HERMIT 1000C

Environmental Data Logger

Model SE1000C

Operator's Manual

May 1995
Software Version 4.3

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

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In-Situ Inc.
210 South 3rd Street
P.O. Box I
Laramie, Wyoming 82070-0920
U.S.A.
(307) 742-8213

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Warning

Some models of the HERMIT 1000C use lithium batteries which the Department of Transportation considers a hazardous material. The lithium-powered HERMIT 1000C 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.

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1 Introduction

Your HERMIT 1000C 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 1000C, you have the ability to:

- Measure and record parameters such as level, pressure, temperature, conductivity, and pH using standard In-Situ transducers.
- Easily reprogram your HERMIT 1000C to measure and record parameters from most industry standard 4-20 mA (milliampere) current loop transducers.
- 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 32K bytes (32,768 characters of information) of non-volatile data storage. Even if the HERMIT 1000C'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 LCD (liquid crystal) display, printed on an optional field printer, or transferred to most personal and portable computers via the built-in RS232C interface.
- Operate the HERMIT 1000C at extreme temperatures without having to supply an external power source.

What's New in Software Version 4.3

If you are already familiar with a previous version of the HERMIT 1000C, you may want to take notice of several new features that have been added to software Version 4.3.

- You can store up to 20 tests without erasing data.
- There is a new log schedule.
- The HERMIT checks that the programmed sample rate is long enough to accommodate the transducer delays before you exit the ENTER DATA menu and again before you exit the ENTER XD menu.

How to Use This Manual

This manual has been designed to enable you to gain the maximum benefit from your HERMIT and to answer your questions concerning field installations. If you have just received your new HERMIT, 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 system by reading and following through the examples in Section 2 of this manual — with your HERMIT. The best way to feel at ease with the instrument is to sit down with the manual and the HERMIT and actually key in the examples provided. It won't take long to become familiar with your HERMIT and it is well worth the time invested to obtain a more complete understanding of the instrument.

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

Sections 12 and 13 present field applications of the HERMIT. The procedures presented will give you a guide to programming the HERMIT to solve several common data-collection problems.

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

CAUTION

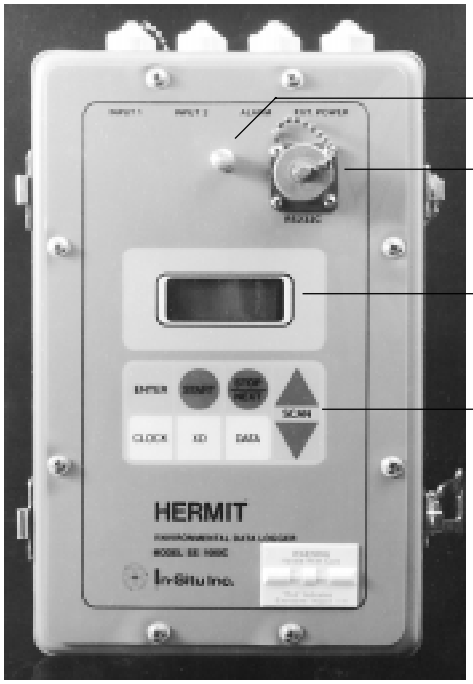
Do not attempt to set up the HERMIT without first becoming thoroughly familiar with Appendix B; it contains information that is important to avoid damaging your instrument when it is set up.

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 or its accessories with any keyboard operation.*

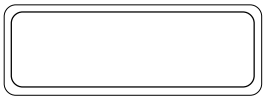
Keyboard Operation



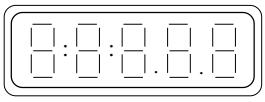
Wakeup

The HERMIT uses a technique called "sleeping" to minimize power consumption and achieve a battery life measured in years instead of months. Your HERMIT is naturally narcoleptic, falling asleep whenever there is no immediate task 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 will "wake" when its internal clock indicates it is time to take a data point, or when you press a key on the front panel.

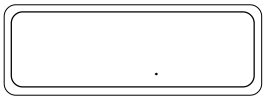
The sleep mode is recognized by a blank display.



Lightly press and release any key. The HERMIT will wake up . . .



. . . and respond with its status display. The unit is now ready for a keypad command. Your status display may look different from this one; see "The Status Display," p. 6.

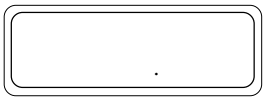


The HERMIT will remain awake as long as you are using the keyboard. In most cases it will return to the sleep mode if no key has been pressed for sixty seconds. If you pause long enough between keystrokes to let the unit sleep, you must wake it and repeat the operation. This will probably occur often at first, when you are learning how to operate the instrument. As you become familiar with the keystrokes needed to do what you want to do, you will be able to enter them more quickly and won't have to consult the manual as often.

Putting the HERMIT to Sleep

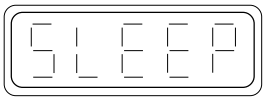
You can put the instrument to sleep manually and conserve battery power by pressing the STOP/NEXT key when the status display is shown.

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

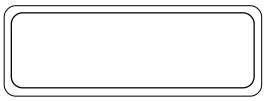


Press STOP/NEXT.

The unit confirms the command by displaying 'SLEEP.'



When you release the key, the unit returns to its sleep mode, as indicated by the blank display.



Battery Life Tip

Make a habit of putting the unit to sleep at the end of every keyboard session; however, if you forget, the instrument will put itself to sleep after 60 seconds.

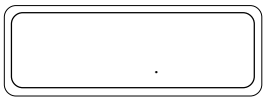
Note: The STOP/NEXT key, like all of the keys on the HERMIT, has several functions. Pressing it will put the HERMIT to sleep only if the status display is showing on the LCD.

View/Program Keys

These are the main keys used to view information stored in the HERMIT and to access the HERMIT's programming features. "XD" is an abbreviation for "transducer."

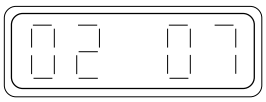
The CLOCK key allows you to view and program the instrument's time of day clock. The XD key permits direct viewing of transducer status and the programming of transducer parameters. The DATA key allows you to view stored data and to program data collection parameters.

Press and release any key to wake the unit.

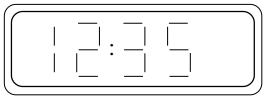


As an example, press the CLOCK key to view the instrument's time of day clock.

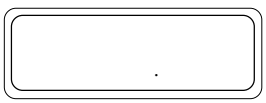
The HERMIT responds by displaying the current date for a few seconds . . .



. . . followed by the current time . . .



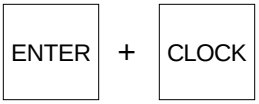
. . . and returns to the status display.



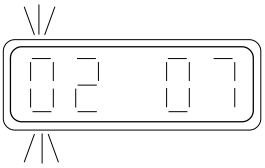
The ENTER Key

The ENTER key, when pressed together with another key, is used to "enter" or "program" parameters.

For example, to "enter" a new date and time into the clock, press the ENTER key with the forefinger of your left hand and hold it down while you press the CLOCK key with the forefinger of your right hand. Release both keys together.

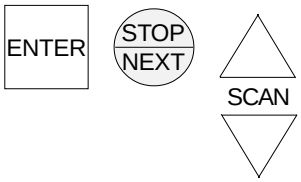


The HERMIT displays its current date, but this time the leftmost digit is flashing, indicating that a numeric entry is required.

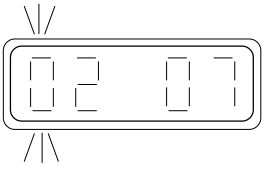


Basic Numeric Entry

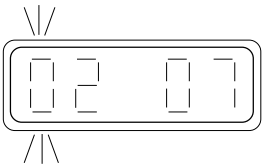
The SCAN, NEXT, and ENTER keys are used to program numeric values. The other keys are also used during some types of numeric entry; however, these are infrequent, and discussion of them is deferred to a later section.



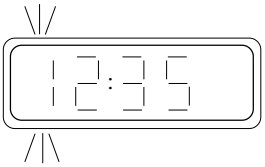
Whenever a number is displayed with a flashing digit, you are being prompted for a numeric entry. If the instrument is asleep, wake it up and repeat the last section so that the current date is in the display.



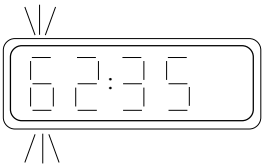
With any numeric entry, you may accept the default value shown in the display, or modify it. To accept the default value, just press ENTER.



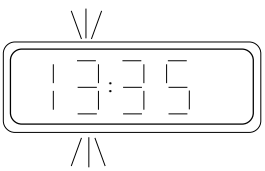
The current time is displayed next, again with the leftmost digit flashing.



Use the SCAN keys to modify the flashing digit. You can scan the digit up or down. The SCAN keys repeat automatically when you hold them down.

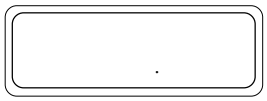


Use the NEXT key to flash the next digit. Use the SCAN keys to change the digit as needed. Repeat this process until the display shows the required value.

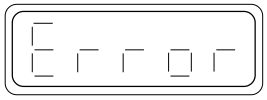


Press the NEXT key several times. Note that the flashing digit wraps back around to the leftmost position when the end of the display has been reached.

Press ENTER to set the displayed value. If you have entered a valid value, the instrument will continue with the next parameter. In this case, the HERMIT will return to the status display.



If you try to enter an invalid value, the HERMIT will display an error message and reprompt you for a correct entry.



Review of Keystrokes During Numeric Entry (flashing digit)

SCAN UP	Increases the value of the flashing digit.
SCAN DOWN	Decreases the value of the flashing digit.
STOP/NEXT	Makes the next digit flash.
ENTER	Stores the displayed number in the HERMIT's memory. Can be used to check the default or pre-programmed value then move to the next display without changing that value.

All keys will repeat automatically when pressed longer than one second. This is particularly useful when entering numeric values using the SCAN keys.

Data Collection Keys

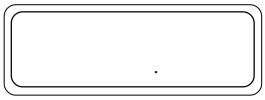
Use the START and STOP keys to control the start and stop of data collection. Like other programming keys, they do not take action immediately when pressed, but instead present a menu, or prompt you for additional information. An accidental press will not cause a sudden start or stop of data collection.

Selecting from Menus

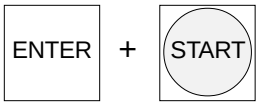
Each of the programming keys provides access to several related programming options. To simplify the access to any given option, the options are listed in menus. Most of us are accustomed to seeing menus displayed in a vertical list, or sometimes side by side in a horizontal list — like the menus of the HERMIT's big brother, the HERMIT 2000. Because its LCD displays only 5 characters at a time, the HERMIT's menus have to be shown on several screens.

The System Setup menu makes a good example. Do not be concerned with the details of the options presented in the menu at this time — they will be covered in a later section.

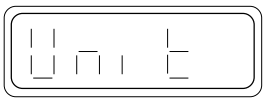
If the instrument has dozed off, lightly press any key to wake it up and get a status display.



Access the System Setup menu by holding down the ENTER key and pressing the START key.



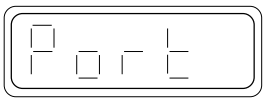
The HERMIT responds by displaying the System Setup menu — but you can only see the very first option at the top of the menu: 'UNIT.'



Note: Whenever you encounter the name of a programming option instead of a numeric value with a flashing digit, you have entered a menu.

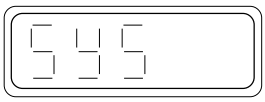
Press SCAN DOWN (the bottom of the SCAN key) . . .

. . . and you will be able to see the next selection: 'PORT.'

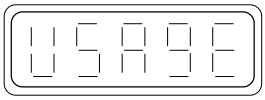


Press SCAN DOWN again . . .

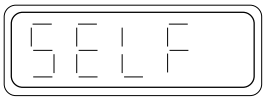
. . . and you will see the third menu option: 'SYS.'

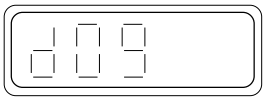


Press SCAN DOWN three more times to see the final three options in the System Setup menu, 'USAGE,' 'SELF,' and 'DOG.'

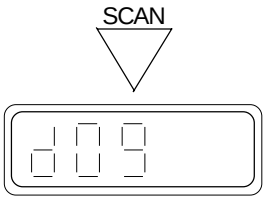


Later in the manual you'll find out what all these options mean. For now, we are just experimenting with looking at the menus.

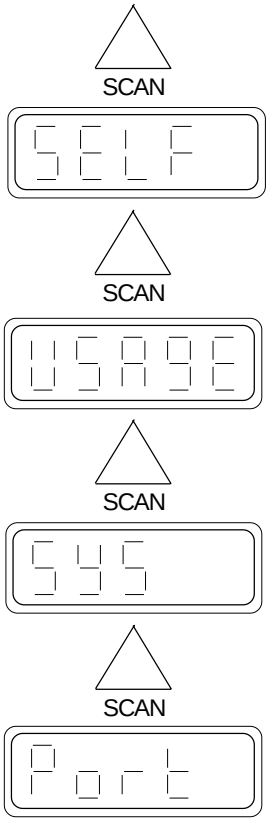




Now press SCAN DOWN again. 'DOG' stays on the display because you have reached the bottom of the menu, where SCAN DOWN no longer has any effect.



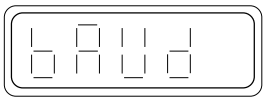
Now press SCAN UP (the top of the SCAN key) four times to move back up through the menu to 'PORT.'



Some menu options have submenus of their own. 'PORT' is one of these. Let's look at the Port submenu.

While 'PORT' is on the display, "select" it by pressing ENTER.

The display shows the first item in the Port submenu of the System Setup menu.

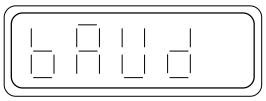


Press SCAN DOWN several times to display the entire Port submenu. You should see the menu shown here. When SCAN DOWN no longer changes the display, you know you have reached the bottom of the menu.

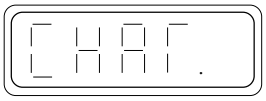
Port Submenu

Top of Menu

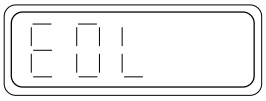
Baud rate



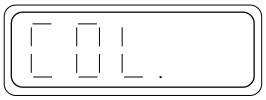
Character length/parity



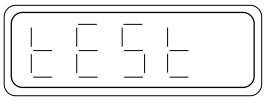
End-of-line sequence



Print width



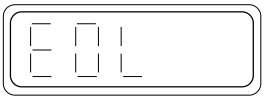
RS232 port test



Bottom of Menu

Now SCAN back UP to 'EOL' . . .

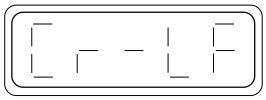
. . . and let's take a look at another type of submenu. When 'EOL' is on the display . . .

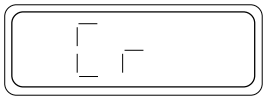


. . . press ENTER to select it.

There are two options for the EOL (end-of-line) sequence for the RS232 port. They are shown as a two-item menu on the HERMIT's display when you select the EOL option. The currently set EOL sequence will appear first. Press SCAN UP or SCAN DOWN to see the other choice.

Top of Menu



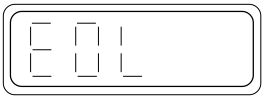


Bottom of Menu

If we wanted to change the EOL sequence, we would simply press ENTER when the desired choice was on the display. Here, we just want to look at the setting without changing it, so now let's exit all the way back to the status display.

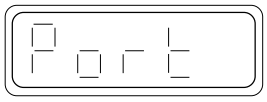
Press STOP/NEXT once . . .

. . . and the display will return to the point where it entered the Port submenu ('EOL') without changing the end-of-line setting.



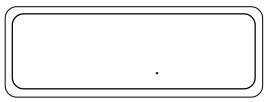
Press STOP/NEXT again . . .

. . . and the display will return to 'PORT,' the point where it entered the System Setup menu.



Press it again . .

. . . and we are back to the status display.



Notice how you travel backwards through all the levels you have encountered.

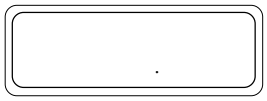
Review of Keystrokes in a Menu

SCAN DOWN	Displays the next option.
SCAN UP	Displays the previous option.
ENTER	"Selects" the displayed option so that you can look at its default (previously programmed) value, modify it, or see its submenu, if there is one.
STOP/NEXT	Aborts the selection process without changing the current setting and backs out of the menu. Hold down to back all the way out of a deep menu to the status display.

All keys repeat automatically when pressed longer than a second.

The Status Display

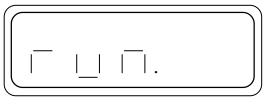
You have already seen the status display several times. It is presented whenever the HERMIT is awake and ready to accept a keypress. The status display shown here indicates that:



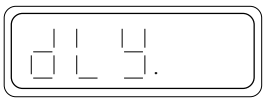
- The instrument is in idle mode. No test is running or programmed to start.
- The HERMIT is operating on its internal battery pack and the battery pack is in good condition.
- The instrument is ready for you to press a key.

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

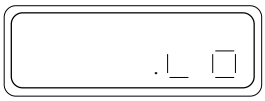
The left side of the status display is used to show the instrument's current operating mode. This display shows run mode: a test is running and the HERMIT is recording data.



This display shows delay mode: a test has been programmed, and the HERMIT is waiting for a delayed start.



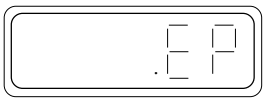
If the internal battery pack begins to run low, the low battery indicator will be displayed on the right side of the LCD. This status display indicates a low battery in idle mode.



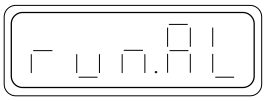
CAUTION

When the low battery indicator appears on the status display, the internal battery pack has no more than one month capacity remaining, even less depending on instrument usage. If you are caught with a low battery 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 external power indicator is displayed when the instrument is operating on external power.



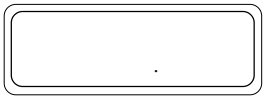
If the alarm is programmed "on," the alarm indicator will appear on the right side of the display during a test.



