Digitilt DataMate & DMM Software

50310999

This equipment should be installed, maintained, and operated by technically-qualified personnel. Any errors or omissions in data, or its interpretations, are not the responsibility of Slope Indicator Company. The information herein is subject to change without notification.

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Introduction

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The Manual

This manual is a combined operating guide for the Digitilt DataMate and DMM (DataMate Manager) software.

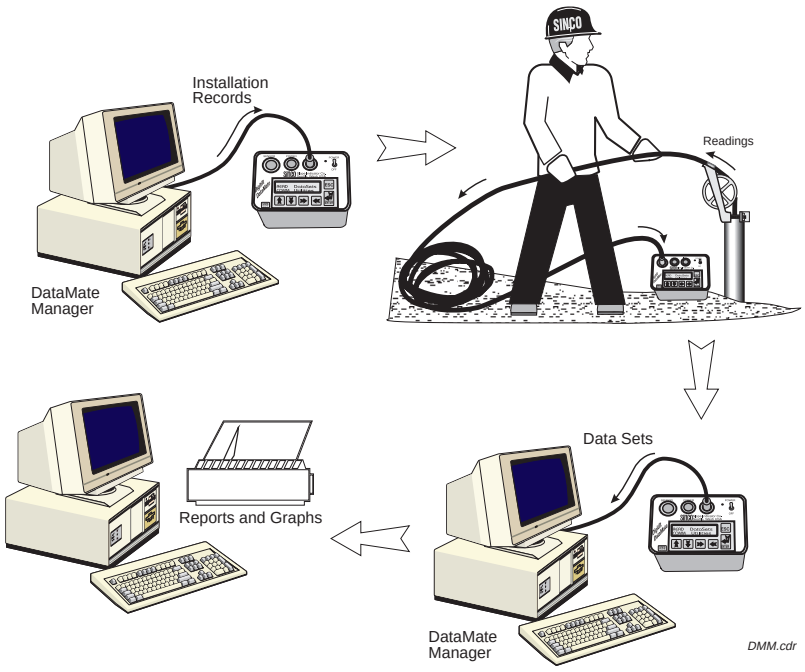
The DataMate

The Digitilt® DataMate is a compact inclinometer readout that records data from a Digitilt inclinometer probe, tiltmeter, or spiral sensor. The DataMate stores over 10,000 data points in up to 40 data sets.

The DMM Program

The DataMate Manager software (DMM) is an integral part of the DataMate system. DMM creates a project database that holds records of inclinometer installations and data from inclinometer surveys.

Before you take the DataMate into the field, you will use DMM to transfer a list of inclinometer installations to the DataMate. When you return from the field, you will use DMM to transfer data from the DataMate to the project database on the PC. DMM can also generate simple reports and graphs. For more sophisticated data reduction and graphing, use Slope Indicator's DigiPro software.



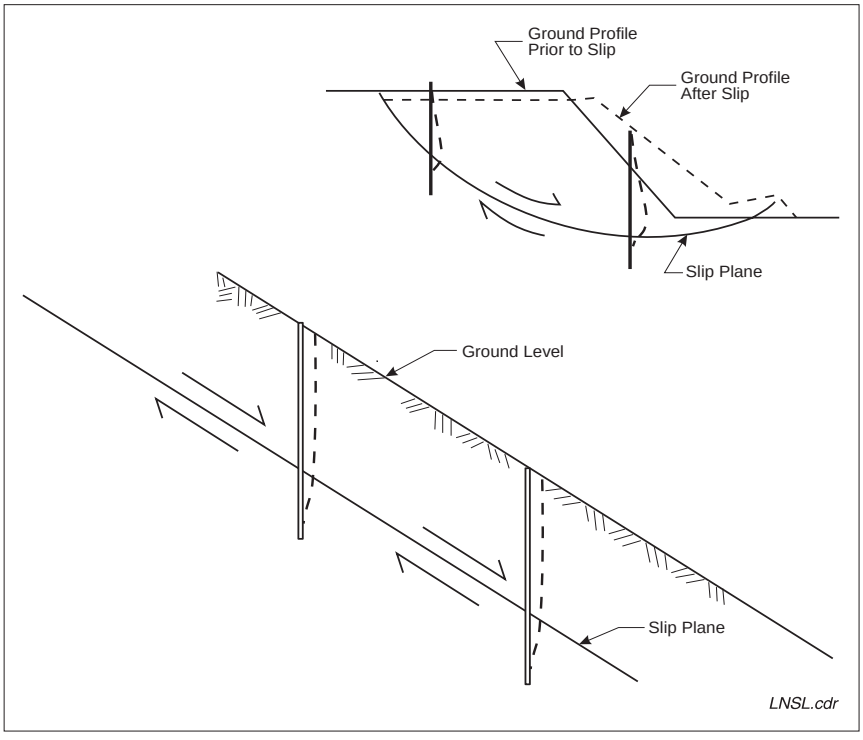
About Inclinometers

Inclinometers are used to monitor lateral earth movements in landslide areas and embankments. They can also monitor deflection of retaining walls and piles. Horizontal inclinometers are used to monitor settlement in foundations and embankments.

An inclinometer system includes inclinometer casing, an inclinometer probe and control cable, and an inclinometer readout unit, such as the Digitilt DataMate.

Inclinometer casing is typically installed in a near-vertical borehole that passes through a zone of suspected movement. The bottom of the casing is anchored in stable ground and serves as a reference. The inclinometer probe is used to survey the casing and establish its initial position.

Ground movement causes the casing to move from its initial position to a new position. The rate, depth, and magnitude of this displacement is calculated by comparing data from the initial survey to data from subsequent surveys.

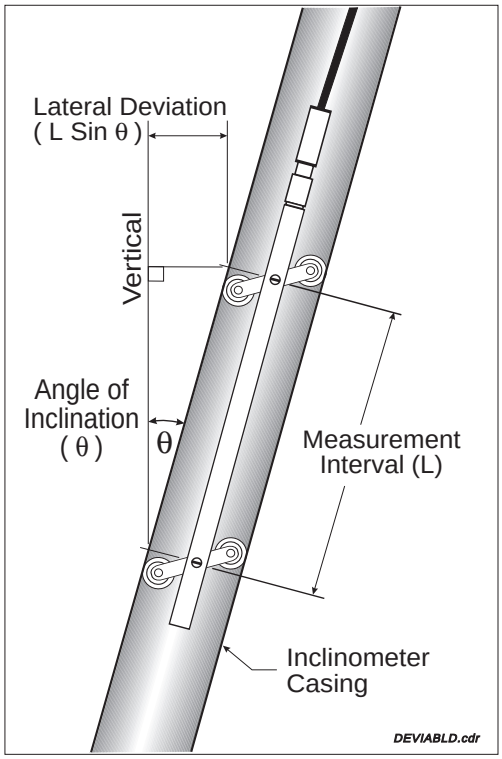


Inclination Measurements

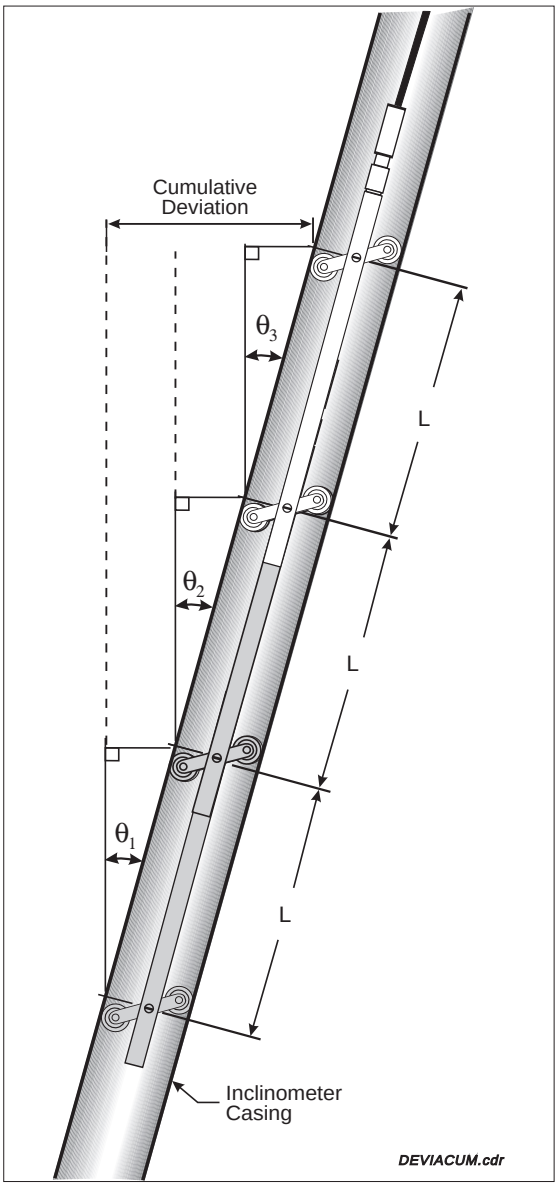
The inclinometer probe does not measure displacement directly. Instead, it measures the tilt of the casing.

Lateral Deviation

Tilt is converted to a lateral distance as shown below. Deviation at one interval is called *incremental* deviation. The sum of incremental deviations is called *cumulative* deviation.



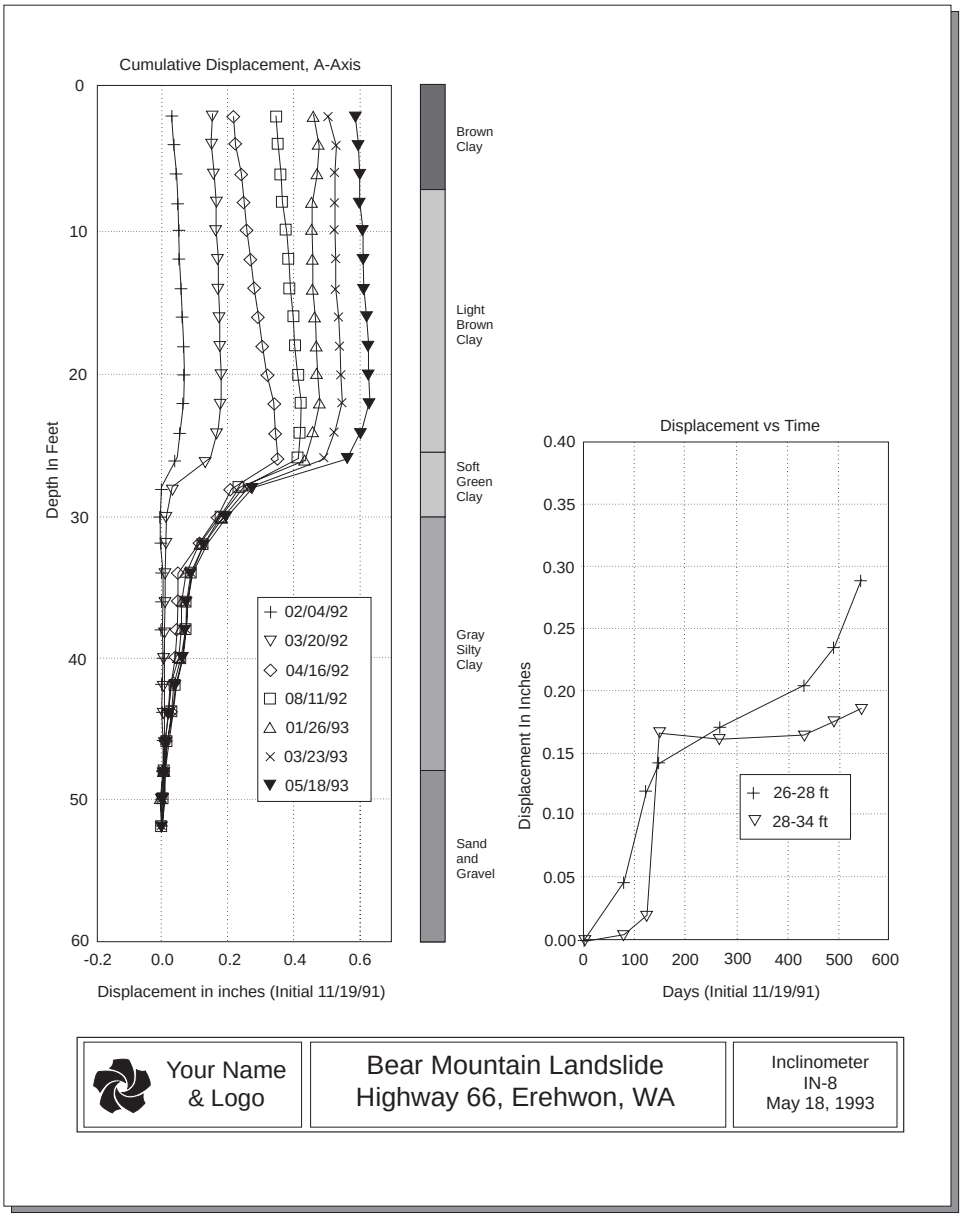
Incremental Deviation



Cumulative Deviation

Displacement

Changes in deviation, i.e. changes in the position of the casing, are called displacements. The change at one interval is called incremental displacement. The sum of incremental displacements is called *cumulative* displacement. DMM can produce reports and simple graphs of displacement. Slope Indicator's DigiPro program can produce more sophisticated graphs for up to 21 datasets.



Graphs of Displacement Generated by the DigiPro Program

Converting Reading Units to Lateral Deviations

DataMate Readings

Readings displayed by the DataMate are proportional to the angle of tilt (θ). With a metric probe, the DataMate displays readings as sin θ ⎫25000. With an English probe, the readings are displayed as sin θ ⎫20000.

Note

Normally, reading units are converted to lateral deviation by computer software, such as the DMM program or the DigiPro program. Below, we show how to perform the conversion manually.

Metric Reading Units

Suppose you were taking a manual reading with a metric probe and the DataMate showed the following:

```
Manual mode: METRIC
A= 321    B= -298
```

Divide the reading by 25000 to obtain the sin θ value for each axis:

$$\sin\theta \text{ (A-axis)} = \frac{321}{25000}$$

$$= 0.01284$$

$$\sin\theta \text{ (B-axis)} = \frac{-298}{25000}$$

$$= -0.01192$$

Now multiply sin θ by the measurement interval. The interval used with metric probes is typically 0.5 meters or 500 mm.

$$\text{Lateral Deviation (A-axis)} = 0.0128 \times 500\,mm$$

$$= 6.42\,mm$$

$$\text{Lateral Deviation (B-axis)} = -0.0117 \times 500\,mm$$

$$= -5.96\,mm$$

English Reading Units

Suppose you are taking a manual reading with an English probe and the DataMate shows the following:

```
Manual mode: ENGLISH
A= 204    B= -488
```

Divide the reading by 20000 to obtain the sin θ value for each axis:

$$\sin\theta\ (\text{A-axis}) = \frac{204}{20000}$$

$$= 0.0102$$

$$\sin\theta\ (\text{B-axis}) = \frac{-488}{20000}$$

$$= -0.0244$$

To find lateral deviation, multiply sin θ by the measurement interval. The interval with English probes is typically 2 feet or 24 inches:

$$\text{Deviation (A-axis)} = 0.0102 \times 24\,\textit{inch}$$

$$= 0.245\,\textit{inch}$$

$$\text{Deviation (B-axis)} = -0.0244 \times 24\,\textit{inch}$$

$$= -0.586\,\textit{inch}$$

Eliminating Sensor Offset

A full data set includes both 0 and 180 readings for each axis. See Chapters 5 and 6 for a full explanation. The sign of the 180 readings is opposite that of the 0 readings since the probe is rotated 180 degrees.

Ideally, the two readings for each depth would be identical except for the sign, but sensor offset and sensor placement introduce differences.

Therefore, the two readings are averaged by finding the algebraic difference of the two values and dividing by two.

