum Hardware

Personal computer with a Pentium 300 MHz processor or better and:

- 512 MB RAM
- Hard disk with 10 MB of free disk space
- CD-ROM drive
- VGA graphics adapter and monitor (default) with 256 colors or better
- Mouse
- Keyboard
- PCI serial card or an available USB port with an RS-232 serial-to-USB adapter

Recommended Hardware

- Pentium 1 GHz processor
- 1 Gigabyte RAM
- SVGA graphics adapter and monitor (default) with 1024 colors

WINDOWS 2000 EDITION

Minimum Hardware

Personal computer with a Pentium 300 MHz processor or better and:

- 128 MB RAM
- Hard disk with 10 MB of free disk space
- CD-ROM drive
- VGA graphics adapter and monitor (default) with 256 colors or better
- Mouse
- Keyboard
- PCI serial card or an available USB port with an RS-232 serial-to-USB adapter

Recommended Hardware

- Pentium 1 GHz processor
- 512 MB RAM
- SVGA graphics adapter and monitor (default) with 1024 colors

SOFTWARE INSTALLATION

The Troxler Plus Calibration Suite contains two separate software applications. One application is used exclusively for Troxler Model 3430 Plus and 3440 Plus gauges. The second software application is exclusively for Troxler Model 3451 gauges. Each of these software packages must be installed separately.

To install the Troxler Plus Calibration Suite application(s) of your choice:

Insert the Calibration CD-ROM into the computer's CD-ROM drive.

The CD-ROM is AutoPlay (or AutoRun) enabled. Wait for the AutoPlay screen for this CD-ROM to be displayed. Follow the onscreen instructions for installing the software application (or applications) that you wish to use.

NOTE

If the AutoPlay function is disabled on this computer, follow your operating system's instructions for running the AutoPlay program on a CD-ROM.

The installation of either of the two software applications adds a **Troxler Plus** program group to the computer's **Programs** menu. Each application will have its own program subgroup within the **Troxler Plus** program group. Each program subgroup will have four menu items:

- The calibration software application itself
- An **Uninstall** item for the software application
- A **Register Software** item
- A **Help and Support** item

NOTES

CHAPTER 2

CALIBRATION REGISTRATION PROGRAM

The Troxler Plus Calibration Suite must be registered with Troxler before either of the software applications will function. The *Calibration Registration* program described in this chapter accomplishes this task. The Calibration Registration program performs two functions: sending the registration information to a Troxler representative and unlocking the Troxler Plus Calibration Suite for use.

The following sections detail the system requirements, installation and operation of the Calibration Registration program

CONTENTS

SYSTEM REQUIREMENTS

The system requirements for the Calibration Registration program are the same as those listed for the Troxler Calibration Program on page 1–3.

STARTING CALIBRATION REGISTRATION

NOTE

The following procedure applies to any of the Windows operating systems supported by the Troxler Plus Calibration Suite.

To start the Calibration Registration program:

Click the Windows **Start** button, then select the **All Programs** menu and the **Troxler Plus** program group.

From the **Troxler Plus** program group, select either the **3451** or **3430 and 3440 Plus** program subgroup. Fromt that subgroup, select the **Register Software** menu item.

After the software has been loaded, the main menu shown in Figure 2–1 is displayed.

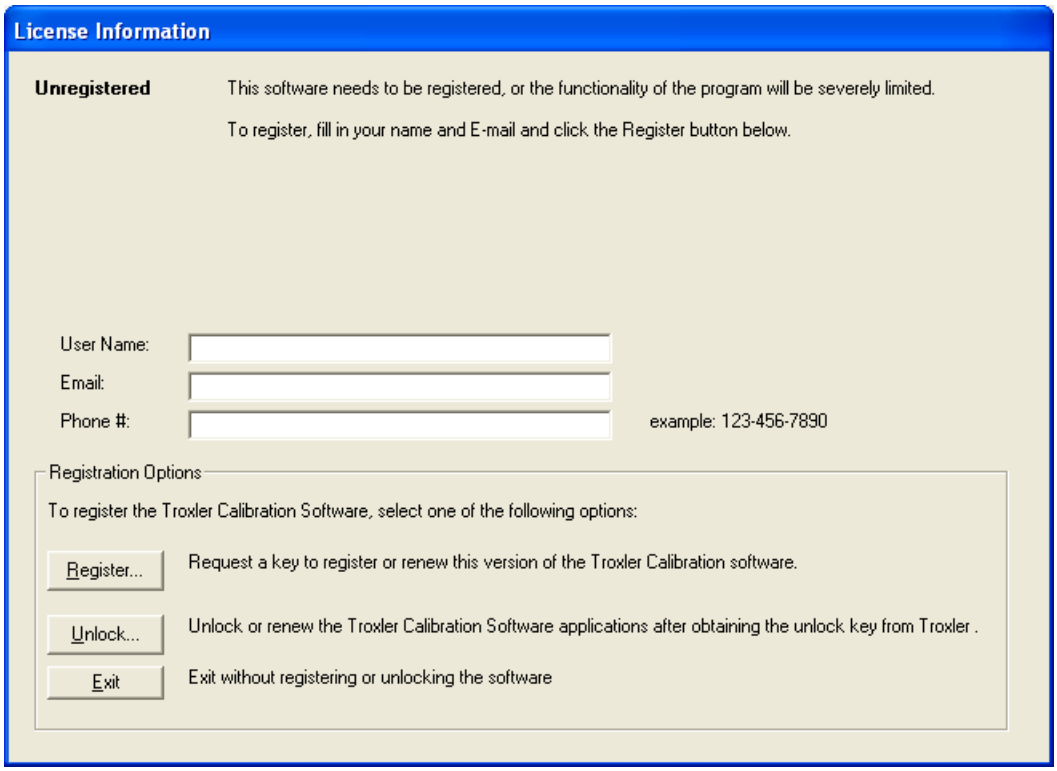

Figure 2–1. Calibration Registration Main Menu

REGISTERING THE SOFTWARE

To register the Troxler Plus Calibration Suite, from the Calibration Registration main menu shown in Figure 2–1:

1. Enter your customer/company name.

2. Enter your customer/company e-mail address.

3. Enter your telephone number.

4. Press the ⟨**Register**⟩ button. The Calibration Registration program creates a file on the desktop named *TroxlerRegistrationInfo.txt*. and displays a **Register Software** prompt.

5. As directed, e-mail the *TroxlerRegistrationInfo.txt* file to **softwaresupport@troxlerlabs.com** using the subject line "Calibration Software Registration Request."

6. Press the ⟨**OK**⟩ button to exit.

UNLOCKING THE SOFTWARE

After registering the Troxler Plus Calibration Suite software as described in the previous section, you will receive an e-mail response from Troxler that contains a keycode that will unlock the software for use. To unlock the software using the unlock key:

1. On the Calibration Registration main menu (see Figure 2–1), press the ⟨**Unlock**⟩ button. The **Open key file** message box shown in Figure 2–2 is displayed. Click the ⟨**OK**⟩ button.

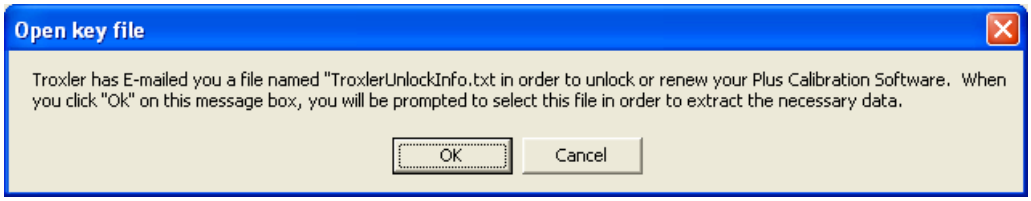

Figure 2–2. Unlocking the Software

2. A **File Open** dialog box is now displayed. Use this dialog box to open the file *TroxlerUnlockInfo.txt* that was e-mailed to you from Troxler. Once this file has been opened, the software will be unlocked.

NOTE

The Calibration Registration program only needs to be run once, even if the software applications for the calibration of both the Troxler Model 3451 gauge *and* the 3430 Plus and 3440 Plus gauges have been installed. Running the Calibration Registration program for one of the two software applications unlocks both applications.

EXITING CALIBRATION REGISTRATION

Before turning off the computer, be sure to exit the Calibration Registration program by pressing the ⟨**Exit**⟩ button from the main menu (see Figure 2–1).

CHAPTER 3

MODEL 3430/3440 PLUS CALIBRATION

This chapter provides instructions for calibrating a Model 3430 Plus or 3440 Plus Surface Moisture-Density Gauge using the Troxler Plus Calibration Suite software. The information presented here includes procedures for resolving issues encountered during the calibration process. A calibration procedure outline and checklist is provided at the end of this chapter.

CONTENTS

SECURITY FEATURES

The Model 3430 Plus and 3440 Plus gauges feature security functions that inhibit unauthorized users from accessing or tampering with gauge functions and data. This security extends to the manner in which calibrations are performed. Consequently, there are several points during a typical calibration when a *security check* is performed by the software. Most of these points occur when a menu-level function is begun.

The security check ensures that the gauge that is being calibrated should be communicating with the computer that is calibrating it, and vice versa. When a menu-level function that requires a security check is begun, the message box shown in Figure 3–1 is displayed.

Figure 3–1. Initialize Communication Protocol Message Box

As directed, confirm that the gauge is on and that the RS-232 cable is properly plugged in and configured, then click the ⟨**OK**⟩ button.

The program then looks for a “security key” that the gauge and computer share if they are authorized to communicate with each another. One of three scenarios could take place:

- If there is currently no key, the software will ask the gauge for the key, and the gauge will pass the key to the computer.
- If there is a valid key, the software tries the key in the gauge to confirm that it works.
- If there is a key but it is not valid, the key will fail when the software tries it in the gauge.

The first two scenarios are the most common.

If the security key is confirmed, the software displays a message box that states **The key is obtained**. A number, which varies from gauge to gauge, is displayed in the left side of the message box. To complete the security check and continue with the calibration, click ⟨**OK**⟩.

If the security key cannot be confirmed, a **Communications error** message box similar to the one shown in Figure 3–2 is displayed. Follow the instructions in the message box, and resume the calibration.

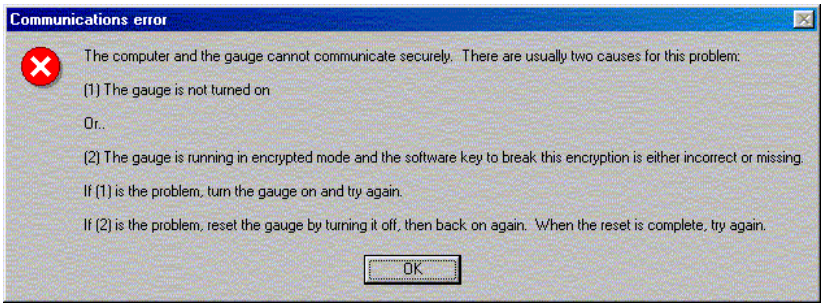

Figure 3–2. Communications Error Message Box

CALIBRATION PROCEDURE

GAUGE SETUP/INITIAL STABILITY

1. Turn the gauge on by turning the power switch on its control panel to the "On" (1) position. Allow a warmup of approximately 20 minutes.

2. Select a bay for calibration. The bay must contain the magnesium, mag/aluminum, aluminum, and mag/poly calibration blocks.

3. Place the gauge's reference standard block on the mag/aluminum block in the standard count orientation. Place the gauge on the standard block as described in the instructions for taking a standard count in Chapter 4 of the gauge's *Manual of Operation and Instruction*.

4. Connect one end (male) of an RS-232 null modem cable to the gauge's RS-232 port (male). Connect the other end to the RS-232 port of the calibration bay cable switch box (see Figure 3–3), or directly to the Com 1 port on the back of the calibration computer. If using the cable switch box, connect the null modem cable to the *B* port, which is labeled either *3430/3440 Plus* or *345x*.

5. If using the cable switch box, set its front panel switch to the **3451** (*B*) position.

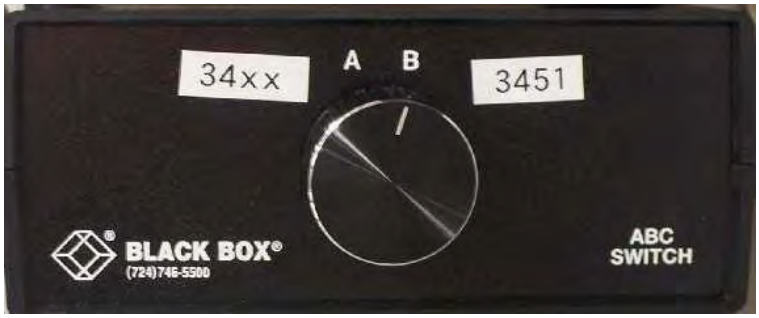

Figure 3–3. Calibration Bay Cable Switch Box

6. Double-click the **Cal3430/3440 Plus** icon on the Windows desktop. The calibration program starts, briefly displaying a splash screen that identifies the software and version number.

7. When the splash screen is complete, the program **Main Menu** (see Figure 3–4) is displayed. The options that are available on the **Main Menu** will vary depending upon the tasks that have been most recently undertaken.

NOTE

Although not shown in Figure 3–4, the bottom of the Main Menu will include a color-coded *license status caption*. The license status caption informs the user how long his/her current software license will be valid. In order to save space and focus on the specific tasks involved in calibrating a gauge, the license status caption is not shown on any of the Main Menu examples shown in the calibration sections of the chapter. For more information on the license status caption, refer to page 3–28.

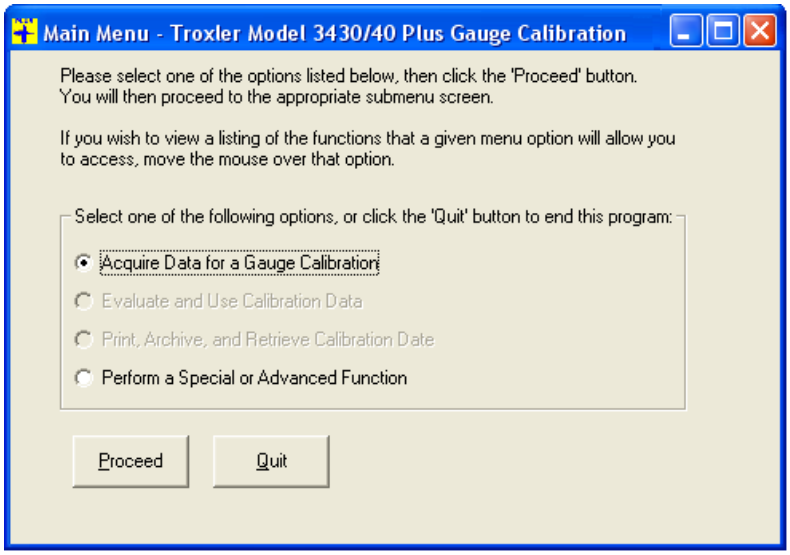

Figure 3–4. Main Menu
(License Status Caption Not Shown)

8. As shown in Figure 3–4, select the **Acquire Data for a Gauge Calibration** option, then click ⟨**Proceed**⟩. The **Count Acquisition SubMenu** (Submenu 1) is displayed, as shown in Figure 3–5. Again, the options that are available in the submenu depend upon the tasks that have been most recently undertaken.

9. On the gauge, perform a software reset as follows:
   a. From the gauge's **Ready** screen, press ⟨**SETUP**⟩ to access the **Setup** menu.
   b. Press ⟨**.**⟩ ⟨**9**⟩ to access the gauge's **Extended** menu. The gauge first requests an access code.
   c. Press ⟨**4**⟩ ⟨**7**⟩ ⟨**0**⟩ ⟨**8**⟩, then press the ⟨**ENTER/START**⟩ key. The **Extended** menu is displayed.
   d. From the **Extended** menu; press ⟨**8**⟩ to perform a software reset.
   e. The gauge displays a warning that system variables will be reset to default values. Press ⟨**YES**⟩.
   f. The gauge performs a software reset, then displays a prompt that asks whether you wish to change the gauge serial number from its current value of *0*. Press ⟨**YES**⟩.
   g. When prompted, enter the serial number of the gauge and press ⟨**ENTER/START**⟩. The gauge confirms the change and returns to the **Extended** menu.

10. Set the *Clock/Calendar* function to the current time and date as follows:
    a. From the **Extended** menu, press ⟨**1**⟩ to display the **Clock/Calendar** menu.
    b. From the **Clock/Calendar** menu, press ⟨**1**⟩ to change the time. The default time stored in the gauge is displayed.
    c. Enter the current time and press ⟨**ENTER/START**⟩. The gauge sets the time and returns to the **Clock/Calendar** menu.
    d. Press ⟨**2**⟩ to change the date. The default date stored in the gauge is displayed.
    e. Enter the current date and press ⟨**ENTER/START**⟩. The gauge sets the date and returns to the **Clock/Calendar** menu.
    f. Press ⟨**ESC**⟩ twice to return to the **Setup** menu.

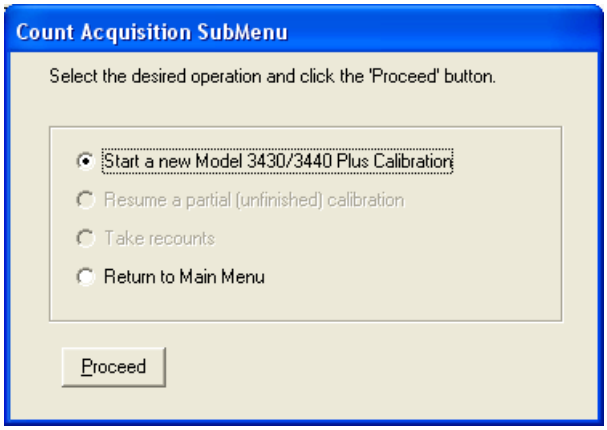

Figure 3–5. Count Acquisition Submenu

11. From the **Setup** menu, press ⟨**3**⟩ to access the *Depth Mode* function. The gauge displays the current depth mode, which should be set to the default, *Manual*, mode.
    - If the gauge to be calibrated is a Model 3440 Plus, press ⟨**2**⟩ to select the *Automatic* depth mode. The gauge confirms the selection then returns to the **Setup** menu.
    - If the gauge to be calibrated is a Model 3430 Plus, press ⟨**1**⟩ to select the *Manual* depth mode. (A Model 3430 Plus gauge has no depth indicator, therefore the *Automatic* depth mode is not available.) The gauge confirms the selection then returns to the **Setup** menu.

12. The gauge must be in *Command Line Interface (CLI)* mode in order to communicate with the computer. To enable CLI mode:
    a. From the **Setup** menu, press ⟨**.**⟩ ⟨**9**⟩ to access the gauge's **Extended** menu. The gauge again requests an access code.
    b. Press ⟨**4**⟩ ⟨**7**⟩ ⟨**0**⟩ ⟨**8**⟩, then press the ⟨**ENTER/START**⟩ key. The **Extended** menu is displayed.
    c. From the **Extended** menu, press ⟨**.**⟩ ⟨**9**⟩ to access the gauge's **Factory** menu. The gauge again requests an access code.
    d. Press ⟨**3**⟩ ⟨**7**⟩ ⟨**6**⟩ ⟨**7**⟩, then press the ⟨**ENTER/START**⟩ key. The **Factory** menu is displayed.
    e. From the **Factory** menu, press ⟨**1**⟩. The gauge enables the CLI mode and returns to the **Factory** menu.

13. Return to the calibration computer. To begin the new calibration, select the **Start a new Model 3430/3440 Plus Calibration** radio button, then click ⟨**Proceed**⟩. The gauge performs a security check as described on page 3–2. After the security check is passed, if an unfinished calibration is in the gauge memory, a warning screen is displayed. Otherwise, the **Recalibration?** message box (see Figure 3–6) is displayed.

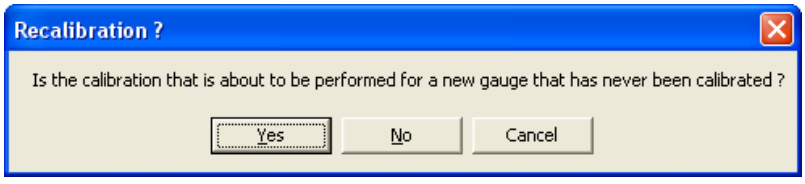

Figure 3–6. Recalibration Query Message Box

14. If the calibration about to be undertaken is for a brand new gauge that has never been calibrated, click ⟨**Yes**⟩ or simply press the ⟨**Enter**⟩ key. If the gauge is not new, click ⟨**No**⟩.

15. The software then displays the query, **Does this gauge have an automatic depth indicator installed?** Click the correct response, based upon whether or not the gauge being calibrated has a depth indicator.

16. The software then requests the properties of the gauge and the calibration to be performed (gauge model, gauge serial number, calibration bay number, gauge index rod type, and calibration type), as shown in Figure 3–7. Enter the pertinent information and click the ⟨**Proceed**⟩ button.

    - If the calibration being performed is a two-block recalibration, information pertaining to the most recent full calibration of this gauge must be obtained as described in the *Two-Block Calibration Option* section that begins on page 3–33.
    - If the calibration being performed is *not* a two-block calibration, proceed directly to step 0.

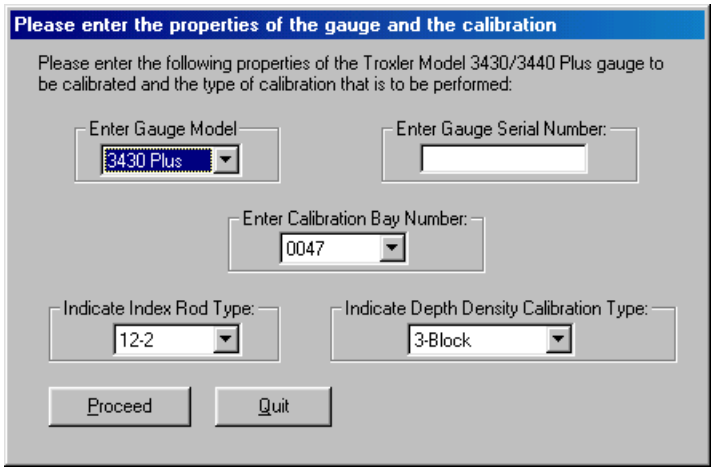

Figure 3–7. Calibration Properties Entry Form

17. The gauge is now ready to begin the stat test. The software displays a message box directing the user to ensure that the gauge is ready for the stat test. Ensure that the gauge's reference standard block is in position on the mag/aluminum block and that the gauge is in the standard count position as described in step 3 of this section. Click ⟨**OK**⟩ to proceed with the stat test.

18. Once the ⟨**OK**⟩ button is clicked, the stat test counts begin. A stat test consists of twenty 1-minute counts. A progress bar displays the status of the progress of the stat test. When the stat test is completed, a **Stat Test Results** message box similar to the one shown in Figure 3–8 is displayed.

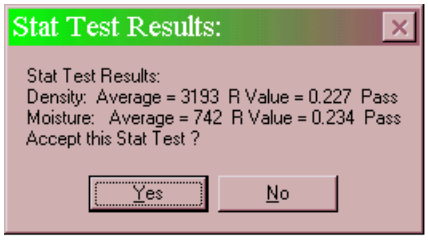

Figure 3–8. Stat Test Results Message Box

19. The stat test should pass both the moisture and density measurement systems.

- If the stat test *does* pass all measurement systems *and* meets the Calibration Inspection Limit requirements, click the ⟨**Yes**⟩ button. The program displays a message box indicating that this stat test has been accepted. Click ⟨**OK**⟩ to continue. At this point the initial setup and stability tests for this gauge are complete; proceed to the *Backscatter and Transmission Density Calibration Counting* section on the following page.
- If the stat test *does not* pass all measurement systems, click the ⟨**No**⟩ button. A critical message box is displayed telling you that the stat test has failed, and the program will return to step 7, displaying Figure 3–4. Repeat the stat test; if the gauge fails the second stat test, return it to Service or Assembly to have it analyzed and repaired.
- If the stat test *does* pass all measurement systems, but one or both of the standard counts fail to fall within the required *Calibration Inspection Limits*, click the ⟨**No**⟩ button. A critical message box is displayed telling you that the stat test has failed, and the program will return to step 7, displaying Figure 3–4. Repeat the stat test; if the gauge fails to meet the *Calibration Inspection Limits* for a second time, return it to Service or Assembly to have it analyzed and repaired.

BACKSCATTER AND TRANSMISSION DENSITY CALIBRATION COUNTING

Once the gauge has passed the stat test, the calibration software performs a series of calibration measurement counts. The software keeps track of which count must be taken next and how long that count should last. For each measurement, the software prompts the user to place the gauge on the proper calibration block and to place the source rod in a particular measurement position.

When the gauge is ready to take a calibration count, the **Prepare gauge for count** prompt shown in Figure 3–9 is displayed. Note that the example shown in Figure 3–9 is for the first count to be taken: using the magnesium block with the source rod in the backscatter position.

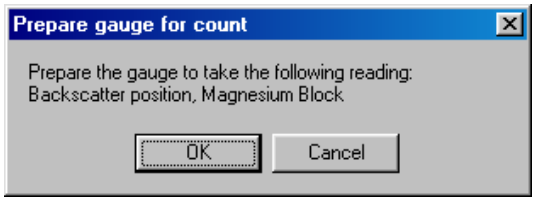

Figure 3–9. Prepare Gauge for Count Screen

1. To take this count, place the gauge on the block indicated by the **Prepare gauge for count** prompt, with the source rod in the position indicated. Press down gently on the end of the handle (without touching the trigger) to ensure that the handle is properly seated. Then, proceed to step 2.

NOTE

If you need to halt the calibration for any reason, click the ⟨Cancel⟩ button on the Prepare gauge for count prompt. The software will display a new message box, noting that this calibration can be resumed at a later time. When the ⟨OK⟩ button is clicked on this new message box, the software will proceed to step 16.

2. Click the ⟨**OK**⟩ button to proceed with the reading. The software displays a progress bar showing which count is being made and how much time is left in the count. Wait for the count to finish.

3. When the count is complete, the **Prepare gauge for count** prompt is displayed, again showing which count is to be made next. When all measurement counts on the calibration blocks are complete, the program will proceed to step 4. Otherwise, go back to step 1.

4. When the calibration block counts are complete, the gauge displays a message box prompting the user to take a drift test. Place the gauge's reference standard block on the mag/aluminum calibration block, and then place the gauge on the reference standard block, with the source rod in the **SAFE** position.

5. Follow the gauge prompts to take the drift test. Upon completion of the drift test, the software displays the results as shown in Figure 3–10.

   - If the drift test passes, click the ⟨**Yes**⟩ button. The software displays a message box that notifies the user that the just-completed calibration is now the *Active Calibration*. The software then returns to the **Count Acquisition SubMenu**. Proceed to step 19.
   - If, however, the drift test fails any of the three systems, the drift test must be repeated. Click the ⟨**No**⟩ button. The software displays a confirmation that the drift test was rejected. Click the ⟨**OK**⟩ button and proceed to step 6.