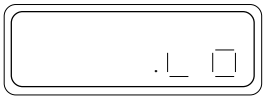
The following combinations of the test status indicators (left side) and power/alarm status indicators (right side) are possible.

Regardless of the specific combination of status indicators, the HERMIT is ready for a keypress.

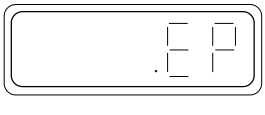
Idle mode, battery OK



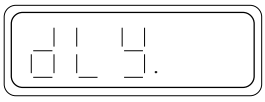
Idle mode, battery low



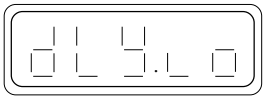
Idle mode, external power in use



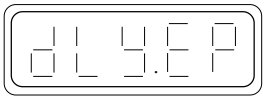
Delay mode, battery OK



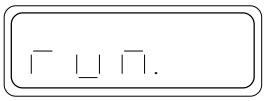
Delay mode, battery low



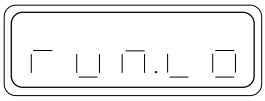
Delay mode, external power in use



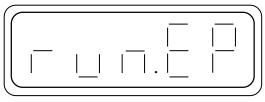
Run mode, battery OK



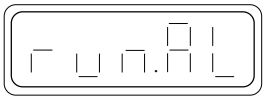
Run mode, battery low



Run mode, external power in use



Run mode, alarm activated



Note: The displays shown throughout the manual are presented as though the HERMIT were operating on its internal battery pack; however, you may wish to use external power (see Appendix B) while you are learning to use the instrument.

Using Your HERMIT

Let's try a simple data collection problem to get the feel of your HERMIT. For the example illustrated here, it will not be necessary to connect a transducer to the instrument. If the HERMIT 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.

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

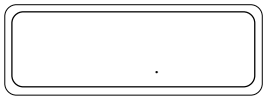
Defining the Test

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

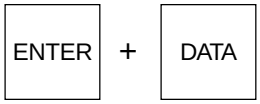
1. what test number we will be performing,
2. at what rate to sample the input channels,
3. how many input channels we will be using,
4. what type of transducer will be connected to each input channel.

The HERMIT 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.

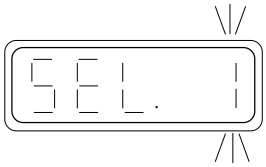
Press and release any key on the keyboard to wake the instrument and get a status display.



Press the ENTER key and hold it down while you press the DATA key.

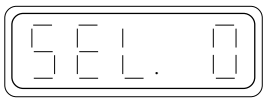


The HERMIT responds by asking you to select a test number.

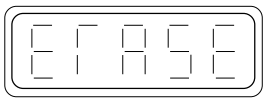


The default test number shown in the display is the next safe test number: the next available test number that can be run while still retaining data recorded in lower numbered tests. The default number is also the highest test number you can select since tests are recorded consecutively. You may select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

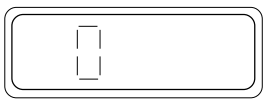
Use the SCAN keys to select test 0 and press ENTER.



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

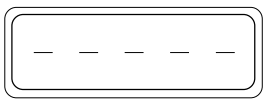


The display will toggle between 'ERASE' and a list of the test numbers that will be erased. Press ENTER to confirm the erasure.

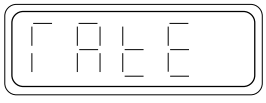


Note: If you do not wish to have data erased, press the STOP/NEXT key to cancel and then use the default test number shown in the display.

A line of dashes may appear briefly as the HERMIT erases old tests and configures its memory for the new test.



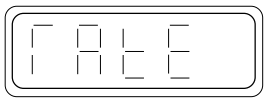
The display then shows 'RATE,' the top option in the ENTER DATA menu.



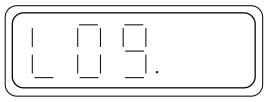
Programming the Sample Rate

Let's set up this test to use the linear sample mode, which will collect data points at evenly spaced time intervals. Since we want to see things happen fast, let's take a data point every minute.

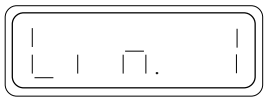
While 'RATE' is on the display, press ENTER to select the sample rate option.



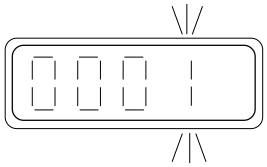
The current sample mode selection is displayed first.



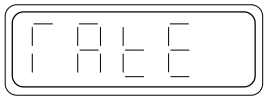
Use the SCAN keys to display 'LIN.1' (linear mode 1), to collect data points spaced evenly over time. Press ENTER to select this option.



Next we are prompted to enter the sample rate in minutes. Press SCAN UP to increase the numeric value of the blinking digit. Press SCAN DOWN to decrease the value. Then press NEXT to blink the next digit. Use these keys to set a one-minute sample rate, as shown here. When you are finished, press ENTER.



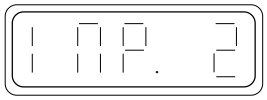
The display will return to 'RATE' in the ENTER DATA menu.



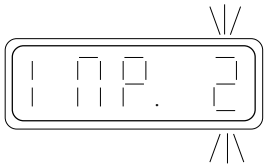
Selecting the Number of Inputs

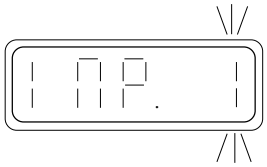
Next, we need to program the number of input channels that will be used during the test. For our example we will be using one input.

If the display is still showing 'RATE,' press SCAN DOWN to display 'INP.' (number of active inputs). If the HERMIT has dozed off, repeat this section from page 7 to wake the instrument and re-access the ENTER DATA menu. Then SCAN DOWN to 'INP.' and press ENTER.

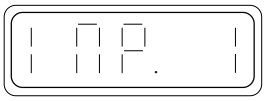


The current number of active inputs will start to blink, either a 1 or a 2. If 1 is flashing, press ENTER. If 2 is flashing, SCAN DOWN to 1, then press ENTER.





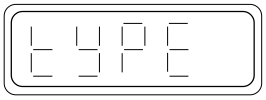
The number of inputs will stop flashing, confirming our new selection.



Defining Input Data Types

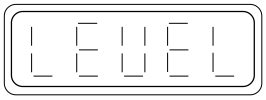
The last step in defining our test is to select the type of data to be collected on each input channel. Selection of the data type will determine both the measurement technique used to sample the transducer connected to that input and the equations used to convert the measurement results to appropriate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

If the display is still showing 'INP.,' press SCAN DOWN to display 'TYPE' (the input type option). If the display has gone blank, repeat this section from page 7 to wake the instrument and re-access the ENTER DATA menu. Then SCAN DOWN to 'TYPE' and press ENTER.

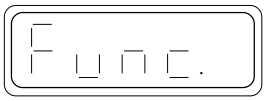


The input type is independently programmable for each input channel. Since we specified only one input in the last step, the HERMIT doesn't need to ask which input we want to define; it displays the input type menu for the single input.

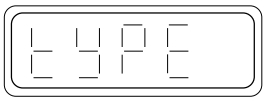
There are three data types available to choose from; the display shows the currently selected type.



Use the SCAN keys to display 'FUNC.' (function type). Press ENTER to select the function type.

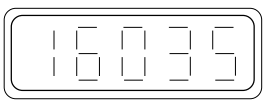


The display will return to 'TYPE' in the ENTER DATA menu.

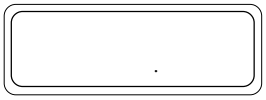


The function data type allows you to collect data from any 4-20 mA transducer and convert the results to the desired units using a simple linear or quadratic equation. The other data types provide more complex data reduction features and will be discussed in later sections.

Press STOP/NEXT to exit the menu. The display shows the number of data points that can be taken with the present setup . . .



. . . and returns to the status display.

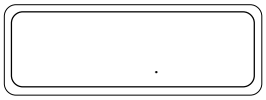


From this point on, all other functions and menu displays will automatically be tailored to match your test setup. For this reason it is important to configure the test through the ENTER DATA menu before attempting to alter other programmable settings.

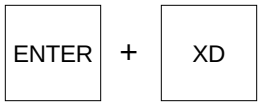
Setting Up the Inputs

Now that we have entered the basic test parameters, we need to program the values that will determine how the 4-20 mA output of the transducer will be converted to meaningful units.

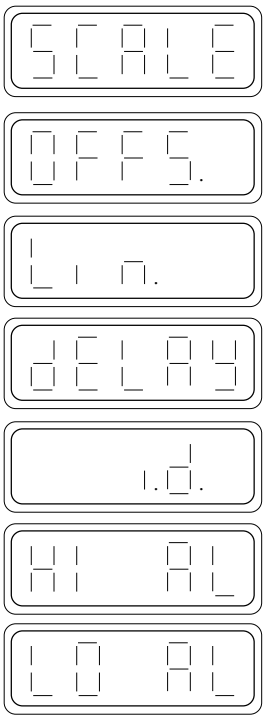
If the HERMIT has dozed off, press any key to wake it up again.



Press the ENTER key and hold it down while you press the XD key.



Top of Menu

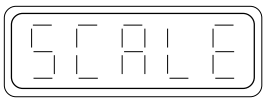


Bottom of Menu

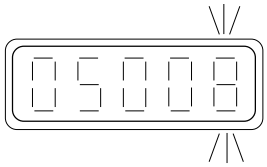
The top selection of the transducer menu for input 1 is displayed. The transducer menu will vary according to the input type specified in the ENTER DATA menu. Since we programmed input 1 as a function type, the display will show 'SCALE,' the top selection of the function menu. If you would like to see all the options in this menu now, you can do so by pressing **SCAN DOWN** repeatedly.

The scale factor ('SCALE'), offset ('OFFS.'), and linearity ('Lin.') 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 parameters are found on 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.

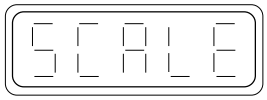
Press SCAN, if necessary, to move the display back to ''SCALE' and press ENTER.



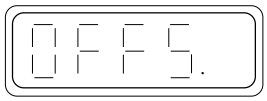
Use the SCAN and NEXT keys to set the scale factor. It may be necessary to round the value to fit the instrument's display. Press ENTER to set the value.



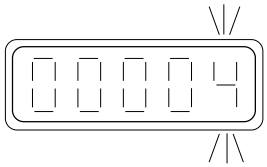
The display will return to 'SCALE.'



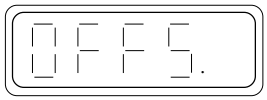
Press SCAN DOWN to display the 'OFFS.' (offset) option and press ENTER.



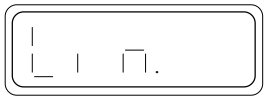
Use the SCAN and NEXT keys to enter the transducer offset. Press ENTER to set the value.



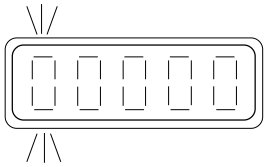
The display will return to the offset option.



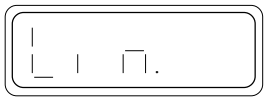
SCAN DOWN to display the 'LIN.' (linearity) option and press ENTER.



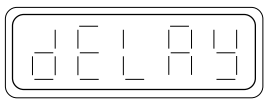
If a parameter is not specified, make certain it is programmed to zero. Use the SCAN and NEXT keys to set zero and press ENTER.



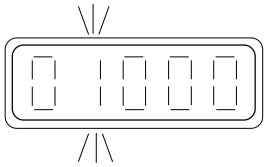
The display returns to the 'LIN.' menu option.



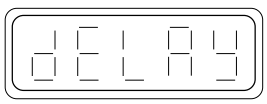
Press SCAN DOWN to display the 'DELAY' (transducer warmup delay) option and press ENTER.



Use the SCAN and NEXT keys to set a warmup delay of 1000 mSEC (milliseconds) and press ENTER. The HERMIT will power the transducer for one second before taking a reading.



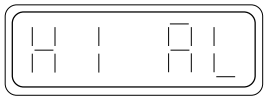
The display returns to 'DELAY.'



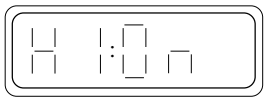
Note: The warmup delay is rarely specified on third-party transducers and must often be determined by experiment. In-Situ's standard transducers use a warmup delay of 50 mSEC unless specified otherwise. A one-second delay is used here only for the purpose of example.

You could program a unique identification number for this channel using the 'I.D.' menu option, but let's skip this option for now. The high and low alarm options will be explained in detail in a later section. For the time being, let's make sure that both the high alarm and the low alarm are turned off.

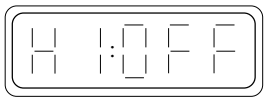
Press SCAN DOWN to display 'HI AL' (the high alarm option) and press ENTER.



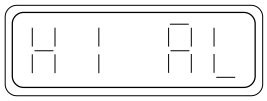
The current on/off status of the high alarm is displayed. Use SCAN UP to turn the alarm on and SCAN DOWN to turn it off.



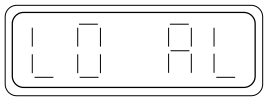
Press ENTER when the display shows 'OFF.'



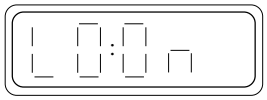
The display will return to 'HI AL.'



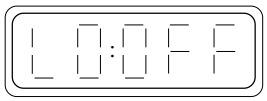
SCAN DOWN to 'LO AL' (the low alarm option) and press ENTER.



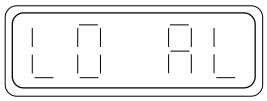
The current on/off status of the low alarm is displayed. Use SCAN UP to turn the alarm on and SCAN DOWN to turn it off.



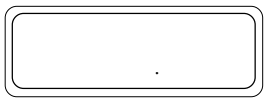
Press ENTER when the display shows 'OFF.'



The display will return to 'LO AL.'



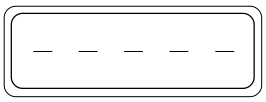
Press STOP/NEXT to exit the menu and return to the status display.



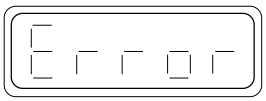
Reading the Transducer

Now let's take a quick reading on this channel. Press the XD key.

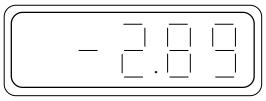
The HERMIT will power the transducer and wait for the programmed warmup delay period . . .



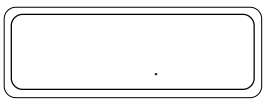
. . . then take a reading, and turn the transducer off. We are warned that no transducer has been connected to the input . . .



. . . then presented with a default transducer reading. If a transducer had been connected, a correct pressure reading would have been displayed. For this example, we will leave the transducer disconnected.

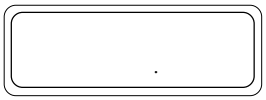


Press STOP/NEXT to return to the status display. Now we're ready to start collecting some data.



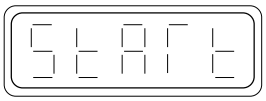
Starting the Test

At the status display . . .

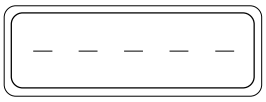


. . . press the START key.

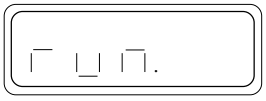
The display will show 'START,' the top option of the HERMIT's start menu. Press ENTER to select this option (immediate start).



Dashes are displayed briefly to indicate that a data point is being recorded.

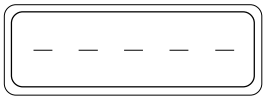


We are then returned to the status display. Notice that an indicator has been added to show that a test is running.



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

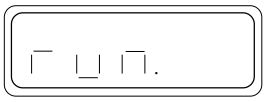
As you continue with the example, you will be interrupted occasionally as the instrument takes another data point.



Viewing Recorded Data

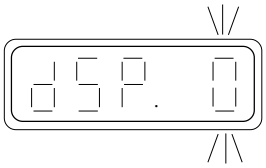
Recorded data can be viewed while the test is running or after the test is stopped.

At the status display . . .

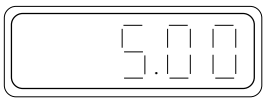


. . . press the DATA key.

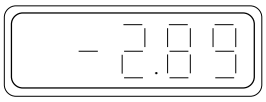
The display will show 'DSP' and prompt you to enter the number of the test you want to view (you can also view tests other than the one that is running). The default selection is the currently running test. Press ENTER to view our sample test.



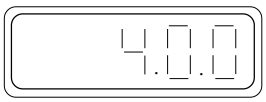
The display shows the elapsed time in minutes of the last data point recorded . . .

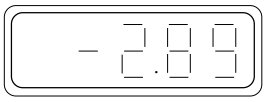


. . . and then the recorded transducer value in PSI.



Press SCAN DOWN. The display will show the time of the previous data point, then the data point value. You can hold down this key to move backward through the data file, although we haven't recorded much data for this test.

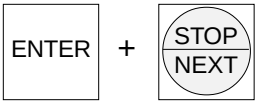




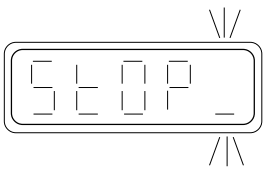
Press STOP/NEXT twice to exit the view data mode and return to the status display.

Stopping the Test

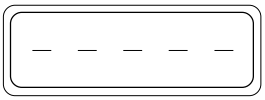
To stop data recording, press the ENTER key and hold it down while you press STOP/NEXT.



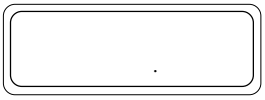
STOP does not act immediately. Confirm the stop command by pressing ENTER. This will stop the test.



The HERMIT will take a moment to organize the data storage . . .



. . . then will return you to the status display. Note that the 'run' indicator is no longer displayed.



Battery Life Tip

Don't waste battery power and memory endurance by leaving the HERMIT 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 ENTER XD menu. 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 in the ENTER DATA menu, 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.

Reminder

Always begin the setup of a new test by first selecting a test number in the ENTER DATA menu. 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.

Review

As you may have begun to realize, the HERMIT 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.

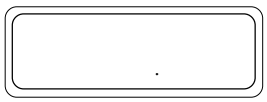
3 Time of Day Clock

The HERMIT 1000C 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.

