TROXLER TRAINING
Model : 3430-Plus / 3440-Plus

GAUGE GEOMETRY

GAMMA SOURCE
(DENSITY)
CI 8mCi

GAMMA DETECTOR
TUBES

NEUTRON SOURCE
(MOISTURE)
AM-241-BE
40 mCi

NEUTRON DETECTOR
TUBE

GAUGE CALIBRATION

COUNTS

1200

2600

3200

4000

0   500   1000   1500   1750   2000   2500

A   B   C

KG PER CUBIC METRE

TROXLER 3430-Plus/3440-Plus GAUGE SHOWING ROD POSITIONS

SAFE POSITION (Use for Storage and Standard Counts)

INDEXER TRIGGER

BACKSCATTER POSITION

50 mm (2 in)

SOURCE ROD

INDEX ROD

DIRECT TRANSMISSION POSITIONS

300 mm (12 in)
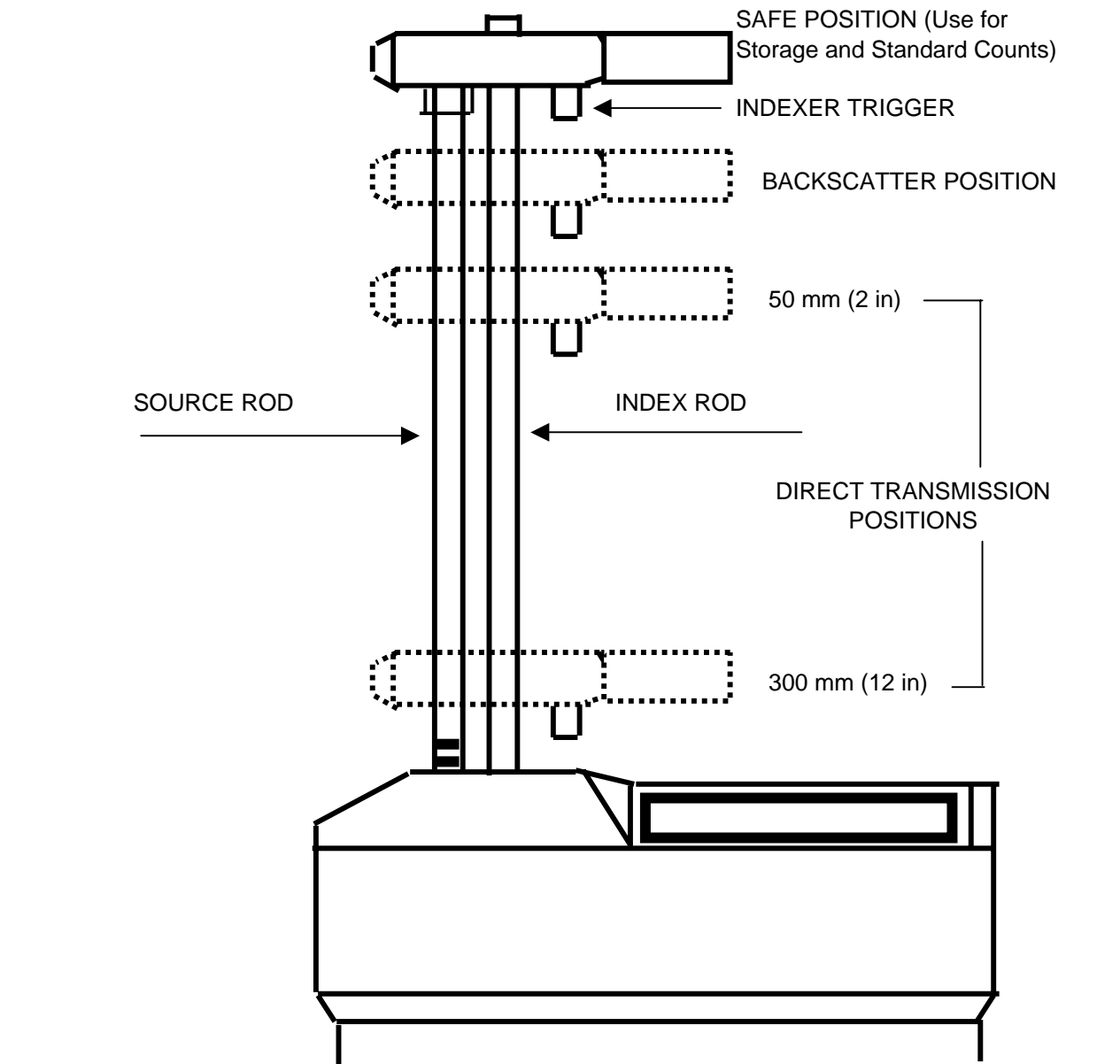
Place the gauge on the reference standard block as shown in Figure 2-2, making sure the block top and gauge base are clean and smooth, with no soil or other material to prevent good surface-to-surface contact. The gauge must be positioned between the raised edges of the block and with the right side of the gauge firmly seated against the metal butt plate on the block.