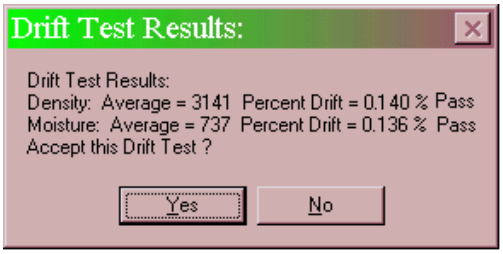

Figure 3–10. Drift Test Results Display

6. The software displays another message box stating that the counting has been halted at the user request. Click ⟨**OK**⟩.

7. The **Count Acquisition SubMenu** will again be displayed. However, the second option, **Resume a partial (unfinished) calibration**, is option available as shown in Figure 3–11. Select this option and click the ⟨**Proceed**⟩ button.

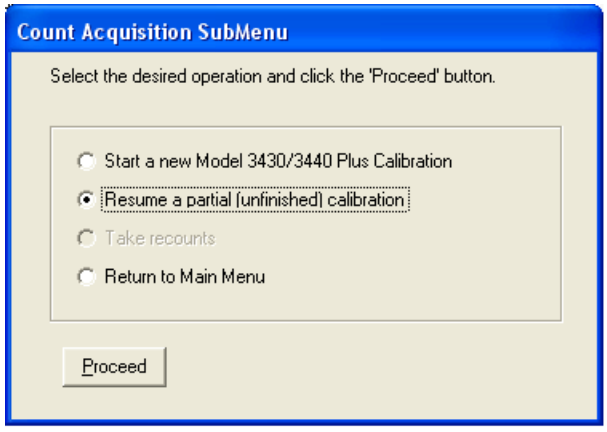

Figure 3–11. Count Acquisition SubMenu, Resume a Partial (Unfinished) Calibration Option Selected

8. The software performs a security check, as described in the *Security Features* section on page 3–2. When the security check is complete, the software displays a message box showing the partial calibration that is in memory and asks if the user wishes to continue. Click ⟨**OK**⟩ to proceed.

9. The gauge now displays a message box that asks if the user wishes to proceed with a drift test. Click ⟨**OK**⟩ to proceed.

10. Since this is the second drift test, the gauge prompts the user to move the gauge source rod up and down. Move the source rod up and down a few times as directed, then ensure that the gauge is placed correctly on the reference standard block and that the source rod is properly seated in the **SAFE** position. When this is done, click the ⟨**OK**⟩ button to start the second drift test.

11. Allow the second drift test to complete.
    - If the second drift test passes the system (or systems) that failed in the *first* drift test, click the ⟨**Yes**⟩ button. The software displays a message box that notifies the user that the just-completed calibration is now the *Active Calibration*. The software then returns to the **Count Acquisition SubMenu**. Proceed to step 19.
    - If, however, the drift test fails any system that it also failed in the first drift test, then a *provisional drift test* needs to be conducted to check gauge electrical stability. Click the ⟨**No**⟩ button.

12. The software displays a message box that states that a provisional drift test must be conducted. Click ⟨**OK**⟩ to continue.

13. The gauge must now wait 3 hours before the provisional drift test counts can be made. For the next 3 hours, the computer displays a screen that shows how much time is left in the 3-hour period. Allow this 3-hour period to conclude.

14. After 3 hours, the gauge will automatically conduct the five 4-minute counts required for the provisional drift test. Allow these counts to conclude.

15. Upon completion of the provisional drift test, the software displays the results similar to Figure 3–10 on page 3–8. For this test, however, the values used to determine the % drift are the results of the second drift test and the results of the provisional drift test. Because the gauge was not moved between these two sets of counts, the results are a true representation of the electronic stability of the gauge.
    - If the provisional drift test passes the system (or systems) that it failed in the first and second drift tests, click the ⟨**Yes**⟩ button. The software displays a message box that notifies the user that the just-completed calibration is now the *Active Calibration*. The software then returns to the **Count Acquisition SubMenu**. Proceed to step 19.
    - If, however, the drift test fails any system or systems that it also failed in the first and second drift tests, then this gauge has an electrical stability problem that must be corrected. **Halt the calibration process and take the gauge to Assembly or Service for analysis and repair.**

16. The **Count Acquisition SubMenu** will again be displayed with the second option, **Resume a partial (unfinished) calibration**, available as shown in Figure 3–11 on page 3–8. Select this option and click the ⟨**Proceed**⟩ button.

17. The software performs a security check, as described in the *Security Features* section on page 3–2. When the security check is complete, the software displays a message box showing the partial calibration that is in memory and asks if the user wishes to continue. Click ⟨**OK**⟩ to proceed.

18. The **Prepare gauge for count** prompt shown in Figure 3–9 is displayed, informing the user which count needs to be taken next. Proceed to step 1 on page 3–7 to initiate this count.

19. Now that the drift test has passed, the calibration data collection is complete. The **Count Acquisition SubMenu** will again be displayed with the options shown in Figure 3–12. From the **Main Menu** you will be able to initiate the process of reviewing the data just collected. Select the fourth option, **Return to Main Menu**, click ⟨**Proceed**⟩, and then proceed to the next section, *Computing Calibration Constants*.

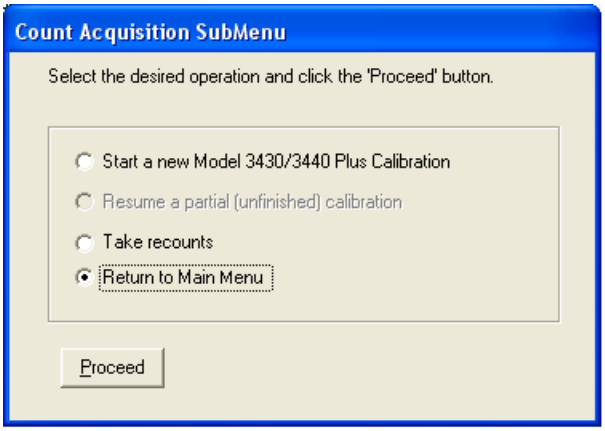

Figure 3–12. Count Acquisition SubMenu, after Calibration Counts are Complete

COMPUTING CALIBRATION CONSTANTS

If there is an active calibration currently in the memory of the gauge, then one can compute the calibration constants for the gauge. In order to compute these constants, do the following:

1. From the **Main Menu**, select the second option, **Evaluate and Use Calibration Data**, as shown in Figure 3–13, then click the ⟨**Proceed**⟩ button:

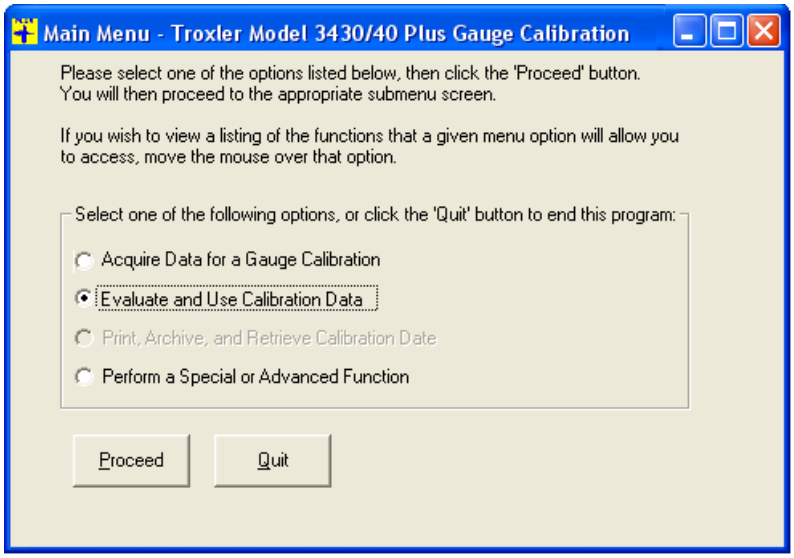

Figure 3–13. Main Menu, Evaluate and Use Calibration Data

2. The **Calibration Constants Submenu** is displayed. As shown in Figure 3–14, select the second option, **Compute calibration constants for gauge number x** (where *x* is the serial number of the current active calibration), and click the ⟨**Proceed**⟩ button.

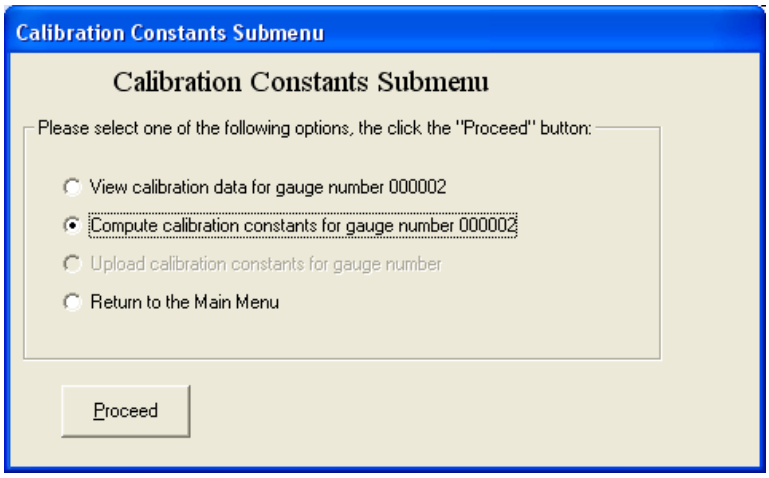

Figure 3–14. Calibration Constants Submenu, Compute Calibration Constants Option Selected

3. The program computes the calibration constants for the currently active calibration – in this instance, gauge number *2*. If these calibration constants are computed without error, a **Constants computed** message box is displayed. Click ⟨**OK**⟩ to continue.

4. The software then displays the results of the computation of the calibration constants, as shown in Figure 3–15.

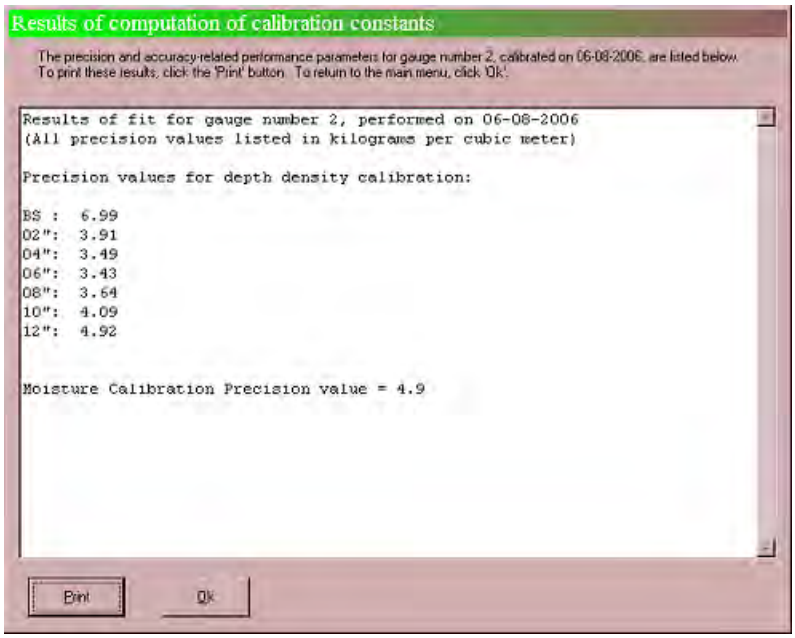

Figure 3–15. Results of Computation of Calibration Constants

5. Click the ⟨**Print**⟩ button to generate a printout, then review these precision values. When the review is complete, click the ⟨**Ok**⟩ button.

   - If any of these values exceed the *Calibration Inspection Limits* values, then the gauge may need to be repaired. Proceed to step 10.
   - If all of the values are within the *Calibration Inspection Limits*, continue to step 6.

6. The **Calibration Constants Submenu** is again displayed, with all four options enabled. As shown in Figure 3–16, select the third option, **Upload calibration constants for gauge number *x* to the gauge**, where *x* is the gauge serial number, and click the ⟨**Proceed**⟩ button.

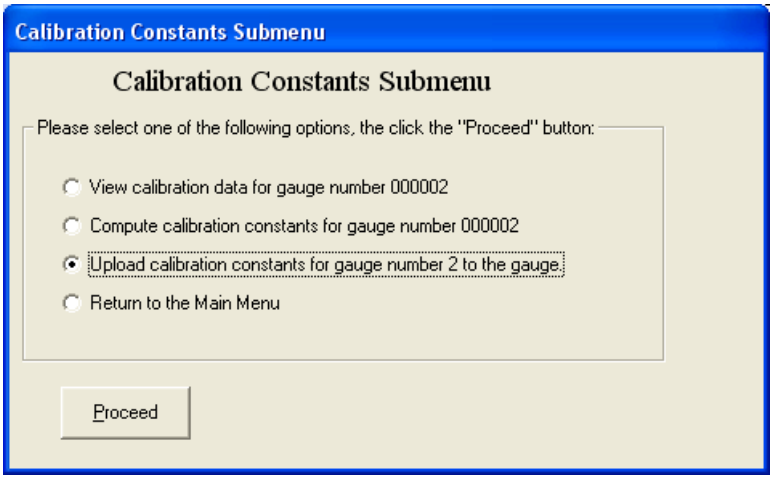

Figure 3–16. Calibration Constants Submenu, Upload Calibration Constants Option Selected

7. The gauge now performs a security check, as described in the *Security Features* section that begins on page 3–2. When the security check is passed, the program proceeds with loading the calibration constants into the gauge. A status bar keeps track of the process. When the upload is complete, the software displays a message box that states **Calibration storage complete!** Click the ⟨**OK**⟩ button to continue.

8. The **Calibration Constants Submenu** is again displayed, with all four options available as shown in Figure 3–16. Select the fourth option, **Return to the Main Menu**, and click the ⟨**Proceed**⟩ button.

9. The software returns to the **Main Menu** (see Figure 3–4 on page 3–4). Proceed to the *Calibration Quality Assurance* section on page 3–15 to run the QA tests on this newly calibrated gauge.

10. The **Calibration Constants Submenu** is again displayed, with all four options available as shown in Figure 3–16. Select the fourth option, **Return to the Main Menu**, and click the ⟨**Proceed**⟩ button.

11. The software returns to the **Main Menu** (see Figure 3–4 on page 3–4). Proceed to the *Calibration Recounts* on the following page, and take the necessary recounts with the gauge.

CALIBRATION RECOUNTS

On occasion, a calibration reading must be repeated in order to meet performance parameter requirements. The following section describes how to take *recounts* for a specific gauge calibration.

1. From the **Main Menu** (see Figure 3–4 on page 3–4), select the **Acquire Data for a Gauge Calibration** option, then click ⟨**Proceed**⟩.

2. The **Count Acquisition SubMenu** (Submenu 1) is displayed, as shown in Figure 3–17. The options that are available in the submenu depend upon the tasks that have been most recently undertaken. As shown in Figure 3–17, select the third option, **Take recounts**, and click the ⟨**Proceed**⟩ button.

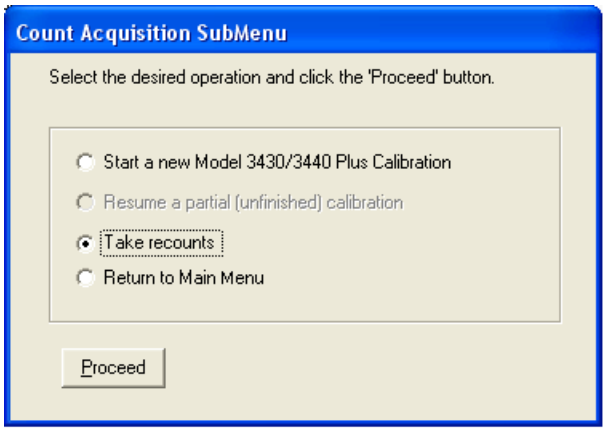

Figure 3–17. Count Acquisition Submenu, Take Recounts Option Selected

3. The software performs a security check, as described in the *Security Features* section on page 3–2. When the security check is passed, the software displays a message box showing the active calibration that is available for recounting. If the calibration denoted in this message box is correct, click ⟨**Yes**⟩ and proceed to step 4. Otherwise, click ⟨**No**⟩.

4. Once ⟨**Yes**⟩ is clicked on the preceding message box, the **Recount Selection Form** (see Figure 3–18) is displayed. The form contains an option button for each recount that can be made with this particular calibration. To take a recount, click the option button beside the recount desired, then click the ⟨**Proceed**⟩ button. If you do not wish to take a recounts, then click the default option button, **No Recounts Required**, and then click the ⟨**Proceed**⟩ button.

5. The **Prepare gauge for count** prompt, shown in Figure 3–9 on page 3–7, is displayed. The text of the prompt will reflect the recount that was selected.

6. To take the recount, place the gauge on the block indicated by the prompt, with the source rod in the position indicated, and click ⟨**OK**⟩. The gauge count will proceed. The software displays a progress bar showing which count is being made and how much time is left in the count. Wait for the count to finish.

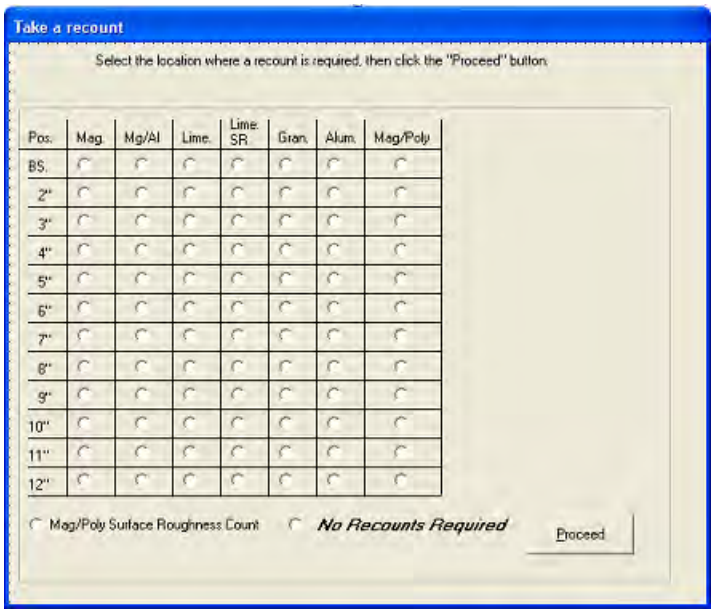

Figure 3–18. Recount Selection Form

7. Once the recount is complete, a message box is displayed asking if another recount is required.
   - If another recount is required, click the ⟨**Yes**⟩ button and return to step 4.
   - If no further recounts are required, click ⟨**No**⟩ and proceed to step 8.
8. The **Main Menu** is now displayed. Return to the *Computing Calibration Constants* section that begins on page 3–10 and follow the directions to re-compute the calibration constants using the new recounts.

CALIBRATION QUALITY ASSURANCE

Generating the Calibration Accuracy Check Form and Clearing the Project Data Storage Area

During the Quality Assurance phase of gauge calibration, gauge measurements are compared against the accepted values of the quantities that are being measured. These accepted values are printed on the *Calibration Accuracy Check Form*. In order to perform the QA tests, therefore, this form must be printed as described in the following procedure.

1. To generate the *Calibration Accuracy Check Form*, select the **Perform a Special or Advanced Function** option on the **Main Menu**, as shown in Figure 3–19, then click the ⟨**Proceed**⟩ button

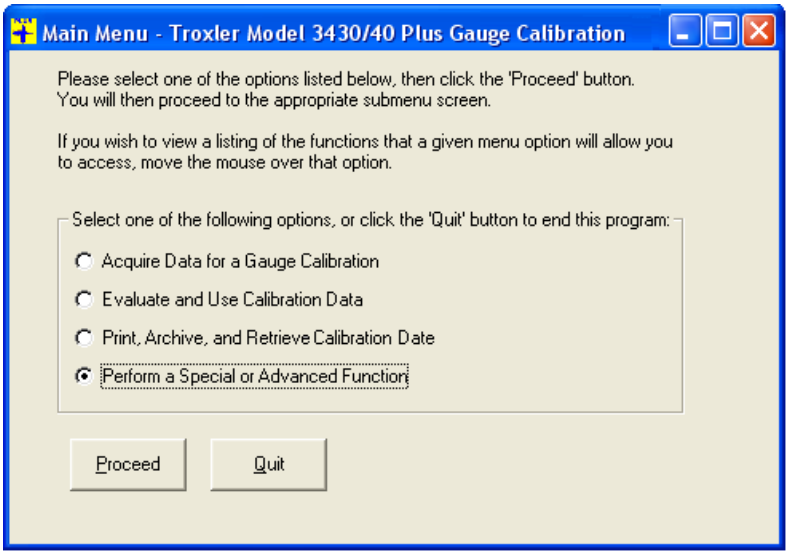

Figure 3–19. Main Menu with Option 4 Selected

2. The **Special Functions Submenu** (see Figure 3–20) is now displayed. This submenu allows access to several special functions. The function to be used at this time is the first available option, **Print an Accuracy Check Form (QA Form) for gauge *x***, where *x* is the gauge serial number for the active calibration. Select this option and click ⟨**Proceed**⟩.

3. The **Units Selection Screen** is now displayed. This screen allows the user to select the units – either pounds per cubic foot (English) or kilograms per cubic meter (metric) – in which the form will be printed. Select the default value of English (pcf) and then click the **Print QA Sheet** button.

4. A printer dialog screen is displayed. Select the printer to be used to print the QA form, then click the **Print** button.

5. The printer dialog screen will now disappear, leaving the **Units Selection Screen** visible. Click the ⟨**Quit**⟩ button to return to the **Special Functions Submenu**. Retrieve the QA form from the printer.

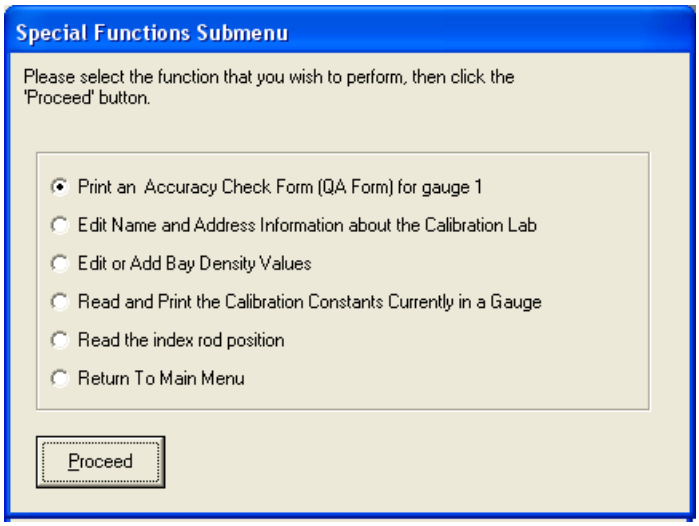

Figure 3–20. Special Functions Submenu

6. From the **Special Functions Submenu**, select the last option, **Return to Main Menu**, and click ⟨**Proceed**⟩. The program returns to the **Main Menu**. To continue the Calibration Quality Assurance process, proceed to the following section, *Acquiring and Evaluating the Data*.

Acquiring and Evaluating the Data

For the Quality Assurance phase of the calibration process, the calibration bay computer is not used to communicate with the gauge. Instead, turn your attention to the gauge itself for this section.

While doing the Calibration Quality Assurance testing, it is possible that one or more of the density or moisture QA counts will fail to meet the Quality Assurance criteria. If this is the case, then the QA process is halted and the calibration position that was found lacking is recalibrated. When the recounts are complete and the calibration constants are recomputed and loaded into the gauge, the Quality Assurance testing does not have to start completely over. Instead, the Quality Assurance testing can resume at the depth where the previous problems were encountered.

If the gauge calibration has not had any Quality Assurance testing done yet, then proceed to step 1 and start from the beginning. However, if you have just completed taking recounts because of a previous QA problem, then you may resume the QA process at the position where the problem was encountered. If the problem was a density QA failure, then you must start at that position in the magnesium block and take QA readings in both the magnesium and aluminum blocks.

1. Prepare to take a standard count by placing the gauge's polyethylene reference standard block in the center of the mag/aluminum block. Place the gauge on the polyethylene standard block, with its source rod is in **SAFE** position.

2. The gauge is probably still displaying the **Factory** menu. Press the ⟨**ESC**⟩ the key on the gauge keypad until the gauge goes back to **Ready** screen.

3. From the **Ready** screen on the gauge, press the ⟨**STD**⟩ key on the gauge keypad.

4. Press the ⟨**YES**⟩ key when the gauge asks if you wish to take a new standard count.

5. The gauge screen reminds the user how to orient the gauge for a standard count. Press the ⟨**ENTER/START**⟩ key, and the 4-minute standard count will proceed. The screen will notify the user that the standard count is in progress, and will inform the user of how much time is left in the count. Wait for this count to conclude.

6. When the standard count is complete, the gauge screen is displayed giving the results of the count. *Whether or not a particular count failed is not relevant at this point, since there are probably no standard counts in the system.* Compare the two standard counts themselves to the limits printed near the top of page 1 of the *Calibration Accuracy Check Form*. If both counts fall within these limits, then record the values on the *Calibration Accuracy Check Form* and proceed to step 9.
   - If any one of the standard counts fall outside these limits, AND this is the first standard count to be taken in the QA tests, then go to step 7.
   - If any one of the standard counts fall outside these limits, AND this is the second time during the QA tests that this has occurred, then record this value on the *Calibration Accuracy Check Form* and halt the QA process. Take the gauge to Assembly or Service to have it analyzed and repaired.

7. Press the ⟨**NO**⟩ key on the current message box to indicate that you do not wish to use the standard counts that were just acquired. The gauge display will ask if you wish to take another standard count.

8. Press ⟨**YES**⟩ on the gauge keypad and return to step 4 for the recount.

9. Press ⟨**YES**⟩ to accept the standard count. The gauge will return to the **Ready** screen.

10. It is now time to configure the gauge settings for the QA readings. Press the ⟨**MODE**⟩ key on the gauge keypad.

11. From the **Mode** screen, press the ⟨**2**⟩ key to put the gauge in *Soil* mode. The gauge confirms this setting, then returns to the **Ready** screen.

12. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

13. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

14. From the **Time** screen, press ⟨**2**⟩ to set the count time to 1 minute. The gauge confirms this setting, then returns to the **Setup** menu.

15. From the **Setup** menu, press ⟨**2**⟩ to set the units.

16. From the **Units** screen, press ⟨**1**⟩ to set the units to English (pcf). The gauge confirms this setting, then returns to the **Setup** menu.

17. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

18. Place the gauge on the center of the magnesium calibration block in the proper measurement position. Place the source rod in backscatter position, making sure the handle clicks into the backscatter notch. Press down gently on the end of the handle (without touching the trigger) to ensure that the handle is properly seated.

19. Press the ⟨**ENTER/START**⟩ key and wait for the count to conclude.

20. Upon completion of the count, the gauge displays the wet density, dry density, and moisture values. However, the display does *not* contain the actual density count, which is also needed. Do not record any of the data on this screen; instead, press the ⟨**ENTER/START**⟩ key.

