

# Digitilt DataMate

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# Digitilt DataMate

**What is the DataMate?** The Digitilt DataMate is a recording readout that is used with Digitilt inclinometer probes (vertical or horizontal), Digitilt tiltmeters, and the spiral sensor. It works with both metric and English unit versions of these sensors.

Readings stored in the DataMate are transferred to a PC using the DMM software supplied with the DataMate. The use of this software is covered in a separate manual: DMM for Windows.

## DataMate Controls



**Power Switch** When you switch power on, the DataMate displays a copyright notice for ten seconds or until you press Enter. The copyright date serves as the version number for the DataMate.

**Connector Sockets** **Sensor:** Socket for inclinometer control cable.  
**Power:** Socket for battery charger or external power.  
**I/O:** Socket for hand switch or computer interface cable.  
Note: All connector sockets are waterproof only when connectors or protective caps are plugged in.

**Keypad** **Up:** Moves cursor up. In edit mode, scrolls forward through the alphabet (a...z) and numbers (0...9).  
**Down:** Moves cursor down. In edit mode, scrolls backwards through the alphabet (z...a) and numbers (9...0).  
**Left:** Moves cursor to the left.  
**Right:** Moves cursor to the right.  
**Esc:** Cancels current process and returns to menu.  
**Enter:** Chooses menu items. In record mode, records readings.

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## DataMate Menus

1. Use the arrow keys to select (highlight) a menu item.
2. Press Enter to choose the item or Esc to exit the item.

### Main Menu

The Main menu appears when you turn on the DataMate. The Main menu shows the main functions of the DataMate.

Read	Datasets
Comm	Utilities

### Read Menu

The Read menu lets you record inclinometer readings, edit inclinometer installation parameters, review and correct readings, and operate as a manual readout that displays readings but does not record them.

Record	Installation
Correct	Manual Read

### Datasets Menu

The Datasets menu lets you list datasets (surveys) in memory, validate a dataset, check available memory, delete a dataset, compare two datasets, and print a dataset to a communications program.

Dir	Validate	Memory
Del	Compare	Print

### Comm Menu

Comm puts the DataMate into communications mode for transferring data to and from a computer. Communications requires the DMM program, the included serial interface cable, and an RS232 serial port at the computer. If your computer has only USB connectors, you must use a USB-to-serial adapter or a PCM serial adaptor.

Waiting for PC . . .
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### Utilities Menu

The Utilities menu lets you set defaults, and check battery voltage and available memory.

Batt	Beep	Light
Temp	Date	Contrast

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## Setting Defaults

**Date and Time:** Choose Date from the Utilities menu. The DataMate displays the current date and time. Press Enter to edit the date. Press Up or Down to change the year, then press Right to move the cursor to month, etc. Press Enter when done.

**Beeper:** Choose Beep from the Utilities menu. Press Enter to toggle the beeper on or off.

**Backlight:** Choose Light from the Utilities menu to switch backlight on. Choose again to switch backlight off. Backlight increases battery drain by about 12 percent.

**LCD Contrast:** Choose Contrast from the Press Up or Down to adjust contrast for easy viewing. Press Esc when done.

## Checking Battery Voltage

Choose Batt from the Utilities menu. A new, fully charged battery shows approximately 6.2 volts with a full charge. If the main battery shows 5.9 volts or lower, you should recharge the battery before using the DataMate.

For best performance of both the DataMate and its battery, you should establish the practice of recharging the battery after every use of the DataMate. See the DataMate Maintenance chapter for instructions on recharging the battery.

At 5.5 volts, the DataMate displays a low-battery warning. If you see this warning, turn off the DataMate and recharge the battery as soon as possible.

A new Lithium backup battery shows approximately 3.3 volts. When the reading falls below 2.7 volts, the DataMate should be returned to Slope Indicator for servicing.

## Checking Memory

Choose Memory from the Datasets menu. The DataMate can hold readings from 2,500 depths and up to 40 datasets (surveys).

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# Setting Up

**Overview** Setting up the DataMate involves entering a list of inclinometer installations into the DataMate's memory.

- You can enter this information using a computer and DMM software.
- You can enter this information using the DataMate's keypad.

**Using DMM** This method is convenient when you have a number of inclinometer installations to enter. Detailed instructions are provided in the DMM manual. The basic steps are:

1. Use DMM to create a setup database on your PC.
2. Connect the DataMate to your PC.
3. Use DMM to transfer the setup to the DataMate.