Suppose the A0 reading is 193 and the A180 reading is -201.

$$\text{Averaged Reading} = \frac{193 - (-201)}{2}$$

$$= 197$$

Notes

1

Installing DMM software

Notes

Installing DMM

1. Turn on the computer and wait for the DOS prompt. Insert the distribution disk into drive A.

2. Type **`a:install`** and press R. If you are using the B drive to install DMM, type **`b:install`** and press R.
   Install displays system requirements for running DMM. Press the space bar to continue.

3. Install prompts for a disk drive. If you want to install DMM on the C: drive (typical), press R to select this drive or move the highlight bar to a different drive and then press R.

4. Install prompts for a directory for DMM and suggests using a directory name of **`\DMM.`** Press **R** to accept this directory. To specify a different directory, type a directory name and press R. The Install program creates the directory if it does not exist.

5. Install now displays your computer's configuration. Press any key (e.g. the space bar) to continue.

6. The Install program copies DMM to your hard disk and expands the compressed files. This may take some time on slower computers. Afterwards, the Install program verifies that DMM was copied correctly.

7. The Install program requests permission to make some simple changes to your **`CONFIG.SYS`** file.

   If you answer "yes," DMM examines the file. If the **`FILES`** and **`BUFFERS`** values are too small, it asks if you want to increase them. Answer "yes." DMM then makes these changes but does not change anything else in the file. If there is no **CONFIG.SYS**file on your computer, the Install program creates one with the necessary values

   If you answer "no," DMM examines **`config.sys`** and lists changes that you must make manually.

8. When the Install program is finished, it displays a message confirming that DMM was installed successfully. Press any key to return to DOS. The **`\DMM`** directory may contain a file called **README**that contains information that arrived too late for inclusion in the manual.

9. Reboot (restart) your computer to activate the new configuration settings.

Notes

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Creating a Project Database

Notes

What is a Project Database?

A project database stores three kinds of information: calibration information for the inclinometer probe, information about each inclinometer installation, and data from each inclinometer survey.

A project database can contain up to 64,000 "installations" and 64,000 data sets for each installation. In practice, you will find it more efficient to create a different database for each project. You can create as many project databases as needed.

The project database resides on your PC. A small part of the database, the information about each inclinometer installation, is transferred to the DataMate. The DataMate uses this information when it records an inclinometer survey. Later, the survey data is transferred to the project database on the PC and erased from the DataMate.

Database Records

A database stores information in three kinds of "records."

Sensor Records

The project database keeps a record for each inclinometer probe or tiltmeter that you have. The record contains information such as sensor serial number, model number, English or metric version, and other information.

Installation Records

The project database keeps a record for each inclinometer installation. The installation record contains a two-part identifier ("site" and "installation") and additional fields to characterize the casing such as depth, reading interval, and A0 orientation.

Data Sets

The project database keeps data (readings) from each inclinometer survey in a "data set." Each data set is identified by a number (1, 2, 3, ...) and contains the time and date of the survey, the operator's initials, and the readings recorded at each depth.

Installation Identifiers

Every installation record has a two-part identifier. The identifier keeps data from one installation separate from data for other installations. Here is the recommended convention to use for identifiers:

The first part of the identifier is called "site" and the second part is called "installation." At least one part of the identifier must be unique.

Site Identifier

If there are several installations at a particular site or along a particular highway, etc, choose a "site" identifier that is appropriate to all. For example, all the inclinometers along State Route 18 could use a site identifier of SR18.

Installation Identifier

The second part of the identifier should be unique. For example, each installation along State Route 18 could be given a number, such as INCL1, INCL2, INCL3, ...

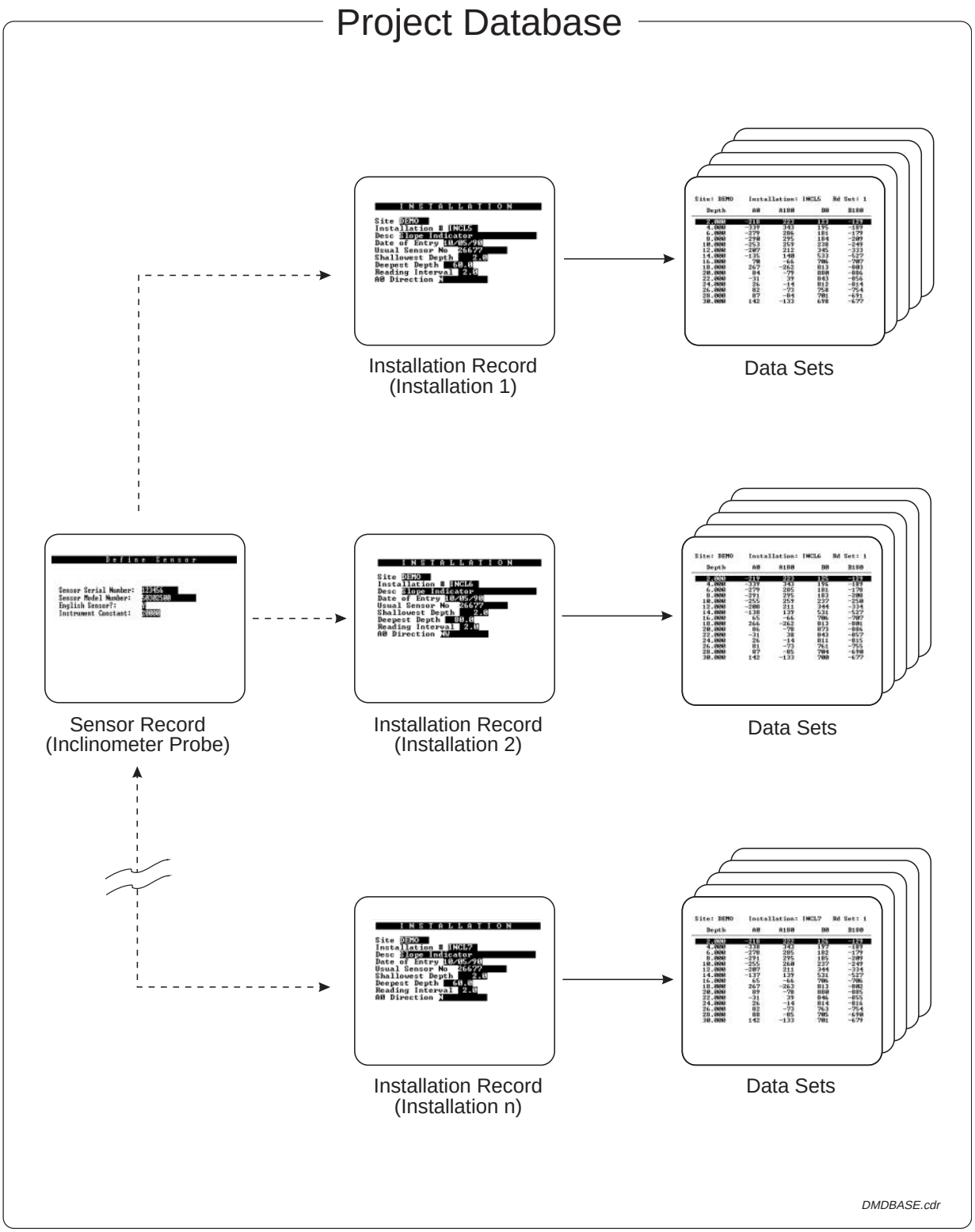
Thus the complete identifier for each installation would be SR18-INCL1, SR18-INCL2, and so on.

Suppose there are inclinometer installations along State Route 99 as well. These would be given a site identifier of SR99, which would keep them separate from the inclinometers along SR18. The installation identifiers could then follow the same INCL1, INCL2, INCL3 pattern as before.

Note Do not use the year or date to identify an installation. All records are automatically date and time stamped.

Separate or Same Database?

You could also create separate project databases for SR18 and SR99. Here is the basic rule: If the inclinometer installations are related and the data from them may someday be included in the same report, they should be stored in the same project database.


Project Database
Installation Record
(Installation 1)
Data Sets
Sensor Record
(Inclinometer Probe)
Installation Record
(Installation 2)
Data Sets
Installation Record
(Installation n)
Data Sets
DMDBASE.cdr

Step 1: Create Database Files

1. Type **`cd \dmm`** and press R to change to the DMM directory.

2. Type **`dmm`** and press R to run the program. Since DMM cannot find a project database, it prompts you to create a file.

3. Press **F** to create the database files. Enter a name for the new database. The name can contain up to eight characters. Press R**.**

4. DMM looks for a file with that name, and then asks if you want to create it. Type **Y** to create the file. DMM creates several empty files that belong to the new database.

5. DMM prompts: **`Create sensor file: c:\dmm\<your database name>.sns?`**

   Type **Y** to create a sensor file with the same name as other files in your project database. This name makes it easy to transfer files or back up files. If you answer ‘’no,’’ DMM creates a sensor file that has the name “sensor.dbf.” This name may be convenient if you have many inclinometer probes and many different projects, but it complicates the back up process.

6. After the database files have been created, the DMM Main Menu appears. Go to Step 2.

Step 2: Enter Sensor Information

The project database requires a record for each inclinometer probe, tiltmeter, or spiral sensor that you use.

1. Select **Enter Sensor Info**.
2. DMM displays fields that define the sensor (probe). A prompt at the bottom of the screen asks if you want to add records. Type **Y** or press R.
3. Enter the sensor serial number. Then press R.
4. Enter the sensor model number. This field is for reference only and is not included in reports. Current Slope Indicator model numbers are 50302500 for the English vertical probe, 50302510 for the metric vertical probe, 50302900 for the English horizontal probe, and 50302910 for the metric horizontal probe.
5. Choose English or metric. Type **Y** for English and **N** for Metric.
6. For "instrument constant," enter 20000 for English probes or 25000 for metric probes. Then press R.

Note There are several advanced-mode fields that are hidden from view unless you type **M** for **Mode** on the Main menu. Neither the DataMate nor DMM currently uses these fields. However, they are used by Slope Indicator's DigiPro software and can be edited with DMM if you so choose. To hide the advanced mode fields again, type **M** again at the Main menu.

7. When you are finished, press R or d. At the bottom of the display, DMM asks if you want to save the information. Type **Y** or press R to save. Type **N** to abort.
8. To enter information for another sensor, type **A** (add). When you are finished, type **Q** or press E to return to the Main menu.
9. Go to Step 3.

Step 3: Create an Installation Record

1 At the Main Menu, move the cursor to **`View/Edit Data`** and press R. You can also press **V** for the same result. If there are no installation records in the database, DMM asks if you want to add records. Type **Y** or press R. DMM displays entry fields for the first record.

2 Enter a "site" identifier with up to six alphanumeric characters. If you enter fewer than six characters, press R to move the cursor down to the next field. If you enter all six characters, the cursor moves down to the next field automatically.

Next enter an ''installation" identifier with up to six alphanumeric characters. If you enter fewer than six characters, press *R* to move down to the next field.

If you make a mistake, move the cursor back to either field and type in your corrections. After the record is saved, however, these identifiers cannot be changed.

3 For ''desc,'' enter a description up to 50 characters long. Part of the description field is hidden and can be seen only if you use the cursor to scroll to the right.

4 The date is for reference only. It indicates only when the installation record was entered into DMM and is not a date stamp for readings. If the displayed date is incorrect, you can type in a different date. It is not necessary to type the separator bars (/ /).

5 Enter the serial number of your probe and press R. If you can't remember the serial number, type "?" and press R. At the bottom of the display, DMM prompts: **`... pick (Y/N)`**. Press Y, then move the highlight bar to the probe you want and press R to copy it to the installation record.

6 Enter the shallowest depth for the installation and press R. The shallowest depth is generally 2 feet or 0.5 meters. Then enter the deepest depth for the installation and press R.

7 Enter the reading interval, then press R. The typical reading interval for English systems is 2 feet. The typical interval for for metric systems is 0.5 meters.

8. Enter A0 Direction. Enter a compass heading or other identifier (up to three characters) for the A0 casing groove.

9. When you are finished, press R or d. Type **Y** or R to save the information. To add another installation record, go to Step 4. Otherwise, type **Q (Quit/Return**) or press E to return to the Main menu.

Note: DMM allows you to create data sets for an installation, but this is done only for data that must be entered manually. The DataMate creates its own data sets and DMM stores them under the proper installation. If you create a data set by accident, press E to cancel the process.

Step 4: Add Another Installation Record

1. Use either the **Add** or the **Copy** command to add other installation records to the DMM database.

   The **copy** command may save time since it copies a previous record and then lets you change the installation identifiers and any other values that may be different.

2. Save the new installation record by pressing R or the d key.

3. Add any other installation records. When you are finished, press **Q** or E to return to the Main Menu.

Modifying an Installation Record

Use the Modify command to change anything in the installation record except the site and installation identifiers. To change these, see "Modifying Identifiers" below.

1. Select the installation record that you want to correct.
2. Select **Modify**. Then move the cursor to the field you want to change and enter the correct information.
3. When you are done, press R or the d key. Type **Y** or R to save the information.
4. Type **Q (Quit/Return**) or press E to return to the Main Menu.

Modifying Identifiers

To change the site and installation identifiers, you must copy the installation record, enter new identifiers, and then delete the old installation record.

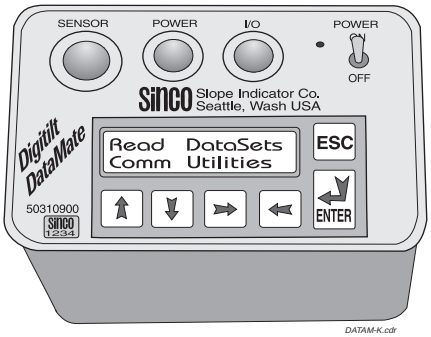
1. Select the installation record that you want to correct.
2. Select **Copy**. Enter the correct information in the ''site'' and ''installation'' fields.
3. When you are finished, press R or the d key. Type **Y** or R to save the information.
4. Select the *old, unwanted installation record.*
5. Select **Delete**. Then type **Y** to confirm the deletion.
6. Type **Q (Quit/Return**) or press E to return to the Main Menu.

3

Meet the DataMate

Notes

Controls on the Front Panel



Power ON/OFF Power switch. When you switch power on, the DataMate displays a copyright notice for ten seconds or until you press R. The copyright date serves as the version number for the DataMate. If you call for technical support, have this version number ready.

Sensor Socket for inclinometer control cable.

Power Socket for battery charger or external power.

I/O Socket for hand switch or computer interface cable. All connector sockets are waterproof only when connector or protective caps are plugged in.

t Moves cursor up. In edit mode, t key changes character under cursor. Each successive press moves forward through alphabet (a...z) and numbers (0...9).

b Moves cursor down. In edit mode, b key changes character under cursor. Each successive press moves backwards through alphabet (z...a) and numbers (9...0).

l Moves cursor to left.

r Moves cursor to right.

E Aborts current process and returns to menu.

R Accepts choice of selected menu item. In edit mode, accepts edited entry. In record mode, records readings.

Using the Menus

1. Select a function with btlr. Then press R.
2. Exit a function with E. Press E once or twice more to return to the Main menu.

Main Menu

The Main menu appears when you turn on the DataMate.

```
Read   DataSets
Comm   Utilities
```

Read

Select this menu if you want to record data, correct data, display readings from the sensor (for testing or manual reading), or edit inclinometer installation parameters.

```
Record  Installation
Correct ManualRead
```

DataSets

Select this menu to list data sets in memory, check available memory space, validate data sets, compare data sets, delete data sets, or send data to a serial printer or communications program.

```
Dir Validate Memory
Del Compare  Print
```

Comm

Select this menu to put the DataMate into communication mode to transfer inclinometer data and installation parameters to a PC. Requires the DMM program.

```
Waiting for PC ...
```

Utilities

Select this menu to check the DataMate's battery and its internal humidity and temperature. You can also use this menu to control the beeper, adjust the LCD backlight and contrast, and to set the time and date.

```
Batt  Beep  Light
Temp  Date  Contrast
```

Setting Up

Set Date and Time

The DataMate stamps readings with the current time and date.

1. Turn on the DataMate. From the Main menu, select **`Utilities`**, then press R.
2. Select **`Date`**.
3. The DataMate displays the current date in a year, month, day format and the current time in a 24-hour format. To change the date and time, press R.
4. Press t or b to set the year. Press r to move the cursor to the month.