21. Press the ⟨**RECALL**⟩ key to recall the measurement that was just made. Note the displayed Wet Density (WD) value. On the QA form, record the Wet Density value in the *Density Quality Test* table for the current calibration block, in the first *Dens* column, in the row corresponding to the current index rod orientation of the gauge.

22. Press the up arrow key to display the density and moisture counts.

23. On the QA form, record the Density Count (DC) value that is displayed. This density count value should be recorded in the *Density Quality Test* table for the current calibration block, in the *Dens Cnt.* column, in the row corresponding to the current index rod orientation of the gauge.

24. Compare the wet density value just recorded to the range of allowed densities listed at the top of the table.
    - If the wet density just read lies within this range, then the QA count can be acquired at the next location; proceed to step 37.
    - If the wet density just read does not lie within this range, however, then a recount is required; proceed to step 25.

25. Move the index rod up and down a couple of times, then back into the current measurement position. Make sure that the gauge is seated properly.

26. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

27. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

28. From the **Time** screen, press the ⟨**2**⟩ key to set the count time to 1 minute if the gauge is not in backscatter position. However, if the gauge is in backscatter position, press the ⟨**3**⟩ key to set the count time to 4 minutes. The gauge will confirm this setting, then return to the **Setup** menu.

29. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

30. Press the ⟨**ENTER/START**⟩ key on the gauge keypad and wait for the count to conclude.

31. The gauge will display the wet density, dry density, and moisture values. However, the current display does not contain the actual density count, which is also needed. Do not record any of the data on this screen; simply press the ⟨**ENTER/START**⟩ key.

32. Press the ⟨**RECALL**⟩ key to recall the measurement that was just made. On the QA form, record the Wet Density (WD) value that is displayed. This Wet Density value should be recorded in the *Density Quality Test* table for the current calibration block, in the second *Dens.* column, in the row corresponding to the current index rod orientation of the gauge.

33. Press the up arrow key to display the density and moisture counts

34. On the QA form, record the Density Count (DC) value that is displayed. This density count value should be recorded in the *Density Quality Test* table for the current calibration block, in the *Dens RC.* column, in the row corresponding to the current index rod orientation of the gauge.

35. Compare the wet density value just recorded to the range of allowed densities listed at the top of the table.

    - If the wet density just read lies within this range, then the QA count can be acquired at the next location; proceed to step 37.
    - If the wet density just read does not lie within this range, however, then a recount is required; proceed to step 36.

36. The Quality Assurance Testing must cease at this point and calibration recounts must be made at the current index rod position in the current calibration block. Return to step 1 of the *Calibration Recounts* section that begins on page 3–13.

37. It is now time to take the next Quality Assurance density reading. If the last reading was a backscatter reading, then proceed to step 38. Otherwise, proceed to step 43.

38. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

39. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

40. From the **Time** screen, press the ⟨**1**⟩ key to set the count time to 15 seconds. The gauge confirms this setting, then return to the **Setup** menu.

41. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

42. Position the gauge index rod into the next measurement position, then return to step 19.

43. If the last reading was at the lowest index rod position for this gauge, then proceed to step 50. Otherwise, proceed to step 44.

44. If the current gauge count time is at 15 seconds, return to step 42. Otherwise, proceed to step 45.

45. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

46. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

47. From the **Time** screen, press the ⟨**1**⟩ key to set the count time to 15 seconds. The gauge confirms this setting, then returns to the **Setup** menu.

48. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

49. Return to step 42.

50. The index rod position of the gauge is currently at its deepest position. If the current gauge count time is 1 minute, proceed to step 55. Otherwise, proceed to step 51.

51. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

52. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

53. From the **Time** screen, press the ⟨**2**⟩ key to set the count time to 1 minute. The gauge confirms this setting, then returns to the **Setup** menu.

54. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

55. If the gauge is currently in the aluminum block, then the density phase of the Quality Assurance testing is complete. Move the gauge to the Mag/Poly block and proceed to step 58.

56. Place the gauge on the center of the aluminum calibration block in the proper measurement position. Place the source rod in backscatter position, making sure the handle clicks into the backscatter notch. Press down gently on the end of the handle (without touching the trigger) to ensure that the handle is properly seated.

57. Return to step 19.

58. Place the gauge on the center of the Mag/Poly calibration block in the proper measurement position. Place the source rod in backscatter position, making sure the handle clicks into the backscatter notch. Press down gently on the end of the handle (without touching the trigger) to ensure that the handle is properly seated.

59. Press the ⟨**ENTER/START**⟩ key and wait for the count to conclude.

60. The gauge displays the wet density, dry density, and moisture values. However, the current display does not contain the actual moisture count, which is also needed. Do not record any of the data on this screen; simply press the ⟨**ENTER/START**⟩ key.

61. Press the ⟨**RECALL**⟩ key to recall the measurement that was just made. Note the moisture content (M) value that is displayed on the QA form. Record this Moisture value in the *Moisture Quality Test* section in the first *Measured Moisture* space.

62. Press the up arrow key to display the density and moisture counts

63. Note the Moisture Count (MC) value that is displayed on the QA form. Record this count value in the *Moisture Quality Test* section in the *Moisture Count* space.

64. Compare the moisture content just recorded to the range of allowed moisture contents at the top of the table.

    - If the moisture content just read lies within this range, then the moisture QA count is done; proceed to step 77.
    - If the moisture content just read does not lie within this range, however, then a recount is required; proceed to step 65.

65. Move the index rod up and down a couple of times, then back into the current measurement position. Make sure that the gauge is seated properly.

66. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

67. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

68. From the **Time** screen, press the ⟨**3**⟩ key to set the count time to 4 minutes. The gauge confirms this setting, then returns to the **Setup** menu.

69. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

70. Press the ⟨**ENTER/START**⟩ key and wait for the count to conclude.

71. The gauge displays the wet density, dry density, and moisture values. However, the current display does not contain the actual moisture count, which is also needed. Do not record any of the data on this screen; simply press the ⟨**ENTER/START**⟩ key.

72. Press the ⟨**RECALL**⟩ key to recall the measurement that was just made. Note the moisture content (M) value that is displayed. On the QA form, record this Moisture value in the *Moisture Quality Test* section in the second *Measured Moisture* space.

73. Press the up arrow key to display the density and moisture counts

74. Note the Moisture Count (MC) value that is displayed. On the QA form, record this count value in the *Moisture Quality Test* section in the *Moist. recount* space.

75. Compare the moisture content just recorded to the range of allowed moisture contents at the top of the table.

    - If the moisture content just read lies within this range, then the moisture QA count is done; proceed to step 77.
    - If the moisture content just read does not lie within this range, however, then a recount is required; proceed to step 76.

76. The Quality Assurance Testing must cease at this point and calibration recounts must be made for the mag/poly moisture block to re-compute the moisture calibration curve. Return to step 1 of the *Calibration Recounts* section that begins on page 3–13.

77. If this is a gauge that has never been calibrated before, then the limestone and special Mag/Poly readings must be made; proceed to step 78. However, if this is a repair gauge that has been calibrated before, then the Quality Assurance phase is complete; proceed to the *Archival and Report Generation* section on page 3–25 to archive the calibration and print the calibration report.

78. Place the gauge on the limestone block in the Special QA bay in calibration. Put the gauge in backscatter position.

79. If the current count time for the gauge is 1 minute, then proceed to step 84. Otherwise, proceed to step 80.

80. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

81. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

82. From the **Time** screen, press the ⟨**2**⟩ key to set the count time to 1 minute. The gauge confirms this setting, then returns to the **Setup** menu.

83. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

84. Press the ⟨**ENTER/START**⟩ key and wait for the count to conclude.

85. The gauge displays the wet density, dry density, and moisture values. However, the current display does not contain the actual density count, which is also needed. Do not record any of the data on this screen; simply press the ⟨**ENTER/START**⟩ key.

86. Press the ⟨**RECALL**⟩ key to recall the measurement that was just made. Note the Wet Density (WD) value that is displayed. On the QA form, record this Wet Density value in the *Limestone QA Count* table for the current calibration block, in the first *Dens* column in the row that corresponds to whether the gauge is in backscatter position without the shims (*BS*) or if the gauge is in backscatter position with the shims (*SR*).

87. Press the up arrow key to display the density and moisture counts

88. Note the Density Count (DC) value that is displayed. On the QA form, record the density count value in the *Limestone QA Count* table for the current calibration block, in the *Dens Cnt.* column in the row that corresponds to whether the gauge is in backscatter position without the shims (*BS*) or if the gauge is in backscatter position with the shims (*SR*).

89. If the gauge is currently on the surface roughness shims, then proceed to step 93. Otherwise, proceed to step 90.

90. Compare the wet density value just recorded to the range of allowed BS densities listed at the top of the table.
    - If the wet density just read lies within this range, then the QA count can be acquired at the next location: proceed to step 91.
    - If the wet density just read does not lie within this range, however, then a recount is required: proceed to step 94.

91. Put the surface roughness shims under the gauge, leaving the gauge itself in backscatter position on the limestone block.

92. Return to step 79 to take the SR reading.

93. Compare the wet density value just recorded to the BS density that was measured previously, before the SR shims were put in place.
    - If the difference in these two wet density readings is less than the allowed difference listed at the top of the table, then the Limestone QA counts are complete; proceed to step 107.
    - If the difference in these wet density values does not lie within this range, however, then a recount is required; proceed to step 94.

94. Move the index rod up and down a couple of times, then back into the current measurement position. Make sure that the gauge is seated properly.

95. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

96. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

97. From the **Time** screen, press the ⟨**3**⟩ key to set the count time to 4 minutes. The gauge confirms this setting, then returns to the **Setup** menu.

98. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

99. Press the ⟨**ENTER/START**⟩ key and wait for the count to conclude.

100. The gauge displays the wet density, dry density, and moisture values. However, the current display does not contain the actual density count, which is also needed. Do not record any of the data on this screen; simply press the ⟨**ENTER/START**⟩ key.

101. Press the ⟨**RECALL**⟩ key to recall the measurement that was just made. Note the Wet Density (WD) value that is displayed. On the QA form, record this Wet Density value in the *Limestone QA Count* table for the current calibration block, in the second *Dens* column, in the row that corresponds to whether the gauge is in backscatter position without the shims (*BS*) or if the gauge is in backscatter position with the shims (*SR*).

102. Press the up arrow key to display the density and moisture counts

103. Note the Density Count (DC) value that is displayed. On the QA form, record this density count value in the *Limestone QA Count* table for the current calibration block, in the *Dens RC* column in the row that corresponds to whether the gauge is in backscatter position without the shims (*BS*) or if the gauge is in backscatter position with the shims (*SR*).

104. If the gauge is currently on the surface roughness shims, proceed to step 106. Otherwise, proceed to step 105.

105. Compare the wet density value just recorded to the range of allowed BS densities listed at the top of the table.

    - If the wet density just read lies within this range, then the QA count can be acquired for surface roughness; return to step 91.
    - If the wet density just read does not lie within this range, however, then the gauge requires repair. Stop the QA process and proceed to the *Calibration Recounts* section on page 3–13 to take the required recounts.

106. Compare the wet density value just recorded to the BS density that was measured previously, before the SR shims were put in place.

    - If the difference in these two wet density readings is less than the allowed difference listed at the top of the table, then the Limestone QA counts are complete; proceed to step 107.
    - If the difference in these wet density values does not lie within this range, however, then the gauge requires repair. Stop the QA process and proceed to the *Calibration Recounts* section on page 3–13 to take the required recounts.

107. It is now time to take the QA measurement on the special Mag/Poly block in the QA bay. This block has a higher density and a lower moisture content than the mag/poly blocks located in the regular calibration bays. Place the gauge on this block, with the source rod in the 6-inch measurement position.

108. If the current count time for the gauge is 1 minute, then proceed to step 113. Otherwise, proceed to step 109.

109. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

110. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

111. From the **Time** screen, press the ⟨**2**⟩ key to set the count time to 1 minute. The gauge confirms this setting, then returns to the **Setup** menu.

112. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

113. Press the ⟨**ENTER/START**⟩ key and wait for the count to conclude.

114. The gauge displays the wet density, dry density, and moisture values. However, the current display does not contain the actual density and moisture counts, which are also needed. Do not record any of the data on this screen; simply press the ⟨**ENTER/START**⟩ key.

115. Press the ⟨**RECALL**⟩ key to recall the measurement that was just made. Note the Wet Density (WD) and moisture (M) values that are displayed on the gauge. On the QA form, record this Wet Density value in the *Special Mag/Poly Count* table, in the first *Dens* column. Record the Moisture value in the *Special Mag/Poly Count* table in the first *Moist* column.

116. Press the up arrow key to display the density and moisture counts

117. Note the Density Count (DC) and Moisture Count (MC) values that are displayed on the gauge. On the QA form, record the density count value in the *Special Mag/Poly Count* table, under *Dens Cnt*. Record the moisture count value in the *Special Mag/Poly Count* table, under *Mois Cnt*.

118. Compare the wet density and moisture values just recorded to the ranges of allowed densities listed at the top of the table.

    - If the wet density and moisture values just read lie within the respective ranges, then the Quality Assurance phase is complete; proceed to the *Archival and Report Generation* section on page 3–25 to archive the calibration and print the calibration report.
    - If either the wet density or the moisture value does not lie within the specified range, however, then a recount is needed; proceed to step 119.

119. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

120. From the **Ready** screen, press the ⟨**SETUP**⟩ key. The **Setup** menu is displayed.

121. From the **Setup** menu, press the ⟨**1**⟩ key to set the count time.

122. From the **Time** screen, press the ⟨**3**⟩ key to set the count time to 1 minute. The gauge confirms this setting, then returns to the **Setup** menu.

123. Press the ⟨**ESC**⟩ key to return to the **Ready** screen.

124. Press the ⟨**ENTER/START**⟩ key and wait for the count to conclude.

125. The gauge displays the wet density, dry density, and moisture values. However, the current display does not contain the actual density and moisture counts, which are also needed. Do not record any of the data on this screen; simply press the ⟨**ENTER/START**⟩ key.

126. Press the ⟨**RECALL**⟩ key to recall the measurement that was just made. Note the Wet Density (WD) and moisture (M) values that are displayed on the gauge. On the QA form, record the Wet Density value in the *Special Mag/Poly Count* table in the second *Dens* column. Record the Moisture value in the *Special Mag/Poly Count* table in the second *Moist* column.

127. Press the up arrow key to display the density and moisture counts

128. Note the Density Count (DC) and Moisture Count (MC) values that are displayed on the gauge. On the QA form, record the density count value in the *Special Mag/Poly Count* table, under *Dens RC*. Record the moisture count value in the *Special Mag/Poly Count* table, under *Mois RC*.

129. At this point, two density measurements and two moisture measurements exist in the *Special Mag/Poly Count* table.
   - If both density readings lie outside the allowed range, or both moisture readings lie outside the allowed range, then the gauge requires repair. Stop the calibration process and take this gauge to Assembly or Service for analysis and repair.
   - However, if either one of the density reading lies inside the allowed range, and either one of the moisture readings lies within this range, then the Quality Assurance phase is complete; proceed to the *Archival and Report Generation* section below to archive the calibration and print the calibration report.

ARCHIVAL AND REPORT GENERATION

1. Go back to the calibration PC. The **Main Menu** should be displayed. As shown in Figure 3–21, select the third option, **Print, Archive, and Retrieve Calibration Data**, then click the ⟨**Proceed**⟩ button.

2. The **Data Retrieval and Archival SubMenu** (see Figure 3–22) is displayed. The first option allows you to archive and print a report for the currently active calibration, if it has not been archived yet. As shown in Figure 3–22, this option lists the serial number of the currently active calibration; in this example, it is serial number *2*. Select the first option and click the ⟨**Proceed**⟩ button.

3. The software displays a message box that asks the user to ensure that the active calibration has passed the QA portion of the calibration procedure before archiving the results. Since the QA process has already been performed, click ⟨**OK**⟩ on this message box.

4. The software now prompts the user to enter his/her initials. This information will be saved with the archived calibration information. Enter your initials (at least two, but no more than three) and click ⟨**OK**⟩.

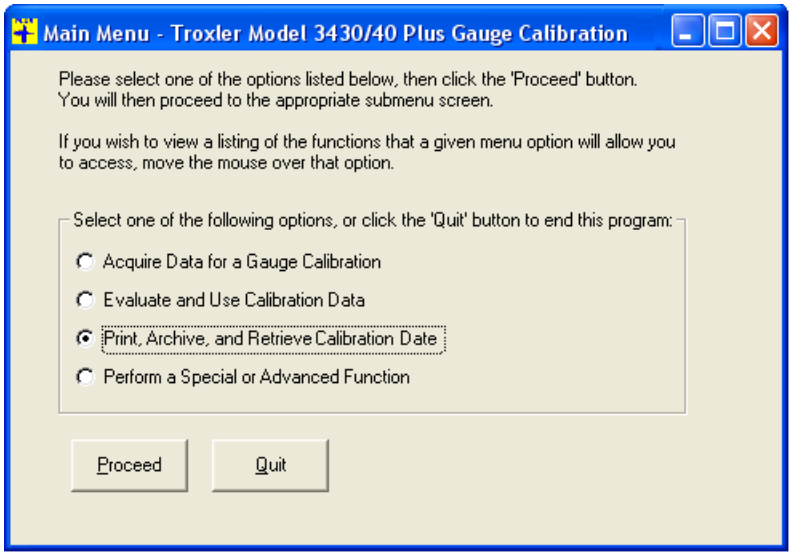

Figure 3–21. Main Menu, Print, Archive, and Retrieve Calibration Data Option Selected

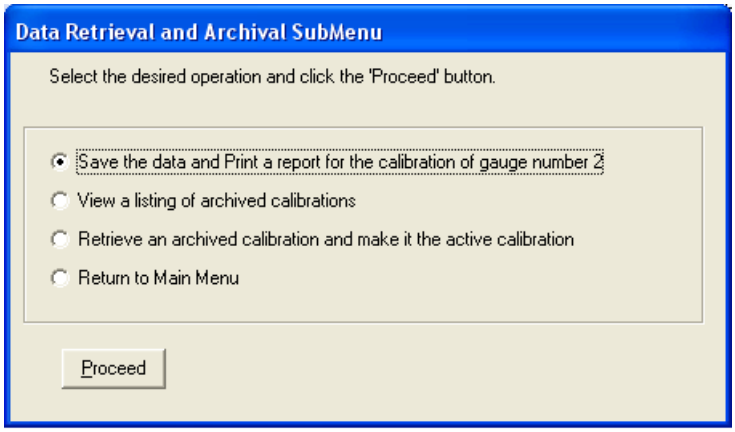

Figure 3–22. Data Retrieval and Archival SubMenu

5. After the user has entered valid initials, the calibration data record for the active calibration is archived to the calibration data file on the calibration bay computer. When the archival is complete, the software displays a message box confirming that the active calibration has been saved to the archived data file. The message box also informs the user that he/she needs to print the calibration report as well. Click the ⟨**Proceed**⟩ button to continue.

6. At this point, the program generates two calibration reports, one in metric units (kilograms per cubic meter and millimeters) and one in imperial units (pounds per cubic foot and inches). After a few seconds, the metric version of the report is displayed for review, as shown in Figure 3–23. To switch between metric and English units, select the appropriate radio button in the **Display Calibration As** box. Select the units (all new gauges use metric reports) and click the ⟨**Print Calibration Sheets**⟩ button.

7. Before printing the report, the user is asked to select the printer to use and the number of printouts to generate. Use the default printer and the default number of printouts (two).

8. When prompted if you wish to print tables, always answer "*No*" unless the customer has specifically asked for tables. In the very rare case that the user wants tables, answer "*Yes*."

9. Wait for the report(s) to complete their printing, then click the ⟨**Return to Main Menu**⟩ button on the screen shown in Figure 3–23. The software returns to the **Data Retrieval and Archival SubMenu** shown in Figure 3–22. Note that, unlike in Figure 3–22, the first option is no longer available.

10. From the **Data Retrieval and Archival SubMenu**, select the fourth option, **Return to Main Menu**, then click the ⟨**Proceed**⟩ button.

11. The program now returns to the **Main Menu**. Note that, unlike in Figure 3–21, the second option on the **Main Menu** is no longer available.

12. Collect the calibration reports that were just printed. Keep one report for archival at Troxler, and put one report aside to be shipped to the customer. For the copy of the calibration report to be shipped to the customer, remove and discard the un-numbered sheet with the heading << *FACTORY USE ONLY*>>. This sheet can be retained for the copy that is kept here for archival at Troxler.

The calibration process is now complete.

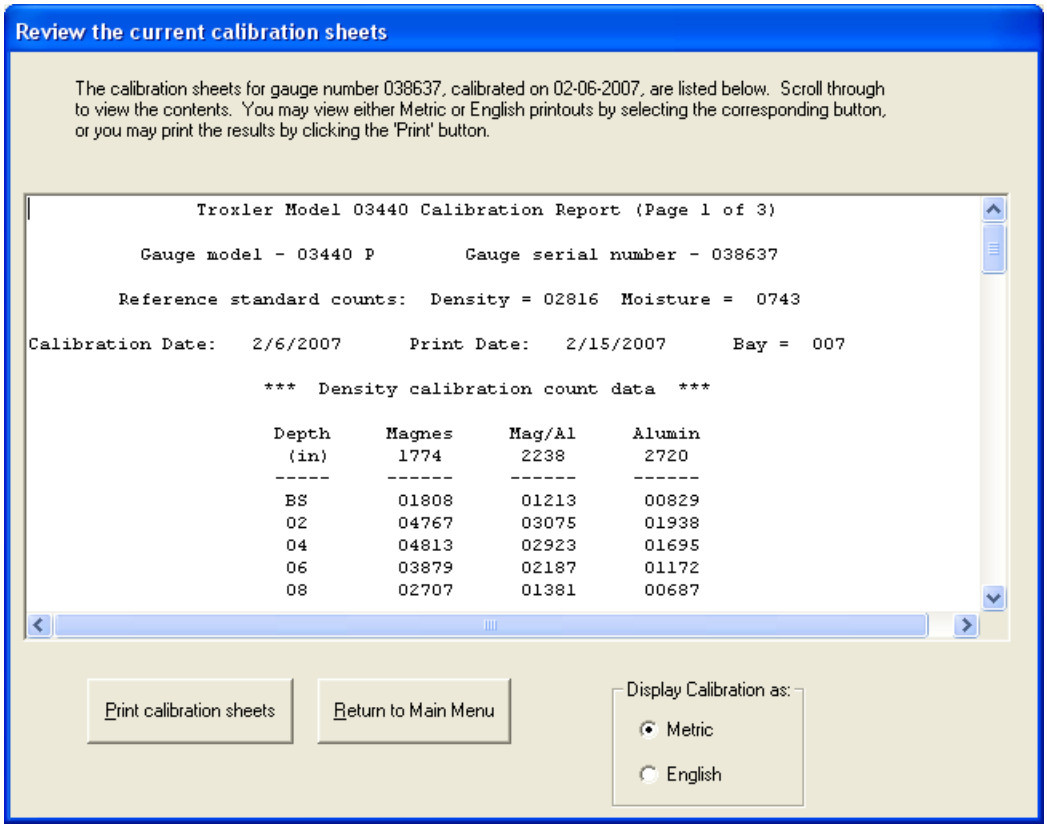

Figure 3–23. Calibration Report Review Screen

LICENSE STATUS CAPTION

The Troxler 3430/3440 Plus Calibration Software package must be registered with Troxler to be fully operational. When the software is registered, a license is issued. This license is valid for a negotiated number of calibrations (between 1 and 99) and a specific time period. The license, therefore, can expire in two ways: the total number of negotiated calibrations can be exceeded, or the negotiated time period can be exceeded.

When the Troxler 3430/3440 Plus Calibration Software is run, the **Main Menu** is displayed. The bottom third of the **Main Menu** contains a *License Status Caption.* This caption informs the user – whenever the program is run – what the current status of the license is and whether the license must be upgraded immediately or in the near future.

If the software has not been registered, the **Main Menu** looks similar to the example in Figure 3–24.

Note that the License Status Caption has a red background with white letters, and a *CRITICAL* status. The text informs the user that the software is unregistered and provides instructions on correcting the situation. Also note that, since the software is unregistered, the ability to acquire new calibration data is unavailable, so the user cannot start a new calibration.

When the software is registered with Troxler, the user is assigned a specific number of calibrations that can be performed with the software and a specific date range in which these calibrations can be performed. After the registration process is completed, the **Main Menu** looks similar to the example shown in Figure 3–25.

Note that the License Status Caption has a green background with black letters, and a *Normal* status. The *Normal* status denotes (a) the software has been registered, (b) there are more than one new calibrations still available on the license, and (c) the license expiration date is more than 30 days away from the current date.

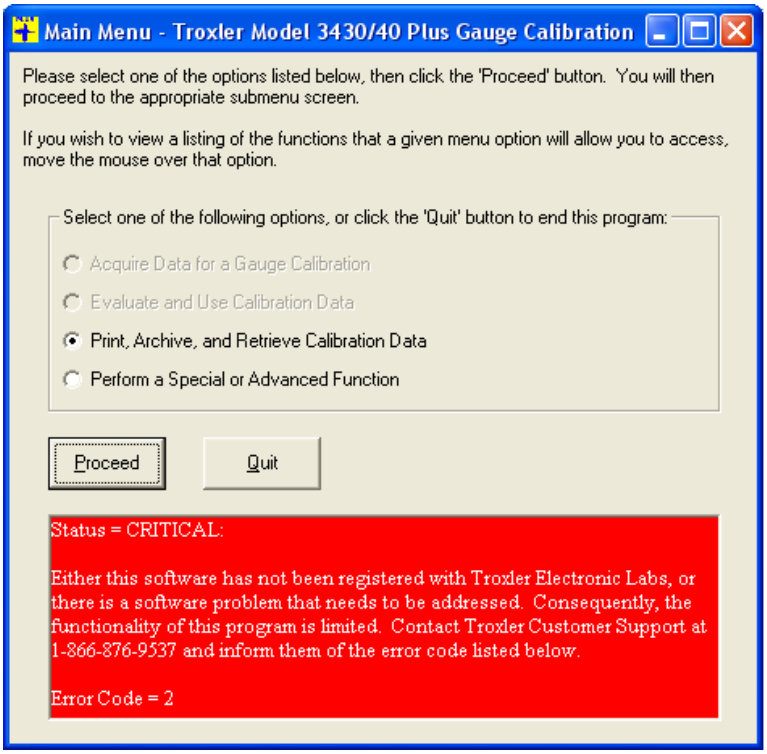

Figure 3–24. Main Menu for Unlicensed Software

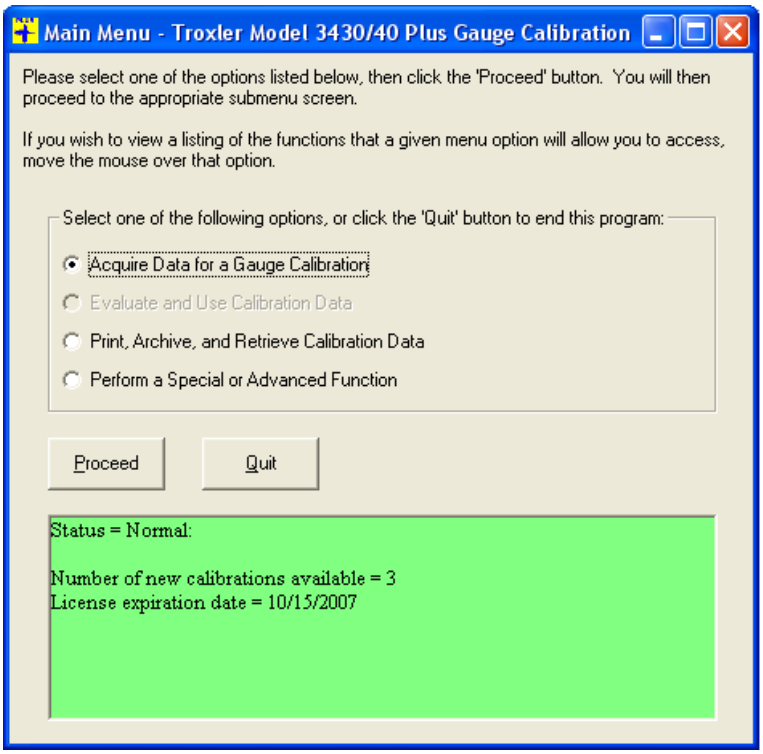

Figure 3–25. Main Menu for Licensed Software, Normal Status

The License Status Caption will continue to stay green until either the number of available calibrations reaches one or less, or the current date is less than thirty days from the license expiration date. When there is only one new calibration available on their license, the **Main Menu** looks similar to the example shown in Figure 3–26.