MOISTURE MODE
Depth of Measurement

SURFACE

50 mm

100 mm

150 mm

200 mm
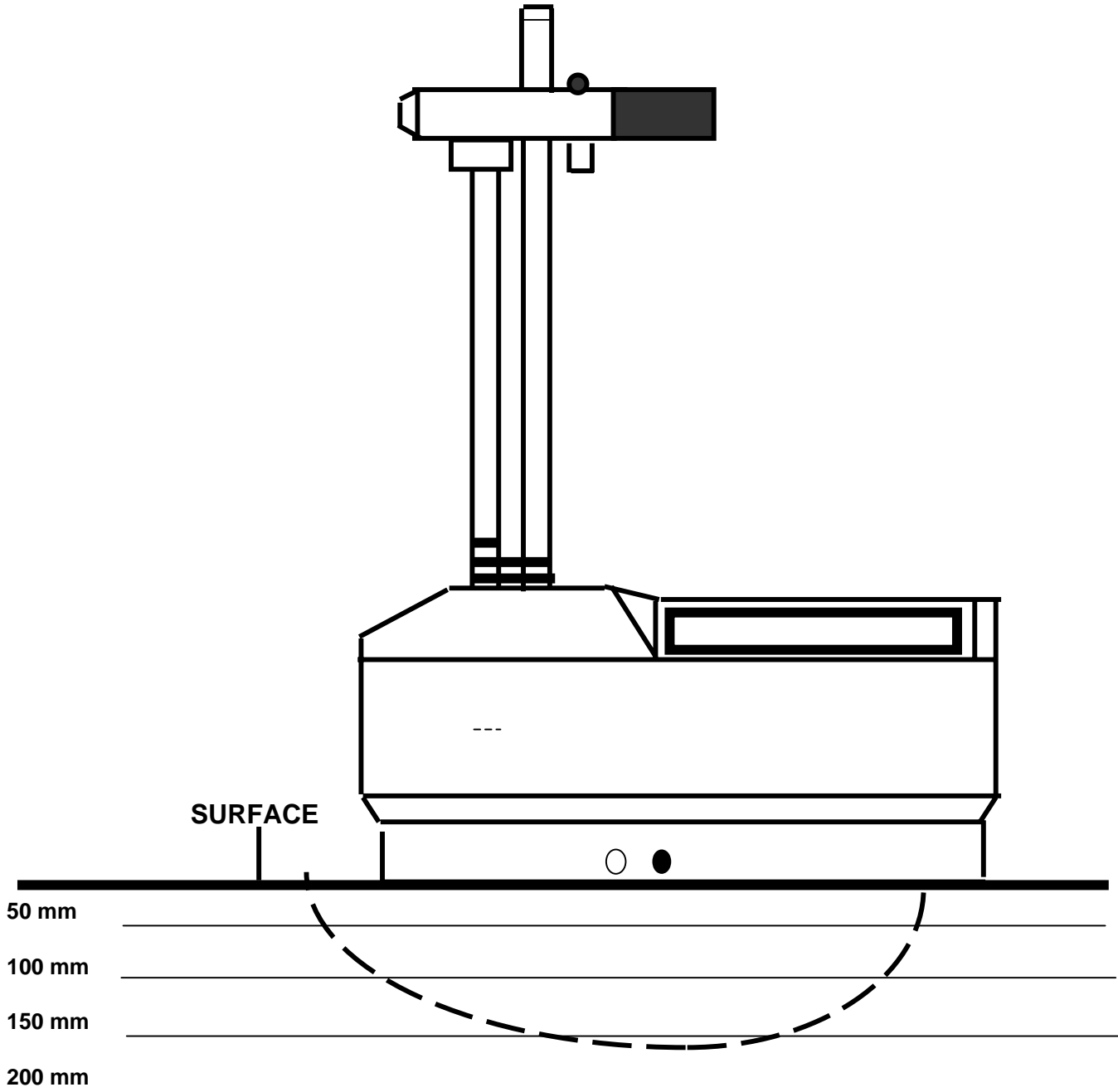
Effect of Moisture on Depth of Measurement
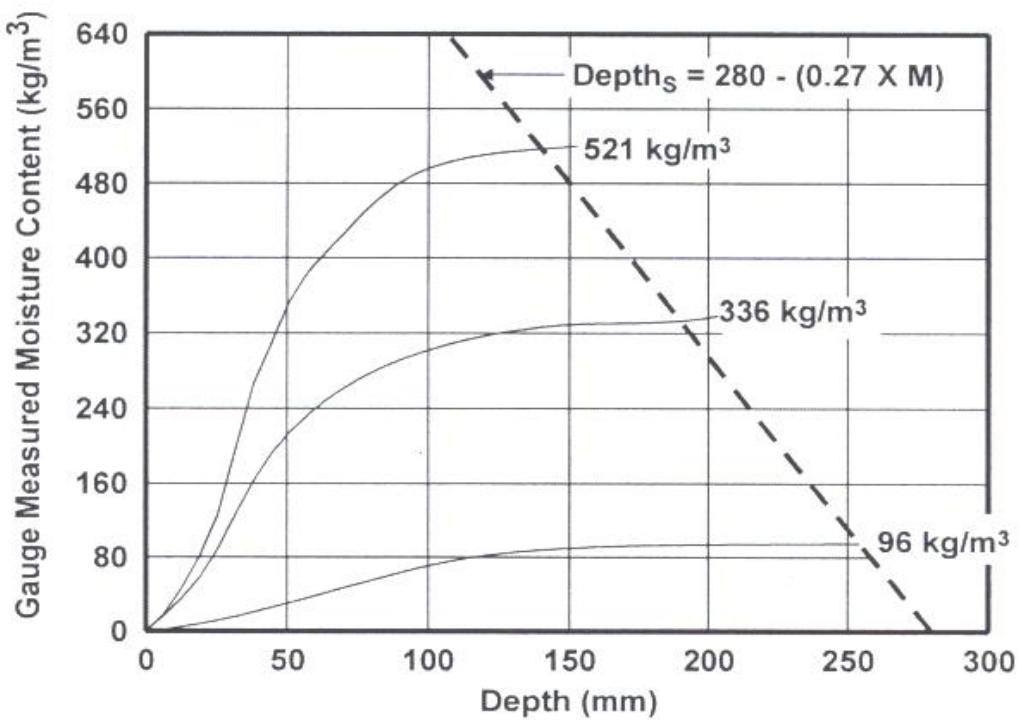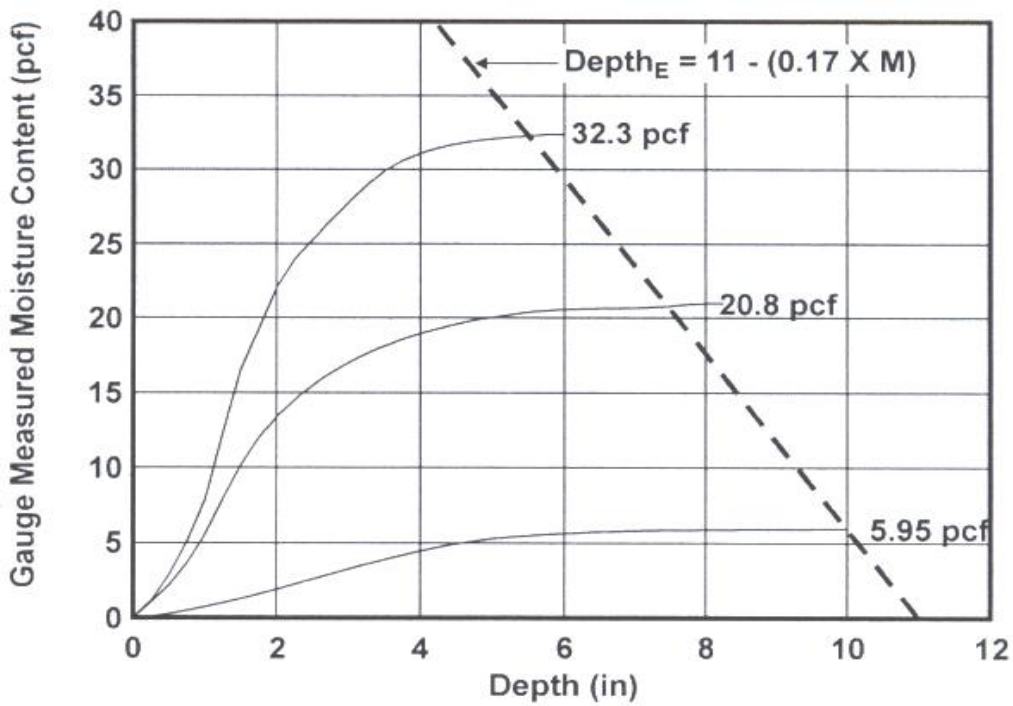
The dotted lines indicate the maximum depth of gauge measurement at a given soil moisture content.

BACKSCATTER MODE

SURFACE
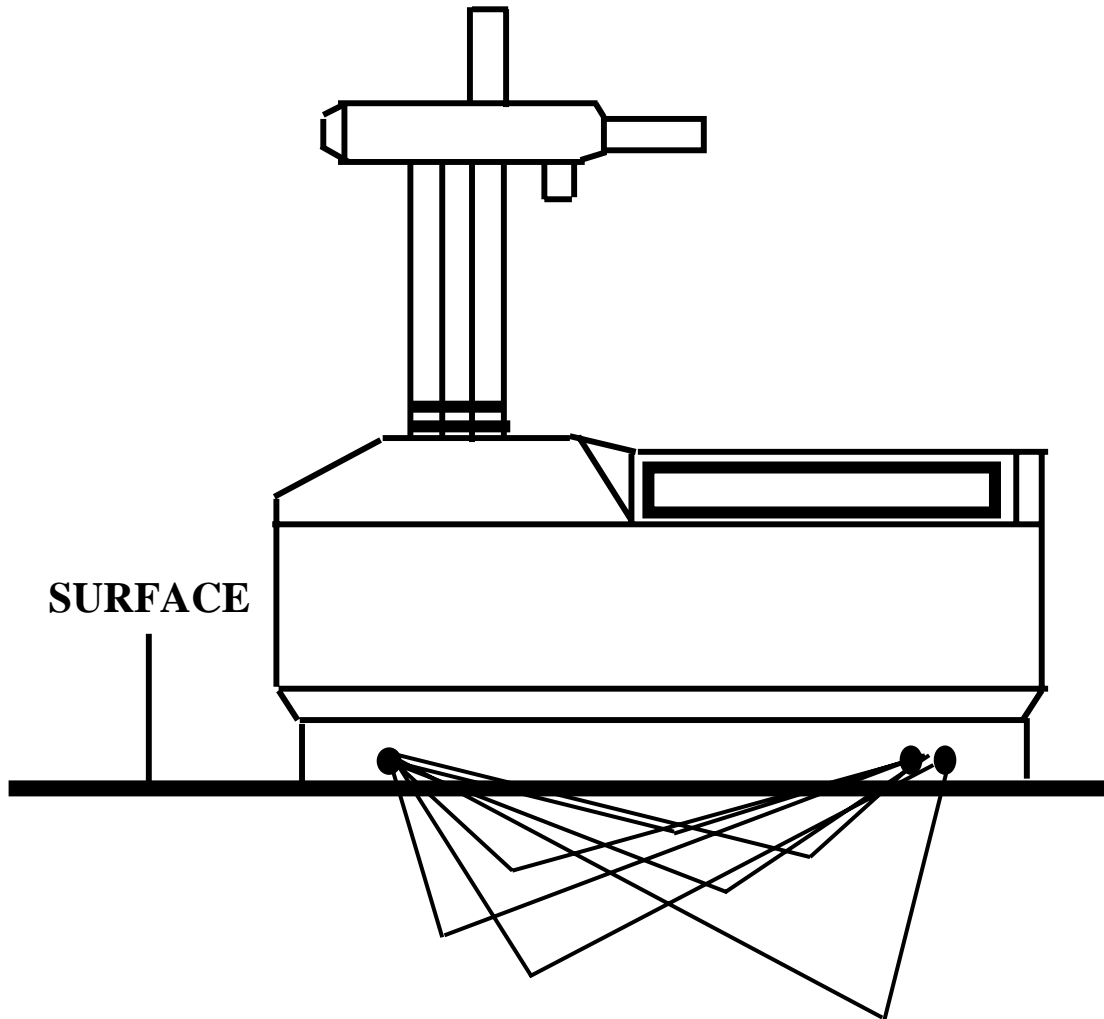
BACKSCATTER MODE
Depth of Measurement

