HERMIT 2000

Environmental Data Logger

Model SE2000

Operator's Manual

September 1994
Software Version 3.4

In-Situ Inc.
Helping monitor the earth's resources

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Warning

Some models of the HERMIT 2000 use lithium batteries which the Department of Transportation considers a hazardous material. The lithium-powered HERMIT 2000 must never be transported on passenger aircraft. To do so is a violation of Federal Law (49 CFR 171.2). Please read and observe the shipping instructions sent to you with the data logger before attempting to ship it.

Contents

1 Introduction

Your HERMIT 2000 Environmental Data Logger is a versatile, self-contained, and extremely rugged field instrument that enables you to accurately perform a wide variety of hydrologic and environmental tests. To mention just a few of the special features of your HERMIT 2000, you have the ability to:

- Measure and record parameters such as level, flow, pressure, temperature, conductivity, and pH using standard In-Situ transducers.
- Easily reprogram your HERMIT 2000 to measure and record parameters from most industry standard 4-20 mA (milliampere) current loop transducers.
- Directly monitor and record flow from orifice plate discharge pipes.
- Collect fast, accurate time-drawdown data from constant-rate or stepped-rate pump tests, including the recovery phase. This powerful feature is equally suited to slug tests.
- Perform unattended long-term monitoring of aquifers, lakes, streams, reservoirs, waste-disposal sites, or any environment where data collection is critical or difficult.
- Record data in as much as 512K bytes (524,288 characters of information) of non-volatile data storage. Even if the HERMIT 2000's battery pack should fail, data will remain safe.
- Display and report all measured parameters in their selected measurement units. Data may be viewed on the large LCD (liquid crystal) display, printed or plotted on an optional field printer, or transferred to most personal and portable computers via the built-in RS232C interface.
- Operate the HERMIT 2000 at extreme temperatures without having to supply an external power source.

What's New in Software Version 3.4

If you are already familiar with a previous version of the HERMIT 2000, you may want to take notice of several new features that have been added to software Version 3.4:

- When you press **START** to begin a test with Level type inputs, the HERMIT 2000 will ask whether you have set a reference. See Section 7, Running a Test.
- When Level type inputs were used for a test, you can display the reference level in PSI while viewing the test data. This information is also printed in the data file header. See Section 8, Viewing Stored Data, and Section 10, Printing Data.

How To Use This Manual

This manual has been designed to enable you to gain the maximum benefit from your HERMIT 2000 and to answer your questions concerning field installations. If you have just received your new HERMIT 2000, read Appendix B before you attempt to operate the instrument. Appendix B contains unpacking instructions and other important owner's information.

Then familiarize yourself with the HERMIT 2000 system by reading and following through the examples in section 2 of this manual — with your HERMIT 2000. The best way to feel at ease with the instrument is to sit down with the operator's manual and the HERMIT 2000 and actually key in the examples provided in each of the sections. It won't take long to become familiar with your HERMIT 2000 and it is well worth the time invested to obtain a more complete understanding of the instrument.

Sections 3 through 11 of the operator's manual discuss each of the programming and control features of the HERMIT 2000, in the order you will most likely come to use them.

Sections 12 through 14 present field applications of the HERMIT 2000. The procedures presented in these sections will give you a guide to programming the HERMIT 2000 to solve several common data-collection problems.

After you've become familiar with the HERMIT 2000 system, you may wish to enhance your data-collection capabilities with additional inputs, expanded data storage, new types of transducers, and other field accessories. Be sure to check the accessories list in Appendix A.

CAUTION

Do not attempt to set up the HERMIT without first becoming thoroughly familiar with Appendix B; it contains information that is important to avoid damaging your instrument when it is set up.

2 Getting Started

In this section, we will discuss many topics in relatively few pages so that you can "get on board" fast. For this reason, some of the more sophisticated concepts are greatly simplified or reserved for later sections.

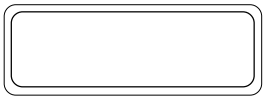
After working through this section, you'll have enough background to try things on your own, which is an excellent way to attain a good working knowledge of your instrument. *And don't worry, you can't damage the HERMIT 2000 or its accessories with any keyboard operation.*

The Keyboard

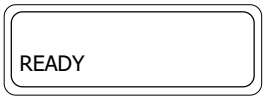
How to Wake the HERMIT 2000

The HERMIT 2000 uses a technique referred to as "sleeping" to minimize power consumption, achieving a battery life measured in years instead of months. Your HERMIT 2000 is naturally narcoleptic, falling asleep whenever there is no immediate task for the instrument to perform. When the instrument is asleep, only its internal clock and keyboard circuits remain active (the data storage memory is non-volatile and requires no power to retain stored information). The HERMIT 2000 will wake up when its internal clock indicates the time for a data point or when you press a key on the front panel.

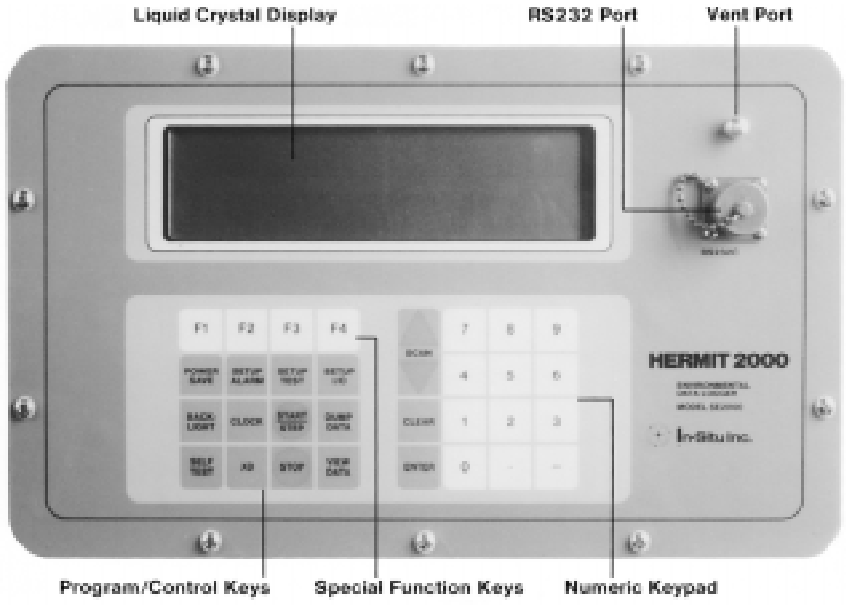
The sleep mode is recognized by a blank display.



Lightly press and release any key. The HERMIT 2000 will wake and respond with **READY** in about 2 seconds.

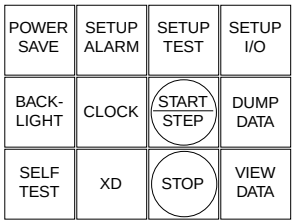


The HERMIT 2000 will remain awake as long as you are using the keyboard. If you have not pressed a key for about 60 seconds, the instrument will go back to sleep and the display will go blank.

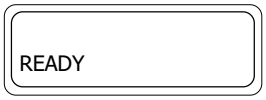


Program/Control Keys

Use these keys to select a specific control or programming feature of the HERMIT 2000. Most of these keys do not perform an immediate action but instead present a menu, or prompt you for additional information.

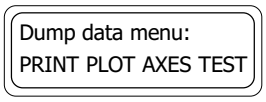


If the instrument has dozed off, press and release any key to wake it up.



As an example, press the **DUMP DATA** key.

The instrument responds by displaying the dump data menu.

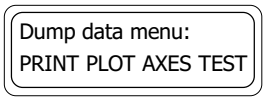


Special Function Keys

The special function keys are used to select options from menus presented in the display.

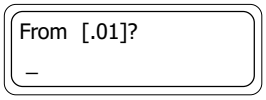
Menus will appear on the bottom line of the display in response to a program or control key selection. **F1** selects the first option, **F2** the second, and so forth from left to right.

Continuing with the previous example, press **F3** to select the AXES option in the dump data menu.



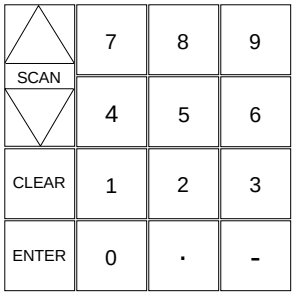
The axes setup menu is displayed (menus are often several levels deep). This menu consists of three selections, so only keys **F1**, **F2**, and **F3** are used.

Press **F3** to select the Y-AXIS option from the menu. The instrument now prompts us for a numeric entry that will determine ***from*** what value the y-axis will begin.

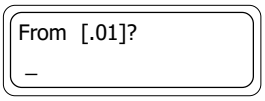


The Numeric Keypad

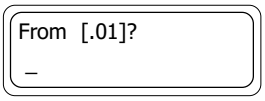
The numeric keypad is used to enter numeric values. You can also use the keypad to correct entry errors and **CLEAR** out of menus.



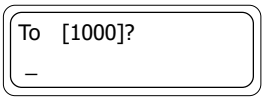
The HERMIT 2000 prompts for a numeric value by displaying a question mark and an underline cursor.



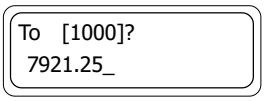
The default or currently programmed value for the parameter is enclosed within brackets. If you wish to use the displayed value, just press **ENTER** without typing any digits.



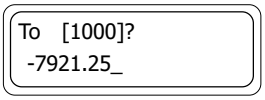
The instrument will enter the default value and continue to the next display. In this example, the next prompt is for a numeric entry that will determine ***to*** what value the y-axis will extend.



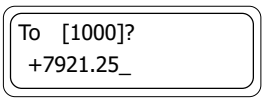
Key in digits and decimal points just as you would on a calculator.



The **–** key changes the sign of an entry value. Press it once to make the entry negative. . .

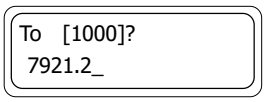


. . . again to toggle the entry positive.

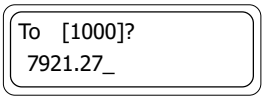


Note: Some parameters may require a positive only or an integer value. In these cases the HERMIT 2000 will ignore the change sign and decimal point keys to help remind you of the appropriate entry limits.

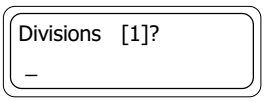
Use the **CLEAR** key to backspace over an incorrect digit . . .



. . . then continue keying in the number. Press **ENTER** to end your entry.



The HERMIT 2000 will enter your keyed value and continue to the next display.



The HERMIT 2000 stores numeric values in scientific notation with eight significant digits. If you enter a number with more than eight significant digits, the HERMIT 2000 will truncate the entry to eight digits. The range of values maintained in the instrument is $-.99999999 \times 10^{127}$ through $-.1 \times 10^{127}$, 0, and $.1 \times 10^{127}$ through $.99999999 \times 10^{127}$.

Now key in several digits, but *don't* press the **ENTER** key.

```
Divisions  [1]?
 123_
```

Press the **CLEAR** key and hold it down. After about one half second the key action will begin to repeat.

```
Divisions  [1]?
 12_
```

Continue holding the **CLEAR** key until you return to the **READY** display. Notice how you travel backwards through all the displays you have encountered.

```
READY
```

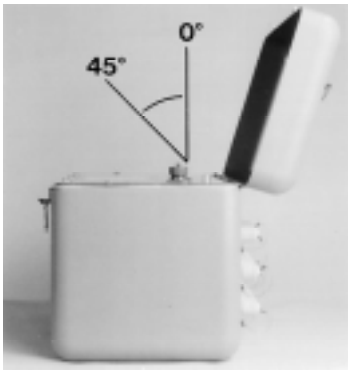
Note: You can use the **CLEAR** key to back out of any display. If you end up in a menu or display that you hadn't intended to be in, just press **CLEAR** to back up.

The **CLEAR**, **SCAN**, **ENTER**, and special function keys **F1**, **F2**, **F3**, and **F4** all make use of the auto-repeat feature (all other keys accept only one press at a time).

Display Control

The HERMIT 2000 features a large, easy-to-read LCD (liquid crystal) display. The display has excellent readability even in direct sunlight; in fact, the more light the better.

The LCD is optimized for comfortable viewing from below the plane perpendicular to the display as shown.



When viewing the display in low ambient lighting conditions, it may be convenient to use the electroluminescent backlight. Press the **BACKLIGHT** key to turn the backlight on; press it again to turn the backlight off.

```
BACK-
LIGHT
```

Try this while shading the display with the operator's manual. The backlight will wash out in normal ambient lighting conditions, making it difficult to see.

Battery Life Tip

Use the backlight feature only as necessary. Excessive use of the backlight will seriously impact battery life. If the backlight must be used for an extended period, use it inconjunction with external power.

The backlight will switch off automatically when the HERMIT 2000 goes to sleep.

The POWER SAVE Key

Press the **POWER SAVE** key and release it. The HERMIT 2000 will blank its display and go to sleep. This action helps to extend battery life by cutting short the normal 60-second sleep delay.

Battery Life Tip

Make a habit of pressing POWER SAVE at the end of every keyboard session.

The READY Display

Press and release any key. The HERMIT 2000 will wake and respond with **READY**.

```
READY
```

The **READY** prompt is presented whenever the HERMIT 2000 is awake and ready to accept a program or control key. The **READY** display shown above indicates that:

- The instrument is idle. No test is running or programmed to start.
- The HERMIT 2000 is operating on its internal battery pack and the battery pack is in good condition.
- The instrument is ready for you to press a program or control key. All other keys will be ignored.

As the operating status of the HERMIT 2000 changes, other information is added to the **READY** display.

If the internal battery pack begins to run low, the low bat indicator will be displayed.

```
READY          (low bat)
```

CAUTION

When the low bat indicator appears in the READY display, the internal battery pack has no more than one month capacity remaining, even less depending on instrument usage. If you are caught with low bat during a test, connect to external power if possible. You cannot lose stored data even if the battery becomes completely drained. Simply connect to external power, dump your data, and return the instrument for a battery replacement.

The ext pwr indicator is displayed when the instrument is operating on external power.

```
READY          (ext pwr)
```

The top line of the **READY** display is used to display data collection information such as **Test 0: RUNNING**, indicating that the HERMIT 2000 is recording data for test 0.

```
Test 0: RUNNING
READY          (ext pwr)
```

The **READY** display may show a combination of the various indicators; however, the **READY** still indicates that the HERMIT 2000 is ready for a program or control key.

Note: The displays shown throughout the operator's manual are presented as though the HERMIT 2000 were operating on its internal battery pack; however, you may wish to use external power during your training sessions.

System Self-Test

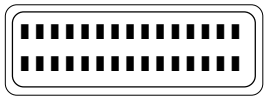
You can check the operational integrity and the configuration of the HERMIT 2000 by pressing the **SELF TEST** key.

SELF TEST causes the instrument to run through an electronic check of all internal components, including program memory, data storage memory, and the display. The self-test operation does not affect the contents of test data stored in memory.

Press and release any key on the keyboard to wake the instrument and get the **READY** display.

```
READY
```

Press the **SELF TEST** key. First, the display is checked by turning on every display element.



The instrument then tests its program ROMs (read-only memory containing the instrument's personality) . . .

```
SE2000 V3.4  2K-01250
PROGRAM ROMS...PASS
```

. . .then its RAM (random-access memory used as a scratchpad for computing results) . . .

```
SE2000 V3.4  2K-01250
RAM TEST...       PASS
```

. . . and its data storage memory (used to store the configurations and results of your tests).

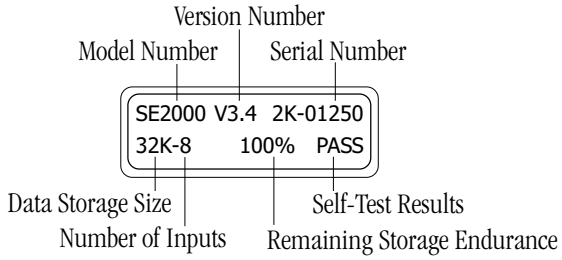
```
SE2000 V3.4  2K-01250
STORAGE TEST...  PASS
```

The HERMIT 2000 then reports the number of watchdog occurrences and the most recent error code generated.

```
SE2000 V3.4  2K-01250
WATCHDOGS:        0/00
```

The watchdog is an internal electronic circuit that resets the HERMIT 2000 when normal operation is upset by nearby lightning strikes, static discharges, and other similar types of electrical surges. Ideally the number of recorded watchdogs will remain zero; however, occasional watchdogs associated with storm events can be considered normal. Unusually high or frequent watchdogs may indicate a malfunction. Appendix D contains a list of watchdog error codes.

The final self-test display identifies the HERMIT 2000's configuration and all installed options:



If **FAIL** is indicated at any point in the self-test sequence, or a high number of watchdogs are recorded, the instrument may require service. See Appendix B for information on how to obtain repair service.

Note: If the HERMIT 2000 is recording data, an abbreviated form of the self-test is performed. After testing the display, the sequence will skip to the watchdog count. This allows the instrument to respond quickly to preprogrammed delayed starts and data point time intervals.

The non-volatile data storage used in the HERMIT 2000 has a limit to the number of times that data can be written to it, referred to as the memory "endurance." The self-test configuration display indicates the amount of memory endurance remaining. Your HERMIT 2000 is shipped with 100%. Typically, over 700,000 data points can be stored before "wearing out" the memory and reaching 0%.

Press the **CLEAR** key to return to the **READY** display.

Using Your HERMIT 2000

Let's try a simple data collection problem to get the feel of your HERMIT 2000. For the examples illustrated here, it will not be necessary to connect a transducer to the instrument. If the HERMIT 2000 happens to fall asleep while you are working through the problem, you will have to wake it up and repeat the section you were on from the beginning. If you make an entry error while keying in the example, just use the **CLEAR** key to back up.

For our example, we will record pressure for a few minutes using a standard In-Situ pressure transducer.

Defining the Test

The process of collecting a set of data with the HERMIT 2000 is referred to as "running a test." The first step in running a test is to define the basic test conditions.

- What test number we will be performing.
- At what rate to sample the input channels.
- How many input channels we will be using.
- What type of data will be collected on each input channel.

The HERMIT 2000 allows you to record as many as twenty different tests in memory, each with its own unique setup and data, without having to dump the data between tests. Tests are always recorded sequentially from test 0 to test 19. Let's clear the memory of any old tests and begin with test 0.

Press and release any key on the keyboard to wake the instrument.

```
READY
```

Press the **SETUP TEST** key to begin programming.

SETUP TEST

The HERMIT 2000 responds by asking you what test number you wish to set up.

```
Set up test#  [1]?
_
```

The test number shown in the display is the next ***safe*** test number—the next available test number that can be run while still retaining data recorded in lower numbered tests. The default number is also the highest test number you can select since tests are recorded consecutively. You may select any test number from 0 to the default selection shown.

Key in test 0 and press **ENTER**.

```
Set up test#  [1]?
 0_
```

The HERMIT 2000 will tell you if your selected test number will cause previously recorded tests to be erased.

```
Erase test#  0?
(Press F4 to erase)
```

Press **F4** to confirm that the recorded tests are no longer needed and may be erased.

Note: If you do not wish to have data erased, press **CLEAR** and use the default test number.

After pressing **F4** you are given one last chance to change your mind!

```
Erase code (3210)?
_
```

Key in the erase code as shown in the display and press **ENTER** . The instrument will not erase data until the correct code is entered.

```
Erase code (3210)?
 3210_
```

The indicated tests are then erased and the data storage is set up for our new test.

```
Test 0: Setup...
```

The display will show the number of data points that can be collected with the current setup, along with the number of days that we can run at the present rate . . .

```
DATA POINTS :    3825
Days at rate :     38
```

Note: The numbers that appear in your display may be different from those shown here depending on the amount of storage and the number of input channels installed in your instrument, as well as the previously programmed setup for test 0.

. . . followed by the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

The alarm start option will be explained in detail in later sections. For the time being, let's make sure that it is turned off:

Press **F1** to select the **ALARM** option in the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

We are presented with a new menu selection. The current setting of the alarm start option is shown enclosed within brackets. Press **F2** to make sure it is OFF.

```
Alarm start  [OFF]?
ON  OFF
```

Programming the Sample Rate

Press **F2** to select the **RATE** option in the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

The instrument prompts us to select the sample mode. The current selection is shown in brackets. Press **F3** to select **LIN1** (linear mode 1, data points spaced evenly over time).

```
Sample mode  [LOG]?
LOG USER LIN1 LIN2
```

Next we are prompted to enter the sample rate in minutes. Since we want to see things happen fast, let's take a data point every minute.

```
Rate (min)  [15]?
_
```

Key in 1 and press **ENTER** .

```
Rate (min)  [15]?
 1_
```

Our new data capacities are displayed . . .

```
DATA POINTS :    3825
Days at rate :      3
```

. . . and we are returned to the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

Selecting the Number of Transducers

Next, we need to program the number of input channels and transducers (abbreviated XD in the displays and on the keyboard) that will be recorded during the test.

Press **F3** to select the **#XDs** (number of transducers) option in the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

The instrument prompts for the number of transducers. The current selection and default value is displayed within brackets.

```
Number of XDs  [4]?
_
```

For our example we will be using one transducer. Key in 1 and press **ENTER** .

```
Number of XDs  [4]?
 1_
```

Our new data capacities are displayed . . .

```
DATA POINTS :   15558
Days at rate :     11
```

. . .and we are returned to the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

Defining Input Data Types

The last step in defining our test is to select the type of data to be collected on each input channel. Selection of the data type will determine both the measurement technique used to sample the transducer connected to an input and the equations used to convert the measurement results to appropriate units.

Press **F4** to select the **TYPE** option in the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

We are presented with a menu of 4 data types. The type of data is independently programmable for each input channel. The current selection is shown next to the input channel number.

```
Input 1:        Level (F)
LEVEL FLOW FUNC DUAL
```

Press **F3** to select the **FUNC** (function) option from the menu. The display will confirm your selection.

```
Input 1:        Function
LEVEL FLOW FUNC DUAL
```

The function data type allows you to collect data from any 4-20 mA transducer and convert the results to the desired units using a simple linear or quadratic equation. The other data types provide more complex data reduction features and will be discussed in later sections.

Press **CLEAR** to exit the data type menu. Our new data capacities are displayed . . .

```
DATA POINTS :   15558
Days at rate :     11
```

. . . and we are returned to the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

Press **CLEAR** again to exit the test setup menu and return to the **READY** display.

```
READY
```

From this point on, all other functions and menu displays will be automatically tailored to match your **SETUP TEST** selections. For this reason it is important to configure the test using the **SETUP TEST** function before attempting to alter other programmable settings.

Setting Up the Inputs

Now that we have set up the basic test parameters, we need to program the values that will determine how the 4-20 mA outputs of the transducers will be converted to meaningful units.