Note that the License Status Caption has a yellow background with black letters, and an *Attention needed* status. The caption then goes on to explain why attention is needed – there is only one new calibration still available. Note that the **Acquire Data for a Gauge Calibration** option is available, thereby allowing the user to perform this remaining calibration.

If more than one calibration remains on the license, but the license expires in less than 30 days, the **Main Menu** looks similar to the example shown in Figure 3–27. Note that the License Status Caption again has a yellow background with black letters, and an *Attention needed* status, but the text reflects the different license status. The caption explains why attention is needed – the license will expire in seven days. Note that the **Acquire Data for a Gauge Calibration** button is available since there are still four remaining calibrations on the current license.

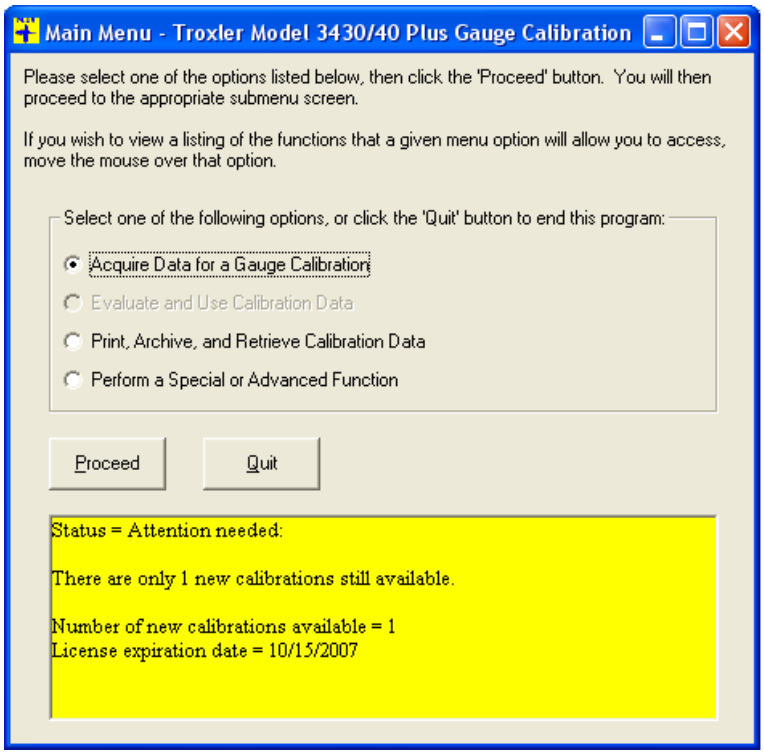

Figure 3–26. Main Menu, Only One Calibration Left on License

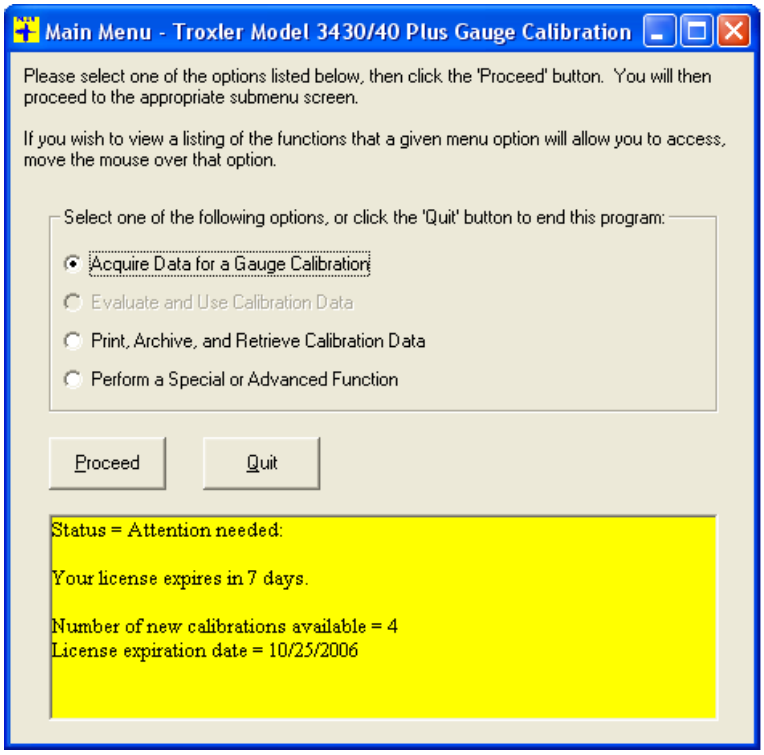

Figure 3–27. Main Menu, License Expires in Less Than 30 Days

If the user tries to run the software after the license has expired, the **Main Menu** looks similar to the example shown in Figure 3–28.

The License Status Caption has a red background with white letters, and a CRITICAL status. The text informs the user that the software expiration date has been exceeded and instructs the user how to correct this situation. Also note that, since the software license has expired, the ability to acquire new calibration data is unavailable, so the user cannot start a new calibration.

Similarly, suppose that the user has performed all of the calibrations authorized by the license before the expiration date. The software license will still end. If the user tries to run the software, the **Main Menu** looks similar to the example shown in Figure 3–29.

Note that the License Status Caption again has a red background with white letters, and a *CRITICAL* status. The text informs the user that the allocated number of calibrations negotiated with the current license have been exhausted, and instructs the user how to correct this situation. Also note that, since the software license has expired, the ability to acquire new calibration data is unavailable, so the user cannot start a new calibration

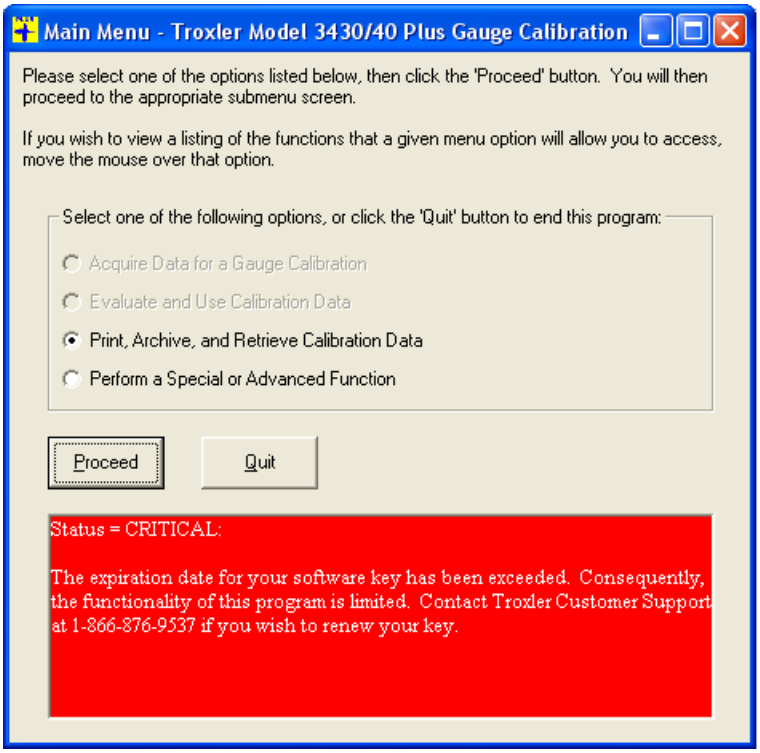

Figure 3–28. Main Menu, License Has Expired

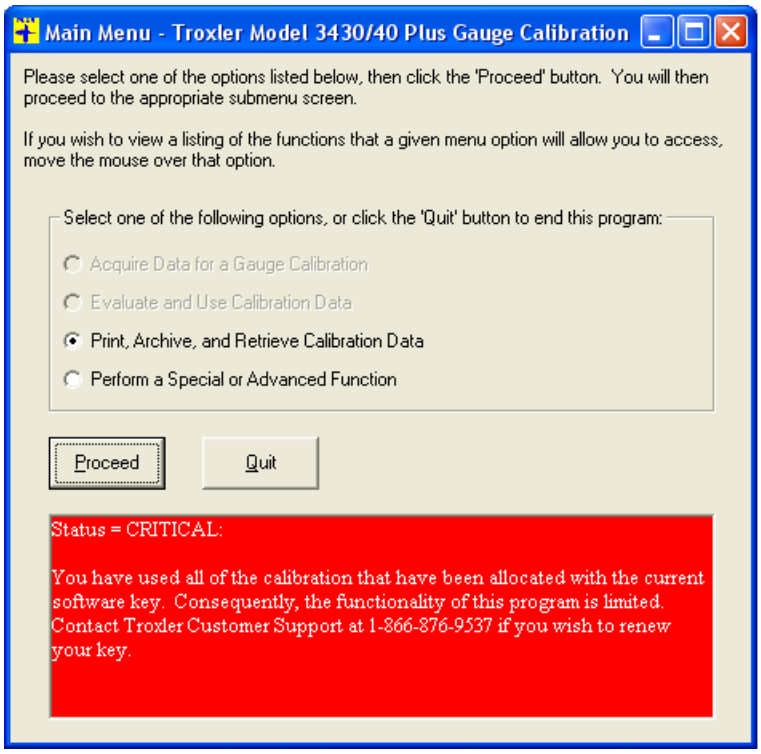

Figure 3–29. Main Menu, All Calibrations Have Been Used

TWO-BLOCK CALIBRATION OPTION

The mag/aluminum calibration block is the most expensive to manufacture and sell. International users of Troxler calibration blocks frequently do not purchase this more expensive mag/aluminum block. Instead, they purchase only the aluminum and magnesium density blocks and perform a *Two-block Recalibration* of previously calibrated gauges. *Recalibration* is the operative term here: if the gauge has never been calibrated, the two-block method cannot be used. By omitting the mag/aluminum density calibration count at a particular index rod position, one of the three readings required to compute the A, B, and C constants for that position has been eliminated. The user is then left with two data points (the magnesium and aluminum counts and density values) to solve for three unknowns (A, B, and C). The two-block method circumvents this problem by re-using the B value from the most recent full calibration of the gauge, thereby leaving only two unknowns (A and C) to be solved with the two data points.

Consequently, in order to perform a two-block calibration, one must have access to the B values from the most recent full calibration of the gauge. Unless the gauge has suffered some sort of damage or erasure of its memory, these values should be in the gauge memory and accessible from the calibration program. If the gauge has lost these values, however, they must be retrieved from the Troxler calibration database or from the gauge owner's calibration report, and entered manually into the calibration program. This section addresses these two options for obtaining the B values for a two-block calibration, assuming that there is ready access to the B values. If not, one simply cannot do the two-block recalibration.

1. Refer back to the *Gauge Setup/Initial Stability* section of this chapter, specifically step 16 on page 3–6. Suppose the user wishes to perform a two-block calibration. After the user enters the properties of the calibration (which includes indicating that the calibration will be a two-block calibration) on the Calibration Properties Entry Form (see Figure 3–7 on page 3–6) and clicks the ⟨**Proceed**⟩ button, the software displays the message box shown in Figure 3–30. Click ⟨**Yes**⟩ on this message box.

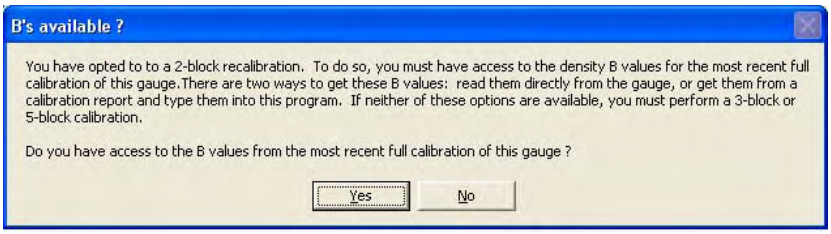

Figure 3–30. Two Block B Value Accessibility Message Box

2. The calibration program displays a message box that asks **Do you wish to try to retrieve the B values automatically from the gauge?**
   - If the B values needed to run the two-block calibration are to be read from the gauge memory, click the ⟨**Yes**⟩ button and proceed to step 3.
   - If, instead, the B values will be entered manually from the calibration report, click ⟨**No**⟩ and proceed to step 7.

3. The calibration program now queries the gauge ands read the B values from the gauge memory into the program. No user interaction is required for this retrieval. When the read is complete, the software displays a message box that states **Calibration Constants Complete.** Click ⟨**OK**⟩ to continue.

4. The program now displays the B*1000 values that were retrieved from the gauge (see Figure 3–31). These values are in cubic meters per kilogram. Review the values and click the ⟨**Proceed**⟩ button.

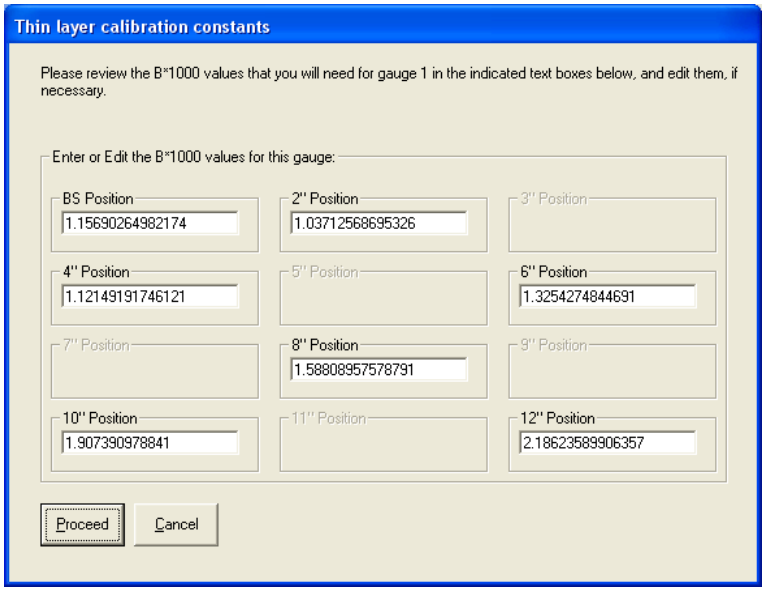

Figure 3–31. Two-Block B Value Review Form

5. The B values are now written to a file on the computer that will be retrieved when needed. The software displays a message box stating **2-block constants are saved**. Click ⟨**OK**⟩ to continue.

6. The required two-block constants are now available for the program. It is now time to perform the gauge stat test. Return to the *Gauge Setup/Initial Stability* section of this chapter, and proceed to step 17 on page 3–6.

7. If the user elects to enter the B values manually from the calibration report, the Two-Block B Value Entry Form shown in Figure 3–32 is displayed. Refer to the calibration report and enter the two-block *B*1000* values manually into this form. The values must be entered in the units of cubic meters per kilogram. When all values have been entered, click the ⟨**Proceed**⟩ button and go to step 5.

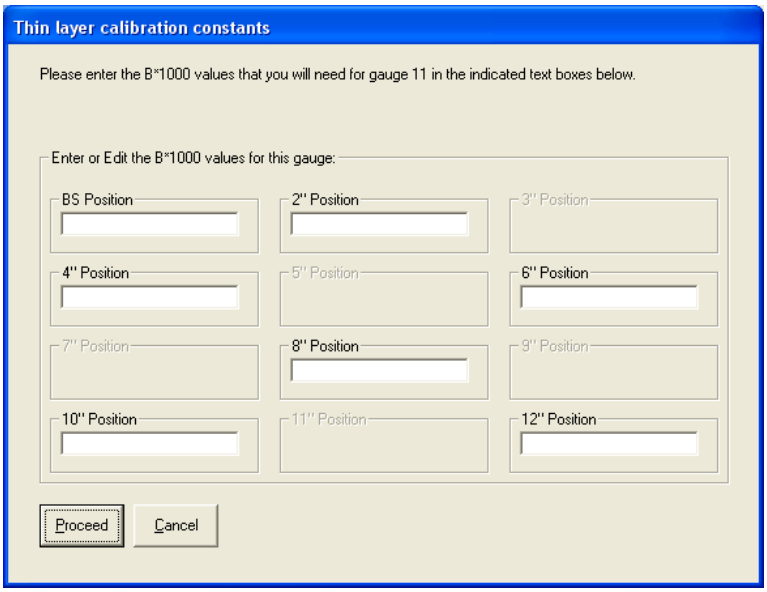

Figure 3–32. Two-Block B Value Entry Form

CALIBRATION PROCEDURE OUTLINE AND CHECKLIST

- ❑ Connect the gauge to the RS-232 null modem cable. This cable should be connected to Com port 1 of the computer.
- ❑ Turn on gauge and allow it to power up and complete the self-test.
- ❑ Go to the calibration bay computer and run the 3430/3440 Plus Calibration Program on the calibration bay computer.
- ❑ Select the **Acquire Data For a Gauge Calibration** option from the program's **Main Menu**.
- ❑ Go to the gauge and press the ⟨**SETUP**⟩ Button.
- ❑ Press ⟨**.**⟩ ⟨**9**⟩ to access the **Extended** menu. When prompted for a code, enter *4708*.
- ❑ From the **Extended** menu, press ⟨**7**⟩ and follow the gauge instructions to perform a software reset.
- ❑ When the software reset is done, indicate that the gauge serial number will be reset, and follow the instructions to re-enter the correct gauge serial number.
- ❑ When the **Extended** menu appears again, press ⟨**1**⟩ for the **Clock/Calendar** menu, and follow the instructions to set the correct time and date.
- ❑ When the time and date are set and the gauge returns to the **Extended** menu, press the ⟨**ESC**⟩ key twice to return to the **Setup** menu.
- ❑ Press ⟨**3**⟩ on the **Setup** menu to access the *Depth Mode* function. If the gauge is a 3430 Plus, set the mode to *Manual*; if the gauge is a 3440 Plus, set the mode to *Automatic*.
- ❑ Once the depth mode is set and confirmed, the gauge returns to the **Setup** menu. Press ⟨**.**⟩ ⟨**9**⟩ to access the **Extended** menu. When prompted for a code, enter *4708*.
- ❑ From the **Extended** menu, press ⟨**.**⟩ ⟨**9**⟩ to access the **Factory** menu. When prompted for a code, enter *3767*.
- ❑ From the **Factory** menu, press ⟨**1**⟩ to put the gauge in *Command Line Interface (CLI)* mode.
- ❑ Once the gauge is in CLI mode, return to the calibration computer and select **Start a new Model 3430/3440 Plus Calibration** from the program's **Count Acquisition SubMenu**.
- ❑ Answer the queries about whether the gauge is new (never been calibrated before) and if it has a depth strip, then fill in the form that asks more specific questions about the calibration to be performed.
- ❑ Conduct successful stat test.
- ❑ Consult *Calibration Inspection Limits* to ensure that the gauge density and moisture average standard counts from the stat test meet these limits.
- ❑ Collect all required calibration counts as prompted by the software.

- ❑ Conduct a successful drift test.
- ❑ Compute the calibration constants (select **Evaluate and Use Calibration Data** from the **Main Menu** and follow the prompts).
- ❑ Consult *Calibration Inspection Limits* to ensure that the relevant performance parameters listed after the computation of the calibration constants meet the Inspection Limit requirements.
- ❑ Download the calibration constants into the gauge (select **Evaluate and Use Calibration Data** from the **Main Menu** and follow the prompts).
- ❑ Print a *Calibration Accuracy Check Form* (select **Perform a Special or Advanced Function** from the **Main Menu** and follow the prompts).
- ❑ Run the Calibration Accuracy Tests (QA Test) successfully.
- ❑ From the calibration program, archive the calibration and print the calibration reports (select **Print, Archive, and Retrieve Calibration Data** from the **Main Menu** and follow the prompts).
- ❑ Check and confirm one last time that the data on the calibration report meets the requirements of the *Calibration Inspection Limits.*
- ❑ File one copy of the calibration report, and put the other with the gauge.

CHAPTER 4

MODEL 3451 RECALIBRATION

This chapter provides instructions for recalibrating a Model 3451 Enhanced RoadReader™ Plus Surface Moisture-Density Gauge using the Troxler Plus Calibration Suite software. The information presented here includes procedures for resolving issues encountered during the calibration process. A calibration procedure outline and checklist is provided at the end of this chapter.

CONTENTS

SECURITY FEATURES OF THE MODEL 3451

The Troxler Model 3451 features security functions that inhibit unauthorized users from accessing or tampering with gauge functions and data. This security extends to the manner in which calibrations are performed. Consequently, there are several points during a typical calibration when a *security check* is performed by the software. Most of these points occur when a menu-level function is begun.

The security check ensures that the gauge that is being calibrated should be communicating with the computer that is calibrating it, and vice versa. When a menu-level function that requires a security check is begun, the message box shown in Figure 4–1 is displayed.

Figure 4–1. Initialize Communication Protocol Message Box

As directed, confirm that the gauge is on and that the RS-232 cable is properly plugged in and configured, then click the ⟨**OK**⟩ button.

The program then looks for a "security key" that the gauge and computer share if they are authorized to communicate with each another. One of three scenarios could take place:

- If there is currently no key, the software will ask the gauge for the key, and the gauge will pass the key to the computer.
- If there is a valid key, the software tries the key in the gauge to confirm that it works.
- If there is a key but it is not valid, the key will fail when the software tries it in the gauge.

The first two scenarios are the most common.

If the security key is confirmed, the software displays a message box that states **The key is obtained**. A number, which varies from gauge to gauge, is displayed in the left side of the message box. To complete the security check and continue with the calibration, click ⟨**OK**⟩.

If the security key cannot be confirmed, a **Communications error** message box similar to the one shown in Figure 4–2 is displayed. Follow the instructions in the message box, and resume the calibration.

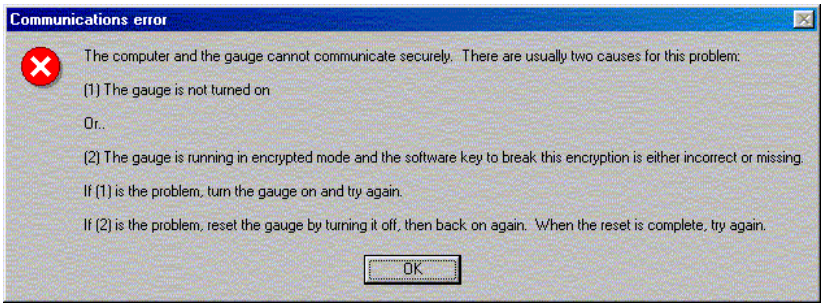

Figure 4–2. Communications Error Message Box

RECALIBRATION PROCEDURE - TROXLER MODEL 3451

GAUGE SETUP/INITIAL STABILITY

1. Select a bay for calibration. The bay must contain the magnesium, mag/aluminum, aluminum, and mag/poly calibration blocks.

2. Place the gauge's reference standard block on the mag/aluminum block in the standard count orientation. Place the gauge on the standard block as described in the instructions for taking a standard count in Chapter 4 of the gauge's *Manual of Operation and Instruction*.

3. Turn the gauge on by pressing the power switch on its back panel, as shown in Figure 4–3. Allow a warm-up of approximately 10 minutes.

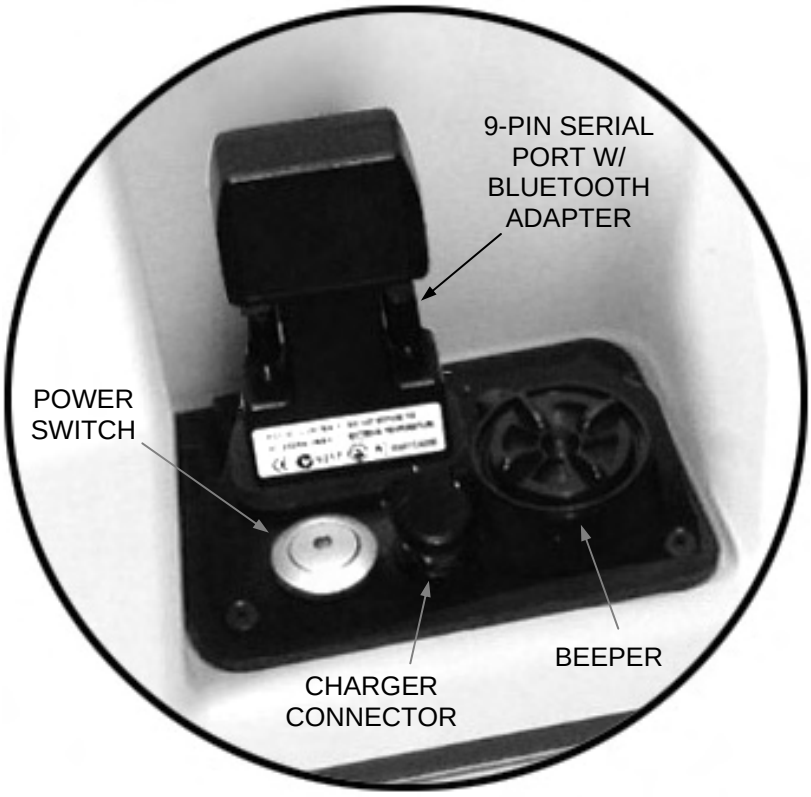

Figure 4–3. Gauge Back Panel

4. Connect one end (male) of an RS-232 *straight-through* serial cable (*not* a null modem cable) to the gauge's RS-232 port (see Figure 4–3). Connect the other end either directly to the RS-232 serial port of the computer or to the RS-232 port of the calibration bay cable switch box (see Figure 4–4), specifically to the *B* port, which is labeled either *3430/3440 Plus* or *345x*.

NOTE

If the Bluetooth® wireless serial adapter is installed in the RS-232 port, as shown in Figure 4–3, it must be removed before connecting the RS-232 null modem cable to the port.