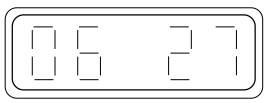
Displaying the Clock

Begin at the status display. The clock can be displayed in any mode (idle, run, or delay).

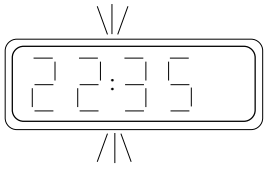


Press the CLOCK key.

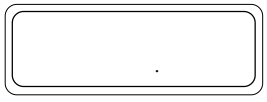
The HERMIT will display the month and day for a few seconds . . .



. . . then the hours and minutes with the colon blinking . . .



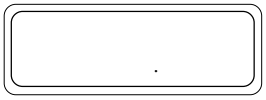
. . . and return to the status display.



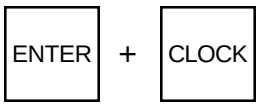
Setting the Clock

The time of day clock can only be set when the HERMIT is in idle mode. The clock cannot be set if the instrument is running a test or waiting for a delayed start.

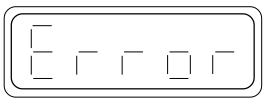
Begin at the status display.



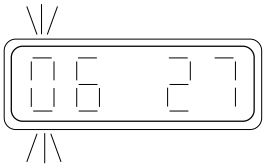
Press the ENTER key and hold it down while you press the CLOCK key.



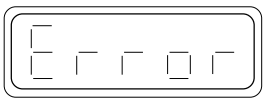
If the HERMIT is not in idle mode, 'Error' will be displayed for a few seconds and you will be returned to the status display. Wait until the test is over before trying to set the clock.



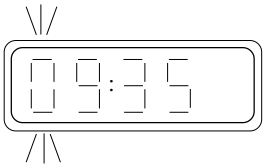
The HERMIT first prompts for the date. Use the SCAN and NEXT keys to set the correct month and day, then press ENTER.



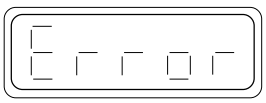
The month must be in the range 1-12, the day in the range 1-31 depending on the month. If you enter an invalid date, the 'Error' message will flash and you will be reprompted for a correct entry.



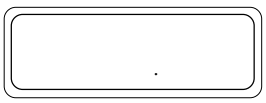
You are prompted for the time of day next. Use the SCAN and NEXT keys to set the correct hour and minute, then press ENTER to set the time and start the clock.



The hours must be in the range 0-23, the minutes in the range 0-59. If you enter an invalid time, the 'Error' message will flash and you will be reprompted for a correct entry.



Then the HERMIT returns to the status display.



To synchronize the HERMIT's time of day clock with an external clock, set the time one minute ahead of the external clock and press ENTER when the clocks match. The HERMIT sets the seconds of its clock to zero when you press ENTER.

4 Setting Up a Test: The ENTER DATA Menu

In Section 2, the ENTER DATA menu was used to program the four basic parameters of a test:

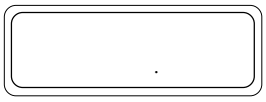
1. Selection of the test number
2. The sample rate
3. The number of input channels to use
4. The type of data to be collected on each input channel

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

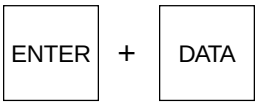
Note: You cannot set up a new test if a test is running or if the HERMIT is waiting for a delayed start.

Selecting the Test Number

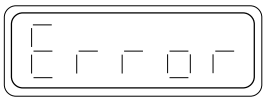
Begin at the status display. If the instrument is asleep, press and release any key to wake it.



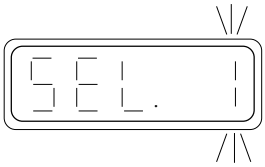
Hold down the ENTER key and, while holding it down, press the DATA key.



If the HERMIT is not in the idle mode, the 'Error' message will be displayed. Wait until the currently programmed test is finished before trying to set up another test.

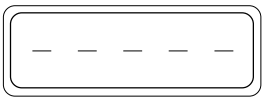


The HERMIT responds by asking you to select a test number.

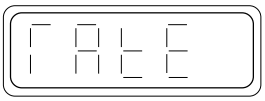


You can record as many as twenty tests, numbered consecutively from 0 to 19, each with its unique setup and data. The default test number shown on the display is the next available test number; selecting it will ensure that test data already recorded in the instrument will not be overwritten. Test numbers 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 HERMIT takes a few seconds to copy the previous test setup to the new test . . .

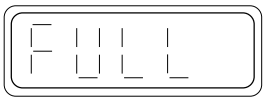


. . . and then presents the top option of the ENTER DATA menu.



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.

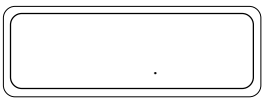
This message is displayed if there is insufficient memory remaining to set up a new test



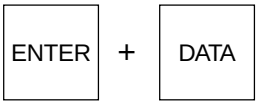
Erasing Old Tests

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.

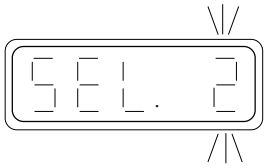
Begin at the status display.



Hold down the ENTER key and, while holding it down, press the DATA key.

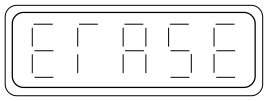


When you are prompted to select a test number, SCAN to the lowest test number you wish to erase, and press ENTER.

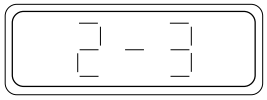


The test number you select, and all higher test numbers, will be erased. Selecting test 0 will cause all test data to be erased.

The HERMIT will warn you that your selection will cause previously recorded tests to be erased by repeating the 'ERASE' warning . . .

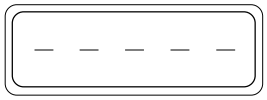


. . . followed by a list of the test numbers that will be erased.

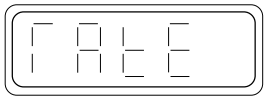


Note: If you do not wish to have data erased, press STOP/NEXT and use the default test number.

Press ENTER to confirm erasure. The indicated test(s) will be erased and the previous test setup copied to the new test . . .



. . . the display then shows the top option in the ENTER DATA menu.



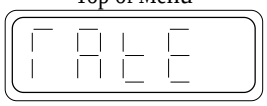
The ENTER DATA Menu

The ENTER DATA menu consists of three options, as shown below. Use the SCAN keys to move the display between options. Use the ENTER key to select an option. Each option is explained in detail in the following pages.

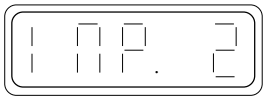
ENTER DATA Menu

Top of Menu

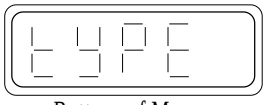
The sample rate



The number of input channels to use



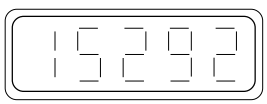
The type of data to be collected on each input channel



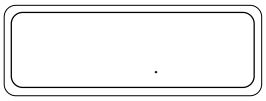
Bottom of Menu

Use the STOP/NEXT key when you are ready to exit the menu.

The display will show the number of data points that can be collected with the current setup . . .



. . . and then return to the status display.

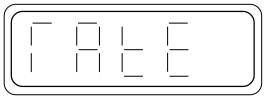


Sample Rate Options

The sample rate setting determines how often the HERMIT will record input channel readings. Both input channels share the common sample rate setting. There are two parts to the sample rate:

1 The sample mode is set first. It can be
   - Linear 1: data points spaced evenly over time, measured in minutes,
   - Linear 2: data points spaced evenly over time, measured in seconds, or
   - Logarithmic.
2 The sample rate (interval between readings) is prompted next. It can range from 2 seconds to 1440 minutes (24 hours), depending on the sample mode.

To program the sample rate, press ENTER to select the 'RATE' option in the ENTER DATA menu.

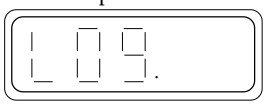


The following menu will be displayed. The currently selected sample mode is shown first. The SCAN UP key moves toward the top of the menu, the SCAN DOWN key toward the bottom. STOP/NEXT will exit this menu and return to the ENTER DATA menu without changing the current sample mode or rate setting. Press ENTER to select the desired sample mode.

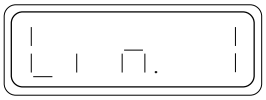
Sample Mode Menu

Top of Menu

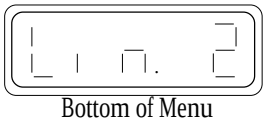
Logathrimic sampling



Linear mode 1 (minutes)



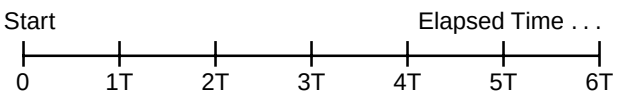
Linear mode 2 (seconds)



Bottom of Menu

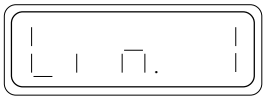
Linear Sampling (Modes 1 & 2)

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

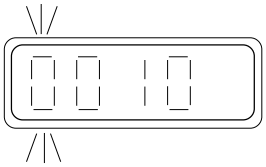


Linear mode 1 allows the sample rate to be programmed from 1 to 1440 minutes. This mode is useful for collecting long-term data and for recording background data prior to running pump or slug tests.

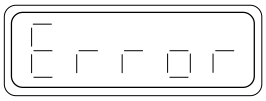
When you select the 'LIN.1' option from the sample mode menu . . .



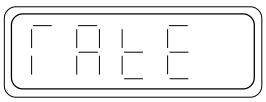
. . . you will be prompted to enter a sample rate in minutes. Use the SCAN and NEXT keys to set the sample rate and press ENTER.



The sample rate must be in the range 1-1440 minutes. If you enter an illegal value, you will get the 'Error' message and then be reprompted for a correct entry.

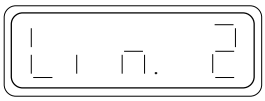


The display returns to 'RATE' in the ENTER DATA menu.

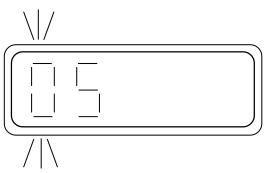


Linear mode 2 allows faster sampling. The sample rate may be set from 2 to 59 seconds. Use this mode for collecting fast, continuous data.

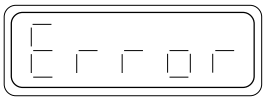
When you select the 'LIN.2' option from the sample mode menu . . .



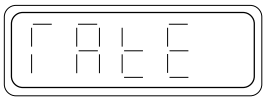
. . . you will be prompted to enter a sample rate in seconds. Use the SCAN and NEXT keys to set the sample rate and press ENTER.



The sample rate must be in the range 2-59 seconds. If you enter an illegal value, you will get the 'Error' message and then be reprompted for a correct entry.



The display returns to 'RATE' in the ENTER DATA menu.



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

Transducer Delay: The sample interval must be longer than the transducer delays. These include the warmup delay, prompted in the ENTER XD menus (Section 5), and the time required to read a dual-mode probe (5 seconds), plus one second for the HERMIT to perform internal calculations. You will not be allowed to exit the ENTER DATA menu if the sum of the delays exceeds the sample rate.

Keyboard Operation During the Test: Because of the rapidity of data collection in this sample mode, the HERMIT can't do anything else while the test is running. Only the STOP function is active (see Section 7).

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.

Logarithmic Sampling

Log sampling optimizes data collection speed and memory usage for pump and slug tests. These 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.

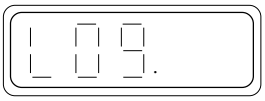
The HERMIT's log sampling mode solves these problems by using the sampling schedule outlined below.

Standard Log Schedule

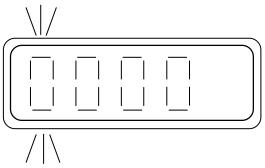
Log Cycle	Elapsed Time	Sample Interval	Points/Cycle
1	0-20 seconds	0.2 second	101
2	20-60 seconds	1 second	40
3	1-10 minutes	12 seconds	45
4	10-100 minutes	2 minutes	45
5	100-1000 minutes	20 minutes	45
6	1000-10000 minutes	200 minutes	45
7	> 10000 minutes	1440 minutes	—

As you can see, the sample intervals begin closely spaced and are automatically made longer with each log cycle.

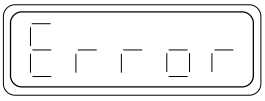
When you select the 'LOG' option from the sample mode menu . . .



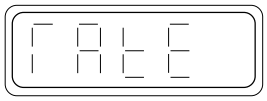
. . . you will be prompted to enter a maximum sample interval in minutes. Use the SCAN and NEXT keys to set the interval and press ENTER. To use the standard log schedule shown above, enter a value of 0 or 1440.



The maximum sample interval must be in the range 0-1440 minutes. If you enter an illegal value, you will see the 'Error' message and then be reprompted for a correct entry.



The display returns to 'RATE' in the ENTER DATA menu.



You can tailor the standard log schedule to suit your test requirements by entering an appropriate maximum sample interval. The HERMIT will collect data according to the standard log schedule until it reaches a log cycle with a sample interval greater than the programmed maximum interval. Sampling then switches over to the maximum interval for the remainder of the test. For example, if you select the log sample mode and enter a maximum sample interval of 5 minutes, the instrument would record data using the following modified log schedule:

Log Cycle	Elapsed Time	Sample Interval
1	0-20 seconds	0.2 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 maximum sample interval you can enter is one minute, the instrument will always use the standard schedule through log cycle 3.

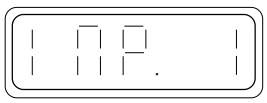
The following points should be considered when setting up a test in the log sample mode:

Transducer Warmup Delay: During the first minute of the log mode (log cycles 1 and 2), the HERMIT uses a transducer warmup delay of 50 mSEC for all active inputs, regardless of the warmup delays programmed. After cycle 2, the programmed warmup delays are used. Make certain that the transducers you choose are compatible with the fast data requirements of the log sample mode.

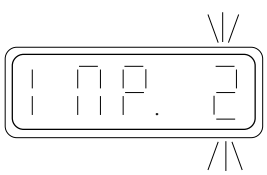
Dual-Mode Transducers: Due to the time required to read a dual-mode transducer, all dual-mode data recorded during the first minute of log mode will be meaningless and should be ignored. The data recorded during this period will vary depending on the setting of the transducer's coefficients, but the start of good data should be readily apparent when looking at the data.

The Number of Inputs

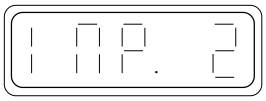
To program the number of active inputs, press ENTER to select the 'INP.' option in the ENTER DATA menu.



You will be prompted to enter the number of active inputs for the test. Use SCAN DOWN to select 1 active input, SCAN UP to select 2 active inputs. Press ENTER to set the new number.



The display returns to 'INP.' in the ENTER DATA menu with the new input number set.



Input channels are always used sequentially. If you program one input for a test, it must be connected to channel one.

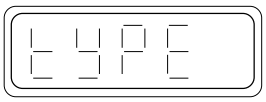
Selecting two active inputs will reduce the number of sample points available for a test by at least half, will increase the average power consumption of the unit during data collection, and will increase the complexity of instrument setup.

Battery Life Tip

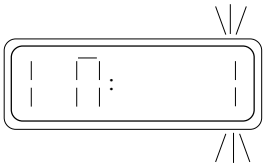
Do not program the number of inputs to be greater than the number that will actually be used. Recording data from an unused input channel wastes battery power and data storage space.

Input Data Types

To review or change input types, press ENTER to select the 'TYPE' option in the ENTER DATA menu.



If two inputs are active, the HERMIT will prompt for the input you wish to set first. Press ENTER to select the input and display the type menu. This prompt is skipped if only one input is active.

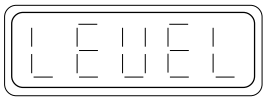


The following menu will be displayed. The currently selected input type is shown first. The SCAN UP key moves toward the top of the menu, the SCAN DOWN key toward the bottom. STOP/NEXT will exit this menu without changing the current input type setting. Press ENTER to select the desired input type.

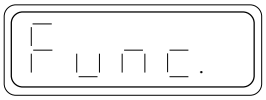
Input Type Menu

Top of Menu

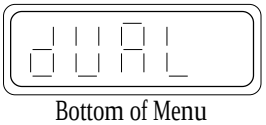
Level type



Function type

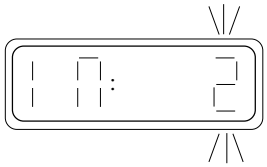


Dual type



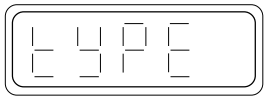
Bottom of Menu

If two inputs are active, the other input number is displayed with a blinking digit after the type for the first input is set. Press ENTER to display the type selection and menu for this input. Select the type for the second input as above, and press ENTER.



Note: If you are using one level or function type and one dual type, for best results the dual type should be connected to input channel 2.

When you have set the data type for all active input channels, press STOP/NEXT. The display will return to 'TYPE' in the ENTER DATA menu.



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.

The following is a brief description of each of the input types and their basic uses. The parameters used with each input type are programmed via the ENTER XD menus and are discussed in detail in Section 5.

Level Type

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.

Function Type

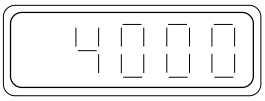
The function type input uses a flexible quadratic equation to convert the output of any conventional 4-20 mA transducer to its basic measurement units. Use this type to obtain direct readings of pressure from a pressure transducer, temperature from a temperature transducer, flow from a flow transducer, 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).

Dual Type

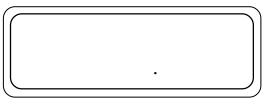
The dual type selection is used with dual-parameter transducers such as In-Situ's conductivity/temperature and pH/temperature transducers. This type of transducer permits the recording of two parameters with a single input channel.

Exiting the ENTER DATA Menu

Exit the ENTER DATA menu by pressing STOP/ NEXT at any of the three main menu options. The amount of free storage will be displayed . . .