If the HERMIT 2000 has dozed off, press and release any key to wake it up again.

```
READY
```

Press the **XD** key to gain access to the transducer menus.

```
XD
```

The transducer menu for input channel 1 is displayed along with a reminder that the input has been programmed as a function type.

```
Input 1:    Function
READ I.D.          more
```

Press **F4** to select the **more** option from the menu. Additional menu options for our function type input are displayed.

```
Input 1:    Function
LIN SCALE OFFS DELAY
```

The linearity (**LIN**), scale factor (**SCALE**), and offset (**OFFS**) parameters shown in the menu will program the coefficients of a quadratic equation that will convert the transducer output to the desired units. The values for these "Quadratic Coefficients" are generally found on a data tag attached to the cable reel.

For purposes of this example, our pressure transducer has a scale factor of 50.078 and an offset of 0.036. These values will convert readings to PSI units.

Press **F1** to select the **LIN** (linearity) option. The instrument prompts for a linearity value.

```
Linearity [0]?
_
```

If a parameter is not specified, make certain it is set to zero. Key in 0 and press **ENTER** .

```
Linearity [0]?
0_
```

Press **F2** to select the **SCALE** (scale factor) option.

```
Input 1: Function
LIN SCALE OFFS DELAY
```

At the scale prompt, key in the transducer scale factor and press **ENTER**.

```
Scale [16]?
50.078_
```

Press **F3** to select the **OFFS** (offset) option.

```
Input 1: Function
LIN SCALE OFFS DELAY
```

At the offset prompt, key in the transducer offset and press **ENTER** .

```
Offset [4]?
0.036_
```

Now press **F4** to select the **DELAY** option.

```
Input 1: Function
LIN SCALE OFFS DELAY
```

Key in a warmup delay of 1000 mSEC (milliseconds) and press **ENTER**. The HERMIT 2000 will power the transducer for one second before taking a reading.

```
Delay mSEC [50]?
1000_
```

Note: The warmup delay is rarely specified on third-party transducers and must often be determined by experiment. In-Situ's standard transducers use a warmup delay of 50 mSEC unless specified otherwise. A one-second delay is used here only for the purpose of example.

Press **CLEAR** to exit the parameter menu . . .

```
Input 1: Function
LIN SCALE OFFS DELAY
```

. . . and return to the first input setup menu. Press **F1** to select the **READ** option.

```
Input 1: Function
READ I.D.          more
```

The HERMIT 2000 will power the input channel and wait for the programmed warmup delay period . . .

```
Input 1: Function
Busy...
```

. . . and then take a transducer reading and turn off the input channel. We are warned that no transducer has been connected to the input channel.

```
Input 1: Function
Not connected?
```

If a transducer had been connected, the HERMIT 2000 would have displayed the reading in the programmed units. Press **ENTER** to take additional readings from the same transducer. These readings will confirm that the transducers are properly connected and that you have programmed the transducer parameters correctly. For this example, we will leave the transducer disconnected.

Press **CLEAR** to return to the transducer menu.

```
Input 1: Function
READ I.D.          more
```

Press **CLEAR** again to return to the **READY** display. We're now ready to start collecting some data.

```
READY
```

Starting the Test

From the **READY** display, press the **START/STEP** key.

The instrument displays the start menu. Press **F1** to select an **IMMEDIATE** start.

```
Test 0: Start menu
IMMEDIATE DELAYED
```

The data point display flashes briefly to indicate that a data point has been recorded at an elapsed time of 0 minutes.

```
*** DATA POINT ***
0.000 min.
```

We are then returned to the **READY** display. Notice that a test **RUNNING** indicator has been added.

```
Test 0: RUNNING
READY
```

The HERMIT 2000 will record a transducer reading once every minute until you **STOP** the test or all the available data storage space is used up.

As you continue with the example, you will be interrupted occasionally as the instrument takes another data point.

```
*** DATA POINT ***
1.000 min.
```

Viewing Recorded Data

From the **READY** display, press the **VIEW DATA** key. Recorded data can be viewed while the test is running or after the test is stopped.

You are prompted to enter a test number for viewing (you can also view tests other than the one that is running). The default selection is the currently running test or the highest test that has been run. Press **ENTER** to select our sample test.

```
Test [0]?
_
```

Next select the test step. Press **ENTER** to select step 0.

```
Step [0]?
_
```

Note: Tests can be subdivided into steps by re-starting the test in coincidence with a particular test event, such as the change in pumping rate during a stepped-rate pump test. When you first start a test you are automatically in step 0. Detailed discussions of step testing are reserved for later sections.

Next select the percentage into the test data you wish to begin viewing. Zero percent is at the beginning of the test; 100 percent is at the end of the test, or the most recent data point if the test is still running.

```
View %  [100]?
_
```

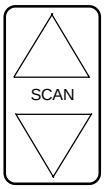
Let's view data from the beginning of the test by keying in 0 and pressing **ENTER** .

```
View %  [100]?
 0_
```

The display shows our recorded data in PSI at an elapsed time of zero minutes (the start of the test). Our pressure readings show negative results since we did not connect a transducer to the input channel.

```
Input 1:  Function
- ¯      0.0000     -2.899
```

Use the **SCAN** keys to scan through the recorded data. **SCAN UP** scans in the direction of increasing elapsed time; **SCAN DOWN** scans in the direction of decreasing elapsed time. These keys will auto-repeat if you continue to hold them down.



If you press **SCAN DOWN** while viewing data at elapsed time zero . . .

```
Input 1:  Function
- ¯      0.0000     -2.899
```

. . . the display will show the start date and time momentarily (which may be incorrect since we did not set the clock before starting the test) . . .

```
Input 1:  Function
- ¯      10/03    00:00:00
```

. . . then return to the view data display.

```
Input 1:  Function
- ¯      0.0000     -2.899
```

Note: The arrows in the display indicate that function keys **F1** and **F2** may be used to scan through the input channels. Since we have programmed only one input channel, these keys perform no function.

Press **CLEAR** to back out of the view data display. Note that the view percentage shows the point at which you stopped viewing. If you wish, you can move quickly to another point in the test by entering a new percentage.

```
View %  [50.190114]?
_
```

Press **CLEAR** again to exit to the **READY** display.

```
Test 0: RUNNING
READY
```

Stopping the Test

To stop data recording, press the **STOP** key.

You are asked to confirm the stop command by pressing the **ENTER** key.

```
Test 0: Stop
(Enter to confirm)
```

Note: If the **STOP** key was pressed accidentally or you do not wish to stop the test, press **CLEAR** to back out.

Press **ENTER** to stop the test. The HERMIT 2000 will take a few seconds to organize the data storage . . .

```
Test 0: Stop
```

. . . then will return you to the **READY** display.

```
READY
```

Battery Life Tip

Don't waste battery power and memory endurance by leaving the HERMIT 2000 running after the test is finished. Use the STOP function to turn data recording off.

Data Security

Once you have stopped a test, the raw transducer data recorded in memory cannot be altered; however, you may edit the transducer parameters in the XD menus. Since raw data (transducer data before computing the units) is stored separately from the transducer parameters, you may correct errors in the parameters without having to recalculate your data.

If you set up for a new test by selecting the next test number as presented by the **SETUP TEST** function, all previous data and setup parameters become protected and cannot be altered. Any changes you make in programming will pertain only to your current test.

Review

As you may have begun to realize, the HERMIT 2000 is capable of running much more sophisticated tests than the one demonstrated in this section. We will jump right into the detailed operating and programming features beginning with the next section. If you are not yet comfortable with the basic operation of the instrument, you may wish to review the material presented in this section before continuing.

WARNING

Always begin the setup of a new test by first selecting a test number with the SETUP TEST function. If you begin with any other function you may be inadvertently editing the parameters of your previous test. Your test data is completely secure and uneditable only after incrementing to the next test number.

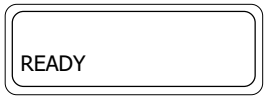
3 Time of Day Clock

The HERMIT 2000 maintains an internal, battery powered, time of day clock. The clock remains operational when the instrument sleeps, keeping track of the month, day of the month, and the time of day in hours, minutes, and seconds. The clock is used to record the start date and time of a test, and may be used to program delayed start operations.

Time is kept in the 24-hour, or military, format, where 0 hours is midnight. A time of 11:00 indicates 11 A.M. and a time of 23:00 indicates 11 P.M. The clock runs on a four-year cycle and does not keep track of leap years.

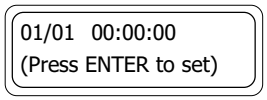
Displaying the Clock

Begin at the **READY** display. The clock can be displayed while in any operating mode.

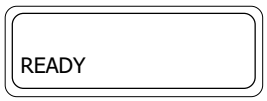


Press the **CLOCK** key.

The HERMIT 2000 will display the current date and time.



Press **CLEAR** to exit to the **READY** display. If no key is pressed, after 10 seconds the display will return to **READY** automatically.

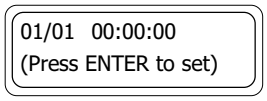


Setting the Clock

The time of day clock can only be set while the HERMIT 2000 is idle. The clock cannot be set if the instrument is running a test or if it is waiting for a delayed or alarm start.

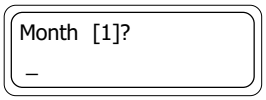
Press the CLOCK key while at the READY display.

The HERMIT 2000 will display the current date and time. Press **ENTER** to begin setting the clock.

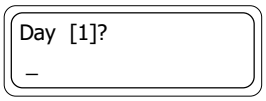


Note: If the instrument is not idle, the **ENTER** prompt will not be displayed and the **ENTER** key will be ignored.

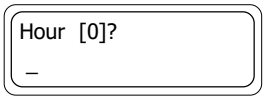
The HERMIT 2000 first prompts for the month. The month must be in the range 1 to 12. Don't forget that if the value shown within the brackets is correct, you can press **ENTER** without re-keying the value.



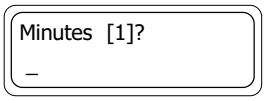
The day of the month must be in the range 1 to 31 and is checked against the maximum number of days in the month just entered.



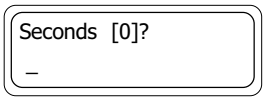
The hour must be in the range 0 to 23.



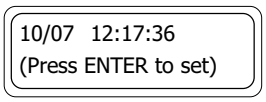
Enter minutes in the range 0 to 59.



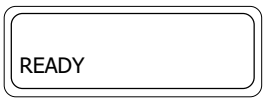
Seconds must also be in the range 0 to 59. The clock is set as soon as you press **ENTER** .



The new date and time are displayed. If you have set any parameter incorrectly, press **ENTER** and repeat your entries.



Press **CLEAR** to exit to the **READY** display. If no key is pressed, after 10 seconds the display will return to **READY** automatically.



4 Setting Up a Test

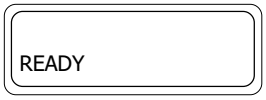
In Section 2, the **SETUP TEST** function was used to program the four basic parameters of a test:

- Selection of the test number
- The sample rate
- The number of input channels to use
- The type of data to be collected on each input channel

Since other functions and menu displays will be tailored to your **SETUP TEST** selections, it is important to properly set up a test before programming other instrument functions. This section will expand on the options available in the **SETUP TEST** menus.

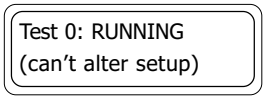
Selecting the Test Number

Begin at the **READY** display. If the instrument is asleep, press and release any key to wake it.

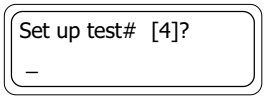


Press the **SETUP TEST** key to begin programming.

You cannot set up a new test if a test is running or if the HERMIT 2000 is waiting for a delayed or alarm start.

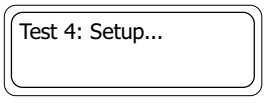


A new test can be programmed only when the instrument is idle. The HERMIT 2000 responds by asking you to select a test number.

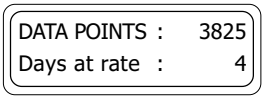


You can record as many as twenty tests, numbered consecutively from 0 to 19, each with its unique setup and data. The default test number shown in brackets on the display is the next available test number; selecting it will ensure that test data already recorded in the instrument will not be overwritten. Test numbers cannot be selected out of sequence. The test number shown in the display is the highest entry you can make.

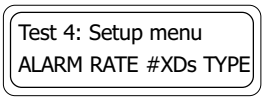
Press **ENTER** to select the default test number. The previous test setup is copied to the new test . . .



. . . the available data point capacity and test time in days is displayed . . .



. . . followed by the test setup menu.

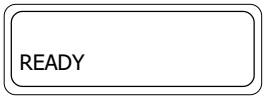


Note: The setup parameters are copied from the previous test to simplify re-running a test (you don't have to re-enter all of the test parameters). Of course, the test setup can be modified or completely changed if you wish.

Erasing Old Tests

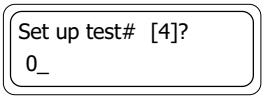
As you continue to record tests into the memory, you will find that the amount of memory available for new tests continues to grow smaller. This translates into fewer days of recording at a given sample rate, or longer sample rates to achieve the required test lengths. At some point it will become desirable to erase old test data to free up the memory for a new test. You can erase old test data by selecting a lower test number than the default test presented by the HERMIT 2000.

Begin at the **READY** display.



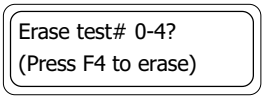
Press the **SETUP TEST** key to begin programming.

When you are prompted for a test number, key in the lowest test number you wish to erase.



The test number you select, ***and all higher test numbers,*** will be erased. Selecting test 0 will cause all test data to be erased.

The HERMIT 2000 will warn you when your selection will cause previously recorded tests to be erased. Press **F4** to confirm the selection.



Note: If you do not wish to have data erased, press **CLEAR** and use the default test number.

After pressing **F4** you are given one last chance to back out!

```
Erase code (3210)?
_
```

Key in the erase code as shown in the display and press **ENTER**. The instrument will not erase data until the correct code is entered.

```
Erase code (3210)?
 3210_
```

The indicated tests are then erased . . .

```
Test 0: Setup...
ALARM RATE #XDs TYPE
```

. . . the amount of storage now available is displayed . . .

```
DATA POINTS :  14421
Days at rate :     17
```

. . . followed by the test setup menu.

```
Test 4: Setup menu
ALARM RATE #XDs TYPE
```

The setup parameters for the selected test are not erased. You may re-run the test using its old parameters, or modify them as needed for a new test.

Sample Rate Options

The sample rate determines how often input channel readings will be recorded. All input channels share the common sample rate setting. There are two parts to the sample rate setting. The sample mode is set first; the four choices are described on the following pages. The sample rate (interval between readings) is prompted next.

Press **F2** in the test setup menu to select the **RATE** option.

```
Test 4: Setup menu
ALARM RATE #XDs TYPE
```

You are first prompted to select a sample mode. The currently programmed mode is shown in brackets. Use the special function keys **F1**-**F4** to select one of the four available sample modes:

```
Sample mode  [LOG]?
LOG USER LIN1 LIN2
```

LOG	logarithmic sampling schedule (see below)
USER	customized sampling schedule (see p. 13)
LIN1	data points spaced evenly over time (minutes)
LIN2	data points spaced evenly over time (seconds)

You are then prompted for the sample rate (interval between readings). This prompt will vary depending on the sample mode. The currently programmed rate is shown in brackets. Key in the sample rate and press **ENTER**.

```
Rate (min)  [1]?
```

Allowable entries are:

LOG	0-1440 minutes (see below)
USER	1-65535 minutes, 1-65535 points (see p. 13)
LIN1	1-1440 minutes
LIN2	2-59 seconds

The amount of storage and the number of days that can be run at the selected rate are displayed . . .

```
DATA POINTS :  14421
Days at rate :     17
```

. . . and you are returned to the test setup menu.

```
Test 4: Setup menu
ALARM RATE #XDs TYPE
```

Linear Sampling (LIN1 & LIN2)

Selection of a linear sampling mode causes the HERMIT 2000 to record one reading from each active input channel at the specified sample rate.

In **Linear mode 1** the sample interval can be set from 1 minute to 1440 minutes (one day). This mode is useful for collecting long-term data and for recording background data prior to running pump or slug tests.

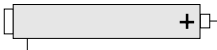
Linear mode 2 allows faster sampling: 2 to 59 seconds between readings. Use this mode for collecting fast, continuous data for short tests.

The following points should be considered when setting up a test in the Linear 2 sample mode with a very fast sample rate:

- **Transducer Delays:** The sample rate must be equal to or longer than the sum of the transducer delays. These include the warmup delay, prompted in the transducer menus (Section 5) and the time required to read each dual-mode probe (5 seconds), plus one second for the HERMIT 2000 to perform internal calculations. You will not be allowed to exit the Test Setup menu if the sum of the delays exceeds the sample rate.
- **Keyboard Operation During the Test:** Because of the rapidity of data collection in the LIN2 mode, the HERMIT 2000 can't do anything else while the test is running. Only the STOP function is active (see Section 7).

Logarithmic Sampling

Log sampling optimizes data collection speed and memory usage for pump and slug tests. Pump and slug tests characteristically begin with very rapid changes in values, and end with very slowly changing values. If you were to program a very fast linear rate, you could characterize the early stages of the test; however, you would be quickly inundated with excessive data during the later stages of the test, possibly running out of memory before the test is complete. Conversely, a slower linear rate would allow you to run a test longer, but would not provide enough early-time information to properly characterize the data.



Battery Life Tip

Battery life improves with longer sample intervals. Select a sample rate that gives good data quality without wasting battery energy collecting excessive or redundant points.

The log sampling mode of the HERMIT 2000 solves these problems by using the sampling schedule outlined below.

Standard Log Schedule

Log Cycle	Elapsed Time	Sample Interval	Points/Cycle
1	0-20 seconds	0.5 second	41
2	20-60 seconds	1 second	40
3	1-10 minutes	12 seconds	45
4	10-100 minutes	2 minutes	45
5	100-1000 minutes	20 minutes	45
6	1000-10,000 minutes	200 minutes	45
7	> 10,000 minutes	1440 minutes	

As you can see, the sample intervals begin closely spaced and are automatically made longer with each log cycle. To use the standard log schedule, enter 0 or 1440 at the sample rate prompt.

You can tailor the standard log schedule to suit your requirements with an appropriate choice of sample rate. *In the log mode, the sample rate you enter determines the maximum sample interval you wish to have occur during the test.* The HERMIT 2000 will collect data according to the standard log schedule until it reaches a log cycle with a sample interval *greater* than your programmed sample rate. Sampling then switches over to the programmed sample rate for the remainder of the test.

For example, if you select the log sampling mode and key in a sample rate of 5 minutes, the instrument would record data using the following modified log schedule.

Log Cycle	Elapsed Time	Sample Interval
1	0-20 seconds	0.5 second
2	20-60 seconds	1 second
3	1-10 minutes	12 seconds
4	10-100 minutes	2 minutes
5	100 minutes . . .	5 minutes

Since the fastest sample rate you can enter is one minute, the instrument will always use the standard schedule through log cycle 3.

Consider the following when setting up a test in the log sample mode:

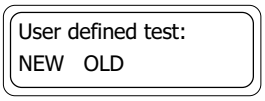
- **Transducer Warmup Delay:** During the first ten minutes (log cycles 1 through 3), the HERMIT 2000 uses a transducer warmup delay of 50 mSEC for all active inputs, regardless of the warmup delays programmed. After cycle 3, the programmed warmup delays are used. Make sure that the transducers you choose are compatible with the fast data requirements of the log sample mode.

- **Dual-Mode Transducers:** Due to the time required to read a dual-mode transducer, all dual-mode data recorded during the first three log cycles (ten minutes) will be meaningless and should be ignored. The data recorded during this period will vary depending on the coefficient settings, but the start of good data should be readily apparent.

User-Defined Sampling

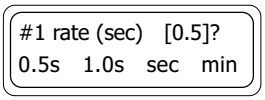
The "USER" sample mode allows you to design a custom sampling program for your test. The program consists of eight distinct sampling cycles which you define. For each cycle, you specify the sampling rate (interval between readings) and the number of data points (readings) to be collected. The instrument determines the length of each cycle based on your entries.

In cycles 1 through 7, samples can be taken at intervals of 0.5 second, 1 second, 2-59 seconds, or 1-65535 minutes. In cycle 8, samples can be taken at 2-59 seconds or 1-65535 minutes.



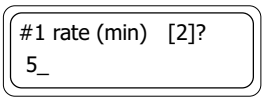
When you select the USER sample mode, you are first asked whether to use a NEW or an OLD user-defined schedule. Press **F1** to define a new schedule; press **F2** if you have previously defined a schedule and wish to use it again, or to select the default user schedule (see next page).

If you select OLD, no further information will be requested. You will be returned to the test setup menu.

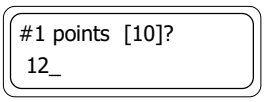


If you choose NEW, you will be asked to specify the rate (interval between readings) for the first cycle. The current rate for cycle #1 is shown in brackets. Use the special function keys **F1**-**F4** to select one of the four available options.

If you choose 0.5 second (**F1**) or 1.0 second (**F2**), the selected rate will be entered and the prompt for Points will come up.



If you choose seconds or minutes, then use the numeric keypad to enter the rate. The allowable range for Seconds is 2-59. The allowable range for Minutes is 1-65535. Press **ENTER** when you have specified the rate.



Then specify the number of data points to be collected in cycle #1. The current number of points is shown in brackets. Key in a number and press **ENTER**. Minimum: 1. Maximum: 65535. Maximum for a cycle with 0.5-sec or 1-sec sample rate: 255.

Now cycle #1 is defined. The rate times the number of points determines the length of the cycle. For the example above, a 5-minute sampling rate for 12 points equals an hour (5 ´ 12 = 60).

Note: For cycle #1, an initial data point will always be taken at time = 0. For the example above, the data logger will record 12 points plus one point at time = 0 for a total of 13 actual points recorded during cycle #1.

When you have set the sample rate and number of points for cycle #1, you will be prompted for the same information for cycles #2 through #7.

For cycle #8, there are only two rate options. Press **F3** to select seconds, then key in a number between 2 and 59, *or* press **F4** for minutes, and key in a number between 1 and 65535.

```
#8 rate (sec)  [2]?
                sec  min
```

In cycle #8, you will be prompted only for "rate." The HERMIT will automatically calculate the number of points that can be taken at that rate based on the instrument's available memory.

You need to define all eight cycles. If your test only requires four distinct cycles, you can, for example, define cycles 5 through 8 to be exactly the same as 4. Or make 1 and 2 identical, 3 and 4 identical, etc.

The default user-defined schedule is shown below.

Standard [Default "OLD"] User Schedule

Cycle #	Rate (Sample Interval) You enter	Points/Cycle You enter	Elapsed Time HERMIT calculates
# 1	1 minute	6	0-6 minutes
# 2	2 minutes	7	6-20 minutes
# 3	5 minutes	4	20-40 minutes
# 4	10 minutes	8	40-120 minutes
# 5	20 minutes	6	120-240 minutes
# 6	30 minutes	8	240-480 minutes
# 7	60 minutes	16	480-1440 minutes
# 8	120 minutes	—	> 1440 minutes

Here are some suggestions to help you set up a USER schedule:

- The schedule shown above remains in the instrument's memory as the current "OLD" schedule only until you change any of the values. Then your changes become the "OLD" schedule.
- To see the settings for the current "OLD" schedule, select NEW; the most recent settings will be shown in brackets as the defaults.
- You don't need to make the sampling less and less frequent, as in the schedule above. You could specify the early cycles to be sparse, for example, then put in every-minute sampling for one cycle, then go back to sparse.
- You can use part of the OLD schedule by pressing CLEAR after you have defined a couple of NEW cycles. If you press CLEAR at any point while defining a USER schedule, the HERMIT will use the last-defined schedule for the remaining cycles.
- One day is 1440 minutes.