   Continue until the correct date and time are displayed. Press R to confirm your entries, or press E to cancel any changes.

Disable or Enable Beeper

Select the **`Utilities`** menu. Then select **`Beep`**. Pressing R enables or disables the beeper. The default is beeper on.

Switch Backlight On/Off

Select the **`Utilities`** menu. Then select **`Light`**. Backlight is switched on. Select Light again to switch backlight off. Backlight increases battery drain by about 12 percent.

LCD Contrast

Select **`Utilities`** menu. Then select **`Contrast`**. Use the t and b keys to adjust the contrast for easy viewing. Press E when done.

Charging the Battery

Battery Check

1. From the Main menu, select **`Utilities`**. Then press E.
2. Select **`Batt`** and press R.
3. The main battery reads approximately 6.2 volts with a full charge. The DataMate uses a sealed lead-acid, "gel-cell" battery which should be recharged after every use.

   The DataMate displays a low battery warning when voltage drops to 5.5 volts. Turn off the DataMate when the warning appears and then recharge as soon as possible. *Deep discharge of the main battery can reduce its performance and shorten its life.*

   The Lithium backup battery should read approximately 2.9 volts. This battery supplies power to the DataMate clock and data memory when the main battery is discharged. When the DataMate is charged normally, the backup battery should last between 5 and 10 years. When the reading falls below 2.3 volts, the DataMate should be returned to Slope Indicator for servicing.
4. Press E to return to the **`Utilities`** menu.

Recharging the Battery

Use the charger supplied with the DataMate. Plug the charger's LEMO connector into the DataMate's POWER socket. Plug the charger itself into an ac outlet. Maximum charge time is 72 hours. Longer charge times may damage the battery.

Use the battery check function in the Utilities menu to check the charging process. When the battery is charging, the voltage reading should increase. If the reading does not increase, there may be a problem in the charging circuit or the battery may be damaged. In either case, the DataMate should be returned to Slope Indicator for servicing.

Checking Humidity

1. From the Main menu, select **Utilities**.
2. Select **Temp**.
3. The temperature reading indicates the temperature inside the DataMate.
4. Check the **Humidity** reading. It should be between 20 and 60 percent. If humidity exceeds 75%, replace desiccant.

Replacing the Desiccant

1. Turn the DataMate upside-down. Support the unit to prevent damage to the power switch.
2. Remove the two screws in the bottom of the case.
3. Pull off the case. Do not touch any of the electronic components inside the DataMate. Static discharge from your fingers can destroy electronic components.
4. Find the desiccant packet between the battery and the panel connectors and remove it.
5. Replace the desiccant pack with a new one. Or place the old desiccant in an oven at 250 ⊃F (121 ⊃C) for 16 hours. Do not use a microwave oven to renew the desiccant. You may damage your microwave oven.
6. Apply a light coat of silicone grease to the gasket. Then slip the DataMate back into its case. Check that the gasket is seated properly.
7. Lubricate the O-rings on the screws with silicone grease. Then replace the screws in the bottom of the case and tighten to draw the panel squarely against the gasket. Do not over-tighten the screws.

Cleaning the DataMate

Cleaning the Case and Panel

Check that sockets are capped. Then wash case and panel with a mild detergent and water. Do not use alcohol, acetone, or other solvents. They will damage the paint, plastic, O-rings, and gasket.

Cleaning Connectors

If the connector contacts are dirty, gently clean them with a cotton swab or soft bristle brush (moistened with small quantity of denatured alcohol). Do not use other solvents, contact cleaners, or spray lubricants, since these will damage the rubber inserts inside the connectors.

Always use protective caps to keep the connector sockets clean and the inside of the DataMate dry. The sockets are waterproof only when caps are in place or a connector is inserted.

4

Preparing the DataMate

Notes

Step 1: Check Memory

1. Turn on the DataMate. From the Main menu, select **DataSets**.

2. Select **Memory** to view the available memory.

   The DataMate can store up to 10,000 data points distributed in a maximum of 40 data sets. In a standard two-pass survey, the DataMate records four data points at each depth (A0, A180, B0, B180). Thus 10,000 data points is the data from 2500 depths, the equivalent of surveying 1250 meters of casing at half-meter intervals (or 5000 feet of casing at two-foot intervals).

3. If there isn't enough memory to accommodate the data sets you are about to load, delete some of the old data sets. See "Deleting Data Sets" later in this chapter.

Step 2: Connect DataMate to PC

1. Connect the flat end of the DataMate interface cable to the serial port on your PC. The interface cable has a DB25 connector. If your computer has a 9-pin connector, use the DB9-to-DB25 adapter included with the DataMate.

2. Connect the other end of the interface cable to the DataMate's I/O socket.

3. Go to Step 3.

Step 3: Preparing the PC

4. Turn on your PC. From the DOS prompt, change to the DMM directory by typing **`cd \dmm`** and pressing R.

5. Type **`dmm`** and press R to run the DMM program**.**

6. Using the cursor keys, highlight the appropriate database and press R. DMM displays a list of databases and prompts you to select an existing database. All database names have an **`HDR`** extension.

7. If the database is in a different directory, type **`D`** for **`Change Directory`** and press R. Enter the drive and path for the database and press Rto display a new list of databases. Use the b key to highlight the database you want to use and press R.

8. Go to Step 4.

Step 4: Establish the Link

At this point, the DMM Main Menu should be displayed. If it isn't, press E until it appears.

1. Turn on the DataMate. From the DataMate's Main Menu, select **Comm**. The DataMate prompts: **Waiting for PC.**

2. Type **D** to select DataMate Comm. DMM displays the Communications menu. The status box (below the menu) shows that the PC is not linked to the DataMate.

3. Type **E** to select **Establish Comm Link**. Now the status box says ''linked.'' The screen on the DataMate shows **Linked to PC.** If this message is not displayed, see the last page of this chapter for possible remedies.

4. Go to Step 5.

Step 5: Loading the DataMate

This step has two parts. First, you must create a list of installation records that you want to transfer to the DataMate. Second, you must send the list to the DataMate.

1. Type **L** to select **Load Installations.** DMM asks the DataMate to send a list of installation records. After a few seconds, DMM displays the list (see Figure 1). In the example, the list is empty since there are currently no installation records in the DataMate.

2. To copy an installation record from the project database to this list, type **C**. DMM displays the installation records currently in the database (see Figure 2). In the example here, there are three installation records in the project database.

3. Select the installation record you want, then press R. This adds the installation record to the list (see Figure 3). In the example here, we've added the first installation record to this list. You can select up to 40 installation records (one record at a time).

4. To move an installation to another position on the list, move the cursor to the record that you want to move. Type **M** for **Move**, move the cursor to the new location, then press R.

   You can also use the **Exchange** command to exchange the position of two records. Move the cursor to the first record. Type **E**, then move the cursor to the other record. Press R to complete the exchange.

5. Type **S** to send the modified list to the DataMate. If you change the list, but forget to send it, DMM warns you that the list has been changed but not sent. Type **N** to clear the message, then type **S** to send the list.

6. When you are finished, type **B** for **Break Comm Link**.

7. Turn off the DataMate.

Figure 1

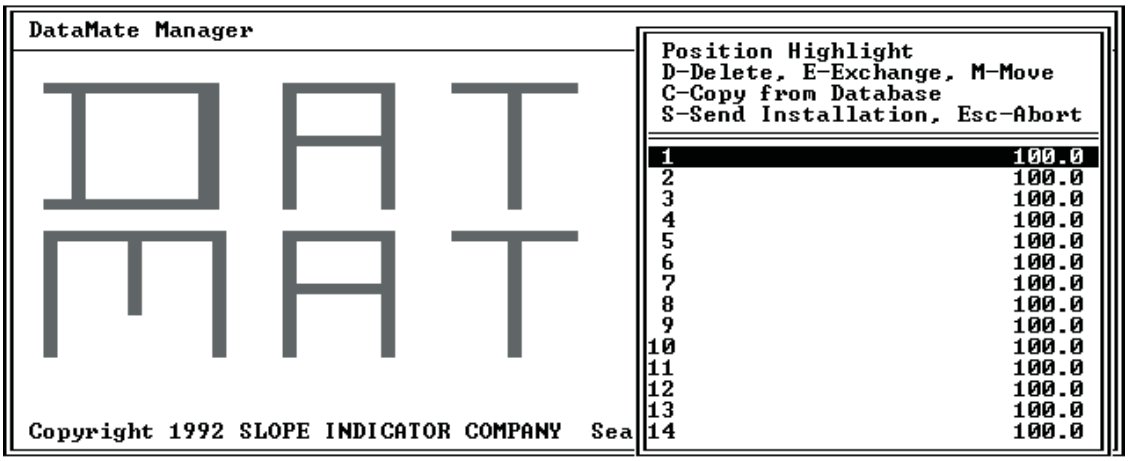


Figure 2

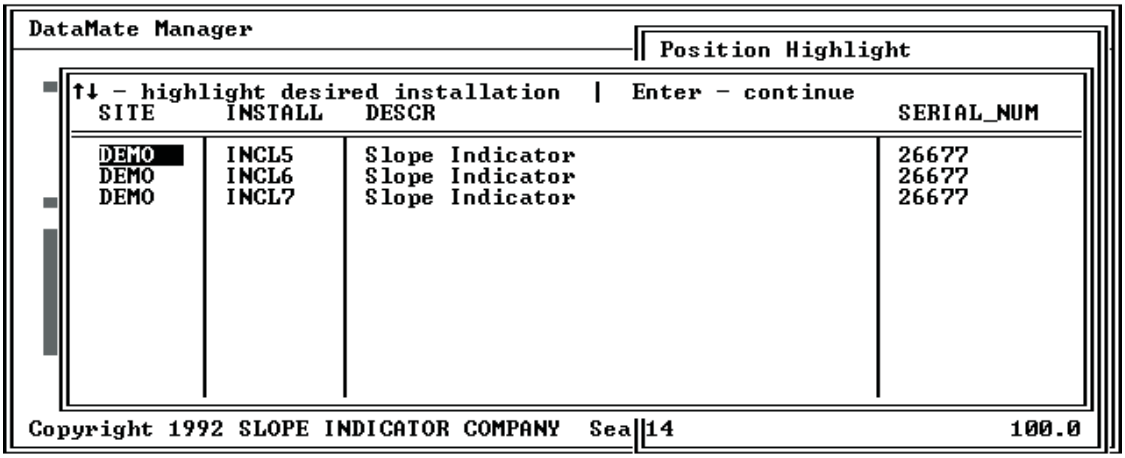
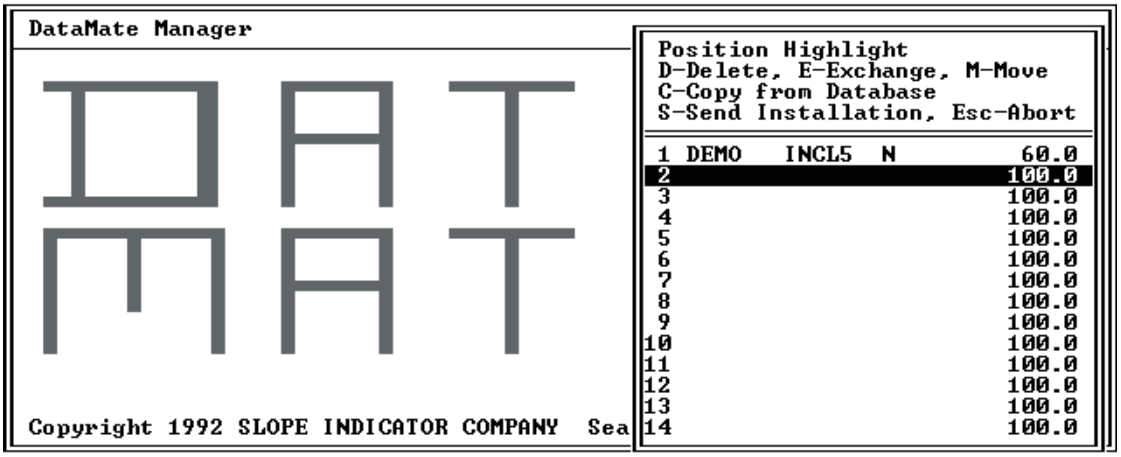


Figure 3



Deleting Installation Records

The DataMate itself provides no functions for deleting installation records in its memory. You must use DMM to delete them.

1. Establish Communication between the PC and the DataMate.
2. Select **`Load Installations`**. The DataMate sends a list of its installation records.
3. Using cursor keys, select the installation record that you want to delete from the DataMate. Then type **`D`** to delete the record. If you accidentally delete a record, press E. The installations are not actually deleted until you send the updated list. You can delete only one installation record at a time. Repeat this process to delete additional records.
4. Type **`S`** to send the updated list to the DataMate.
5. Press E to return to the Main menu.

Note You can also use the **`X-Erase memory`** command to clear the DataMate's memory—but this erases both installation records and data.

Deleting Data Sets

This removes selected data sets from the DataMate's memory to make room for new data.

1. Establish Communication between the PC and the DataMate.
2. To remove unwanted data sets, type **`D`** for **`Delete`**. DMM requests and then displays a list of data sets contained in the DataMate.
3. Data sets are identified by site, installation number, data set number, and date. A carat (^) between the data set number and the date indicates that the data set has already been transferred from the DataMate.
4. Tag (select) the data sets you wish to delete: Move the cursor to a data set and type **`T`**. A triangle appears to the right of the date. Tag as many data sets as necessary.
5. Press Rto delete the tagged data sets from the DataMate. After the tagged data sets are deleted, DMM returns to the Communications Menu.

Sending Data Sets to the DataMate

Use this procedure to transfer a dataset from the PC to the DataMate.

1. Establish Communication between the PC and the DataMate.

2. Type **S**. DMM displays a list of installations in the project database identified by site, installation, and description. You can use the l and r keys to view additional information about each installation.

3. Select an installation: Move the cursor to the required installation and press R.

4. DMM displays a list of data sets for that installation. Data sets are identified by **RDG_SET** (data set number), **DATE_READ** (date of survey), and **TIME_READ** (time of survey).

5. Select a data set by moving the cursor to the required data set and pressing R. The selected data set will then be transferred. At the bottom left of the display, DMM displays "working." A transfer status message appears soon after this message is displayed.

6. After the data set is transferred, DMM returns to the Communications Menu.

7. Repeat steps 2 through 6 to send other data sets to the DataMate.

The DMM Scheduler

The scheduler lets you establish different lists of installation records. Each list is called a ‘’group.’’ If you have more than 40 installations, the scheduler provides a convenient way to transfer different sets of 40 to the DataMate.

Getting Started

1. From the DMM’s **`Communications Menu`**, select **`Scheduler`**, then press R.
2. When you run the Scheduler for the first time, DMM asks you to create a file in which to store the scheduler’s data.
3. To create a group of installations, type **`C`**. The Scheduler prompts you for a group name (up to six characters). Type a name for the group. The name appears in the group window. The **`0`** represents the number of installations that the group contains.
4. To add an installation to the group, type **`A`**. Installations in the project database appear in the lower window. Scroll through them, highlight the desired installation, and press R.
5. To add another installation to the group, type **`A`** again. Continue until you’ve added all the installations you need.
6. To view a list of the installations in the group, press r. The list is displayed in the Installation window.

Navigating the Group Window

Use the following commands to set up a scheduler group:

Create Group: Use this to create a new group of installations.

Add Installation: This displays the main database's list of installations. Use the arrow keys to highlight the desired installation, then press R. (This is similar to adding installations in the Installation Window.)

Delete Group: This deletes the selected group and its installations from the scheduler.

r and l keys: Use these to switch between the scheduler's Group Window and Installation Window.

Send Installations: If a link with the DataMate was established before entering the scheduler, this command sends the installations in the selected group to the DataMate.

Note The **`Send Installations`** command erases everything in the DataMate's memory, including all data sets, before it sends a group.

Quit: This returns you to the Communications Menu.