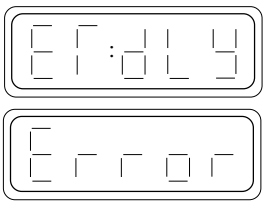


. . . and then the status display will return to the screen.



The HERMIT checks for illegal test parameters before you can exit.

This message means that the programmed delays exceed the programmed sample rate. You need to select a longer sample rate or shorten the transducer delays (if possible, consistent with the requirements of the transducers being used).



The interval between transducer readings must be longer than the sum of the transducer delays. The delays include:

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

(2) 5 seconds for each dual type programmed, plus

(3) 4 seconds for instrument wake-up (log mode and LIN1 only — the HERMIT doesn't go to sleep in LIN2 mode), plus

(4) 1 second for internal calculations.

For example,

1 XD with 50 mSEC delay	=	0.05 second
1 dual probe	=	5 seconds
Internal calculation	=	1 second
Total delays	=	6.05 seconds.

You would not be allowed to exit the ENTER DATA menu with a sample rate less than 7 seconds in the LIN2 sample mode.

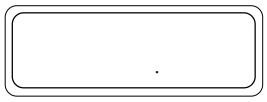
Hint: If you change transducers and then try to set up a new test with a fast LIN2 sample rate (say, 2 seconds), it is possible that the test setup copied from the previous test will include transducer delays that exceed the new fast sample rate. In this case, you will have to "trick" the HERMIT into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

5 *Setting Up Transducers: The ENTER XD Menus*

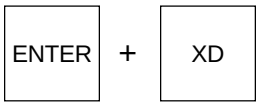
After setting up the basic test parameters using the ENTER DATA menu, you need to identify the transducers that will be connected to each input channel. Once identified, the HERMIT will have enough information to convert the output of each transducer to the appropriate measurement units.

Note: Do not begin setting up transducer parameters until you have selected a test number and programmed the basic test parameters using the ENTER DATA menu. Otherwise you will be editing transducer parameters from the previous test, causing a change in your test data.

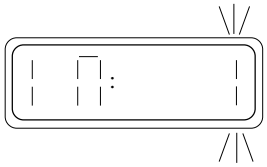
Begin at the status display. Transducer parameters for the current test can be programmed or modified in any mode (idle, run, or delay).



Hold down the ENTER key and, while holding it down, press the XD key.



If two inputs are active for this test, the HERMIT will prompt for the input you wish to program first. Press ENTER to select the input channel and display the transducer menu for that channel. This prompt is skipped if only one input is active.



The display proceeds to the appropriate transducer menu, as determined by the type of input (Level, Function, or Dual) specified for that channel when you set up the test. Discussion of the Level type menu begins on this page, the Function type on p. 21, and the Dual type on p. 22.

If two inputs are active, they may be programmed in any order. When you have entered all the parameters for one input, the display will automatically proceed to the other input. When both inputs have been programmed, press STOP/NEXT until the status display returns to the screen.

The final step is to connect the transducer(s) and take a reading on each active channel (see p. 23).

Advanced Numeric Entry

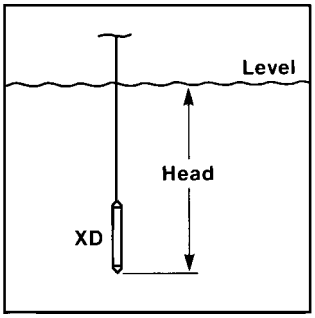
Up to this point numeric entry has been limited to positive numbers less than 1000. This is sufficient for most applications, but the HERMIT is capable of more flexible input. During the entry of a number, all of the keys can actually be used as follows:

CLOCK	Clear number to 000.00
XD	Clear number to 0000.0
DATA	Clear number to 00000
SCAN	Change the blinking digit.
NEXT	Move the blinking digit.
START	Change the sign of the number after the number is input. Note that the negative sign occupies one digit position, causing a loss of significant figures.
ENTER	Enter the number as displayed.

Use these keys to change the decimal point position to accommodate larger or smaller numbers. They also offer an easy way to clear the entry to zero.

Programming Level Types

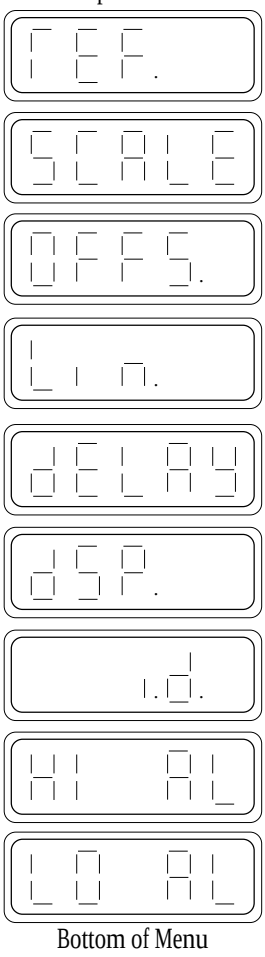
The level type input derives level readings from head values taken with a pressure transducer. There are several programmable parameters that allow you to solve a variety of level measurement problems.



The following menu will be displayed for a level type input. Use the SCAN DOWN key to move toward the bottom of the menu, SCAN UP to move toward the top. STOP/ NEXT will exit the menu for the current input channel without changing any of the programmed settings. Press ENTER to select an option.

The individual options are discussed on the following pages.

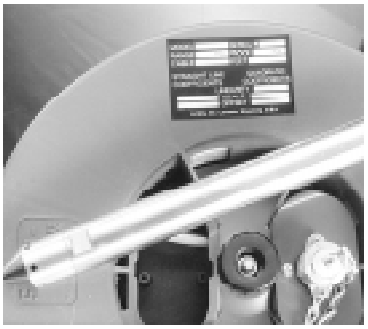
ENTER XD Menu: Level Type



If two inputs are active: When you have entered all the parameters for one input, the display will automatically proceed to the other input. When both inputs have been programmed, press STOP/NEXT until the status display returns to the screen.

Transducer Parameters

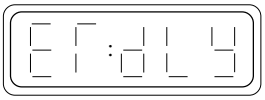
Four of the menu parameters are used to convert the 4-20 mA transducer output to a pressure in PSI units. These parameters may be found on the cable reel, or on a data tag attached to the cable. For the HERMIT 1000C, be sure to use the "Quadratic Coefficients."



- Scale factor — Select 'SCALE' from the menu, input the transducer scale factor, and press ENTER. This value should not be zero for a pressure transducer.
- Offset — Scan down to 'OFFS.,' input the transducer offset, and press ENTER. Set to zero if not specified by the transducer manufacturer.
- Linearity — Scan down to 'LIN.,' input the linearity, and press ENTER. Set to zero if not specified.

Remember that the CLOCK, XD, and DATA keys can be used to change the position of the decimal point. If the coefficient is negative, be sure to include the minus sign (START key). Refer to the box on p. 18. Since the HERMIT can accommodate a maximum of 2 decimal places, you may need to round the values to fit the display.

- Warmup delay — Scan down to 'DELAY,' input the transducer warmup delay in milliseconds (mSEC), and press ENTER. For an In-Situ transducer, set to 50 mSEC unless specified otherwise. You will most likely have to determine this value by experiment for third-party transducers. Reminder: During the first minute of log sampling, the HERMIT uses a warmup delay of 50 mSEC, regardless of the delay programmed. If you've selected the log sample mode, make certain that the transducers you choose 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.) If you see this screen and then the 'Error' message, select a longer sample rate.

The HERMIT calculates the intermediate pressure reading 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

Choosing a Display Mode

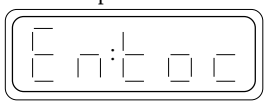
The HERMIT can display readings in English units (feet of water) or Standard International units (meters of water), and readings may be referenced either to the surface or to the top of the well casing.

The following menu will be displayed when you select the display mode option ('DSP.') from the ENTER XD menu. The currently selected display mode is shown first. The SCAN UP key moves toward the top of the menu, the SCAN DOWN key toward the bottom. STOP/NEXT will exit this menu and return to the ENTER XD menu without changing the current display mode setting. Press ENTER to select the desired display mode.

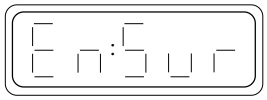
Display Mode Menu

Top of Menu

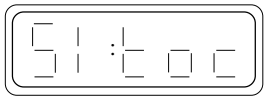
Feet of water, Top of Casing reference



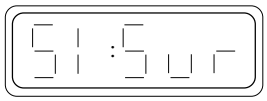
Feet of water, Surface reference



Meters of water, Top of Casing reference

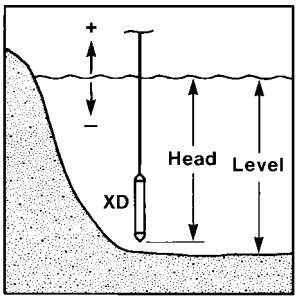


Meters of water, Surface reference

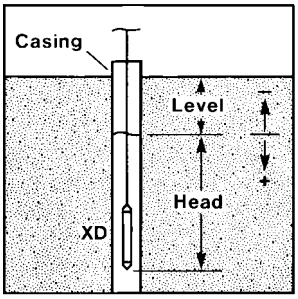


Bottom of Menu

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.



The intermediate transducer pressure is converted to a head value using the following formula:

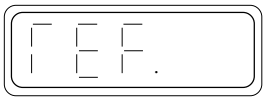
$$H = P \bullet U$$

where H = Head value
P = Pressure in PSI
U = Conversion units: 2.30667 feet of water/PSI or 0.703072 meters of water/PSI

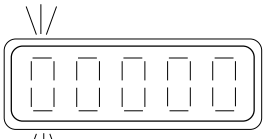
Entering the Reference Level

The transducer must be connected to the instrument and placed at its initial depth before the reference level is entered. Therefore, although it's prompted first, it's a good idea to leave the reference level until last. You can program the other transducer parameters in the office; then when the instrument is in the field and the transducer is in the water, re-access the ENTER XD menu and enter the reference level.

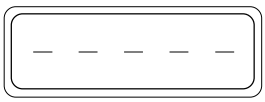
To program the reference level, press ENTER to select the 'REF.' option in the ENTER XD menu.



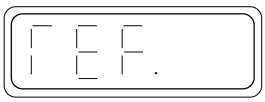
You will be prompted to enter a value for the reference level. Use the SCAN and NEXT keys to enter the reference level and press ENTER.



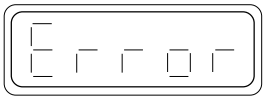
The HERMIT will power up the transducer and take a corresponding reference head reading . . .



. . . then the display returns to 'REF.' in the ENTER XD menu.



The transducer must be connected and set at its initial depth before the reference level is entered; otherwise the 'Error' message will appear.



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 entered, the HERMIT can compute surface levels as:

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

Similarly, top of casing levels are computed as:

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

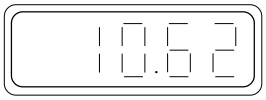
where L(t) = Level at time t
R = Reference level
H(r) = Head at time when reference level was entered
H(t) = Head at time t

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 scale factor, offset, and linearity. 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. Select the display mode (units and TOC or surface level) you require for the test.
4. 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.
5. Connect the transducer to the input channel.
6. Press the XD key to check the transducer operation.

The reading shown on the display is the transducer head.



7. Adjust the transducer until the head reading indicates that the transducer is set at the desired depth.
8. Input the reference level with the transducer set and connected to the instrument.

Programming Function Types

The function mode is used to convert the 4-20 mA current values obtained from a transducer to meaningful measurement units. This mode can be used to obtain direct readings in PSI from pressure transducers or used with other transducers to measure temperature, flow rate, barometric pressure, etc.

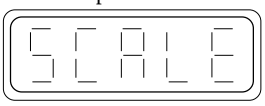
The following menu will be displayed for a function type input. Use the SCAN DOWN key to move toward the bottom of the menu, SCAN UP to move toward the top. STOP/ NEXT will exit the menu for the current input channel without changing any of the programmed settings. Press ENTER to select an option.

The individual options are discussed on the following pages.

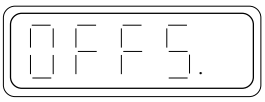
If two inputs are active: When you have entered all the parameters for one input, the display will automatically proceed to the other input. When both inputs have been programmed, press STOP/NEXT until the status display returns to the screen.

ENTER XD Menu: Function Type — Top of Menu

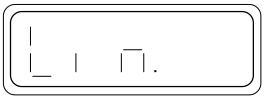
Transducer scale factor



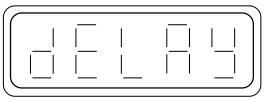
Transducer offset



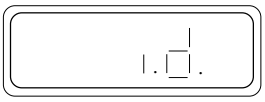
Transducer linearity



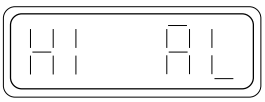
Transducer warmup delay



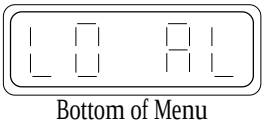
Input channel I.D.
(optional, see p. 23)



High alarm setting
(optional, see Section 6)



Low alarm setting
(optional, see Section 6)



Bottom of Menu

Transducer Parameters

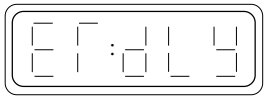
There are four transducer parameters that you must enter for a function type. These parameters may be found on the cable reel, or on a data tag attached to the cable. For the HERMIT 1000C, be sure to use the "Quadratic Coefficients."

- Scale factor — Select 'SCALE' from the menu, input the transducer scale factor, and press ENTER. This value should not be zero for a pressure transducer.
- Offset — Scan down to 'OFFS.,' input the transducer offset, and press ENTER. Set to zero if not specified.
- Linearity — Scan down to 'LIN.,' input the linearity, and press ENTER. Set to zero if not specified.

Remember that the CLOCK, XD, and DATA keys can be used to change the position of the decimal point. If the coefficient is negative, be sure to include the minus sign (START key). Refer to the box on p. 18. Since the HERMIT can accommodate a maximum of 2 decimal places, you may need to round the values to fit the display.

- Warmup delay — Scan down to 'DELAY,' input the transducer warmup delay in milliseconds (mSEC), and press ENTER. 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 minute of log sampling, the HERMIT uses a warmup delay of 50 mSEC, regardless of the delay programmed. If you've selected the log sample mode, make certain that the transducers you choose 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.) If you see this screen and then the 'Error' message, select a longer sample rate.



The HERMIT 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

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

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

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

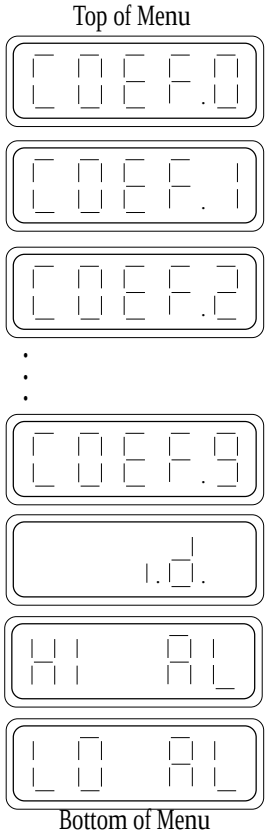
You can have readings in any other units of flow by multiplying all three parameters by the appropriate conversion factor. The warmup delay will have to be determined by experiment if it is not identified by the manufacturer. Use the shortest warmup delay possible that gives consistent and stable readings.

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 following menu will be displayed for a dual type input. Use the SCAN DOWN key to move toward the bottom of the menu, SCAN UP to move toward the top. STOP/NEXT will exit the menu for the current input channel without changing any of the programmed settings. Press ENTER to select an option.

ENTER XD Menu: Dual Type

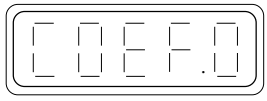


If two inputs are active: When you have entered all the parameters for one input, the display will automatically proceed to the other input. When both inputs have been programmed, press STOP/NEXT until the status display returns to the screen.

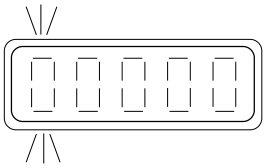
Coefficient Entry

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

To program the ten coefficients, press ENTER to select the 'COEF.0' option from the ENTER XD menu.

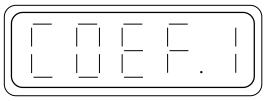


You will be prompted to enter the coefficient 0 value provided with the transducer.



Remember that the CLOCK, XD, and DATA keys can be used during numeric entry if you need to change the position of the decimal point. If the coefficient is negative, be sure to include the minus sign (START key). Refer to the box on p. 18. Since the HERMIT can accommodate a maximum of 2 decimal places, you may need to round the values to fit the instrument's display.

Press ENTER to set the new value. The display will proceed to the next coefficient.



Enter all ten coefficients in this way, pressing ENTER after each entry. When you have entered the last coefficient ('COEF.9'), you can use the SCAN and ENTER keys to review or edit the coefficients individually. Press STOP/NEXT to return to the menu.

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

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

where T = Temperature in degrees Celsius
X = Transducer temperature reading

Coefficients C3 through C7 are used to calculate the primary value (e.g., pH or conductivity)

$$V = [C3 + Y*C4/10 + Y^2*C5/100] * C7/1000 + C6$$

where V = Value
Y = Transducer value

Coefficients C8 and C9 are used to correct the primary value for temperature variations:

$$V_c = \frac{V}{1 + \frac{C8}{1000}(T\text{-}25)} + C9$$

If you wish to display uncompensated primary values, set coefficients C8 and C9 to zero. Refer to the specific dual-mode transducer manual for other coefficient options you may have.

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

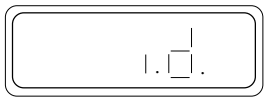
Battery Life Tip

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.

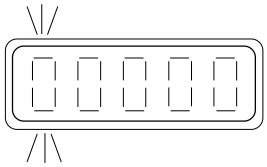
Assigning an I.D.

Each input channel can be assigned a five-digit identification number 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. parameter is optional and may be left at 00000.

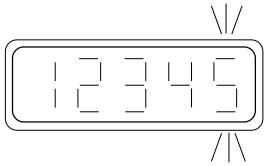
Press ENTER to select the 'I.D.' option from any ENTER XD menu.



