

# PEMS Bar Code User's Guide

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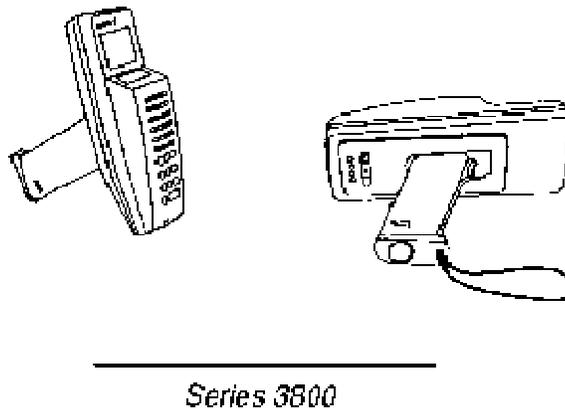


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## 1.0 Introduction

The Project Environmental Measurements System (PEMS) is the data management system for use by all UCOR Environmental Management and Enrichment Facility (EM&EF) Program projects to support environmental monitoring and clean-up efforts. PEMS provides organization, integrity, security, traceability, and consistency of the environmental measurements data generated during an environmental investigation or restoration project. The system supports sample analysis planning, laboratory statements of work, field planning, sample collection and shipment, field measurement collection, analytical laboratory results (electronic data deliverables and screening), sample tracking, data assessment, and the transfer of data to the Oak Ridge Environmental Information System (OREIS). In addition, PEMS allows data entry via mobile computing devices (i.e. bar code readers).



A bar code reader is a programmable data entry tool. It scans bar codes as well as allowing keyed data entry. The Symbol LDT 3805 is the mobile computing device supported by PEMS. It is a hand-held computer capable of executing DOS based programs written in the Microsoft C programming language.

### 1.1 What can a Bar Code Reader do for You?

The benefits of using a bar code reader for automated data collection are simple: speed and accuracy. Time after time, it has been proven that entering Bar Code data is at least 100 times faster and more accurate than traditional manual keyboard entry, which translates into a dramatic increase in efficiency and productivity for any operation. For example, the typical error rate for human data entry is one error per 300 characters. Barcode scanners are much more accurate; the error rate can be as good as one error in 36 trillion characters, depending on the type of barcode used.

Even keyed entry is faster and more accurate than hand entering a value on a field form, because a data entry clerk must manually enter data into PEMS. Using the barcode reader eliminates manual data entry by clerical staff.

An intelligent use of bar code menu sheets can replace most of the keyed fields in the PEMS barcode application with a barcode scan. For example, a bar code menu sheet with a list of monitoring locations could be used instead of keying the data into the barcode reader. This provides even more speed/accuracy.

## **1.2 How Can You Get a Bar Code Reader?**

Bar Code Readers and their peripherals are provided to projects free of charge on a first-come first-serve basis. The following hardware/software is necessary to implement the use of a barcode reader on your project:

### **Hardware**

- A Symbol LDT 3805 Bar Code Reader.
- A Cradle Base Module 3866.
- A null modem cable (9-pin female to 25-pin male)
- A Symbol AC Power Supply Cable
- A Symbol AC Power adapter

### **Software**

- Bar Code application program (PEMS.HEX)
- Code 39 Barcode fonts (BARCODEFONTS.ZIP)
- Bar Code/PC communications software (COMMUNICATIONS.ZIP)

The software can be downloaded from:

<https://www-pems.ettp.energy.gov/pems/home/home.html>

Contact PEMS Support at [pems@ettp.doe.gov](mailto:pems@ettp.doe.gov) to obtain a barcode reader.

## **1.3 PEMS User Support**

Send email for PEMS User Support to:  
[pems@ettp.doe.gov](mailto:pems@ettp.doe.gov)

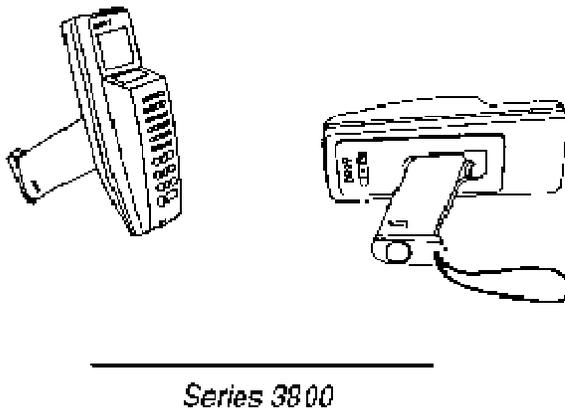
## **1.4 System Requirements**

- Internet ready PC
  - 9 pin COM1 port, configured as follows:  
(BPS: 9600, Data bits: 7, Parity: Even, Stop bits: 1, Flow Control: Xon/Xoff)
- Internet browser:
  - Netscape® Communicator 4.77