DEPTH

SURFACE

AFFECT

25 mm	50%
50 mm	30%
75 mm	15%
100 mm	5%
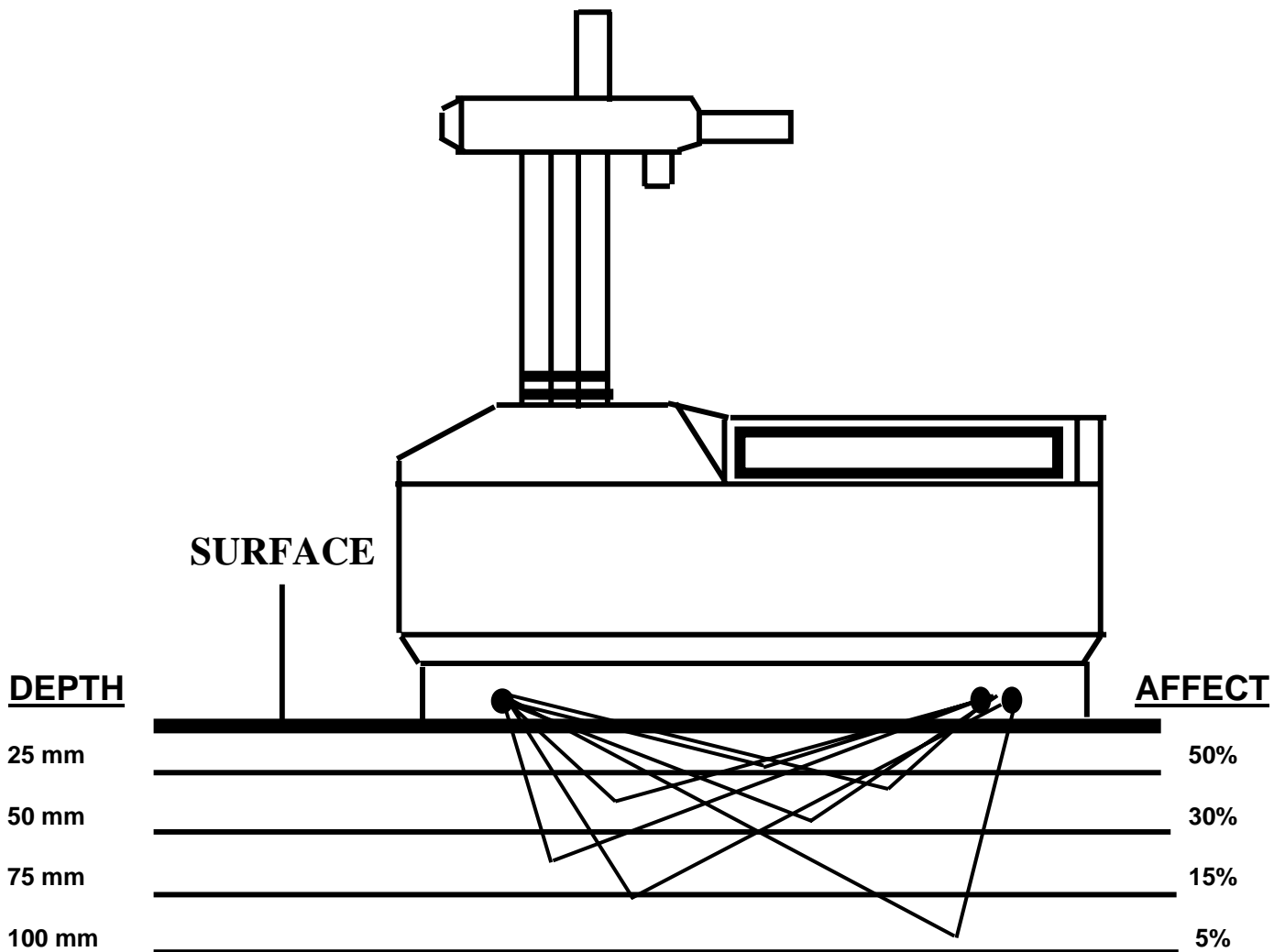
BACKSCATTER
(Depth of Top Layer)

Chart plotting TOP LAYER EFFECT (y-axis, 0% to 100%) versus DEPTH OF TOP LAYER (MM) (x-axis, 0 to 110).
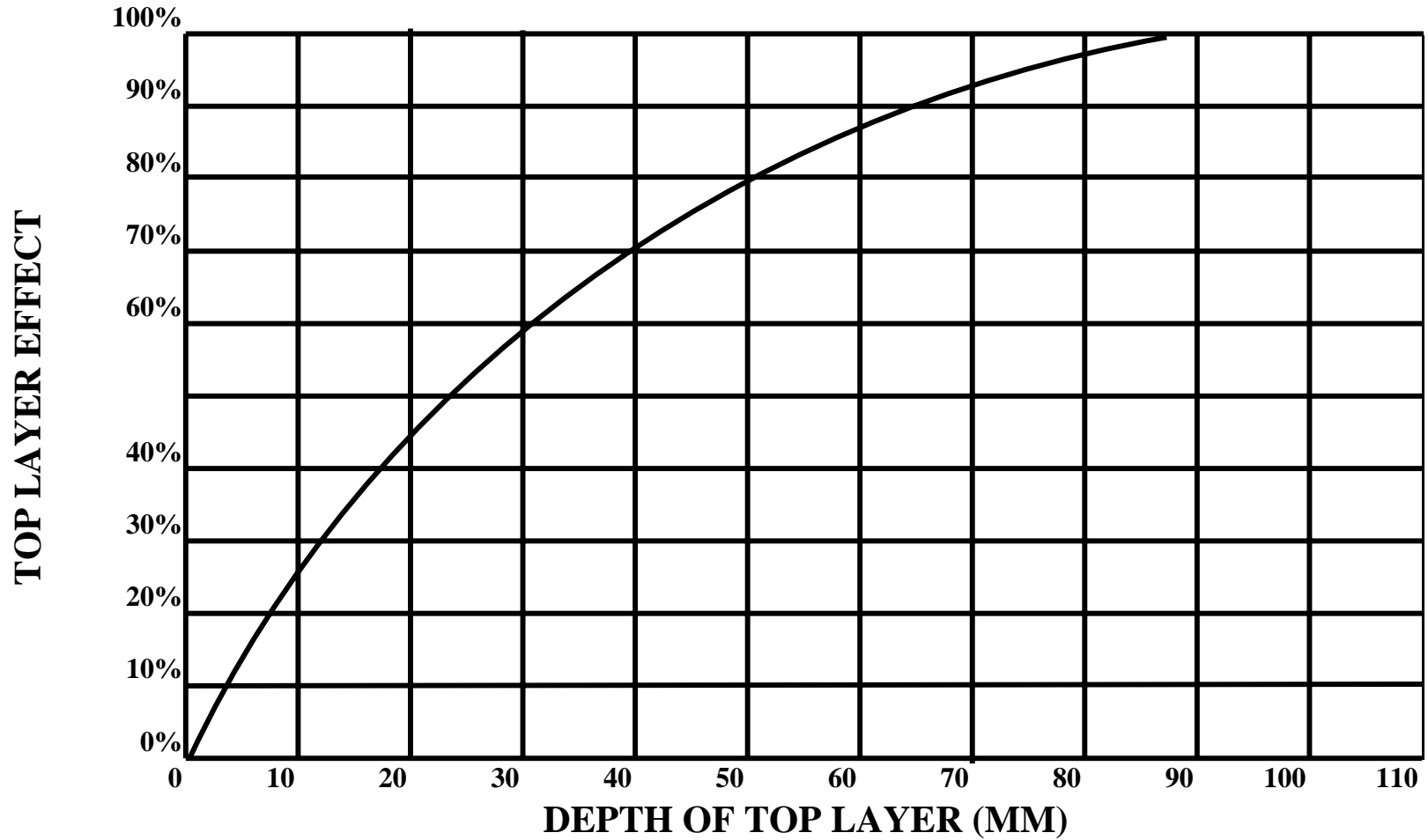
DIRECT TRANSMISSION GEOMETRY

GAUGE

SURFACE

DETECTORS

PHOTON PATHS

SOURCE

Min = 50 mm (2 in)