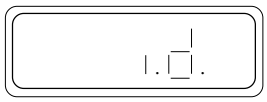
You will be prompted to enter the identification number. The current I.D. is shown on the display.



Use the SCAN and NEXT keys to set the desired I.D. When the number is as you want it, press ENTER.



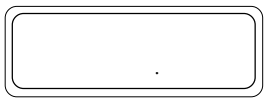
The display will return to the ENTER XD menu.



Reading a Transducer

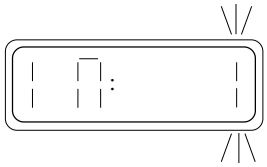
When you have entered all of the parameters in the ENTER XD menu, connect the transducer to its input channel and take a quick reading to verify operation. A transducer will not read correctly until the cable is properly connected and all of the parameters contained in the menu have been programmed.

Starting from the status display . . .

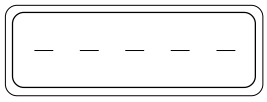


. . . press the XD key.

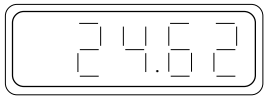
If two inputs are active, an input number is displayed with a blinking digit. SCAN to the desired input number, if necessary, and press ENTER to select the input. This prompt is skipped if only one input is active.



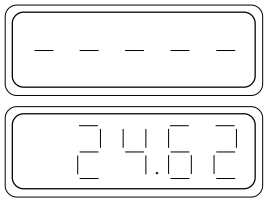
The HERMIT will power the input channel, wait for the programmed warmup delay period . . .



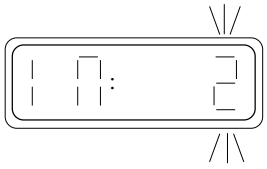
. . . then take a transducer reading and display the result in the programmed units, and turn the transducer off.

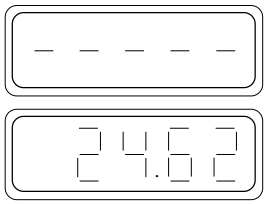


Press XD again to take repeated readings from the same transducer.

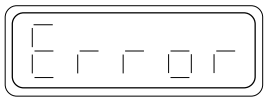


If two inputs are active, pressing STOP/ NEXT will bring up the prompt for the other input. Press ENTER to select the new input and the HERMIT will take a reading as before.

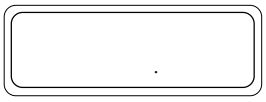




If the HERMIT cannot obtain a valid reading, the 'Error' message will flash briefly, and then a default value will be displayed. Make certain that the transducer is connected to the proper input channel and that all connections are secure.



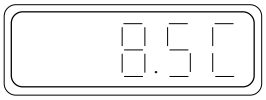
When the inputs have been read, press STOP/ NEXT until the status display returns to the screen.



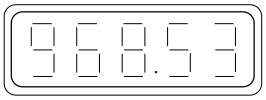
Level Mode: When a level mode transducer is connected and the HERMIT is idle or waiting for a delayed start, the transducer depth (head) is displayed instead of the water level. This allows the operator to properly set the transducer below the largest expected drop in water level.

Dual Mode: A dual mode reading takes about 4 seconds.

The temperature is displayed first, to one decimal place, followed by a 'C' to indicate degrees Celsius . . .



. . . then the primary parameter (e.g., conductivity), to two decimal places.



When the dual-mode data are printed, temperature will be complete to three decimal places. The shortened display is to help differentiate between the two readings.

6: *Setting Up Alarms*

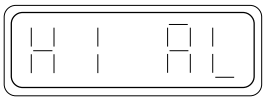
The alarm function allows you to synchronize other field equipment, such as pumps or automatic samplers, with alarms detected by the HERMIT. Refer to Section 14 for wiring details.

Each input on the HERMIT 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. A high alarm on input 1 or a high alarm on input 2 will activate the high alarm contact. Similarly, a low alarm on input 1 or a low alarm on input 2 will activate the low alarm contact.

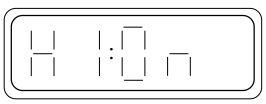
The values programmed for each alarm setting must be in the same units as the measured value. The alarm outputs are only active while the HERMIT is running a test and are updated at each sample interval. If the high or low alarm contact is activated, it will remain activated even if the instrument is asleep. When in the logarithmic sample mode, alarms are not checked during the first two minutes of the test. Only the primary parameter of a dual mode transducer is compared with alarm settings (dual mode temperature does not have alarm settings).

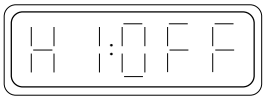
Programming the High Alarm Limit

Select the high alarm option at any ENTER XD menu by pressing ENTER when the display shows 'HI AL.'

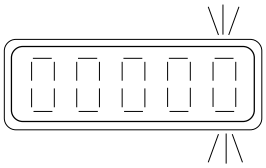


The current on/off status of the high alarm for the active input is displayed. SCAN UP to turn the alarm on, SCAN DOWN to turn it off. STOP/ NEXT will return to the ENTER XD menu without changing the current status. Press ENTER to select the desired on/off setting.



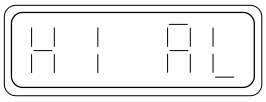


If selected off, the display returns to the ENTER XD menu. If selected on, you are prompted to enter a value to activate the high alarm. Use the SCAN and NEXT keys to enter the value.



Enter the high limit in the same units used for other transducer parameters on this input channel. The high alarm will activate when a data point reading is greater than or equal to the high alarm limit.

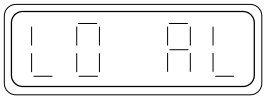
Press ENTER to set the new value. The display returns to the ENTER XD menu. The high alarm will be activated if a data point is greater than or equal to the programmed value.



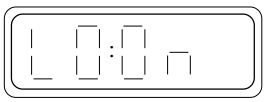
Note: If you have already programmed a low alarm for an input, the HERMIT will require that your high limit be greater than the low limit. The instrument will not accept a high limit entry that is less than or equal to the low limit entry.

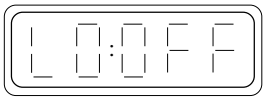
Programming the Low Alarm Limit

Select the low alarm option at any ENTER XD menu by pressing ENTER when the display shows 'LO AL.'

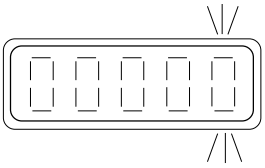


The current on/off status of the low alarm for the active input is displayed. SCAN UP to turn the alarm on, SCAN DOWN to turn it off. STOP/NEXT will return to the ENTER XD menu without changing the current status. Press ENTER to select the desired on/off setting.



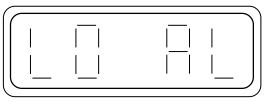


If selected off, the display returns to the ENTER XD menu. If selected on, you are prompted to enter a value to activate the low alarm. Use the SCAN and NEXT keys to enter the value.



Enter the low limit in the same units used for other transducer parameters on this input channel. The low alarm will activate when a data point reading is less than or equal to the low alarm limit.

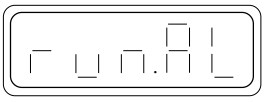
Press ENTER to set the new value. The display returns to the ENTER XD menu. The low alarm will be activated if a data point is less than or equal to the programmed value.



Note: If you have already programmed a high alarm for an input, the HERMIT 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.

Press STOP/NEXT to return to the status display.

When you start the test, the status display will contain an indication that the alarm is programmed on.

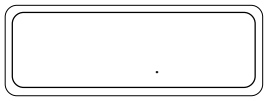


7 Running a Test

When all test and transducer parameters have been programmed as described in Sections 4 and 5, and when the transducers are connected and emplaced, the test may be started. First, 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.

Accessing the Start Menu

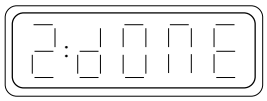


Beginning from the status display . .

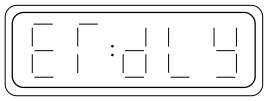
.

. . . press the START key.

Before allowing access to the start menu, the HERMIT checks your test setup for illegal test conditions.



If the currently active test has already been run, you will not be allowed to start. Be sure to select a test number and set up the test in the ENTER DATA menu before trying to start a test.



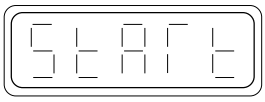
This message means that the programmed delays exceed the programmed sample interval. If dual type inputs are being used with a very fast linear 2 sample rate, or if the sum of the transducer warmup delays exceeds the sample rate, select a longer sample rate.

If the test conditions pass this check, the HERMIT displays the start menu. Press SCAN DOWN to display the delayed start option, SCAN UP to display the immediate start option. Press STOP/NEXT to cancel the start function without collecting data. Press ENTER when the desired start type is on the display.

Start Menu

Top of Menu

Immediate start option

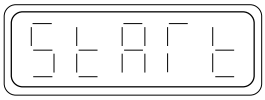


Delayed start option

Bottom of Menu

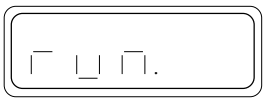
Immediate Start Option

For an immediate start, press ENTER when the display shows 'START.' The HERMIT begins collecting data immediately.

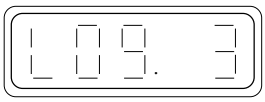


The screen display will vary depending on the sample rate programmed for the test. In addition, the availability of keyboard functions during the test (p. 27) will be different depending on how fast the HERMIT is recording data.

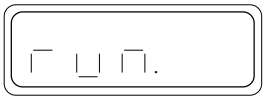
If the Linear 1 sample mode has been selected, the status display returns to the screen with the 'run' indicator added. All keyboard functions are available.



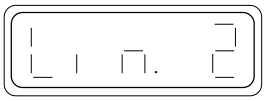
If the Log sample mode has been selected, the unit displays 'LOG' and the number of the log cycle (p. 15) during the first ten minutes. Only the STOP function is active until . . .



. . . the status display returns to the screen. At this point, normal keyboard operation is restored.

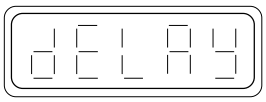


If the Linear 2 sample mode has been selected, the unit displays 'LIN.2' until you stop the test. Because of the rapidity of data collection in this sample mode, the HERMIT can't do anything else while the test is running. Only the STOP function is active.

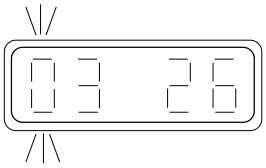


Delayed Start Option

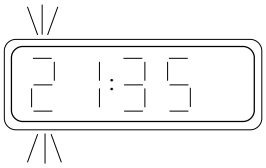
To set up a delayed start, press ENTER when the display shows 'DELAY.'



The HERMIT prompts for the delayed start date first. Use the SCAN and NEXT keys to enter the date you want the test to start, and press ENTER.

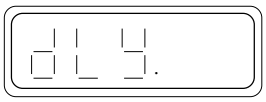


Then you are prompted for the delayed start time. Use the SCAN and NEXT keys to enter the time you want the test to start, and press ENTER.



To avoid an 'Error' message, the delayed start date and time must meet the same criteria as an internal clock setting. See Setting the Clock in Section 3.

The status display returns to the screen. An indicator is added to show that the HERMIT is waiting for a delayed start.



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

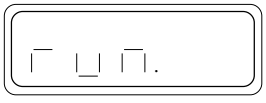
Stepping the Test

The HERMIT 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 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.

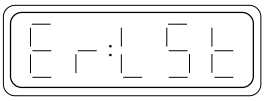
You can have as many as five steps within a test, numbered 0 to 4. When you first start a test, you are actually starting Step 0.

Begin at the status display. A test can be stepped only if it is already running.

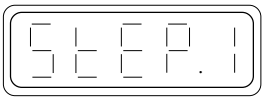


Press the START key.

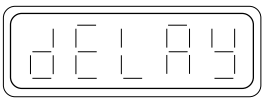
An error message will be displayed if the last step is already running, or if there is insufficient memory to start the next step.



Otherwise the next step number is displayed. To start the step immediately, press ENTER while the display is showing the step number.



To program a delayed start for the step, SCAN DOWN to display the delayed start option and press ENTER.



If you select a delayed start, the HERMIT will prompt you through the set-up procedure for a delayed step start, which is exactly the same as the delayed test start procedure described earlier on this page.

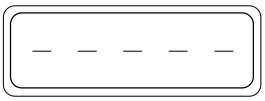
Note: When a delayed start is programmed for a step, data collection for the previous step will stop. The HERMIT does not record data while it is waiting for a delayed start.

While the Test is Running

In most cases, the HERMIT's data functions are available while the test is running. The exceptions are (1) the first 10 minutes 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 using the DATA key.
- You can print data for any test or step by connecting a printer through the RS232 port and turning it on, then pressing the DATA key.
- You can take manual readings on any transducer using the XD key.
- You can modify the transducer and alarm parameters of the test that is running.

You may be interrupted occasionally as the instrument collects and records a data point.

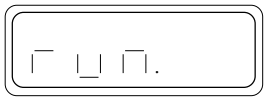


There is no function that you can perform that will cause the HERMIT to miss or delay taking a data point.

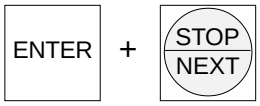
Stopping the Test

Data collection is stopped manually from the keyboard; it is not a programmable function. Data collection stops automatically when the memory is full.

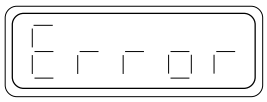
Begin at the status display with the unit in an active data collection mode (either run or delay).



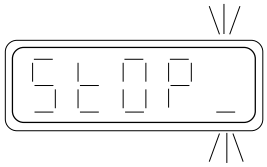
To stop data collection, press the ENTER key and hold it down while you press STOP/NEXT.



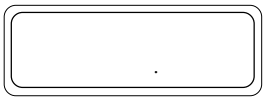
The 'Error' message is displayed if the unit is already stopped and is in the idle mode.



Otherwise the stop prompt is displayed with an underline cursor flashing. Press ENTER to confirm the stop selection, or press STOP/NEXT to cancel the selection.



When the stop function is confirmed, the status display returns to the screen.



Note: When the HERMIT is collecting data very rapidly (Linear 2 sample mode or the first three log cycles), there will be no opportunity to confirm or cancel the STOP selection. Simply hold the ENTER and STOP/NEXT keys until the test stops..

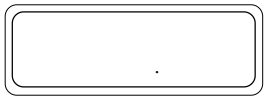
Battery Life Tip

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

8 Viewing Stored Data

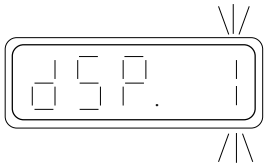
Data from any test may be viewed at any time.

Starting from the status display . . .

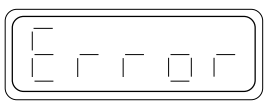


. . . press the DATA key.

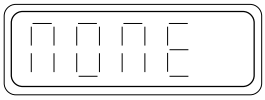
The display will show 'DSP' and the HERMIT will prompt for a test number. The highest test number is the default selection. Select the default by pressing ENTER, or SCAN to your selection and press ENTER.



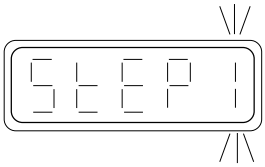
The selected test number must be in the range zero to the default test or you will get an 'Error' message.



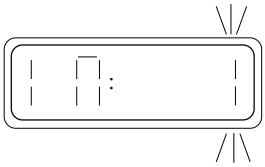
If the selected test has not been run and contains no data, 'NONE' will be displayed. The message will display briefly and you will be reprompted for the test number.



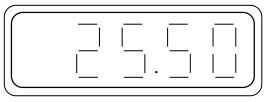
If the test was stepped, you are prompted to select the step you wish to view. The highest step number is displayed as the default. Press ENTER, or SCAN to the desired step and press ENTER. This prompt is skipped if no steps were used.



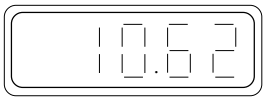
If both input channels were active during the test, the HERMIT will prompt for an input number. To view data for the default input, just press ENTER; or SCAN to the other input and press ENTER. This prompt is skipped if only one input was active.



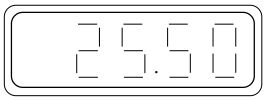
The display will show the elapsed time in minutes of the last data point recorded . . .



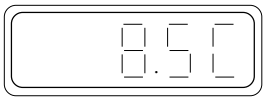
. . . and then the data point value in the specified units.



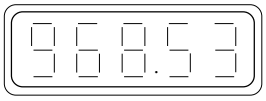
Data for a dual-mode probe will be shown on three screens: elapsed time . . .



. . . then the temperature in degrees Celsius . . .



. . . then the primary value (conductivity, pH, etc.) in the programmed units.



Scanning the Data

The SCAN keys may be used to scan through the recorded data.

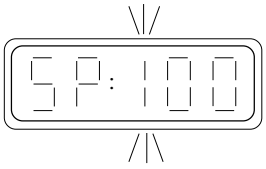
- SCAN UP moves toward the end of the test, in the direction of increasing elapsed time (later data points)
- SCAN DOWN moves toward the beginning of the test, in the direction of decreasing elapsed time (earlier data points)

Press a SCAN key once, the display will show elapsed time, then the data point value. If you hold down a SCAN key, the display will scroll rapidly through the elapsed time; when you release the key, the display will show the data point value for the last displayed time.

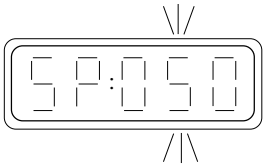
Selecting a View Percentage

To move quickly to a different segment of data without scanning, you can specify the point in the test where you would like to start 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). The default is 100 percent.

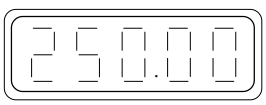
Press ENTER during the data display. The HERMIT will prompt for a "Start Percentage," the percentage into the test where you want to view the data.



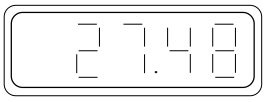
Use the SCAN and NEXT keys to select the view percentage and press ENTER. 50 percent will jump to the middle of the test.



The display will show the elapsed time at the midpoint of the test . . .