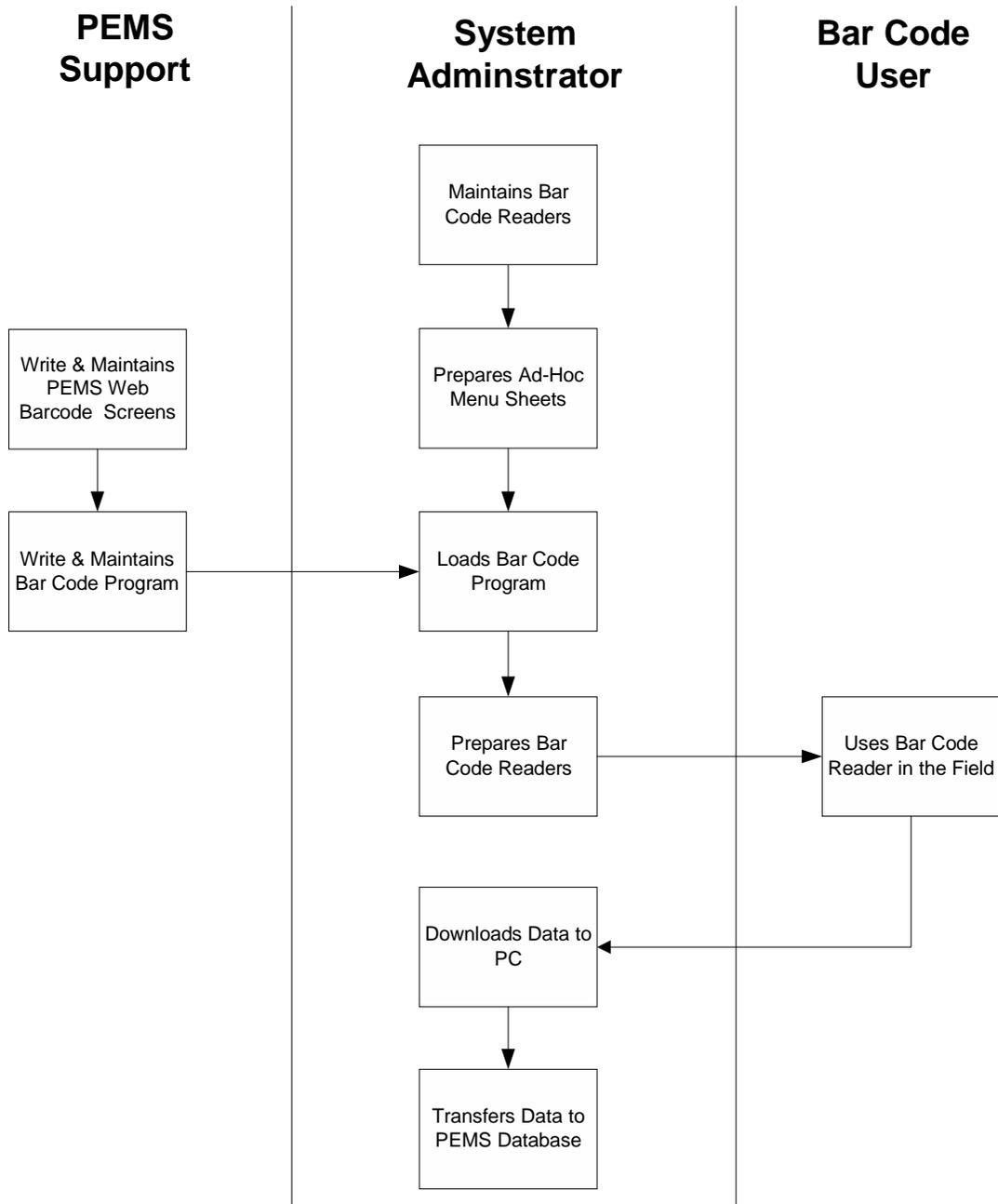
## 2.0 How to Use the Bar Code Reader

Bar code readers will be used to read bar code labels for various activities within PEMS. Only Code 39 bar code labels will be used. The Laser Data Terminal (LDT) 3805 will be used to collect and transmit bar code data. The bar code readers will be programmed in Microsoft C, version 6.00. Programs will be written for each data collection activity. If you need modifications made to the program, then contact PEMS Support. The data collected by the bar code reader is stored in an ASCII file. The ASCII file is downloaded from the bar code reader to a personal computer and then uploaded to the PEMS database for further data processing.

**Fig. 1**



## 2.1 Responsibilities Matrix



## 2.2 System Administrator

The System Administrator is responsible for maintaining the bar code readers, loading C programs into the bar code readers, preparing bar code readers for data collection, downloading bar code reader data files to a PC, and transferring those files to the PEMS database. If the project desires the use of additional menu sheets, then the System Administrator is responsible for creating them. This person is usually the PEMS Project Data Coordinator.

## 2.3 LDT 3805 Bar Code Reader Maintenance

The Bar Code Maintenance Checklist should be updated every time maintenance is performed. The bar code reader number, maintenance action, and date/time will be filled in along with the person's initials performing the maintenance action.

Maintenance Checklist					
Bar Code Reader #	Primary (NiCad) Battery Changed	Backup Battery Replaced	Program Version	Date/ Time Checked	Initials

**Fig. 2 Maintenance Checklist.**

## 2.3.1 Cleaning

The LDT 3805 requires a minimum amount of maintenance. Proper use and care will increase their life. Cleaning should be done as needed. To clean the bar code reader, use a clean soft cloth dampened with a mild cleaner such as soap and water.

**CAUTION:** DO NOT POUR, SPRAY OR SPILL ANY LIQUID ONTO ANY PART OF THE BAR CODE READER.

## 2.3.2 Battery Charging

This section describes the process for charging the batteries of the LDT 3805 bar code reader.

The NiCad battery will be charged after a day of use. Spare NiCad batteries are kept with the Bar Code Reader System Administrator. The cradle base module will be used to charge the NiCad battery packs used in the LDT 3805. It is set up as follows:

- A. Connect the power supply cord with the round plug to the power connector on the side of the cradle.
- B. Plug the 110-Volt power cable into a wall 110-Volt outlet.
- C. The red and green indicators light for about 3 seconds, blink for 3 seconds, and then go out.
- D. Fit the bottom of the bar code reader into the bottom of the cradle slot.
- E. Push the top of the bar code reader against the back of the cradle.
- F. The green charging indicator lights and the terminal is turned on.
- G. The bar code reader must be left in the cradle up to 8 hours to recharge a fully discharged battery.