Navigating the Installation Window

Use the following commands to load installations into a scheduler group:

Add Installation: This displays the main database's list of installations. Use the arrow keys to highlight the desired installation, then press R.

Delete Installation: This deletes the highlighted installation from the selected group's installation list.

r and l keys: Use these to switch between the scheduler's Group Window and Installation Window.

Send Installations: If a link with the DataMate was established before entering the scheduler, this command is active.

Quit: This returns you to the Communications Menu.

Trouble with the Communications Link

Error Messages

If a link cannot be established between the PC and the DataMate, DMM displays an error message. Also, the status box In the lower right corner of the computer screen says "Not Linked."

Troubleshooting

Is the DataMate screen blank?D?

This may be an indication that the interface cable is defective. Turn off the Datamate and remove the interface cable from the I/O socket. Now turn on the DataMate. If the display is normal, the cable is either defective or connected to the wrong PC port.

Does the DataMate display "Waiting for PC?"

If the DataMate is turned on, but no message is displayed, press the DataMate's E key until it displays the Main Menu. Then select **Comm**.

Is the DataMate connected to the PC?

One end of the interface cable should be inserted into the DataMate's I/O socket. The other end of the cable should be connected to the PC's serial port.

Is the correct comm port selected?

DMM requires a comm port that is not used by another device. DMM defaults to COM1 but can be set to use COM2. If you have a mouse or a modem connected to your computer, you may have to use the COM2 option.

To change the active comm port, select **DataMate Comm** in the Main menu, then select **CommPort/Baud** to change the comm port.

Is the baud rate too fast?

This is unlikely to be a problem except for telephone communication. However, if you see "retry" messages appearing in the communications status window, try selecting a slower data rate.

The DataMate defaults to 9600 baud. If communication errors occur, try setting the DMM's baud rate to 4800 or 2400. To do this, select "DataMate Comm" at the Main menu, then select "CommPort/Baud" to change the baud rate. There is no need to change the DataMate's baud rate, since it automatically adjusts to any change in the DMM's baud rate.

5

Recording Inclinometer Data

Notes

Step 1: Gather Equipment

Before you leave the office, make sure you have the following equipment:

- DataMate with fully charged battery
- Hand switch (recommended)
- Digitilt inclinometer probe (check that the wheels are clean and lubricated)
- Control cable
- Pulley assembly (recommended)
- Tarp or ground-cloth (on which to assemble equipment)
- Rag (to wipe off cable and dry probe)
- Gloves
- Basket or box (to hold cable)

Step 2: Check the DataMate

If you need to review any of these steps below, see Chapter 3, "Meet the DataMate."

1. Check the batteries. The main battery should read approximately 6.2 volts with a full charge.

2. Check the time and date.

3. Check the names of the installations to make sure that the correct installation records are loaded into the DataMate. To check the list, select **Read** from the Main menu, then select **Installation**. Use the t and b keys to scan the installation list. If you need to load different installations, use the procedures in Chapter 4.

4. Check memory.

5. Turn off the DataMate.

Step 3: Connect Inclinometer Probe

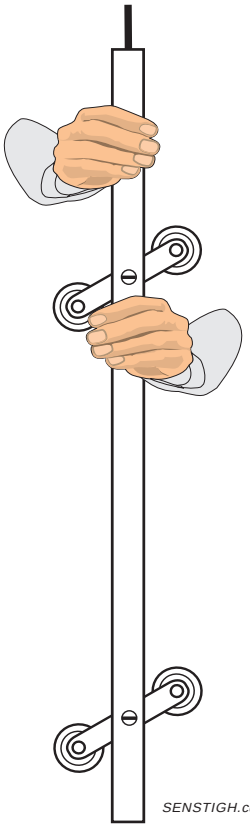
1. Grasp the *upper* end of the inclinometer probe, but do not hold the wheels. To avoid bending the wheel assemblies, hold the probe just below the upper wheel assembly as shown in the illustration.

2. Align the cable connector and insert it into the probe.

3. Tighten the connector nut with your fingers. If necessary, use the wrench (supplied with the probe) to tighten the nut, but do not over-tighten the nut, since you may damage the O-ring.

4. Connect the other end of the control cable to the Sensor socket on the DataMate.

5. Connect the hand-switch to the I/O socket.

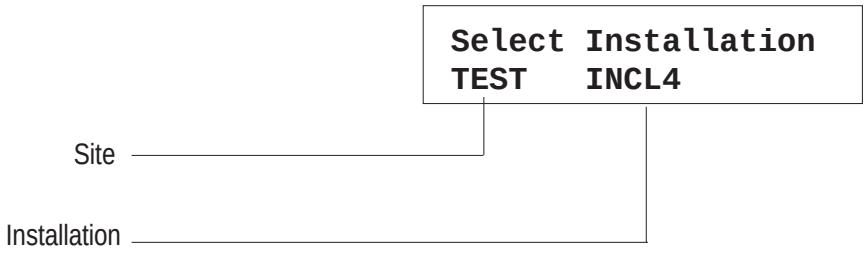


Step 4: Select an Installation

1 Turn on the DataMate. Press R to display the main menu.

2 Select **Read** and press R.

3 Select **Record** and press R. You should now see a display showing a site and installation (an example is shown below):



4 Using the b and t keys, select an installation. Then press R.

5 The DataMate displays the installation parameters. You may want to change the operator's initials, etc. If no changes are necessary, press and hold the R key until the DataMate displays the start depth.

If you accidentally change the site or installation names, press E to abort and start over. This will prevent the creation of a new (and unwanted) installation record

6 The DataMate displays the start depth. You are now ready to survey the first inclinometer site. The DataMate display now looks something like this:

7 Go to Step 5.

Step 5: Record Inclinometer Data

1 Unlock and remove the protective cap from the casing. Attach the pulley assembly and remove the pulley wheel.

2 Insert the probe into the casing with the *upper* wheels of both wheel assemblies in the A0 groove. Replace the pulley. Lower the probe slowly, to the bottom of the casing. Do not allow the probe to strike the bottom.

The probe is typically lowered slightly below the starting depth and then raised to the starting depth. In the example here, our start depth is 50 meters and our interval is 0.5 meter.

3 Allow 5 or 10 minutes for the probe to adjust to the temperature in the casing. Raise the probe to the depth shown on the DataMate's display. The diamond symbol (◆) next to the depth indicates that readings on the top line are "live."

```
  50.◆   204     -488
Depth      A0     B0
```

4 Wait for the readings to stabilize. You will see three diamonds on the screen when both readings are stable within two units.

```
  50.◆   204◆   -488◆
Depth      A0     B0
```

5 To record the readings, press the button on the hand switch or the R key on the DataMate. The DataMate display now looks something like this:

```
  49.5◆   204◆   -488◆
50.*    204*    -488*
```

The readings just recorded are moved to the bottom line and marked with the * symbol. The top line shows the next depth to be recorded.

6 Raise the probe to the next depth. The DataMate displays new readings. When three diamonds appear, record. Continue for each depth until you complete readings for the end (shallowest) depth.

7 The DataMate now displays options, with the cursor on **Continue**. Press R or the hand switch to continue.

```
Continue  0
Done      Del
```

8 Remove the probe and rotate it 180 degrees. This time the upper wheels of both wheel assemblies are inserted into the *A180* groove. Lower the probe below the lowest depth, then raise it to the starting depth.When the three diamonds appear, record the A180 and B180 readings for the start depth.

```
  50.|  -144|   547|
Depth   A180   B180
```

9 Raise the probe to the next depth, wait for the probe to stabilize, then record the next depth. Note that 180 degree readings are marked with the π symbol (π radians = 180⊃).

```
  49.5|  -250|   652|
50.π*  -144π   547π
```

Continue until the probe reaches the end (shallowest) depth. This completes the survey. Press E, R, or select **Done**.

The DataMate has already stored the data—there is no explicit "save-data" command. When you return to the office, you will transfer the data sets to a PC using the DMM program.

Note The B-axis casing grooves are not usually used since biaxial inclinometer probes obtain B-axis readings simultaneously with the A0 and A180 readings.

Correct Mistakes

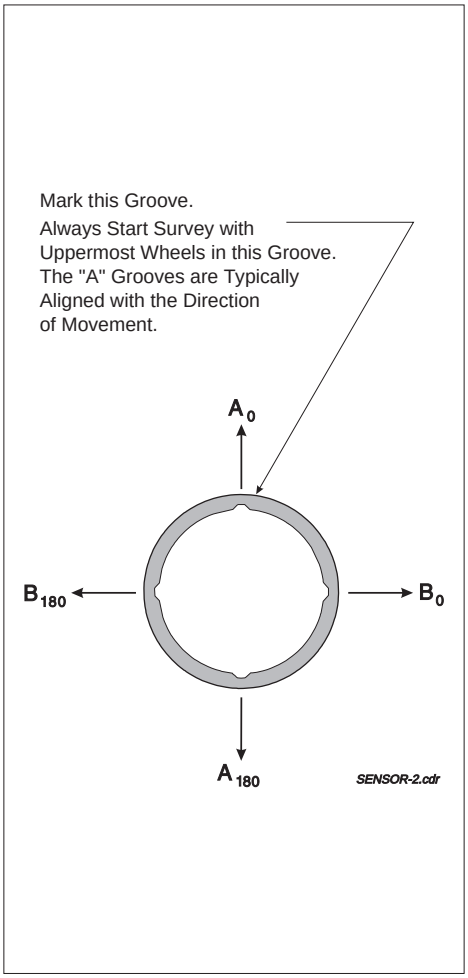
1. If you make a mistake during recording, you can start again at any depth. Using the b key, scroll to a previous depth. Make sure it is on the *top* line of the display.
2. Lower the probe below the depth, then pull it up to the exact depth.
3. Press R to turn on ‘’record’’ mode. A | appears next to the depth, showing that the readings on the top line are “live.” The bottom line shows the stored readings for that depth.
4. Wait for readings to stabilize:Watch for three diamonds (|||).
5. To record the live readings, press the button on the hand switch or the R key on the DataMate. The live readings will replace the old readings.
6. Continue re-recording subsequent depths as if you were taking the readings for the first time.

To Abort a Survey

1. Press Eto abort a survey. If you press E by mistake, select **Continue** to continue the survey.
2. Select **Del** to delete the aborted data set. Then press R.
3. The DataMate prompts for confirmation. Press t to confirm.
4.

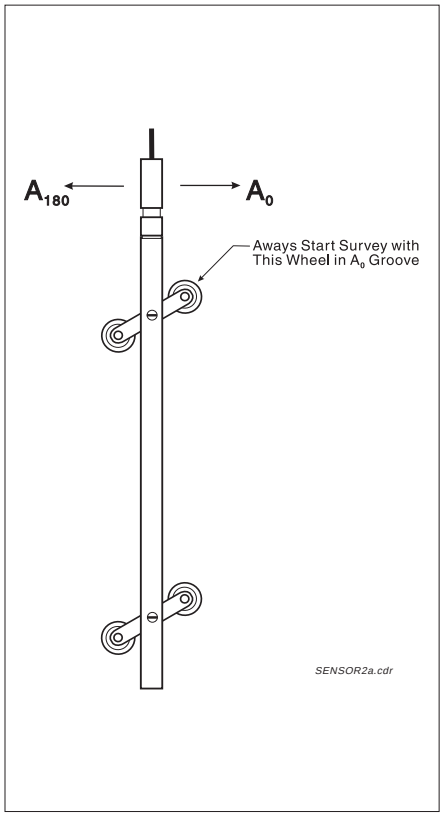
Hints for Better Data

General hints



- For the highest accuracy, always use the same probe and control cable. If you must use different probes, be sure to note the serial number of the probe used for each data set so corrections can be made during data processing.
- Always use the same reference for the depth marks on the control cable. If one technician uses the cleat on the pulley assembly as reference and another technician uses the top of the casing as reference, there will be a one-foot variation in the probe position from survey to survey. Accurate results require placement repeatability of 1/4" or better.
- Mark the A0 groove with paint or with a notch in the casing. Always start the survey by placing the top wheels of the probe in that groove. Training of technicians should include the importance of starting with the probe in the correct orientation.
- We recommend that a new installation be surveyed three times and the checksum statistics for each data set be compared. Choose a representative set as the initial reading set. All other data sets will be compared with this set. Also note the standard deviation of checksums (explained in Chapter 6) for this set; this can be used for quick validation of subsequent data sets.

On Site



- At the site, lay out your equipment on a plastic sheet or tarp. Use a basket or box to hold the control cable.
- Before lowering the probe, turn on the DataMate to energize the accelerometers. This makes them less susceptible to shock.
- For the first pass, be sure to insert the probe into the casing with the *upper* wheels of both wheel assemblies in the A0 groove. For the second pass, insert the upper wheels in the A180 groove.
- If you pull the probe past the intended depth, lower it below the intended depth and raise it again to the correct depth. To position the probe accurately, you must always approach the depth from the same direction.
- After completing the survey, wipe off the probe and cable. Replace end-caps and place the probe in its protective case. Coil the cable. Replace the indicator's protective plugs. Remove the pulley assembly and replace and lock the protective cap.
- When you return to the office, wipe off the indicator and recharge its batteries. Transfer the data set to a PC. Oil the probe wheels. Clean the connectors on the control cable with a cotton swab. Do not use spray lubricants or other solvents. If the storage place is dry, remove all protective caps from probe, indicator, and control cable to allow the connectors to dry.

Memory Considerations

In a standard two-pass survey, the DataMate records four data points at each depth (A0, A180, B0, B180). Thus 10,000 data points is the data from 2500 depths, the equivalent of surveying 1250 meters of casing at half-meter intervals or 5000 feet of casing at two-foot intervals.

Memory Limits

The DataMate has two memory limits. First, it can hold no more than 10,000 data points. Second, it can index no more than 40 data sets.

Automatic Memory Check

When you select an installation, the DataMate checks its depth and calculates how many data points will be required for the survey. If there is enough free memory, the DataMate displays the first depth.

No Room in Memory

The DataMate displays this message if the 10,000 data point limit is exceeded. This message is displayed if there are already 10,000 readings in memory. To proceed, you must delete some data sets. See "Deleting Data Sets."

Too Many Data Sets

The DataMate displays this message if you are attempting to create a 41st data set. To proceed, you must delete a data set. See "Deleting Data Sets."

We recommend that you transfer datasets to the PC regularly and then delete all data sets except any that are required for the Compare function.

How to Delete Data Sets

1. Select **DataSets** from the Main menu. Then select **Del**.
2. Press b to scroll through the list of data sets. Press r to scroll sideways to display the date. The **^** symbol indicates a data set was already transferred to the PC and may be deleted.
3. Place the cursor on the data set to be deleted, then press R.
4. To confirm, press the t key. If you change your mind and decide to keep the data set, press E.

- Delete additional data sets as required. For more information on deleting data sets, see Chapter 7.

Notes

6

Validating the Data Set

Notes

About Checksums

A checksum, sometimes called a "face error," is the sum of a 0- and a 180-degree reading at the same depth. Ideally, the sum should be zero since the readings have opposite signs. In practice, however, variations in casing grooves, the positioning of the probe, and the zero-offset of the probe itself contribute to non-zero checksums.

Although a checksum by itself is insufficient for error analysis or data validation, you can use checksum *statistics* to evaluate the quality of your data. The **`Validate`** routine in the DataMate lets you view the mean checksum and the standard deviation of checksums. It's a good idea to validate the data set while you're still in the field. If you find a bad reading, you can correct it.

Mean Checksum

The mean checksum is used more to evaluate the inclinometer probe itself than to evaluate a data set. The mean checksum indicates the probable zero offset for the inclinometer probe. Typically, the mean checksum is less than 50. Large offsets (a mean checksum greater than 100) may indicate a damaged probe.

Standard Deviation of Checksums

The standard deviation provides the surest and easiest way of validating the data set. You can compare the standard deviation for the current data set to a typical standard deviation established for that installation.

It is good practice to make several "initial" surveys of the casing. Compare the data sets and select one of them to be the official "initial" data set. Delete the others. Since the initial data set represents good readings, the standard deviation of checksums for that data set can be used as "typical" for that installation. Note that the "typical" is likely to be different for every installation.