The Number of Transducers

From the test setup menu, press **F3** to program the number of transducers (**#XDs**).

```
Test 4: Setup menu
ALARM RATE #XDs TYPE
```

You are prompted to enter the number of transducers to be used during the test. The current selection is shown in brackets.

```
Number of XDs  [1]?
_
```

When you press **ENTER**, the amount of storage and the maximum test length are displayed . . .

```
DATA POINTS :   14421
Days at rate :     17
```

. . . and you are returned to the test setup menu.

```
Test 4: Setup menu
ALARM RATE #XDs TYPE
```

Input channels are always used sequentially. If you program two transducers for a test, they should be connected to input channels one and two, four transducers should be connected to input channels one through four, and so on.

Battery Life Tip

Do not program the number of transducers to a number greater than the number that will actually be used. Recording data from unused input channels wastes battery power and data storage space.

More About Input Data Types

To review or change input types, press **F4** to select the **TYPE** option in the test setup menu.

```
Test 4: Setup menu
ALARM RATE #XDs TYPE
```

The display will show the type selection for input channel 1 and a menu with four type options.

```
Input 1:   Function
LEVEL FLOW FUNC DUAL
```

Use the **SCAN** keys to review the type selection for each input. The menu selections remain the same for all inputs.

```
Input 2:   Function
LEVEL FLOW FUNC DUAL
```

The **SCAN** keys will auto-repeat when held down longer than about a half-second.

Use the special function keys to change the type of the displayed input channel.

```
Input 2:   Level (F)
LEVEL FLOW FUNC DUAL
```

When you have set the data type for all your active input channels, press **CLEAR** to exit. The display will show the amount of free storage . . .

```
DATA POINTS :   14421
Days at rate :     38
```

. . . and then return to the test setup menu.

```
Test 4: Setup menu
ALARM RATE #XDs  TYPE
```

The selection of a data type defines two important characteristics of an input channel.

- The technique used to power up, and take a reading from, the transducer connected to the input channel.
- The data reduction equations that will be used to convert the raw output of the transducer to meaningful results in the desired units.

In this section we will present a brief description of each of the input types and their basic uses. The parameters used with each input type are programmed via the XD function key and are discussed in detail in Section 5.

Function Type

Press **F3** to program an input channel as a function (**FUNC**) type.

```
Input 1:  Function
LEVEL FLOW  FUNC DUAL
```

The function type input uses a flexible quadratic equation to convert the output of any conventional 4-20 mA transducer to its basic measurement units. Use the function type to obtain direct readings of pressure from a pressure transducer, temperature from a temperature transducer, flow from a flow transducer, etc. With proper modification of the quadratic equation coefficients, transducer readings can be reported in any equivalent units of measurements (temperature in degrees Fahrenheit or degrees Celsius, for example).

Level Type

Press **F1** to designate an input channel as a level type.

```
Input 1:  Level (F)
LEVEL FLOW  FUNC DUAL
```

The level type input allows you to use pressure transducers to solve a wide variety of water level measurement problems. It first uses the basic quadratic equation to convert the 4-20 mA output of a pressure transducer to units of PSI (pounds per square inch). PSI units are then automatically converted to water levels in selectable units of feet or meters. You can even select surface water or top of casing orientation and program the specific gravity of the water or fluid you're working in.

Flow Type

Press **F2** to designate an input channel as a flow type.

```
Input 1:  Flow
LEVEL FLOW  FUNC DUAL
```

The flow type input gives you the ability to use a pressure transducer to indirectly measure the flow rate from a discharge pipe equipped with an orifice plate. In a manner similar to the level type input, the 4-20 mA output of a pressure transducer is converted to PSI. PSI is then converted to flow using a standard orifice equation and a programmable calibration coefficient.

Dual Type

Press **F4** to designate an input channel as a dual type.

```
Input 1:  Dual
LEVEL FLOW  FUNC DUAL
```

The dual type selection is used with dual-parameter transducers such as In-Situ's conductivity/temperature and pH/temperature transducers. This type of transducer permits the recording of two parameters with a single input channel.

Exiting the Test Setup Menu

The HERMIT 2000 checks for illegal test parameters before you can exit the test setup menu.

If the sum of all the transducer delays exceeds the programmed sample rate, select a longer sample rate.

```
Test 0: DELAYS>RATE!
(can't start/step)
```

In figuring the delays, include:

(1) the warmup delay for each function, level, and flow type transducer programmed; these are prompted in the transducer menus (Section 5) and will normally be 50 mSEC, plus

(2) 5 seconds required to read each dual type programmed, plus

(3) 5 seconds for instrument wake-up (log mode and LIN1 only — the HERMIT 2000 doesn't go to sleep in LIN2 mode), plus

(4) 1 second for internal calculations.

For example,

10 XD's with 50 mSEC delays	=	.5 second
2 dual probes	=	10 seconds
Internal calculation	=	1 second
Total delays	=	11.5 seconds.

You would not be allowed to start this test with a sample rate less than 12 seconds in the LIN2 sample mode.

Note: If you change transducers and then try to set up a new test with a fast LIN2 sample rate (say, 2 seconds), it is possible that the test setup copied from the previous test will include transducer delays that exceed the new fast sample rate. In this case, you will have to "trick" the HERMIT 2000 into letting you exit the test setup menu: First, program a sample rate long enough to accommodate the previous delays. Then access the transducer menus and input the new delays. Then re-access the test setup menu and set the 2 second LIN2 sample rate.

5 Setting Up Transducers

After setting up the basic test parameters using the **SETUP TEST** function, you need to identify the transducers that will be connected to each input channel. Once identified, the HERMIT 2000 will have enough information to convert the output of each transducer to the appropriate measurement units.

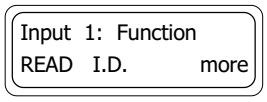
IMPORTANT

Do not begin setting up transducer parameters until you have selected a test number and programmed the basic test parameters using the SETUP TEST function. Otherwise you will be editing transducer parameters from the previous test.

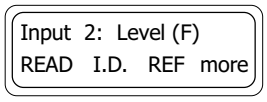
To access the transducer menus, press the **XD** (transducer) key when you are at the **READY** display.

Transducer parameters for the current test number can be programmed or modified while in any test mode (idle, running, etc.).

The display will show the transducer menu for input channel 1.



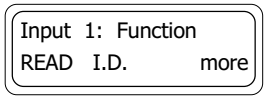
Use the **SCAN** keys to move to the desired input channel. The menu selections vary automatically to match the data type of the input channel.



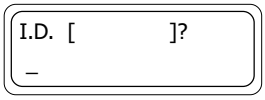
Assigning an I.D.

Each input channel can be assigned an eight-character identification to help document field test conditions. You can program the I.D. with a well number, transducer serial number, or any other piece of meaningful information. The I.D. is optional and may be left blank.

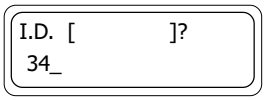
Press **F2** in any transducer main menu to select the **I.D.** option.



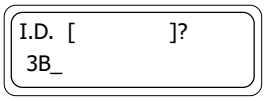
You will be prompted to enter the I.D. The current setting of the I.D. is shown within brackets.



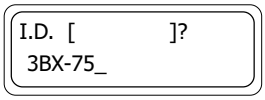
You can key in digits directly using the numeric keypad . . .



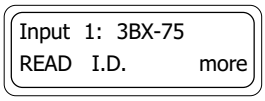
. . . or use the **SCAN** keys to change a keyed digit to any character or symbol.



You can key in up to 8 digits, symbols, or characters. Longer entries will be truncated to the first 8 characters. Entries less than 8 characters will be left-justified and padded with spaces.



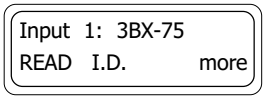
When you press **ENTER**, the display will return to the transducer menu. The I.D. will replace the type description in the top line of the display.



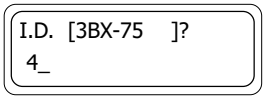
Clearing an I.D.

The input channel I.D. will be output with printouts, plots, and data transfers, and will be copied along with other transducer parameters from test to test. Keying in a new I.D. will overwrite an old I.D. in the same manner as keying in a new numeric value will replace an old value. Use the following procedure to completely clear an unwanted I.D.

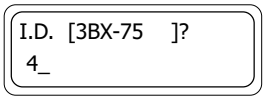
Press **F2** to select the **I.D.** option.



When you are prompted for a new I.D., key in any digit . . .



. . and **SCAN DOWN** until you reach the space character. Press the **ENTER** key.



The I.D. will be blanked, and the input channel type will again be displayed in the transducer menu.

```
Input 1: Function
READ  I.D.        more
```

Reading a Transducer

The **READ** function is common to all of the transducer menus. Press F1 to **READ** a value from the input channel's transducer.

```
Input 1: Function
READ  I.D.        more
```

The HERMIT 2000 will power the input channel and take a transducer reading . . .

```
Input 1: Function
Busy...
```

. . . then display the result in the programmed units. The display format will vary depending on the data type of the input channel.

```
Input 1: Function
          22.070
```

Press **ENTER** to take repeated readings from the same transducer.

```
Input 1: Function
          22.070
```

Use the **SCAN** keys to take readings on other input channels.

```
Input 2: Level (F)
 (25.465)        16.239
```

This message means the HERMIT 2000 cannot obtain a valid reading. Make sure the transducer is connected to the proper input channel and that all connections are secure.

```
Input 1: Function
Not connected?
```

Press **CLEAR** to return to the transducer menus.

```
Input 1: Function
READ  I.D.        more
```

Note: Transducers will not read correctly until all of the parameters contained in their corresponding menus have been programmed.

Programming Function Types

The parameters for a function type input are contained in two menus. Press **F4** in the main menu to access the second menu.

```
Input 1: Function
READ I.D.         more
```

Press **CLEAR** to return to the main menu.

```
Input 1: Function
LIN SCALE OFFS DELAY
```

There are four transducer parameters that you must enter for a function type. These parameters may be found on the cable reel, or on a data tag attached to the cable. Use the column labeled "Quadratic Coefficients."

- **LIN** Linearity — Set to zero if not specified by the transducer manufacturer.
- **SCALE** Scale factor — Set as specified by the manufacturer; this value should not be zero for a pressure transducer.
- **OFFS** Offset — Set to zero if not specified.
- **DELAY** Warmup delay — For an In-Situ transducer, set to 50 mSEC unless specified otherwise. You will probably have to determine this value by experiment for third-party transducers. **Reminder**: During the first ten minutes of log sampling, the HERMIT 2000 uses a warmup delay of 50 mSEC, regardless of the delay programmed. If you've selected the log sample mode, make certain that your transducers are compatible with this requirement.

The unit will check that the sum of the delays does not exceed the selected sample rate. (This is only likely to be a problem with third-party XDs and a very fast LIN2 sample rate.) This error message means you need to use shorter delays if possible, or a longer sample rate.

```
Test 0: DELAYS>RATE!
(can't start/step)
```

When you have entered all of the parameters, connect the transducer to its input channel and use the **READ** function in the transducer menu to verify proper operation.

The HERMIT 2000 computes function readings as follows:

$$\text{READING} = LX^2 + SX + O$$

where X = Normalized* transducer value (0-1)
L = Linearity
S = Scale factor in units full scale
O = Offset

**Transducer reading (in mA) minus 4 divided by 16*

The units of the linearity, scale, and offset parameters determine the units of the reading. Readings in units other than those specified by the manufacturer can be obtained by multiplying or dividing the linearity, scale, and offset by the appropriate conversion factor before entering them into the HERMIT 2000.

The parameters for a third-party 4-20 mA transducer must often be calculated. As an example, if a 4-20 mA flow transducer specifies an output range of 10 to 100 GPM (gallons per minute), calculate the parameters as

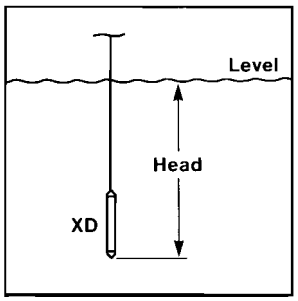
Linearity	=	0 (will most often be the case)
Scale factor	=	100 - 10 = 90 GPM full scale
Offset	=	10 GPM

You can have readings in any other units of flow by multiplying all three parameters by the appropriate conversion factor. The warmup delay will have to be determined by experiment if it is not identified by the manufacturer. Use the shortest warmup delay possible that gives consistent and stable readings.

Note: To help you keep track of input configurations such as the flow meter example above, you might want to enter an I.D. description such as "FLOW GPM."

Programming Level Types

The level type input derives level readings from head values taken with a pressure transducer. There are several programmable parameters that allow you to solve a wide variety of level measurement problems.



The parameters for a level type input are presented in three menus. Use the **more** option to access a deeper menu. Use **CLEAR** to back up to the previous menu level.

```
Input 2: Level (F)
READ I.D. REF.  more
```

```
Input 2: Level (F)
LIN SCALE OFFS more
```

```
Input 2: Level (F)
DELAY SG UNITS MODE
```

Three of the menu parameters are used to convert the 4-20 mA transducer output to a pressure in PSI units. These may be found on the cable reel, or on a data tag attached to the cable. Use the column labeled "Quadratic Coefficients."

- **LIN** Linearity — Set to zero if not specified by the transducer manufacturer.
- **SCALE** Scale factor — Set as specified by the manufacturer; this value should not be zero for a pressure transducer.
- **OFFS** Offset — Set to zero if not specified.
- **DELAY** Warmup delay — For an In-Situ transducer, set to 50 mSEC unless specified otherwise. You will probably have to determine this value by experiment for third-party transducers. **Reminder**: During the first ten minutes of log sampling, the HERMIT 2000 uses a warmup delay of 50 mSEC, regardless of the delay programmed. If you've selected the log sample mode, make certain that your transducers are compatible with this requirement.

The unit will check that the sum of the delays does not exceed the selected sample rate. (This is only likely to be a problem with third-party XDs and a very fast LIN2 sample rate.) This error message means you need to use shorter delays if possible, or a longer sample rate.

```
Test 0: DELAYS>RATE!
(can't start/step)
```

The intermediate pressure reading is calculated using the quadratic formula

$$P = LX^2 + SX + O$$

where	P	=	Pessure in PSI
	X	=	Normalized* transducer value (0-1)
	L	=	Linearity
	S	=	Scale factor in PSI full scale
	O	=	Offset in PSI

**Transducer reading (in mA) minus 4 divided by 16*

Units Selection

Head and level may be displayed as feet or meters of water. Select the **UNITS** option from the menus.

```
Input 2: Level (F)
DELAY SG UNITS MODE
```

Use the special function keys to select feet or meters. The current selection is shown in brackets.

```
Units [F]?
FEET METERS
```

Your choice of units is also displayed with the type description in all of the menus.

```
Input 2: Level (F)
DELAY SG UNITS MODE
```

The intermediate transducer pressure is converted to a head value as follows:

$$H = P \times U / SG$$

where H = Head value
P = Pressure in PSI
U = Conversion units: 2.30667 feet of water/PSI or 0.703072 meters of water/PSI
SG = Specific gravity (fluid density/water density)

Adjusting for Specific Gravity

If the working fluid is not water, you can specify the fluid's specific gravity. Select the **SG** option from the menus.

```
Input 2: Level (F)
DELAY SG UNITS MODE
```

Key in the specific gravity and press **ENTER**. Use a value of 1 when working with water.

```
SG [1]?
_
```

The display returns to the transducer menus.

```
Input 2: Level (F)
DELAY SG UNITS MODE
```

Note: Some situations may require that you determine the fluid's specific gravity to obtain accurate test results. Such situations include monitoring in gasified wells and waters with salt-water intrusion or other contaminants.

Choosing a Level Mode

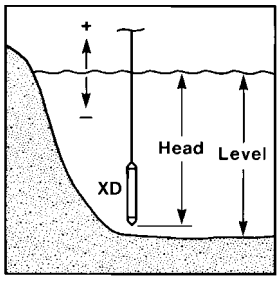
Press **F4** to select the **MODE** option from the transducer menus.

```
Input 2: Level (F)
DELAY SG UNITS MODE
```

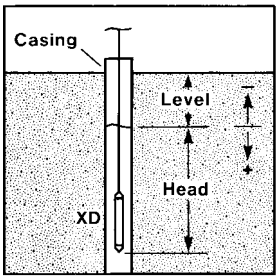
You have a choice of **TOC** (top of casing) or **SURFACE** level modes. The current selection is shown in brackets.

```
Mode [TOC]?
TOC SURFACE
```

Use the **surface** mode to monitor surface water situations such as streams and lakes, or to use head data directly. *Increasing* water levels correspond to *increasing* level readings. *Decreasing* water levels correspond to *decreasing* level readings.



Select the **top of casing** mode when monitoring groundwater and readings referenced to the top of the well casing are required. In this case *decreasing* water levels correspond to *increasing* top of casing readings. *Increasing* water levels will correspond to *decreasing* top of casing readings.



Setting the Reference Level

Press **F3** to select the **REF.** option from the transducer menus.

```
Input 2: Level (F)
READ I.D. REF. more
```

Key in a value for the reference level and press **ENTER**.

```
Ref. [0]?
_
```

The HERMIT 2000 will power up the transducer and take a corresponding reference head reading . . .

```
Ref. [0]?
Busy...
```

. . . and then return to the transducer menu.

```
Input 2: Level (F)
READ I.D. REF. more
```

The transducer must be connected and placed at its initial depth before keying in the reference level.

```
Ref. [0]?
Not connected?
```

The reference level is used to reference changes in head to changes in an initial water level. The reference level is arbitrary and may be set to any value suitable for the test conditions. When monitoring a lake, for example, you might set the reference level at:

- The present depth of the lake with respect to the lake bottom so that readings are presented as lake depth.
- The altitude of the lake surface so that readings are displayed as altitudes.
- Zero, so that readings will reflect only changes, both positive and negative, from the initial reference level.

CAUTION

Though the reference level is very flexible in definition, you must select and enter a reference level for each level input, with the transducers connected and set, before starting a test.

Once the reference levels are set, the HERMIT 2000 can compute surface levels as:

$$L(t) = R - [H(r) - H(t)]$$

Similarly, top of casing levels are computed as:

$$L(t) = R + [H(r) - H(t)]$$

where L(t) = Level at time
R = Reference level
H(r) = Head at time when reference level was entered
H(t) = Head at time t

Level Setup Procedure

You can use the following procedure to properly set up a pressure transducer with a level type input channel.

1. Program the transducer parameters of linearity, scale factor, and offset. Remember to set to zero any parameter not specified.

2. Program the transducer warmup delay. Set it to 50 mSEC if not specified otherwise.

3. Enter the specific gravity. Make sure it's set to 1 if you are working with water.

4. Select the units and level mode you require for the test.

5. Lower the transducer beneath the water surface. Secure it in place below the lowest anticipated water level, but not so low that the range of the transducer might be exceeded at the highest anticipated level.

6. Connect the transducer to the input channel and use the **READ** option to check the operation of the transducer.

   ```
   Input 2: Level (F)
   READ I.D. REF.   more
   ```

   The reading shown in parentheses is the transducer head. The reading to the right is the computed level.

   ```
   Input 2: Level (F)
    (20.672)        -2.900
   ```

   Adjust the transducer setting until the head reading indicates that the transducer is set at the desired depth. The level reading should be ignored at this point since we have not yet specified the reference level.

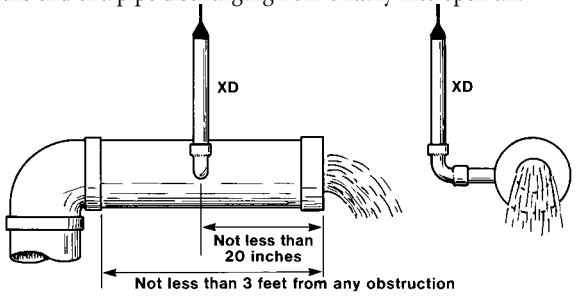
7. Enter the reference level with the transducer connected and in position.

8. Repeat the **READ** function and verify that the level reading now reads properly.

   ```
   Input 2: Level (F)
    (20.672)        130.900
   ```

Programming Flow Types

The flow type input channel measures flow rate indirectly by using a pressure transducer to measure the pressure behind an orifice plate at the end of a pipe discharging horizontally into open air.



The parameters for a flow type input are contained in three menus. Use the more option to access a deeper menu. Use **CLEAR** to back up to the previous menu level.

```
Input 3: Flow
READ I.D. KxA    more
```

```
Input 3: Flow
LIN SCALE OFFS more
```

```
Input 3: Flow
DELAY SG
```

Three of the menu parameters are used to convert the 4-20 mA transducer output to a pressure in PSI units. These may be found on the cable reel, or on a data tag attached to the cable. Use the column labeled "Quadratic Coefficients."

- **LIN** Linearity — Set to zero if not specified by the transducer manufacturer.

- **SCALE** Scale factor — Set as specified by the manufacturer; this value should not be zero for a pressure transducer.

- **OFFS** Offset — Set to zero if not specified.

- **DELAY** Warmup delay — For an In-Situ transducer, set to 50 mSEC unless specified otherwise. You will probably have to determine this value by experiment for third-party transducers. **Reminder**: During the first ten minutes of log sampling, the HERMIT 2000 uses a warmup delay of 50 mSEC, regardless of the delay programmed. If you've selected the log sample mode, make certain that your transducers are compatible with this requirement.

The unit will check that the sum of the delays does not exceed the selected sample rate. (This is only likely to be a problem with third-party XDs and a very fast LIN2 sample rate.) This error message means you need to use shorter delays if possible, or a longer sample rate.

```
Test 0: DELAYS>RATE!
(can't start/step)
```

The intermediate pressure reading is calculated using the quadratic formula

$$P = LX^2 + SX + O$$

where
- P = Pressure in PSI
- X = Normalized* transducer value (0-1)
- L = Linearity
- S = Scale factor in PSI full scale
- O = Offset in PSI

**Transducer reading (in mA) minus 4 divided by 16*

Adjusting for Specific Gravity

If the working fluid is not water, you can specify the fluid's specific gravity. Select the **SG** option from the menus.

```
Input 3: Flow
DELAY SG
```

Key in the specific gravity and press **ENTER**. Use a value of 1 when working with water.

```
SG [1]?
_
```

The display returns to the transducer menus.

```
Input 3: Flow
DELAY SG
```

The intermediate transducer pressure is converted to a head value as follows:

$$H = P \times U / SG$$

where H = Head in feet
P = Pressure in PSI
U = 2.30667 feet of water/PSI
SG = Specific gravity (fluid density/water density)

Entering the Orifice Coefficient

Select the **KxA** option from the transducer menu.

```
Input 3: Flow
READ I.D. KxA more
```

Key in your computed value of KxA and press **ENTER**.