DIRECT TRANSMISSION MODE

SURFACE

DEPTH

50 mm

100 mm

150 mm

200 mm

250 mm

300 mm
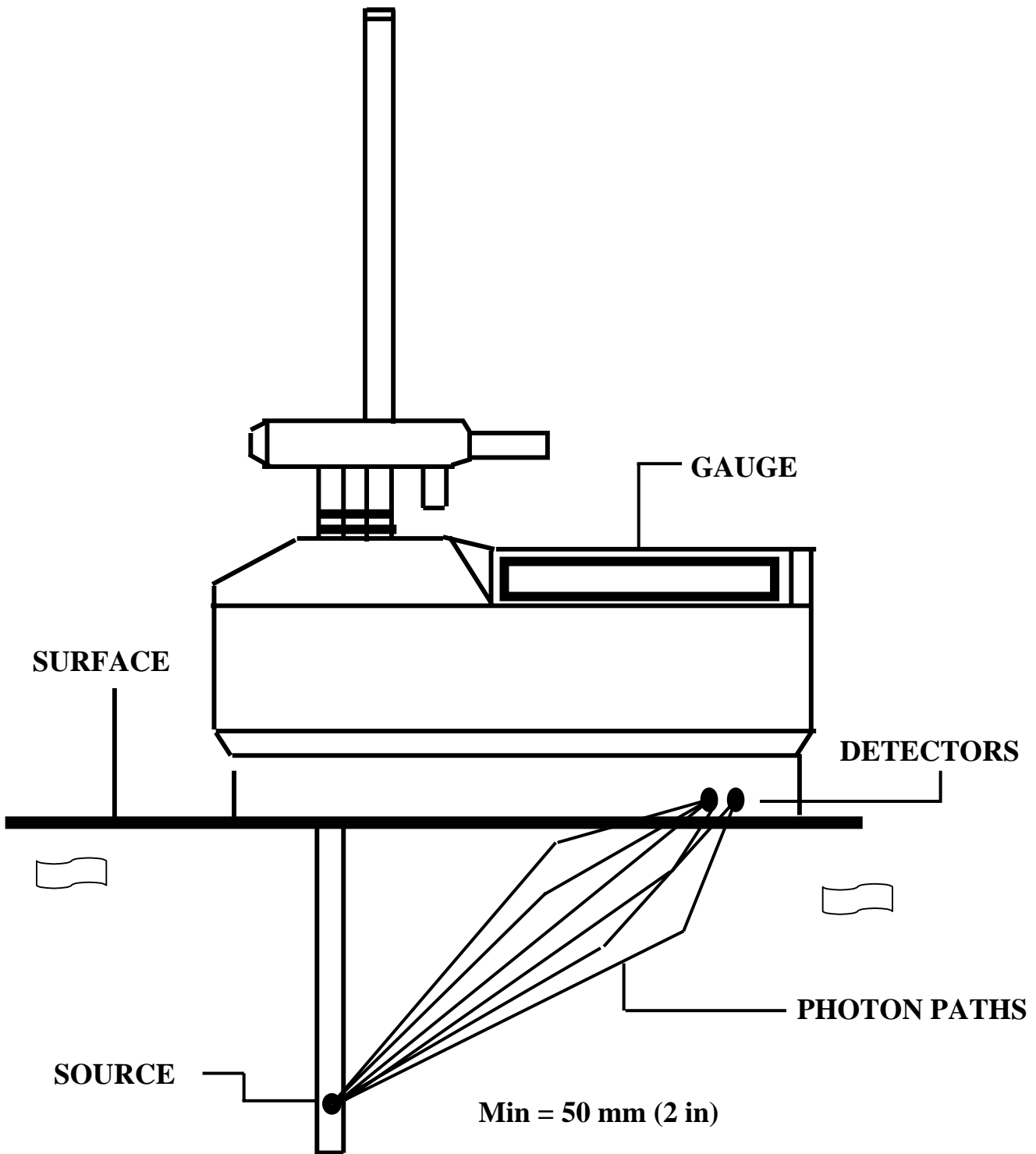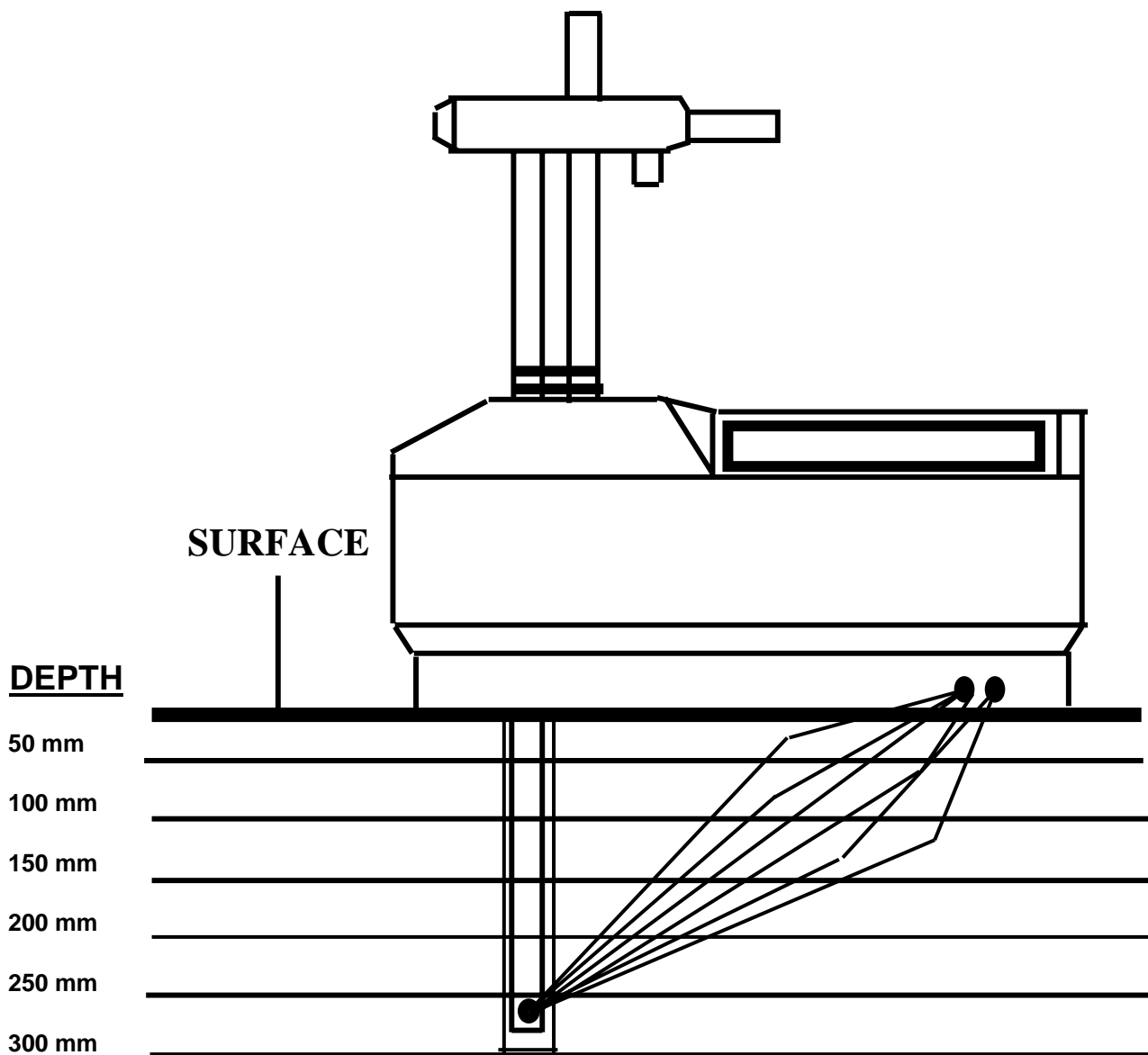
Criteria prior to taking a Measurement in Direct Transmission Mode

SURFACE

Probe against side of hole

50mm   Minimum Gap Below Probe

REMOTE KEYPAD
(MODEL 3440 PLUS ONLY)

TRIGGER

SOURCE ROD

EXTERNAL BEEPER
(MODEL 3440 PLUS ONLY)

POWER
SWITCH

DISPLAY

KEYPAD

POWER SWITCH

3440 Plus™

```
                -Ready-
04-08-2007 10:39 AM
Prj: TROXLER
        Press <START>
```

TROXLER

USB PORT*

BATTERY
CHARGING
INDICATOR

CHARGER
CONNECTOR

A STORE	B RECALL	C LIGHT	D YES	E NO	ESC
F PROJ	G STATUS	H 7	I 8	J 9	BACK SPACE ←
K SETUP	L OFFSET	M 4	N 5	O 6	P + ⬆
Q TARGET	R MODE	S 1	T 2	U 3	V - ⬇
W STD	X SPACE	Y 0	Z °	ALPHA LOCK	ENTER START

RS-232 PORT

* The USB port is included only on the Model 3440 Plus.

Table 3–1. Keypad Functions

KEY	FUNCTION	PAGE
⟨STORE⟩	Store the most recent data in the current project file.	4–13, 4–16, 8–14
⟨RECALL⟩	Display the most recent data.	4–17
⟨PROJ⟩	Select or create a project file and view, output, or erase project data file.	8–2
⟨STATUS⟩	Displays gauge status information.	3–9
⟨SETUP⟩	Displays the gauge **Setup** menu.	5–3
⟨OFFSET⟩	Enable, disable, or change a density, moisture, or trench offset.	7–2
⟨TARGET⟩	Select, enter, or disable a Gmb (Marshall), Proctor, or Gmm (Voidless density) value.	6–2
⟨MODE⟩	Select the measurement mode, *Asphalt* or *Soil*.	3–15
⟨STD⟩	Take a standard count.	4–2
⟨SPACE⟩	Enter a space.	
⟨LIGHT⟩	Manually toggle the LCD and keypad backlights on and off.	3–16
⟨YES⟩	Respond *yes* to *yes/no* questions.	
⟨NO⟩	Respond *no* to *yes/no* questions.	
⟨ESC⟩	Return the display to the *Ready* screen without storing or updating the data.	
⟨0⟩ .. ⟨9⟩	Enter numbers and access menu options.	
⟨.⟩	Enter a decimal point.	
⟨ALPHA LOCK⟩	Access the letters.	
⟨BACK SPACE⟩	Moves cursor back one space.	
⟨↑⟩, ⟨↓⟩	Scroll through menu options or view screens.	
⟨ENTER/START⟩	Accept data entry or begin a measurement.	
⟨A⟩ .. ⟨Z⟩	Enter letters. Access these keys by first pressing ⟨**ALPHA LOCK**⟩.	