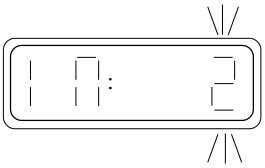


. . . then the data point value.

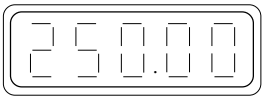


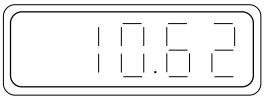
Changing the Input Channel

If two inputs were active during the test, pressing STOP/NEXT during the data display will bring up the prompt for the other input.



Press ENTER to select the new input. The display will remain at the same elapsed time on the new channel.



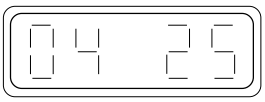


This sequence of STOP/NEXT followed by ENTER can be used to move back and forth between channels. When you change channels, the display stays at the same elapsed time value, allowing you to review the data for both inputs at any given elapsed time.

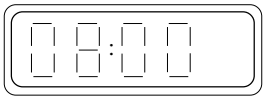
Viewing the Start Time

Press START during the data display.

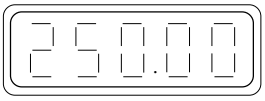
The HERMIT will show the start date of the test or selected step . . .

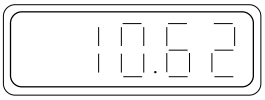


. . . then the start time . . .



. . . then return to the view data display at the point where you displayed the start time.





Log Mode Data

Elapsed time values for the first few seconds of log mode data will appear somewhat ambiguous due to the LCD's inability to show small decimal values. Elapsed time up to one minute cannot be displayed with full resolution, though it will print properly. Use the table on page 30 to convert the displayed terms to their full resolution.

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.

Log Mode Elapsed Time Values

Sample No.	Minutes Display	Minutes Actual	Sample No.	Minutes Display	Minutes Actual	Sample No.	Minutes Display	Minutes Actual
0	0.00	0.0000	49	0.16	0.1633	98	0.32	0.3266
1	0.00	0.0033	50	0.16	0.1666	99	0.33	0.3300
2	0.00	0.0066	51	0.17	0.1700	100	0.33	0.3333
3	0.01	0.0100	52	0.17	0.1733	101	0.35	0.3500
4	0.01	0.0133	53	0.17	0.1766	102	0.36	0.3666
5	0.01	0.0166	54	0.18	0.1800	103	0.38	0.3833
6	0.02	0.0200	55	0.18	0.1833	104	0.40	0.4000
7	0.02	0.0233	56	0.18	0.1866	105	0.41	0.4166
8	0.02	0.0266	57	0.19	0.1900	106	0.43	0.4333
9	0.03	0.0300	58	0.19	0.1933	107	0.45	0.4500
10	0.03	0.0333	59	0.19	0.1966	108	0.46	0.4666
11	0.03	0.0366	60	0.20	0.2000	109	0.48	0.4833
12	0.04	0.0400	61	0.20	0.2033	110	0.50	0.5000
13	0.04	0.0433	62	0.20	0.2066	111	0.51	0.5166
14	0.04	0.0466	63	0.21	0.2100	112	0.53	0.5333
15	0.05	0.0500	64	0.21	0.2133	113	0.55	0.5500
16	0.05	0.0533	65	0.21	0.2166	114	0.56	0.5666
17	0.05	0.0566	66	0.22	0.2200	115	0.58	0.5833
18	0.06	0.0600	67	0.22	0.2233	116	0.60	0.6000
19	0.06	0.0633	68	0.22	0.2266	117	0.61	0.6166
20	0.06	0.0666	69	0.23	0.2300	118	0.63	0.6333
21	0.07	0.0700	70	0.23	0.2333	119	0.65	0.6500
22	0.07	0.0733	71	0.23	0.2366	120	0.66	0.6666
23	0.07	0.0766	72	0.24	0.2400	121	0.68	0.6833
24	0.08	0.0800	73	0.24	0.2433	122	0.70	0.7000
25	0.08	0.0833	74	0.24	0.2466	123	0.71	0.7166
26	0.08	0.0866	75	0.25	0.2500	124	0.73	0.7333
27	0.09	0.0900	76	0.25	0.2533	125	0.75	0.7500
28	0.09	0.0933	77	0.25	0.2566	126	0.76	0.7666
29	0.09	0.0966	78	0.26	0.2600	127	0.78	0.7833
30	0.10	0.1000	79	0.26	0.2633	128	0.80	0.8000
31	0.10	0.1033	80	0.26	0.2666	129	0.81	0.8166
32	0.10	0.1066	81	0.27	0.2700	130	0.83	0.8333
33	0.11	0.1100	82	0.27	0.2733	131	0.85	0.8500
34	0.11	0.1133	83	0.27	0.2766	132	0.86	0.8666
35	0.11	0.1166	84	0.28	0.2800	133	0.88	0.8833
36	0.12	0.1200	85	0.28	0.2833	134	0.90	0.9000
37	0.12	0.1233	86	0.28	0.2866	135	0.91	0.9166
38	0.12	0.1266	87	0.29	0.2900	136	0.93	0.9333
39	0.13	0.1300	88	0.29	0.2933	137	0.95	0.9500
40	0.13	0.1333	89	0.29	0.2966	138	0.96	0.9666
41	0.13	0.1366	90	0.30	0.3000	139	0.98	0.9833
42	0.14	0.1400	91	0.30	0.3033	140	1.00	1.0000
43	0.14	0.1433	92	0.30	0.3066	141	1.20	1.2000
44	0.14	0.1466	93	0.31	0.3100	142	1.40	1.4000
45	0.15	0.1500	94	0.31	0.3133	143	1.60	1.6000
46	0.15	0.1533	95	0.31	0.3166	144	1.80	1.8000
47	0.15	0.1566	96	0.32	0.3200	145	2.00	2.0000
48	0.16	0.1600	97	0.32	0.3233			

Reminder: Due to the time required to read a dual-mode transducer, all dual-mode data recorded during the first minute of log sampling will be meaningless and should be ignored. The data recorded during this period will vary depending on the transducer's coefficients, but the start of good data should be readily apparent when looking at the data.

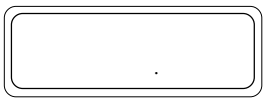
9 Using the RS232 Port

The HERMIT's RS232 port allows you to print 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 parameters 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.

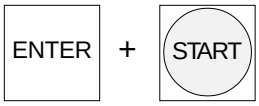
Accessing the System Setup Menu

The RS232 port parameters are accessed through the System Setup menu.

Begin at the status display. The System Setup menu can be displayed in any mode.



Press the ENTER key and hold it down while you press the START key.

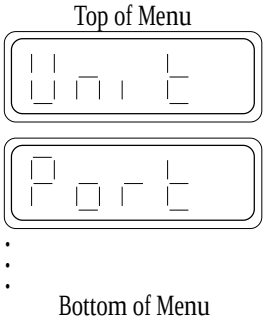


The System Setup menu consists of six options. We are only concerned with the first two options here (the remaining options will be discussed in Section 11). Use the SCAN DOWN key to move toward the bottom of the menu, SCAN UP to move toward the top. To select an option, press ENTER.

System Setup Menu

Unit identification

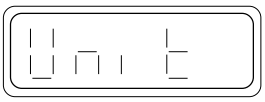
RS232 Port



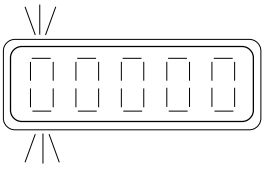
Programming a Unit Identification

The optional five-digit unit identification number may be used to help identify printouts and data transfers when data is output to the RS232 port.

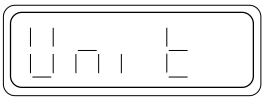
To modify the unit's identification number, select 'UNIT' from the System Setup menu.



You are prompted to enter a unit identification number. Use the SCAN and NEXT keys to set the unit i.d. and press ENTER.



The display returns to 'UNIT' in the System Setup menu.



RS232 Port Parameters

To program the RS232 port parameters, select 'PORT' from the System Setup menu. The following menu will be displayed. The SCAN DOWN key moves toward the bottom of the menu, the SCAN UP key toward the top. STOP/NEXT will exit this menu and return to 'PORT' in the System Setup menu without changing the current port parameters. To select an option, press ENTER.

RS232 Port Menu

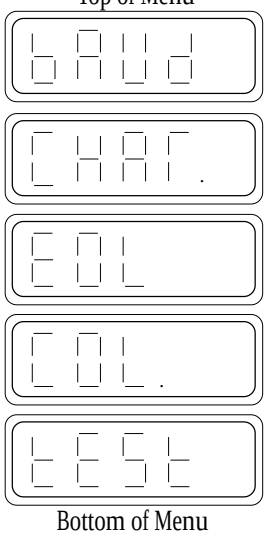
Baud rate

Character length/parity

End-of-line sequence

Print width

RS232 port test

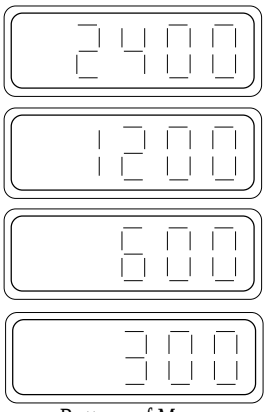


Baud Rate

Four options will be presented when you select 'BAUD' from the Port menu. The current baud rate is shown first. Use the SCAN keys to display additional options. Press ENTER to accept the baud rate shown and return to the Port menu, or STOP/NEXT to return to the Port menu without changing the current baud setting.

Baud Rate menu

Top of Menu



Bottom of Menu

Character Length and Parity

Three options will be presented when you select 'CHAR.' from the Port menu. The current character configuration is shown first. Use the SCAN keys to display additional options. Press ENTER to accept the character length/parity shown and return to the Port menu, or STOP/NEXT to return to the Port menu without changing the current character setting.

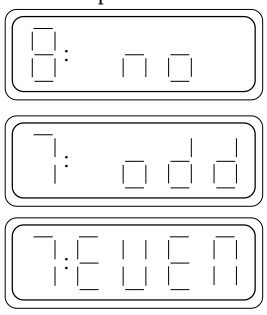
Character/Parity Menu

Top of Menu

8 bits per character, no parity bit

7 bits per character plus an odd parity bit

7 bits per character plus an even parity bit



Bottom of Menu

End-Of-Line Sequence

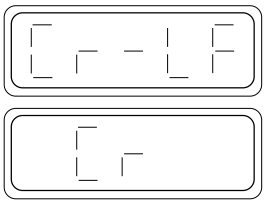
Two options are available for the end-of-line sequence ('EOL'). The current EOL sequence is shown first. Press SCAN UP or SCAN DOWN to display an additional option. Press ENTER to accept the EOL sequence shown and return to the Port menu, or STOP/NEXT to return to the Port menu without changing the current EOL sequence.

EOL Menu

Top of Menu

Carriage return with line feed

Carriage return only

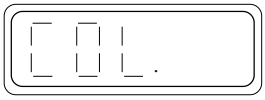


Bottom of Menu

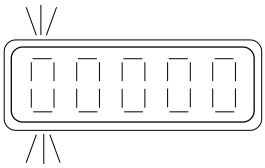
Print Width

The HERMIT supports multiple-column print formats and will adjust the number of columns of data to match the size of your printer. The smallest print width that can be used with the HERMIT is 24 columns. The largest is 255.

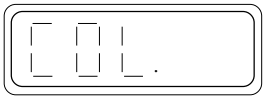
To set the print width, select 'COL.' from the RS232 Port menu.



You will be prompted to enter the column width of your printer. You can select a print width from 24 to 255 columns. Use a print width of 34 or more to print both inputs at once. Press ENTER to set the print width.



The display will return to the RS232 Port menu.



A print width of 24 columns causes printouts to be made in a format compatible with older versions of the HERMIT. Print widths of 25 to 255 columns allow the HERMIT to print in its newer expanded formats. Section 10 contains examples of printouts with different settings.

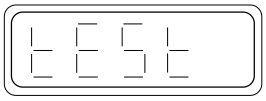
The first four port parameters must be set to match the settings of the printer or computer to be connected; refer to the owner's manual of the particular device. Settings for interfacing to several In-Situ accessories are outlined below.

	Field Printers		PC's with	
	SE1004B	GFP-80	DataTransfer	HERMIT-DM
Baud rate	1200	2400	2400	2400
Char. length:Parity	8:No	8:No	8:No	8:No
EOL sequence	CR	CR	CR	CR
Print width	24-25	80	80	24

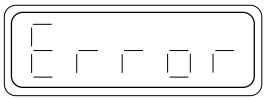
Testing the RS232 Port

A special RS232 port test feature is available in the Port menu that will allow you to test your port configurations without having to collect and dump data. First, make certain that all cables are connected and that the printer or computer is switched on.

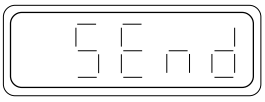
Select 'TEST' from the Port menu.



The HERMIT 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.

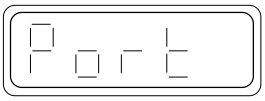


The display will show 'Send' and several single-spaced test lines will be output to the print device. If the lines are not single spaced or appear garbled in any way, check the RS232 parameter settings of the HERMIT and the print device.



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

Press and hold the STOP/NEXT key to abort the test output early. The display will then return to 'PORT' in the System Setup menu.



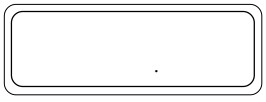
10 Outputting Data

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.

> ***CAUTION***
>
> *Transferring data to a computer will require a program on the receiving computer that allows proper handling of the incoming data. This does not happen automatically. In many cases a terminal emulation program with file storage capabilities may be sufficient.*

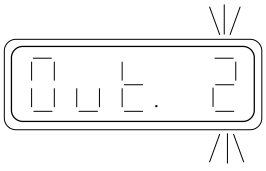
The steps are identical to those for displaying data (Section 8), except that the RS232 port must be connected and the receiving device switched on before you begin. Refer to Section 9, Using the RS232 Port, if you encounter difficulties while attempting to print data.

Get the port and receiving device ready, then press any key to wake the instrument and get a status display.

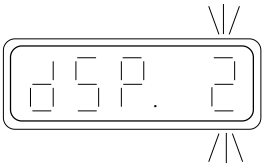


Press the DATA key.

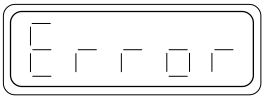
If the RS232 port is properly connected, the unit will automatically direct data to the port instead of to the LCD; the display will show 'Out' and prompt for a test number. The highest test number available is shown as the default. Select the default by pressing ENTER; or SCAN to the desired test number and press ENTER.



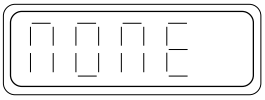
If the instrument does not detect that the printer is connected, the display will show 'DSP,' meaning data will be routed to the display for viewing. Double check all connectors and make sure the printer is switched on. Then begin again from the status display.



The selected test number must be in the range zero to the default test or you will get an 'Error' message.

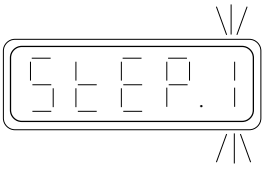


If the selected test has not been run and contains no data, the display will show 'NONE.'

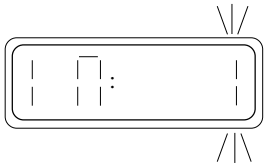


The message will display briefly and you will be reprompted for the test number.

If the test was stepped, you are prompted to select the step to be printed. Only one step is output at a time. The highest step number in the test is displayed as the default. To print data for the default step, just press ENTER; or SCAN to the desired step and press ENTER. This prompt is skipped if no steps were used.

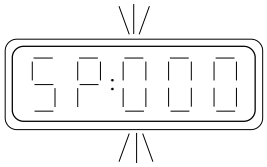


If both input channels were active during the test and the print width will not allow both to be printed, the HERMIT will prompt for an input number. To print data from the default input, just press ENTER; or SCAN to the other input and press ENTER. This prompt is skipped if only one input was active or if the print width can handle both.

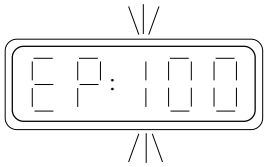


The print width is set in the RS232 Port submenu of the System Setup menu. The setting should be at least 34 columns to transfer or print two inputs. Refer to Section 9, page 32.

You will be prompted for the "Start Percentage," the percentage into the test at which you wish to start printing. The default is 0%, the start of the test. Use the SCAN and NEXT keys to set the start percentage and press ENTER.

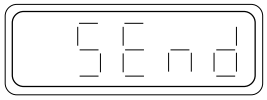


You will be prompted for the "End Percentage," the point in the test data at which you wish to stop printing. The default is 100%, the end of the test. Use the SCAN and NEXT keys to set the end percentage and press ENTER.

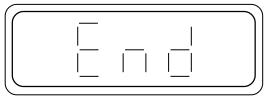


Any portion of the data may be printed. For example, select 0% to 50% to print just the first half of the test or step.

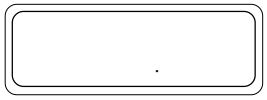
When you press ENTER, data transfer will begin. The display will show 'Send.'



You can abort a printout early by pressing STOP/NEXT. The display will show 'End' and then return to the status display.



The status display will return to the screen when the printout is finished.



+ *Battery Life Tip*

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

Reminder: Due to the time required to read a dual-mode transducer, all dual-mode data recorded during the first minute of a test using the log sample mode will be meaningless and should be ignored. The data recorded during this period will vary depending on the setting of the transducer's coefficients, but the start of good data should be readily apparent when looking at the data.

Print Formats

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

Multiple-Input Format

When you select a print width other than 24 columns (25 to 255 columns) the HERMIT will automatically transfer as many inputs as the printer width can handle. You can use the multiple-input format with 24-column printers such as In-Situ's SE1004B by selecting a print width of 25 columns. A printout of one input in the multiple-input format is shown below.