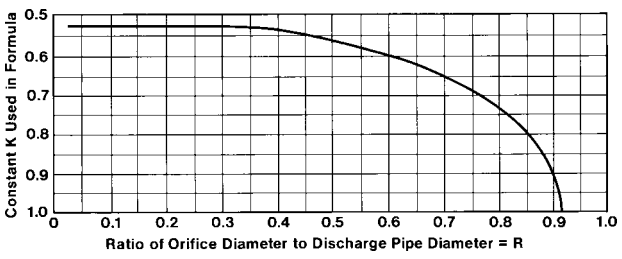
```
KxA [0]?
_
```

The display will return to the transducer menu.

```
Input 3: Flow
READ I.D. KxA more
```

Use the following procedure to compute the value of the orifice coefficient (KxA) as used in the HERMIT 2000:

1. Compute the ratio R as the diameter of the orifice divided by the inside diameter of the pipe. You can use any convenient units of measure as long as both diameters are in the same units.
2. Use the computed value of R and the curve below to determine the value of K.



3. Compute the area A of the orifice in square inches ($\pi d^2/4$).
4. Compute the product KxA and enter this value into the instrument. The resulting flow will be in gallons per minute (GPM).

Other units of flow can be obtained by multiplying KxA by the appropriate conversion factor before entering it into the HERMIT 2000. Orifice flow is computed as:

$$Q = KxA\ (27.7874)\ \sqrt{H}$$

where Q = Volumetric flow rate in GPM
K = Orifice coefficient from curve
A = Orifice area in square inches
H = Transducer head in feet

Flow Setup Procedure

You can use the following procedure to properly set up a pressure transducer with a flow type input channel.

1. Program the transducer parameters of linearity, scale factor, and offset. Remember to set to zero any parameter not specified.
2. Program the transducer warmup delay. Set it to 50 mSEC if not specified otherwise.
3. Enter the specific gravity. Make certain it has been set to 1 if you are working with water.
4. Compute and enter the orifice coefficient KxA.
5. Connect the transducer to the discharge pipe and make all cable connections to the HERMIT 2000.
6. Use the **READ** option to check the operation of the transducer.

   If possible, generate flow prior to a test to verify transducer operation, and that all parameters have been entered correctly.

```
Input 3: Flow
READ I.D. KxA more
```

```
Input 3: Flow
        25.760
```

Programming Dual Types

The dual type input allows you to interface with one of In-Situ's unique dual parameter transducers such as conductivity/temperature or pH/temperature. These transducers permit the measurement of temperature and a temperature-dependent parameter with a single input channel.

The parameters for a dual type input are presented in a single menu.

```
Input 4: Dual
READ I.D. COEF.
```

Press **F3** to select the **COEF**. option. Key in each coefficient (0-9), pressing **ENTER** after each entry.

```
Coef. 0 [4]?
_
```

You can use the **SCAN** keys to review or edit the coefficients individually. Press **CLEAR** to return to the transducer menu.

The dual type input uses ten coefficients to convert the transducer output to meaningful readings. The coefficients may be found on the cable reel or with accompanying documentation.

Coefficients C0, C1, and C2 are used to compute temperature in degrees Celsius using the following formula:

$$T = C0 + X \cdot C1/10 + X^2 \cdot C2/100$$

where T = Temperature in degrees Celsius
X = Normalized transducer temperature

Coefficients C3-C5 are used to calculate the primary value (e.g., conductivity, pH):

$$V = C3 + Y \cdot C4/10 + Y2 \cdot C5/100$$

where V = Measured value
Y = Normalized transducer value

The primary value is corrected for temperature variations (V_c) as follows:

$$V_c = \frac{C6 + V \times C7/1000}{1 + C8(T-25)/1000} + C9$$

If you wish to display uncompensated primary values, set coefficient C8 to zero. Refer to the specific dual-mode transducer manual for other options you may have.

Press **READ** to take a transducer reading and verify proper connection and operation of the transducer.

```
Input 4: Dual
READ  I.D.  COEF.
```

Readings on a dual-mode transducer require about five seconds.

```
Input 4: Dual
Busy...
```

The temperature and primary values are displayed simultaneously.

```
Input 4: Dual
 20.60ºC          7.600
```

Reminder: Due to the time required to read a dual-mode transducer, all dual-mode data recorded during the first ten minutes of a test in the log sample mode will be meaningless and should be ignored.

Battery Life Tip

Dual-mode transducers consume considerably more power than their single-function counterparts. Minimizing the number of reads will help to extend battery life, as will increasing the sample interval. Select a sample rate that gives good data quality without recording excessive or redundant points.

6 Setting Up Alarms

The alarm function on the HERMIT 2000 adds two powerful capabilities to your tests.

- You can synchronize the start of a test to the occurrence of an alarm event.
- You can synchronize other field equipment, such as an automatic sampler, with alarms detected by the HERMIT 2000.

If your test does not require either of these features, you may skip this section and return to it at a later time.

Alarm Operation

Each input on the HERMIT 2000 has an independently programmable alarm with a high and low limit setting. Since there is only one contact output for a high alarm and one for a low alarm, the alarms for each input are "or'ed" together. Thus a high alarm on input 1 or a high alarm on input 2 will activate the high alarm contact. Similarly a low alarm on an input or any other input will activate the low alarm contact.

Inputs are checked against their alarm limits at each data point while a test is running. If the high or low alarm contact is activated, it will remain activated even if the instrument is asleep.

Note: When the HERMIT 2000 is programmed in the log sample mode, alarms are not checked during the first ten minutes of the test.

Programming the Alarm Limits

To access the alarm menu, press the **SETUP ALARM** key while in the **READY** display. Alarm limits may be programmed in any test mode.

SETUP ALARM

The HERMIT 2000 will display the alarm menu. Press **F1** to select the **SETUP** option.

```
Alarm menu:    [OFF]
SETUP STATUS OUTPUTS
```

The display will show the limit menu for input 1 and the current on/off status for each limit.

```
Input 1: Function
HIGH [OFF]  LOW [OFF]
```

Use the **SCAN** keys to access the limit menus for other inputs.

```
Input 2: Level [F]
HIGH [OFF]  LOW [OFF]
```

Note: The high and low alarm limits for a dual type input apply only to the primary value. Dual type temperature does not have alarm limits.

High Limit

Press **F1** to select the **HIGH** option from an input's limit menu.

```
Input 2: Level [F]
HIGH [OFF]  LOW [OFF]
```

The on/off status of the alarm limit is shown in brackets. Press **F1** to turn the alarm limit **ON**. Press **F2** to turn the alarm limit **OFF**.

```
HIGH [OFF]?
ON   OFF
```

If you turn the limit on, the HERMIT 2000 will prompt you for the high limit. Key in your value for the high alarm limit and press **ENTER**.

```
HIGH ALARM [0]?
_
```

The display will return to the input's limit menu with the new on/off status updated in brackets.

```
Input 2: Level [F]
HIGH [ON]  LOW [OFF]
```

Enter the high limit in the same units that you have entered other transducer parameters for the input. The high alarm will activate when a data point reading is greater than or equal to the high alarm limit.

Note: If you have already programmed a low alarm for an input, the HERMIT 2000 will require that your high limit be greater than the low limit. The instrument will not accept a high limit entry that is less than or equal to the low limit entry.

Low Limit

Press **F2** to select the **LOW** option from an input's limit menu.

```
Input 2: Level [F]
HIGH [OFF]  LOW [OFF]
```

The on/off status of the low alarm limit is shown in brackets. Press **F1** to turn the alarm limit **ON**. Press **F2** to turn the alarm limit **OFF**.

```
LOW [OFF]?
ON   OFF
```

If you turn the limit on, the HERMIT 2000 will prompt you for the low limit. Key in your value for the low alarm limit and press **ENTER**.

```
LOW ALARM [0]?
_
```

The display will return to the input's limit menu with the new on/off status updated in brackets.

```
Input 2: Level [F]
HIGH [OFF]  LOW [ON]
```

Make certain that you enter the low limit in the same units that you have entered other parameters for the input. The low alarm will activate when a data point reading is less than or equal to the low alarm limit.

Note: If you have already programmed a high alarm for an input, the HERMIT 2000 will require that your low limit be less than the high limit. The instrument will not accept a low limit entry that is greater than or equal to the high limit entry.

Enabling Alarm Outputs

From the alarm menu, press **F3** to toggle the alarm output enable.

```
Alarm menu:    [OFF]
SETUP STATUS OUTPUTS
```

The current output on/off status is shown in brackets.

```
Alarm menu:    [ON]
SETUP STATUS OUTPUTS
```

In order to activate the alarm output contacts, the alarm **OUTPUTS** option must be **ON**. If the alarm outputs are off, the HERMIT 2000 will still check alarm limits and display alarm conditions, but the alarm contacts will not be activated. This feature allows you to test transducers and alarm functions without triggering devices connected to the alarm output. You can also switch off annoying external alarms while the cause of an alarm is being determined and corrective actions are being taken.

Viewing the Alarm Status

An immediate indication of an alarm is given by **ALM** in the **READY** display.

```
Test 0: RUNNING  ALM
READY
```

Press **SETUP ALARM** to access the alarm menu. Press **F2** to select the alarm **STATUS** option.

```
Alarm menu:    [ON]
SETUP STATUS OUTPUTS
```

A list of all active inputs is displayed along with the alarm status for each input. Press **CLEAR** to exit the display.

```
12345678
--HH--LL
```

One of several characters will be displayed to indicate the alarm status of an input channel.

- **–** There is no alarm condition on the input channel, or no limits have been programmed.
- **L** The input channel had a low alarm at the last data point scan.
- **H** The input channel had a high alarm at the last data point scan.

Programming for Alarm Start

The alarm start function allows you to delay the start of a test until an alarm event occurs. Input channels that have programmed alarm limits will be monitored for an alarm without recording data. When any alarm occurs, recording will start on all active input channels.

The alarm start function is found in the test setup menu. Press the **SETUP TEST** key at the **READY** display to access the menu.

SETUP TEST

Select a new test number if necessary.

```
Setup test#  [0]?
_
```

Press **F1** to select the **ALARM** option in the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

The current on/off status of the alarm start function is shown in brackets. Press **F1** to turn the alarm start **ON**; press **F2** to turn it **OFF**.

```
Alarm start  [OFF]?
ON  OFF
```

If you turn the alarm start on, the HERMIT 2000 will prompt you for the scan rate in minutes. Key in a value and press **ENTER**.

```
Scan rate  [15]?
_
```

The display will return to the test setup menu.

```
Test 0: Setup menu
ALARM RATE #XDs TYPE
```

The scan rate is independent of the test sample rate and may be in the range 1 to 2880 minutes (48 hours).

Battery Life Tip

The HERMIT 2000 conserves battery power during alarm start by sampling only the input channels that have alarm limits programmed. You can improve battery life by selecting the slowest scan rate that is practical for your test.

The alarm start function will not be activated until you use the **START** function.

7 Running a Test

Before starting a test, use the following checklist to be certain that all parameters have been properly programmed.

- Check that the clock indicates the correct date and time.
- Check that all transducers are connected and read properly.
- If you have enabled the alarm start option, make certain that the necessary alarm limits have been programmed.

Accessing the Start Menu

Press the **START/STEP** key at the **READY** display.

The HERMIT 2000 will present the start menu. Press **F1** to start immediately or **F2** to program a delayed start.

```
Test 0: Start menu
IMMEDIATE DELAYED
```

Before displaying the start menu, the HERMIT checks your test setup.

If the test uses Level type inputs, the HERMIT 2000 will ask whether you have set Reference. If you have, press **ENTER** to see the start menu. If you haven't, press **CLEAR**; then go to the transducer menu and set the Reference for each Level input as described on pp. 47-48.

```
Is Reference Set ???
ENTER=Go CLEAR=Quit
```

You cannot start over a test that already has data. Use the **SETUP TEST** function to erase the old data or to select a new test number.

```
Test 000: HAS DATA!
(can't start/step)
```

If the sum of all the transducer warmup delays exceeds the programmed sample rate, select a longer sample rate.

```
Test 0: DELAYS>RATE
(can't start/step)
```

See the end of Section 4, "Exiting the Test Setup Menu," if you need help getting past this error message.

Immediate Start Option

Press **F1** while in the start menu to select the **IMMEDIATE** start option.

```
Test 0: Start menu
IMMEDIATE DELAYED
```

The HERMIT 2000 will start the test and record the first data point. The screen display will vary depending on the sample rate programmed for the test. In addition, the availability of keyboard functions during the test (p. 27) will be different depending on how fast the HERMIT 2000 is recording data.

LIN1. If the Linear 1 sample mode was selected, this screen will be displayed as the first data point is recorded.

```
*** DATA POINT ***
0.0000 min.
```

Then the display will exit the start menu and return to the **READY** prompt. The top line of the display will indicate that the test is running. All keyboard functions are available.

```
Test 0: RUNNING
READY
```

LOG. If the log sample mode was programmed, the HERMIT 2000 will be busy as fast data are recorded.

```
*** DATA POINT ***
LOG 1
```

No keys are active during log cycles 1 and 2 (the first 60 seconds of the test).

```
*** DATA POINT ***
LOG 2
```

When log cycle 2 is complete (after 1 minute) the instrument will return to the **READY** display. Normal keyboard operation is restored.

```
Test 0: RUNNING
READY
```

LIN2. In the Linear 2 sample mode, the unit displays this screen until you stop the test. Due to the speed of data collection in this mode, the HERMIT 2000 can't do anything else while the test is running. Only the **STOP** function is active.

```
*** LINEAR 2 ***
```

Delayed Start Option

Press **F2** while in the start menu to select the **DELAYED** start option.

```
Test 0: Start menu
IMMEDIATE DELAYED
```

Key in the date and time that you wish to have the HERMIT 2000 start the test.

```
Month [4]?
_
```

The entry limits for the delayed start date and time are the same as entries for the time of day clock.

```
Day [10]?
_
```

```
Hour [13]?
_
```

```
Minutes [22]?
_
```

Note: The defaults shown are the current time, so don't select the defaults all the way down; at least add one minute to the minute default.

The display will return to the **READY** prompt with an indicator confirming that a delayed start has been programmed.

```
Test 0: Delay start
READY
```

The HERMIT 2000 will automatically start the test at the programmed date and time. You can edit the start date and time by re-entering the start function and keying in a new delayed start time. You can also override a delayed start by selecting the immediate start option.

Alarm Start Operation

The alarm start option, if enabled through the test setup menu, is engaged automatically when you select an immediate or delayed start.

If you select the **IMMEDIATE** start option . . .

```
Test 0: Start menu
IMMEDIATE DELAYED
```

. . . the instrument will scan the input channels and check for any alarms.

```
*** DATA POINT ***
(alarm check)
```

The display will return to the **READY** prompt with an alarm start indicator.

```
Test 0: Alarm start
READY
```

The HERMIT 2000 will continue to scan for alarms at the programmed scan rate until an alarm occurs. The test is then started automatically.

```
Test 0: RUNNING
READY
```

If you have selected the **DELAYED** start option . . .

```
Test 0: Start menu
IMMEDIATE DELAYED
```

. . . the instrument will wait until the programmed delayed start time . . .

```
Test 0: Delay start
READY
```

. . . then enter the alarm start mode. The test will start automatically when an alarm is detected.

```
Test 0: Alarm start
READY
```

Stepping the Test

The HERMIT 2000 gives you the option to subdivide a test into steps. This feature is useful when running constant rate and stepped rate pump tests with or without a recovery phase.

When you step a test, the HERMIT 2000 will:

- Partition the storage memory to keep step data separated.
- Record the start date and time of the step.
- Restart its programmed sampling schedule with an elapsed time of 0.

You can have as many as five steps within a test, numbered 0 to 4. When you first start a test, you are actually starting step 0.

Press the **START/STEP** key at the **READY** display. A test can be stepped only if it is already running.

```
Test 0: RUNNING
READY
```

The instrument will present the start menu for the next step.

```
Step 1: Start menu
IMMEDIATE DELAYED
```

If step 4 is already running, you will not be able to access the start menu.

```
Test 0: LAST STEP!
(can't start/step)
```

The start menu options for a step are identical to those for starting the test. If you have enabled the alarm start option, it will remain in effect for each step. You can defeat the alarm start by turning off all alarm limits.

When a delayed start is programmed for a step, the HERMIT 2000 continues to record data for the previous step up to the time that the new step begins.

While the Test is Running

In most cases, all the HERMIT 2000 data reduction functions are available to you while a test is running. The exceptions are (1) the first minute of a test in the log sample mode, and (2) an entire test in the Linear 2 sample mode.

- You can **VIEW DATA** for any test or step stored in memory.
- You can print or plot the test data of any test using the **DUMP DATA** function.
- You can modify the transducer and alarm parameters of the test that is running.
- You can take manual readings on any transducer by using the read function contained in the **XD** menus.

You may be interrupted occasionally as the intrument collects and records a data point. The elapsed time of the test or step will be displayed.

```
*** DATA POINT ***
1440.00 min.
```

There is no function that you can perform that will cause the HERMIT 2000 to miss or delay taking a data point.

Stopping the Test

Press the **STOP** key while in the **READY** display.

You are prompted to confirm the stop function by pressing the **ENTER** key. (If you don't want to stop the test, press **CLEAR**.)

```
Test 0: Stop
(Enter to confirm)
```

The HERMIT 2000 will stop the test . . .

```
Test 0: Stop
```

. . . and return to the **READY** display.

```
READY
```

Note: A test cannot be stopped during the first minute of the log sample mode (log cycles 1 and 2). In the Linear 2 sample mode, there will be no opportunity to confirm or cancel the **STOP** selection.

Battery Life Tip

Don't waste battery power and memory endurance by leaving the HERMIT 2000 running after the test is finished. Use the STOP function to turn data recording off.

8 Viewing Stored Data

Data from any test may be viewed at any time. From the **READY** display, press the **VIEW DATA** key.

You cannot access the view data function if no data have been collected.

```
(no data collected)
```

The HERMIT 2000 will prompt for a test number and displays the highest test number as the default. To select the default, just press **ENTER**; or key in your selection and press **ENTER**.

```
Test [1]?
_
```

You are then prompted to select the test step. The highest step number is displayed as the default.

```
Step [0]?
_
```

Next select the percentage into the test to begin viewing. Zero percent is the beginning of the test, 100 percent is the end of the test (or the most recent data point if the test is still running).

```
View % [100]?
_
```

The display will show the elapsed time in minutes and the data in the specified units for input channel 1.

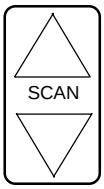
```
Input 1: Level (F)
- ¯      0.0000   27.632
```

Note: The temperature value recorded for a dual type input will be added to the top line of the display. The bottom line will display elapsed time in minutes and the primary value.

```
Input 1:          20.00°C
- ¯      0.0000   134.781
```

Scanning the Data

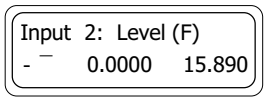
Use the **SCAN** keys to scan through the recorded data. **SCAN UP** scans in the direction of *increasing* elapsed time; **SCAN DOWN** scans in the direction of *decreasing* elapsed time. These keys will auto-repeat if you continue to hold them down.



Changing the Input Channel

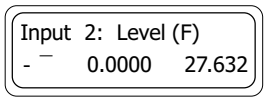
You can access the data for other input channels by using the special function keys. Press F1 to increase the input number, F2 to decrease the input number. These keys will auto-repeat if you continue to hold them down.

As you scan through the input channels, the display will remain at the same elapsed time value, allowing you to review the data for all inputs at any given elapsed time.

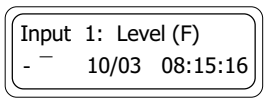


Viewing the Start Time

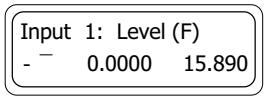
SCAN down to an elapsed time of zero. It does not matter which input channel you are currently viewing.



Press **SCAN DOWN**. The display will show the start date and time of the test or selected step . . .



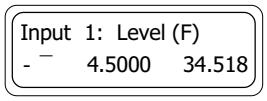
. . . then return to the view data display.



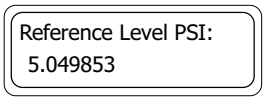
Viewing the Reference Level

If the test uses Level type inputs, you can display the reference level in PSI while viewing the test data.

While a data point is displayed, press the **VIEW DATA** key.

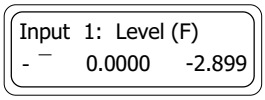


The Reference Level for that channel will appear. This is the PSI head value at the moment the Reference was entered. The HERMIT 2000 will show the Reference Level for a few seconds and then return to the data display.

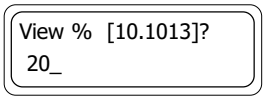


Changing the View Percentage

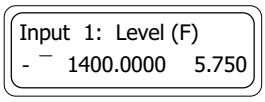
You can move quickly to another segment of data without scanning by changing the view percentage. Press **CLEAR** to exit the view display.



The default view percentage shows the point at which you stopped viewing. Key in a new value for the view percentage and press **ENTER**.



You will be returned to the view display at the new percentage.



Battery Life Tip

It can be very time consuming to use the view display to retrieve stored data from long tests. If done often, it can be tough on battery life as well. Use external power if possible, or consider dumping the data to a printer or computer using the RS232 port.

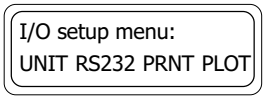
9 Using the RS232 Port

The RS232 port on the HERMIT 2000 allows you to print or plot stored data on a field printer, or dump data to most personal or portable computers that are also equipped with an RS232 port. This section will explain how to program the RS232 port to match the requirements of your printer or computer. If you are not familiar with making the cable connections between the instrument and the printer or computer, be certain to read the information contained in Appendix B of this manual.

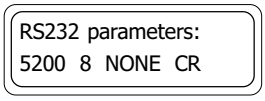
RS232 Parameters

Start at the READY display. You can change RS232 parameters while in any test mode. Press the **SETUP I/O** key.

The HERMIT 2000 will display the input/output setup menu. Press **F2** to select the RS232 option.



The current settings of the parameters are displayed as a menu. Use



the special function keys to change the parameter settings.

The menu shows four parameters. From left to right these are:

- **Baud rate**—pressing **F1** selects between 300, 1200, 2400, and 9600 baud.
- **Character length**—pressing **F2** selects between 7 and 8 bits per character.
- **Parity**—pressing **F3** selects between an odd, even, and no (none) parity bit.
- **End of line sequence (EOL)**—pressing F4 selects between a carriage return (CR) only and a carriage return with linefeed (CR-LF) sequence.

These four parameters must be set to match the settings of the printer or computer to be connected; refer to the owner's manual of the particular device. Settings for interfacing to several In-Situ accessories are outlined below.