5. On the cable switch box, set its front panel switch to the **3451** (*B*) position.

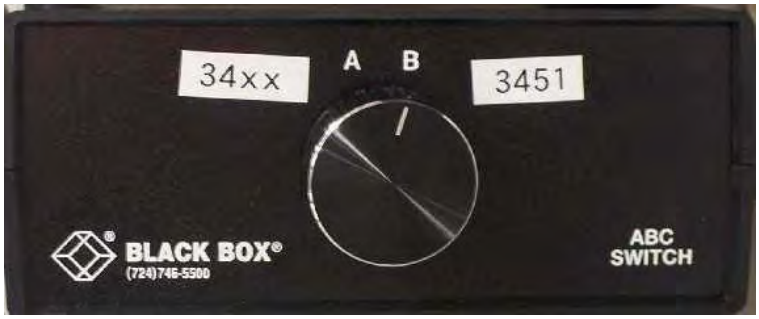

Figure 4–4. Calibration Bay Cable Switch Box

6. Double-click the **Cal3451** icon on the Windows desktop. The calibration program starts, briefly displaying a splash screen that identifies the software and version number.

7. When the splash screen is complete, the program **Main Menu** (see Figure 4–5) is displayed. The options that are available on the **Main Menu** will vary depending upon the tasks that have been most recently undertaken.

NOTE

Although not shown in Figure 4–5, the bottom of the Main Menu includes a color-coded *license status caption*. The license status caption informs the user how long his/her current software license will be valid. In order to save space and focus on the specific tasks involved in calibrating a gauge, the license status caption is not shown on any of the Main Menu examples shown in the calibration sections of the chapter. For more information on the license status caption, refer to page 4–38.

8. As shown in Figure 4–5, select the **Acquire Data for a Gauge Calibration** option, then click ⟨**Proceed**⟩. The **3451 Count Acquisition SubMenu** (Submenu 1) is displayed, as shown in Figure 4–6. Again, the options that are available in the submenu depend upon the tasks that have been most recently undertaken.

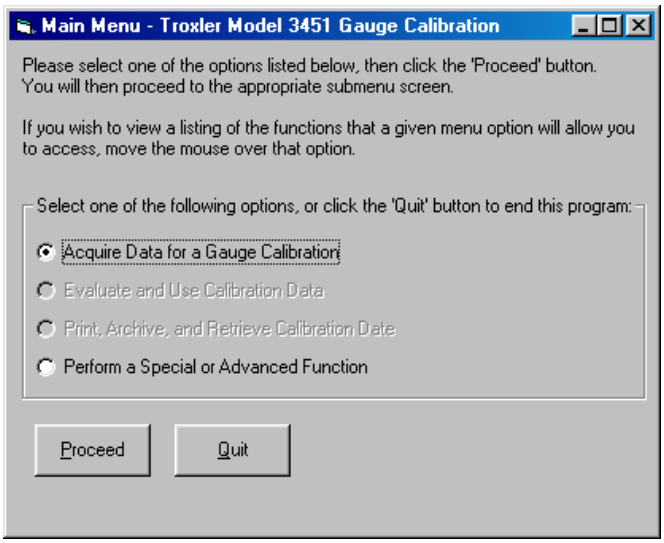

Figure 4–5. Main Menu
(License Status Caption Not Shown)

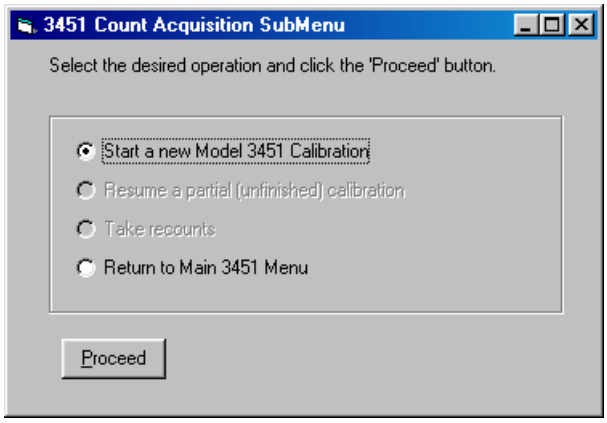

Figure 4–6. 3451 Count Acquisition SubMenu

9. To begin the new calibration, select the **Start a new Model 3451 Calibration** radio button, then click ⟨**Proceed**⟩. The gauge performs a security check as described on page 4–2. After the security check is passed, if an unfinished calibration is in the gauge memory, a warning screen is displayed. Otherwise, the **Recalibration?** message box (see Figure 4–7) is displayed.

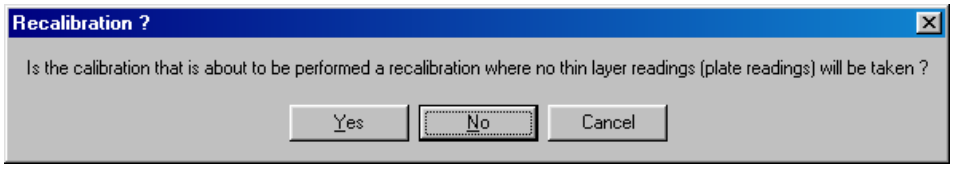

Figure 4–7. Recalibration Query Message Box

10. Since the calibration about to be undertaken is a **recalibration**, click the ⟨**Yes**⟩ button since no thin layer readings are done.

11. The **Recalibration Options** form (see Figure 4–8) is now displayed. Since this is a recalibration, the thin layer calibration constants must be available. If they are in the gauge memory, then they can be downloaded from the gauge. This is the preferable method. If not, they can be read from a Troxler database of 3451 calibration constants (only available to Troxler Electronic Laboratories), or manually typed in from a previous calibration report (only available if that report is available).

    The **Recalibration Options** form therefore has at least two options on it (download from the gauge or type in from the calibration report). Select the first option, **Read the thin layer constants from the gauge**, unless the gauge memory has been corrupted and cleared, then click the ⟨**Proceed**⟩ button.

    Whatever option was selected, follow the instructions provided to get these constants into the program.

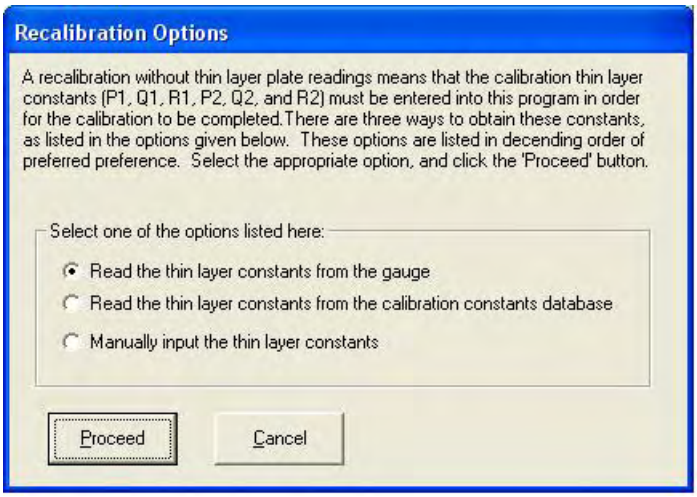

Figure 4–8. Recalibration Options Form

12. The software then requests the properties of the gauge and the calibration to be performed (gauge serial number, calibration bay number, gauge index rod type, and calibration type), as shown in Figure 4–9. Enter the pertinent information and click the ⟨**Proceed**⟩ button.

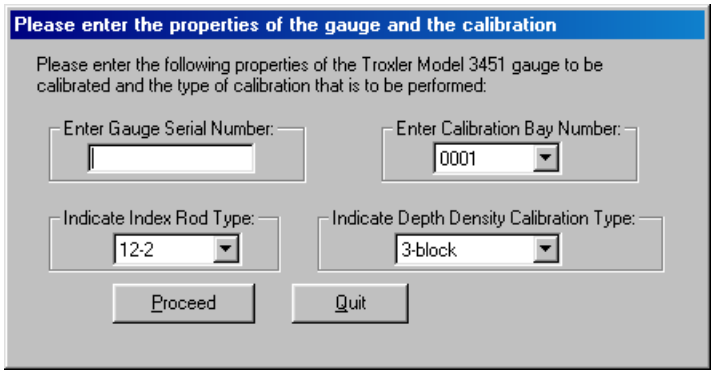

Figure 4–9. Calibration Properties Entry Form

13. The program now performs a *calibration initialization* of the gauge. This initialization consists of three steps: passing the gauge serial number from the program to the gauge, initializing the portion of flash memory in the gauge where the depth strip calibration information is stored, and calibrating the depth strip. The program first attempts to retrieve the status of the gauge baseboard.

    - If the computer is unable to contact the gauge, the software displays an error message box that states **Error Communicating with gauge during baseboard check.** Click the ⟨**OK**⟩ button on this error message to continue. The software then displays a prompt that asks **Do you wish to try to initiate communications with the gauge again?**
        - To repeat step 11, click ⟨**OK**⟩.
        - To return to the **3451 Count Acquisition SubMenu** shown in Figure 4–6, click ⟨**Cancel**⟩.
    - If instead the gauge is able to contact the gauge baseboard successfully, then the software displays the **Results of baseboard check** message box shown in Figure 4–10. The contents of the message box may differ slightly from the figure, however the *Baseboard Connected*, *Battery Status = OK*, and *Checksum results: Pass* items should all be true. Click ⟨**OK**⟩ to continue.

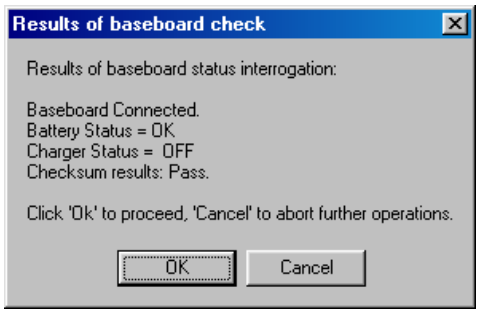

Figure 4–10. Results of Baseboard Check Message Box

14. When the ⟨**OK**⟩ button on the **Results of baseboard check** message box is clicked, the program clears the location in flash memory where the depth strip calibration data is stored. When this operation is completed successfully, the software displays a confirmation message box. Click ⟨**OK**⟩ on that message box.

15. It is now time to calibrate the depth strip of the gauge. The software displays a message box prompting the user to put the gauge in backscatter position. It is critical that the gauge be placed correctly in backscatter position before clicking ⟨**OK**⟩ on this message box. Otherwise, the strip will be incorrectly calibrated. Place the gauge in backscatter position and click ⟨**OK**⟩.

16. After the depth strip has been calibrated successfully, the software displays a confirmation message box. Click ⟨**OK**⟩ on this message box and put the index rod back into the **SAFE** position.

17. At this point the gauge is ready to begin the stat test. The program displays a message box informing the user to ensure that the gauge is ready for the stat test. These preparations were made in step 2. Click the ⟨**OK**⟩ button on this message box.

18. The stat test counts begin, consisting of twenty 1-minute counts. A progress bar keeps the user continuously updated on the progress of the stat test. When the counts are complete, the program displays the results as shown in Figure 4–11. The stat test should pass all three measurement systems.

    - If the stat test *does not* pass all three measurement systems, click the ⟨**No**⟩ button. A critical message box is displayed telling you that the stat test has failed, and the program will return to step 8, displaying Figure 4–6. Try the stat test again. If it fails for a second time, return the gauge to Service to have it checked for problems.
    - If the stat test *does* pass all three measurement systems, but one or more of the standard counts falls outside of the *Calibration Inspection Limits* for these gauges, then click the ⟨**No**⟩ button. A critical message box is displayed telling you that the stat test has failed, and the program will return to step 8, displaying Figure 4–6. Try the stat test again. If it fails to satisfy the *Calibration Inspection Limits* for a second time, return the gauge to Service to have it checked for problems.
    - If the stat test *does* pass all three measurement systems, and the standard counts meet the *Calibration Inspection Limits*, then click the ⟨**Yes**⟩ button. The initial setup and stability tests for this gauge are complete. Proceed to the *Backscatter and Transmission Density Calibration Counting* section on the following page.

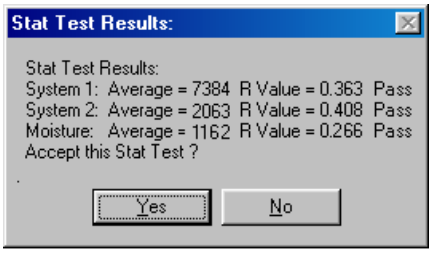

Figure 4–11. Stat Test Results Message Box

BACKSCATTER AND TRANSMISSION DENSITY CALIBRATION COUNTING

Once the gauge has passed the stat test, the calibration software performs a series of calibration measurement counts. The software keeps track of which count must be taken next and how long that count should last. For each measurement, the software prompts the user to place the gauge on the proper calibration block and to place the source rod in a particular measurement position.

When the gauge is ready to take a calibration count, the **Prepare gauge for count** prompt shown in Figure 4–12 is displayed. Note that the example shown in Figure 4–12 is for the first count to be taken: using the magnesium block with the source rod in the backscatter position.

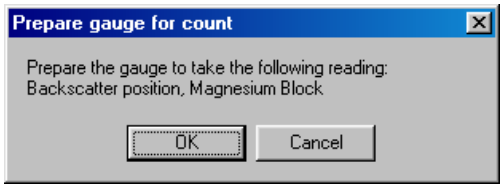

Figure 4–12. Prepare Gauge for Count Screen

20. To take this count, place the gauge on the block indicated by the **Prepare gauge for count** prompt, with the source rod in the position indicated. Press down gently on the end of the handle (without touching the trigger) to ensure that the handle is properly seated. Then, proceed to step 21.

NOTE

If you need to halt the calibration for any reason, click the ⟨Cancel⟩ button on the Prepare gauge for count prompt. The software will display a new message box, noting that this calibration can be resumed at a later time. When the ⟨OK⟩ button is clicked on this new message box, the software will proceed to step 35.

21. Click the **⟨OK⟩** button to proceed with the reading. The software displays a progress bar showing which count is being made and how much time is left in the count. Wait for the count to finish.

22. When the count is complete, the **Prepare gauge for count** prompt is displayed, again showing which count is to be made next. When all measurement counts on the calibration blocks are complete, the program will proceed to step 23. Otherwise, go back to step 20.

23. When the calibration block counts are complete, the gauge displays a message box prompting the user to take a drift test. Place the gauge's reference standard block on the mag/aluminum calibration block, and then place the gauge on the reference standard block, with the source rod in the **SAFE** position.

24. Follow the gauge prompts to take the drift test. Upon completion of the drift test, the software displays the results as shown in Figure 4–13.

    - If the drift test passes, click the ⟨**Yes**⟩ button. The software displays a message box that notifies the user that the just-completed calibration is now the *Active Calibration*. The software then returns to the **3451 Count Acquisition SubMenu**. Proceed to step 38.
    - If, however, the drift test fails any of the three systems, the drift test must be repeated. Click the ⟨**No**⟩ button. The software displays a confirmation that the drift test was rejected. Click the ⟨**OK**⟩ button and proceed to step 25.

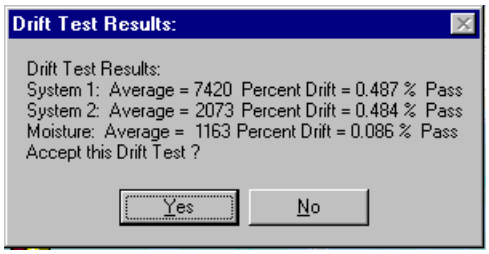

Figure 4–13. Drift Test Results Display

25. The software displays another message box stating that the counting has been halted at the user request. Click ⟨**OK**⟩.

26. The **3451 Count Acquisition SubMenu** will again be displayed. However, the second option, **Resume a partial (unfinished) calibration**, is option available as shown in Figure 4–14. Select this option and click the ⟨**Proceed**⟩ button.

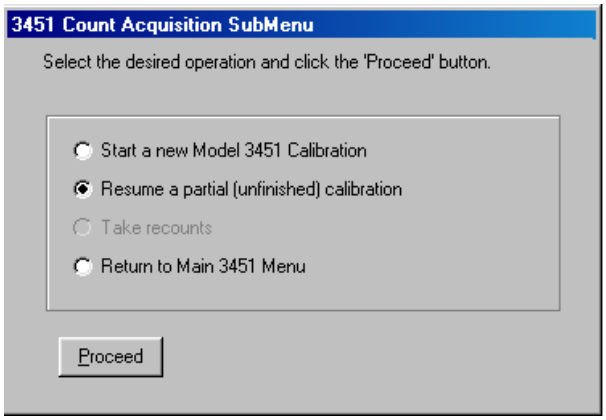

Figure 4–14. 3451 Count Acquisition SubMenu, Resume a Partial (Unfinished) Calibration Option Selected

27. The software performs a security check, as described in the *Security Features of the Model 3451* section on page 4–2. When the security check is complete, the software displays a message box showing the partial calibration that is in memory and asks if the user wishes to continue. Click ⟨**OK**⟩ to proceed.

28. The gauge now displays a message box that asks if the user wishes to proceed with a drift test. Click ⟨**OK**⟩ to proceed.

29. Since this is the second drift test, the gauge prompts the user to move the gauge source rod up and down. Move the source rod up and down a few times as directed, then ensure that the gauge is placed correctly on the reference standard block and that the source rod is properly seated in the **SAFE** position. When this is done, click the ⟨**OK**⟩ button to start the second drift test.

30. Allow the second drift test to complete.

    - If the second drift test passes the system (or systems) that failed in the *first* drift test, click the ⟨**Yes**⟩ button. The software displays a message box that notifies the user that the just-completed calibration is now the *Active Calibration*. The software then returns to the **Count Acquisition SubMenu**. Proceed to step 38.
    - If, however, the drift test fails any system that it also failed in the first drift test, then a *provisional drift test* needs to be conducted to check gauge electrical stability. Click the ⟨**No**⟩ button.

31. The software displays a message box that states that a provisional drift test must be conducted. Click ⟨**OK**⟩ to continue.

32. The gauge must now wait 3 hours before the provisional drift test counts can be made. For the next 3 hours, the computer displays a screen that shows how much time is left in the 3-hour period. Allow this 3-hour period to conclude.

33. After 3 hours, the gauge will automatically conduct the five 4-minute counts required for the provisional drift test. Allow these counts to conclude.

34. Upon completion of the provisional drift test, the software displays the results similar to Figure 4–13 on page 4–9. For this test, however, the values used to determine the % drift are the results of the second drift test and the results of the provisional drift test. Because the gauge was not moved between these two sets of counts, the results are a true representation of the electronic stability of the gauge.

    - If the provisional drift test passes the system (or systems) that it failed in the first and second drift tests, click the ⟨**Yes**⟩ button. The software displays a message box that notifies the user that the just-completed calibration is now the *Active Calibration*. The software then returns to the **3451 Count Acquisition SubMenu**. Proceed to step 38.
    - If, however, the drift test fails any system or systems that it also failed in the first and second drift tests, then this gauge has an electrical stability problem that must be corrected. **Halt the calibration process and take the gauge to Assembly or Service for analysis and repair.**

35. The **3451 Count Acquisition SubMenu** will again be displayed with the second option, **Resume a partial (unfinished) calibration**, available as shown in Figure 4–14 on page 4–9. Select this option and click the ⟨**Proceed**⟩ button.

36. The software performs a security check, as described in the *Security Features of the Model 3451* section on page 4–2. When the security check is complete, the software displays a message box showing the partial calibration that is in memory and asks if the user wishes to continue. Click ⟨**OK**⟩ to proceed.

37. The **Prepare gauge for count** prompt shown in Figure 4–12 is displayed, informing the user which count needs to be taken next. Proceed to step 20on page 4–8 to initiate this count.

38. Now that the drift test has passed, the calibration data collection is complete. The **3451 Count Acquisition SubMenu** will again be displayed with the options shown in Figure 4–15. From the **Main Menu** you will be able to initiate the process of reviewing the data just collected. Select the fourth option, **Return to Main 3451 Menu**, click ⟨**Proceed**⟩, and then proceed to the next section, *Computing Calibration Constants*.

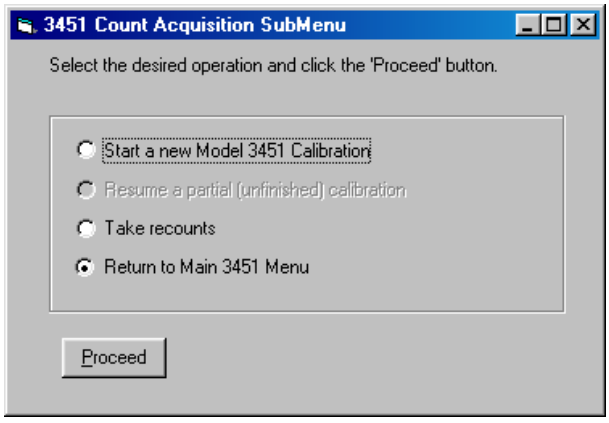

Figure 4–15. Count Acquisition SubMenu, after Calibration Counts are Complete

COMPUTING CALIBRATION CONSTANTS

If there is an active calibration currently in the memory of the gauge, then one can compute the calibration constants for the gauge. In order to compute these constants, do the following:

12. From the **Main Menu**, select the second option, **Evaluate and Use Calibration Data**, as shown in Figure 4–16, then click the ⟨**Proceed**⟩ button:

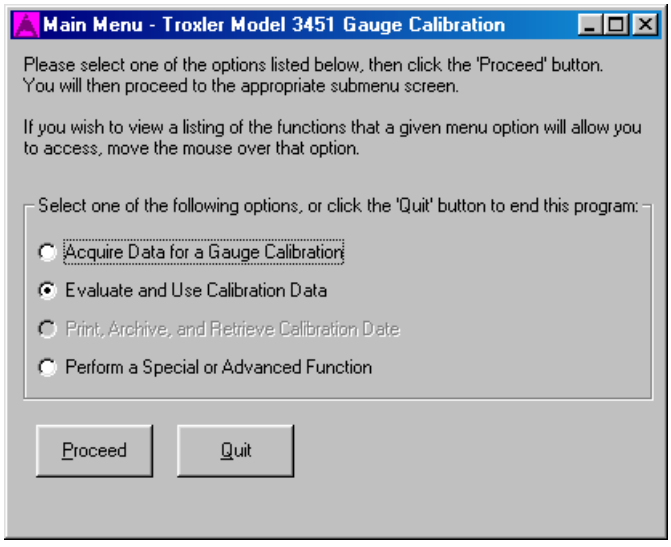

Figure 4–16. Main Menu, Evaluate and Use Calibration Data

13. The **Calibration Constants Submenu** is displayed. As shown in Figure 4–17, select the second option, **Compute calibration constants for gauge number x** (where *x* is the serial number of the current active calibration), and click the ⟨**Proceed**⟩ button.

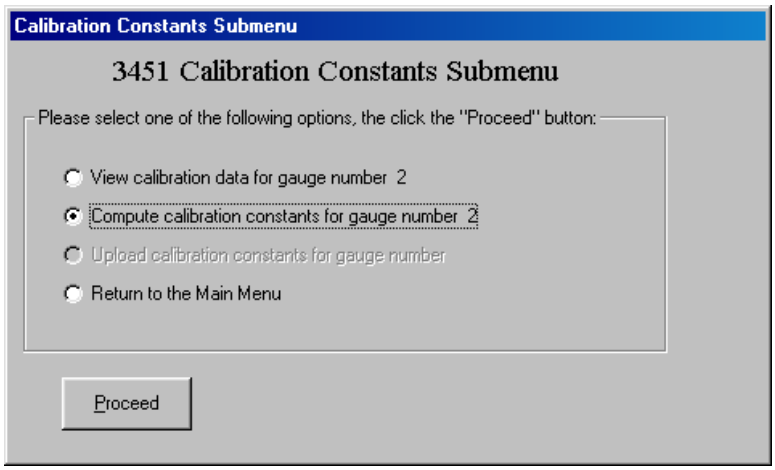

Figure 4–17. Calibration Constants Submenu, Compute Calibration Constants Option Selected

14. The program computes the calibration constants for the currently active calibration – in this instance, gauge number *2*. If these calibration constants are computed without error, a **Constants computed** message box is displayed. Click ⟨**OK**⟩ to continue.

15. The software then displays the results of the computation of the calibration constants, as shown in Figure 4–18.

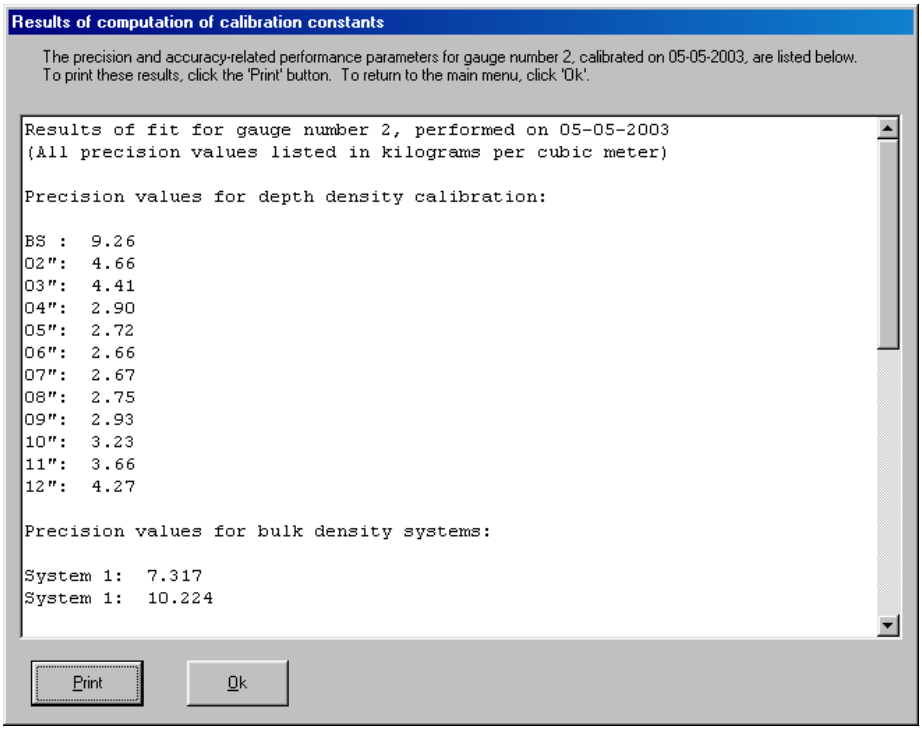

Figure 4–18. Results of Computation of Calibration Constants

16. Click the ⟨**Print**⟩ button to generate a printout, then review these precision values.
    - If any of these values exceed the *Calibration Inspection Limits* values, then the gauge may need recounts. Click the ⟨**Ok**⟩ button and proceed to step 22.
    - If all of the values are within the *Calibration Inspection Limits*, then the calibration constants are ready to load into the gauge. Click the ⟨**Ok**⟩ button and continue to step 17.

17. The **Calibration Constants Submenu** is again displayed, with all four options enabled. As shown in Figure 4–19, select the third option, **Upload calibration constants for gauge number *x* to the gauge**, where *x* is the gauge serial number, and click the ⟨**Proceed**⟩ button.