**CAUTION:** DO NOT CHARGE IF BATTERY TEMPERATURE IS BELOW 0 C (32 F). IF BELOW 0 C, WAIT TWO HOURS FOR THE BATTERY TO WARM UP. The green blinking light indicates charging is taking place.

- H. When charging is complete, the green light will stay on continuously.

Indicator Lights:

- Blinking Green: Fast Charging
- Solid Green: Charged; continues to trickle charge

## 2.3.3 Replacing Batteries

This section describes the process for replacing the backup batteries of the LDT 3805 bar code reader.

The LDT 3805 bar code reader has no lithium batteries to be replaced.

## 2.3.4 Downloading Bar Code Program to your PC

Download the PEMS.HEX file from the 'Downloads' option on the left pane of the PEMS home page. This file is located in the 'Barcode Downloads' section. The PEMS Home Page URL is:

<https://www-pems.ettp.energy.gov/pems/home/home.html>

## 2.3.5 Loading C Programs into the Bar Code Readers

You will need an internet ready PC with a 9-pin male COM1 port. You will need to download the COMMUNICATIONS.EXE file from the PEMS homepage, then unzip the file and follow the readme.txt instructions.

The following steps accomplish program loading:

- A. The bar code reader number, program version number, and date should be filled in at this time on the Maintenance Checklist (section 2.3) before proceeding.
- B. Ensure that the bar code reader is turned off. Place the bar code reader into the cradle base module.
- C. Ensure that the 12-Volt end of the AC power supply cable is plugged into the cradle module and the 110-Volt end is plugged into a wall outlet. Ensure the male end of the null modem cable is inserted into the cradle module and the female end into the COM1 port of the PC.
- D. Press and hold the letter **F** key and the letter **I** key on the bar code reader simultaneously.
- E. While holding these keys down, press and release the **PWR** key.
- F. Release the letter **F** and the letter **I** keys. The bar code reader screen will display:

COMMAND MODE

Select function  
Self Test

To exit the command mode at any time, press the **CLR** key.

- G. Press the **Down** arrow key once. This will change Self Test to Program Loader on the bar code reader display.
- H. Press the **Enter** key. This will select the Program Loader. The bar code reader screen will display:  
  
Program Loader  
WARNING EEPROM  
WILL BE ERASED  
CONTINUE? <ENT>
- I. Press the **Enter** key. This action will erase the Electrically Erasable Programmable Read Only Memory (EEPROM) and Non-Volatile Memory (NVM) and takes about 1 minute. This must be erased before loading the new program.

- J. After the NVM is erased, press the **Up** arrow key once. This action will select the 19200 baud rate. Press the **Enter** key.
- K. Press the **Enter** key to select 7 bits.
- L. Press the **Enter** key to select Odd Parity.
- M. Press the **Enter** key to select None on Flow Control.
- N. The HEX file, PEMS.HEX, which includes all the necessary files for booting and executing the C program on the bar code reader, will be provided by Programming Support. To download from PEMS homepage see section 2.1 of this document.
- O. On the PC, download the PEMS.HEX file to the bar code reader by executing the SENDHEX utility. (Note: call PEMS support to get the SENDHEX.EXE program). At a DOS prompt type without commas:

SENDHEX PEMS 19200

Press the **Enter** key on the PC.

- P. The PC will then display:

Press **Enter** to start data communication.

Press the **Enter** key on the bar code reader, then the **Enter** key on the PC. The bar code reader will display:

Line 1-Program Loader  
Line 2- Receiving: XXXX. XXXX

This is the program download address. After the program download is completed, the bar code reader displays:

Line 1-Program Loader  
Line 2-Status 0000.

The status should be four zeroes. If status code is not zeroes, contact Programming Support.

- Q. Remove the bar code reader from the cradle module. This turns the bar code reader off. If on, turn it off.
- R. On the bar code reader, press and hold down the **4** and **5** keys.
- S. While holding down these keys, press and release the **PWR** key.
- T. Release the **4** and **5** keys. The bar code reader will boot to the C:\ prompt.
- U. Type PEMS and press the **Enter** key. The PEMS program will start.
- V. Check the date and time on the bar code reader when the Date Test function executes. Press F2 to quit the Bar Code program. Write the initials of the person loading the program on the Maintenance Checklist form.

## 2.3.6 Preparing Bar Code Readers for Data Collection

This section details the steps for deleting data files from the bar code reader and starting the C program. The System Administrator performs these tasks after downloading the data file from the bar code reader and before the bar code reader is given back to the user.

Preparing the reader for data collection is accomplished as follows:

- A. If the bar code reader display is blank, press the **PWR** key. The display should be: D:\>. If this prompt does not appear, turn the bar code reader off. Then while holding down the **4** and **5** keys, turn the bar code reader on. Release the **4** and **5** keys. The display should be: D:\>. If display is still incorrect, replace the bar code reader and notify Programming Support of the problem.
- B. At the D:\> prompt, type DEL \*.DAT and press the **Enter** key. This deletes all data files from the bar code reader. **Warning: do not perform this command unless you have downloaded the data files first. Otherwise, there could be a loss of data. At the D:\> prompt, type DIR \*.\* and press the Enter key to view files before deleting them.**
- C. To restart the PEMS project program on the bar code reader, type PEMS and press the **Enter** key. The bar code reader will display the following:  

```
Version: current version  
Date: current date  
By: author  
Bar code Reader#  
#####
```
- D. Make sure that the Version=3.0
- E. This display indicates that the bar code reader is ready to use. If this display is not correct, see section 2.3.5 for Loading the C Program into the Bar Code Reader. Press F2 to quit the program.