	Field Printers		PC's with
	SE1004B	GFP-80	DataTransfer
Baud rate	1200	9600	9600
Character length	8	8	8
Parity	None	None	None
EOL sequence	CR	CR	CR

Selecting the Print Width

The HERMIT 2000 supports multiple-column print formats and will adjust the number of columns of data to match the size of your printer. The smallest printer size that can be used with the HERMIT 2000 is 24 columns.

From the I/O setup menu, press **F3** to select the **PRNT** option.

```
I/O setup menu:
UNIT RS232 PRNT PLOT
```

Key in a value for the print width and press **ENTER**. The current print width setting is shown in brackets. You can select a print width from 24 to 255 columns.

```
Print width  [80]?
_
```

The display will return to the I/O setup menu.

```
I/O setup menu:
UNIT RS232 PRNT PLOT
```

A print width of 24 columns causes printouts to be made in a format compatible with older versions of the HERMIT 2000. Print widths of 25 to 255 columns allow the HERMIT 2000 to print in its newer expanded formats. Settings for interfacing several In-Situ accessories are outlined below.

	Field Printers		PC's with
	SE1004B	GFP-80	DataTransfer
Print width	25	80	24-255

Selecting the Plotter Type

Graphics output is supported by most of In-Situ's field printers and many compatible printers. The plot size and plot command formats vary with the type of printer, so you must program the HERMIT 2000 with your printer type.

From the I/O setup menu, press **F4** to select the **PLOT** option.

```
I/O setup menu:
UNIT RS232 PRNT PLOT
```

The current plotter type setting is shown. Press **F1** to cycle through the available plotter types.

```
Plotter type:
SE1004B
```

Press **CLEAR** or **ENTER** when the display shows the plotter type you want. The display will then return to the I/O setup menu.

```
I/O setup menu:
UNIT RS232 PRNT PLOT
```

Note: Selection of the plotter type doesn't affect the print width setting or the RS232 parameters. You must set all three menu options for proper operation of the printer.

Programming a Unit Identification

The HERMIT 2000 has a programmable, eight-character identification string that is output with all printouts, plots, and data transfers. You can use the unit number to identify an instrument, site location, etc. The unit number is optional and may be left blank.

From the I/O setup menu, press **F1** to select the UNIT option.

```
I/O setup menu:
UNIT RS232 PRNT PLOT
```

You will be prompted to enter the unit number. The current setting of the unit number is shown in brackets.

```
Unit#  [       ]?
_
```

Key in the unit number. You can use the SCAN keys to change a keyed digit to any character or symbol.

```
Unit#  [       ]?
 SITE 76_
```

You can key in up to 8 digits, symbols, or characters. Entries of more than 8 characters will be truncated to the first 8 characters. Entries less than 8 characters will be left-justified and padded with spaces. You can enter a blank unit number by keying in a single digit and scanning it to a space character.

When you press **ENTER**, the display will return to the I/O setup menu.

```
I/O setup menu:
UNIT RS232 PRNT PLOT
```

Note: The unit number is common to all tests. It is not stored individually for each test.

Testing the RS232 Port

A special RS232 port test feature is available in the dump data menu that will allow you to test your port configurations without having to collect and dump data.

Access the dump data menu by pressing the **DUMP DATA** key while at the **READY** display.

DUMP DATA

Press **F4** to select the **TEST** option from the menu.

```
Dump data menu:
PRINT PLOT AXES TEST
```

Make certain that all cables are connected and that the printer or computer is switched on. Press **ENTER** to start the test.

```
Press ENTER to start
```

The HERMIT 2000 will prompt you to double check the connections if it does not detect that a device is connected to the RS232 port. You will also get this message if the print device is not turned on.

```
Press ENTER to start
Not connected?
```

Several single-spaced test lines will be output to the print device. If the lines are not single-spaced or appear garbled in any way, check the RS232 parameter settings of the HERMIT 2000 and the print device.

```
OUTPUT TEST LINE
OUTPUT TEST LINE
OUTPUT TEST LINE
OUTPUT TEST LINE
OUTPUT TEST LINE
```

Press and hold the **CLEAR** key to abort the test output early.

```
Press CLEAR to abort
```

The display will return to the dump data menu when the test is complete.

```
Dump data menu:
PRINT PLOT AXES TEST
```

10 Printing Data

This section will describe the procedures necessary to generate tabular printouts of test data on a field printer. These same procedures can be used to transfer test data to a personal or portable computer. You can print data from any test at any time. You can even print the partial data from a test that is still running.

Note: Before you can begin to print data, the RS232 port must be programmed to match the parameters of the printer or computer. Refer to Section 9 if you encounter difficulties while attempting to print data.

While at the **READY** display, press the **DUMP DATA** key to access the dump data menu.

DUMP DATA

The dump data menu contains options for printing and plotting data. Plotting data will be discussed in Section 11.

```
Dump data menu:
PRINT PLOT AXES TEST
```

Press **F1** to select the PRINT option. Key in the number of the test you wish to print and press **ENTER**. The highest test number available is displayed as the default selection.

```
Test [0]?
_
```

Next select the test step. The highest step number in the test is displayed as the default selection.

```
Step [0]?
_
```

You are then prompted for the number of the input channel you wish to have printed in the first column. Input channel 1 is the default.

```
Start at input# [1]?
_
```

Next key in the number of columns of input channel data you wish to print.

```
Columns [4]?
_
```

The default is the maximum number of columns available based on the number of input channels used in the test and the print width available (see p. 29). If you wish to print the data for a single input channel, key in a column value of 1.

Select the start and end percentages of the test data. Use the defaults of 0% to 100% to print data from start to finish.

```
Start % [0]?
_
```

```
End % [100]?
_
```

Any portion of the data may be printed. For example, select 0% to 50% to print just the first half of the test or step.

The increment selection determines if any data points are to be skipped. An increment of 1 prints every data point, an increment of 2 prints every other point, an increment of 3 every third point, and so on.

```
Increment [1]?
_
```

The HERMIT 2000 is now ready to print the data. Make certain that all connections are made and that the printer is turned on. Press **ENTER** to start printing.

```
Press ENTER to start
```

You will be prompted if the instrument does not detect that the printer is connected. Double check all connectors and make sure the printer is switched on.

```
Press ENTER to start
Not connected?
```

You can abort a printout early by pressing and holding the **CLEAR** key until the display returns to the dump data menu.

```
Press CLEAR to abort
```

The display will return to the dump data menu when the printout is finished.

```
Dump data menu:
PRINT PLOT AXES TEST
```

Battery Life Tip

If you have a lot of data to print, we recommend that you use external power if possible. The HERMIT 2000 consumes considerably more power when it must stay awake than it does when it can use its sleep mode.

Print Formats

The organization of the printed test data will vary slightly depending on the print width you have selected and the number of columns of data printed.

Multi-Column Mode

When you select a print width other than 24 columns (25 to 255 columns), the HERMIT 2000 will print data using the multi-column format. You can use the multi-column format with 24-column printers such as In-Situ's SE1004B by selecting a print width of 25 columns. An example of a one-input printout in the multi-column format is shown below.

1 Title identifying the type of instrument that was used to record the data.

2 Date and time of printout.

3 Unit identification number and test number.

4 Identifies the input channel, type of data, Surface or TOC mode for a level type, and the input channel I.D. if one was set.

5 A record of the transducer parameters used to collect the data.

6 The step number of the data and the start date and time of the step (or test if step 0).

7 Tabular data of elapsed time in minutes and the input channel data in the selected units.

8 End-of-printout marker.

```
1          SE2000
     Environmental Logger
2         01/05 05:09

3    Unit# Test 0

     Setups:      INPUT  1
4    -------      --------
     Type  Level (F)
     Mode  Surface
     I.D.

     Reference    27.200
     PSI at Ref.  5.049
5    SG           1.000
     Linearity    0.420
     Scale factor 98.610
     Offset       0.070
     Delay mSEC   50.000

6    Step 0  01/05 04:58:49

     Elapsed Time INPUT  1
     ------------ --------
       0.0000      27.200
       0.0083      27.200
       0.0166      27.200
       0.0250      27.200
       0.0333      27.200
       0.0416      27.760
       0.0500      29.256
       0.0583      32.402
7      0.0666      36.764
       0.0750      47.143
       0.0833      62.236
       0.0916      77.087
       0.1000      87.107
       0.1083     102.971

       9.4000      28.321
       9.6000      28.321
       9.8000      28.321
      10.0000      28.321
8    END
```

The information contained in multiple-input printouts is the same, but header information is centered for greater readability. Shown below is a four-input printout (elapsed time plus four input channels).

```
                    SE2000
               Environmental Logger
                   01/05 06:18

               Unit#         Test 0

Setups:       INPUT 1   INPUT 2   INPUT 3   INPUT 4
-------       -------   -------   -------   -------
Type         Level(F)  Level(F)  Level(F)  Level(F)
Mode          Surface       TOC       TOC       TOC
I.D.

Reference      27.200    27.200    27.200    27.200
PSI at Ref.     5.049     5.049     5.049     5.049
SG              1.000     1.000     1.000     1.000
Linearity       0.420     0.000     0.000     0.000
Scale factor   98.610    99.000    50.000     5.000
Offset          0.070     0.120     0.070     0.070
Delay mSEC     50.000    50.000    50.000    50.000

        Step 0 01/05 05:22:01

Elapsed Time INPUT 1  INPUT 2  INPUT 3  INPUT 4
-----------  -------  -------  -------  -------
 0.0000       28.321    35.268   61.646   28.400
 1.0000       60.988    35.237   61.646   28.400
 2.0000       60.988    35.206   61.662   28.400
 3.0000       60.988    35.268   61.646   28.400
 4.0000       60.988    35.237   61.662   28.400
 5.0000       60.988    35.268   61.662   28.400
 6.0000       60.988    35.300   61.646   28.400
 7.0000       60.988    35.300   61.646   28.400
 8.0000       60.988    35.268   61.646   28.400
 9.0000       60.988    35.237   61.662   28.400
10.0000       60.988    35.331   61.662   28.400
11.0000       60.988    35.237   61.662   28.400
12.0000       60.988    35.300   61.646   28.400
13.0000       60.988    35.300   61.646   28.400
14.0000       60.988    35.300   61.662   28.400
15.0000       60.988    35.175   61.646   28.400
16.0000       60.988    35.268   61.646   28.400
17.0000       28.988    35.300   61.662   28.400
18.0000       28.988    35.268   61.662   28.400
19.0000       28.988    35.268   61.646   28.400
20.0000       28.988    35.331   61.646   28.400
21.0000       28.988    35.268   61.646   28.400
END
```

24-Column Mode

If you require data transfer compatibility with previous versions of the HERMIT 2000, such as when transferring data to a PC or compatible using In-Situ's HERMIT-DM program, set the print width to 24 columns.

This format will restrict you to printing or transferring one input channel at a time. To maintain compatibility, the input channel I.D. does not appear in the header. If a level input type is operating in the Top of Casing mode, TOC will be indicated; if no indication appears, the mode is Surface. All other input parameters are printed.

```
          SE2000
    Environmental Logger
        01/05 05:09

 Unit#           Test 0

INPUT  1: Level (F) TOC

Reference        27.200
PSI at Ref.       5.049
SG                1.000
Linearity         0.420
Scale factor     98.610
Offset            0.070
Delay mSEC       50.000

Step 0  01/05 04:58:49

Elapsed Time  INPUT  1
------------  --------
   0.0000       27.200
   0.0083       27.200
   0.0166       27.200
   0.0250       27.200
   0.0333       27.200
   0.0416       27.760
   0.0500       29.256
   0.0583       32.402
   0.0666       36.764
   0.0750       47.143
   0.0833       62.236

   9.2000       28.321
   9.4000       28.321
   9.6000       28.321
   9.8000       28.321
  10.0000       28.321
END
```

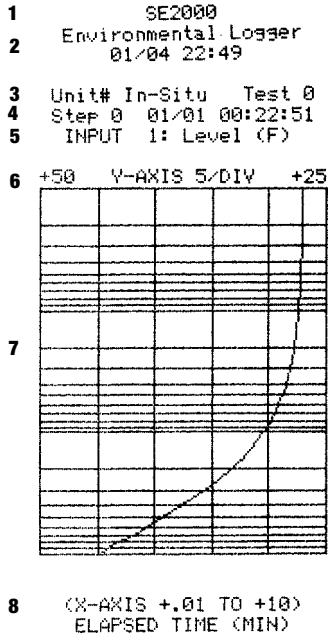
11 Plotting Data

One of the most powerful features of your HERMIT 2000 is its ability to plot recorded data on a field printer without the use of a computer. You can plot data from any input channel in any test at any time. You can even plot partial data from a test that is still running.

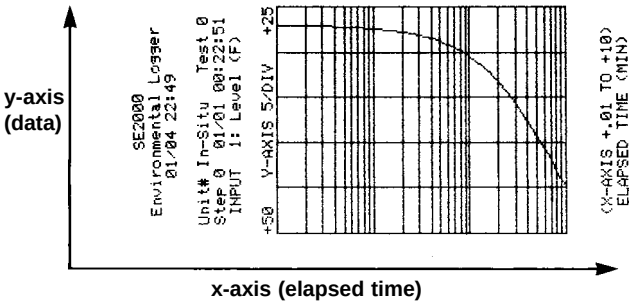
Note: The plot function is intended to work with an In-Situ or compatible field printer. It is not recommended that you use the plot function to transfer data to a computer as the data will not be in a format suitable for processing. Before you begin plotting, the RS232 port must be programmed to match the parameters of the printer. Refer to Section 9 if you encounter difficulties while attempting to plot data.

Plots are generated on the field printer in a strip-chart fashion with the x-axis (elapsed time) printed along the length of the page and the y-axis (data) printed along the width of the page. A sample plot is shown below.

1 Title identifying the type of instrument that was used to record the data.
2 Date and time of the plot.
3 Unit identification number and test number.
4 The step number of the data and the start date and time of the step (or test if step 0).
5 Identifies the input channel and the type of data, or the input channel I.D. if one was programmed.
6 Y-axis label and scale information.
7 Plotted data. The grid is generated automatically during the plot.
8 X-axis label and scale information.



For conventional viewing, rotate the plot 90 degrees:



The x-axis is always the elapsed time in minutes. The y-axis is the input channel data in the specified units plotted as a function of time. There are three basic steps required to plot data.

- Select an axes format.
- Scale the axes to fit the data.
- Plot the data.

The plot functions are accessed by pressing the **DUMP DATA** key while at the **READY** display.

SETUP
TEST

Use the **AXES** option to select the axes format and scale. Use the **PLOT** option to plot your data.

Dump data menu:
PRINT PLOT AXES TEST

All of the plot parameters are stored in a portion of the non-volatile memory so that your plot setups will not be lost when the HERMIT 2000 goes to sleep.

Choosing an Axes Format

Press **F3** to select the **AXES** option in the dump data menu.

Dump data menu:
PRINT PLOT AXES TEST

You are presented with the axes setup menu. Press **F1** to select the **FORMAT** option.

Axes setup menu:
FORMAT X-AXIS Y-AXIS

The current plot format is displayed as a menu. Use the special function keys to change the format settings.

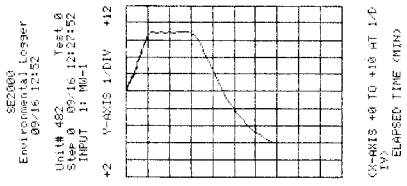
Plot format:
LINEAR PAGE GRID

Plot Types

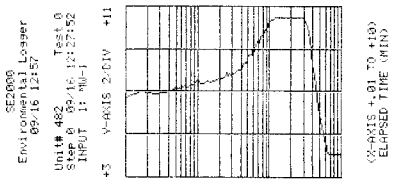
Press **F1** in the plot format menu to select one of four plot types. Press **ENTER** or **CLEAR** to exit the menu.

Plot format:
LINEAR PAGE GRID

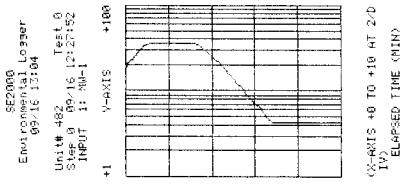
LINEAR specifies a plot with both the x-axis and the y-axis having linear divisions.



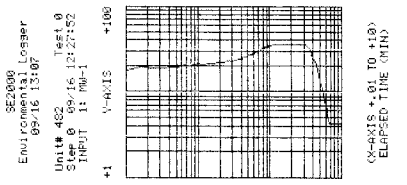
LOG-LIN specifies a semi-log plot with logarithmic x-axis divisions and linear y-axis divisions.



LIN-LOG specifies a semi-log plot with linear x-axis divisions and logarithmic y-axis divisions.



LOG-LOG selects a plot with both the x-axis and the y-axis having logarithmic divisions. In the log-log mode, the y-axis represents *change* in the recorded value from the initial value at time zero.



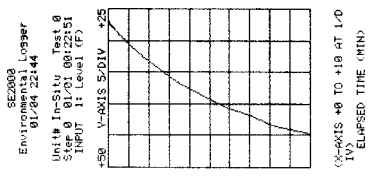
These examples show the same data plotted in the different axes formats. The usefulness of each plot type depends on the type of monitoring or test you have recorded.

Plot Sizes

Press **F2** in the plot format menu to select between single-**PAGE** size and strip-**CHART** size. Press **ENTER** or **CLEAR** to exit the menu.

Plot format:
LINEAR PAGE GRID

You have already seen examples of the **PAGE** size. The actual size of plot will vary depending on the printer you choose. On a printer that uses 8 ½ x 11 inch paper such as In-Situ's GFP-80, the plot will fit on a single page.



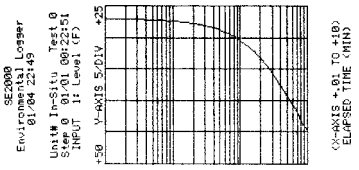
The **CHART** selection produces a plot that is seven to ten times the length of the page mode. The y-axis width of the plot remains the same. The chart mode is particularly useful when you need a complete plot of long-term data but still would like to see some detail in short-term variations.

Division Markings

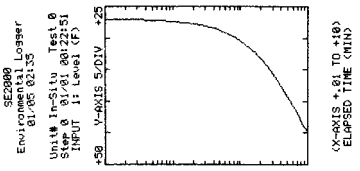
Press **F3** in the plot format menu to select between **TICS** and **GRID** division markings.

Plot format:
SEM-LOG PAGE GRID

Our previous examples have all been plotted in the **GRID** mode.



The **TICS** mode removes the center grid and labels the divisions with tic marks along the outside border.



Scaling the Axes

Once you have selected an axes format, you must set the scale of the x- and y-axes to match the data you wish to plot. Improper scaling can result in missed features and even blank graphs.

You can determine a starting point for axes scaling by identifying the minimum and maximum values recorded for the input channel you wish to plot. You can use the **VIEW DATA** function to scan through the data on the LCD display, or the **PRINT** function with its increment option to generate an abbreviated printout of the data.

If you are still at the plot format menu, press **CLEAR**.

Plot format:
SEM-LOG PAGE GRID

The display will return to the axes setup menu.

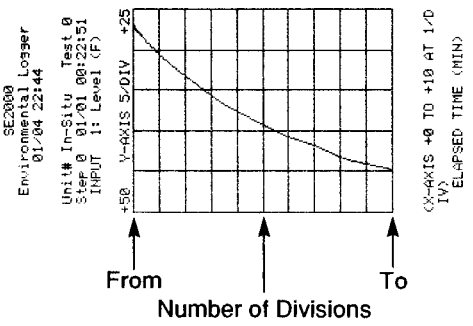
Axes setup menu:
FORMAT X-AXIS Y-AXIS

X-Axis Scaling

The x-axis always represents the elapsed time in minutes and may have linear or logarithmic divisions depending upon your selection of the axes format. Since the requirements for each format are unique, they will be discussed separately.

Linear X-Axis Scaling

Scaling of a linear x-axis requires the entry of three parameters:



To scale the x-axis, press **F2** to select the X-AXIS option from the axes setup menu.

```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

Key in the elapsed time, in minutes, that you wish to begin plotting *from* and press **ENTER**. You will not be allowed to enter a value less than zero, or a value that is greater than or equal to the current *to* setting.

```
From [0]?
_
```

Next key in the elapsed time, in minutes, that you wish to plot *to* and press **ENTER**. You will not be allowed to enter a value that is less than or equal to your *from* setting.

```
To [1000]?
_
```

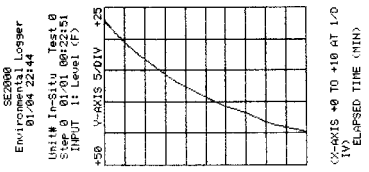
Lastly, key in the number of divisions you want to have the x-axis divided into. The HERMIT 2000 will automatically scale the divisions based on your *from* and *to* entries.

```
Divisions [1]?
_
```

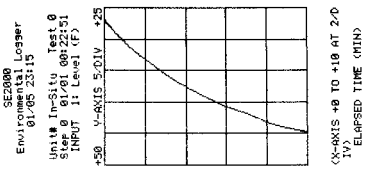
The display will return to the axes setup menu.

```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

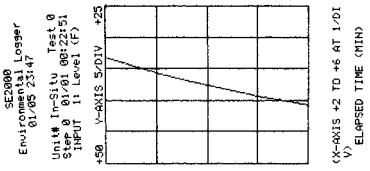
The selection of the number of divisions is a matter of convenience. This sample plot was made from 0 to 10 minutes with 10 divisions, resulting in 1-minute intervals per division.



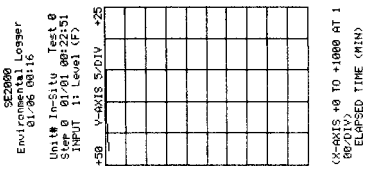
Here the same data are plotted with only 5 divisions, resulting in 2 minutes per division.



You are not restricted to plotting an entire test at one time, or to plotting from time 0. You can "blow up" any portion of the test. Here, for example, the data are plotted from 2 to 6 minutes, enlarging that portion of the test for easier viewing.

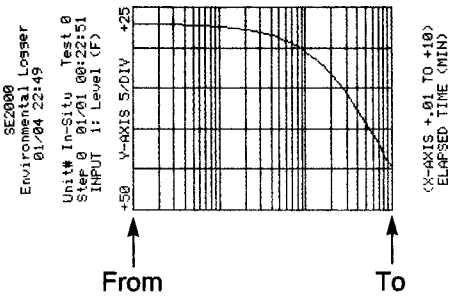


This is an example of what might be considered a poor choice of x-axis scaling. The time scale is so long that little information can be extracted from the plot.



Logarithmic X-axis Scaling

Scaling of a logarithmic x-axis in the semi-log or log-log modes requires the entry of only two parameters:



The number of log cycle divisions is calculated automatically by the HERMIT 2000.

To scale the x-axis, press **F2** to select the **X-AXIS** option from the axes setup menu.

```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

Key in the elapsed time, in minutes, that you wish to begin plotting *from* and press **ENTER**. Choose a log cycle increment such as .001, .01, .1, and so on. You will not be allowed to enter a value greater than or equal to the current *to* setting.