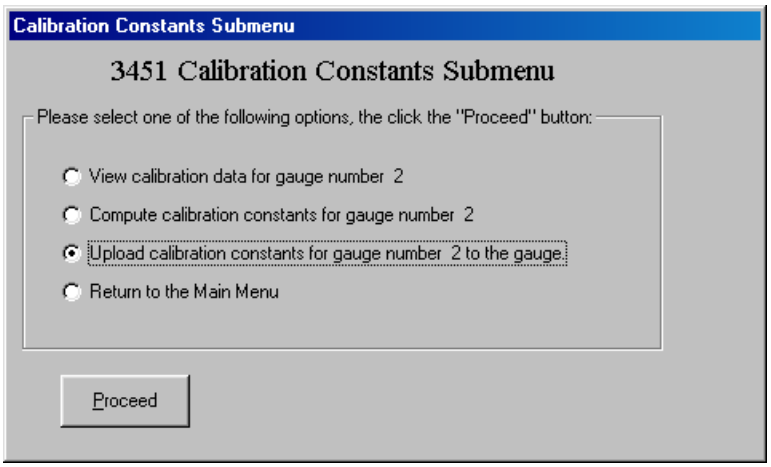

Figure 4–19. Calibration Constants Submenu, Upload Calibration Constants Option Selected

18. The gauge now performs a security check, as described in the *Security Features of the Model 3451* section that begins on page 4–2. When the security check is passed, the program proceeds with loading the calibration constants into the gauge. A status bar keeps track of the process. When the upload is complete, the software displays a message box that states **Calibration storage complete!** Click the ⟨**OK**⟩ button to continue.

19. The **Calibration Constants Submenu** is again displayed, with all four options available as shown in Figure 4–19. Select the fourth option, **Return to the Main Menu**, and click the ⟨**Proceed**⟩ button.

20. The software returns to the **Main Menu** (see Figure 4–5 on page 4–4). Proceed to the *Calibration Quality Assurance* section on page 4–16 to run the QA tests on this newly calibrated gauge.

21. The **Calibration Constants Submenu** is again displayed, with all four options available as shown in Figure 4–19. Select the fourth option, **Return to the Main Menu**, and click the ⟨**Proceed**⟩ button.

22. The software returns to the **Main Menu** (see Figure 4–5 on page 4–4). Proceed to the *Calibration Recounts* section on the following page, and take the necessary recounts with the gauge.

CALIBRATION RECOUNTS

On occasion, a calibration reading must be repeated in order to meet performance parameter requirements. The following section describes how to take *recounts* for a specific gauge calibration.

9. From the **Main Menu** (see Figure 4–5 on page 4–4), select the **Acquire Data for a Gauge Calibration** option, then click ⟨**Proceed**⟩.

10. The **3451 Count Acquisition SubMenu** (Submenu 1) is displayed, as shown in Figure 4–20. The options that are available in the submenu depend upon the tasks that have been most recently undertaken. As shown in Figure 4–20, select the third option, **Take recounts**, and click the ⟨**Proceed**⟩ button.

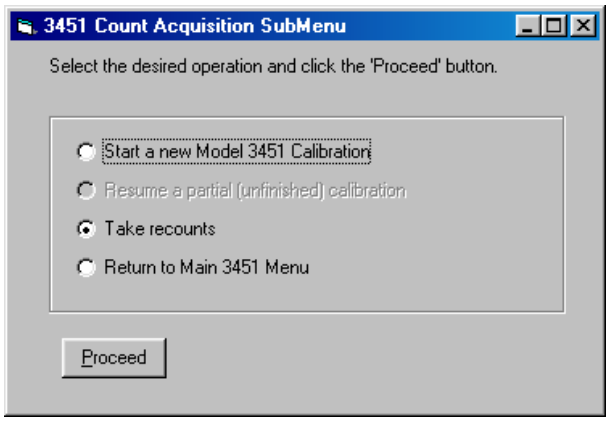

Figure 4–20. Count Acquisition Submenu, Take Recounts Option Selected

11. The gauge now performs a security check, as described in the *Security Features of the Model 3451* section that begins on page 4–2. When the security check is passed, the software displays a message box showing the active calibration that is available for recounting. If the calibration denoted in this message box is correct, click ⟨**Yes**⟩ and proceed to the following step. Otherwise, click ⟨**No**⟩.

12. Once ⟨**Yes**⟩ is clicked on the preceding message box, the **Recount Selection Form** (see Figure 4–21) is displayed. The form contains an option button for each recount that can be made with this particular calibration. To take a recount, click the option button beside the recount desired, then click the ⟨**Proceed**⟩ button. If you do not wish to take a recounts, then click the default option button, **No Recounts Required**, and then click the ⟨**Proceed**⟩ button.

13. The **Prepare gauge for count** prompt, shown in Figure 4–12 on page 4–8, is displayed. The text of the prompt will reflect the recount that was selected.

14. To take the recount, place the gauge on the block indicated by the prompt, with the source rod in the position indicated, and click ⟨**OK**⟩. The gauge count will proceed. The software displays a progress bar showing which count is being made and how much time is left in the count. Wait for the count to finish.

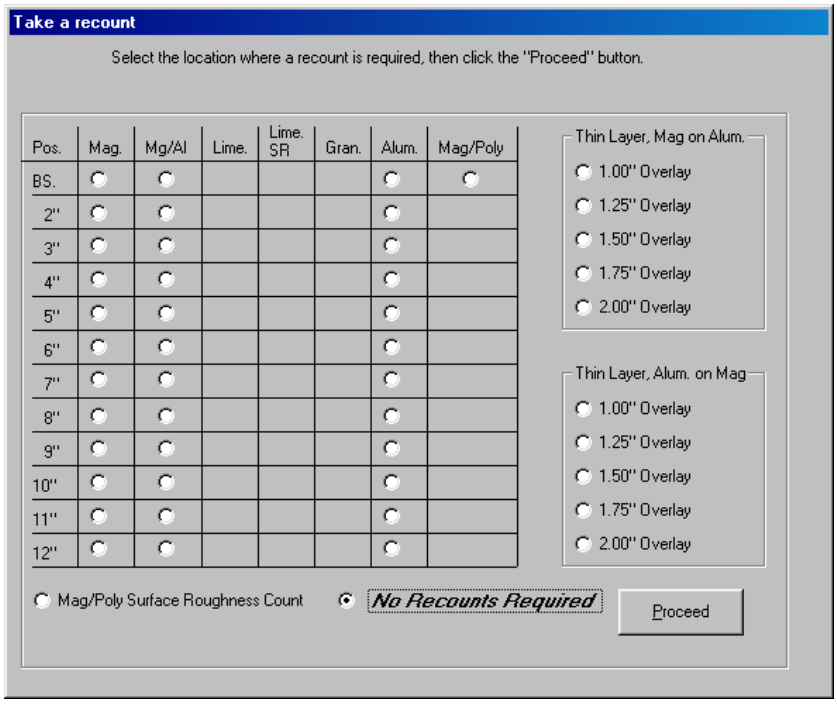

Figure 4–21. Recount Selection Form

15. Once the recount is complete, a message box is displayed asking if another recount is required.
    - If another recount is required, click the ⟨**Yes**⟩ button and return to step 12.
    - If no further recounts are required, click ⟨**No**⟩ and proceed to step 16.
16. The **Main Menu** is now displayed. Return to the *Computing Calibration Constants* section that begins on page 4–11 and follow the directions to re-compute the calibration constants using the new recounts.

CALIBRATION QUALITY ASSURANCE

Generating the Calibration Accuracy Check Form and Clearing the Project Data Storage Area

During the Quality Assurance phase of gauge calibration, gauge measurements are compared against the accepted values of the quantities that are being measured. These accepted values are printed on the *Calibration Accuracy Check Form*. In order to perform the QA tests, therefore, this form must be printed as described in the following procedure.

7. To generate the *Calibration Accuracy Check Form*, select the **Perform a Special or Advanced Function** option on the **Main Menu**, as shown in Figure 4–22, then click the ⟨**Proceed**⟩ button

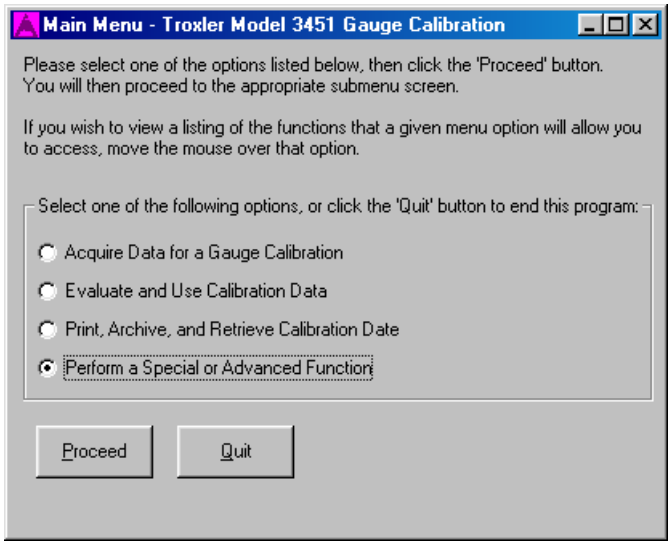

Figure 4–22. Main Menu with Option 4 Selected

8. The **Special Functions Submenu** (see Figure 4–23) is now displayed. This submenu allows access to several special functions. The function to be used at this time is the first available option, **Print an Accuracy Check Form (QA Form) for gauge *x***, where *x* is the gauge serial number for the active calibration. Select this option and click ⟨**Proceed**⟩.

9. The **Units Selection Screen** is now displayed. This screen allows the user to select the units – either pounds per cubic foot (English) or kilograms per cubic meter (metric) – in which the form will be printed. Select the default value of English (pcf) and then click the **Print QA Sheet** button.

10. A printer dialog screen is displayed. Select the printer to be used to print the QA form, then click the **Print** button.

11. The printer dialog screen will now disappear, leaving the **Units Selection Screen** visible. Click the ⟨**Quit**⟩ button to return to the **Special Functions Submenu**. Retrieve the QA form from the printer.

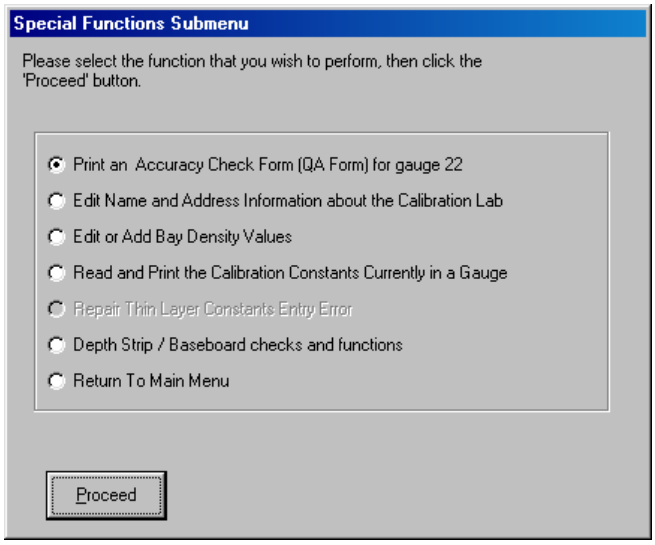

Figure 4–23. Special Functions Submenu

12. The project data must now be cleared from the gauge memory. From the **Special Functions Submenu**, select the sixth option, **Depth Strip/Baseboard checks and functions**, and click the ⟨**Proceed**⟩ button. The gauge now performs a security check, as described in the *Security Features of the Model 3451* section that begins on page 4–2. When the security check is complete, the **Select the desired IO special function** menu shown in Figure 4–24 is displayed.

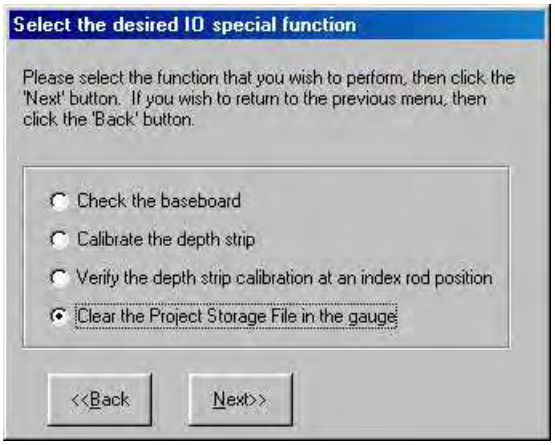

Figure 4–24. Select the Desired IO Special Function Menu

13. Select the fourth option, **Clear the Project Storage File in the gauge**, then click the ⟨**Next**⟩ button. The program sends the appropriate command to the gauge to clear this file. When the gauge has confirmed this operation, the program displays a message box informing the user that this operation has been performed successfully. Click ⟨**OK**⟩ on this message box.

14. The **Select the desired IO special function** menu is still displayed. Click ⟨**Back**⟩ to return to the **Special Functions Submenu**.

15. From the **Special Functions Submenu**, select the last option, **Return to Main Menu**, and click ⟨**Proceed**⟩. The program returns to the **Main Menu**. To continue the Calibration Quality Assurance process, proceed to the following section, *Acquiring and Evaluating the Data*.

Acquiring and Evaluating the Data

For the Quality Assurance phase of the calibration process, the calibration bay computer is not used to communicate with the gauge. Instead, the Intermec® 700 Series Color Mobile Computer (hereafter referred to as *PDA*) will be used.

Figure 4–25. Intermec 700 Series Mobile Computer (PDA)

1. Disconnect the RS-232 cable that is currently connected from the gauge to the computer. Install the Bluetooth wireless serial adapter (hereafter referred to as the *wireless serial adapter* into the RS-232 port on the gauge and screw it snugly into place. Figure 4–3 on page 4–2 shows the wireless serial adapter properly installed in the gauge.

2. Get the PDA that will be used with this gauge. Turn on the PDA by pressing the yellow button labeled **I/0** on the keypad. The PDA powers up, then displays the **Troxler** menu shown in Figure 4–26.

3. Using the PDA stylus, click the ⟨**Troxler 3451**⟩ button. The software displays a splash screen that includes the software version and gauge serial number. The software then establishes Bluetooth wireless communications between the PDA and gauge. When the PDA has established communications with the gauge, the software displays the status of the gauge's nickel-metal hydride (NiMH) batteries, as shown in Figure 4–27.

4. Click the ⟨**Done**⟩ button to continue. The gauge then enters a five-minute warmup period and the PDA displays a **Gauge Warmup** screen. If the gauge has been on for several hours, click the ⟨**Abort**⟩ button. Otherwise, wait for the warmup to conclude.

5. After the warmup is either aborted or allowed to conclude, the RoadReader Plus main menu shown in Figure 4–28 is displayed. **Un**-check the checkbox labeled **GPS Enabled** in order to disable the GPS capabilities of the gauge during the calibration procedure. (The GPS will be turned back on once the calibration is complete.)

6. To conduct the Quality Assurance testing, the current calibration constants must first be uploaded from the gauge into the PDA. To begin this process, click the ⟨**Gauge Tools**⟩ button on the RoadReader Plus main menu. The PDA displays the **Gauge Tools** menu shown in Figure 4–29.

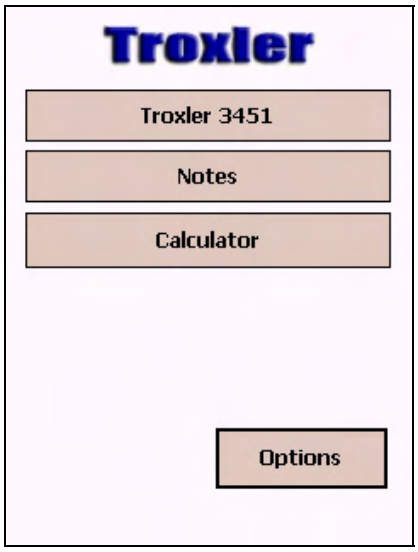

Figure 4–26. Troxler Menu

Figure 4–28. RoadReader Plus Main Menu (with GPS Enabled)

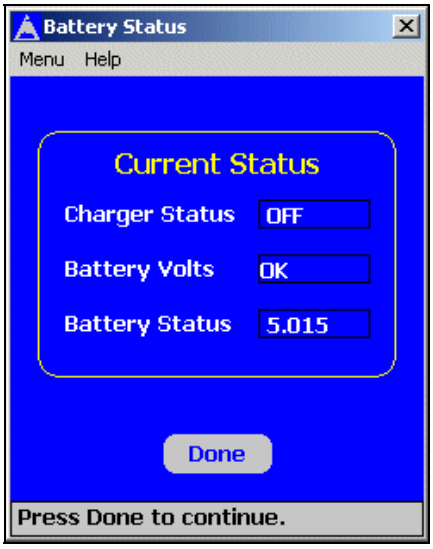

Figure 4–27. Battery Status Display

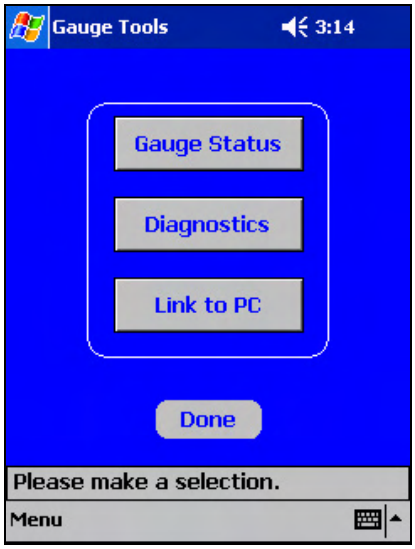

Figure 4–29. Gauge Tools Menu

7. From the **Gauge Tools** menu, click the ⟨**Diagnostics**⟩ button. The **Diagnostics Menu** shown in Figure 4–30 is displayed. Click the word **Menu** in the lower left corner of the screen. A dropdown menu is displayed in the lower left corner, as shown in Figure 4–31.

8. From the dropdown menu, select the **Service Menu** option. The software requests a *Service Code*. Using the keypad displayed on the screen or the PDA keypad itself, enter the service code *1961*, then click the ⟨**OK**⟩ button. The **Service Menu** (see Figure 4–32) is displayed.

9. Click the ⟨**Calib Const.**⟩ button to display the **Calibration Constants** menu (Figure 4–33).

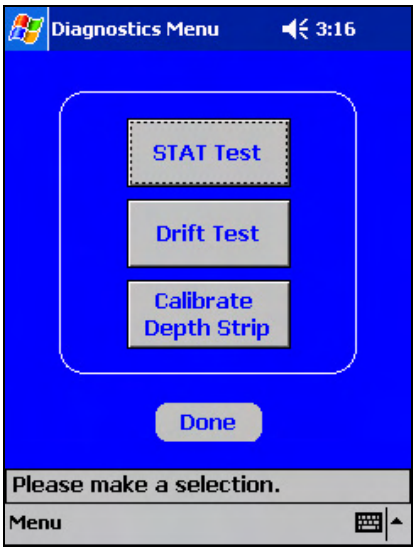

Figure 4–30. Diagnostics Menu

Figure 4–32. Service Menu

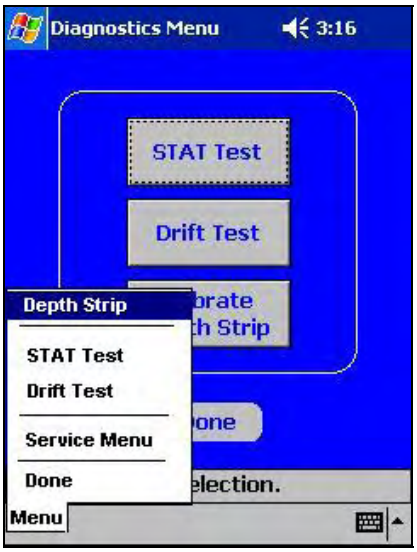

Figure 4–31. Diagnostics Menu, with Dropdown Menu Activated

Figure 4–33. Calibration Constants Menu

10. On the **Calibration Constants** menu, click the ⟨**Automatic**⟩ button. The PDA interrogates the gauge to collect the calibration constants. During this time, the PDA displays the message **Collecting Data from the gauge**.

11. When the data transfer is complete (approximately 1 or 2 seconds), the PDA returns to the **Calibration Constants** menu, with a message box stating **Calibration Constants Complete** superimposed over it. Click ⟨**OK**⟩ to display only the **Calibration Constants** menu.

12. On the **Calibration Constants** menu, click the ⟨**Done**⟩ button to return to the **Service Menu**.

13. On the **Service Menu**, click ⟨**Gauge Type**⟩ to access the **Gauge Type Menu** (see Figure 4–34).

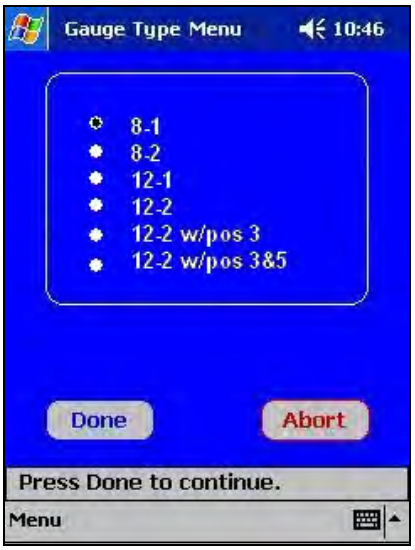

Figure 4–34. Gauge Type Menu

14. Select the index rod type from the six options shown on the **Gauge Type Menu**, then click the ⟨**Done**⟩ button. The PDA returns to the **Service Menu**.

15. On the **Service Menu**, click the ⟨**Done**⟩ button to return to the **Diagnostics Menu**.

16. On the **Diagnostics Menu**, click the ⟨**Done**⟩ button to return to the **Gauge Tools** menu.

17. On the **Gauge Tools** menu, click the ⟨**Done**⟩ button to return to RoadReader Plus main menu.

18. The QA counting can now proceed. First, prepare to take a standard count by placing the gauge's polyethylene standard block on the center of the mag/aluminum block, then placing the gauge on the polyethylene standard block. Ensure that the source rod is in the **SAFE** position.

19. Click the ⟨**Standard Count**⟩ button on the RoadReader Plus main menu. The **Standard Menu** (see Figure 4–35) is displayed.

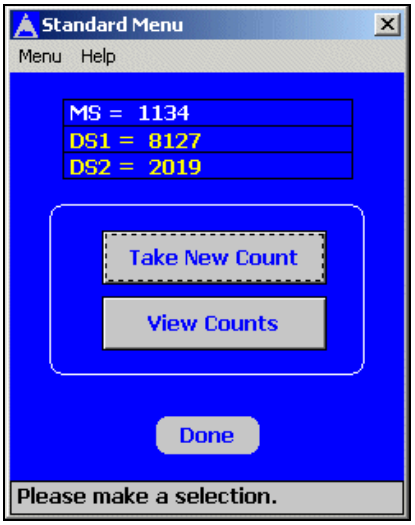

Figure 4–35. Standard Menu

20. Click the ⟨**Take New Count**⟩ button to begin the standard count. A message box is displayed, reminding the user how to orient the gauge for a standard count.

21. Click ⟨**OK**⟩ on this message box to begin the 4-minute standard count. During the count, the PDA displays the message **Standard Count in Progress**, as well as the amount of time that is left in the count. Wait for this count to conclude.

22. When the standard count is complete, the PDA displays a message box that shows the results of the count, and asks **Do you wish to use this new standard count?** *Whether or not a particular count failed in not relevant at this point, since there are probably no standard counts in the system.* Compare the three standard counts themselves (System 1, System 2, and Moisture) to the limits printed near the top of page 1 of the *Calibration Accuracy Check* form.
    - If all three standard counts fall within these limits, then record the values on the *Calibration Accuracy Check* form and proceed to step 24.
    - If any one of the standard counts fall outside these limits, AND this is the first standard count to be taken in the QA tests, then go to step 23.
    - If any one of the standard counts fall outside these limits, AND this is the second time during the QA tests that this has occurred, then record this value on the *Calibration Accuracy Check* form and halt the calibration process. Take the gauge to Service for analysis and repair.

23. Click ⟨**No**⟩ on the current message box to indicate that you **do not** wish to use the standard counts that were just acquired. Another message box is displayed, confirming that these standard counts will not be stored. Click ⟨**Ok**⟩ to return to the **Standard Menu**. Return to step 20 to retake the standard count.

24. Click ⟨**Yes**⟩ on the current message box to indicate that you **do** wish to use the standard counts that were just acquired. One of two possible message boxes will be displayed:
    - If the standard counts just taken are **not** consistent with the four standard counts that are in memory (and they likely will not be, since a history of standard counts has yet to be stored), the PDA displays a message box that asks **Do you wish to erase the last four standard counts?** If this message box is displayed, proceed to step 25.
    - If instead you get the message box that states the standard counts have been stored, click the ⟨**Ok**⟩ button to return to the **Standard Menu** and proceed to step 27.

25. Click the ⟨**Yes**⟩ button to indicate that you wish to erase the last four standard counts in memory. Another message box is displayed to confirm that the standard counts have been stored and the standard counts that were in memory have been erased.

26. Click ⟨**Ok**⟩ to acknowledge that the standard counts have been saved and the standard counts that were previously in memory have been erased. The **Standard Menu** is displayed.

27. Click the ⟨**Done**⟩ button on the **Standard Menu** to return to the RoadReader Plus main menu.

28. It is now time to start taking the QA measurements on the calibration blocks. However, to take measurement counts with a Troxler Model 3451, the user must first create a new *project*. To create a project, click the ⟨**Project Access**⟩ button on the RoadReader Plus main menu. The Project Menu (see Figure 4–36) is displayed.

29. On the **Project Menu**, ensure that both the **Disable Storage to Gauge** and **Disable Project Notes** checkboxes are **checked**, as in Figure 4–36. If either box is unchecked, be sure to check it.

30. Click the ⟨**New**⟩ button on the **Project Menu**. The first page of the **Setup Wizard** is displayed.

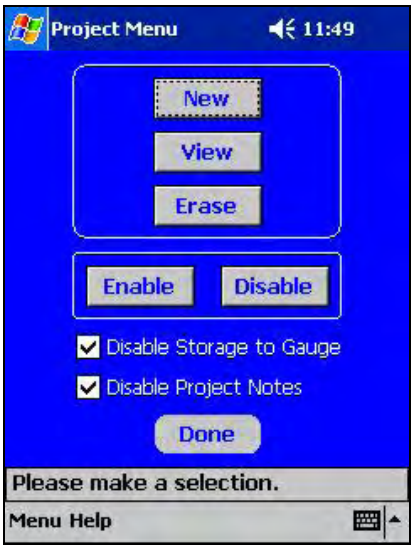

Figure 4–36. Project Menu

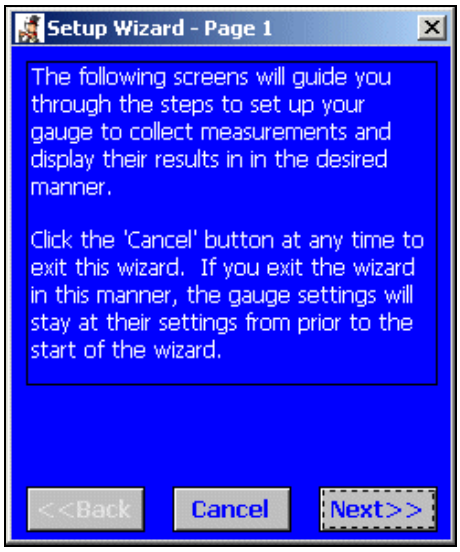

Figure 4–37. Project Setup Wizard, First Page

31. The **Setup Wizard** is a series of screens that provides step-by-step instructions for setting up a new project. Using the wizard, the operator is prompted to select the measurement mode, measurement units, count time, and target values to be used for this project. Table 4–1 shows the gauge function that is selected on each page of the wizard. Click the ⟨**Next**⟩ button to step through the wizard pages, and set each function to the value shown in the third column of Table 4–1.