## 2.4 Uploading Bar Code Reader Data Files to a PC

This section describes the steps to be performed when uploading data files from the bar code reader to a personal computer. The System Administrator performs these tasks after the bar code reader is returned from the field. These steps must be completed before the data files are deleted from the bar code reader.

You will need to get the TDRD.EXE program, getfield.bat, and getsmpl.bat programs from PEMS Support before downloading Bar Code files.

- A. Ensure the female end of the null modem cable is connected to the COM1 port of the PC.
- B. Place the bar code reader into the cradle module. If the bar code reader is on and the collection program is running, press <**FUNC**> **2** to display the D:\ prompt. If the display has shut down to save power, press the **PWR** key to continue the program and press <**FUNC**> **2** to display the D:\ prompt. Otherwise, press the **PWR** key and then press the **4** and **5** keys simultaneously to turn the bar code reader on. Release the **4** and **5** keys. The bar code reader should display D:\>. If not successful, contact Programming Support.
- C. Ensure that the unattached end of the null modem cable is connected to the communications port of

the cradle module.

- D. Press the letter **T** key on the bar code reader keypad and press the **Enter** key. "T" is a batch job on the bar code reader to transfer any type of file to a PC.
- E. Select the appropriate program according to the sample type:
  - 1. For Field Measurements, use the PC keyboard from the C:\BARCODE subdirectory to enter:  
  
getfield filename  
  
and press the **Enter** key.
  - 2. For Sample Collection, use the PC keyboard from the C:\BARCODE subdirectory to enter  
  
getsmpl filename  
  
and press the **Enter** key.
- F. Once the data is downloaded, the PC will return to the normal system prompt. On the bar code reader, press **Ctrl - Bksp** to return to the D:\> prompt
- G. Unplug the null modem cable from the cradle module.
- H. The newly downloaded files should be on your PC's hard drive.

## 2.5 Transferring Data Files to the PEMS database

Log onto the PEMS application on the web. The URL is

<https://www-pems.ettp.energy.gov/pems/ppems/Pems.login>

Go to "Data Management" and select the "Transfer Barcode Reader Data" link under the "Barcode Transactions" section. Select the type of file to be transferred and either enter the path and filename of the file to be transferred or use the 'Browse' button to select the file. Click on the 'Click Here to Continue' icon to transfer the data files from your PC to the PEMS database.

## 2.6 Menu Sheet Preparation

A Menu Sheet is a sheet of bar code labels that may be scanned in response to a bar code reader prompt. The PEMS web application supplies 2 sheets:

Field Measurement Parameters  
Field Measurement Units

These sheets may be generated from the PEMS application. Ad-hoc sheets may be generated from a word processor such as MS Word, that has a code 39 bar code font. Both Ad-hoc menu sheets and the PEMS generated menu sheets require that you load Code 39 barcode fonts onto your PC. These fonts may be downloaded from 'Downloads' menu of the PEMS Home Page at:

<https://www-pems.ettp.energy.gov/pems/home/home.html>

Any bar code must begin and end with an exclamation mark '!'. For example:

Monitoring Location= GW-123

would need to be entered as !GW-123! on your menu sheet. Then, simply select the !GW-123! text and change the font to C39P24DITt. Print the menu sheets to a laser printer and insert the pages into a plastic cover sheet.

## **2.7 FIELD USER**

Field Users must be familiar with using and handling of bar code equipment, as well as charging and replacing batteries.

### **2.7.1 Bar Code Reader Use and Handling**

The LDT 3805 bar code reader is a dust-proof, water resistant, and sealed against most environmental contaminants. It can withstand multiple 4-ft drops onto a concrete surface covered by one-eighth inch asphalt floor tile and continue operating without malfunction or loss of data. See the Series 3800 Portable Terminals User's Guide for details.

### **2.7.2 User Equipment Configuration**

This section specifies the components for each bar code equipment configuration utilized by the user.

**LDT 3805.** The following items are required by bar code user:

- LDT 3805 Portable Data Terminal
- NiCad battery pack
- Bar Code labels (Code 39) on Sample Labels
- Menu sheets
- Transaction flow chart

### **2.7.3 Entering Data**

There are two ways to enter data into the bar code reader:

- Keyed entry
- Laser scan

Scanning is the preferable way to input data and reduce errors.

### **2.7.4 Laser Scanner Use**

The following steps describe the proper method for data scanning using a laser:

- A. Pull the trigger of the bar terminal handle to power on the bar code reader.

- B. Hold the bar code reader within range and at a slight angle to the bar code label you wish to scan and pull the trigger. A thin red beam appears over and must cover the entire length of the bar code. Do not hold the scanner directly over the bar code. The larger the bar code, the farther away you should hold the scanner.