**Using the DataMate** This method is convenient when you are in the field or when you need to add just one or two installations.

1. Choose Read.
2. Choose Installation.
3. Press Down key to scroll past any previously entered installations. The cursor stops on the word, "Create." Press Enter.
4. Enter the required information (see next page).

Use the Up and Down keys to scroll through the alphabet. Use the Left and Right keys to move the cursor to the left or right. Press Enter to move to the next field.

If you make a mistake, you can correct it later. Continue entering information as required. When you finish, the DataMate returns to the menu. Choose Installation from the menu, then choose the installation that you want to correct.

Press Enter to skip existing values. Make changes as required.

**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, and you cannot enter an installation. You cannot delete installations using the DataMate keypad, but you can still record a survey, if necessary. At recording time, select any installation and change its parameters as necessary.

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## Installation Fields

**Site & Install#:** Required. Every installation must have a two-part identifier: “site” and “installation.” Enter up to 6 characters for each part.

**A0 dir:** Optional. Enter up to 3 characters to identify the compass heading of the A grooves. Not used for any calculation.

**Operator:** Optional. Enter up to 3 characters to identify the operator.

**Sensor#:** Optional. Enter the serial number of the probe.

**Sens Type:** Required. Choose Digitilt for inclinometers.

**Units:** Required. Choose Metric or English. If you don't know, check the distance between the upper and lower wheels of the probe: 0.5 m for metric systems; 2 feet for English-unit systems.

**Ins Constant:** Required. Enter 25000 for metric-unit systems and 20000 for English-unit systems.

**Start:** Required. Enter the starting depth for the survey. (Surveys are started at the bottom of the casing.) With English-systems, it is best to use an even number so that 2-foot intervals coincide with cable markings. Unit labels are not used.

**End:** Required. Enter the ending depth for the survey, typically, 0.5 for metric-unit systems or 2 for English-unit systems. Unit labels are not used.

**Interval:** Required. Enter 0.5 for metric-unit systems and 2 for English unit systems. Unit labels are not used.

## Check the DataMate

To verify that the DataMate now contains your installation list:

1. Choose Read from the main menu.
2. Choose Installation.
3. Scroll through the list of installations.

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# Recording Readings

## Good Practices

1. Use the same probe and control cable for each survey, if possible.
2. Use a pulley assembly, if possible. It protects the control cable and provides a good reference.
3. Use a consistent top reference. The goal is repeatable placement of the probe within 5 mm or 1/4 inch. If one technician uses a pulley and another technician does not, probe positioning will be inconsistent, and data will be unusable.
4. Power up the probe before you lower it into the casing. This helps to protect the accelerometers from shock.
5. Always wait 10 minutes for the probe to adjust to the temperature of the borehole. This helps prevent bias-shift (offset) errors.
6. Always draw the probe upward to the reading depth. If you accidentally draw the probe above the intended depth, lower the probe down to the previous depth, then draw it back up to the intended depth. This technique ensures the probe will be positioned consistently.
7. Wait for displayed readings to stabilize. The DataMate displays 3 diamonds when readings have stabilized within two units.
8. When you remove the probe from the casing, clamp your hand over the wheels to prevent them from springing free or causing the body of the probe to strike the side of the casing. This helps prevent bias-shift (offset) errors.
9. Check your readings on site using the DataMate's Validate command. If necessary, you can correct bad readings by repositioning the probe and using the Correct command.

## Recording Readings

Here are the basic steps for performing an inclinometer survey.

1. Connect probe, cable, and DataMate. Plug the connector from the control cable into the DataMate's Sensor socket.
2. Switch on the DataMate and press Enter to display the main menu.

Read	Datasets
Comm	Utilities

3. Choose Read, then Choose Record.

Record	Installation
Correct	Manual Read

4. Choose the appropriate installation from the list.

Select Installation
SR18 IN1

5. Press Enter to step through the installation parameters without making changes. Normally, no editing is required.

Edit Installation
Site :SR18 IN1

← Press Enter to step through these parameters

6. Finally the DataMate displays the Start depth (bottom depth).

The diamond next to the depth indicates a "live" reading .

→ 50.◆	204	48
Depth	A0	B0

7. Insert the probe into the casing with upper wheels in the A0 direction. Lower the probe to the bottom of the casing or slightly below the start depth.
8. Wait ten minutes for the probe to adjust to the temperature at the bottom. This step is important for consistent readings.
9. Begin the survey. Raise the probe to the start depth, then watch the display. When numbers stabilize (you see three diamonds), press Enter to record the reading.