STANDARD COUNT

NOTE:

Always take standard counts using the reference standard block provided with the gauge.

Before taking a standard count, ensure that the gauge base and reference standard block are dry and free of debris.

Choose a standard count site that meets the following criteria:

- A smooth surface such that the reference standard block does not rock

- At least 3 meters (10ft) from any large vertical surface

- At least 10 meters (33 ft) from any other radioactive source

Turn the gauge on. At the ***Ready*** display, press the ***<STD>*** key. The gauge displays the last standard counts for density (DS) and moisture (MS).

```
Standard Count
DS = ####
MS = ####
Take New Count?
```

NOTE:
The *<STD>* key is active only when the Ready Screen is displayed.

- To take a new standard count, press ***<YES>*** .

- To view the last four standard counts, press ***<NO>*** .

NOTE

Ensure that the source rod is in the standard (SAFE) position and is securely seated by *firmly* tapping down on the handle of the source rod.

BUTT PLATE

REFERENCE
STANDARD
BLOCK

BEDDING

SURFACE

AIR VOIDS
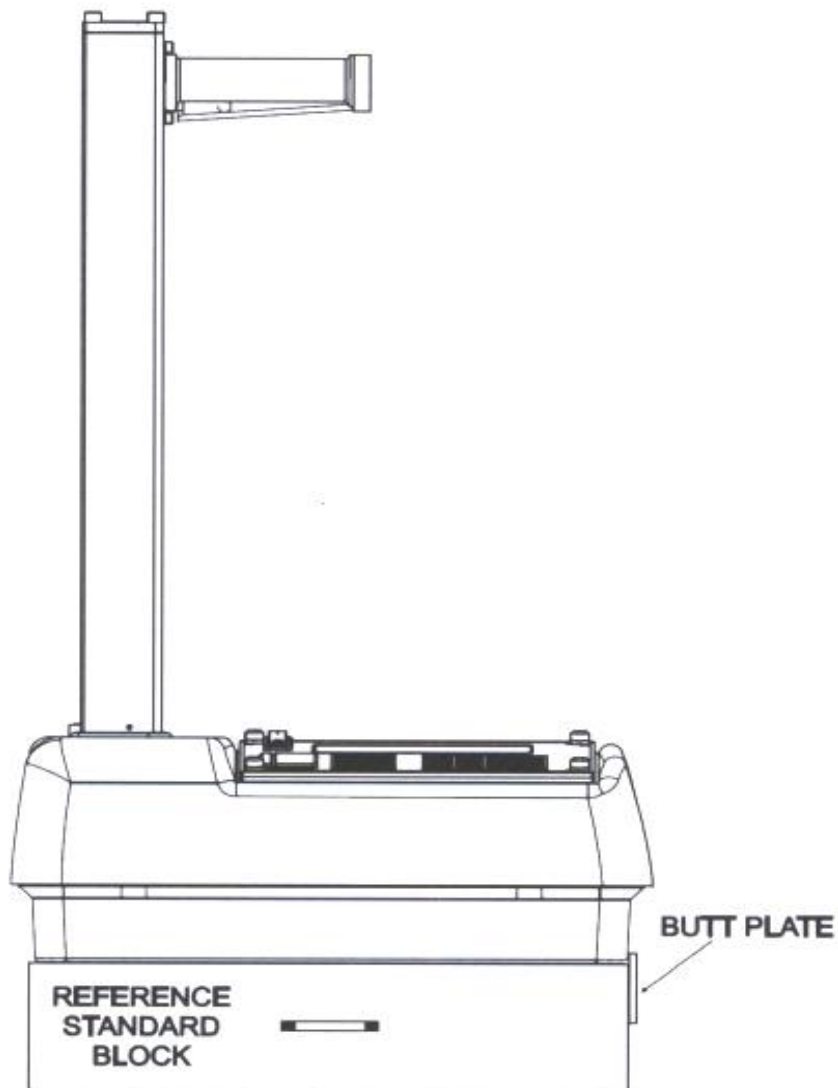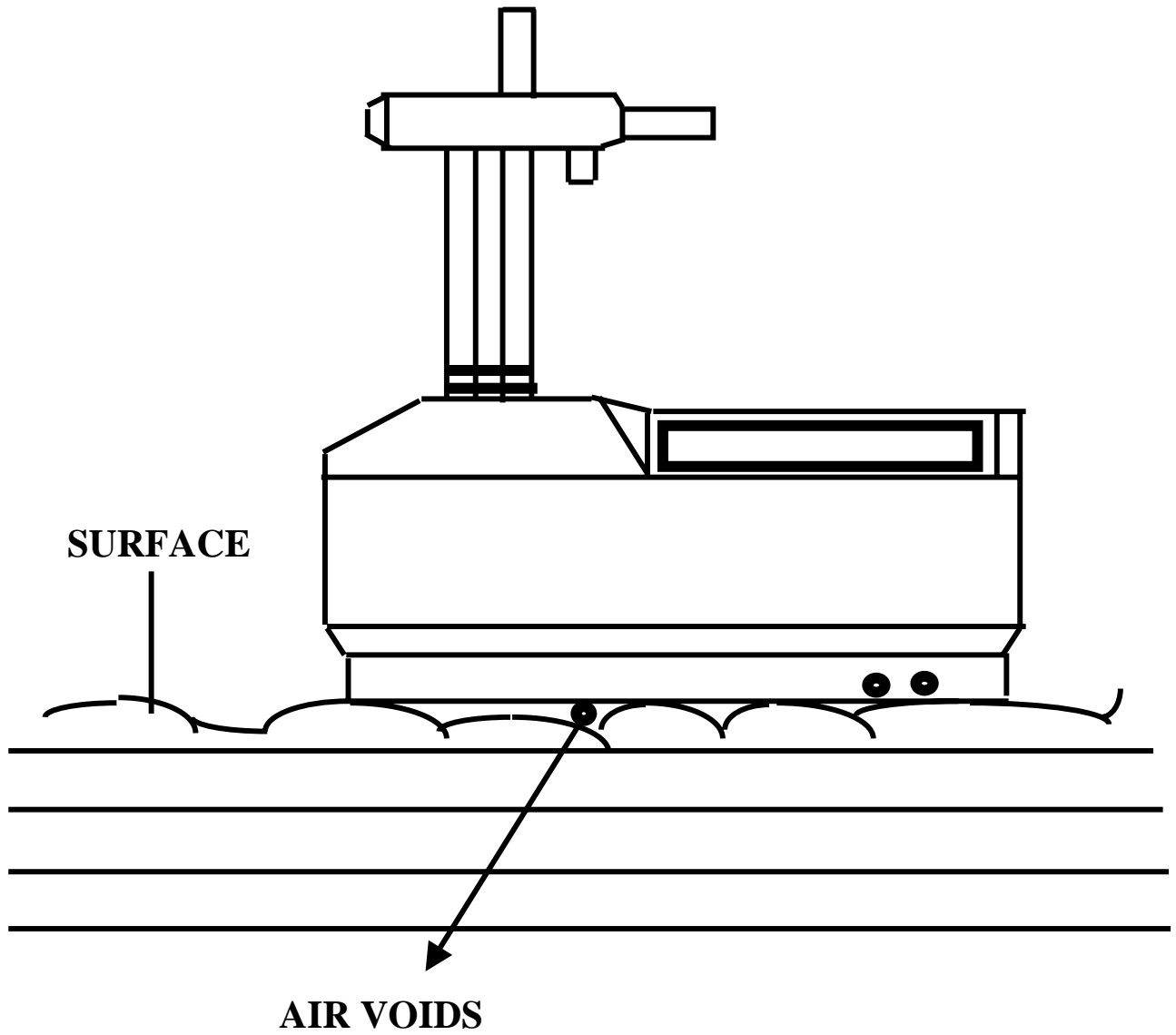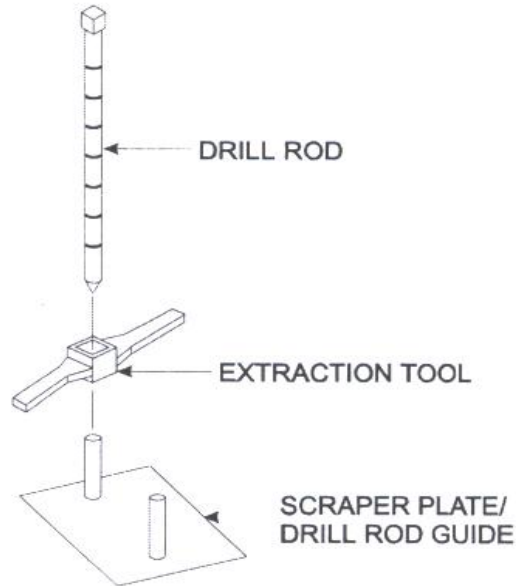
Figure 4–2. Drill Rod Assembly

✓ Remove the drill rod by pulling straight up and twisting the extraction tool. *Do not loosen the drill rod by tapping from side to side with a hammer.* Also, do not rock the extraction tool from side to side. This will distort the hole or cause loose material to fall into the hole.