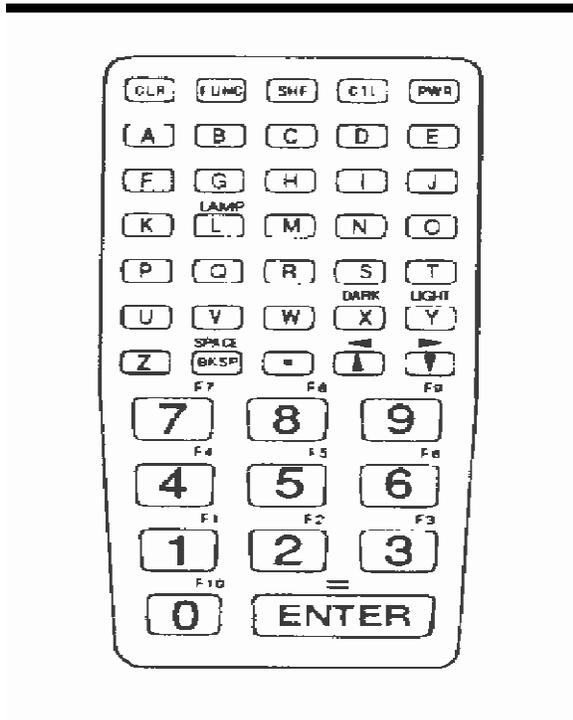
**CAUTION:** DO NOT LOOK INTO THE LASER BEAM OR POINT IT AT ANOTHER PERSON. LASERS CAN CAUSE EYE DAMAGE.

- C. If the red line does not touch the bar code, re-aim the scanner and repeat step B. If the scanner still does not operate, see your Programming Support for help.

## 2.7.5 Keying Data

In addition to scanning data, the key pad can be used to input data into the bar code reader. To use this method of data input, type the data value in with the key pad. If all character slots are filled, it is not necessary to press the **Enter** key, the bar code reader will automatically go to the next display. If all character slots are not filled, press the **Enter** key.

Fig. 3



## 2.7.6 Display

The LCD display consists of eight lines of 20 characters, all of which can be displayed at one time. The cursor will be the left-most position. The display shows the size of each data entry field. For example, 'Team Leader Badge' is displayed on one line and the next line displays #####, indicating the input field size. The series of pound symbols (#) indicate the maximum number of characters that can be scanned or

keyed.

When new lines are displayed, the previous lines are scrolled up. A maximum of eight lines is displayed.

If the display is not used over a period of time, it will shut down. This automatic shutoff helps reduce battery discharge. To turn on the display and continue the transaction, press the **PWR** key on the LDT 3805 key pad. The program resumes where the display went off.

## **2.7.7 Low Battery Indicator**

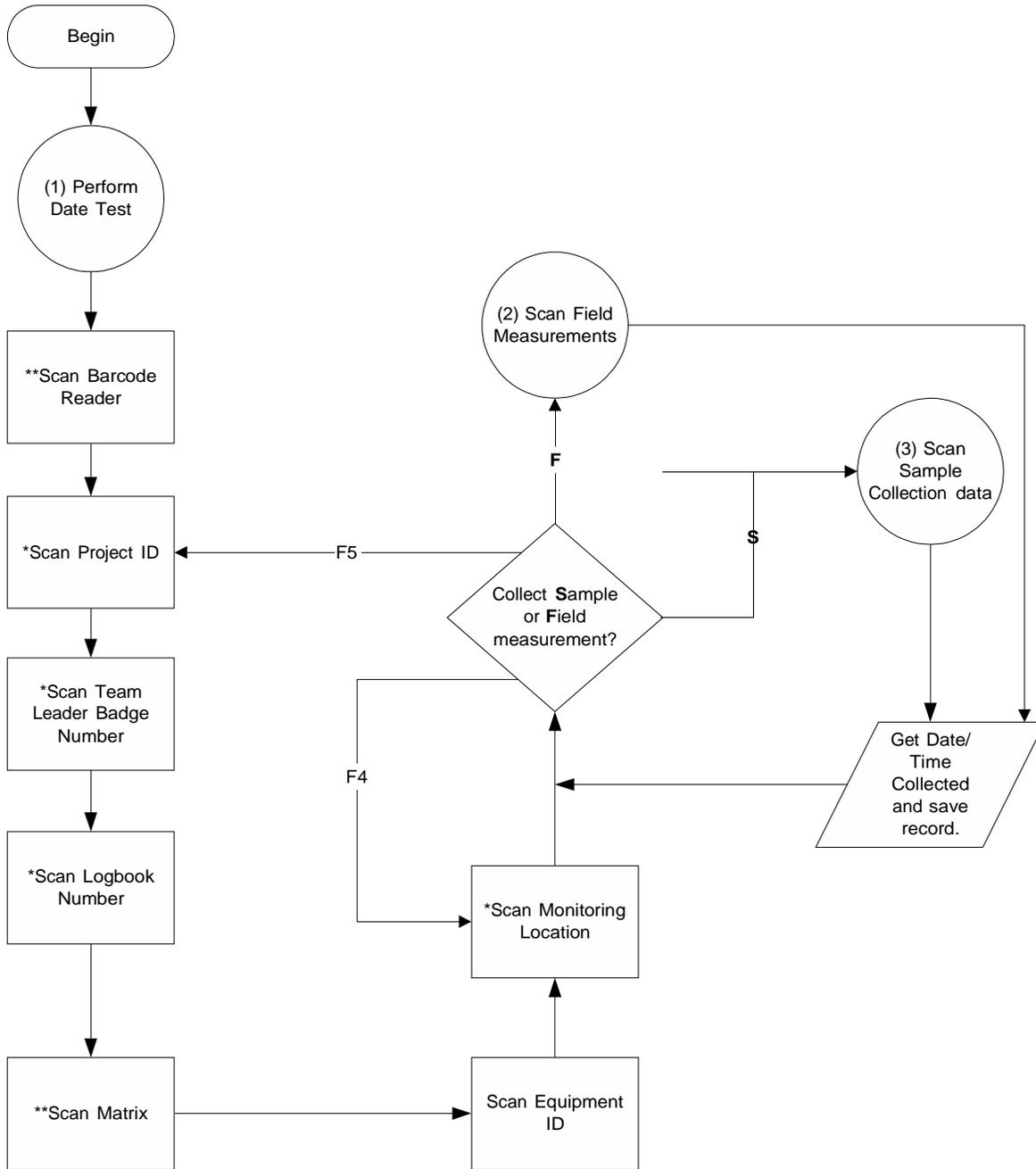
A fat blinking cursor on the display indicates a low battery. When this happens, transport the reader to the System Administrator as soon as practical, otherwise data may be lost.