1 Title identifying the instrument used to record the data.

2 Date and time of printout.

3 Unit identification number and the 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 programmed.

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          SE1000C
       Environmental Logger
2          04/18 09:40

3      Unit# 04018  Test 0

   Setups:          INPUT  1
4  -----------      --------
   Type             Function
   I.D.             00420

   Linearity        0.000
5  Scale factor     16.000
   Offset           4.000
   Delay mSEC       50.000

6  Step 0  04/18 09:26:55

   Elapsed Time     INPUT  1
   ------------     --------
      0.0000          19.926
      0.0033          19.922
      0.0066          19.922
      0.0100          19.922
      0.0133          19.920
      0.0166          19.920
      0.0200          19.922
7     0.0233          19.924
      0.0266          19.924
      0.0300          19.926
      0.0333          19.928
      0.0366          19.926
      0.0400          19.928
      0.0433          19.926
      0.0466          19.926

      9.6000          19.922
      9.8000          19.920
     10.0000          19.924
     12.0000          19.924
8  END
```

The multiple-input format is the same when both input channels are printed; however, the header information is centered for greater readability. Shown below is a printout of data from two inputs using a print width setting of 34 columns or greater.

```
                SE1000C
          Environmental Logger
              12/13 11:13

Unit# 00002  Test 18

Setups:     INPUT  1   INPUT  2
-------     --------   --------
Type        Function       Dual
I.D.           00000      00000

Linearity      0.000
Scale factor  16.000
Offset         4.000
Delay mSEC    50.000

Coef. 0           25.310
Coef. 1           268.950
Coef. 2           27.540
Coef. 3           -0.730
Coef. 4           3258.10
Coef. 5           91.160
Coef. 6           0.360
Coef. 7           -17.180
Coef. 8           3.200
Coef. 9           6.760

Step 0  12/13 11:09:55

  Elapsed Time   INPUT  1   INPUT  2
  ------------   --------   --------
  0.0000            9.192      2.059
                                29.156
  0.2000            9.192      2.059
                                29.156
  0.4000            9.190      2.059
                                29.156
  0.6000            9.195      2.059
                                29.152
  0.8000            9.188      2.059
                                29.156
  1.0000            9.190      2.059
                                29.156
  1.2000            9.190      2.059
                                29.154
  1.4000            9.192      2.059
                                29.156
  1.6000            9.190      2.059
                                29.156
  1.8000            9.192      2.059
                                29.156
  2.0000            9.192      2.059
                                29.156
END
```

Single-Input Format

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

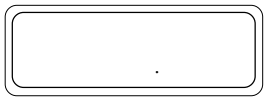
This format will restrict you to printing or transferring one input channel at a time. To maintain compatibility, the input channel I.D. does not appear in the header. If a level input type is operating in the Top of Casing mode, TOC will be indicated; if no indication appears, the mode is Surface. All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

```
          SE1000C
      Environmental Logger
          04/18 10:23

       Unit# 04018  Test 1

INPUT  1: Level (F)

Reference      0.000
Linearity      0.050
Scale factor   9.930
Offset         0.080
Delay mSEC     50.000

Step 0  04/18 10:08:24

Elapsed Time        INPUT  1
------------        --------
   0.0000              0.000
   1.0000              0.000
   2.0000             -0.003
   3.0000              3.389
   4.0000              3.389
   5.0000              8.234
   6.0000              5.807
   7.0000             10.660
   8.0000              3.377
   9.0000             -3.870
  10.0000              3.383
  11.0000              8.234
  12.0000              0.971
  13.0000             -0.254
  14.0000              4.592
END
```

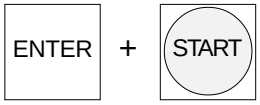
11 System Configuration & Self-Test

Four options in the System Setup menu keep track of the HERMIT's internal operations.

Begin at the status display. The System Setup menu can be displayed in any mode.



Press the ENTER key and hold it down while you press the START key.

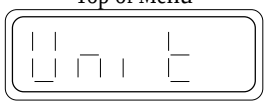


The first two menu options were discussed under the RS232 port, Section 9. Here we are interested in the next four. Use the SCAN DOWN key to move toward the bottom of the menu, SCAN UP to move toward the top. To select an option, press ENTER.

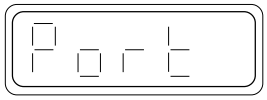
System Setup Menu

Top of Menu

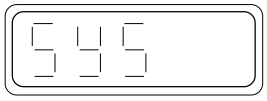
Unit identification (see p. 31)



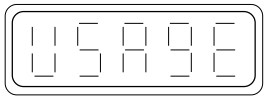
RS232 Port (see p.31)



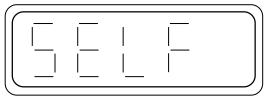
System configuration



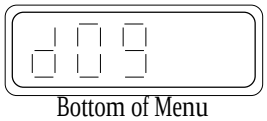
Memory usage



System self-test



Watchdog counter

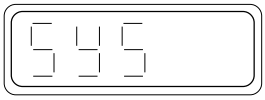


Bottom of Menu

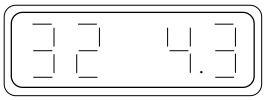
System Configuration

This option presents a two-screen display identifying the HERMIT's configuration and all installed options.

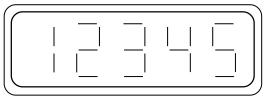
To view the system configuration, select 'SYS.' from the System Setup menu.



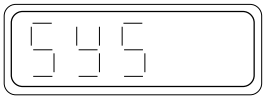
The display first shows the number of kilobytes of data memory installed and the unit's program version . . .



. . . then the unit's serial number . . .



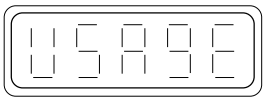
. . . and returns to the System Setup menu.



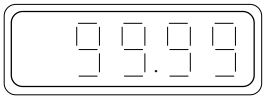
Memory Usage

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

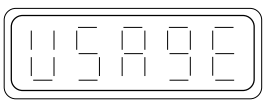
Select 'USAGE' from the System Setup menu.



The display shows the amount of memory usage remaining, in percent, . . .



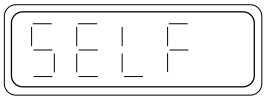
. . . and returns to the System Setup menu.



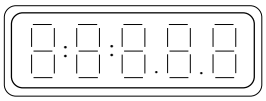
System Self-Test

The self-test feature enables you to check the operational integrity of the HERMIT. In a self-test the instrument runs 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.

Select 'SELF' from the System Setup menu.

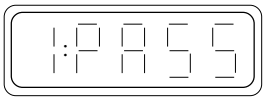


First, the display is tested . . .

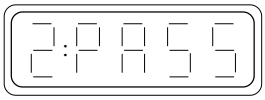


. . . then six individual tests are performed and pass/fail is indicated for each . . .

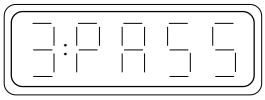
1: CPU board ROM checksum



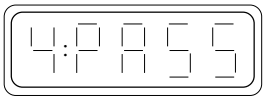
2: expansion board ROM checksum



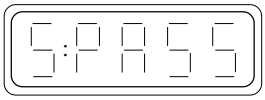
3: CPU board test



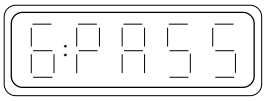
4: keyboard/display card test



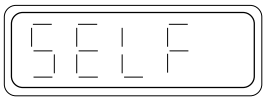
5: measurement board test



6: non-volatile memory test



. . . and the display returns to the System Setup menu.

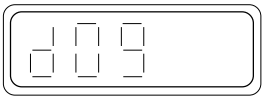


If FAIL is indicated at any point in the self-test sequence, the instrument may require service. See Appendix B for information on how to obtain repair service.

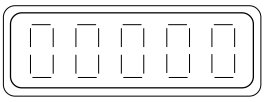
Watchdog Counter

The watchdog is an internal electronic circuit that resets the HERMIT 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. See Appendix B for information on how to obtain repair service.

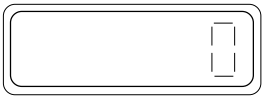
Select 'DOG' from the System Setup menu.



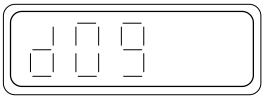
The HERMIT then reports the number of watchdog occurrences . . .



. . . and the most recent error code generated. Appendix D contains a list of watchdog error codes.



. . . and returns to the System Setup menu.



Press STOP/NEXT to return to the status display.

System Reset

If the instrument wakes up with 'RESET' displayed, this indicates that the non-volatile memory has been compromised. In the rare event that this should occur, refer to Appendix D for assistance.

12 Running a Pump Test

This section summarizes procedures for collecting downhole water level data in a well during a pump test. The HERMIT will be used to collect background data prior to the test, drawdown data during the test, and recovery data after the test. A pressure transducer will be used to measure head and the HERMIT will be programmed to present all readings as water levels measured from the top of the well casing (positive numbers increasing into the well). A transducer is selected that is capable of measuring the maximum drawdown expected in the well.

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 appropriate programming section for details.

Setting Up

Begin by programming the HERMIT to collect background data in the well:

1. Check that the clock shows the correct date and time. Set it if necessary. CLOCK
2. Use the ENTER DATA menu to enter the basic test parameters. ENTER + DATA
   - SEL. If no other tests are stored in memory, select test 0 to get the maximum storage capacity.
   - RATE Select the linear 1 sampling mode and enter an appropriate sample rate. In this case, set the sample rate to 30 minutes.
   - INP. Select 1 active input.
   - TYPE Select the type of input as LEVEL.
3. Use the ENTER XD menu to enter the transducer parameters. ENTER + XD
   - REF. Skip the entry of the reference level for now.
   - SCALE, OFFS., LIN. Enter the transducer coefficients on the cable reel. Set to zero any coefficient that is not specified.
   - DELAY Enter a warmup delay of 50 mSEC unless specified otherwise.
   - DSP. Select the Top Of Casing mode and feet or meters of water as you prefer.
   - I.D. Optional; you may leave it zero or enter your own identifying label.
   - HI AL, LO AL Set off or to desired value.
4. Lower the pressure transducer into the well. The transducer must be set below the lowest anticipated drawdown, though it is not necessary that it be at the bottom of the well. Connect the transducer to the HERMIT.

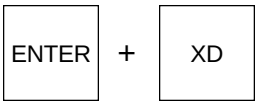
> **CAUTION**
>
> *Do not allow the cable jacket to come in contact with the sharp edges of the well casing as the transducer is lowered into the well. Exposing a punctured or ripped cable jacket to water can result in permanent damage to the transducer.*

5. Use the XD key to display the transducer's depth and to verify that all connections have been made properly. XD
6. Secure the cable to the casing to prevent the transducer from slipping away from its initial setting.

Note: It may be necessary to allow time for the transducer to come to temperature equilibrium with the water before continuing. This usually requires no more than two hours. If your head reading appears 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. Access the ENTER XD menu again, select the REF. option, and set the initial water level as measured from the top of the casing. Drawdown can be recorded directly by setting the reference to zero.

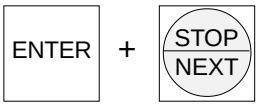


Collecting Background Data

1. Use the START function to begin collecting data.

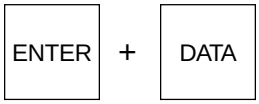
   The HERMIT is now left in the field to collect background data on the well.

2. Upon returning to the field the day of the pump test, use the STOP function to end the background data collection.



Setting Up the Pump Test

1. Enter the basic parameters for the pump test.



   SEL. Select test 1.
   RATE Select the LOG sampling mode so that fast time-drawdown data will be recorded early in the test. The maximum sample interval should be selected as appropriate for the test. In this case set it to 15 minutes.
   INP., TYPE The number and type of inputs do not need to be changed.

2. The transducer parameters do not need to be re-entered. They were automatically copied when test 1 was selected.

3. Double check the transducer setting and connections by observing the transducer depth with the XD key.

The HERMIT is now ready to begin the drawdown phase of the test.

The Drawdown Phase

4. Use the START function to begin collecting drawdown data. The START (immediate start) option can be used if the pump start switch is conveniently close to the HERMIT or if synchronization is not critical. If the instrument is too far away from the pump start switch, program the HERMIT for a delayed start using the DELAY option.

Once the test is started the HERMIT will be recording time-drawdown data. After the first ten minutes of the test, the HERMIT keyboard will be available for you to use.

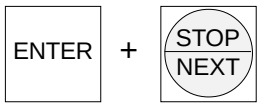
- You can use the DATA key to monitor the progress of the test.
- You can print any portion of the test while it is running by connecting the RS232 port before pressing the DATA key.

The Recovery Phase

Recovery data are most conveniently recorded by stepping the test.

5. Use the START function to begin collecting recovery data. Synchronize the HERMIT 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.

6. Use the STOP function to stop recording when the test is completed.



The final data may be viewed or output, or another test may be run by selecting a new test number (memory capacity permitting).

Test Variations

Many variations to the basic pump test are possible. Here are several common ones:

- A second input could be used, in the function mode, during drawdown to monitor the flow rate out of a well.
- Stepped rate pump tests require that the flow rate be stepped one or more times during the course of drawdown. The HERMIT 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.

13 Long-Term Monitoring

This section presents the procedure for monitoring the depth of a reservoir, lake, or stream over an extended period of time. As in the previous example, a pressure transducer is used to measure head, but this time the HERMIT will be programmed to present the water level references as elevation. Additionally, the second input will be used to monitor conductivity as a measure of the water quality; temperature is also monitored when the In-Situ conductivity probe is used so, in effect, three parameters are being monitored and recorded.

1. Check that the clock is correct and set it if necessary. CLOCK

2. Use the ENTER DATA menu to enter the basic test parameters. ENTER + DATA

   SEL. Select test 0 to get the maximum storage capacity.
   RATE Select the linear 1 sampling mode and enter the required sample rate.
   INP. Select 2 active inputs.
   TYPE Select input 1 as a LEVEL input; select input 2 as a DUAL input.

3. Enter the transducer parameters for input 1. ENTER + XD

   REF. Skip the entry of the reference level for now.
   SCALE OFFS. LIN. Enter the transducer coefficients found on the cable reel. Set to zero any coefficient that is not specified.
   DELAY Enter a warmup delay of 50 mSEC unless specified otherwise.
   DSP. Select the Surface mode and feet or meters of water as you prefer.
   I.D. Optional; you may leave it zero or enter your own identifying label.
   HI AL, LO AL Set off or to desired value.

4. Enter the transducer parameters for input 2: ENTER + XD

   COEF.0-9 Enter ten coefficient values marked on cable reel or data tag.
   I.D. Optional; leave it zero or enter an identifying label.
   HI AL, LO AL Set off or to desired value.

5. Set both transducers at the desired depth (below the lowest anticipated water level) and connect both transducers to the HERMIT.

6. Use the XD key to display the depth of the pressure transducer on input channel 1, and the conductivity and temperature values of the dual-mode probe on input channel 2. This will verify that all connections have been made properly. XD

7. Access the ENTER XD menu again, select input 1 and the 'REF.' option, and enter the reference elevation of the water surface. This reference is arbitrary and may reflect the actual elevation, the depth of the water, or may be set to zero if only changes in level are important. ENTER + XD

8. Use the START function to begin collecting data. Often it is convenient to use the delayed start to begin, for example, at the quarter hour when a fifteen-minute sampling rate is being used. START

The HERMIT is now left to collect data in the field. Data may be displayed or output at any time without affecting data collection. Use the STOP function to terminate data collection. Data collection will stop automatically when 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.

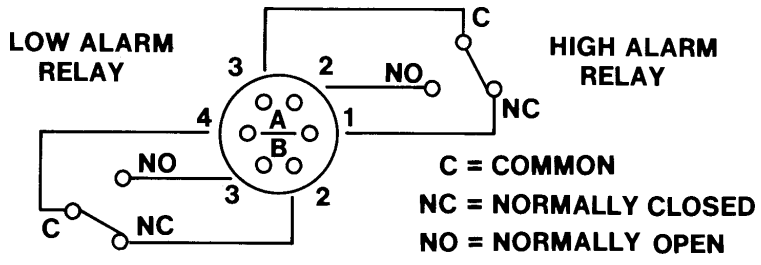
The alarm contacts and their pinouts on the back (cable) side of the mating connector are shown below. Note that no power is supplied by the instrument for use by the alarm circuitry. Any devices connected to the alarm contacts must supply their own power. The alarm relays are of a mechanical latching type so that the correct position is maintained even when the HERMIT is asleep.

The interface cable color code assignments are as follows:

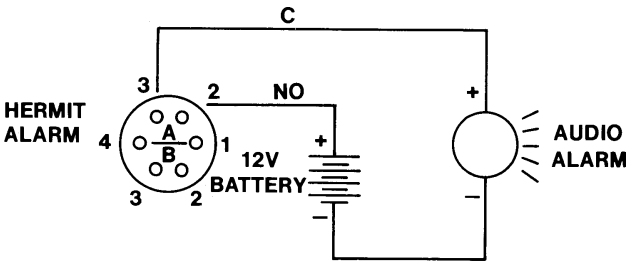
Function	Color
High Alarm – Normally closed	Black
High Alarm – Normally open	White or Brown*
High Alarm – Common	Red
Low Alarm – Normally closed	Blue or Orange*
Low Alarm – Normally open	Yellow
Low Alarm – Common	Green

** 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.*

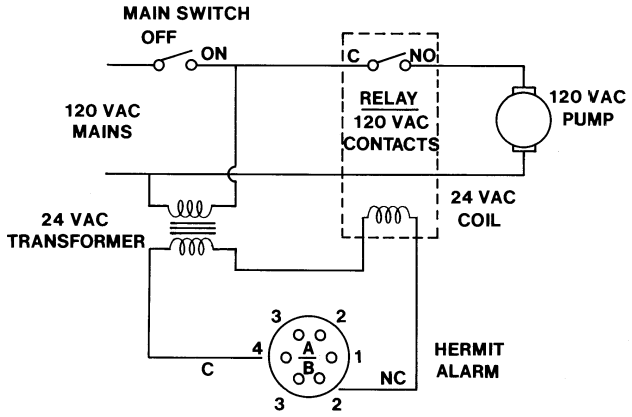


The alarm connection illustrated below is used to turn on a 12 VDC audio alarm when a high alarm occurs.



LOOP IS CONNECTED WHEN HIGH ALARM OCCURS

The connection shown below is used to turn off a 120 VAC pump when a low alarm occurs.



LOOP IS BROKEN WHEN 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.

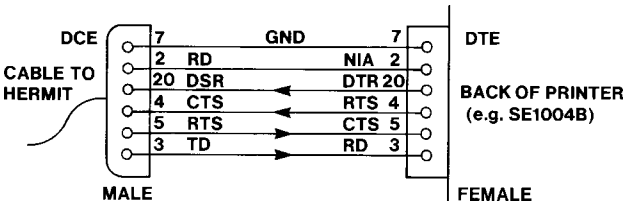
The pins on the RS232 cable of the HERMIT that must be connected properly are listed below. Signal directions are referenced to the HERMIT.

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

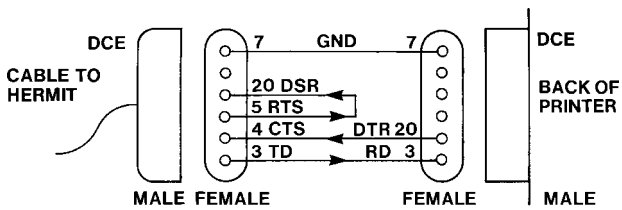
The RTS output goes high when the HERMIT is ready to dump data and remains high until the output is complete. The DSR input must be high and remain high for the HERMIT to recognize that an external device is connected. Data are output via TD.

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.

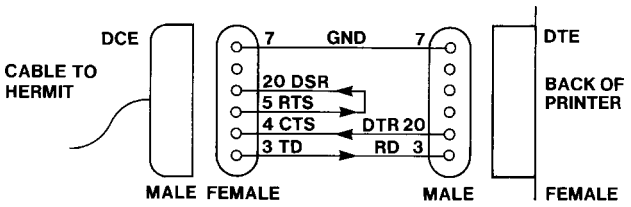
Signal connections for the standard printer interface, where no adapter is required, are shown below for reference.



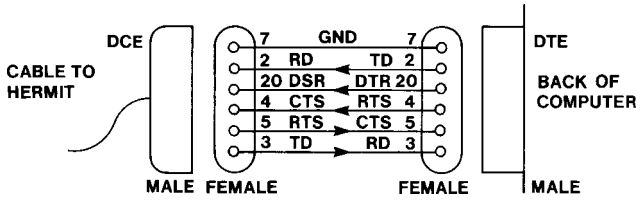
The illustration below shows the adapter necessary to connect to a printer that uses DTR (Data Terminal Ready) handshaking instead of CTS and does not supply a signal to maintain DSR active.



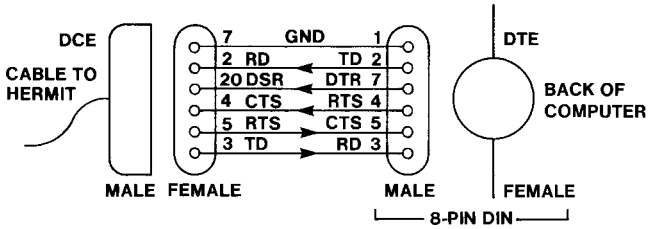
Many printers, such as those from IBM and HP, have a male connector, are configured as DCE, and use DTR/DSR handshake. An adapter for these printer types is shown below.



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.



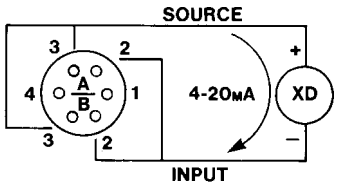
Some computers do not use the standard 25-pin connector. An adapter is supplied with the HERMIT for connection to an IBM PC/AT or compatible. The example below shows a connection for the Epson HX-20.



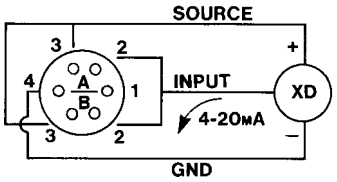
Finally, many computers do not require an adapter to work. Radio Shack's TRS-80 Model 100 is a good example.

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 1000C Operator's Manual
- HERMIT 1000C 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.

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.

- 1KPO. Holds one HERMIT 1000C and one SE1004B field printer.
- 1KP1. Holds one HERMIT 1000C, one SE1004B field printer, and one of the following:
  - transducer with 400 ft. cable on ABS plastic reel
  - 400 ft. extension cable on ABS plastic reel.
- 1KP2. Holds one HERMIT 1000C, one SE1004B field printer, and two of the following:
  - Transducer with 400 ft. cable on ABS plastic reel
  - 400 ft. extension cable on ABS plastic reel.
- 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 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.

Unpacking and Inspection

Your HERMIT 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 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.

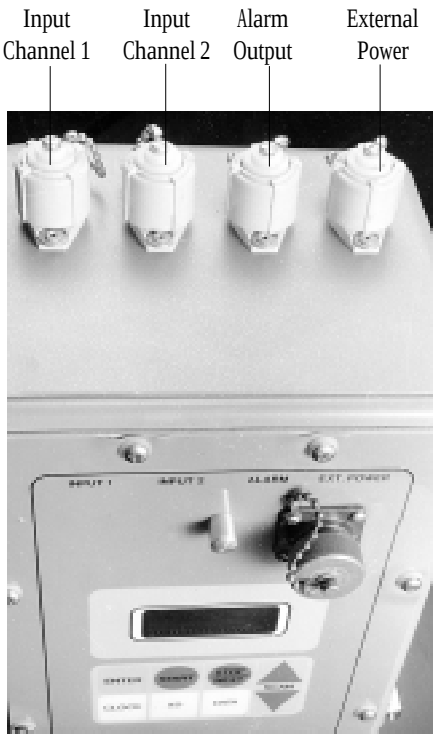
Please check to ensure that you have received all of the standard accessories included with the HERMIT. Review the list of standard accessories in Appendix A. If any accessory items are missing, please contact In-Situ immediately.

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, it must always be shipped in its original carton and with the necessary documentation.

Connector Panel

Understanding the connector panel layout of your HERMIT is important for safe and efficient operation. The connectors are labeled in the photograph here.



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 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 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 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.

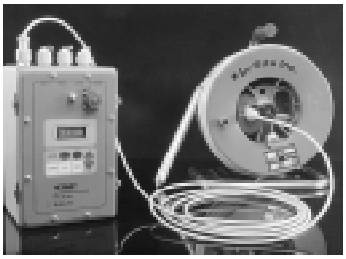
2. Gently pull the connector halves apart. Store the cable or accessory in its original container or where it will be safe from damage to the contacts.

3. Replace the protective cap on the instrument connector.

Transducer Installation

Transducers can be installed at either of the input channel connectors on the HERMIT. Transducers should be installed consecutively beginning at input channel one. The HERMIT 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'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 whenever it is convenient. The HERMIT 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

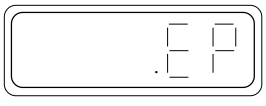
The cigarette lighter adapter allows the HERMIT to tap into the 12 VDC battery of most vehicles. Use only with vehicles employing a 12 VDC negative ground system. Some vehicles require that the ignition switch be left in the "ON" or "ACC" (accessory) position for proper operation of the cigarette lighter.

To connect the cigarette lighter adapter:

1. Connect the lighter adapter to the External Power port of the HERMIT.

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 to confirm that external power is properly connected.



Power Pack

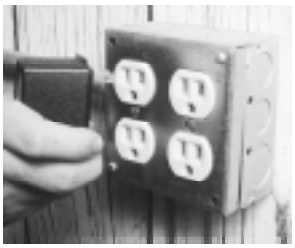
The wall-mounted power pack converts the 120 VAC available at a wall socket to power suitable for the HERMIT.

> ***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.*

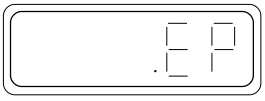
To connect the power pack:

1. Connect the power pack to the External Power port of the HERMIT.

2. Plug the power pack into a 120 VAC indoor wall outlet.



3. Wake the HERMIT to confirm that external power is properly connected.



RS232 Installation

The RS232C port on the front panel of the HERMIT 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 and RS232 accessory. Refer to Section 9 for assistance.

Disconnect RS232 accessories in the reverse order of installation.

Operating Considerations

The HERMIT 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 can be permanently damaged if used outside its operating specifications.

Temperature Ranges

The storage and operating temperatures for the HERMIT 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 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 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 through the transducer vent tube outlet (to the left of 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 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 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 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 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 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 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 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 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 owner's names and instrument serial numbers.

Appendix C: Shipping Instructions

> ***Warning***
>
> *Most models of the HERMIT 1000C 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 1000C.*

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 1000C. Please refer to this leaflet for current packaging, labeling, and shipping requirements for the lithium-powered HERMIT.

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.

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: Watchdog Error Codes

The following "watchdog" errors are generated by the HERMIT under fault conditions. The number of watchdog occurrences and the most recently generated error number can be displayed through the watchdog option of the System Setup menu. 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.

Code	Error Condition
1	Watchdog recovery
2	Lost program recovery
3	Unit was unable to put itself to sleep
4	Unit was unable to format the memory (on reset only)
5	Unit was unable to create the system file (reset only)
6	Unit was unable to create its pointer file (reset only
7	Unit was unable to create its test file (reset only)
8	Unit failed a self-test

System Reset

If the instrument wakes up with 'RESET' displayed, this indicates that the non-volatile memory has been compromised. You have two alternatives:

1. Press ENTER to confirm a reset. The unit will attempt to re- initialize its memory.

a. If successful, the status display will return to the screen. This indicates the unit is functional, but all previously stored data and test configurations will be lost.

b. If the status display does not return to the screen, it means the instrument was not able to re-initialize the memory and must be sent in for servicing. Contact In-Situ's Product Service Facility as described under "How to Obtain Repair Service" in Appendix B.

2. Press STOP/NEXT to cancel the reset. You might prefer to do this when there is valuable data in the memory that you don't want to lose. The data may be recoverable at the factory. Contact In-Situ's Product Service Facility as described under "How to Obtain Repair Service" in Appendix B.

Appendix E: Specifications

General

Dimensions	7W x 11L x 9D in. (18 x 28 x 23 cm)
Weight	12 pounds (5.5 kg)
Operating and storage temperature	-40ºC to +70ºC (-40ºF to +158ºF)
Accuracy	± 0.06% of full scale (at constant temperature) ± 0.2% of full scale (includes temperature effects)
Resolution	± 0.15% of full scale
Stability	± 0.002% of full scale per ºC

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	Programmable, 50 mSEC to 60 sec
Input resistance	185 ohms typical
Accuracy	± 0.2% of full scale
Resolution	± 0.015% of full scale
Stability	± 0.005% of full scale per ºC

Data Sampling

Memory type	Non-volatile EEPROM
Memory capacity	32K
Data point capacity	16,000
Linear sampling rates	
Linear Mode 1	Programmable 1 min to 1440 min
Linear Mode 2	Programmable 2 sec to 59 sec
Logarithmic sampling rate	0.2 sec from 0 to 20 sec 1 sec from 20 to 60 sec 12 sec from 1 to 10 min 2 min from 10 to 100 min 20 min from 100 to 1000 min 200 min from 1000 to 10,000 min 2000 min from 10,000 min Programmable 1 min to 1440 min after 10 min

Battery

Type	Lithium inorganic
Expected life	Greater than 100,000 data points or 5 yrs

External Power Input

Input voltage	+12 VDC to +18 VDC
Input current	20 mA typical, 350 mA peak

Alarm Contacts

Contact voltage	30 VDC or 30 VAC max
Contact current	1 ampere max

RS232 Interface

Output voltage swing	± 4 VDC min, ± 5 VDC typical
Handshake input voltage	± 15 VDC max, ± 3 VDC min
Baud rate	Selectable 300 to 2400 baud
Character length	Selectable 7 or 8 bits
Parity	Selectable Odd, Even, or None
End-of-line sequence	Selectable CR or CR/LF
Hardware Handshake	CTS

Appendix F: DataTransfer: HERMIT Data Transfer Utility

Using DataTransfer: Quick Summary

1. Wake the HERMIT. In the Port menu (press Enter + Start, scan down to Port), set Baud: 2400, Char: 8:no, EOL: Cr, Col.: 80.
2. Install DataTransfer. Connect the HERMIT to the PC.
3. Exit Windows. Set the the DOS prompt to the directory where you installed Data Transfer. Type DT <return>. Press any key to continue.
4. Enter a file name for the data, with a period and 3-letter extension (like .txt). Set the com port and Baud: 2400, Parity: None, Character: 8 bits, End of line sequence: Cr.
5. At the computer, press the F1 key.
6. On the HERMIT, press the Data key. Select the test number, step number, start and end percentage.
7. At the computer, press any key to start the transfer.

Introduction

DataTransfer allows transfer of raw data from the HERMIT 1000C to the IBM PC and compatibles. 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 program 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 drive.

Version 1.4, July 1992. Copyright © 1989, 1990, 1992, by In-Situ Inc. All rights reserved.

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 1000C. This entails setting the communication parameters and getting the HERMIT to display "Send." Refer to Sections 9 and 10, or see pages 54-55 below.
4. Press any key on the PC keyboard to start the data transfer.

A more detailed description with step-by-step instructions of the transfer process follows.

Preparing the PC

To begin preparing the PC, 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 52).

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 (.txt, .dat, .out).

   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.