When you obtain a new data set, run the DataMate's validation routine. Compare its checksum statistics to those of the initial data set. If the standard deviation is 3 to 5 units of typical, the data is probably good. For example, if the typical standard deviation is 4, then acceptable standard deviations for subsequent data sets could range as high as 7 or 9. Narrower limits may be appropriate for deeper installations and critical measurements. Wider limits may be appropriate for shallower installations or for poorly-installed casing.

Group Mean & Standard Deviation

The DataMate also calculates checksum statistics for groups (zones) of ten depths. This is especially useful in deeper installations, where the large number of readings may make a single bad reading statistically "invisible."

Individual Checksums

Once you find a zone that is suspect, you can isolate the questionable reading depth by examining the checksums produced at each depth. As a rule of thumb, checksums for the A-axis should be within 10 units of the mean checksum for that axis. For example, if the mean checksum is 5, acceptable A-axis checksums can be as large as -5 or +15. The checksums for the B-axis should within 20 units of the mean checksum for that axis. Larger checksums may indicate that the probe wasn't positioned correctly or the reading was not stable when recorded. It may also indicate one of the following problems:

- Debris in the groove.
- An out-of-round casing section.
- A separated casing section.
- An inclinometer wheel on a casing joint.

Validating a Data Set

Here is a typical validation procedure:

1. Check the standard deviation. Is it typical for this casing? If so, the data set is probably good and needs no further validation. You can quit the validation routine.

2. If the standard deviation is large, check the standard deviation for the different zones. If any group shows an obvious problem, examine the individual checksums in that group.

3. If you find a checksum that is too large, examine the readings at that depth to determine whether the bad reading was recorded in the 0 or the 180 orientation. Afterwards, you can correct the data by taking another reading for that depth.

View Standard Deviation

1. Select **`Validate`** from the **`DataSets`** menu.

2. Using the t and b keys, select the data set to validate. Then press R.

3. After a short delay, you will see a display that shows both the mean (MN) checksum and the standard deviation (SD) of checksums:

```
MN A=51.337 B=45.674
SD A=4.1781 B=5.7170
```

4. Compare the standard deviation with the “typical” SD that you have established for the installation.

5. If the standard deviation is acceptable, press E to quit. Otherwise, look at the SD for each zone.

View Zone with Largest Standard Deviation

1 To view the ‘’worst’’ zone, press r. You will see a display that looks something like this:

```
   25. -  20.   S.D.
A=3.2264  B=10.3388
```

In this example, the DataMate determined that the largest SD was in the zone from 25 to 20 meters.

2 To view the mean checksum for this zone, press l. You will see a display that looks something like this:

```
   25. -  20.   MEAN
A=53.1000  B=42.9000
```

View Other Zones

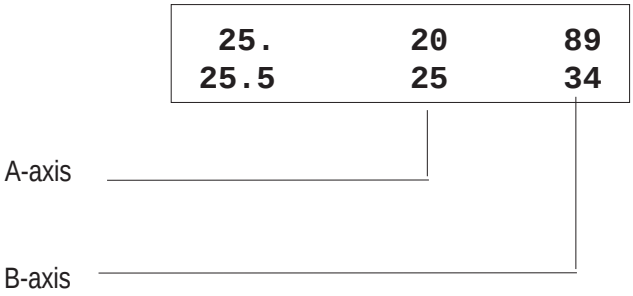
1 You can use the t and b keys to scroll through different zones. Use the l and r keys to toggle between mean and standard deviation.

2 If you decide the survey is acceptable, press E to quit. Otherwise, note the zones that you want to inspect and continue.

View Individual Checksums

A large checksum can be caused by a probe-positioning error, such as taking two readings at the same depth or making a mistake with the depth marks on the control cable. Another possible cause could be an obstruction in the casing groove. Follow the steps below to find depths with large checksums:

1 After the DataMate calculates the mean and standard deviation for the entire installation, press Rto view checksums. You will see a display that looks something like this:



The DataMate first displays the largest checksum in the data set. In the example here, the largest checksum is for the B-axis readings at 25 meters. Since the checksum of 89 stands out from other checksums in the B-axis, we would make a note of that depth.

2 Use the t and b keys to view checksums at other depths. Here we scrolled down two more depths.

```
 26.      31      15
26.5      29      27
```

3 When you are finished viewing checksums, press Esc. Next try to isolate the bad reading.

Isolating the Bad Reading

You have identified a depth that may have a bad reading. To determine which reading is bad (the 0 or the 180), examine readings at nearby depths to find a reading that is outside of the normal range.

1. From the Main menu, select **Read**, then press R.
2. Select **Correct**, then press R. The DataMate displays a list of data sets.
3. Find the data set that you just recorded. If necessary, press r to view dates. Move the cursor to that data set and press R.
4. Press and hold the R key until you see this screen:

```
0   Validate Done
180 Compare  Del
```

5. Choose the 0-degree orientation and press R. The DataMate displays data at the start depth. The "*" means 0 orientation.

```
  30.*   151*   -98*
Depth     A0     B0
```

If you start with the 180 orientation, the screen looks like this:

```
  30.π   103π   -138π
Depth     A0     B0
```

6 Use t or b to scroll through data until you reach the depth with the questionable readings.

Continuing from the example in the previous step, we want to investigate a reading at 25 meters since we saw a checksum of 89 in the B-axis at that depth.

A0 and B0 readings, 25 and 25.5 meters

25.*	49*	73*
25.5*	65*	-3*

7 To look at the corresponding 180 reading, press r. The 180 readings are marked with the π.

25.*	49*	73*
25.π	-61π	-16π

8 Use the t or b key to scroll through data with this view. Press r again to return to the original display (the l key does the same thing). Examine both the 0 and 180 readings at nearby depths.

24.*	35*	-7*
24.π	-46π	15π

24.5*	43*	-3*
24.5π	-51π	27π

This B0 reading does not fit the pattern of the B0 readings above and below.

Since the A-axis seems unaffected, there is probably an obstruction in the casing. If it were a probe-positioning problem, readings for both the A- and B-axis would be bad.

25.*	49*	73*
25.π	-61π	-16π

25.5*	65*	4*
25.5π	-78π	-6π

26.*	70*	13*
26.π	-90π	-29π

9 To correct a reading, note its depth and orientation, and use the "Correct" function.

Correcting a Reading

1 From the Correct menu, select either **0** or **180** depending on the orientation of the reading you need to retake.

```
0   Validate Done
180 Compare  Del
```

2 Press t or b until the questionable reading is displayed on the *top* line of the display. In the example here, we want to re-record the B0 reading at 25 meters.

```
 25.*     49*     73*
25.5*     65*     -3*
```

3 Insert the probe in the proper 0 or 180 orientation. Lower the probe below the suspect reading and allow time for the probe to adjust to the casing temperature. The raise the probe to the proper depth.

4 Press R to make the top line active. A diamond symbol (◊) appears next to the depth to show the live reading. The bottom line shows the stored reading. Wait for a stable reading, then compare the "live" reading on top line to the recorded reading on bottom line.

```
 25.◊     49◊     -5◊
 25.*     49*     73*
```

5 To record the live reading (overwrite the stored reading), press R. Or press E to cancel the operation. After you record the reading, the DataMate displays the next depth on the top line.

6 At this point, you can continue re-recording readings, review data for other depths, or press E to quit.

Cumulative Deviation

The DataMate calculates a single value for cumulative deviation from vertical.

1 At the Main Menu, select "DataSets." Then select "Compare."

2 The DataMate asks you to select the current data set. Press R to select the suggested set or find a different set using the t or b keys. You will see a display like this:

```
Current DataSet?
DEMO INCL1      21
```

3 The DataMate asks you to compare with a "previous" data set. Press E since you do not want to calculate displacement.

```
Previous Set or ESC:
DEMO INCL1      21
```

4 The DataMate asks you to confirm a conversion value of 1. Press R to display deviation in meters or feet (the same units used in the survey).

```
Conversion = 1
Press ENTER if OK
```

5 The DataMate then calculates the cumulative deviation for the data set and displays it.

```
Deviation:       m
A=0.6164  B= 0.1835
```

6 Press E to return to the **DataSets** menu.

Note The DataMate calculates cumulative deviation by summing incremental deviations from the bottom of the casing to the top. If you are interested in borehole drift, you probably want the top of the borehole to be used as reference. Summing from the top, the deviation at the bottom of the borehole should be 0.6164 meters in the A180 direction and 0.1835 meters in the B180 direction, the opposite direction, but same magnitude as shown on the display.

Cumulative Displacement

The DataMate must have two data sets in its memory to calculate displacement. Cumulative displacement is typically calculated by comparing the current data set to the initial data set.

1. Select **DataSets** from the Main menu. Press R.

2. Select **Compare** from the **DataSets** menu and press R.

3. The DataMate prompts for the *current* data set. If you have just finished the survey, the current data set is already selected. Press R.

```
Current DataSet?
DEMO INCL1       21
```

4. The DataMate prompts for the *previous* data set. Use the t or b keys to scroll through the list of data sets until the cursor is on the previous (initial) data set. Then press R.

```
Previous Set or ESC:
DEMO INCL1     1
```

5. The DataMate asks you to confirm a conversion value of 1000 for a displacement in millimeters. In English units, a conversion value of 12 gives displacement in inches. Press R

```
Conversion = 1000
 Press ENTER if ok
```

6. The DataMate then calculates the cumulative deviation for the data set and displays it. For example:

```
Displacement:   mm
A=1.5000  B= 3.2000
```

7. Press E to return to the **DataSets** menu.

7

Other Field Procedures

Notes

Taking Manual Readings

In the manual read mode, the DataMate displays A and B axis readings, but does not record them. Depths and orientation are not displayed and the stable-reading diamonds do not appear.

However, manual mode can be useful for reading tiltmeters, for checking the probe, and for taking readings when the DataMate memory is full.

1. Turn on the DataMate. Select **Read**, then press R.

2. Select **Manual Read**, then press R.

3. Select **English units** or **Metric units** to match the calibration of your sensor. Then press R.

4. The DataMate now displays "live" A0 and B0 readings. There are no depths displayed, no 0 or 180 markings, and no diamonds to indicate stable readings.

```
Manual mode: METRIC
A= 123    B=  36
```

Creating an Installation Record with the DataMate

General Considerations

- Any installation record that you create with the DataMate is automatically re-created in the project database when you transfer a data set to the PC.
- If it is necessary to duplicate an installation record that already exists in the project database, DMM will keep its existing installation record, and store the new data under it. In this case, however, you must make certain that you have specified the site and installation identifiers *exactly as they appear in the project database*.
- If the data set is stored in the wrong place in the database, or if you made a "dummy" installation because you couldn't remember the exact identifiers, DMM lets you move the data set to the correct installation later. See Chapter 10, ''Managing the Database.''

Steps

1. Turn on the DataMate. From the Main menu, select **`Read`**. Then press R.
2. Select **`Installation`**, then press R.
3. Using b, scroll past any previously entered installations. The cursor stops on the word "Create." Press R.
4. Enter the site and installation identifiers and any other required parameters. The t and b keys change the cursor character or the suggested value. The l and r keys move the cursor left or right. Press R after each correct entry.

Note The DataMate can hold a maximum of 40 installation records. If there are already 40 installation records in the DataMate, the **`Create`** command does not appear.

Deleting Data Sets with the DataMate

The DataMate has two memory limits: First, it can hold no more than 10,000 data points. Second, it can index no more than 40 data sets.

If the DataMate prompts “No room in memory,” you have exceeded the 10,000 data-point limit. If the DataMate prompts: “Too many data sets,” you are attempting to create a 41st data set.

If you wish to survey the installation anyway, you must delete a data set to free sufficient memory (or take manual readings).

1. From the main menu, select **`DataSets`**. Then select **`Del`**.
2. The DataMate prompts for a data set to delete. Use b to scroll through the list of data sets.You can press r to display the date for each set. A **^** symbol next to the data set number shows that the dataset has been transferred to PC and is a likely candidate for deletion.
3. Place the cursor on the data set to be deleted, the press R.
4. To confirm the deletion, press the t key. If you decide not to delete the data set, press E.
5. Delete additional data sets as required.

Caution Do not turn off the DataMate during the deletion process. Data may be lost as the DataMate reindexes the data.

Printing from the DataMate

Printing is normally done from the DMM program on your PC. However, it is possible to print directly to a serial printer or to a file on a PC which is running a communications program.

Printing to a Serial Printer

1. Use the DataMate interface cable to connect the DataMate I/O port to a serial printer.
2. Set the printer for ''no parity'' and the word length to ''8 bit.''
3. Set your printer to 9600, 4800, 2400, or 1200 baud (9600 is the fastest).
4. Put the printer ''on line.''
5. Select **`Print`** from the DataMate's **`DataSets`** menu.
6. Use the b key to set the baud rate of the DataMate to match that of the printer. Press R.
7. Select a data set to be printed using the b key. Press R to print.

Printing to a Disk File

To print a data set to a disk file you must run a communications program on your PC.

1. Connect the DataMate I/O connector to the PC serial port using the interface cable supplied with the DataMate.

2. Run the communication program on the PC. Set the communication parameters for 9600 baud, no parity, and 8 bit word length.

3. The easiest way to transfer the data is to use the “capture” or “log” function of the communications program. This function stores all text displayed on the PC screen in a file.

4. Specify a filename that will make identification of the data set easy.

5. Start the capture function. Then select **`Print`** from the DataMate’s **`DataSets`** menu.

6. Use the DataMate’s b key to set the baud rate of the DataMate to match that of the communication program. Press R.

7. Select a data set to be transferred using the b key. Press R. As the DataMate sends the data, you should be able to see it on the PC screen.

8. Close the log file.

Modem Transfers

You can transfer inclinometer data from the DataMate to a computer over a telephone line. Modem transfers require two Hayes-compatible modems: one for the DataMate and one for the PC and two operators, one at the DataMate and the other at the PC. The instructions below assume that the DataMate operator is in the field and wants to transfer data to a PC at the office.

Task 1: Connect Field Modem

1. Connect the DataMate to the modem using a modem cable (Slope Indicator part number 50310952). Or convert the interface cable supplied with the DataMate to a modem cable by adding a null-modem to modem converter (available at most computer-supply stores).

2. Connect a telephone line to the modem. This step assumes that a modular phone jack is available.

3. Supply power to the modem. The modem may not turn on until communication is initiated. See your modem user manual for details.

Task 2: Call the Office

1. Inform your office of the telephone number at your location and the list of data sets or installation records that you want to transfer to (or from) the DataMate.

2. Hang up. Disconnect the telephone line from the telephone.

3. Connect the DataMate to the modem and plug the modem line to the telephone jack.

4. Turn on the DataMate and select **Comm**. The DataMate will display **Waiting for PC.**

5. When the operator at the office makes the connection to the DataMate, you will see **Linked to PC ***** on the DataMate.

6. Wait for the PC operator to complete the transfer operations. When the operator breaks the connection, you will see this on the DataMate:

```
End of Communication
ESC to exit
```

7. Disconnect the DataMate and plug in your telephone. Wait for a call from the office.

Task 3: At the Office

1. Run the DMM program. Type **D** to select **DataMate Comm.** Set the communication port and baud rate to match the modems' configurations.

2. Type **M** to select **Modem Dialer**. DMM now displays the phonebook window.

3. Type **D** to dial a stored number or type **M** to enter the field number manually. DMM returns to the communications menu and displays **Waiting for connection...** at the bottom of the screen.

4. When DMM displays **DataMate:Linked** below the communications menu, the telephone modem link has been established.

5. Perform data transfers or any other operations just as if there were a direct wire communication link.

6. Press **B** for **Break Comm Link** when finished.

7. Call the field telephone to tell the field operator that the transfer was successful.

8

Transferring Data to the PC

Notes

Step 1: Connect DataMate to PC

1. Connect the interface cable to the serial port on your PC. If your computer has a 9-pin connector, use the DB9-to-DB25 adapter included with the DataMate.