## **2.7.8 Field Replacement of NiCad Battery**

An alkaline battery carrier tray and one 9-volt battery will be sent out with each LDT 3805 bar code reader.

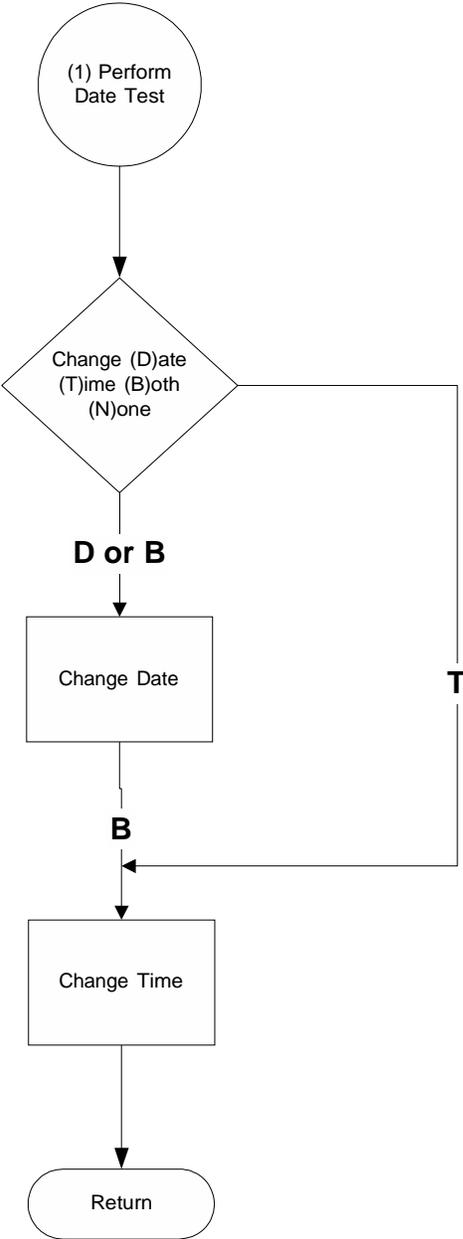
- A. Twist the D ring on the bottom of the handle 90 degrees counter-clockwise and remove the end cap.
- B. Remove the NiCad battery pack.
- C. Insert the alkaline battery into the alkaline battery adapter. Make sure the positive (+) and negative (-) signs on the battery are on the same side as the positive and negative signs on the picture of the battery inside the adapter.
- D. Hold the adapter so that the solid plastic side is down and the battery is visible on the top. Slide the adapter into the battery compartment with the rounded (large) size toward the back of the bar code reader.
- E. Push firmly on the side of the battery nearest the back of the bar code reader until the battery snaps into the contacts.
- F. Put the end cap on and twist the D-ring halfway clockwise to lock it.
- G. Press the D ring flat to secure it.