✓ Carefully pick up the scraper plate.
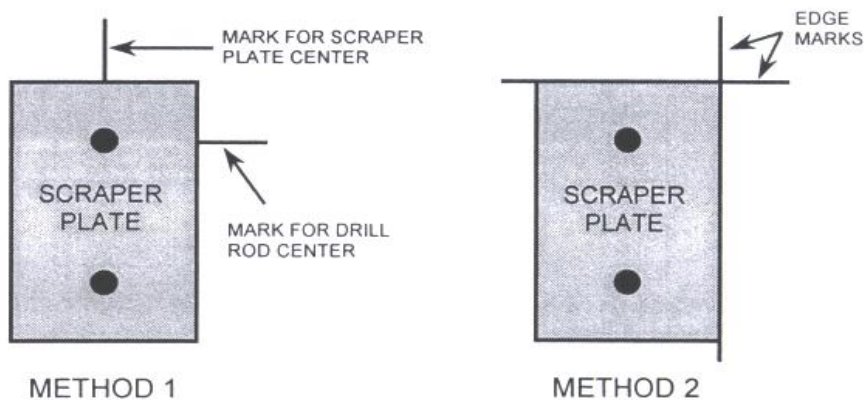
Figure 4–3. Marking the Test Area

MOISTURE CORRECTIONS FOR VARYING SOILS

MOISTURE:

The 3400 Series measures moisture by determining the hydrogen (H) content of the soil and relating this to water (H_2O) content. In some soils there are compounds other than water, which contain hydrogen. Also, there are elements in some soils, which absorbs = Hydrogen Atoms

To determine a correction factor, proceed as follows:

1) Take five or more oven dry and gauge sample pairs. Be sure oven dry samplers are at least 1000-2000 grams taken under the center of the gauge to a depth of 15-20 cm or 6-8 inches. Be sure nuclear tests are taken with the Moisture Correction set at ØØ on

2) Prepare a chart as shown below.

| Sample No.	%M Oven Dry	%M Gauge	%Oven Dry - % Gauge
	4.5	8.6	-4.1
2	4	5.8	-1.8
3	7.2	9.7	-2.5
4	6.7	8.6	-1.9
5	5.1	7.3	-2.2
Average	**5.5**	**8**	**-2.5**

The difference between the oven dry and the gauge samples is expected to vary from sample to sample due to normal variation. If the difference indicates the gauge is sometimes higher and sometimes lower than the oven dry, no correction may be needed. If

Calculate the correction factor, using the average value, as follows:

$$\text{Correction Factor} = \frac{\text{\% M Oven Dry - \% M Gauge}}{100 + \text{\% M Gauge}} \times 1000$$

Dial this value into the Moisture Correction switches on the 3411B scaler, paying attention to the algebraic sign. In the example above, the moisture correction would be as follows:

$$= \frac{-2.5}{100 + 8.0} \times 1000 = -23$$

The correction is independent of dry density and wet density and adjusts the apparent moisture to a true moisture regardless of dry density. This value can be used for all future tests on the same soil type.

Occasionally, nonhomogeneous soils may be encountered in which differences between gauge and oven dry readings are not consistent between samples. In this case, one correction factor is not practical.

TRENCH MEASUREMENTS

Sidewall Affect within 0,6 metre
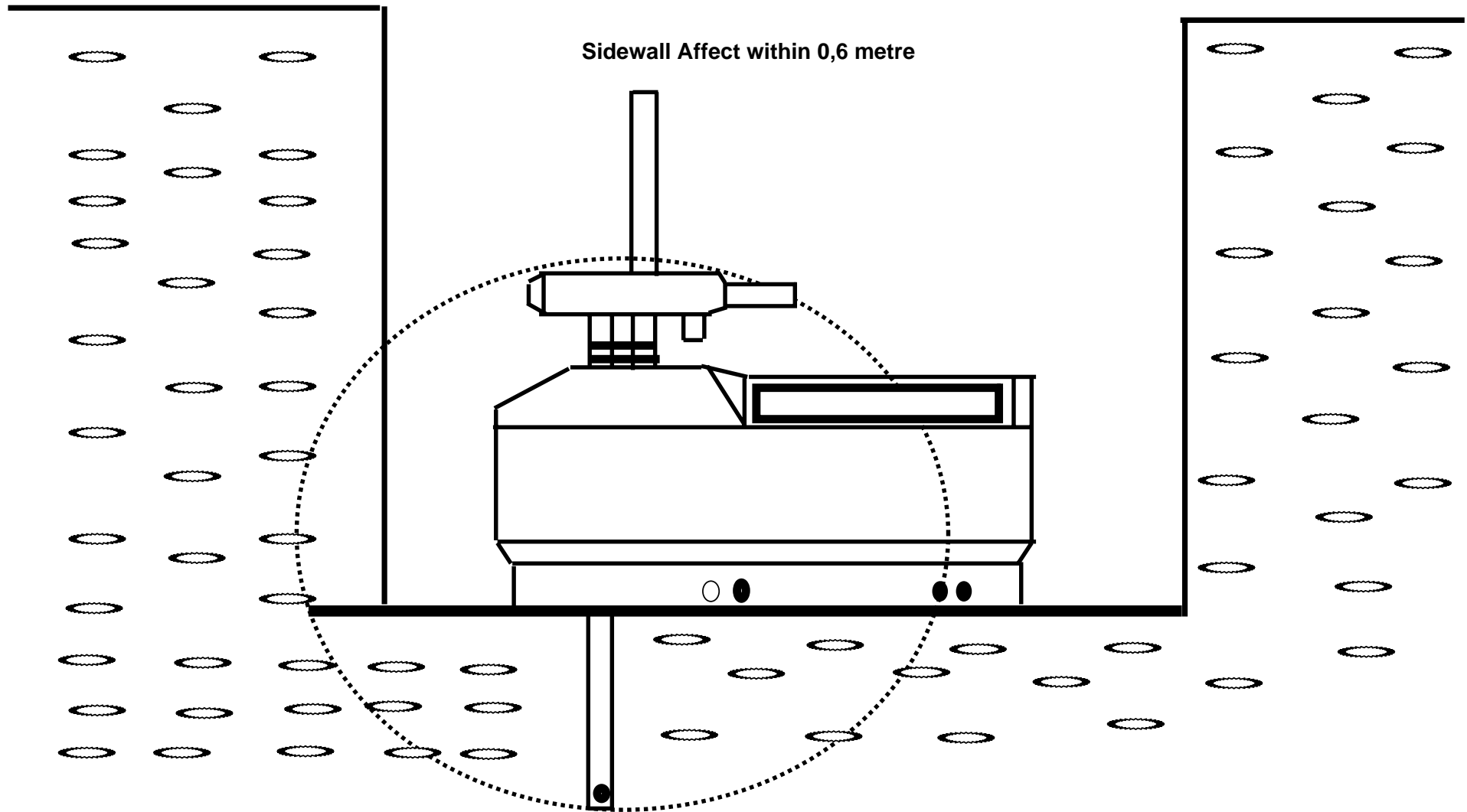
GAUGE PARTS AND ACCESSORIES

GAUGE
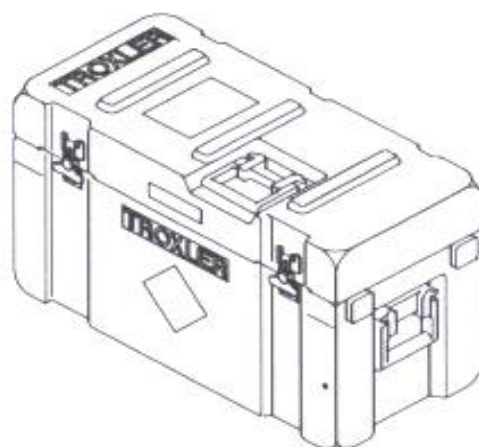
TRANSPORT CASE
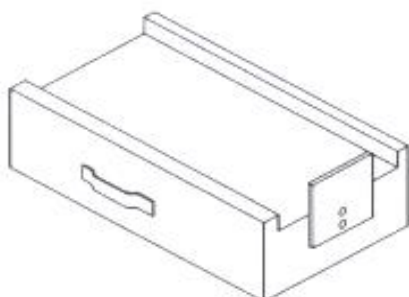
REFERENCE STANDARD BLOCK
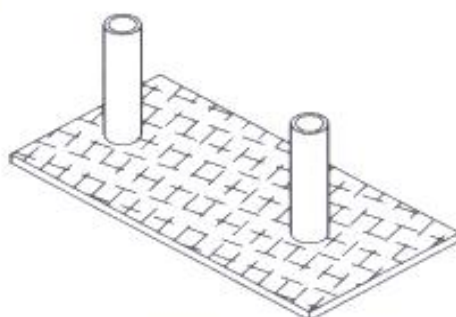
SCRAPER PLATE/ DRILL ROD GUIDE

DC ADAPTER
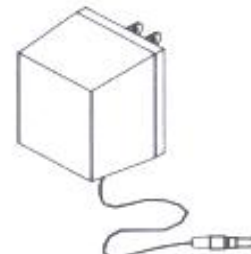
AC CHARGER

DRILL ROD

EXTRACTION TOOL
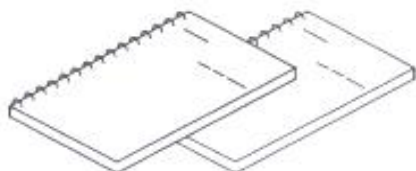
OPERATOR'S MANUAL AND TRANSPORTATION GUIDE

SOURCE CERTIFICATE AND QUICK REFERENCE CARD

1. The **Gauge** is the portable instrument containing all electronic modules, the rechargeable battery pack, detectors, and the radioactive sources.