```
From [0]?
_
```

CAUTION

Do not attempt to plot from zero since LOG (0) is undefined. Plotting from zero in the log formats will cause plotting to stop with only the header information being printed.

Next key in the elapsed time, in minutes, that you wish to plot *to* and press **ENTER**. Choose a log cycle increment such as 10, 100, 1000, and so on. You will not be allowed to enter a value less than or equal to your *from* setting.

```
To [1000]?
_
```

Note: The logarithmic x-axis always plots between divisions that are multiples of ten. If you choose endpoints that are not multiples of ten, the HERMIT 2000 will choose the nearest multiples for you. For example, if you programmed endpoints to plot from .02 to 5 minutes, the HERMIT 2000 would generate a plot from .01 to 10 minutes.

Skip the divisions prompt by just pressing the **ENTER** key. The current setting of the number of divisions will have no effect when the x-axis is in a logarithmic format.

```
Divisions [1]?
_
```

The display will return to the axes setup menu.

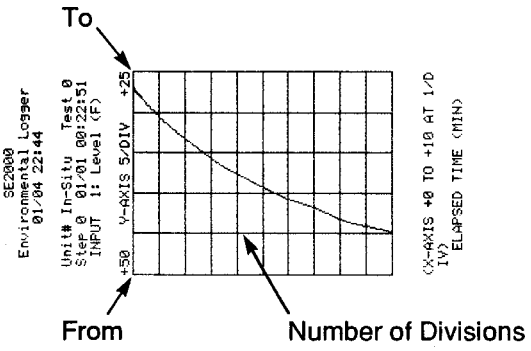
```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

Y-Axis Scaling

The y-axis represents input channel data in the specified units plotted as a function of time. The y-axis may have linear or logarithmic divisions depending upon your selection of the axes format.

Linear Y-Axis Scaling

The y-axis will have linear divisions when either the linear or semi-log formats have been selected. Scaling of a linear y-axis requires the entry of three parameters:



To scale the y-axis, press **F3** to select the **Y-AXIS** option from the axes setup menu.

```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

Key in the y-axis value, in the same units that the data is in, that you wish the plot to begin *from* and press **ENTER**.

```
From [0]?
_
```

Next key in the value that you wish the y-axis to extend *to*. You will not be allowed to enter a value that is equal to your *from* setting.

```
To [1000]?
_
```

Lastly, key in the number of divisions you want to have the y-axis divided into. The HERMIT 2000 will automatically scale the divisions based on your *from* and *to* entries.

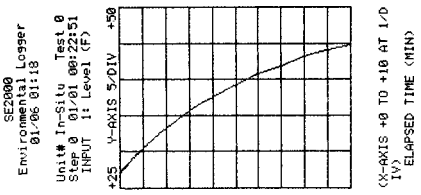
```
Divisions [1]?
_
```

The display will return to the axes setup menu.

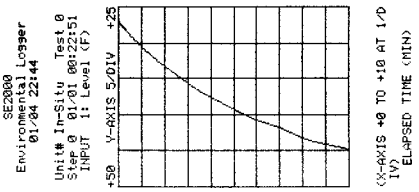
```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

There are no restrictions on the range of the y-axis endpoints in either the positive or negative direction. You can even swap the polarity of the endpoints.

For example, if the data were surface water levels, we might prefer that the y-axis be oriented conventionally with increasing levels going up.

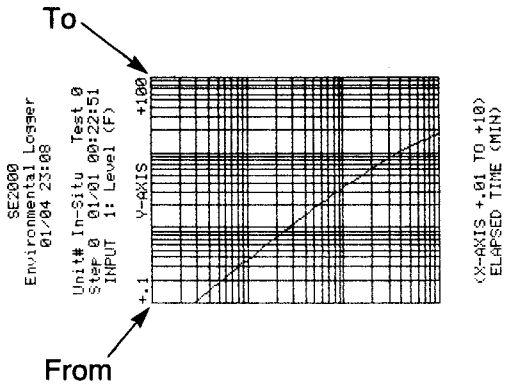


However, if the same data were top of casing readings from a pump test, we might prefer that increasing levels be oriented downward. The HERMIT 2000 will allow you to scale the y-axis either way on both the linear and semi-log formats.



Logarithmic Y-Axis Scaling

Selection of the log-log axes format causes the y-axis to be scaled with logarithmic divisions, and the data to be plotted as the absolute value of the change in data since time zero. This plot format is aimed at, but not restricted to, type curve generation for pump tests. Scaling of the logarithmic y-axis requires the entry of two parameters:



The number of log cycle divisions is calculated automatically by the HERMIT 2000.

To scale the y-axis, press **F3** to select the **Y-AXIS** option from the axes setup menu.

```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

Key in the change in value that you wish to begin plotting *from* and press **ENTER**. Choose a log cycle increment such as .001, .01, .1, and so on.

```
From [0]?
_
```

Next key in the change in value that you wish to plot *to* and press **ENTER**. Choose a log cycle increment such as 1, 10, 100, and so on.

```
To [1000]?
_
```

Note: The logarithmic y-axis always plots between divisions that are multiples of ten. If you choose endpoints that are not multiples of ten, the HERMIT 2000 will choose the nearest multiples for you. For example, if you programmed endpoints to plot from changes of .005 to 3, the HERMIT 2000 would scale the plot from .001 to 10.

CAUTION

Do not choose endpoints that are less than or equal to zero since the logarithm function is undefined in this region. You must also choose endpoints such that the from value is less that the to value. Incorrect settings for logarithmic scaling will cause plotting to stop with only the header information being printed.

Skip the divisions prompt by just pressing the **ENTER** key. The current setting of the number of divisions will have no effect when the y-axis is in the logarithmic format.

```
Divisions [1]?
_
```

The display will return to the axes setup menu.

```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

Generating a Plot

Once you have selected an axes format and have scaled each axis, generating a plot is as easy as printing data. Since the plot parameters are stored, you do not have to re-enter the format information between plots unless you require a new format.

If the display is still at the axes setup menu, press **CLEAR** to return to the dump data menu.

```
Axes setup menu:
FORMAT X-AXIS Y-AXIS
```

Press **F2** to select the **PLOT** option.

```
Dump data menu:
PRINT PLOT AXES TEST
```

Key in the number of the test you wish to plot and press **ENTER**. The highest test number available is displayed as the default selection.

```
Test [0]?
_
```

Next select the test step. The highest step number in the test is displayed as the default selection.

```
Step [0]?
_
```

Select the input channel to be plotted. Only one input can be plotted at a time.

```
Input [1]?
_
```

Select the start and end percentages of the test data. Use the defaults of 0% to 100% to plot data from start to finish.

```
Start % [0]?
_
```

Any portion of the data may be plotted. For example, select 0% to 50% to plot just the first half of the test or step.

```
END % [100]?
_
```

Note: If you have scaled the x-axis to plot only a portion of the data, you can speed plotting by selecting the start and end percentages to match the plot scale.

The increment selection determines if any data points are to be skipped. An increment of 1 plots every data point, an increment of 2 plots every other point, an increment of 3 every third point, and so on.

```
Increment [1]?
_
```

The HERMIT 2000 is now ready to plot the data. Make certain that all connections are made and that the printer is turned on. Press **ENTER** to start plotting.

```
Press ENTER to start
```

You will be prompted if the instrument does not detect that the printer is connected. Double check all connectors and make sure the printer is switched on.

```
Press ENTER to start
Not connected?
```

You can abort a plot early by pressing and holding the **CLEAR** key until the display returns to the dump data menu.

```
Press CLEAR to abort
```

The display will return to the dump data menu when the plot is finished.

```
Dump data menu:
PRINT PLOT AXES TEST
```

12 Running a Pump Test

The scenario presented in this section uses a HERMIT 2000 to collect time-drawdown data during a pump test. Detailed keyboard and display sequences are omitted to permit using this section as a checklist. If you have any difficulty following the procedures outlined in this section, refer back to the necessary programming section for details.

For the purpose of this example, a HERMIT 2000 and four pressure transducers will be used to run a pump test with the following requirements.

- Record time-drawdown data in a pumped well and two observation wells.
- Record the pump discharge rate by using an orifice plate flowmeter.
- Record recovery data on the three wells after the pump has been shut off.

Setting Up

Begin by programming the HERMIT 2000 with the basic test conditions.

1. Check that the clock shows the correct date and time. Set it if necessary. CLOCK

2. Use the **SETUP TEST** function to define the basic test parameters. SETUP TEST

   TEST# If no other tests are stored in memory, select test 0 to get the maximum storage capacity.
   ALARM Set the alarm start option **OFF**.
   RATE Select the **LOG** sampling mode so that fast, early time-drawdown data will be recorded. The longest sample interval should be selected as approriate for the test. In this case, set the sample rate to 15 minutes.
   #XDs In this example, 4 transducers are used.
   TYPE Set input channels 1 through 3 for **LEVEL** and input channel 4 for **FLOW**.

Next enter the parameters for each of the pressure transducers that will be used to measure level.

3. Use the XD function to enter the transducer parameters. Enter the following for inputs 1-3: XD

   I.D. The I.D. is optional. Leave it blank or key in your own identifying label.
   REF. Skip the entry of the reference level for now.
   LIN SCALE OFFS Key in the transducer coefficients as found on the cable reel. Set to zero any coefficient that is not specified.
   DELAY Key in a warmup delay of 50 mSEC unless specified otherwise.
   SG Make certain that the specific gravity is set to one for water.
   UNITS Select feet or meters of water as you prefer.
   MODE Use the **TOC** (top of casing) mode so that drawdown is measured directly.

Now enter the transducer parameters for the flow input.

4. Use the XD function to enter the transducer parameters for input 4: XD

   I.D. The I.D. is optional. Leave it blank or key in your own identifying label.
   KxA Key in the orifice plate coefficient (refer to Section 5 for details).
   LIN SCALE OFFS Key in the transducer coefficients as found on the cable reel. Set to zero any coefficient that is not specified.
   DELAY Key in a warmup delay of 50 mSEC unless specified otherwise.
   SG Make certain that the specific gravity is set to one for water.

We're now ready to install the transducers and connect them to the HERMIT 2000.

5. Lower pressure transducers that will be used to measure levels into the wells and set them below the lowest anticipated drawdown. Connect the transducers to the HERMIT 2000.

CAUTION

Do not allow the cable jacket to come in contact with the sharp edges of the well casing as the transducer is lowered into the well. Exposing a punctured or ripped cable jacket to water can result in permanent damage to the transducer.

Use the **READ** function contained in the transducer menu to verify the transducer settings. The head readings shown in parentheses are used for this purpose. Disregard the level readings since the reference levels have not been set yet.

6. Secure the cables to the casing to prevent the transducers from slipping away from their initial settings.

Note: It may be necessary to allow time for the transducers to come to temperature equilibrium with the water before continuing. This usually requires no more than two hours. If your head readings appear to drift, allow more time for stabilization.

CAUTION

Do not set a pressure transducer below the level of the pump in a pumping well. The pressure transients generated by the pump will cause false level readings. Large pumps can swallow the transducer and cause permanent damage to both the transducer and the pump.

7. Use the **REF.** function in the transducer menu to set the initial water level in each well as measured from the top of the casings. Drawdown can be recorded directly by setting all references to zero.

8. Install the pressure transducer that will be used to measure flow behind the orifice plate in the discharge line as illustrated in Section 5. Connect the transducer to the HERMIT 2000.

   Use the **READ** function contained in the transducer menu to verify correct operation of the transducer.

9. Repeat the read function on all input channels to double check the operation of the system.

Recording the Drawdown

The HERMIT 2000 is now ready to begin the drawdown phase of the test. Synchronizing the HERMIT 2000 with the pump start may be accomplished in two ways.

- If the instrument is close enough to the pump start switch, the **IMMEDIATE** start option can be used.

- If the instrument is too far away from the pump start switch, program the HERMIT 2000 for a delayed start using the **DELAYED** option.

Once the test is started the HERMIT 2000 will be recording time-drawdown data and recording the pump discharge rate. After the first two minutes of the test the HERMIT 2000 keyboard will be available for you to use.

- You can **VIEW** the data to monitor the progress of the test.
- You can print or plot any portion of the test while it is running by using the **DUMP DATA** function.

The Recovery Phase

Recovery data are most conveniently recorded by stepping the test.

- Synchronize the HERMIT 2000 to the pump shutoff using either the immediate or delayed start option. The instrument will restart its logarithmic sampling rate, providing you with fast, early recovery data.

- Use the **STOP** function to stop recording when the test is completed.

Test Variations

Many variations to the basic pump test are possible. Several common ones are listed below.

- Stepped rate pump tests require that the flow rate be stepped one or more times during the course of drawdown. The HERMIT 2000 allows you to step a test as many as five times. Steps 0 through 3 could be used to record four different flow steps, saving step 4 for the recovery phase.
- The pump test procedure is readily adapted to slug testing. By changing the test number after each test, you can run as many as twenty slug tests without having to dump data in between.
- When measuring low flow rates, it may be more practical to use an in-line flowmeter rather than an orifice plate. These types of transducers can be accommodated by programming a **FUNCTION** type input instead of the **FLOW** type input.

13 Long-Term Monitoring

For the example in this section, we will use the HERMIT 2000 to record spring runoff in a mountain creek that is otherwise dry the rest of the year. The creek is inaccessible throughout the winter and early spring months.

- A pressure transducer will be used to measure the water level.
- A temperature transducer will be used to measure the air temperature.
- There is no need to collect data until water begins to flow in the creek.

Setting Up

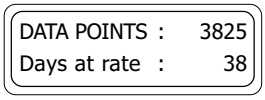
Begin by programming the HERMIT 2000 with the basic test conditions.

1. Check that the clock shows the correct date and time. Set it if necessary. CLOCK

2. Use the **SETUP TEST** function to define the basic test parameters. SETUP TEST

   TEST# There should be no need to retain other test data. Select test 0 to get the maximum storage capacity.
   ALARM We will use the alarm start feature to delay recording until water is detected in the creek. Set the alarm start option ON with a scan rate of three hours (180 minutes). The scan rate can be adjusted to suit the detection requirements of the test.
   RATE Select the LIN1 sampling mode with a sample rate suited to the test. In this example, we would like to record data every half hour (30 minutes) once water has been detected in the creek.
   #XDs In this example, 2 transducers are used.
   TYPE Set input channel 1 to **LEVEL** type and input channel 2 to **FUNCTION** type.

With a 16K byte HERMIT 2000, we can record data for 76 days or roughly two and a half months after water is detected in the creek.



Next enter the parameters for the pressure transducer that will be used to measure level.

3. Use the **XD** function to enter the transducer parameters for input 1. XD

   I.D. The I.D. is optional. Leave it blank or key in your own identifying label.
   REF. Skip the entry of the reference level for now.
   LIN SCALE OFFS Key in the transducer coefficients as found on the cable reel. Set to zero any coefficient that is not specified.
   DELAY Key in a warmup delay of 50 mSEC unless specified otherwise.
   SG Make certain that the specific gravity is set to one for water.
   UNITS Select feet or meters of water as you prefer.
   MODE Use the **SURFACE** mode so that water levels can be referenced to the creek bottom or a surveyed marker.

Now enter the transducer parameters for the temperature transducer.

4. Use the XD function to enter the following parameters for input 2. XD

   I.D. The I.D. is optional. Leave it blank or key in your own identifying label.
   LIN SCALE OFFS Key in the transducer coefficients as found on the cable reel. Set to zero any coefficient that is not specified.
   DELAY Key in a warmup delay of 50 mSEC unless specified otherwise.

We're now ready to install the transducers and connect them to the HERMIT 2000.

5. Install the pressure transducer in the bottom of the creek bed in such a manner as to insure that it will not be moved by the flow of water. Connect both transducers to the HERMIT 2000.

   Use the **READ** function contained in the transducer menu to verify the operation of each transducer. Use only the head reading in parentheses for the level input since the reference level has not been set yet.

6. Use the **REF**. function in the transducer menu to set the initial water level. Since we are installing the transducer in a dry creek bed, set the reference to zero. Verify the reference setting using the **READ** function.

We now need to program the alarm conditions that will determine when data recording begins.

7. Use the **SETUP ALARM** function to program a **HIGH** alarm for the level input. Set the alarm at 0.2 feet (about 2 inches). Make sure that you use units consistent with the measurement units. Turn the **LOW** alarm OFF.

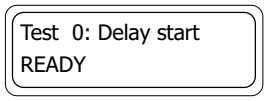
8. The high and low alarms for the temperature input should be **OFF**.

Starting the Test

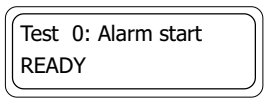
Since we want to record spring runoff data, there is no reason to waste power checking for water in the creek until spring.

9. Use the **DELAYED** start option to program in the date and time you wish monitoring to begin. The 1st of April might be an appropriate start date.

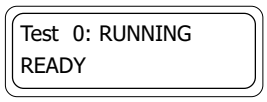
The HERMIT 2000 will enter the delayed start mode. Once it goes to sleep, the instrument will not wake until the designated time.



On the 1st of April, the instrument will wake up and enter the alarm start mode. The HERMIT 2000 will take readings on the water level input every three hours but will not record the data.



When the water level finally exceeds the 0.2 foot level we programmed, the HERMIT 2000 will start recording level and temperature data at the 30 minute sample rate.



The HERMIT 2000 will continue to record data until it is stopped or until its memory is full.

14 Hardware Interfacing

The information contained in this section is designed to help you interface third-party peripherals to your HERMIT. To make proper use of this information you should be prepared to:

- Read and understand a schematic diagram.
- Research other equipment manuals for interface details.
- Run to an electronics store for parts.
- Use a soldering iron and other small tools for electronic assembly.

If any of these resources are not available to you, contact In-Situ's service personnel for assistance, or quotes on custom cables and interfaces.

> ***Warning***
>
> *In-Situ does not warrant the HERMIT against damages caused by the interfacing of peripheral devices not provided by In-Situ. In-Situ cannot guarantee the accuracy of the information contained in this section, or its suitability for your application.*

External Power

The external power accessories supplied with your HERMIT should satisfy most requirements for conserving the life of the internal battery pack. It is recommended that you do not use any other type of external power accessory.

Alarm Outputs

The alarm connector contains connections for both the high and low alarm contacts. An alarm interface cable is supplied with the HERMIT. Do not use any other type of cable as this will compromise the integrity of waterproof operation.

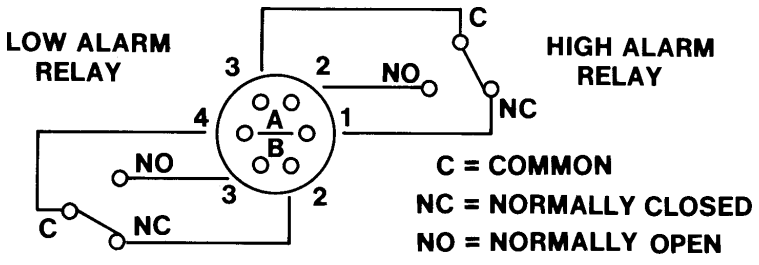
The alarm contacts and their pinouts on the back (cable) side of the mating connector are shown below. Note that no power is supplied by the instrument for use by the alarm circuitry. Any devices connected to the alarm contacts must supply their own power. The alarm relays are of a mechanical latching type so that the correct position is maintained even when the HERMIT is asleep.

The interface cable color code assignments are as follows:

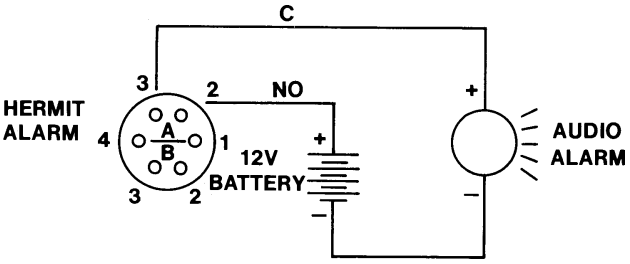
Function	Color
High Alarm – Normally closed	Black
High Alarm – Normally open	White or Brown*
High Alarm – Common	Red
Low Alarm – Normally closed	Blue or Orange*
Low Alarm – Normally open	Yellow
Low Alarm – Common	Green

** One or the other will be present.*

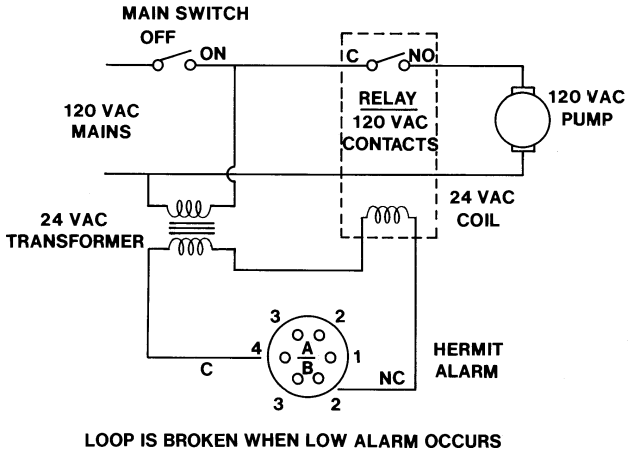
> ***Warning***
>
> *Never use the relay contacts to switch more than 30 volts AC or DC. Damage to the HERMIT could result.*



The alarm connection illustrated below is used to turn on a 12 VDC audio alarm when a high alarm occurs.



The connection shown below is used to turn off a 120 VAC pump when a low alarm occurs.



RS232 Port

In addition to the data transmission parameters discussed in Section 9, the following hardware characteristics must be satisfied for proper operation of an RS232 interface:

- Correct matching of cable genders
- Correct matching of DTE and DCE devices
- Correct matching of handshake method

RS232 serial interfaces are designed to connect one piece of Data Terminal Equipment (DTE) to one piece of Data Communications Equipment (DCE). The accessory cable supplied with your HERMIT is configured as DCE with a male connector. As such it will connect directly to any RS232 port that is configured as DTE with a female connector. If the RS232 port of the printer or computer being interfaced is not configured as DTE with a female connector, it will be necessary to wire an adapter.

If the operator's manual or labeling at the connector of the device does not use the DTE/DCE terminology, its configuration can be determined by identifying the function of pin 3 on the RS232 connector from a schematic, pinout, or signal diagram. If pin 3 is labeled as INPUT, DATA IN, RECEIVED DATA, RD, RxD, or a similar phrase, then the device is DTE; otherwise it is DCE.

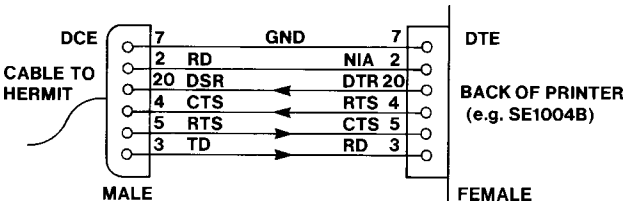
The pins on the RS232 cable of the HERMIT that must be connected properly are listed below. Signal directions are referenced to the HERMIT.