### 3.0 Bar Code Program Flow

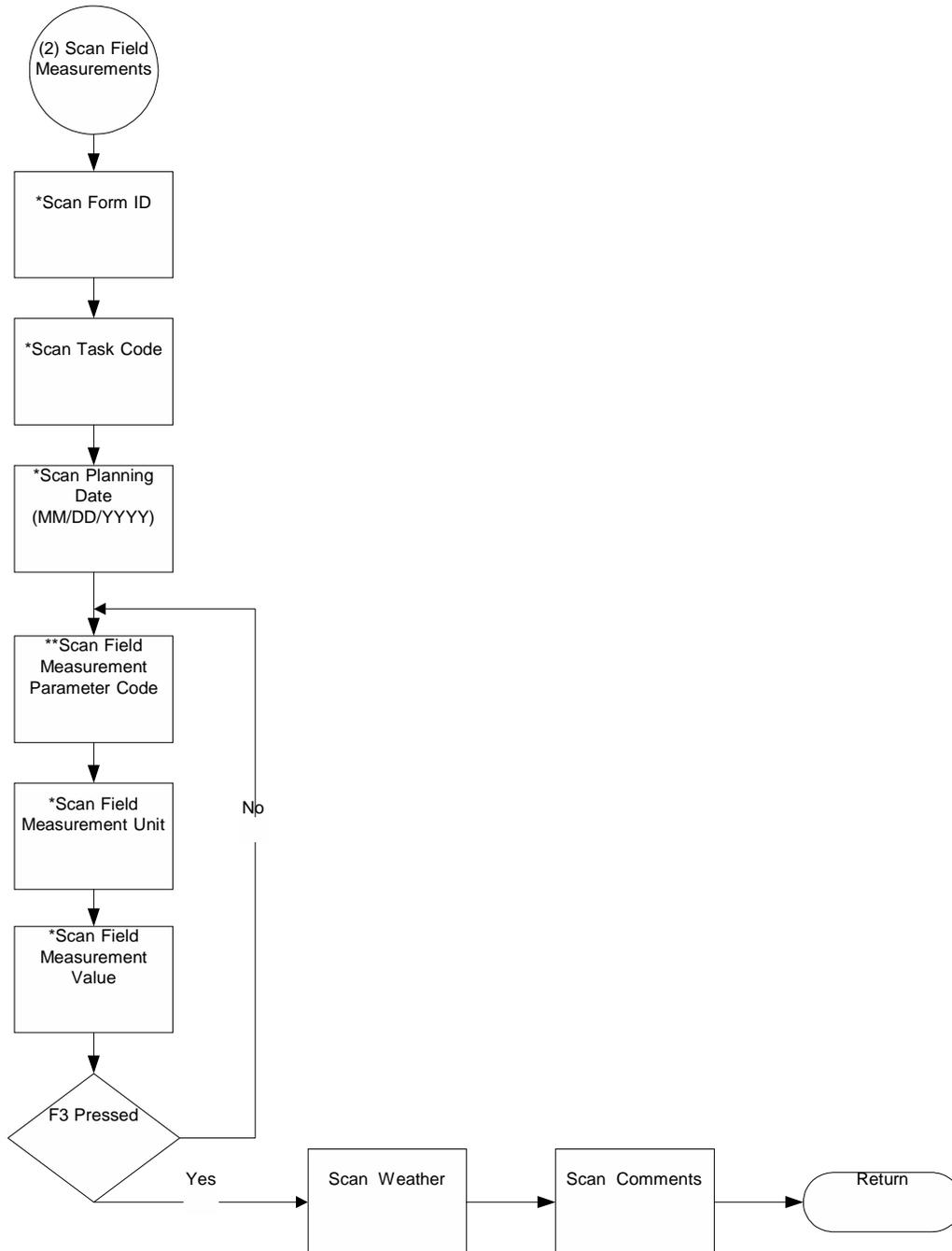


- \* - Required
- \*\* - Required and field must be totally filled in
- F1 - Previous field
- F2 - Quit
- F4 - Return to Scan Monitoring Location
- F5 - Return to Scan Project

### 3.1 Date Test Flow



## 3.2 Field Measurements Flow



\* - Required

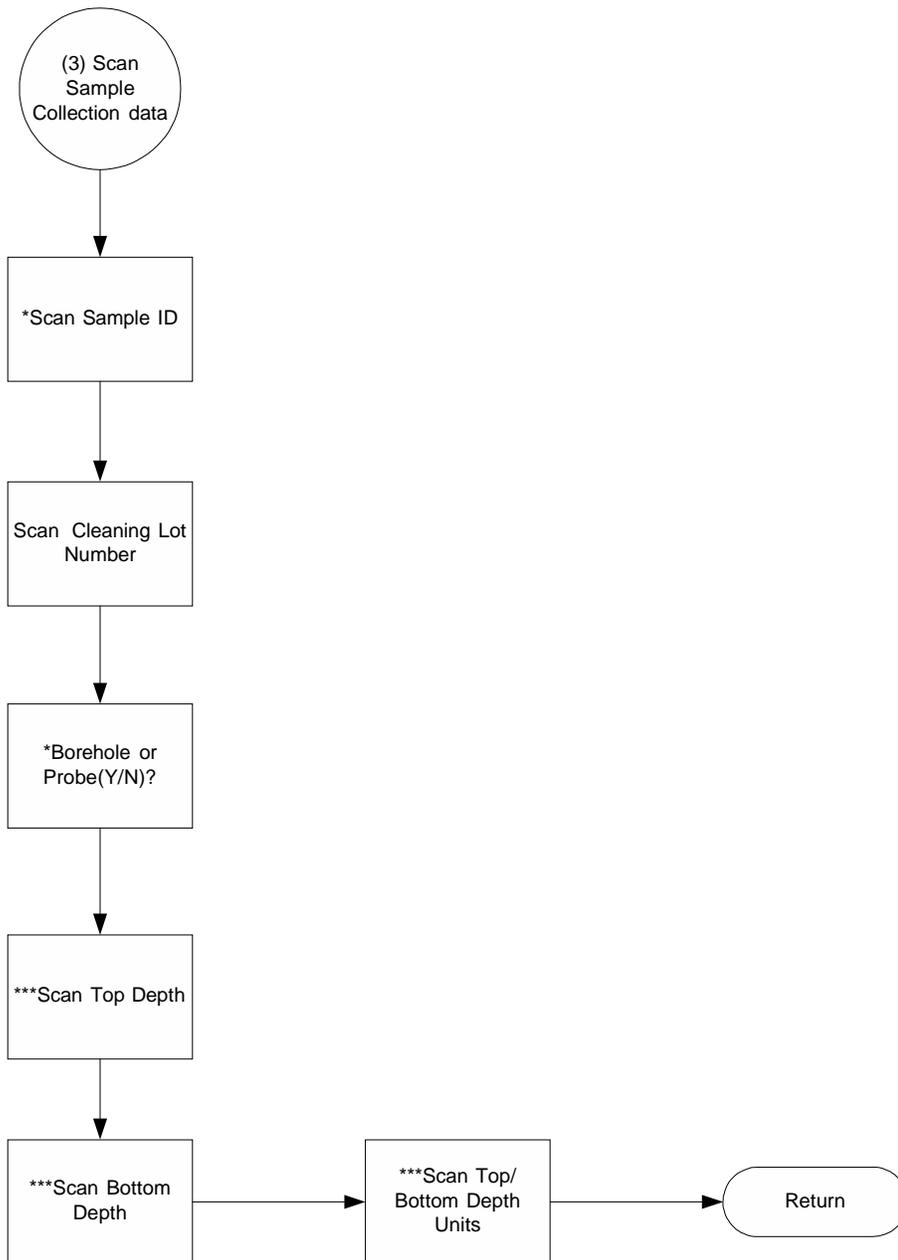
\*\* - Required for 1st Field Measurement, but otherwise skips to "Weather" with empty field

F1 - Previous field

F2 - Quit

F3 - Skip to Scan Weather

### 3.3 Sample Measurements Flow



\* - Required

\*\*\* - Required for Soil Samples at Borehole or Probe Locations

F1 - Previous field

F2 - Quit

## 4.0 File Formats

The Bar Code Reader contains a "RAM" drive that simulates a small hard drive. It is named drive D:. The drive has space for 256K of data files. During the course of the operation the Bar Code reader, 2 files will be generated:

FIELD.DAT, A file containing field measurement transactions.