2. The **Reference Standard Block** provides a measurement standard for standard counts. It is also used during stability and drift tests.

3. The **Drill Rod** is used to drill holes for direct transmission measurements. *Do not use the source rod of the gauge to drill holes.*

4. The **Scraper Plate/Drill Rod Guide** is used to prepare the test site and to guide the drill rod when preparing the source rod hole for direct transmission measurements.

5. The **Extraction Tool** provides leverage to remove the drill rod from soil materials.

6. The **AC Charger** and **DC Adapter** are used to charge the gauge batteries. The ac charger accepts 90 – 220 V ac, 50/60 Hz and supplies 12 V dc. The dc adapter allows recharging from an automobile cigarette lighter.

7. The **Transport Case** provided with the gauge has been approved as a Type A package. Always use this transport case when transporting or shipping the gauge.

8. The **Manual** details how to use the gauge. Both the manual and the **Transportation Guide** discuss radiation safety and gauge shipping concerns.

9. A **Printer** (optional, not shown) connects to the gauge for printing data.

10. A **Printer Cable** (optional, not shown) is used to connect the gauge to a serial printer or computer.

PROJECT MENU

The gauge can store approximately 750 readings. The *Project* and *Store* functions allow handling of measurement data. Measurement results are stored in files (memory locations) called *projects*, which are named by the operator. Projects are managed using the **Projects** menu. From this menu, the operator can select a project (make an existing project active so that additional data may be added to it), view project data, create a new project, erase projects, output project data to the selected destination (via the serial or USB port), deactivate a project, and enable the *Auto-Store* function.

To access the **Projects** menu, press ⟨**PROJ**⟩. The gauge displays:

```
        -Projects-      ↕
1. Select
2. View
3. Create
```

```
        -Projects-      ↕
4. Erase
5. Output Project
6. Set Output Dest.
```

```
        -Projects-      ↕
7. Deactivate
8. Auto-Store
```
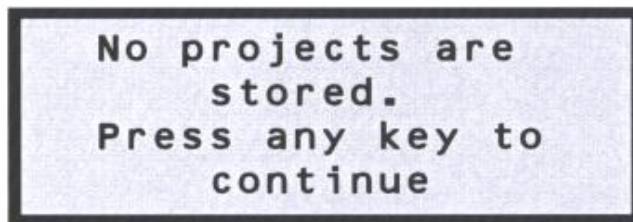
NOTE
The ⟨**PROJ**⟩ key is active only when the **Ready** screen is displayed.

Use the arrow keys to scroll through the menu options. Use the numeric keys to select a menu option. Press ⟨**ESC**⟩ to return to the **Ready** screen.

SELECT

To select an existing project, press ⟨**1**⟩ at the **Projects** menu shown on page 8–2.
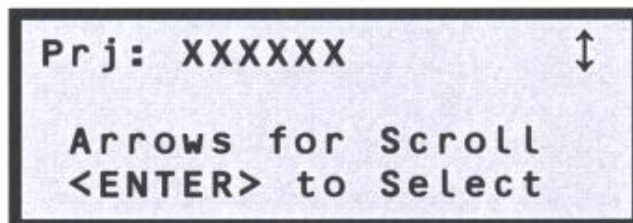
▶ If no projects have been created, the gauge displays the error message:

```
No projects are
       stored.
Press any key to
     continue
```

Press any key to return to the **Projects** menu, and create a project as described on page 8–5.

▶ If a project has been created, the gauge displays:

```
Prj: XXXXXX              ↕

Arrows for Scroll
<ENTER> to Select
```

Use the arrow keys to scroll through the names of the existing projects. When the desired project is displayed, press ⟨**ENTER/START**⟩ to select it as active. The gauge sets the selected project as active, briefly displays a confirmation message, and returns to the **Projects** menu.

CREATE A PROJECT

To create a new project, press ⟨3⟩ at the **Projects** menu shown on page 8–2. The gauge displays:

```
    Project Name   A

    _
  <ALPHA> for Letters
    <ENTER> to Exit
```
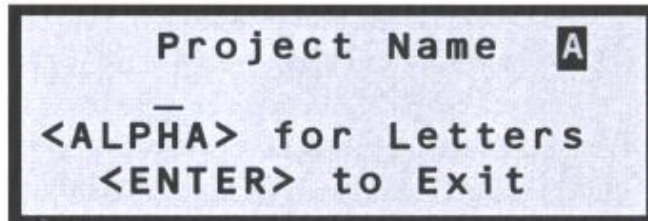
Press the ⟨**ALPHA LOCK**⟩ key to enable the alphabetic keys on the gauge. When the alphabetic keys are enabled, the symbol **A** appears in the upper right of the display, as shown above.

Enter the project name (up to twelve alphanumeric characters) and press the ⟨**ENTER/START**⟩ key. The gauge displays:

```
    Make Project
         XXX
       Active?
    <YES> or <NO>
```
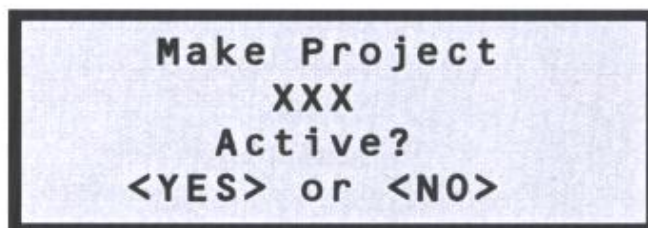
▶ To save the new project name without activating it, press ⟨**NO**⟩. The gauge saves the new project, briefly displays the name of the active project (if any), and returns to the **Projects** menu.

▶ To save the new project name and activate the project, press ⟨**YES**⟩. The gauge enables the new project, displays a brief confirmation message, and returns to the **Projects** menu.

ERASE PROJECTS

To erase either a selected project file or all project files, press ⟨**4**⟩ at the **Projects** menu shown on page 8–2. The gauge displays the **Erase** menu:

```
    Erase:
1. One Project
2. All Projects
  Press # to Select
```

▶ To erase a single project, press ⟨**1**⟩. If more than one project has been created, the gauge displays:

```
Prj: XXX              ↕

   Arrows for Scroll
  <ENTER> to Select
```

Use the arrow keys to scroll through the project names displayed on the first line. When the gauge displays the desired project, press ⟨**ENTER/START**⟩. At the **Are you sure?** prompt, press the ⟨**YES**⟩ key. The gauge erases the project and returns to the **Projects** menu.

▶ To erase all projects, press ⟨**2**⟩ at the **Erase** menu. At the **Are You Sure?** prompt, press the ⟨**YES**⟩ key. The gauge erases all the projects and returns to the **Projects** menu.

OUTPUT PROJECT

The *Output Project* function within the **Projects** menu allows the operator to print (or upload) project data stored in the gauge to a computer or serial printer connected to the serial port, or to a USB printer or flash drive connected to the USB port. To select the output destination, see page 8–10.

NOTE

The USB port is included only on Model 3440 Plus gauges.

To output project data via the 9-pin serial port, connect a serial cable to the port. Ensure that the serial cable meets the pinout shown on page F–6. An optional serial cable, PN 113128, is available from Troxler. Connect the serial cable to the printer (or computer) serial port.

NOTE

To upload data to a computer, use the HyperTerminal® application available from the Windows® Accessories menu. This application can be used to transfer data from the gauge to the computer. For more information on setting up HyperTerminal to communicate with the gauge, see Appendix H.

To output project data to a USB printer via the USB port, connect a USB cable to the USB port and connect the cable to the USB printer. To output project data to a USB flash drive, connect the flash drive directly to the USB port.

NOTE

The opening for the USB port will accept a device with maximum dimensions of 10 mm (0.40 in.) high by 29 mm (0.79 in.) wide.

NOTE

A list of compatible USB devices is available at: www.troxlerlabs.com/PRODUCTS/PRODLIT/otherlit.shtml

SET OUTPUT DESTINATION

As described on page 8–7, the gauge can print (or upload) project data to a computer or serial printer connected to the serial port, or to a USB printer or flash drive (also referred to as a "thumb drive") connected to the USB port.