Table 4–1. Setup Wizard Page Functions and Selections

Setup Wizard Page	Gauge Function	Set To
2	Measurement mode	Soils Mode
3	Measurement units	Pounds per cubic foot
4	Count time	1 minute
7	Target value	Do NOT use Target Density

32. After the project settings are complete, the wizard displays the selected gauge measurement configuration for review. Ensure that all settings are as shown in Table 4–1 and click the ⟨**Next**⟩ button.

33. The wizard now requests a project name. The name that is entered is arbitrary, but call it *factory* for convention sake. Enter the project name *factory* using either the screen keypad (you must first activate it by clicking the keyboard icon in the lower right corner of the screen) or the keypad of the PDA itself. When finished, click the ⟨**Ok**⟩ button.

34. The PDA displays the confirmation message **Gauge configuration has been set according to your specifications.** Click ⟨**Ok**⟩ to continue.

35. The **Project Menu** (see Figure 4–36) is again displayed. Click ⟨**Done**⟩ to return to the RoadReader Plus main menu. The project name entered in step 33 is displayed on the RoadReader Plus main menu.

36. Place the gauge on the center of the magnesium calibration block in the proper measurement position. Place the source rod in backscatter position, making sure the handle clicks into the backscatter notch. Press down gently on the end of the handle (without touching the trigger) to ensure that the handle is properly seated.

37. Click the ⟨**Take a Reading**⟩ button on the RoadReader Plus main menu to begin a 1-minute count. During the count, the PDA displays the total duration of the count (1 minute, 4 minutes, or 15 seconds), as well as the current index rod position. A running countdown of the time remaining in the count is displayed in the lower left corner of the screen.

38. When the count is complete, the PDA displays the count results, as shown in Figure 4–38.

    If the current count is being made on the magnesium block, go to the *Magnesium block density measurements* section of the *Calibration Accuracy Check Form*, page 1. If the current count is being made on the aluminum block, go to the *Aluminum block density measurements* section on page 2 of the form.

    There is a table for recording these measurement results. Find the row that corresponds to the current index rod position of the gauge. In the *SYS 1 CNT* column, record the System 1 count from the count results display. In the *SYS 2 CNT* column, record the System 2 count from the count results display. In the **first** *DENS* column (located between the *SYS 2 CNT* and *SYS 1 RC* columns), record the Wet Density value from the count results display.

39. After the counts have been recorded, click the ⟨**ok**⟩ button on the count results display. The gauge returns to the RoadReader Plus main menu.

40. Refer to the wet density value just recorded on the *Calibration Accuracy Check Form* in step 38. Compare this wet density value to the allowed range of wet density values printed on the *Calibration Accuracy Check Form* for this block.

    - If the wet density value just recorded falls within this allowed range, then this QA reading has passed; proceed to step 53.
    - If, however, the wet density value just recorded falls outside this allowed range, then another QA reading is required; proceed to step 41.

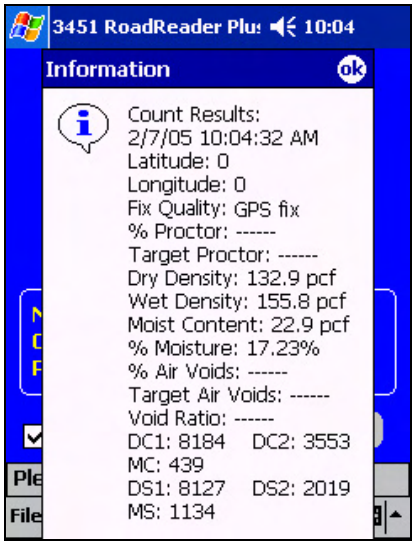

Figure 4–38. Count Results Display

41. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA displays the **Change Settings** menu (see Figure 4–39).

42. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The PDA displays the **Gauge Setup** menu (see Figure 4–40).

43. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The PDA displays the **Count Time Menu** (see Figure 4–41).

44. Click the ⟨**4 minutes**⟩ button on the **Count Time Menu**. A message box confirms the count change.

45. Click ⟨**ok**⟩ on the message box that confirmed the count time change.

46. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

47. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

48. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.

49. From the RoadReader Plus main menu, click the ⟨**Take a Reading**⟩ button to begin the recount in the current block at the current source rod position. During the count, the PDA displays the total duration of the count (1 minute, 4 minutes, or 15 seconds), as well as the current index rod position. A running countdown of the time remaining in the count is displayed in the lower left corner of the screen.

50. When the count has concluded, the results of the count are displayed as shown in Figure 4–38. In the *block density measurements* section of the *Calibration Accuracy Check Form* for the current block, there is a table for recording these measurement results. Find the row that corresponds to the current index rod position of the gauge. In the *SYS 1 RC* column, record the System 1 count from the count results display. In the *SYS 2 RC* column, record the System 2 count from the count results display. In the **second** *DENS* column (located to the left of the *SYS 1 RC* column), record the Wet Density value from the count results display.

Figure 4–39. Change Settings Menu

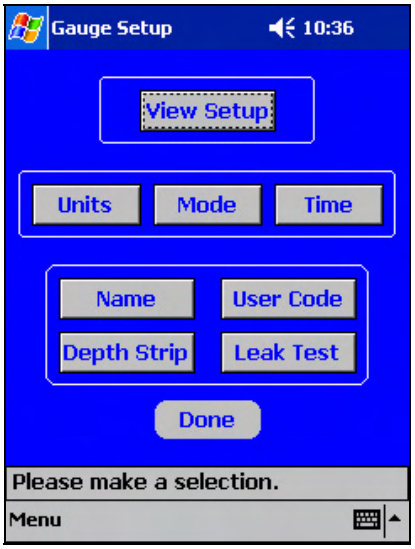

Figure 4–40. Gauge Setup Menu

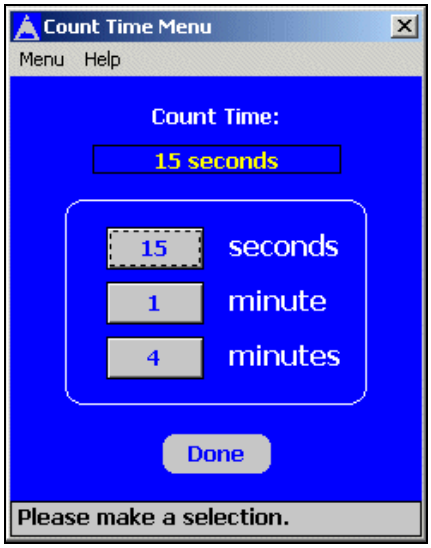

Figure 4–41. Count Time Menu

51. Click the ⟨**ok**⟩ button on the count results display. The PDA returns to the RoadReader Plus main menu.

52. Refer back to the wet density value just recorded on the *Calibration Accuracy Check Form* in step 50. Compare this wet density value to the allowed range of wet density values printed on the *Calibration Accuracy Check Form* for this block.

    - If the wet density value just recorded does fall within this allowed range, then this QA reading has passed; proceed to step 53.
    - If, however, the wet density value just recorded falls outside this allowed range, then the gauge needs recounts at this depth. Proceed to the *Calibration Recounts* section on page 4–14 to take the recounts.

53. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA displays the **Change Settings** menu (see Figure 4–39).

54. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The **Gauge Setup** menu is then displayed (see Figure 4–40).

55. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The **Count Time Menu** is then displayed (see Figure 4–41).

56. Click the ⟨**15 seconds**⟩ button on the **Count Time Menu**. A message box confirms the count change.

57. Click ⟨**ok**⟩ on the message box that confirmed the counting time change.

58. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

59. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

60. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.

61. Place the gauge index rod in the next available depth position. Make sure that the rod handle has clicked into the proper position and that the index rod is pulled firmly against the block's access hole.

62. From the RoadReader Plus main menu, click the ⟨**Take a Reading**⟩ button to begin the count on the current block at the current source rod position. During the count, the PDA displays the total duration of the count (1 minute, 4 minutes, or 15 seconds), as well as the current index rod position. A running countdown of the time remaining in the count is displayed in the lower left corner of the screen.

63. When the count has concluded, the results of the count are displayed as shown in Figure 4–38. In the *block density measurements* section of the *Calibration Accuracy Check Form* for the current block, there is a table for recording these measurement results. Find the row that corresponds to the current index rod position of the gauge. In the *SYS 1 CNT* column, record the System 1 count from the count results display. In the *SYS 2 CNT* column, record the System 2 count from the count results display. In the **first** *DENS* column (located between the *SYS 2 CNT* and *SYS 1 RC* columns), record the Wet Density value from the count results display.

64. Click the ⟨**ok**⟩ button on the count results display. The PDA returns to the RoadReader Plus main menu.

65. Refer back to the wet density value just recorded on the *Calibration Accuracy Check Form* in step 63. Compare this wet density value to the allowed range of wet density values printed on the *Calibration Accuracy Check Form* for this block.

    - If the wet density value just recorded does fall within this allowed range, then this QA reading has passed; proceed to step 86.
    - If, however, the wet density value just recorded falls outside this allowed range, proceed to step 66.

66. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA will then display the **Change Settings** menu (see Figure 4–39).

67. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The **Gauge Setup** menu is then displayed (see Figure 4–40).

68. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The **Count Time Menu** is then displayed (see Figure 4–41).

69. Click the ⟨**1 minute**⟩ button on the **Count Time Menu**. A message box confirms the count change.

70. Click ⟨**ok**⟩ on the message box that confirmed the count time change.

71. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

72. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

73. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.

74. From the RoadReader Plus main menu, click the ⟨**Take a Reading**⟩ button to begin the recount in the current block at the current source rod position. During the count, the PDA displays the total duration of the count (1 minute, 4 minutes, or 15 seconds), as well as the current index rod position. A running countdown of the time remaining in the count is displayed in the lower left corner of the screen.

75. When the count has concluded, a message box is displayed asking if you wish to add Project Notes. Click ⟨**No**⟩. The results of the count are then displayed as shown in Figure 4–38. In the *block density measurements* section of the *Calibration Accuracy Check Form* for the current block, there is a table for recording these measurement results. Find the row that corresponds to the current index rod position of the gauge. In the *SYS 1 RC* column, record the System 1 count from the count results display. In the *SYS 2 RC* column, record the System 2 count from the count results display. In the **second** *DENS* column (located to the left of the *SYS 1 RC* column), record the Wet Density value from the count results display.

76. Click the ⟨**ok**⟩ button on the count results display. The PDA returns to the RoadReader Plus main menu.

77. Refer back to the wet density value just recorded on the *Calibration Accuracy Check Form* in step 75. Compare this wet density value to the allowed range of wet density values printed on the Calibration Accuracy Check form for this block.

    - If the wet density value just recorded does fall within this allowed range, then this QA reading has passed; proceed to step 78.
    - If, however, the wet density value just recorded falls outside this allowed range, then the gauge needs recounts at this depth. Proceed to the *Calibration Recounts* section on page 4–14 to take the recounts.

78. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA will then display the **Change Settings** menu (see Figure 4–39).

79. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The **Gauge Setup** menu is then displayed (see Figure 4–40).

80. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The **Count Time Menu** is then displayed (see Figure 4–41).

81. Click the ⟨**15 seconds**⟩ button on the **Count Time Menu**. A message box confirms the count change.

82. Click ⟨**ok**⟩ on the message box that confirmed the count time change.

83. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

84. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

85. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.

86. If the measurement that was just completed was for the last index rod position in this block, then proceed to step 87. Otherwise, return to step 61 to take a count at the next index rod position.

87. If the calibration block in which the preceding counts were taken was the aluminum block, then it is time to take the moisture count; proceed to step 98. If the calibration block in which the preceding counts were taken was the magnesium block, then proceed to step 88.

88. Move the gauge to the aluminum calibration block in this bay. Place the gauge on the center of the aluminum calibration block in the proper measurement position. Place the source rod in backscatter position, making sure the handle clicks into the backscatter notch. Press down gently on the end of the handle (without touching the trigger) to ensure that the handle is properly seated.

89. In order to take this backscatter count, the gauge count time has to be set to 1 minute. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA displays the **Change Settings** menu (see Figure 4–39).

90. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The **Gauge Setup** menu is then displayed (see Figure 4–40).

91. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The **Count Time Menu** is then displayed (see Figure 4–41).

92. Click the ⟨**1 minute**⟩ button on the **Count Time Menu**. A message box confirms the count change.

93. Click ⟨**ok**⟩ on the message box that confirmed the count time change.

94. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

95. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

96. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.

97. Turn to the second page of the *Calibration Accuracy Check Form*. Return to step 37 to acquire the aluminum block QA counts.

98. It is now time to take the moisture QA count. Place the gauge in backscatter position on the mag/poly block.

99. In order to take this moisture count, the gauge count time has to be set to 1 minute. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA displays the **Change Settings** menu (see Figure 4–39).

100. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The **Gauge Setup** menu is then displayed (see Figure 4–40).

101. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The **Count Time Menu** is then displayed (see Figure 4–41).

102. Click the ⟨**1 minute**⟩ button on the **Count Time Menu**. A message box confirms the count change.

103. Click ⟨**ok**⟩ on the message box that confirmed the count time change.

104. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

105. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

106. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.

107. From the RoadReader Plus main menu, click the ⟨**Take a Reading**⟩ button to begin the recount in the current block at the current source rod position. During the count, the PDA displays the total duration of the count (1 minute, 4 minutes, or 15 seconds), as well as the current index rod position. A running countdown of the time remaining in the count is displayed in the lower left corner of the screen.

108. When the count has concluded, the results of the count are displayed as shown in Figure 4–38. Note the value listed beside the heading *Moisture count* = from the count results display, and record this value in the *Moisture Quality Test* section of the *Calibration Accuracy Check Form* (at the bottom of page 2) beside the heading *Moisture count:*. Next, note the value listed beside the heading *Moist. Content* = on the count results display and record the value in the *Moisture Quality Test* section of the *Calibration Accuracy Check Form* beside the **first** *Measured moisture:* heading.

109. Click the ⟨**ok**⟩ button on the count results display. The PDA returns to the RoadReader Plus main menu.

110. Compare the value recorded beside the *Measured moisture* heading on the *Calibration Accuracy Check Form* to the allowed range of measured moistures listed on the line above it.

    - If the measured moisture value falls within this range, then the gauge has passed the moisture measurement portion of the QA test; proceed to step 123.
    - If, however, the measured moisture value falls outside this range, then a recount is necessary; proceed to step 111.

111. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA displays the **Change Settings** menu (see Figure 4–39).

112. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The **Gauge Setup** menu is then displayed (see Figure 4–40).

113. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The **Count Time Menu** is then displayed (see Figure 4–41).

114. Click the ⟨**4 minutes**⟩ button on the **Count Time Menu**. A message box confirms the count change.

115. Click ⟨**ok**⟩ on the message box that confirmed the count time change.

116. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

117. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

118. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.

119. From the RoadReader Plus main menu, click the ⟨**Take a Reading**⟩ button to begin the recount in the current block at the current source rod position. During the count, the PDA displays the total duration of the count (1 minute, 4 minutes, or 15 seconds), as well as the current index rod position. A running countdown of the time remaining in the count is displayed in the lower left corner of the screen.

120. When the count has concluded, the results of the count are displayed as shown in Figure 4–38. Note the value listed beside the heading *Moisture count* = from the count results display, and record this value in the *Moisture Quality Test* section of the *Calibration Accuracy Check Form* (at the bottom of page 2) beside the heading *Moist. recount:*. Next, note the value listed beside the heading *Moist. Content* = on the count results display and record the value in the *Moisture Quality Test* section of the *Calibration Accuracy Check Form* beside the **second** *Measured moisture:* heading.

121. Click the ⟨**ok**⟩ button on the count results display. The PDA returns to the RoadReader Plus main menu.

122. Compare the value recorded beside the second *Measured moisture* heading on the *Calibration Accuracy Check Form* to the allowed range of measured moistures listed two lines above it.

    - If the measured moisture value falls within this range, then the gauge has passed the moisture measurement portion of the QA test; proceed to step 123.
    - If, however, the measured moisture value falls outside this range, then halt the calibration process; the moisture system of this gauge needs recounts. Proceed to the *Calibration Recounts* section on page 4–14 to take the recounts.

123. At this point it is time to take the thin layer QA counts. For these readings, the gauge must be in *Thin Layer* mode rather than *Soil* mode. To put the gauge in *Thin Layer* mode, first click the ⟨**Change Settings**⟩ button from the RoadReader Plus main menu.

124. The PDA displays the **Change Settings** menu (see Figure 4–39). Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu.

125. The PDA displays the **Gauge Setup** menu (see Figure 4–40). Click the ⟨**Mode**⟩ button on the **Gauge Setup** menu.

126. The PDA displays a message box informing the user that he or she has elected to change the mode and will therefore be sent to the **Setup Wizard**. Click the ⟨**OK**⟩ button on this message box.

127. The first page of the **Setup Wizard** is displayed (see Figure 4–37). Click the ⟨**Next**⟩ button.

128. The second page of the **Setup Wizard** is displayed. This page is used to select the measurement mode. Select **Thin Layer Mode** from the dropdown menu and click the ⟨**Next**⟩ button.

129. The next page of the wizard is used to select the measurement units. Select **pounds per cubic foot** from the dropdown menu and click ⟨**Next**⟩.

130. The next page of the wizard is used to select the count time. Select **1 minute** as the count time, then click ⟨**Next**⟩.

131. The **Setup Wizard** now displays a page used to indicate the thickness of the top layer of the material being tested. Select **1.00 inches** from the dropdown menu, then click the ⟨**Next**⟩ button.

132. The next page of the wizard is used to indicate the number of counts per site that will be averaged for the final count response at that site. Select **1 Reading per test site** from the dropdown menu and click ⟨**Next**⟩.

133. The next page of the wizard is used to select a target density, if desired. Select **Do NOT use Target density** for this option, then click ⟨**Next**⟩.

134. The **Setup Wizard** now displays the configuration selections for this project. Review the settings and click the ⟨**Next**⟩ button.

135. The wizard now displays a message box that requests a project name. The current project name is displayed in the input line of this box. Click the ⟨**Ok**⟩ button to keep the current project name; do not change the text in the input box.

136. The PDA displays the confirmation message **Gauge configuration has been set according to your specifications.** Click ⟨**Ok**⟩ to continue.

137. The **Gauge Setup** menu is displayed at this point (see Figure 4–40). Click the ⟨**Done**⟩ button to return to the **Change Settings** menu (see Figure 4–39).

138. Click the ⟨**Done**⟩ button on the **Change Settings** menu. The PDA returns to the RoadReader Plus main menu.

139. From the RoadReader Plus main menu, click the ⟨**Project Access**⟩ button. The **Project Menu** is displayed (see Figure 4–36).

140. On the **Project Menu**, make sure that the **Disable Project Notes** and **Disable Storage to Gauge** checkboxes are both **checked**. If either of these checkboxes is unchecked, then check it.

141. When the check boxes on the **Project Menu** have been set according to step 140, click the ⟨**Done**⟩ button. The PDA returns to the RoadReader Plus main menu.

142. Place the gauge on the center of the magnesium calibration block in the proper measurement position.

143. Place the source rod in backscatter position, making sure the handle clicks into the backscatter notch. Press down gently on the end of the handle (without touching the trigger) to ensure that the handle is properly seated.

144. Click the ⟨**Take a Reading**⟩ button on the RoadReader Plus main menu. The PDA displays **Position the gauge for count 1 out of 1 and click OK**. Click ⟨**OK**⟩.

145. The gauge takes a 1-minute count. During the count, the PDA displays the total duration of the count (1 minute, 4 minutes, or 15 seconds), as well as the current index rod position. A running countdown of the time remaining in the count is displayed in the lower left corner of the screen.

146. When the count is complete, the PDA displays the *first* thin layer count results display, as shown in Figure 4–42). This display contains part of the pertinent information from the count that was just taken. There is no need to record the data on this display. Click the ⟨**OK**⟩ button. The PDA displays the *second* thin layer count results display, as shown in Figure 4–43. This displays contains the remainder of the pertinent information from the count just taken.

    Page 3 of the *Calibration Accuracy Check Form* contains a section titled *Thin Layer Mode Accuracy Check*. This section has two subsections designated *Part I* and *Part II*. Go to *Part I*.

    This subsection includes a table with three rows. Select the row that corresponds to the block on which the preceding count was taken (mag, mag/aluminum, or aluminum). Record the following information in the appropriate locations in that row.

    From the thin layer count results display, record the System 1 average count (*DC1 Average*) in the *Sys 1 Cnt* box on the *Calibration Accuracy Check Form*. Next, record the System 2 average count (*DC2 Average*) in the *Sys 2 Cnt* box on the *Calibration Accuracy Check Form*. Finally, record the Density value in the **first** *Dens* box on the *Calibration Accuracy Check Form*.

147. Click the ⟨**ok**⟩ button on the count results display. The PDA returns to the RoadReader Plus main menu.

148. Compare the value for *Dens* recorded in step 146 to the range of density values allowed for the current calibration block. This range of allowed densities is shown just above the table itself.

    - If the measured density value falls within this range, then the gauge has passed the thin layer QA test for this block only; proceed to step .
    - If, however, the measured density value falls outside this range, then a recount is necessary; proceed to step 149.

Figure 4–42. First Thin Layer Count Results Display

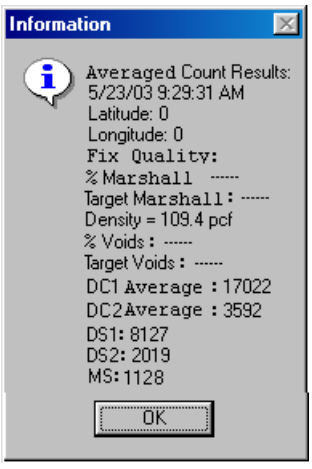

Figure 4–43. Second Thin Layer Count Results Display

149. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA will then display the **Change Settings** menu (see Figure 4–39).

150. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The **Gauge Setup** menu is then displayed (see Figure 4–40).

151. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The **Count Time Menu** is then displayed (see Figure 4–41).

152. Click the ⟨**4 minutes**⟩ button on the **Count Time Menu**. A message box confirms the count change.

153. Click ⟨**ok**⟩ on the message box that confirmed the count time change.

154. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

155. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

156. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.

157. Tap the ⟨**Take a Reading**⟩ button on the RoadReader Plus main menu screen. The PDA displays **Position the gauge for count 1 out of 1 and click OK**. Click ⟨**OK**⟩.

158. The gauge will take a 4-minute count. During the count, the PDA displays the total duration of the count (1 minute, 4 minutes, or 15 seconds), as well as the current index rod position. A running countdown of the time remaining in the count is displayed in the lower left corner of the screen.

159. When the count is complete, the PDA displays the *first* thin layer count results display, as shown in Figure 4–42). Click the ⟨**OK**⟩ button. The PDA displays the *second* thin layer count results display, as shown in Figure 4–43.

    Page 3 of the *Calibration Accuracy Check Form* contains a section titled *Thin Layer Mode Accuracy Check*. This section has two subsections designated *Part I* and *Part II*. Go to *Part I*.

    This subsection includes a table with three rows. Select the row that corresponds to the block on which the preceding count was taken (mag, mag/aluminum, or aluminum). Record the following information in the appropriate locations in that row.

    From the thin layer count results display, record the System 1 average count (*DC1 Average*) in the *Sys 1 RC* box on the *Calibration Accuracy Check Form*. Next, record the System 2 average count (*DC2 Average*) in the *Sys 2 RC* box on the *Calibration Accuracy Check Form*. Finally, record the Density value in the **second** *Dens* box on the *Calibration Accuracy Check Form*.

160. Click the ⟨**ok**⟩ button on the count results display. The PDA returns to the RoadReader Plus main menu.

161. Compare the value for *Dens* recorded in step 159 to the range of density values allowed for the current calibration block. This range of allowed densities is shown just above the table itself.

    - If the measured density value falls within this range, then the gauge has passed the thin layer QA test for this block only; proceed to step 162.
    - If, however, the measured density value falls outside this range, then the thin layer system for this gauge needs recounts. Proceed to the *Calibration Recounts* section on page 4–14 to take the recounts.

162. From the RoadReader Plus main menu, click the ⟨**Change Settings**⟩ button. The PDA displays the **Change Settings** menu (see Figure 4–39).

163. Click the ⟨**Gauge Setup**⟩ button on the **Change Settings** menu. The **Gauge Setup** menu is then displayed (see Figure 4–40).

164. From the **Gauge Setup** menu, click the ⟨**Time**⟩ button. The **Count Time Menu** is then displayed (see Figure 4–41).

165. Click the ⟨**1 minute**⟩ button on the **Count Time Menu**. A message box confirms the count change.

166. Click ⟨**ok**⟩ on the message box that confirmed the count time change.

167. Click ⟨**Done**⟩ on the **Count Time Menu**. The **Gauge Setup** menu is displayed.

168. Click ⟨**Done**⟩ on the **Gauge Setup** menu. The **Change Settings** menu is displayed.

169. Click ⟨**Done**⟩ on the **Change Settings** menu. The RoadReader Plus main menu is displayed.
    - If the thin layer count(s) just obtained were on the magnesium block, then place the gauge on the center of the mag/aluminum calibration. Return to step 143.
    - If the thin layer count(s) just obtained were on the mag/aluminum block, then place the gauge on the center of the aluminum calibration. Return to step 143.
    - If the thin layer count(s) just obtained were on the aluminum block, then Part I of the Thin Layer Mode Accuracy Check is complete; proceed to step 170.

170. The QA portion of the calibration process is complete. Keep the completed *Calibration Accuracy Check Form* with the other documentation for this gauge, and proceed to the following section, *Registry Save*.

REGISTRY SAVE

Before packing away the PDA, the GPS must be turned back on and the Windows registry must be backed up. Perform these tasks by doing the following:

1. From the RoadReader Plus main menu, check the checkbox labeled **GPS Enabled** so that the GPS is enabled.

2. From the RoadReader Plus main menu, click the ⟨**Exit**⟩ button. The PDA returns to the **Troxler** menu shown in Figure 4–26 on page 4–19.

3. From the **Troxler** menu, click the ⟨**Options**⟩ button. The **Intermec Launcher** menu (see Figure 4–44) is displayed.

4. Click the ⟨**System**⟩ button on the **Intermec Launcher** menu. The PDA requests a password request. Do not enter anything in the password box; instead, click the ⟨**OK**⟩ button.