2. Connect the other end of the interface cable to the DataMate's I/O socket.

Step 2: Prepare the PC

1. Turn on your PC. At the DOS prompt, type **`cd \dmm`** and press R.

2. Type **`dmm`** and press R to run the DMM program**.**

3. Use the cursor keys to highlight the appropriate database and press R.

   If the database is in a different directory, type **`D`** for **`Change Directory`** and press R. Enter the drive and path for the database and press Rto display a new list of databases. Use the b key to highlight the database you want to use and press R.

4. DMM displays its main menu.

Step 3: Establish the Link

1. Turn on the DataMate. Select **`Comm`**. The DataMate prompts: **`Waiting for PC.`**

2. Type **`D`** to select DataMate Comm. DMM displays the Communications menu. The status box below the menu shows that the PC is not linked to the DataMate.

3. Type **`E`** to select **`Establish Comm Link`**. Now the status box says ''linked.'' The screen on the DataMate shows **`Linked to PC.`** If you can't establish the link, check ''Failed Communications'' in Chapter 4.

4. You are now ready to receive data sets from the DataMate.

Step 4: Transferring the Data Sets

1 Select **`Receive Data Sets`** from DMM's communication menu and press R. After a short delay, DMM displays a list of data sets from the DataMate. In the example at right (Figure 1), there are three new data sets in the DataMate. The first three data sets are marked with a caret " ^ ", which indicates that they have been transferred once before.

2 Move the cursor to a new data set and press **T** to tag it. (The new data sets are not marked with a caret "^"). As you tag each data set, DMM marks it with a triangle (right side). In Figure 2, three data sets are tagged for transfer.

3 Press R to start the transfer process. You will see communications "activity" on the screen. When the transfer process is done, DMM returns to the Communications Menu, as shown in Figure 3.

4 Select **`Break Comm Link`**. Then turn off the DataMate.

Note The DataMate actually sends only a copy of the data sets. The original data remains in the DataMate. You must delete these data sets from time to time to make room for new ones. See ''Deleting Data Sets'' in Chapter 4).

Data sets are identified by site and installation number, a data set number, and a date and time.

A carat (^) between the number and the date indicates that the data set has already been transferred from the DataMate. In the example here, the first data set for each installation has already been transferred.

```
T-Tags & Untags Data Sets
A-Tag All, U-Untag all
Enter-Continue  Esc-Abort

DEMO    INCL5      1^93/04/12
DEMO    INCL6      1^93/04/12
DEMO    INCL7      1^93/04/12
DEMO    INCL5      2 93/05/13 ◄
DEMO    INCL6      2 93/05/13 ◄
DEMO    INCL7      2 93/05/13 ◄
```

Figure 1

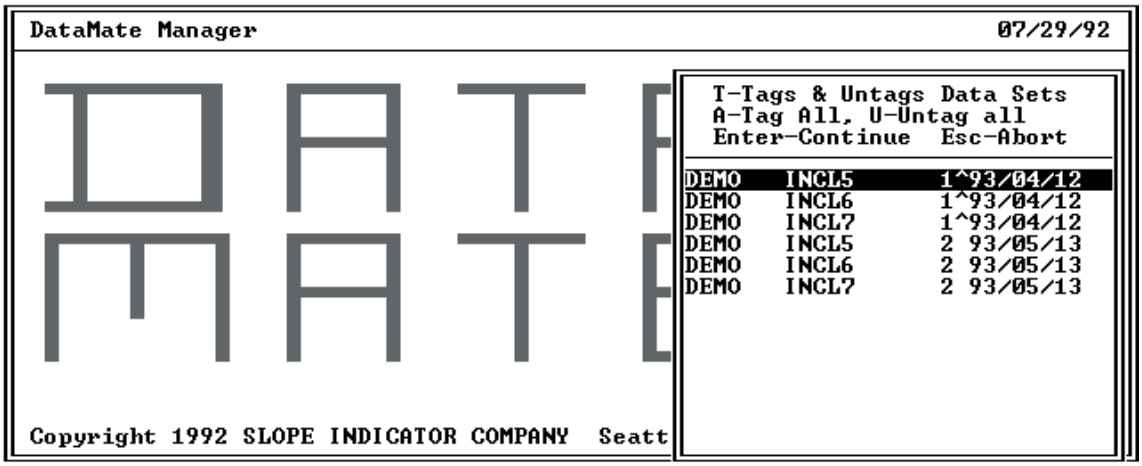


Figure 2

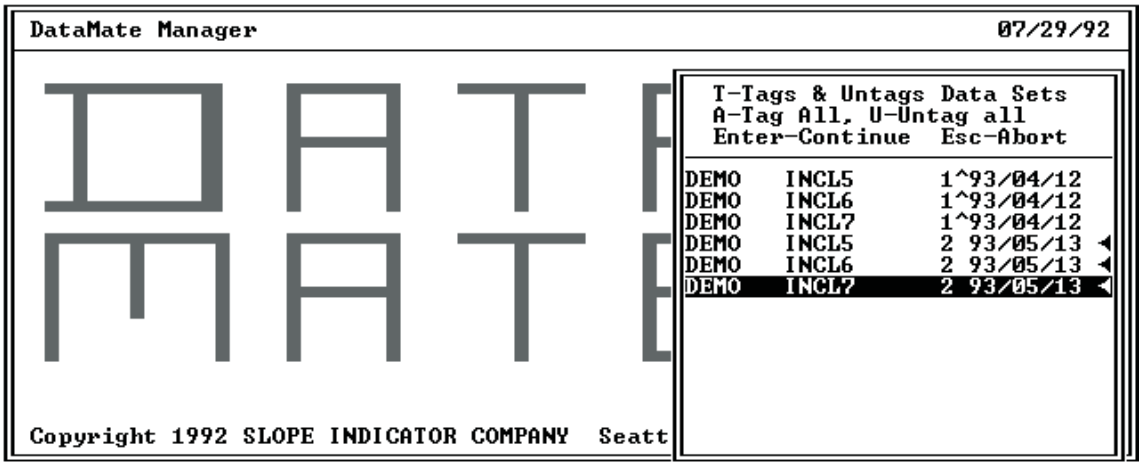
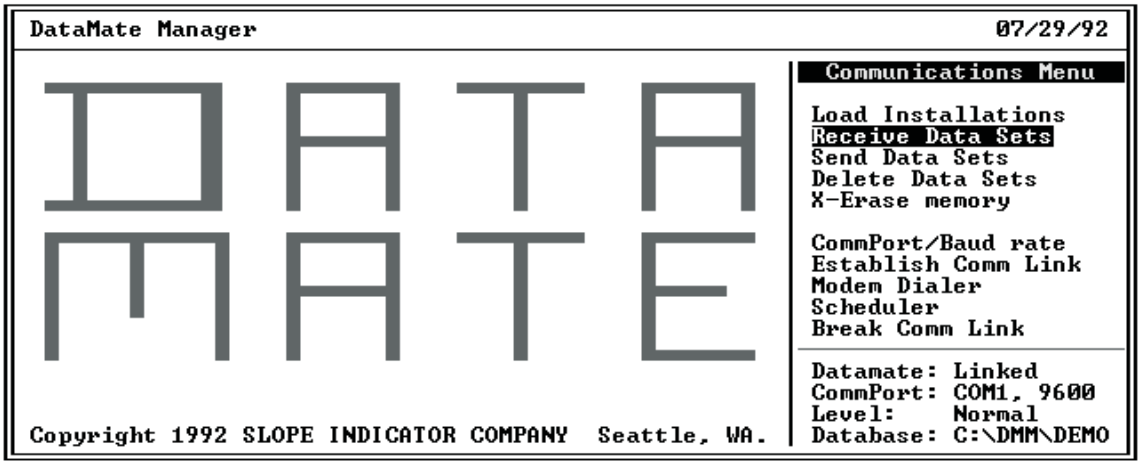


Figure 3



Step 5: Checking the Project Database

1. Press E to return to DMM's Main Menu.

2. Type **V** for **View/Edit Data**.

3. Select inclinometer site and installation number by typing **N** to display the next installation and **P** to display the previous installation.

4. Type **O** or press R to open the Data Set Window.

5. Type **L** to list all data sets.

6. Using the cursor, select one of the data sets you just transferred to the PC. DMM assigns the next available number to the data set, so it may be necessary to identify the set by date rather than by number. Press R.

7. Type **O** to open the Data Window. If you did not validate the dataset in the field, you may with to type **V** for **Validate** (Checksums are explained in Chapter 6). Then press E to return to the Data Window.

8. Type **L** to list data. Use t or b keys to inspect the data set. Then Press E to exit list mode.

9. Press E again to return to the Data Set Window. Repeat this process to check other data sets. Go to Step 6.

Step 6: Adding Field Notes

(Optional) You can add field notes to an installation record to describe changes at a particular installation. This creates a "memo" record.

1. From the DMM type **V** for **View/Edit Data**.
2. Select the installation.
3. Type **F** for **Field Notes**.
4. Type in your notes.
5. To save the notes, hold down C and type **W**.
   To abort, press E.

Step 7: Deleting Extra Data Sets from the DataMate

1. Establish communication between DMM and the DataMate.
2. Type **D**. After a short delay, DMM displays a list of data sets held in the DataMate. A carat "^" after the data set number marks data sets that have been transferred from the DataMate. Any data set marked with the caret is a candidate for deletion.
3. Move the cursor to the data set you want to delete, then tag it by typing **T**. A triangle appears to the right of the date. Tag other data sets as necessary.
4. Press R to delete the tagged data sets from the DataMate. After DMM deletes the tagged data sets, it returns to the Communications Menu.

About Data Set Numbers

Data from each inclinometer survey is called a "data set." Each data set is identified by site and installation, a number, and the calendar date and time of the survey.

Dataset numbers in the DataMate may be different from those in the project database. This will not cause problems, but you may be interested in how data set numbers are handled.

Temporary Numbers in DataMate

The DataMate assigns a temporary number to each data set as it is recorded. It assigns #1 to the first set (for each installation), #2 to the next set, and so on. If you erase data sets from the DataMate's memory, the DataMate will assign numbers starting from 1 again.

Permanent Numbers in Database

When you transfer data sets to the project database, DMM assigns a permanent number to each data set. The new number is based not only on the next available number in the database, but also the date and time of the survey. Thus DMM is not confused by the temporary numbers that the DataMate assigns.

Suppose you have recorded 5 data sets (for an installation), transferred them to the project database, and then erased them from the DataMate's memory. The DataMate will assign #1 to the next data set that you record, even though it is actually the sixth data set for that installation. When you transfer the new data set from the DataMate, DMM will check that the time and date of the survey is more recent than dataset #5, which is already in the database. Then it will assign it a permanent number of #6.

Permanent Numbers in DataMate

If you later transfer a data set from the project database to the DataMate, its permanent data set number will not change. For example, if you transfer data set #1 to the DataMate, it will remain data set #1. This is useful if you want to use an initial set to calculate displacement.

Duplicate Data Sets

DMM does not allow duplicate data sets in the database. If you try to transfer a second copy of a data set that is already in the database, DMM will display a message telling you that the data set has already been transferred.

If you must transfer the new data set, delete the old one from the project database before you attempt to transfer the new one. See Chapter 10, "Maintaining the Database."

9

Generating Reports

Notes

Selecting a Data Set for the Report

1. Run DMM. Select the project database.

2. When the Main Menu appears, type **V** for "View/Edit Data." Type **N** for "Next" to select the installation record you want. Then press R. To see a list of all sites and installations, press **L** for "List," then use the b and t keys to select the installation.

3. Press **O** for "Open Next." DMM opens the Data Set window and automatically selects data set #1. To select a different data set, use the "Next" command. To see a list of all data sets for this installation, press **L** for "List," then move the highlight bar to the data set you want and press R.

4. Go to instructions for displacement or deviation reports.

Report of Cumulative Displacement

1. Select the current data set.

2. Type **C** for "Compare Data."

3. DMM asks if you want to compare the data with an initial data set. Press **Y**.

4. DMM asks if you want to sum from the bottom. Press **Y** if the bottom of the installation is fixed and can be used as reference. Type **N** to use the top of the casing as reference.

5. DMM asks for the initial data set number. Press R to accept data set #1 or enter a different data set number and press R.

6. DMM asks for a conversion factor and the units. The default units (1000 for metric and 12 for English) produce displacements in millimeters or inches.

7. DMM asks if you want to display incremental deviations (rather than changes in reading units). Type **Y** or **N**. See explanation later in this chapter.

8. DMM asks if you want to include checksum statistics. Type **Y** to include statistics or **N** to exclude statistics.

9. DMM prompts for the destination of the report. You can "print" the report to the screen, to a printer, or to a file. Press **P, S, or F**. These are explained later in the chapter.

Report of Cumulative Deviation

1. Select the current data set.

2. Type **C** for "Compare Data." DMM asks if you want to compare the data with a previous data set. Type **N**.

3. DMM asks if you want to sum from the bottom. Press **Y** if the bottom of the installation is fixed and can be used as reference. Type **N** if to use the top of the casing as reference.

4. DMM asks for the initial data set number. Press R to accept data set #1 or enter another data set number and press R.

5. DMM asks for a conversion factor and the units. A value of 1 will produce deviation in meters or feet.

6. DMM asks if you want to display incremental deviations (rather than differences in reading units). Type **Y** or **N**.

7. DMM asks if you want to include checksum statistics. Type **Y** to include statistics or **N** to exclude statistics.

8. DMM prompts for the destination of the report. You can "print" the report to the screen, to a printer, or to a file. Press **P, S, or F**.

Viewing Data on Screen

1. Run a report of displacement or deviation as explained on preceding pages.

2. When DMM prompts for the destination of the report (Printer, Screen, or File), press **S** for screen. DMM immediately displays tabular data. You can scroll through data with the t and b keys.

3. Switch to a graphic view of the data by pressing r or l. Press r to see a graph of cumulative displacement. Press l to see a graph of incremental displacement.

4. To change the scale of the graph, press R, input a different full-scale value, and press R again.

5. To return to the display of tabular data, press the r or l key.

6. Press e to view B-axis data. Once you press the e key, you cannot return to A-axis data.

7. Press E when done.

Printing Data on a Printer

1. Run a report of displacement or deviation as explained on preceding pages.

2. When DMM prompts for the destination of the report (Printer, Screen, or File), press **P** for printer.

3. DMM asks if you want to print A-axis data. Type Y to print or N to suppress.

4. DMM asks if you want to print B-axis data. Type Y to print or Y to suppress.

5. DMM asks if you want to print a graph. Type Y to print or N to suppress printing of graphs.

   If you choose to print a graph, DMM asks if you want to auto-scale the graph. If you press R for auto-scaling, DMM sets the full scale of the graph about 1/3 larger than the largest data value and starts printing. Press N if you want to disable autoscaling. DMM will then print tabular data first and afterwards asks you to enter the highest value for the A-axis.

6. DMM asks if your printer supports the IBM character set. If your printer supports the IBM character set, type **Y**. Otherwise, type **N**.

   The IBM character set includes characters for drawing lines and boxes. If you tell DMM that your printer does not support the IBM character set, DMM will use dashes and asterisks that are supported by all printers.

7. Examples of printed reports are presented at the end of this chapter.

Printing Data to a File

1. Run a report of displacement or deviation as explained on preceding pages.

2. When DMM prompts for the destination of the report (Printer, Screen, or File), press **F** File.

3. DMM prompts for a filename. Enter a file name and press R.

4. DMM asks if you want to print A-axis data. Type Y to print or N to suppress.

5. DMM asks if you want to print B-axis data. Type Y to print or N to suppress.

6. DMM asks if you want to print a graph. Type Y to print or N to suppress printing of graphs.

   If you choose to print a graph, DMM asks if you want to auto-scale the graph. If you press R for auto-scaling, DMM sets the full scale of the graph about 1/3 larger than the largest data value and starts printing. Press N if you want to disable autoscaling. DMM will then print tabular data first and afterwards asks you to enter the highest value for the A-axis.