NOTE
The USB port is included only on Model 3440 Plus gauges.
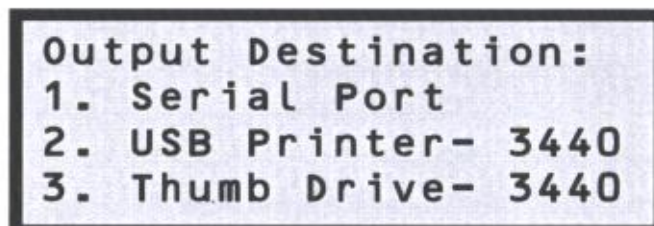
NOTE
The opening for the USB port will accept a device with maximum dimensions of 10 mm (0.40 in.) high by 29 mm (0.79 in.) wide.

NOTE
A list of USB devices that are compatible with the gauge is available on the following page of the Troxler website: www.troxlerlabs.com/PRODUCTS/PRODLIT/otherlit.shtml

To select the output destination, press ⟨**6**⟩ at the **Projects** menu shown on page 8–2. The gauge displays:

```
Output Destination:
1. Serial Port
2. USB Printer- 3440
3. Thumb Drive- 3440
```

Use the numeric keys to select the desired output destination. The gauge enables the selected option, displays a brief confirmation message, and returns to the **Projects** menu. Press ⟨**ESC**⟩ to return to the **Ready** screen.

WINDOWS HYPERTERMINAL

To print (upload) data from the gauge to a computer equipped with a Microsoft Windows XP operating system, use the *HyperTerminal* program as described in the following sections.

HYPERTERMINAL SETUP

To configure the Windows *HyperTerminal* program and set up a dedicated icon to transfer data from the gauge, perform the following steps:

1. Click on the **Start** button, select the **Programs** menu, and then the **Accessories** folder. Select the **Communications** subfolder, and then select the **HyperTerminal** icon.

2. From the **HyperTerminal** window, double-click on the **Hypertrm** icon. The **Connection Description** window is displayed. This window is used to set up a new connection.

3. In the **Name** box, enter a name (for example, *Troxler Data*) for the new connection. Select an icon to use for the connection, then click **OK**. The **Connect To** window is displayed.

4. In the **Connect To** window, *do not* enter a telephone number. Instead, select **Direct to Com1**, **Direct to Com2**, **Direct to Com3**, or **Direct to Com4**, depending upon the computer. The **COM# Properties** window is displayed, where # is the number of the selected COM port.

5. Configure the **Port Settings** as follows:

Bits per second	9600
Data bits	8
Parity	None
Stop bits	1
Flow control	Xon-Xoff

6. Click **OK**. The **Troxler Data – HyperTerminal** window is displayed, where *Troxler Data* is the icon name entered in step 3.

7. From the toolbar, click on **File** and select **Save** from the dropdown menu.

8. Close the **Troxler Data – HyperTerminal** window by selecting **Exit** from the **File** menu.

EQUIPMENT CONNECTION

Connect the gauge to the computer using the appropriate serial cable (see the list of *Options* on page C–29). Connect the gauge's serial port (see Figure 3–1 on page 3–2) to the computer COM port selected in step 4 of the *HyperTerminal Setup* section on the previous page.

PRINTING (UPLOADING) PROJECT DATA

To print (upload) project data from the gauge to the computer:

1. On the computer, click on the **Start** button, then select the **Programs** menu and the **Accessories** folder. Select the **Communications** subfolder, then select the **HyperTerminal** icon.

2. From the **HyperTerminal** window, double-click on the **Troxler Data – HyperTerminal** icon (where *Troxler Data* is the icon name entered in the *HyperTerminal Setup* section on the previous page). The **Troxler Data – HyperTerminal** window is displayed.

3. From the toolbar, click **Transfer**, then select **Capture Text** from the dropdown menu. The **Capture Text** window is displayed, showing a default folder and filename to be used to store the data. Troxler recommends using the default settings when first using the program. After selecting a filename, click **Start** to enable data capture.

4. On the gauge, select the project data to be printed (uploaded) to the computer, and follow the instructions in Chapter 8 to print the data to the computer. The project data will be displayed in the **Troxler Data – HyperTerminal** window as it is uploaded.

5. When the data transmission is complete, select **Transfer** from the toolbar. Then select **Capture Text** and **Stop** from the dropdown submenu.

6. Exit the *HyperTerminal* program.

VIEWING PROJECT DATA

After project data has been printed (uploaded) to the computer, the
.txt file can be viewed using Microsoft Notepad or a word
processing program, such as Microsoft Word®.

The data can also be imported into an Excel spreadsheet, which can
then be used to manipulate and manage the data. To import the data
into an Excel spreadsheet:

1. Open the Excel program.

2. From the Excel toolbar, click **Data**, then select **Get External
    Data** and **Import Text File**. The **Import Text File** window is
    displayed.

3. Select the file that was saved when data was downloaded using
    the *Hyperterminal* program, then click **Import**. The **Text
    Import Wizard** is displayed.

4. In step 1 of the **Text Import Wizard**, check the **Delimited**
    radio button, then click **Next**. In step 2 of the wizard, select
    only the **Comma** checkbox, then click **Next**. In step 3, select
    the **General** radio button, then click **Finish**. The **Import Data**
    window is displayed.

5. Check the **Existing worksheet** radio button, then click **OK** to
    import the data.

Figure 8–1 on page 8–9 defines the information contained in each
column of the spreadsheet.

SAFETY PROCEDURES ON TROXLER NUCLEAR GAUGES ONLY

USE OF GAUGE:

1.   The Radiation Protection Officer shall ensure that all persons handling the gauges are familiar with the correct operating procedures.

2.   Don't expose the source rod other than when measuring in the direct transmission mode.

3.   Don't move or carry the gauge by placing your hands underneath the gauge.

4.   Don't place the gauge on your lap when moving from one test position to another while travelling in a vehicle.

5.   Always keep the Troxler in its transport case with the trigger mechanism locked when it is not being used.

6.   Carry or move the gauge using the gauge handle.

7.   A red flag must be mounted on a yellow and black striped pole so as to be clearly visible to all operators of vehicles or earthmoving equipment.

TRANSPORTING THE GAUGE:

1. When transporting a Troxler Moisture / Density Gauge by road, 3 x radioactive removable warning signs must be displayed on the vehicle.

   One sign on either side (door) of the vehicle, and one sign on the back of the vehicle.

   The name and telephone number of the person to be contacted in the event of an emergency must appear adjacent to each sign.

   These signs must be removed when radioactive matter is not being transported.

2. An enclosed vehicle must be used for day-to-day transport of the gauge. If a bakkie is used, a lockable canopy must be installed and the gauge must be secured to the vehicle.

3. A vehicle may not be left unattended with the gauge in (or on) it.

4. If the gauge is going to be used outside South Africa, all the necessary documentation (dangerous goods form) as well as an export authority must be acquired prior to shipment.

STORAGE:

1.   No radioactive material or instrument or apparatus containing such material may be stored on any premises zoned for domestic purposes.

2.   When in storage the source assembly must be locked in the "off" or fully shielded position.

3.   Warning signs, of a design approved by the Department, must be displayed at the entrance to the storeroom or storage area to indicate the presence of radioactive material. The "trefoil" symbol must appear on the sign, as it should also include the working "Danger - Radiation".

4.   Dose rates outside the store should not exceed 2.5 uSv/h (0,25 mR/h).

5.   A notice containing the names and telephone numbers of the persons who can be telephoned in the event of an emergency, must be displayed at all storage facilities for radioactive material.

6.   The storage facility must be lockable and unauthorised entry must be prevented.

7.   A logbook must be provided in which the instrument/s must be signed into and out of the storage facility.

8.   No radioactive material may be stored with, or in close proximity to any corrosive, combustible, or explosive materials.

9.   In the case where an instrument must be stored in a laboratory the user must ensure that a distance of at least two meters be maintained between the instrument and the working area (or any place where people linger).

STANDARD COUNT LOG

Serial Number

DATE	MOISTURE - MS	DENSITY - DS

DATE	MOISTURE - MS	DENSITY - DS

NUCLEAR COMPACTION TEST DATA

PROJECT _____

JOB NUMBER _____

DATE _____

TAKEN BY _____

TEST NUMBER	1	2	3	4	5	6	7	8	9	10
STATION										
OFFSET										
ELEVATION										
MODE AND DEPTH										
DENSITY COUNT										
WET DENSITY										
MOISTURE COUNT										
MOISTURE										
DRY DENSITY										
% MOISTURE										
STANDARD DENSITY										
OPTIMUM MOISTURE										
% COMPACTION										
MOISTURE CORRECTION										

TEST NUMBER	11	12	13	14	15	16	17	18	19	20
STATION										
OFFSET										
ELEVATION										
MODE AND DEPTH										
DENSITY COUNT										
WET DENSITY										
MOISTURE COUNT										
MOISTURE										
DRY DENSITY										
% MOISTURE										
STANDARD DENSITY										
OPTIMUM MOISTURE										
% COMPACTION										
MOISTURE CORRECTION										

DENSITY	MOISTURE	REMARKS