50.◆	206◆	52◆
Depth	A0	B0

Three diamonds ◆◆◆ indicate stable reading. Press Enter to record.

Recording a Survey continued

10. The DataMate beeps, and scrolls up to the next depth. The reading you just recorded is now on the bottom line. Raise the probe to the next depth (shown in the top line of the display) and wait for the numbers to stabilize. Press Enter to record the reading.

After you record the reading, pull the probe up to the next depth.

48.♦	210	55
50.*	206*	52*

Recorded readings are marked with a \*.

11. Repeat this process until you have recorded a reading at the top of the casing. The DataMate displays a menu. Choose Continue.

Continue	0
Done	Del

12. The DataMate now displays the starting depth for the second pass. Remove the probe from the casing and rotate it 180 degrees so that the upper wheels point to the A180 direction. Insert the probe and lower to the bottom of the casing, or slightly below the start depth.

50.♦	-210	-60
Depth	A180	B180

13. Raise the probe to the start depth, and wait for the numbers to stabilize. Press Enter to record.

48♦	-215	-75
50.π*	-210π	-60π

Recorded readings for the second pass are marked with the Pi symbol.

14. Repeat these steps until the probe is at the top of the casing and you have recorded the last reading. Choose Done from the menu, and remove the probe from the casing.

Continue	0
Done	Del

15. Optional. You may want to validate the survey using the DataMate's validate command. See Appendix 1.

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## To Correct a Mistake

1. Use the Down key to return to the depth where the mistake was made. The depth should appear on the top line of the display.
2. Lower the probe until it is slightly below that depth, then raise it to the exact depth. This positions the probe normally.
3. Press Enter to make the top line active. A diamond appears next to the depth, showing that the readings on the top line are “live.”
4. Wait for the readings to stabilize, then press Enter to record.
5. Continue recording as in a normal survey.

## To Cancel a Survey

1. Press Esc. (If you press Esc by mistake, press Continue).
2. Choose Del to delete the survey that you cancelled.
3. The DataMate prompts for confirmation. Press Up to confirm.

## To Delete a Survey

If you want to record a survey, but the DataMate prompts “no room in memory” or “too many datasets,” you must free some memory by deleting a dataset.

1. Choose DataSets from the main menu.
2. Choose Del.
3. Select a dataset to delete and press Enter. (Datasets marked with the ^ symbol have been retrieved by a PC, so it might be safe to delete one of them.)
4. Press Up to confirm the deletion or Esc to cancel. The DataMate deletes the dataset and indexes its memory. To avoid possible loss of data, do not switch the DataMate off during this process.

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# Retrieving Readings

**Overview** Retrieving readings involves connecting your DataMate to a PC and running a program on your PC. You can use DMM software for this purpose (recommended) or you can use a terminal program.

**Using DMM** **This is the standard way to retrieve readings.** Detailed instructions are provided in the DMM manual. The basic steps are:

1. Connect the DataMate to your PC and put it into Comm mode.
2. Start DMM and choose Retrieve Surveys.
3. Drag and drop the retrieved surveys into your project database (or export surveys to a text file).

## Using a Terminal Program

1. Connect the DataMate to the PC.
2. Start your terminal program. Set it for 8-bit, no parity at 9600 bps.
3. Set the terminal program to “capture” or “log” the data sent from the DataMate. Specify a file name for the captured data.
4. Choose Print from the DataMate’s. Set the baud rate for 9600 and press Enter. Then select the dataset and press Enter to “print” it.
5. Your terminal program will usually display the readings as they are sent from the DataMate.
6. Close the file with your terminal program.

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# Maintenance

## Recharging the Battery

Recharge the lead-acid battery after every use. Charging overnight is common practice.

Plug the charger into an AC mains socket. Plug the Lemo connector into the DataMate's Power socket. Use the Utilities - Batt function to check that the battery is charging. You should see the voltage reading increasing. 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.

A new, fully charged battery shows about 6.2 volts. During normal use, voltage should stay above 5.9 volts.

We recommend that you do not operate the DataMate when battery voltage drops below 5.9 volts. Deep discharge of the battery may damage its ability to recharge. Operation time for lower voltages is shown in the table below. The battery should be recharged immediately after operating at these voltage levels.