7. DMM asks if your printer supports the IBM character set. If your printer supports the IBM character set, type **Y**. Otherwise, type **N**.

   The IBM character set includes characters for drawing lines and boxes. If you tell DMM that your printer does not support the IBM character set, DMM will use dashes and asterisks that are supported by all printers.

Incremental Deviations vs. Differences

When you generate a report, DMM asks whether to display "Incremental Deviations and Displacements" or "Differences and Changes." These terms are explained below:

Incremental Deviations & Displacements

When you select "incremental deviations," DMM displays 0- and 180-readings, and then converts the "average" of these readings to lateral deviation. (See the Introduction Chapter for details of converting reading units to units of length). Lateral deviation at one depth is called "incremental deviation." In the report, the column heading for incremental deviation is "INCR DEV."

Displacement is the change in deviation between the current data set and the initial data set (current - initial). Displacement at one depth is called "incremental displacement." In the report, the column heading for incremental displacement is "INCR DISP."

Incremental displacements are accumulated from the bottom (or top) to provide a value for cumulative displacement at each depth. In the report, the column heading is "CUM DISP."

Example

Look at the 58 foot depth in the sample report. The incremental deviation for the initial ("previous") set is -0.0504. How did DMM arrive at this value?

Find the "average" of 0- and 180-readings:

$$Averaged\ Reading = \frac{Reading_{0} - Reading_{180}}{2}$$

$$= \frac{-39 - 45}{2}$$

$$= -42$$

Convert averaged reading to lateral deviation. This is an English system, so the instrument constant is 20,000. For a result in inches, we multiply by 24.

$$Lateral\ Deviation = L \times \frac{Reading\,Unit}{20{,}000}$$

$$= 24\,inch \times \frac{-42}{20{,}000}$$

$$= -0.0504\,inch$$

SLOPE INDICATOR DATA REDUCTION ——————————————————————————— PAGE 1
Printed by DMM on June 7,1993
SITE: DEMO
HOLE NUMBER 45
site description 3.34 test installation

	+- PREVIOUS -+	+- CURRENT -+
DATA SET #	1	5
SENSOR #	26677	26677
DATE	10/05/93 13:44	10/11/93 11:22
READINGS PER DIRECTION	30	30
SENSORS:	26677	26677

	+—- PREVIOUS DATA —-+			+—- CURRENT DATA —-+			INCR DISP	CUM.DISP.
DEPTH	A0	A180	INCR.DEV	A0	A180	INCR.DEV	IN.	IN.
2.000	-218	223	-0.2646	-227	206	-0.2598	0.0048	0.2268
4.000	-339	343	-0.4092	-347	329	-0.4056	0.0036	0.2220
6.000	-279	286	-0.3390	-289	271	-0.3360	0.0030	0.2184
8.000	-290	295	-0.3510	-299	283	-0.3492	0.0018	0.2154
10.000	-253	259	-0.3072	-264	246	-0.3060	0.0012	0.2136
12.000	-207	212	-0.2514	-216	195	-0.2466	0.0048	0.2124
14.000	-135	140	-0.1650	-139	125	-0.1584	0.0066	0.2076
16.000	70	-66	0.0816	59	-81	0.0840	0.0024	0.2010
18.000	267	-262	0.3174	269	-279	0.3288	0.0114	0.1986
20.000	84	-79	0.0978	90	-106	0.1176	0.0198	0.1872
22.000	-31	39	-0.0420	-34	24	-0.0348	0.0072	0.1674
24.000	26	-14	0.0240	25	-37	0.0372	0.0132	0.1602
26.000	82	-73	0.0930	76	-90	0.0996	0.0066	0.1470
28.000	87	-84	0.1026	87	-106	0.1158	0.0132	0.1404
30.000	142	-133	0.1650	137	-153	0.1740	0.0090	0.1272
32.000	235	-226	0.2766	230	-243	0.2838	0.0072	0.1182
34.000	217	-210	0.2562	214	-233	0.2682	0.0120	0.1110
36.000	74	-65	0.0834	73	-86	0.0954	0.0120	0.0990
38.000	117	-103	0.1320	99	-111	0.1260	-0.0060	0.0870
40.000	297	-291	0.3528	286	-303	0.3534	0.0006	0.0930
42.000	324	-319	0.3858	323	-339	0.3972	0.0114	0.0924
44.000	174	-169	0.2058	178	-189	0.2202	0.0144	0.0810
46.000	-10	13	-0.0138	-8	-8	0.0000	0.0138	0.0666
48.000	-6	14	-0.0120	-15	-1	-0.0084	0.0036	0.0528
50.000	34	-26	0.0360	30	-42	0.0432	0.0072	0.0492
52.000	-69	78	-0.0882	-76	62	-0.0828	0.0054	0.0420
54.000	-54	53	-0.0642	-52	33	-0.0510	0.0132	0.0366
56.000	-67	75	-0.0852	-72	58	-0.0780	0.0072	0.0234
58.000	-39	45	-0.0504	-32	27	-0.0354	0.0150	0.0162
60.000	29	-19	0.0288	30	-20	0.0300	0.0012	0.0012

Deviations and Displacements

Example continued

The incremental displacement at 58 feet is 0.0150 inches. How did DMM arrive at this value?

$$\textit{Incremental Displacement} = \textit{Deviation}_{\textit{current}} - \textit{Deviation}_{\textit{initial}}$$

$$= -0.0354\,\textit{inch} - (-0.0504\,\textit{inch})$$

$$= 0.015\,\textit{inch}$$

Cumulative displacement at 58 feet is 0.0162 inch. How did DMM arrive at this value?

$$\textit{Cumulative Displacement at Depth}_{n} = D_1 + D_2 + \mathrm{K} + D_n$$

$$= 0.0012 + 0.0150\,\textit{inch}$$

$$= 0.0162\,\textit{inch}$$

Differences and Changes

When you select "Differences and Changes," DMM displays 0- and 180-readings, and then calculates a "difference" value. This way of presenting data originated in pre-computer days: Most of the steps in data reduction are carried out in "reading units" which typically involve fewer digits. It is provided as an option for those who are used to looking at "differences and changes."

The difference value is the algebraic difference of the 0- and 180-reading. In the report, the column heading for difference values is "DIFF."

The column heading "CHANGE" lists the change between the current difference value and the initial difference value at each depth (current - initial). This is similar to incremental displacement, but is in reading units rather than units of length.

Values under the column heading "CUM DISP" are cumulative displacements.

Example

Look at the 58 foot depth in the sample report. The difference value for the "previous" set is listed as -84. How did DMM arrive at this value?

$$\textit{Difference Value} = \textit{Reading}_{0} - \textit{Reading}_{180}$$

$$= -39 - 45$$

$$= -84\ \textit{reading units}$$

Change at the 58 foot depth is 25 reading units. How did DMM arrive at this value?

$$\textit{Change} = \textit{Difference}_{\textit{current}} - \textit{Difference}_{\textit{initial}}$$

$$= -59 - (-84)\ \textit{reading units}$$

$$= 25\ \textit{reading units}$$

```
SLOPE INDICATOR DATA REDUCTION ————————————————————————————————-  PAGE  1
Printed by DMM on June  7,1993
SITE: DEMO
HOLE NUMBER 45
site description 3.34 test installation
                +- PREVIOUS -+          +- CURRENT -+
DATA SET #              1                    5
SENSOR #               26677                26677
DATE                 10/05/93  13:44         10/11/93  11:22
READINGS PER DIRECTION   30                   30
SENSORS:               26677                26677
================================================================================
          +—- PREVIOUS DATA —-+     +—- CURRENT DATA —-+    CHANGE   CUM.DISP.
   DEPTH    A0   A180     DIFF      A0   A180     DIFF              IN.
   2.000  -218   223    -441      -227   206    -433         8    0.2268
   4.000  -339   343    -682      -347   329    -676         6    0.2220
   6.000  -279   286    -565      -289   271    -560         5    0.2184
   8.000  -290   295    -585      -299   283    -582         3    0.2154
  10.000  -253   259    -512      -264   246    -510         2    0.2136
  12.000  -207   212    -419      -216   195    -411         8    0.2124
  14.000  -135   140    -275      -139   125    -264        11    0.2076
  16.000    70   -66     136        59   -81     140        4    0.2010
  18.000   267  -262     529       269  -279     548       19    0.1986
  20.000    84   -79     163        90  -106     196       33    0.1872
  22.000   -31    39     -70       -34    24     -58       12    0.1674
  24.000    26   -14      40        25   -37      62       22    0.1602
  26.000    82   -73     155        76   -90     166       11    0.1470
  28.000    87   -84     171        87  -106     193       22    0.1404
  30.000   142  -133     275       137  -153     290       15    0.1272
  32.000   235  -226     461       230  -243     473       12    0.1182
  34.000   217  -210     427       214  -233     447       20    0.1110
  36.000    74   -65     139        73   -86     159       20    0.0990
  38.000   117  -103     220        99  -111     210      -10    0.0870
  40.000   297  -291     588       286  -303     589        1    0.0930
  42.000   324  -319     643       323  -339     662       19    0.0924
  44.000   174  -169     343       178  -189     367       24    0.0810
  46.000   -10    13     -23        -8    -8       0       23    0.0666
  48.000    -6    14     -20       -15    -1     -14        6    0.0528
  50.000    34   -26      60        30   -42      72       12    0.0492
  52.000   -69    78    -147       -76    62    -138        9    0.0420
  54.000   -54    53    -107       -52    33     -85       22    0.0366
  56.000   -67    75    -142       -72    58    -130       12    0.0234
  58.000   -39    45     -84       -32    27     -59       25    0.0162
  60.000    29   -19      48        30   -20      50        2    0.0012
================================================================================
 END OF RECORDS
```

Differences and Changes

Example continued

The cumulative displacement at 58 feet is 0.0162 inches. How did DMM arrive at this value? First, find the cumulative change at each depth (in traditional terminology: the "sum of changes").

$$\text{Cumulative Change}_n = \text{Change}_1 + \text{Change}_2 + \text{K} + \text{Change}_n$$

$$= 2 + 25$$

$$= 27 \text{ reading units}$$

Since the 0- and 180-readings have not been "averaged," we must divide by two: = 13.5 reading units

Finally, we must convert reading units to inches:

$$\text{Displacement in Inches} = L \times \frac{\text{Reading Units}}{20{,}000}$$

$$= 24\,\text{inch} \times \frac{13.5}{20{,}000}$$

$$= 0.0162\,\text{inch}$$

10

Managing the Database

Notes

Using the ASCII File Editor

You can use the ASCII file editor to edit and view ASCII files, such PC-SLIN and RPP files as well as DOS configuration and batch files. The ASCII file editor is especially valuable for changing site and installation identifiers when you import data into the project database.

1. Type **A** to open the editor window.

2. Type in the name of the file you want and press R or type in ***.*** and press R for a list of files. Then move the cursor to the file that you want and press R.

3. DMM displays editor defaults and a list of commands. Press R to accept tab spacing. Press R again to permit updating. If you type **N**, you can view the file, but you cannot save any changes you make to it.

4. DMM displays the file for updating. After updating, press C **W** to save the file (hold down the C key and type **W**). DMM saves the file very quickly and again asks for the file to load. To abandon changes made to a file, press E.

5. If there are no other files to edit, press E to exit the editor.

Importing Data

DMM can import data from PC-SLIN and RPP files. DMM also accepts manually-entered data, as explained later in this chapter. If your inclinometer data is in other file formats, such as those used by G-Tilt®, Lotus® , or dBase®, you can use Slope Indicator's DigiPro Utilities software to import data sets.

The PC-SLIN and RPP formats use one file per data set. Each file has a "header," a section at the beginning of the file that contains information about the installation and the data set. When DMM imports a file, it uses the information in the header to create the "site" and "installation" identifiers, data set numbers, description, date, and other fields.

How DMM imports a PC-SLIN file

Installation Records

This PC-SLIN field:	*becomes this DMM field:*	*Comments*
Project No	Site	Uses first 6 characters
Hole No	Installation	Uses first 6 characters
Text below "project no"	Desc	
A+CompassDirection	A0 Direction	

Data Sets

Reading Set No	Data Set #	
Date	Date	Converted to MM/DD/YY

How DMM imports an RPP file

Installation Records

This RPP field:	*becomes this DMM field:*	*Comments*
Project	Site	Uses first 6 characters
Hole #	Installation	Uses first 6 characters
Job Desc	Desc	
Dir Code	A0 Direction	

Importing Data

1. Copy the data files into the DMM directory.
2. Use DMM's ASCII file editor to examine fields such as "project no" or "hole no." DMM will use these fields to create "site" and "installation" identifiers. Make any necessary changes, then save the file.
3. Return to the Main Menu and type **G** for **Get Files**.
4. DMM prompts the type of file. Type **R** for RPP file or **A** for PC-SLIN (ASCII). Or type **D** for a direct connection to the RPP (explained later).
5. DMM asks for a filename. Type in the filename and press R.

   If you don't know the filename, type ***.*** to view a list of all files in the current. Put the cursor on the file you want to import and press R.
6. DMM displays the file header and asks if it is the correct data set. Press R to import the file or **N** to abandon the import process.
7. DMM reads the file into the project database, displays a message indicating the file was loaded, and then returns to the Main menu.

About Duplicate Data Sets

When you import a file, DMM checks the project database for a data set with the same site and installation, date, and time. If a matching data set is found, DMM halts the import process and prompts ''duplicate data set.''

PC-SLIN/ASCII files: If you still want to import the ''duplicate'' file, use the ASCII file editor to change the reading set number. Then type **G** for **Get Files** again.

RPP files: DMM will assign it the next available data set number and ask if you want to continue with the import.

Importing Directly from RPP

1. Connect the RPP to a serial port on your computer. Turn on the computer, run DMM, and select the project database. Turn on the RPP.

2. From the DMM Main menu, type **G** for **Get Files**.

3. DMM prompts you for the type of file to import. Type **D** to import directly from RPP.

4. DMM asks which serial port is being used. Type in the number of your comm port.

5. The RPP Upload window appears. Respond to the three prompts, then press any key on your computer keyboard to continue. DMM obtains a directory from the RPP.

6. Mark the files you want to transfer using the **M** command (mark/unmark). Then press R to load the marked files into the project database. To cancel the transfer, press E.

7. DMM displays a message indicating it it transferring the file. When done, DMM asks if the data set is the correct one. If you type **Y**, DMM saves the file.

8. DMM repeats this procedure for all marked files and then returns to the Main Menu.

Note The small window below the RPP Upload Window displays the same information shown on the RPP screen.

Entering Data Sets Manually

1. Run DMM and select the appropriate project database. If you are creating a project database, see Chapter 2.

2. From the DMM Main menu, select **`View/Edit Data`**.

3. Select the installation record under which you want to enter a new data set. Then press R. If your database contains many installations, type **`L`** for **`List`**. DMM displays a list of installation records. Highlight the one you want to work with (using the cursor keys) and press R.

4. Type **`O`** to open the Data Set Window. DMM automatically opens data set #1. If there are already some data sets for this installation, type **`A`** for Add. DMM creates a new data set and assigns it the next available number.

5. Enter appropriate values for the following fields. Press R after each entry until you've finished.
   - Data Set # (default is the first available number)
   - Reading Date (default is today's date)
   - Reading Time (default is the current time)
   - Operator (enter initials of person who did the survey)
   - Spiral Set? (default is N)
   - Actl Sensor # (enter probe serial number)
   - Actl Cnst (enter 25000 for metric or 20000 for English probe)

6. DMM displays a prompt at the bottom of the screen. Type **`Y`** to save the new data set record.

7. Type **`O`** for **`Open Next`**. This opens the Data Window so you can type in the data.

8. Enter depth and readings for the first depth. The order in which you enter depths is not critical, so you can start with any depth. Press R after each entry to go to the next field.

9. When you've finished with one depth, type **`A`** to add readings for another depth. After you've entered all the depths, press E several times to return to the Main menu. DMM saves the new data set automatically.