Panel Connector	RS232 Connector	Signal Name	Direction
A	7	Signal Ground	-
B	2	Receive Data (RD)	Input
C	20	Data Set Ready (DSR)	Input
D	4	Clear to Send (CTS)	Input
E	5	Request to Send (RTS)	Output
F	3	Transmit Data (TD)	Output

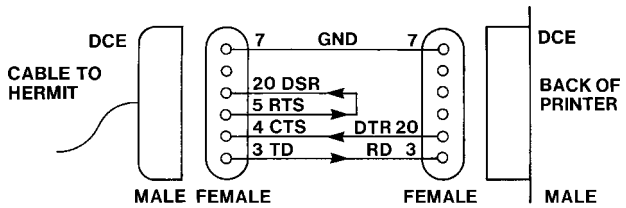
The RTS output goes high when the HERMIT is ready to dump data and remains high until the output is complete. The DSR input must be high and remain high for the HERMIT to recognize that an external device is connected. Data are output via TD.

The CTS and RD inputs are used for handshaking. CTS high indicates that the receiving device is ready; low indicates that it is not ready. The HERMIT will accept XON/XOFF (DC1/DC3) character handshaking on the RD input. If CTS remains low (not ready) or no XON character is received after XOFF for 90 seconds, the HERMIT will abort the output procedure. If DSR is lost any time during the transfer, the instrument will abort immediately.

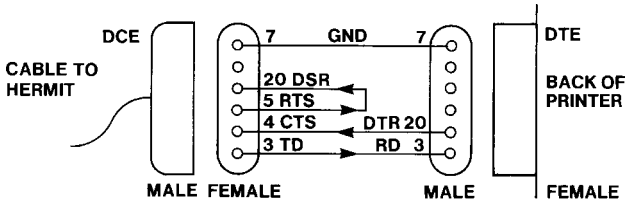
Signal connections for the standard printer interface, where no adapter is required, are shown below for reference.



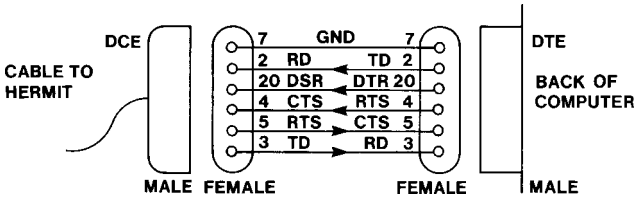
The illustration below shows the adapter necessary to connect to a printer that uses DTR (Data Terminal Ready) handshaking instead of CTS and does not supply a signal to maintain DSR active.



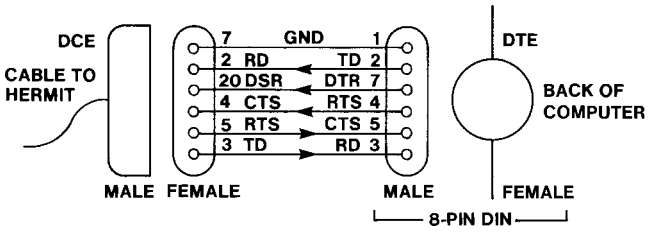
Many printers, such as those from IBM and HP, have a male connector, are configured as DCE, and use DTR/DSR handshake. An adapter for these printer types is shown below.



A computer interface adapter for IBM PCs and compatibles is shown below. Note that this adapter is supplied as a standard accessory. This type of adapter is also available as a standard product from most computer accessory sales companies.



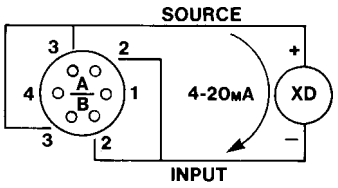
Some computers do not use the standard 25-pin connector. An adapter is supplied with the HERMIT for connection to an IBM PC/AT or compatible. The example below shows a connection for the Epson HX-20.



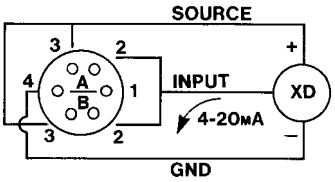
Finally, many computers do not require an adapter to work. Radio Shack's TRS-80 Model 100 is a good example.

Transducers

Transducers other than those provided by In-Situ may be adapted for use with the HERMIT. Mating connectors must be ordered separately from In-Situ. Do not use any other type of connector as this will compromise the integrity of waterproof operation.



The wiring of a standard 2-wire 4-20 mA transducer is shown here. The HERMIT provides loop power at approximately 24 VDC and has a nominal resistance of 185 ohms. Loop power is supplied only when the instrument needs to take a measurement.



Transducers that require more power than can be supplied within the 4-20 mA loop can be used in the 3-wire configuration shown here. The source output of the HERMIT can supply as much as 100 mA. The output is protected by current-limiting circuitry.

Appendix A: Accessories

Standard Accessories

Your HERMIT comes equipped with one each of the following standard accessories:

- HERMIT 2000 Operator's Manual
- HERMIT 2000 Pocket Guide
- Factory-installed lithium battery pack
- Serial interface cable kit for connection to the RS232C port, including:
  - Serial cable with 6-pin circular to DB9 female connector
  - DB9 male to DB25 male adapter
  - DB9 male to DB25 female adapter
- External power pack, including:
  - 12 VDC automobile cigarette lighter adapter
  - 120 VAC to 15 VDC wall-mount power pack
- Alarm interface cable
- DataTransfer software for transferring raw data from the HERMIT to the IBM PC and compatibles.

Optional Accessories

In addition to the standard accessories shipped with your HERMIT, In-Situ also makes available the following optional accessories.

Input Channel Expansion

The HERMIT 2000 is available in standard configuratinos of 4, 8, 12, and 16 input channels. Configurations with up to 32 input channels are available on special order. Input channel expansion requires installation by the factory.

Memory Expansion

Non-volatile data storage memory for the HERMIT 2000 is available in the following configurations:

- 64K bytes--standard with 4- and 8-channel instruments
- 128K bytes--standard with 12- and 16-channel instruments
- 192K, 256K, 320K, 384K. 448K, and 512K bytes

Field Printers

- **SE1004B 24-Column Printer.** The SE1004B is a compact, lightweight printer that permits low to moderate speed printouts of tabularized and graphic data. The SE1004B requires an external 12 VDC power source for operation and includes adapters for an automobile cigarette lighter and 120 VAC wall outlet.
- **GFP-80 80-Column Printer.** The GFP-80 is a high speed, portable field printer that permits printouts of multi-column, tabularized data and large 8.5 K 11 inch, high-resolution graphic data. It operates on its own internal, rechargeable battery pack.

Transducers

All of In-Situ's transducers come to the customer ready to use: fully calibrated and complete with cable, reel, and pre-wired connectors.

- Pressure. Pressure transducers can be used with the HERMIT to measure pressure, level, and flow. In-Situ offers a variety of pressure transducer sizes and ranges to cover most measurement requirements.
- **Conductivity/Temperature.** A dual-mode transducer, the conductivity/temperature probe permits the simultaneous measurement of both conductivity and temperature while using only one input channel. The HERMIT can be programmed to provide readings of uncompensated or temperature-compensated conductivity.
- **pH/Temperature.** Also a dual-mode transducer, the pH/temperature probe permits measurement of temperature and temperature-compensated pH on one channel.
- **Barometric Pressure.** This transducer provides an accurate measurement of absolute pressure in the 8 to 16 PSIA range. Pressure is displayed in PSIA; conversion factors are provided to display results in mm Hg, inches H2O, and inches Hg, to name a few.

Shipping Containers

Heavy-duty polyethylene shipping containers are water-tight, pressure- tight to 0.5 psi, have sturdy and comfortable carrying handles, and can be used as a seat in the field. They are approved by the U.S. Department of Transportation as configured by In-Situ Inc. and have appropriate decals affixed. The containers are specifically sized and fitted with high-density foam inserts to accommodate the most common combinations of instruments. Space is provided for a packet of documents, computer software, and other necessary accessories.

- **2KPO.** Holds one HERMIT 2000 and one SE1004B field printer.
- **4XD.** Holds any four-reel combination of the following:
  - Transducer with 400 ft. cable on ABS plastic reel
  - 400 ft. extension cable on ABS plastic reel.

Appendix B: Installation, Maintenance, & Service

The information presented in this appendix covers the initial setup of your HERMIT 2000 Environmental Data Logger and includes procedures for the proper use and care of the instrument.

Note: Become thoroughly familiar with the information in this appendix before attempting to operate your HERMIT 2000.

Unpacking and Inspection

Your HERMIT 2000 is another example of the quality and attention to detail in engineering and construction that have become a trademark of In-Situ instrumentation. Each instrument is thoroughly tested and calibrated by people who are dedicated to providing you with the best possible product and service.

Your HERMIT 2000 was carefully inspected before shipping and should be ready to operate right out of the box. Check the instrument for any physical damage sustained during shipment. Notify In-Situ and file a claim with the carriers involved if there is any such damage; do not attempt to operate the instrument.

Please check to ensure that you have received all of the standard accessories included with the HERMIT 2000. Review the list of standard accessories in Appendix A. If any accessory items are missing, please contact In-Situ immediately.

Note: Transducers and other optional accessories are shipped separately and should also be inspected for physical damage and the fulfillment of your order.

Please save all packing materials and accompanying shipping documents. Due to the lithium battery pack used in the HERMIT 2000, it must always be shipped in its original carton and with the necessary documentation.

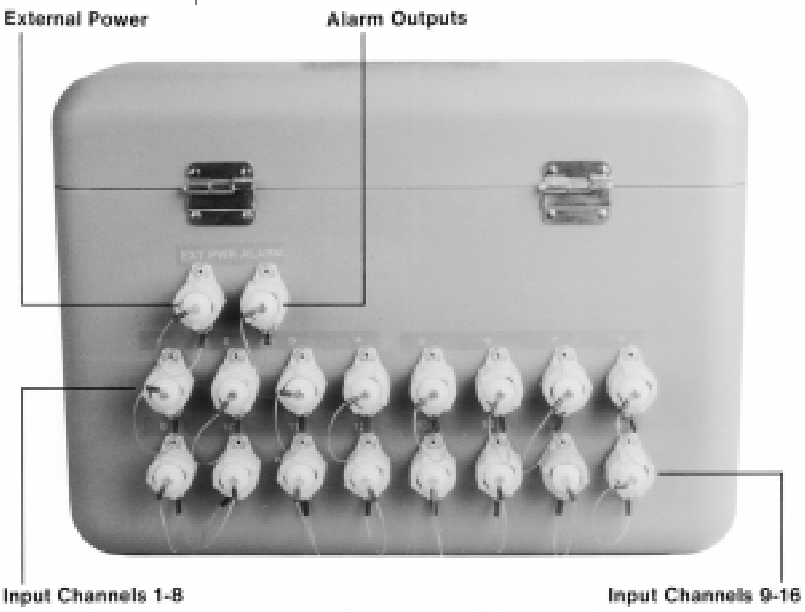
Rear Panel

Understanding the connector panel layout of your HERMIT 2000 is important for safe and efficient operation. The connectors are labeled in the photograph below. Depending on the instrument's configuration, some input channel connectors may not be present.

Although the connectors are water-resistant even without their protective caps, the connecting pins are subject to damage by dirt and other foreign objects unless the connectors are properly attached to a mating cable or protective cap. **Always cap a connector when it is not in use.**

Installing Transducers and Accessories

All rear panel connectors are labeled and keyed so that mating cables and accessories fit only one way; never try to force a connection. It is possible to accidentally plug a cable or accessory into the wrong connector (e.g., external power into an input channel), but *don't worry, you can't damage the HERMIT 2000 or its accessories with any wrong combination of connections.*

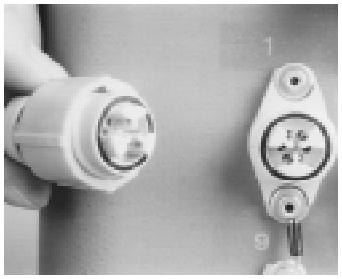


General Connector Installation and Removal

Cables and accessories may be installed or removed as often as your needs require. To install connectors, observe the following procedures.

1. Remove the protective cap from the rear panel connector. If the mating cable or accessory has a protective cap, remove it also.

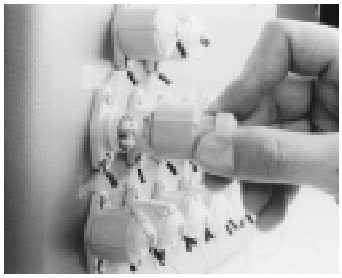
2. Orient the connector patterns so that the large tab in the cable or accessory connector is up.



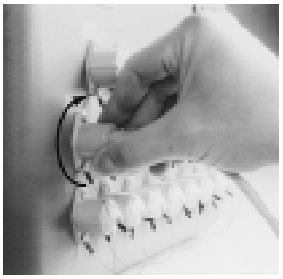
CAUTION

Proper operation of a transducer or accessory is dependent upon a clean, dry connection. Make certain that connectors are clean and dry before attempting to install them.

3. Gently press the connector halves together. Excessive force should not be required.



4. Tighten the connector's lock ring to establish a tight connection and water-resistant seal.



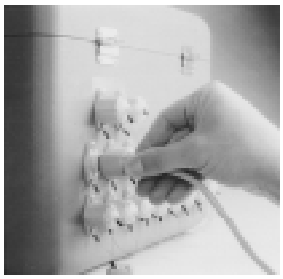
CAUTION

If a connector jams during installation, it may be upside down or blocked by dirt or other foreign objects. Attempting to force it further may result in damage to the connector or instrument.

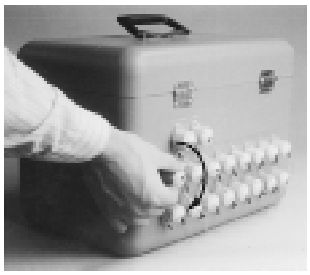
To remove a connector, observe the following procedure.

1. Loosen the connector's lock ring.

2. Gently pull the connector halves apart. Store the cable or accessory in its original container or where it will be safe from damage to the contacts.



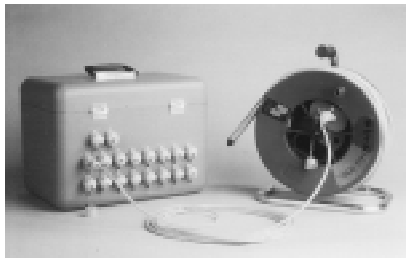
3. Replace the protective cap on the instrument connector.



Transducer Installation

Transducers can be installed at any of the input channel connectors on the rear panel of the HERMIT 2000. Transducers are typically installed consecutively beginning at input channel one. The HERMIT 2000 must then be programmed to identify the type and characteristics of each transducer connected.

Transducers mounted on reels are supplied with a jumper cable for convenient connection to the instrument. Transducers on cable without a reel connect directly to the instrument without a jumper cable.



External Power Installation

The HERMIT 2000's internal lithium battery pack is designed to supply the instrument and its connected transducers with clean, reliable power for several years. You can extend the life of the battery pack by using the external power accessories supplied with your HERMIT 2000 whenever it is convenient. The HERMIT 2000 will automatically switch over to external power when it is present and will automatically switch back to its own internal battery pack if the external power source is disconnected or depleted.

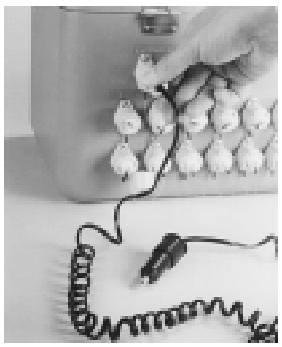
> ***Warning***
>
> *Use only the external power accessories provided with your instrument. Connection of an improper power source could cause permanent damage to the instrument and the transducers connected to it.*

Cigarette Lighter Adapter

The cigarette lighter adapter allows the HERMIT 2000 to tap into the 12 VDC battery of most vehicles. Use only with vehicles employing a 12 VDC negative ground system. Some vehicles require that the ignition switch be left in the "ON" or "ACC" (accessory) position for proper operation of the cigarette lighter.

To connect the cigarette lighter adapter:

1. Connect the lighter adapter to the External Power port of the HERMIT 2000.



2. Remove the car's cigarette lighter and install the adapter in the socket. Turn the car's ignition switch to "ON" or "ACC" if required.

3. Wake the HERMIT 2000 to confirm that external power is properly connected.

READY (ext pwr)

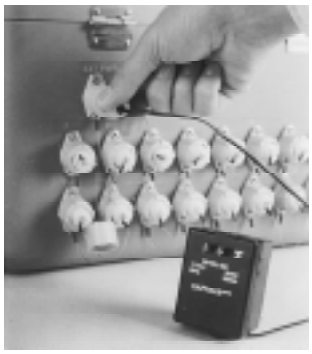
Power Pack

The wall-mounted power pack converts the 120 VAC available at a wall socket to power suitable for the HERMIT 2000.

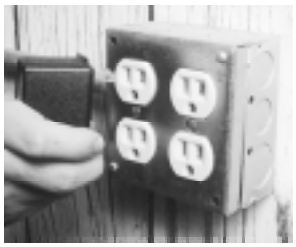
> ***Warning***
>
> - *The power pack is designed for 120 VAC power sources only. Connection to an improper power source can cause permanent damage to the instrument and the transducers connected to it.*
> - *The power pack is designed for indoor use only.*
> - *Improper use of the power pack will present an electrical shock hazard to personnel.*

To connect the power pack:

1. Connect the power pack to the External Power port of the HERMIT 2000.



2. Plug the power pack into a 120 VAC indoor wall outlet.



3. Wake the HERMIT 2000 to confirm that external power is properly connected.

READY (ext pwr)

RS232 Installation

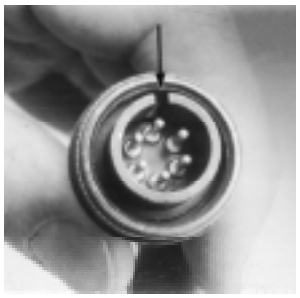
The RS232C port on the front panel of the HERMIT 2000 allows the instrument to communicate with field printers and personal or portable computers.

> ***CAUTION***
>
> *The RS232C port is water-resistant only when attached to its mating cable or protective cap. As with other connectors on the HERMIT, always cap it when it is not in use.*

To install the RS232 connector, observe the following procedures:

1. Remove the protective cap from the front panel RS232 port.

2. Orient the cable connector so that the keyway is lined up with the key on the RS232 port.



3. Gently press the connector halves together. Excessive force should not be required.

> ***CAUTION***
>
> *Proper operation of the RS232C interface is dependent upon a clean, dry connection. Make certain the connector is clean and dry before attempting to install it.*

> ***CAUTION***
>
> *If the connector jams during installation, it may be upside down or blocked by dirt or other foreign objects. Attempting to force it further may result in damage to the connector or instrument.*

4. Tighten the connector's lock ring to establish a tight connection and water-resistant seal.

5. Select the end of the general-purpose cable that matches the connector style of the accessory. Attach the RS232 cable to the accessory. The RS232 port is ready to communicate.

Note: It may be necessary to match the communication protocol between the HERMIT 2000 and RS232 accessory. Refer to Section 9 for assistance.

Disconnect RS232 accessories in the reverse order of installation.

Operating Considerations

The HERMIT 2000 is an extremely rugged instrument and has been designed to withstand the harsh treatment frequently encountered in field situations. However, as with any electronic instrument, the HERMIT 2000 can be permanently damaged if used outside its operating specifications.

Temperature Ranges

The storage and operating temperatures for the HERMIT 2000 are:

-40º to 70ºC -40º to 158ºF

Installation in extremely hot and sunny climates may require the use of a shade to prevent temperatures inside the HERMIT 2000 from exceeding the upper limit. In extremely cold climates, it may be necessary to bury the instrument to prevent internal temperatures from dropping below the lower limit.

Potential for Water Damage

The HERMIT 2000 is designed to be used around water, but reasonable caution should be exercised to prevent water damage. Do not submerge the instrument or allow it to remain in standing water. If you're using it in rain or snow, close the cover. If the face plate gets wet, dry it off. Cap all connectors that are not in use.

Special care should be taken to ensure that no water is introduced into the HERMIT 2000 through the transducer vent tube outlet (just above the RS232 port). If you suspect that water has gotten inside the instrument, contact In-Situ's Product Service facility at your earliest convenience.

Calibration

The HERMIT 2000 is designed to maintain its accuracy specifications through its useful service life without requiring periodic calibration. The accuracy of the instrument can be adversely affected, however, by such factors as:

- improper care and handling
- lightning strikes and similar surges
- exceeding operating temperature limits
- physical damage or abuse

Under these circumstances it may become necessary to recalibrate the instrument. Contact In-Situ's Product Service facility for information on periodic check-ups and recalibration.

Potential for Radio/Television Interference

The HERMIT 2000 generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this manual, may cause interference to radio communications. Your instrument has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of the HERMIT 2000 in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

General Cleaning

Before cleaning, disconnect the HERMIT from external power sources and make certain that unused connectors are properly capped.

Clean the HERMIT with a soft cloth dampened in clean water or in water containing a mild detergent. Dry the instrument promptly with another soft cloth. Avoid using an excessive amount of water, and do not use any abrasive cleaners, especially on the display window.

Warranty Information

The HERMIT 2000 is warranted by In-Situ against defects in materials and workmanship for two (2) years from the date of original purchase. If you transfer ownership, this warranty is automatically transferred to the new owner and remains in effect for the original 2-year period.

During the warranty period, In-Situ will repair or, at our option, replace at no charge any instrument that proves to be defective, provided it is returned, shipping prepaid, to In-Situ's Product Service facility. The customer is responsible for any customs duties in connection with the return of the instrument.

This warranty does not apply to the discharge of the internal lithium battery pack due to normal operation of the instrument, or if the instrument has been damaged by accident or misuse, or as a result of service or modification by other than In-Situ's Product Service facility, or by interfacing of peripherals not provided by In-Situ. In-Situ shall have no obligation to modify or update instruments once manufactured. This warranty does not apply to In-Situ transducer products.

No other warranty is expressed or implied. Under no circumstances does this warranty provide a remedy in excess of the price of the equipment. The repair of an instrument is your exclusive remedy. In-Situ, Inc., shall not be liable for consequential damages.

How to Obtain Repair Service

If you suspect that your HERMIT 2000 is malfunctioning and repair is required, you can help assure efficient servicing by following these guidelines:

1. Call In-Situ's Product Service facility toll-free at 1-800-446-7488.
2. Be prepared to describe the configuration of the HERMIT 2000 exactly as it was at the time of the malfunction; transducers, accessories, and programming in use at that time should be noted.
3. Write a description of the malfunction symptoms for service personnel, indicating whether the malfunction occurs intermittently or constantly.
4. Save printouts or any other materials that illustrate the problem area.
5. If service is required, obtain an RMA (return material authorization) number from service personnel.
6. Ship your HERMIT 2000 according to the shipping instructions outlined in Appendix C.

Please do not return equipment to In-Situ's Product Service facility without first contacting service personnel by phone.

Serial Number

Each HERMIT 2000 carries an individual serial number on the inside surface of the lid. This serial number is also programmed into the instrument and is displayed as part of the System Configuration (see Section 11). It is recommended that owners keep a separate record of this number. Should your instrument be lost or stolen, the serial number is often necessary for tracing and recovery, as well as any insurance claims. If necessary, In-Situ maintains complete records of original HERMIT 2000 owner's names and instrument serial numbers.