Battery Test Voltage	Time Remaining
5.8 v	6.5 hours
5.7 v	2.5 hours
5.6 v	1 hour
5.5 v	15 minutes

## Moisture Management

When you return to the office, remove caps from the DataMate's connectors and allow connectors to air-dry for a number of hours.

Use desiccant to keep the inside of the readout dry. This is particularly important in hot humid weather. Warm moist air trapped in the readout can condense when the readout is brought into a cool air-conditioned office.

To check the moisture level in the DataMate, choose Temp from the Utilities menu. The DataMate displays humidity and temperature. If humidity exceeds 75%, replace the desiccant. Humidity levels from 20 to 60% are normal.

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- Replacing the Desiccant**      You must open the DataMate to change the desiccant. You should ground yourself to prevent a static discharge that could damage the DataMate's electronics.
- Remove the two screws from the bottom of the case. Hold the top panel and pull off the case. Look for the desiccant pack between the battery and the panel connectors. Replace the desiccant pack with a new one. You may be able to renew the 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.
- Before you replace the case, apply a light coat of silicone grease to the gasket. Also lubricate the O-rings on the screws. Then slip the DataMate back into its case, checking that the gasket is seated properly. Replace the screws and tighten to draw the top panel squarely against the case. Do not over-tighten the screws.
- 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 solvents contained in such products will damage the rubber inserts inside the connectors.
- 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.

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# Appendix 1: Validating Readings

**About Checksums** A checksum is the sum of 0 and 180 degree readings at the same depth. Ideally, the sum should be zero since the readings have opposite signs. In practice, variations in casing grooves, the positioning of the probe, and the zero-offset of the probe 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.

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 be 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. Larger checksums may also be caused by debris in the groove, an out-of-round casing section, a separated casing section, a wheel falling on a casing joint.

**Standard Deviation of Checksums** 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.

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## 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. Also look for drifting mean checksums. A drifting mean may indicate a problem with the electronics inside the probe.
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.

### Check the Standard Deviation

1. Choose Validate from the DataSets menu.
2. Choose a dataset to validate.
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. If the standard deviation is acceptable, press Esc to quit. Otherwise, look at the SD for each zone.

### Check Zone Statistics

1. Press Enter to view the zone with the largest SD. You will see a display that looks something like this:

Zone statistics include 10 readings. In this case, there are 10 half-meter readings in the zone from 25m to 20m.

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

2. To view the mean checksum for this zone, press the Left arrow. Press Right to redisplay the SD.
3. Press Up or Down to display other zones. Again, the Left and Right keys toggle between mean and standard deviation.
4. If you decide the survey is acceptable, press Esc to quit. Otherwise, note the zones (depths) that you want to inspect and continue.

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## View Individual Checksums

Follow the steps below to find depths with large checksums:

1. After viewing the checksum statistics, press Enter to view checksums. The DataMate first displays the largest checksum in the dataset. In this case, the 89 in the B axis is largest.

25.	20	89
25.5	25	34

Depths                      A                      B

2. Use the Up and Down keys to view checksums at other depths. When you are finished viewing checksums, press Esc.

## Isolating the Bad Reading

A large checksum may indicate a bad reading, but does not indicate which reading was bad (the 0 or the 180 reading?). To isolate the bad reading, you must view readings above and below the suspect reading. .

1. Choose Read from the main menu.
2. Choose Correct, then choose a dataset (If necessary, press Right to see dates).
3. Press the Enter key to skip through parameters.
4. Choose 0 (orientation). Scroll through readings to the suspect depth. Check readings above and below the depth. A bad reading does not fit with the readings above and below it.
5. To view 180 readings at the same depth, press the Right arrow. Press again to display the 0 readings.
6. Note the depth and orientation of the bad reading. Then press Esc.

## Correcting a Reading

1. Choose Correct from the Read menu.
2. Choose 0 or 180, and scroll the DataMate to the required depth. The depth should be displayed on the top line.
3. Lower the probe to the required depth. Wait for the probe to adjust to the temperature in the borehole (5 to 10 minutes if the probe has been in open air)
4. Press Enter to activate the reading. Press Enter again to record the reading.