Exporting Data

1. Run DMM and select a project database.

2. Select **`View/Edit Data`**. DMM opens the installation window and automatically selects the first installation record in the database. To select a different installation, type **`L`** for "List." Put the cursor on the installation that you want and press R.

3. Type **`O`** for "Open Next." DMM opens the Data Set window and automatically selects data set #1. To select a different data set, type **`L`** for "List." Put the cursor on the data set that you want and press R.

4. Press **`W`** for the "Write ASCII" command. DMM asks if you want to export the file as an ASCII (PC-SLIN) file. Press **`Y`** for an PC-SLIN format file or **`N`** for an RPP format file.

5. DMM prompts **`Printer/Screen/File/Quit`**. Type **`F`** for file.

6. DMM prompts for a filename. Enter a file name and press R. You can enter a different drive and path along with the filename.

7. DMM asks if you want to include titles and header information. If you are exporting to a spreadsheet, press **`N`** since you want only numbers.

Deleting Data Sets

1. Run DMM and select the appropriate project database.
2. From the DMM Main menu, select **`View/Edit Data`**.
3. Select the installation record that contains the data set you want to delete. If your database contains many installations, type **`L`** for **`List`**. DMM displays a list of installation records. Highlight the one you want to work with (using the cursor keys) and press R.
4. Type **`O`** or press R to open the Data Set Window. From there, select the data set. If your database contains many data sets, type **`L`** for **`List`**. DMM displays a list of data sets. Highlight the one you want to work with (using the cursor keys) and press R.
5. Type **`D`** for **`Delete`**.
6. DMM displays the following message: **`Delete Complete Data Set?`** Type **`Y`** and press R to delete the data set. To cancel the operation, type **`N`** and press R.
7. Press E twice to return to the Main menu.

Deleting Installation Records

Note You must delete all data sets stored for an installation before you can delete the installation record itself.

1. Run DMM and select the appropriate project database.
2. From the DMM Main menu, select **View/Edit Data**.
3. Select the installation record.
   If your database contains many installations, type **L** for **List**. DMM displays a list of installation records. Highlight the one you want to work with (using the cursor keys) and press R.
4. Type **D** for **Delete**.
5. DMM displays the following message: **Delete (Y/N)?** Type **Y** and press R to delete the installation record. To cancel the operation type **N** and press R.
6. Press E. DMM now asks if you want to delete the memo records associated with this installation record. Memo records are the ''field notes'' that you might have entered when you transferred data from the DataMate to DMM.
7. Type **Y** and press R to delete the memo records.

Editing Data Sets

1. Run DMM and select the project database.
2. Select **View/Edit Data**.
3. Select the installation record that contains the data set you want to edit. If your database contains many installations, type **L** for "List." DMM displays a list of installation records. Highlight the one you want to work with (using the cursor keys) and press R.
4. Type **O** or press R to open the Data Set Window. From there, select the data set. If your database contains many data sets, type **L** for **List**. DMM displays a list of data sets. Highlight the one you want to work with (using the cursor keys) and press R.
5. To change information in the data set record, type **M** for "Modify." Otherwise, skip to step 7.

Note You cannot change the data set number. The only way to do this is to export the data set as an ASCII file, edit it, then import it. See ''Moving Data'' later in this chapter.

6. Change the appropriate fields in the data set record. Press R after each field or press d to accept all fields as displayed. DMM asks if you want to save. Type **Y** or R to save. To abort, type **N**.
7. Type **O** or press R to open the Data Window. Select the depth that contains the reading you want to edit. To select the depth, type **L** for **List**. Highlight the depth you want (using the cursor keys) and press R.
8. Type **M** for **Modify**. Edit each of the fields for that depth by typing new values and pressing R. To skip a field without editing it, simply press R without changing the entry.
9. Press E until you return to the Main menu.

Moving Data

If data is accidently stored under the wrong "site" & "installation" identifiers, you can "move" it to the correct one.

Moving the data set involves exporting the data set as an ASCII file, editing the identifiers with the ASCII file editor, and then importing the file.

1. Select the data set that you want to move.
2. Export the data set as an ASCII (PC-SLIN) file. See "Exporting Data" earlier in this chapter. Answer "Yes" when DMM asks if you want to include titles and headers.
3. Edit the file with the ASCII File Editor. Instructions for using the editor are presented at the beginning of this chapter. Use the editor to enter the appropriate identifiers. See "Importing Data" earlier in this chapter to review how DMM translates PCSLIN data to a form suitable for the project database.

Note Do not change the spacing between field names and their values. For example, the spaces on either side of the " = " sign are critical.

4. Import the data. Follow instructions for importing a file given under "Importing Data" earlier in this chapter.
5. Delete the old, unwanted data set. See "Deleting Data Sets" and "Deleting Installation Records" earlier in this chapter.

Indexing Files

DMM uses index files to keep track of files in a project database. Because index files can grow larger than data files, it's a good idea to "re-index" from time to time. New index files save disk space because they are smaller, and they also speed access to data.

If you have trouble accessing data or if DMM displays unexpected data, try re-indexing. The problem will most likely be resolved.

1. Run DMM and select the appropriate project database.
2. Type **`I`** for **`Index Data Files`**.

Appendix A

Recording Spiral Data

Notes

General Considerations

- Before a spiral survey, you must determine the zero-offset of the sensor. Later, after transferring data to the project database, enter the offset value into the "Offset A" field of the spiral data set. Use either DMM or DigiPro Utilities to do this.
- Spiral surveys are started at the bottom (even though readings are later processed from the top). A full spiral survey requires four passes through the casing, with the sensor in a different orientation (A0, A180, B0, and B180) on each pass. Readings are taken at 1.5m intervals with the metric sensor and 5 ft intervals with the English sensor.
- The DataMate displays spiral readings in arc minutes.
- DMM cannot process spiral data. The DigiPro Utilities program is used to "expand" the spiral set. The DigiPro program then corrects data sets for spiral when it creates a graph.

Step 1: Preparation

1 Determine offset of spiral sensor (See Spiral Sensor manual). Write down offset for later entry into the project database.

2 Connect the spiral sensor to the DataMate using inclinometer control cable. Turn on the DataMate. Attach the pulley assembly to the casing and remove the pulley wheel.

3 Insert the spiral sensor into the casing with the *upper* wheels of both wheel assemblies in the A0 groove. Replace the pulley.

Lower the sensor to the bottom of the casing. Do not allow the sensor to strike bottom. Allow five to ten minutes for the spiral sensor to adjust to the temperature in the casing.

4 While you wait, set up the DataMate: Select "Read," then "Record," and then the installation.

5 Press R until the cursor is on "Sens Type." Press t to select "spiral," then press R.

6 Press t to set "Units" to metric or English. Then press R.

7 Press R to bypass other fields until the cursor is on "Interval." Change the value to 1.5 (meters) for a metric spiral sensor or 5.0 (feet) for an English spiral sensor. Then press R.

Step 2: Recording Spiral Data

1 The DataMate displays the start depth. Raise the sensor to that depth. The reading is displayed in the A0 column. It stabilizes very quickly. Press the button on the hand switch or press the R key on the DataMate to record the reading.

```
  50.|   -14|      |
Depth      A0    B0
```

2 The reading just recorded is moved to the bottom line and marked with a * symbol. The top line shows the next depth to be recorded. The reading on the top line will change when you move the sensor.

```
  48.5|    33|      |
50.*   -14*       *
```

3 Raise the sensor to the next depth. Record the reading. Continue for each depth until you complete readings for the end (shallowest) depth. The DataMate now displays options, with the cursor on **Continue**. Press R or the hand switch to continue.

```
Continue  0
Done      Del
```

4 Remove the spiral sensor and rotate it 180 degrees. This time, insert the upper wheels of both wheel assemblies into the *A180* groove. Lower the sensor to the bottom, then raise it to the starting depth.

```
  50.|   -13|      |
Depth    A180   B180
```

5 Record the reading, then raise the sensor to the next depth. Note that the 180 degree reading is marked with the π symbol.

```
  48.5|    33|      |
50.π*    -13π       π
```

6 Continue raising the sensor and recording readings until you record the reading for the end (shallowest) depth. The display then looks like this:

```
Press ENTER for B
reading, else ESC
```

7 Press R to start the B0 pass. Remove and re-insert the sensor with the upper wheels in the *B0* groove. Continue as with the A0 and A180 passes.

Step 3: Entering Spiral Offset into DMM

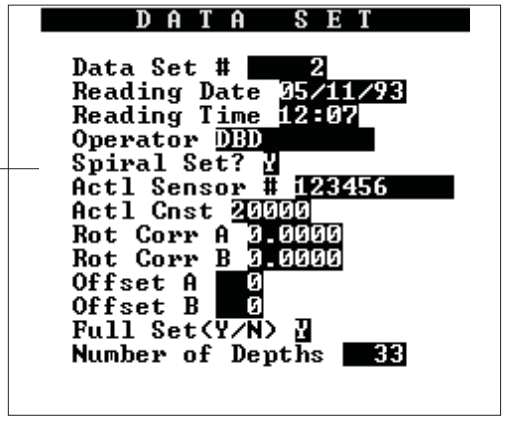
1. Transfer the spiral set to the project database.

2. At the Main Menu, press **M** for "Mode" to change DMM into "Advanced Mode."

3. Press V for "View/Edit Data."

4. Select the installation record that contains the spiral data set.

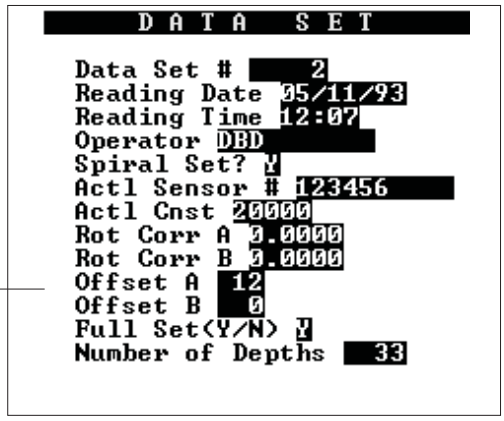
5. Type **O** to open the Data Set Window. Select the spiral set. If you are not sure of the data set number, you can identify the spiral set from the "Spiral Set" field as shown below.



6. Type **M** for "modify," then move the cursor to the "Offset A" field. Type in the zero offset.

   Press d. Then press R to save the record.

Enter the zero offset for the spiral sensor here



Appendix B

DOS Review

Notes

What is DOS?

DOS stands for Disk Operating System. For example, MS-DOS is a program that controls your disk drives and understands commands issued from the keyboard.

Today, most computers run DOS automatically from their hard disks or from ROM. A few computers still require a DOS "boot" disk that must be inserted when you turn on the computer.

DOS displays a prompt, such as A>, to indicate that it is ready to receive a command or run a program.

Programs

To run a program, type the name of the program, and press R. For example, to run the DMM.EXE program, type `dmm` and press R. It is not necessary to type the **EXE** extension.

Note DOS does not distinguish between upper and lower case letters. This means you can enter commands and filenames using lower case characters. (You don't have to press the S key.)

Commands

DOS provides command words such as **copy**, **delete**, and **rename**. Most commands are followed by "arguments" or "parameters" such as disk drives, paths, and file names.

To enter a command, type in the command word, a space, and then the argument. If there are two arguments, put a space between them. The command will not take effect until you press the R key.

Note In this book, the ^ symbol signifies a single space. For example, to enter this command: **copy^a:*.***, you would type **copy**, press M, type **a:*.***, and then press the R key.

Disk Drives

DOS computers use the letters A, B, C, or D to name disk drives. Floppy disk drives are usually named A and B. Hard disk drives are commonly named C and sometimes D. Your computer may have other alphabetic drive names as well.

Drive names are almost always followed by a colon (**:**), so it may be easier to think of a drive name as a letter + colon (**A:** or **a:**).

Changing Drives

The DOS prompt is usually the letter of the drive you are currently using. To change drives, type in the drive name and press R.

For example, **A>** is the current drive. To change to drive C, type **c:** and press R. The DOS prompt then changes to **C>**.

Filenames

Computers store data in files. Every file has a unique name that is up to eight characters long, followed by a period and an optional three character extension. For example, the file **DMM.EXE** has the name "DMM" followed by a period and an extension of "EXE."

Filenames are always displayed in uppercase characters, even if they were originally entered in lower case characters.

Extensions make it easier to locate certain types of files. Some extensions are reserved for DOS use. The **EXE** and **COM** extensions signify program files. A **BAT** extension signifies a "batch" file. You may be familiar with the **AUTOEXEC.BAT** file already. DMM automatically assigns extension to the files in the database.

Directories

Disks can now store so many files that locating a file can be difficult. For this reason, hard disks are usually subdivided into "directories." Each directory contains a smaller number of files, so individual files are easier to locate. Every directory has a unique name up to eight characters long. By default, the DMM program and the project database are placed in a directory called "DMM."

Making Directories

To make a new directory, type md^name R. **MD** is the "make directory" command, ^ is a single space, and name is a name up to eight characters long.

For example, **md^\i-90** creates a directory named "I-90." The **** signifies the root directory of the disk. For more details, refer to "directories" and "paths" in your DOS manual.

Changing Directories

Files stored in one directory are not visible when you are "logged" into another directory. To gain access to those files, it is necessary to change directories. Type **cd^name** R. **cd** is the "change directory" command, ^ is a single space, and name is the name of a directory.

For example, **cd^\i-90** R logs you into the directory named "I-90." The **** signifies the root directory of the disk. For more details, refer to "directories" and "paths" in your DOS manual.

Listing Files

To list the files in the current directory, type **dir** and press R. A list of files scrolls past, probably too quickly to read.
If you type **dir/p**, DOS displays a "page" of file names and pauses. Press the space bar to see the next page.

To list a set of database files created by the DMM program, type **dir^filename.*/p** R (replace filename with the name of the database). **dir** lists the files in the current directory, ^ is a single space, filename is the name of your database, ***** matches any file extension, and the **/p** displays a page of file names.

Renaming Files

To rename a file, type **ren^oldname^newname** R. The "rename" command is **ren** and **oldname** is the name of an existing file, the ^ represents a single space, and **newname** is the new name for the file.

To rename a project database, you must rename all the files in that database. For example, to rename the **BAKERRDG** database files to **TUNNEL** files, type **ren^bakerrdg.*^tunnel.*** R.

Deleting Files

To delete a file, type **del^filename** R. **del** is the "delete" command, ^ is a single space, and **filename** is the name of a file that you want to erase.

To recover an accidentally deleted file, you can purchase "undelete" programs, such as *Norton Utilities*. Recent versions of DOS are also supplied with undelete programs.

Copying Files

To copy a file, type **copy**^**source**^**destination** R. **copy** is the "copy" command, **source** is the name of the file you want to copy, and **destination** is the desired location and name for the copied file. ^ represents a single space between arguments.

The examples below show only a few of the many useful variations of the basic copy routine. You should consult your DOS manual for more details.

Example 1: **copy**^**a:dmm.exe**^**c:**R places a copy of the DMM program onto drive C.

Example 2: **copy**^**a:filename.***^**c:** R copies all database files on drive A to drive C (use the real name of your database instead of filename).

If your computer has only one disk drive, you can still copy from disk to disk. Type **copy**^**a:filename**^**b:** R as if you actually had a drive B. DOS will treat your single drive as two disk drives, A and B. DOS copies information from the source disk in drive A into the computer's memory and then prompts you to change disks so it can copy the data in memory to the second disk.

Formatting a Disk

Use this command with caution. Never format your hard disk unless you have backed up all of your data. In general, use the format command only with floppy disks.

When you take a new floppy disk out of the box, it usually isn't ready for use. First you have to *format* it. This involves running a program called **FORMAT.COM** which is included with DOS. Check your DOS manual for complete instructions.

To format a disk, type format^drive_name: R. Drive_name designates the disk drive containing the new disk, such as **A:** or **B:**

Since the **FORMAT** program erases any data on the disk, you should use care when you format disks. Check that you have specified the correct drive name and that you have inserted a new or unwanted disk in the drive. If you accidentally format the wrong disk, you may be able to recover the data with unformat programs, such as *Norton Utilities*.

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