Appendix C: Shipping Instructions

> ***Warning***
>
> *Most models of the HERMIT 2000 have an internal lithium battery pack. The Department of Transportation (DOT) and the International Air Transport Association (IATA) consider lithium to be a hazardous material. Special packaging, labeling, and documentation are required for shipping the lithium-powered HERMIT 2000.*

Since hazardous materials shipping regulations are subject to frequent changes, we have prepared a separate leaflet entitled "In-Situ Inc. Shipping Instructions for Handling In-Situ Data Loggers." This was sent to you with your HERMIT 2000. Please refer to this leaflet for current packaging, labeling, and shipping requirements for the lithium-powered HERMIT 2000.

If the original materials are lost or unusable, or you have difficulties arranging shipment, please contact our shipping and receiving department toll-free at 1-800-446-7488.

Note: No special shipping requirements apply to the non-lithium-powered HERMIT 2000.

Repairs. Instruments returned for service should be sent, shipping prepaid, to In-Situ's Product Service facility:

In-Situ, Inc.
Product Service Department
210 South 3rd Street
Laramie, WY 82070
RMA # (assigned number here)

Please include the RMA (return material authorization) number assigned to you by service personnel on the shipping label. Refer to the Section **How to Obtain Repair Service** in Appendix B. Damage sustained during transit is not covered under your warranty. In-Situ recommends that the customer insure all shipments. Warranty repairs will be shipped back to the customer prepaid.

Rentals. Rental customers should return cleaned equipment, shipping prepaid, to In-Situ's Instrument Rental facility:

In-Situ, Inc.
Instrument Rental
210 South 3rd Street
Laramie, WY 82070

Appendix D: Error Messages

The following errors are generated by the HERMIT 2000 under fault conditions. The most recently generated error number can be displayed using the self-test function. A large number of recorded errors indicates that the instrument may require service. Refer to Appendix B for information on how to obtain repair service.

Error No.	Displayed Message	Error Condition
00	SYSTEM	Recovery from an undefined error condition.
01	WATCHDOG	Normal watchdog recovery from a transient event.
02	INTERRUPT	The program has generated an illegal BIOS interrupt.
03	BIOS CALL	The program has attempted to call an undefined BIOS subroutine.
04	SLEEP	The instrument cannot properly enter its sleep mode.
05	STACK	Internal program stack underflow.
06	INPUT#	The program has attempted to read a nonexistent input channel.
10	OVERFLOW	Math expression overflow. Result or intermediate result > .99999999 × 10^{127}.
11	UNDERFLOW	Math expression underflow. Result or intermediate result > .99999999 × 10^{-127}.
12	/ZERO	Division by zero.
13	ARG RANGE	Argument out of range.
14	SQRT(-)	Square root of a negative number.
15	LOG(0,-)	Logarithm of zero or a negative number.
16	NEG ^X.X	Negative value raised to a non-integer power.
20	PLT DEV.	The program has selected an illegal plot device.
21	PLT SETUP	The program attempted an incorrect plot setup.
22	PLT ABORT	Plotting aborted due to an illegal or out-of-range coordinate pair.
30	CHECKSUM	Storage directory checksum error. The instrument must perform a complete reset to recover. Data are not recoverable by the user.
31	BAD I.D.	The instrument cannot properly access a data storage record or a data storage record is bad.
32	WRITE	Value written to data storage did not read back correctly.
33	RECORD#	The program attempted to access a nonexistent data storage record.
34	OFFSET#	The program attempted to access an illegal offset value within a record.
35	DIR. FULL	The data storage directory is full.
36	FILENAME	The program has attempted to access a data storage file that does not exist.
37	CLOSED	The program has attempted to read or write a closed file.
38	EOF	End-of-file error. The program has attempted to read or write past the end of a file or past the end of data storage.

Appendix E: Specifications

HERMIT 2000 with Lithium Battery

General

Dimensions	25.4 x 40.6 x 28 cm (10 x 16 x 11 in.)
Weight	10 kg (20 lb.)
Operating & storage temperature	-40ºC to +70ºC (-40ºF to +158ºF)

Transducer Input(s)

Type	4 to 20 mA, 2 or 3 wire
Source voltage	+20 to +28 VDC, pulsed
Source current	100 mA max
Source pulse width	50 mSEC typical
Input resistance	185 ohms typical
Accuracy	±0.2% of full scale
Resolution	±0.015% of full scale
Stability	±0.005% of full scale/ºC

Data Sampling

Memory type	Non-volatile EEPROM
Memory capacity	16K standard, expandable to 512K
Data point capacity	8,000 standard, expandable to 256,000
Linear sampling rate	Programmable 2 sec to 1440 min
Log sampling rate	0.5 sec from 0 to 20 sec 1 sec from 20 to 60 sec 12 sec from 60 to 600 sec 2 min from 10 to 100 min 20 min from 100 to 1000 min 200 min from 1000 to 10,000 min 1440 min from 10,000 min programmable 1 min to 24 hs after 10 min

Battery

Type	Lithium inorganic
Expected life	Greater than 100,000 data points

External Power Input

Input voltage	+12 VDC to +18 VDC (+13.8 VDC nominal)
Input current	50 mA typical, 500 mA peak

Alarm Contacts

Contact voltage	30 VDC or 30 VAC max
Contact current	1 ampere max

RS232C Interface

Output voltage swing	±4 VDC min, ±5 VDC typical
Input voltage range	±15 VDC max, ±3 VDC min
Baud rate	Programmable 300 to 9600 baud
Character length	Programmable 7 or 8 bits
Parity	Programmable Odd, Even, or None
End-of-line sequence	Programmable CR or CR/LF
Handshake	CTS or XON/XOFF (DC1/DC3)

HERMIT 2000 with Lead-Acid Battery

General

Dimensions	25.4 x 40.6 x 28 cm (10 x 16 x 11 in.)
Weight	10.7 kg (23.6 lb.)
Operating and storage temperature	-15ºC to +40ºC (5ºF to 104ºF)

Battery

Type	Lead acid
Capacity	6.4 Ampere-hours

The usage that can be expected from a single battery charge depends on the temperature and the type of probe being used, as shown in the table below:

Probe Type	Temperature	Charge Life*
Level, Function	-15ºC	6 months or 72,000 data points
Level, Function	+25ºC	6 months or 96,000 data points
Level, Function	+40ºC	6 months or 25,000 data points
Dual	-15ºC	6 months or 5,800 data points
Dual	+25ºC	6 months or 7,700 data points
Dual	+40ºC	6 months or 2,000 data points

** Assumptions: Two hours of set-up time per month; Download on battery power at 9600 baud*

External Power Input

Input voltage	+12 VDC to +18 VDC (+13.8 VDC nominal)
Input current	50 mA typical, 500 mA peak

Power adapter can power unit and charge batteries at the same time. A fully discharged battery will require 24 hours to charge.

Appendix F: DataTransfer
HERMIT Data Transfer Utility

Using DataTransfer: Quick Summary

1. Wake the HERMIT, press **SETUP I/O**, press **F2** for RS232. Set 9600, 8, none, CR.
2. Press **F3** for PRNT and set Print width to 80.
3. Install DataTransfer. Connect the HERMIT to the PC.
4. Exit Windows. Set the the DOS prompt to the directory where you installed Data Transfer. Type DT <enter>. Press any key.
5. Enter a file name for the data, with a period and 3-letter extension (like .txt). Set the com port and Baud: 9600, Parity: None, Character: 8 bits, End of line sequence: Cr.
6. At the computer, press the **F1** key.
7. On the HERMIT, press the **Dump Data** key, then **F1** for PRINT. Select the test number, step number, input channel to start with, number of columns of data, start and end percentage.
8. At the computer, press any key to start the transfer.

Introduction

DataTransfer allows transfer of raw data from the HERMIT 2000 to the IBM PC and compatibles.

You may transfer as many as 24 input channels (columns) at a time. However, this number is decreased by 1 for each input channel containing dual-mode inputs. In general, no more than 12 dual-mode inputs can be transferred at a time.

Transferred data containing header information and numeric data are stored in a file of your choice. In addition, you have the option to store the numeric data (without the header information) in a separate file. The file containing the numeric data may then be easily transported into a spreadsheet or other software for further manipulation.

Environment and Hardware Requirements

DataTransfer requires an IBM PC, XT, AT, or 100% compatible, equipped with an asynchronous communications adapter (RS232 port), running under DOS V2.0 or higher.

DataTransfer is supplied on 3½" and 5¼" double-sided double-density diskettes formatted using MS-DOS. The program is copyable to another diskette or hard disk.

Installing DataTransfer

We recommend running DataTransfer from a backup copy, not from the master diskette. To install or create a backup of the master, follow these steps:

1. Insert the DataTransfer master diskette in drive A. The master should contain the following files:

   DT.BAT
   DATATRAN.EXE

2. If you are installing DataTransfer to a floppy diskette, insert a blank, formatted diskette into drive B.
3. Set the system prompt to the drive and/or directory where DataTransfer is to be installed.
4. Type COPY A:*.* <return>.

Transferring Data

Overview

To begin the data transfer process, follow these steps:

1. Type DT<return>.
2. Enter the file name(s) and set the communication parameters, then press <F1>.
3. Prepare your HERMIT instrument. This entails setting the communication parameters and getting the HERMIT 2000 to display

the message "Press CLEAR to abort." Refer to Sections 9 and 10, earlier in this manual, or see pages 56-57 below.

4. Press any key on the PC keyboard to start the data transfer.

A more detailed description with step-by-step instructions follows.

Preparing the PC

To begin the data transfer process, follow these steps:

1. Boot DOS V2.0 or higher. Refer to your DOS manual for more information.

2. It is recommended that you run DataTransfer from a backup copy. If you have not already done so, create a backup at this point, following the instructions under "Installing DataTransfer (page 54).

3. Set the desired drive (prompt) from which DataTransfer will be executed.

4. If DataTransfer will be run from a floppy diskette, put the program diskette in the drive set in step 3.

5. Put an empty, formatted diskette in the drive you plan to have data transferred to. You may, of course, transfer data to a hard drive if you have one.

6. Type DT <return>. You will first see a banner page identifying the program and version number. Press any key to display the screen shown in Figure 1.

7. **Enter the file names.** At the first prompt on the screen labeled "Header + numeric data file name," enter the path name and file name of the file in which data (all header information plus all numeric data) will be stored upon transfer. If you do not specify a path name, the data file will be created in the drive and directory from which you are running DataTransfer. End the file name with a period and a 3-letter extension (like .txt or .dat).

```
          HERMIT Data Transfer Utility

Header + numeric data file name :
Create numeric data file        : No




----F1 = Begin Transfer   ESC = Quit----


Communications port          : COM1
Baud rate                    : 9600
Parity                       : None
Character length (data bits) : 8 bits
End of line sequence         : CR
```

Figure 1. DataTransfer main screen

You have an option to create **another** file containing only the numeric data (no header information is included) upon transfer. If you would like to create a file containing numeric data only, press the space bar until "Yes" is highlighted at the"Create numeric data file" prompt and press <return>. If you do not wish to create this second file, press the space bar until "No" is highlighted and press <return>.

If you answered "Yes" to the "Create numeric data file" prompt, you must enter a path name and file name at the "Numeric data file name" prompt to indicate where the numeric data will be stored. If you do not specify a path name, the data file will be created in the drive and directory from which you are running DataTransfer. For convenience, the file can have the same name as the "header + numeric data file" name, with a .num extension.

8. **Set the communication parameters.** The communication parameters on the HERMIT and in DataTransfer must be the same before data transfer can take place. You should now select the port and communications parameters required for the data transfer. Generally, this will only need to be performed once, unless you change the communication parameters on the HERMIT Data Logger or plan to use another communications port. The configuration parameters are stored in a file named DT.INS in the drive and directory from which you are running DataTransfer. (If DT.INS does not already exist, DataTransfer will create it automatically.)

   The recommended settings for the HERMIT 2000 are:

Baud rate	:	9600
Parity	:	none
Character length	:	8
End of line sequence	:	CR

   To configure the communications port follow these steps:

   a. Move to the Communications Port prompt. Press the space bar to highlight the serial port that your HERMIT is connected to, either COM1 or COM2, then press <return>.
   b. To select the baud rate, press the space bar to highlight the the baud rate set on the HERMIT (9600, 2400, 1200, or 300), then press <return>.
   c. To select the parity, press the space bar to highlight the parity set on your HERMIT (Odd, Even, or None), then press <return>.
   d. To select the character length, press the space bar to highlight either 7 bits or 8 bits for the character length (also referred to as the number of data bits per character), then press <return>.
   e. To select the end of line sequence, press the space bar to highlight the option, either CR or CR-LF, that corresponds to the setting on the HERMIT, then press <return>.

Transferring the Data

1. Once you have entered the file name(s) and selected the communication parameters, press the <F1> key to begin the transfer. The instructions on the screen will change to those shown in Figure 2.

2. If the HERMIT has not aleady been prepared for data transfer, this is the time to do it. If prepared properly, it will display the message "Press CLEAR to abort." Follow the instructions below to prepare your HERMIT 2000.

3. When the HERMIT is ready, press any key on the PC keyboard. The message "**Transferring data . . .**" appears on the screen. When all data have been transferred the message "**End of data**" appears and the cursor is returned to the "Header + numeric data file name" prompt.

Stopping DataTransfer

If you wish to abort the transfer of data early, just press **CLEAR** on the HERMIT 2000. The cursor will be returned to the "Header + numeric data file name" prompt. Any data already transferred is saved in the appropriate files and you may now quit the DataTransfer program to manipulate the data or you may change file names, alter the communication parameters, and begin another transfer.

To quit DataTransfer and return to the DOS prompt, press the <ESC> key while the cursor is located at any of the file name or communication parameter prompts.

Preparing the Hermit 2000

Using the Cable

Connect the HERMIT instrument to the PC using the interface cable supplied with the HERMIT. If you have the cable with a round connector head at one end (to connect to the HERMIT) and just one flat

```
         HERMIT Data Transfer Utility

Header + numeric data file name: \MYDIR\ALL.OUT
Create numeric data file       : Yes
Numeric data file name         : NUMERIC.DAT

   Wait until:
      Hermit 1000 shows "out" or "SEnd"
      Hermit 2000 shows "Press CLEAR to abort"

   Then, press any key to begin transfer ...

Communications port         : COM1
Baud rate                   : 9600
Parity                      : None
Character length (data bits): 8 bits
End of line sequence        : CR
```

Figure 2. Messages appear about the transfer once the <F1> key is pressed

25-pin head connector at the other end, a gender changer or cable adapter is usually necessary to be able to plug into a serial (RS232) communications port. If you have the general purpose data interface cable (this cable has 3 connectors on one end of the cable and a round head connector at the other end), no gender changers or cable adapters are necessary. Just plug the 25-pin or 9-pin female connector into the back of the PC. Make sure that the connections on both ends of the cable are tight.

Reminder: The serial port on your PC is almost certain to be male. The 25-pin female port on your PC is for a printer and will not work for downloading.

Note: The last section of this Appendix shows the configuration of the cables. If your PC does not have a standard RS232 9-pin or 25-pin port, then you must obtain a new cable for your PC. The cable configuration can be inferred from the information given in "The Accessory Cable (page 58).

Setting the Communication (RS232) Parameters

Before using the RS232 port, select the RS232 communication parameters that you will use. The following are strongly suggested:

Baud rate	9600
Character length	8
Parity	None
End of line sequence	CR

To change these parameters on your HERMIT 2000:

1. At the **READY** display, press the **SETUP I/O** key to access the input/output setup menu.

2. Press **F2** to select the RS232 option. The current settings of the parameters are displayed as a menu:

3. Use the special function keys to change the parameter settings.
   a. Press **F1** to change the baud rate [300, 1200, 2400, or 9600].
   b. Press **F2** to change the character length [7 or 8 bits per character].
   c. Press **F3** to change the parity [odd, even, or none].
   d. Press **F4** to change the end of line sequence [carriage return only (CR) or a carriage return with a linefeed (CR-LF)].

4. Press **CLEAR** to return to the **READY** display.

Selecting the Print Width

If you are planning to transfer more than one input at a time, you will need to increase the print width.

1. At the **READY** display, press the **SETUP I/O** key to access the I/O setup menu.

2. Press **F3** to select the PRNT option. The current print width setting is shown in brackets. You may select a print width from 24

characters (corresponding to 1 column of data) to 255 characters (24 columns of data).

3. Key in a value for the print width and press **ENTER**. The display will return to the I/O setup menu.

4. Press **CLEAR** to return to the **READY** display.

Dumping Data

1. At the **READY** display, press the **DUMP DATA** key to access the dump data menu:

2. Press **F1** to select the **PRINT** option. The highest test number available is displayed as the default selection:

3. Key in the number of the test you wish to transfer and press **ENTER**.

4. Next select the test step. The highest step number in the test is displayed as the default. Press **ENTER** to select it or key in the desired step and press **ENTER**.

5. You are now prompted for the number of the input channel you wish to have transferred first. Input 1 is the default. Press **ENTER** to select the default or key in the input you want to start with and press **ENTER**.

6. Next key in the number of columns of input channel data you wish to transfer and press **ENTER**. The default is the maximum number available based on the number of inputs used in the test and the print width setting (see above).

   Note: On HERMIT 2000s with software versions earlier than 2.3, the order of these two prompts is reversed. You are prompted first for "Columns" (the number of input channels to transfer) and then for "Input" (the channel to transfer first). If you select more than one column, input channels will be transferred in sequential order. For example, if you enter 3 at the Columns prompt, and 2 at the Input prompt, then inputs 2, 3, and 4 will be transferred.

7. Next select the "Start %" and "End %" of the test data. Use the defaults of 0% to 100% to transfer data from start to finish. Press **ENTER** to select the defaults or key in new percentages and press **ENTER**. Any portion of the data may be transferred. For example, select 0% to 50% to print just the first half of the test or step.

8. The "Increment" selection determines if any data points are to be skipped. An increment of 1 transfers every data point, 2 transfers every other data point, 3 every third data point, and so on. Press **ENTER** to select the default increment or key in a new increment and press **ENTER**.

   The HERMIT 2000 is now ready to transfer the data. The HERMIT should show the message "Press ENTER to start."

9. Press **ENTER** on the HERMIT to start the transfer. The HERMIT should then display the message "Press CLEAR to abort."

Transferring the Test Line

A special test feature is available in the dump data menu that will allow you to test your HERMIT-to-PC setup before dumping data.

1. At the **READY** display, press the **DUMP DATA** key to access the dump data menu:

2. Press **F4** to select the **TEST** option. The HERMIT will display the message "Press ENTER to start." Make certain that all cables are connected and that the PC is switched on.

3. Press **ENTER** to start the test. The HERMIT will display the message "Press CLEAR to abort."

4. Several single-spaced test lines will be written to the transfer file containing header and numeric data on your PC. Quit the DataTransfer program and type TYPE filename to see the test lines, which should look something like this:

```
OUTPUT TEST LINE
OUTPUT TEST LINE
OUTPUT TEST LINE
. . .
```

   If the lines are not single-spaced or appear garbled in any way, check the communication parameter settings of the HERMIT 2000 and the PC.

Troubleshooting

Problems Before Transferring Data

PROBLEM	SOLUTION
The PC "freezes" or locks up.	• Reboot the PC.
When entering a response, the PC beeps and will not proceed	• Verify that a valid response is being entered. Refer to the bottom of the screen for instructions about each prompt.

Error Messages During Transfer

MESSAGE	SOLUTION
Timeout error.	• Verify that the HERMIT is connected to the correct port. • Verify that the HERMIT 2000 says "Press CLEAR to abort" when any key is pressed (see Transferring the Data, step 2). • Verify that the serial communications port on the PC is in good working order (no pins bent or loose). • Verify that cable connections are tight.

Error Messages During Transfer (continued)

MESSAGE	SOLUTION
Break signal detected. This message may also appear at the end of data transfer, or if the connection to the PC is broken. This message does not necessarily indicate an error.	•Verify that the communication parameters in DataTransfer and the HERMIT match. •Verify that there is data in the HERMIT at the test being dumped. •Transfer the HERMIT Test line to the PC.
Parity error.	•Verify that the parity setting on the PC and the HERMIT match (No parity is strongly suggested).
Framing error.	•Verify that the character length (data bits) setting on the PC and HERMIT match (8 bits with no parity is strongly suggested).
Overrun error.	•Verify that the communication parameters in DataTransfer and on the HERMIT match.
The number of columns being transferred exceeds 24. (Dual-mode inputs take 2 columns.) Transfer aborted.	•No more than 24 input channels can be transferred at a time. (This number is decreased by 1 for each input channel containing dual-mode inputs.) Transfer fewer columns of data.

If these remedies do not solve the problem, contact In-Situ Inc. for assistance. Please note the exact conditions under which the error occurred so that efficient technical support can be provided.

The Accessory Cable

RS232 serial interfaces are designed to connect one piece of Data Terminal Equipment (DTE) to one piece of Data Communications Equipment (DCE). The accessory cable supplied with your HERMIT is configured as DCE with a male connector. It will connect directly to any RS232 port that is configured as DTE with a female connector. If the RS232 port of the personal computer is not configured as DTE with a female connector, it will be necessary to wire an adapter.

If the operator's manual or labeling at the connector of the device does not use the DTE/DCE terminology, its configuration can be determined by identifying the function of pin 3 on the RS232 connector from a schematic, pinout, or signal diagram. If pin 3 is labeled INPUT, DATA IN, RECEIVED DATA, RD, RxD, or a similar phrase, then the device is DTE; otherwise it is DCE.

The pins on the RS232 cable of the HERMIT are listed below. Signal directions are referenced to the HERMIT.

PANEL CONNECTOR	25-PIN RS232 CONNECTOR	SIGNAL NAME	DIRECTION
A	7	Signal Ground	—-
B	2	Receive Data (RD)	Input
C	20	Data Set Ready (DSR)	Input
D	4	Clear to Send (CTS)	Input
E	5	Request to Send (RTS)	Output
F	3	Transmit Data (TD)	Output

PANEL CONNECTOR	9-PIN RS232 CONNECTOR	SIGNAL NAME	DIRECTION
A	5	Signal Ground	—-
B	3	Receive Data (RD)	Input
C	4	Data Set Ready (DSR)	Input
D	7	Clear to Send (CTS)	Input
E	8	Request to Send (RTS)	Output
F	2	Transmit Data (TD)	Output

The RTS output goes high when the HERMIT is ready to dump data and remains high until the output is complete. The DSR input must be high and remain high for the HERMIT to recognize that an external device is connected. Data are output via TD.

The DTS and RD inputs are used for handshaking. CTS high indicates that the receiving device is ready; low indicates that is is not ready. The HERMIT will accept XON/XOFF (DC1/DC3) character handshaking on the RD input. If CTS remains low (not ready) or no XON character is received after XOFF for 3 seconds on the HERMIT 1000B or for 90 seconds on the HERMIT 2000, the HERMIT will abort the output procedure. If DSR is lost any time during the transfer, the instrument will abort immediately.