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# Appendix 2: Data Reduction

**Overview** The DataMate can calculate a single value for cumulative deviation or cumulative displacement.

- Cumulative Deviation**
1. At the Main Menu, select “DataSets.” Then select “Compare.”
  2. The DataMate prompts for the current data set. Press Enter to select the suggested dataset or scroll to find a different dataset.
  3. The DataMate prompts for a “previous” dataset. Press Esc since you do not want to calculate displacement.
  4. The DataMate asks you to confirm a conversion value of 1. Press Enter. This will display metric data in meters and English data in feet.
  5. The DataMate then calculates the cumulative deviation for the data set and displays it.
  6. Press Esc 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. The DataMate does not offer this as a choice, but when summing from the top, the deviation at the bottom of the borehole will be the same value except in the opposite direction.

**Cumulative Displacement** To calculate displacement, the DataMate must contain two surveys for the same installation.

1. Choose Dataset from the main menu, then choose Compare.
2. The DataMate prompts for the current data set. Press Enter to select the suggested dataset or scroll to find a different dataset. Then the DataMate prompts for a “previous” dataset. Scroll to find the initial set, then press Enter.
3. The DataMate prompts for a conversion value. Enter 1000 for a displacement in millimeters (with metric data). Enter 12 for a displacement in inches (with English unit data).
4. The DataMate then calculates the cumulative displacement for the data set and displays it. Press Esc when done.

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# Appendix 3: Trouble-Shooting

Tech Notes at  
SlopeIndicator.Com

Many questions can be answered by a visit to the Tech Notes section of [www.slopeindicator.com](http://www.slopeindicator.com). Go to Support - TechNotes. The scroll down the page to find the inclinometer tech notes. Take a look at the Digitilt DataMate Q & A page.

Readings don't stabilize

If this happens occasionally, but readings are stable within 3 digits, you can take the reading anyway. The DataMate's "ready" signal requires stability within 2 digits, but a single digit makes very little difference in the reading.

If this problem always occurs at a single installation and at a just a few depths, it is possible that the backfill around the casing is incomplete.

Reading instability can be caused by a low battery, so always check battery voltage before you leave the office.

If readings always take a long time to stabilize, and this happens at all installations, contact Slope Indicator.

System Error  
or DataMate Stops Working

You may see a "system error" message or the DataMate locks up, doesn't keep time, or has intermittent failures. These problems may be caused by a discharged battery or by a loose board inside the DataMate.

To check for a loose "SMP" board, ground yourself and the DataMate, then remove the two screws from the bottom of the case and pull the case off the DataMate. Remove the four screws from the corners of the battery bracket and then remove the battery and bracket assembly. This exposes the underlying printed circuit boards. The SMP module is the long, narrow circuit board that is plugged into the main board. Push on the edge of the board to verify that it is fully seated in the socket connector on the main board. Also look for corrosion or loose connections elsewhere.

There are also 2 ICs socketed on the under side of the SMP; the SMP must be removed to check these. When reinserting the SMP, take care to ensure it is correctly aligned with the sockets. Now try the Datamate, again. If the problem is still there, please contact the factory.

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**Strange Readings**

**A and B readings are both about +6000 or -6000:** Mid-range readings like this point to a cable problem. In this case, it is likely that one of the power wires is bad. The problem may be in a broken or corroded wire in the connector.

**Readings are about 12,000:** If your DataMate shows a full scale reading, such as 12,000, when the probe is near vertical, there is probably water in the connector or in the cable.

**Readings are all zero:** Readings looked OK when you recorded them but now are zero. This indicates a problem with the SMP board. See system error above.

**Self Test Error Messages**

**Error channel 0:** Bad signal input. Return for servicing.

**Error channel 1:** Lithium Battery. Can continue use, but lithium battery will not protect data if main battery is discharged.

**Error channel 2:** High reference voltage. Affects readings. Try recharging battery. If error persists, return for service.

**Error channel 3:** Low reference voltage. Affects readings. Try recharging battery. If error persists, return for service.

**Error channel 4:** +4.9 V readout power. Does not affect readings but could cause errors in operation. Try recharging battery. If error persists, return for service.

**Error channel 5:**  $\pm 12V$  sensor power. Disconnect control cable and probe. Try again. If error goes away, problem could be in probe or cable. Connect cable only. If no error, then probe is the problem. This error could also be caused by discharged battery. So try recharging battery first. If error persists, some component must be returned for servicing.

**Error channel 6:** +2.5 / -5V internal power supply. Can affect readings and communications. Return for service.

**Error channel 7:** Main battery is low. Try recharging. If error persists, replace battery.