5. The Windows Desktop (see Figure 4–45) is displayed on the PDA. Press the ⟨**Start**⟩ button in the upper left of the display, and select **Registry Save** from the dropdown menu.

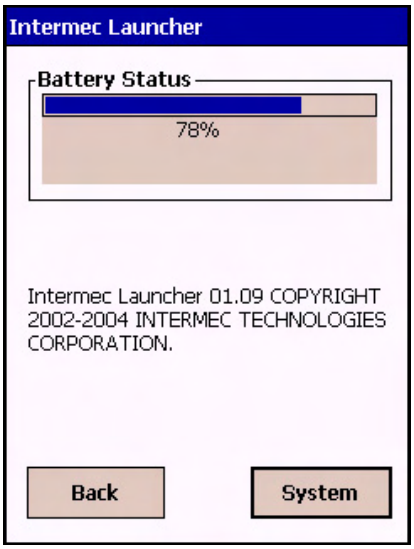

Figure 4–44. Intermec Launcher Menu

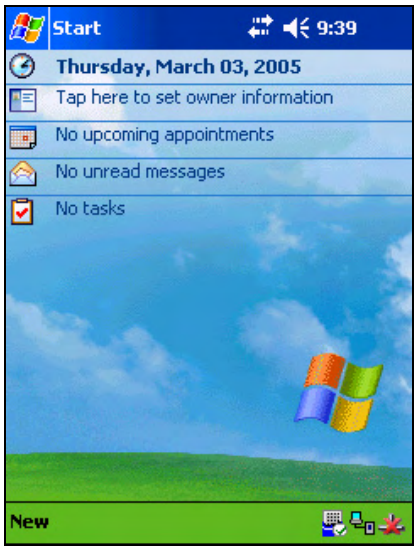

Figure 4–45. Windows Desktop

6. When the Registry Save is complete, the PDA displays a confirmation message box. Click ⟨**Ok**⟩ on this message box.

7. The Windows Desktop is still displayed on the PDA. Press the ⟨**Start**⟩ button in the upper left and select **Intermec Launcher** from the dropdown menu, The PDA returns to the **Troxler** menu.

8. Press the orange power switch (labeled **I/O**) located in the upper left corner of the PDA keypad. This will put the PDA to sleep.

9. Remove the batteries from the PDA.

10. Proceed to the following section, *Archival and Report Generation*, to archive the calibration data on the calibration bay PC and print the calibration report.

ARCHIVAL AND REPORT GENERATION

13. Go back to the calibration PC. The **Main Menu** should be displayed. As shown in Figure 4–46, select the third option, **Print, Archive, and Retrieve Calibration Data**, then click the ⟨**Proceed**⟩ button.

14. The **3451 Count Acquisition SubMenu** shown in Figure 4–47 is displayed. The first option allows you to archive and print a report for the currently active calibration, if it has not been archived yet. As shown in Figure 4–47, this option lists the serial number of the currently active calibration; in this example, it is serial number *2*. Select the first option and click the ⟨**Proceed**⟩ button.

15. The software displays a message box that asks the user to ensure that the active calibration has passed the QA portion of the calibration procedure before archiving the results. Since the QA process has already been performed, click ⟨**OK**⟩ on this message box.

16. The software now prompts the user to enter his/her initials. This information will be saved with the archived calibration information. Enter your initials (at least two, but no more than three) and click ⟨**OK**⟩.

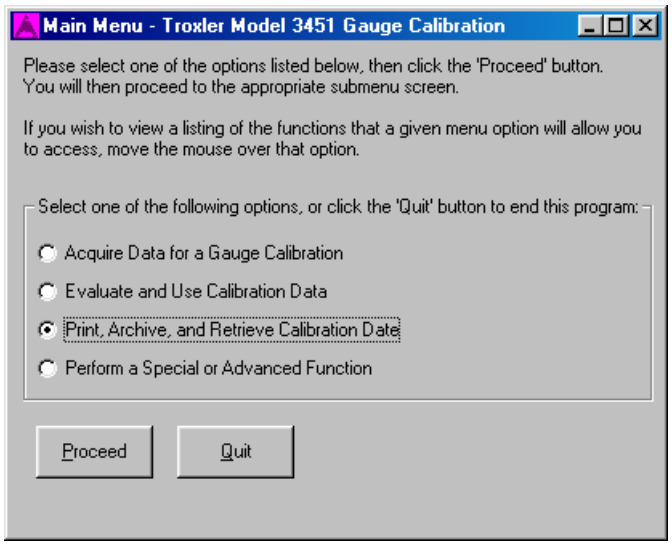

Figure 4–46. Main Menu, Print, Archive, and Retrieve Calibration Data Option Selected

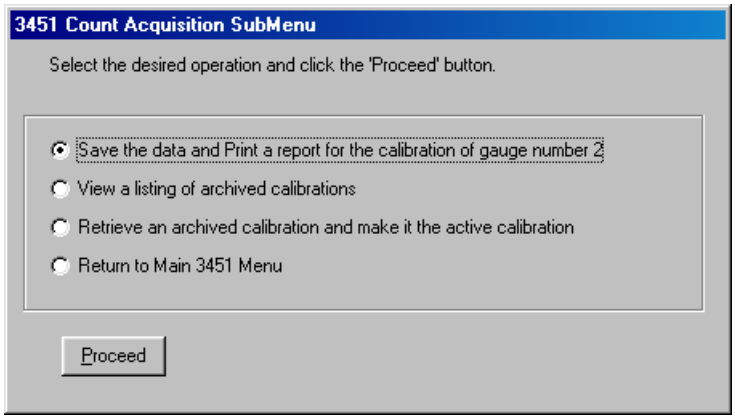

Figure 4–47. Data Retrieval and Archival SubMenu

17. After the user has entered valid initials, the calibration data record for the active calibration is archived to the calibration data file on the calibration bay computer. When the archival is complete, the software displays a message box confirming that the active calibration has been saved to the archived data file. The message box also informs the user that he/she needs to print the calibration report as well. Click the ⟨**Proceed**⟩ button to continue.

18. At this point, the program generates two calibration reports, one in metric units (kilograms per cubic meter and millimeters) and one in imperial units (pounds per cubic foot and inches). After a few seconds, the metric version of the report is displayed for review, as shown in Figure 4–48. To switch between metric and English units, select the appropriate radio button in the **Display Calibration As** box. Select the units (all new gauges use metric reports) and click the ⟨**Print Calibration Sheets**⟩ button.

19. Before printing the report, the user is asked to select the printer to use and the number of printouts to generate. Use the default printer and the default number of printouts (two).

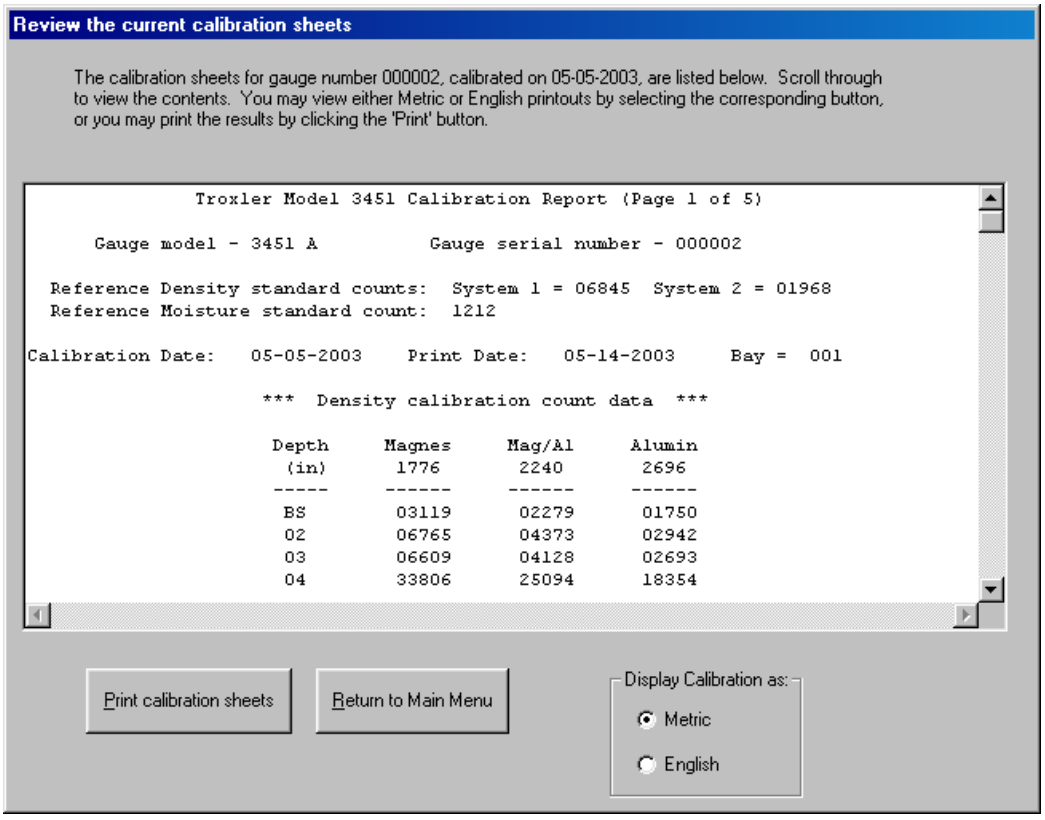

Figure 4–48. Calibration Report Review Screen

20. When prompted if you wish to print tables, always answer "*No*" unless the customer has specifically asked for tables. In the very rare case that the user wants tables, answer "*Yes*."

21. Wait for the report(s) to complete their printing, then click the ⟨**Return to Main Menu**⟩ button on the screen shown in Figure 4–48. The software returns to the **3451 Count Acquisition SubMenu** shown in Figure 4–47. Note that, unlike in Figure 4–47, the first option is no longer available.

22. From the **3451 Count Acquisition SubMenu**, select the fourth option, **Return to Main 3451 Menu**, then click the ⟨**Proceed**⟩ button.

23. The program now returns to the **Main Menu**. Note that, unlike in Figure 4–46, the second option on the **Main Menu** is no longer available.

24. Collect the calibration reports that were just printed. Keep one report for archival at Troxler, and put one report aside to be shipped to the customer. For the copy of the calibration report to be shipped to the customer, remove and discard the un-numbered sheet with the heading << *FACTORY USE ONLY*>>. This sheet can be retained for the copy that is kept here for archival at Troxler.

The calibration process is now complete.

LICENSE STATUS CAPTION

The Troxler 3451 Calibration Software package must be registered with Troxler to be fully operational. When the software is registered, a license is issued. This license is valid for a negotiated number of calibrations (between 1 and 99) and a specific time period. The license, therefore, can expire in two ways: the total number of negotiated calibrations can be exceeded, or the negotiated time period can be exceeded.

When the Troxler 3451 Calibration Software is run, the **Main Menu** is displayed. The bottom third of the **Main Menu** contains a *License Status Caption.* This caption informs the user – whenever the program is run – what the current status of the license is and whether the license must be upgraded immediately or in the near future.

If the software has not been registered, the **Main Menu** looks similar to the example in Figure 4–49.

Note that the License Status Caption has a red background with white letters, and a *CRITICAL* status. The text informs the user that the software is unregistered and provides instructions on correcting the situation. Also note that, since the software is unregistered, the ability to acquire new calibration data is unavailable, so the user cannot start a new calibration.

When the software is registered with Troxler, the user is assigned a specific number of calibrations that can be performed with the software and a specific date range in which these calibrations can be performed. After the registration process is completed, the **Main Menu** looks similar to the example shown in Figure 4–50.

Note that the License Status Caption has a green background with black letters, and a *Normal* status. The *Normal* status denotes (a) the software has been registered, (b) there are more than one new calibrations still available on the license, and (c) the license expiration date is more than 30 days away from the current date.

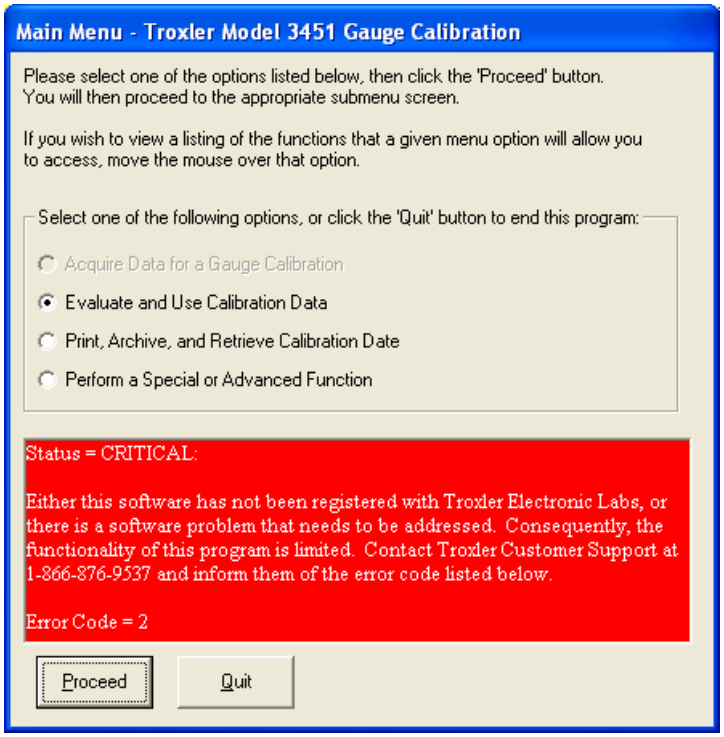

Figure 4–49. Main Menu for Unlicensed Software

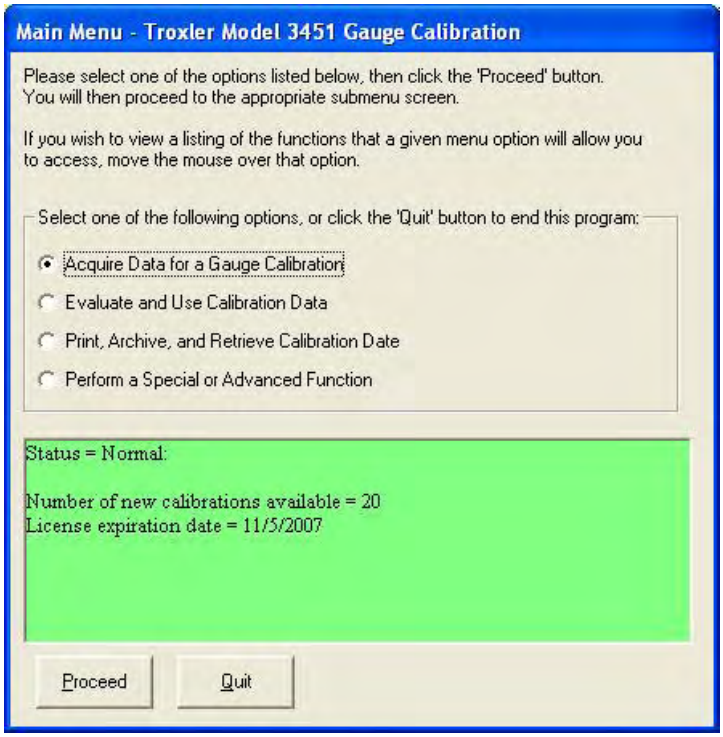

Figure 4–50. Main Menu for Licensed Software, Normal Status

The License Status Caption will continue to stay green until either the number of available calibrations reaches one or less, or the current date is less than thirty days from the license expiration date. When there is only one new calibration available on their license, the **Main Menu** looks similar to the example shown in Figure 4–51.

Note that the License Status Caption has a yellow background with black letters, and an *Attention needed* status. The caption then goes on to explain why attention is needed – there is only one new calibration still available. Note that the **Acquire Data for a Gauge Calibration** option is available, thereby allowing the user to perform this remaining calibration.

If more than one calibration remains on the license, but the license expires in less than 30 days, the **Main Menu** looks similar to the example shown in Figure 4–52. Note that the License Status Caption again has a yellow background with black letters, and an *Attention needed* status, but the text reflects the different license status. The caption explains why attention is needed – the license will expire in seven days. Note that the **Acquire Data for a Gauge Calibration** button is available since there are still four remaining calibrations on the current license.

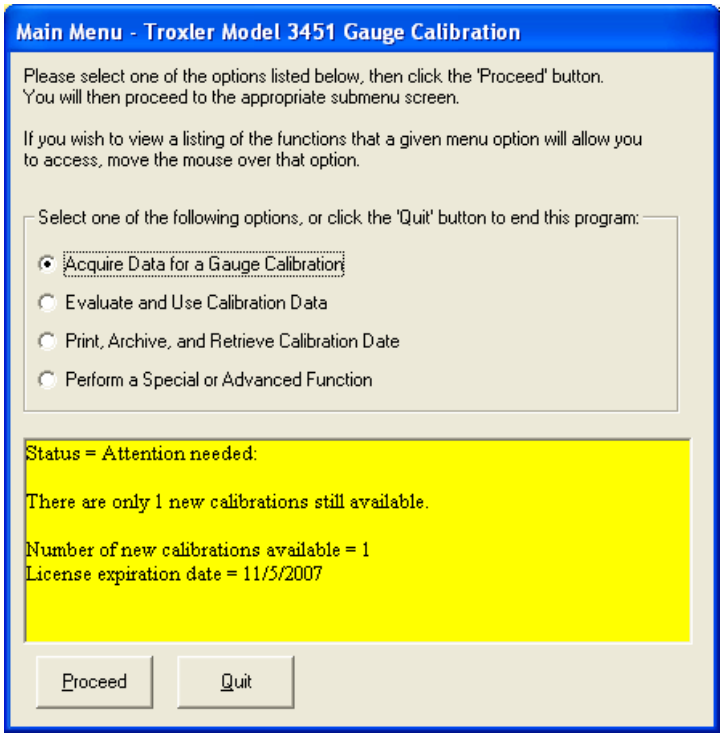

Figure 4–51. Main Menu, Only One Calibration Left on License

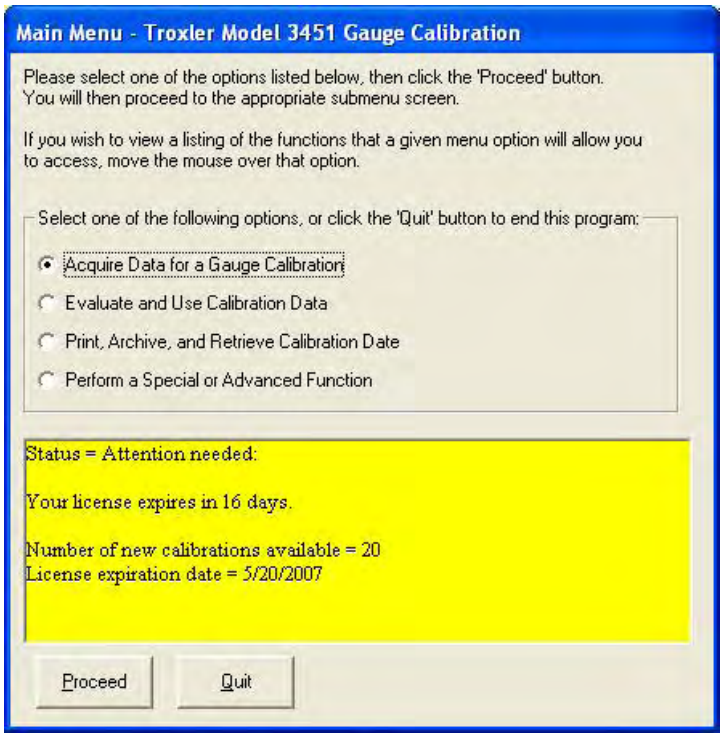

Figure 4–52. Main Menu, License Expires in Less Than 30 Days

If the user tries to run the software after the license has expired, the **Main Menu** looks similar to the example shown in Figure 4–53.

The License Status Caption has a red background with white letters, and a CRITICAL status. The text informs the user that the software expiration date has been exceeded and instructs the user how to correct this situation. Also note that, since the software license has expired, the ability to acquire new calibration data is unavailable, so the user cannot start a new calibration.

Similarly, suppose that the user has performed all of the calibrations authorized by the license before the expiration date. The software license will still end. If the user tries to run the software, the **Main Menu** looks similar to the example shown in Figure 4–54.

Note that the License Status Caption again has a red background with white letters, and a *CRITICAL* status. The text informs the user that the allocated number of calibrations negotiated with the current license have been exhausted, and instructs the user how to correct this situation. Also note that, since the software license has expired, the ability to acquire new calibration data is unavailable, so the user cannot start a new calibration

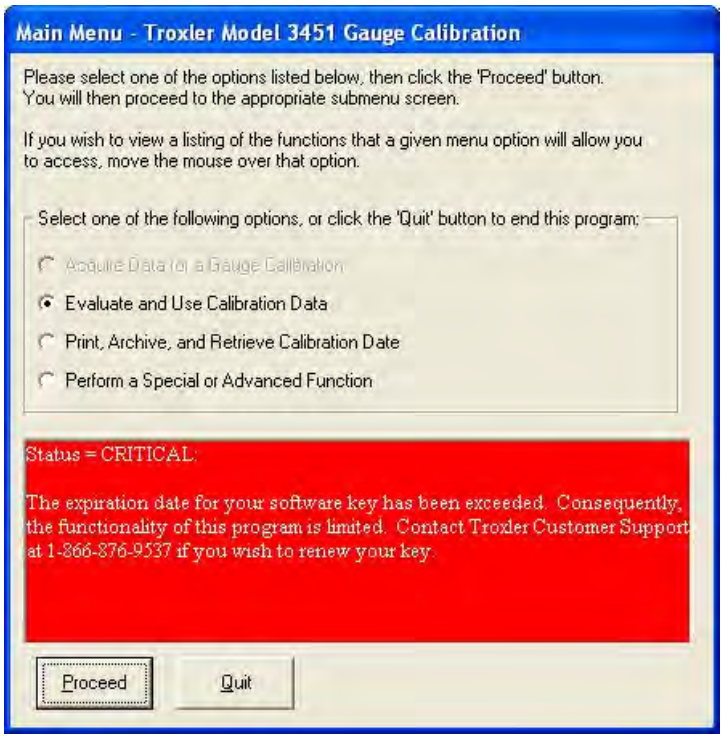

Figure 4–53. Main Menu, License Has Expired

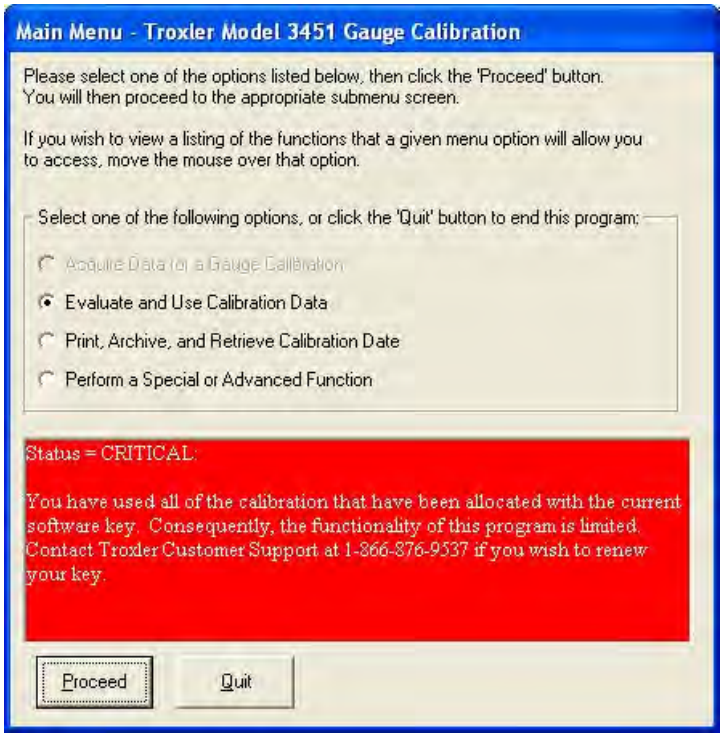

Figure 4–54. Main Menu, All Calibrations Have Been Used

CALIBRATION PROCEDURE OUTLINE AND CHECKLIST

- ❑ Connect gauge to the RS-232 *straight-through* cable (*not* a null modem cable). This cable should be connected to Com port 1 of the computer.
- ❑ Turn on gauge and allow it to power up and complete the self-test. If the gauge is new, make sure that it has had four hours to warm up.
- ❑ Go to the calibration bay computer and run the 3451 calibration program on the calibration bay computer.
- ❑ Select the **Acquire Data for a Gauge Calibration** option from the program's **Main Menu**.
- ❑ Select **Start a new Model 3451 Calibration** from the **3451 Count Acquisition Submenu**.
- ❑ Answer the queries about whether the gauge is new (never been calibrated before).
- ❑ If the gauge is a recalibration, answer the query regarding where the thin layer constants will be taken from and follow the instructions from the program for entering them accordingly. The preferable way to enter the thin layer constants into the program is to download them from the gauge.
- ❑ Fill in the form that asks more specific questions about the calibration to be performed.
- ❑ Follow the program's instructions regarding the flash memory clearing and the depth strip calibration.
- ❑ Conduct a successful stat test.
- ❑ Consult *Calibration Inspection Limits* to ensure that the gauge density and moisture average standard counts from the stat test meet these limits.
- ❑ Collect all required calibration counts as prompted by the software.
- ❑ Conduct a successful drift test.
- ❑ Compute the calibration constants (choose the **Evaluate and Use Calibration Data** option from the **Main Menu** and follow the prompts).
- ❑ Make sure that the applicable listed performance parameters meet the Calibration Inspection Limit criteria.
- ❑ Download the calibration constants into the gauge (choose the **Evaluate and Use Calibration Data** option from the **Main Menu** and follow the prompts).
- ❑ Print a *Calibration Accuracy Check Form* (choose the **Perform a Special or Advanced Function** option from the **Main Menu** and follow the prompts).
- ❑ Clear the project storage file in the gauge (choose the **Perform a Special or Advanced Function** option from the **Main Menu**, then choose the **Depth Strip/Baseboard checks and functions** option from the **Special Functions Submenu**, and follow the prompts).
- ❑ Connect the Bluetooth wireless serial adapter into the gauge's RS-232 port, and turn on the Intermec® 700 Series Color Mobile Computer (PDA) that goes with the gauge.
- ❑ Initiate the 3451 RoadReader Plus program on the PDA and abort the warmup period.
- ❑ Turn off the GPS.

- ❑ Go from the **Diagnostics Menu** to the **Service Menu** (**Service Menu** code = *1961*) and click the ⟨**Calib Const.**⟩ button. Upload the calibration constants from the gauge to the PDA using the *Automatic* option.
- ❑ Also from the **Service Menu**, enter the gauge type (index rod type).
- ❑ Run the Calibration Accuracy Tests (QA Test) successfully from the PDA.
- ❑ Turn the GPS back on.
- ❑ Run the Registry Save on the PDA.
- ❑ Remove the batteries from the PDA.
- ❑ From the calibration program, archive the calibration and print the calibration reports (choose the **Print, Archive, and Retrieve Calibration Data** option from the **Main Menu** and follow the prompts).
- ❑ File one copy of the calibration report, and put the other with the gauge.