SAMPLE.DAT, A file containing sample collection transactions.

Each transaction appends a row to one of the files, depending on the type of transaction. The files are in Comma-Separated-Values (CSV) format. The commas are at fixed positions. This file is uploaded to your PC and then uploaded in the PEMS database. Sometimes it may benefit you to modify the file while it is on your PC before uploading it to the PEMS database. The sections below describe the file formats.

### 4.1 FIELD.DAT

Beginning Column Position	Length	Field Name	Description
1	7	*Reader No	The Bar Code Reader No (i.e. PDT0100)
9	10	*Project ID	The Project ID
20	7	*Badge No	The Team Leader Badge No
28	15	*Logbook No	The Logbook No
44	2	*Matrix	The Matrix Type (see PEMS for valid values)
47	9	Equipment ID	The Equipment ID
57	15	*Monitoring Location	The Monitoring Location
73	15	*Form ID	The Field Form ID
89	5	*Task Code	The Task Code
95	10	*Planning Date	The Planning Date in (MM/DD/YYYY)
106	9	*Parameter	The Field Measurement Parameter Code (see PEMS for valid values)
116	16	*Field Units	The Field Measurement Unit
133	10	*Field Result	The Field Measurement Result in numeric decimal format
144	20	*Weather	The Weather
165	20	*Comments	The Comments
186	10	Field Date	The Field Measurement Collection Date in (MM/DD/YYYY)
197	4	*Field Time	The Field Measurement Collection Time in (HHMM)

\* Required fields

## 4.2 SAMPLE.DAT

Beginning Column Position	Length	Field Name	Description
1	7	*Reader No	The Bar Code Reader No (i.e. PDT0100)
9	10	*Project ID	The Project ID
20	7	*Badge No	The Team Leader Badge No
28	15	*Logbook No	The Logbook No
44	2	*Matrix	The Matrix Type (see PEMS for valid values)
47	9	Equipment ID	The Equipment ID
57	15	*Monitoring Location	The Monitoring Location
73	15	*Sample ID	The Sample ID (for each container)
89	15	Lot No	The Certified Lot No
105	10	Top Depth	The Top Depth in numeric decimal format
116	10	Bottom Depth	The Bottom Depth in numeric decimal format
127	16	Depth Units	The Depth Units
144	10	*Sample Date	The Sample Date in (MM/DD/YYYY)
155	4	*Sample Time	The Sample Time in (HHMM)

\* required

## REFERENCES

- A. Series 3800 System Administration Manual by Symbol Technologies, Inc., Costa Mesa, California (Document No. 59042-00-90), Version 2.0, September 1992)
- B. Series 3800 Portable Terminals User's Guide by Symbol Technologies, Inc., Costa Mesa, California (Part No.58694-00-82, Version 1.0)
- C. Series 3000 Application Programmer's Manual, Part I and II, version 1.3, January 1993, Part III, version 1.2, February 1992, Symbol Technologies Inc., Costa Mesa, California
- D. Programmer's Guide Series 3000 Terminal Application Developer's Library, Symbol Technologies Inc., Costa Mesa, California, version 2.3, October 1992
- E. Programmer's Implementation Manual Series 3000 Portable Terminals, Symbol Technologies, Inc., version 1.3, September 1992
- F. Microsoft C Reference, Microsoft Corporation

## Glossary

**ASCII:** **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange. An International Standards Organization 7-bit character set established by the American National Standards Institute designed to achieve compatibility among data services.

**Bar Code:** A graphic representation of numeric or alphanumeric data in the form of variable-width bars and spaces. The bar code industry uses the term **Symbology** to denote each particular bar code scheme, whereas the term **symbol** refers to the bar code label itself.

**Bar Code Reader:** A device that reads data encoded in a bar code.

**Code 39:** A bar code scheme of three wide elements out of a total of 9: five bars with four spaces between them. Code 39 has code words for the 10 digits (0-9), the 26 letters (A-Z) and eight special symbols: hyphen (-), period (.), space ( ), asterisk (\*), dollar (\$), slash (/), plus (+), and percent (%).

**Keying:** Typing in data values using the keypad and pressing the **Enter** key.

**LCD:** **L**iquid **C**rystal **D**isplay. Displays various alphanumeric, graphic, or sketch results. The LCD can display as many as eight lines of 20 characters per line.

**Menu sheet:** A sheet of bar code labels that may be scanned in response to a bar code reader prompt.

**Pivotal prompt:** A prompt with multiple correct responses including function keys which may reroute the data flow, exit the transaction, display data, or review data.

**Scanning:** A laser gun can work as a scanner using the point and shoot motion.

**Transaction:** The prompts from the bar code reader program and the expected responses for the data collection activity.

**Transaction type:** The type of data that will be collected.

**Transaction flow chart:** A flow chart prepared for a specific transaction to show the user the prompts and the flow order of how the information will be collected. The word "scan" may be used for either scanning or keying information.

**Upload:** To transfer data or files from the LDT 3805 bar code readers to a host computer by way of a RS-232-C communication line.

**URL:** Uniform Resource Locator