```
          HERMIT Data Transfer Utility

Header + numeric data file name :
Create numeric data file        : No




----F1 = Begin Transfer   ESC = Quit----


Communications port          : COM1
Baud rate                    : 2400
Parity                       : None
Character length (data bits) : 8 bits
End of line sequence         : CR
```

Figure 1. DataTransfer main screen

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 1000C are:

Baud rate	:	2400
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>.

Note: In the HERMIT 1000C, character length and parity appear together in one prompt. "8:no" means 8 data bits, no parity.

   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.

```
          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                   : 2400
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

2. If the HERMIT 1000C has not already been prepared for data transfer, this is the time to do it. If prepared properly, it will show "Send" on the display. Follow the instructions below to prepare your HERMIT 1000C.

3. When the HERMIT is ready, press any key on the PC keyboard to begin the data transfer. 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 STOP/NEXT on the HERMIT 1000C. 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 the DataTransfer program and return to the DOS prompt, press <ESC> while the cursor is located at any of the file name or communication parameter prompts.

Preparing the HERMIT 1000C

Using the Cable

Connect the HERMIT 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 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 56).

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	2400
Character length & parity	8:no
End of line sequence	CR
Print width	80

To change these parameters on your HERMIT 1000C, start from the status display.

1. Hold down the ENTER key and press START. The display should show "Unit."

2. Press the SCAN DOWN key so that the display shows "Port," and press ENTER. The display is now at the port menu. Use the SCAN keys to move through the port menu and view or change baud rate, character length and parity, end of line sequence, or print width. STOP/NEXT will exit the port menu and return to the system menu. The port menu is shown in Section 9, page 31.

3. To set the baud rate, press ENTER when the display shows "baud." The current baud rate is displayed. Use the SCAN keys to display additional options. To set the recommended baud rate press ENTER when the display shows "2400." The display will return to the port menu.

4. To set the character length & parity, press ENTER when the display shows "char." The current character length & parity setting is displayed. Use the SCAN keys to display additional options. To set the recommended character:parity press ENTER when the display shows "8:no." The display will return to the port menu.

5. To set the end of line sequence, press ENTER when the display shows "EOL." The current EOL sequence is displayed. Use the SCAN keys to display another option. To set the recommended EOL sequence press ENTER when the display shows "Cr." The

display will return to the port menu.

6. To set the print width, press ENTER when the display shows "COL." You are prompted to enter a print width in columns. The current setting is displayed with the leftmost digit flashing. You can enter a width from 24 to 255 columns. 80 is recommended. Use the SCAN and NEXT keys to set the print width and press ENTER. The display will return to the port menu.

Dumping Data

1. At the status display press the DATA key. If the RS232 port is properly connected, the HERMIT will automatically direct data to the port. "Out" and the test number will appear on the display.

   Note: If "DSP" is displayed, make sure the cable connections are tight, the PC is turned on, and the communication parameters match between HERMIT and PC. Review "Preparing the PC" and/or "Setting the Communication (RS232) Parameters."

2. As soon as the DATA key is pressed, the HERMIT will blink the current test number. Use the SCAN key to display the number of the test you want to transfer. Press ENTER.

3. If the test used more than one step, the highest step number is displayed. Only one step is output at a time. SCAN to the step number to be transferred and press ENTER. This prompt is skipped if no steps were used.

   Note: If you entered a print width less than 34 at the Col. prompt, and the test used more than one input channel, you will have to select the input channel to be transferred. If the print width is set to 80 as recommended, both inputs can be transferred at once.

4. The HERMIT prompts for SP ("Start Percentage"), the percentage into the test at which you wish to start transferring data. The default is 0%, the start of the test. Use the SCAN and NEXT keys to set the start percentage and press ENTER.

5. Now enter EP ("End Percentage"), the point in the test data at which you wish to stop the transfer. The default is 100%, the end of the test. Use the SCAN and NEXT keys to set the end percentage 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.

   When you press ENTER to set the end percentage, the transfer will begin. The display will show "SEnd."

Transferring the Test Line

A special test feature is available in the port menu that will allow you to test your HERMIT to PC setup before dumping data.

1. At the status display hold down the ENTER key and press START. The display should show "Unit."

2. Press the SCAN DOWN key so that the display shows "Port," and press ENTER. The display is now at the port menu.

3. Press the SCAN DOWN key to move down through the port menu to the display that shows "test."

4. Make certain that all cables are connected and that the PC is switched on. Press ENTER to start the test. The HERMIT will show "Send."

   One or more 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 1000C 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.
After all connections are made, the HERMIT shows "dSP" instead of "Send."	• Verify that the communication parameters in DataTransfer and on the HERMIT match. • Verify that the communications port on the PC is selected properly. • Verify that the HERMIT is connected to the serial (RS232) communications port (male on PC) and not to the parallel port (female on PC) generally used for printer cable connection. • Verify that the serial communications port on the PC is in good working order (no pins bent or loose). • Verify that the correct connection adapter (gender changer) is being used (not a NULL modem). • Transfer the HERMIT Test line.

Error Messages During Transfer

MESSAGE	SOLUTION
Timeout error.	• Verify that the HERMIT is connected to the correct port. • Verify that the HERMIT displays "Send" 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.
Break signal detected. This message may also appear at the end of data transfer, whenSTOP/NEXT is pressed on the HERMIT 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.